



INSTRUCTION MANUAL (DETAILED)

High functionality and high performance

FR-A820-00046(0.4K) to 04750(90K)(-GF) FR-A840-00023(0.4K) to 06830(280K)(-GF) FR-A842-07700(315K) to 12120(500K)(-GF) FR-A846-00023(0.4K) to 03610(132K)



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Safety instructions

Thank you for choosing Mitsubishi Electric inverter.

This Instruction Manual (Detailed) provides detailed instructions for advanced settings of the FR-A800 series inverters.

Incorrect handling might cause an unexpected fault. Before using this product, read all the relevant instruction manuals carefully to ensure proper use.

Do not attempt to install, operate, maintain or inspect this product until you have read the Instruction Manuals and appended documents carefully. Do not use this product until you have a full knowledge of this product mechanism, safety information and instructions.

Installation, operation, maintenance and inspection must be performed by qualified personnel. Here, qualified personnel means a person who meets all the following conditions:

- A person who possesses a certification in regard with electric appliance handling, or person took a proper engineering training. Such training may be available at your local Mitsubishi Electric office. Contact your local sales office for schedules and locations.
- A person who can access operating manuals for the protective devices (for example, light curtain) connected to the safety
 control system, or a person who has read these manuals thoroughly and familiarized themselves with the protective
 devices.

In this Instruction Manual, the safety instruction levels are classified into "WARNING" and "CAUTION".

MARNING Incorrect handling may cause hazardous conditions, resulting in death or severe injury.

⚠CAUTION Incorrect handling may cause hazardous conditions, resulting in medium or slight injury, or may cause only material damage.

Note that even the **A CAUTION** level may lead to a serious consequence depending on conditions. Be sure to follow the instructions of both levels as they are critical to personnel safety.

◆Electric shock prevention

↑ WARNING

- Do not remove the front cover or the wiring cover while the power of this product is ON, and do not run this product with the front cover or the wiring cover removed as the exposed high voltage terminals or the charging part of the circuitry can be touched. Doing so may cause an electric shock.
- Even if power is OFF, do not remove the front cover except for wiring or periodic inspection as the inside of this product is charged. Doing so may cause an electric shock.
- Before wiring or inspection, check that the LED display of the operation panel is OFF. Any person who is involved in
 wiring or inspection shall wait for 10 minutes or longer after the power supply has been cut off, and check that there are
 no residual voltage using a digital multimeter or the like. The capacitor is charged with high voltage for some time after
 power OFF, and it is dangerous.
- This product must be earthed (grounded). Earthing (grounding) must conform to the requirements of national and local safety regulations and electrical code (NEC section 250, IEC 61140 class 1 and other applicable standards). A neutralpoint earthed (grounded) power supply must be used for 400 V class of this product to be compliant with EN standard.
- Any person who is involved in wiring or inspection of this product shall be fully competent to do the work.
- This product body must be installed before wiring. Otherwise you may get an electric shock or be injured.
- Do not touch the setting dial or keys with wed hands. Doing so may cause an electric shock.
- Do not subject the cables to scratches, excessive stress, heavy loads or pinching. Doing so may cause an electric shock.
- Do not change the cooling fan while power is ON as it is dangerous.
- Do not touch the printed circuit board or handle the cables with wet hands. Doing so may cause an electric shock.
- Never touch the motor terminals, etc. right after powering OFF as the DC voltage is applied to the motor for 1 second at powering OFF if the main circuit capacitor capacity is measured. Doing so may cause an electric shock.
- Before wiring or inspection for a PM motor, confirm that the PM motor is stopped as a PM motor is a synchronous motor with high-performance magnets embedded inside and high-voltage is generated at the motor terminals while the motor is running even after the power of this product is turned OFF. In an application, such as fan and blower, that the motor may be driven by the load, connect a low-voltage manual contactor at the output side of this product and keep it open during wiring and inspection of this product. Otherwise you may get an electric shock.

◆Fire prevention

CAUTION

- This product must be installed on a nonflammable wall without holes in it so that its components cannot be touched from behind. Installing it on or near flammable material may cause a fire.
- If this product becomes faulty, the product power must be switched OFF. A continuous flow of large current may cause a fire.
- When using a brake resistor, a sequence that will turn OFF power when a fault signal is output must be configured. Otherwise the brake resistor may excessively overheat due to damage of the brake transistor and such, causing a fire.
- Do not connect a resistor directly to the DC terminals P/+ and N/-. Doing so could cause a fire.
- Be sure to perform daily and periodic inspections as specified in the Instruction Manual. There is a possibility of explosion, damage, or fire if this product is used without inspection.

◆Injury prevention

∴CAUTION

- The voltage applied to each terminal must be as specified in the Instruction Manual. Otherwise an explosion or damage may occur.
- The cables must be connected to the correct terminals. Otherwise an explosion or damage may occur.
- The polarity (+ and -) must be correct. Otherwise an explosion or damage may occur.
- While power is ON or for some time after power-OFF, do not touch this product as it will be extremely hot. Doing so may
 cause burns.

◆Additional instructions

The following instructions must be also followed. If this product is handled incorrectly, it may cause unexpected fault, an injury, or an electric shock.

⚠ CAUTION

Transportation and installation

- To prevent injury, wear cut-resistant gloves when opening packaging with sharp tools.
- Use proper lifting techniques or a trolley when carrying products. Failure to do so may lead to injuries.
- Do not stand or place any heavy object on this product.
- Do not stack the boxes containing this product higher than the number recommended.
- When carrying this product, do not hold it by the front cover. It may fall or break.
- During installation, caution must be taken not to drop this product as doing so may cause injuries.
- The product must be installed on a surface that withstands the weight of the product.
- Do not install this product on a hot surface.
- Ensure the mounting orientation of this product is correct.
- Ensure this product is mounted securely in its enclosure.
- Do not install or operate this product if it is damaged or has parts missing.
- Foreign conductive objects must be prevented from entering this product. That includes screws and metal fragments or other flammable substance such as oil.
- As this product is a precision instrument, do not drop or subject it to impact.
- The surrounding air temperature must be between -10 and +50°C*1 (non-freezing) for this product at HD (heavy duty), ND (normal duty) (initial setting), or LD (light duty) rating, and between -10 and +40°C*2 (non-freezing) for this product at SLD (super light duty) rating. Otherwise the product may be damaged.
- The ambient humidity must be 95% RH or less (non-condensing) for this product. Otherwise the product may be damaged. (Refer to page 37 for details.)
- The temporary storage temperature (applicable to a short limited time such as a transportation time) must be between 20 and +65°C. Otherwise this product may be damaged.
- This product must be used indoors (without corrosive gas, flammable gas, oil mist, dust and dirt). Otherwise the product may be damaged.
- Do not use this product at an altitude above 2500 m. Vibration should not exceed 5.9 m/s^{2*3} at 10 to 55 Hz in X, Y, and Z directions. Otherwise the product may be damaged. (For details, refer to page 37.)
- If halogens (including fluorine, chlorine, bromine, and iodine) contained in fumigants for wood packages enter this product, the product may be damaged. Prevent the entry of fumigant residuals or use an alternative method such as heat disinfection. Note that sterilization of disinfection of wood packages should be performed before packing the product.

Wiring

- Do not install a power factor correction capacitor, surge absorber, or radio noise filter on the output side of this product.
 These devices may overheat or burn out.
- The output terminals (terminals U, V, and W) must be connected to a motor correctly. Otherwise the motor will rotate inversely.
- Even with the power OFF, high voltage is still applied to the terminals U, V and W while the PM motor is running. Ensure
 the PM motor has stopped before carrying out any wiring. Otherwise you may get an electric shock.
- Never connect a PM motor to a commercial power supply. Connecting a commercial power supply to the input terminals
 (U, V, W) of a PM motor will burn it out. The PM motor must be applied a power from this product with the output terminals
 (U, V, W).

Test operation

- Before starting the test operation, confirm or adjust the parameter settings. Failure to do so may cause some machines
 to make unexpected motions.
 - *1 0 to +50°C for the FR-A800-GF.
 - *2 0 to 40°C for the FR-A800-GF.
 - $^{*}3$ 2.9 m/s² or less for the FR-A840-04320(160K) or higher.

WARNING

Usage

- Stay away from the equipment after using the retry function in this product as the equipment will restart suddenly after the output shutoff of this product.
- Depending on the function settings of this product, the product does not stop its output even when the STOP/RESET key on the operation panel is pressed. To prepare for it, provide a separate circuit and switch (to turn OFF the power of this product, or apply a mechanical brake, etc.) for an emergency stop.
- Be sure to turn OFF the start (STF/STR) signal before clearing the fault as this product will restart the motor suddenly after a fault is cleared.
- Do not use a PM motor for an application that the motor may be driven by the load and run at a speed higher than the maximum motor speed.
- Use only a three-phase induction motor or PM motor as a load on this product. Connection of any other electrical equipment to the output of this product may damage the equipment.
- Performing pre-excitation (by using the LX or X13 signal) during torque control (under Real sensorless vector control) may rotate a motor at a low speed even though a start command (STF or STR) is not given. This product with the start command ON may also rotate the motor at a low speed when the speed limit value is set to zero. Confirm that the motor running does not cause any safety problems before performing pre-excitation.
- Do not modify this product.
- Do not remove any part which is not instructed to be removed in the Instruction Manuals. Doing so may lead to a failure or damage of this product.

CAUTION

Usage

- The electronic thermal O/L relay function may not be enough for protection of a motor from overheating. It is recommended to install an external thermal relay or a PTC thermistor for overheat protection.
- Do not repeatedly start or stop this product with a magnetic contactor on its input side. Doing so may shorten the life of this product.
- Use a noise filter or other means to minimize electromagnetic interference with other electronic equipment used nearby this product.
- Appropriate precautions must be taken to suppress harmonics. Otherwise harmonics in power systems generated from this product may heat/damage a power factor correction capacitor or a generator.
- To drive a 400 V class motor with this product, use an insulation-enhanced motor, or take measures to suppress surge voltage. Otherwise surge voltage, which is attributed to the length and thickness of wire, may occur at the motor terminals, causing the motor insulation to deteriorate.
- As all parameters return to their initial values after the Parameter clear or All parameter clear is performed, the needed parameters for this product operation must be set again before the operation is started.
- This product can be easily set for high-speed operation. Therefore, consider all things related to the operation such as the performance of a motor and equipment in a system before the setting change.
- This product's brake function cannot be used as a mechanical brake. Use a separate device instead.
- Perform an inspection and test operation of this product if it has been stored for a long period of time.
- To avoid damage to this product due to static electricity, static electricity in your body must be discharged before you
 touch this product.
- Only one PM motor can be connected to a single unit of this product.
- A PM motor must be used under PM sensorless vector control. Do not use a synchronous motor, induction motor, or synchronous induction motor.
- Do not connect a PM motor to this product with it set to the induction motor control setting (initial setting). Do not connect an induction motor to this product with it set to the PM sensorless vector control setting. Doing so will cause failure.
- As a process of starting a PM motor, turn ON the power of this product first, and then close the contactor on the output side of this product.
- To maintain the security (confidentiality, integrity, and availability) of the inverter and the system against unauthorized access, DoS*1 attacks, computer viruses, and other cyberattacks from external devices via network, take appropriate measures such as firewalls, virtual private networks (VPNs), and antivirus solutions. We shall have no responsibility or liability for any problems involving inverter trouble and system trouble by DoS attacks, unauthorized access, computer viruses, and other cyberattacks.

Emergency stop

- A safety backup such as an emergency brake must be provided for devices or equipment in a system to prevent hazardous conditions in case of failure of this product or an external device controlling this product.
- If the breaker installed on the input side of this product trips, check for wiring faults (such as short circuits) and damage
 to internal parts of this product. Identify and remove the cause of the trip before resetting the tripped breaker (or before
 applying the power to this product again).
- When any protective function is activated, take an appropriate corrective action before resetting this product to resume the operation.

Maintenance, inspection and parts replacement

• Do not carry out a megger (insulation resistance) test on the control circuit of this product. Doing so will cause failure.

Disposal

• This product must be treated as industrial waste.

^{*1} DoS: A denial-of-service (DoS) attack disrupts services by overloading systems or exploiting vulnerabilities, resulting in a denial-of-service (DoS) state

General instruction

• For clarity, illustrations in this Instruction Manual may be drawn with covers or safety guards removed. Ensure all covers and safety guards are properly installed prior to starting operation. For details on the PM motor, refer to the Instruction Manual of the PM motor.

CHAPTER 1 INTRODUCTION

| 1.1 | Product checking and accessories | .17 |
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| 1.2 | Component names | .19 |
| 1.3 | Operation steps | .21 |
| 1.4 | Related manuals | .23 |

INTRODUCTION

The contents described in this chapter must be read before using this product.

Always read the instructions before use.

For the separated converter type, refer to the "INTRODUCTION" in the FR-A802 (Separated Converter Type) Instruction Manual (Hardware).

For the IP55 compatible model, refer to the "INTRODUCTION" in the FR-A806 (IP55/UL Type 12 specification) Instruction Manual (Hardware).

Abbreviations

| Item | Description |
|---|--|
| DU | Operation panel (FR-DU08) |
| Operation panel | Operation panel (FR-DU08) and LCD operation panel (FR-LU08) |
| Parameter unit | Parameter unit (FR-PU07) |
| PU | Operation panel and parameter unit |
| Inverter | Mitsubishi Electric FR-A800 series inverter |
| FR-A800-GF | FR-A800 series inverter with built-in CC-Link IE Field Network communication function |
| Vector control compatible option | FR-A8AP/FR-A8AL/FR-A8APA/FR-A8APR/FR-A8APS (plug-in option), FR-A8TP (control terminal option) |
| Pr. | Parameter number (Number assigned to function) |
| PU operation | Operation using the PU (operation panel/parameter unit) |
| External operation | Operation using the control circuit signals |
| Combined operation | Combined operation using the PU (operation panel/parameter unit) and External operation |
| Mitsubishi Electric standard motor | SF-JR |
| Mitsubishi Electric constant- torque motor | SF-HRCA |
| Vector control dedicated motor | SF-V5RU |
| Mitsubishi Electric IPM motor | MM-CF |

Trademarks

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- · PROFIBUS and Profibus-DP are trademarks of PROFIBUS & PROFINET International.
- · Other company and product names herein are the trademarks and registered trademarks of their respective owners.

Notes on descriptions in this Instruction Manual

· Connection diagrams in this Instruction Manual appear with the control logic of the input terminals as sink logic, unless otherwise specified. (For the control logic, refer to page 72.)

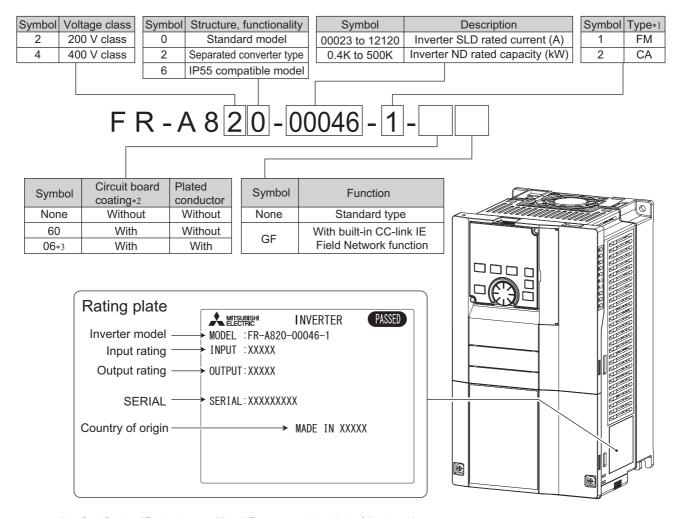
♦ Harmonic Suppression Guidelines

All the models of the inverters used by specific consumers are covered by "the Harmonic Suppression Guidelines for Consumers Who Receive High Voltage or Special High Voltage". (For details, refer to page 123.)

1.1 Product checking and accessories

Unpack the product and check the rating plate and the capacity plate of the inverter to ensure that the model agrees with the order and the product is intact.

♦ Inverter model



*1 Specification differs by the type. Major differences are shown in the following table.

| | | Initial setting | | | | |
|---------------------------------|--|---------------------|---------------|-----------------|---|--|
| Туре | Monitor output | Built-in EMC filter | Control logic | Rated frequency | Pr.19 Base frequency voltage | |
| FM (terminal FM equipped model) | Terminal FM (pulse train output) Terminal AM (analog voltage output (0 to ±10 VDC)) | OFF | Sink logic | 60 Hz | 9999 (same as the power supply voltage) | |
| CA (terminal CA equipped model) | Terminal CA (analog current output (0 to 20 mADC)) Terminal AM (analog voltage output (0 to ±10 VDC)) | ON | Source logic | 50 Hz | 8888 (95% of the power supply voltage) | |

- *2 Conforming to IEC 60721-3-3 3C2/3S2
- *3 Applicable for the FR-A820-00340(5.5K) or higher, and the FR-A840-00170(5.5K) or higher.



• In this Instruction Manual, the inverter model name consists of the applicable motor capacity and the rated current. (Example) FR-A820-00046(0.4K)

♦ Accessory

· Fan cover fixing screws

These screws are necessary for compliance with the EU Directives. (Refer to the Instruction Manual (Startup).)

| Capacity | Screw size (mm) | Quantity |
|--|-----------------|----------|
| FR-A820-00105(1.5K) to FR-A820-00250(3.7K) FR-A840-00083(2.2K), FR-A840-00126(3.7K) | M3 × 35 | 1 |
| FR-A820-00340(5.5K), FR-A820-00490(7.5K) FR-A840-00170(5.5K), FR-A840-00250(7.5K) | M3 × 35 | 2 |
| FR-A820-00630(11K) to FR-A820-01250(22K) FR-A840-00310(11K) to FR-A840-00620(22K) | M4×40 | 2 |

• Eyebolt for hanging the inverter

| Capacity | Eyebolt size | Quantity | |
|--|--------------|----------|--|
| FR-A840-04320(160K) to FR-A840-06830(280K) | M12 | 2 | |



♦ How to read the SERIAL number

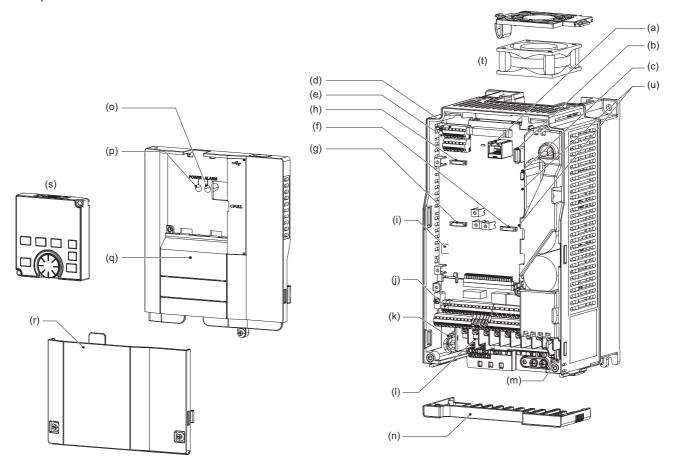
| Rating p | late e | xample | e |
|----------|------------|------------|----------------|
| | \bigcirc | \bigcirc | 000000 |
| Symbol | Year | Month | Control number |
| | | SERIA | L |

The SERIAL consists of one symbol, two characters indicating the production year and month, and six characters indicating the control number.

The last digit of the production year is indicated as the Year, and the Month is indicated by 1 to 9, X (October), Y (November), or Z (December).

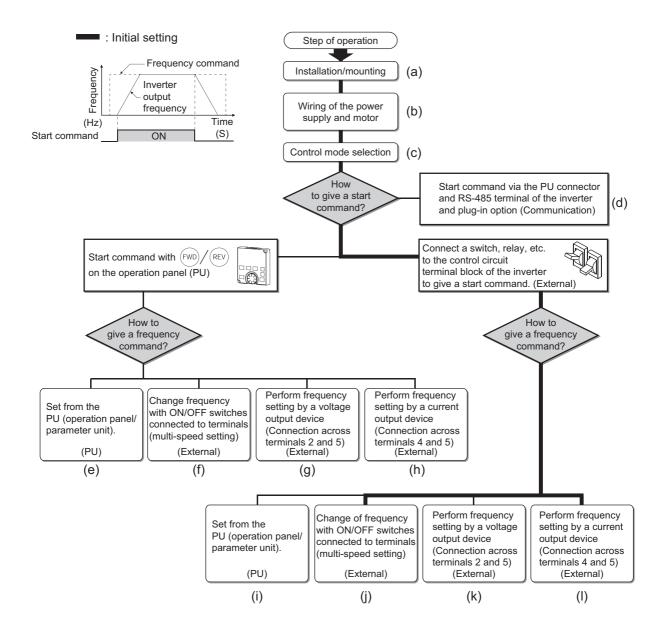
1.2 Component names

Component names are as follows.



| Symbol | Name | Description | | | | | |
|--------|---|--|-------------|--|--|--|--|
| (a) | PU connector | Connects the operation panel or the parameter unit. This connector also enables the RS-485 communication. | 84 | | | | |
| (b) | USB A connector | Connects a USB memory device. | 85 | | | | |
| (c) | USB mini B connector | Connects a personal computer and enables communication with FR Configurator2. | 85 | | | | |
| (d) | RS-485 terminals | Enables RS-485, MODBUS RTU communication. | 86 | | | | |
| (e) | Terminating resistor selection switch (SW1) | Select whether or not to use the terminating resistor for RS-485 communication. | 86 | | | | |
| (f) | Plug-in option connector 1 | Connects a plug-in option or a communication option. (For the FR-A800-GF, | Instruction | | | | |
| (g) | Plug-in option connector 2 | a CC-Link IE Field Network communication circuit board is installed to the | Manual of | | | | |
| (h) | Plug-in option connector 3 | connector 1. Refer to page 110.) | the option | | | | |
| (i) | Voltage/current input switches (SW2) | Selects between voltage and current for the input via terminals 2 and 4. | 496 | | | | |
| (j) | Control circuit terminal block | Connects cables for the control circuit. | 68 | | | | |
| (k) | EMC filter ON/OFF connector | Turns ON/OFF the EMC filter. | 120 | | | | |
| (I) | Main circuit terminal block | Connects cables for the main circuit. | 54 | | | | |
| (m) | Charge lamp | Stays ON while the power is supplied to the main circuit. | 55 | | | | |
| (n) | Wiring cover | This cover is removable without unplugging cables. (FR-A820-01250(22K) or lower, FR-A840-00620(22K) or lower) | 57 | | | | |
| (o) | Alarm lamp | Turns ON when the protective function of the inverter is activated. | 55 | | | | |
| (p) | Power lamp | Stays ON while the power is supplied to the control circuit (R1/L11, S1/L21). | 55 | | | | |
| (q) | Upper front cover | Remove this cover for the installation of the product, installation of a plug-in (communication) option, RS-485 terminal wiring, switching of the voltage/current input switches, etc. (The FR-A800-GF had a front cover with an LED display cover.) | 33 | | | | |
| (r) | Lower front cover | Remove this cover for wiring. | 33 | | | | |
| (s) | Operation panel (FR-DU08) | Operates and monitors the inverter. | 138 | | | | |
| (t) | Cooling fan | Cools the inverter. (FR-A820-00105(1.5K) or higher, FR-A840-00083(2.2K) or higher) | 816 | | | | |
| (u) | Switches (SW3 and SW4) for manufacturer setting | Do not change the initial setting (OFF of OF). | _ | | | | |

1.3 Operation steps



| Symbol | Overview | Refer to page |
|--------|---|---------------|
| (a) | Install the inverter. | 37 |
| (b) | Perform wiring for the power supply and the motor. | 55 |
| (c) | Select the control method (V/F control, Advanced magnetic flux vector control, Vector control, or PM sensorless vector control). | 221 |
| (d) | Give the start command via communication. | 659 |
| (e) | Give both the start and frequency commands from the PU. (PU operation mode) | 149 |
| (f) | Give the start command from the PU and the frequency command via terminals RH, RM, and RL. (External/PU combined operation mode 2) | 151 |
| (g) | Give the start command from the PU and the frequency command by voltage input via terminal 2. (External/PU combined operation mode 2) | 152 |
| (h) | Give the start command from the PU and the frequency command by current input via terminal 4. (External/PU combined operation mode 2) | 153 |
| (i) | Give the start command via terminal STF or STR and the frequency command from the PU. (External/PU combined operation mode 1) | 155 |
| (j) | Give the start command via terminal STF or STR and the frequency command via terminals RH, RM, and RL. (External operation mode) | 156 |
| (k) | Give the start command via terminal STF or STR and the frequency command by voltage input via terminal 2. (External operation mode) | 157 |
| (I) | Give the start command via terminal STF or STR and the frequency command by current input via terminal 4. (External operation mode) | 160 |

1.4 **Related manuals**

Manuals related to the FR-A800 inverter are shown in the following table.

| Name | Manual number |
|---|----------------|
| FR-A800 Instruction Manual (Startup) | IB-0600493 |
| FR-A800-GF Instruction Manual (Startup) | IB-0600600 |
| FR-A802 (Separated Converter Type) Instruction Manual (Hardware) | IB-0600533 |
| FR-A802-GF (Separated Converter Type) Instruction Manual (Hardware) | IB-0600601 |
| FR-CC2 (Converter unit) Instruction Manual | IB-0600542 |
| FR-A806 (IP55/UL Type 12 specification) Instruction Manual (Hardware) | IB-0600531ENG |
| FR Configurator 2 Instruction Manual | IB-0600516ENG |
| FR-A800/F800 PLC Function Programming Manual | IB-0600492ENG |
| FR-A800/F800 Safety Stop Function Instruction Manual | BCN-A23228-001 |

MEMO

CHAPTER 2 INSTALLATION AND WIRING

| 2.1 | Peripheral devices | 27 |
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| 2.2 | Removal and reinstallation of the operation panel or the front covers | 33 |
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| 2.10 | Connection of stand-alone option units | 97 |
| 2.11 | Wiring for use of the CC-Link IE Field Network (FR-A800-GF) | 110 |

INSTALLATION AND WIRING

This chapter explains the installation and the wiring of this product.

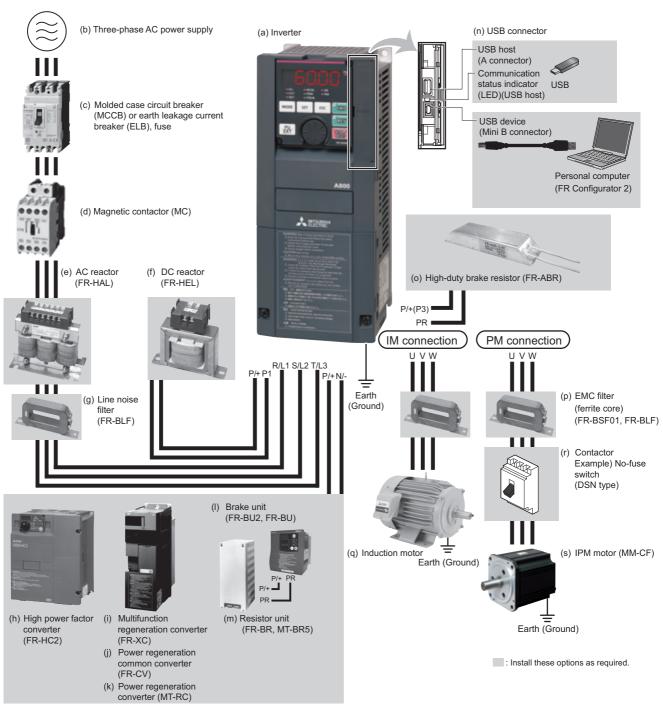
Always read the instructions before use.

For the separated converter type, refer to the "INSTALLATION AND WIRING" in the FR-A802 (Separated Converter Type) Instruction Manual (Hardware).

For the IP55 compatible model, refer to the "INSTALLATION AND WIRING" in the FR-A806 (IP55/UL Type 12 specification) Instruction Manual (Hardware).

2.1 Peripheral devices

2.1.1 Inverter and peripheral devices



| Symbol | Name | Overview | Refer to page |
|--------|--|--|----------------|
| (a) | Inverter (FR-A800) | The life of the inverter is influenced by the surrounding air temperature. The surrounding air temperature should be as low as possible within the permissible range. This must be noted especially when the inverter is installed in an enclosure. Incorrect wiring may lead to damage of the inverter. The control signal lines must be kept fully away from the main circuit lines to protect them from noise. The built-in EMC filter can reduce the noise. | 37, 46, 120 |
| (b) | Three-phase AC power supply | Must be within the permissible power supply specifications of the inverter. | 826 |
| (c) | Molded case circuit breaker (MCCB), earth leakage circuit breaker (ELB), or fuse | Must be selected carefully since an inrush current flows in the inverter at power ON. | 29 |
| (d) | Magnetic contactor (MC) | Install this to ensure safety. Do not use this to start and stop the inverter. Doing so will shorten the life of the inverter. | 128 |
| (e) | AC reactor (FR-HAL) | Install this to suppress harmonics and to improve the power factor. An AC reactor (FR-HAL) (option) is required when installing the inverter near a large power supply system (1000 kVA or more). Under such condition, the inverter may be damaged if you do not use a reactor. Select a reactor according to the applied motor capacity. | 127 |
| (f) | DC reactor (FR-HEL) | Install this to suppress harmonics and to improve the power factor. Select a reactor according to the applied motor capacity. For the FR-A820-03800(75K) or higher, FR-A840-02160(75K) or higher, or a motor with a capacity of 75 kW or higher, always connect the FR-HEL. When using the DC reactor with the FR-A820-03160(55K) or lower, FR-A840-01800(55K) or lower, remove the jumper across terminals P/+ and P1 before connecting the DC reactor to the inverter. | 127 |
| (g) | Noise filter (FR-BLF) | The FR-A820-03160(55K) or lower, FR-A840-01800(55K) or lower are equipped with the common mode choke. | 118 |
| (h) | High power factor converter (FR-HC2) | Suppresses the power supply harmonics significantly. Install this as required. | 104 |
| (i) | Multifunction regeneration converter (FR-XC)*1 | | 105 |
| (j) | Power regeneration common converter (FR-CV)*1 | Provides a large braking capability. Install this as required. | 107 |
| (k) | Power regeneration converter (MT-RC)*1 | | 108 |
| (I) | Brake unit (FR-BU2, FR-BU, BU)*1 | Allows the inverter to provide the optimal regenerative braking capability. | |
| (m) | Resistor unit (FR-BR, MT-BR5)*1 | Install this as required. | 100 |
| (n) | USB connection | Connect between the inverter and a personal computer with a USB (ver. 1.1) cable. Use a USB memory device to copy parameter settings or use the trace function. | 85 |
| (o) | High-duty brake resistor (FR-ABR)*1 | Improves the braking capability of the inverter built-in brake. Remove the jumper across terminals PR and PX to connect this (7.5K or lower). Always install a thermal relay when using a brake resistor for the inverters with 11K or higher capacity. | 97 |
| (p) | Noise filter (ferrite core) (FR-BSF01, FR-BLF) | Install this to reduce the electromagnetic noise generated from the inverter. The noise filter is effective in the range from about 0.5 to 5 MHz. A wire should be wound four turns at maximum. | 118 |
| (q) | Induction motor | Connect a squirrel-cage induction motor. | _ |
| (r) | Example) No-fuse switch (DSN type) | Connect this for an application where a PM motor is driven by the load even while the inverter power is OFF. Do not open or close the contactor while the inverter is running (outputting). | _ |
| (s) | IPM motor (MM-CF) | Use the specified motor. An IPM motor cannot be driven by the commercial power supply. | 833 |

^{*1} To select a stand-alone option, refer to the Instruction Manual of each option.



- · To prevent an electric shock, always earth (ground) the motor and inverter.
- Do not install a power factor correction capacitor, surge suppressor, or capacitor type filter on the inverter's output side. Doing so will cause the inverter shut off or damage the capacitor or surge suppressor. If any of the above devices is connected, immediately remove it. When installing a molded case circuit breaker on the output side of the inverter, contact the manufacturer of the molded case circuit breaker.
- Electromagnetic wave interference:

 The input/output (main circuit) of the inverter includes high frequency components, which may interfere with the communication devices (such as AM radios) used near the inverter. To minimize interference, enabling the built-in EMC filter or installing an external EMC filters is effective. (Refer to page 120.)
- For details on the options and peripheral devices, refer to the respective Instruction Manual.
- A PM motor cannot be driven by the commercial power supply.
- A PM motor is a motor with permanent magnets embedded inside. High voltage is generated at the motor terminals while the
 motor is running. Before closing the contactor at the output side, make sure that the inverter power is ON and the motor is
 stopped.

2.1.2 Peripheral devices

Check the model of the inverter you purchased. Appropriate peripheral devices must be selected according to the capacity. Refer to the following table for right selection.

◆ Molded case circuit breaker / earth leakage circuit breaker

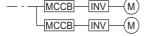
• This is a matrix showing the rated current of the molded case circuit breaker (MCCB) or earth leakage circuit breaker (ELB) (NF or NV type) according to the selected inverter and rating.

| | | Without AC/DC power factor improving reactor | | | | With AC/ | With AC/DC power factor improving reactor | | | |
|---------|----------------------|--|-------|----------|----------|----------|---|-------|-------|--|
| Voltage | Inverter model | SLD | LD | ND | HD | SLD | LD | ND | HD | |
| | FR-A820-00046(0.4K) | 10 A | 10 A | 5 A | 5 A | 10 A | 10 A | 5 A | 3 A | |
| | FR-A820-00077(0.75K) | 15 A | 15 A | 10 A | 5 A | 15 A | 15 A | 10 A | 5 A | |
| | FR-A820-00105(1.5K) | 20 A | 20 A | 15 A | 10 A | 15 A | 15 A | 15 A | 10 A | |
| | FR-A820-00167(2.2K) | 30 A | 30 A | 20 A | 15 A | 30 A | 30 A | 15 A | 15 A | |
| | FR-A820-00250(3.7K) | 50 A | 50 A | 30 A | 20 A | 40 A | 40 A | 30 A | 15 A | |
| | FR-A820-00340(5.5K) | 75 A | 60 A | 50 A | 30 A | 50 A | 50 A | 40 A | 30 A | |
| | FR-A820-00490(7.5K) | 100 A | 75 A | 60 A | 50 A | 75 A | 75 A | 50 A | 40 A | |
| | FR-A820-00630(11K) | 125 A | 125 A | 75 A | 60 A | 100 A | 100 A | 75 A | 50 A | |
| 200 V | FR-A820-00770(15K) | 150 A | 150 A | 125 A | 75 A | 125 A | 125 A | 100 A | 75 A | |
| class | FR-A820-00930(18.5K) | 175 A | 175 A | 150 A | 125 A | 150 A | 125 A | 125 A | 100 A | |
| | FR-A820-01250(22K) | 225 A | 225 A | 175 A | 150 A | 175 A | 150 A | 125 A | 125 A | |
| | FR-A820-01540(30K) | 300 A | 250 A | 225 A | 175 A | 225 A | 200 A | 150 A | 125 A | |
| | FR-A820-01870(37K) | 350 A | 300 A | 250 A | 225 A | 250 A | 225 A | 200 A | 150 A | |
| | FR-A820-02330(45K) | 400 A | 400 A | 300 A | 250 A | 350 A | 300 A | 225 A | 200 A | |
| | FR-A820-03160(55K) | _ | _ | 400 A | 300 A | 500 A | 400 A | 300 A | 225 A | |
| | FR-A820-03800(75K) | _ | _ | _ | _ | 500 A | 400 A | 400 A | 300 A | |
| | FR-A820-04750(90K) | _ | _ | _ | _ | 600 A | 500 A | 400 A | 400 A | |
| | FR-A840-00023(0.4K) | 5 A | 5 A | 5 A | 5 A | 5 A | 5 A | 5 A | 3 A | |
| | FR-A840-00038(0.75K) | 10 A | 10 A | 5 A | 5 A | 10 A | 10 A | 5 A | 5 A | |
| | FR-A840-00052(1.5K) | 10 A | 10 A | 10 A | 5 A | 10 A | 10 A | 10 A | 5 A | |
| | FR-A840-00083(2.2K) | 20 A | 20 A | 10 A | 10 A | 15 A | 15 A | 10 A | 10 A | |
| | FR-A840-00126(3.7K) | 30 A | 30 A | 20 A | 10 A | 20 A | 20 A | 15 A | 10 A | |
| | FR-A840-00170(5.5K) | 30 A | 30 A | 30 A | 20 A | 30 A | 30 A | 20 A | 15 A | |
| | FR-A840-00250(7.5K) | 50 A | 50 A | 30 A | 30 A | 40 A | 40 A | 30 A | 20 A | |
| | FR-A840-00310(11K) | 60 A | 60 A | 50 A | 30 A | 50 A | 50 A | 40 A | 30 A | |
| | FR-A840-00380(15K) | 75 A | 75 A | 60 A | 50 A | 60 A | 60 A | 50 A | 40 A | |
| | FR-A840-00470(18.5K) | 100 A | 100 A | 75 A | 60 A | 75 A | 75 A | 60 A | 50 A | |
| | FR-A840-00620(22K) | 125 A | 125 A | 100 A | 75 A | 100 A | 100 A | 75 A | 60 A | |
| 400 V | FR-A840-00770(30K) | 150 A | 150 A | 125 A | 100 A | 125 A | 100 A | 100 A | 75 A | |
| class | FR-A840-00930(37K) | 175 A | 175 A | 150 A | 125 A | 150 A | 125 A | 100 A | 100 A | |
| | FR-A840-01160(45K) | 200 A | 200 A | 175 A | 150 A | 175 A | 150 A | 125 A | 100 A | |
| | FR-A840-01800(55K) | _ | _ | 200 A | 175 A | 225 A | 200 A | 150 A | 125 A | |
| | FR-A840-02160(75K) | _ | _ | _ | — | 225 A | 225 A | 200 A | 150 A | |
| | FR-A840-02600(90K) | _ | _ | _ | _ | 350 A | 225 A | 225 A | 200 A | |
| | FR-A840-03250(110K) | _ | _ | _ | _ | 400 A | 350 A | 225 A | 225 A | |
| | FR-A840-03610(132K) | _ | _ | _ | _ | 400 A | 400 A | 350 A | 225 A | |
| | FR-A840-04320(160K) | _ | _ | _ | _ | 500 A | 400 A | 400 A | 350 A | |
| | FR-A840-04810(185K) | _ | _ | _ | _ | 600 A | 500 A | 400 A | 400 A | |
| | FR-A840-05470(220K) | _ | _ | _ | _ | 600 A | 600 A | 500 A | 400 A | |
| | FR-A840-06100(250K) | _ | _ | _ | _ | 700 A | 600 A | 600 A | 500 A | |
| | FR-A840-06830(280K) | _ | _ | <u> </u> | _ | 800 A | 700 A | 600 A | 600 A | |



[•] Select an MCCB according to the power supply capacity.

• Install one MCCB per inverter. For the use in the United States or Canada, refer to "Instructions for UL and cUL" in the Instruction Manual (Startup) or Instruction Manual (Hardware), and select an appropriate fuse or molded case circuit breaker (MCCB).



- When the inverter capacity is larger than the motor capacity, select an MCCB and a magnetic contactor according to the inverter model, and select cables and reactors according to the motor output.
- When the breaker installed on the inverter input side is shut off, check for the wiring fault (short circuit), damage to internal parts of the inverter etc. The cause of the output shutoff must be identified and removed before turning ON the power of the breaker.

◆ Magnetic contactor at the inverter's input line

• This is a matrix showing the model name of the Mitsubishi magnetic contactor to be installed at the inverter's input line according to the selected inverter and rating.

| V-14 | | Without AC/DC power factor improving reactor | | | With AC/DC power factor improving reactor | | | | |
|----------------|----------------------|--|--------|--------|---|--------|--------|--------|--------|
| Voltage | Inverter model | SLD | LD | ND | HD | SLD | LD | ND | HD |
| | FR-A820-00046(0.4K) | S-T10 | S-T10 | S-T10 | S-T10 | S-T10 | S-T10 | S-T10 | S-T10 |
| ı | FR-A820-00077(0.75K) | S-T10 | S-T10 | S-T10 | S-T10 | S-T10 | S-T10 | S-T10 | S-T10 |
| | FR-A820-00105(1.5K) | S-T10 | S-T10 | S-T10 | S-T10 | S-T10 | S-T10 | S-T10 | S-T10 |
| | FR-A820-00167(2.2K) | S-T21 | S-T21 | S-T10 | S-T10 | S-T10 | S-T10 | S-T10 | S-T10 |
| | FR-A820-00250(3.7K) | S-T25 | S-T25 | S-T21 | S-T10 | S-T21 | S-T21 | S-T10 | S-T10 |
| | FR-A820-00340(5.5K) | S-T35 | S-T35 | S-T35 | S-T21 | S-T35 | S-T25 | S-T21 | S-T10 |
| | FR-A820-00490(7.5K) | S-T50 | S-T35 | S-T35 | S-T35 | S-T35 | S-T35 | S-T35 | S-T21 |
| 00011 | FR-A820-00630(11K) | S-T65 | S-T50 | S-T35 | S-T35 | S-T50 | S-T50 | S-T35 | S-T35 |
| 200 V class | FR-A820-00770(15K) | S-T65 | S-T65 | S-T50 | S-T35 | S-T50 | S-T50 | S-T50 | S-T35 |
| Class | FR-A820-00930(18.5K) | S-T100 | S-T100 | S-T65 | S-T50 | S-T65 | S-T65 | S-T50 | S-T50 |
| | FR-A820-01250(22K) | S-N150 | S-T100 | S-T100 | S-T65 | S-T100 | S-T100 | S-T65 | S-T50 |
| | FR-A820-01540(30K) | S-N150 | S-N150 | S-T100 | S-T100 | S-N150 | S-N125 | S-T100 | S-T65 |
| | FR-A820-01870(37K) | S-N180 | S-N180 | S-N150 | S-T100 | S-N150 | S-N150 | S-N125 | S-T100 |
| | FR-A820-02330(45K) | S-N220 | S-N220 | S-N180 | S-N150 | S-N180 | S-N180 | S-N150 | S-N125 |
| | FR-A820-03160(55K) | _ | _ | S-N220 | S-N180 | S-N300 | S-N300 | S-N180 | S-N150 |
| | FR-A820-03800(75K) | _ | _ | _ | _ | S-N400 | S-N300 | S-N300 | S-N180 |
| | FR-A820-04750(90K) | _ | _ | _ | _ | S-N600 | S-N400 | S-N300 | S-N300 |
| | FR-A840-00023(0.4K) | S-T10 | S-T10 | S-T10 | S-T10 | S-T10 | S-T10 | S-T10 | S-T10 |
| | FR-A840-00038(0.75K) | S-T10 | S-T10 | S-T10 | S-T10 | S-T10 | S-T10 | S-T10 | S-T10 |
| | FR-A840-00052(1.5K) | S-T10 | S-T10 | S-T10 | S-T10 | S-T10 | S-T10 | S-T10 | S-T10 |
| | FR-A840-00083(2.2K) | S-T10 | S-T10 | S-T10 | S-T10 | S-T10 | S-T10 | S-T10 | S-T10 |
| | FR-A840-00126(3.7K) | S-T21 | S-T21 | S-T10 | S-T10 | S-T12 | S-T12 | S-T10 | S-T10 |
| | FR-A840-00170(5.5K) | S-T21 | S-T21 | S-T21 | S-T10 | S-T21 | S-T21 | S-T12 | S-T10 |
| | FR-A840-00250(7.5K) | S-T21 | S-T21 | S-T21 | S-T21 | S-T21 | S-T21 | S-T21 | S-T12 |
| | FR-A840-00310(11K) | S-T35 | S-T35 | S-T21 | S-T21 | S-T21 | S-T21 | S-T21 | S-T21 |
| | FR-A840-00380(15K) | S-T35 | S-T35 | S-T35 | S-T21 | S-T35 | S-T35 | S-T21 | S-T21 |
| | FR-A840-00470(18.5K) | S-T35 | S-T35 | S-T35 | S-T35 | S-T35 | S-T35 | S-T35 | S-T21 |
| | FR-A840-00620(22K) | S-T50 | S-T50 | S-T35 | S-T35 | S-T50 | S-T50 | S-T35 | S-T35 |
| 400 V | FR-A840-00770(30K) | S-T65 | S-T65 | S-T50 | S-T35 | S-T50 | S-T50 | S-T50 | S-T35 |
| class | FR-A840-00930(37K) | S-T100 | S-T100 | S-T65 | S-T50 | S-T65 | S-T65 | S-T50 | S-T50 |
| | FR-A840-01160(45K) | S-N150 | S-T100 | S-T100 | S-T65 | S-T100 | S-T100 | S-T65 | S-T50 |
| | FR-A840-01800(55K) | _ | _ | S-T100 | S-T100 | S-N150 | S-T100 | S-T100 | S-T65 |
| | FR-A840-02160(75K) | _ | _ | _ | _ | S-N180 | S-N150 | S-T100 | S-T100 |
| | FR-A840-02600(90K) | _ | _ | _ | _ | S-N220 | S-N180 | S-N150 | S-T100 |
| | FR-A840-03250(110K) | _ | _ | _ | _ | S-N300 | S-N220 | S-N180 | S-N150 |
| | FR-A840-03610(132K) | _ | _ | _ | _ | S-N300 | S-N300 | S-N220 | S-N180 |
| | FR-A840-04320(160K) | _ | _ | _ | _ | S-N400 | S-N300 | S-N300 | S-N220 |
| | FR-A840-04810(185K) | _ | _ | _ | _ | S-N600 | S-N400 | S-N300 | S-N300 |
| | FR-A840-05470(220K) | _ | _ | _ | _ | S-N600 | S-N600 | S-N400 | S-N300 |
| | FR-A840-06100(250K) | _ | _ | _ | _ | S-N600 | S-N600 | S-N600 | S-N400 |
| | FR-A840-06830(280K) | _ | _ | | _ | S-N800 | S-N600 | S-N600 | S-N600 |

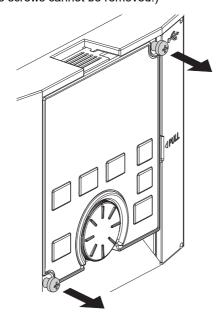


- The matrix shows the magnetic contactor selected according to the standards of Japan Electrical Manufacturers' Association (JEM standards) for AC-1 class. The electrical durability of magnetic contactor is 500,000 times. When the MC is used for emergency stops during motor driving, the electrical durability is 25 times. If using the MC for emergency stop during motor driving, select the MC for the inverter input current according to the rated current against JEM 1038 standards for AC-3 class. When installing an MC on the inverter output side to switch to the commercial-power supply operation while running a generalpurpose motor, select the MC for the rated motor current according to the rated current against JEM 1038 standards for AC-3 class.
- · When the inverter capacity is larger than the motor capacity, select an MCCB and a magnetic contactor according to the inverter model, and select cables and reactors according to the motor output.
- · When the breaker installed on the inverter input side is shut off, check for the wiring fault (short circuit), damage to internal parts of the inverter etc. The cause of the output shutoff must be identified and removed before turning ON the power of the breaker.

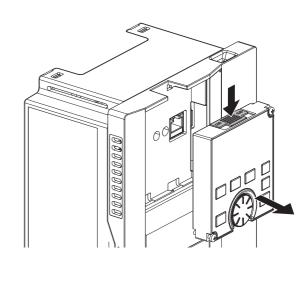
2.2 Removal and reinstallation of the operation panel or the front covers

Removal and reinstallation of the operation panel

 Loosen the two screws on the operation panel. (These screws cannot be removed.)

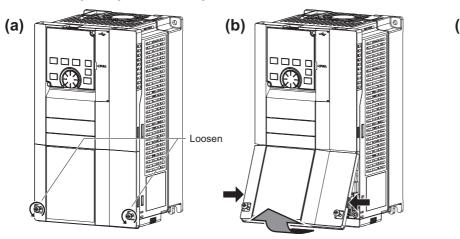


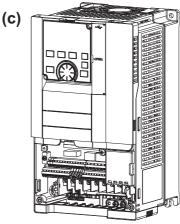
 Press the upper edge of the operation panel while pulling out the operation panel.



To reinstall the operation panel, align its connector on the back with the PU connector of the inverter, and insert the operation panel. After confirming that the operation panel is fit securely, tighten the screws. (Tightening torque: 0.40 to 0.45 N·m)

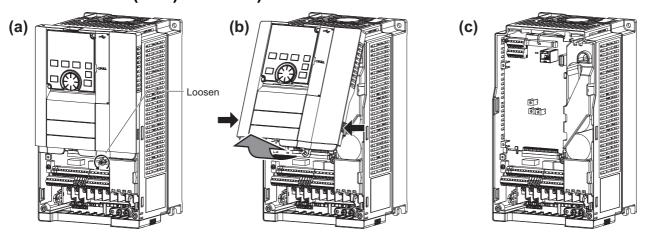
◆ Removal of the lower front cover (FR-A820-01540(30K) or lower, FR-A840-00770(30K) or lower)





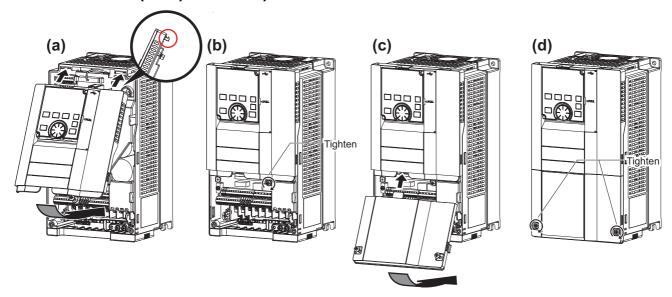
- (a) Loosen the screws on the lower front cover. (These screws cannot be removed.)
- (b) While holding the areas around the installation hooks on the sides of the lower front cover, pull out the cover using its upper side as a support.
- (c) With the lower front cover removed, the main circuit and the control circuit can be wired.

◆ Removal of the upper front cover (FR-A820-01540(30K) or lower, FR-A840-00770(30K) or lower)



- (a) With the lower front cover removed, loosen the screw on the upper front cover. (This screw cannot be removed.) (FR-A820-00340(5.5K) to FR-A820-01540(30K) and FR-A840-00170(5.5K) to FR-A840-00770(30K) have two mounting screws.)
- (b) While holding the areas around the installation hooks on the sides of the upper front cover, pull out the cover using its upper side as a support.
- (c) With the upper front cover removed, the RS-485 terminals can be wired and the plug-in option can be installed.

◆ Reinstallation of the front covers (FR-A820-01540(30K) or lower, FR-A840-00770(30K) or lower)

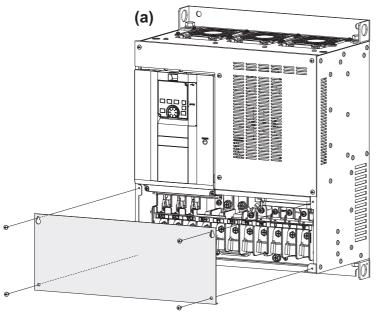


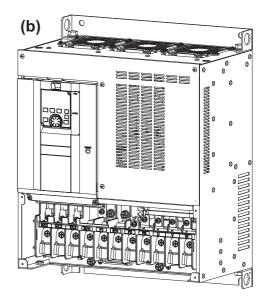
- (a) Clip on the upper front cover as illustrated. Check that it is properly secured.
- (b) Tighten the screws on the lower part of the cover. (FR-A820-00340(5.5K) to FR-A820-01540(30K) and FR-A840-00170(5.5K) to FR-A840-00770(30K) have two mounting screws.)
- (c) Install the lower front cover by inserting the upper hook into the socket of the upper front cover.
- (d) Tighten the screws on the lower part of the lower front cover.



· When installing the upper front cover, fit the connector of the operation panel securely along the guides of the PU connector.

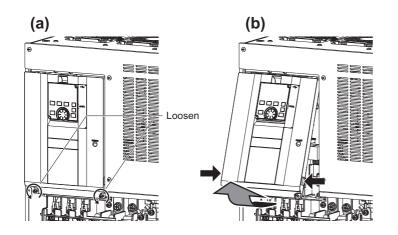
◆ Removal of the lower front cover (FR-A820-01870(37K) or higher, FR-A840-00930(37K) or higher)

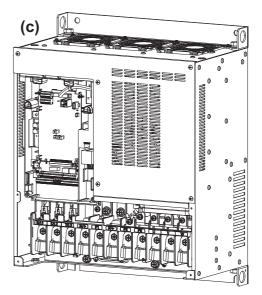




- (a) Remove the mounting screws to remove the lower front cover.
- (b) With the lower front cover removed, the main circuit can be wired.

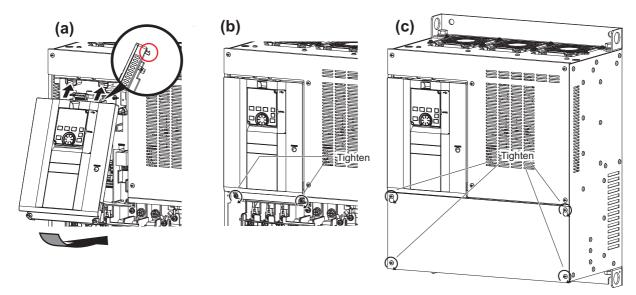
◆ Removal of the upper front cover (FR-A820-01870(37K) or higher, FR-A840-00930(37K) or higher)





- (a) With the lower front cover removed, loosen the screws on the upper front cover. (These screws cannot be removed.)
- (b) While holding the areas around the installation hooks on the sides of the upper front cover, pull out the cover using its upper side as a support.
- (c) With the upper front cover removed, the control circuit and the RS-485 terminals can be wired and the plug-in option can be installed.

◆ Reinstallation of the front covers (FR-A820-01870(37K) or higher, FR-A840-00930(37K) or higher)



- (a) Clip on the upper front cover as illustrated. Check that it is properly secured.
- (b) Tighten the screws on the lower part of the cover.
- (c) Attach the lower front cover using the screws.



• Fully make sure that the front cover has been reinstalled securely. Always tighten the installation screws of the front cover.

2.3 Installation of the inverter and enclosure design

When designing or manufacturing an inverter enclosure, determine the structure, size, and device layout of the enclosure by fully considering the conditions such as heat generation of the contained devices and the operating environment. An inverter unit uses many semiconductor devices. To ensure higher reliability and long period of operation, operate the inverter in the ambient environment that completely satisfies the equipment specifications.

2.3.1 Inverter installation environment

The following table lists the standard specifications of the inverter installation environment. Using the inverter in an environment that does not satisfy the conditions deteriorates the performance, shortens the life, and causes a failure. Refer to the following points, and take adequate measures.

Standard environmental specifications of the inverter

| | Item | | Description | | | | | |
|-----------------|------------------------------|--|--|--|--|--|--|--|
| Surrounding air | LD, ND (initial setting), HD | -10 to +50°C ^{*1} (non-freezing) | S cm Inverter Measurement position 5 cm 5 cm | | | | | |
| temperature | SLD | -10 to +40°C*2(non-freezing) | Measurement 5 cm | | | | | |
| Ambient humid | lity | With circuit board coating (conformi (non-condensing) Without circuit board coating: 90% | ing to class 3C2/3S2 in IEC 60721-3-3): 95% RH or less RH or less (non-condensing) | | | | | |
| Storage tempe | rature | -20 to +65°C ^{*3} | | | | | | |
| Atmosphere | | Indoors (free from corrosive gas, fla | ammable gas, oil mist, dust and dirt) | | | | | |
| Altitude | | Maximum 2500 m*4 | | | | | | |
| Vibration | <u> </u> | 5.9 m/s ² or less ^{*5} at 10 to 55 Hz (in either X, Y, or Z direction) | | | | | | |

- *1 0 to +50°C for the FR-A800-GF.
- *2 0 to +40°C for the FR-A800-GF.
- *3 Temperature applicable for a short time, for example, in transit.
- *4 For the installation at an altitude above 1000 m, consider a 3% reduction in the rated current per 500 m increase in altitude.
- *5 2.9 m/s² or less for the FR-A840-04320(160K) or higher.

◆ Temperature

The permissible surrounding air temperature of the inverter is between -10°C and +50°C (-10°C and +40°C at the SLD rating). (The permissible surrounding air temperature of the FR-A800-GF is between 0 and +50°C (0 and +40°C for the SLD rating).) Always operate the inverter within this temperature range. Operation outside this range will considerably shorten the service lives of the semiconductors, parts, capacitors and others. Take the following measures to keep the surrounding air temperature of the inverter within the specified range.

■ Measures against high temperature

- Use a forced ventilation system or similar cooling system. (Refer to page 41.)
- · Install the enclosure in an air-conditioned electric chamber.
- · Block direct sunlight.
- Provide a shield or similar plate to avoid direct exposure to the radiated heat and wind of a heat source.
- · Ventilate the area around the enclosure well.

■ Measures against low temperature

- · Provide a space heater in the enclosure.
- · Do not power OFF the inverter. (Keep the start signal of the inverter OFF.)

■ Sudden temperature changes

- · Select an installation place where temperature does not change suddenly.
- Avoid installing the inverter near the air outlet of an air conditioner.
- If temperature changes are caused by opening/closing of a door, install the inverter away from the door.



• For the amount of heat generated by the inverter unit, refer to page 40.

Humidity

Operate the inverter within the ambient air humidity of usually 45 to 90% (up to 95% with circuit board coating). Too high humidity will pose problems of reduced insulation and metal corrosion. On the other hand, too low humidity may cause a spatial electrical breakdown. The humidity conditions for the insulation distance defined in JEM 1103 standard "Insulation Distance from Control Equipment" is 45 to 85%.

■ Measures against high humidity

- · Make the enclosure enclosed, and provide it with a hygroscopic agent.
- · Provide dry air into the enclosure from outside.
- · Provide a space heater in the enclosure.

■ Measures against low humidity

Air with proper humidity can be blown into the enclosure from outside. Also, when installing or inspecting the unit, discharge your body (static electricity) beforehand, and keep your body away from the parts and patterns.

■ Measures against condensation

Condensation may occur if frequent operation stops change the in-enclosure temperature suddenly or if the outside air temperature changes suddenly.

Condensation causes such faults as reduced insulation and corrosion.

- · Take the measures against high humidity.
- Do not power OFF the inverter. (Keep the start signal of the inverter OFF.)

◆ Dust, dirt, oil mist

Dust and dirt will cause such faults as poor contacts, reduced insulation and cooling effect due to the moisture-absorbed accumulated dust and dirt, and in-enclosure temperature rise due to a clogged filter. In an atmosphere where conductive powder floats, dust and dirt will cause such faults as malfunction, deteriorated insulation and short circuit in a short time. Since oil mist will cause similar conditions, it is necessary to take adequate measures.

■ Countermeasure

- Place the inverter in a totally enclosed enclosure.
 Take measures if the in-enclosure temperature rises. (Refer to page 41.)
- Purge air.

♦ Corrosive gas, salt damage

If the inverter is exposed to corrosive gas or to salt near a beach, the printed board patterns and parts will corrode or the relays and switches will result in poor contact.

Pump clean air from outside to make the in-enclosure air pressure higher than the outside air pressure.

In such places, take the measures given in the previous paragraph.

Explosive, flammable gases

As the inverter is non-explosion proof, it must be contained in an explosion-proof enclosure. In places where explosion may be caused by explosive gas, dust or dirt, an enclosure cannot be used unless it structurally complies with the guidelines and has passed the specified tests. This makes the enclosure itself expensive (including the test charges). The best way is to avoid installation in such places and install the inverter in a non-hazardous place.

High altitude

Use the inverter at an altitude of within 2500 m. For use at an altitude above 1000 m, consider a 3% reduction in the rated current per 500 m increase in altitude.

If it is used at a higher place, it is likely that thin air will reduce the cooling effect and low air pressure will deteriorate dielectric strength.

♦ Vibration, impact

The vibration resistance of the inverter is up to 5.9 m/s^2 (2.9 m/s^2 or less for the FR-A840-04320(160K) or higher) at 10 to 55 Hz frequency and 1 mm amplitude for the directions of X, Y, Z axes. Applying vibration and impacts for a long time may loosen the structures and cause poor contacts of connectors, even if those vibration and impacts are within the specified values. Especially when impacts are applied repeatedly, caution must be taken because such impacts may break the installation feet.

■ Countermeasure

- Provide the enclosure with rubber vibration isolators.
- Strengthen the structure to prevent the enclosure from resonance.
- Install the enclosure away from the sources of the vibration.

2.3.2 Amount of heat generated by the inverter

♦ Installing the heat sink inside the enclosure

When the heat sink is installed inside the enclosure, the amount of heat generated by the inverter unit is shown in the following tables.

| | | Α | mount of hea | t generated (| (W) |
|-------------|----------------------|------|--------------|---------------|------|
| Voltage | Inverter model | SLD | LD | ND | HD |
| | FR-A820-00046(0.4K) | 60 | 55 | 40 | 30 |
| | FR-A820-00077(0.75K) | 95 | 85 | 60 | 40 |
| | FR-A820-00105(1.5K) | 140 | 130 | 110 | 70 |
| | FR-A820-00167(2.2K) | 200 | 185 | 130 | 100 |
| | FR-A820-00250(3.7K) | 310 | 285 | 190 | 135 |
| | FR-A820-00340(5.5K) | 355 | 320 | 240 | 160 |
| | FR-A820-00490(7.5K) | 525 | 480 | 350 | 230 |
| | FR-A820-00630(11K) | 570 | 515 | 370 | 280 |
| 200 V class | FR-A820-00770(15K) | 770 | 700 | 590 | 450 |
| | FR-A820-00930(18.5K) | 950 | 850 | 720 | 600 |
| | FR-A820-01250(22K) | 1000 | 950 | 880 | 840 |
| | FR-A820-01540(30K) | 1450 | 1300 | 1050 | 880 |
| | FR-A820-01870(37K) | 1650 | 1480 | 1270 | 1050 |
| | FR-A820-02330(45K) | 2120 | 1900 | 1610 | 1300 |
| | FR-A820-03160(55K) | 2750 | 2450 | 1830 | 1450 |
| | FR-A820-03800(75K) | 3020 | 2710 | 2180 | 1700 |
| | FR-A820-04750(90K) | 3960 | 3530 | 2700 | 2220 |
| | FR-A840-00023(0.4K) | 55 | 50 | 40 | 30 |
| | FR-A840-00038(0.75K) | 75 | 70 | 55 | 40 |
| | FR-A840-00052(1.5K) | 85 | 80 | 70 | 50 |
| | FR-A840-00083(2.2K) | 130 | 120 | 100 | 75 |
| | FR-A840-00126(3.7K) | 175 | 160 | 130 | 90 |
| | FR-A840-00170(5.5K) | 245 | 230 | 170 | 135 |
| | FR-A840-00250(7.5K) | 345 | 315 | 220 | 165 |
| | FR-A840-00310(11K) | 370 | 345 | 280 | 210 |
| | FR-A840-00380(15K) | 450 | 415 | 390 | 285 |
| | FR-A840-00470(18.5K) | 565 | 520 | 450 | 385 |
| | FR-A840-00620(22K) | 740 | 675 | 520 | 450 |
| 400 V class | FR-A840-00770(30K) | 930 | 825 | 690 | 560 |
| 400 V Class | FR-A840-00930(37K) | 1110 | 1020 | 840 | 700 |
| | FR-A840-01160(45K) | 1340 | 1220 | 1020 | 860 |
| | FR-A840-01800(55K) | 2000 | 1640 | 1290 | 1060 |
| | FR-A840-02160(75K) | 2520 | 2100 | 1790 | 1350 |
| | FR-A840-02600(90K) | 3150 | 2575 | 2200 | 1770 |
| | FR-A840-03250(110K) | 3600 | 2800 | 2300 | 1850 |
| | FR-A840-03610(132K) | 4050 | 3600 | 2800 | 2250 |
| | FR-A840-04320(160K) | 4650 | 3800 | 3450 | 2650 |
| | FR-A840-04810(185K) | 5300 | 4650 | 3850 | 3400 |
| | FR-A840-05470(220K) | 5850 | 5100 | 4550 | 3700 |
| | FR-A840-06100(250K) | 6650 | 5850 | 5100 | 4500 |
| | FR-A840-06830(280K) | 7550 | 6600 | 5900 | 5050 |



[•] The figures indicate the amount of heat generated when the output current is the rated current, power supply voltage is 220 V (200 V class) or 440 V (400 V class), and the carrier frequency is 2 kHz.

Installing the heat sink outside the enclosure

When the heat sink is installed outside the enclosure, the amount of heat generated by the inverter unit is shown in the following tables. (For details on protruding the heat sink through a panel, refer to page 44.)

| | | | | An | nount of hea | t generate | d (W) | | |
|-------------|----------------------|----------|--------------|------------|--------------|------------|--------------|-------------|-----------|
| Voltage | Inverter model | Heat sir | nk section (| outside of | enclosure) | Contro | ol section (| inside of e | nclosure) |
| | | SLD | LD | ND | HD | SLD | LD | ND | HD |
| | FR-A820-00105(1.5K) | 104 | 95 | 77 | 40 | 36 | 35 | 33 | 30 |
| | FR-A820-00167(2.2K) | 161 | 147 | 95 | 70 | 39 | 38 | 35 | 30 |
| | FR-A820-00250(3.7K) | 263 | 240 | 155 | 103 | 47 | 45 | 35 | 32 |
| | FR-A820-00340(5.5K) | 265 | 235 | 174 | 110 | 90 | 85 | 66 | 50 |
| | FR-A820-00490(7.5K) | 375 | 340 | 244 | 155 | 150 | 140 | 106 | 75 |
| | FR-A820-00630(11K) | 405 | 365 | 261 | 190 | 165 | 150 | 109 | 90 |
| | FR-A820-00770(15K) | 555 | 500 | 421 | 315 | 215 | 200 | 169 | 135 |
| 200 V class | FR-A820-00930(18.5K) | 690 | 615 | 520 | 430 | 260 | 235 | 200 | 170 |
| | FR-A820-01250(22K) | 700 | 665 | 620 | 595 | 300 | 285 | 260 | 245 |
| | FR-A820-01540(30K) | 1035 | 925 | 745 | 615 | 415 | 375 | 305 | 265 |
| | FR-A820-01870(37K) | 1170 | 1040 | 895 | 735 | 480 | 440 | 375 | 315 |
| | FR-A820-02330(45K) | 1520 | 1360 | 1150 | 920 | 600 | 540 | 460 | 380 |
| | FR-A820-03160(55K) | 1960 | 1740 | 1280 | 1000 | 790 | 710 | 550 | 450 |
| | FR-A820-03800(75K) | 2165 | 1930 | 1530 | 1180 | 855 | 780 | 650 | 520 |
| | FR-A820-04750(90K) | 2860 | 2530 | 1925 | 1560 | 1100 | 1000 | 775 | 660 |
| | FR-A840-00023(0.4K) | 20 | 18 | 12 | 6 | 35 | 32 | 28 | 24 |
| | FR-A840-00038(0.75K) | 36 | 32 | 23 | 12 | 39 | 38 | 32 | 28 |
| | FR-A840-00052(1.5K) | 42 | 39 | 33 | 19 | 43 | 41 | 37 | 31 |
| | FR-A840-00083(2.2K) | 77 | 71 | 57 | 38 | 53 | 49 | 43 | 37 |
| | FR-A840-00126(3.7K) | 120 | 109 | 86 | 53 | 55 | 51 | 44 | 37 |
| | FR-A840-00170(5.5K) | 180 | 170 | 120 | 90 | 65 | 60 | 50 | 45 |
| | FR-A840-00250(7.5K) | 260 | 235 | 160 | 115 | 85 | 80 | 60 | 50 |
| | FR-A840-00310(11K) | 260 | 245 | 195 | 145 | 110 | 100 | 85 | 65 |
| | FR-A840-00380(15K) | 315 | 290 | 275 | 200 | 135 | 125 | 115 | 85 |
| | FR-A840-00470(18.5K) | 395 | 360 | 310 | 265 | 170 | 160 | 140 | 120 |
| | FR-A840-00620(22K) | 510 | 465 | 360 | 305 | 230 | 210 | 160 | 145 |
| 400 V class | FR-A840-00770(30K) | 655 | 575 | 480 | 385 | 275 | 250 | 210 | 175 |
| 400 V Class | FR-A840-00930(37K) | 780 | 720 | 590 | 485 | 330 | 300 | 250 | 215 |
| | FR-A840-01160(45K) | 970 | 880 | 740 | 610 | 370 | 340 | 280 | 250 |
| | FR-A840-01800(55K) | 1400 | 1140 | 890 | 730 | 600 | 500 | 400 | 330 |
| | FR-A840-02160(75K) | 1780 | 1470 | 1250 | 925 | 740 | 630 | 540 | 425 |
| | FR-A840-02600(90K) | 2235 | 1820 | 1540 | 1230 | 915 | 755 | 660 | 540 |
| | FR-A840-03250(110K) | 2540 | 1960 | 1590 | 1260 | 1060 | 840 | 710 | 590 |
| | FR-A840-03610(132K) | 2830 | 2500 | 1950 | 1570 | 1220 | 1100 | 850 | 680 |
| | FR-A840-04320(160K) | 3250 | 2660 | 2410 | 1850 | 1400 | 1140 | 1040 | 800 |
| F | FR-A840-04810(185K) | 3700 | 3250 | 2690 | 2380 | 1600 | 1400 | 1160 | 1020 |
| | FR-A840-05470(220K) | 4090 | 3570 | 3180 | 2590 | 1760 | 1530 | 1370 | 1110 |
| <u> </u> | FR-A840-06100(250K) | 4650 | 4090 | 3570 | 3150 | 2000 | 1760 | 1530 | 1350 |
| | FR-A840-06830(280K) | 5280 | 4620 | 4130 | 3530 | 2270 | 1980 | 1770 | 1520 |



• The figures indicate the amount of heat generated when the output current is the rated current, power supply voltage is 220 V (200 V class) or 440 V (400 V class), and the carrier frequency is 2 kHz.

2.3.3 Cooling system types for inverter enclosure

From the enclosure that contains the inverter, the heat of the inverter and other equipment (transformers, lamps, resistors, etc.) and the incoming heat such as direct sunlight must be dissipated to keep the in-enclosure temperature lower than the permissible temperatures of the in-enclosure equipment including the inverter.

The cooling systems are classified as follows in terms of the cooling calculation method.

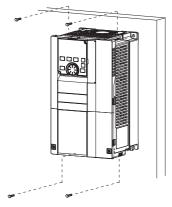
- · Cooling by natural heat dissipation from the enclosure surface (totally enclosed type)
- · Cooling by heat sink (aluminum fin, etc.)

- Cooling by ventilation (forced ventilation type, pipe ventilation type)
- Cooling by heat exchanger or cooler (heat pipe, cooler, etc.)

| | Cooling system | Enclosure structure | Comment |
|------------|---|---------------------|---|
| | Natural ventilation (enclosed type / open type) | → INV | This system is low in cost and generally used, but the enclosure size increases as the inverter capacity increases. This system is for relatively small capacities. |
| Natural | Natural ventilation (totally enclosed type) | | Being a totally enclosed type, this system is the most appropriate for hostile environment having dust, dirt, oil mist, etc. The enclosure size increases depending on the inverter capacity. |
| | Heat sink cooling | Heat sink INV | This system has restrictions on the heat sink mounting position and area. This system is for relatively small capacities. |
| Forced air | Forced ventilation | | This system is for general indoor installation. This is appropriate for enclosure downsizing and cost reduction, and often used. |
| | Heat pipe | Heat pipe | This system is a totally enclosed type, and is appropriate for enclosure downsizing. |

2.3.4 Inverter installation

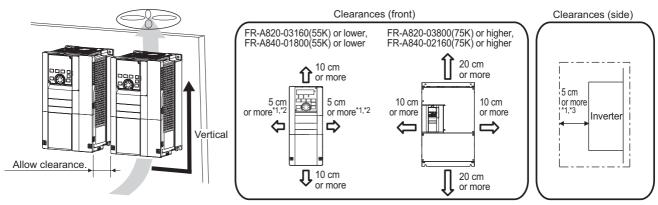
♦ Inverter placement



Fix six positions for the FR-A840-04320(160K) or higher.

- · Install the inverter on a strong surface securely with screws.
- · Leave enough clearances and take cooling measures.
- Avoid places where the inverter is subjected to direct sunlight, high temperature and high humidity.
- Install the inverter on a nonflammable wall surface.
- When encasing multiple inverters in an enclosure, install them in parallel as a cooling measure.
- For heat dissipation and maintenance, keep clearance between the inverter and the other devices or enclosure surface.

 The space below the inverter is required for wiring, and the space above the inverter is required for heat dissipation.
- When designing or building an enclosure for the inverter, carefully consider influencing factors such as heat generation of the contained devices and the operating environment.



- *1 For the FR-A820-00250(3.7K) or lower and FR-A840-00126(3.7K) or lower, allow 1 cm or more clearance.
- *2 When using the FR-A820-01250(22K) or lower and FR-A840-00620(22K) or lower at the surrounding air temperature of 40°C or less (30°C or less for the SLD rated inverter), inverters can be mounted side by side without leaving any clearance.
- *3 There needs to be a space of at least 30 cm in front of the inverter to replace the cooling fan of the FR-A840-04320(160K) or higher. Refer to page 816 for fan replacement.

Installation orientation of the inverter

Install the inverter on a wall as specified. Do not mount it horizontally or in any other way.

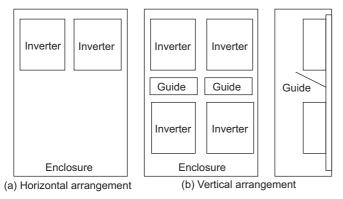
◆ Above the inverter

Heat is blown up from inside the inverter by the small fan built in the unit. Any equipment placed above the inverter should be heat resistant.

Arrangement of multiple inverters

When multiple inverters are placed in the same enclosure, generally arrange them horizontally as shown in the figure (a). When it is inevitable to arrange them vertically to minimize space, take such measures as to provide guides between the inverters since heat generated in the inverters in bottom row can increase the temperatures in the inverters in top row, causing inverter failures.

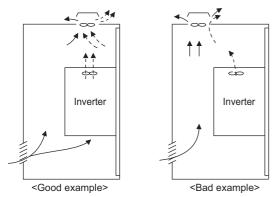
When installing multiple inverters, fully take measures to prevent the surrounding air temperature of the inverter from being higher than the permissible value by providing ventilation or increasing the enclosure size.



Arrangement of multiple inverters

◆ Arrangement of the ventilation fan and inverter

Heat generated in the inverter is blown up from the bottom of the unit as warm air by the cooling fan. When installing a ventilation fan for that heat, determine the place of ventilation fan installation after fully considering an air flow. (Air passes through areas of low resistance. Make an airway and airflow plates to expose the inverter to cool air.)



Arrangement of the ventilation fan and inverter

2.3.5 Protruding the heat sink through a panel

When encasing the inverter to an enclosure, the heat generated in the enclosure can be greatly reduced by protruding the heat sink of the inverter.

When installing the inverter in a compact enclosure, etc., this installation method is recommended.

♦ When using the panel through attachment (FR-A8CN)

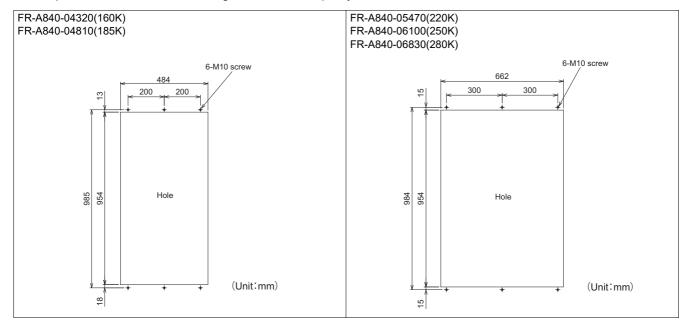
For the FR-A820-00105(1.5K) to 04750(90K) and the FR-A840-00023(0.4K) to 03610(132K), a heat sink can be protruded outside the enclosure using a panel through attachment (FR-A8CN). (For the FR-A840-04320(160K) or higher, the attachment is not necessary when the heat sink is to be protruded.)

For a panel cut dimension drawing and an installation procedure of the panel through attachment (FR-A8CN) to the inverter, refer to a manual of FR-A8CN.

◆ Protrusion of heat sink for the FR-A840-04320(160K) or higher

■ Panel cutting

Cut the panel of the enclosure according to the inverter capacity.

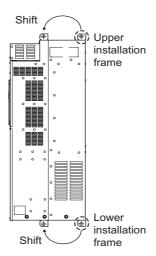


■ Mount point change of installation frame from the rear to the front

The upper and lower installation frames are attached on the inverter (one for each position).

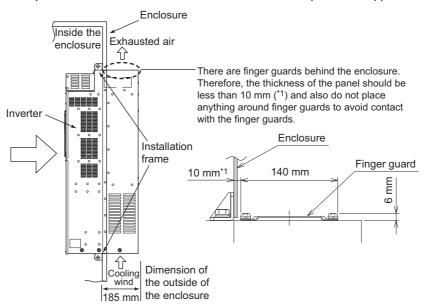
Change the mount point of the upper and lower installation frames from the rear to the front as shown in the figure.

When reattaching the installation frames, make sure that the installation orientation is correct.



■ Installation of the inverter on the enclosure

Push the inverter heat sink part outside the enclosure, and fix the inverter to the panel with upper and lower installation frames.

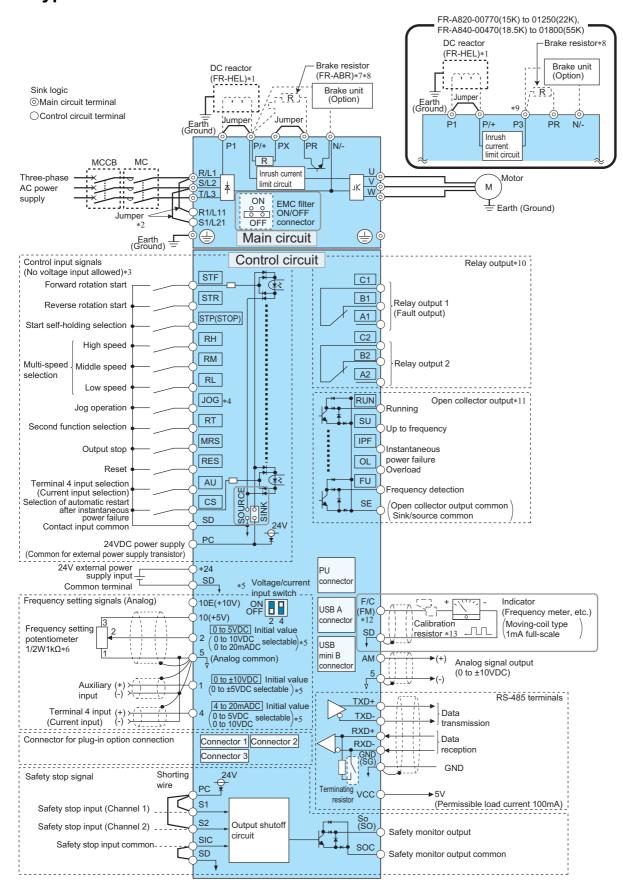




- As the heat sink part protruded through the panel includes a cooling fan, this type of installation is not suitable for the environment of water drops, oil, mist, dust, etc.
- Be careful not to drop screws, dust etc. into the inverter and cooling fan section.

Terminal connection diagrams

◆ Type FM

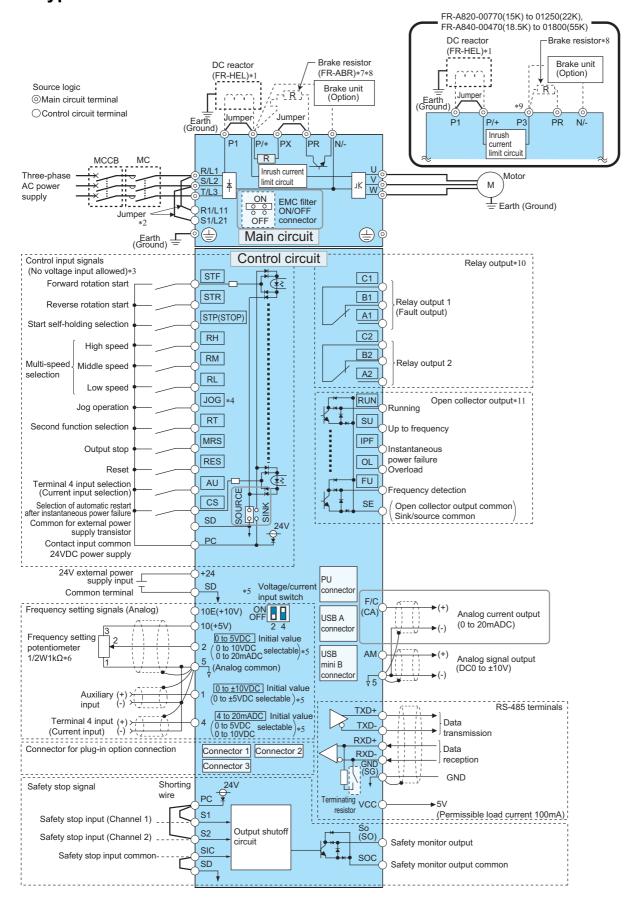


- *1 For the FR-A820-03800(75K) or higher, the FR-A840-02160(75K) or higher, or whenever a 75 kW or higher motor is used, always connect a DC reactor (FR-HEL), which is available as an option. Refer to page 826 to select the right DC reactor according to the applicable motor capacity. When a DC reactor is connected to the FR-A820-03160(55K) or lower or the FR-A840-01800(55K) or lower, if a jumper is installed across terminals P1 and P/+, remove the jumper before installing the DC reactor. (The jumper is not installed for the FR-A820-03800(75K) or higher and the FR-A840-02160(75K) or higher.)
- *2 When using separate power supply for the control circuit, remove the jumper between R1/L11 and S1/L21.
- *3 The function of these terminals can be changed using the Input terminal function selection (Pr.178 to Pr.189). (Refer to page 521.)
- *4 Terminal JOG is also used as a pulse train input terminal. Use **Pr.291** to choose JOG or pulse.
- *5 Terminal input specifications can be changed by analog input specification switchover (**Pr.73**, **Pr.267**). To input a voltage, set the corresponding switch of the voltage/current input selection switch assembly to the OFF position. To input a current, set the switch to the ON position. Terminals 10 and 2 are also used as a PTC input terminal (**Pr.561**). (Refer to page 421.)
- *6 It is recommended to use 2 W 1 k Ω when the frequency setting signal is changed frequently.
- *7 Remove the jumper between terminals PR and PX to connect the brake resistor. (FR-A820-00490(7.5K) or lower and FR-A840-00250(7.5K) or lower).
- *8 Connect a brake resistor across terminals P/+ (P3) and PR. (Terminal PR is equipped in the FR-A820-00046(0.4K) to 01250(22K), and FR-A840-00023(0.4K) to 01800(55K).) Install a thermal relay to prevent overheating and damage of brake resistors. (Refer to page 97.)
- *9 Do not connect the DC power supply (under DC feeding mode) to terminal P3.
- *10 The function of these terminals can be changed using the Output terminal function selection (Pr.195 or Pr.196). (Refer to page 473.)
- *11 The function of these terminals can be changed using the Output terminal function selection (Pr.190 to Pr.194). (Refer to page 473.)
- *12 Terminal FM can be used to output pulse trains as open collector output by setting **Pr.291**.
- *13 Not required when calibrating the scale with the operation panel.

NOTE

- To prevent a malfunction due to noise, keep the signal cables 10 cm or more away from the power cables. Also, keep the cables of the main circuit for input and output separated.
- After wiring, wire offcuts must not be left in the inverter.
 Wire offcuts can cause a fault, failure or malfunction. Always keep the inverter clean.
 - When drilling mounting holes in an enclosure etc., take caution not to allow chips and other foreign matter to enter the inverter.
- Set the switches of the voltage/current input selection switch assembly correctly. Incorrect setting may cause a fault, failure or malfunction.

♦ Type CA



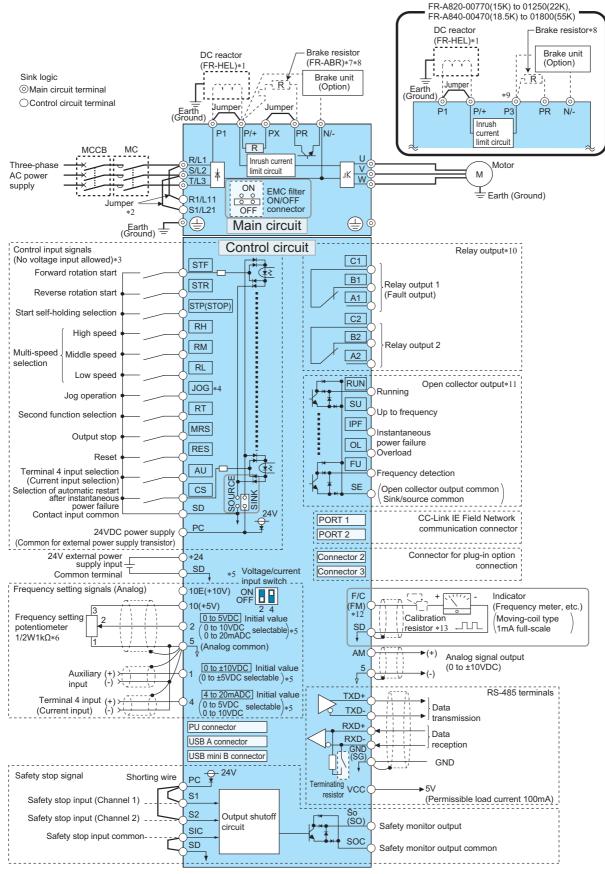
- *1 For the FR-A820-03800(75K) or higher, the FR-A840-02160(75K) or higher, or whenever a 75 kW or higher motor is used, always connect a DC reactor (FR-HEL), which is available as an option. Refer to page 826 to select the right DC reactor according to the applicable motor capacity. When a DC reactor is connected to the FR-A820-03160(55K) or lower or the FR-A840-01800(55K) or lower, if a jumper is installed across terminals P1 and P/+, remove the jumper before installing the DC reactor. (The jumper is not installed for the FR-A820-03800(75K) or higher and the FR-A840-02160(75K) or higher.)
- *2 When using separate power supply for the control circuit, remove the jumper between R1/L11 and S1/L21.
- *3 The function of these terminals can be changed using the Input terminal function selection (Pr.178 to Pr.189). (Refer to page 521.)
- *4 Terminal JOG is also used as a pulse train input terminal. Use Pr.291 to choose JOG or pulse.
- *5 Terminal input specifications can be changed by analog input specification switchover (**Pr.73**, **Pr.267**). To input a voltage, set the corresponding switch of the voltage/current input selection switch assembly to the OFF position. To input a current, set the switch to the ON position. Terminals 10 and 2 are also used as a PTC input terminal (**Pr.561**). (Refer to page 421.)
- *6 It is recommended to use 2 W 1 k Ω when the frequency setting signal is changed frequently.
- *7 Remove the jumper between terminals PR and PX to connect the brake resistor. (FR-A820-00490(7.5K) or lower and FR-A840-00250(7.5K) or lower).
- *8 Connect a brake resistor across terminals P/+ (P3) and PR. (Terminal PR is equipped in the FR-A820-00046(0.4K) to 01250(22K), and FR-A840-00023(0.4K) to 01800(55K).) Install a thermal relay to prevent overheating and damage of brake resistors. (Refer to page 97.)
- *9 Do not connect the DC power supply (under DC feeding mode) to terminal P3.
- *10 The function of these terminals can be changed using the Output terminal function selection (Pr.195 or Pr.196). (Refer to page 473.)
- *11 The function of these terminals can be changed with the output terminal assignment (Pr.190 to Pr.194). (Refer to page 473.)

• NOTE

- To prevent a malfunction due to noise, keep the signal cables 10 cm or more away from the power cables. Also, keep the cables of the main circuit for input and output separated.
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 Set the switches of the voltage/current input selection switch assembly correctly. Incorrect setting may cause a fault, failure or malfunction

◆ Type FM (FR-A800-GF)



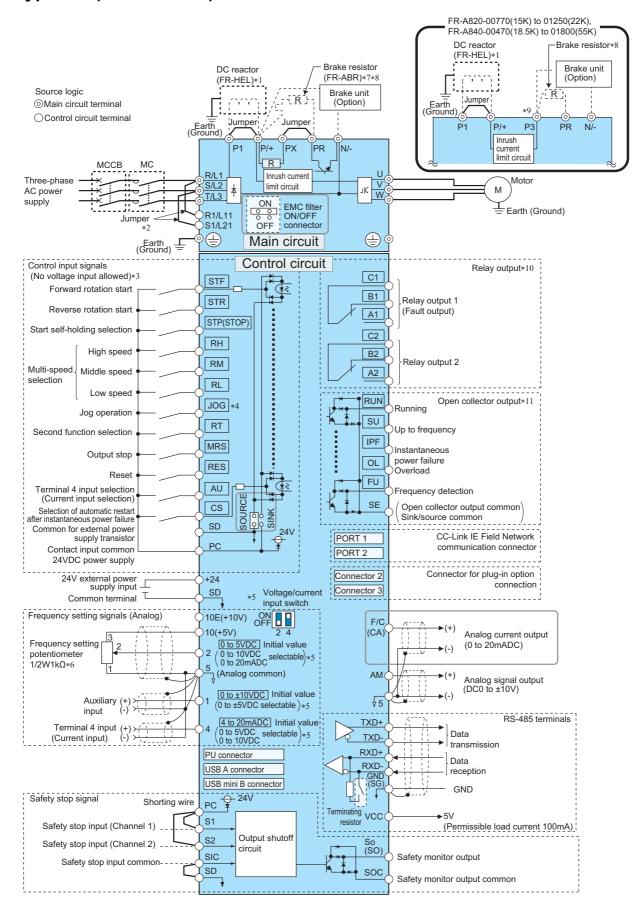
^{*1} For the FR-A820-03800(75K) or higher, the FR-A840-02160(75K) or higher, or whenever a 75 kW or higher motor is used, always connect a DC reactor (FR-HEL), which is available as an option. Refer to page 826 to select the right DC reactor according to the applicable motor capacity. When a DC reactor is connected to the FR-A820-03160(55K) or lower or the FR-A840-01800(55K) or lower, if a jumper is installed across terminals P1 and P/+, remove the jumper before installing the DC reactor. (The jumper is not installed for the FR-A820-03800(75K) or higher and the FR-A840-02160(75K) or higher.)

- *2 When using separate power supply for the control circuit, remove the jumper between R1/L11 and S1/L21.
- *3 The function of these terminals can be changed using the Input terminal function selection (Pr.178 to Pr.189). (Refer to page 521.)
- 4 Terminal JOG is also used as a pulse train input terminal. Use Pr.291 to choose JOG or pulse.
- *5 Terminal input specifications can be changed by analog input specification switchover (**Pr.73**, **Pr.267**). To input a voltage, set the corresponding switch of the voltage/current input selection switch assembly to the OFF position. To input a current, set the switch to the ON position. Terminals 10 and 2 are also used as a PTC input terminal (**Pr.561**). (Refer to page 421.)
- *6 It is recommended to use 2 W 1 kΩ when the frequency setting signal is changed frequently.
- *7 Remove the jumper between terminals PR and PX to connect the brake resistor. (FR-A820-00490(7.5K) or lower and FR-A840-00250(7.5K) or lower).
- *8 Connect a brake resistor across terminals P/+ (P3) and PR. (Terminal PR is equipped in the FR-A820-00046(0.4K) to 01250(22K), and FR-A840-00023(0.4K) to 01800(55K).) Install a thermal relay to prevent overheating and damage of brake resistors. (Refer to page 97.)
- *9 Do not connect the DC power supply (under DC feeding mode) to terminal P3.
- *10 The function of these terminals can be changed using the Output terminal function selection (Pr.195 or Pr.196). (Refer to page 473.)
- *11 The function of these terminals can be changed using the Output terminal function selection (Pr.190 to Pr.194). (Refer to page 473.)
- *12 Terminal FM can be used to output pulse trains as open collector output by setting Pr.291.
- *13 Not required when calibrating the scale with the operation panel.

MOTE

- To prevent a malfunction due to noise, keep the signal cables 10 cm or more away from the power cables. Also, keep the cables of the main circuit for input and output separated.
- After wiring, wire offcuts must not be left in the inverter.
 Wire offcuts can cause a fault, failure or malfunction. Always keep the inverter clean.
 - When drilling mounting holes in an enclosure etc., take caution not to allow chips and other foreign matter to enter the inverter.
- Set the switches of the voltage/current input selection switch assembly correctly. Incorrect setting may cause a fault, failure or malfunction.

◆ Type CA (FR-A800-GF)



- *1 For the FR-A820-03800(75K) or higher, the FR-A840-02160(75K) or higher, or whenever a 75 kW or higher motor is used, always connect a DC reactor (FR-HEL), which is available as an option. Refer to page 826 to select the right DC reactor according to the applicable motor capacity. When a DC reactor is connected to the FR-A820-03160(55K) or lower or the FR-A840-01800(55K) or lower, if a jumper is installed across terminals P1 and P/+, remove the jumper before installing the DC reactor. (The jumper is not installed for the FR-A820-03800(75K) or higher and the FR-A840-02160(75K) or higher.)
- *2 When using separate power supply for the control circuit, remove the jumper between R1/L11 and S1/L21.
- *3 The function of these terminals can be changed using the Input terminal function selection (Pr.178 to Pr.189). (Refer to page 521.)
- *4 Terminal JOG is also used as a pulse train input terminal. Use **Pr.291** to choose JOG or pulse.
- *5 Terminal input specifications can be changed by analog input specification switchover (**Pr.73**, **Pr.267**). To input a voltage, set the corresponding switch of the voltage/current input selection switch assembly to the OFF position. To input a current, set the switch to the ON position. Terminals 10 and 2 are also used as a PTC input terminal (**Pr.561**). (Refer to page 421.)
- *6 It is recommended to use 2 W 1 k Ω when the frequency setting signal is changed frequently.
- *7 Remove the jumper between terminals PR and PX to connect the brake resistor. (FR-A820-00490(7.5K) or lower and FR-A840-00250(7.5K) or lower).
- *8 Connect a brake resistor across terminals P/+ (P3) and PR. (Terminal PR is equipped in the FR-A820-00046(0.4K) to 01250(22K), and FR-A840-00023(0.4K) to 01800(55K).) Install a thermal relay to prevent overheating and damage of brake resistors. (Refer to page 97.)
- *9 Do not connect the DC power supply (under DC feeding mode) to terminal P3.
- *10 The function of these terminals can be changed using the Output terminal function selection (Pr.195 or Pr.196). (Refer to page 473.)
- *11 The function of these terminals can be changed with the output terminal assignment (Pr.190 to Pr.194). (Refer to page 473.)

• NOTE

- To prevent a malfunction due to noise, keep the signal cables 10 cm or more away from the power cables. Also, keep the cables of the main circuit for input and output separated.
- cables of the main circuit for input and output separated.
 After wiring, wire offcuts must not be left in the inverter.
 Wire offcuts can cause a fault, failure or malfunction. Always keep the inverter clean.
- Set the switches of the voltage/current input selection switch assembly correctly. Incorrect setting may cause a fault, failure or malfunction

When drilling mounting holes in an enclosure etc., take caution not to allow chips and other foreign matter to enter the inverter.

2.5 Main circuit terminals

Details on the main circuit terminals 2.5.1

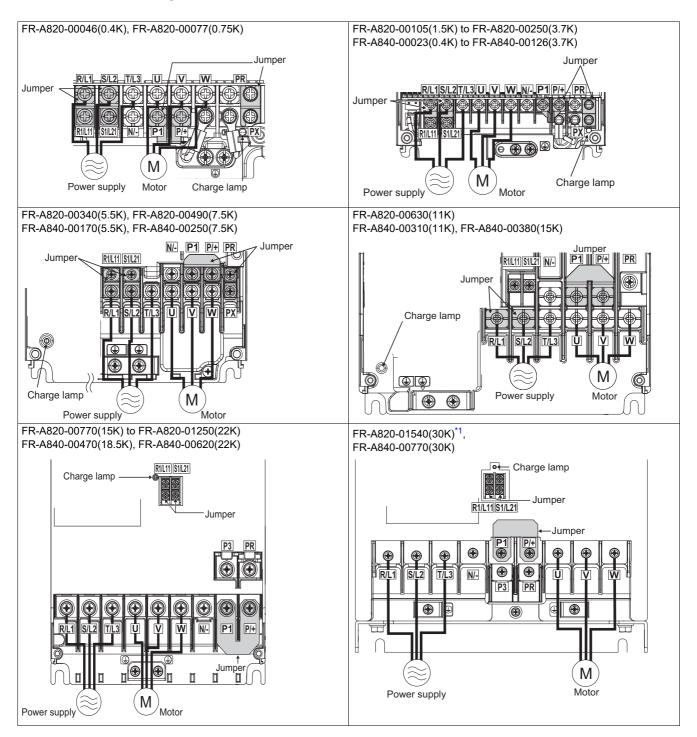
| Terminal symbol | Terminal name | Terminal function description | Refer to page |
|---------------------|---|---|---------------|
| R/L1, S/L2, T/L3 | AC power input | Connect these terminals to the commercial power supply. Do not connect anything to these terminals when using the high power factor converter (FR-HC2), multifunction regeneration converter (FR-XC)*1, or power regeneration common converter (FR-CV). | _ |
| U, V, W | Inverter output | Connect these terminals to a three-phase squirrel cage motor or a PM motor. | _ |
| R1/L11, S1/L21 | Power supply for the control circuit | Connected to the AC power supply terminals R/L1 and S/L2. To retain the fault display and fault output, or to use the high power factor converter (FR-HC2), multifunction regeneration converter (FR-CV), remove the jumpers across terminals R/L1 and R1/L11 and across S/L2 and S1/L21, and supply external power to these terminals. The power capacity necessary when separate power is supplied from R1/L11 and S1/L21 differs according to the inverter capacity. FR-A820-00630(11K) or lower, FR-A840-00380(15K) or lower: 60 VA FR-A820-00770(15K) or higher, FR-A840-00470(18.5K) or higher: 80 VA | 77 |
| P/+, PR | Brake resistor connection for FR-A820-00630(11K) or lower, or FR-A840-00380(15K) or lower | Connect an optional brake resistor (FR-ABR) across terminals P/+ and PR. Remove the jumper across terminals PR and PX for the inverter capacity that has terminal PX. Connecting a brake resistor increases the regenerative braking capability. | 97 |
| P3, PR | Brake resistor connection for FR-A820-00770(15K) to 01250(22K), or FR-A840-00470(18.5K) to 01800(55K) | Connect an optional brake resistor across terminals P3 and PR. Connecting a brake resistor increases the regenerative braking capability. | |
| P/+, N/- P3, N/- | Brake unit connection Brake unit connection for FR-A820-00770(15K) to 01250(22K), or FR-A840-00470(18.5K) to 01800(55K) | Connect the brake unit (FR-BU2, FR-BU, BU), power regeneration common converter (FR-CV), power regeneration converter (MT-RC), high power factor converter (FR-HC2), multifunction regeneration converter (FR-XC), or DC power supply (under DC feeding mode). When connecting multiple inverters, FR-A820-00770(15K) to 01250(22K) or FR-A840-00470(18.5K) to 01800(55K), in parallel using the FR-CV, FR-HC2, or FR-XC*1, always use either terminal P/+ or P3 for the connection. (Do not use terminals P/+ and P3 together.) Do not connect the DC power supply between terminals P3 and N/ Use terminals P/+ and N/- for DC feeding. | 100 |
| P/+, P1 | DC reactor connection for FR-A820-03160(55K) or lower, or FR-A840-01800(55K) or lower DC reactor connection for FR-A820-03800(75K) or higher, or | Remove the jumper across terminals P/+ and P1, and connect a DC reactor. When a DC reactor is not connected, the jumper across terminals P/+ and P1 should not be removed. When using a motor with a capacity of 75 kW or higher, always connect a DC reactor, which is available as an option. Always connect a DC reactor, which is available as an option. | 109 |
| PR, PX | FR-A840-02160(75K) or higher Built-in brake circuit connection | When the jumper is connected across terminals PX and PR (initial status), the built-in brake circuit is valid. The built-in brake circuit is equipped in the FR-A820-00490(7.5K) or lower and FR-A840-00250(7.5K) or lower. | _ |
| | Earth (ground) | For earthing (grounding) the inverter chassis. Be sure to earth (ground) the inverter. | 67 |

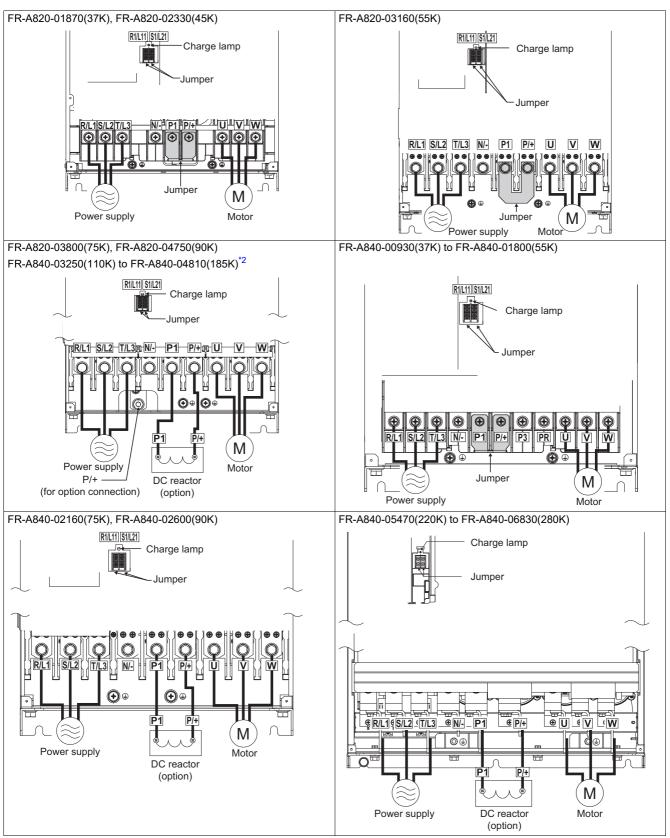
^{*1} Available when used in the common bus regeneration mode



• When connecting an optional brake resistor (FR-ABR) or a brake unit (FR-BU2, FR-BU, BU), remove the jumpers across terminals PR and PX. For the details, refer to page 97.

2.5.2 Main circuit terminal layout and wiring to power supply and motor

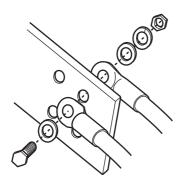




- *1 Terminals P3 and PR of the FR-A820-01540(30K) are not provided with a screw. Do not connect anything to them.
- *2 When an option other than the DC reactor must be connected to terminal P/+, use terminal P/+ (for option connection).



- Make sure the power cables are connected to the R/L1, S/L2, and T/L3. (Phase need not be matched.) Never connect the power cable to the U, V, and W of the inverter. Doing so will damage the inverter.
- Connect the motor to U, V, and W. (The phases must be matched.)
- When wiring the inverter main circuit conductor of the FR-A840-05470(220K) or higher, tighten a nut from the right side of the
 conductor. When wiring two cables, place cables on both sides of the conductor. For wiring, use bolts (nuts) provided with the
 inverter. (Refer to the following figure.)



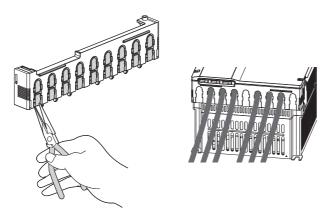
■ Handling of the wiring cover

(FR-A820-00630(11K) to 01250(22K), FR-A840-00310(11K) to 00620(22K))

For the hook of the wiring cover, cut off the necessary parts using a pair of needle-nose pliers etc.



• Cut off the same number of lugs as wires. If parts where no wire is put through have been cut off (10 mm or more), protective structure (IEC 60529) becomes an open type (IP00).



2.5.3 Recommended cables and wiring length

Select a recommended size cable to ensure that the voltage drop ratio is within 2%.

If the wiring distance is long between the inverter and motor, the voltage drop in the main circuit will cause the motor torque to decrease especially at a low speed.

The following tables show the recommended cable size for cables that are 20 m in length.

♦ For the ND rating

• 200 V class (220 V input power supply, without a power factor improving AC or DC reactor)

| | | | Crimp t | erminal | Cable gauge | | | | | | | | |
|-------------------------------|-----------------------------|-----------------|-------------------------|---------|------------------------|------------|------------|----------------------------------|------------------------|-------------------|------------------------|------------|----------------------------------|
| Applicable | Terminal | Tightening | Crimp | emma | HI | V cable | s, etc. (| mm²)*1 | AWG/ | MCM ^{*2} | PVC c | ables, e | tc. (mm²)*3 |
| inverter model FR-A820-[] | screw size ^{*4} | torque (N·m) | R/L1, S/L2, T/ L3 | U, V, W | R/L1, S/L2, T/L3 | U, V, W | P/+, P1 | Earthing (grounding) cable | R/L1, S/L2, T/L3 | U, V, W | R/L1, S/L2, T/L3 | U, V, W | Earthing (grounding) cable |
| 00046(0.4K) to 00167(2.2K) | M4 | 1.5 | 2-4 | 2-4 | 2 | 2 | 2 | 2 | 14 | 14 | 2.5 | 2.5 | 2.5 |
| 00250(3.7K) | M4 | 1.5 | 5.5-4 | 5.5-4 | 3.5 | 3.5 | 3.5 | 3.5 | 12 | 12 | 4 | 4 | 4 |
| 00340(5.5K) | M5 (M4) | 2.5 | 5.5-5 | 5.5-5 | 5.5 | 5.5 | 5.5 | 5.5 | 10 | 10 | 6 | 6 | 6 |
| 00490(7.5K) | M5 (M4) | 2.5 | 14-5 | 8-5 | 14 | 8 | 14 | 5.5 | 6 | 8 | 16 | 10 | 16 |
| 00630(11K) | M5 | 2.5 | 14-5 | 14-5 | 14 | 14 | 14 | 8 | 6 | 6 | 16 | 16 | 16 |
| 00770(15K) | M6 | 4.4 | 22-6 | 22-6 | 22 | 22 | 22 | 14 | 4 | 4 | 25 | 25 | 16 |
| 00930(18.5K) | M8 (M6) | 7.8 | 38-8 | 22-8 | 38 | 22 | 38 | 14 | 2 | 4 | 35 | 25 | 25 |
| 01250(22K) | M8 (M6) | 7.8 | 38-8 | 38-8 | 38 | 38 | 38 | 22 | 2 | 2 | 35 | 35 | 25 |
| 01540(30K) | M8 (M6) | 7.8 | 60-8 | 60-8 | 60 | 60 | 60 | 22 | 1/0 | 1/0 | 50 | 50 | 25 |
| 01870(37K) | M10 (M8) | 26.5 | 80-10 | 60-10 | 80 | 60 | 80 | 22 | 3/0 | 1/0 | 70 | 70 | 35 |
| 02330(45K) | M10 (M8) | 26.5 | 100-10 | 100-10 | 100 | 100 | 100 | 38 | 4/0 | 4/0 | 95 | 95 | 50 |
| 03160(55K) | M12 (M8) | 46 | 100-12 | 100-12 | 100 | 100 | 100 | 38 | 4/0 | 4/0 | 95 | 95 | 50 |

• 200 V class (220 V input power supply, with a power factor improving AC or DC reactor)

| | | Tightoning | Outure 4 | | | | | Ca | ble gau | ge | | | |
|-------------------------------|-----------------------------|-----------------|-------------------------|---------|------------------------|------------|------------|----------------------------------|------------------------|-------------------|------------------------|------------|----------------------------------|
| Applicable | Terminal | Tightening | Crimp t | erminai | HI | V cable | s, etc. (ı | mm ²) ^{*1} | AWG/ | MCM ^{*2} | PVC c | ables, e | tc. (mm ²)*3 |
| inverter model FR-A820-[] | screw size ^{*4} | torque (N·m) | R/L1, S/L2, T/ L3 | u, v, w | R/L1, S/L2, T/L3 | U, V, W | P/+, P1 | Earthing (grounding) cable | R/L1, S/L2, T/L3 | U, V, W | R/L1, S/L2, T/L3 | U, V, W | Earthing (grounding) cable |
| 00046(0.4K) to 00167(2.2K) | M4 | 1.5 | 2-4 | 2-4 | 2 | 2 | 2 | 2 | 14 | 14 | 2.5 | 2.5 | 2.5 |
| 00250(3.7K) | M4 | 1.5 | 5.5-4 | 5.5-4 | 3.5 | 3.5 | 3.5 | 3.5 | 12 | 12 | 4 | 4 | 4 |
| 00340(5.5K) | M5 (M4) | 2.5 | 5.5-5 | 5.5-5 | 5.5 | 5.5 | 5.5 | 5.5 | 10 | 10 | 6 | 6 | 6 |
| 00490(7.5K) | M5 (M4) | 2.5 | 14-5 | 8-5 | 14 | 8 | 14 | 5.5 | 8 | 8 | 10 | 10 | 10 |
| 00630(11K) | M5 | 2.5 | 14-5 | 14-5 | 14 | 14 | 14 | 8 | 6 | 6 | 16 | 16 | 16 |
| 00770(15K) | M6 | 4.4 | 22-6 | 22-6 | 22 | 22 | 22 | 14 | 4 | 4 | 25 | 25 | 16 |
| 00930(18.5K) | M8 (M6) | 7.8 | 22-8 | 22-8 | 22 | 22 | 38 | 14 | 4 | 4 | 25 | 25 | 16 |
| 01250(22K) | M8 (M6) | 7.8 | 38-8 | 38-8 | 38 | 38 | 38 | 22 | 2 | 2 | 35 | 35 | 25 |
| 01540(30K) | M8 (M6) | 7.8 | 60-8 | 60-8 | 60 | 60 | 60 | 22 | 1/0 | 1/0 | 50 | 50 | 25 |
| 01870(37K) | M10 (M8) | 26.5 | 60-10 | 60-10 | 60 | 60 | 80 | 22 | 1/0 | 1/0 | 70 | 70 | 35 |
| 02330(45K) | M10 (M8) | 26.5 | 100-10 | 100-10 | 100 | 100 | 100 | 38 | 4/0 | 4/0 | 95 | 95 | 50 |
| 03160(55K) | M12 (M8) | 46 | 100-12 | 100-12 | 100 | 100 | 100 | 38 | 4/0 | 4/0 | 95 | 95 | 50 |
| 03800(75K) | M12 (M8) | 46 | 150-12 | 150-12 | 125 | 125 | 125 | 38 | 250 | 250 | 120 | 120 | _ |
| 04750(90K) | M12 (M8) | 46 | 150-12 | 150-12 | 150 | 150 | 150 | 38 | 300 | 300 | 150 | 150 | _ |

• 400 V class (440 V input power supply, without a power factor improving AC or DC reactor)

| | | | Crimp t | erminal | | | | Ca | ble gau | ge | | | |
|----------------------------------|-----------------------------|-----------------|----------------------|---------|------------------------|------------|------------|----------------------------------|------------------------|-------------------|------------------------|------------|----------------------------------|
| Applicable | Terminal | Tightening | Crimp t | emma | HI | V cable | s, etc. (| mm²)*1 | AWG/ | MCM ^{*2} | PVC c | ables, e | etc. (mm ²)*3 |
| inverter model FR-A840-[] | screw size ^{*4} | torque (N·m) | R/L1, S/ L2, T/L3 | U, V, W | R/L1, S/L2, T/L3 | U, V, W | P/+, P1 | Earthing (grounding) cable | R/L1, S/L2, T/L3 | U, V, W | R/L1, S/L2, T/L3 | U, V, W | Earthing (grounding) cable |
| 00023(0.4K) to 00126(3.7K) | M4 | 1.5 | 2-4 | 2-4 | 2 | 2 | 2 | 2 | 14 | 14 | 2.5 | 2.5 | 2.5 |
| 00170(5.5K) | M4 | 1.5 | 2-4 | 2-4 | 2 | 2 | 3.5 | 3.5 | 12 | 14 | 2.5 | 2.5 | 4 |
| 00250(7.5K) | M4 | 1.5 | 5.5-4 | 5.5-4 | 3.5 | 3.5 | 3.5 | 3.5 | 12 | 12 | 4 | 4 | 4 |
| 00310(11K) | M5 | 2.5 | 5.5-5 | 5.5-5 | 5.5 | 5.5 | 5.5 | 5.5 | 10 | 10 | 6 | 6 | 10 |
| 00380(15K) | M5 | 2.5 | 8-5 | 5.5-5 | 8 | 5.5 | 8 | 5.5 | 8 | 10 | 10 | 6 | 10 |
| 00470(18.5K) | M6 | 4.4 | 14-6 | 8-6 | 14 | 8 | 14 | 8 | 6 | 8 | 16 | 10 | 16 |
| 00620(22K) | M6 | 4.4 | 14-6 | 14-6 | 14 | 14 | 22 | 14 | 6 | 6 | 16 | 16 | 16 |
| 00770(30K) | M6 | 4.4 | 22-6 | 22-6 | 22 | 22 | 22 | 14 | 4 | 4 | 25 | 25 | 16 |
| 00930(37K) | M8 | 7.8 | 22-8 | 22-8 | 22 | 22 | 22 | 14 | 4 | 4 | 25 | 25 | 16 |
| 01160(45K) | M8 | 7.8 | 38-8 | 38-8 | 38 | 38 | 38 | 22 | 1 | 2 | 50 | 50 | 25 |
| 01800(55K) | M8 | 7.8 | 60-8 | 60-8 | 60 | 60 | 60 | 22 | 1/0 | 1/0 | 50 | 50 | 25 |

400 V class (440 V input power supply, with a power factor improving AC or DC reactor)

| | | | Crimp terminal | | Cable gauge | | | | | | | | | |
|------------------------------|-----------------------------|-----------------|-------------------------|---------|------------------------|------------|------------|----------------------------------|------------------------|-------------------|------------------------|------------|----------------------------------|--|
| Applicable | Terminal | Tightening | Crimp t | erminai | HI | V cable | s, etc. (ı | mm²)*1 | AWG/ | MCM ^{*2} | PVC c | ables, e | tc. (mm²)*3 | |
| inverter model FR-A840-[] | screw size ^{*4} | torque (N·m) | R/L1, S/L2, T/ L3 | U, V, W | R/L1, S/L2, T/L3 | U, V, W | P/+, P1 | Earthing (grounding) cable | R/L1, S/L2, T/L3 | U, V, W | R/L1, S/L2, T/L3 | U, V, W | Earthing (grounding) cable | |
| 00023(0.4K) | | | | | | | | | | | | | | |
| to 00126(3.7K) | M4 | 1.5 | 2-4 | 2-4 | 2 | 2 | 2 | 2 | 14 | 14 | 2.5 | 2.5 | 2.5 | |
| 00170(5.5K) | M4 | 1.5 | 2-4 | 2-4 | 2 | 2 | 3.5 | 3.5 | 12 | 14 | 2.5 | 2.5 | 4 | |
| 00250(7.5K) | M4 | 1.5 | 5.5-4 | 5.5-4 | 3.5 | 3.5 | 3.5 | 3.5 | 12 | 12 | 4 | 4 | 4 | |
| 00310(11K) | M5 | 2.5 | 5.5-5 | 5.5-5 | 5.5 | 5.5 | 5.5 | 5.5 | 10 | 10 | 6 | 6 | 10 | |
| 00380(15K) | M5 | 2.5 | 5.5-5 | 5.5-5 | 5.5 | 5.5 | 8 | 5.5 | 10 | 10 | 6 | 6 | 10 | |
| 00470(18.5K) | M6 | 4.4 | 8-6 | 8-6 | 8 | 8 | 14 | 8 | 8 | 8 | 10 | 10 | 16 | |
| 00620(22K) | M6 | 4.4 | 14-6 | 14-6 | 14 | 14 | 22 | 14 | 6 | 6 | 16 | 16 | 16 | |
| 00770(30K) | M6 | 4.4 | 22-6 | 22-6 | 22 | 22 | 22 | 14 | 4 | 4 | 25 | 25 | 16 | |
| 00930(37K) | M8 | 7.8 | 22-8 | 22-8 | 22 | 22 | 22 | 14 | 4 | 4 | 25 | 25 | 16 | |
| 01160(45K) | M8 | 7.8 | 38-8 | 38-8 | 38 | 38 | 38 | 22 | 2 | 2 | 50 | 50 | 25 | |
| 01800(55K) | M8 | 7.8 | 60-8 | 60-8 | 60 | 60 | 60 | 22 | 1/0 | 1/0 | 50 | 50 | 25 | |
| 02160(75K) | M10 | 26.5 | 60-10 | 60-10 | 60 | 60 | 60 | 22 | 1/0 | 1/0 | 50 | 50 | 25 | |
| 02600(90K) | M10 | 26.5 | 60-10 | 60-10 | 60 | 60 | 80 | 22 | 3/0 | 3/0 | 50 | 50 | 25 | |
| 03250(110K) | M10 (M12) | 26.5 | 80-10 | 80-10 | 80 | 80 | 80 | 22 | 3/0 | 3/0 | 70 | 70 | 35 | |
| 03610(132K) | M10 (M12) | 26.5 | 100-10 | 100-10 | 100 | 100 | 100 | 38 | 4/0 | 4/0 | 95 | 95 | 50 | |
| 04320(160K) | M12 (M10) | 46 | 150-12 | 150-12 | 125 | 125 | 150 | 38 | 250 | 250 | 120 | 120 | 70 | |
| 04810(185K) | M12 (M10) | 46 | 150-12 | 150-12 | 150 | 150 | 150 | 38 | 300 | 300 | 150 | 150 | 95 | |
| 05470(220K) | M12 (M10) | 46 | 100-12 | 100-12 | 2×100 | 2×100 | 2×100 | 60 | 2×4/0 | 2×4/0 | 2×95 | 2×95 | 95 | |
| 06100(250K) | M12 (M10) | 46 | 100-12 | 100-12 | 2×100 | 2×100 | 2×125 | 60 | 2×4/0 | 2×4/0 | 2×95 | 2×95 | 95 | |
| 06830(280K) | M12 (M10) | 46 | 150-12 | 150-12 | 2×125 | 2×125 | 2×125 | 60 | 2×250 | 2×250 | 2×120 | 2×120 | 120 | |

- *1 For the FR-A820-03160(55K) or lower and FR-A840-01800(55K) or lower, HIV cable (600 V grade heat-resistant PVC insulated wire) etc. with a continuous maximum permissible temperature of 75°C. It assumes that the cables will be used in a surrounding air temperature of 50°C or less and the wiring distance is 20 m or shorter.
 - For the FR-A820-03800(75K) or higher, FR-A840-02160(75K) or higher, LMFC (heat resistant flexible cross-linked polyethylene insulated cable) etc. with a continuous maximum permissible temperature of 90°C or more. It is assumed that the cables will be used in a surrounding air temperatures of 50°C or less and housed in an enclosure.
- *2 For all the 200 V class capacities and FR-A840-01160(45K) or lower, THHW cable with a continuous maximum permissible temperature of 75°C. It assumes that the cables will be used in a surrounding air temperature of 40°C or less and the wiring distance is 20 m or shorter.
 - For the FR-A840-01800(55K) or higher, THHN cable with a continuous maximum permissible temperature of 90°C. It is assumed that the cables will be used in a surrounding air temperatures of 40°C or less and housed in an enclosure.
 - (For the use in the United States or Canada, refer to "Instructions for UL and cUL" in the Instruction Manual (Startup) or Instruction Manual (Hardware).)
- *3 For the FR-A820-00770(15K) or lower and the FR-A840-01160(45K) or lower, PVC cable with a continuous maximum permissible temperature of 70°C. It assumes that the cables will be used in a surrounding air temperature of 40°C or less and the wiring distance is 20 m or shorter. For the FR-A820-00930(18.5K) or higher and the FR-A840-01800(55K) or higher, XLPE cable with a continuous maximum permissible temperature of 90°C. It is assumed that the cables will be used in a surrounding air temperatures of 40°C or less and housed in an enclosure. (Selection example mainly for use in Europe.)
- *4 Screws for terminals R/L1, S/L2, T/L3, U, V, W, PR, PX, P/+, N/-, and P1, and the screw for earthing (grounding).

 The size of screws for terminals PR and PX on FR-A820-00340(5.5K) and FR-A820-00490(7.5K) is indicated in parentheses.

 The size of the earthing (grounding) screw on FR-A820-00930(18.5K) or higher and FR-A840-04320(160K) or higher is indicated in parentheses.

 The size of the screw for terminal P/+ for option connection on FR-A840-03250(110K) and FR-A840-03610(132K) is indicated in parentheses.

♦ For the SLD rating

• 200 V class (220 V input power supply, without a power factor improving AC or DC reactor)

| | | | Crimp terminal | | Cable gauge | | | | | | | | | |
|------------------------------|-----------------------------|-----------------|----------------------|---------|---|------------|------------|----------------------------------|------------------------|-------------------|---------------------------------------|------------|----------------------------------|--|
| Applicable | Terminal | Tightening | Crimp | erminai | HIV cables, etc. (mm ²) ^{*1} | | | | AWG/ | MCM ^{*2} | PVC cables, etc. (mm ²)*3 | | | |
| inverter model FR-A820-[] | screw size ^{*4} | torque (N·m) | R/L1, S/ L2, T/L3 | U, V, W | R/L1, S/L2, T/L3 | U, V, W | P/+, P1 | Earthing (grounding) cable | R/L1, S/L2, T/L3 | U, V, W | R/L1, S/L2, T/L3 | U, V, W | Earthing (grounding) cable | |
| 00046(0.4K) | M4 | 1.5 | 2-4 | 2-4 | 2 | 2 | 2 | 2 | 14 | 14 | 2.5 | 2.5 | 2.5 | |
| 00077(0.75K) | M4 | 1.5 | 2-4 | 2-4 | 2 | 2 | 2 | 2 | 14 | 14 | 2.5 | 2.5 | 2.5 | |
| 00105(1.5K) | M4 | 1.5 | 2-4 | 2-4 | 2 | 2 | 2 | 2 | 14 | 14 | 2.5 | 2.5 | 2.5 | |
| 00167(2.2K) | M4 | 1.5 | 5.5-4 | 5.5-4 | 3.5 | 3.5 | 3.5 | 3.5 | 12 | 12 | 4 | 4 | 4 | |
| 00250(3.7K) | M4 | 1.5 | 5.5-4 | 5.5-4 | 5.5 | 5.5 | 5.5 | 5.5 | 10 | 10 | 6 | 6 | 6 | |
| 00340(5.5K) | M5 (M4) | 2.5 | 14-5 | 8-5 | 14 | 8 | 14 | 5.5 | 6 | 8 | 16 | 10 | 16 | |
| 00490(7.5K) | M5 (M4) | 2.5 | 14-5 | 14-5 | 14 | 14 | 14 | 8 | 6 | 6 | 16 | 16 | 16 | |
| 00630(11K) | M5 | 2.5 | 22-5 | 22-5 | 22 | 22 | 22 | 14 | 4 | 4 | 25 | 25 | 16 | |

| | | | Crimp t | orminal | | | | Ca | ble gau | ge | | | |
|------------------------------|-----------------------------|-----------------|----------------------|---------|---|------------|------------|----------------------------------|------------------------|------------|---------------------------------------|------------|----------------------------|
| Applicable | Terminal | Tightening | Crimp terminal | | HIV cables, etc. (mm ²) ^{*1} | | | | AWG/MCM*2 | | PVC cables, etc. (mm ²)*3 | | |
| inverter model FR-A820-[] | screw size ^{*4} | torque (N·m) | R/L1, S/ L2, T/L3 | U, V, W | R/L1, S/L2, T/L3 | U, V, W | P/+, P1 | Earthing (grounding) cable | R/L1, S/L2, T/L3 | U, V, W | R/L1, S/L2, T/L3 | U, V, W | Earthing (grounding) cable |
| 00770(15K) | M6 | 4.4 | 38-6 | 22-6 | 38 | 22 | 38 | 14 | 2 | 4 | 50 | 25 | 25 |
| 00930(18.5K) | M8 (M6) | 7.8 | 38-8 | 38-8 | 38 | 38 | 38 | 22 | 2 | 2 | 50 | 50 | 25 |
| 01250(22K) | M8 (M6) | 7.8 | 60-8 | 60-8 | 60 | 60 | 60 | 22 | 1/0 | 1/0 | 50 | 50 | 25 |
| 01540(30K) | M8 (M6) | 7.8 | 80-8 | 80-8 | 80 | 80 | 80 | 22 | 3/0 | 3/0 | 70 | 70 | 35 |
| 01870(37K) | M10 (M8) | 26.5 | 100-10 | 100-10 | 100 | 100 | 100 | 38 | 4/0 | 4/0 | 95 | 95 | 50 |
| 02330(45K) | M10 (M8) | 26.5 | 100-10 | 100-10 | 100 | 100 | 100 | 38 | 4/0 | 4/0 | 95 | 95 | 50 |

• 200 V class (220 V input power supply, with a power factor improving AC or DC reactor)

| | | (| 0 | | Cable gauge | | | | | | | | |
|------------------------------|-----------------------------|-----------------|--------------------------|---------|------------------------|------------|------------|----------------------------------|------------------------|-------------------|------------------------|------------|----------------------------------|
| Applicable | Terminal | Tightening | Crimp t | erminal | HI | V cable | s, etc. (ı | mm ²)*1 | AWG/ | MCM ^{*2} | PVC c | ables, e | etc. (mm²)*3 |
| inverter model FR-A820-[] | screw size ^{*4} | torque (N·m) | R/L1, S/ L2, T/ L3 | U, V, W | R/L1, S/L2, T/L3 | U, V, W | P/+, P1 | Earthing (grounding) cable | R/L1, S/L2, T/L3 | U, V, W | R/L1, S/L2, T/L3 | U, V, W | Earthing (grounding) cable |
| 00046(0.4K) | M4 | 1.5 | 2-4 | 2-4 | 2 | 2 | 2 | 2 | 14 | 14 | 2.5 | 2.5 | 2.5 |
| 00077(0.75K) | M4 | 1.5 | 2-4 | 2-4 | 2 | 2 | 2 | 2 | 14 | 14 | 2.5 | 2.5 | 2.5 |
| 00105(1.5K) | M4 | 1.5 | 2-4 | 2-4 | 2 | 2 | 2 | 2 | 14 | 14 | 2.5 | 2.5 | 2.5 |
| 00167(2.2K) | M4 | 1.5 | 5.5-4 | 5.5-4 | 3.5 | 3.5 | 3.5 | 3.5 | 12 | 12 | 4 | 4 | 4 |
| 00250(3.7K) | M4 | 1.5 | 5.5-4 | 5.5-4 | 5.5 | 5.5 | 5.5 | 5.5 | 10 | 10 | 6 | 6 | 6 |
| 00340(5.5K) | M5 (M4) | 2.5 | 8-5 | 8-5 | 8 | 8 | 14 | 5.5 | 8 | 8 | 10 | 10 | 10 |
| 00490(7.5K) | M5 (M4) | 2.5 | 14-5 | 14-5 | 14 | 14 | 14 | 8 | 6 | 6 | 16 | 16 | 16 |
| 00630(11K) | M5 | 2.5 | 22-5 | 22-5 | 22 | 22 | 22 | 14 | 4 | 4 | 25 | 25 | 16 |
| 00770(15K) | M6 | 4.4 | 22-6 | 22-6 | 22 | 22 | 38 | 14 | 4 | 4 | 25 | 25 | 25 |
| 00930(18.5K) | M8 (M6) | 7.8 | 38-8 | 38-8 | 38 | 38 | 38 | 22 | 2 | 2 | 50 | 50 | 25 |
| 01250(22K) | M8 (M6) | 7.8 | 60-8 | 60-8 | 60 | 60 | 60 | 22 | 1/0 | 1/0 | 50 | 50 | 25 |
| 01540(30K) | M8 (M6) | 7.8 | 80-8 | 80-8 | 80 | 80 | 80 | 22 | 3/0 | 3/0 | 70 | 70 | 35 |
| 01870(37K) | M10 (M8) | 26.5 | 100-10 | 100-10 | 100 | 100 | 100 | 38 | 4/0 | 4/0 | 95 | 95 | 50 |
| 02330(45K) | M10 (M8) | 26.5 | 100-10 | 100-10 | 100 | 100 | 100 | 38 | 4/0 | 4/0 | 95 | 95 | 50 |
| 03160(55K) | M12 (M8) | 46 | 150-12 | 150-12 | 125 | 125 | 125 | 38 | 250 | 250 | 120 | 120 | _ |
| 03800(75K) | M12 (M8) | 46 | 150-12 | 150-12 | 150 | 150 | 150 | 38 | 2×4/0 | 2×4/0 | 2×95 | 2×95 | _ |
| 04750(90K) | M12 (M8) | 46 | 100-12 | 100-12 | 2×100 | 2×100 | 2×100 | 60 | 2×4/0 | 2×4/0 | 2×95 | 2×95 | _ |

• 400 V class (440 V input power supply, without a power factor improving AC or DC reactor)

| | | | Cuiman 4 | e wasin al | | | | Ca | ble gau | ge | | | |
|------------------------------|-----------------|-----------------|--------------------------|------------|------------------------|------------|------------|----------------------------------|------------------------|------------|------------------------|------------|----------------------------------|
| Applicable | Terminal | Tightening | Crimp | erminal | HI | V cable | s, etc. (| mm²)*1 | AWG/ | MCM*2 | PVC c | ables, e | tc. (mm²)*3 |
| inverter model FR-A840-[] | screw size*4 | torque (N·m) | R/L1, S/ L2, T/ L3 | u, v, w | R/L1, S/L2, T/L3 | U, V, W | P/+, P1 | Earthing (grounding) cable | R/L1, S/L2, T/L3 | U, V, W | R/L1, S/L2, T/L3 | U, V, W | Earthing (grounding) cable |
| 00023(0.4K) | M4 | 1.5 | 2-4 | 2-4 | 2 | 2 | 2 | 2 | 14 | 14 | 2.5 | 2.5 | 2.5 |
| 00038(0.75K) | M4 | 1.5 | 2-4 | 2-4 | 2 | 2 | 2 | 2 | 14 | 14 | 2.5 | 2.5 | 2.5 |
| 00052(1.5K) | M4 | 1.5 | 2-4 | 2-4 | 2 | 2 | 2 | 2 | 14 | 14 | 2.5 | 2.5 | 2.5 |
| 00083(2.2K) | M4 | 1.5 | 2-4 | 2-4 | 2 | 2 | 2 | 2 | 14 | 14 | 2.5 | 2.5 | 2.5 |
| 00126(3.7K) | M4 | 1.5 | 2-4 | 2-4 | 2 | 2 | 3.5 | 3.5 | 12 | 14 | 2.5 | 2.5 | 4 |
| 00170(5.5K) | M4 | 1.5 | 5.5-4 | 5.5-4 | 3.5 | 3.5 | 3.5 | 3.5 | 12 | 12 | 4 | 4 | 4 |
| 00250(7.5K) | M4 | 1.5 | 5.5-4 | 5.5-4 | 5.5 | 5.5 | 5.5 | 5.5 | 10 | 10 | 6 | 6 | 10 |
| 00310(11K) | M5 | 2.5 | 8-5 | 5.5-5 | 8 | 5.5 | 8 | 5.5 | 8 | 10 | 10 | 6 | 10 |
| 00380(15K) | M5 | 2.5 | 14-5 | 8-5 | 14 | 8 | 14 | 8 | 6 | 8 | 16 | 10 | 16 |
| 00470(18.5K) | M6 | 4.4 | 14-6 | 14-6 | 14 | 14 | 22 | 14 | 6 | 6 | 16 | 16 | 16 |
| 00620(22K) | M6 | 4.4 | 22-6 | 22-6 | 22 | 22 | 22 | 14 | 4 | 4 | 25 | 25 | 16 |
| 00770(30K) | M6 | 4.4 | 22-6 | 22-6 | 22 | 22 | 22 | 14 | 4 | 4 | 25 | 25 | 16 |
| 00930(37K) | M8 | 7.8 | 38-8 | 38-8 | 38 | 38 | 38 | 22 | 1 | 2 | 50 | 50 | 25 |
| 01160(45K) | M8 | 7.8 | 60-8 | 60-8 | 60 | 60 | 60 | 22 | 1/0 | 1/0 | 50 | 50 | 25 |

400 V class (440 V input power supply, with a power factor improving AC or DC reactor)

| | | | O::::::::::: 4 | | | | | Ca | ıble gau | ge | | | |
|------------------------------|-----------------------------|-----------------|-------------------------|---------|------------------------|------------|------------|----------------------------------|------------------------|------------|------------------------|------------|----------------------------------|
| Applicable | Terminal | Tightening | Crimp | erminal | HI | V cable | s, etc. (ı | mm²)*1 | AWG/ | MCM*2 | PVC c | ables, e | tc. (mm²)*3 |
| inverter model FR-A840-[] | screw size ^{*4} | torque (N·m) | R/L1, S/L2, T/ L3 | u, v, w | R/L1, S/L2, T/L3 | U, V, W | P/+, P1 | Earthing (grounding) cable | R/L1, S/L2, T/L3 | U, V, W | R/L1, S/L2, T/L3 | U, V, W | Earthing (grounding) cable |
| 00023(0.4K) | M4 | 1.5 | 2-4 | 2-4 | 2 | 2 | 2 | 2 | 14 | 14 | 2.5 | 2.5 | 2.5 |
| 00038(0.75K) | M4 | 1.5 | 2-4 | 2-4 | 2 | 2 | 2 | 2 | 14 | 14 | 2.5 | 2.5 | 2.5 |
| 00052(1.5K) | M4 | 1.5 | 2-4 | 2-4 | 2 | 2 | 2 | 2 | 14 | 14 | 2.5 | 2.5 | 2.5 |
| 00083(2.2K) | M4 | 1.5 | 2-4 | 2-4 | 2 | 2 | 2 | 2 | 14 | 14 | 2.5 | 2.5 | 2.5 |
| 00126(3.7K) | M4 | 1.5 | 2-4 | 2-4 | 2 | 2 | 3.5 | 3.5 | 14 | 14 | 2.5 | 2.5 | 4 |
| 00170(5.5K) | M4 | 1.5 | 5.5-4 | 5.5-4 | 3.5 | 3.5 | 3.5 | 3.5 | 12 | 12 | 4 | 4 | 4 |
| 00250(7.5K) | M4 | 1.5 | 5.5-4 | 5.5-4 | 5.5 | 5.5 | 5.5 | 5.5 | 10 | 10 | 6 | 6 | 10 |
| 00310(11K) | M5 | 2.5 | 5.5-5 | 5.5-5 | 5.5 | 5.5 | 8 | 5.5 | 10 | 10 | 6 | 6 | 10 |
| 00380(15K) | M5 | 2.5 | 8-5 | 8-5 | 8 | 8 | 14 | 8 | 8 | 8 | 10 | 10 | 16 |
| 00470(18.5K) | M6 | 4.4 | 14-6 | 14-6 | 14 | 14 | 22 | 14 | 6 | 6 | 16 | 16 | 16 |
| 00620(22K) | M6 | 4.4 | 22-6 | 22-6 | 22 | 22 | 22 | 14 | 4 | 4 | 25 | 25 | 16 |
| 00770(30K) | M6 | 4.4 | 22-6 | 22-6 | 22 | 22 | 22 | 14 | 4 | 4 | 25 | 25 | 16 |
| 00930(37K) | M8 | 7.8 | 38-8 | 38-8 | 38 | 38 | 38 | 22 | 2 | 2 | 50 | 50 | 25 |
| 01160(45K) | M8 | 7.8 | 60-8 | 60-8 | 60 | 60 | 60 | 22 | 1/0 | 1/0 | 50 | 50 | 25 |
| 01800(55K) | M8 | 7.8 | 60-8 | 60-8 | 60 | 60 | 60 | 22 | 1/0 | 1/0 | 50 | 50 | 25 |
| 02160(75K) | M10 | 26.5 | 80-10 | 80-10 | 80 | 80 | 80 | 22 | 3/0 | 3/0 | 70 | 70 | 35 |
| 02600(90K) | M10 | 26.5 | 100-10 | 100-10 | 100 | 100 | 100 | 38 | 4/0 | 4/0 | 95 | 95 | 50 |
| 03250(110K) | M10 (M12) | 26.5 | 150-10 | 150-10 | 125 | 125 | 150 | 38 | 250 | 250 | 120 | 120 | 70 |
| 03610(132K) | M10 (M12) | 26.5 | 150-10 | 150-10 | 150 | 150 | 150 | 38 | 300 | 300 | 150 | 150 | 95 |
| 04320(160K) | M12 (M10) | 46 | 100-12 | 100-12 | 2×100 | 2×100 | 2×100 | 60 | 2×4/0 | 2×4/0 | 2×95 | 2×95 | 95 |
| 04810(185K) | M12 (M10) | 46 | 100-12 | 100-12 | 2×100 | 2×100 | 2×125 | 60 | 2×4/0 | 2×4/0 | 2×95 | 2×95 | 95 |
| 05470(220K) | M12 (M10) | 46 | 150-12 | 150-12 | 2×125 | 2×125 | 2×125 | 60 | 2×250 | 2×250 | 2×120 | 2×120 | 120 |
| 06100(250K) | M12 (M10) | 46 | 150-12 | 150-12 | 2×150 | 2×150 | 2×150 | 60 | 2×300 | 2×300 | 2×150 | 2×150 | 150 |
| 06830(280K) | M12 (M10) | 46 | 150-12 | 150-12 | 2×200 | 2×200 | 2×200 | 100 | 2×350 | 2×350 | 2×185 | 2×185 | 2×95 |

- *1 For the FR-A820-03160(55K) or lower and FR-A840-01800(55K) or lower, HIV cable (600 V grade heat-resistant PVC insulated wire) etc. with a continuous maximum permissible temperature of 75°C. It assumes that the cables will be used in a surrounding air temperature of 50°C or less and the wiring distance is 20 m or shorter.
 - For the FR-A820-03800(75K) or higher, FR-A840-02160(75K) or higher, LMFC (heat resistant flexible cross-linked polyethylene insulated cable) etc. with a continuous maximum permissible temperature of 90°C or more. It is assumed that the cables will be used in a surrounding air temperatures of 50°C or less and housed in an enclosure.
- *2 For all the 200 V class capacities and FR-A840-01160(45K) or lower, THHW cable with a continuous maximum permissible temperature of 75°C. It assumes that the cables will be used in a surrounding air temperature of 40°C or less and the wiring distance is 20 m or shorter. For the FR-A840-01800(55K) or higher, THHN cable with a continuous maximum permissible temperature of 90°C. It is assumed that the cables will be used in a surrounding air temperatures of 40°C or less and housed in an enclosure. (For the use in the United States or Canada, refer to "Instructions for UL and cUL" in the Instruction Manual (Startup) or Instruction Manual (Hardware))
- *3 For the FR-A820-00770(15K) or lower and the FR-A840-01160(45K) or lower, PVC cable with a continuous maximum permissible temperature of 70°C. It assumes that the cables will be used in a surrounding air temperature of 40°C or less and the wiring distance is 20 m or shorter. For the FR-A820-00930(18.5K) or higher and the FR-A840-01800(55K) or higher, XLPE cable with a continuous maximum permissible temperature of 90°C. It is assumed that the cables will be used in a surrounding air temperatures of 40°C or less and housed in an enclosure. (Selection example mainly for use in Europe.)
- *4 Screws for terminals R/L1, S/L2, T/L3, U, V, W, PR, PX, P/+, N/-, and P1, and the screw for earthing (grounding).

 The size of screws for terminals PR and PX on FR-A820-00340(5.5K) and FR-A820-00490(7.5K) is indicated in parentheses.

 The size of the earthing (grounding) screw on FR-A820-00930(18.5K) or higher and FR-A840-04320(160K) or higher is indicated in parentheses.

 The size of the screw for terminal P/+ for option connection on FR-A840-03250(110K) and FR-A840-03610(132K) is indicated in parentheses.

♦ For the LD rating

• 200 V class (220 V input power supply, without a power factor improving AC or DC reactor)

| | | | Crimp t | erminal | | | | Ca | ble gau | ige | | | |
|------------------------------|-----------------------------|-----------------|--------------------------|---------|------------------------|------------|------------|----------------------------------|------------------------|-------------------|------------------------|------------|----------------------------------|
| Applicable | Terminal | Tightening | Crimp t | emma | HI | V cable | s, etc. (| mm²)*1 | AWG/ | MCM ^{*2} | PVC c | ables, e | tc. (mm²)*3 |
| inverter model FR-A820-[] | screw size ^{*4} | torque (N·m) | R/L1, S/ L2, T/ L3 | u, v, w | R/L1, S/L2, T/L3 | U, V, W | P/+, P1 | Earthing (grounding) cable | R/L1, S/L2, T/L3 | U, V, W | R/L1, S/L2, T/L3 | U, V, W | Earthing (grounding) cable |
| 00046(0.4K) | M4 | 1.5 | 2-4 | 2-4 | 2 | 2 | 2 | 2 | 14 | 14 | 2.5 | 2.5 | 2.5 |
| 00077(0.75K) | M4 | 1.5 | 2-4 | 2-4 | 2 | 2 | 2 | 2 | 14 | 14 | 2.5 | 2.5 | 2.5 |
| 00105(1.5K) | M4 | 1.5 | 2-4 | 2-4 | 2 | 2 | 2 | 2 | 14 | 14 | 2.5 | 2.5 | 2.5 |
| 00167(2.2K) | M4 | 1.5 | 5.5-4 | 5.5-4 | 3.5 | 3.5 | 3.5 | 3.5 | 12 | 12 | 4 | 4 | 4 |
| 00250(3.7K) | M4 | 1.5 | 5.5-4 | 5.5-4 | 5.5 | 5.5 | 5.5 | 5.5 | 10 | 10 | 6 | 6 | 6 |

| | | | Crimp t | erminal | | | | Ca | ble gau | ge | | | |
|------------------------------|-----------------------------|-----------------|--------------------------|---------|------------------------|------------|------------|----------------------------------|------------------------|-------------------|------------------------|------------|----------------------------|
| Applicable | Terminal | Tightening | Crimp | emma | HI | V cable | s, etc. (| mm²)*1 | AWG/ | MCM ^{*2} | PVC c | ables, e | tc. (mm²)*3 |
| inverter model FR-A820-[] | screw size ^{*4} | torque (N·m) | R/L1, S/ L2, T/ L3 | U, V, W | R/L1, S/L2, T/L3 | U, V, W | P/+, P1 | Earthing (grounding) cable | R/L1, S/L2, T/L3 | U, V, W | R/L1, S/L2, T/L3 | U, V, W | Earthing (grounding) cable |
| 00340(5.5K) | M5 (M4) | 2.5 | 8-5 | 5.5-5 | 14 | 5.5 | 14 | 5.5 | 6 | 10 | 16 | 6 | 16 |
| 00490(7.5K) | M5 (M4) | 2.5 | 14-5 | 14-5 | 14 | 14 | 14 | 8 | 6 | 6 | 16 | 16 | 16 |
| 00630(11K) | M5 | 2.5 | 22-5 | 22-5 | 22 | 22 | 22 | 14 | 4 | 4 | 25 | 25 | 16 |
| 00770(15K) | M6 | 4.4 | 38-6 | 22-6 | 38 | 22 | 38 | 14 | 2 | 4 | 35 | 25 | 25 |
| 00930(18.5K) | M8 (M6) | 7.8 | 38-8 | 38-8 | 38 | 38 | 38 | 22 | 2 | 2 | 35 | 35 | 25 |
| 01250(22K) | M8 (M6) | 7.8 | 60-8 | 60-8 | 60 | 60 | 60 | 22 | 1/0 | 1/0 | 50 | 50 | 25 |
| 01540(30K) | M8 (M6) | 7.8 | 80-8 | 60-8 | 80 | 60 | 80 | 22 | 3/0 | 1/0 | 70 | 70 | 35 |
| 01870(37K) | M10 (M8) | 26.5 | 100-10 | 100-10 | 100 | 100 | 100 | 38 | 4/0 | 4/0 | 95 | 95 | 50 |
| 02330(45K) | M10 (M8) | 26.5 | 100-10 | 100-10 | 100 | 100 | 100 | 38 | 4/0 | 4/0 | 95 | 95 | 50 |

• 200 V class (220 V input power supply, with a power factor improving AC or DC reactor)

| | | | Crimp t | erminal | | | | Ca | ble gau | ge | | | |
|------------------------------|-----------------------------|-----------------|--------------------------|---------|------------------------|------------|------------|----------------------------------|------------------------|-------------------|------------------------|------------|----------------------------------|
| Applicable | Terminal | Tightening | Crimp | emma | HI | V cable | s, etc. (ı | mm²)*1 | AWG/ | MCM ^{*2} | PVC c | ables, e | etc. (mm²)*3 |
| inverter model FR-A820-[] | screw size ^{*4} | torque (N·m) | R/L1, S/ L2, T/ L3 | U, V, W | R/L1, S/L2, T/L3 | U, V, W | P/+, P1 | Earthing (grounding) cable | R/L1, S/L2, T/L3 | U, V, W | R/L1, S/L2, T/L3 | U, V, W | Earthing (grounding) cable |
| 00046(0.4K) | M4 | 1.5 | 2-4 | 2-4 | 2 | 2 | 2 | 2 | 14 | 14 | 2.5 | 2.5 | 2.5 |
| 00077(0.75K) | M4 | 1.5 | 2-4 | 2-4 | 2 | 2 | 2 | 2 | 14 | 14 | 2.5 | 2.5 | 2.5 |
| 00105(1.5K) | M4 | 1.5 | 2-4 | 2-4 | 2 | 2 | 2 | 2 | 14 | 14 | 2.5 | 2.5 | 2.5 |
| 00167(2.2K) | M4 | 1.5 | 5.5-4 | 5.5-4 | 3.5 | 3.5 | 3.5 | 3.5 | 12 | 12 | 4 | 4 | 4 |
| 00250(3.7K) | M4 | 1.5 | 5.5-4 | 5.5-4 | 5.5 | 5.5 | 5.5 | 5.5 | 10 | 10 | 6 | 6 | 6 |
| 00340(5.5K) | M5 (M4) | 2.5 | 5.5-5 | 5.5-5 | 5.5 | 5.5 | 14 | 5.5 | 10 | 10 | 6 | 6 | 6 |
| 00490(7.5K) | M5 (M4) | 2.5 | 14-5 | 14-5 | 14 | 14 | 14 | 8 | 6 | 6 | 16 | 16 | 16 |
| 00630(11K) | M5 | 2.5 | 22-5 | 22-5 | 22 | 22 | 22 | 14 | 4 | 4 | 25 | 25 | 16 |
| 00770(15K) | M6 | 4.4 | 22-6 | 22-6 | 22 | 22 | 38 | 14 | 4 | 4 | 25 | 25 | 16 |
| 00930(18.5K) | M8 (M6) | 7.8 | 38-8 | 38-8 | 38 | 38 | 38 | 22 | 2 | 2 | 35 | 35 | 25 |
| 01250(22K) | M8 (M6) | 7.8 | 60-8 | 60-8 | 60 | 60 | 60 | 22 | 1/0 | 1/0 | 50 | 50 | 25 |
| 01540(30K) | M8 (M6) | 7.8 | 60-8 | 60-8 | 60 | 60 | 80 | 22 | 1/0 | 1/0 | 70 | 70 | 35 |
| 01870(37K) | M10 (M8) | 26.5 | 100-10 | 100-10 | 100 | 100 | 100 | 38 | 4/0 | 4/0 | 95 | 95 | 50 |
| 02330(45K) | M10 (M8) | 26.5 | 100-10 | 100-10 | 100 | 100 | 100 | 38 | 4/0 | 4/0 | 95 | 95 | 50 |
| 03160(55K) | M12 (M8) | 46 | 150-12 | 150-12 | 125 | 125 | 125 | 38 | 250 | 250 | 120 | 120 | _ |
| 03800(75K) | M12 (M8) | 46 | 150-12 | 150-12 | 150 | 150 | 150 | 38 | 2×4/0 | 2×4/0 | 150 | 150 | _ |
| 04750(90K) | M12 (M8) | 46 | 150-12 | 150-12 | 150 | 150 | 2×100 | 60 | 2×4/0 | 2×4/0 | 2×95 | 2×95 | _ |

• 400 V class (440 V input power supply, without a power factor improving AC or DC reactor)

| | | | Cuiman 4 | a was in a l | | | | Ca | ble gau | ge | | | |
|------------------------------|-----------------------------|-----------------|--------------------------|--------------|------------------------|------------|------------|----------------------------------|------------------------|-------------------|------------------------|------------|----------------------------------|
| Applicable | Terminal | Tightening | Crimp | erminal | HI | V cable | s, etc. (| mm ²) ^{*1} | AWG/ | MCM ^{*2} | PVC c | ables, e | tc. (mm²)*3 |
| inverter model FR-A840-[] | screw size ^{*4} | torque (N·m) | R/L1, S/ L2, T/ L3 | U, V, W | R/L1, S/L2, T/L3 | U, V, W | P/+, P1 | Earthing (grounding) cable | R/L1, S/L2, T/L3 | U, V, W | R/L1, S/L2, T/L3 | U, V, W | Earthing (grounding) cable |
| 00023(0.4K) | M4 | 1.5 | 2-4 | 2-4 | 2 | 2 | 2 | 2 | 14 | 14 | 2.5 | 2.5 | 2.5 |
| 00038(0.75K) | M4 | 1.5 | 2-4 | 2-4 | 2 | 2 | 2 | 2 | 14 | 14 | 2.5 | 2.5 | 2.5 |
| 00052(1.5K) | M4 | 1.5 | 2-4 | 2-4 | 2 | 2 | 2 | 2 | 14 | 14 | 2.5 | 2.5 | 2.5 |
| 00083(2.2K) | M4 | 1.5 | 2-4 | 2-4 | 2 | 2 | 2 | 2 | 14 | 14 | 2.5 | 2.5 | 2.5 |
| 00126(3.7K) | M4 | 1.5 | 2-4 | 2-4 | 2 | 2 | 3.5 | 3.5 | 12 | 14 | 2.5 | 2.5 | 4 |
| 00170(5.5K) | M4 | 1.5 | 5.5-4 | 5.5-4 | 3.5 | 3.5 | 3.5 | 3.5 | 12 | 12 | 4 | 4 | 4 |
| 00250(7.5K) | M4 | 1.5 | 5.5-4 | 5.5-4 | 5.5 | 5.5 | 5.5 | 5.5 | 10 | 10 | 6 | 6 | 10 |
| 00310(11K) | M5 | 2.5 | 8-5 | 5.5-5 | 8 | 5.5 | 8 | 5.5 | 8 | 10 | 10 | 6 | 10 |
| 00380(15K) | M5 | 2.5 | 14-5 | 8-5 | 14 | 8 | 14 | 8 | 6 | 8 | 16 | 10 | 16 |
| 00470(18.5K) | M6 | 4.4 | 14-6 | 14-6 | 14 | 14 | 22 | 14 | 6 | 6 | 16 | 16 | 16 |
| 00620(22K) | M6 | 4.4 | 22-6 | 22-6 | 22 | 22 | 22 | 14 | 4 | 4 | 25 | 25 | 16 |
| 00770(30K) | M6 | 4.4 | 22-6 | 22-6 | 22 | 22 | 22 | 14 | 4 | 4 | 25 | 25 | 16 |
| 00930(37K) | M8 | 7.8 | 38-8 | 38-8 | 38 | 38 | 38 | 22 | 1 | 2 | 50 | 50 | 25 |
| 01160(45K) | M8 | 7.8 | 60-8 | 60-8 | 60 | 60 | 60 | 22 | 1/0 | 1/0 | 50 | 50 | 25 |

400 V class (440 V input power supply, with a power factor improving AC or DC reactor)

| | | | Oniman 4 | | | | | Ca | ble gau | ge | | | |
|------------------------------|-----------------------------|-----------------|--------------------------|---------|------------------------|------------|------------|----------------------------------|------------------------|------------|------------------------|------------|----------------------------------|
| Applicable | Terminal | Tightening | Crimp t | erminai | HI | V cable | s, etc. (| mm²)*1 | AWG/I | MCM*2 | PVC c | ables, e | tc. (mm²)*3 |
| inverter model FR-A840-[] | screw size ^{*4} | torque (N·m) | R/L1, S/ L2, T/ L3 | u, v, w | R/L1, S/L2, T/L3 | U, V, W | P/+, P1 | Earthing (grounding) cable | R/L1, S/L2, T/L3 | U, V, W | R/L1, S/L2, T/L3 | U, V, W | Earthing (grounding) cable |
| 00023(0.4K) | M4 | 1.5 | 2-4 | 2-4 | 2 | 2 | 2 | 2 | 14 | 14 | 2.5 | 2.5 | 2.5 |
| 00038(0.75K) | M4 | 1.5 | 2-4 | 2-4 | 2 | 2 | 2 | 2 | 14 | 14 | 2.5 | 2.5 | 2.5 |
| 00052(1.5K) | M4 | 1.5 | 2-4 | 2-4 | 2 | 2 | 2 | 2 | 14 | 14 | 2.5 | 2.5 | 2.5 |
| 00083(2.2K) | M4 | 1.5 | 2-4 | 2-4 | 2 | 2 | 2 | 2 | 14 | 14 | 2.5 | 2.5 | 2.5 |
| 00126(3.7K) | M4 | 1.5 | 2-4 | 2-4 | 2 | 2 | 3.5 | 3.5 | 14 | 14 | 2.5 | 2.5 | 2.5 |
| 00170(5.5K) | M4 | 1.5 | 5.5-4 | 5.5-4 | 3.5 | 3.5 | 3.5 | 3.5 | 12 | 12 | 4 | 4 | 4 |
| 00250(7.5K) | M4 | 1.5 | 5.5-4 | 5.5-4 | 5.5 | 5.5 | 5.5 | 5.5 | 10 | 10 | 6 | 6 | 6 |
| 00310(11K) | M5 | 2.5 | 5.5-5 | 5.5-5 | 5.5 | 5.5 | 8 | 5.5 | 10 | 10 | 6 | 6 | 6 |
| 00380(15K) | M5 | 2.5 | 8-5 | 8-5 | 8 | 8 | 14 | 8 | 8 | 8 | 10 | 10 | 10 |
| 00470(18.5K) | M6 | 4.4 | 14-6 | 14-6 | 14 | 14 | 22 | 14 | 6 | 6 | 16 | 16 | 16 |
| 00620(22K) | M6 | 4.4 | 22-6 | 22-6 | 22 | 22 | 22 | 14 | 4 | 4 | 25 | 25 | 16 |
| 00770(30K) | M6 | 4.4 | 22-6 | 22-6 | 22 | 22 | 22 | 14 | 4 | 4 | 25 | 25 | 16 |
| 00930(37K) | M8 | 7.8 | 38-8 | 38-8 | 38 | 38 | 38 | 22 | 2 | 2 | 50 | 50 | 25 |
| 01160(45K) | M8 | 7.8 | 60-8 | 60-8 | 60 | 60 | 60 | 22 | 1/0 | 1/0 | 50 | 50 | 25 |
| 01800(55K) | M8 | 7.8 | 60-8 | 60-8 | 60 | 60 | 60 | 22 | 1/0 | 1/0 | 50 | 50 | 25 |
| 02160(75K) | M10 | 26.5 | 60-10 | 60-10 | 60 | 60 | 80 | 22 | 1/0 | 1/0 | 50 | 50 | 25 |
| 02600(90K) | M10 | 26.5 | 80-10 | 80-10 | 80 | 80 | 80 | 22 | 3/0 | 3/0 | 70 | 70 | 35 |
| 03250(110K) | M10 (M12) | 26.5 | 100-10 | 100-10 | 100 | 100 | 100 | 38 | 4/0 | 4/0 | 95 | 95 | 50 |
| 03610(132K) | M10 (M12) | 26.5 | 150-10 | 150-10 | 125 | 125 | 150 | 38 | 250 | 250 | 120 | 120 | 70 |
| 04320(160K) | M12 (M10) | 46 | 150-12 | 150-12 | 150 | 150 | 150 | 38 | 300 | 300 | 150 | 150 | 95 |
| 04810(185K) | M12 (M10) | 46 | 100-12 | 100-12 | 2×100 | 2×100 | 2×100 | 60 | 2×4/0 | 2×4/0 | 2×95 | 2×95 | 95 |
| 05470(220K) | M12 (M10) | 46 | 100-12 | 100-12 | 2×100 | 2×100 | 2×125 | 60 | 2×4/0 | 2×4/0 | 2×95 | 2×95 | 95 |
| 06100(250K) | M12 (M10) | 46 | 150-12 | 150-12 | 2×125 | 2×125 | 2×125 | 60 | 2×250 | 2×250 | 2×120 | 2×120 | 120 |
| 06830(280K) | M12 (M10) | 46 | 150-12 | 150-12 | 2×150 | 2×150 | 2×150 | 60 | 2×300 | 2×300 | 2×150 | 2×150 | 150 |

- *1 For the FR-A820-03160(55K) or lower and FR-A840-01800(55K) or lower, HIV cable (600 V grade heat-resistant PVC insulated wire) etc. with a continuous maximum permissible temperature of 75°C. It assumes that the cables will be used in a surrounding air temperature of 50°C or less and the wiring distance is 20 m or shorter.
 - For the FR-A820-03800(75K) or higher, FR-A840-02160(75K) or higher, LMFC (heat resistant flexible cross-linked polyethylene insulated cable) etc. with a continuous maximum permissible temperature of 90°C or more. It is assumed that the cables will be used in a surrounding air temperatures of 50°C or less and housed in an enclosure.
- *2 For all the 200 V class capacities and FR-A840-01160(45K) or lower, THHW cable with a continuous maximum permissible temperature of 75°C. It assumes that the cables will be used in a surrounding air temperature of 40°C or less and the wiring distance is 20 m or shorter. For the FR-A840-01800(55K) or higher, THHN cable with a continuous maximum permissible temperature of 90°C. It is assumed that the cables will be used in a surrounding air temperatures of 40°C or less and housed in an enclosure. (For the use in the United States or Canada, refer to "Instructions for UL and cUL" in the Instruction Manual (Startup) or Instruction Manual (Hardware))
- *3 For the FR-A820-00770(15K) or lower and the FR-A840-01160(45K) or lower, PVC cable with a continuous maximum permissible temperature of 70°C. It assumes that the cables will be used in a surrounding air temperature of 40°C or less and the wiring distance is 20 m or shorter. For the FR-A820-00930(18.5K) or higher and the FR-A840-01800(55K) or higher, XLPE cable with a continuous maximum permissible temperature of 90°C. It is assumed that the cables will be used in a surrounding air temperatures of 40°C or less and housed in an enclosure. (Selection example mainly for use in Europe.)
- *4 Screws for terminals R/L1, S/L2, T/L3, U, V, W, PR, PX, P/+, N/-, and P1, and the screw for earthing (grounding).

 The size of screws for terminals PR and PX on FR-A820-00340(5.5K) and FR-A820-00490(7.5K) is indicated in parentheses.

 The size of the earthing (grounding) screw on FR-A820-00930(18.5K) or higher and FR-A840-04320(160K) or higher is indicated in parentheses.

 The size of the screw for terminal P/+ for option connection on FR-A840-03250(110K) and FR-A840-03610(132K) is indicated in parentheses.

♦ For the HD rating

• 200 V class (220 V input power supply, without a power factor improving AC or DC reactor)

| | | | Crimp t | erminal | | | | Са | ble gau | ge | | | |
|------------------------------|-----------------------------|-----------------|--------------------------|---------|------------------------|------------|------------|----------------------------------|------------------------|-------------------|------------------------|------------|----------------------------------|
| Applicable | Terminal | Tightening | Crimp | emma | HI | V cable | s, etc. (| mm²)*1 | AWG/ | MCM ^{*2} | PVC c | ables, e | tc. (mm²)*3 |
| inverter model FR-A820-[] | screw size ^{*4} | torque (N·m) | R/L1, S/ L2, T/ L3 | U, V, W | R/L1, S/L2, T/L3 | U, V, W | P/+, P1 | Earthing (grounding) cable | R/L1, S/L2, T/L3 | U, V, W | R/L1, S/L2, T/L3 | U, V, W | Earthing (grounding) cable |
| 00046(0.4K) | M4 | 1.5 | 2-4 | 2-4 | 2 | 2 | 2 | 2 | 14 | 14 | 2.5 | 2.5 | 2.5 |
| 00077(0.75K) | M4 | 1.5 | 2-4 | 2-4 | 2 | 2 | 2 | 2 | 14 | 14 | 2.5 | 2.5 | 2.5 |
| 00105(1.5K) | M4 | 1.5 | 2-4 | 2-4 | 2 | 2 | 2 | 2 | 14 | 14 | 2.5 | 2.5 | 2.5 |
| 00167(2.2K) | M4 | 1.5 | 2-4 | 2-4 | 2 | 2 | 2 | 2 | 14 | 14 | 2.5 | 2.5 | 2.5 |
| 00250(3.7K) | M4 | 1.5 | 2-4 | 2-4 | 2 | 2 | 2 | 2 | 14 | 14 | 2.5 | 2.5 | 2.5 |

| | | | Crimp t | orminal | | | | Ca | ble gau | ge | | | |
|------------------------------|-----------------------------|-----------------|--------------------------|---------|------------------------|------------|------------|----------------------------------|------------------------|-------------------|------------------------|------------|----------------------------------|
| Applicable | Terminal | Tightening | Crimp t | emma | HI | V cable | s, etc. (| mm²)*1 | AWG/ | MCM ^{*2} | PVC c | ables, e | tc. (mm²)*3 |
| inverter model FR-A820-[] | screw size ^{*4} | torque (N·m) | R/L1, S/ L2, T/ L3 | U, V, W | R/L1, S/L2, T/L3 | U, V, W | P/+, P1 | Earthing (grounding) cable | R/L1, S/L2, T/L3 | U, V, W | R/L1, S/L2, T/L3 | U, V, W | Earthing (grounding) cable |
| 00340(5.5K) | M5 (M4) | 2.5 | 5.5-4 | 5.5-4 | 3.5 | 3.5 | 3.5 | 3.5 | 12 | 12 | 4 | 4 | 4 |
| 00490(7.5K) | M5 (M4) | 2.5 | 5.5-5 | 5.5-5 | 5.5 | 5.5 | 5.5 | 5.5 | 10 | 10 | 6 | 6 | 6 |
| 00630(11K) | M5 | 2.5 | 14-5 | 8-5 | 14 | 8 | 14 | 5.5 | 6 | 8 | 16 | 10 | 16 |
| 00770(15K) | M6 | 4.4 | 14-6 | 14-6 | 14 | 14 | 14 | 8 | 6 | 6 | 16 | 16 | 16 |
| 00930(18.5K) | M8 (M6) | 7.8 | 22-8 | 22-8 | 22 | 22 | 22 | 14 | 4 | 4 | 25 | 25 | 16 |
| 01250(22K) | M8 (M6) | 7.8 | 38-8 | 22-8 | 38 | 22 | 38 | 14 | 2 | 4 | 35 | 25 | 25 |
| 01540(30K) | M8 (M6) | 7.8 | 38-8 | 38-8 | 38 | 38 | 38 | 22 | 2 | 2 | 35 | 35 | 25 |
| 01870(37K) | M10 (M8) | 26.5 | 60-10 | 60-10 | 60 | 60 | 60 | 22 | 1/0 | 1/0 | 50 | 50 | 25 |
| 02330(45K) | M10 (M8) | 26.5 | 80-10 | 60-10 | 80 | 60 | 80 | 22 | 3/0 | 1/0 | 70 | 70 | 35 |
| 03160(55K) | M12 (M8) | 46 | 100-12 | 100-12 | 100 | 100 | 100 | 38 | 4/0 | 4/0 | 95 | 95 | 50 |

• 200 V class (220 V input power supply, with a power factor improving AC or DC reactor)

| | | | Cuiman 4 | e rmin el | | | | Ca | ble gau | ge | | | |
|------------------------------|-----------------------------|-----------------|--------------------------|-----------|------------------------|------------|------------|----------------------------------|------------------------|-------------------|------------------------|------------|----------------------------|
| Applicable | Terminal | Tightening | Crimp | erminal | HI | V cable | s, etc. (| mm²)*1 | AWG/ | MCM ^{*2} | PVC c | ables, e | tc. (mm²)*3 |
| inverter model FR-A820-[] | screw size ^{*4} | torque (N·m) | R/L1, S/ L2, T/ L3 | U, V, W | R/L1, S/L2, T/L3 | U, V, W | P/+, P1 | Earthing (grounding) cable | R/L1, S/L2, T/L3 | U, V, W | R/L1, S/L2, T/L3 | U, V, W | Earthing (grounding) cable |
| 00046(0.4K) | M4 | 1.5 | 2-4 | 2-4 | 2 | 2 | 2 | 2 | 14 | 14 | 2.5 | 2.5 | 2.5 |
| 00077(0.75K) | M4 | 1.5 | 2-4 | 2-4 | 2 | 2 | 2 | 2 | 14 | 14 | 2.5 | 2.5 | 2.5 |
| 00105(1.5K) | M4 | 1.5 | 2-4 | 2-4 | 2 | 2 | 2 | 2 | 14 | 14 | 2.5 | 2.5 | 2.5 |
| 00167(2.2K) | M4 | 1.5 | 2-4 | 2-4 | 2 | 2 | 2 | 2 | 14 | 14 | 2.5 | 2.5 | 2.5 |
| 00250(3.7K) | M4 | 1.5 | 2-4 | 2-4 | 2 | 2 | 2 | 2 | 14 | 14 | 2.5 | 2.5 | 2.5 |
| 00340(5.5K) | M5 (M4) | 2.5 | 5.5-5 | 5.5-5 | 3.5 | 3.5 | 3.5 | 3.5 | 12 | 12 | 4 | 4 | 4 |
| 00490(7.5K) | M5 (M4) | 2.5 | 5.5-5 | 5.5-5 | 5.5 | 5.5 | 5.5 | 5.5 | 10 | 10 | 6 | 6 | 6 |
| 00630(11K) | M5 | 2.5 | 14-5 | 8-5 | 14 | 8 | 14 | 5.5 | 8 | 8 | 10 | 10 | 10 |
| 00770(15K) | M6 | 4.4 | 14-6 | 14-6 | 14 | 14 | 14 | 8 | 6 | 6 | 16 | 16 | 16 |
| 00930(18.5K) | M8 (M6) | 7.8 | 22-8 | 22-8 | 22 | 22 | 22 | 14 | 4 | 4 | 25 | 25 | 16 |
| 01250(22K) | M8 (M6) | 7.8 | 22-8 | 22-8 | 22 | 22 | 38 | 14 | 4 | 4 | 25 | 25 | 16 |
| 01540(30K) | M8 (M6) | 7.8 | 38-8 | 38-8 | 38 | 38 | 38 | 22 | 2 | 2 | 35 | 35 | 25 |
| 01870(37K) | M10 (M8) | 26.5 | 60-10 | 60-10 | 60 | 60 | 60 | 22 | 1/0 | 1/0 | 50 | 50 | 25 |
| 02330(45K) | M10 (M8) | 26.5 | 60-10 | 60-10 | 60 | 60 | 80 | 22 | 1/0 | 1/0 | 70 | 70 | 35 |
| 03160(55K) | M12 (M8) | 46 | 100-12 | 100-12 | 100 | 100 | 100 | 38 | 4/0 | 4/0 | 95 | 95 | 50 |
| 03800(75K) | M12 (M8) | 46 | 100-12 | 100-12 | 100 | 100 | 100 | 38 | 4/0 | 4/0 | 95 | 95 | 50 |
| 04750(90K) | M12 (M8) | 46 | 150-12 | 150-12 | 125 | 125 | 125 | 38 | 250 | 250 | 120 | 120 | _ |

• 400 V class (440 V input power supply, without a power factor improving AC or DC reactor)

| | | | Crimp t | orminal | | | | Ca | ble gau | ge | | | |
|------------------------------|-----------------------------|-----------------|--------------------------|---------|------------------------|------------|------------|----------------------------------|------------------------|-------------------|------------------------|------------|----------------------------------|
| Applicable | Terminal | Tightening | Crimp t | erminal | HI | V cable | s, etc. (| mm ²) ^{*1} | AWG/ | MCM ^{*2} | PVC c | ables, e | etc. (mm ²)*3 |
| inverter model FR-A840-[] | screw size ^{*4} | torque (N·m) | R/L1, S/ L2, T/ L3 | U, V, W | R/L1, S/L2, T/L3 | U, V, W | P/+, P1 | Earthing (grounding) cable | R/L1, S/L2, T/L3 | U, V, W | R/L1, S/L2, T/L3 | U, V, W | Earthing (grounding) cable |
| 00023(0.4K) | M4 | 1.5 | 2-4 | 2-4 | 2 | 2 | 2 | 2 | 14 | 14 | 2.5 | 2.5 | 2.5 |
| 00038(0.75K) | M4 | 1.5 | 2-4 | 2-4 | 2 | 2 | 2 | 2 | 14 | 14 | 2.5 | 2.5 | 2.5 |
| 00052(1.5K) | M4 | 1.5 | 2-4 | 2-4 | 2 | 2 | 2 | 2 | 14 | 14 | 2.5 | 2.5 | 2.5 |
| 00083(2.2K) | M4 | 1.5 | 2-4 | 2-4 | 2 | 2 | 2 | 2 | 14 | 14 | 2.5 | 2.5 | 2.5 |
| 00126(3.7K) | M4 | 1.5 | 2-4 | 2-4 | 2 | 2 | 2 | 2 | 14 | 14 | 2.5 | 2.5 | 2.5 |
| 00170(5.5K) | M4 | 1.5 | 2-4 | 2-4 | 2 | 2 | 2 | 2 | 14 | 14 | 2.5 | 2.5 | 2.5 |
| 00250(7.5K) | M4 | 1.5 | 2-4 | 2-4 | 2 | 2 | 3.5 | 3.5 | 12 | 14 | 2.5 | 2.5 | 2.5 |
| 00310(11K) | M5 | 2.5 | 5.5-5 | 5.5-5 | 3.5 | 3.5 | 3.5 | 3.5 | 12 | 12 | 4 | 4 | 4 |
| 00380(15K) | M5 | 2.5 | 5.5-5 | 5.5-5 | 5.5 | 5.5 | 5.5 | 5.5 | 10 | 10 | 6 | 6 | 6 |
| 00470(18.5K) | M6 | 4.4 | 8-6 | 5.5-6 | 8 | 5.5 | 8 | 5.5 | 8 | 10 | 10 | 6 | 10 |
| 00620(22K) | M6 | 4.4 | 14-6 | 8-6 | 14 | 8 | 14 | 8 | 6 | 8 | 16 | 10 | 16 |
| 00770(30K) | M6 | 4.4 | 14-6 | 14-6 | 14 | 14 | 22 | 14 | 6 | 6 | 16 | 16 | 16 |
| 00930(37K) | M8 | 7.8 | 22-8 | 22-8 | 22 | 22 | 22 | 14 | 4 | 4 | 25 | 25 | 16 |
| 01160(45K) | M8 | 7.8 | 22-8 | 22-8 | 22 | 22 | 22 | 14 | 4 | 4 | 25 | 25 | 16 |
| 01800(55K) | M8 | 7.8 | 38-8 | 38-8 | 38 | 38 | 38 | 22 | 1 | 2 | 50 | 50 | 25 |

400 V class (440 V input power supply, with a power factor improving AC or DC reactor)

| | | | Oniman 4 | | | | | Ca | ble gau | ge | | | |
|------------------------------|-----------------------------|-----------------|--------------------------|---------|------------------------|------------|------------|----------------------------------|------------------------|------------|------------------------|------------|----------------------------------|
| Applicable | Terminal | Tightening | Crimp | erminal | HI | V cable | s, etc. (| mm²)*1 | AWG/ | MCM*2 | PVC c | ables, e | tc. (mm²)*3 |
| inverter model FR-A840-[] | screw size ^{*4} | torque (N·m) | R/L1, S/ L2, T/ L3 | u, v, w | R/L1, S/L2, T/L3 | U, V, W | P/+, P1 | Earthing (grounding) cable | R/L1, S/L2, T/L3 | U, V, W | R/L1, S/L2, T/L3 | U, V, W | Earthing (grounding) cable |
| 00023(0.4K) | M4 | 1.5 | 2-4 | 2-4 | 2 | 2 | 2 | 2 | 14 | 14 | 2.5 | 2.5 | 2.5 |
| 00038(0.75K) | M4 | 1.5 | 2-4 | 2-4 | 2 | 2 | 2 | 2 | 14 | 14 | 2.5 | 2.5 | 2.5 |
| 00052(1.5K) | M4 | 1.5 | 2-4 | 2-4 | 2 | 2 | 2 | 2 | 14 | 14 | 2.5 | 2.5 | 2.5 |
| 00083(2.2K) | M4 | 1.5 | 2-4 | 2-4 | 2 | 2 | 2 | 2 | 14 | 14 | 2.5 | 2.5 | 2.5 |
| 00126(3.7K) | M4 | 1.5 | 2-4 | 2-4 | 2 | 2 | 2 | 2 | 14 | 14 | 2.5 | 2.5 | 2.5 |
| 00170(5.5K) | M4 | 1.5 | 2-4 | 2-4 | 2 | 2 | 2 | 2 | 14 | 14 | 2.5 | 2.5 | 2.5 |
| 00250(7.5K) | M4 | 1.5 | 2-4 | 2-4 | 2 | 2 | 3.5 | 3.5 | 12 | 14 | 2.5 | 2.5 | 2.5 |
| 00310(11K) | M5 | 2.5 | 5.5-6 | 5.5-6 | 3.5 | 3.5 | 3.5 | 3.5 | 12 | 12 | 4 | 4 | 4 |
| 00380(15K) | M5 | 2.5 | 5.5-5 | 5.5-5 | 5.5 | 5.5 | 5.5 | 5.5 | 10 | 10 | 6 | 6 | 6 |
| 00470(18.5K) | M6 | 4.4 | 5.5-6 | 5.5-6 | 5.5 | 5.5 | 8 | 5.5 | 10 | 10 | 6 | 6 | 6 |
| 00620(22K) | M6 | 4.4 | 8-6 | 8-6 | 8 | 8 | 14 | 8 | 8 | 8 | 10 | 10 | 10 |
| 00770(30K) | M6 | 4.4 | 14-6 | 14-6 | 14 | 14 | 22 | 14 | 6 | 6 | 16 | 16 | 16 |
| 00930(37K) | M8 | 7.8 | 22-8 | 22-8 | 22 | 22 | 22 | 14 | 4 | 4 | 25 | 25 | 16 |
| 01160(45K) | M8 | 7.8 | 22-8 | 22-8 | 22 | 22 | 22 | 14 | 4 | 4 | 25 | 25 | 16 |
| 01800(55K) | M8 | 7.8 | 38-8 | 38-8 | 38 | 38 | 38 | 22 | 2 | 2 | 50 | 50 | 25 |
| 02160(75K) | M10 | 26.5 | 60-10 | 60-10 | 60 | 60 | 60 | 22 | 1/0 | 1/0 | 50 | 50 | 25 |
| 02600(90K) | M10 | 26.5 | 60-10 | 60-10 | 60 | 60 | 60 | 22 | 1/0 | 1/0 | 50 | 50 | 25 |
| 03250(110K) | M10 (M12) | 26.5 | 60-10 | 60-10 | 60 | 60 | 80 | 22 | 3/0 | 3/0 | 50 | 50 | 25 |
| 03610(132K) | M10 (M12) | 26.5 | 80-10 | 80-10 | 80 | 80 | 80 | 22 | 3/0 | 3/0 | 70 | 70 | 35 |
| 04320(160K) | M12 (M10) | 46 | 100-12 | 100-12 | 100 | 100 | 100 | 38 | 4/0 | 4/0 | 95 | 95 | 50 |
| 04810(185K) | M12 (M10) | 46 | 150-12 | 150-12 | 125 | 125 | 150 | 38 | 250 | 250 | 120 | 120 | 70 |
| 05470(220K) | M12 (M10) | 46 | 150-12 | 150-12 | 150 | 150 | 150 | 38 | 300 | 300 | 150 | 150 | 95 |
| 06100(250K) | M12 (M10) | 46 | 100-12 | 100-12 | 2×100 | 2×100 | 2×100 | 60 | 2×4/0 | 2×4/0 | 2×95 | 2×95 | 95 |
| 06830(280K) | M12 (M10) | 46 | 100-12 | 100-12 | 2×100 | 2×100 | 2×125 | 60 | 2×4/0 | 2×4/0 | 2×95 | 2×95 | 95 |

- *1 For the FR-A820-03160(55K) or lower and FR-A840-01800(55K) or lower, HIV cable (600 V grade heat-resistant PVC insulated wire) etc. with a continuous maximum permissible temperature of 75°C. It assumes that the cables will be used in a surrounding air temperature of 50°C or less and the wiring distance is 20 m or shorter.
 - For the FR-A820-03800(75K) or higher, FR-A840-02160(75K) or higher, LMFC (heat resistant flexible cross-linked polyethylene insulated cable) etc. with a continuous maximum permissible temperature of 90°C or more. It is assumed that the cables will be used in a surrounding air temperatures of 50°C or less and housed in an enclosure.
- *2 For all the 200 V class capacities and FR-A840-01160(45K) or lower, THHW cable with a continuous maximum permissible temperature of 75°C. It assumes that the cables will be used in a surrounding air temperature of 40°C or less and the wiring distance is 20 m or shorter. For the FR-A840-01800(55K) or higher, THHN cable with a continuous maximum permissible temperature of 90°C. It is assumed that the cables will be used in a surrounding air temperatures of 40°C or less and housed in an enclosure. (For the use in the United States or Canada, refer to "Instructions for UL and cUL" in the Instruction Manual (Startup) or Instruction Manual (Hardware))
- *3 For the FR-A820-00770(15K) or lower and the FR-A840-01160(45K) or lower, PVC cable with a continuous maximum permissible temperature of 70°C. It assumes that the cables will be used in a surrounding air temperature of 40°C or less and the wiring distance is 20 m or shorter. For the FR-A820-00930(18.5K) or higher and the FR-A840-01800(55K) or higher, XLPE cable with a continuous maximum permissible temperature of 90°C. It is assumed that the cables will be used in a surrounding air temperatures of 40°C or less and housed in an enclosure. (Selection example mainly for use in Europe.)
- *4 Screws for terminals R/L1, S/L2, T/L3, U, V, W, PR, PX, P/+, N/-, and P1, and the screw for earthing (grounding).

 The size of screws for terminals PR and PX on FR-A820-00340(5.5K) and FR-A820-00490(7.5K) is indicated in parentheses.

 The size of the earthing (grounding) screw on FR-A820-00930(18.5K) or higher and FR-A840-04320(160K) or higher is indicated in parentheses.

 The size of the screw for terminal P/+ for option connection on FR-A840-03250(110K) and FR-A840-03610(132K) is indicated in parentheses.

The line voltage drop can be calculated by the following formula:

Line voltage drop [V] =
$$\frac{\sqrt{3} \times \text{wire resistance } [\text{m}\Omega/\text{m}] \times \text{wiring distance } [\text{m}] \times \text{current } [\text{A}]}{1000}$$

Use a larger diameter cable when the wiring distance is long or when the voltage drop (torque reduction) in the low speed range needs to be reduced.



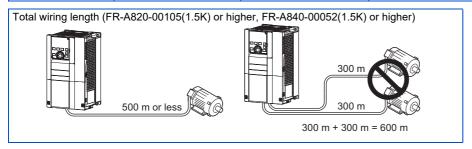
- · Tighten the terminal screw to the specified torque.
 - A screw that has been tightened too loosely can cause a short circuit or malfunction.
 - A screw that has been tightened too tightly can cause a short circuit or malfunction due to the unit breakage.
- · Use crimp terminals with insulation sleeves to wire the power supply and motor.

◆ Total wiring length

■ With induction motor

Connect one or more general-purpose motors within the total wiring length shown in the following table. (The wiring length should be 100 m or shorter under Vector control.)

| Pr.72 setting (carrier frequency) | FR-A820-00046(0.4K) FR-A840-00023(0.4K) | FR-A820-00077(0.75K) FR-A840-00038(0.75K) | FR-A820-00105(1.5K) or higher FR-A840-00052(1.5K) or higher |
|-----------------------------------|--|--|---|
| 2 (2 kHz) or lower | 300 m | 500 m | 500 m |
| 3 (3 kHz) or higher | 200 m | 300 m | 500 m |



When driving a 400 V class motor by the inverter, surge voltages attributable to the wiring constants may occur at the motor terminals, deteriorating the insulation of the motor. In this case, take one of the following measure.

 Use a "400 V class inverter-driven insulation-enhanced motor" and set Pr.72 PWM frequency selection according to the wiring length.

| Wiring length 50 m or shorter | Wiring length 50 to 100 m | Wiring length longer than 100 m | |
|----------------------------------|---------------------------|------------------------------------|--|
| 15 (14.5 kHz) or lower | 9 (9 kHz) or lower | 4 (4 kHz) or lower | |

 For the FR-A840-01800(55K) or lower, connect a surge voltage suppression filter (FR-ASF-H/FR-BMF-H) at the output side of the inverter. For the FR-A840-02160(75K) or higher, connect a sine wave filter (MT-BSL/BSC) at the output side of the inverter.

■ With PM motor

Use the wiring length of 100 m or shorter when connecting a PM motor.

Use one PM motor for one inverter. Multiple PM motors cannot be connected to an inverter.

When the wiring length exceeds 50 m for a 400 V class motor driven by an inverter under PM sensorless vector control, set "9" (6 kHz) or less in **Pr.72 PWM frequency selection**.



- Especially for long-distance wiring, the inverter may be affected by a charging current caused by stray capacitance of the
 wiring, leading to an activation of the overcurrent protection, malfunction of the fast-response current limit operation, or even
 to an inverter failure. It may also cause a malfunction or fault of the equipment connected ON the inverter output side. If the
 fast-response current limit function malfunctions, disable the function. (Refer to Pr.156 Stall prevention operation selection
 on page 431.)
- A surge voltage suppression filter (FR-ASF-H/FR-BMF-H) can be used under V/F control and Advanced magnetic flux vector control.

A sine wave filter (MT-BSL/BSC) can be used under V/F control. Do not use the filters under different control methods.

- For details on Pr.72 PWM frequency selection, refer to page 356.
- Refer to page 130 to drive a 400 V class motor by an inverter.
- The carrier frequency is limited during PM sensorless vector control. (Refer to page 356.)

Earthing (grounding) precautions 2.5.4

Always earth (ground) the motor and inverter.

Purpose of earthing (grounding)

Generally, an electrical apparatus has an earth (ground) terminal, which must be connected to the ground before use.

An electrical circuit is usually insulated by an insulating material and encased. However, it is impossible to manufacture an insulating material that can shut off a leakage current completely, and actually, a slight current flows into the case. The purpose of earthing (grounding) the case of an electrical apparatus is to prevent operators from getting an electric shock from this leakage current when touching it.

To avoid the influence of external noises, the earthing (grounding) is important to EMI-sensitive equipment that handle lowlevel signals or operate very fast such as audio equipment, sensors, computers.

Earthing (grounding) system to be established

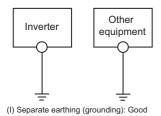
As described previously, the purpose of earthing (grounding) is roughly classified into the electrical shock prevention and the prevention of malfunction due to the influence of electromagnetic noise. These two purposes should be clearly distinguished, and the appropriate earth (ground) system must be established to prevent the leakage current having the inverter's high frequency components from reversing through another earth (ground) point for malfunction prevention by following these instructions:

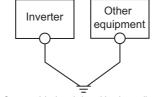
- Make the separate earth (ground) connection (I) for high frequency products such as the inverter from any other devices (EMI-sensitive devices described above) wherever possible.
 - Establishing adequate common (single-point) earth (ground) system (II) shown in the following figure is allowed only in cases where the separate earth (ground) system (I) is not feasible. Do not make inadequate common (single-point) earth (ground) connection (III).

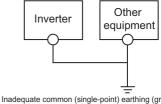
As leakage currents containing many high frequency components flows into the earthing (grounding) cables of the inverter and peripheral devices (including a motor), the inverter must also be earthed (grounded) separately from EMI-sensitive devices described above.

In a high building, it may be effective to use its iron structure frames as earthing (grounding) electrode for EMI prevention in order to separate from the earth (ground) system for electric shock prevention.

- Earthing (Grounding) must conform to the requirements of national and local safety regulations and electrical codes (NEC section 250, IEC 61140 class 1 and other applicable standards). A neutral-point earthed (grounded) power supply for 400 V class inverter in compliance with EN standard must be used.
- Use the thickest possible earthing (grounding) cable. The earthing (grounding) cable should be equal to the size indicated in the table on page 57.
- The earthing (grounding) point should be as close as possible to the inverter, and the earth (ground) wire length should be as short as possible.
- Run the earthing (grounding) cable as far away as possible from the I/O wiring of the EMI-sensitive devices and run them in parallel in the minimum distance.







(II) Common (single-point) earthing (grounding): OK

(III) Inadequate common (single-point) earthing (grounding): Bad



• To be compliant with the EU Directive (Low Voltage Directive), refer to the Instruction Manual (Startup).

2.6 **Control circuit**

2.6.1 **Details on the control circuit terminals**

♦ Input signal

| Туре | Terminal symbol | Common | Terminal name | Terminal function description | | Rated specification | Refer to page |
|---------------|------------------|--|---|---|---|--|---|
| | STF*1 | _ | Forward rotation start | Turn ON the STF signal to start forward rotation and turn it OFF to stop. | When the STF and STR signals are turned ON | | |
| | STR*1 | | | Reverse rotation start | Turn ON the STR signal to start reverse rotation and turn it OFF to stop. | simultaneously, the stop command is given. | Input resistance: 4.7 kΩ, voltage when contacts |
| | STP (STOP)*1 | | Start self-holding selection | Turn ON the STP (STOP) signal to s signal. | 9 | are open: 21 to 27 VDC, current when contacts are short-circuited: 4 to 6 mADC | 722 |
| | RH RM RL*1 | | Multi-speed selection | Multi-speed can be selected according combination of RH, RM and RL signal | • | | 411 |
| | | | Jog mode selection | Turn ON the JOG signal to enable Jog (initial setting) and turn ON the start signal to start JOG operation. | | | 410 |
| Contact input | (sir | SD (sink (negative | Pulse train input | Terminal JOG is also used as a puls terminal. To use as a pulse train input the Pr.291 setting. (maximum input pulse: 100k pulses/s | terminal, change | Input resistance: 2 kΩ, current when contacts are short-circuited: 8 to 13 mADC | 406 |
| | RT*1 CC | common)) PC (source (positive common)) | Second function selection | Turn ON the RT signal to enable the When the second function such as "5 boost" and "Second V/F (base frequenturning ON the RT signal enables the | Second torque ency)" is set, | | 525 |
| | MRS*1 | | Output stop | Turn ON the MRS signal (20 ms or n inverter output. Use this signal to sho output when stopping the motor with electromagnetic brake. | ut off the inverter | Input resistance: 4.7 | 524 |
| | RES*1 | | Reset | Use this signal to reset a fault output protective function is activated. Turn signal for 0.1 second or longer, then In the initial setting, reset is always et Pr.75, reset can be enabled only at a occurrence. The inverter recovers abothe reset is released. | ON the RES turn it OFF. nabled. By setting an inverter fault | kΩ, voltage when contacts are open: 21 to 27 VDC, current when contacts are short-circuited: 4 to 6 mADC | 336 |
| | AU*1 | | Terminal 4 input selection | The terminal 4 function is available of signal is ON. Turning the AU signal ON makes ter | • | | 496 |
| | CS*1 | | Selection of automatic restart after instantaneous power failure | When the CS signal is left ON, the in automatically at power restoration. N setting is necessary for this operation setting, a restart is disabled. | ote that restart | | 628, 635 |

| Туре | Terminal symbol | Common | Terminal name | Terminal function description | Rated specification | Refer to page |
|--------------------|-----------------|--------|----------------------------------|--|--|---------------------|
| | 10E | 5 | Frequency setting | When connecting the frequency setting potentiometer at an initial status, connect it to terminal 10. | 10 VDC ±0.4 V, permissible load current: 10 mA | 496 |
| | 10 | 5 | power supply | Change the input specifications of terminal 2 using Pr.73 when connecting it to terminal 10E. | 5 VDC ±0.5 V, permissible load current: 10 mA | 496 |
| / setting | 2 | 5 | Frequency setting (voltage) | Inputting 0 to 5 VDC (or 0 to 10 V, 0 to 20 mA) provides the maximum output frequency at 5 V (10 V, 20 mA) and makes input and output proportional. Use Pr.73 to switch among input 0 to 5 VDC (initial setting), 0 to 10 VDC, and 0 to 20 mA. Set the voltage/current input switch 1 for terminal 2 in the ON position to select current input (0 to 20 mA).*2 | permissible voltage: 20 VDC. For current input, input resistance: 245 ±5 Ω, maximum permissible current: 30 mA. | 496 |
| Frequency setting | 4 | 5 | Frequency setting (current) | Inputting 4 to 20 mADC (or 0 to 5 V, 0 to 10 V) provides the maximum output frequency at 20 mA and makes input and output proportional. This input signal is valid only when the AU signal is ON (terminal 2 input is invalid). Use Pr.267 to switch among input 4 to 20 mA (initial setting), 0 to 5 VDC, and 0 to 10 VDC. Set the voltage/current input switch 2 for terminal 4 in the OFF position to select voltage input (0 to 5 V / 0 to 10 V).*2 Use Pr.858 to switch terminal functions. | | 496 |
| | 1 | 5 | Frequency setting auxiliary | Input 0 to ±5 VDC or 0 to ±10 VDC to add this signal to the frequency setting signal input via terminal 2 or 4. Use Pr.73 to switch between input 0 to ±5 VDC and 0 to ±10 VDC (initial setting). Use Pr.868 to switch terminal functions. | Input resistance: 10 to 11 kΩ, maximum permissible voltage: ±20 VDC. | 496 |
| Thermistor | 10 2 | _ | PTC thermistor input | For receiving PTC thermistor outputs. When PTC thermistor is valid (Pr.561 ≠ "9999"), terminal 2 is not available for frequency setting. | Applicable PTC thermistor specification, overheat detection resistance: 0.5 to 30 k Ω (Set by Pr.561) | 415 |
| Power supply input | +24 | SD | 24 V external power supply input | For connecting a 24 V external power supply. If a 24 V external power supply is connected, power is supplied to the control circuit while the main power circuit is OFF. | Input voltage: 23 to 25.5 VDC, input current: 1.4 A or less | 80 |

 ^{*1} The terminal function can be selected by Pr.178 to Pr.196 (Input terminal function selection). (Refer to page 521.)
 *2 Set Pr.73, Pr.267, and the voltage/current input switch correctly, then input an analog signal in accordance with the setting. Applying a voltage with the switch ON (current input is selected) or applying a current with the switch OFF (voltage input is selected) could cause component damage of the inverter or analog circuits of output devices. (For the details, refer to page 496.)

^{*3} Sink logic is initially set for the FM-type inverter.

^{*4} Source logic is initially set for the CA-type inverter.

♦ Output signal

| Туре | Terminal symbol | Common | Terminal name | Terminal function descr | ription | Rated specification | Refer to page |
|----------------|--------------------------------|--|--|--|--|---|---------------------|
| Relay | A1, B1, C1*1 | _ | Relay output 1 (fault output) | changeover contact output that indicates that an inverter's protective function has been activated and the outputs are stopped. Fault: discontinuity across B and C (continuity across A and C), Normal: continuity across B and C (discontinuity across A and C) changeover contact output | | VAC 0.3 A (power factor = 0.4), 30 VDC 0.3 A | 473 |
| | A2, B2, C2 ^{*1} | _ | Relay output 2 | | | | 473 |
| | RUN*1 | SE | Inverter running | The output is in LOW state when the inverter output frequency is equal to or higher than the starting frequency (initial value: 0.5 Hz). The output is in HIGH state during stop or DC injection brake operation. | | | 473 |
| | SU*1 | SE | Up to frequency | The output is in LOW state when the output frequency is within the set frequency range ±10% (initial value). The output is in HIGH state during acceleration/deceleration and at a stop. | Fault code (4 bits) output. (Refer to page 492.) | Permissible load: 24 VDC (27 VDC at maximum) 0.1 A (The voltage drop is | 484 |
| Open collector | OL*1 | SE | Overload warning | The output is in LOW state when stall prevention is activated by the stall prevention function. The output is in HIGH state when stall prevention is canceled. | | 2.8 V at maximum while the signal is ON.) The open collector transistor is ON (conductive) in LOW | 431 |
| | IPF ^{*1} | SE | Instantaneous power failure | The output is in LOW state when an instantaneous power failure occurs or when the undervoltage protection is activated. | | state. The transistor is OFF (not conductive) in HIGH state. | 628, 635 |
| | FU ^{*1} | SE | Frequency detection | The output is in LOW state when the inverter output frequency is equal to or higher than the preset detection frequency, and is in HIGH state when it is less than the preset detection frequency. | | | 484 |
| | FM*2 | For meter SD NPN open collector output | For meter | oi fr | Output item: output frequency (initial setting) | Permissible load current: 2 mA, pulse for full scale: 1440 pulses/ s | 457 |
| Pulse | | | Among several monitor items such as output frequency, select one to output it via these terminals. The signal is not output during an inverter reset. The size of output signal is proportional to the magnitude of the | This terminal can be used for open collector outputs depending on the Pr.291 setting. | Maximum output pulse: 50k pulses/s, permissible load current: 80 mA | 406 | |
| Analog | АМ | 5 | Analog voltage output | torque. | Output item: output frequency (initial | Output signal: 0 ±10 VDC, permissible load current: 1 mA (load impedance 10 kΩ or more), resolution: 13 bits | 457 |
| | CA*3 | 5 | Analog current output | | setting) | Load impedance: 200 to 450 Ω , output signal: 0 to 20 mADC | 457 |

^{*1} The terminal function can be selected by Pr.190 to Pr.196 (Output terminal function selection). (Refer to page 473.)

^{*2} Terminal FM is provided in the FM-type inverter.

^{*3} Terminal CA is provided in the CA-type inverter.

♦ Safety stop signal

| Terminal symbol | Terminal name | Common | Terminal function description | Rated specification | Refer to page |
|-----------------|--|--------|---|---|---------------------|
| S1 | Safety stop input (channel 1) | | Use terminals S1 and S2 to receive the safety stop signal input from the safety relay module. Terminals S1 and S2 can be used at a time (dual channel). The Inverter judges the condition of the internal safety circuit from the status (shorted (prepared) between terminals S1 and | Input resistance: 4.7 | |
| S2 | Safety stop input (channel 2) | SIC | from the status (shorted/opened) between terminals S1 and SIC, or between S2 and SIC. When the status is opened, the inverter output is shut off. In the initial status, terminal S1 and S2 are shorted with terminal PC by shorting wires. Terminal SIC is shorted with terminal SD. Remove the shorting wires and connect the safety relay module when using the safety stop function. | kΩ, input current: 4 to 6 mADC (with 24 VDC input) | 82 |
| So (SO) | Safety monitor output (open collector output) | SOC | The output status varies depending on the input status of the safety stop signals. The output is in HIGH state during occurrence of the internal safety circuit failure. The output is in LOW state otherwise. (The open collector transistor is ON (conductive) in LOW state. The transistor is OFF (not conductive) in HIGH state.) Refer to the Safety Stop Function Instruction Manual if the output becomes in HIGH state even though both terminals S1 and S2 are open. (Contact your sales representative for this manual.) | Permissible load: 24 VDC (27 VDC at maximum), 0.1 A (The voltage drop is 3.4 V at maximum while the signal is ON.) | |

◆ Common terminal

| Terminal symbol | Common | Terminal name | Terminal function description | Rated specification | Refer to page |
|-----------------|--------|---------------------------------------|--|--|---------------------------------------|
| SD | _ | Contact input common (sink)*1 | Common terminal for the contact input terminal (sink logic), terminal FM. | _ | |
| | | External transistor common (source)*2 | Connect this terminal to the power supply common terminal of a transistor output (open collector output) device, such as a programmable controller, in the source logic to avoid malfunction by undesirable current. | | _ |
| | | 24 VDC power supply common | Common terminal for the 24 VDC power supply (terminal PC, terminal +24). Isolated from terminals 5 and SE. | | |
| PC | _ | External transistor common (sink)*1 | Connect this terminal to the power supply common terminal of a transistor output (open collector output) device, such as a programmable controller, in the sink logic to avoid malfunction by undesirable current. | Power supply voltage range: 19.2 to 28.8 | 73 |
| | | | Contact input common (source)*2 | Common terminal for contact input terminal (source logic). | VDC, permissible load current: 100 mA |
| | SD | 24 VDC power supply | Can be used as a 24 VDC 0.1 A power supply. | | |
| 5 | _ | Frequency setting common | Common terminal for the frequency setting signal (via terminal 2, 1, or 4) and for the analog output terminals AM and CA. Do not earth (ground). | _ | 496 |
| SE | _ | Open collector output common | Common terminal for terminals RUN, SU, OL, IPF, FU | _ | _ |
| SIC | _ | Safety stop input terminal common | Common terminal for terminals S1 and S2. | _ | 82 |
| soc | _ | Safety monitor output terminal common | Common terminal for terminal So (SO). | _ | 82 |

^{*1} Sink logic is initially set for the FM-type inverter.

^{*2} Source logic is initially set for the CA-type inverter.

Communication

| Туре | Terminal Termina | | Terminal name | Terminal function desc | ription | Refer to page |
|------|---|-------------|----------------------|--|---|------------------|
| 85 | _ | | PU connector | RS-485 communication can be made through the PU connector (For connection on a 1:1 basis only) Conforming standard: EIA-485 (RS-485) Transmission format: Multidrop link Communication speed: 4800 to 115200 bps Wiring length: 500 m | | 659 |
| RS-4 | Wiring length: 500 m TXD+ Inverter transmission terminal RXD+ Inverter reception RXD+ Inverter reception Transmission format: Multidrop link Wiring length: 500 m RS-485 communication can be made through the RS-485 termin Conforming standard: EIA-485 (RS-485) Transmission format: Multidrop link | | e RS-485 terminals. | | | |
| | term | RXD+ | Inverter reception | Conforming standard: EIA-485 (RS-485) Transmission format: Multidrop link | | 661 |
| | 85 | RXD- | terminal | Communication speed: 300 to 115200 bps | | |
| | RS-485 | GND (SG) | Earthing (grounding) | Overall length: 500 m | | |
| | | | USB A connector | A connector (receptacle). Plug a USB memory device into this connector to copy parameter settings or use the trace function. | Interface: conforms to USB | 85 |
| USB | _ | | USB B connector | Mini B connector (receptacle). By connecting the inverter to a personal computer via this connector, FR Configurator2 installed on the computer can be used for setting the inverter, or monitoring or testing the inverter operation. | 1.1 (USB 2.0 full-speed compatible) Transmission speed: 12 Mbps | 85 |

◆ CC-Link IE Field Network (FR-A800-GF)

| Туј | e Terminal name | Terminal function description | Refer to page |
|------|-----------------|---|------------------|
| Щ | PORT 1 | | |
| CC-I | PORT 2 | Communication can be made via the CC-Link IE Field Network. | 110 |

2.6.2 Control logic (sink/source) change

Switch the control logic of input signals as necessary.

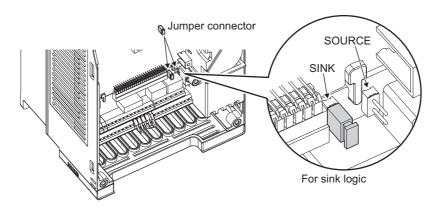
To change the control logic, change the jumper connector position on the control circuit board.

Connect the jumper connector to the connector pin of the desired control logic.

The control logic of input signals is initially set to the sink logic (SINK) for the type FM inverter.

The control logic of input signals is initially set to the source logic (SOURCE) for the type CA inverter.

(The output signals may be used in either the sink or source logic independently of the jumper connector position.)





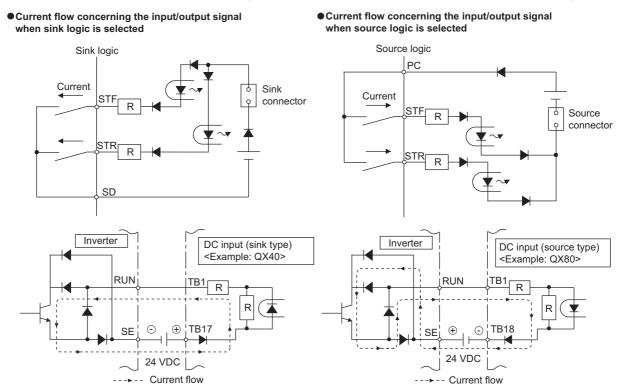
- · Make sure that the jumper connector is installed correctly.
- · Never change the control logic while power is ON.
- To change the control logic for the FR-A800-GF, remove the control circuit terminal block and change the jumper connector position. (Refer to page 819 for details on how to remove the terminal block.) After changing the jumper connector position, reinstall the control circuit terminal block securely in place.

◆ Sink logic and source logic

- In the sink logic, a signal turns ON when a current exits from the corresponding signal input terminal.

 Terminal SD is common to the contact input signals. Terminal SE is common to the open collector output signals.
- In the source logic, a signal turns ON when a current enters into the corresponding signal input terminal.

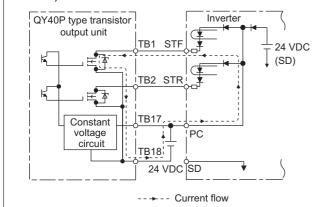
 Terminal PC is common to the contact input signals. Terminal SE is common to the open collector output signals.



· When using an external power supply for transistor output

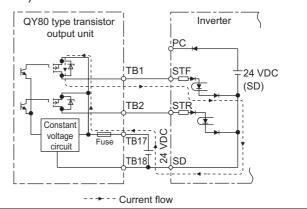
Sink logic

Use terminal PC as a common terminal, and perform wiring as follows. (Do not connect terminal SD on the inverter with the terminal of 0 V for the external power supply. When using terminals PC-SD as a 24 VDC power supply, do not install an external power supply in parallel with the inverter. Doing so may cause a malfunction in the inverter due to undesirable currents.)



Source logic

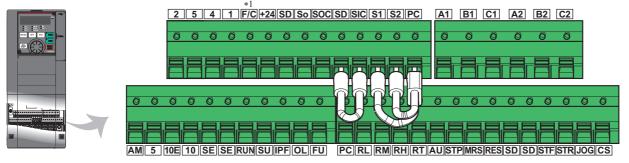
Use terminal SD as a common terminal, and perform wiring as follows. (Do not connect terminal PC on the inverter with the terminal of +24 V for the external power supply. When using terminals PC-SD as a 24 VDC power supply, do not install an external power supply in parallel with the inverter. Doing so may cause a malfunction in the inverter due to undesirable currents.)



2.6.3 Wiring of control circuit

◆ Control circuit terminal layout

Recommended cable gauge: 0.3 to 0.75 mm²



*1 This terminal operates as terminal FM for the type FM inverter. For the type CA inverter, the terminal operates as terminal CA.

Wiring method

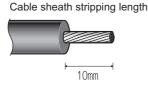
■ Power supply connection

Use crimp terminals and stripped wire for the control circuit wiring. For single wire, the stripped wire can be used without crimp terminal.

Connect the end of wires (crimp terminal or stranded wire) to the terminal block.

7. Strip the signal wires as follows. If too much of the wire is stripped, a short circuit may occur with neighboring wires. If not enough of the wire is stripped, wires may become loose and fall out.

Twist the stripped end of wires to prevent them from fraying. Do not solder them.

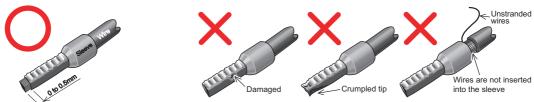






2. Crimp the terminals on the wire.

Insert the wire into a crimp terminal, making sure that 0 to 0.5 mm of the wire protrudes from the end of the sleeve. Check the condition of the crimp terminals after crimping. Do not use the crimp terminals of which the crimping is inappropriate, or the face is damaged.



Crimp terminals commercially available (as of October 2020)

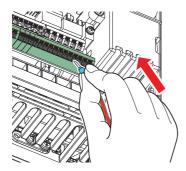
· Phoenix Contact Co., Ltd.

| Wire gauge | | Crimping tool | | |
|-------------------------|------------------------|---------------------------|---------------------------|------------|
| (mm ²) | With insulation sleeve | Without insulation sleeve | For UL wire ^{*1} | model No. |
| 0.3 | AI 0,34-10TQ | _ | _ | |
| 0.5 | AI 0,5-10WH | _ | AI 0,5-10WH-GB | |
| 0.75 | AI 0,75-10GY | A 0,75-10 | AI 0,75-10GY-GB | OBUADEOV O |
| 1 | AI 1-10RD | A 1-10 | AI 1-10RD/1000GB | CRIMPFOX 6 |
| 1.25, 1.5 | AI 1, 5-10BK | A 1, 5-10 | AI 1,5-10BK/1000GB*2 | |
| 0.75 (two-wire product) | AI-TWIN 2×0,75-10GY | _ | _ | |

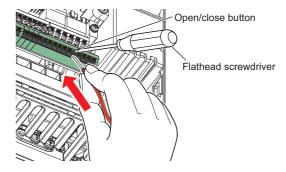
- *1 A ferrule terminal with an insulation sleeve compatible with the MTW wire which has a thick wire insulation.
- *2 Applicable for terminals A1, B1, C1, A2, B2, C2.
- · NICHIFU Co., Ltd.

| Wire gauge | Blade terminal part | Insulation cap part No. | Crimping tool model |
|--------------------|---------------------|-------------------------|---------------------|
| (mm ²) | No. | | No. |
| 0.3 to 0.75 | BT 0.75-11 | VC 0.75 | NH 69 |

3. Insert the wire into the terminal block.



When using single wire or stranded wire without crimp terminal, push an open/close button all the way down with a flathead screwdriver, and insert the wire.

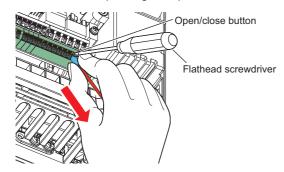


NOTE

- · When using stranded wires without a blade terminal, twist enough to avoid short circuit with a nearby terminals or wires.
- Place the flathead screwdriver vertical to the open/close button. In case the blade tip slips, it may cause an inverter damage or injury.

■ Wire removal

Pull the wire while pushing the open/close button all the way down firmly with a flathead screwdriver.





- · Pulling out the wire forcefully without pushing the open/close button all the way down may damage the terminal block.
- Use a small flathead screwdriver (tip thickness: 0.4 mm / tip width: 2.5 mm).
 If a flathead screwdriver with a narrow tip is used, terminal block may be damaged.
 Commercially available products (as of October 2020)

| Product name | Model | Manufacturer |
|--------------|------------------|---------------------------|
| Screwdriver | SZF 0- 0,4 × 2,5 | Phoenix Contact Co., Ltd. |

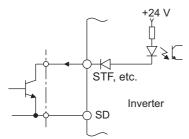
• Place the flathead screwdriver vertical to the open/close button. In case the blade tip slips, it may cause an inverter damage or injury.

◆ Common terminals of the control circuit (SD, PC, 5, SE)

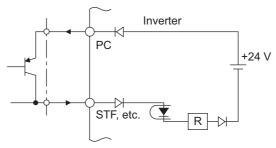
- Terminals SD (sink logic), PC (source logic), 5, and SE are common terminals (0 V) for I/O signals. (All common terminals are isolated from each other.) Do not earth (ground) these terminals. Avoid connecting terminal SD (sink logic) with terminal 5, terminal PC (source logic) with terminal 5, and terminal SE with terminal 5.
- In the sink logic, terminal SD is a common terminal for the contact input terminals (STF, STR, STP (STOP), RH, RM, RL, JOG, RT, MRS, RES, AU, and CS) and the pulse train output terminal (FM*1). The open collector circuit is isolated from the internal control circuit by photocoupler.
- In the source logic, terminal PC is a common terminal for the contact input terminals (STF, STR, STP (STOP), RH, RM, RL, JOG, RT, MRS, RES, AU, CS). The open collector circuit is isolated from the internal control circuit by photocoupler.
- Terminal 5 is a common terminal for the frequency setting terminals (1, 2, and 4) and the analog output terminals (AM and CA^{*2}). It should be protected from external noise using a shielded or twisted cable.
- Terminal SE is a common terminal for the open collector output terminals (RUN, SU, OL, IPF, and FU). The contact input circuit is isolated from the internal control circuit by photocoupler.
 - *1 Terminal FM is provided in the FM-type inverter.
 - *2 Terminal CA is provided in the CA-type inverter.

◆ Signal inputs by contactless switches

The contact input terminals of the inverter (STF, STR, STP (STOP), RH, RM, RL, JOG, RT, MRS, RES, AU, and CS) can be controlled using a transistor instead of a contact switch as follows.



External signal input using transistor (sink logic)



External signal input using transistor (source logic)

2.6.4 Wiring precautions

- It is recommended to use a cable of 0.3 to 0.75 mm² for the connection to the control circuit terminals.
- The wiring length should be 30 m (200 m for terminal FM) at the maximum.
- Use two or more parallel micro-signal contacts or twin contacts to prevent contact faults when using contact inputs since the control circuit input signals are micro-currents.

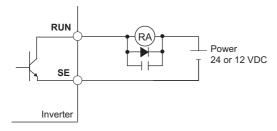




Micro signal contacts

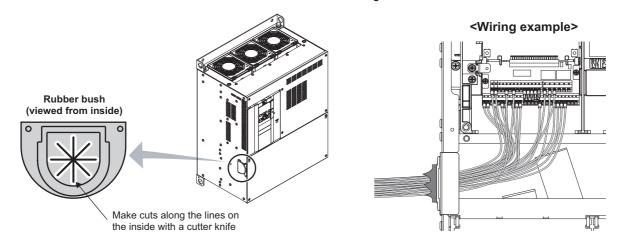
Twin contacts

- To suppress EMI, use shielded or twisted cables for the control circuit terminals and run them away from the main and power circuits (including the 200 V relay sequence circuit). For the cables connected to the control circuit terminals, connect their shields to the common terminal of the connected control circuit terminal. When connecting an external power supply to terminal PC, however, connect the shield of the power supply cable to the negative side of the external power supply. Do not directly earth (ground) the shield to the enclosure, etc.
- · Always apply a voltage to the fault output terminals (A1, B1, C1, A2, B2, and C2) via a relay coil, lamp, etc.
- When a relay coil is connected to the output terminals, use one with a surge absorbing function (reflux diode). When the
 voltage application direction is incorrect, the inverter will be damaged. Pay attention to the diode direction or other
 precautions to avoid incorrect wiring.



• For the FR-A820-03160(55K) or higher and FR-A840-02160(75K) or higher, separate the wiring of the control circuit away from the wiring of the main circuit.

Make cuts in rubber bush of the inverter side and lead the wires through.



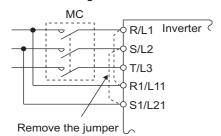
2.6.5 When using separate power supplies for the control circuit and the main circuit

- ◆ Cable size for the control circuit power supply (terminals R1/L11 and S1/L21)
 - Terminal screw size: M4

Cable gauge: 0.75 to 2 mm²
 Tightening torque: 1.5 N·m

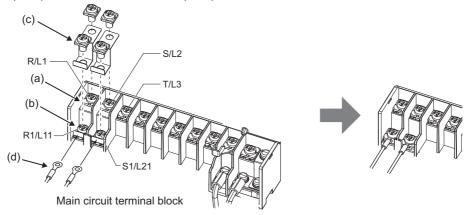
◆ Connection method

Connection diagram

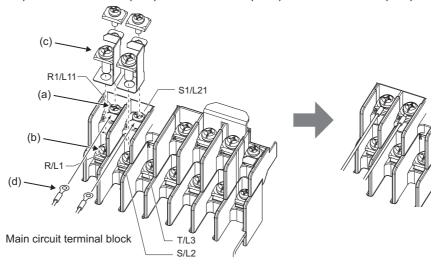


If a fault occurs and the electromagnetic contactor (MC) installed at the inverter's input line is opened, power supply to the control circuit is also stopped and the fault signals cannot be output anymore. Terminals R1/L11 and S1/L21 of the control circuit are provided to keep outputting the fault signals in such a case. Follow the following steps to wire terminals R1/L11 and S1/L21 on the inverter to the power input lines of the MC. Do not connect the power cable to incorrect terminals. Doing so may damage the inverter.

• FR-A820-00250(3.7K) or lower, FR-A840-00126(3.7K) or lower

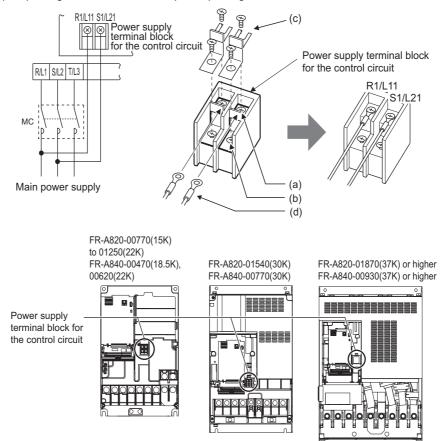


- (a) Remove the upper screws.
- (b) Remove the lower screws.
- (c) Remove the jumper.
- (d) Connect the separate power cable for the control circuit to the lower terminals (R1/L11, S1/L21).
- FR-A820-00340(5.5K) to FR-A820-00630(11K), FR-A840-00170(5.5K) to FR-A840-00380(15K)



- (a) Remove the upper screws.
- (b) Remove the lower screws.
- (c) Remove the jumper.
- (d) Connect the separate power cable for the control circuit to the upper terminals (R1/L11, S1/L21).

• FR-A820-00770(15K) or higher, FR-A840-00470(18.5K) or higher



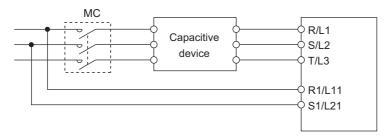
- (a) Remove the upper screws.
- (b) Remove the lower screws.
- (c) Pull the jumper toward you to remove.
- (d) Connect the separate power cable for the control circuit to the upper terminals (R1/L11, S1/L21).



- When using separate power supplies, always remove the jumpers across terminals R/L1 and R1/L11 and across S/L2 and S1/L21. The inverter may be damaged if the jumpers are not removed.
- When the control circuit power is supplied from other than the input line of the MC, the voltage of the separate power supply must be the same as that of the main control circuit.
- The power capacity necessary when separate power is supplied from R1/L11 and S1/L21 differs according to the inverter capacity.

| Inverter | Power supply capacity |
|---|-----------------------|
| FR-A820-00630(11K) or lower FR-A840-00380(15K) or lower | 60 VA |
| FR-A820-00770(15K) or higher FR-A840-00470(18.5K) or higher | 80 VA |

- If the main circuit power is switched OFF (for 0.1 second or more) then ON again, the inverter is reset and a fault output will not be held.
- When a power supply is provided for the control circuit separately from the main circuit and a capacitive device (such as an EMC filter or a radio noise filter) is connected, refer to the following diagram. (For the wiring example to comply with ship classification standards, refer to page 858.)



2.6.6 When supplying 24 V external power to the control circuit

Connect the 24 V external power supply across terminals +24 and SD to turn the I/O terminal ON/OFF operation, keep the operation panel ON, and carry out communication during communication operation even at power-OFF state of inverter's main circuit power supply. When the main circuit power supply is turned ON, the power supply is switched from the 24 V external power supply to the main circuit power supply.

◆ Specification of the applied 24 V external power supply

| Item | Rated specification |
|---------------|---------------------|
| Input voltage | 23 to 25.5 VDC |
| Input current | 1.4 A or less |

Commercially available products (as of October 2020)

| Model | Product overview | Manufacturer |
|----------------------------|--|-------------------|
| S8FS-G05024C*1 | Specifications: Capacity 50 W, output voltage 24 VDC, output current 2.2 A Installation method: Direct installation, screw type terminal block with cover Input: Single-phase 100 to 240 VAC | |
| S8VK-S06024 ^{*1} | Specifications: Capacity 60 W, output voltage 24 VDC, output current 2.5 A Installation method: DIN rail, push-in (spring) type terminal block Input: Single-phase 100 to 240 VAC | OMRON Corporation |
| S8VK-WA24024 ^{*1} | Specifications: Capacity 240 W, output voltage 24 VDC, output current 10 A Installation method: DIN rail, push-in (spring) type terminal block Input: Three-phase 200 to 240 VAC | |

^{*1} For the latest information about OMRON power supply, contact OMRON corporation.

◆ Starting and stopping the 24 V external power supply operation

- Supplying 24 V external power while the main circuit power is OFF starts the 24 V external power supply operation.
 Likewise, turning OFF the main circuit power while supplying 24 V external power starts the 24 V external power supply operation.
- · Turning ON the main circuit power stops the 24 V external power supply operation and enables the normal operation.

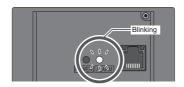
NOTE

- When the 24 V external power is supplied while the main circuit power supply is OFF, the inverter operation is disabled.
- In the initial setting, when the main circuit power supply is turned ON during the 24 V external power supply operation, a reset is performed in the inverter, then the power supply changes to the main circuit power supply. (The reset can be disabled using **Pr.30**. (Refer to page 724.))

Confirming the 24 V external power supply input

• During the 24 V external power supply operation, "EV" blinks on the operation panel. The alarm lamp also blinks. Thus, the 24 V external power supply operation can be confirmed even when the operation panel is removed.





• During 24 V external power supply operation, the 24 V external power supply operation (EV) signal is output. To use the EV signal, set "68 (positive logic) or 168 (negative logic)" in one of **Pr.190 to Pr.196 (Output terminal function selection)** to assign function to an output terminal.

Operation while the 24 V external power is supplied

- Fault history and parameters can be read and parameters can be written (when the parameter write from the operation panel is enabled) using the operation panel keys.
- The safety stop function is invalid during the 24 V external power supply operation.
- During the 24 V external power supply operation, the monitor items and signals related to inputs to main circuit power supply, such as the output current, converter output voltage, and IPF signal, are invalid.
- The alarms, which have occurred when the main circuit power supply is ON, continue to be output after the power supply is changed to the 24 V external power supply. Perform the inverter reset or turn OFF then ON the power to reset the faults.
- If the power supply changes from the main circuit power supply to the 24 V external power supply while measuring the main circuit capacitor's life, the measurement completes after the power supply changes back to the main circuit power supply (**Pr.259** = "3").
- The output data is retained when "1 or 11" is set in Pr.495 Remote output selection.

NOTE

- Inrush current equal to or higher than the 24 V external power supply specification may flow at power-ON. Confirm that the power supply and other devices are not affected by the inrush current and the voltage drop caused by it. Depending on the power supply, the overcurrent protection may be activated to disable the power supply. Select the power supply and capacity carefully.
- When the wiring length between the external power supply and the inverter is long, the voltage often drops. Select the appropriate wiring size and length to keep the voltage in the rated input voltage range.
- In a serial connection of several inverters, the current increases when it flows through the inverter wiring near the power supply. The increase of the current causes voltage to drop further. When connecting different inverters to different power supplies, use the inverters after confirming that the input voltage of each inverter is within the rated input voltage range. Depending on the power supply, the overcurrent protection may be activated to disable the power supply. Select the power supply and capacity carefully.
- "E.SAF" or "E.P24" may appear when the start-up time of the 24 V power supply is too long (less than 1.5 V/s) in the 24 V external power supply operation.
- "E.P24" may appear when the 24 V external power supply input voltage is low. Check the external power supply input.
- Do not touch the control circuit terminal block (circuit board) during the 24 V power supply operation (when conducted). Otherwise you may get an electric shock or burn.

2.6.7 Safety stop function

◆ Function description

The terminals related to the safety stop function are as follows.

| Terminal symbol | Terminal function description | | | | | | |
|------------------|---|--|--|--|--|--|--|
| S1 ^{*1} | Input terminal as the safety stop channel 1. | Status of both the circuit between terminals S1 and SIC and | | | | | |
| S2*1 | Input terminal as the safety stop channel 2. | the circuit between terminals S2 and SIC Open: Safety stop is activated. Shorted: Safety stop is not activated | | | | | |
| SIC*1 | Common terminal for S1 and S2. | | | | | | |
| So (SO) | Output terminal used for fault detection and fault indication display. The terminal is ON (conducted) while no internal safety circuit failure*2 exists. | OFF: Internal safety circuit fault ^{*2} ON: No internal safety circuit failure ^{*2} | | | | | |
| SOC | Open collector output (terminal So (SO)) common | | | | | | |

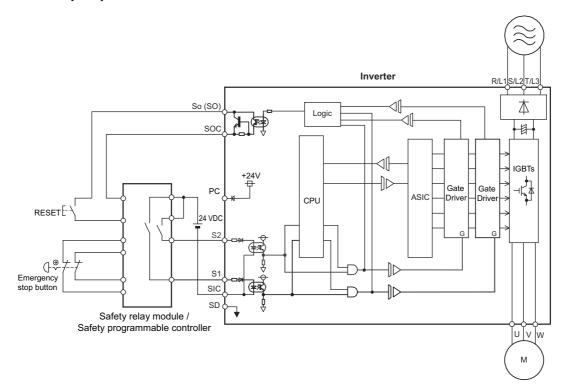
- *1 In the initial status, terminals S1 and PC, S2 and PC, and SIC and SD are respectively shorted with shorting wires. To enable the safety stop function, remove all the shorting wires, and then connect a safety relay module as shown in the connection diagram.
- *2 When any fault listed on the next page occurs in the internal safety circuit, the corresponding indication is shown on the operation panel.



• Terminal So (SO) can be used to display a fault indication and to prevent restarting of the inverter. The signal output from terminal So (SO) cannot be used to input a safety stop signal to other devices.

♦ Connection diagram

To prevent restart at failure occurrence, connect terminals So (SO) and SOC to the reset button, which are the feedback input terminals of the safety relay module.



♦ Safety stop function operation

| Input | Internal safety circuit | Input terminal ' 2 | | Output terminal | Output signal ^{*8*9*10} | Inverter operating status | Operation panel indication | |
|--------------------------|-------------------------|--------------------|------|------------------|-------------------------------------|-----------------------------|----------------------------|-----------------|
| power status S1 S2 So (S | | So (SO) | SAFE | | E.SAF*6 | SA ^{*7} | | |
| OFF | _ | _ | _ | OFF | OFF | Output shutoff (Safe state) | Not displayed | Not displayed |
| | Normal | ON | ON | ON ^{*3} | OFF | Operation enabled | Not displayed | Not displayed |
| | Normal | ON | OFF | OFF*4 | OFF ^{*4} | Output shutoff (Safe state) | Displayed | Displayed |
| | Normal | OFF | ON | OFF*4 | OFF*4 | Output shutoff (Safe state) | Displayed | Displayed |
| ON | Normal | OFF | OFF | ON ^{*3} | ON ^{*3} | Output shutoff (Safe state) | Not displayed | Displayed |
| | Fault | ON | ON | OFF | OFF | Output shutoff (Safe state) | Displayed | Not displayed*5 |
| | Fault | ON | OFF | OFF | OFF | Output shutoff (Safe state) | Displayed | Displayed |
| | Fault | OFF | ON | OFF | OFF | Output shutoff (Safe state) | Displayed | Displayed |
| | Fault | OFF | OFF | OFF | OFF | Output shutoff (Safe state) | Displayed | Displayed |

^{*1} The terminal ON state shows that the terminal is conducted (the line is closed), and the OFF state shows that the terminal is not conducted (the line is open).

^{*3} If any of the faults shown in the following table occurs, terminal So (SO) and the SAFE signal turn OFF.

| Fault type | Operation panel indication |
|--|----------------------------|
| Option fault | E.OPT |
| Communication option fault | E.OP1 to E.OP3 |
| Parameter storage device fault (control circuit board) | E.PE |
| Retry count excess | E.RET |
| Parameter storage device fault (main circuit board) | E.PE2 |
| Operation panel power supply short circuit/RS-485 terminals power supply short circuit | E.CTE |
| 24 VDC power fault | E.P24 |
| Safety circuit fault | E.SAF |
| Overspeed occurrence | E.OS |

| Fault type | Operation panel indication | |
|----------------------------------|----------------------------|--|
| Speed deviation excess detection | E.OSD | |
| Signal loss detection | E.ECT | |
| Excessive position fault | E.OD | |
| Brake sequence fault | E.MB1 to E.MB7 | |
| CPU fault | E.CPU | |
| | E.5 to E.7 | |
| Encoder phase fault | E.EP | |
| Magnetic pole position unknown | E.MP | |
| Internal circuit fault | E.13 | |

^{*4} When the internal safety circuit is operated normally (no faults occurs), terminal So (SO) and the SAFE signal remains ON until "E.SAF" is displayed. Terminal So (SO) and the SAFE signal turns OFF when "E.SAF" is displayed.

^{*9} To assign the function of the SAFE signal to an output terminal, set either value shown in the following table in any of **Pr.190 to Pr.196 (Output terminal function selection)**.

| Output signal | Pr.190 to Pr.196 settings | | |
|---------------|---------------------------|----------------|--|
| Output signal | Positive logic | Negative logic | |
| SAFE | 80 | 180 | |

^{*10} The use of SAFE signal has not been certified for compliance with safety standards.

For more details, refer to the Safety Stop Function Instruction Manual.

Find a PDF file of the manual in the CD-ROM enclosed with the product.

The manual can also be downloaded in PDF form from the Mitsubishi Electric FA Global Website.

www.MitsubishiElectric.co.jp/fa

^{*2} When not using the safety stop function, short across terminals S1 and PC, S2 and PC, and SIC and SD to use the inverter. (In the initial status, terminals S1 and PC, S2 and PC, and SIC and SD are respectively shorted with shorting wires.)

^{*5 &}quot;SA" is displayed when terminals S1 and S2 are identified as OFF due to a fault occurred in the internal safety circuit.

^{*6} If another fault occurs when the fault E.SAF occurs, the other fault indication may be displayed.

^{*7} If another warning occurs when the warning SA occurs, the other warning indication may be displayed.

^{*8} The ON/OFF state of the output signal is the one for the positive logic. The ON and OFF are reversed for the negative logic.

2.7 Communication connectors and terminals

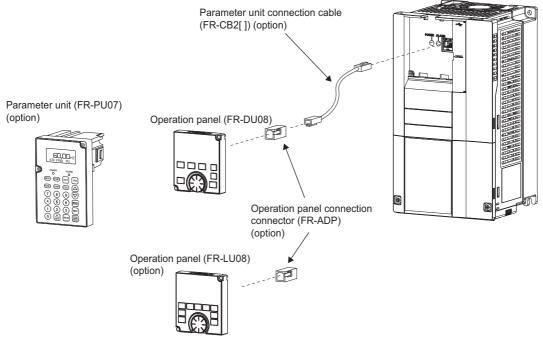
2.7.1 PU connector

Mounting the operation panel or the parameter unit on the enclosure surface

• Having an operation panel or a parameter unit on the enclosure surface is convenient. With a connection cable, the operation panel or the parameter unit can be mounted to the enclosure surface and connected to the inverter.

Use the cable option FR-CB2[] or the following connector and cable available on the market. (To install the operation panel, the optional connector (FR-ADP) is also required.)

Securely insert one end of the cable into the PU connector and the other end into the connection connector on the parameter unit or the FR-ADP attached on the operation panel until the stoppers are fixed.





• Refer to the following table when fabricating the cable on the user side. Keep the total cable length within 20 m.

| Name | Remarks |
|---------------------|---|
| Communication cable | Cable compliant with EIA-568 (such as 10BASE-T cable) |

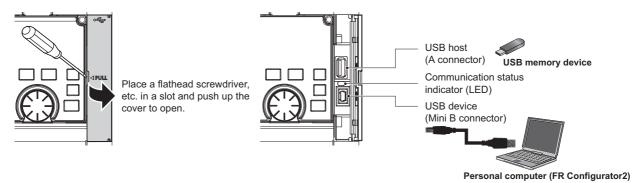
Communication operation

• Using the PU connector as a computer network port enables communication operation from a personal computer, etc. When the PU connector is connected with a personal, FA or other computer by a communication cable, a user program can run to monitor the inverter or read and write parameters.

Communication can be performed with the Mitsubishi inverter protocol (computer link operation).

For the details, refer to page 659.

2.7.2 USB connector



♦ USB host communication

| | Interface | Conforms to USB 1.1 |
|-----------------------|---------------|--|
| Transı | mission speed | 12 Mbps |
| Wi | ring length | Maximum 5 m |
| C | Connector | USB A connector (receptacle) |
| 0 | Format | FAT32 |
| Compatible USB memory | Capacity | 1 GB or more (used in the recorder mode of the trace function) |
| Encryption function | | Not available |

• Different inverter data can be saved in a USB memory device.

The USB host communication enables the following functions.

| Function | Description | Refer to page |
|------------------------|--|---------------------|
| Parameter copy | Copies the parameter settings from the inverter to the USB memory device. A maximum of 99 parameter setting files can be saved in a USB memory device. The parameter setting data copied in the USB memory device can be copied to other inverters. This function is useful in backing up the parameter setting or for sharing the parameter setting among multiple inverters. The parameter setting file can be copied onto a personal computer from the USB memory device and edited using FR Configurator2. | 747 |
| Trace | The monitoring data and output status of the signals can be saved in a USB memory device. The saved data can be imported to FR Configurator2 to diagnose the operating status of the inverter. | 649 |
| PLC function data copy | This function copies the PLC function project data to a USB memory device when the PLC function is used. The PLC function project data copied in the USB memory device can be copied to other inverters. This function is useful in backing up the parameter setting and for allowing multiple inverters to operate by the same sequence programs. | 646 |

- When the inverter recognizes the USB memory device without any problem, " [] - " is briefly displayed on the operation panel.
- When the USB memory device is removed, " [_____ = " is briefly displayed on the operation panel.
- The operating status of the USB host can be checked on the LED display of the inverter.

| LED display status | Operating status | |
|--------------------|---|--|
| OFF | No USB connection. | |
| ON | The communication is established between the inverter and the USB device. | |
| Fast blinking | The USB memory device is being accessed. (Do not remove the USB memory device.) | |
| Slow blinking | Error in the USB connection. | |

- When a device such as a USB charger is connected to the USB connector and an excessive current (500 mA or higher) flows, USB host error "[_______ " (UF warning) is displayed on the operation panel.
- When the UF warning appears, the USB error can be canceled by removing the USB device and setting **Pr.1049** = "1". (The UF warning can also be canceled by resetting the inverter power or resetting with the RES signal.)



- · Do not connect devices other than a USB memory device to the inverter.
- If a USB device is connected to the inverter via a USB hub, the inverter cannot recognize the USB memory device properly.

◆ USB device communication

The inverter can be connected to a personal computer with a USB (ver. 1.1) cable.

Parameter setting and monitoring can be performed by using FR Configurator2.

| Interface | Conforms to USB 1.1 |
|--------------------|-----------------------------------|
| Transmission speed | 12 Mbps |
| Wiring length | Maximum 5 m |
| Connector | USB mini B connector (receptacle) |
| Power supply | Self-powered |



• For details on FR Configurator2, refer to the Instruction Manual of FR Configurator2.

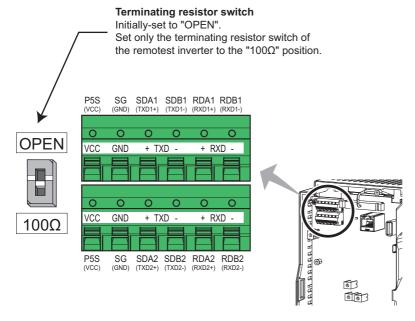
2.7.3 RS-485 terminal block

◆ Communication operation

| Conforming standard | EIA-485 (RS-485) |
|---------------------|------------------------------|
| Transmission format | Multidrop link |
| Communication speed | maximum 115200 bps |
| Overall length | 500 m |
| Connection cable | Twisted pair cable (4 pairs) |

The RS-485 terminals enable communication operation from a personal computer, etc. When the PU connector is connected with a personal, FA or other computer by a communication cable, a user program can run to monitor the inverter or read and write parameters.

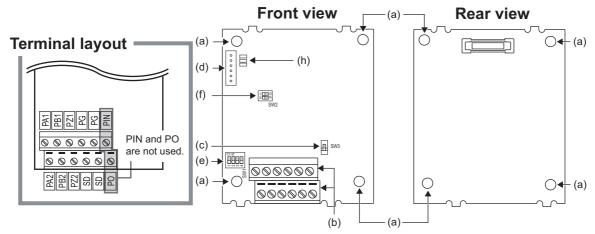
Communication can be performed with the Mitsubishi inverter protocol (computer link operation) and MODBUS RTU protocol. For the details, refer to page 661.



2.8 Connection to a motor with encoder (Vector control)

Using encoder-equipped motors together with a Vector control compatible option enables speed, torque, and positioning control operations under orientation control, encoder feedback control, and full-scale Vector control. This section explains wiring for use of the FR-A8AP.

♦ Appearance and parts name of the FR-A8AP



| Symbol | Name | Description | Refer to page |
|--------|---|---|---------------|
| (a) | Mounting hole | Used for installation to the inverter. | _ |
| (b) | Terminal block | Connected with the encoder. | 91 |
| (c) | Encoder type selection switch (SW3) | Switches the encoder type (differential line driver/complementary). | 88 |
| (d) | CON2 connector | Used for extension. | _ |
| (e) | Terminating resistor selection switches (SW1) | Switch ON or OFF the internal terminating resistor. | 88 |
| (f) | Switches (SW2) for manufacturer setting | Do not change the initial setting (both SW2-1 and SW2-2 switches: OFF ::). | _ |
| (g) | Board mounted option connector | Used to connect this product to the option connector on the inverter. | 19 |
| (h) | LED for manufacturer check | Not used. | _ |

♦ Terminals of the FR-A8AP

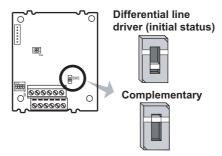
| Terminal symbol | Terminal name | Description | |
|-----------------|--|---|--|
| PA1 | Encoder A-phase signal input terminal | | |
| PA2 | Encoder A-phase inverse signal input terminal | | |
| PB1 | Encoder B-phase signal input terminal | A. D. and 7 phase signals are input from the appealar | |
| PB2 | Encoder B-phase inverse signal input terminal | A-, B- and Z-phase signals are input from the encoder. | |
| PZ1 | Encoder Z-phase signal input terminal | | |
| PZ2 | Encoder Z-phase inverse signal input terminal | | |
| PG | Encoder power supply (positive) input terminal | Input terminal for the encoder power supply. | |
| SD | Encoder power supply ground terminal | Connect the external power supply and the encoder power cable. When the encoder output is the differential line driver type, only 5 V can be input. Mat the voltage of the external power supply same as the encoder output voltage. (Check the encoder specification.) | |
| PIN | Not used. | | |
| PO | TNOT USEU. | | |

• NOTE

- · When the encoder's output voltage differs from its input power supply voltage, the signal loss detection (E.ECT) may occur.
- Incorrect wiring or faulty setting to the encoder will cause a fault such as an overcurrent (E.OC[]) and an inverter overload (E.THT). Correctly perform the encoder wiring and setting.

◆ Switches on the FR-A8AP

• Use the encoder type selection switch (SW3) to select the differential line driver or the complementary. It is initially set to the differential line driver. Switch its position according to the output circuit.

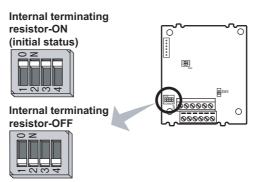


· Use the terminating resistor selection switches (SW1) to select ON/OFF of the internal terminating resistor.

Set the switches ON (initial status) when an encoder output type is differential line driver, and set OFF when complementary.

ON: With internal terminating resistor (initial status)

OFF: Without internal terminating resistor





- · Set all switches to the same setting (ON/OFF).
- Set the switches OFF when sharing an encoder with another unit (NC (computerized numerical controller), etc.) having a terminating resistor under the differential line driver setting.
- · Motor and switch setting

| Motor | | Encoder type selection switch (SW3) | Terminating resistor selection switches (SW1) | Power supply specification*2 |
|--|---------|-------------------------------------|---|------------------------------|
| Mitsubishi Electric standard motor | SF-JR | Differential | ON | 5 V |
| with encoder | SF-HR | Differential | ON | 5 V |
| Mitsubishi Electric high-efficiency motor with encoder | Others | *1 | *1 | *1*3 |
| Mitsubishi Electric constant-torque motor with encoder | SF-JRCA | Differential | ON | 5 V |
| | SF-HRCA | Differential | ON | 5 V |
| motor with encoder | Others | *1 | *1 | *1*3 |
| Vector control dedicated motor | SF-V5RU | Complementary | OFF | 12 V |
| Other manufacturer's motor with encoder | | *1 | *1 | *1*3 |

- *1 Set according to the motor (encoder).
- *2 Prepare the power supply (5 V/12 V/15 V/24 V) for the encoder according to the encoder's output voltage. When the control terminal option FR-A8TP is installed, 24 V power supply can be provided from the FR-A8TP.
- *3 When the encoder output is the differential line driver type, only 5 V can be input.



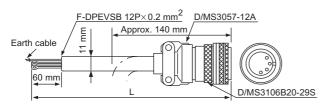
- The SW2 switches are for manufacturer setting. Do not change the setting.
- When the power supply of the inverter is turned OFF, also turn off the power supply of the encoder. Otherwise, the plug-in option may be damaged.

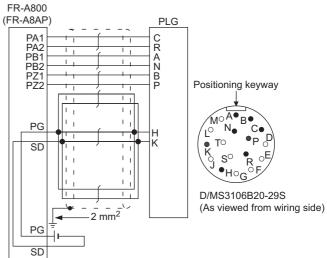
· Encoder specifications

| Item | Encoder for SF-JR | Encoder for SF-V5RU |
|----------------------|---|---|
| Resolution | 1024 pulses/rev | 2048 pulse/rev |
| Power supply voltage | 5 VDC ± 10% | 12 VDC ±10%, 24 VDC ±10% |
| Current consumption | 150 mA | 150 mA |
| Output signal form | Phase A and Phase B: 90 degrees out of phase, Phase Z: 1 pulse/rev | Phase A and Phase B: 90 degrees out of phase, Phase Z: 1 pulse/rev |
| Output circuit | Differential line driver AM26LS31 equivalent | Complementary |
| Output voltage | H level: 2.4 V or more, L level: 0.5 V or less | H level: (Power supply for encoder - 3 V) or more, L level: 3 V or less |

♦ Encoder cable

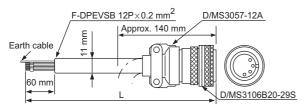
■ SF-JR/HR/JRCA/HRCA with encoder



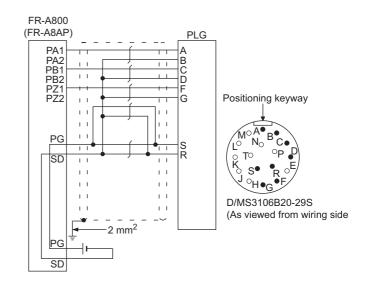


| Model | Length L (m) |
|-----------|--------------|
| FR-JCBL5 | 5 |
| FR-JCBL15 | 15 |
| FR-JCBL30 | 30 |

■ SF-V5RU, SF-THY



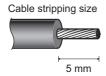
A P clip for earthing (grounding) a shielded cable is provided.



| Model | Length L (m) |
|------------|--------------|
| FR-V7CBL5 | 5 |
| FR-V7CBL15 | 15 |
| FR-V7CBL30 | 30 |

When using an encoder cable (FR-JCBL, FR-V5CBL, etc.) dedicated to the conventional motor, the cables need to be
treated as the terminal block of the FR-A8AP is an insertion type. Cut the crimp terminal of the encoder cable and strip its
sheath to make its cable wires loose. Also, treat the shielding wires of the shielded twisted pair cable to ensure that they
do not contact conductive areas.

Wire the stripped cable after twisting it to prevent it from becoming loose. In addition, do not solder it.









Information on crimp terminals
 Commercially available products (as of October 2020)
 Phoenix Contact Co., Ltd.

| Terminal screw | Wire gauge | Ferrule part No. | | Crimping tool | |
|----------------|--------------------|------------------------|---------------------------|---------------|--|
| size | (mm ²) | With insulation sleeve | Without insulation sleeve | model No. | |
| M2 | 0.3 | AI 0,34-6TQ | A 0,34-7 | CRIMPFOX 6 | |
| IVIZ | 0.5 | AI 0,5-6WH | A 0,5-6 | CINIMIFFOX | |

NICHIFU Co., Ltd.

| Terminal screw size | Wire gauge (mm ²) | Blade terminal part No. | Insulation cap part No. | Crimping tool model No. |
|---------------------|----------------------------------|-------------------------|-------------------------|-------------------------|
| M2 | 0.3 to 0.75 | BT 0.75-7 | VC 0.75 | NH 69 |

• When using a blade terminal (without insulation sleeve), take caution that the twisted wires do not come out.

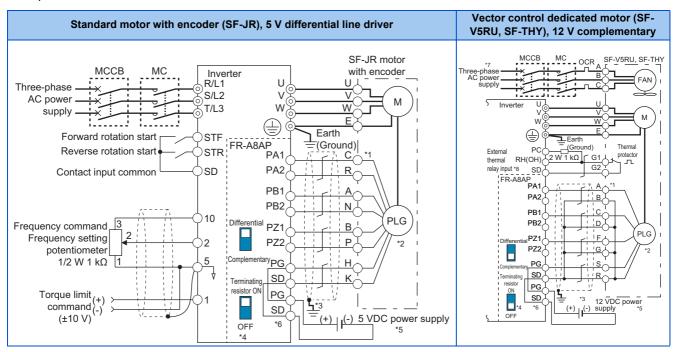


· Connection terminal compatibility table

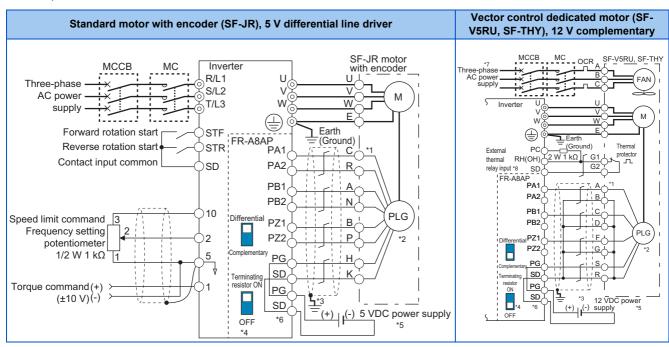
| Motor | | SF-V5RU, SF-THY | SF-JR/HR/JRCA/HRCA (with encoder) |
|---------------------|-----|----------------------------------|-----------------------------------|
| Encoder cable | | FR-V7CBL | FR-JCBL |
| | PA1 | PA | PA |
| | PA2 | Do not connect anything to this. | PAR |
| | PB1 | PB | PB |
| FR-A8AP terminal | PB2 | Do not connect anything to this. | PBR |
| FIX-AOAF tellilliai | PZ1 | PZ | PZ |
| | PZ2 | Do not connect anything to this. | PZR |
| | PG | PG | 5E |
| | SD | SD | AG2 |

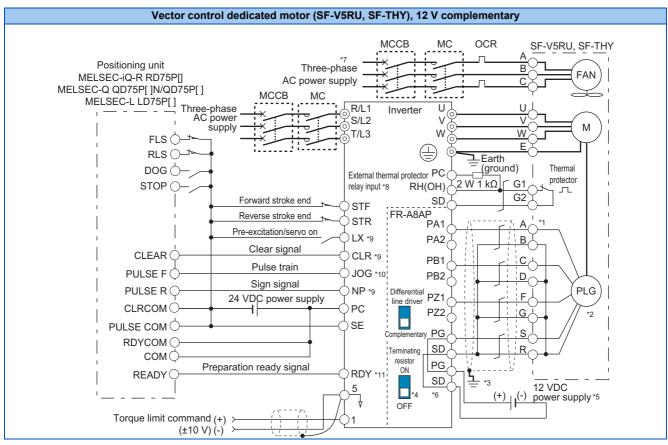
♦ Wiring example

· Speed control



· Torque control



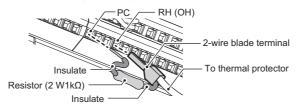


- *1 The pin number differs according to the encoder used.
 - Speed, control, torque control, and position control by pulse train input are available with or without the Z-phase being connected.
- *2 Connect the encoder so that there is no looseness between the motor and motor shaft. Speed ratio must be 1:1.
- *3 Earth (ground) the shield of the encoder cable to the enclosure using a tool such as a P-clip. (Refer to page 93.)
- *4 For the complementary, set the terminating resistor selection switches in the OFF position. (Refer to page 88.)
- *5 A separate external power supply is necessary according to the encoder power specification. When the encoder output is the differential line driver type, only 5 V can be input.
 - Make the voltage of the external power supply the same as the encoder output voltage, and connect the external power supply between terminals PG and SD
- *6 For terminal compatibility of the FR-JCBL, FR-V7CBL, and FR-A8AP, refer to page 90.
- *7 Single-phase power supply (200 V/50 Hz, 200 to 230 V/60 Hz) is used for the fan for a 7.5 kW or lower dedicated motor.
- *8 Connect the recommended 2W1kΩ resistor between terminals PC and OH. (Recommended product: MOS2C102J 2W1kΩ by KOA Corporation) Insert the input line and the resistor to a 2-wire blade terminal, and connect the blade terminal to terminal OH. (For the recommended 2-wire blade terminals, refer to page 74.)

Insulate the lead wire of the resistor, for example by applying a contraction tube, and shape the wires so that the resistor and its lead wire do not touch other cables. Caulk the lead wire securely together with the thermal protector input line using a 2-wire blade terminal. (Do not subject the lead wire's bottom area to an excessive pressure.)

To use a terminal as terminal OH, assign the OH (External thermal relay input) signal to an input terminal. (Set "7" in any of **Pr.178 to Pr.189**. For details, refer to page 521.)

When OH signal is assigned to terminal RH (**Pr.182** = "7")

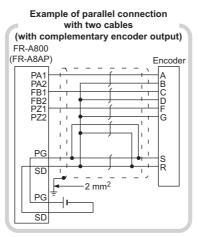


- *9 Assign the function using Pr.178 to Pr.184, Pr.187 to Pr.189 (Input terminal function selection).
- *10 When position control is selected, terminal JOG function is invalid and simple position pulse train input terminal becomes valid.
- *11 Assign the function using Pr.190 to Pr.194 (Output terminal function selection).

♦ Instructions for encoder cable wiring

• Use shielded twisted pair cables (0.2 mm² or larger) to connect the FR-A8AP. For the wiring to terminals PG and SD, use several cables in parallel or use a thick cable, according to the wiring length.

To protect the cables from noise, run them away from any source of noise (such as the main circuit and power supply voltage).

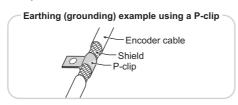


| Wiring length | Parallel connec | Larger-size cable | |
|----------------|----------------------------------|-----------------------------------|--------------------------------|
| Within 10 m | At least two cables in parallel | Mina mayona 0.0 | 0.4 mm ² or larger |
| Within 20 m | At least four cables in parallel | Wire gauge 0.2 mm ² | 0.75 mm ² or larger |
| Within 100 m*1 | At least six cables in parallel | | 1.25 mm ² or larger |

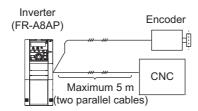
*1 When differential line driver is set and a wiring length is 30 m or more.

The wiring length can be extended to 100 m by increasing the 5 V power supply (approximately to 5.5 V) while using six or more 0.2 mm² gauge cables in parallel or a 1.25 mm² or larger gauge cable. The voltage applied must be within power supply specifications of encoder.

• To reduce noise of the encoder cable, earth (ground) the encoder's shielded cable to the enclosure (as close as possible to the inverter) with a metal P-clip or U-clip.



• When one encoder is shared between the FR-A8AP and CNC (computerized numerical controller), its output signal should be connected as follows. In this case, the wiring length between the FR-A8AP and CNC should be as short as possible, within 5 m.





- For details on the optional encoder dedicated cable (FR-JCBL/FR-V7CBL), refer to page 89.
- The FR-V7CBL is provided with a P-clip for earthing (grounding) shielded cables.

2.9 Parameter settings for a motor with encoder

◆ Parameters for the encoder (Pr.359, Pr.369, Pr.851, Pr.852)

· Set the encoder specifications.

| P | r. | Name | Initial value | Setting range | e Description | |
|-------------|---|----------------------------|------------------|---|--|--|
| | | | | 0 | Set when using a motor for which forward rotation (encoder) is clockwise | Set for the operation at 120 Hz or less. |
| 350 | 952 | | | 100 (CW) viewed from the shaft | | Set for the operation at a frequency higher than 120 Hz. |
| C141 | 359 852 C141 C241 Encoder rotation direction | Encoder rotation direction | 1 | 1 | Set when using a motor for which forward rotation (encoder) is | Set for the operation at 120 Hz or less. |
| | | | 101 | counterclockwise (CCW) viewed from the shaft. | Set for the operation at a frequency higher than 120 Hz. | |
| 369 C140 | 851 C240 | Number of encoder pulses | 1024 | 0 to 4096 | Set the number of encoder pulses. Set the number of pulses before it is multiplied by 4. | |

The parameters above can be set when a Vector control compatible option is installed.

• The following table shows parameters to be set according to the Vector control compatible option to be used.

| Item | FR-A8AP/FR-A8AL/FR- A8APA parameter | FR-A8APR parameter | FR-A8APS parameter | FR-A8TP parameter |
|-------------------------------------|--|--------------------------|---|-------------------|
| Encoder/Resolver rotation direction | Pr.359 | Pr.852 | | |
| Number of detector pulses | Pr.369 | — (fixed pulses of 1024) | (obtained via communication from the encoder) | Pr.851 |

◆ Parameter settings for the motor under Vector control

| Moto | or model | Pr.9 Electronic thermal O/L relay | Pr.71 Applied motor | Pr.80 Motor capacity | Pr.81 Number of motor poles | Pr.359/Pr.852 Encoder rotation direction | Pr.369/Pr.851 Number of encoder pulses |
|---|--|---|-----------------------|-------------------------|-----------------------------------|---|---|
| | SF-JR | Rated motor current | 0 (initial value) | Motor capacity | Number of motor poles | 1 (initial value) | 1024 (initial value) |
| Mitsubishi Electric | SF-JR 4P 1.5 kW or lower | Rated motor current | 20 | Motor capacity | 4 | 1 (initial value) | 1024 (initial value) |
| standard motor | SF-HR | Rated motor current | 40 | Motor capacity | Number of motor poles | 1 (initial value) | 1024 (initial value) |
| | Others | Rated motor current | 0 (3)*1 | Motor capacity | Number of motor poles | *2 | *2 |
| Mitsubishi | SF-JRCA 4P | Rated motor current | 1 | Motor capacity | 4 | 1 (initial value) | 1024 (initial value) |
| Electric constant-torque | SF-HRCA | Rated motor current | 50 | Motor capacity | Number of motor poles | 1 (initial value) | 1024 (initial value) |
| motor | Others | Rated motor current | 1 (13) ^{*1} | Motor capacity | Number of motor poles | *2 | *2 |
| | SF-V5RU (1500 r/min series) | 0*3 | 30 | Motor capacity | 4 | 1 (initial value) | 2048 |
| Vector control dedicated motor | SF-V5RU (other than the 1500 r/min series) | 0*3 | 1 (13) ^{*1} | Motor capacity | 4 | 1 (initial value) | 2048 |
| | SF-THY | 0*3 | 30 (33) ^{*1} | Motor capacity | 4 | 1 (initial value) | 2048 |
| Other manufacturer's standard motor | _ | Rated motor current | 0 (3)*1 | Motor capacity | Number of motor poles | *2 | *2 |
| Other manufacturer's constant-torque motor | _ | Rated motor current | 1 (13) ^{*1} | Motor capacity | Number of motor poles | *2 | *2 |
| PM motor | | Refer to the Instr | uction Manual of | f the FR-A8APR. | | | |

^{*1} Offline auto tuning is required. (Refer to page 532.)

 When using the inverter with the SF-V5RU (1500 r/min series), refer to the following table to set Pr.83 Rated motor voltage and Pr.84 Rated motor frequency.

| B# -4 | SF-V5RU | | | | |
|----------------|-----------|------------|-----------|------------|--|
| Motor capacity | 20 | 0 V | 400 V | | |
| capacity | Pr.83 (V) | Pr.84 (Hz) | Pr.83 (V) | Pr.84 (Hz) | |
| 1.5 kW | 188 | 52 | 345 | 52 | |
| 2.2 kW | 188 | 52 | 360 | 52 | |
| 3.7 kW | 190 | 52 | 363 | 52 | |
| 5.5 kW | 165 | 51 | 322 | 51 | |
| 7.5 kW | 164 | 51 | 331 | 51 | |
| 11 kW | 171 | 51 | 320 | 51 | |
| 15 kW | 164 | 51 | 330 | 51 | |

| Matau | SF-V5RU | | | | |
|----------------|-----------|------------|-----------|------------|--|
| Motor capacity | 20 | 0 V | 400 V | | |
| capacity | Pr.83 (V) | Pr.84 (Hz) | Pr.83 (V) | Pr.84 (Hz) | |
| 18.5 kW | 171 | 51 | 346 | 51 | |
| 22 kW | 160 | 51 | 336 | 51 | |
| 30 kW | 178 | 51 | 328 | 51 | |
| 37 kW | 166 | 51 | 332 | 51 | |
| 45 kW | 171 | 51 | 342 | 51 | |
| 55 kW | 159 | 51 | 317 | 51 | |

• When using the inverter with the SF-V5RU1, SF-V5RU3, or SF-V5RU4, refer to the following table to set **Pr.83 Rated motor voltage** and Pr.84 Rated motor frequency.

| Motor model | Pr.83 | Pr.84 setting | |
|--|-------------|---------------|---------------|
| Motor moder | 200 V class | 400 V class | F1.04 Setting |
| SF-V5RU1-30kW or lower | 160 V | 320 V | |
| SF-V5RU1-37kW | 170 V | 340 V | 33.33 Hz |
| SF-V5RU3-22kW or lower | 160 V | 320 V | 33.33 HZ |
| SF-V5RU3, 30kW | 170 V | 340 V | |
| SF-V5RU4-3.7kW and 7.5kW | 150 V | 300 V | |
| SF-V5RU4 and motors other than described above | 160 V | 320 V | 16.67 Hz |

^{*2} Set this parameter according to the motor.

^{*3} Use the thermal protector input provided with the motor.

♦ Combination with the Vector control dedicated motor

When using the inverter with a Vector control dedicated motor, refer to the following table.

· Combination with the SF-V5RU and SF-THY (ND rating)

| Voltage | | 200 V class | | | 400 V class | | |
|----------------|---|-------------|--------------------|-------------|------------------------------|--------------|--|
| Rated speed | | | 1500 | r/min | | | |
| Base frequency | | 50 Hz | | | | | |
| Maximum speed | | | 3000 | r/min | | | |
| Motor capacity | ity Motor frame Motor model Inverter model FR-A820-[] | | Motor frame No. | Motor model | Inverter model FR-A840-[] | | |
| 1.5 kW | 90L | SF-V5RU1K | 00167(2.2K) | 90L | SF-V5RUH1K | 00083(2.2K) | |
| 2.2 kW | 100L | SF-V5RU2K | 00250(3.7K) | 100L | SF-V5RUH2K | 00083(2.2K) | |
| 3.7 kW | 112M | SF-V5RU3K | 00340(5.5K) | 112M | SF-V5RUH3K | 00126(3.7K) | |
| 5.5 kW | 132S | SF-V5RU5K | 00490(7.5K) | 132S | SF-V5RUH5K | 00250(7.5K) | |
| 7.5 kW | 132M | SF-V5RU7K | 00630(11K) | 132M | SF-V5RUH7K | 00310(11K) | |
| 11 kW | 160M | SF-V5RU11K | 00770(15K) | 160M | SF-V5RUH11K | 00380(15K) | |
| 15 kW | 160L | SF-V5RU15K | 00930(18.5K) | 160L | SF-V5RUH15K | 00470(18.5K) | |
| 18.5 kW | 180M | SF-V5RU18K | 01250(22K) | 180M | SF-V5RUH18K | 00620(22K) | |
| 22 kW | 180M | SF-V5RU22K | 01540(30K) | 180M | SF-V5RUH22K | 00770(30K) | |
| 30 kW | 200L*2 | SF-V5RU30K | 01870(37K) | 200L*2 | SF-V5RUH30K | 00930(37K) | |
| 37 kW | 200L*2 | SF-V5RU37K | 02330(45K) | 200L*2 | SF-V5RUH37K | 01160(45K) | |
| 45 kW | 200L*2 | SF-V5RU45K | 03160(55K) | 200L*2 | SF-V5RUH45K | 01800(55K) | |
| 55 kW | 225S*1 | SF-V5RU55K | 03800(75K) | 225S*1 | SF-V5RUH55K | 02160(75K) | |
| 75 kW | 250MD | SF-THY | 04750(90K) | 250MD | SF-THY | 02600(90K) | |
| 90 kW | _ | _ | _ | 250MD | SF-THY | 03250(110K) | |
| 110 kW | _ | _ | _ | 280MD | SF-THY | 03610(132K) | |
| 132 kW | _ | _ | _ | 280MD | SF-THY | 04320(160K) | |
| 160 kW | _ | _ | _ | 280MD | SF-THY | 04810(185K) | |
| 200 kW | _ | _ | _ | 280L | SF-THY | 05470(220K) | |
| 250 kW | _ | _ | _ | 315H | SF-THY | 06830(280K) | |

• Combination with the SF-V5RU1, 3, 4, and SF-THY (ND rating)

| | SF-V5RU[]1 (1:2) | | SF-V5RU[]3 (1:3) | | SF-V5RU[]4 (1:4) | | | | |
|----------------|-----------------------|----------------------|---------------------------------|-----------------------|------------------|---------------------------------|-----------------------|----------------------|---------------------------------|
| Voltage | | 200 V class | | | | | | | |
| Rated speed | 1000 r/min | | 1000 r/min | | 500 r/min | | | | |
| Base frequency | 33.33 Hz | | 33.33 Hz | | 16.6 Hz | | | | |
| Maximum speed | 2000 r/min | | 3000 r/min | | 2000 r/min | | | | |
| Motor capacity | Motor frame No. | Motor model | Inverter model FR-A820-[] | Motor frame No. | Motor model | Inverter model FR-A820-[] | Motor frame No. | Motor model | Inverter model FR-A820-[] |
| 1.5 kW | 100L | SF-V5RU1K1(Y) | 00167(2.2K) | 112M | SF-V5RU1K3(Y) | 00167(2.2K) | 132M | SF-V5RU1K4(Y) | 00167(2.2K) |
| 2.2 kW | 112M | SF-V5RU2K1(Y) | 00250(3.7K) | 132S | SF-V5RU2K3(Y) | 00250(3.7K) | 160M | SF-V5RU2K4(Y) | 00250(3.7K) |
| 3.7 kW | 132S | SF-V5RU3K1(Y) | 00340(5.5K) | 132M | SF-V5RU3K3(Y) | 00340(5.5K) | 160L | SF-V5RU3K4 | 00490(7.5K)*4 |
| 5.5 kW | 132M | SF-V5RU5K1(Y) | 00490(7.5K) | 160M | SF-V5RU5K3(Y) | 00490(7.5K) | 180L | SF-V5RU5K4 (Y) | 00490(7.5K) |
| 7.5 kW | 160M | SF-V5RU7K1(Y) | 00630(11K) | 160L | SF-V5RU7K3(Y) | 00630(11K) | 200L | SF-V5RU7K4(Y) | 00630(11K) |
| 11 kW | 160L | SF-V5RU11K1(Y) | 00770(15K) | 180M | SF-V5RU11K3(Y) | 00770(15K) | 225S | SF-V5RU11K4(Y) | 00770(15K) |
| 15 kW | 180M | SF-V5RU15K1(Y) | 00930(18.5K) | 180L | SF-V5RU15K3(Y) | 00930(18.5K) | 225S | SF-V5RU15K4 | 01250(22K)*4 |
| 18.5 kW | 180L | SF-V5RU18K1(Y) | 01250(22K) | 200L | SF-V5RU18K3(Y) | 01250(22K) | 250MD | SF-THY ^{*5} | 01250(22K) |
| 22 kW | 200L | SF-V5RU22K1(Y) | 01540(30K) | 200L | SF-V5RU22K3(Y) | 01540(30K) | 280MD | SF-THY*5 | 01540(30K) |
| 30 kW | 200L*3 | SF-V5RU30K1(Y) | 01870(37K) | 225S*1 | SF-V5RU30K3(Y) | 01870(37K) | 280MD | SF-THY*5 | 01870(37K) |
| 37 kW | 225S | SF-V5RU37K1(Y) | 02330(45K) | 250MD*1 | SF-THY*5 | 02330(45K) | 280MD | SF-THY*5 | 02330(45K) |
| 45 kW | 250MD | SF-THY*5 | 03160(55K) | 250MD*1 | SF-THY*5 | 03160(55K) | 280MD | SF-THY*5 | 03160(55K) |
| 55 kW | 250MD | SF-THY ^{*5} | 03800(75K) | 280MD*1 | SF-THY*5 | 03800(75K) | 280L | SF-THY*5 | 03800(75K) |

400 V class are developed upon receipt of order.

- *1 The maximum speed is 2400 r/min.
- *2 80% output in the high-speed range. (The output is reduced when the speed is 2400 r/min or faster.)
- $^{\star}3$ 90% output in the high-speed range. (The output is reduced when the speed is 1000 r/min or faster.)
- *4 For motors with overload capacity 150% 60 seconds ("Y" at the end of their model names), contact your sales representative.
- *5 This model is developed upon receipt of order.

2.10 Connection of stand-alone option units

The inverter accepts a variety of stand-alone option units as required.

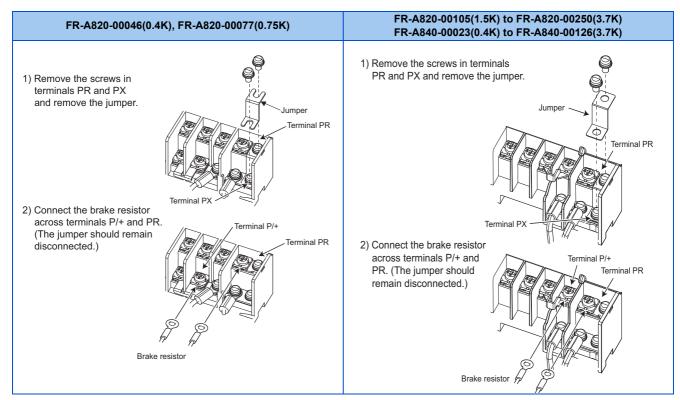
Incorrect connection will cause inverter damage or accident. Connect and operate the option unit carefully in accordance with the Instruction Manual of the corresponding option unit.

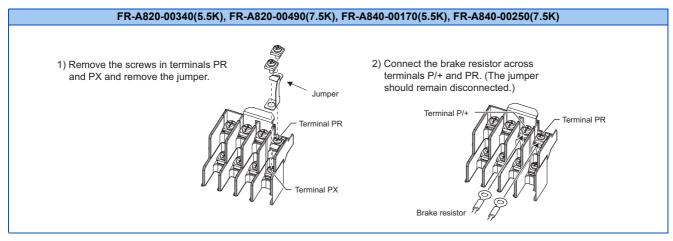
2.10.1 Connection of the brake resistor

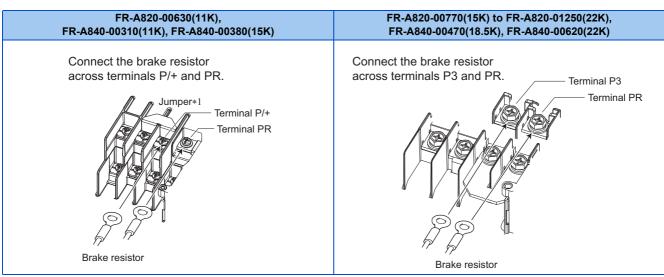
- When an inverter-driven motor is driven by a load or requires rapid deceleration, install an external brake resistor. Connect the brake resistor to terminals P/+(P3) and PR. (For the locations of terminal P/+(P3) and PR, refer to the terminal block layout (page 55).)
- For the FR-A820-00490(7.5K) or lower and the FR-A840-00250(7.5K) or lower, the plug-in brake resistor is connected to terminals P/+ and PX.

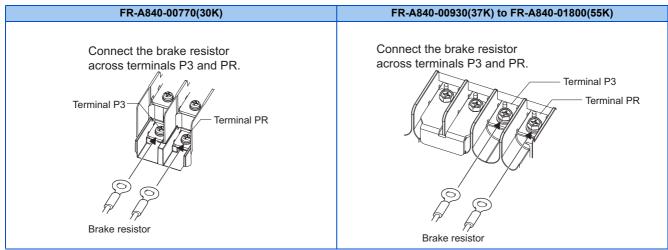
When the plug-in brake resistor does not have enough thermal capability for high-duty operation, install an external brake resistor. At this time, remove the jumper across terminals PR and PX and connect the brake resistor to terminals P/+ and PR. terminal block layout (page 55).)

Removing jumpers across terminals PR and PX disables the plug-in brake resistor (power is not supplied). The plug-in brake resistor can be left connected to the inverter, and so is the plug-in brake resistor's lead wire connected to the terminal.









*1 Do not remove the jumper across terminals P/+ and P1 except when connecting a DC reactor (FR-HEL).

NOTE

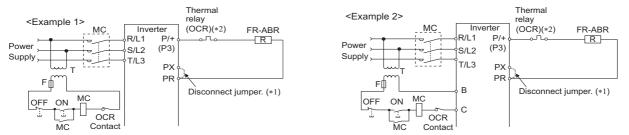
- For the FR-A820-00490(7.5K) or lower and the FR-A840-00250(7.5K) or lower, the jumper across terminals PR and PX must be disconnected before connecting the dedicated brake resistor. Doing so may damage the inverter.
- · A brake resistor cannot be used with options such as brake units, high power factor converters, and power regeneration converters.

♦ Connection of the dedicated external brake resistor (FR-ABR)

The FR-ABR can be applied to the FR-A820-01250(22K) or lower and the FR-A840-00620(22K) or lower. Set parameters as follows:

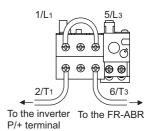
• Pr.30 Regenerative function selection = "1"

- Pr.70 Special regenerative brake duty = 10% (for 7.5K or lower) or 6% (for 11K or higher)
 (Refer to page 724.)
- When the regenerative brake transistor is damaged, the following sequence is recommended to prevent overheat and burnout of the brake resistor.



- *1 Since the FR-A820-00630(11K) or higher and FR-A840-00310(11K) or higher are not provided with terminal PX, a jumper need not to be removed.
- *2 Refer to the following table for the thermal relay models for each capacity. Refer to the following diagram for the connection. (Always install a thermal relay when using a brake resistor for the inverters with 11K or higher capacity.)

| Power supply voltage | High-duty brake resistor | Thermal relay model (Mitsubishi electric product) | Rated operating current |
|----------------------|--------------------------|---|--|
| | FR-ABR-0.4K | TH-T25-0.7A | |
| | FR-ABR-0.75K | TH-T25-1.3A | |
| | FR-ABR-2.2K | TH-T25-2.1A | |
| | FR-ABR-3.7K | TH-T25-3.6A | |
| 200 V | FR-ABR-5.5K | TH-T25-5A | |
| | FR-ABR-7.5K | TH-T25-6.6A | |
| | FR-ABR-11K | TH-T25-11A | |
| | FR-ABR-15K | TH-T25-11A | |
| | FR-ABR-22K | TH-T65-22A | 120 VAC: 2 A (NO contact) / 3 A (NC contact), |
| | FR-ABR-H0.4K | TH-T25-0.24A | 240 VAC: 1 A (NO contact) / 2 A (NC contact) (AC15 class) |
| | FR-ABR-H0.75K | TH-T25-0.35A | 110 VDC: 0.2 A, 220 VDC: 0.1 A (DC13 class) |
| | FR-ABR-H1.5K | TH-T25-0.9A | , |
| | FR-ABR-H2.2K | TH-T25-1.3A | |
| 400 V | FR-ABR-H3.7K | TH-T25-2.1A | |
| | FR-ABR-H5.5K | TH-T25-2.5A | |
| | FR-ABR-H7.5K | TH-T25-3.6A | |
| | FR-ABR-H11K | TH-T25-6.6A | |
| | FR-ABR-H15K | TH-T25-6.6A | |
| | FR-ABR-H22K | TH-T25-9A | |



◆ Connection of a brake resistor other than the FR-ABR

A brake resistor can be used with the FR-A820-01250(22K) or lower and the FR-A840-01800(55K) or lower. Use a brake resistor that has resistance and power consumption values higher than the following. Also, the brake resistor must

Use a brake resistor that has resistance and power consumption values higher than the following. Also, the brake resistor must have a sufficient capacity to consume the regenerative power.

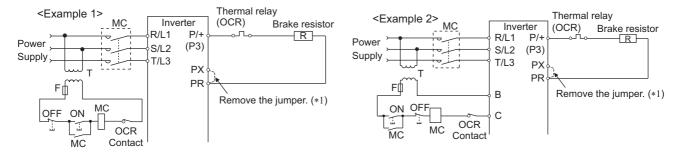
| Voltage class | Inverter | Minimum resistance (Ω) | Power consumption (kW) |
|---------------|----------------------|------------------------|------------------------|
| | FR-A820-00046(0.4K) | 100 | 1.44 |
| | FR-A820-00077(0.75K) | 80 | 1.81 |
| | FR-A820-00105(1.5K) | 50 | 2.89 |
| | FR-A820-00167(2.2K) | 33 | 4.38 |
| | FR-A820-00250(3.7K) | 30 | 4.81 |
| 200 V class | FR-A820-00340(5.5K) | 18 | 8.02 |
| | FR-A820-00490(7.5K) | 18 | 8.02 |
| | FR-A820-00630(11K) | 12 | 12.0 |
| | FR-A820-00770(15K) | 8.5 | 17.0 |
| | FR-A820-00930(18.5K) | 6.5 | 22.2 |
| | FR-A820-01250(22K) | 6.5 | 22.2 |

| Valtage along | Inverter | Minimum registance (O) | Power consumption (kW)*1 | | |
|---------------|----------------------|------------------------|--------------------------|--------------|--|
| Voltage class | inverter | Minimum resistance (Ω) | Pr.977 = "0" | Pr.977 = "1" | |
| | FR-A840-00023(0.4K) | 371 | 1.56 | 1.66 | |
| | FR-A840-00038(0.75K) | 236 | 2.45 | 2.61 | |
| | FR-A840-00052(1.5K) | 190 | 3.04 | 3.24 | |
| | FR-A840-00083(2.2K) | 130 | 4.44 | 4.74 | |
| | FR-A840-00126(3.7K) | 83 | 6.96 | 7.42 | |
| | FR-A840-00170(5.5K) | 66 | 8.75 | 9.34 | |
| | FR-A840-00250(7.5K) | 45 | 12.8 | 13.7 | |
| 400 V class | FR-A840-00310(11K) | 34 | 17.0 | 18.1 | |
| | FR-A840-00380(15K) | 34 | 17.0 | 18.1 | |
| | FR-A840-00470(18.5K) | 21 | 27.5 | 29.3 | |
| | FR-A840-00620(22K) | 21 | 27.5 | 29.3 | |
| | FR-A840-00770(30K) | 13.5 | 42.8 | 45.6 | |
| | FR-A840-00930(37K) | 13.5 | 42.8 | 45.6 | |
| | FR-A840-01160(45K) | 13.5 | 42.8 | 45.6 | |
| | FR-A840-01800(55K) | 13.5 | 42.8 | 45.6 | |

^{*1} Power consumption differs according to the voltage protection level. The voltage protection level is set in Pr.977. (Refer to page 345.)

Set parameters as follows:

- Pr.30 Regenerative function selection = "1"
- Set **Pr.70 Special regenerative brake duty** according to the amount and frequency of the regenerative driving, and make sure that the resistor can consume the regenerative power properly. (Refer to page 724.)
- When the regenerative brake transistor is damaged, install a thermal relay as shown in the following sequence to prevent overheat and burnout of the brake resistor. Properly select a thermal relay according to the regenerative driving frequency or the rated power or resistance of the brake resistor.



*1 Since the FR-A820-00630(11K) or higher and FR-A840-00310(11K) or higher are not provided with terminal PX, a jumper need not to be removed.

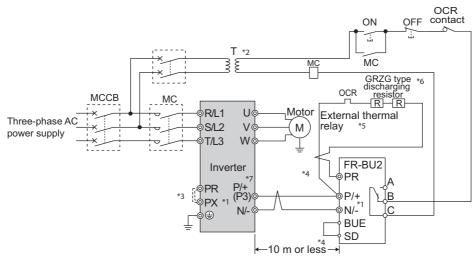
↑ CAUTION

- If the resistor selection is incorrect, overcurrent may damage the inverter built-in brake transistor. Besides, the resistor may be burned due to overheat.
- · If the selection of the thermal relay is incorrect, the resistor may be burned due to overheat.

2.10.2 Connection of the brake unit (FR-BU2)

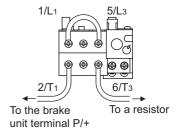
Connect the brake unit (FR-BU2(-H)) as follows to improve the braking capability during deceleration.

◆ Connection example with the GRZG type discharging resistor



- *1 When wiring, make sure to match the terminal symbols (P/+, N/-) on the inverter and on the brake unit (FR-BU2). (Incorrect connection will damage the inverter and brake unit.)
- *2 When the power supply is 400 V class, install a stepdown transformer.
- *3 Be sure to remove the jumper across terminals PR and PX when using the FR-BU2 with the inverter of FR-A820-00490(7.5K) or lower, or FR-A840-00250(7.5K) or lower.
- *4 The wiring distance between the inverter, brake unit (FR-BU2) and discharging resistor must be within 5 m. When using twisted pair cable, use the cable within 10 m.
- *5 It is recommended to install an external thermal relay to prevent overheat of the discharging resistor.
- *6 For the connection method of the discharging resistor, refer to the Instruction Manual of the FR-BU2.
- *7 Terminal P3 is equipped in the FR-A820-00770(15K) to 01250(22K), and FR-A840-00470(18.5K) to 01800(55K). Terminal P3 has the same function as terminal P/+ on the inverter.
- · Recommended external thermal relay

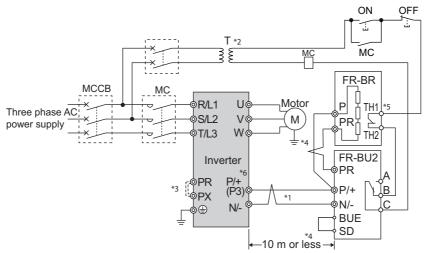
| brake unit | Discharging resistor | Recommended external thermal relay | |
|--------------|--------------------------------|------------------------------------|--|
| FR-BU2-1.5K | GZG 300W-50Ω (one) | TH-T25 1.3A | |
| FR-BU2-3.7K | GRZG 200-10Ω (three in series) | TH-T25 3.6A | |
| FR-BU2-7.5K | GRZG 300-5Ω (four in series) | TH-T25 6.6A | |
| FR-BU2-15K | GRZG 400-2Ω (six in series) | TH-T25 11A | |
| FR-BU2-H7.5K | GRZG 200-10Ω (six in series) | TH-T25 3.6A | |
| FR-BU2-H15K | GRZG 300-5Ω (eight in series) | TH-T25 6.6A | |
| FR-BU2-H30K | GRZG 400-2Ω (twelve in series) | TH-T25 11A | |





- Set "1" in Pr.0 Brake mode selection in the FR-BU2 to use a GRZG type discharging resistor.
- Do not remove the jumper across terminals P/+ and P1 except when connecting a DC reactor (FR-HEL).

◆ Connection example with the FR-BR(-H) resistor unit



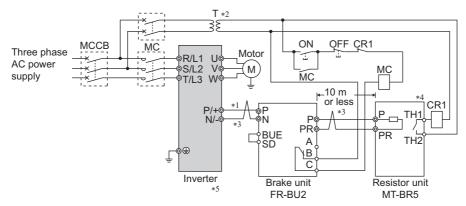
- *1 When wiring, make sure to match the terminal symbols (P/+, N/-) on the inverter and on the brake unit (FR-BU2). (Incorrect connection will damage the inverter and brake unit.)
- *2 When the power supply is 400 V class, install a stepdown transformer.
- *3 Be sure to remove the jumper across terminals PR and PX when using the FR-BU2 with the inverter of FR-A820-00490(7.5K) or lower, or FR-A840-00250(7.5K) or lower.
- *4 The wiring distance between the inverter, brake unit (FR-BU2) and resistor unit (FR-BR) must be within 5 m. When using twisted pair cable, use the cable within 10 m.
- *5 The contact between TH1 and TH2 is closed in the normal status and is open at a fault.
- *6 Terminal P3 is equipped in the FR-A820-00770(15K) to 01250(22K), and FR-A840-00470(18.5K) to 01800(55K). Terminal P3 has the same function as terminal P\+ on the inverter.



• Do not remove the jumper across terminals P/+ and P1 except when connecting a DC reactor (FR-HEL).

◆ Connection example with the MT-BR5 type resistor unit

After making sure that the wiring is correct and secure, set **Pr.30 Regenerative function selection** = "1" and **Pr.70 Special regenerative brake duty** = "0 (initial value)". Set **Pr.0 Brake mode selection** = "2" in the brake unit FR-BU2.



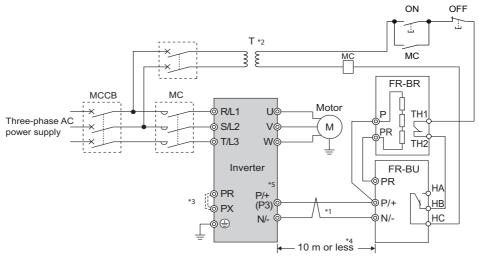
- *1 When wiring, make sure to match the terminal symbols (P/+, N/-) on the inverter and on the brake unit (FR-BU2). (Incorrect connection will damage the inverter and brake unit.)
- *2 When the power supply is 400 V class, install a stepdown transformer.
- *3 The wiring distance between the inverter, brake unit (FR-BU2) and resistor unit (FR-BR) must be within 5 m. When using twisted pair cable, use the cable within 10 m.
- *4 The contact between TH1 and TH2 is open in the normal status and is closed at a fault.
- *5 The CN8 connector used with the MT-BU5 type brake unit is not used.



• The warning "oL" of the stall prevention (overvoltage) does not occur while **Pr.30 Regenerative function selection** = "1" and **Pr.70 Special regenerative brake duty** = 0% (initial value). (Refer to page 724.)

2.10.3 Connection of the brake unit (FR-BU)

Connect the brake unit (FR-BU(-H)) as follows to improve the braking capability during deceleration. The FR-BU is compatible with the FR-A820-03160(55K) or lower and the FR-A840-01800(55K) or lower.



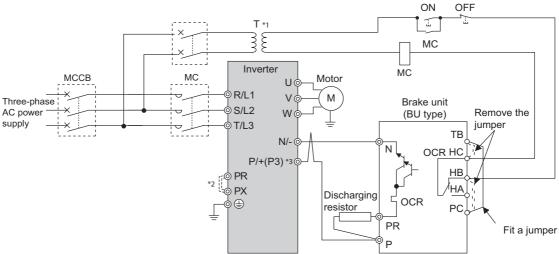
- *1 When wiring, make sure to match the terminal symbols (P/+, N/-) on the inverter and on the brake unit (FR-BU(-H)). (Incorrect connection will damage the inverter.)
- *2 When the power supply is 400 V class, install a stepdown transformer.
- *3 For the FR-A820-00490(7.5K) or lower and FR-A840-00250(7.5K) or lower, be sure to remove the jumper across terminals PR and PX.
- *4 The wiring distance between the inverter, brake unit (FR-BU) and resistor unit (FR-BR) must be within 5 m. When using twisted pair cable, use the cable within 10 m.
- *5 Terminal P3 is equipped in the FR-A820-00770(15K) to 01250(22K), and FR-A840-00470(18.5K) to 01800(55K). Terminal P3 has the same function as terminal P\+ on the inverter.



- If the transistors in the brake unit should become faulty, the resistor will overheat. Install a magnetic contactor on the inverter's input side and configure a circuit that shut off the current in case of a fault.
- Do not remove the jumper across terminals P/+ and P1 except when connecting a DC reactor (FR-HEL).

2.10.4 Connection of the brake unit (BU type)

Connect the brake unit (BU type) correctly as follows. Incorrect connection will damage the inverter. Remove the jumpers across terminals HB and PC and terminals TB and HC on the brake unit, and fit one across terminals PC and TB. The BU type brake unit is compatible with the FR-A820-03160(55K) or lower and the FR-A840-01800(55K) and lower.



- *1 When the power supply is 400 V class, install a stepdown transformer.
- *2 For the FR-A820-00490(7.5K) or lower and FR-A840-00250(7.5K) or lower, be sure to remove the jumper across terminals PR and PX.
- *3 Terminal P3 is equipped in the FR-A820-00770(15K) to 01250(22K), and FR-A840-00470(18.5K) to 01800(55K). Terminal P3 has the same function as terminal P\+ on the inverter.

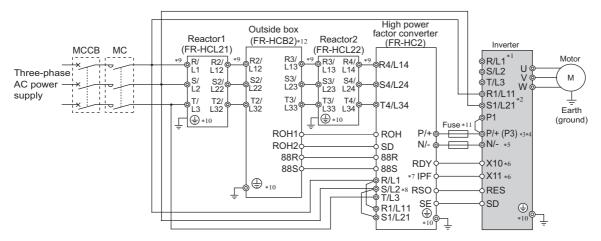


- The wiring distance between the inverter, brake unit, and discharging resistor must be within 2 m. Even when the cable is twisted, the wiring length must be within 5 m.
- If the transistors in the brake unit should become faulty, the resistor will overheat and result in a fire. Install a magnetic contactor on the inverter's input side and configure a circuit that shut off the current in case of a fault.
- · Do not remove the jumper across terminals P/+ and P1 except when connecting a DC reactor (FR-HEL).

2.10.5 Connection of the high power factor converter (FR-HC2)

When connecting the high power factor converter (FR-HC2) to suppress power harmonics, perform wiring securely as follows. Incorrect connection will damage the high power factor converter and the inverter.

After making sure that the wiring is correct and secure, set the rated motor voltage in **Pr.19 Base frequency voltage** (under V/F control) or **Pr.83 Rated motor voltage** (under other than V/F control) and "2 or 102" in **Pr.30 Regenerative function selection**. (Refer to page 724.)



- *1 Remove jumpers across terminals R/L1 and R1/L11 as well as across terminals S/L2 and S1/L21, and connect the power supply for the control circuit to terminals R1/L11 and S1/L21. Do not connect anything to power input terminals (R/L1, S/L2, and T/L3). Incorrect connection will damage the inverter. (The E.OPT fault (Option fault) occurs. (Refer to page 791.))
- *2 Instead of connecting the terminals to the AC power supply, the control circuit can be powered by connecting terminal R1/L11 to terminal P/+ (P3) and terminal S1/L21 to terminal N/-. In this case, do not connect the terminals to the AC power supply. Doing so will damage the inverter.
- *3 Terminal P3 is equipped in the FR-A820-00770(15K) to 01250(22K), and FR-A840-00470(18.5K) to 01800(55K). When connecting multiple inverters in parallel, always use either terminal P/+ or P3 for the connection. (Do not use terminals P/+ and P3 together.)
- *4 When the FR-HC2 is connected, the jumper across terminals P/+ and P1 does not affect the function. (The FR-HC2 can be connected with the jumper connected (initial setting). Refer to page 55 for the jumper connection status in the initial setting.)
- *5 Do not install an MCCB across terminals P/+ and N/- (between terminals P and P/+ or between terminals N and N/-). Connecting the opposite polarity of terminals N/- and P/+ will damage the inverter.
- *6 Use **Pr.178 to Pr.189 (Input terminal function selection)** to assign the terminals used for the X10 (X11) signal. (Refer to page 521.) For RS-485 or any other communication where the start command is only transmitted once, use the X11 signal to save the operation mode at the time of an instantaneous power failure.
- *7 Assign the IPF signal to a terminal on the FR-HC2. (Refer to the Instruction Manual of the FR-HC2.)
- *8 Always connect terminals R/L1, S/L2, and T/L3 on the FR-HC2 to the power supply. Operating the inverter without connecting them will damage the FR-HC2.
- *9 Do not install an MCCB or MC across terminals (R/L1, S/L2, T/L3) on the reactor 1 and terminals (R4/L14, S4/L24, T4/L34) on the FR-HC2. Doing so disrupts proper operation.
- *10 Securely perform grounding (earthing) by using the grounding (earthing) terminal.
- *11 Installation of a fuse is recommended. (Refer to the Instruction Manual of the FR-HC2.)
- *12 Outside box is not available for the FR-HC2-H280K or higher. Connect filter capacitors, inrush current limit resistors, and magnetic contactors. (Refer to the Instruction Manual of the FR-HC2.)



- The voltage phases of terminals R/L1, S/L2, and T/L3 and the voltage phases of terminals R4/L14, S4/L24, and T4/L34 must be matched
- The control logic (sink logic/source logic) of the high power factor converter and the inverter must be matched. (Refer to page 72.)
- Do not connect a DC reactor (FR-HEL) to the inverter when the FR-HC2 is connected.

↑ CAUTION

 Always connect terminal RDY on the FR-HC2 to a terminal where the X10 signal or MRS signal is assigned on the inverter. Always connect terminal SE on the FR-HC2 to terminal SD on the inverter. Not connecting these terminals may damage the FR-HC2.

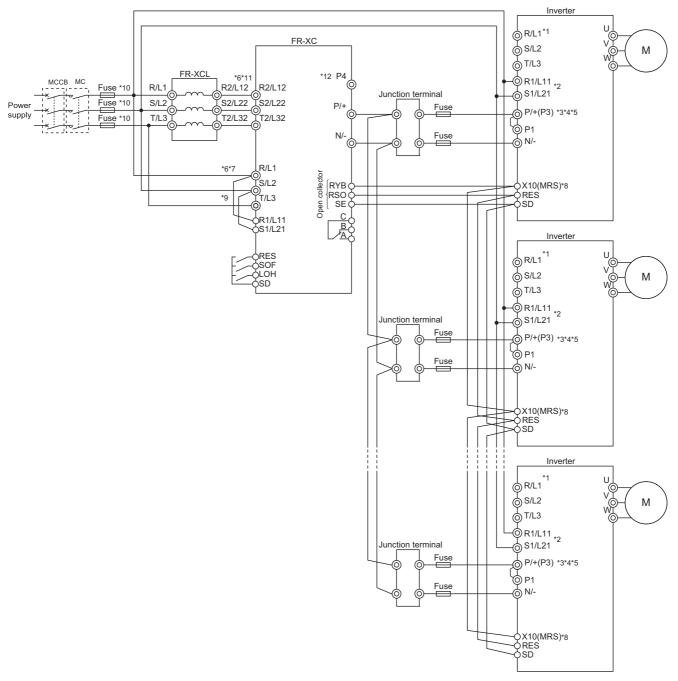
2.10.6 Connection of the multifunction regeneration converter (FR-XC)

◆ Common bus regeneration mode with harmonic suppression disabled (Pr.416 = "0")

When connecting the multifunction regeneration converter (FR-XC) to improve the braking capability, perform wiring securely as follows. Failure to do so will damage the converter and the inverter.

Turn ON switch 1 (connection mode setting switch) in the function selection switch assembly (SW2). If the switch setting does not match the actual wiring, the connection mode fault "E.T" occurs.

After making sure that the wiring is correct and secure, set "2 or 102" in **Pr.30 Regenerative function selection**. (Refer to page 724.)



- *1 Never connect the power supply to terminals R/L1, S/L2, and T/L3 on the inverter. Doing so will damage the inverter and the converter.
- *2 Instead of connecting the terminals to the AC power supply, the control circuit can be powered by connecting terminal R1/L11 to terminal P/+ (P3) and terminal S1/L21 to terminal N/-. In this case, do not connect the terminals to the AC power supply. Doing so will damage the inverter.
- *3 Terminal P3 is equipped in the FR-A820-00770(15K) to 01250(22K), and FR-A840-00470(18.5K) to 01800(55K). When connecting multiple inverters in parallel, always use either terminal P/+ or P3 for the connection. (Do not use terminals P/+ and P3 together.)
- *4 When the FR-XC is connected, the jumper across terminals P/+ and P1 does not affect the function. (The FR-XC can be connected with the jumper connected.) Refer to page 55 for the jumper connection status in the initial setting.)
- *5 Connect between the inverter terminal P/+ and the converter terminal P/+ and between the inverter terminal N/- for polarity consistency.
 - Connecting opposite polarity of terminals P/+ and N/- will damage the converter and the inverter.
- *6 Confirm the correct phase sequence of three-phase current to connect between the reactor and the converter, and between the power supply and terminals R/L1, S/L2, and T/L3.
- Incorrect connection will damage the converter.
- *7 Be sure to connect the power supply and terminals R/L1, S/L2, and T/L3 of the converter. Operating the inverter without connecting them will damage the converter.
- *8 Assign the X10 signal to any of the input terminals.
- *9 To use separate power supply for the control circuit, remove each jumper at terminal R1/L11 and terminal S1/L21.
- *10 Install UL listed fuses on the input side of the reactor to meet the UL/cUL standards (refer to the FR-XC Instruction Manual for information about the fuse).

- *11 Do not install an MCCB or MC between the reactor and the converter. Doing so disrupts proper operation.
- *12 Do not connect anything to terminal P4.

M CAUTION

• In the common bus regeneration mode, always connect between the converter terminal RYB and the inverter terminal to which the X10 (MRS) signal is assigned and between the converter terminal SE and the inverter terminal SD. If the terminals are not connected, the converter may be damaged.

• NOTE

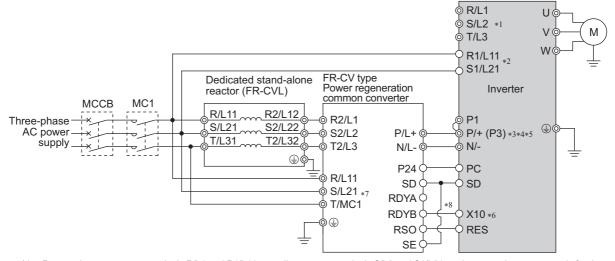
- The control logic (sink logic/source logic) of the converter and the inverter must be matched. The converter does not operate
 properly if the control logic is not consistent with each other.
 (Refer to page 72 for the switching of the control logic. Refer to the FR-XC Instruction Manual for the switching of the control
 logic of the converter.)
- · Keep the wiring length between terminals as short as possible.
- When the power is distorted or falls off sharply, the reactors may generate abnormal acoustic noise. This acoustic noise is caused by the power supply fault and not by the damage of the converter.
- Configure a system so that the magnetic contactor at the converter input side shuts off the power supply at a failure of the converter or the connected inverter. (The converter does not shut off the power supply by itself.) Failure to do so may overheat and burn the resistors in the converter and the connected inverter.
- Do not connect a DC reactor to the inverter when using the converter in the common bus regeneration mode.
- For details on model selection and connection, refer to the FR-XC Instruction Manual.
- For details on connection in common bus regeneration mode with harmonic suppression enabled or in power regeneration mode 2, refer to the FR-XC Instruction Manual.

2.10.7 Connection of the power regeneration common converter (FR-CV)

When wiring for connecting the power regeneration common converter (FR-CV) to the inverter, make sure to match the terminal symbols (P/+, N/-) on the inverter and on the power regeneration common converter.

The FR-CV is compatible with the FR-A820-03160(55K) or lower and the FR-A840-01800(55K) or lower.

After making sure that the wiring is correct and secure, set "2 or 102" in **Pr.30 Regenerative function selection**. (Refer to page 724.)



- *1 Remove jumpers across terminals R/L1 and R1/L11 as well as across terminals S/L2 and S1/L21, and connect the power supply for the control circuit to terminals R1/L11 and S1/L21. Do not connect anything to power input terminals (R/L1, S/L2, and T/L3). Incorrect connection will damage the inverter. (The E.OPT fault (Option fault) occurs. (Refer to page 791.))
- *2 Instead of connecting the terminals to the AC power supply, the control circuit can be powered by connecting terminal R1/L11 to terminal P/+ (P3) and terminal S1/L21 to terminal N/-. In this case, do not connect the terminals to the AC power supply. Doing so will damage the inverter.
- *3 Terminal P3 is equipped in the FR-A820-00770(15K) to 01250(22K), and FR-A840-00470(18.5K) to 01800(55K). When connecting multiple inverters in parallel, always use either terminal P/+ or P3 for the connection. (Do not use terminals P/+ and P3 together.)
- *4 When the FR-CV is connected, the jumper across terminals P/+ and P1 does not affect the function. (The FR-CV can be connected with the jumper connected.)
- *5 Do not install an MCCB across terminals P/+ and N/- (between terminals P/L+ and P/+ or between N/L- and N/-). Connecting the opposite polarity of terminals N/- and P/+ will damage the inverter.

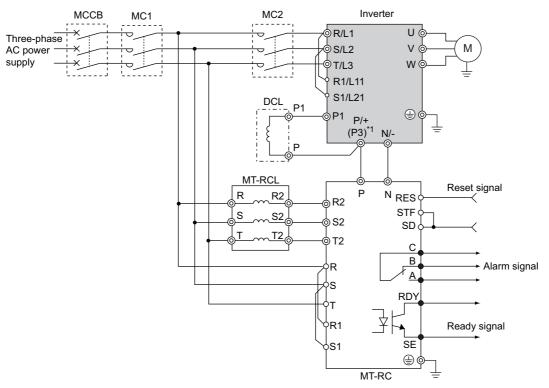
- *6 Use Pr.178 to Pr.189 (Input terminal function selection) to assign the terminals used for the X10 signal. (Refer to page 521.)
- *7 Be sure to connect the power supply and terminals R/L11, S/L21, and T/MC1. Operating the inverter without connecting them will damage the power regeneration common converter.
- *8 Always connect terminal RDY on the FR-HC2 to a terminal where the X10 signal or MRS signal is assigned on the inverter. Always connect terminal SE on the FR-HC2 to terminal SD on the inverter. Not connecting these terminals may damage the FR-CV.



- The voltage phases of terminals R/L11, S/L21, and T/MC1 and the voltage phases of terminals R2/L1, S2/L2, and T2/L3 must be matched.
- Use the sink logic when the FR-CV is connected. It cannot be connected when the source logic is selected.
- Do not connect a DC reactor (FR-HEL) to the inverter when the FR-CV is connected.

2.10.8 Connection of the power regeneration converter (MT-RC)

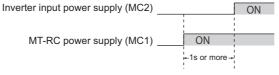
When connecting the power regeneration converter (MT-RC), perform wiring securely as follows. Incorrect connection will damage the power regeneration converter and the inverter. The MT-RC is compatible with FR-A840-02160(75K) or higher. After making sure that the wiring is correct and secure, set "1" in **Pr.30 Regenerative function selection** and "0" in **Pr.70 Special regenerative brake duty**.



*1 Terminal P3 is equipped in the FR-A820-00770(15K) to 01250(22K), and FR-A840-00470(18.5K) to 01800(55K). Terminal P3 has the same function as terminal P\+ on the inverter.



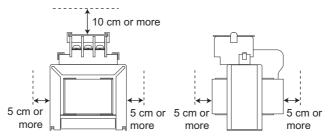
 When using the inverter with the MT-RC, install a magnetic contactor (MC) at the input side of the inverter so that power is supplied to the inverter after one second or more has elapsed after powering ON the MT-RC. When power is supplied to the inverter prior to the MT-RC, the inverter and the MT-RC may be damaged or the MCCB may be shut off or damaged.



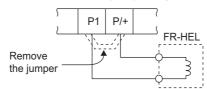
• When connecting the power coordination reactor and others, refer to Instruction Manual of the MT-RC for precautions.

2.10.9 Connection of the DC reactor (FR-HEL)

Keep the surrounding air temperature within the permissible range (-10 to +50°C). Keep enough clearance around the
reactor because it heats up. (Take 10 cm or more clearance on top and bottom and 5 cm or more on left and right
regardless of the installation direction.)



When using the DC reactor (FR-HEL), connect it to terminals P/+ and P1.
 In this case, the jumper connected across terminals P/+ and P1 must be removed. Otherwise, the reactor will not be effective. (The jumper is not installed for the FR-A820-03800(75K) or higher and the FR-A840-02160(75K) or higher.)



- Select a DC reactor according to the applied motor capacity (refer to page 826). For the FR-A820-03800(75K) or higher, the FR-A840-02160(75K) or higher, and when a 75 kW or higher motor is used, always connect a DC reactor.
- Since the DC reactor (FR-HEL) is electrically connected to the enclosure through mounting screws, the DC reactor is earthed (grounded) by being securely mounted to the enclosure. However, if the DC reactor is not earthed (grounded) securely enough, an earthing (grounding) cable may be used.

When using an earthing (grounding) cable for the FR-HEL-(H)55K or lower, wire the cable to the installation hole where varnish is removed. (Refer to the Instruction Manual of the FR-HEL.)

For the FR-HEL-(H)75K or higher, use an earth (ground) terminal to perform earthing (grounding). (Refer to the Instruction Manual of the FR-HEL.)

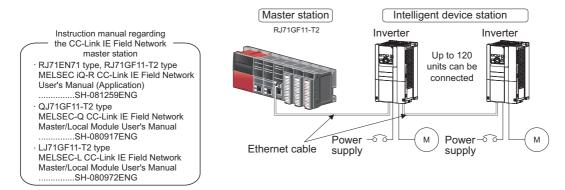


- · The wiring distance must be within 5 m.
- As a reference, the cable gauge for the connection must be equal to or larger than that of the power cables (R/L1, S/L2, T/L3) and the earthing (grounding) cable. (Refer to page 57.)

2.11 Wiring for use of the CC-Link IE Field Network (FR-A800-GF)

2.11.1 System configuration example

- Mount the "RJ71EN71", "RJ71GF11-T2", "QJ71GF11-T2", or "LJ71GF11-T2" type CC-Link IE Field Network master/local module on the main or extension base unit having the programmable controller CPU used as the master station.
- · Connect the CC-Link IE Field Network programmable controller (master station) to the inverter with an Ethernet cable.



2.11.2 Network configuration

Network topology

- The network can be wired into star topology, line topology, and ring topology.
- A network can consist of a combination of star and line topologies, but the ring topology cannot be combined with star or line topology.

| Item | Description |
|---------------|--|
| Star tanalagy | Modules are configured into a star using a switching hub and Ethernet cables. Slave stations can be easily added in a star |
| Star topology | topology. Furthermore, data link continues among normally-operating stations in a star topology.*1 |
| Line topology | Modules are configured into a line with Ethernet cables. A switching hub is not required. If an error occurs, the station in |
| | error and the stations after that are disconnected from the network.*1 |
| Ring topology | Modules are configured into a ring using Ethernet cables. Data link continues with the stations that are operating normally. |
| | A switching hub is not required.*1 |

^{*1} Add/remove slave stations one by one. If multiple slave stations are added/removed at a time, all stations on the network will be reconnected, resulting in a momentarily error in all the stations.

Station number and connection position

· Modules can be connected in any order regardless of the station number.

Cascade connection

• Up to 20-layer connection is available for the cascade connection.

♦ Replacing CC-Link IE Field Network devices

· For star topology, slave stations can be replaced without powering off the whole system.



 Refer to the MELSEC iQ-R, MELSEC-Q, or MELSEC-L CC-Link IE Field Network Master/Local Module User's Manual for the detailed network configurations.

2.11.3 Network components

This section describes components comprising the CC-Link IE Field Network.

◆ Connection cable

· For wiring, use the 1000BASE-T compliant Ethernet cables.

| Ethernet cable | Board mounted option connector | Туре |
|--|--------------------------------|--|
| Cata war Fa an hinh an atrainht aghla (daubla ahialdad) | RJ-45 connector | The following conditioning cables: |
| Category 5e or higher straight cable (double shielded/ STP) | | IEEE802.3 (1000BASE-T) |
| | | ANSI/TIA/EIA-568-B (Category 5e) |

· Recommended products (as of October 2020)

| Model | Manufacturer |
|------------------|--|
| SC-E5EW series*1 | Mitsubishi Electric System & Service Co., Ltd. |

*1 SC-E5EW cable is for in-enclosure and indoor uses. SC-E5EW-L cable is for outdoor use.



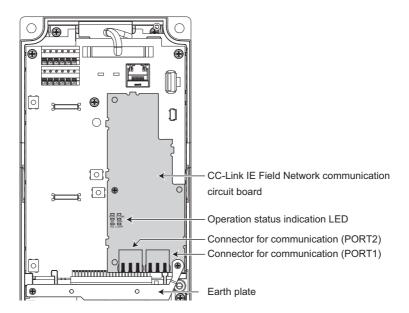
- · For CC-Link IE Field Network wiring, use the recommended wiring components by CC-Link Partner Association.
- Cables for CC-Link IE Controller Network cannot be used for CC-Link IE Field Network.
- · Depending on the cable connector shape, the cable may not be connected to the communication connector.

Hubs

- · Use hubs that meet the following conditions. Operation is not guaranteed if the hubs do not meet these conditions.
 - Compliance with the IEEE802.3 (1000BASE-T)
 - Support of the auto MDI/MDI-X function
 - Support of the auto-negotiation function
 - Switching hub (layer 2 switch)*1
 - *1 A repeater hub is not available.
- · Industrial switching hub

| NZ2EHG-T8 Mitsubishi Electric Corporation |
|--|
| MZZELIG-16 Mitsubishi Electric Corporation |

2.11.4 Component names of the CC-Link IE Field Network communication circuit board



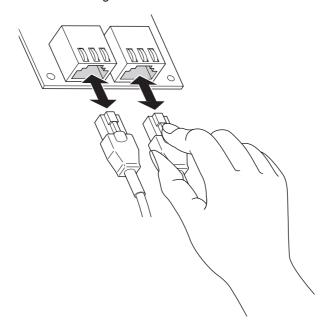


• Do not remove the CC-Link IE Field Network communication circuit board or the earth plate.

2.11.5 Wiring method

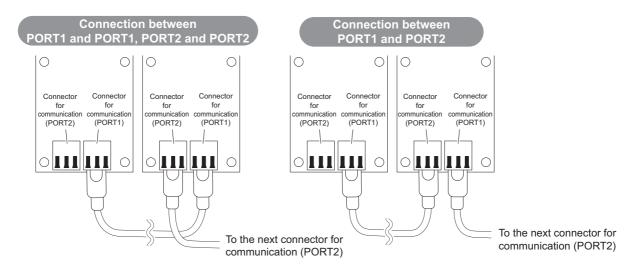
♦ Ethernet cable connection

- · Connect or remove an Ethernet cable after switching the power of the inverter OFF.
- When wiring the Ethernet cable to the communication connector, check the connecting direction of the Ethernet cable connector. Insert the connector to the communication connector until it clicks.
- When removing the Ethernet cable from the communication connector, hold down the latch on the Ethernet cable connector, and pull out the cable while holding the latch.





- · PORT 1 and PORT 2 do not need to be distinguished.
 - When only one connector is used in star topology, either PORT 1 or PORT 2 is applicable.
 - When using two connectors for line topology and ring topology, an Ethernet cable can be connected to the connectors in any combination For example, the cable can be connected across two of PORT 1 or across PORT 1 and PORT 2.

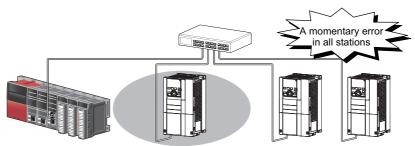


◆ Precautions

• Do not touch the core of the cable-side or module-side connector, and protect it from dirt or dust. If oil from your hand, dirt or dust is attached to the core, it can increase transmission loss, arising a problem in data link.

- · Check the following:
 - Is any Ethernet cable disconnected?
 - Is any of the Ethernet cables shorted?
 - Are the connectors securely connected?
- Do not use Ethernet cables with broken latches. Doing so may cause the cable to unplug or malfunction.
- Hold the connector part when connecting and disconnecting the Ethernet cable. Pulling a cable connected to the module may damage the module or cable, or result in malfunction due to poor contact.
- The maximum station-to-station distance is 100 m. However, the distance may be shorter depending on the operating environment of the cable. For details, contact your cable manufacturer.
- Check the instructions on page 110 before wiring, and perform correct wiring.
- When the operations listed below are performed, all stations on the network may be reconnected. At that time, a data link error may momentarily occur in all the stations, and the communication error E.OP1 may occur in the connected inverters.

| Network configuration | Operation |
|-------------------------------|--|
| Star topology | Powering ON/OFF a slave station or the switching hub |
| | Connecting/disconnecting an Ethernet cable connected to the switching hub |
| | Disconnecting an Ethernet cable from a slave station and connecting it to another slave station or to the switching hub |
| | • Disconnecting ten stations or more, or disconnecting half the number of slave stations in the system or |
| | more |
| | Changing the network topology when adding a slave station |
| Line topology / ring topology | Simultaneously powering ON/OFF multiple stations |
| | Simultaneously connecting/disconnecting Ethernet cables to/from multiple stations (When a data link |
| | faulty station returns, a data link error will occur in all the stations.) |
| | Disconnecting ten stations or more, or disconnecting half the number of slave stations in the system or more |
| | Changing the network topology when adding a slave station |



At plug in/unplug or power ON/OFF

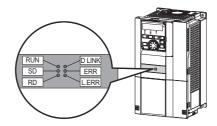
 To keep outputting a data link error (inverter communication error), set Pr.500 Communication error execution waiting time or Pr.502 Stop mode selection at communication error.



- When wiring cables to the inverter's RS-485 terminals, take caution not to let the cables touch the CC-Link IE Field Network communication circuit board or of the inverter's circuit board. Otherwise, electromagnetic noises may cause malfunctions.
- · After wiring, wire offcuts must not be left in the inverter. Doing so may cause a fault, failure, or malfunction.

2.11.6 Operation status LEDs

· Check the operation status LED to confirm the CC-Link IE Field Network operating status.



| LED name | Description | ON | OFF |
|----------|-----------------------------------|--|--|
| RUN | Operating status | Normal operation (normal 5 V internal voltage)*1 | Hardware failure |
| SD | Transmission status | Data transmitting | No data transmitting |
| RD | Reception status | Data receiving | No data receiving |
| D LINK | Cyclic communication status | Cyclic transmitting | No cyclic transmitting or disconnected |
| ERR | Node failure status ^{*2} | Node failure | Normal operation |
| L.ERR | Link error | Received data error | Received data normal |

 ^{*1} Also lit in no-communication state.
 *2 This LED indicates a communication break between the master station and the inverter (due to cable disconnection or breakage, power-OFF of the master power supply, or reset, etc.).

CHAPTER 3 PRECAUTIONS FOR USE OF THE INVERTER

| 3.1 | Electro-magnetic interference (EMI) and leakage currents | 116 |
|-----|---|-----|
| 3.2 | Power supply harmonics | 123 |
| 3.3 | Installation of a reactor | |
| 3.4 | Power shutdown and magnetic contactor (MC) | 128 |
| 3.5 | Countermeasures against deterioration of the 400 V class motor insulation | 130 |
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| 3.7 | Failsafe system which uses the inverter | 134 |

3 PRECAUTIONS FOR USE OF THE INVERTER

This chapter explains the precautions for use of this product.

Always read the instructions before use.

For the separated converter type, refer to the "PRECAUTIONS FOR USE OF THE INVERTER" in the FR-A802 (Separated Converter Type) Instruction Manual (Hardware).

For the IP55 compatible model, refer to the "PRECAUTIONS FOR USE OF THE INVERTER" in the FR-A806 (IP55/UL Type 12 specification) Instruction Manual (Hardware).

3.1 Electro-magnetic interference (EMI) and leakage currents

3.1.1 Leakage currents and countermeasures

Capacitance exists between the inverter I/O cables, other cables and earth and in the motor, through which a leakage current flows. The amount of current leakage depends on the factors such as the size of the capacitance and the carrier frequency. Low acoustic noise operation at an increased carrier frequency of the inverter will increase current leakage. Take the following precautions to prevent current leakage. Earth leakage circuit breakers should be selected based on their rated current sensitivity, independently of the carrier frequency setting.

◆ To-earth (ground) leakage currents

Leakage currents may flow not only into the power system of the inverter but also into the other power systems through the earthing (grounding) cable, etc. These leakage currents may operate earth leakage circuit breakers and earth leakage relays unnecessarily.

■ Precautions

- If the carrier frequency setting is high, decrease the **Pr.72 PWM frequency selection** setting.

 Note that motor noise increases. Selecting **Pr.240 Soft-PWM operation selection** makes the sound inoffensive.
- By using earth leakage circuit breakers designed to suppress harmonics and surge voltage in the power system of the inverter and other devices, operation can be performed with the carrier frequency kept high (with low noise).



- · Long wiring will increase the leakage current.
- High motor capacity will increase the leakage current. The leakage current of the 400 V class is larger than that of the 200 V class.

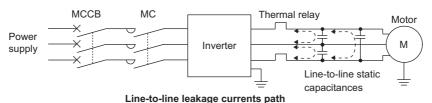
♦ Line-to-line leakage currents

Harmonics of leakage currents flowing in static capacitance between the inverter output cables may operate the external thermal relay unnecessarily. When the wiring length is long (50 m or more) for the 400 V class small-capacity models (FR-A840-00250(7.5K) or lower), the external thermal relay is likely to operate unnecessarily because the ratio of the leakage current to the rated motor current increases.

■ Line-to-line leakage current example (200 V class)

| Motor capacity | Rated motor | Leakage current (mA)*1 | | Condition |
|----------------|-------------|------------------------|---------------------|---|
| (kW) | current (A) | Wiring length 50 m | Wiring length 100 m | Condition |
| 0.4 | 1.8 | 310 | 500 | |
| 0.75 | 3.2 | 340 | 530 | |
| 1.5 | 5.8 | 370 | 560 | Motor: SF-JR 4P Carrier frequency: 14.5 kHz |
| 2.2 | 8.1 | 400 | 590 | • Cable: 2 mm ² , 4 cores |
| 3.7 | 12.8 | 440 | 630 | Cable. 2 mm , 4 cores Cabtyre cable |
| 5.5 | 19.4 | 490 | 680 | Castyle casis |
| 7.5 | 25.6 | 535 | 725 | |

The leakage currents of the 400 V class are about twice as large



■ Countermeasures

- · Use Pr.9 Electronic thermal O/L relay.
- · If the carrier frequency setting is high, decrease the Pr.72 PWM frequency selection setting. Note that motor noise increases. Selecting Pr.240 Soft-PWM operation selection makes the sound inoffensive. To ensure that the motor is protected against line-to-line leakage currents, it is recommended to use a temperature sensor to directly detect motor temperature.

■ Installation and selection of the molded case circuit breaker

Install a molded case circuit breaker (MCCB) on the power receiving side to protect the wiring at the inverter input side. Select an MCCB according to the inverter input side power factor, which depends on the power supply voltage, output frequency and load. Especially for a completely electromagnetic MCCB, a slightly large capacity must be selected since its operation characteristic varies with harmonic currents. (Check it in the data of the corresponding breaker.) As an earth leakage current breaker, use the Mitsubishi earth leakage current breaker designed for harmonics and surge suppression.

Selecting the rated sensitivity current for the earth leakage circuit breaker

To install the earth leakage circuit breaker on the inverter circuit, select its rated sensitivity current as follows, independently of the PWM carrier frequency.

· Breaker designed for harmonic and surge suppression Rated sensitivity current

$$l\Delta n \geq 10 \times (lg1 + lgn + lgi + lg2 + lgm)$$

Standard breaker Rated sensitivity current

$$I\Delta n \ge 10 \times \{Ig1 + Ign + Igi + 3 \times (Ig2 + Igm)\}$$

Ig1, Ig2: Leakage currents in wire path during commercial power supply operation

Ign: Leakage current from noise filters on the input side of the

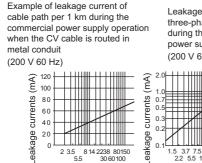
Igm: Leakage current from the motor during commercial power supply operation

Igi: Leakage current of inverter unit

Example of leakage current of cable path

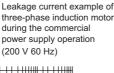
operation when the CV cable is routed in

per 1km during the commercial power supply



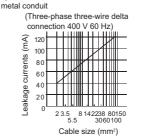
8 14 2238 80150 30 60 100

Cable size (mm²)

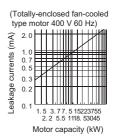


1.5 3.7 7.5 15223755 2.2 5.5 11 18.5 3045

Motor capacity (kW)

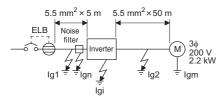


Leakage current example of three phase induction motor during the commercial power supply operation



For "\" connection, the amount of leakage current is approx. 1/3 of the above value

Example



| Item | Breaker designed for harmonic and surge suppression | Standard breaker |
|--|---|------------------|
| Leakage current lg1 (mA) | $33 \times \frac{5m}{1000m} = 0.17$ | |
| Leakage current Ign (mA) | 0 (without noise filter) | |
| Leakage current Igi (mA) | 1 (without EMC filter). For the inverter, refer to | |
| Leakage current Ig2 (mA) | $33 \times \frac{50\text{m}}{1000\text{m}} = 1.65$ | |
| Motor leakage current Igm (mA) | 0.18 | |
| Total leakage current (mA) | 3.00 | 6.66 |
| Rated sensitivity current (mA) (≥ Ig × 10) | 30 | 100 |

Inverter leakage current (with and without EMC filter)

| | Voltage | EMC filter | | Remarks | |
|----------------------------|---------|------------|----------|---|--|
| | (V) | ON (mA) | OFF (mA) | Remarks | |
| | 200 | 22 | 1 | | |
| Phase earthing (grounding) | 400 | 35 | 2 | Input power conditions | |
| Earthed-neutral system | 400 | 2 | 1 | 220 V/60 Hz (200 V class) or 440 V/60 (400 V class), within 3% of power suppl unbalance | |



- Install the earth leakage circuit breaker (ELB) on the input side of the inverter.
- In the A connection earthed-neutral system, the sensitivity current is blunt against a ground fault in the inverter output side.
 Earthing (Grounding) must conform to the requirements of national and local safety regulations and electrical codes. (NEC section 250, IEC 61140 class 1 and other applicable standards)
- When the breaker is installed on the output side of the inverter, it may be unnecessarily operated by harmonics even if the effective value is within the rating.
- In this case, do not install the breaker since the eddy current and hysteresis loss will increase, leading to temperature rise.
- The following models and products are standard breakers: the models BV-C1, BC-V, NVB, NV-L, NV-G2N, NV-G3NA, and NV-2F, the earth leakage circuit breakers with AA neutral wire open-phase protection, and the earth leakage relays (except NV-ZHA).

The other series, models, and products are designed for harmonic and surge suppression: the NV-C series, NV-S series, MN series, the models NV30-FA, NV50-FA, NV-H, and BV-C2, earth leakage alarm breaker NF-Z, and the earth leakage relay NV-ZHA.

3.1.2 Techniques and measures for electromagnetic compatibility (EMC)

Some electromagnetic noises enter the inverter to cause the inverter malfunction, and others are radiated by the inverter to cause the peripheral devices to malfunction. (The former is called EMS problem, the latter is called EMI problem, and both is called EMC problem.) Though the inverter is designed to be immune to noises, it requires the following basic measures and EMS measures as it handles low-level signals. Pay attention to the electromagnetic noises that could be generated by the inverter since the inverter chops outputs at high carrier frequency. If these electromagnetic noises cause peripheral devices to malfunction, EMI countermeasures should be taken to suppress noises. These techniques differ slightly depending on EMI paths.

Basic measures

• Do not run the power cables (I/O cables) and signal cables of the inverter in parallel with each other and do not bundle them.

- Use shielded twisted pair cables for the detector connecting and control signal cables and connect the sheathes of the shielded cables to terminal SD.
- · Ground (Earth) the inverter, motor, etc. at one point.

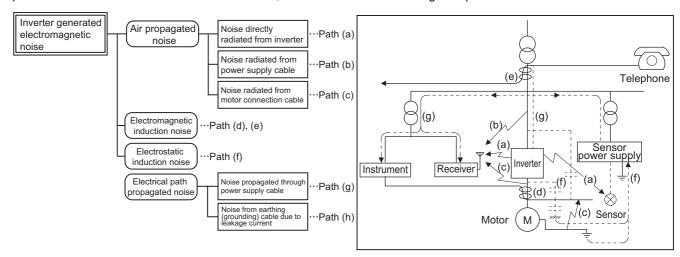
◆ EMS measures to reduce electromagnetic noises that enter the inverter and cause it to malfunction

When devices that generate many electromagnetic noises (which use magnetic contactors, electromagnetic brakes, many relays, for example) are installed near the inverter and the inverter may malfunction due to electromagnetic noises, the following countermeasures must be taken:

- · Provide surge suppressors for devices that generate many electromagnetic noises to suppress electromagnetic noises.
- · Install data line filters to signal cables (refer to page 120).
- · Ground (Earth) the shields of the detector connection and control signal cables with cable clamp metal.

◆ EMI measures to reduce electromagnetic noises that are radiated by the inverter to cause the peripheral devices to malfunction

Inverter-generated noises are largely classified into those radiated by the inverter itself and by the I/O cables connected to its main circuit, those electromagnetically and electrostatically induced to the signal cables of the peripheral devices close to the power cable connected to the inverter main circuit, and those transmitted through the power cables.



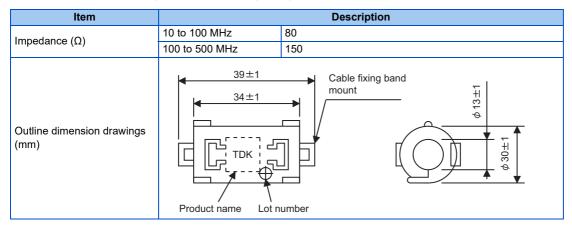
| Noise propagation path | Countermeasure |
|------------------------|--|
| (a), (b), (c) | When devices that handle low-level signals and are liable to malfunction due to electromagnetic noises, e.g. instruments, receivers and sensors, are contained in the enclosure that contains the inverter or when their signal cables are run near the inverter, the devices may malfunction due to by air-propagated electromagnetic noises. The following countermeasures must be taken: Install easily affected devices as far away as possible from the inverter. Run easily affected signal cables as far away as possible from the inverter and its I/O cables. Do not run the signal cables and power cables (inverter I/O cables) in parallel with each other and do not bundle them. Set the EMC filter ON/OFF connector of the inverter to the ON position. (Refer to page 120.) Inserting a line noise filter into the output suppresses the radiated noise from the cables. Use shielded cables as signal cables and power cables and run them in individual metal conduits to produce further effects. |
| (d), (e), (f) | When the signal cables are run in parallel with or bundled with the power cables, magnetic and static induction noises may be propagated to the signal cables to cause malfunction of the devices and the following countermeasures must be taken: Install easily affected devices as far away as possible from the inverter. Run easily affected signal cables as far away as possible from the inverter and its I/O cables. Do not run the signal cables and power cables (inverter I/O cables) in parallel with each other and do not bundle them. Use shielded cables as signal cables and power cables and run them in individual metal conduits to produce further effects. |
| (g) | When the peripheral devices use the power system of the inverter, its generated noises may flow back through the power supply cables to cause malfunction of the devices and the following countermeasures must be taken: • Set the EMC filter ON/OFF connector of the inverter to the ON position. (Refer to page 120.) • Install the line noise filter (FR-BLF/FR-BSF01) to the power cables (output cables) of the inverter. |

| Noise propagation path | Countermeasure |
|------------------------|---|
| | When a closed loop circuit is formed by connecting the peripheral device wiring to the inverter, leakage currents may |
| (h) | flow through the earthing (grounding) cable of the inverter to cause the device to malfunction. In that case, |
| | disconnecting the earthing (grounding) cable from the device may stop the malfunction of the device. |

■ Data line filter

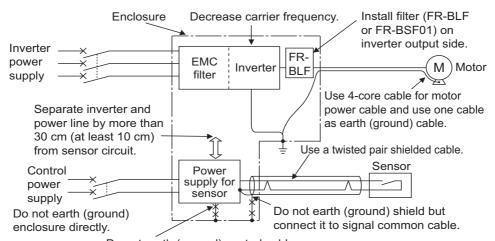
Data line filter is effective as an EMI countermeasure. Provide a data line filter for the detector cable, etc.

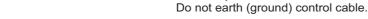
- Commercially available data line filter: ZCAT3035-1330 (by TDK), ESD-SR-250 (by TOKIN)
- Specification example (ZCAT3035-1330 by TDK)



The impedance values above are reference values, and not guaranteed values.

■ EMI measure example







• For compliance with the EU EMC Directive, refer to the Instruction Manual (Startup).

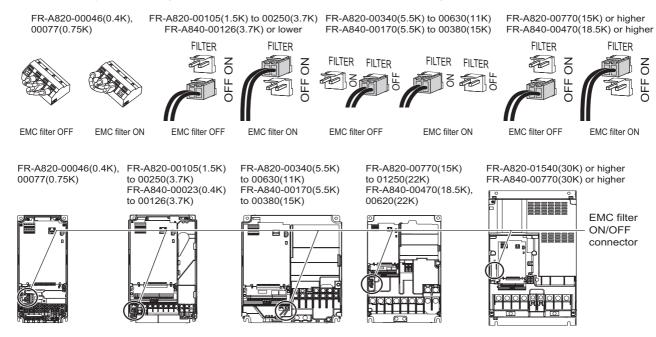
3.1.3 Built-in EMC filter

This inverter is equipped with a built-in EMC filter (capacitive filter) and a common mode choke.

These are effective in reducing air-propagated noise on the input side of the inverter.

To enable the EMC filter, set the EMC filter ON/OFF connector to the ON position. The FM type is initially set to "disabled" (OFF), and the CA type to "enabled" (ON).

The input side common mode choke, which is built in the FR-A820-03160(55K) or lower and the FR-A840-01800(55K) or lower inverter, is always enabled regardless of the EMC filter ON/OFF connector setting.

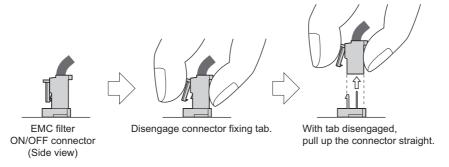


♦ How to enable or disable the filter

■ For FR-A820-00105(1.5K) or higher and FR-A840-00023(0.4K) or higher

- Before removing a front cover, check to make sure that the indication of the inverter operation panel is OFF, wait for at least 10 minutes after the power supply has been switched OFF, and check that there is no residual voltage using a digital multimeter or the like.
- When disconnecting the connector, push the fixing tab and pull the connector straight without pulling the cable or forcibly pulling the connector with the tab fixed.
 - When installing the connector, also engage the fixing tab securely.

 (If it is difficult to disconnect the connector, use a pair of needle-nose pliers, etc.)



■ For FR-A820-00077(0.75K) or lower

- Before removing a front cover, check to make sure that the indication of the inverter operation panel is OFF, wait for at least 10 minutes after the power supply has been switched OFF, and check that there is no residual voltage using a digital multimeter or the like.
- Remove the control circuit terminal block. (Refer to page 819.)
- Connect the shorting wire to the corresponding terminal to enable or disable the filter. Connect the wire to the terminal in the same way as general wiring of the control circuit terminal block. (Refer to page 74.)
- · After switching, reinstall the control circuit terminal block as it was.



- Fit the connector or shorting wire to either ON or OFF position.
- Enabling (turning ON) the EMC filter increases leakage current. (Refer to page 117.)

MARNING

• While power is ON or when the inverter is running, do not open the front cover. Otherwise you may get an electric shock.

3.2 Power supply harmonics

3.2.1 Power supply harmonics

The inverter may generate power supply harmonics from its converter circuit to affect the power generator, power factor correction capacitor etc. Power supply harmonics are different from noise and leakage currents in source, frequency band and transmission path. Take the following countermeasure suppression techniques.

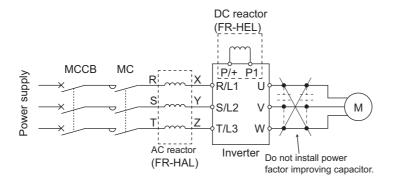
· Differences between harmonics and noises

| Item | Harmonics | Noise |
|-----------------------------|--|---|
| frequency | Normally 40th to 50th degrees or less (3 kHz or less). | High frequency (several 10 kHz to 1 GHz order). |
| Location | To-electric channel, power impedance. | To-space, distance, wiring path. |
| Quantitative understanding | Theoretical calculation possible. | Random occurrence, quantitative grasping difficult. |
| Generated amount | Nearly proportional to the load capacity. | Changes with the current variation ratio. (Gets larger as switching speed increases.) |
| Affected equipment immunity | Specified by standards per equipment. | Different depending on maker's equipment specifications. |
| Countermeasure | Provide a reactor. | Increase distance. |

Countermeasures

The harmonic current generated from the inverter to the input side differs according to various conditions such as the wiring impedance, whether a reactor is used or not, and output frequency and output current on the load side.

For the output frequency and output current, we understand that this should be calculated in the conditions under the rated load at the maximum operating frequency.



• NOTE

The power factor improving capacitor and surge suppressor on the inverter output side may be overheated or damaged by the
harmonic components of the inverter output. Also, since an excessive current flows in the inverter to activate overcurrent
protection, do not provide a capacitor and surge suppressor on the inverter output side when the motor is driven by the inverter.
 For power factor improvement, install a reactor on the inverter input side or in the DC circuit.

3.2.2 Harmonic suppression guidelines in Japan

Inverters have a converter section (rectifier circuit) and generate a harmonic current.

Harmonic currents flow from the inverter to a power receiving point via a power transformer. The Harmonic Suppression Guidelines was established to protect other consumers from these outgoing harmonic currents.

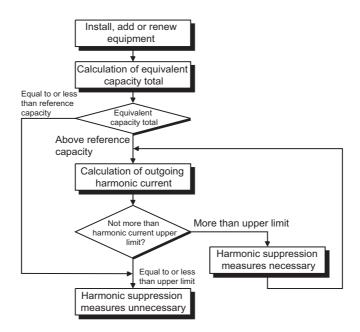
The three-phase 200 V input specifications 3.7 kW or lower were previously covered by "the Harmonic Suppression Guidelines for Household Appliances and General-purpose Products" and other models were covered by "the Harmonic Suppression Guidelines for Consumers Who Receive High Voltage or Special High Voltage". However, the transistorized inverter has been excluded from the target products covered by "the Harmonic Suppression Guidelines for Household Appliances and General-purpose Products" in January 2004 and "the Harmonic Suppression Guideline for Household Appliances and General-purpose Products" was repealed on September 6, 2004.

All capacity and all models of general-purpose inverter used by specific consumers are now covered by "the Harmonic Suppression Guidelines for Consumers Who Receive High Voltage or Special High Voltage" (hereinafter referred to as "the Specific Consumer Guidelines").

- "Specific Consumer Guidelines"
 This guideline sets forth the maximum harmonic currents outgoing from a high-voltage or especially high-voltage receiving consumer who will install, add or renew harmonic generating equipment. If any of the maximum values is exceeded, this guideline requires that consumer to take certain suppression measures.
- · Maximum values of outgoing harmonic currents per 1 kW contract power

| Received power voltage | 5th | 7th | 11th | 13th | 17th | 19th | 23rd | Over 23rd |
|------------------------|-----|------|------|------|------|------|------|-----------|
| 6.6 kV | 3.5 | 2.5 | 1.6 | 1.3 | 1.0 | 0.9 | 0.76 | 0.70 |
| 22 kV | 1.8 | 1.3 | 0.82 | 0.69 | 0.53 | 0.47 | 0.39 | 0.36 |
| 33 kV | 1.2 | 0.86 | 0.55 | 0.46 | 0.35 | 0.32 | 0.26 | 0.24 |

♦ Application of the specific consumer guidelines



■ Conversion factor

| Classification | Circu | Conversion factor Ki | |
|----------------|------------------------------------|--|-----------|
| | | Without reactor | K31 = 3.4 |
| 2 | Three-phase bridge (capacitor | With reactor (AC side) | K32 = 1.8 |
| 3 | smoothing) | With reactor (DC side) | K33 = 1.8 |
| | | With reactors (AC, DC sides) | K34 = 1.4 |
| 5 | Self-excitation three-phase bridge | When a high power factor converter is used | K5 = 0 |

■ Equivalent capacity limit

| Received power voltage | Reference capacity |
|------------------------|--------------------|
| 6.6 kV | 50 kVA |
| 22/33 kV | 300 kVA |
| 66 kV or more | 2000 kVA |

■ Harmonic content (when the fundamental current is considered as 100%)

| Reactor | 5th | 7th | 11th | 13th | 17th | 19th | 23rd | 25th |
|---------------------|-----|------|------|------|------|------|------|------|
| Not used | 65 | 41 | 8.5 | 7.7 | 4.3 | 3.1 | 2.6 | 1.8 |
| Used (AC side) | 38 | 14.5 | 7.4 | 3.4 | 3.2 | 1.9 | 1.7 | 1.3 |
| Used (DC side) | 30 | 13 | 8.4 | 5.0 | 4.7 | 3.2 | 3.0 | 2.2 |
| Used (AC, DC sides) | 28 | 9.1 | 7.2 | 4.1 | 3.2 | 2.4 | 1.6 | 1.4 |

■ Calculation of equivalent capacity P0 of harmonic generating equipment

"Equivalent capacity" is the capacity of a 6-pulse converter converted from the capacity of consumer's harmonic generating equipment and is calculated by the following equation. If the sum of equivalent capacities is higher than the limit (refer to the list of the equivalent capacity limits), harmonics must be calculated by the equation in next subheading.

 $P0 = \Sigma (Ki \times Pi) [kVA]$

Ki: Conversion factor (Refer to the list of the conversion factors.)

Pi: Rated capacity of harmonic generating equipment *1 [kVA]

i: Number indicating the conversion circuit type

*1 Rated capacity: Determined by the capacity of the applied motor and found in the table "Rated capacities and outgoing harmonic currents of inverter-driven motors". The rated capacity used here is used to calculate the generated harmonic amount and is different from the power supply capacity required for actual inverter drive.

■ Calculation of outgoing harmonic current

<u>Outgoing harmonic current = fundamental wave current (value converted from received power voltage) × operation ratio × harmonic content</u>

- Operation ratio: actual load factor × operation time ratio during 30 minutes
- · Harmonic content: Refer to the list of the harmonic content.

■ Rated capacities and outgoing harmonic currents of inverter-driven motors

| Applicable | | mental irrent (A) | Fundamental wave current | Rated capacity | Outgoir | ng harmor | nic curren | | ed from 6.0 on ratio) | 6 kV (mA) | (No react | or, 100% |
|------------|-------|----------------------|-------------------------------|----------------|---------|-----------|------------|-------|--------------------------|-----------|-----------|----------|
| motor (kW) | 200 V | 400 V | converted from 6.6 kV (mA) | (kVA) | 5th | 7th | 11th | 13th | 17th | 19th | 23rd | 25th |
| 0.4 | 1.61 | 0.81 | 49 | 0.57 | 31.85 | 20.09 | 4.165 | 3.773 | 2.107 | 1.519 | 1.274 | 0.882 |
| 0.75 | 2.74 | 1.37 | 83 | 0.97 | 53.95 | 34.03 | 7.055 | 6.391 | 3.569 | 2.573 | 2.158 | 1.494 |
| 1.5 | 5.50 | 2.75 | 167 | 1.95 | 108.6 | 68.47 | 14.20 | 12.86 | 7.181 | 5.177 | 4.342 | 3.006 |
| 2.2 | 7.93 | 3.96 | 240 | 2.81 | 156.0 | 98.40 | 20.40 | 18.48 | 10.32 | 7.440 | 6.240 | 4.320 |
| 3.7 | 13.0 | 6.50 | 394 | 4.61 | 257.1 | 161.5 | 33.49 | 30.34 | 16.94 | 12.21 | 10.24 | 7.092 |
| 5.5 | 19.1 | 9.55 | 579 | 6.77 | 376.1 | 237.4 | 49.22 | 44.58 | 24.90 | 17.95 | 15.05 | 10.42 |
| 7.5 | 25.6 | 12.8 | 776 | 9.07 | 504.4 | 318.2 | 65.96 | 59.75 | 33.37 | 24.06 | 20.18 | 13.97 |
| 11 | 36.9 | 18.5 | 1121 | 13.1 | 728.7 | 459.6 | 95.29 | 86.32 | 48.20 | 34.75 | 29.15 | 20.18 |
| 15 | 49.8 | 24.9 | 1509 | 17.6 | 980.9 | 618.7 | 128.3 | 116.2 | 64.89 | 46.78 | 39.24 | 27.16 |
| 18.5 | 61.4 | 30.7 | 1860 | 21.8 | 1209 | 762.6 | 158.1 | 143.2 | 79.98 | 57.66 | 48.36 | 33.48 |
| 22 | 73.1 | 36.6 | 2220 | 25.9 | 1443 | 910.2 | 188.7 | 170.9 | 95.46 | 68.82 | 57.72 | 39.96 |
| 30 | 98.0 | 49.0 | 2970 | 34.7 | 1931 | 1218 | 252.5 | 228.7 | 127.7 | 92.07 | 77.22 | 53.46 |
| 37 | 121 | 60.4 | 3660 | 42.8 | 2379 | 1501 | 311.1 | 281.8 | 157.4 | 113.5 | 95.16 | 65.88 |
| 45 | 147 | 73.5 | 4450 | 52.1 | 2893 | 1825 | 378.3 | 342.7 | 191.4 | 138.0 | 115.7 | 80.10 |
| 55 | 180 | 89.9 | 5450 | 63.7 | 3543 | 2235 | 463.3 | 419.7 | 234.4 | 169.0 | 141.7 | 98.10 |

| Applicable | | mental rrent (A) | Fundamental wave current | Rated capacity | Outgoin | g harmon | | converted | | , , | (with a DC | reactor, |
|------------|-------|---------------------|-------------------------------|----------------|---------|----------|------|-----------|------|------|------------|----------|
| motor (kW) | 200 V | 400 V | converted from 6.6 kV (mA) | (kVA) | 5th | 7th | 11th | 13th | 17th | 19th | 23rd | 25th |
| 75 | 245 | 123 | 7455 | 87.2 | 2237 | 969 | 626 | 373 | 350 | 239 | 224 | 164 |
| 90 | 293 | 147 | 8909 | 104 | 2673 | 1158 | 748 | 445 | 419 | 285 | 267 | 196 |
| 110 | 357 | 179 | 10848 | 127 | 3254 | 1410 | 911 | 542 | 510 | 347 | 325 | 239 |
| 132 | _ | 216 | 13091 | 153 | 3927 | 1702 | 1100 | 655 | 615 | 419 | 393 | 288 |
| 160 | _ | 258 | 15636 | 183 | 4691 | 2033 | 1313 | 782 | 735 | 500 | 469 | 344 |
| 220 | _ | 355 | 21515 | 252 | 6455 | 2797 | 1807 | 1076 | 1011 | 688 | 645 | 473 |
| 250 | _ | 403 | 24424 | 286 | 7327 | 3175 | 2052 | 1221 | 1148 | 782 | 733 | 537 |
| 280 | _ | 450 | 27273 | 319 | 8182 | 3545 | 2291 | 1364 | 1282 | 873 | 818 | 600 |
| 315 | _ | 506 | 30667 | 359 | 9200 | 3987 | 2576 | 1533 | 1441 | 981 | 920 | 675 |
| 355 | _ | 571 | 34606 | 405 | 10382 | 4499 | 2907 | 1730 | 1627 | 1107 | 1038 | 761 |
| 400 | _ | 643 | 38970 | 456 | 11691 | 5066 | 3274 | 1949 | 1832 | 1247 | 1169 | 857 |
| 450 | _ | 723 | 43818 | 512 | 13146 | 5696 | 3681 | 2191 | 2060 | 1402 | 1315 | 964 |
| 500 | _ | 804 | 48727 | 570 | 14618 | 6335 | 4093 | 2436 | 2290 | 1559 | 1462 | 1072 |
| 560 | _ | 900 | 54545 | 638 | 16364 | 7091 | 4582 | 2727 | 2564 | 1746 | 1636 | 1200 |
| 630 | _ | 1013 | 61394 | 718 | 18418 | 7981 | 5157 | 3070 | 2886 | 1965 | 1842 | 1351 |

■ Determining if a countermeasure is required

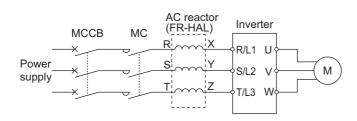
A countermeasure for harmonics is required if the following condition is satisfied: outgoing harmonic current > maximum value per 1 kW contract power × contract power.

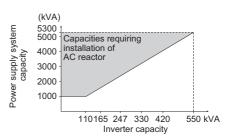
■ Harmonic suppression techniques

| No. | Item | Description |
|-----|---|--|
| 1 | Reactor installation (FR- HAL, FR-HEL) | Install an AC reactor (FR-HAL) on the AC side of the inverter or a DC reactor (FR-HEL) on its DC side, or install both to suppress outgoing harmonic currents. |
| 2 | High power factor converter (FR-HC2), multifunction regeneration converter (FR-XC) | This converter trims the current waveform to be a sine waveform by switching the rectifier circuit (converter module) with transistors. Doing so suppresses the generated harmonic amount significantly. Connect it to the DC area of an inverter. Use the high power factor converter (FR-HC2) with the accessories that come as standard. To use the FR-XC series converter, use the converter with an FR-XCB box-type reactor and enable the harmonic suppression function. |
| 3 | Installation of power factor improving capacitor | When used with a reactor connected in series, the power factor improving correction capacitor can absorb harmonic currents. |
| 4 | Transformer multi-phase operation | Use two transformers with a phase angle difference of 30° in combinations of A to A and A to A , to provide an effect corresponding to 12 pulses, reducing low-degree harmonic currents. |
| 5 | Passive filter (AC filter) | A capacitor and a reactor are used together to reduce impedances at specific frequencies. Harmonic currents are expected to be absorbed greatly by using this technique. |
| 6 | Active filter | This filter detects the current in a circuit generating a harmonic current and generates a harmonic current equivalent to a difference between that current and a fundamental wave current to suppress the harmonic current at the detection point. Harmonic currents are expected to be absorbed greatly by using this technique. |

3.3 Installation of a reactor

When the inverter is connected near a large-capacity power transformer (1000 kVA or more) or when a power factor correction capacitor is to be switched over, an excessive peak current may flow in the power input circuit, damaging the converter circuit. To prevent this, always install an AC reactor (FR-HAL), which is available as an option.





3.4 Power shutdown and magnetic contactor (MC)

◆ Inverter input side magnetic contactor (MC)

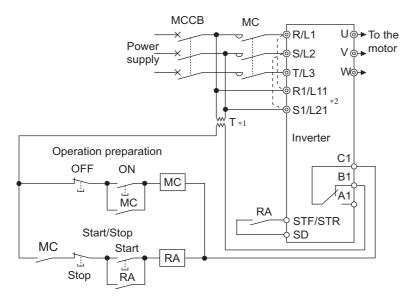
On the inverter input side, it is recommended to provide an MC for the following purposes. (Refer to page 29 for selection.)

- To disconnect the inverter from the power supply at activation of a protective function or at malfunctioning of the driving system (emergency stop, etc.).
 - For example, an MC prevents overheat or burnout of the brake resistor when heat capacity of the resistor is insufficient or brake regenerative transistor is damaged with short while connecting an optional brake resistor.
- To prevent any accident due to an automatic restart at power restoration after an inverter stop made by a power failure.
- To separate the inverter from the power supply to ensure safe maintenance and inspection work.

 Use the inverter input current as a reference for selection of an MC to perform an emergency stop during operation, and select the MC conforming to JEM 1038-AC-3 class rated operational current.



- Since repeated inrush currents at power ON will shorten the life of the converter circuit (switching life is about 1,000,000 times), frequent starts and stops of the magnetic contactor must be avoided. Turn ON or OFF the start (STF/STR) signal for the inverter start control to run or stop the inverter.
- Inverter start/stop circuit example
 As shown in the following figure, always use the start signal (turn ON or OFF the STF/STR signal) to make a start or stop.



- *1 When the power supply is 400 V class, install a stepdown transformer.
- *2 To hold the Fault signal when the inverter's protective circuit is activated, connect the control circuit power supply terminals R1/L11 and S1/L21 to the input side of the MC. Before connection, remove jumpers across terminals R/L1 and R1/L11 and across terminals S/L2 and S1/L21. (Refer to page 77 for removal of the jumper.)

♦ Handling of the magnetic contactor on the inverter's output side

Switch the magnetic contactor between the inverter and motor only when both the inverter and motor are at a stop. When the magnetic contactor is turned ON while the inverter is operating, overcurrent protection of the inverter and such will activate. When the magnetic contactor is provided to switch to a commercial power supply, for example, it is recommended to use the electronic bypass function **Pr.135 to Pr.139** (refer to page 563). (The commercial power supply operation is not available with Vector control dedicated motors (SF-V5RU, SF-THY) nor with PM motors.)

◆ Handling of the manual contactor on the inverter's output side

A PM motor is a synchronous motor with high-performance magnets embedded inside. High-voltage is generated at the motor terminals while the motor is running even after the inverter power is turned OFF. In an application where the PM motor is driven by the load even after the inverter is powered OFF, a low-voltage manual contactor must be connected at the inverter's output side.

NOTE

- Before wiring or inspection for a PM motor, confirm that the PM motor is stopped. In an application, such as fan and blower, where the motor is driven by the load, a low-voltage manual contactor must be connected at the inverter's output side, and wiring and inspection must be performed while the contactor is open. Otherwise you may get an electric shock.
- Do not open or close the contactor while the inverter is running (outputting).

3.5 Countermeasures against deterioration of the 400 V class motor insulation

In the PWM type inverter, a surge voltage attributable to wiring constants is generated at the motor terminals. Especially in a 400 V class motor, the surge voltage may deteriorate the insulation. When the 400 V class motor is driven by the inverter, consider the following countermeasures:

♦ Countermeasures (with induction motor)

It is recommended to take one of the following countermeasures:

■ Rectifying the motor insulation and limiting the PWM carrier frequency according to the wiring length

For the 400 V class motor, use an <u>insulation-enhanced motor</u>.

Specifically,

- Order a "400 V class inverter-driven insulation-enhanced motor".
- For the dedicated motor such as the constant-torque motor and low-vibration motor, use an "inverter-driven dedicated motor".
- · Set Pr.72 PWM frequency selection as indicated below according to the wiring length.

| | Wiring length | | | | | |
|-------------------------------|------------------------|--------------------|--------------------|--|--|--|
| | Shorter than 50 m | 50 to 100 m | Longer than 100 m | | | |
| Pr.72 PWM frequency selection | 15 (14.5 kHz) or lower | 9 (9 kHz) or lower | 4 (4 kHz) or lower | | | |

■ Suppressing the surge voltage on the inverter side

- For the FR-A840-01800(55K) or lower, connect the surge voltage suppression filter (FR-ASF-H/FR-BMF-H) to the inverter output side.
- For the FR-A840-02160(75K) or higher, connect the sine wave filter (MT-BSL/BSC) to the inverter output side.

♦ Countermeasures (with PM motor)

When the wiring length exceeds 50 m, set "9" (6 kHz) or less in Pr.72 PWM frequency selection.



- For details on **Pr.72 PWM frequency selection**, refer to page 356. (When using an optional sine wave filter (MT-BSL/BSC), set "25" (2.5 kHz) in **Pr.72**.)
- For details on the surge voltage suppression filter (FR-ASF-H/FR-BMF-H) and the sine wave filter (MT-BSL/BSC), refer to the Instruction Manual of each option.
- A surge voltage suppression filter (FR-ASF-H/FR-BMF-H) can be used under V/F control and Advanced magnetic flux vector control. A sine wave filter (MT-BSL/BSC) can be used under V/F control. Do not use the filters under different control methods.
- The carrier frequency is limited during PM sensorless vector control. (Refer to page 356.)

3.6 Checklist before starting operation

The FR-A800 series inverter is a highly reliable product, but incorrect peripheral circuit making or operation/handling method may shorten the product life or damage the product. Before starting operation, always recheck the following points.

| Checkpoint | Countermeasure | Refer to page | Check by user |
|--|---|---------------|---------------|
| Crimp terminals are insulated. | Use crimp terminals with insulation sleeves to wire the power supply and the motor. | _ | |
| The wiring between the power supply (terminals R/L1, S/L2, T/L3) and the motor (terminals U, V, W) is correct. | Application of power to the output terminals (U, V, W) of the inverter will damage the inverter. Never perform such wiring. | 55 | |
| No wire offcuts are left from the time of wiring. | Wire offcuts can cause a fault, failure, or malfunction. Always keep the inverter clean. When drilling mounting holes in an enclosure etc., take caution not to allow chips and other foreign matter to enter the inverter. | _ | |
| The main circuit cable gauge is correctly selected. | Use an appropriate cable gauge to suppress the voltage drop to 2% or less. If the wiring distance is long between the inverter and motor, a voltage drop in the main circuit will cause the motor torque to decrease especially during the output of a low frequency. | 57 | |
| The total wiring length is within the specified length. | Keep the total wiring length within the specified length. In long distance wiring, charging currents due to stray capacitance in the wiring may degrade the fast-response current limit operation or cause the equipment on the inverter's output side to malfunction. Pay attention to the total wiring length. | 57 | |
| Countermeasures are taken against EMI. | The input/output (main circuit) of the inverter includes high frequency components, which may interfere with the communication devices (such as AM radios) used near the inverter. In such case, enable the EMC filter (turn ON the EMC filter ON/OFF connector) to minimize interference. | 120 | |
| On the inverter's output side, there is no power factor correction capacitor, surge suppressor, or radio noise filter installed. | Doing so will shut off the inverter output or damage the capacitor or surge suppressor. If any of the above devices is connected, immediately remove it. | _ | |
| When performing an inspection or rewiring on the product that has been energized, the operator has waited long enough after shutting off the power supply. | For a short time after the power-OFF, a high voltage remains in the smoothing capacitor, and it is dangerous. Before performing an inspection or rewiring, wait 10 minutes or longer after the power supply turns OFF, then confirm that the voltage across the main circuit terminals P/+ and N/- of the inverter is low enough using a digital multimeter, etc. | _ | |
| The inverter's output side has no short circuit or ground fault occurring. | A short circuit or ground fault on the inverter's output side may damage the inverter module. Fully check the insulation resistance of the circuit prior to inverter operation since repeated short circuits caused by peripheral circuit inadequacy or an earth (ground) fault caused by wiring inadequacy or reduced motor insulation resistance may damage the inverter module. Fully check the to-earth (ground) insulation and phase-to-phase insulation of the inverter's output side before power-ON. Especially for an old motor or use in hostile atmosphere, securely check the motor insulation resistance, etc. | _ | |
| The circuit is not configured to use the inverter's input-side magnetic contactor to start/stop the inverter frequently. | Since repeated inrush currents at power ON will shorten the life of the converter circuit, frequent starts and stops of the magnetic contactor must be avoided. Turn ON or OFF the inverter's start (STF/STR) signal to run or stop the inverter. | 128 | |
| A mechanical brake is not connected to terminals P/+ and PR. | To terminals P/+ and PR, connect only an external brake resistor. | 97 | |
| The voltage applied to the inverter I/O signal circuits is within the specifications. | Application of a voltage higher than the permissible voltage to the inverter I/O signal circuits or opposite polarity may damage the I/O devices. Especially check the wiring to prevent the speed setting potentiometer from being connected incorrectly to short circuit terminals 10E and 5. | 68 | |

| Checkpoint | Countermeasure | Refer to page | Checkby user |
|--|--|---------------|-----------------|
| When using the electronic bypass | When using a switching circuit as shown below, chattering due to misconfigured sequence or arc generated at switching may allow undesirable current to flow in and damage the inverter. Miswiring may also damage the inverter. (The commercial power supply operation is not available with Vector control dedicated motors (SF-V5RU, SF-THY) nor with PM motors.) MC1 | | |
| operation, electrical and mechanical interlocks are provided between the electronic bypass contactors MC1 and MC2. | Power supply R/L1 U MC2 MC2 Undesirable current Inverter If switching to the commercial power supply operation while a failure such as an | _ | |
| | output short circuit has occurred between the magnetic contactor MC2 and the motor, the damage may further spread. If a failure has occurred between the MC2 and the motor, a protection circuit such as using the OH signal input must be provided. | | |
| A countermeasure is provided for power restoration after a power failure. | If the machine must not be restarted when power is restored after a power failure, provide an MC on the inverter's input side and also make up a sequence which will not switch ON the start signal. If the start signal (start switch) remains ON after a power failure, the inverter will automatically restart as soon as the power is restored. | _ | |
| For Vector control, the encoder is properly installed. | The encoder must be directly connected to a motor shaft without any backlash. (Real sensorless vector control or PM sensorless vector control do not require an encoder.) | 87 | |
| A magnetic contactor (MC) is installed on the inverter's input side. | On the inverter's input side, connect an MC for the following purposes: • To disconnect the inverter from the power supply at activation of a protective function or at malfunctioning of the driving system (emergency stop, etc.). • To prevent any accident due to an automatic restart at power restoration after an inverter stop made by a power failure. • To separate the inverter from the power supply to ensure safe maintenance and inspection work. To use an MC to perform an emergency stop during operation, select the MC conforming to JEM 1038-AC-3 rated current for the inverter rated input current. | 128 | |
| The magnetic contactor on the inverter's output side is properly handled. | Switch the magnetic contactor between the inverter and motor only when both the inverter and motor are at a stop. | 128 | |
| When using a PM motor, a low-voltage manual contactor is installed on the inverter's output side. | A PM motor is a synchronous motor with high-performance magnets embedded inside. High-voltage is generated at the motor terminals while the motor is running even after the inverter power is turned OFF. In an application, such as fan and blower, where the motor is driven by the load, a low-voltage manual contactor must be connected on the inverter's output side, and wiring and inspection must be performed while the contactor is open. Otherwise you may get an electric shock. | 128 | |
| An EMI countermeasure is provided for the frequency setting signals. | If electromagnetic noise generated from the inverter causes the frequency setting signal to fluctuate and the motor rotation speed to be unstable when changing the motor speed with analog signals, the following countermeasures are effective: • Do not run the signal cables and power cables (inverter I/O cables) in parallel with each other and do not bundle them. • Run the signal cables as far away as possible from the power cables (inverter I/O cables). • Use shielded cables. • Install a data line filter to signal cable (example: ZCAT3035-1330 by TDK). | 118 | |
| A countermeasure is provided for an overload operation. | When performing frequent starts/stops by the inverter, rise/fall in the temperature of the transistor element of the inverter will repeat due to a repeated flow of large current, shortening the life from thermal fatigue. Since thermal fatigue is related to the amount of current, the life can be increased by reducing current at locked condition, starting current, etc. Reducing current may extend the service life but may also cause torque shortage, which leads to a start failure. Adding a margin to the current can eliminate such a condition. For an induction motor, use an inverter of a higher capacity (up to two ranks). For a PM motor, use an inverter and PM motor of higher capacities. | _ | |
| The specifications and rating match the system requirements. | Make sure that the specifications and rating match the system requirements. | 826 | |

| Checkpoint | Countermeasure | Refer to page | Check by user |
|--|--|---------------|---------------|
| Countermeasures are taken against electrical corrosion on the motor bearing. | When a motor is driven by the inverter, axial voltage is generated on the motor shaft, which may cause electrical corrosion of the bearing in rare cases depending on the wiring, load, operating conditions of the motor or specific inverter settings (high carrier frequency and EMC filter ON). Contact your sales representative to take appropriate countermeasures for the motor. The following shows examples of countermeasures for the inverter. • Decrease the carrier frequency. • Turn OFF the EMC filter. • Provide a common mode choke *1 on the output side of the inverter. (This is effective regardless of the EMC filter ON/OFF connector setting.) | _ | |

^{*1} Recommended common mode choke: FT-3KM F series FINEMET® common mode choke cores manufactured by Hitachi Metals, Ltd. FINEMET is a registered trademark of Hitachi Metals, Ltd.

3.7 Failsafe system which uses the inverter

When a fault is detected by the protective function, the protective function activates and outputs the Fault signal. However, the Fault signal may not be output at an inverter's fault occurrence when the detection circuit or output circuit fails, etc. Although Mitsubishi assures the best quality products, provide an interlock which uses inverter status output signals to prevent accidents such as damage to the machine when the inverter fails for some reason. Also at the same time consider the system configuration where a failsafe from outside the inverter, without using the inverter, is enabled even if the inverter fails.

◆ Interlock method which uses the inverter status output signals

By combining the inverter output signals to provide an interlock as shown below, an inverter failure can be detected.

| No. | Interlock method | Check method | Used signals | Refer to page |
|-----|--|---|--|---------------|
| а | Inverter protective function operation | Operation check of an alarm contact. Circuit error detection by negative logic. | Fault (ALM) signal | 483 |
| b | Inverter operating status | Operation ready signal check. | Inverter operation ready (RY) signal | 479 |
| С | Inverter running status | Logic check of the start signal and running signal. | Start (STF or STR) signal Inverter running (RUN) signal | 479, 722 |
| d | Inverter running status | Logic check of the start signal and output current. | Start (STF or STR) signal Output current detection (Y12) signal | 487, 722 |

 When using various signals, assign the functions to Pr.190 to Pr.196 (Output terminal function selection) referring to the table on the left.

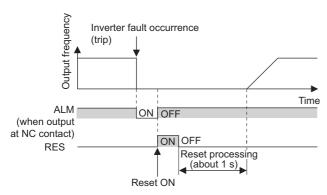
| Output | Pr.190 to Pr | 90 to Pr.196 setting | | | | |
|--------|----------------|----------------------|--|--|--|--|
| signal | Positive logic | Negative logic | | | | |
| ALM | 99 | 199 | | | | |
| RY | 11 | 111 | | | | |
| RUN | 0 | 100 | | | | |
| Y12 | 12 | 112 | | | | |



 Changing the terminal assignment using Pr.190 to Pr.196 (Output terminal function selection) may affect the other functions. Set parameters after confirming the function of each terminal.

■ Checking by using the Fault signal output from the inverter... (a)

When the inverter's protective function activates and the inverter output is stopped, the Fault (ALM) signal is output. (The ALM signal is assigned to terminal A1B1C1 in the initial setting). With this signal, check that the inverter operates properly. In addition, negative logic can be set. (ON when the inverter is normal, OFF when the fault occurs.)

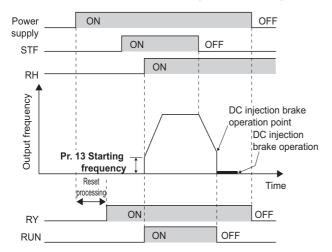


■ Checking the inverter operating status by using the Inverter operation ready signal output from the inverter ... (b)

The Inverter operation ready (RY) signal is output when the inverter power is ON and the inverter becomes operative. Check if the RY signal is output after powering ON the inverter.

■ Checking the inverter operating status by using the start signal input to the inverter and the Inverter running signal output from the inverter ... (c)

The Inverter running (RUN) signal is output when the inverter is running. (The RUN signal is assigned to terminal RUN in the initial setting.) Check if the RUN signal is output while a start signal (the STF/STR signal for forward/reverse rotation command) is input to the inverter. Even after the start signal is turned OFF, the RUN signal is kept output until the inverter makes the motor to decelerate and to stop. For the logic check, configure a sequence considering the inverter's deceleration time.



■ Checking the motor operating status by using the start signal input to the inverter and the Output current detection signal output from the inverter ... (d)

The Output current detection (Y12) signal is output when the inverter operates and currents flows into the motor.

Check if the Y12 signal is output while a start signal (the STF/STR signal for forward/reverse rotation command) is input to the inverter. The Y12 signal is initially set to be output at 150% inverter rated current. Adjust the level to around 20% using no load current of the motor as reference with **Pr.150 Output current detection level**.

Like the Inverter running (RUN) signal, even after the start signal is turned OFF, the Y12 signal is kept output until the inverter stops the output to a decelerating motor. For the logic check, configure a sequence considering the inverter's deceleration time.

♦ Backup method which does not use the inverter

Even if the interlock is provided by the inverter status signal, enough failsafe is not ensured depending on the failure status of the inverter itself. For example, if an inverter CPU fails in a system interlocked with the inverter's Fault, start, and RUN signals, no Fault signals will be output and the RUN signal will be kept ON because the inverter CPU is down.

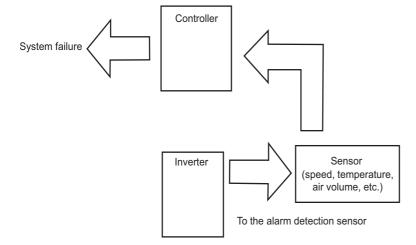
Provide a speed detector to detect the motor speed and current detector to detect the motor current, and consider the backup system such as performing a check as follows according to the level of importance of the system.

■ Start signal and actual operation check

Check the motor running and motor current while the start signal is input to the inverter by comparing the start signal to the inverter and detected speed of the speed detector or detected current of the current detector. Note that the current is flowing through the motor while the motor coasts to stop, even after the inverter's start signal is turned OFF. For the logic check, configure a sequence considering the inverter's deceleration time. In addition, it is recommended to check the three-phase current when using the current detector.

■ Command speed and actual operation check

Check for a gap between the actual speed and commanded speed by comparing the inverter's speed command and the speed detected by the speed detector.



CHAPTER 4 BASIC OPERATION

| 4.1 | Operation panel (FR-DU08) | 138 |
|-----|---|-----|
| 4.2 | Monitoring the inverter | |
| 4.3 | Easy setting of the inverter operation mode | |
| 4.4 | Frequently-used parameters (simple mode parameters) | |
| 4.5 | Basic operation procedure (PU operation) | |
| 4.6 | Basic operation procedure (External operation) | |
| 4.7 | Basic operation procedure (JOG operation) | |

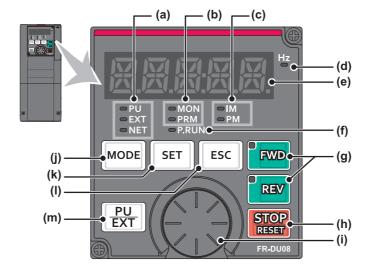
4 BASIC OPERATION

This chapter explains the basic operation of this product. Always read the instructions before use.

4.1 Operation panel (FR-DU08)

4.1.1 Components of the operation panel (FR-DU08)

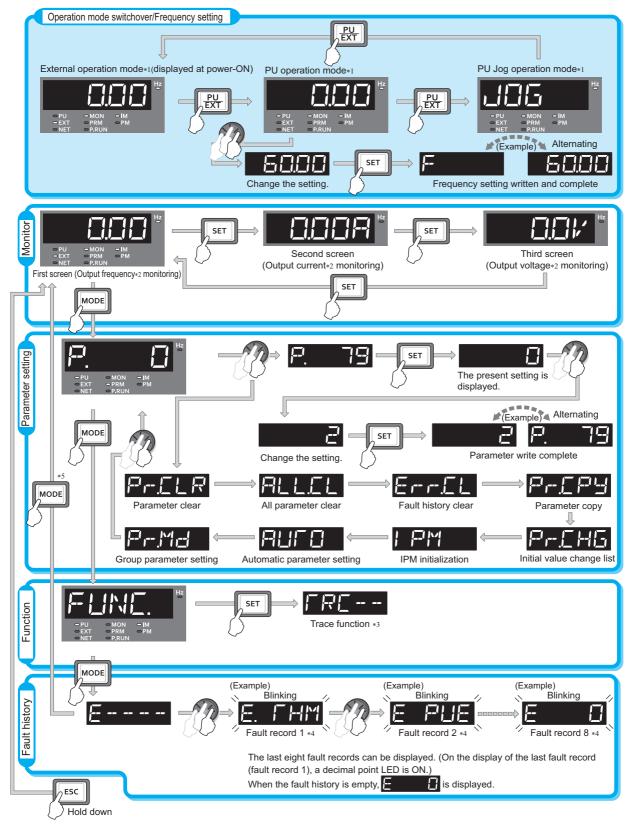
To mount the operation panel (FR-DU08) on the enclosure surface, refer to page 84.



| No. | Appearance | Name | Description |
|-----|------------------------|--|--|
| (a) | ⇔ PU ⇔ EXT ⊶ NET | Inverter operation mode LED indicator | PU: ON when the inverter is in the PU operation mode. EXT: ON when the inverter is in the External operation mode. (ON when the inverter in the initial setting is powered ON.) NET: ON when the inverter is in the Network operation mode. PU and EXT: ON when the inverter is in the External/PU combined operation mode 1 or 2. |
| (b) | □ MON □ PRM | Operation panel mode LED indicator | MON: ON when the operation panel is in the monitor mode. Quickly blinks twice intermittently while the protective function is activated. Slowly blinks when the display-off function of the operation panel is valid. PRM: ON when the operation panel is in the parameter setting mode. |
| (c) | □IM □PM | Controlled motor type LED indicator | IM: ON when the inverter is set to control the induction motor. PM: ON when the inverter is set to control the PM motor. The indicator blinks during test operation. |
| (d) | Hz | Frequency unit LED indicator | ON when the actual frequency is monitored. (Blinks when the set frequency is monitored.) |
| (e) | | Monitor (5-digit LED) | Shows a numeric value (readout) of a monitor item such as the frequency or a parameter number. (The monitor item can be changed according to the settings of Pr.52, Pr.774 to Pr.776.) |
| (f) | □P.RUN | PLC function LED indicator | ON when the PLC function of the inverter is valid. |
| (g) | FWD REV | FWD key, REV key | FWD key: Starts forward rotation operation. Its LED is ON during forward rotation operation. REV key: Starts reverse rotation operation. Its LED is ON during reverse rotation operation. Either LED blinks under the following conditions. • When the frequency command is not given even if the forward/reverse command is given. • When the frequency command is equal to the starting frequency or lower. • When the MRS signal is being input. |
| (h) | STOP | STOP/RESET key | Stops the operation commands. Used to reset the inverter when the protective function is activated. |
| (i) | | Setting dial | The setting dial of the Mitsubishi Electric inverters. Turn the setting dial to change the setting of frequency or parameter, etc. Press the setting dial to perform the following operations: • To display a set frequency on the LED display in the monitor mode. (The monitor item shown on the display can be changed by using Pr.992 .) • To display the present setting during calibration. • To display a fault record number in the fault history mode. |
| (j) | MODE | MODE key | Switches the operation panel to a different mode. The easy setting of the inverter operation mode is enabled by pressing this key simultaneously with PU EXT. Every key on the operation panel becomes inoperable by holding this key for 2 seconds. The key inoperable function is invalid when Pr.161 = "0 (initial setting)". (Refer to page 341.) |
| (k) | SET | SET key | Confirms each selection. When this key is pressed during inverter operation, the monitor item changes. (The monitor item on each screen can be changed according to the settings of Pr.52, Pr.774 to Pr.776.) |
| (I) | ESC | ESC key | Goes back to the previous display. Holding this key for a longer time changes the display back to the monitor mode. |
| (m) | PU EXT | PU/EXT key | Switches between the PU operation mode, the PUJOG operation mode, and the External operation mode. The easy setting of the inverter operation mode is enabled by pressing this key simultaneously with MODE. Also cancels the PU stop warning. |

4.1.2 Basic operation of the operation panel

♦ Basic operation



- *1 For details on operation modes, refer to page 389.
- *2 The monitor item can be changed. (Refer to page 446.)
- *3 For details on the trace function, refer to page 649.
- *4 For details on the fault history, refer to page 779.
- *5 The USB memory mode indication appears while a USB memory device is connected. (Refer to page 85.)

♦ Parameter setting mode

In the parameter setting mode, inverter functions (parameters) are set.

The following table explains the indications in the parameter setting mode.

| Operation panel indication | Function name | Description | Refer to page |
|----------------------------|-----------------------------|--|---------------------|
| P. | Parameter setting mode | Under this mode, the set value of the displayed parameter number is read or changed. | 142 |
| P-CLR | Parameter clear | Clears and resets parameter settings to the initial values. Calibration parameters and offline auto tuning parameters are not cleared. For details on the uncleared parameters, refer to page 864. | 743 |
| ALLEL | All parameter clear | Clears and resets parameter settings to the initial values. Calibration parameters and the offline auto tuning parameters are also cleared. For details on the uncleared parameters, refer to page 864. | 743 |
| ErrEL | Fault history clear | Deletes the fault history. | 774 |
| PHEPY | Parameter copy | Copies the parameter settings saved in the inverter to the operation panel. The parameters copied to the operation panel can be also copied to other inverters. | 744 |
| Pr-CHG | Initial value change list | Identifies the parameters that have been changed from their initial settings. | 751 |
| I PM | IPM initialization | Changes the parameters to the settings required to drive an IPM motor (MM-CF) as a batch. Also changes the parameters back to the settings required to drive an induction motor. | 230 |
| AUFO | Automatic parameter setting | Changes parameter settings as a batch. The target parameters include communication parameters for the Mitsubishi Electric human machine interface (GOT) connection and the parameters for the rated frequency settings of 50 Hz/60 Hz. | 350 |
| P-Md | Group parameter setting | Displays parameter numbers by function groups. | 201 |

4.1.3 Digital characters and their corresponding printed equivalents

Digital characters displayed on the operation panel display are as follows.

| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Α | B(b) | С | С | D(d) |
|------|------------|------|-------------|------|----------|------|------|------|---|------|------|------|----------|------|
| | 1 | | \exists | 1 | 5 | 8 | 1 | | | H | 占 | | <u>_</u> | ᆸ |
| E(e) | F(f) | G(g) | H(h) | l(i) | J(j) | K(k) | L(I) | M(m) | N | n | 0 | 0 | P(p) | Q(q) |
| E | F = | 巨 | }- { | | | K | 1 | 7 | N | 1-7 | | | P | |
| R | r | S(s) | T(t) | U | u | V | ٧ | W | w | X(x) | Y(y) | Z(z) | | |
| R | ı | 5 | | | <u> </u> | 1,' | 11 | W | M | X | 1-1 | 7 | | |

4.1.4 Changing the parameter setting value

The following shows the procedure to change the setting of Pr.1 Maximum frequency.

Operating procedure

- **1.** Turning ON the power of the inverter The operation panel is in the monitor mode.
- Changing the operation mode
 Press PU to choose the PU operation mode. [PU] indicator turns ON.
- 3. Selecting the parameter setting mode

 Press Mode to choose the parameter setting mode. (The parameter number read previously appears.)
- 4. Selecting the parameter

 Turn until "P. /" (Pr.1) appears. Press SET to read the present set value.

 " [2000]" (initial value) appears.
- **5.** Changing the setting value

Turn to change the set value to " are displayed alternately.

- Turn to read another parameter.
- Press SET to show the setting again on the LCD display.
- Press SET twice to show the next parameter.
- Press Mode three times to return the monitor display to the indication of the frequency.

• NOTE

• If a parameter write condition is not satisfied, a parameter write error appears on the LCD display. (Refer to page 779.)

| Error indication | Description |
|-------------------------|------------------------------|
| E- 1 | Parameter write error |
| E-2 | Write error during operation |
| ErB | Calibration error |
| E 4 | Mode designation error |

• When **Pr.77 Parameter write selection** = "0 (initial setting)," the parameter setting change is only available while the inverter is stopped and under the PU operation mode. To enable the parameter setting change while the inverter is running or under the operation mode other than PU operation mode, change the **Pr.77** setting. (Refer to page 345.)

4.2 Monitoring the inverter

4.2.1 Monitoring of output current and output voltage

Point P

• Press SET on the operation panel in the monitor mode to switch the monitor item between output frequency, output current, and output voltage.

Operating procedure

- **1.** Press MODE during inverter operation to monitor the output frequency. [Hz] indicator turns ON.
- **2.** Press SET to monitor the output current. This operation is valid under any operation mode of the inverter and whether the inverter is running or at a stop. The unit of current "A" appears.
- **3.** Press set to monitor the output voltage. The unit of voltage "V" appears.

NOTE

Other monitor item, such as output power or set frequency, is also available. Use Pr.52 Operation panel main monitor selection or Pr.774 Operation panel monitor selection 1 to Pr.776 Operation panel monitor selection 3 to change the setting. (Refer to page 446.)

4.2.2 First priority monitor screen

The first priority monitor screen, which is displayed first when the operation panel becomes in the monitor mode, is selectable.

To set it, press set it, press for a while when the desired monitor item is displayed on a monitor screen.

The following show the procedure to set the monitor screen displaying the output current as the first priority monitor screen.

Operating procedure

- **1.** Change the mode of the operation panel to the monitor mode, and switch the monitor screen to the one on which the output current can be monitored.
- **2.** Press set as the first priority monitor screen is set as the first priority monitor screen.
- 3. When the operation panel is in the monitor mode next time, the output current monitored value is displayed first.

• NOTE

• Use Pr.52 Operation panel main monitor selection or Pr.774 Operation panel monitor selection 1 to Pr.776 Operation panel monitor selection 3 to change the monitor item. (Refer to page 446.)

4.2.3 Displaying the set frequency

To display the present set frequency, change the mode of the operation panel to the monitor mode and press the setting dial

) while the inverter runs in the PU operation mode or in the External/PU combined operation mode 1 (**Pr.79 Operation** mode selection = "3").



• Use Pr.992 Operation panel setting dial push monitor selection to change the item to be displayed. (Refer to page 446.)

4.3 Easy setting of the inverter operation mode

The operation mode suitable for start and speed command combinations can be set easily using **Pr.79 Operation mode selection**.

The following shows the procedure to operate with the external start command (STF/STR) and the frequency command by using .

Operating procedure

1. Press PU and MODE for 0.5 seconds.



2. Turn until "79 --- 3" (External/PU combined operation mode 1) appears. (For other settings, refer to the following table.)



3. Press SET to confirm the selection. External/PU combined operation mode 1 (**Pr.79** = "3") is set.

| | Onematic | | , , , , , , , , , , , , , , , , , , , |
|--|------------------------|----------------------------------|---------------------------------------|
| Operation panel indication | Start command | n method Frequency command | Operation mode |
| Blinking OF THE PRIN PM PM | FWD, REV | 3 *1 | PU operation mode |
| Blinking OF TOWN -PM -PM | External (STF, STR) | Analog voltage input | External operation mode |
| Blinking O TO NET - PRUM - PM | External (STF, STR) | ⊕ *1 | External/PU combined operation mode 1 |
| Blinking OF THE PRUN -IM -PM -PM -PM -PM -PRUN -PM -PRUN -PM -PRUN -PM -PRUN - | FWD, REV | Analog voltage input | External/PU combined operation mode 2 |

^{*1} To use the setting dial as a potentiometer, refer to page 341.



- " appears if the **Pr.79** setting is tried to be changed while the inverter is set that only the parameters registered in the user group are read (**Pr.160** = "1") but **Pr.79** is not included in the user group.
- " appears if a setting change is attempted during inverter operation. Turn OFF the start command (, or STF/STR signal).
- If MODE is pressed before pressing SET, the easy setting is terminated and the operation panel returns to the monitor mode. If the easy setting is terminated while **Pr.79** = "0 (initial value)", check the inverter operation mode because the inverter may switch its operation mode between the PU operation mode and the External operation mode.
- Reset by pressing STOP is enabled.
- The priorities of the frequency commands while **Pr.79** = "3" are "Multi-speed operation (RL/RM/RH/REX) > PID control (X14) > terminal 4 analog input (AU) > digital input from the operation panel".

4.4 Frequently-used parameters (simple mode parameters)

Parameters that are frequently used for the FR-A800 series are grouped as simple mode parameters.

When **Pr.160 User group read selection** = "9999", only the simple mode parameters are displayed on the operation panel. This section explains the simple mode parameters.

4.4.1 Simple mode parameter list

For simple variable-speed operation of the inverter, the initial values of the parameters may be used as they are. Set the necessary parameters to meet the load and operational specifications. Parameter's setting, change and check can be made on the operation panel (FR-DU08).



Pr.160 User group read selection can narrow down the displayed parameters to only the simple mode parameters. (In the
initial setting, all parameters are displayed.) Set Pr.160 User group read selection as required. (To change the parameter
setting, refer to page 142.)

| Pr.160 setting | Description | | | | |
|-------------------|--|--|--|--|--|
| 9999 | Only simple mode parameters are displayed. | | | | |
| 0 (initial value) | All parameters (simple mode parameters and extended parameters) are displayed. | | | | |
| 1 | Only parameters registered in user groups are displayed. | | | | |

♦ Simple mode parameter

| _ | Pr. | | | Initial v | /alue ^{*11} | _ | | Refer |
|-----|--------------|---|---|--|----------------------|---|---|---------------------|
| Pr. | group | Name | Increment | FM | CA | Range | Application | to page |
| 0 | G000 | Torque boost | 0.1% | 6% ^{*1} 4% ^{*2} 3% ^{*3} | | 0 to 30% | Set this parameter to obtain a higher starting torque under V/F control. Also set this when a loaded motor cannot be driven, the warning | 706 |
| U | G000 | Torque boost | 0.1% | 2% ^{*4} 1% ^{*5} | | 0 10 30% | "OL" occurs, and the inverter output is shut off with the fault indication "E.OC1". | 706 |
| 1 | H400 | Maximum frequency | 0.01 Hz | 120 Hz ^{*7} | | 0 to 120 Hz | Set the upper limit for the output frequency. | 428 |
| 2 | H401 | Minimum frequency | 0.01 Hz | 0 Hz | | 0 to 120 Hz | Set the lower limit for the output frequency. | |
| 3 | G001 | Base frequency | 0.01 Hz | 60 Hz | 50 Hz | 0 to 590 Hz | Set this parameter when the rated motor frequency is 50 Hz. Check the rating plate of the motor. | 707 |
| 4 | D301 | Multi-speed setting (high speed) | 0.01 Hz | 60 Hz | 50 Hz | 0 to 590 Hz | | 151, |
| 5 | D302 | Multi-speed setting (middle speed) | 0.01 Hz | 30 Hz | | 0 to 590 Hz | Pre-set the speeds that will be switched among by terminals. | 151, 156, 411 |
| 6 | D303 | Multi-speed setting (low speed) | 0.01 Hz | 10 Hz | | 0 to 590 Hz | | |
| 7 | F010 | Acceleration time | 0.1 s | 5s ^{*9} 15s ^{*10} | | 0 to 3600 s | Sets the acceleration time. | 367 |
| 8 | F011 | Deceleration time | 0.1 s | 5s ^{*9} 15s ^{*10} | | 0 to 3600 s | Sets the deceleration time. | 307 |
| 9 | H000 C103 | Electronic thermal O/L relay | 0.01 A ^{*6} 0.1 A ^{*7} | Inverter current | | 0 to 500 A ^{*6} 0 to 3600 A ^{*7} | Protects the motor from heat. Set the rated motor current. | 415 |
| 79 | D000 | Operation mode selection | 1 | 0 | | 0 to 4, 6, 7 | Select the start and frequency command sources. | 389 |
| 125 | T022 | Terminal 2 frequency setting gain frequency | 0.01 Hz | 60 Hz | 50 Hz | 0 to 590 Hz | Allows the frequency at the maximum potentiometer setting (5 V in the initial setting) to be changed. | 159, 505 |
| 126 | T042 | Terminal 4 frequency setting gain frequency | 0.01 Hz | 60 Hz | 50 Hz | 0 to 590 Hz | Allows the frequency at the maximum current input (20 mA in the initial setting) to be changed. | 161, 505 |
| 160 | E440 | User group read selection | 1 | 0 | | 0, 1, 9999 | This function restricts the parameters that are read by the operation panel and parameter unit. | 354 |
| 998 | E430 | PM parameter initialization | 1 | 0 | | 0, 3003, 3103, 8009, 8109, 9009, 9109 | Selects the PM sensoriess vector control and set the parameters that are required to drive a | |
| 999 | E431 | Automatic parameter setting | 1 | 9999 | | 1, 2, 10, 11, 12, 13, 20, 21, 9999 | Changes parameter settings as a batch. The target parameters include communication parameters for the Mitsubishi Electric human machine interface (GOT) connection and the parameters for the rated frequency settings of 50/60 Hz. | 350 |

- $^{\star}1 \quad \text{The initial value for the FR-A820-00077} (0.75\text{K}) \text{ or lower and FR-A840-00038} (0.75\text{K}) \text{ or lower.}$
- *2 The initial value for the FR-A820-00105(1.5K) to FR-A820-00250(3.7K), FR-A840-00052(1.5K) to FR-A840-00126(3.7K).
- *3 The initial values for the FR-A820-00340(5.5K), FR-A820-00490(7.5K), FR-A840-00170(5.5K), FR-A840-00250(7.5K).
- *4 The initial value for the FR-A820-00630(11K) to FR-A820-03160(55K), FR-A840-00310(11K) to FR-A840-01800(55K).
- *5 The initial value for the FR-A820-03800(75K) or higher and FR-A840-02160(75K) and higher.
- *6 For the FR-A820-03160(55K) or lower, and FR-A840-01800(55K) or lower.
- $^{\star}7$ For the FR-A820-03800(75K) or higher, and FR-A840-02160(75K) or higher.
- *8 The initial value for the FR-A820-00077(0.75K) or lower and FR-A840-00038(0.75K) or lower is set to the 85% of the inverter rated current.
- $^{\star}9$ $\,$ The initial value for the FR-A820-00490(7.5K) or lower and FR-A840-00250(7.5K) or lower.
- *10 Initial value for the FR-A820-00630(11K) or higher and FR-A840-00310(11K) and higher.
- *11 The initial value in "FM" column is for the FM-type inverter that has terminal FM, and that in "CA" column is for the CA-type inverter that has terminal CA.

◆ Parameters for the CC-Link IE Field Network communication (FR-A800-GF)

| Pr. | Pr. group | Name | Increment | Initial value | Range | Application | Refer to page | | |
|-----|-----------|---|-----------|------------------|---|--|---------------------|--|--|
| 313 | M410 | DO0 output selection | 1 | 9999 | 0 to 8, 10 to 20, 22, 25 to 28, 30 to 36, 38 to 57, 60, 61, 63, 64, 68, 70, 79, | | | | |
| 314 | M411 | DO1 output selection | 1 | 9999 | 80, 84 to 99, 100 to 108, 110 to 116, 120, 122, 125 to 128, 130 to 136, 138, to 157, 160, 161, 163, 164, | Assign signals to the remote registers RX10 to RX12. | 473, 758 | | |
| 315 | M412 | DO2 output selection | 1 | 9999 | 168, 170, 179, 180, 184 to 199, 200 to 208, 300 to 308, 9999 | | | | |
| | | Communication | | | 0 (100) | Enables the error reset function in any | | | |
| | - | reset selection/ Ready bit status | | | | operation mode. Enables the error reset function only in the | | | |
| 349 | | selection | - 1 | 0 | 1 (101) | Network operation mode. | | | |
| 040 | | 0 | | | 0 | Enables the error reset function in any operation mode. | 663 | | |
| | N010 | Communication reset selection | | | | Enables the error reset function only in the | _ | | |
| | | | | | 1 | Network operation mode. | | | |
| 434 | N110 | Network number (CC- Link IE) | 1 | 0 | 0 to 255 | Enter the network number of the inverter. | 752 | | |
| 435 | N111 | Station number (CC-Link IE) | 1 | 0 | 0 to 255 | Enter the station number of the inverter. | | | |
| 500 | N011 | Communication error execution waiting time | 0.1s | 0 s | 0 to 999.8 s | Set the time from when the communication line error occurs until the inverter starts the operation for the communication error | | | |
| 501 | N012 | Communication error occurrence count display | 1 | 0 | 0 | Displays the communication error occurrence count | 663 | | |
| 502 | N013 | Stop mode selection at communication error | 1 | 0 | 0 to 4 | Set the operations when the communication line error occurs and when the communication line error is removed. | | | |
| | | Frequency | | | 0 | Signed frequency command value | | | |
| 541 | N100 | command sign selection | 1 | 0 | 1 | Unsigned frequency command value | 752 | | |
| | | Operation frequency | | | 0 to 590 Hz | Set the frequency for the operation when a communication error occurs. | | | |
| 779 | N014 | during communication error | 0.01 Hz. | 9999 | 9999 | The motor runs at the frequency used before the communication error. | 663 | | |



[•] When Pr.160 in the FR-A800-GF is set to "9999", the parameters for the CC-Link IE Field Network communication, as well as the simple mode parameters, are displayed.

4.5 Basic operation procedure (PU operation)

Select a method to give the frequency command from the list below, and refer to the specified page for its procedure.

| Method to give the frequency command | Refer to page |
|--|---------------|
| Setting the frequency on the operation panel in the frequency setting mode | 149 |
| Give commands by turning the setting dial like a potentiometer | 150 |
| Give commands by turning ON/OFF switches wired to inverter's terminals (multi-speed setting) | 151 |
| Setting the frequency by inputting voltage signals | 152 |
| Setting the frequency by inputting current signals | 153 |

4.5.1 Setting the frequency on the operation panel (example: operating at 30 Hz)



• Use the operation panel (FR-DU08) to give a start command and a frequency command. (PU operation)

Operation panel (FR-DU08)



The following shows the procedure to operate at 30 Hz.

Operating procedure

- **1.** Turning ON the power of the inverter The operation panel is in the monitor mode.
- **2.** Changing the operation mode

Press $\boxed{\frac{\text{PU}}{\text{EXT}}}$ to choose the PU operation mode. [PU] indicator turns ON.

3. Setting the frequency

While the indication is flashing, press SET to confirm the selection for the frequency. "F" and "JIII" are displayed alternately. After about three seconds of alternate display, the monitor display goes back to "IIII" (the indication of a monitored value).

(If set is not pressed during the flashing for about five seconds, the monitor display goes back to " (0.00

Hz). In that case, turn again and set the frequency.)

4. Start \rightarrow acceleration \rightarrow constant speed

Press FWD or REV to start running. The frequency value on the monitor increases according to the setting of

(To change the set frequency, return to step 3. The previously set frequency appears.)

5. Deceleration → stop

Press Fig. to stop. The frequency value on the monitor decreases according to the setting of Pr.8 Deceleration

time, the monitor displays "[[[]]" (0.00 Hz), and the motor stops rotating.



• To display the set frequency under PU operation mode or External/PU combined operation mode 1 (Pr.79 = "3"), press (3) (Refer to page 446.)



can also be used like a potentiometer to perform inverter operation. (Refer to page 150.)

Parameters referred to

Pr.7 Acceleration time, Pr.8 Deceleration time page 367 Pr.79 Operation mode selection page 389

Perform PU operation using the setting dial like a 4.5.2 potentiometer



Set Pr.161 Frequency setting/key lock operation selection = "1" (setting dial potentiometer).

The following shows the procedure to change the frequency from 0 Hz to 60 Hz during operation.

Operating procedure

- Turning ON the power of the inverter The operation panel is in the monitor mode.
- 2. Changing the operation mode

Press $\left\| \frac{PU}{EXT} \right\|$ to choose the PU operation mode. [PU] indicator turns ON.

3. Changing the parameter setting Change Pr.161 setting to "1". (To change the setting, refer to page 142.)

4. Start

Press FWD or REV to start the inverter operation.

5. Setting the frequency

> Turn until " until " appears. The value in the flashing indication is set as the value of a set frequency (The indication blinks for about five seconds). needs not to be pressed.



- If the indication changes from the blink of "60.00" to the display of "0.00", Pr.161 Frequency setting/key lock operation selection may be set to a value other than "1".
- Simply turning enables frequency setting whether the inverter is running or at a stop.
- The newly-set frequency is saved as the set frequency in EEPROM after 10 seconds.
- With the setting dial, the frequency can go up to the setting value of Pr.1 Maximum frequency. Check the Pr.1 Maximum frequency setting, and adjust the setting according to the application.

Parameters referred to

Pr.1 Maximum frequency page 428

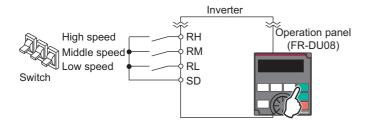
Pr.161 Frequency setting/key lock operation selection ☐ page 341

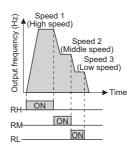
4.5.3 Setting the frequency with switches (multi-speed setting)

Point P

- Use FWD or REV on the operation panel (FR-DU08) to give a start command.
- Turn ON the RH, RM, or RL signal to give a frequency command (multi-speed setting).
- Set Pr.79 Operation mode selection = "4" (External/PU combination operation mode 2).

[Connection diagram]





The following shows the procedure to operate at a low speed (10 Hz).

Operating procedure

- **1.** Turning ON the power of the inverter The operation panel is in the monitor mode.
- 2. Changing the operation mode

 Set "4" in Pr.79. [PU] and [EXT] indicators are ON. (To change the setting, refer to page 144.)
- **3.** Setting the frequency

 Turn ON the low-speed switch (RL signal).
- Start → acceleration → constant speed
 Press FWD or REV to start running. The frequency value on the monitor increases according to the setting of Pr.7
 Acceleration time, and " \[\(\limits_{\text{III}} \right] \]" (10.00 Hz) appears on the monitor.
- Deceleration → stop

 Press STOP to stop. The frequency value on the monitor decreases according to the setting of Pr.8 Deceleration time, the monitor displays "☐☐" (0.00 Hz), and the motor stops rotating. Turn OFF the low-speed switch (RL signal).

NOTE

- Initially, the high-speed switch (RH signal) is set to 60 Hz for the FM type inverter or 50 Hz for the CA type inverter. The middle-speed switch (RM signal) is set to 30 Hz, and the low-speed switch (RL signal) is set to 10 Hz. (To change the settings, use **Pr.4**, **Pr.5**, and **Pr.6**, respectively.)
- In the initial setting, if two or more speed switches (signals) are simultaneously turned ON, priority is given to the switch (signal) for the lower speed. For example, when both RH and RM signals turn ON, the RM signal (**Pr.5**) has the higher priority.
- · Up to 15-speed switching operation can be performed.

Parameters referred to

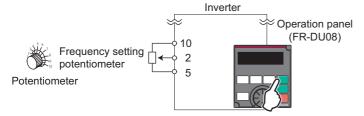
Pr.4 to Pr.6 (multi-speed setting) page 411
Pr.7 Acceleration time, Pr.8 Deceleration time page 367
Pr.79 Operation mode selection page 389

4.5.4 Setting the frequency using an analog signal (voltage input)



- Use FWD or REV on the operation panel (FR-DU08) to give a start command.
- Use the frequency setting potentiometer to give a frequency command (by connecting it to terminals 2 and 5 (voltage input)).
- Set Pr.79 Operation mode selection = "4" (External/PU combination operation mode 2).

[Connection diagram] (The inverter supplies 5 V power to the frequency setting potentiometer via terminal 10.)



The following shows the procedure to operate at 60 Hz.

Operating procedure

- **1.** Turning ON the power of the inverter The operation panel is in the monitor mode.
- 2. Changing the operation mode

 Set "4" in Pr.79. [PU] and [EXT] indicators are ON. (To change the setting, refer to page 142.)
- 3. Start

Press FWD or FREV. [FWD] or [REV] indicator blinks as no frequency command is given.

4. Acceleration → constant speed

5. Deceleration

Turn the frequency setting potentiometer counterclockwise slowly to full. The frequency value on the monitor decreases according to the setting of **Pr.8 Deceleration time**, the monitor displays "☐☐☐" (0.00 Hz), and the motor stops rotating. [FWD] or [REV] indicator blinks.

6. Stop

Press RESET . [FWD] or [REV] indicator turns OFF.

■ NOTE

- To change the frequency (60 Hz) at the maximum voltage input (initial value: 5 V), adjust **Pr.125 Terminal 2 frequency setting** gain frequency.
- To change the frequency (0 Hz) at the minimum voltage input (initial value: 0 V), adjust the calibration parameter C2 Terminal 2 frequency setting bias frequency.
- When terminal 10 is used, the maximum output frequency may fluctuate in a range of ±6 Hz due to fluctuations in the output voltage (5 V ±0.5 VDC). Use Pr.125 or Pr.C4 to adjust the output frequency at the maximum analog input as required. (Refer to page 505.)
- When terminal 10E is used, the maximum output frequency may fluctuate (in a range of ±2 to 3 Hz) due to fluctuations in the output voltage (10 ±0.4 VDC). Use Pr. 125 or Pr. C4 to adjust the output frequency at the maximum analog input as required. (Refer to page 505.)

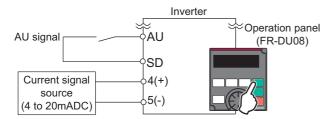
Pr.7 Acceleration time, Pr.8 Deceleration time page 367 Pr.79 Operation mode selection page 389 Pr.125 Terminal 2 frequency setting gain frequency page 505 C2(Pr.902) Terminal 2 frequency setting bias frequency page 505

4.5.5 Setting the frequency using an analog signal (current input)

Point P

- Use FWD or REV on the operation panel (FR-DU08) to give a start command.
- Use the current regulator which outputs 4 to 20 mA to give a frequency command (by connecting it across terminals 4 and 5 (current input)).
- · Turn ON the AU signal.
- Set Pr.79 Operation mode selection = "4" (External/PU combination operation mode 2).

[Connection diagram]



The following shows the procedure to operate at 60 Hz.

Operating procedure

- **1.** Turning ON the power of the inverter The operation panel is in the monitor mode.
- 2. Changing the operation mode

 Set "4" in Pr.79. [PU] and [EXT] indicators are ON. (To change the setting, refer to page 142.)
- **3.** Selecting the input via terminal 4 Turn ON the Terminal 4 input selection (AU) signal. Input via terminal 4 to the inverter is enabled.
- **4.** Start

Press FWD or REV. [FWD] or [REV] indicator blinks as no frequency command is given.

- 5. Acceleration → constant speed
 Input a current of 20 mA to the inverter from the regulator. The frequency value on the monitor increases according to the setting of Pr.7 Acceleration time, and "☐☐☐☐" (60.00 Hz) appears on the monitor.
- Deceleration
 Input a current of 4 mA or less. The frequency value on the monitor decreases according to the setting of Pr.8

 Deceleration time, the monitor displays " (0.00 Hz), and the motor stops rotating. [FWD] or [REV] indicator blinks.
- **7.** Stop

Press STOP [REV] indicator turns OFF.



- Pr.184 AU terminal function selection must be set to "4 (initial value)" (AU signal).
- To change the frequency (60 Hz) at the maximum current input (initial value: 20 mA), adjust Pr.126 Terminal 4 frequency setting gain frequency.
- To change the frequency (0 Hz) at the minimum current input (initial value: 4 mA), adjust the calibration parameter C5 Terminal 4 frequency setting bias frequency.

Pr.7 Acceleration time, Pr.8 Deceleration time page 367
Pr.79 Operation mode selection page 389
Pr.126 Terminal 4 frequency setting gain frequency page 505
Pr.184 AU terminal function selection page 521
C5(Pr.904) Terminal 4 frequency setting bias frequency page 505

4.6 Basic operation procedure (External operation)

Select a method to give the frequency command from the list below, and refer to the specified page for its procedure.

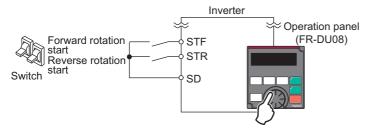
| Method to give the frequency command | Refer to page |
|---|---------------|
| Setting the frequency on the operation panel in the frequency setting mode | 155 |
| Turning ON/OFF switches wired to inverter's terminals (multi-speed setting) | 156 |
| Setting the frequency by inputting voltage signals | 157 |
| Setting the frequency by inputting current signals | 160 |

4.6.1 Setting the frequency on the operation panel



- Turn ON the STF/STR signal to give a start command.
- Use on the operation panel (FR-DU08) to give a frequency command.
- Set Pr.79 = "3" (External/PU combined operation mode 1).

[Connection diagram]



The following shows the procedure to operate at 30 Hz.

Operating procedure

- Changing the operation mode
 Set "3" in Pr.79. [PU] and [EXT] indicators are ON. (To change the setting, refer to page 142.)
- **2.** Setting the frequency

Turn until the target frequency " [(30.00 Hz) appears. The indication blinks for about five seconds. While the indication is flashing, press set to confirm the selection for the frequency. " F" and " [(1) " are displayed alternately. After about three seconds of alternate display, the monitor display goes back to " (1) " (the indication of a monitored value). (If set is not pressed during the flashing for about five seconds, the monitor display goes back to " (0.00 Hz). In that case, turn again and set the frequency.)

- 3. Start → acceleration → constant speed

 Turn ON the start switch (STF/STR signal). The frequency value on the monitor increases according to the setting

 of Pr.7 Acceleration time, and "∃□□□" (30.00 Hz) appears on the monitor. [FWD] indicator is ON during the
 forward rotation, and [REV] indicator is ON during the reverse rotation. (To change the set frequency, return to step

 2. The previously set frequency appears.)
- 4. Deceleration → stop Turn OFF the start switch (STF/STR signal). The frequency value on the monitor decreases according to the setting of Pr.8 Deceleration time, the monitor displays "☐☐☐" (0.00 Hz), and the motor stops rotating.



- When both the forward rotation start switch (STF signal) and the reverse rotation start switch (STR signal) are turned ON, the motor cannot be started. If both are turned ON while the inverter is running, the inverter decelerates to a stop.
- Pr.178 STF terminal function selection must be set to "60" (or Pr.179 STR terminal function selection must be set to "61") (initial value).
- Setting Pr.79 Operation mode selection = "3" enables multi-speed operation.
- If STOP on the operation panel is pressed during the External operation, the inverter stops and the PU stop warning is activated ("P 5" appears on the LCD display of the operation panel). To reset the PU stop warning, turn OFF the start switch (STF or STR signal), and then press PU (refer to page 338).

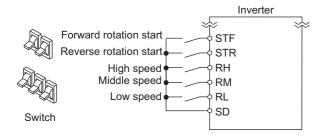
Pr.4 to Pr.6 (multi-speed setting) page 411, Pr.7 Acceleration time, Pr.8 Deceleration time page 367
Pr.178 STF terminal function selection, Pr.179 STR terminal function selection page 521
Pr.79 Operation mode selection page 389

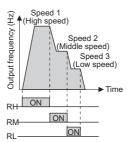
4.6.2 Setting the frequency and giving a start command with switches (multi-speed setting) (Pr.4 to Pr.6)



- Turn ON the STF/STR signal to give a start command.
- Turn ON the RH, RM, or RL signal to give a frequency command (multi-speed setting).

[Connection diagram]





The following shows the procedure to operate at a high speed (60 Hz).

Operating procedure

- **1.** Turning ON the power of the inverter The operation panel is in the monitor mode.
- **2.** Setting the frequency
 Turn ON the high-speed switch (RH signal).
- 3. Start → acceleration → constant speed

 Turn ON the start switch (STF/STR signal). The frequency value on the monitor increases according to the setting of Pr.7 Acceleration time, and "☐☐☐" (60.00 Hz) appears on the monitor. [FWD] indicator is ON during the forward rotation, and [REV] indicator is ON during the reverse rotation. When the RM signal is turned ON, 30 Hz is displayed. When the RL signal is turned ON, 10 Hz is displayed.
- **4.** Deceleration → stop
 Turn OFF the start switch (STF/STR signal). The frequency value on the monitor decreases according to the setting
 of **Pr.8 Deceleration time**, the monitor displays "☐☐☐" (0.00 Hz), and the motor stops rotating. [FWD] or [REV] indicator turns OFF. Turn OFF the high-speed switch (RH signal).



- When both the forward rotation start switch (STF signal) and the reverse rotation start switch (STR signal) are turned ON, the motor cannot be started. If both are turned ON while the inverter is running, the inverter decelerates to a stop.
- Initially, the high-speed switch (RH signal) is set to 60 Hz for the FM type inverter or 50 Hz for the CA type inverter. The middlespeed switch (RM signal) is set to 30 Hz, and the low-speed switch (RL signal) is set to 10 Hz. (To change the settings, use Pr.4, Pr.5, and Pr.6, respectively.)
- In the initial setting, if two or more speed switches (signals) are simultaneously turned ON, priority is given to the switch (signal) for the lower speed. For example, when both RH and RM signals turn ON, the RM signal (Pr.5) has the higher priority.
- · Up to 15-speed switching operation can be performed.

Pr.4 to Pr.6 (multi-speed setting) page 411 Pr.7 Acceleration time, Pr.8 Deceleration time page 367

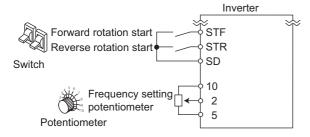
Setting the frequency using an analog signal 4.6.3 (voltage input)

Point P

- Turn ON the STF/STR signal to give a start command.
- · Use the frequency setting potentiometer to give a frequency command (by connecting it across terminals 2 and 5 (voltage input)).

[Connection diagram]

(The inverter supplies 5 V power to the frequency setting potentiometer via terminal 10.)



The following shows the procedure to operate at 60 Hz.

Operating procedure

- 1. Turning ON the power of the inverter The operation panel is in the monitor mode.

Turn ON the start switch (STF/STR signal). [FWD] or [REV] indicator blinks as no frequency command is given.

- Acceleration → constant speed Turn the frequency setting potentiometer clockwise slowly to full. The frequency value on the monitor increases indicator is ON during the forward rotation, and [REV] indicator is ON during the reverse rotation.
- 4. Deceleration

2.

Turn the frequency setting potentiometer counterclockwise slowly to full. The frequency value on the monitor decreases according to the setting of **Pr.8 Deceleration time**, the monitor displays "\|\pi \|\pi \|\pi \|\pi \|\pi \|\pi \|\notation time, the monitor displays \|\pi \|\pi \|\pi \|\pi \|\pi \|\notation time, the monitor displays \|\pi \|\pi \|\pi \|\pi \|\pi \|\pi \|\pi \|\notation time, the monitor displays \|\pi \|\pi \|\pi \|\pi \|\notation time, the monitor displays \|\pi \|\p stops rotating. [FWD] or [REV] indicator blinks.

5. Stop Turn OFF the start switch (STF/STR signal). [FWD] or [REV] indicator turns OFF.



- When both the forward rotation start switch (STF signal) and the reverse rotation start switch (STR signal) are turned ON, the motor cannot be started. If both are turned ON while the inverter is running, the inverter decelerates to a stop.
- Pr.178 STF terminal function selection must be set to "60" (or Pr.179 STR terminal function selection must be set to "61")
 (initial value).
- When terminal 10 is used, the maximum output frequency may fluctuate in a range of ±6 Hz due to fluctuations in the output voltage (5 V ±0.5 VDC). Use **Pr. 125** or Pr. C4 to adjust the output frequency at the maximum analog input as required. (Refer to page 505.)
- When terminal 10E is used, the maximum output frequency may fluctuate (in a range of ±2 to 3 Hz) due to fluctuations in the output voltage (10 ±0.4 VDC). Use **Pr. 125** or **Pr. C4** to adjust the output frequency at the maximum analog input as required. (Refer to page 505.)

Pr.7 Acceleration time, Pr.8 Deceleration time page 367
Pr.178 STF terminal function selection, Pr.179 STR terminal function selection page 521

4.6.4 Changing the frequency (60 Hz, initial value) at the maximum voltage input (5 V, initial value)



· Change the maximum frequency.

The following shows the procedure to change the frequency at 5 V from 60 Hz (initial value) to 50 Hz using a frequency setting potentiometer for 0 to 5 VDC input. Set 50 Hz in **Pr.125** so that the inverter outputs 50 Hz at 5 V input.

Operating procedure

1. Selecting the parameter

Press | SET | to read the present set value. (60.00 Hz)

2. Changing the maximum frequency

Press SET to confirm the selection. " \[\] and " \[\] and " \[\] are displayed alternately.

3. Selecting the mode and the monitor item

Press Mode three times to select the monitor mode, and change the monitor item to the frequency.

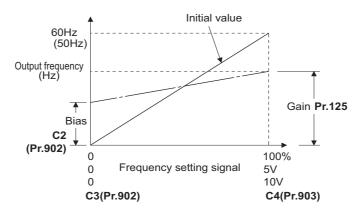
4. Start

Turn ON the start switch (STF/STR signal), and turn the frequency setting potentiometer clockwise slowly to full. (Refer to steps 2 and 3 in 4.6.3.)

The motor is operated at 50 Hz.



• To change the frequency at the input of 0 V (minimum voltage), use the calibration parameter C2.



Other adjustment methods for the frequency setting voltage gain are the following: adjustment by applying a voltage directly
across terminals 2 and 5, and adjustment using a specified point without applying a voltage across terminals 2 and 5. (Refer
to page 505.)

Parameters referred to

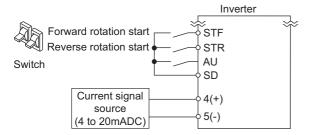
Pr.125 Terminal 2 frequency setting gain frequency page 505
C2(Pr.902) Terminal 2 frequency setting bias frequency page 505
C4(Pr.903) Terminal 2 frequency setting gain page 505

4.6.5 Setting the frequency using an analog signal (current input)

Point P

- Turn ON the STF/STR signal to give a start command.
- · Turn ON the AU signal.
- Set Pr.79 Operation mode selection = "2" (External operation mode).

[Connection diagram]



The following shows the procedure to operate at 60 Hz.

Operating procedure

- **1.** Turning ON the power of the inverter The operation panel is in the monitor mode.
- **2.** Selecting the input via terminal 4 Turn ON the Terminal 4 input selection (AU) signal. Input via terminal 4 to the inverter is enabled.
- **3.** Start

 Turn ON the start switch (STF/STR signal). [FWD] or [REV] indicator blinks as no frequency command is given.
- 4. Acceleration → constant speed Input a current of 20 mA to the inverter from the regulator. The frequency value on the monitor increases according to the setting of Pr.7 Acceleration time, and "☐☐☐☐" (60.00 Hz) appears on the monitor. [FWD] indicator is ON during the forward rotation, and [REV] indicator is ON during the reverse rotation.
- Deceleration
 Input a current of 4 mA or less. The frequency value on the monitor decreases according to the setting of Pr.8

 Deceleration time, the monitor displays "☐☐ " (0.00 Hz), and the motor stops rotating. [FWD] or [REV] indicator blinks.
- **6.** Stop

 Turn OFF the start switch (STF/STR signal). [FWD] or [REV] indicator turns OFF.

• NOTE

- When both the forward rotation start switch (STF signal) and the reverse rotation start switch (STR signal) are turned ON, the motor cannot be started. If both are turned ON while the inverter is running, the inverter decelerates to a stop.
- Pr.184 AU terminal function selection must be set to "4 (initial value)" (AU signal).

Parameters referred to

Pr.7 Acceleration time, Pr.8 Deceleration time ☐ page 367
Pr.184 AU terminal function selection ☐ page 521

4.6.6 Changing the frequency (60 Hz, initial value) at the maximum current input (at 20 mA, initial value)



· Change the maximum frequency.

The following shows the procedure to change the frequency at 20 mA from 60 Hz (initial value) to 50 Hz using a frequency setting potentiometer for 4 to 20 mA input. Set 50 Hz in **Pr.126** so that the inverter outputs 50 Hz at 20 mA input.

Operating procedure

1. Selecting the parameter

Press SET to read the present set value (60.00 Hz).

2. Changing the maximum frequency

Turn to change the set value to "5 [] [] (50.00 Hz).

Press SET to confirm the selection. "SIIII" and "P. IZE" are displayed alternately.

3. Selecting the mode and the monitor item

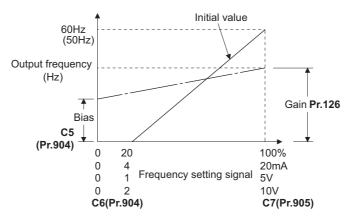
Press MODE three times to select the monitor mode and to monitor a frequency.

4. Start

Turn ON the start switch (STF or STR) to apply a 20 mA current (refer to steps 3 and 4 in 4.6.5). Operate at 50 Hz.

NOTE

• To change the frequency at the input of 4 mA (minimum current), use the calibration parameter C5.



 Other adjustment methods for the frequency setting current gain are the following: adjustment by applying a current through terminals 4 and 5, and adjustment using a specified point without applying a current through terminals 4 and 5. (Refer to page 505.)

Parameters referred to

Pr.126 Terminal 4 frequency setting gain frequency ☐ page 505
C5(Pr.904) Terminal 4 frequency setting bias frequency ☐ page 505
C7(Pr.905) Terminal 4 frequency setting gain ☐ page 505

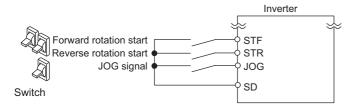
4.7 Basic operation procedure (JOG operation)

4.7.1 Giving a start command by using external signals for JOG operation

Point P

- JOG operation is performed while the JOG signal is ON.
- Use Pr.15 Jog frequency to set a frequency, and set Pr.16 Jog acceleration/deceleration time to set the acceleration/deceleration time for JOG operation.
- Set Pr.79 Operation mode selection = "2" (External operation mode).

[Connection diagram]



The following shows the procedure to operate at 5 Hz.

Operating procedure

- **1.** Turning ON the power of the inverter The operation panel is in the monitor mode.
- Turning ON the JOG signal
 Turn ON the JOG switch (JOG signal). The inverter is set ready for the JOG operation.
- 3. Start → acceleration → constant speed

 Turn ON the start switch (STF/STR signal). The frequency increases according to the setting of Pr.16 Jog

 acceleration/deceleration time, and "与口口" (5.00 Hz) appears on the LCD display. [FWD] indicator is ON during the forward rotation, and [REV] indicator is ON during the reverse rotation.
- 4. Deceleration → stop Turn OFF the start switch (STF/STR signal). The frequency decreases according to the setting of Pr.16 Jog acceleration/deceleration time. "☐☐☐" (0.00 Hz) appears on the LCD display, and the motor stops rotating. [FWD] or [REV] indicator turns OFF. Turn OFF the JOG switch (JOG signal).

• NOTE

- To change the frequency, change the setting of **Pr.15 Jog frequency** (initial value: 5 Hz).
- To change the acceleration/deceleration time, change the setting of Pr.16 Jog acceleration/deceleration time (initial value: 0.5 second).

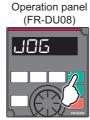
Parameters referred to

Pr.15 Jog frequency, Pr.16 Jog acceleration/deceleration time ☞ page 410 Pr.79 Operation mode selection ☞ page 389

4.7.2 Giving a start command from the operation panel for JOG operation



• JOG operation is performed while wo or with or the operation panel is pressed.



The following shows the procedure to operate at 5 Hz.

Operating procedure

- **1.** Turning ON the power of the inverter The operation panel is in the monitor mode.
- **2.** Changing the operation mode

Press PU twice to choose the PUJOG operation mode. The display shows " , , and [PU] indicator is ON.

- 3. Start → acceleration → constant speed

 Hold FWD or REV down to keep the JOG operation. The frequency increases according to the setting of Pr.16

 Jog acceleration/deceleration time, and "☐☐□" (5.00 Hz) appears on the LCD display.
- **4.** Deceleration \rightarrow stop

Release or or requency decreases according to the setting of **Pr.16 Jog acceleration/ deceleration time**. "[] (0.00 Hz) appears on the LCD display, and the motor stops rotating.



- To change the frequency, change the setting of Pr.15 Jog frequency (initial value: 5 Hz).
- To change the acceleration/deceleration time, change the setting of **Pr.16 Jog acceleration/deceleration time** (initial value: 0.5 second).

Parameters referred to

Pr.15 Jog frequency, Pr.16 Jog acceleration/deceleration time 🖙 page 410

MEMO

CHAPTER 5 PARAMETERS

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5 PARAMETERS

This chapter explains the function setting for use of this product.

Always read the instructions before use.

The following marks are used to indicate the controls. (Parameters without any mark are valid for all the controls.)

| Mark | Control method | Applied motor |
|---------------|---------------------------------------|---------------------------------------|
| V/F | V/F control | |
| Magnetic:flux | Advanced magnetic flux vector control | Three-phase induction motor |
| Sensorless | Real sensorless vector control | |
| Vector | Vector control | Three-phase induction motor, PM motor |
| PM | PM sensorless vector control | PM motor |

The setting range and the initial value of parameters differ depending on the structure or functions of the inverter. The following common designations are used for each type of the inverter models.

| Inverter model | Common designation |
|----------------|--------------------------|
| FR-A8[]0 | Standard model |
| FR-A8[]2 | Separated converter type |
| FR-A8[]6 | IP55 compatible model |

5.1 Parameter list

5.1.1 Parameter list (by parameter number)

For simple variable-speed operation of the inverter, the initial values of the parameters may be used as they are. Set the necessary parameters to meet the load and operational specifications. Parameter's setting, change and check can be made on the operation panel (FR-DU08).



- **Simple** indicates simple mode parameters. Use **Pr.160 User group read selection** to indicate the simple mode parameters only (initial setting is to indicate the extended mode parameters).
- The changing of the parameter settings may be restricted in some operating statuses. Use **Pr.77 Parameter write selection** to change the setting of the restriction.
- Refer to page 864 for instruction codes for communication and availability of Parameter clear, all clear, and Parameter copy.

| | | Pr. | | | Minimum | Initial | value | Refer | Customer | | | | | | |
|--------------------------------|-------------|-------------------|--|----------------------------|----------------------|------------------------|--------|-------------|------------------------------|--|--|------------------|--|--|--|
| Function | Pr. | group | Name | Setting range | setting increments | FM | CA | to page | setting | | | | | | |
| | | | | | increments | 6% ^{*1} | | | | | | | | | |
| | | | | | | 4% ^{*1} | | | | | | | | | |
| | 0 | G000 | Torque boostSimple | 0 to 30% | 0.1% | 3% ^{*1} | | 706 | | | | | | | |
| | | | | | | 2% ^{*1} | | | | | | | | | |
| | | | | | | 1% ^{*1} | | - | | | | | | | |
| | | | | | | 120 Hz | ,*2 | | | | | | | | |
| | 1 | H400 | Maximum frequency Simple | 0 to 120 Hz | 0.01 Hz | 60 Hz* | | 428 | | | | | | | |
| | 2 | H401 | Minimum frequency Simple | 0 to 120 Hz | 0.01 Hz | 0 Hz | | 428 | | | | | | | |
| _ | 3 | G001 | Base frequency Simple | 0 to 590 Hz | 0.01 Hz | 60 Hz | 50 Hz | 707 | | | | | | | |
| tio | _ | | Multi-speed setting (high | | | | | | | | | | | | |
| Ę | 4 | D301 | speed) Simple | 0 to 590 Hz | 0.01 Hz | 60 HZ | 50 Hz | 411 | | | | | | | |
| Basic function | 5 | D302 | Multi-speed setting (middle | 0 to 590 Hz | 0.01 Hz | 30 Hz | | 411 | | | | | | | |
| å | | | speed)Simple | 0 10 000 1 12 | 0.0 | 00 | | | | | | | | | |
| | 6 | D303 | Multi-speed setting (low speed) Simple | 0 to 590 Hz | 0.01 Hz | 10 Hz | | 411 | | | | | | | |
| | | | abaaa) auribie) | | | 5s ^{*4} | | | | | | | | | |
| | 7 | F010 | Acceleration time Simple | 0 to 3600 s | 0.1 s | 15s ^{*5} | | 367 | | | | | | | |
| | | | | | | 5s*4 | | | | | | | | | |
| | 8 | F011 | Deceleration time Simple | 0 to 3600 s | 0.1 s | 15s*5 | | 367 | | | | | | | |
| | | | Electronic thermal O/L | 0 to 500 A*2 | 0.01 A ^{*2} | 100 | . 415. | | | | | | | | |
| | 9 | H000 C103 | relay <u>Simple</u> | | | Inverter rated current | | 532, | | | | | | | |
| | 0103 | Ra | Rated motor current Simple | 0 to 3600 A*3 | 0.1 A ^{*3} | odiront | | 551 | | | | | | | |
| ē | 10 | G100 | DC injection brake operation frequency | 0 to 120 Hz, 9999 | 0.01 Hz | 3 Hz | | 715 | | | | | | | |
| bral | 44 | 0404 | DC injection brake operation | 0.1.10.0000 | 0.4 | 0.5 | | 745 | | | | | | | |
| DC injection brake | 11 | G101 | time | 0 to 10 s, 8888 | 0.1 s | 0.5 s | | 715 | | | | | | | |
| njec | | | | | | | | | DC injection brake operation | | | 4% ^{*6} | | | |
|)C | 12 | G110 | voltage | 0 to 30% | 0.1% | 2%*6 | | 715 | | | | | | | |
| | | | | | | 1% ^{*6} | | 004 | | | | | | | |
| _ | 13 | F102 | Starting frequency | 0 to 60 Hz | 0.01 Hz | 0.5 Hz | | 381, 382 | | | | | | | |
| _ | 14 | G003 | Load pattern selection | 0 to 5, 12 to 15 | 1 | 0 | | 708 | | | | | | | |
| ion | 15 | D200 | Jog frequency | 0 to 590 Hz | 0.01 Hz | 5 Hz | | 410 | | | | | | | |
| JOG operation | | | la massalametiam/ | | | | | | | | | | | | |
| do (| 16 F002 Jog | | Jog acceleration/ deceleration time | 0 to 3600 s | 0.1 s | 0.5 s | | 410 | | | | | | | |
| ğ | | decoleration time | | | | | | | | | | | | | |
| _ | 17 | T720 | MRS input selection | 0, 2, 4 | 1 | 0 | | 524 | | | | | | | |
| _ | 18 | H402 | High speed maximum | 0 to 590 Hz | 0.01 Hz | 120 Hz | | 428 | | | | | | | |
| | .0 | | frequency | | 0.01112 | 60 Hz* | 3 | 120 | | | | | | | |
| _ | 19 | G002 | Base frequency voltage | 0 to 1000 V, 8888, 9999 | 0.1 V | 9999 | 8888 | 707 | | | | | | | |
| ne | 20 | F000 | Acceleration/deceleration | 1 to 590 Hz | 0.01 Hz | 60 Hz | 50 Hz | 367 | | | | | | | |
| n tir | | . 555 | reference frequency | . 10 000 1 12 | 3.01112 | 00112 | 00112 | 001 | | | | | | | |
| atio | | | | | | | | | | | | | | | |
| eler | | | | | | | | | | | | | | | |
|)dec | 21 | F001 | Acceleration/deceleration | 0, 1 | 1 | 0 | | 367 | | | | | | | |
| tion | 4 1 | 1-001 | time increments | U, I | | U | | 307 | | | | | | | |
| Acceleration/deceleration time | | | | | | | | | | | | | | | |
| O | | | | | | | | | | | | | | | |
| ∢ | | | | | | | | | | | | | | | |

| | | _ | | | Minimum | Initial | value | - · | a . |
|---------------------|----------|-----------------|--|---|----------------------|---------|-------|---------------|------------------|
| Function | Pr. | Pr. group | Name | Setting range | setting | FM | CA | Refer to page | Customer setting |
| | | group | | | increments | LIAI | CA | | Setting |
| ntion | 22 | H500 | Stall prevention operation level (Torque limit level) | 0 to 400% | 0.1% | 150% | | 245, 431 | |
| Stall prevention | 23 | H610 | Stall prevention operation level compensation factor at double speed | 0 to 200%, 9999 | 0.1% | 9999 | | 431 | |
| Multi-speed setting | 24 to 27 | D304 to D307 | Multi-speed setting (speed 4 to speed 7) | 0 to 590 Hz, 9999 | 0.01 Hz | 9999 | | 411 | |
| _ | 28 | D300 | Multi-speed input compensation selection | 0, 1 | 1 | 0 | | 411 | |
| _ | 29 | F100 | Acceleration/deceleration pattern selection | 0 to 6 | 1 | 0 | | 372 | |
| | 30 E300 | | Regenerative function | 0 to 2, 10, 11, 20, 21, 100 to 102, 110, 111, 120, 121*11 | 1 | 0 | | | |
| _ | | E300 | selection | 2, 10, 11, 102, 110, 111* ¹² | 1 | 10 | | 724 | |
| | | | | 0, 2, 10, 20, 100, 102, 110, 120 ^{*13} | 1 | 0 | | | |
| <u>o</u> | 31 | H420 | Frequency jump 1A | 0 to 590 Hz, 9999 | 0.01 Hz | 9999 | | 429 | |
| <u>un</u> | 32 | H421 | Frequency jump 1B | 0 to 590 Hz, 9999 | 0.01 Hz | 9999 | | 429 | |
| ر رک | 33 | H422 | Frequency jump 2A | 0 to 590 Hz, 9999 | 0.01 Hz | 9999 | | 429 | |
| Frequency jump | 34 | H423 | Frequency jump 2B | 0 to 590 Hz, 9999 | 0.01 Hz | 9999 | | 429 | |
| req | 35 | H424 | Frequency jump 3A | 0 to 590 Hz, 9999 | 0.01 Hz | 9999 | | 429 | |
| L | 36 | H425 | Frequency jump 3B | 0 to 590 Hz, 9999 | 0.01 Hz | 9999 | | 429 | |
| | 37 | M000 | Speed display | 0, 1 to 9998 | 1 | 0 | | 444 | |
| ou | 41 | M441 | Up-to-frequency sensitivity | 0 to 100% | 0.1% | 10% | | 484 | |
| ecti | 42 | M442 | Output frequency detection | 0 to 590 Hz | 0.01 Hz | 6 Hz | | 484 | |
| Frequency detection | 43 | M443 | Output frequency detection for reverse rotation | 0 to 590 Hz, 9999 | 0.01 Hz | 9999 | | 484 | |
| | 44 | F020 | Second acceleration/ deceleration time | 0 to 3600 s | 0.1 s | 5 s | | 367, 622 | |
| | 45 | F021 | Second deceleration time | 0 to 3600 s, 9999 | 0.1 s | 9999 | | 367, 622 | |
| Ę | 46 | G010 | Second torque boost | 0 to 30%, 9999 | 0.1% | 9999 | | 706 | |
| ctio | 47 | G011 | Second V/F (base frequency) | 0 to 590 Hz, 9999 | 0.01 Hz | 9999 | | 707 | |
| Second function | 48 | H600 | Second stall prevention operation level | 0 to 400% | 0.1% | 150% | | 431 | |
| Secon | 49 | H601 | Second stall prevention operation frequency | 0 to 590 Hz, 9999 | 0.01 Hz | 0 Hz | | 431 | |
| | 50 | M444 | Second output frequency detection | 0 to 590 Hz | 0.01 Hz | 30 Hz | | 484 | |
| | _, | H010 | Second electronic thermal O/ | 0 to 500 A, 9999 *2 | 0.01 A ^{*2} | 0000 | | 415, | |
| | 51 | C203 | L relay Rated second motor current | 0 to 3600 A, 9999 *3 | 0.1 A ^{*3} | 9999 | | 532, 551 | |

| | | Dr | Pr | | Minimum | Initial | Initial value | | Customer |
|-------------------------------------|-------------------|----------------------------|---|--|---|---------|---------------|---------------------|----------|
| Function | Pr. | group | Name | Setting range | setting increments | FM | CA | Refer to page | setting |
| Ĕ | 52 | M100 | Operation panel main monitor selection | 0, 5 to 14, 17 to 20, 22 to 36, 38 to 46, 50 to 57, 61, 62, 64, 67, 71 to 75, 87 to 98, 100 | 1 | 0 | | 446 | |
| Monitoring function | 54 | M300 FM/CA terminal functi | | 1 to 3, 5 to 14, 17, 18, 21, 24, 32 to 34, 36, 46, 50, 52, 53, 61, 62, 67, 70, 87 to 90, 92, 93, 95, 97, 98 | 1 | 1 | | 457 | |
| Mon | 55 | M040 | Frequency monitoring reference | 0 to 590 Hz | 0.01 Hz | 60 Hz | 50 Hz | 457 | |
| | 56 | M041 | Current monitoring reference | 0 to 500 A *2 0 to 3600 A *3 | 0.01 A ^{*2} 0.1 A ^{*3} | Inverte | er rated t | 457 | |
| tart | 57 | A702 | Restart coasting time | 0, 0.1 to 30 s, 9999 | 0.1 A | 9999 | | 628, 635 | |
| Automatic restart | 58 | A703 | Restart cushion time | 0 to 60 s | 0.1 s | 1 s | | 628 | |
| _ | 59 | F101 | Remote function selection | 0 to 3, 11 to 13 | 1 | 0 | | 377 | |
| _ | 60 | G030 | Energy saving control selection | 0, 4, 9 | 1 | 0 | | 712 | |
| ation | 61 | F510 | Reference current | 0 to 500 A, 9999 *2 0 to 3600 A, 9999 *3 | 0.01 A ^{*2} 0.1 A ^{*3} | 9999 | | 384, 387 | |
| lecelera | 62 | F511 | Reference value at acceleration | 0 to 400%, 9999 | 0.1 A ° | 9999 | | 384 | |
| ation/d | 63 | F512 | Reference value at deceleration | 0 to 400%, 9999 | 0.1% | 9999 | | 384 | |
| Automatic acceleration/deceleration | 64 | F520 | Starting frequency for elevator mode | 0 to 10 Hz, 9999 | 0.01 Hz | 9999 | | 387 | |
| _ | 65 | H300 | Retry selection | 0 to 5 | 1 | 0 | | 426 | |
| _ | 66 | H611 | Stall prevention operation reduction starting frequency | 0 to 590 Hz | 0.01 Hz | 60 Hz | 50 Hz | 431 | |
| Retry | 67 | H301 | Number of retries at fault occurrence | 0 to 10, 101 to 110 | 1 | 0 | | 426 | |
| A. | 68 | H302 | Retry waiting time | 0.1 to 600 s | 0.1 s | 1 s | | 426 | |
| | 69 | H303 | Retry count display erase | 0 | 1 | 0 | | 426 | |
| _ | 70 ^{*14} | G107 | Special regenerative brake duty | 0 to 100% | 0.1% | 0% | | 724 | |
| - | 71 | C100 | Applied motor | 0 to 6, 13 to 16, 20, 23, 24, 30, 33, 34, 40, 43, 44, 50, 53, 54, 70, 73, 74, 330, 333, 334, 8090, 8093, 8094, 9090, 9093, 9094 | 1 | 0 | | 528, 532, 551 | |
| _ | 72 | E600 | PWM frequency selection | 0 to 15 ^{*2} 0 to 6, 25 ^{*3} | 1 | 2 | | 356 | |
| _ | 73 | Т000 | Analog input selection | 0 to 7, 10 to 17 | 1 | 1 | | 496, 501 | |
| _ | 74 | T002 | Input filter time constant | 0 to 8 | 1 | 1 | | 503 | |
| | | 1 | · - | I . | I. | | | | |

| | | Pr. | | | Minimum | Initial | value | Refer | Customer |
|----------------|--------------------|-------|---|---|---|--------------------|-------|---------------------|----------|
| Function | Pr. | group | Name | Setting range | setting increments | FM | CA | to page | setting |
| | | _ | Reset selection/ disconnected PU detection/ PU stop selection | 0 to 3, 14 to 17, 1000 to 1003, 1014 to 1017 0 to 3, 14 to 17, 100 to 103, 114 to 117, 1000 to 1003, 1014 to 1017, 1100 to 1103, 1114 to | 1 | 14 | | | |
| _ | 75 | E100 | Reset selection | 1117 0 to 3 | | | | 336 | |
| | | E100 | Disconnected PU detection | | | 0 | | | |
| | | E102 | PU stop selection | 0, 1 | | 1 | | | |
| | | E107 | Reset limit | 0 ^{*2} 0, 1 ^{*3} | 1 | 0 | | | |
| _ | 76 | M510 | Fault code output selection | 0 to 2 | 1 | 0 | | 492 | |
| _ | 77 | E400 | Parameter write selection | 0 to 2 | 1 | 0 | | 345 | |
| _ | 78 | D020 | Reverse rotation prevention selection | 0 to 2 | 1 | 0 | | 406 | |
| _ | 79 | D000 | Operation mode selection Simple | 0 to 4, 6, 7 | 1 | 0 | | 389, 398 | |
| | | | | 0.4 to 55 kW, 9999*2 | 0.01 kW ^{*2} | | | 221, | |
| | 80 | C101 | Motor capacity | 0 to 3600 kW, 9999*3 | 0.1 kW ^{*3} | 9999 | | 532, 551 | |
| | 81 | C102 | Number of motor poles | 2, 4, 6, 8, 10, 12, 9999 | 1 | 9999 | | 221, 532, 551 | |
| | 82 | C125 | Motor excitation current | 0 to 500 A, 9999*2 | 0.01 A ^{*2} | 9999 | | 532 | |
| | 02 | 0123 | Motor excitation current | 0 to 3600 A, 9999*3 | 0.1 A ^{*3} | 3333 | | 332 | |
| | 83 | C104 | Rated motor voltage | 0 to 1000 V | 0.1 V | 200 V*7 400 V*8 | | 221, 532, | |
| | | | | | | 400 V | | 551 | |
| | 84 | C105 | Rated motor frequency | 10 to 400 Hz, 9999 | 0.01 Hz | 9999 | | 221, 532, 551 | |
| | 85 | G201 | Excitation current break point | 0 to 400 Hz, 9999 | 0.01 Hz | 9999 | | 711 | |
| stant | 86 | G202 | Excitation current low-speed scaling factor | 0 to 300%, 9999 | 0.1% | 9999 | | 711 | |
| Motor constant | 89 | G932 | Speed control gain (Advanced magnetic flux vector) | 0 to 200%, 9999 | 0.1% | 9999 | | 228 | |
| Ž | 00 | 0400 | Matanagaratant (D4) | 0 to 50 Ω, 9999 ^{*2} | 0.001Ω ^{*2} | 0000 | | 532, | |
| | 90 | C120 | Motor constant (R1) | 0 to 400 mΩ, 9999*3 | 0.01mΩ ^{*3} | 9999 | | 551, 638 | |
| | 91 | C121 | Motor constant (R2) | 0 to 50 Ω, 9999 ^{*2} | 0.001Ω ^{*2} | 9999 | | 532 | |
| | 31 | 0121 | motor constant (N2) | 0 to 400 mΩ, 9999 ^{*3} | 0.01mΩ ^{*3} | 9999 | | 332 | |
| | 92 | C122 | Motor constant (L1)/d-axis | 0 to 6000 mH, 9999*2 | 0.1mH ^{*2} | 9999 | | 532, | |
| | J.L | 0122 | inductance (Ld) | 0 to 400 mH, 9999 ^{*3} | 0.01mH ^{*3} | 0000 | | 551 | |
| | 93 | C123 | Motor constant (L2)/q-axis | 0 to 6000 mH, 9999*2 | 0.1mH ^{*2} | 9999 | | 532, | |
| | 30 | 5.20 | inductance (Lq) | 0 to 400 mH, 9999*3 | 0.01mH ^{*3} | 5555 | | 551 | |
| | 94 | C124 | Motor constant (X) | 0 to 100%, 9999 | 0.1% ^{*2} 0.01% ^{*3} | 9999 | | 532 | |
| | 95 | C111 | Online auto tuning selection | 0 to 2 | 1 | 0 | | 558 | |
| | 95 C111 96 C110 | | Auto tuning setting/status | 0, 1, 11, 101 | 1 | 0 | | 532, 551, 638 | |

| | | D. | | | Minimum | Initial | value | Defer | Customor |
|----------------------------|-----|--------------|---|-------------------------------------|--------------------|-------------|-------|------------------|------------------|
| Function | Pr. | Pr. group | Name | Setting range | setting increments | FM | CA | Refer to page | Customer setting |
| | 100 | G040 | V/F1 (first frequency) | 0 to 590 Hz, 9999 | 0.01 Hz | 9999 | | 713 | |
| | 101 | G041 | V/F1 (first frequency voltage) | 0 to 1000 V | 0.1 V | 0 V | | 713 | |
| | 102 | G042 | V/F2 (second frequency) | 0 to 590 Hz, 9999 | 0.01 Hz | 9999 | | 713 | |
| Adjustable 5 points V/F | 103 | G043 | V/F2 (second frequency voltage) | 0 to 1000 V | 0.1 V | 0 V | | 713 | |
| poir | 104 | G044 | V/F3 (third frequency) | 0 to 590 Hz, 9999 | 0.01 Hz | 9999 | | 713 | |
| ble 5 | 105 | G045 | V/F3 (third frequency voltage) | 0 to 1000 V | 0.1 V | 0 V | | 713 | |
| ısta | 106 | G046 | V/F4 (fourth frequency) | 0 to 590 Hz, 9999 | 0.01 Hz | 9999 | | 713 | |
| Adju | 107 | G047 | V/F4 (fourth frequency voltage) | 0 to 1000 V | 0.1 V | 0 V | | 713 | |
| | 108 | G048 | V/F5 (fifth frequency) | 0 to 590 Hz, 9999 | 0.01 Hz | 9999 | | 713 | |
| | 109 | G049 | V/F5 (fifth frequency voltage) | 0 to 1000 V | 0.1 V | 0 V | | 713 | |
| | 110 | F030 | Third acceleration/ deceleration time | 0 to 3600 s, 9999 | 0.1 s | 9999 | | 367 | |
| | 111 | F031 | Third deceleration time | 0 to 3600 s, 9999 | 0.1 s | 9999 | | 367 | |
| on | 112 | G020 | Third torque boost | 0 to 30%, 9999 | 0.1% | 9999 | | 706 | |
| ncti | 113 | G021 | Third V/F (base frequency) | 0 to 590 Hz, 9999 | 0.01 Hz | 9999 | 9999 | | |
| ے | 114 | H602 | Third stall prevention operation level | 0 to 400% | 0.1% | 150% | | 431 | |
| 두 | 115 | H603 | Third stall prevention operation frequency | 0 to 590 Hz | 0.01 Hz | 0 Hz | | 431 | |
| | 116 | M445 | Third output frequency detection | 0 to 590 Hz | 0.01 Hz | 60 Hz 50 Hz | | 484 | |
| | 117 | N020 | PU communication station number | 0 to 31 | 1 | 0 | | 670 | |
| | 118 | N021 | PU communication speed | 48, 96, 192, 384, 576, 768, 1152 | 1 | 192 | | 670 | |
| ion | | _ | PU communication stop bit length / data length | 0, 1, 10, 11 | | 1 | | | |
| unicat | 119 | N022 | PU communication data length | 0, 1 | 1 | 0 | | 670 | |
| шшо | | N023 | PU communication stop bit length | 0, 1 | | 1 | | | |
| PU connector communication | 120 | N024 | PU communication parity check | 0 to 2 | 1 | 2 | | 670 | |
| conn | 121 | N025 | PU communication retry count | 0 to 10, 9999 | 1 | 1 | | 670 | |
| P | 122 | N026 | PU communication check time interval | 0, 0.1 to 999.8 s, 9999 | 0.1 s | 9999 | | 670 | |
| | 123 | N027 | PU communication waiting time setting | 0 to 150 ms, 9999 | 1 ms | 9999 | | 670 | |
| | 124 | N028 | PU communication CR/LF selection | 0 to 2 | 1 | 1 | | 670 | |
| _ | 125 | T022 | Terminal 2 frequency setting gain frequency <u>Simple</u> | 0 to 590 Hz | 0.01 Hz | 60 Hz | 50 Hz | 505 | |
| _ | 126 | T042 | Terminal 4 frequency setting gain frequency <u>Simple</u> | 0 to 590 Hz | 0.01 Hz | 60 Hz | 50 Hz | 505 | |

| | _ | Pr. | Nome | | Minimum | Initial | value | Refer | Custome |
|-------------------|-----|-------|--|--|--------------------|---------|-------|-------------|---------|
| Function | Pr. | group | Name | Setting range | setting increments | FM | CA | to page | setting |
| | 127 | A612 | PID control automatic switchover frequency | 0 to 590 Hz, 9999 | 0.01 Hz | 9999 | | 601 | |
| | 128 | A610 | PID action selection | 0, 10, 11, 20, 21, 40 to 43, 50, 51, 60, 61, 70, 71, 80, 81, 90, 91, 100, 101, 1000, 1001, 1010, 1011, 2000, 2001, 2010, 2011 | 1 | 0 | | 601, 622 | |
| PID operation | 129 | A613 | PID proportional band | 0.1 to 1000%, 9999 | 0.1% | 100% | | 601, 622 | |
| р оре | 130 | A614 | PID integral time | 0.1 to 3600 s, 9999 | 0.1 s | 1 s | | 601, 622 | |
| 죠 | 131 | A601 | PID upper limit | 0 to 100%, 9999 | 0.1% | 9999 | | 601, 622 | |
| | 132 | A602 | PID lower limit | 0 to 100%, 9999 | 0.1% | 9999 | | 601, 622 | |
| | 133 | A611 | PID action set point | 0 to 100%, 9999 | 0.01% | 9999 | | 601, 622 | |
| | 134 | A615 | PID differential time | 0.01 to 10 s, 9999 | 0.01 s | 9999 | | 601, 622 | |
| | 135 | A000 | Electronic bypass sequence selection | 0, 1 | 1 | 0 | | 563 | |
| | 136 | A001 | MC switchover interlock time | 0 to 100 s | 0.1 s | 1 s | | 563 | |
| Bypass | 137 | A002 | Start waiting time | 0 to 100 s | 0.1 s | 0.5 s | | 563 | |
| 3yp | 138 | A003 | Bypass selection at a fault | 0, 1 | 1 | 0 | | 563 | |
| | 139 | A004 | Automatic switchover frequency from inverter to bypass operation | 0 to 60 Hz, 9999 | 0.01 Hz | 9999 | | 563 | |
| ure | 140 | F200 | Backlash acceleration stopping frequency | 0 to 590 Hz | 0.01 Hz | 1 Hz | | 372 | |
| meası | 141 | F201 | Backlash acceleration stopping time | 0 to 360 s | 0.1 s | 0.5 s | | 372 | |
| Backlash measure | 142 | F202 | Backlash deceleration stopping frequency | 0 to 590 Hz | 0.01 Hz | 1 Hz | | 372 | |
| Вас | 143 | F203 | Backlash deceleration stopping time | 0 to 360 s | 0.1 s | 0.5 s | | 372 | |
| - | 144 | M002 | Speed setting switchover | 0, 2, 4, 6, 8, 10, 12, 102, 104, 106, 108, 110, 112 | 1 | 4 | | 444 | |
| PU | 145 | E103 | PU display language selection | 0 to 7 | 1 | _ | | 339 | |
| _ | 147 | F022 | Acceleration/deceleration time switching frequency | 0 to 590 Hz, 9999 | 0.01 Hz | 9999 | | 367 | |
| | 148 | H620 | Stall prevention level at 0 V input | 0 to 400% | 0.1% | 150% | | 431 | |
| ction | 149 | H621 | Stall prevention level at 10 V input | 0 to 400% | 0.1% | 200% | | 431 | |
| Current detection | 150 | M460 | Output current detection level | 0 to 400% | 0.1% | 150% | | 487 | |
| Surrer | 151 | M461 | Output current detection signal delay time | 0 to 10 s | 0.1 s | 0 s | | 487 | |
| 9 | 152 | M462 | Zero current detection level | 0 to 400% | 0.1% | 5% | | 487 | |
| | 153 | M463 | Zero current detection time | 0 to 10 s | 0.01 s | 0.5 s | | 487 | |
| _ | 154 | H631 | Voltage reduction selection during stall prevention operation | 0, 1, 10, 11 | 1 | 1 | | 431 | |
| _ | 155 | T730 | RT signal function validity condition selection | 0, 10 | 1 | 0 | | 525 | |
| _ | 156 | H501 | Stall prevention operation selection | 0 to 31, 100, 101 | 1 | 0 | | 431 | |
| | 157 | M430 | OL signal output timer | 0 to 25 s, 9999 | 0.1 s | 0 s | | 245, | |

| | | Pr. | | | Minimum | Initial | value | Refer | Customer |
|--------------------|-----|-------|--|---|--------------------|---------|-------|---------------------|----------|
| Function | Pr. | group | Name | Setting range | setting increments | FM | CA | to page | setting |
| - | 158 | M301 | AM terminal function selection | 1 to 3, 5 to 14, 17, 18, 21, 24, 32 to 34, 36, 46, 50, 52 to 54, 61, 62, 67, 70, 87 to 90, 91 to 98 | 1 | 1 | | 457 | |
| - | 159 | A005 | Automatic switchover frequency range from bypass to inverter operation | 0 to 10 Hz, 9999 | 0.01 Hz | 9999 | | 563 | |
| _ | 160 | E440 | User group read selection Simple | 0, 1, 9999 | 1 | 0 | | 354 | |
| _ | 161 | E200 | Frequency setting/key lock operation selection | 0, 1, 10, 11 | 1 | 0 | | 341 | |
| Automatic restart | 162 | A700 | Automatic restart after instantaneous power failure selection | 0 to 3, 10 to 13, 1000 to 1003, 1010 to 1013 | 1 | 0 | | 628, 635, 638 | |
| Ö | 163 | A704 | First cushion time for restart | 0 to 20 s | 0.1 s | 0 s | | 628 | |
| omat | 164 | A705 | First cushion voltage for restart | 0 to 100% | 0.1% | 0% | | 628 | |
| Auf | 165 | A710 | Stall prevention operation level for restart | 0 to 400% | 0.1% | 150% | | 628 | |
| ction | 166 | M433 | Output current detection signal retention time | 0 to 10 s, 9999 | 0.1 s | 0.1 s | | 487 | |
| Current detection | 167 | M464 | Output current detection operation selection | 0, 1, 10, 11 | 1 | 0 | | 487 | |
| | 400 | E000 | | | | | | | |
| _ | 168 | E080 | 1 | . 5 | | | | | |
| | 400 | E001 | Parameter for manufacturer sett | ing. Do not set. | | | | | |
| _ | 169 | E081 | | | | | | | |
| ŗ | 170 | M020 | Watt-hour meter clear | 0, 10, 9999 | 1 | 9999 | | 446 | |
| Cumulative monitor | 171 | M030 | Operation hour meter clear | 0, 9999 | 1 | 9999 | | 446 | |
| User group | 172 | E441 | User group registered display/batch clear | 9999, (0 to 16) | 1 | 0 | | 354 | |
| r g | 173 | E442 | User group registration | 0 to 1999, 9999 | 1 | 9999 | | 354 | |
| Use | 174 | E443 | User group clear | 0 to 1999, 9999 | 1 | 9999 | | 354 | |

| Function | Pr. | Pr. | Name Oatt | 2 | Minimum | Initia | value | Refer | Custome | |
|-------------------------------------|-----|-------|----------------------------------|---|-------------------------|-------------------|-------------------|---------|---------|--|
| Function | Pr. | group | Name | Setting range | setting increments | FM | CA | to page | setting | |
| | 178 | T700 | STF terminal function selection | 0 to 20, 22 to 28, 32, 37, 42 to 48, 50 to 53, 57 to 60, 62, 64 to 74, 76 to 80, 85, 87 to 89, 92 to 96, 128, 129, 9999 | 1 | 60 | | 521 | | |
| леnt | 179 | T701 | STR terminal function selection | 0 to 20, 22 to 28, 32, 37, 42 to 48, 50 to 53, 57 to 59, 61, 62, 64 to 74, 76 to 80, 85, 87 to 89, 92 to 96, 128, 129, 9999 | 1 | 61 | | 521 | | |
| signn | 180 | T702 | RL terminal function selection | | 1 | 0 | | 521 | | |
| Input terminal function assignment | 181 | T703 | RM terminal function selection | | 1 | 1 | | 521 | | |
| funct | 182 | T704 | RH terminal function selection | | 1 | 2 | | 521 | | |
| minal | 183 | T705 | RT terminal function selection | 0.41.00.00.41.00.00 | 1 | 3 | | 521 | | |
| out ter | 184 | T706 | AU terminal function selection | 0 to 20, 22 to 28, 32, 37, 42 to 48, 50 to 53, 57 to 59, 62, 64 to 74, 76 to 80, 85, 87 to 89, 92 to 96, 128, 129, 9999 | 1 | 4 | | 521 | | |
| Ē | 185 | T707 | JOG terminal function selection | | 1 | 5 | | 521 | | |
| | 186 | T708 | CS terminal function selection | | 1 | 6 | | 521 | | |
| | 187 | T709 | MRS terminal function selection | | 1 | 24*11** | 13 | - 521 | | |
| | 188 | T710 | STOP terminal function | | 1 | 10 ^{*12} | | 521 | | |
| | 189 | T711 | RES terminal function | | 1 | 62 | | 521 | | |
| | 190 | M400 | RUN terminal function selection | 0 to 8, 10 to 20, 22, 25 to 28, 30 to 36, 38 to | 1 | 0 | | 473 | | |
| | 191 | M401 | SU terminal function selection | 57, 60, 61, 63, 64, 67, 68, 70, 79, 80, 84, 85, 90 to 99, 100 to 108, | 1 | 1 | | 473 | | |
| | 192 | M402 | IPF terminal function selection | 110 to 116, 120, 122, 125 to 128, 130 to 136, 138 to 157, 160, 161, 163, 164, 167, 168 | 125 to 128, 130 to 136, | 1 | 2*11*13 9999*1 | | 473 | |
| ignment | 193 | M403 | OL terminal function selection | 170, 179, 180, 184, 185, 190 to 199, 200 to 208, 211 to 213, 247, | 1 | 3 | | 473 | | |
| ction ass | 194 | M404 | FU terminal function selection | 300 to 308, 311 to 313, 347, 9999 | 1 | 4 | | 473 | | |
| Output terminal function assignment | 195 | M405 | ABC1 terminal function selection | 0 to 8, 10 to 20, 22, 25 to 28, 30 to 36, 38 to 57, 60, 61, 63, 64, 67, 68, 70, 79, 80, 84, 85, 90, 91, 94 to 99, 100 to 108, 110 to 116, 120, 122, 125 to 128, 130 to 136, 138 to 157, 160, | 1 | 99 | | 473 | | |
| _ | 196 | M406 | ABC2 terminal function selection | 130, 138 to 137, 160, 161, 163, 164, 167, 168, 170, 179, 180, 184, 185, 190, 191, 194 to 199, 200 to 208, 211 to 213, 247, 300 to 308, 311 to 313, 347, 9999 | 1 | 9999 | | 473 | | |

| | | Pr. | | | Minimum | Initial | value | Refer | Customer |
|------------------------|--------------------|-----------------|---|---|--------------------|---------|-------|---------|----------|
| Function | Pr. | group | Name | Setting range | setting increments | FM | CA | to page | setting |
| Multi-speed setting | 232 to 239 | D308 to D315 | Multi-speed setting (speed 8 to speed 15) | 0 to 590 Hz, 9999 | 0.01 Hz | 9999 | | 411 | |
| _ | 240 | E601 | Soft-PWM operation selection | 0, 1 | 1 | 1 | | 356 | |
| _ | 241 | M043 | Analog input display unit switchover | 0, 1 | 1 | 0 | | 505 | |
| _ | 242 | T021 | Terminal 1 added compensation amount (terminal 2) | 0 to 100% | 0.1% | 100% | | 501 | |
| _ | 243 | T041 | Terminal 1 added compensation amount (terminal 4) | 0 to 100% | 0.1% | 75% | | 501 | |
| | | _ | Cooling fan operation selection | 0, 1, 101 to 105, 1000, 1001, 1101 to 1105 | 1 | 1 | | | |
| _ | 244 | H100 | Cooling fan operation selection | 0, 1, 101 to 105 | 1 | 1 | | 423 | |
| | | H106 | Cooling fan operation selection during the test operation | 0, 1 | 1 | 0 | | | |
| uo | 245 | G203 | Rated slip | 0 to 50%, 9999 | 0.01% | 9999 | | 736 | |
| ensati | 246 | G204 | Slip compensation time constant | 0.01 to 10 s | 0.01 s | 0.5 s | | 736 | |
| Slip compensation | 247 | G205 | Constant output range slip compensation selection | 0, 9999 | 1 | 9999 | | 736 | |
| _ | 248 | A006 | Self power management selection | 0 to 2 | 1 | 0 | | 569 | |
| _ | 249 | H101 | Earth (ground) fault detection at start | 0, 1 | 1 | 0 | | 425 | |
| _ | 250 | G106 | Stop selection | 0 to 100 s, 1000 to 1100 s, 8888, 9999 | 0.1s | 9999 | | 722 | |
| _ | 251 | H200 | Output phase loss protection selection | 0, 1 | 1 | 1 | | 426 | |
| on | 252 | T050 | Override bias | 0 to 200% | 0.1% | 50% | | 501 | |
| Frequency compensation | 253 | T051 | Override gain | 0 to 200% | 0.1% | 150% | | 501 | |
| _ | 254 | A007 | Main circuit power OFF waiting time | 0 to 3600 s, 9999 | 1 s | 600 s | | 569 | |
| | 255 | E700 | Life alarm status display | (0 to 255) | 1 | 0 | | 359 | |
| × | 256 ^{*15} | E701 | Inrush current limit circuit life display | (0 to 100%) | 1% | 100% | | 359 | |
| Life check | 257 | E702 | Control circuit capacitor life display | (0 to 100%) | 1% | 100% | | 359 | |
| Life | 258 ^{*15} | E703 | Main circuit capacitor life display | (0 to 100%) | 1% | 100% | | 359 | |
| | 259 ^{*15} | E704 | Main circuit capacitor life measuring | 0, 1, 11 | 1 | 0 | | 359 | |
| _ | 260 | E602 | PWM frequency automatic switchover | 0, 1 | 1 | 1 | | 356 | |

| | | Pr. | | | Minimum | Initial | value | Refer | Customer |
|--|-----|--------------|--|--------------------------------------|--------------------|---------|-------|--------------|----------|
| Function | Pr. | group | Name | Setting range | setting increments | FM | CA | to page | setting |
| | 261 | A730 | Power failure stop selection | 0 to 2, 11, 12, 21, 22 | 1 | 0 | | 642 | |
| do | 262 | A731 | Subtracted frequency at deceleration start | 0 to 20 Hz | 0.01 Hz | 3 Hz | | 642 | |
| Power failure stop | 263 | A732 | Subtraction starting frequency | 0 to 590 Hz, 9999 | 0.01 Hz | 60 Hz | 50 Hz | 642 | |
| er failt | 264 | A733 | Power-failure deceleration time 1 | 0 to 3600 s | 0.1 s | 5 s | | 642 | |
| Powe | 265 | A734 | Power-failure deceleration time 2 | 0 to 3600 s, 9999 | 0.1 s | 9999 | | 642 | |
| | 266 | A735 | Power failure deceleration time switchover frequency | 0 to 590 Hz | 0.01 Hz | 60 Hz | 50 Hz | 642 | |
| _ | 267 | T001 | Terminal 4 input selection | 0 to 2 | 1 | 0 | | 496 | |
| _ | 268 | M022 | Monitor decimal digits selection | 0, 1, 9999 | 1 | 9999 | | 446 | |
| _ | 269 | E023 | Parameter for manufacturer sett | ing. Do not set. | | | | | |
| _ | 270 | A200 | Stop-on contact/load torque high-speed frequency control selection | 0 to 3, 11 to 13 | 1 | 0 | | 577, 580 | |
| ontrol | 271 | A201 | High-speed setting maximum current | 0 to 400% | 0.1% | 50% | | 580 | |
| ncy cc | 272 | A202 | Middle-speed setting minimum current | 0 to 400% | 0.1% | 100% | | 580 | |
| enk | 273 | A203 | Current averaging range | 0 to 590 Hz, 9999 | 0.01 Hz | 9999 | | 580 | |
| Load torque high-speed frequency control | 274 | A204 | Current averaging filter time constant | 1 to 4000 | 1 | 16 | | 580 | |
| n-contact ontrol | 275 | A205 | Stop-on contact excitation current low-speed scaling factor | 0 to 300%, 9999 | 0.1% | 9999 | | 577 | |
| cont | | | DIAMA consider frequency of | 0 to 9, 9999*2 | | | | | |
| Stop-o | 276 | A206 | PWM carrier frequency at stop-on contact | 0 to 4, 9999 ^{*3} | 1 | 9999 | | 577 | |
| | 278 | A100 | Brake opening frequency | 0 to 30 Hz | 0.01 Hz. | 3 Hz | | 572 | |
| | 279 | A101 | Brake opening current | 0 to 400% | 0.1% | 130% | | 572 | |
| O | 280 | A102 | Brake opening current detection time | 0 to 2 s | 0.1 s | 0.3 s | | 572 | |
| ů. | 281 | A103 | Brake operation time at start | 0 to 5 s | 0.1 s | 0.3 s | | 572 | |
| anb | 282 | A104 | Brake operation frequency | 0 to 30 Hz | 0.01 Hz. | 6 Hz | | 572 | |
| Se | 283 | A105 | Brake operation time at stop | 0 to 5 s | 0.1 s | 0.3 s | | 572 | |
| Brake sequence | 284 | A106 | Deceleration detection function selection | 0, 1 | 1 | 0 | | 572 | |
| | 285 | A107 | Overspeed detection frequency | 0 to 30 Hz, 9999 | 0.01 Hz. | 9999 | | 269, 572, | |
| | | H416 | Speed deviation excess detection frequency | | | | | 736 | |
| trol | 286 | G400 | Droop gain | 0 to 100% | 0.1% | 0% | | 738 | |
| Droop control | 287 | G401 G402 | Droop filter time constant Droop function activation selection | 0 to 1 s 0 to 2, 10, 11, 20 to 22 | 0.01 s | 0.3 s | | 738 | |
| _ | 289 | M431 | Inverter output terminal filter | 5 to 50 ms, 9999 | 1 ms | 9999 | | 473 | |
| | | | Monitor negative output | | | | | 446, | |
| _ | 290 | M044 | selection | 0 to 7 | 1 | 0 | | 457 | |

| | | Pr. | | | Minimum | Initial | value | Refer | Customer |
|------------|--------------------|--------------|--|---|--------------------|---------|-------|---------------------|----------|
| Function | Pr. | group | Name | Setting range | setting increments | FM | CA | to page | setting |
| _ | 291 | D100 | Pulse train I/O selection | [FM type] 0, 1, 10, 11, 20, 21, 100 | 1 | 0 | | 406, 457 | |
| | | | | [CA type] 0, 1 | | | | | |
| _ | 292 | A110 F500 | Automatic acceleration/ deceleration | 0, 1, 3, 5 to 8, 11 | 1 | 0 | | 384, 387, 572 | |
| _ | 293 | F513 | Acceleration/deceleration separate selection | 0 to 2 | 1 | 0 | | 384 | |
| _ | 294 | A785 | UV avoidance voltage gain | 0 to 200% | 0.1% | 100% | | 642 | |
| _ | 295 | E201 | Frequency change increment amount setting | 0, 0.01, 0.1, 1, 10, | 0.01 | 0 | | 342 | |
| Password | 296 | E410 | Password lock level | 0 to 6, 99, 100 to 106, 199, 9999 | 1 | 9999 | | 348 | |
| Pass | 297 | E411 | Password lock/unlock | (0 to 5), 1000 to 9998, 9999 | 1 | 9999 | | 348 | |
| _ | 298 | A711 | Frequency search gain | 0 to 32767, 9999 | 1 | 9999 | | 532, 638 | |
| _ | 299 | A701 | Rotation direction detection selection at restarting | 0, 1, 9999 | 1 | 0 | | 628 | |
| | 313 ^{*17} | M410 | DO0 output selection | 0 to 8, 10 to 20, 22, 25 | 1 | 9999 | | 473 | |
| | 314 ^{*17} | M411 | DO1 output selection | to 28, 30 to 36, 38 to 57, 60, 61, 63, 64, 68, | 1 | 9999 | | 473 | |
| | 315 ^{*17} | M412 | DO2 output selection | 70, 79, 80, 84 to 99, 100 to 108, 110 to 116, | 1 | 9999 | | 473 | |
| | 316 ^{*16} | M413 | DO3 output selection | 120, 122, 125 to 128, 130 to 136, 138 to 157, 160, 161, 163, 164, | 1 | 9999 | | 473 | |
| Ā Ē | 317 ^{*16} | M414 | DO4 output selection | 168, 170, 179, 180, 184 to 199, 200 to 208, | 1 | 9999 | | 473 | |
| CC-Link IE | 318 ^{*16} | M415 | DO5 output selection | 211 to 213, 247, 248, 300 to 308, 311 to 313, | 1 | 9999 | | 473 | |
| J | 319 ^{*16} | M416 | DO6 output selection | 347, 348, 9999 | 1 | 9999 | | 473 | |
| | 320 ^{*16} | M420 | RA1 output selection | 0 to 8, 10 to 20, 22, 25 to 28, 30 to 36, 38 to | 1 | 9999 | | 473 | |
| | 321 ^{*16} | M421 | RA2 output selection | 57, 60, 61, 63, 64, 68, 70, 79, 80, 84 to 91, 94 | 68, , 94 1 9999 | | 473 | | |
| | 322 ^{*16} | M422 | RA3 output selection | to 99, 200 to 208, 211 to 213, 247, 248, 9999 | 1 | 9999 | | 473 | |
| _ | 328 | E310 | Inverter/converter switching Simple | 0 to 9999 | 1 | 0 | | *18 | |

| | | Pr. | | | Minimum | Initial | value | Refer | Customer |
|----------------------|--------------------|-------|--|--|--------------------|---------|-------|---------|----------|
| Function | Pr. | group | Name | Setting range | setting increments | FM | CA | to page | setting |
| | 331 | N030 | RS-485 communication station number | 0 to 31 (0 to 247) | 1 | 0 | | 670 | |
| | 332 | N031 | RS-485 communication speed | 3, 6, 12, 24, 48, 96, 192, 384, 576, 768, 1152 | 1 | 96 | | 670 | |
| | | _ | RS-485 communication stop bit length / data length | 0, 1, 10, 11 | 1 | 1 | | | |
| | 333 | N032 | RS-485 communication data length | 0, 1 | 1 | 0 | | 670 | |
| | | N033 | RS-485 communication stop bit length | 0, 1 | 1 | 1 | | | |
| ation | 334 | N034 | RS-485 communication parity check selection | 0 to 2 | 1 | 2 | | 670 | |
| RS-485 communication | 335 | N035 | RS-485 communication retry count | 0 to 10, 9999 | 1 | 1 | | 670 | |
| 5 сот | 336 | N036 | RS-485 communication check time interval | 0 to 999.8 s, 9999 | 0.1 s | 0 s | | 670 | |
| RS-48 | 337 | N037 | RS-485 communication waiting time setting | 0 to 150 ms, 9999 | 1 ms | 9999 | | 670 | |
| - | 338 | D010 | Communication operation command source | 0, 1 | 1 | 0 | | 400 | |
| | 339 | D011 | Communication speed command source | 0 to 2 | 1 | 0 | | 400 | |
| | 340 | D001 | Communication startup mode selection | 0 to 2, 10, 12 | 1 | 0 | | 398 | |
| | 341 | N038 | RS-485 communication CR/ LF selection | 0 to 2 | 1 | 1 | | 670 | |
| | 342 | N001 | Communication EEPROM write selection | 0, 1 | 1 | 0 | | 663 | |
| | 343 | N080 | Communication error count | _ | 1 | 0 | | 686 | |
| | | _ | Communication reset selection/Ready bit status selection | 0, 1, 100, 101, 1000, 1001, 1100, 1101, 10000, 10001, 10100, 10101, 11000, 11001, 11100, 11101 | 1 | 0 | | 663 | |
| _ | 349 ^{*17} | N010 | Communication reset selection | 0, 1 | 1 | 0 | | 663 | |
| | | N240 | Ready bit status selection | 0, 1 | 1 | 0 | | 663 | |
| | | N241 | Reset selection after inverter faults are cleared | 0, 1 | 1 | 0 | | 893 | |
| | | N242 | DriveControl writing restriction selection | 0, 1 | 1 | 0 | | 893 | |

| | | Pr. | | | Minimum | Initial | value | Refer | Customer |
|---------------------------------------|-------------------|-------|--|-------------------|--------------------|---------|-------|--------------------|----------|
| Function | Pr. | group | Name | Setting range | setting increments | FM | CA | to page | setting |
| | 350 ^{*9} | A510 | Stop position command selection | 0, 1, 9999 | 1 | 9999 | | 585 | |
| | 351 ^{*9} | A526 | Orientation speed | 0 to 30 Hz | 0.01 Hz. | 2 Hz | | 585 | |
| | 352 ^{*9} | A527 | Creep speed | 0 to 10 Hz | 0.01 Hz. | 0.5 Hz | | 585 | |
| | 353 ^{*9} | A528 | Creep switchover position | 0 to 16383 | 1 | 511 | | 585 | |
| | 354 ^{*9} | A529 | Position loop switchover position | 0 to 8191 | 1 | 96 | | 585 | |
| | 355 ^{*9} | A530 | DC injection brake start position | 0 to 255 | 1 | 5 | | 585 | |
| ıtrol | 356 ^{*9} | A531 | Internal stop position command | 0 to 16383 | 1 | 0 | | 585 | |
| con | 357 ^{*9} | A532 | Orientation in-position zone | 0 to 255 | 1 | 5 | | 585 | |
| io | 358 ^{*9} | A533 | Servo torque selection | 0 to 13 | 1 | 1 | | 585 | |
| Orientation control | 359 ^{*9} | C141 | Encoder rotation direction | 0, 1, 100, 101 | 1 | 1 | | 94, 585, 736 | |
| | 360 ^{*9} | A511 | 16-bit data selection | 0 to 127 | 1 | 0 | | 585 | |
| | 361 ^{*9} | A512 | Position shift | 0 to 16383 | 1 | 0 | | 585 | |
| | 362 ^{*9} | A520 | Orientation position loop gain | 0.1 to 100 | 0, 1 | 1.0 | | 585 | |
| | 363 ^{*9} | A521 | Completion signal output delay time | 0 to 5 s | 0.1 s | 0.5 s | | 585 | |
| | 364 ^{*9} | A522 | Encoder stop check time | 0 to 5 s | 0.1 s | 0.5 s | | 585 | |
| | 365 ^{*9} | A523 | Orientation limit | 0 to 60 s, 9999 | 1 s | 9999 | | 585 | |
| | 366 ^{*9} | A524 | Recheck time | 0 to 5 s, 9999 | 0.1 s | 9999 | | 585 | |
| Ş | 367 ^{*9} | G240 | Speed feedback range | 0 to 590 Hz, 9999 | 0.01 Hz | 9999 | | 736 | |
| dpa | 368 ^{*9} | G241 | Feedback gain | 0 to 100 | 0.1 | 1 | | 736 | |
| Encoder feedback | 369 ^{*9} | C140 | Number of encoder pulses | 0 to 4096 | 1 | 1024 | | 94, 585, 736 | |
| _ | 373 | C142 | Encoder position tuning setting/status | 0, 1 | 1 | 0 | | 542 | |
| _ | 374 | H800 | Overspeed detection level | 0 to 590 Hz, 9999 | 0.01 Hz | 9999 | | 443 | |
| _ | 376 ^{*9} | C148 | Encoder signal loss detection enable/disable selection | 0, 1 | 1 | 0 | | 561 | |
| ပ | 380 | F300 | Acceleration S-pattern 1 | 0 to 50% | 1% | 0% | | 372 | |
| tion | 381 | F301 | Deceleration S-pattern 1 | 0 to 50% | 1% | 0% | | 372 | |
| lera | 382 | F302 | Acceleration S-pattern 2 | 0 to 50% | 1% | 0% | | 372 | |
| S-pattern acceleration/deceleration C | 383 | F303 | Deceleration S-pattern 2 | 0 to 50% | 1% | 0% | | 372 | |
| input | 384 | D101 | Input pulse division scaling factor | 0 to 250 | 1 | 0 | | 406 | |
| Pulse train input | 385 | D110 | Frequency for zero input pulse | 0 to 590 Hz | 0.01 Hz | 0 Hz | | 406 | |
| Pulse | 386 | D111 | Frequency for maximum input pulse | 0 to 590 Hz | 0.01 Hz | 60 Hz | 50 Hz | 406 | |

| | | Pr. | | | Minimum | Initial | l value | Refer | Customer |
|---------------------|--------------------|-------|--|--|--------------------|--------------------|---------|-------------|----------|
| Function | Pr. | group | Name | Setting range | setting increments | FM | CA | to page | setting |
| | 393 ^{*9} | A525 | Orientation selection | 0 to 2, 10 to 12 | 1 | 0 | | 585 | |
| _ | 394 ^{*9} | A540 | Number of machine side gear teeth | 0 to 32767 | 1 | 1 | | 585 | |
| contro | 395 ^{*9} | A541 | Number of motor side gear teeth | 0 to 32767 | 1 | 1 | | 585 | |
| ation | 396 ^{*9} | A542 | Orientation speed gain (P term) | 0 to 1000 | 1 | 60 | | 585 | |
| Orientation control | 397 ^{*9} | A543 | Orientation speed integral time | 0 to 20 s | 0.001 s | 0.333 | s | 585 | |
| | 398 ^{*9} | A544 | Orientation speed gain (D term) | 0 to 100 | 0.1 | 1 | | 585 | |
| | 399 ^{*9} | A545 | Orientation deceleration ratio | 0 to 1000 | 1 | 20 | | 585 | |
| _ | 413 ^{*9} | M601 | Encoder pulse division ratio | 1 to 32767 | 1 | 1 | | 495 | |
| | 414 | A800 | PLC function operation selection | 0 to 2, 11, 12 | 1 | 0 | | 646 | |
| PLC | 415 | A801 | Inverter operation lock mode setting | 0, 1 | 1 | 0 | | 646 | |
| | 416 | A802 | Pre-scale function selection | 0 to 5 | 1 | 0 | | 646 | |
| | 417 | A803 | Pre-scale setting value | 0 to 32767 | 1 | 1 | | 646 | |
| | 419 | B000 | Position command source selection | 0 to 2, 10, 100, 110, 200, 210, 300, 310, 1110, 1310 | 1 | 0 | | 303, 319 | |
| | 420 | B001 | Command pulse scaling factor numerator (electronic gear numerator) | 1 to 32767 | 1 | 1 | | 325 | |
| | 421 | B002 | Command pulse multiplication denominator (electronic gear denominator) | 1 to 32767 | 1 | 1 | | 325 | |
| | 422 | B003 | Position control gain | 0 to 150 s ⁻¹ | 1 s ⁻¹ | 25 s ⁻¹ | | 328 | |
| | 423 | B004 | Position feed forward gain | 0 to 100% | 1% | 0% | | 328 | |
| ontrol | 424 | B005 | Position command acceleration/deceleration time constant | 0 to 50 s | 0.001s | 0 s | | 325 | |
| Position control | 425 | B006 | Position feed forward command filter | 0 to 5 s | 0.001 s | 0 s | | 328 | |
| osií | 426 | B007 | In-position width | 0 to 32767 pulses | 1 pulse | 100 թւ | ılses | 327 | |
| | 427 | B008 | Excessive level error | 0 to 400k pulses, 9999 | 1k pulses | 40k pu | ılses | 327 | |
| | 428 | B009 | Command pulse selection | 0 to 5 | 1 | 0 | | 319 | |
| | 430 | B010 | Clear signal selection Pulse monitor selection | 0, 1 0 to 5, 12, 13, 100 to 105, 112, 113, 1000 to 1005, 1012, 1013, 1100 to 1105, 1112, 1113, 2000 to 2005, 2012, 2013, 2100 to 2105, 2112, 2113, 3000 to 3005, 3012, 3013, 3100 to 3105, 3112, 3113, 8888, 9999 | 1 | 9999 | | 321 | |
| _ | 432 ^{*9} | D120 | Pulse train torque command bias | 0 to 400% | 1% | 0% | | 283 | |
| _ | 433 ^{*9} | D121 | Pulse train torque command gain | 0 to 400% | 1% | 150% | | 283 | |
| Ш | 434 ^{*17} | N110 | Network number (CC-Link IE) | 0 to 255 | 1 | 0 | | 699 | |
| CC-Link IE | 435 ^{*17} | N111 | Station number (CC-Link IE) | 0 to 255 | 1 | 0 | | 699 | |
| _ | 446 | B012 | Model position control gain | 0 to 150 s ⁻¹ | 1 s ⁻¹ | 25 s ⁻¹ | | 328 | |
| | _ | | | 0 .00 0 | | | | 1 | |

| | | Pr. | | | Minimum | Initial | value | Dofor | Customar |
|-----------------------|----------|---------------------------|---|---|-----------------------|---------|-------|---------------------|------------------|
| Function | Pr. | group | Name | Setting range | setting increments | FM | CA | Refer to page | Customer setting |
| | 450 | C200 | Second applied motor | 0, 1, 3 to 6, 13 to 16, 20, 23, 24, 30, 33, 34, 40, 43, 44, 50, 53, 54, 70, 73, 74, 330, 333, 334, 8090, 8093, 8094, 9090, 9093, 9094, 9999 | 1 | 9999 | | 528 | |
| | 451 | G300 | Second motor control method selection | 0 to 6, 10 to 14, 20, 100 to 106, 110 to 114, 9999 | 1 | 9999 | | 221 | |
| | 453 | C201 | Second motor capacity | 0.4 to 55 kW, 9999 ^{*2} | 0.01 kW ^{*2} | 9999 | | 532, | |
| | 400 | 0201 | Second motor capacity | 0 to 3600 kW, 9999*3 | 0.1 kW ^{*3} | 3333 | | 551 | |
| | 454 | C202 | Number of second motor poles | 2, 4, 6, 8, 10, 12, 9999 | 1 | 9999 | | 532, 551 | |
| 벌 | 455 | C225 | Second motor excitation | 0 to 500 A, 9999*2 | 0.01 A ^{*2} | 9999 | | 532 | |
| nsta | 455 C225 | current | 0 to 3600 A, 9999*3 | 0.1 A ^{*3} | | | 332 | | |
| 8 | 456 | 456 C204 | ated second motor voltage 0 to | 0 to 1000 V | 0.1 V | 200 V* | 7 | 532, | |
| oto | | | · | 0.000 | 5 1 | 400 V*8 | | 551 | |
| Second motor constant | 457 | C205 | Rated second motor frequency | 10 to 400 Hz, 9999 | 0.01 Hz | 9999 | | 532, 551 | |
| Sec | 458 | C220 | Second motor constant (R1) | 0 to 50 Ω, 9999*2 | 0.001Ω ^{*2} | 9999 | | 532, 551, | |
| | 430 | C220 | Second motor constant (K1) | 0 to 400 mΩ, 9999 ^{*3} | 0.01mΩ ^{*3} | 3333 | | 638 | |
| | 450 | C224 | Second motor constant (B2) | 0 to 50 Ω, 9999 ^{*2} | 0.001Ω ^{*2} | 9999 5 | | 532 | |
| | 459 | C221 | Second motor constant (R2) | 0 to 400 mΩ, 9999 ^{*3} | 0.01mΩ ^{*3} | 9999 | | 532 | |
| | 460 | C222 | Second motor constant (L1) / | 0 to 6000 mH, 9999*2 | 0.1mH ^{*2} | 9999 | | 532, | |
| | 400 | CZZZ | d-axis inductance (Ld) | 0 to 400 mH, 9999*3 | 0.01mH ^{*3} | 3333 | | 551 | |
| | 461 | 61 C223 | Second motor constant (L2) / | 0 to 6000 mH, 9999*2 | 0.1mH ^{*2} | 9999 | | 532, | |
| | 401 | 401 C223 | q-axis inductance (Lq) | 0 to 400 mH, 9999*3 | 0.01mH ^{*3} | 0000 | | 551 | |
| | 462 C224 | Second motor constant (X) | 0 to 100%, 9999 | 0.1% ^{*2} 0.01% ^{*3} | 9999 | | 532 | | |
| | 463 | C210 | Second motor auto tuning setting/status | 0, 1, 11, 101 | 1 | 0 | | 532, 551, 638 | |

| | _ | Pr. | | 0 44 | Minimum | Initia | value | Refer | Customer |
|-------------------------|-----|-------|--|---------------|--------------------|--------|-------|---------|----------|
| Function | Pr. | group | Name | Setting range | setting increments | FM | CA | to page | setting |
| | 464 | B020 | Digital position control sudden stop deceleration time | 0 to 360 s | 0.1 s | 0 s | | 303 | |
| | 465 | B021 | First target position lower 4 digits | 0 to 9999 | 1 | 0 | | 303 | |
| | 466 | B022 | First target position upper 4 digits | 0 to 9999 | 1 | 0 | | 303 | |
| | 467 | B023 | Second target position lower 4 digits | 0 to 9999 | 1 | 0 | | 303 | |
| | 468 | B024 | Second target position upper 4 digits | 0 to 9999 | 1 | 0 | | 303 | |
| | 469 | B025 | Third target position lower 4 digits | 0 to 9999 | 1 | 0 | | 303 | |
| | 470 | B026 | Third target position upper 4 digits | 0 to 9999 | 1 | 0 | | 303 | |
| | 471 | B027 | Fourth target position lower 4 digits | 0 to 9999 | 1 | 0 | | 303 | |
| | 472 | B028 | Fourth target position upper 4 digits | 0 to 9999 | 1 | 0 | | 303 | |
| | 473 | B029 | Fifth target position lower 4 digits | 0 to 9999 | 1 | 0 | | 303 | |
| | 474 | В030 | Fifth target position upper 4 digits | 0 to 9999 | 1 | 0 | | 303 | |
| | 475 | B031 | Sixth target position lower 4 digits | 0 to 9999 | 1 | 0 | | 303 | |
| | 476 | B032 | Sixth target position upper 4 digits | 0 to 9999 | 1 | 0 | | 303 | |
| itrol | 477 | В033 | Seventh target position lower 4 digits | 0 to 9999 | 1 | 0 | | 303 | |
| n con | 478 | B034 | Seventh target position upper 4 digits | 0 to 9999 | 1 | 0 | | 303 | |
| ositio | 479 | B035 | Eighth target position lower 4 digits | 0 to 9999 | 1 | 0 | | 303 | |
| Simple position control | 480 | B036 | Eighth target position upper 4 digits | 0 to 9999 | 1 | 0 | | 303 | |
| Si | 481 | B037 | Ninth target position lower 4 digits | 0 to 9999 | 1 | 0 | | 303 | |
| | 482 | B038 | Ninth target position upper 4 digits | 0 to 9999 | 1 | 0 | | 303 | |
| | 483 | В039 | Tenth target position lower 4 digits | 0 to 9999 | 1 | 0 | | 303 | |
| | 484 | B040 | Tenth target position upper 4 digits | 0 to 9999 | 1 | 0 | | 303 | |
| | 485 | B041 | Eleventh target position lower 4 digits | 0 to 9999 | 1 | 0 | | 303 | |
| | 486 | B042 | Eleventh target position upper 4 digits | 0 to 9999 | 1 | 0 | | 303 | |
| | 487 | B043 | Twelfth target position lower 4 digits | 0 to 9999 | 1 | 0 | | 303 | |
| | 488 | B044 | Twelfth target position upper 4 digits | 0 to 9999 | 1 | 0 | | 303 | |
| | 489 | B045 | Thirteenth target position lower 4 digits | 0 to 9999 | 1 | 0 | | 303 | |
| | 490 | B046 | Thirteenth target position upper 4 digits | 0 to 9999 | 1 | 0 | | 303 | |
| | 491 | B047 | Fourteenth target position lower 4 digits | 0 to 9999 | 1 | 0 | | 303 | |
| | 492 | B048 | Fourteenth target position upper 4 digits | 0 to 9999 | 1 | 0 | | 303 | |
| | 493 | B049 | Fifteenth target position lower 4 digits | 0 to 9999 | 1 | 0 | | 303 | |
| | 494 | B050 | Fifteenth target position upper 4 digits | 0 to 9999 | 1 | 0 | | 303 | |

| | | Pr. | | | Minimum | Initial | value | Refer | Customer |
|---------------------------------------|--------------------|-------|--|---------------------|--------------------|---------|-------|---------|----------|
| Function | Pr. | group | Name | Setting range | setting increments | FM | CA | to page | setting |
| Remote | 495 | M500 | Remote output selection | 0, 1, 10, 11 | 1 | 0 | | 489 | |
| em | 496 | M501 | Remote output data 1 | 0 to 4095 | 1 | 0 | | 489 | |
| ~ ° | 497 | M502 | Remote output data 2 | 0 to 4095 | 1 | 0 | | 489 | |
| _ | 498 | A804 | PLC function flash memory clear | 0, 9696 (0 to 9999) | 1 | 0 | | 646 | |
| _ | 500 ^{*17} | N011 | Communication error execution waiting time | 0 to 999.8 s | 0.1 s | 0 s | | 663 | |
| _ | 501 ^{*17} | N012 | Communication error occurrence count display | 0 | 1 | 0 | | 663 | |
| _ | 502 | N013 | Stop mode selection at communication error | 0 to 4, 11, 12 | 1 | 0 | | 663 | |
| <u>ق</u> | 503 | E710 | Maintenance timer 1 | 0 (1 to 9998) | 1 | 0 | | 363 | |
| Maintenance | 504 | E711 | Maintenance timer 1 warning output set time | 0 to 9998, 9999 | 1 | 9999 | | 363 | |
| _ | 505 | M001 | Speed setting reference | 1 to 590 Hz | 0.01 Hz | 60 Hz | 50 Hz | 444 | |
| _ | 506 ^{*15} | E705 | Display estimated main circuit capacitor residual life | (0 to 100%) | 1% | 100% | | 359 | |
| _ | 507 | E706 | Display/reset ABC1 relay contact life | 0 to 100% | 1% | 100% | | 359 | |
| _ | 508 | E707 | Display/reset ABC2 relay contact life | 0 to 100% | 1% | 100% | | 359 | |
| on D | 516 | F400 | S-pattern time at a start of acceleration | 0.1 to 2.5 s | 0.1 s | 0.1 s | | 372 | |
| elerati | 517 | F401 | S-pattern time at a completion of acceleration | 0.1 to 2.5 s | 0.1 s | 0.1 s | | 372 | |
| n/dece | 518 | F402 | S-pattern time at a start of deceleration | 0.1 to 2.5 s | 0.1 s | 0.1 s | | 372 | |
| S-pattern acceleration/deceleration D | 519 | F403 | S-pattern time at a completion of deceleration | 0.1 to 2.5 s | 0.1 s | 0.1 s | | 372 | |
| _ | 522 | G105 | Output stop frequency | 0 to 590 Hz, 9999 | 0.01 Hz | 9999 | | 720 | |
| _ | 539 | N002 | MODBUS RTU communication check time interval | 0 to 999.8 s, 9999 | 0.1 s | 9999 | | 686 | |
| _ | 541 ^{*17} | N100 | Frequency command sign selection | 0, 1 | 1 | 0 | | 699 | |
| USB | 547 | N040 | USB communication station number | 0 to 31 | 1 | 0 | | 701 | |
| ň | 548 | N041 | USB communication check time interval | 0 to 999.8 s, 9999 | 0.1 s | 9999 | | 701 | |
| no | 549 | N000 | Protocol selection | 0, 1 | 1 | 0 | | 663 | |
| ınicati | 550 | D012 | NET mode operation command source selection | 0, 1, 9999 | 1 | 9999 | | 400 | |
| Communication | 551 | D013 | PU mode operation command source selection | 1 to 3, 9999 | 1 | 9999 | | 400 | |
| _ | 552 | H429 | Frequency jump range | 0 to 30 Hz, 9999 | 0.01 Hz | 9999 | | 429 | |
| 5 | 553 | A603 | PID deviation limit | 0 to 100%, 9999 | 0.1% | 9999 | | 601 | |
| PID control | 554 | A604 | PID signal operation selection | 0 to 3, 10 to 13 | 1 | 0 | | 601 | |

| | | Pr. | | | Minimum | Initia | l value | Refer | Customer |
|----------------------------|-----|--------------|---|---|----------------------|-------------------|---------------|-------------|----------|
| Function | Pr. | group | Name | Setting range | setting increments | FM | CA | to page | setting |
| <u> </u> | 555 | E720 | Current average time | 0.1 to 1 s | 0.1 s | 1 s | | 363 | |
| orin | 556 | E721 | Data output mask time | 0 to 20 s | 0.1 s | 0 s | | 363 | |
| onit | | | | 0 to 500 A*2 | 0.01 A ^{*2} | | | | |
| Average current monitoring | 557 | E722 | Current average value monitor signal output reference current | 0 to 3600 A*3 | 0.1 A*3 | Inverte curren | er rated t | 363 | |
| _ | 560 | A712 | Second frequency search gain | 0 to 32767, 9999 | 1 | 9999 | | 532, 638 | |
| _ | 561 | H020 | PTC thermistor protection level | 0.5 to 30 kΩ, 9999 | 0.01 kΩ | 9999 | | 415 | |
| _ | 563 | M021 | Energization time carrying- over times | (0 to 65535) | 1 | 0 | | 446 | |
| _ | 564 | M031 | Operating time carrying-over times | (0 to 65535) | 1 | 0 | | 446 | |
| _ | 565 | G301 | Second motor excitation current break point | 0 to 400 Hz, 9999 | 0.01 Hz | 9999 | | 711 | |
| _ | 566 | G302 | Second motor excitation current low-speed scaling factor | 0 to 300%, 9999 | 0.1% | 9999 | | 711 | |
| Second motor constant | 569 | G942 | Second motor speed control gain | 0 to 200%, 9999 | 0.1% | 9999 | | 228 | |
| ting | | | | 0 to 3*11*12 | | | | | |
| Multiple rating | 570 | E301 | Multiple rating setting | 1, 2 ^{*13} | 1 | 2 | | 343 | |
| _ | 571 | F103 | Holding time at a start | 0 to 10 s, 9999 | 0.1 s | 9999 | | 381 | |
| _ | 573 | A680 T052 | 4 mA input check selection | 1 to 4, 11 to 14, 21 to 24, 9999 | 1 | 9999 | | 517 | |
| _ | 574 | C211 | Second motor online auto tuning | 0 to 2 | 1 | 0 | | 558 | |
| trol | 575 | A621 | Output interruption detection time | 0 to 3600 s, 9999 | 0.1 s | 1 s | | 601 | |
| PID control | 576 | A622 | Output interruption detection level | 0 to 590 Hz | 0.01 Hz | 0 Hz | | 601 | |
| ₫ | 577 | A623 | Output interruption cancel level | 900 to 1100% | 0.1% | 1000% | 6 | 601 | |
| | 592 | A300 | Traverse function selection | 0 to 2 | 1 | 0 | | 582 | |
| | 593 | A301 | Maximum amplitude amount | 0 to 25% | 0.1% | 10% | | 582 | |
| Traverse | 594 | A302 | Amplitude compensation amount during deceleration | 0 to 50% | 0.1% | 10% | | 582 | |
| Tra | 595 | A303 | Amplitude compensation amount during acceleration | 0 to 50% | 0.1% | 10% | | 582 | |
| | 596 | A304 | Amplitude acceleration time | 0.1 to 3600 s | 0.1 s | 5 s | | 582 | |
| | 597 | A305 | Amplitude deceleration time | 0.1 to 3600 s | 0.1 s | 5 s | | 582 | |
| _ | 598 | H102 | Undervoltage level | 175 to 215 VDC*7/350 to 430 VDC*8, 9999 | 0.1 V | 9999 | | 425 | |
| _ | 599 | T721 | X10 terminal input selection | 0, 1 | 1 | 0*11*13 1*12 | 3 | 724 | |

| | | Pr. | | | Minimum | Initial | value | Refer | Customer |
|------------------------------|-------------------|-------|---|-------------------|--------------------|---------|-------|-------------|----------|
| Function | Pr. | group | Name | Setting range | setting increments | FM | CA | to page | setting |
| relay | 600 | H001 | First free thermal reduction frequency 1 | 0 to 590 Hz, 9999 | 0.01 Hz | 9999 | | 415 | |
| I 0/L | 601 | H002 | First free thermal reduction ratio 1 | 1 to 100% | 1% | 100% | | 415 | |
| ıerma | 602 | H003 | First free thermal reduction frequency 2 | 0 to 590 Hz, 9999 | 0.01 Hz | 9999 | | 415 | |
| onic th | 603 | H004 | First free thermal reduction ratio 2 | 1 to 100% | 1% | 100% | | 415 | |
| Electronic thermal O/L relay | 604 | H005 | First free thermal reduction frequency 3 | 0 to 590 Hz, 9999 | 0.01 Hz | 9999 | | 415 | |
| _ | 606 | T722 | Power failure stop external signal input selection | 0, 1 | 1 | 1 | | 642 | |
| _ | 607 | H006 | Motor permissible load level | 110 to 250% | 1% | 150% | | 415 | |
| _ | 608 | H016 | Second motor permissible load level | 110 to 250%, 9999 | 1% | 9999 | | 415 | |
| ntrol | 609 | A624 | PID set point/deviation input selection | 1 to 5 | 1 | 2 | | 601, 622 | |
| PID control | 610 | A625 | PID measured value input selection | 1 to 5 | 1 | 3 | | 601, 622 | |
| _ | 611 | F003 | Acceleration time at a restart | 0 to 3600 s, 9999 | 0.1 s | 9999 | | 628, 635 | |
| _ | 617 | G080 | Reverse rotation excitation current low-speed scaling factor | 0 to 300%, 9999 | 0.1% | 9999 | | 711 | |
| oring | 635 ^{*9} | M610 | Cumulative pulse clear signal selection | 0 to 3 | 1 | 0 | | 321 | |
| nonito | 636 ^{*9} | M611 | Cumulative pulse division scaling factor | 1 to 16384 | 1 | 1 | | 321 | |
| e pulse r | 637 ^{*9} | M612 | Control terminal option- Cumulative pulse division scaling factor | 1 to 16384 | 1 | 1 | | 321 | |
| Cumulative pulse monitoring | 638 ^{*9} | M613 | Cumulative pulse storage | 0 to 3 | 1 | 0 | | 321 | |
| | 639 | A108 | Brake opening current selection | 0, 1 | 1 | 0 | | 572 | |
| | 640 | A109 | Brake operation frequency selection | 0, 1 | 1 | 0 | | 572 | |
| | 641 | A130 | Second brake sequence operation selection | 0, 7, 8, 9999 | 1 | 0 | | 572 | |
| | 642 | A120 | Second brake opening frequency | 0 to 30 Hz | 0.01 Hz. | 3 Hz | | 572 | |
| ø | 643 | A121 | Second brake opening current | 0 to 400% | 0.1% | 130% | | 572 | |
| Brake sequence | 644 | A122 | Second brake opening current detection time | 0 to 2 s | 0.1 s | 0.3 s | | 572 | |
| ake se | 645 | A123 | Second brake operation time at start | 0 to 5 s | 0.1 s | 0.3 s | | 572 | |
| Br | 646 | A124 | Second brake operation frequency | 0 to 30 Hz | 0.01 Hz. | 6 Hz | | 572 | |
| | 647 | A125 | Second brake operation time at stop | 0 to 5 s | 0.1 s | 0.3 s | | 572 | |
| | 648 | A126 | Second deceleration detection function selection | 0, 1 | 1 | 0 | | 572 | |
| | 650 | A128 | Second brake opening current selection | 0, 1 | 1 | 0 | | 572 | |
| | 651 | A129 | Second brake operation frequency selection | 0, 1 | 1 | 0 | | 572 | |

| | | Pr. | | | Minimum | Initial | value | Refer | Customer |
|--|-----|-------|--|--------------------------------|--------------------|---------|-------|-------------|----------|
| Function | Pr. | group | Name | Setting range | setting increments | FM | CA | to page | setting |
| <u>5</u> | 653 | G410 | Speed smoothing control | 0 to 200% | 0.1% | 0% | | 741 | |
| Speed smoothing control | 654 | G411 | Speed smoothing cutoff frequency | 0 to 120 Hz | 0.01 Hz | 20 Hz | | 741 | |
| utput | 655 | M530 | Analog remote output selection | 0, 1, 10, 11 | 1 | 0 | | 490 | |
| ō | 656 | M531 | Analog remote output 1 | 800 to 1200% | 0.1% | 1000% |) | 490 | |
| not | 657 | M532 | Analog remote output 2 | 800 to 1200% | 0.1% | 1000% | ò | 490 | |
| <u>ē</u> | 658 | M533 | Analog remote output 3 | 800 to 1200% | 0.1% | 1000% | Ò | 490 | |
| Analog remote output | 659 | M534 | Analog remote output 4 | 800 to 1200% | 0.1% | 1000% | | 490 | |
| gnetic leration | 660 | G130 | Increased magnetic excitation deceleration operation selection | 0, 1 | 1 | 0 | | 735 | |
| dece | 661 | G131 | Magnetic excitation increase rate | 0 to 40%, 9999 | 0.1% | 9999 | | 735 | |
| Increased magnetic excitation deceleration | 662 | G132 | Increased magnetic excitation current level | 0 to 300% | 0.1% | 100% | | 735 | |
| _ | 663 | M060 | Control circuit temperature signal output level | 0 to 100°C | 1°C | 0°C | | 494 | |
| _ | 665 | G125 | Regeneration avoidance frequency gain | 0 to 200% | 0.1% | 100% | | 732 | |
| _ | 668 | A786 | Power failure stop frequency gain | 0 to 200% | 0.1% | 100% | | 642 | |
| _ | 673 | G060 | SF-PR slip amount adjustment operation selection | 2 to 4, 6, 9999 | 1 | 9999 | | 714 | |
| _ | 674 | G061 | SF-PR slip amount adjustment gain | 0 to 500% | 0.1% | 100% | | 714 | |
| _ | 675 | A805 | User parameter auto storage function selection | 1, 9999 | 1 | 9999 | | 646 | |
| - | 679 | G420 | Second droop gain | 0 to 100%, 9999 | 0.1% | 9999 | | 738 | |
| contr | 680 | G421 | Second droop filter time constant | 0 to 1 s, 9999 | 0.01 s | 9999 | | 738 | |
| Second droop control | 681 | G422 | Second droop function activation selection | 0 to 2, 10, 11, 20 to 22, 9999 | 1 | 9999 | | 738 | |
| puoc | 682 | G423 | Second droop break point gain | 0.1 to 100%, 9999 | 0.1% | 9999 | | 738 | |
| Sec | 683 | G424 | Second droop break point torque | 0.1 to 100%, 9999 | 0.1% | 9999 | | 738 | |
| _ | 684 | C000 | Tuning data unit switchover | 0, 1 | 1 | 0 | | 532, 551 | |
| σ | 686 | E712 | Maintenance timer 2 | 0 (1 to 9998) | 1 | 0 | | 363 | |
| Maintenance | 687 | E713 | Maintenance timer 2 warning output set time | 0 to 9998, 9999 | 1 | 9999 | | 363 | |
| inte | 688 | E714 | Maintenance timer 3 | 0 (1 to 9998) | 1 | 0 | | 363 | |
| M | 689 | E715 | Maintenance timer 3 warning output set time | 0 to 9998, 9999 | 1 | 9999 | | 363 | |
| _ | 690 | H881 | Deceleration check time | 0 to 3600 s, 9999 | 0.1 s | 1 s | | 269 | |

| | | | Pr. | | | Minimum | Initial | l value | Refer | Customer |
|--|----------|-----|------|------------------------------|--|---------|---------|---------|-------|----------|
| 10 10 10 10 10 10 10 10 | Function | Pr. | | | Setting range | _ | FM | CA | | |
| Page 1740 Input terminal filter 5 to 50 ms, 9999 1 ms 9999 521 | relay | 692 | H011 | | 0 to 590 Hz, 9999 | 0.01 Hz | 9999 | | 415 | |
| Page 1740 Input terminal filter 5 to 50 ms, 9999 1 ms 9999 521 | II 0/L | 693 | H012 | | 1 to 100% | 1% | 100% | | 415 | |
| Page 1740 Input terminal filter 5 to 50 ms, 9999 1 ms 9999 521 | herma | 694 | H013 | | 0 to 590 Hz, 9999 | 0.01 Hz | 9999 | | 415 | |
| Page 1740 Input terminal filter 5 to 50 ms, 9999 1 ms 9999 521 | onic t | 695 | H014 | | 1 to 100% | 1% | 100% | | 415 | |
| Total C106 | Electr | 696 | H015 | | 0 to 590 Hz, 9999 | 0.01 Hz | 9999 | | 415 | |
| Total Induced voltage constant (phi f) 9999 551 9999 9999 1 9999 551 9999 1 9999 551 9999 1 9999 551 9999 1 9999 551 9999 1 9999 551 9999 1 9999 551 9999 1 9999 551 9999 1 9999 551 9999 1 9999 551 9999 1 9999 551 9999 1 9999 551 9999 1 9999 551 9999 1 9 1 9999 1 9 1 1 | _ | 699 | T740 | Input terminal filter | 5 to 50 ms, 9999 | 1 ms | 9999 | | 521 | |
| Total Tot | | 702 | C106 | Maximum motor frequency | 0 to 400 Hz, 9999 | 0.01 Hz | 9999 | | 551 | |
| T11 | | 706 | C130 | _ | ` '' | - | 9999 | | 551 | |
| T12 | | 707 | C107 | Motor inertia (integer) | 10 to 999, 9999 | 1 | 9999 | | 551 | |
| T17 | | 711 | C131 | Motor Ld decay ratio | 0 to 100%, 9999 | 0.1% | 9999 | | 551 | |
| Total Compensation Compensatio | | 712 | C132 | Motor Lq decay ratio | 0 to 100%, 9999 | 0.1% | 9999 | | 551 | |
| T21 | | 717 | C182 | _ | 0 to 200%, 9999 | 0.1% | 9999 | | 551 | |
| T25 | | 721 | C185 | position detection pulse | | 1 µs | 9999 | | 551 | |
| Table Tab | | 724 | C108 | Motor inertia (exponent) | 0 to 7, 9999 | 1 | 9999 | | 551 | |
| 741 C282 Second starting resistance tuning compensation 0 to 200%, 9999 0.1% 9999 551 742 C285 Second motor magnetic pole detection pulse width 16000 μs, 9999 0.1% 9999 551 743 C206 Second motor maximum frequency 0 to 400 Hz, 9999 0.01 Hz 9999 551 744 C207 Second motor inertia (integer) 10 to 999, 9999 1 9999 551 745 C208 Second motor inertia (exponent) 0 to 7, 9999 1 9999 551 746 C233 Second motor protection current level 100 to 500%, 9999 0.1% 9999 551 747 G350 Second motor low-speed range torque characteristic selection 0, 10, 11, 20, 21, 50, 51, 60, 61, 70, 71, 80, 81, 90, 91, 100, 101, 1010, 1011, 1000, 1001, 1010, 1011, 1000, 2001, 2011 2010, 2011 754 A652 Second PID action selection 0 to 590 Hz, 9999 0.01 Hz 9999 601 755 A651 Second PID action set point 0 to 100%, 9999 0.1% 100% 601 757 A654 Second PID integral time 0.1 to 3600 s, 9999 0.1 s 1 s 601 | stant | 725 | C133 | - | 100 to 500%, 9999 | 0.1% | 9999 | | 551 | |
| 741 C282 Second starting resistance tuning compensation 0 to 200%, 9999 0.1% 9999 551 742 C285 Second motor magnetic pole detection pulse width 16000 μs, 9999 0.1% 9999 551 743 C206 Second motor maximum frequency 0 to 400 Hz, 9999 0.01 Hz 9999 551 744 C207 Second motor inertia (integer) 10 to 999, 9999 1 9999 551 745 C208 Second motor inertia (exponent) 0 to 7, 9999 1 9999 551 746 C233 Second motor protection current level 100 to 500%, 9999 0.1% 9999 551 747 G350 Second motor low-speed range torque characteristic selection 0, 10, 11, 20, 21, 50, 51, 60, 61, 70, 71, 80, 81, 90, 91, 100, 101, 1010, 1011, 1000, 1001, 1010, 1011, 1000, 2001, 2011 2010, 2011 754 A652 Second PID action selection 0 to 590 Hz, 9999 0.01 Hz 9999 601 755 A651 Second PID action set point 0 to 100%, 9999 0.1% 100% 601 757 A654 Second PID integral time 0.1 to 3600 s, 9999 0.1 s 1 s 601 | r con | 738 | C230 | | ` '' | | 9999 | | 551 | |
| 741 C282 Second starting resistance tuning compensation 0 to 200%, 9999 0.1% 9999 551 742 C285 Second motor magnetic pole detection pulse width 16000 μs, 9999 0.1% 9999 551 743 C206 Second motor maximum frequency 0 to 400 Hz, 9999 0.01 Hz 9999 551 744 C207 Second motor inertia (integer) 10 to 999, 9999 1 9999 551 745 C208 Second motor inertia (exponent) 0 to 7, 9999 1 9999 551 746 C233 Second motor protection current level 100 to 500%, 9999 0.1% 9999 551 747 G350 Second motor low-speed range torque characteristic selection 0, 10, 11, 20, 21, 50, 51, 60, 61, 70, 71, 80, 81, 90, 91, 100, 101, 1010, 1011, 1000, 1001, 1010, 1011, 1000, 2001, 2011 2010, 2011 754 A652 Second PID action selection 0 to 590 Hz, 9999 0.01 Hz 9999 601 755 A651 Second PID action set point 0 to 100%, 9999 0.1% 100% 601 757 A654 Second PID integral time 0.1 to 3600 s, 9999 0.1 s 1 s 601 | g | 739 | C231 | Second motor Ld decay ratio | 0 to 100%, 9999 | 0.1% | 9999 | | 551 | |
| T41 C282 tuning compensation 0.16 200%, 9999 0.1% 9999 551 | Σ | 740 | C232 | Second motor Lq decay ratio | 0 to 100%, 9999 | 0.1% | 9999 | | 551 | |
| T42 C286 detection pulse width 16000 μs, 9999 1 μs 9999 551 | | 741 | C282 | _ | 0 to 200%, 9999 | 0.1% | 9999 | | 551 | |
| Tequency | | 742 | C285 | | - | 1 µs | 9999 | | 551 | |
| T44 | | 743 | C206 | | 0 to 400 Hz, 9999 | 0.01 Hz | 9999 | | 551 | |
| Telephone Tele | | 744 | C207 | | 10 to 999, 9999 | 1 | 9999 | | 551 | |
| Temporary Temp | | 745 | C208 | | 0 to 7, 9999 | 1 | 9999 | | 551 | |
| Temporary Temp | | 746 | C233 | | 100 to 500%, 9999 | 0.1% | 9999 | | 551 | |
| 753 A650 Second PID action selection 51, 60, 61, 70, 71, 80, 81, 90, 91, 100, 101, 1010, 1000, 1001, 1010, 1011, 2000, 2001, 2010, 2011 1 | _ | 747 | G350 | range torque characteristic | 0, 9999 | 1 | 9999 | | 233 | |
| 756 A653 Second PID proportional band 0.1 to 1000%, 9999 0.1% 100% 601 757 A654 Second PID integral time 0.1 to 3600 s, 9999 0.1 s 1 s 601 | _ | 753 | A650 | | 51, 60, 61, 70, 71, 80, 81, 90, 91, 100, 101, 1000, 1001, 1010, 1011, 2000, 2001, | 1 | 0 | | 601 | |
| 756 A653 Second PID proportional band 0.1 to 1000%, 9999 0.1% 100% 601 757 A654 Second PID integral time 0.1 to 3600 s, 9999 0.1 s 1 s 601 | contro | 754 | A652 | automatic switchover | 0 to 590 Hz, 9999 | 0.01 Hz | 9999 | | 601 | |
| 756 A653 Second PID proportional band 0.1 to 1000%, 9999 0.1% 100% 601 757 A654 Second PID integral time 0.1 to 3600 s, 9999 0.1 s 1 s 601 | PI - | 755 | A651 | | 0 to 100%, 9999 | 0.01% | 9999 | | 601 | |
| | | 756 | A653 | Second PID proportional | | | 100% | | 601 | |
| | | 757 | A654 | Second PID integral time | 0.1 to 3600 s, 9999 | 0.1 s | 1 s | | 601 | |
| | | 758 | A655 | Second PID differential time | 0.01 to 10 s, 9999 | 0.01 s | 9999 | | 601 | |
| 759 A600 PID unit selection 0 to 43, 9999 1 9999 615 | | 759 | A600 | PID unit selection | 0 to 43, 9999 | 1 | 9999 | | 615 | |

| | | Pr. | | | Minimum | Initial | value | Refer | Customer | | | | | | | | |
|----------------|-----|--------------|---|---|--------------------|---------|-------|-------------|----------|-----|--|---|--|---|--|-----|--|
| Function | Pr. | group | Name | Setting range | setting increments | FM | CA | to page | setting | | | | | | | | |
| | 760 | A616 | Pre-charge fault selection | 0, 1 | 1 | 0 | | 618 | | | | | | | | | |
| | 761 | A617 | Pre-charge ending level | 0 to 100%, 9999 | 0.1% | 9999 | | 618 | | | | | | | | | |
| | 762 | A618 | Pre-charge ending time | 0 to 3600 s, 9999 | 0.1 s | 9999 | | 618 | | | | | | | | | |
| | 763 | A619 | Pre-charge upper detection level | 0 to 100%, 9999 | 0.1% | 9999 | | 618 | | | | | | | | | |
| ge | 764 | A620 | Pre-charge time limit | 0 to 3600 s, 9999 | 0.1 s | 9999 | | 618 | | | | | | | | | |
| e-cha | 765 | A656 | Second pre-charge fault selection | 0, 1 | 1 | 0 | | 618 | | | | | | | | | |
| PID Pre-charge | 766 | A657 | Second pre-charge ending level | 0 to 100%, 9999 | 0.1% | 9999 | | 618 | | | | | | | | | |
| _ | 767 | A658 | Second pre-charge ending time | 0 to 3600 s, 9999 | 0.1 s | 9999 | | 618 | | | | | | | | | |
| | 768 | A659 | Second pre-charge upper detection level | 0 to 100%, 9999 | 0.1% | 9999 | | 618 | | | | | | | | | |
| | 769 | A660 | Second pre-charge time limit | 0 to 3600 s, 9999 | 0.1 s | 9999 | | 9999 | | 618 | | | | | | | |
| ing | 774 | M101 | Operation panel monitor selection 1 | 1 to 3, 5 to 14, 17 to 20, 22 to 36, 38 to 46, 50 to | 1 | 9999 | | 446 | | | | | | | | | |
| Monitoring | 775 | M102 | Operation panel monitor selection 2 | 57, 61, 62, 64, 67, 71 to 75, 87 to 98, 100, | 1 | 9999 | | 446 | | | | | | | | | |
| Ĕ | 776 | M103 | Operation panel monitor selection 3 | 9999 | 1 | 9999 | | 446 | | | | | | | | | |
| _ | 777 | A681 T053 | 4 mA input fault operation frequency | 0 to 590 Hz, 9999 | 0.01 Hz | 9999 | | 9999 | | 517 | | | | | | | |
| _ | 778 | A682 T054 | 4 mA input check filter | 0 to 10 s | 0.01 s | 0 s | | 517 | | | | | | | | | |
| _ | 779 | N014 | Operation frequency during communication error | 0 to 590 Hz, 9999 | 0.01 Hz | 9999 | | 663 | | | | | | | | | |
| _ | 788 | G250 | Low speed range torque characteristic selection | 0, 9999 | 1 | 9999 | | 233 | | | | | | | | | |
| _ | 791 | F070 | Acceleration time in low- speed range | 0 to 3600 s, 9999 | 0.1 s | 9999 | | 367 | | | | | | | | | |
| _ | 792 | F071 | Deceleration time in low- speed range | 0 to 3600 s, 9999 | 0.1 s | 9999 | | 367 | | | | | | | | | |
| _ | 799 | M520 | Pulse increment setting for output power | 0.1, 1, 10, 100, 1000 kWh | 0.1 kWh | 1 kWh | | 493 | | | | | | | | | |
| _ | 800 | G200 | Control method selection | 0 to 6, 9 to 14, 20, 100 to 106, 109 to 114 | 1 | 20 | | 221 | | | | | | | | | |
| _ | 801 | H704 | Output limit level | 0 to 400%, 9999 | 0.1% | 9999 | | 245, 283 | | | | | | | | | |
| _ | 802 | G102 | Pre-excitation selection | 0, 1 | 1 | 0 | | 715 | | | | | | | | | |
| and | 803 | G210 | Constant output range torque characteristic selection | 0 to 2, 10, 11 | 1 | 0 | | 245, 283 | | | | | | | | | |
| Torque command | 804 | D400 | Torque command source selection | 0 to 6 | 1 | 0 | | 0 | | 0 | | 0 | | 0 | | 283 | |
| orque | 805 | D401 | Torque command value (RAM) | 600 to 1400% | 1% | 1000% | | 283 | | | | | | | | | |
| ř | 806 | D402 | Torque command value (RAM, EEPROM) | 600 to 1400% | 1% | 1000% |) | 283 | | | | | | | | | |
| Ħ | 807 | H410 | Speed limit selection | 0 to 2 | 1 | 0 | | 287 | | | | | | | | | |
| Speed limit | 808 | H411 | Forward rotation speed limit/ speed limit | 0 to 400 Hz | 0.01 Hz. | 60 Hz | 50 Hz | 287 | | | | | | | | | |
| Spe | 809 | H412 | Reverse rotation speed limit/ reverse-side speed limit | 0 to 400 Hz, 9999 | 0.01 Hz | 9999 | | 287 | | | | | | | | | |

| | | Pr. | | | Minimum | Initial | value | Refer | Customer |
|------------------|-------------------|-------|--|----------------------|--------------------|---------|-------|-------------|----------|
| Function | Pr. | group | Name | Setting range | setting increments | FM | CA | to page | setting |
| | 810 | H700 | Torque limit input method selection | 0 to 2 | 1 | 0 | | 245 | |
| | 811 | D030 | Set resolution switchover | 0, 1, 10, 11 | 1 | 0 | | 245, 444 | |
| Ħ | 812 | H701 | Torque limit level (regeneration) | 0 to 400%, 9999 | 0.1% | 9999 | | 245 | |
| Torque limit | 813 | H702 | Torque limit level (3rd quadrant) | 0 to 400%, 9999 | 0.1% | 9999 | | 245 | |
| Torq | 814 | H703 | Torque limit level (4th quadrant) | 0 to 400%, 9999 | 0.1% | 9999 | | 245 | |
| | 815 | H710 | Torque limit level 2 | 0 to 400%, 9999 | 0.1% | 9999 | | 245 | |
| | 816 | H720 | Torque limit level during acceleration | 0 to 400%, 9999 | 0.1% | 9999 | | 245 | |
| | 817 | H721 | Torque limit level during deceleration | 0 to 400%, 9999 | 0.1% | 9999 | | 245 | |
| guiur | 818 | C112 | Easy gain tuning response level setting | 1 to 15 | 1 | 2 | | 254 | |
| Easy gain tuning | 819 | C113 | Easy gain tuning selection | 0 to 2 | 1 | 0 | | 254 | |
| | 820 | G211 | Speed control P gain 1 | 0 to 1000% | 1% | 60% | | 254 | |
| | 821 | G212 | Speed control integral time 1 | 0 to 20 s | 0.001 s | 0.333 | s | 254 | |
| | 822 | T003 | Speed setting filter 1 | 0 to 5 s, 9999 | 0.001 s | 9999 | | 503 | |
| | 823 ^{*9} | G215 | Speed detection filter 1 | 0 to 0.1 s | 0.001 s | 0.001 | s | 332 | |
| | 824 | G213 | Torque control P gain 1 (current loop proportional gain) | 0 to 500% | 1% | 100% | | 294, 333 | |
| | 825 | G214 | Torque control integral time 1 (current loop integral time) | 0 to 500 ms | 0.1 ms | 5 ms | | 294, 333 | |
| | 826 | T004 | Torque setting filter 1 | 0 to 5 s, 9999 | 0.001 s | 9999 | | 503 | |
| | 827 | G216 | Torque detection filter 1 | 0 to 0.1 s | 0.001 s | 0 s | | 332 | |
| Adjustment | 828 | G224 | Model speed control gain | 0 to 1000% | 1% | 60% | | 263, 328 | |
| Adjus | 829 ^{*9} | A546 | Number of machine end encoder pulses | 0 to 4096, 9999 | 1 | 9999 | | 585 | |
| | 830 | G311 | Speed control P gain 2 | 0 to 1000%, 9999 | 1% | 9999 | | 254 | |
| | 831 | G312 | Speed control integral time 2 | 0 to 20 s, 9999 | 0.001 s | 9999 | | 254 | |
| | 832 | T005 | Speed setting filter 2 | 0 to 5 s, 9999 | 0.001 s | 9999 | | 503 | |
| | 833 ^{*9} | G315 | Speed detection filter 2 | 0 to 0.1 s, 9999 | 0.001 s | 9999 | | 332 | |
| | 834 | G313 | Torque control P gain 2 (current loop proportional gain) | 0 to 500%, 9999 | 1% | 9999 | | 294 | |
| | 835 | G314 | Torque control integral time 2 (current loop integral time) | 0 to 500 ms, 9999 | 0.1 ms | 9999 | | 294 | |
| | 836 | T006 | Torque setting filter 2 | 0 to 5 s, 9999 | 0.001 s | 9999 | | 503 | |
| | 837 | G316 | Torque detection filter 2 | 0 to 0.1 s, 9999 | 0.001 s | 9999 | | 332 | |
| | 840 | G230 | Torque bias selection | 0 to 3, 24, 25, 9999 | 1 | 9999 | | 265 | |
| | 841 | G231 | Torque bias 1 | 600 to 1400%, 9999 | 1% | 9999 | | 265 | |
| | 842 | G232 | Torque bias 2 | 600 to 1400%, 9999 | 1% | 9999 | | 265 | |
| (A) | 843 | G233 | Torque bias 3 | 600 to 1400%, 9999 | 1% | 9999 | | 265 | |
| bia | 844 | G234 | Torque bias filter | 0 to 5 s, 9999 | 0.001 s | 9999 | | 265 | |
| ne | 845 | G235 | Torque bias operation time | 0 to 5 s, 9999 | 0.01 s | 9999 | | 265 | |
| Torque bias | 846 | G236 | Torque bias balance compensation | 0 to 10 V, 9999 | 0.1 V | 9999 | | 265 | |
| | 847 | G237 | Fall-time torque bias terminal 1 bias | 0 to 400%, 9999 | 1% | 9999 | | 265 | |
| | 848 | G238 | Fall-time torque bias terminal 1 gain | 0 to 400%, 9999 | 1% | 9999 | | 265 | |

| | | Pr. | | | Minimum | Initial | value | Refer | Customer | | | | |
|---------------------|--------------------|-------|--|--------------------------------|----------------------|------------------|-----------|---------------------|----------|------|--|--|--|
| Function | Pr. | group | Name | Setting range | setting increments | FM | CA | to page | setting | | | | |
| | 849 | T007 | Analog input offset adjustment | 0 to 200% | 0.1% | 100% | | 503 | | | | | |
| | 850 | G103 | Brake operation selection | 0 to 2 | 1 | 0 | | 715 | | | | | |
| | 851 ^{*9} | C240 | Control terminal option- Number of encoder pulses | 0 to 4096 | 1 | 2048 | | 94 | | | | | |
| | 852 ^{*9} | C241 | Control terminal option- Encoder rotation direction | 0, 1, 100, 101 | 1 | 1 | | 94 | | | | | |
| | 853 ^{*9} | H417 | Speed deviation time | 0 to 100 s | 0.1 s | 1 s | | 269 | | | | | |
| | 854 | G217 | Excitation ratio | 0 to 100% | 1% | 100% | | 332 | | | | | |
| unction | 855 ^{*9} | C248 | Control terminal option- Signal loss detection enable/ disable selection | 0, 1 | 1 | 0 | | 561 | | | | | |
| Additional function | 858 | T040 | Terminal 4 function assignment | 0, 1, 4, 9999 | 1 | 0 | | 245, 431, 500 | | | | | |
| Adi | 859 | C126 | Torque current/Rated PM | 0 to 500 A, 9999 ^{*2} | 0.01 A ^{*2} | 9999 | | 532, | | | | | |
| | 003 | 0120 | motor current | 0 to 3600 A, 9999*3 | 0.1 A ^{*3} | 2222 | | 551 | | | | | |
| | | | Second motor torque | 0 to 500 A, 9999*2 | 0.01 A ^{*2} | 9999 532, 551 | | 532. | | | | | |
| | 860 | C226 | current/Rated PM motor current | 0 to 3600 A, 9999*3 | 0.1 A ^{*3} | | | 9999 | | 9999 | | | |
| | 862 ^{*9} | C242 | Encoder option selection | 0, 1 | 1 | 0 | | 226 | | | | | |
| | 863 ^{*9} | M600 | Control terminal option- Encoder pulse division ratio | 1 to 32767 | 1 | 150% | | 495 | | | | | |
| | 864 | M470 | Torque detection | 0 to 400% | 0.1% | 150% | 488 | | | | | | |
| | 865 | M446 | Low speed detection | 0 to 590 Hz | 0.01 Hz | 1.5 Hz | | 484 | | | | | |
| Indication | 866 | M042 | Torque monitoring reference | 0 to 400% | 0.1% | 150% | | 457 | | | | | |
| _ | 867 | M321 | AM output filter | 0 to 5 s | 0.01 s | 0.01 s | | 463 | | | | | |
| _ | 868 | T010 | Terminal 1 function assignment | 0 to 6, 9999 | 1 | 0 | | 245, 431, 500 | | | | | |
| _ | 869 | M334 | Current output filter | 0 to 5 s | 0.01 s | _ | 0.02 s | 463 | | | | | |
| _ | 870 | M440 | Speed detection hysteresis | 0 to 5 Hz | 0.01 Hz | 0 Hz | | 484 | | | | | |
| _ | 871 ^{*9} | C243 | Control terminal option— Encoder position tuning setting/status | 0, 1 | 1 | 0 | | 542 | | | | | |
| ive | 872 ^{*15} | H201 | Input phase loss protection selection | 0, 1 | 1 | 0 | | 426 | | | | | |
| Protective function | 873 ^{*9} | H415 | Speed limit | 0 to 400 Hz | 0.01 Hz. | 20 Hz | | 269 | | | | | |
| Pro | 874 | H730 | OLT level setting | 0 to 400% | 0.1% | 150% | | 245 | | | | | |
| | 875 | H030 | Fault definition | 0, 1 | 1 | 0 | | 422 | | | | | |
| | 876 ^{*9} | H022 | Thermal protector input | 0, 1 | 1 | 1 | | 415 | | | | | |
| 5 | 877 | G220 | Speed feed forward control/ model adaptive speed control selection | 0 to 2 | 1 | 0 | | 263, 328 | | | | | |
| 878 | 878 | G221 | Speed feed forward filter | 0 to 1 s | 0.01 s | 0 s | | 263 | | | | | |
| Control system | 879 | G222 | Speed feed forward torque limit | 0 to 400% | 0.1% | 150% | | 263 | | | | | |
| Contr | 880 | C114 | Load inertia ratio | 0 to 200 times | 0.1 times | 7 times | S | 254, 263, 328 | | | | | |
| | 881 | G223 | Speed feed forward gain | 0 to 1000% | 1% | 0% | | 263 | | | | | |

| | | Pr. | | | Minimum | Initial value | Refer | Customer |
|--------------------------|-------------------|-------|--|----------------------------|-----------------------|------------------------|-------------|----------|
| Function | Pr. | group | Name | Setting range | setting increments | FM CA | | setting |
| | 882 | G120 | Regeneration avoidance operation selection | 0 to 2 | 1 | 0 | 732 | |
| idance | 883 | G121 | Regeneration avoidance operation level | 300 to 1200 V | 0.1 V | DC380V*7 DC760V*8 | 732 | |
| Regeneration avoidance | 884 | G122 | Regeneration avoidance at deceleration detection sensitivity | 0 to 5 | 1 | 0 | 732 | |
| Regenera | 885 | G123 | Regeneration avoidance compensation frequency limit value | 0 to 590 Hz, 9999 | 0.01 Hz | 6 Hz | 732 | |
| | 886 | G124 | Regeneration avoidance voltage gain | 0 to 200% | 0.1% | 100% | 732 | |
| _ | 887 ^{*9} | C244 | Control terminal option— Encoder magnetic pole position offset | 0 to 16383, 65535 | 1 | 65535 | 542 | |
| e | 888 | E420 | Free parameter 1 | 0 to 9999 | 1 | 9999 | 350 | |
| Free parameter | 889 | E421 | Free parameter 2 | 0 to 9999 | 1 | 9999 | 350 | |
| | 891 | M023 | Cumulative power monitor digit shifted times | 0 to 4, 9999 | 1 | 9999 | 446, 467 | |
| | 892 | M200 | Load factor | 30 to 150% | 0.1% | 100% | 467 | |
| ن | 893 | M201 | Energy saving monitor reference (motor capacity) | 0.1 to 55 kW ^{*2} | 0.01 kW ^{*2} | Inverter rate capacity | d 467 | |
| Energy saving monitoring | 894 | M202 | Control selection during commercial power-supply operation | 0 to 3600 kW*3 | 0.1 kW ^{*3} | 0 | 467 | |
| aving | 895 | M203 | Power saving rate reference value | 0, 1, 9999 | 1 | 9999 | 467 | |
| 3y s | 896 | M204 | Power unit cost | 0 to 500, 9999 | 0.01 | 9999 | 467 | |
| Enerç | 897 | M205 | Power saving monitor average time | 0 to 1000 h, 9999 | 1 h | 9999 | 467 | |
| | 898 | M206 | Power saving cumulative monitor clear | 0, 1, 10, 9999 | 1 | 9999 | 467 | |
| | 899 | M207 | Operation time rate (estimated value) | 0 to 100%, 9999 | 0.1% | 9999 | 467 | |

| | Pr. | Pr. | | | Minimum | Initial | value | Refer | Customer |
|-----------------------|-----------------------------|-------|--|---------------|--------------------|---------|-------|---------|----------|
| Function | Pr. | group | Name | Setting range | setting increments | FM | CA | to page | setting |
| | C0 (900) ^{*10} | M310 | FM/CA terminal calibration | _ | _ | _ | | 463 | |
| | C1 (901) ^{*10} | M320 | AM terminal calibration | _ | _ | _ | | 463 | |
| | C2 (902) ^{*10} | T200 | Terminal 2 frequency setting bias frequency | 0 to 590 Hz | 0.01 Hz | 0 Hz | | 505 | |
| | C3 (902)*10 | T201 | Terminal 2 frequency setting bias | 0 to 300% | 0.1% | 0% | | 505 | |
| | 125 (903) ^{*10} | T202 | Terminal 2 frequency setting gain frequency | 0 to 590 Hz | 0.01 Hz | 60 Hz | 50 Hz | 505 | |
| | C4 (903)*10 T203 | | Terminal 2 frequency setting gain | 0 to 300% | 0.1% | 100% | | 505 | |
| | C5 (904)*10 | T400 | Terminal 4 frequency setting bias frequency | 0 to 590 Hz | 0.01 Hz | 0 Hz | | 505 | |
| | C6 (904) ^{*10} | T401 | Terminal 4 frequency setting bias | 0 to 300% | 0.1% | 20% | | 505 | |
| | 126 (905) ^{*10} | T402 | Terminal 4 frequency setting gain frequency | 0 to 590 Hz | 0.01 Hz | 60 Hz | 50 Hz | 505 | |
| | C7 (905) ^{*10} | T403 | Terminal 4 frequency setting gain | 0 to 300% | 0.1% | 100% | | 505 | |
| | C12 (917) ^{*10} | T100 | Terminal 1 bias frequency (speed) | 0 to 590 Hz | 0.01 Hz | 0 Hz | | 505 | |
| leter | C13 (917) ^{*10} | T101 | Terminal 1 bias (speed) | 0 to 300% | 0.1% | 0% | | 505 | |
| Calibration parameter | C14 (918) ^{*10} | T102 | Terminal 1 gain frequency (speed) | 0 to 590 Hz | 0.01 Hz | 60 Hz | 50 Hz | 505 | |
| ration | C15 (918) ^{*10} | T103 | Terminal 1 gain (speed) | 0 to 300% | 0.1% | 100% | | 505 | |
| Calib | C16 (919) ^{*10} | T110 | Terminal 1 bias command (torque/magnetic flux) | 0 to 400% | 0.1% | 0% | | 510 | |
| | C17 (919) ^{*10} | T111 | Terminal 1 bias (torque/ magnetic flux) | 0 to 300% | 0.1% | 0% | | 510 | |
| | C18 (920) ^{*10} | T112 | Terminal 1 gain command (torque/magnetic flux) | 0 to 400% | 0.1% | 150% | | 510 | |
| | C19 (920)*10 | T113 | Terminal 1 gain (torque/ magnetic flux) | 0 to 300% | 0.1% | 100% | | 510 | |
| | C8 (930) ^{*10} | M330 | Current output bias signal | 0 to 100% | 0.1% | _ | 0% | 463 | |
| | C9 (930) ^{*10} | M331 | Current output bias current | 0 to 100% | 0.1% | _ | 0% | 463 | |
| | C10 (931) ^{*10} | M332 | Current output gain signal | 0 to 100% | 0.1% | _ | 100% | 463 | |
| | C11 (931) ^{*10} | M333 | Current output gain current | 0 to 100% | 0.1% | _ | 100% | 463 | |
| | C38 (932) ^{*10} | T410 | Terminal 4 bias command (torque/magnetic flux) | 0 to 400% | 0.1% | 0% | | 510 | |
| | C39 (932) ^{*10} | T411 | Terminal 4 bias (torque/ magnetic flux) | 0 to 300% | 0.1% | 20% | | 510 | |
| | C40 (933) ^{*10} | T412 | Terminal 4 gain command (torque/magnetic flux) | 0 to 400% | 0.1% | 150% | | 510 | |
| | C41 (933) ^{*10} | T413 | Terminal 4 gain (torque/ magnetic flux) | 0 to 300% | 0.1% | 100% | | 510 | |

| | | _ | | | Minimum | Initial | value | | _ |
|---------------------|-----------------------------|--------------|---|---|------------|-------------------|-------|---------------|------------------|
| Function | Pr. | Pr. group | Name | Setting range | setting | FM | CA | Refer to page | Customer setting |
| | C42 | 3 | | | increments | | OA . | | |
| | (934) ^{*10} | A630 | PID display bias coefficient | 0 to 500, 9999 | 0.01 | 9999 | | 615 | |
| splay | C43 (934) ^{*10} | A631 | PID display bias analog value | 0 to 300% | 0.1% | 20% | | 615 | |
| PID display | C44 (935)*10 | A632 | PID display gain coefficient | 0 to 500, 9999 | 0.01 | 9999 | | 615 | |
| | C45 (935)*10 | A633 | PID display gain analog value | 0 to 300% | 0.1% | 100% | | 615 | |
| _ | 977 | E302 | Input voltage mode selection | 0 to 2 | 1 | 0 | | 345 | |
| | 000 | E490 | Parameter copy alarm | 10 ^{*2} | 1 | 10 ^{*2} | | 744 | |
| _ | 989 | E490 | release | 100 ^{*3} | 1 | 100 ^{*3} | | 744 | |
| | 990 | E104 | PU buzzer control | 0, 1 | 1 | 1 | | 340 | |
| PU | 991 | E105 | PU contrast adjustment | 0 to 63 | 1 | 58 | | 340 | |
| Monitoring | 992 | M104 | Operation panel setting dial push monitor selection | 0 to 3, 5 to 14, 17 to 20, 22 to 36, 38 to 46, 50 to 57, 61, 62, 64, 67, 71 to 75, 87 to 98, 100 | 1 | 0 | | 446 | |
| ō | 994 | G403 | Droop break point gain | 0.1 to 100%, 9999 | 0.1% | 9999 | | 738 | |
| Droop control | 995 | G404 | Droop break point torque | 0.1 to 100% | 0.1% | 100% | | 738 | |
| _ | 997 | H103 | Fault initiation | 0 to 255, 9999 | 1 | 9999 | | 425 | |
| | 998 | E430 | PM parameter | 0, 3003, 3103, 8009, | 1 | 0 | | 230 | |
| | 330 | E430 | initialization Simple | 8109, 9009, 9109 | Į | U | | 230 | |
| _ | 999 | E431 | Automatic parameter setting <u>Simple</u> | 1, 2, 10, 11, 12, 13, 20, 21, 9999 | 1 | 9999 | | 350 | |
| _ | 1000 | E108 | Direct setting selection | 0 to 2 | 1 | 0 | | 340 | |
| _ | 1002 | C150 | Lq tuning target current adjustment coefficient | 50 to 150%, 9999 | 0.1% | 9999 | | 551 | |
| on | 1003 | G601 | Notch filter frequency | 0, 8 to 1250 Hz | 1 Hz | 0 | | 271 | |
| ıcti | 1004 | G602 | Notch filter depth | 0 to 3 | 1 | 0 | | 271 | |
| Additional function | 1005 | G603 | Notch filter width | 0 to 3 | 1 | 0 | | 271 | |
| ~ | 1006 | E020 | Clock (year) | 2000 to 2099 | 1 | 2000 | | 334 | |
| Clock | 1007 | E021 | Clock (month, day) | Jan. 1 to Dec. 31 | 1 | 101 | | 334 | |
| Ö | 1008 | E022 | Clock (hour, minute) | 0:00 to 23:59 | 1 | 0 | | 334 | |
| _ | 1015 | A607 | Integral stop selection at limited frequency | 0 to 2, 10 to 12 | 1 | 0 | | 601 | |
| _ | 1016 | H021 | PTC thermistor protection detection time | 0 to 60 s | 1 s | 0 | | 415 | |
| _ | 1018 | M045 | Monitor with sign selection | 0, 1, 9999 | 1 | 9999 | | 446 | |

| | | Pr. | | | Minimum | Initial | value | Refer | Customer |
|-------------------|--------------------|-------|--|---|--------------------|-----------------------|-------|---------|----------|
| Function | Pr. | group | Name | Setting range | setting increments | FM | CA | to page | setting |
| | 1020 | A900 | Trace operation selection | 0 to 4 | 1 | 0 | | 649 | |
| | 1021 | A901 | Trace mode selection | 0 to 2 | 1 | 0 | | 649 | |
| | 1022 | A902 | Sampling cycle | 0 to 9 | 1 | 2 | | 649 | |
| | 1023 | A903 | Number of analog channels | 1 to 8 | 1 | 4 | | 649 | |
| | 1024 | A904 | Sampling auto start | 0, 1 | 1 | 0 | | 649 | |
| | 1025 | A905 | Trigger mode selection | 0 to 4 | 1 | 0 | | 649 | |
| | 1026 | A906 | Number of sampling before trigger | 0 to 100% | 1% | 90% | | 649 | |
| | 1027 | A910 | Analog source selection (1ch) | | | 201 | | 649 | |
| | 1028 | A911 | Analog source selection (2ch) | | | 202 | | 649 | |
| | 1029 | A912 | Analog source selection (3ch) | 1 to 3, 5 to 14, 17 to 20, | | 203 | | 649 | |
| | 1030 | A913 | Analog source selection (4ch) | 22 to 24, 32 to 36, 39 to 42, 46, 52 to 54, 61, | | 204 | | 649 | |
| | 1031 | A914 | Analog source selection (5ch) | 62, 64, 67, 71 to 75, 87 to 98, 201 to 213, 222 | 1 | 205 | | 649 | |
| 9 | 1032 | A915 | Analog source selection (6ch) | to 227, 230 to 232, 235 to 238 | | 206 | | 649 | |
| Trace | 1033 | A916 | Analog source selection (7ch) | | | 207 | | 649 | |
| | 1034 | A917 | Analog source selection (8ch) | | | 208 | | 649 | |
| | 1035 | A918 | Analog trigger channel | 1 to 8 | 1 | 1 | | 649 | |
| | 1036 | A919 | Analog trigger operation selection | 0, 1 | 1 | 0 | | 649 | |
| | 1037 | A920 | Analog trigger level | 600 to 1400 | 1 | 1000 | | 649 | |
| | 1038 | A930 | Digital source selection (1ch) | | | 1 | | 649 | |
| | 1039 | A931 | Digital source selection (2ch) | | | 2 | | 649 | |
| | 1040 | A932 | Digital source selection (3ch) | | | 3 | | 649 | |
| | 1041 | A933 | Digital source selection (4ch) | 1 to 255 | 1 | 4 5 6 7 8 | | 649 | |
| | 1042 | A934 | Digital source selection (5ch) | | | | | 649 | |
| | 1043 | A935 | Digital source selection (6ch) | | | | | 649 | |
| | 1044 | A936 | Digital source selection (7ch) | | | | | 649 | |
| | 1045 | A937 | Digital source selection (8ch) | | | | | 649 | |
| | 1046 | A938 | Digital trigger channel | 1 to 8 | 1 | 1 | | 649 | |
| | 1047 | A939 | Digital trigger operation selection | 0, 1 | 1 | 0 | | 649 | |
| _ | 1048 | E106 | Display-off waiting time | 0 to 60 min | 1 min | 0 | | 340 | |
| _ | 1049 | E110 | USB host reset | 0, 1 | 1 | 0 | | 341 | |
| | 1072 | A310 | DC brake judgment time for anti-sway control operation | 0 to 10 s | 0.1 s | 3 s | | 584 | |
| Anti-sway control | 1073 | A311 | Anti-sway control operation selection | 0, 1 | 1 | 0 | | 584 | |
| Ö | 1074 | A312 | Anti-sway control frequency | 0.05 to 3 Hz, 9999 | 0.001 Hz | 1 Hz | | 584 | |
| /ay | 1075 | A313 | Anti-sway control depth | 0 to 3 | 1 | 0 | | 584 | |
| ×S- | 1076 | A314 | Anti-sway control width | 0 to 3 | 1 | 0 | | 584 | |
| √nti | 1077 | A315 | Rope length | 0.1 to 50 m | 0.1 m | 1 m | | 584 | |
| 4 | 1078 | A316 | Trolley weight | 1 to 50000 kg | 1 kg | 1 kg | | 584 | |
| | 1079 | A317 | Load weight | 1 to 50000 kg | 1 kg | 1 kg | | 584 | |
| _ | 1103 | F040 | Deceleration time at emergency stop | 0 to 3600 s | 0.1 s | 5 s | | 367 | |
| _ | 1105 ^{*9} | C143 | Encoder magnetic pole position offset | 0 to 16383, 65535 | 1 | 65535 | | 542 | |
| D | 1106 | M050 | Torque monitor filter | 0 to 5 s, 9999 | 0.01 s | 9999 | | 446 | |
| rin | 1107 | M051 | Running speed monitor filter | 0 to 5 s, 9999 | 0.01 s | 9999 | | 446 | |
| Monitoring | 1108 | M052 | Excitation current monitor filter | 0 to 5 s, 9999 | 0.01 s | 9999 | | 446 | |
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| | | Pr. | | | Minimum | Initial | value | Refer | Customer |
|-------------|-----------------|-----------------|--|-------------------|------------|---------|-------|---------|----------|
| Function | Pr. | group | Name | Setting range | setting | FM | CA | to page | setting |
| | | | Torque command reverse | | increments | | | | |
| _ | 1114 | D403 | selection | 0, 1 | 1 | 1 | | 283 | |
| _ | 1115 | G218 | Speed control integral term clear time | 0 to 9998 ms | 1 ms | 0 s | | 254 | |
| _ | 1116 | G206 | Constant output range speed | 0 to 100% | 0.1% | 0% | | 254 | |
| | | | control P gain compensation Speed control P gain 1 (per- | | | | | | |
| _ | 1117 | G261 | unit system) | 0 to 300, 9999 | 0.01 | 9999 | | 254 | |
| _ | 1118 | G361 | Speed control P gain 2 (per- unit system) | 0 to 300, 9999 | 0.01 | 9999 | | 254 | |
| _ | 1119 | G262 | Model speed control gain (per-unit system) | 0 to 300, 9999 | 0.01 | 9999 | | 263 | |
| _ | 1121 | G260 | Per-unit speed control reference frequency | 0 to 400 Hz | 0.01 Hz. | 120 Hz | | 254 | |
| | 1134 | A605 | PID upper limit manipulated value | 0 to 100% | 0.1% | 100% | | 622 | |
| | 1135 | A606 | PID lower limit manipulated value | 0 to 100% | 0.1% | 100% | | 622 | |
| | 1136 | A670 | Second PID display bias coefficient | 0 to 500, 9999 | 0.01 | 9999 | 9999 | | |
| | 1137 | A671 | Second PID display bias analog value | 0 to 300% | 0.1% | 20% | 20% | | |
| | 1138 A672 | | Second PID display gain coefficient | 0 to 500, 9999 | 0.01 | 9999 | | 615 | |
| | 1139 | A673 | Second PID display gain analog value | 0 to 300% | 0.1% | 100% | | 615 | |
| ntrol | 1140 | A664 | Second PID set point/ deviation input selection | 1 to 5 | 1 | 2 | | 601 | |
| PID control | 1141 | A665 | Second PID measured value input selection | 1 to 5 | 1 | 3 | | 601 | |
| _ | 1142 | A640 | Second PID unit selection | 0 to 43, 9999 | 1 | 9999 | | 601 | |
| | 1143 | A641 | Second PID upper limit | 0 to 100%, 9999 | 0.1% | 9999 | | 601 | |
| | 1144 | A642 | Second PID lower limit | 0 to 100%, 9999 | 0.1% | 9999 | | 601 | |
| | 1145 | A643 | Second PID deviation limit | 0 to 100%, 9999 | 0.1% | 9999 | | 601 | |
| | 1146 | A644 | Second PID signal operation selection | 0 to 3, 10 to 13 | 1 | 0 | | 601 | |
| | 1147 | A661 | Second output interruption detection time | 0 to 3600 s, 9999 | 0.1 s | 1 | | 601 | |
| | 1148 | A662 | Second output interruption detection level | 0 to 590 Hz | 0.01 Hz | 0 Hz | | 601 | |
| | 1149 | A663 | Second output interruption cancel level | 900 to 1100% | 0.1% | 1000% | | 601 | |
| PLC | 1150 to 1199 | A810 to A859 | PLC function user parameters 1 to 50 | 0 to 65535 | 1 | 0 | | 646 | |
| _ | 1220 | B100 | Target position/speed selection | 0 to 2 | 1 | 0 | | 896 | |

| | Pr. | Pr. | | _ | Minimum | Initial | value | Refer | Customer |
|-------------------------|------|-------|--|---|--------------------|---------|-------|---------|----------|
| Function | Pr. | group | Name | Setting range | setting increments | FM | CA | to page | setting |
| | 1221 | B101 | Start command edge detection selection | 0, 1 | 1 | 0 | | 303 | |
| | 1222 | B120 | First positioning acceleration time | 0.01 to 360 s | 0.01 s | 5 s | | 303 | |
| | 1223 | B121 | First positioning deceleration time | 0.01 to 360 s | 0.01 s | 5 s | | 303 | |
| | 1224 | B122 | First positioning dwell time | 0 to 20000 ms | 1 ms | 0 ms | | 303 | |
| | 1225 | B123 | First positioning sub- function | 0 to 2, 10 to 12, 100 to 102, 110 to 112 | 1 | 10 | | 303 | |
| | 1226 | B124 | Second positioning acceleration time | 0.01 to 360 s | 0.01 s | 5 s | | 303 | |
| | 1227 | B125 | Second positioning deceleration time | 0.01 to 360 s | 0.01 s | 5 s | | 303 | |
| | 1228 | B126 | Second positioning dwell time | 0 to 20000 ms | 1 ms | 0 ms | | 303 | |
| | 1229 | B127 | Second positioning sub- function | 0 to 2, 10 to 12, 100 to 102, 110 to 112 | 1 | 10 | | 303 | |
| | 1230 | B128 | Third positioning acceleration time | 0.01 to 360 s | 0.01 s | 5 s | | 303 | |
| | 1231 | B129 | Third positioning deceleration time | 0.01 to 360 s | 0.01 s | 5 s | | 303 | |
| | 1232 | B130 | Third positioning dwell time | 0 to 20000 ms | 1 ms | 0 ms | | 303 | |
| ntrol | 1233 | B131 | Third positioning sub- function | 0 to 2, 10 to 12, 100 to 102, 110 to 112 | 1 | 10 | | 303 | |
| Simple position control | 1234 | B132 | Fourth positioning acceleration time | 0.01 to 360 s | 0.01 s | 5 s | | 303 | |
| positi | 1235 | B133 | Fourth positioning deceleration time | 0.01 to 360 s | 0.01 s | 5 s | | 303 | |
| ple | 1236 | B134 | Fourth positioning dwell time | 0 to 20000 ms | 1 ms | 0 ms | | 303 | |
| Sim | 1237 | B135 | Fourth positioning sub- function | 0 to 2, 10 to 12, 100 to 102, 110 to 112 | 1 | 10 | | 303 | |
| | 1238 | B136 | Fifth positioning acceleration time | 0.01 to 360 s | 0.01 s | 5 s | | 303 | |
| | 1239 | B137 | Fifth positioning deceleration time | 0.01 to 360 s | 0.01 s | 5 s | | 303 | |
| | 1240 | B138 | Fifth positioning dwell time | 0 to 20000 ms | 1 ms | 0 ms | | 303 | |
| | 1241 | B139 | Fifth positioning sub- function | 0 to 2, 10 to 12, 100 to 102, 110 to 112 | 1 | 10 | | 303 | |
| | 1242 | B140 | Sixth positioning acceleration time | 0.01 to 360 s | 0.01 s | 5 s | | 303 | |
| | 1243 | B141 | Sixth positioning deceleration time | 0.01 to 360 s | 0.01 s | 5 s | | 303 | |
| | 1244 | B142 | Sixth positioning dwell time | 0 to 20000 ms | 1 ms | 0 ms | | 303 | |
| | 1245 | B143 | Sixth positioning sub- function | 0 to 2, 10 to 12, 100 to 102, 110 to 112 | 1 | 10 | | 303 | |
| | 1246 | B144 | Seventh positioning acceleration time | 0.01 to 360 s | 0.01 s | 5 s | | 303 | |
| | 1247 | B145 | Seventh positioning deceleration time | 0.01 to 360 s | 0.01 s | 5 s | | 303 | |
| | 1248 | B146 | Seventh positioning dwell time | 0 to 20000 ms | 1 ms | 0 ms | | 303 | |
| | 1249 | B147 | Seventh positioning sub- function | 0 to 2, 10 to 12, 100 to 102, 110 to 112 | 1 | 10 | | 303 | |

| | Pr. Pr. | | Pr. Name | | Minimum | Initial | value | Refer | Customer |
|-------------------------|---------|-------|--|---|--------------------|---------|-------|---------|----------|
| Function | Pr. | group | Name | Setting range | setting increments | FM | CA | to page | setting |
| | 1250 | B148 | Eighth positioning acceleration time | 0.01 to 360 s | 0.01 s | 5 s | | 303 | |
| | 1251 | B149 | Eighth positioning deceleration time | 0.01 to 360 s | 0.01 s | 5 s | | 303 | |
| | 1252 | B150 | Eighth positioning dwell time | 0 to 20000 ms | 1 ms | 0 ms | | 303 | |
| | 1253 | B151 | Eighth positioning sub- function | 0 to 2, 10 to 12, 100 to 102, 110 to 112 | 1 | 10 | | 303 | |
| | 1254 | B152 | Ninth positioning acceleration time | 0.01 to 360 s | 0.01 s | 5 s | | 303 | |
| | 1255 | B153 | Ninth positioning deceleration time | 0.01 to 360 s | 0.01 s | 5 s | | 303 | |
| | 1256 | B154 | Ninth positioning dwell time | 0 to 20000 ms | 1 ms | 0 ms | | 303 | |
| | 1257 | B155 | Ninth positioning sub- function | 0 to 2, 10 to 12, 100 to 102, 110 to 112 | 1 | 10 | | 303 | |
| | 1258 | B156 | Tenth positioning acceleration time | 0.01 to 360 s | 0.01 s | 5 s | | 303 | |
| | 1259 | B157 | Tenth positioning deceleration time | 0.01 to 360 s | 0.01 s | 5 s | | 303 | |
| | 1260 | B158 | Tenth positioning dwell time | 0 to 20000 ms | 1 ms | 0 ms | | 303 | |
| | 1261 | B159 | Tenth positioning sub- function | 0 to 2, 10 to 12, 100 to 102, 110 to 112 | 1 | 10 | | 303 | |
| | 1262 | B160 | Eleventh positioning acceleration time | 0.01 to 360 s | 0.01 s | 5 s | | 303 | |
| | 1263 | B161 | Eleventh positioning deceleration time | 0.01 to 360 s | 0.01 s | 5 s | | 303 | |
| ō | 1264 | B162 | Eleventh positioning dwell time | 0 to 20000 ms | 1 ms | 0 ms | | 303 | |
| contr | 1265 | B163 | Eleventh positioning sub- function | 0 to 2, 10 to 12, 100 to 102, 110 to 112 | 1 | 10 | | 303 | |
| sition | 1266 | B164 | Twelfth positioning acceleration time | 0.01 to 360 s | 0.01 s | 5 s | | 303 | |
| Simple position control | 1267 | B165 | Twelfth positioning deceleration time | 0.01 to 360 s | 0.01 s | 5 s | | 303 | |
| Sim | 1268 | B166 | Twelfth positioning dwell time | 0 to 20000 ms | 1 ms | 0 ms | | 303 | |
| | 1269 | B167 | Twelfth positioning sub- function | 0 to 2, 10 to 12, 100 to 102, 110 to 112 | 1 | 10 | | 303 | |
| | 1270 | B168 | Thirteenth positioning acceleration time | 0.01 to 360 s | 0.01 s | 5 s | | 303 | |
| | 1271 | B169 | Thirteenth positioning deceleration time | 0.01 to 360 s | 0.01 s | 5 s | | 303 | |
| | 1272 | B170 | Thirteenth positioning dwell time | 0 to 20000 ms | 1 ms | 0 ms | | 303 | |
| | 1273 | B171 | Thirteenth positioning sub- function | 0 to 2, 10 to 12, 100 to 102, 110 to 112 | 1 | 10 | | 303 | |
| | 1274 | B172 | Fourteenth positioning acceleration time | 0.01 to 360 s | 0.01 s | 5 s | | 303 | |
| | 1275 | B173 | Fourteenth positioning deceleration time | 0.01 to 360 s | 0.01 s | 5 s | | 303 | |
| | 1276 | B174 | Fourteenth positioning dwell time | 0 to 20000 ms | 1 ms | 0 ms | | 303 | |
| | 1277 | B175 | Fourteenth positioning sub- function | 0 to 2, 10 to 12, 100 to 102, 110 to 112 | 1 | 10 | | 303 | |
| | 1278 | B176 | Fifteenth positioning acceleration time | 0.01 to 360 s | 0.01 s | 5 s | | 303 | |
| | 1279 | B177 | Fifteenth positioning deceleration time | 0.01 to 360 s | 0.01 s | 5 s | | 303 | |
| , | 1280 | B178 | Fifteenth positioning dwell time | 0 to 20000 ms | 1 ms | 0 ms | | 303 | |
| | 1281 | B179 | Fifteenth positioning sub- function | 0, 2, 10, 12, 100, 102, 110, 112 | 1 | 10 | | 303 | |

| | | D. | | | Minimum | Initial | value | Defer | O |
|---|-----------------|-----------------|--|--------------------------|--------------------|--------------------|-------|------------------|------------------|
| Function | Pr. | Pr. group | Name | Setting range | setting increments | FM | CA | Refer to page | Customer setting |
| | 1282 | B180 | Home position return method selection | 0 to 6 | 1 | 4 | | 303 | |
| | 1283 | B181 | Home position return speed | 0 to 30 Hz | 0.01 Hz. | 2 Hz | | 303 | |
| | 1284 | B182 | Home position return shifting speed | 0 to 10 Hz | 0.01 Hz. | 0.5 Hz | | 303 | |
| | 1285 | B183 | Home position shift amount lower 4 digits | 0 to 9999 | 1 | 0 | | 303 | |
| ction | 1286 | B184 | Home position shift amount upper 4 digits | 0 to 9999 | 1 0 | | | 303 | |
| Home position return / position detection | 1287 | B185 | Travel distance after proximity dog ON lower 4 digits | 0 to 9999 | 1 | 2048 | | 303 | |
| rn / posit | 1288 | B186 | Travel distance after proximity dog ON upper 4 digits | 0 to 9999 | 1 | 0 | | 303 | |
| n retui | 1289 | B187 | Home position return stopper torque | 0 to 200% | 0.1% | 40% | 40% | | |
| ositio | 1290 | B188 | Home position return stopper waiting time | 0 to 10 s | 0.1 s | 0.5 s | | 303 | |
| ome p | 1292 | B190 | Position control terminal input selection | 0, 1 | 1 | 0 | | | |
| ¥ | 1293 | B191 | oll feeding mode selection 0, 1 1 0 | | | 303 | | | |
| | 1294 | B192 | Position detection lower 4 digits | 0 to 9999 | 1 | 0 | | 327 | |
| | 1295 | B193 | Position detection upper 4 digits | 0 to 9999 | 1 | 0 | | 327 | |
| | 1296 | B194 | Position detection selection | 0 to 2 | 1 | 0 | | 327 | |
| | 1297 | B195 | Position detection hysteresis width | 0 to 32767 | 1 | 0 | | 327 | |
| _ | 1298 | B013 | Second position control gain | 0 to 150 s ⁻¹ | 1 s ⁻¹ | 25 s ⁻¹ | | 328 | |
| _ | 1299 | G108 | Second pre-excitation selection | 0, 1 | 1 | 0 | | 715 | |
| _ | 1300 to 1343 | N500 to N543 | Communication option parameter For details, refer to the Instruction | | | | | | |
| _ | 1348 | G263 | P/PI control switchover frequency | 0 to 400 Hz | 0.01 Hz. | 0 Hz | | 254 | |
| _ | 1349 | G264 | Emergency stop operation selection | 0, 1, 10, 11 | 1 | 0 | | 367 | |
| _ | 1350 to 1359 | N550 to N559 | Communication option parameter For details, refer to the Instruction | | | | | | |
| _ | 1410 | A170 | Starting times lower 4 digits 0 to 9999 1 0 | | | 576 | | | |
| _ | 1411 | A171 | Starting times upper 4 digits | • | | | 576 | | |
| _ | 1412 | C135 | Motor induced voltage constant (phi f) exponent | 0 to 2, 9999 | 1 | 9999 | | 551 | |
| _ | 1413 | C235 | Second motor induced voltage constant (phi f) exponent | 0 to 2, 9999 | 1 | 9999 | | 551 | |

| | | Pr. | | | Minimum | Initial | value | Refer | Customer |
|--------------------------------------|-----------|-------|---|-------------------------|--------------------|---------|-------|---------|----------|
| Function | Pr. | group | Name | Setting range | setting increments | FM | CA | to page | setting |
| | 1480 | H520 | Load characteristics measurement mode | 0, 1 (2 to 5, 81 to 85) | 1 | 0 | | 439 | |
| | 1481 | H521 | Load characteristics load reference 1 | 0 to 400%, 8888, 9999 | 0.1% | 9999 | | 439 | |
| | 1482 H522 | | Load characteristics load reference 2 | 0 to 400%, 8888, 9999 | 0.1% | 9999 | | 439 | |
| uo | 1483 | H523 | Load characteristics load reference 3 | 0 to 400%, 8888, 9999 | 0.1% | 9999 | | 439 | |
| etection | 1484 | H524 | Load characteristics load reference 4 | 0 to 400%, 8888, 9999 | 0.1% | 9999 | 9999 | | |
| Load characteristics fault detection | 1485 | H525 | Load characteristics load reference 5 | 0 to 400%, 8888, 9999 | 0.1% | 9999 | | 439 | |
| stics 1 | 1486 | H526 | Load characteristics maximum frequency | 0 to 590 Hz | 0.01 Hz | 60 Hz | 50 Hz | 439 | |
| acteri | 1487 H527 | H527 | Load characteristics minimum frequency | 0 to 590 Hz | 0.01 Hz | 6 Hz | | 439 | |
| d char | 1488 | H531 | Upper limit warning detection width | 0 to 400%, 9999 | 0.1% | 20% | | 439 | |
| Loa | 1489 | H532 | Lower limit warning detection width | 0 to 400%, 9999 | 0.1% | 20% | | 439 | |
| | 1490 | H533 | Upper limit fault detection width | 0 to 400%, 9999 | 0.1% | 9999 | | 439 | |
| | 1491 | H534 | Lower limit fault detection width | 0 to 400%, 9999 | 0.1% | 9999 | | 439 | |
| | 1492 | H535 | Load status detection signal delay time / load reference measurement waiting time | 0 to 60 s | 0.1 s | 1 s | | 439 | |
| _ | 1499 | E415 | Parameter for manufacturer sett | ing. Do not set. | | | | | |
| ers. | Pr.CLR | | Parameter clear | (0), 1 | 1 | 0 | | 743 | |
| nete | ALL.CL | | All parameter clear | (0), 1 | 1 | 0 | | 743 | |
| Clear parameters | Err.CL | | Fault history clear | (0), 1 | 1 | 0 | | 774 | |
| _ | Pr.CPY | | Parameter copy | (0), 1 to 3 | 1 | 0 | | 744 | |
| _ | Pr.CHG | | Initial value change list | _ | 1 | 0 | | 751 | |
| _ | IPM | | IPM initialization | 0, 3003 | 1 | 0 | | 230 | |
| _ | AUTO | | Automatic parameter setting | _ | _ | _ | | 350 | |
| _ | Pr.MD | | Group parameter setting | (0), 1, 2 | 1 | 0 | | 201 | |

- *1 Differs according to the capacity.
 - 6%: FR-A820-00077(0.75K) or lower, FR-A840-00038(0.75K) or lower
 - 4%: FR-A820-00105(1.5K) to FR-A820-00250(3.7K), FR-A840-00052(1.5K) to FR-A840-00126(3.7K)
 - 3%: FR-A820-00340(5.5K), FR-A820-00490(7.5K), FR-A840-00170(5.5K), FR-A840-00250(7.5K)
 - 2%: FR-A820-00630(11K) to FR-A820-03160(55K), FR-A840-00310(11K) to FR-A840-01800(55K)
 - 1%: FR-A820-03800(75K) or higher, FR-A840-02160(75K) or higher
- *2 The setting range or initial value for the FR-A820-03160(55K) or lower and FR-A840-01800(55K) or lower.
- *3 The setting range or initial value for the FR-A820-03800(75K) or higher and FR-A840-02160(75K) or higher.
- *4 The initial value for the FR-A820-00490(7.5K) or lower and FR-A840-00250(7.5K) or lower.
- $^{*}5$ The initial value for the FR-A820-00630(11K) or higher and FR-A840-00310(11K) or higher.
- *6 Differs according to the capacity.
 - 4%: FR-A820-00490(7.5K) or lower, FR-A840-00250(7.5K) or lower
 - 2%: FR-A820-00630(11K) to FR-A820-03160(55K), FR-A840-00310(11K) to FR-A840-01800(55K)
 - 1%: FR-A820-03800(75K) or higher, FR-A840-02160(75K) or higher
- *7 The value for the 200 V class.
- *8 The value for the 400 V class.
- *9 The setting is available only when a plug-in option that supports Vector control is installed. For the corresponding parameters of each option, refer
- *10 The parameter number in parentheses is that used (displayed) on the LCD operation panel and the parameter unit.
- *11 The setting range or initial value for the standard model.
- *12 The setting range or initial value for the separated converter type.
- *13 The setting range or initial value for the IP55 compatible model.
- *14 The setting is available for the standard structure model.
- *15 The setting is available for the standard structure model and the IP55 compatible model.
- *16 The setting is available when the PLC function is enabled.

- *17 The setting is available for the FR-A800-GF or when a compatible plug-in option is installed.
- *18 Refer to the FR-A8AVP Instruction Manual (For Inverter/Converter Switching).

5.1.2 Use of a function group number for the identification of parameters

A parameter identification number shown on the PU can be switched from a parameter number to a function group number. As parameters are grouped by function and displayed by the group, the related parameters can be set continually at a time.

◆ Changing a parameter identification number to a function group number

| Pr.MD setting | Description |
|---------------|--|
| 0 | The setting of parameter identification number remains the same as the last setting. |
| 1 | The parameter number is used for the identification of parameters, and displayed in numerical order. |
| 2 | The function group number is used for the identification of parameters, and displayed in alphanumeric order. |

Operating procedure

- **1.** Turning ON the power of the inverter The operation panel is in the monitor mode.
- 2. Selecting the parameter setting mode

 Press Mode to choose the parameter setting mode. (The parameter number read previously appears on the 12-segment LCD display.)
- Selecting the use of the function group number

 Turn to change the set value to "-" (function group number). Press SET to confirm the Group parameter setting. "-" and "-" are displayed alternately after the setting is completed.

♦ Selecting a parameter by function group number to change its setting

The following shows the procedure to change the setting of **P.H400 (Pr.1) Maximum frequency**.

Operating procedure

| 1. | Turning ON the power of the inverter The operation panel is in the monitor mode. |
|----|---|
| 2. | Changing the operation mode |
| | Press PU to choose the PU operation mode. [PU] indicator turns ON. |
| 3. | Selecting the parameter setting mode |
| | Press Model to choose the parameter setting mode. (The parameter number read previously appears on the 12-segment LCD display.) |
| 4. | Enabling the function group selection |
| | Press several times until " appears. Parameter groups can now be selected. |
| 5. | Enabling the function group selection |
| | Turn until " (Protective function parameter 4) appears. Press SET to confirm the selection. |
| | " |
| _ | of Protective function parameter 4. |
| 6. | Selecting a parameter |
| | Turn until " |
| | value." (initial value)" appears. |

7. Changing the setting value

| Turn | | to change | e the set value to | • " <u>5000</u> ". | . Press SET | to confirm | the selec | tion. "🔚 🔲 | ∭" and |
|------|--|-----------|--------------------|---------------------|---------------|------------|-----------|------------|--------|
| | | } _ " a | re displayed alte | rnately after the s | etting is com | pleted. | | | |

5.1.3 Parameter list (by function group number)

◆ E: Environment setting parameters

Parameters for the inverter operating environment.

| Pr. group | Pr. | Name | Refer |
|-----------|------|--|-----------------------------|
| E000 | 168 | Parameter for manufacturer setting | to page g. Do not |
| E000 | 100 | set. | |
| E001 | 169 | Parameter for manufacturer setting set. | g. Do not |
| E020 | 1006 | Clock (year) | 334 |
| E021 | 1007 | Clock (month, day) | 334 |
| E022 | 1008 | Clock (hour, minute) | 334 |
| E023 | 269 | Parameter for manufacturer setting set. | g. Do not |
| E080 | 168 | Parameter for manufacturer setting set. | g. Do not |
| E081 | 169 | Parameter for manufacturer setting set. | g. Do not |
| E100 | 75 | Reset selection | 336 |
| E101 | 75 | Disconnected PU detection | 336 |
| E102 | 75 | PU stop selection | 336 |
| E103 | 145 | PU display language selection | 339 |
| E104 | 990 | PU buzzer control | 340 |
| E105 | 991 | PU contrast adjustment | 340 |
| E106 | 1048 | Display-off waiting time | 340 |
| E107 | 75 | Reset limit | 336 |
| E108 | 1000 | Direct setting selection | 340 |
| E110 | 1049 | USB host reset | 341 |
| E200 | 161 | Frequency setting/key lock operation selection | 341 |
| E201 | 295 | Frequency change increment amount setting | 342 |
| E300 | 30 | Regenerative function selection | 724 |
| E301 | 570 | Multiple rating setting | 343 |
| E302 | 977 | Input voltage mode selection | 345 |
| E310 | 328 | Inverter/converter switching Simple | *7 |
| E400 | 77 | Parameter write selection | 345 |
| E410 | 296 | Password lock level | 348 |
| E411 | 297 | Password lock/unlock | 348 |
| E415 | 1499 | Parameter for manufacturer setting set. | |
| E420 | 888 | Free parameter 1 | 350 |
| E421 | 889 | Free parameter 2 | 350 |
| E430 | 998 | PM parameter initialization Simple | 230 |
| E431 | 999 | Automatic parameter setting Simple | 350 |
| E440 | 160 | User group read selection <u>Simple</u> | 354 |
| E441 | 172 | User group registered display/ batch clear | 354 |
| E442 | 173 | User group registration | 354 |
| E443 | 174 | User group clear | 354 |
| E490 | 989 | Parameter copy alarm release | 744 |
| E600 | 72 | PWM frequency selection | 356 |
| E601 | 240 | Soft-PWM operation selection | 356 |

| Pr. group | Pr. | Name | Refer to page |
|-----------|-------------------|---|------------------|
| E602 | 260 | PWM frequency automatic switchover | 356 |
| E700 | 255 | Life alarm status display | 359 |
| E701 | 256 ^{*4} | Inrush current limit circuit life display | 359 |
| E702 | 257 | Control circuit capacitor life display | 359 |
| E703 | 258 ^{*4} | Main circuit capacitor life display | 359 |
| E704 | 259 ^{*4} | Main circuit capacitor life measuring | 359 |
| E706 | 507 | Display/reset ABC1 relay contact life | 359 |
| E707 | 508 | Display/reset ABC2 relay contact life | 359 |
| E710 | 503 | Maintenance timer 1 | 363 |
| E711 | 504 | Maintenance timer 1 warning output set time | 363 |
| E712 | 686 | Maintenance timer 2 | 363 |
| E713 | 687 | Maintenance timer 2 warning output set time | 363 |
| E714 | 688 | Maintenance timer 3 | 363 |
| E715 | 689 | Maintenance timer 3 warning output set time | 363 |
| E720 | 555 | Current average time | 363 |
| E721 | 556 | Data output mask time | 363 |
| E722 | 557 | Current average value monitor signal output reference current | 363 |

♦ F: Parameters for the settings of the acceleration/deceleration time and the acceleration/deceleration pattern

Parameters for the motor acceleration/deceleration characteristics.

| Pr. group | Pr. | Name | Refer to page |
|-----------|-----|--|------------------|
| F000 | 20 | Acceleration/deceleration reference frequency | 367 |
| F001 | 21 | Acceleration/deceleration time increments | 367 |
| F002 | 16 | Jog acceleration/deceleration time | 410 |
| F003 | 611 | Acceleration time at a restart | 628, 635 |
| F010 | 7 | Acceleration time Simple | 367 |
| F011 | 8 | Deceleration time Simple | 367 |
| F020 | 44 | Second acceleration/ deceleration time | 367, 622 |
| F021 | 45 | Second deceleration time | 367, 622 |
| F022 | 147 | Acceleration/deceleration time switching frequency | 367 |
| F030 | 110 | Third acceleration/ deceleration time | 367 |
| F031 | 111 | Third deceleration time | 367 |

| Pr. group | Pr. | Name | Refer to page |
|-----------|------|--|---------------------|
| F040 | 1103 | Deceleration time at emergency stop | 367 |
| F070 | 791 | Acceleration time in low-speed range | 367 |
| F071 | 792 | Deceleration time in low-speed range | 367 |
| F100 | 29 | Acceleration/deceleration pattern selection | 372 |
| F101 | 59 | Remote function selection | 377 |
| F102 | 13 | Starting frequency | 381, 382 |
| F103 | 571 | Holding time at a start | 381 |
| F200 | 140 | Backlash acceleration stopping frequency | 372 |
| F201 | 141 | Backlash acceleration stopping time | 372 |
| F202 | 142 | Backlash deceleration stopping frequency | 372 |
| F203 | 143 | Backlash deceleration stopping time | 372 |
| F300 | 380 | Acceleration S-pattern 1 | 372 |
| F301 | 381 | Deceleration S-pattern 1 | 372 |
| F302 | 382 | Acceleration S-pattern 2 | 372 |
| F303 | 383 | Deceleration S-pattern 2 | 372 |
| F400 | 516 | S-pattern time at a start of acceleration | 372 |
| F401 | 517 | S-pattern time at a completion of acceleration | 372 |
| F402 | 518 | S-pattern time at a start of deceleration | 372 |
| F403 | 519 | S-pattern time at a completion of deceleration | 372 |
| F500 | 292 | Automatic acceleration/ deceleration | 384, 387, 572 |
| F510 | 61 | Reference current | 384, 387 |
| F511 | 62 | Reference value at acceleration | 384 |
| F512 | 63 | Reference value at deceleration | 384 |
| F513 | 293 | Acceleration/deceleration separate selection | 384 |
| F520 | 64 | Starting frequency for elevator mode | 387 |

♦ D: Parameters for the setting of operation command and frequency command

Parameters for setting the command source to the inverter, and the motor driving frequency and torque.

| Pr. group | Pr. | Name | Refer to page |
|-----------|-----|--|------------------|
| D000 | 79 | Operation mode selection Simple | 389, 398 |
| D001 | 340 | Communication startup mode selection | 398 |
| D010 | 338 | Communication operation command source | 400 |

| Pr. group | Pr. | Name | Refer |
|-----------------|-------------------|--|-------------|
| i i. gioup | | Name | to page |
| D011 | 339 | Communication speed command source | 400 |
| D012 | 550 | NET mode operation command source selection | 400 |
| D013 | 551 | PU mode operation command source selection | 400 |
| D020 | 78 | Reverse rotation prevention selection | 406 |
| D030 | 811 | Set resolution switchover | 245, 444 |
| D100 | 291 | Pulse train I/O selection | 406, 457 |
| D101 | 384 | Input pulse division scaling factor | 406 |
| D110 | 385 | Frequency for zero input pulse | 406 |
| D111 | 386 | Frequency for maximum input pulse | 406 |
| D120 | 432 ^{*1} | Pulse train torque command bias | 283 |
| D121 | 433 ^{*1} | Pulse train torque command gain | 283 |
| D200 | 15 | Jog frequency | 410 |
| D300 | 28 | Multi-speed input compensation selection | 411 |
| D301 | 4 | Multi-speed setting (high speed) <u>Simple</u> | 411 |
| D302 | 5 | Multi-speed setting (middle speed)Simple | 411 |
| D303 | 6 | Multi-speed setting (low speed) Simple | 411 |
| D304 to D307 | 24 to 27 | Multi-speed setting (speed 4 to speed 7) | 411 |
| D308 to D315 | 232 to 239 | Multi-speed setting (speed 8 to speed 15) | 411 |
| D400 | 804 | Torque command source selection | 283 |
| D401 | 805 | Torque command value (RAM) | 283 |
| D402 | 806 | Torque command value (RAM, EEPROM) | 283 |
| D403 | 1114 | Torque command reverse selection | 283 |

♦ H: Protective function parameter

Parameters to protect the motor and the inverter.

| Pr. group | Pr. | Name | Refer to page |
|-----------|-----|--|---------------------|
| Н000 | 9 | Electronic thermal O/L relay (Simple) | 415, 532, 551 |
| H001 | 600 | First free thermal reduction frequency 1 | 415 |
| H002 | 601 | First free thermal reduction ratio 1 | 415 |
| H003 | 602 | First free thermal reduction frequency 2 | 415 |
| H004 | 603 | First free thermal reduction ratio 2 | 415 |
| H005 | 604 | First free thermal reduction frequency 3 | 415 |
| H006 | 607 | Motor permissible load level | 415 |

| Pr. group | Pr. | Name | Refer to page |
|--------------|-------------------|---|------------------|
| | | | 415. |
| H010 | 51 | Second electronic thermal O/L relay | 532, |
| | | | 551 |
| H011 | 692 | Second free thermal reduction frequency 1 | 415 |
| | | Second free thermal reduction | |
| H012 | 693 | ratio 1 | 415 |
| H013 | 694 | Second free thermal reduction | 415 |
| 11010 | 004 | frequency 2 | 410 |
| H014 | 695 | Second free thermal reduction ratio 2 | 415 |
| | | Second free thermal reduction | |
| H015 | 696 | frequency 3 | 415 |
| H016 | 608 | Second motor permissible | 415 |
| 11010 | 000 | load level | 413 |
| H020 | 561 | PTC thermistor protection | 415 |
| | | PTC thermistor protection | |
| H021 | 1016 | detection time | 415 |
| H022 | 876 ^{*1} | Thermal protector input | 415 |
| H030 | 875 | Fault definition | 422 |
| H100 | 244 | Cooling fan operation | 423 |
| птоо | 244 | selection | 423 |
| H101 | 249 | Earth (ground) fault detection at start | 425 |
| H102 | 598 | Undervoltage level | 425 |
| H103 | 997 | Fault initiation | 425 |
| | | Cooling fan operation | |
| H106 | 244 | selection during the test | 423 |
| | | operation | |
| H200 | 251 | Output phase loss protection selection | 426 |
| | *4 | Input phase loss protection | |
| H201 | 872 ^{*4} | selection | 426 |
| H300 | 65 | Retry selection | 426 |
| H301 | 67 | Number of retries at fault | 426 |
| H302 | 68 | Retry waiting time | 426 |
| H303 | 69 | Retry count display erase | 426 |
| H400 | 1 | Maximum frequency Simple | 428 |
| H401 | 2 | Minimum frequency (Simple) | 428 |
| 11-101 | _ | High speed maximum | 720 |
| H402 | 18 | frequency | 428 |
| H410 | 807 | Speed limit selection | 287 |
| H411 | 808 | Forward rotation speed limit/ | 287 |
| | | speed limit | |
| H412 | 809 | Reverse rotation speed limit/ reverse-side speed limit | 287 |
| H414 | 1113 | Speed limit method selection | 287 |
| H415 | 873 ^{*1} | Speed limit | 269 |
| | | Speed deviation excess | 269, |
| H416 | 285 | detection frequency | 736 |
| H417 | 853 ^{*1} | Speed deviation time | 269 |
| H420 | 31 | Frequency jump 1A | 429 |
| H421 | 32 | Frequency jump 1B | 429 |
| H422 | 33 | Frequency jump 2A | 429 |
| H423 | 34 | Frequency jump 2A | 429 |
| H424 H425 | 35 36 | Frequency jump 3A Frequency jump 3B | 429 429 |
| H429 | 552 | Frequency jump range | 429 |
| 20 | | squarray jump runge | 0 |

| Pr. group | Pr. | Name | Refer to page |
|-----------|------|---|------------------|
| H500 | 22 | Stall prevention operation | 245, |
| | | level (Torque limit level) Stall prevention operation | 431 |
| H501 | 156 | selection | 431 |
| H520 | 1480 | Load characteristics measurement mode | 439 |
| H521 | 1481 | Load characteristics load reference 1 | 439 |
| H522 | 1482 | Load characteristics load reference 2 | 439 |
| H523 | 1483 | Load characteristics load reference 3 | 439 |
| H524 | 1484 | Load characteristics load reference 4 | 439 |
| H525 | 1485 | Load characteristics load reference 5 | 439 |
| H526 | 1486 | Load characteristics maximum frequency | 439 |
| H527 | 1487 | Load characteristics minimum frequency | 439 |
| H531 | 1488 | Upper limit warning detection width | 439 |
| H532 | 1489 | Lower limit warning detection width | 439 |
| H533 | 1490 | Upper limit fault detection width | 439 |
| H534 | 1491 | Lower limit fault detection width | 439 |
| H535 | 1492 | Load status detection signal delay time / load reference measurement waiting time | 439 |
| H600 | 48 | Second stall prevention operation level | 431 |
| H601 | 49 | Second stall prevention operation frequency | 431 |
| H602 | 114 | Third stall prevention operation level | 431 |
| H603 | 115 | Third stall prevention operation frequency | 431 |
| H610 | 23 | Stall prevention operation level compensation factor at double speed | 431 |
| H611 | 66 | Stall prevention operation reduction starting frequency | 431 |
| H620 | 148 | Stall prevention level at 0 V input | 431 |
| H621 | 149 | Stall prevention level at 10 V input | 431 |
| H631 | 154 | Voltage reduction selection during stall prevention operation | 431 |
| H700 | 810 | Torque limit input method selection | 245 |
| H701 | 812 | Torque limit level (regeneration) | 245 |
| H702 | 813 | Torque limit level (3rd quadrant) | 245 |
| H703 | 814 | Torque limit level (4th quadrant) | 245 |
| H704 | 801 | Output limit level | 245, 283 |
| H710 | 815 | Torque limit level 2 | 245 |
| H720 | 816 | Torque limit level during acceleration | 245 |

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| H721 | 817 | Torque limit level during deceleration | 245 |
| H730 | 874 | OLT level setting | 245 |
| H800 | 374 | Overspeed detection level | 443 |
| H881 | 690 | Deceleration check time | 270 |

♦ M: Monitoring and its output signal

Parameters for the settings regarding the monitoring to check the inverter's operating status and the output signals for the monitoring.

| Pr. group | Pr. | Name | Refer to page |
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| M000 | 37 | Speed display | 444 |
| M001 | 505 | Speed setting reference | 444 |
| M002 | 144 | Speed setting switchover | 444 |
| M020 | 170 | Watt-hour meter clear | 446 |
| M021 | 563 | Energization time carrying- over times | 446 |
| M022 | 268 | Monitor decimal digits selection | 446 |
| M023 | 891 | Cumulative power monitor digit shifted times | 446, 467 |
| M030 | 171 | Operation hour meter clear | 446 |
| M031 | 564 | Operating time carrying-over times | 446 |
| M040 | 55 | Frequency monitoring reference | 457 |
| M041 | 56 | Current monitoring reference | 457 |
| M042 | 866 | Torque monitoring reference | 457 |
| M043 | 241 | Analog input display unit switchover | 505 |
| M044 | 290 | Monitor negative output selection | 446, 457 |
| M045 | 1018 | Monitor with sign selection | 446 |
| M050 | 1106 | Torque monitor filter | 446 |
| M051 | 1107 | Running speed monitor filter | 446 |
| M052 | 1108 | Excitation current monitor filter | 446 |
| M060 | 663 | Control circuit temperature signal output level | 494 |
| M100 | 52 | Operation panel main monitor selection | 446 |
| M101 | 774 | Operation panel monitor selection 1 | 446 |
| M102 | 775 | Operation panel monitor selection 2 | 446 |
| M103 | 776 | Operation panel monitor selection 3 | 446 |
| M104 | 992 | Operation panel setting dial push monitor selection | 457, 446 |
| M200 | 892 | Load factor | 467 |
| M201 | 893 | Energy saving monitor reference (motor capacity) | 467 |
| M202 | 894 | Control selection during commercial power-supply operation | 467 |
| M203 | 895 | Power saving rate reference value | 467 |
| M204 | 896 | Power unit cost | 467 |

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| M205 | 897 | Power saving monitor average time | 467 |
| M206 | 898 | Power saving cumulative monitor clear | 467 |
| M207 | 899 | Operation time rate (estimated value) | 467 |
| M300 | 54 | FM/CA terminal function selection | 457 |
| M301 | 158 | AM terminal function selection | 457 |
| M310 | C0 (900)*2 | FM/CA terminal calibration | 463 |
| M320 | C1 (901) ^{*2} | AM terminal calibration | 463 |
| M321 | 867 | AM output filter | 463 |
| M330 | C8 (930) ^{*2} | Current output bias signal | 463 |
| M331 | C9 (930) ^{*2} | Current output bias current | 463 |
| M332 | C10 (931) ^{*2} | Current output gain signal | 463 |
| M333 | C11 (931) ^{*2} | Current output gain current | 463 |
| M334 | 869 | Current output filter | 463 |
| M400 | 190 | RUN terminal function selection | 473 |
| M401 | 191 | SU terminal function selection | 473 |
| M402 | 192 | IPF terminal function selection | 473 |
| M403 | 193 | OL terminal function selection | 473 |
| M404 | 194 | FU terminal function selection | 473 |
| M405 | 195 | ABC1 terminal function selection | 473 |
| M406 | 196 | ABC2 terminal function selection | 473 |
| M410 | 313 ^{*5*6} | DO0 output selection | 473 |
| M411 | 314 ^{*5*6} | DO1 output selection | 473 |
| M412 | 315 ^{*5*6} | DO2 output selection | 473 |
| M413 | 316 ^{*5} | DO3 output selection | 473 |
| M414 | 317 ^{*5} | DO4 output selection | 473 |
| M415 | 318 ^{*5} | DO5 output selection | 473 |
| M416 | 319 ^{*5} | DO6 output selection | 473 |
| M420 | 320 ^{*5} | RA1 output selection | 473 |
| M421 | 321 ^{*5} | RA2 output selection | 473 |
| M422 | 322 ^{*5} | RA3 output selection | 473 |
| M430 | 157 | OL signal output timer | 245, |
| M431 | 289 | Inverter output terminal filter | 431 473 |
| M433 | 166 | Output current detection signal retention time | 487 |
| M440 | 870 | Speed detection hysteresis | 484 |
| M441 | 41 | Up-to-frequency sensitivity | 484 |
| M442 | 42 | Output frequency detection | 484 |
| M443 | 43 | Output frequency detection for reverse rotation | 484 |
| M444 | 50 | Second output frequency detection | 484 |
| M445 | 116 | Third output frequency detection | 488, 484 |
| M446 | 865 | Low speed detection | 484 |
| M460 | 150 | Output current detection level | 487 |

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| M461 | 151 | Output current detection signal delay time | 487 |
| M462 | 152 | Zero current detection level | 487 |
| M463 | 153 | Zero current detection time | 487 |
| M464 | 167 | Output current detection operation selection | 487 |
| M470 | 864 | Torque detection | 488 |
| M500 | 495 | Remote output selection | 489 |
| M501 | 496 | Remote output data 1 | 489 |
| M502 | 497 | Remote output data 2 | 489 |
| M510 | 76 | Fault code output selection | 492 |
| M520 | 799 | Pulse increment setting for output power | 493 |
| M530 | 655 | Analog remote output selection | 490 |
| M531 | 656 | Analog remote output 1 | 490 |
| M532 | 657 | Analog remote output 2 | 490 |
| M533 | 658 | Analog remote output 3 | 490 |
| M534 | 659 | Analog remote output 4 | 490 |
| M600 | 863 ^{*1} | Control terminal option- Encoder pulse division ratio | 495 |
| M601 | 413 ^{*1} | Encoder pulse division ratio | 495 |
| M610 | 635 ^{*1} | Cumulative pulse clear signal selection | 321 |
| M611 | 636 ^{*1} | Cumulative pulse division scaling factor | 321 |
| M612 | 637 ^{*1} | Control terminal option- Cumulative pulse division scaling factor | 321 |
| M613 | 638 ^{*1} | Cumulative pulse storage | 321 |

♦ T: Multi-function input terminal parameters

Parameters for the setting of the input terminals via which commands are given to the inverter.

| Pr. group | Pr. | Name | Refer to page |
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| T000 | 73 | Analog input selection | 496, 501 |
| T001 | 267 | Terminal 4 input selection | 496 |
| T002 | 74 | Input filter time constant | 503 |
| T003 | 822 | Speed setting filter 1 | 503 |
| T004 | 826 | Torque setting filter 1 | 503 |
| T005 | 832 | Speed setting filter 2 | 503 |
| T006 | 836 | Torque setting filter 2 | 503 |
| T007 | 849 | Analog input offset adjustment | 503 |
| T010 | 868 | Terminal 1 function assignment | 245, 431, 500 |
| T021 | 242 | Terminal 1 added compensation amount (terminal 2) | 501 |
| T022 | 125 | Terminal 2 frequency setting gain frequency Simple | 505 |
| T040 | 858 | Terminal 4 function assignment | 245, 431, 500 |
| T041 | 243 | Terminal 1 added compensation amount (terminal 4) | 501 |

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| | | Terminal 4 frequency setting | |
| T042 | 126 | gain frequency Simple | 505 |
| T050 | 252 | Override bias | 501 |
| T051 | 253 | Override gain | 501 |
| T052 | 573 | 4 mA input check selection | 517 |
| T053 | 777 | 4 mA input fault operation frequency | 517 |
| T054 | 778 | 4 mA input check filter | 517 |
| T100 | C12 (917) ^{*2} | Terminal 1 bias frequency (speed) | 505 |
| T101 | C13 (917) ^{*2} | Terminal 1 bias (speed) | 505 |
| T102 | C14 (918) ^{*2} | Terminal 1 gain frequency (speed) | 505 |
| T103 | C15 (918) ^{*2} | Terminal 1 gain (speed) | 505 |
| T110 | C16 (919) ^{*2} | Terminal 1 bias command (torque/magnetic flux) | 510 |
| T111 | C17 (919) ^{*2} | Terminal 1 bias (torque/ magnetic flux) | 510 |
| T112 | C18 (920) ^{*2} | Terminal 1 gain command (torque/magnetic flux) | 510 |
| T113 | C19 (920) ^{*2} | Terminal 1 gain (torque/ magnetic flux) | 510 |
| T200 | C2 (902) ^{*2} | Terminal 2 frequency setting bias frequency | 505 |
| T201 | C3 (902) ^{*2} | Terminal 2 frequency setting bias | 505 |
| T202 | 125 (903) ^{*2} | Terminal 2 frequency setting gain frequency | 505 |
| T203 | C4 (903) ^{*2} | Terminal 2 frequency setting gain | 505 |
| T400 | C5 (904) ^{*2} | Terminal 4 frequency setting bias frequency | 505 |
| T401 | C6 (904) ^{*2} | Terminal 4 frequency setting bias | 505 |
| T402 | 126 (905) ^{*2} | Terminal 4 frequency setting gain frequency | 505 |
| T403 | C7 (905) ^{*2} | Terminal 4 frequency setting gain | 505 |
| T410 | C38 (932) ^{*2} | Terminal 4 bias command (torque/magnetic flux) | 510 |
| T411 | C39 (932) ^{*2} | Terminal 4 bias (torque/ magnetic flux) | 510 |
| T412 | C40 (933) ^{*2} | Terminal 4 gain command (torque/magnetic flux) | 510 |
| T413 | C41 (933) ^{*2} | Terminal 4 gain (torque/ magnetic flux) | 510 |
| T700 | 178 | STF terminal function selection | 521 |
| T701 | 179 | STR terminal function selection | 521 |
| T702 | 180 | RL terminal function selection | 521 |
| T703 | 181 | RM terminal function selection | 521 |
| T704 | 182 | RH terminal function selection | 521 |
| T705 | 183 | RT terminal function selection AU terminal function selection | 521 |
| T706 | 184 | JOG terminal function selection | 521 |
| T707 | 185 | selection | 521 |

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| T708 | 186 | CS terminal function selection | 521 |
| T709 | 187 | MRS terminal function selection | 521 |
| T710 | 188 | STOP terminal function selection | 521 |
| T711 | 189 | RES terminal function selection | 521 |
| T720 | 17 | MRS input selection | 524 |
| T721 | 599 | X10 terminal input selection | 724 |
| T722 | 606 | Power failure stop external signal input selection | 642 |
| T730 | 155 | RT signal function validity condition selection | 525 |
| T740 | 699 | Input terminal filter | 521 |

♦ C: Motor constant parameters

Parameters for the applied motor setting.

| Pr. group | Pr. | Name | Refer to page |
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| C000 | 684 | Tuning data unit switchover | 532, 551 |
| C100 | 71 | Applied motor | 528, 532 |
| C101 | 80 | Motor capacity | 221, 532, 551 |
| C102 | 81 | Number of motor poles | 221, 532, 551 |
| C103 | 9 | Rated motor current Simple | 415, 532, 551 |
| C104 | 83 | Rated motor voltage | 221, 532, 551 |
| C105 | 84 | Rated motor frequency | 221, 532, 551 |
| C106 | 702 | Maximum motor frequency | 551 |
| C107 | 707 | Motor inertia (integer) | 551 |
| C108 | 724 | Motor inertia (exponent) | 551 |
| C110 | 96 | Auto tuning setting/status | 532, 551, 638 |
| C111 | 95 | Online auto tuning selection | 558 |
| C112 | 818 | Easy gain tuning response level setting | 254 |
| C113 | 819 | Easy gain tuning selection | 254 |
| C114 | 880 | Load inertia ratio | 254, 263 |
| C120 | 90 | Motor constant (R1) | 532, 551, 638 |
| C121 | 91 | Motor constant (R2) | 532 |
| C122 | 92 | Motor constant (L1)/d-axis inductance (Ld) | 532, 551 |
| C123 | 93 | Motor constant (L2)/q-axis inductance (Lq) | 532, 551 |
| C124 | 94 | Motor constant (X) | 532 |
| C125 | 82 | Motor excitation current | 532 |
| C126 | 859 | Torque current/Rated PM motor current | 532, 551 |

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| C130 | 706 | Induced voltage constant (phi f) | 551 |
| C131 | 711 | Motor Ld decay ratio | 551 |
| C132 | 712 | Motor Lq decay ratio | 551 |
| C133 | 725 | Motor protection current level | 551 |
| C135 | 1412 | Motor induced voltage constant (phi f) exponent | 551 |
| C140 | 369 ^{*1} | Number of encoder pulses | 94, 585, 736 |
| C141 | 359 ^{*1} | Encoder rotation direction | 94, 585, 736 |
| C142 | 373 ^{*1} | Encoder position tuning setting/status | 542 |
| C143 | 1105 ^{*1} | Encoder magnetic pole position offset | 542 |
| C148 | 376 ^{*1} | Encoder signal loss detection enable/disable selection | 561 |
| C150 | 1002 | Lq tuning target current adjustment coefficient | 551 |
| C182 | 717 | Starting resistance tuning compensation | 551 |
| C185 | 721 | Starting magnetic pole position detection pulse width | 551 |
| C200 | 450 | Second applied motor | 528 |
| C201 | 453 | Second motor capacity | 532, 551 |
| C202 | 454 | Number of second motor poles | 532, 551 |
| C203 | 51 | Rated second motor current | 415, 532, 551 |
| C204 | 456 | Rated second motor voltage | 532, 551 |
| C205 | 457 | Rated second motor frequency | 532, 551 |
| C206 | 743 | Second motor maximum frequency | 551 |
| C207 | 744 | Second motor inertia (integer) | 551 |
| C208 | 745 | Second motor inertia (exponent) | 551 |
| C210 | 463 | Second motor auto tuning setting/status | 532, 551, 638 |
| C211 | 574 | Second motor online auto tuning | 558 |
| C220 | 458 | Second motor constant (R1) | 532, 551, 638 |
| C221 | 459 | Second motor constant (R2) | 532 |
| C222 | 460 | Second motor constant (L1) / d-axis inductance (Ld) | 532, 551 |
| C223 | 461 | Second motor constant (L2) / q-axis inductance (Lq) | 532, 551 |
| C224 | 462 | Second motor constant (X) | 532 |
| C225 | 455 | Second motor excitation current | 532 |
| C226 | 860 | Second motor torque current/ Rated PM motor current | 532, 551 |
| C230 | 738 | Second motor induced voltage constant (phi f) | 551 |
| C231 | 739 | Second motor Ld decay ratio | 551 |
| C232 | 740 | Second motor Lq decay ratio | 551 |
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| C233 | 746 | Second motor protection current level | 551 |
| C235 | 1413 | Second motor induced voltage constant (phi f) exponent | 551 |
| C240 | 851 ^{*1} | Control terminal option- Number of encoder pulses | 94 |
| C241 | 852 ^{*1} | Control terminal option- Encoder rotation direction | 94 |
| C242 | 862 ^{*1} | Encoder option selection | 226 |
| C243 | 871 ^{*1} | Control terminal option— Encoder position tuning setting/status | 542 |
| C244 | 887 ^{*1} | Control terminal option— Encoder magnetic pole position offset | 542 |
| C248 | 855 ^{*1} | Control terminal option-Signal loss detection enable/disable selection | 561 |
| C282 | 741 | Second starting resistance tuning compensation | 551 |
| C285 | 742 | Second motor magnetic pole detection pulse width | 551 |

♦ A: Application parameters

Parameters for the setting of a specific application.

| Pr. group | Pr. | Name | Refer to page |
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| A000 | 135 | Electronic bypass sequence selection | 563 |
| A001 | 136 | MC switchover interlock time | 563 |
| A002 | 137 | Start waiting time | 563 |
| A003 | 138 | Bypass selection at a fault | 563 |
| A004 | 139 | Automatic switchover frequency from inverter to bypass operation | 563 |
| A005 | 159 | Automatic switchover frequency range from bypass to inverter operation | 563 |
| A006 | 248 | Self power management selection | 569 |
| A007 | 254 | Main circuit power OFF waiting time | 569 |
| A100 | 278 | Brake opening frequency | 572 |
| A101 | 279 | Brake opening current | 572 |
| A102 | 280 | Brake opening current detection time | 572 |
| A103 | 281 | Brake operation time at start | 572 |
| A104 | 282 | Brake operation frequency | 572 |
| A105 | 283 | Brake operation time at stop | 572 |
| A106 | 284 | Deceleration detection function selection | 572 |
| A107 | 285 | Overspeed detection frequency | 572 |
| A108 | 639 | Brake opening current selection | 572 |
| A109 | 640 | Brake operation frequency selection | 572 |
| | | Automatic acceleration/ | 384, |
| A110 | A110 292 | deceleration | 387, |
| 4400 | 0.40 | Occupation to the second secon | 572 |
| A120 | 642 | Second brake opening frequency | 572 |
| A121 | 643 | Second brake opening current | 572 |
| A122 | 644 | Second brake opening current detection time | 572 |

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| A123 | 645 | Second brake operation time at start | 572 |
| A124 | 646 | Second brake operation frequency | 572 |
| A125 | 647 | Second brake operation time at stop | 572 |
| A126 | 648 | Second deceleration detection function selection | 572 |
| A128 | 650 | Second brake opening current selection | 572 |
| A129 | 651 | Second brake operation frequency selection | 572 |
| A130 | 641 | Second brake sequence operation selection | 572 |
| A170 | 1410 | Starting times lower 4 digits | 576 |
| A171 | 1411 | Starting times upper 4 digits | 576 |
| A200 | 270 | Stop-on contact/load torque high- | 577, |
| | 0 | speed frequency control selection | 580 |
| A201 | 271 | High-speed setting maximum current | 580 |
| A202 | 272 | Middle-speed setting minimum current | 580 |
| A203 | 273 | Current averaging range | 580 |
| A204 | 274 | Current averaging filter time constant | 580 |
| A205 | 275 | Stop-on contact excitation current low-speed scaling factor | 577 |
| A206 | 276 | PWM carrier frequency at stop-on contact | 577 |
| A300 | 592 | Traverse function selection | 582 |
| A301 | 593 | Maximum amplitude amount | 582 |
| A302 | 594 | Amplitude compensation amount during deceleration | 582 |
| A303 | 595 | Amplitude compensation amount during acceleration | 582 |
| A304 | 596 | Amplitude acceleration time | 582 |
| A305 | 597 | Amplitude deceleration time | 582 |
| A310 | 1072 | DC brake judgment time for anti- sway control operation | 584 |
| A311 | 1073 | Anti-sway control operation selection | 584 |
| A312 | 1074 | Anti-sway control frequency | 584 |
| A313 | 1075 | Anti-sway control depth | 584 |
| A314 | 1076 | Anti-sway control width | 584 |
| A315 | 1077 | Rope length | 584 |
| A316 | 1078 | Trolley weight | 584 |
| A317 | 1079 | Load weight | 584 |
| A510 | 350 ^{*1} | Stop position command selection | 585 |
| A511 | 360 ^{*1} | 16-bit data selection | 585 |
| A512 | 361 ^{*1} | Position shift | 585 |
| A520 | 362 ^{*1} | Orientation position loop gain | 585 |
| A521 | 363 ^{*1} | Completion signal output delay time | 585 |
| A522 | 364 ^{*1} | Encoder stop check time | 585 |
| A523 | 365 ^{*1} | Orientation limit | 585 |
| A524 | 366 ^{*1} | Recheck time | 585 |
| | | | |
| A525 | 393 ^{*1} | Orientation selection | 585 |
| A526 | 351 ^{*1} | Orientation speed | 585 |
| A527 | 352 ^{*1} | Creep speed | 585 |
| A528 | 353 ^{*1} | Creep switchover position | 585 |

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| group A529 | 354 ^{*1} | Position loop switchever position | to page |
| | | Position loop switchover position | |
| A530 | 355 ^{*1} | DC injection brake start position | 585 |
| A531 | 356 ^{*1} | Internal stop position command | 585 |
| A532 | 357 ^{*1} | Orientation in-position zone | 585 |
| A533 | 358 ^{*1} | Servo torque selection | 585 |
| A540 | 394 ^{*1} | Number of machine side gear teeth | 585 |
| A541 | 395 ^{*1} | Number of motor side gear teeth | 585 |
| A542 | 396 ^{*1} | Orientation speed gain (P term) | 585 |
| A543 | 397 ^{*1} | Orientation speed integral time | 585 |
| A544 | 398 ^{*1} | Orientation speed gain (D term) | 585 |
| A545 | 399 ^{*1} | Orientation deceleration ratio | 585 |
| - 10 10 | | Number of machine end encoder | |
| A546 | 829 ^{*1} | pulses | 585 |
| A600 | 759 | PID unit selection | 615 |
| A601 | 131 | PID upper limit | 601, |
| | | | 622 |
| A602 | 132 | PID lower limit | 601, 622 |
| A603 | 553 | PID deviation limit | 601 |
| A604 | 554 | PID signal operation selection | 601 |
| A605 | 1134 | PID upper limit manipulated value | 622 |
| A606 | 1135 | PID lower limit manipulated value | 622 |
| A607 | 1015 | Integral stop selection at limited frequency | 601 |
| A610 | 128 | PID action selection | 601, 622 |
| A611 | 133 | PID action set point | 601, 622 |
| A612 | 127 | PID control automatic switchover frequency | 601 |
| A613 | 129 | PID proportional band | 601, 622 |
| A614 | 130 | PID integral time | 601, 622 |
| A615 | 134 | PID differential time | 601, 622 |
| A616 | 760 | Pre-charge fault selection | 618 |
| A617 | 761 | Pre-charge ending level | 618 |
| A618 | 762 | Pre-charge ending time | 618 |
| A619 | 763 | Pre-charge upper detection level | 618 |
| A620 | 764 | Pre-charge time limit | 618 |
| A621 | 575 | Output interruption detection time | 601 |
| A622 | 576 | Output interruption detection level | 601 |
| A623 | 577 | Output interruption cancel level | 601 |
| A624 | 609 | PID set point/deviation input selection | 601, 622 |
| A625 | 610 | PID measured value input selection | 601, 622 |
| A630 | C42 (934) ^{*2} | PID display bias coefficient | 615 |
| A631 | C43 (934) ^{*2} | PID display bias analog value | 615 |
| A632 | C44 (935) ^{*2} | PID display gain coefficient | 615 |
| A633 | C45 (935) ^{*2} | PID display gain analog value | 615 |
| A640 | 1142 | Second PID unit selection | 601 |
| A641 | 1143 | Second PID upper limit | 601 |
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| B175 | 1277 | Fourteenth positioning sub- function | 303 |
| B176 | 1278 | Fifteenth positioning acceleration time | 303 |
| B177 | 1279 | Fifteenth positioning deceleration time | 303 |
| B178 | 1280 | Fifteenth positioning dwell time | 303 |
| B179 | 1281 | Fifteenth positioning sub- function | 303 |
| B180 | 1282 | Home position return method selection | 303 |
| B181 | 1283 | Home position return speed | 303 |
| B182 | 1284 | Home position return shifting speed | 303 |
| B183 | 1285 | Home position shift amount lower 4 digits | 303 |

| Pr. group | Pr. | Name | Refer to page |
|-----------|------|---|------------------|
| B184 | 1286 | Home position shift amount upper 4 digits | 303 |
| B185 | 1287 | Travel distance after proximity dog ON lower 4 digits | 303 |
| B186 | 1288 | Travel distance after proximity dog ON upper 4 digits | 303 |
| B187 | 1289 | Home position return stopper torque | 303 |
| B188 | 1290 | Home position return stopper waiting time | 303 |
| B190 | 1292 | Position control terminal input selection | 303 |
| B191 | 1293 | Roll feeding mode selection | 303 |
| B192 | 1294 | Position detection lower 4 digits | 327 |
| B193 | 1295 | Position detection upper 4 digits | 327 |
| B194 | 1296 | Position detection selection | 327 |
| B195 | 1297 | Position detection hysteresis width | 327 |

♦ N: Communication operation parameters

Parameters for the setting of communication operation such as the communication specifications or operating characteristics.

| Pr. group | Pr. | Name | Refer to page |
|-----------|-------------------|--|------------------|
| N000 | 549 | Protocol selection | 663 |
| N001 | 342 | Communication EEPROM write selection | 663 |
| N002 | 539 | MODBUS RTU communication check time interval | 686 |
| N010 | 349 ^{*6} | Communication reset selection | 663 |
| N011 | 500 ^{*6} | Communication error execution waiting time | 663 |
| N012 | 501 ^{*6} | Communication error occurrence count display | 663 |
| N013 | 502 | Stop mode selection at communication error | 663 |
| N014 | 779 | Operation frequency during communication error | 663 |
| N020 | 117 | PU communication station number | 670 |
| N021 | 118 | PU communication speed | 670 |
| N022 | 119 | PU communication data length | 670 |
| N023 | 119 | PU communication stop bit length | 670 |
| N024 | 120 | PU communication parity check | 670 |
| N025 | 121 | PU communication retry count | 670 |
| N026 | 122 | PU communication check time interval | 670 |
| N027 | 123 | PU communication waiting time setting | 670 |
| N028 | 124 | PU communication CR/LF selection | 670 |
| N030 | 331 | RS-485 communication station number | 670 |
| N031 | 332 | RS-485 communication speed | 670 |

| Pr. group | Pr. | Name | Refer to page |
|-------------------------------------|-------------------------------------|--|------------------|
| N032 | 333 | RS-485 communication data length | 670 |
| N033 | 333 | RS-485 communication stop bit length | 670 |
| N034 | 334 | RS-485 communication parity check selection | 670 |
| N035 | 335 | RS-485 communication retry count | 670 |
| N036 | 336 | RS-485 communication check time interval | 670 |
| N037 | 337 | RS-485 communication waiting time setting | 670 |
| N038 | 341 | RS-485 communication CR/LF selection | 670 |
| N040 | 547 | USB communication station number | 701 |
| N041 | 548 | USB communication check time interval | 701 |
| N080 | 343 | Communication error count | 686 |
| N100 | 541 ^{*6} | Frequency command sign selection | 699 |
| N110 | 434 ^{*6} | Network number (CC-Link IE) | 699 |
| N111 | 435 ^{*6} | Station number (CC-Link IE) | 699 |
| N240 | 349 ^{*6} | Ready bit status selection | 663 |
| N241 | 349 ^{*6} | Reset selection after inverter faults are cleared | 893 |
| N242 | 349 ^{*6} | DriveControl writing restriction selection | 893 |
| N500 to N543, N550 to N559 | 1300 to 1343, 1350 to 1359 | Communication option parameters For details, refer to the Instruction of the option. | |

♦ G: Control parameters

Parameters for motor control.

| Pr. group | Pr. | Name | Refer to page |
|-----------|-----|--|------------------|
| G000 | 0 | Torque boost <u>Simple</u> | 706 |
| G001 | 3 | Base frequency Simple | 707 |
| G002 | 19 | Base frequency voltage | 707 |
| G003 | 14 | Load pattern selection | 708 |
| G010 | 46 | Second torque boost | 706 |
| G011 | 47 | Second V/F (base frequency) | 707 |
| G020 | 112 | Third torque boost | 706 |
| G021 | 113 | Third V/F (base frequency) | 707 |
| G030 | 60 | Energy saving control selection | 712 |
| G040 | 100 | V/F1 (first frequency) | 713 |
| G041 | 101 | V/F1 (first frequency voltage) | 713 |
| G042 | 102 | V/F2 (second frequency) | 713 |
| G043 | 103 | V/F2 (second frequency voltage) | 713 |
| G044 | 104 | V/F3 (third frequency) | 713 |
| G045 | 105 | V/F3 (third frequency voltage) | 713 |
| G046 | 106 | V/F4 (fourth frequency) | 713 |
| G047 | 107 | V/F4 (fourth frequency voltage) | 713 |
| G048 | 108 | V/F5 (fifth frequency) | 713 |
| G049 | 109 | V/F5 (fifth frequency voltage) | 713 |
| G060 | 673 | SF-PR slip amount adjustment operation selection | 714 |

| Pr. group | Pr. | Name | Refer |
|--------------|--------------------------|---|---------|
| G061 | 674 | SF-PR slip amount adjustment | to page |
| G001 | 074 | gain | 7 14 |
| G080 | 617 | Reverse rotation excitation | 711 |
| GUOU | 017 | current low-speed scaling factor | 711 |
| G100 | 10 | DC injection brake operation | 715 |
| G 100 | 10 | frequency | 7 15 |
| G101 | 11 | DC injection brake operation time | 715 |
| G102 | 802 | Pre-excitation selection | 715 |
| G103 | 850 | Brake operation selection | 715 |
| G105 | 522 | Output stop frequency | 720 |
| G106 | 250 | Stop selection | 722 |
| G107 | 70 ^{*3} | Special regenerative brake duty | 724 |
| | | Second pre-excitation | |
| G108 | 1299 | selection | 715 |
| G110 | 12 | DC injection brake operation | 715 |
| 0110 | 12 | voltage | 710 |
| G120 | 882 | Regeneration avoidance operation selection | 732 |
| 0464 | 000 | Regeneration avoidance | 700 |
| G121 | 883 | operation level | 732 |
| | | Regeneration avoidance at | |
| G122 | 884 | deceleration detection sensitivity | 732 |
| | | Regeneration avoidance | |
| G123 | 885 | compensation frequency limit | 732 |
| | | value | |
| G124 | 886 | Regeneration avoidance voltage gain | 732 |
| G125 | CCE | Regeneration avoidance | 722 |
| G125 | 665 | frequency gain | 732 |
| G130 | 660 | Increased magnetic excitation deceleration operation | 735 |
| G 130 | 000 | selection | 733 |
| G131 | 661 | Magnetic excitation increase | 735 |
| 0101 | 001 | rate | 700 |
| G132 | 662 | Increased magnetic excitation current level | 735 |
| G200 | 800 | Control method selection | 221 |
| G201 | 85 | Excitation current break point | 711 |
| G202 | 86 | Excitation current low-speed | 711 |
| G203 | | scaling factor | |
| | 245 | Rated slip Slip compensation time | 736 |
| G204 | 246 | constant | 736 |
| G205 | 247 | Constant output range slip | 736 |
| | | compensation selection | |
| G206 | 1116 | Constant output range speed control P gain compensation | 254 |
| G210 | 803 | Constant output range torque | 245, |
| | | characteristic selection | 283 |
| G211 | 820 | Speed control P gain 1 | 254 |
| G212 | 821 | Speed control integral time 1 Torque control P gain 1 | 254 |
| G213 | 824 | (current loop proportional | 294, |
| | | gain) | 333 |
| G214 | 825 | Torque control integral time 1 | 294, |
| | | (current loop integral time) | 333 |
| G215 | 823 ^{*1} 827 | Speed detection filter 1 | 332 |
| G216 G217 | 82 <i>1</i> 854 | Torque detection filter 1 Excitation ratio | 332 |
| 92 11 | JU-7 | =ASILULION IULIO | 002 |

| Pr. group | Pr. | Name | Refer to page |
|-----------|-------------------|--|------------------|
| G218 | 1115 | Speed control integral term clear time | 254 |
| G220 | 877 | Speed feed forward control/ model adaptive speed control selection | 263 |
| G221 | 878 | Speed feed forward filter | 263 |
| G222 | 879 | Speed feed forward torque limit | 263 |
| G223 | 881 | Speed feed forward gain | 263 |
| G224 | 828 | Model speed control gain | 263 |
| G230 | 840 | Torque bias selection | 265 |
| G231 | 841 | Torque bias 1 | 265 |
| G232 | 842 | Torque bias 2 | 265 |
| G233 | 843 | Torque bias 3 | 265 |
| G234 | 844 | Torque bias filter | 265 |
| G235 | 845 | Torque bias operation time Torque bias balance | 265 |
| G236 | 846 | compensation | 265 |
| G237 | 847 | Fall-time torque bias terminal 1 bias | 265 |
| G238 | 848 | Fall-time torque bias terminal 1 gain | 265 |
| G240 | 367 ^{*1} | Speed feedback range | 736 |
| G241 | 368 ^{*1} | Feedback gain | 736 |
| G250 | 788 | Low speed range torque characteristic selection | 233 |
| G260 | 1121 | Per-unit speed control reference frequency | 254 |
| G261 | 1117 | Speed control P gain 1 (per- unit system) | 254 |
| G262 | 1119 | Model speed control gain (per- unit system) | 263 |
| G263 | 1348 | P/PI control switchover frequency | 254 |
| G264 | 1349 | Emergency stop operation selection | 367 |
| G300 | 451 | Second motor control method selection | 221 |
| G301 | 565 | Second motor excitation current break point | 711 |
| G302 | 566 | Second motor excitation current low-speed scaling factor | 711 |
| G311 | 830 | Speed control P gain 2 | 254 |
| G312 | 831 | Speed control integral time 2 | 254 |
| G313 | 834 | Torque control P gain 2 (current loop proportional gain) | 294 |
| G314 | 835 | Torque control integral time 2 (current loop integral time) | 294 |
| G315 | 833 ^{*1} | Speed detection filter 2 | 332 |
| G316 | 837 | Torque detection filter 2 | 332 |
| G350 | 747 | Second motor low-speed range torque characteristic selection | 233 |
| G361 | 1118 | Speed control P gain 2 (per- unit system) | 254 |
| G400 | 286 | Droop gain | 738 |
| G401 | 287 | Droop filter time constant | 738 |
| G402 | 288 | Droop function activation selection | 738 |
| G403 | 994 | Droop break point gain | 738 |

| Pr. group | Pr. | Name | Refer to page |
|-----------|------|--|------------------|
| G404 | 995 | Droop break point torque | 738 |
| G410 | 653 | Speed smoothing control | 741 |
| G411 | 654 | Speed smoothing cutoff frequency | 741 |
| G420 | 679 | Second droop gain | 738 |
| G421 | 680 | Second droop filter time constant | 738 |
| G422 | 681 | Second droop function activation selection | 738 |
| G423 | 682 | Second droop break point gain | 738 |
| G424 | 683 | Second droop break point torque | 738 |
| G601 | 1003 | Notch filter frequency | 271 |
| G602 | 1004 | Notch filter depth | 271 |
| G603 | 1005 | Notch filter width | 271 |

| Pr. group | Pr. | Name | Refer to page |
|-----------|-----|--|------------------|
| G932 | 89 | Speed control gain (Advanced magnetic flux vector) | 228 |
| G942 | 569 | Second motor speed control gain | 228 |

- $^{\star}1$ The setting is available when a plug-in option for Vector control is installed.
- *2 On the LCD operation panel or the parameter unit used as the command source, the parameter number in parentheses appears instead of that starting with the letter C.
- *3 The setting is available for the standard model.
- *4 The setting is available for the standard model and the IP55 compatible model.
- *5 The setting is available when the PLC function is enabled.
- *6 The setting is available for the FR-A800-GF or when a compatible plug-in option is installed.
- *7 Refer to the FR-A8AVP Instruction Manual (For Inverter/ Converter Switching).

5.2 Control method

V/F control (initial setting), Advanced magnetic flux vector control, Real sensorless vector control, Vector control, and PM sensorless vector control are available with this inverter.

♦ V/F control

The inverter controls the output frequency (F) and the output voltage (V) so that the ratio of frequency to voltage (V/F) is kept constant when the frequency is changed.

Advanced magnetic flux vector control

The inverter performs vector calculation and divide its output current into the excitation current and the torque current. The inverter compensates the frequency and the voltage to output a current that meets the load torque to the motor, which improves the motor torque at low speed. The output frequency is further compensated (slip compensation) to bring the actual motor speed closer to the commanded speed. This control method is useful when the load fluctuates are severe.



- · Advanced magnetic flux vector control requires the following conditions. If these conditions are not satisfied, select V/F control. Otherwise, malfunctions such as insufficient torque, uneven rotation may occur.
- For the motor capacity, the rated motor current should be equal to or less than the rated inverter current. (It must be 0.4 kW or higher.)
 - If a motor with substantially low rated current compared with the inverter rated current, however, is used, speed and torque accuracies may deteriorate due to torque ripples, etc. Set the rated motor current to about 40% or higher of the inverter rated
- · The motor described in the following table is used.

| Motor | Condition | |
|--|--|--|
| Mitsubishi Electric standard motor (SF-JR) | | |
| Mitsubishi Electric high-efficiency motor (SF-HR) | The offline auto tuning is not required. | |
| Mitsubishi Electric constant-torque motor (SF-JRCA 4P / SF-HRCA) | The offine auto turning is not required. | |
| Mitsubishi Electric high-performance energy-saving motor (SF-PR) | | |
| Other motor (Mitsubishi motor SF-TH, etc. or other manufacturer's motor) | The offline auto tuning is required. | |

- Single-motor operation (one motor to one inverter) is performed.
- The wiring length from inverter to motor is 30 m or less. (When the wiring length exceeds 30 m, perform offline auto tuning with the wiring in place.)
- · A sine wave filter (MT-BSL/BSC) is not used.

Real sensorless vector control

- · As the inverter estimates the motor speed and controls the output current more accurately, a high-level control of the speed and the torque is enabled. Select Real sensorless vector control for a high-accuracy, fast-response control. The offline auto tuning is required initially.
- This control method is useful for the following purposes:
 - To minimize the speed fluctuation even at a severe load fluctuation
 - To generate a low speed torque
 - To prevent machine from damage due to a too large torque (To set the torque limit)
 - To control the torque



- Real sensorless vector control requires the following conditions.
 - If these conditions are not satisfied, select V/F control. Otherwise, malfunctions such as insufficient torque, uneven rotation may occur.
- For the motor capacity, the rated motor current should be equal to or less than the rated inverter current. (It must be 0.4 kW or higher.)
 - If a motor with substantially low rated current compared with the inverter rated current, however, is used, speed and torque accuracies may deteriorate due to torque ripples, etc. Set the rated motor current to about 40% or higher of the inverter rated current.
- · Offline auto tuning is performed.
 - Offline auto tuning is necessary under Real sensorless vector control even when the Mitsubishi Electric motor is used.
- Single-motor operation (one motor to one inverter) is performed.
- · A surge voltage suppression filter (FR-ASF/FR-BMF) or sine wave filter (MT-BSL/BSC) is not used.

Vector control

- · With a vector control option installed, full-scale vector control operation of a motor with an encoder can be performed. Speed control (zero speed control, servo lock), torque control, and position control can be performed with fast response and high accuracy.
- · Vector control has excellent control characteristic compared to other control methods such as V/F control. Its control characteristic is equal to those of DC machines.
- This control method is useful for the following purposes:
 - To minimize the speed fluctuation even at a severe load fluctuation
 - To generate a low speed torque
 - To prevent machine from damage due to a too large torque (To set the torque limit)
 - To control the torque or position
 - To control a torque generated in a motor in a servo-lock state (the motor with its shaft stopped)



- · Vector control requires the following conditions.
 - When the conditions are not satisfied, malfunctions such as insufficient torque, uneven rotation may occur.
- The rated motor current should be equal to or less than the inverter rated current. (It must be 0.4 kW or higher.) If a motor with substantially low rated current compared with the inverter rated current, however, is used, speed and torque accuracies may deteriorate due to torque ripples, etc. Set the rated motor current to about 40% or higher of the inverter rated
- · Torque control is not available for a PM motor.
- · The motor described in the following table is used.

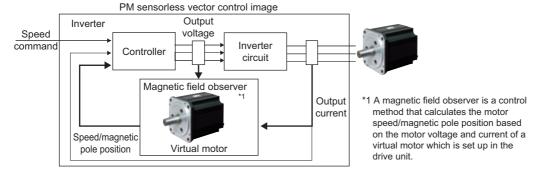
| Motor | Condition | |
|--|--|--|
| Vector control dedicated motor SF-V5RU (1500 r/min series) | | |
| Mitsubishi Electric standard motor with encoder (SF-JR) | | |
| Mitsubishi Electric high-efficiency motor with encoder (SF-HR) | The offline auto tuning is not required. | |
| Mitsubishi Electric constant-torque motor with encoder (SF-JRCA 4P, SF-HRCA) | | |
| Other motors (motors other than SF-V5RU 1500 r/min series, other manufactures' motors, etc.) | The offline auto tuning is required. | |

- Single-motor operation (one motor to one inverter) is performed.
- The wiring length from inverter to motor is 30 m or less. (When the wiring length exceeds 30 m, perform offline auto tuning with the wiring in place.)
- · A surge voltage suppression filter (FR-ASF/FR-BMF) or sine wave filter (MT-BSL/BSC) is not used.

PM sensorless vector control

- · The inverter enables highly efficient motor control and highly accurate motor speed control of a PM (permanent magnet embedded) motor, which is more efficient than an induction motor.
- A speed detector such as an encoder is not required as the inverter estimates the motor speed by the calculation from the inverter output voltage and current. The inverter drives the PM motor with the least required current for a load in order to achieve the highest motor efficiency.

When using an IPM motor MM-CF, simply performing the motor parameter initialization (PM parameter initialization or IPM initialization) enables PM sensorless vector control.





- · The PM sensorless vector control requires the following conditions.
- · The motor described in the following table is used.

| Motor | Condition |
|---|--|
| Mitsubishi Electric IPM motor (MM-CF) | The offline auto tuning is not required. |
| IPM motor (other than MM-CF), SPM motor | The offline auto tuning is required. |

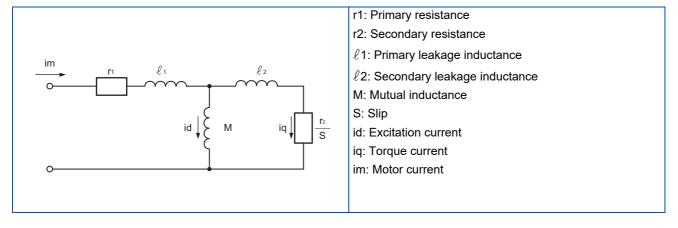
For the motor capacity, the rated motor current should be equal to or less than the rated inverter current. (It must be 0.4 kW or higher.)

If a motor with substantially low rated current compared with the inverter rated current, however, is used, speed and torque accuracies may deteriorate due to torque ripples, etc. Set the rated motor current to about 40% or higher of the inverter rated current.

- · Single-motor operation (one motor to one inverter) is performed.
- The wiring length from the inverter to the motor is 100 m or less. (Refer to page 66.) (When the wiring length from the inverter to the IPM motor MM-CF exceeds 30 m, perform offline auto tuning.)
- · A surge voltage suppression filter (FR-ASF/FR-BMF) or sine wave filter (MT-BSL/BSC) is not used.

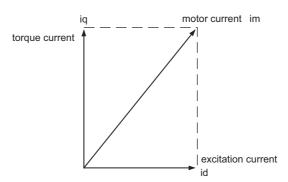
5.2.1 Vector control and Real sensorless vector control

Vector control is one of the control techniques for driving an induction motor. To help explain Vector control, the fundamental equivalent circuit of an induction motor is shown below.



In the above diagram, currents flowing in the induction motor can be classified into a current id (excitation current) for making a magnetic flux in the motor and a current iq (torque current) for causing the motor to develop torque.

In Vector control, the voltage and output frequency are calculated to control the motor so that the excitation current and torque current flow to the optimum as described below:



- The excitation current is controlled to place the internal magnetic flux of the motor in the optimum status.
- The torque command value is derived so that the difference between the motor speed command and the actual speed (speed estimated value for Real sensorless vector control) obtained from the encoder connected to the motor shaft is zero. Torque current is controlled so that torque as set in the torque command is developed.

Motor-generated torque (TM), slip angular velocity (ω s) and the motor's secondary magnetic flux (Φ 2) can be found by the following calculation:

$$TM \propto \Phi 2 \cdot iq$$

$$\Phi 2 = M \cdot id$$

$$\omega s = \frac{r2}{L2} \cdot \frac{iq}{id}$$

where, L2: secondary inductance

$$L2 = \ell 2 + M$$

Vector control provides the following advantages:

- Vector control has excellent control characteristic compared to V/F control and other controls. The control characteristic of the Vector control is equal to those of DC machines.
- It is applicable to fast response applications with which induction motors were previously regarded as difficult to use. Applications requiring a wide variable-speed range from extremely low speed to high speed, frequent acceleration/deceleration operations, continuous four-quadrant operations, etc.
- · Torque control is enabled (when an induction motor is used).
- It allows servo-lock torque control which generates a torque in the motor shaft while stopped. (Not available under Real sensorless vector control.)

Block diagram of Real sensorless vector control PWM modulation Magnetic Pre-excitation $\phi 2$ Vd flux current Output control control voltage id conversion Torque Vq ω * + iq Speed $\omega\,0$ current control control ωFB $\omega \ 0$ $\omega \; \text{FB}$ id Current iq iq conversion Slip calculation φ2 Magnetic id flux Vd calculation Speed estimation **Block diagram of Vector control 本** Μ Encoder **PWM** modulation Pre-excitation Magnetic φ2 id^* Vd current flux Output control voltage control conversion Torque iq* Vq Speed ω 0 current control control ωFB ω0 $\omega \; \text{FB}$ id Current iq iq conversion Slip

calculation

φ2

Magnetic flux calculation

| Speed control | Speed control operation is performed to zero the difference between the speed command (ω^*) and actual rotation value detected by encoder (ω FB). At this time, the motor load is found and its result is transferred to the torque current controller as a torque current command (iq*). |
|---------------------------|--|
| Torque current | A voltage (Vq) is calculated to flow a current (iq) which is identical to the torque current command (iq*) found by the |
| control | speed controller. |
| Magnetic flux | The magnetic flux (Φ2) of the motor is derived from the excitation current (id). The excitation current command (id*) is |
| control | calculated to use that motor magnetic flux (Φ2) as a predetermined magnetic flux. |
| Excitation current | A voltage (Vd) is calculated to flow a current (id) which is identical to the excitation current command (id*). |
| control | |
| Output frequency | Motor slip (ωs) is calculated on the basis of the torque current value (iq) and magnetic flux (Φ2). The output frequency |
| calculation | (ω0) is found by adding that slip (ωs) to the feedback (ωFB) found by a feedback from the encoder. |

The above results are used to make PWM modulation and run the motor.

Changing the control method and mode 5.2.2

Set the control method and the control mode.

V/F control, Advanced magnetic flux vector control, Real sensorless vector control, Vector control, and PM sensorless vector control are the control methods available for selection.

The available control modes are speed control, torque control, and position control modes.

Select a control mode under Real sensorless vector control, Vector control, and PM sensorless vector control. Under Real sensorless vector control, select a control mode from the speed control and torque control modes. Under Vector control, select a control mode from the speed control, torque control, and position control modes. The control method is initially set to V/F control.

When using an IPM motor MM-CF, simply performing the IPM parameter initialization enables the PM sensorless vector control and selects the speed control and position control.

- Select a control method and a control mode by setting Pr.800 (Pr.451) Control method selection.
- The control mode can be switched using a mode switching signal (MC).

| Pr. | Name | Initial value | Setting range | Description | า | | | | |
|-------------|---------------------------------------|---------------|--|---|--|------|--|---------------------------------------|--|
| 71 C100 | Applied motor | 0 | 0 to 6, 13 to 16, 20, 23, 24, 30, 33, 34, 40, 43, 44, 50, 53, 54, 70, 73, 74, 330, 333, 334, 8090, 8093, 8094, 9090, 9093, 9094 | By selecting a standard motor or constant-torque motor the thermal characteristic and motor constant of each motor are set. | | | | | |
| | | | 0.4 to 55 kW ^{*1} | Sat the applied mater canacity | | | | | |
| 80 C101 | Motor capacity | 9999 | 0 to 3600 kW*2 | Set the applied motor capacity. | | | | | |
| | | | 9999 | V/F control | | | | | |
| 81 | Number of motor poles | 9999 | 2, 4, 6, 8, 10, 12 | Set the number of motor poles. | | | | | |
| C102 | Number of motor poles | 9999 | 9999 | V/F control | | | | | |
| 83 C104 | Rated motor voltage | 200/400 V*3 | 0 to 1000 V | Set the rated motor voltage (V). | | | | | |
| 84 | Data di matan fina musika avi | 9999 | 10 to 400 Hz | Set the rated motor frequency (Hz |). | | | | |
| C105 | Rated motor frequency | 9999 | 9999 | The setting value of Pr.3 Base fre | The setting value of Pr.3 Base frequency is used.*4 | | | | |
| | Control method selection | | 0 to 6 | Vector control | | | | | |
| | | | 9 | Vector control, PM sensorless vector control test operation | | | | | |
| | | | 10 to 12 | Real sensorless vector control | | | | | |
| | | 20 | 13, 14 | PM sensorless vector control | | | | | |
| 800 G200 | | | 20 | V/F control / Advanced magnetic flux vector control / PN sensorless vector control | | | | | |
| G200 | | | 100 to 106 | Vector control | | | | | |
| | | | 109 | Vector control, PM sensorless vector control test operation | Fast-response | | | | |
| | | | 110 to 112 | Real sensorless vector control | operation | | | | |
| | | | 110, 113, 114 | PM sensorless vector control | | | | | |
| | | | 0 to 6 | Vector control | | | | | |
| | | | 10 to 12 | Real sensorless vector control | | | | | |
| | | | 13, 14 | PM sensorless vector control | | | | | |
| | | | 20 | V/F control (Advanced magnetic flux vector control) | | | | | |
| 451 | Second motor control method selection | 9999 | 100 to 106 | Vector control | Fast-response | | | | |
| G300 | | 3333 | 110 to 112 | Real sensorless vector control | operation | | | | |
| | | | 110, 113, 114 | PM sensorless vector control | ' | | | | |
| | | | I I | Advanced magnetic flux vector cor | ntrol when the induction | | | | |
| | | | | | | 9999 | | motor is selected in Pr.71 .*5 | |
| | | | | As set in Pr.800 when the PM motor is selected in Pr.71 . | | | | | |

- *1 For the FR-A820-03160(55K) or lower, and FR-A840-01800(55K) or lower.
- *2 For the FR-A820-03800(75K) or higher, and FR-A840-02160(75K) or higher.
- *3 The initial value differs according to the inverter's voltage class (200/400 V class).
- *4 When the IPM motor MM-CF is selected in Pr.71 Applied motor, the rated frequency of the MM-CF is used. When a PM motor other than the MM-CF is selected for Pr.71, 75 Hz (for the motor capacity 15 kW or lower) or 100 Hz (18.5 kW or higher) is used.
- *5 V/F control is set when **Pr.453** and **Pr.454** = "9999".

◆ Setting the motor capacity and the number of motor poles (Pr.80, Pr.81)

- · Motor specifications (the motor capacity and the number of motor poles) must be set to select Advanced magnetic flux vector control, Real sensorless vector control, Vector control, or PM sensorless vector control.
- Set the motor capacity (kW) in Pr.80 Motor capacity and set the number of motor poles in Pr.81 Number of motor poles.



• Setting the number of motor poles in Pr.81 changes the Pr.144 Speed setting switchover setting automatically. (Refer to page 444.)

◆ Selection of the control method and the control mode

• Select a control method (and a control mode) from V/F control (speed control), Advanced magnetic flux vector control (speed control), Real sensorless vector control (speed control or torque control), Vector control (speed control, torque control, or position control), or PM sensorless vector control (speed control or position control).

| Settings of Pr.80 (Pr.453) and Pr.81 (Pr.454) | Pr.71 (Pr.450) | Pr.800 setting ^{*1} | Pr.451 setting ^{*1} | Control method | Control mode | Remarks | |
|---|-------------------------|--|---------------------------------|---|---|--|--|
| | | 0, 100 | | | Speed control | _ | |
| | | 1, 101 | | | Torque control | _ | |
| | | 2, 102 3, 103 | | | Speed control / torque control switchover | MC signal ON: torque control MC signal OFF: speed control | |
| | | | | | Position control | _ | |
| | | 4, 104 | | Vector control ^{*2} | Speed control / position control switchover | MC signal ON: position control MC signal OFF: speed control | |
| | Induction | 5, 105 | | | Position control / torque control switchover | MC signal ON: torque control MC signal OFF: position control | |
| | motor ^{*3} | 6, 106 | | | Torque control (variable-current limiter control) | _ | |
| | | 9, 109 | _ | Vector control test operation | ו | | |
| | | 10, 110 | | | Speed control | _ | |
| | an | 11, 111 | | | Torque control | _ | |
| Other than | | | | Real sensorless vector control | Speed control / torque control switchover | MC signal ON: torque control MC signal OFF: speed control | |
| 9999 | | 20 (initial value) | 20 | Advanced magnetic flux vector control | Speed control | _ | |
| | | _ | 9999 (initial value) | Advanced magnetic flux vector control for the second motor | | | |
| | | 9, 109 | _ | PM sensorless vector control test operation | | | |
| | | 13, 113 | | | Position control*6 | _ | |
| | IPM motor (MM-CF)*4 | 14, 114 | | PM sensorless vector control | Speed control / position control switchover*6 | MC signal ON: position control MC signal OFF: speed control | |
| | | 20 (initial value), 110 | 20, 110 | | Speed control | _ | |
| | | 0, 100 ^{*7} | | | Speed control | _ | |
| | | 3, 103 | | 1 | Position control | _ | |
| | IPM/SPM motor (other | 4, 104*8 | | Vector control*9 | Speed control / position control switchover | MC signal ON: position control MC signal OFF: speed control | |
| | than MM-CF) | 9, 109 | _ | PM sensorless vector contro | ol test operation | | |
| | | 20 (initial value), 110 ^{*10} | 20, 110 ^{*10} | PM sensorless vector control | Speed control | _ | |
| | IPM/SPM motor | _ | 9999 (initial value) | The setting value of Pr.800 is used for the second motor. (PM sensorless vector control (speed control) when Pr.800 = "9 or 109") | | | |
| 9999 ^{*5} | _ | _ | | V/F control | | | |

^{*1} The setting values of 100 and above are used when the fast-response operation is selected.

^{*2} Advanced magnetic flux vector control is applied if a Vector control compatible option is not installed.

^{*3} For an induction motor, the setting "13, 14, 113, or 114" in Pr.800 (Pr.451) has the same meaning as the setting "10 or 110" in Pr.800 (Pr.451) (speed control under Real sensorless vector control).

- *4 For the IPM motor MM-CF, the setting other than "9, 13, 14, 109, 113, 114, or 9999" in Pr.800 (Pr.451) has the same meaning as the setting "20 or 110" in Pr.800 (Pr.451) (speed control under PM sensorless vector control).
- *5 V/F control is applied when Pr.80 or Pr.81 is "9999", regardless of the Pr.800 setting. When Pr.71 is set to the IPM motor MM-CF, PM sensorless vector control is enabled even if Pr.80 ≠ "9999" or Pr.81 = "9999". (When other PM motors are used, set Pr.80 and Pr.81 according to the motor. Otherwise, proper operation cannot be performed.)
- *6 Setting Pr.788 (Pr.747) = "0" (low-speed range torque characteristic disabled) selects speed control.
- *7 The operation for the setting of "0 or 100" is performed when "1, 2, 6, 101, 102, or 106" is set.
- The operation for the setting of "4 or 104" is performed when "5 or 105" is set.
- *9 Speed control under PM sensorless vector control is applied if an option for vector control for PM motor is not installed.
- *10 The operation for the setting of "20 or 110" is performed when "10 to 14 or 111 to 114" is set.

▶ Selecting the fast-response operation (Pr.800 (Pr.451) = "100 to 106, or 109 to 114")

• Setting Pr.800 (Pr.451) = "any of 100 to 106 or 109 to 114" selects the fast-response operation. The fast-response operation is available during Vector control, Real sensorless vector control, and PM sensorless vector control.

| | Speed response | | | |
|--------------------------------|--|---|--|--|
| Control method | Fast-response operation Pr.800 (Pr.451) = "100 to 106, or 109 to 114" | Normal-response operation Pr.800 (Pr.451) = "0 to 6, or 9 to 14" | | |
| Vector control | 130 Hz at maximum | 50 Hz at maximum | | |
| Real sensorless vector control | 50 Hz at maximum*1 | 20 Hz at maximum ^{*2} | | |
| Real Selisoness vector control | 50 Hz at maximum | 10 Hz at maximum ^{*3} | | |
| PM sensorless vector control | 50 Hz at maximum | 30 Hz at maximum | | |

- *1 When driving a 3.7 kW no-load motor.
- $^{\star}2$ $\,$ For the FR-A820-03160(55K) or lower, and FR-A840-01800(55K) or lower.
- *3 For the FR-A820-03800(75K) or higher, and FR-A840-02160(75K) or higher.



- During fast-response operation, the carrier frequency is always 4 kHz. (Refer to page 356.)
- The inverter overload trip (E.THT) is more likely to occur when fast-response operation is set at the SLD or LD rating.

Vector control test operation, PM sensorless vector control test operation (Pr.800 = "9 or 109")

• A test operation for speed control is available without connecting a motor to the inverter.

The speed calculation changes to track the speed command, and such speed changes can be checked on the operation panel or by outputting it as analog signals to terminal FM/CA or AM.



- · Since current is not detected and voltage is not output, monitors related to current and voltage such as output current and output voltage, etc. and output signals do not function.
- For speed calculation, speed is calculated in consideration of Pr.880 Load inertia ratio.
- · Since current synchronization operation occurs during the test operation for PM sensorless vector control, the output frequency becomes the same value as the command frequency.

I/O signal status during the test operation

· During the test operation, the following signals are disabled.

| Input terminal function selection (Pr.178 to Pr.189) | Output terminal function selection (Pr.190 to Pr.196) |
|---|---|
| | Electronic thermal O/L relay pre-alarm (THP) |
| | Brake opening request (BOF) |
| Brake opening completion (BRI) | Second brake opening request (BOF2) |
| Load pattern selection forward/reverse rotation boost (X17) | Orientation complete (ORA) |
| V/F switchover (X18) | Orientation fault (ORM) |
| Orientation command (X22) | Regenerative status output (Y32) |
| Control mode switchover (MC) | In-position (Y36) |
| Start-time tuning start external input (X28) | Travel completed (MEND) |
| Torque bias selection 1, Torque bias selection 2 (X42, X43) | Start time tuning completion (Y39) |
| Second brake sequence open completion (BRI2) | Home position return failure (ZA) |
| Torque limit selection (X93) | Position detection level (FP) |
| | During position command operation (PBSY) |
| | Home position return completed (ZP) |

Parameters referred to

Pr.178 to Pr.189 (Input terminal function selection) ☐ page 521 Pr.190 to Pr.196 (Output terminal function selection) ☐ page 473

◆ Status of the monitoring during the test operation

- o: Fnabled
- x: Disabled (0 is displayed at any time.)
- Δ: A cumulative total before the test operation is displayed.
- -: Not available

| Monitor item | Monitoring on DU/PU | Output via FM/ CA/AM |
|--|---------------------|-------------------------|
| Output frequency | 0 | 0 |
| Fault indication | 0 | _ |
| Frequency setting value | 0 | 0 |
| Motor speed | 0 | 0 |
| Converter output voltage | 0 | 0 |
| Electronic thermal O/L relay load factor | x*2 | x*2 |
| Output current peak value | x*2 | x*2 |
| Converter output voltage peak value | 0 | 0 |
| Load meter | 0 | 0 |
| Cumulative energization time | 0 | _ |
| Reference voltage output | _ | 0 |
| Actual operation time | 0 | _ |
| Cumulative energy | Δ | _ |
| Trace status | 0 | × |
| Station number (RS-485 terminals) | 0 | _ |
| Station number (PU connector) | 0 | _ |
| Station number (CC-Link) | 0 | _ |
| Energy saving effect | 0 | 0 |
| Cumulative energy saving | Δ | _ |
| PID set point | 0 | 0 |
| PID measured value | 0 | 0 |

| Monitor item | Monitoring on DU/PU | Output via FM/ CA/AM |
|---------------------------------|---------------------|-------------------------|
| PID deviation | 0 | o*3 |
| Input terminal status | 0 | _ |
| Output terminal status | 0 | _ |
| Option input terminal status | 0 | _ |
| Option output terminal status | 0 | _ |
| Motor thermal load factor | o*4 | o* 4 |
| Inverter thermal load factor | o*4 | o*4 |
| PTC thermistor value | 0 | _ |
| PID measured value 2 | 0 | 0 |
| Remote output 1 | 0 | 0 |
| Remote output 2 | 0 | 0 |
| Remote output 3 | 0 | 0 |
| Remote output 4 | 0 | 0 |
| PID manipulated variable | 0 | °*3 |
| Second PID set point | 0 | 0 |
| Second PID measured value | 0 | 0 |
| Second PID deviation | 0 | o*3 |
| Second PID measured value 2 | 0 | 0 |
| Second PID manipulated variable | 0 | o*3 |
| Dancer main speed setting | 0 | 0 |

- *1 The monitoring-enabled items differ depending on the output interface (operation panel, parameter unit, terminal FM/CA, or terminal AM). For the details, refer to page 457.
- *2 When the inverter operation is switched to the test operation, the indication is changed to 0. When PM sensorless vector control is selected again after the test operation, the output current peak value and the electronic thermal relay load factor from the last operation are displayed.
- *3 The output is enabled via terminal AM only.
- *4 When the inverter operation is switched to the test operation, the accumulated thermal value is reduced because the output current is considered

Parameters referred to

Pr.52 Operation panel main monitor selection page 446 Pr.158 AM terminal function selection page 457

Changing the control method with external terminals (RT signal, X18 signal)

- Control method (V/F control, Advanced magnetic flux vector control, Real sensorless vector control, Vector control) can be switched using external terminals.
 - The control method can be switched using either the Second function selection (RT) signal or the V/F switchover (X18) signal.
- When using the RT signal, set the second motor in Pr.450 Second applied motor and set the second motor's control
 method in Pr.451 Second motor control method selection. Turning ON the RT signal enables the second function,
 enabling the switchover of the control method.

 When using the X18 signal, turning ON the X18 signal switches the presently-selected control method (Advanced magnetic flux vector control, Real sensorless vector control, Vector control) to the V/F control. Use this method to switch the control method for one motor. At this time, the second functions including the electronic thermal O/L relay characteristic are not changed. (To switch the second functions, use the RT signal.)

To input the X18 signal, set "18" in any of Pr.178 to Pr.189 (Input terminal function selection) to assign the function.

| First motor control method | Second motor control method (RT signal-ON) | Pr.450 setting | Pr.453 to Pr.454 settings | Pr.451 setting |
|--|--|-----------------|---------------------------|-----------------------|
| | | 9999 | _ | _ |
| | V/F control | _ | _ | 9999 |
| | | _ | 9999 ^{*2} | _ |
| | Advanced magnetic flux vector control | Induction motor | | 20 |
| V/F control | Real sensorless vector control | | | 10 to 14 |
| | Vector control | Induction motor | Other than 9999 | 0 to 6, 100 to 106 |
| | | IPM/SPM motor | | 0, 3, 4, 6 |
| | PM sensorless vector control, | IPM/SPM motor | | Other than 9999 |
| | Same control as the first motor*1 | 9999 | _ | _ |
| | V/F control | _ | 9999 ^{*2} | _ |
| Advanced magnetic flux vector control*1 | Advanced magnetic flux vector control | Induction motor | Other than 9999 | 20, 9999 |
| Real sensorless vector control ^{*1} Vector control ^{*1} PM sensorless vector control | Real sensorless vector control |] | | 10 to 14 |
| | Vector control | Induction motor | | 0 to 6, 100 to 106 |
| | | IPM/SPM motor | | 0, 3, 4, 6 |
| | PM sensorless vector control, | IPM/SPM motor | | Other than 9999 |

- *1 V/F control is set by turning ON the X18 signal.
- *2 V/F control when **Pr.453** or **Pr.454** is set to "9999" regardless of the **Pr.451** setting. When **Pr.450** is set to the IPM motor MM-CF, PM sensorless vector control is enabled even if **Pr.453** ≠ "9999" or **Pr.454** = "9999".



- The RT signal is assigned to the terminal RT in the initial status. Set "3" in one of **Pr.178 to Pr.189 (Input terminal function selection)** to assign the RT signal to another terminal.
- The RT signal is a second function selection signal. The RT signal also enables other second functions. (Refer to page 525.)
- The control method could be changed by external terminals (RT signal, X18 signal) while the inverter is stopped. If a signal is switched during the operation, the control method changes after the inverter stops.

◆ Switching between two encoder-equipped motors (Pr.862)

Using the Vector control compatible plug-in options together with the control terminal option (FR-A8TP) enables the Vector
control operation by switching between two encoder-equipped motors according to the RT signal. Use Pr.862 Encoder
option selection to set the combination of the motors (first/second), plug-in option, and control terminal option.

| Pr.862 Encoder option selection | RT signal-OFF (First motor) | RT signal-ON (Second motor) ^{*1} |
|---------------------------------|--------------------------------|--|
| 0 (initial value) | Plug-in option | Control terminal option |
| 1 | Control terminal option | Plug-in option |

*1 When **Pr.450 Second applied motor** ="9999", the first motor is selected even if the RT signal turns ON.



• **Pr.862** setting is valid even when either the plug-in option or control terminal option is installed. For using the control terminal option alone, the motor does not run when **Pr.862** is the initial value as it is. (When the RT signal is OFF)

◆ Changing the control mode with external terminals (MC signal)

• The setting of **Pr.800** or **Pr.451** can be used to switch the control mode by turning ON/OFF the MC signal. Refer to page 223 to set **Pr.800** or **Pr.451**.

To input the MC signal, set "26" in any of Pr.178 to Pr.189 (Input terminal function selection) to assign the function.

- · When using an analog input terminal (terminal 1, 4) for torque limit and torque command, switching of the control mode changes the terminal function as follows:
- · Functions of the terminal 1 under different control modes

| Pr.868 | Speed control/torque control switchover*1 | | | position control nover ^{*2} | Position control/torque control switchover*3 | | |
|----------------------|---|---|--|--|--|---|--|
| setting | Speed control (MC signal-OFF) | Torque control (MC signal-ON) | Speed control (MC signal-OFF) | Position control (MC signal-ON) | Position control (MC signal-OFF) | Torque control (MC signal-ON) | |
| 0 (initial value) | Auxiliary speed setting | Speed limit assistance | Auxiliary speed setting | _ | _ | Speed limit assistance | |
| 1 | Magnetic flux command*4 | Magnetic flux command*4 | Magnetic flux command*4 | Magnetic flux command*4 | Magnetic flux command | Magnetic flux command | |
| 2 | Regenerative torque limit (Pr.810 = "1") | _ | Regenerative torque limit (Pr.810 = "1") | Regenerative torque limit (Pr.810 = "1") | Regenerative torque limit (Pr.810 = "1") | _ | |
| 3 | _ | Torque command (Pr.804 = "0") | _ | _ | _ | Torque command (Pr.804 = "0") | |
| 4 | Torque limit (Pr.810 = "1") | Torque command (Pr.804 = "0") | Torque limit (Pr.810 = "1") | Torque limit (Pr.810 = "1") | Torque limit (Pr.810 = "1") | Torque command (Pr.804 = "0") | |
| 5 | _ | Forward/reverse rotation speed limit (Pr.807 = "2") | _ | _ | _ | Forward/reverse rotation speed limit (Pr.807 = "2") | |
| 6 | _ | _ | Torque bias | _ | _ | _ | |
| 9999 | _ | _ | _ | _ | _ | _ | |

· Terminal 4 functions by control

| Pr.858 | Speed control/torque control switchover*1 | | | position control nover ^{*2} | Position control/torque control switchover*3 | | |
|-------------------|---|----------------------------------|--|--|--|----------------------------------|--|
| setting | Speed control (MC signal-OFF) | Torque control (MC signal-ON) | Speed control (MC signal-OFF) | Position control (MC signal-ON) | Position control (MC signal-OFF) | Torque control (MC signal-ON) | |
| 0 (initial value) | Speed command (AU signal-ON) | Speed limit (AU signal-ON) | Speed command (AU signal-ON) | _ | _ | Speed limit (AU signal-ON)*4 | |
| 1 | Magnetic flux command*4*5 | Magnetic flux command *4*5 | Magnetic flux command *4*5 | Magnetic flux command *4*5 | Magnetic flux command*5 | Magnetic flux command*5 | |
| 4 | Torque limit (Pr.810 = "1")*6 | _ | Torque limit (Pr.810 = "1")*6 | Torque limit (Pr.810 = "1")*6 | Torque limit (Pr.810 = "1")*6 | _ | |
| 9999 | _ | _ | _ | _ | _ | _ | |

-: No function

- *1 Real sensorless vector control (**Pr.800** = "12"), vector control (**Pr.800** = "2")
- *2 Vector control (**Pr.800** = "4"), PM sensorless vector control (**Pr.800** ="14")
- *3 Vector control (**Pr.800** = "5")
- *4 This function is valid under vector control.
- *5 Invalid when Pr.868 = "1".
- *6 Invalid when **Pr.868** = "4".

NOTE

- · Switching between the speed control and the torque control is always enabled regardless of the motor status: in a stop, in running, or in DC injection brake (during pre-excitation).
- · During operation, switching between speed control and position control or between torque control and position control occurs when the output frequency reaches Pr.865 Low speed detection or lower with no position command given.
- Changing the terminal assignment using Pr.178 to Pr.189 (Input terminal function selection) may affect the other functions. Set parameters after confirming the function of each terminal.

Parameters referred to

Pr.178 to Pr.189 (Input terminal function selection) page 521

Pr.450 Second applied motor page 528
Pr.804 Torque command source selection page 283

Pr.807 Speed limit selection page 287
Pr.810 Torque limit input method selection page 245
Pr.858 Terminal 4 function assignment, Pr.868 Terminal 1 function assignment page 500

5.2.3 Selecting the Advanced magnetic flux vector control

Magnetic flux



To use the Advanced magnetic flux vector control, set the motor capacity, the number of motor poles, and the motor type using
 Pr.80 and Pr.81

Advanced magnetic flux vector control

Operating procedure

- **1.** Perform secure wiring. (Refer to page 46.)
- **2.** Make the motor setting (**Pr.71**).

| Motor | | Pr.71 setting ^{*1} | Remarks |
|--|--------------------------|-----------------------------|------------------------------------|
| | SF-JR | 0 (initial value) (3, 4) | |
| Mitsubishi Electric standard motor | SF-JR 4P 1.5 kW or lower | 20 | |
| Mitsubishi Electric high-efficiency motor | SF-HR | 40 | |
| | Others | 0 (3) | Offline auto tuning is required.*2 |
| | SF-JRCA 4P | 1 | |
| Mitsubishi Electric constant-torque motor | SF-HRCA | 50 | |
| | Other (SF-JRC, etc.) | 1 (13) | Offline auto tuning is required.*2 |
| Mitsubishi Electric high-performance energy-saving motor | SF-PR | 70 | |
| Other manufacturer's standard motor | _ | 0 (3) | Offline auto tuning is required.*2 |
| Other manufacturer's constant-torque motor | _ | 1 (13) | Offline auto tuning is required.*2 |

- *1 For the other setting values of **Pr.71**, refer to page 528.
- *2 For offline auto tuning, refer to page 532.
- **3.** Set the motor overheat protection (**Pr.9**). (Refer to page 415.)
- **4.** Set the motor capacity and number of motor poles (**Pr.80**, **Pr.81**). (Refer to page 221.) V/F control is performed when the setting is "9999" (initial value).
- **5.** Set the rated motor voltage and frequency (**Pr.83**, **Pr.84**). (Refer to page 532.)
- **6.** Set the operation command. (Refer to page 389.) Select the start command and speed command.
- **7.** Perform the test operation.

As required

- Perform the offline auto tuning (Pr.96). (Refer to page 532.)
- Select the online auto tuning (Pr.95). (Refer to page 558.)

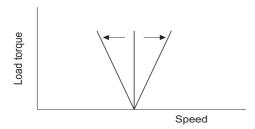
• NOTE

- To perform driving in a better accuracy, perform offline auto tuning, then set the online auto tuning, and select Real sensorless vector control
- Under this control, rotations are more likely to be uneven than under V/F control. (This control method is not suitable for grinder, wrapping machine, etc., which require even rotation at a low speed.)
- For the FR-A820-03160(55K) or lower and the FR-A840-01800(55K) or lower, the operation with a surge voltage suppression filter (FR-ASF-H/FR-BMF-H) installed between the inverter and the motor may reduce the output torque.
- The optional sine wave filter (MT-BSL/BSC) cannot be used between the inverter and the motor.
- Changing the terminal assignment using **Pr.178 to Pr.189 (Input terminal function selection)** may affect the other functions. Set parameters after confirming the function of each terminal.

Keeping the motor speed constant when the load fluctuates (speed control gain)

| Pr. | Name | Initial value | Setting range | Description |
|-------------|--|------------------|---------------|--|
| 89 G932 | Speed control gain (Advanced magnetic flux | 9999 | 0 to 200% | Makes adjustments to keep the motor speed constant during variable load operation under Advanced magnetic flux vector control. The reference value is 100%. |
| vector) | vectory | | 9999 | The gain set by Pr.71. (The gain set in accordance with the motor.) |
| 569 G942 | i i i i i i i i i i i i i i i i i i i | | 0 to 200% | Makes adjustments to keep the second motor speed constant during variable load operation under Advanced magnetic flux vector control. The reference value is 100%. |
| | | | 9999 | The gain set by Pr.450. (The gain set in accordance with the motor.) |

· Use Pr.89 to keep the motor speed constant during variable load operation. (This parameter is useful to make adjustments on the motor speed after replacing a conventional model with an FR-A800 series model.)



Driving two motors under Advanced magnetic flux vector control

- Turning ON the Second function selection (RT) signal enables the second motor operation.
- Set a second motor in Pr.450 Second applied motor. (In the initial setting, "9999" (no second applied motor) is selected. Refer to page 528.)

| Function | RT signal-ON (second motor) | RT signal-OFF (first motor) |
|--|-----------------------------|-----------------------------|
| Applied motor | Pr.450 | Pr.71 |
| Motor capacity | Pr.453 | Pr.80 |
| Number of motor poles | Pr.454 | Pr.81 |
| Speed control gain (Advanced magnetic flux vector) | Pr.569 | Pr.89 |
| Control method selection | Pr.451 | Pr.800 |

■ NOTE

- The RT signal is a Second function selection signal. The RT signal also enables other second functions. (Refer to page 525.) The RT signal is assigned to the terminal RT in the initial status. Set "3" in one of Pr.178 to Pr.189 (Input terminal function selection) to assign the RT signal to another terminal.
- · Changing the terminal assignment using Pr.178 to Pr.189 (Input terminal function selection) may affect the other functions. Set parameters after confirming the function of each terminal.

Parameters referred to

Pr.71, Pr.450 Applied motor page 528 Pr.800, Pr.451 Control method selection page 221

Selecting the PM sensorless vector control 5.2.4

PM

Setting for the PM sensorless vector control by selecting IPM initialization on the operation panel

("} = 141")



- The parameters required to drive an IPM motor MM-CF are automatically set by batch. (Refer to page 231.)
- [PM] indicator on the operation panel (FR-DU08) is turned ON when the PM sensorless vector control is set.

The following shows the procedure to initialize the parameter settings for an MM-CF IPM motor by selecting IPM parameter initialization on the operation panel.

Operating procedure

- Turning ON the power of the inverter The operation panel is in the monitor mode.
- 2, Changing the operation mode

Press PU to choose the PU operation mode.

[PU] indicator turns ON.

3. Selecting the parameter setting mode

Press Mode to choose the parameter setting mode.

[PRM] indicator is ON.

4. IPM initialization selection

Turn 😘 until " 🔭 " (IPM initialization) appears.

5. Displaying the set value

Press | SET | to read the present set value.

"[]" (initial value) appears.

Changing the setting value

Turn to change the value to "] , and press SET to confirm it.

" - | " and " | and " | are displayed alternately. The setting is completed.

| Setting | Description |
|---------|---|
| 0 | Parameter settings for an induction motor |
| 3003 | Parameter settings for MM-CF IPM motor (rotations per minute) |

NOTE

- If parameters are initialized for a PM motor in the IPM initialization mode, the Pr.998 PM parameter initialization setting is automatically changed.
- In the initial parameter setting, the capacity same as the inverter capacity is set in Pr.80 Motor capacity. To use a motor capacity that is one rank lower than the inverter capacity, set Pr.80 Motor capacity by selecting the mode on the operation panel.
- To set a speed by adjusting frequencies or to monitor it, use Pr.998. (Refer to page 231.)

Initializing the parameters required for the PM sensorless vector control (Pr.998)

- PM parameter initialization sets parameters required for driving an IPM motor MM-CF.
- The offline auto tuning enables the operation with an IPM motor other than MM-CF and with SPM motors.
- Two MM-CF PM parameter initialization methods are available; setting **Pr.998 PM parameter initialization**, and selecting IPM initialization (" on the operation panel.") on the operation panel.

| Pr. | Name | Initial value | Setting range | Description | | |
|-------------|-----------------------------|------------------|---------------|--|---|--|
| | | • () | 0 | Parameter setting (in frequencies) for an induction motor | The setting of the motor parameters is changed to the setting required to drive an induction motor. | |
| | | | 3003 | Parameter setting (in rotations per minute) for the MM-CF IPM motor | The setting of the motor parameters is changed to the setting required to drive an | |
| | | | 3103 | Parameter setting (in frequencies) for the MM-CF IPM motor | IPM motor. | |
| 998 E430 | PM parameter initialization | | 8009 | Parameter setting (in rotations per minute) for an IPM motor other than MM-CF (after tuning) | The setting of the motor parameters is changed to the setting required to drive an IPM motor. (Set Pr.71 Applied motor | |
| | | | 8109 | Parameter setting (in frequencies) for an IPM motor other than the MM-CF (after tuning) | and perform offline auto tuning in advance. (Refer to page 551.)) | |
| | | | 9009 | Parameter setting (in rotations per minute) for an SPM motor (after tuning) | The setting of the motor parameters is changed to the setting required to drive an | |
| | | | 9109 | Parameter setting (in frequencies) for an SPM motor (after tuning) | SPM motor. (Set Pr.71 Applied motor and perform offline auto tuning in advance. (Refer to page 551.)) | |

- To use a motor capacity that is one rank lower than the inverter capacity, set **Pr.80 Motor capacity** before performing PM parameter initialization.
- When **Pr.998** = "3003, 8009, or 9009", the monitor is displayed and the frequency is set using the motor rotations per minute. To use frequency to display or set, set **Pr.998** = "3103, 8109, or 9109".
- Set **Pr.998** = "0" to change the PM sensorless vector control parameter settings to the parameter settings required to drive an induction motor.
- When using an IPM motor or SPM motor other than MM-CF, set Pr.998 = "8009, 8109, 9009, or 9109".

• NOTE

- Make sure to set Pr.998 before setting other parameters. If the Pr.998 setting is changed after setting other parameters, some
 of those parameters are initialized too. (Refer to the "List of the target parameters for the motor parameter initialization".)
- To change back to the parameter settings required to drive an induction motor, perform Parameter clear or All parameter clear.
- If the setting of **Pr.998 PM parameter initialization** is changed between "3003, 8009, 9009 (rotations per minute)" ↔ "3103, 8109, 9109 (frequency)", the target parameters are respectively set to their initial values.
 - The purpose of Pr.998 is not to change the display units. Use **Pr.144 Speed setting switchover** to change the display units between rotations per minute and frequency. Using **Pr.144** enables switching the unit between rotations per minute and frequencies without initializing the setting of the motor parameters.
 - Example) Changing the **Pr.144** setting between "6" and "106" switches the display units between frequency and rotations per minute.
- For an inverter out of the capacity range of the IPM motor MM-CF, "3003 or 3103" cannot be set. (Refer to page 833 for the capacities of MM-CF motors.)
- The PM parameter initialization (**Pr.998**) changes parameter settings for the first motor. When a PM motor is used as the second motor, parameters for the second motor must be set individually.

◆ List of the target parameters for the motor parameter initialization

• The parameter settings in the following table are changed to the settings required to perform PM sensorless vector control by selecting the IPM initialization on the operation panel or by using **Pr.998 PM parameter initialization**. The changed settings differ according to the specification (capacity) of the PM motor used.

• Performing Parameter clear or All parameter clear resets these parameter settings to the settings required to drive an induction motor.

| | | | | | Setting | | | | |
|-----------|--|---------------------|-------|--------------------------------|--|--------------------------------|---|---|------------------------|
| | | Induction motor | | PM motor | | PM motor (setting in | | Setting increments | |
| _ | | 0 (initial value) | | rotations p | 8009 | frequencies) 8109 | | | |
| Pr. | Name | FM | CA | 3003 (MM- CF) | 9009 (other than MM- CF) | 3103 (MM- CF) | 9109 (other than MM- CF) | 3003, 8009, 9009 | 0, 3003, 8109, 9109 |
| 1 | Maximum frequency | 120 Hz* | 1 | 3000 r/min | Maximum motor rotations per minute ^{*8} | 200 Hz | Maximum motor frequency [*] 8 | 1 r/min | 0.01 Hz |
| 4 | Multi-speed setting (high speed) | 60 Hz | 50 Hz | 2000 r/min | Pr.84 | 133.33 Hz | Pr.84 | 1 r/min | 0.01 Hz |
| 9 | Electronic thermal O/L relay | Inverter current | rated | Rated motor current*10 | _ | Rated motor current*10 | _ | 0.01 A ^{*1} 0.1 A ^{*2} | |
| 13 | Starting frequency | 0.5 Hz | | 8 r/min*5 | Pr.84 × 10% | 0.5 Hz*6 | Pr.84 × 10% | 1 r/min | 0.01 Hz |
| 15 | Jog frequency | 5 Hz | | 200 r/min | Pr.84 × 10% | 13.33 Hz | Pr.84 × 10% | 1 r/min | 0.01 Hz |
| 18 | High speed maximum frequency | 120 Hz [*] | | 3000 r/min | _ | 200 Hz | _ | 1 r/min | 0.01 Hz |
| 20 | Acceleration/deceleration reference frequency | 60 Hz | 50 Hz | 2000 r/min | Pr.84 | 133.33 Hz | Pr.84 | 1 r/min | 0.01 Hz |
| 22 | Stall prevention operation level | 150% ^{*7} | | 150% ^{*7} | | | | 0.1% | |
| 37 | Speed display | 0 | | 0 | | | | | |
| 55 | Frequency monitoring reference | 60 Hz | 50 Hz | 2000 r/min | Pr.84 | 133.33 Hz | Pr.84 | 1 r/min | 0.01 Hz |
| 56 | Current monitoring reference | Inverter current | rated | Rated motor current*10 | Pr.859 | Rated motor current*10 | Pr.859 | 0.01 A ^{*1} | |
| 71 | Applied motor | 0 | | 330 ^{*3} | _ | 330 ^{*3} | _ | 1 | |
| 80 | Motor capacity | 9999 | | Motor capacity (MM-CF)*4 | _ | Motor capacity (MM-CF)*4 | _ | 0.01 kW ^{*1} | |
| 81 | Number of motor poles | 9999 | | 8 ^{*4} | _ | 8 ^{*4} | _ | 1 | |
| 84 | Rated motor frequency | 9999 | | 2000 r/min | _ | 133.33 Hz | _ | 1 r/min | 0.01 Hz |
| 116 | Third output frequency detection | 60 Hz | 50 Hz | 2000 r/min | Pr.84 | 133.33 Hz | Pr.84 | 1 r/min | 0.01 Hz |
| 125 (903) | Terminal 2 frequency setting gain frequency | 60 Hz | 50 Hz | 2000 r/min | Pr.84 | 133.33 Hz | Pr.84 | 1 r/min | 0.01 Hz |
| 126 (905) | Terminal 4 frequency setting gain frequency | 60 Hz | 50 Hz | 2000 r/min | Pr.84 | 133.33 Hz | Pr.84 | 1 r/min | 0.01 Hz |
| 144 | Speed setting switchover | 4 | | 108 | Pr.81 +100 | 8 | Pr.81 | 1 | |
| 240 | Soft-PWM operation selection | 1 | | 0 | | | | 1 | |
| 263 | Subtraction starting frequency | 60 Hz | 50 Hz | 2000 r/min | Pr.84 | 133.33 Hz | Pr.84 | 1 r/min | 0.01 Hz |
| 266 | Power failure deceleration time switchover frequency | 60 Hz | 50 Hz | 2000 r/min | Pr.84 | 133.33 Hz | Pr.84 | 1 r/min | 0.01 Hz |
| 374 | Overspeed detection level | 9999 | | 3150 r/min | Maximum motor rotations per minute + 10 Hz*8*9 | 210 Hz | Maximum motor frequency + 10 Hz*8 | 1 r/min | 0.01 Hz |
| 386 | Frequency for maximum input pulse | 60 Hz | 50 Hz | 2000 r/min | Pr.84 | 133.33 Hz | Pr.84 | 1 r/min | 0.01 Hz |
| 505 | Speed setting reference | 60 Hz | 50 Hz | 133.33 Hz | Pr.84 | 133.33 Hz | Pr.84 | 0.01 Hz | |

| | | | Setting | | | | | | |
|--------------|---|---------------------|----------------|--|--|-----------------------------------|-----------------------------------|--|------------------------|
| | | Induction motor | | PM motor (setting in rotations per minute) | | PM motor (setting in frequencies) | | Setting increments | |
| Pr. | Name | 0 (initia | ıl value) | 8009 | | | 8109 | | |
| | | FM | CA | 3003 (MM- CF) | 9009 (other than MM- CF) | 3103 (MM- CF) | 9109 (other than MM- CF) | 3003, 8009, 9009 | 0, 3003, 8109, 9109 |
| 557 | Current average value monitor signal output reference current | Inverter current | rated | Rated motor current*10 | Pr.859 | Rated motor current*10 | Pr.859 | 0.01 A ^{*1} 0.1 A ^{*2} | |
| 820 | Speed control P gain 1 | 60% | | 30% | | | 1% | | |
| 821 | Speed control integral time 1 | 0.333 s | | 0.333 s | | | 0.001 s | | |
| 824 | Torque control P gain 1 (current loop proportional gain) | 100% | | 100% | | 1% | | | |
| 825 | Torque control integral time 1 (current loop integral time) | 5 ms | | 20 ms | | | | 0.1 ms | |
| 870 | Speed detection hysteresis | 0 Hz | | 8 r/min | 0.5 Hz*9 | 0.5 Hz | | 1 r/min | 0.01 Hz |
| 885 | Regeneration avoidance compensation frequency limit value | 6 Hz | | 200 r/min | Pr.84 × 10% | 13.33 Hz | Pr.84 × 10% | 1 r/min | 0.01 Hz |
| 000 | Energy saving monitor | Inverter | Inverter rated | | : (D. 00) | | | 0.01 kW ^{*1} | |
| 893 | reference (motor capacity) | current | current | | Motor capacity (Pr.80) | | | 0.1 kW ^{*2} | |
| C14 (918) | Terminal 1 gain frequency (speed) | 60 Hz 50 Hz | | 2000 r/min | Pr.84 | 133.33 Hz | Pr.84 | 1 r/min | 0.01 Hz |
| 1121 | Per-unit speed control reference frequency | 120 Hz*1 60 Hz*2 | | 3000 r/min | Maximum motor rotations per minute*8 | 200 Hz | Maximum motor frequency* | 1 r/min | 0.01 Hz |

-: Not changed

- *1 Initial value for the FR-A820-03160(55K) or lower and FR-A840-01800(55K) or lower.
- *2 Initial value for the FR-A820-03800(75K) or higher and FR-A840-02160(75K) and higher.
- *3 When **Pr.71 Applied motor** = "333, 334, 8093, 8094, 9093, or 9094", the **Pr.71** setting is not changed.
- *4 When a value other than "9999" is set, the set value is not changed.
- *5 200 r/min when Pr.788 Low speed range torque characteristic selection = "0".
- 13.33 Hz when Pr.788 Low speed range torque characteristic selection = "0".
- *7 110% for SLD, 120% for LD, 150% for ND, and 200% for HD (Refer to Pr.570 Multiple rating setting on page 343.)
- *8 The Pr.702 Maximum motor frequency is used as the maximum motor frequency (rotations per minute). When Pr.702 ="9999 (initial value)", the Pr.84 Rated motor frequency is used as the maximum motor frequency (rotations per minute).
- *9 The setting value is converted from frequency to rotations per minute. (It differs according to the number of motor poles.)
- *10 Refer to page 833 for the rated motor current of MM-CF.

• NOTE

• If IPM parameter initialization is performed in rotations per minute (**Pr.998** = "3003, 8009, or 9009"), the parameters not listed in the table and the monitor items are also set and displayed in rotations per minute.

Low-speed range torque characteristics 5.2.5

PM

The torque characteristics in a low-speed range under PM sensorless vector control can be changed.

| Pr. | Name | Initial value | Setting range | Operation |
|---------|---------------------------------------|------------------|--------------------|---|
| 788 | 8 Low speed range torque | | 0 | Disables the low-speed range torque characteristic (current synchronization operation). |
| G250 ch | characteristic selection | 9999 | 9999 ^{*1} | Enables the low-speed range torque characteristic (high frequency superposition control) |
| 747 | 747 Second motor low-speed | | 0 | Disables the low-speed range torque characteristic (current synchronization operation) while the RT signal is ON. |
| (4350) | range torque characteristic selection | 9999 | 9999 ^{*1} | Enables the low-speed range torque characteristic (high frequency superposition control) while the RT signal is ON. |

*1 The low-speed range high-torque characteristic (current synchronization operation) is disabled for PM motors other than MM-CF, even if "9999" is set

◆ When the low-speed range torque characteristic is enabled (Pr.788 = "9999 (initial value)")

- The high frequency superposition control provides enough torque in the low-speed range operation.
- The low-speed range high-torque characteristic is only valid with an MM-CF motor.

♦ When the low-speed range high-torque characteristic is disabled (Pr.788 = "0")

- · The current synchronization operation reduces much motor noise compared with the high frequency superposition control.
- · Since the torque in a low-speed range is low, use this setting for an operation with light start-up load.

Low-speed range high-torque characteristic is set for the second motor (Pr.747)

- Use **Pr.747 Second motor low-speed range torque characteristic selection** to switch the torque characteristic in a low-speed range according to the application or to switch among motors connected to one inverter.
- The Pr.747 becomes valid when the RT signal turns ON.



- Position control under PM sensorless vector control is not available when the current synchronization operation is selected.
 Zero speed and servo lock are also disabled during current synchronization operation.
- For torque characteristics, refer to page 833.
- The RT signal is assigned to the terminal RT in the initial status. Set "3" in one of **Pr.178 to Pr.189 (Input terminal function selection)** to assign the RT signal to another terminal.
- Changing the terminal assignment using **Pr.178 to Pr.189 (Input terminal function selection)** may affect the other functions. Set parameters after confirming the function of each terminal.

Parameters referred to

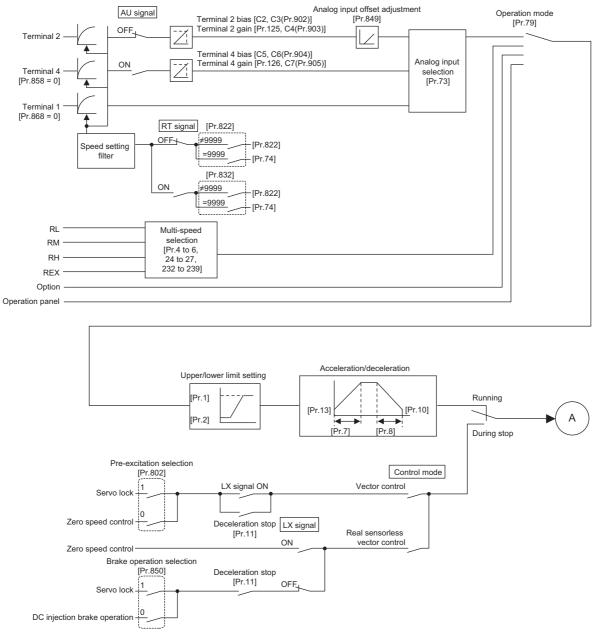
Pr.178 to Pr.189 (Input terminal function selection) F page 521

5.3 Speed control under Real sensorless vector control, vector control, PM sensorless vector control

| Purpose | pose Parameter to set | | | | |
|---|--|---|--|-----|--|
| To limit the torque during speed control | Torque limit | P.H500, P.H700 to P.H704, P.H710, P.H720, P.H721, P.H730, P.T010, P.T040, P.G210 | Pr.22, Pr.801, Pr.803, Pr.810, Pr.812 to Pr.817, Pr.858, Pr.868, Pr.874 | 245 | |
| To adjust the speed control gain | Easy gain tuning gain adjustment | P.C112 to P.C114, P.G206, P.G211, P.G212, P.G218, P.G260, P.G261, P.G311, P.G312, P.G361 | Pr.818 to Pr.821, Pr.830, Pr.831, Pr.880, Pr.1115 to Pr.1118, Pr.1121 | 254 | |
| To improve the motor trackability for the speed command changes | Speed feed forward control, model adaptive speed control | P.G220 to P.G224, P.G262, P.C114 | Pr.828, Pr.877 to Pr.881, Pr.1119 | 263 | |
| To stabilize the speed detection signal | Speed detection filter | P.G215, P.G315 | Pr.823, Pr.833 | 332 | |
| To make starting torque start-up faster | Torque bias | P.G230 to P.G238 | Pr.840 to Pr.848 | 265 | |
| To avoid motor overrunning | Speed deviation excess, speed limit, deceleration check | P.H415 to P.H417, P.H881 | Pr.285, Pr.690, Pr.853, Pr.873 | 269 | |
| To avoid mechanical resonance | Notch filter | P.G601 to P.G603 | Pr.1003 to Pr.1005 | 271 | |
| To adjust the gain during PM sensorless vector control | Speed control gain adjustment | P.G211, P.G212 | Pr.820, Pr.821 | 254 | |

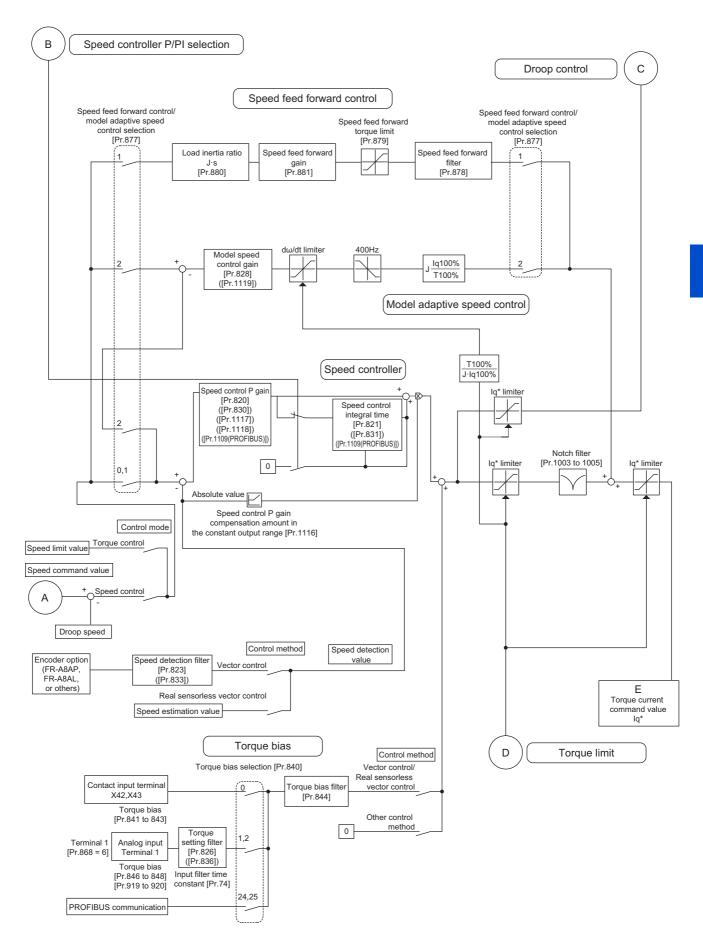
Speed control performs control so that the speed command and the actual motor rotation speed match.

Control block diagram

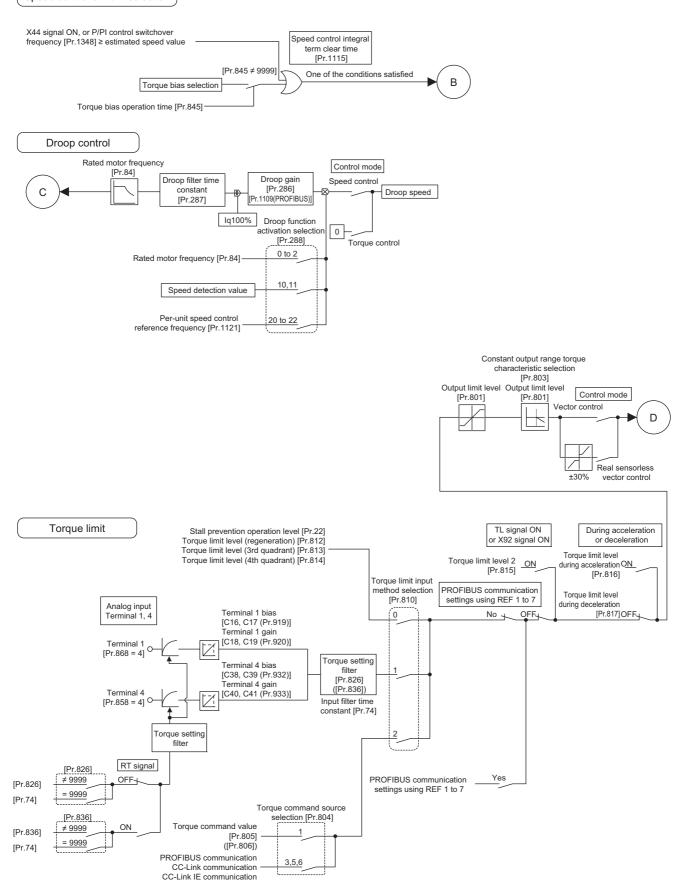


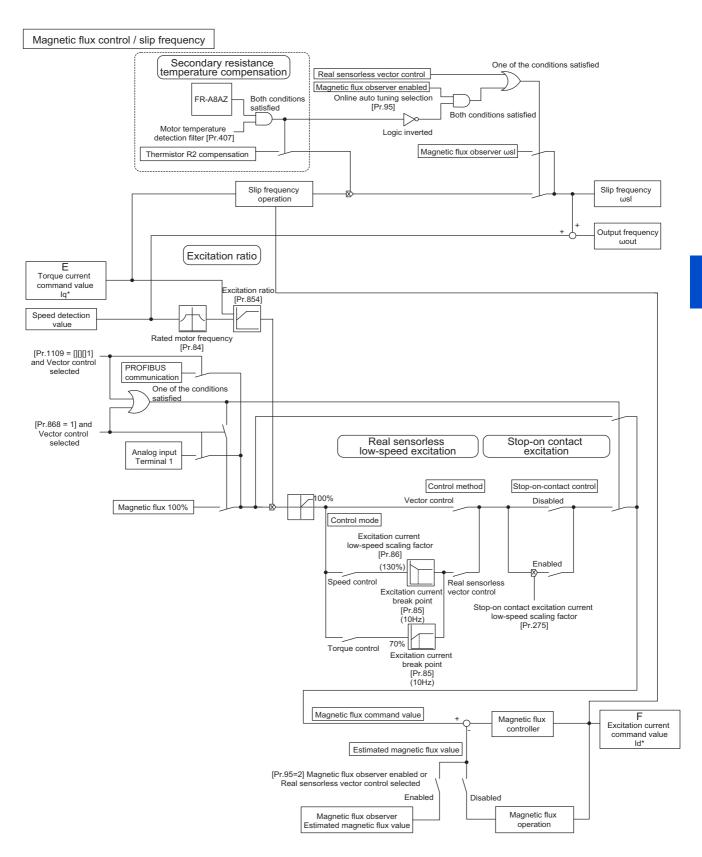


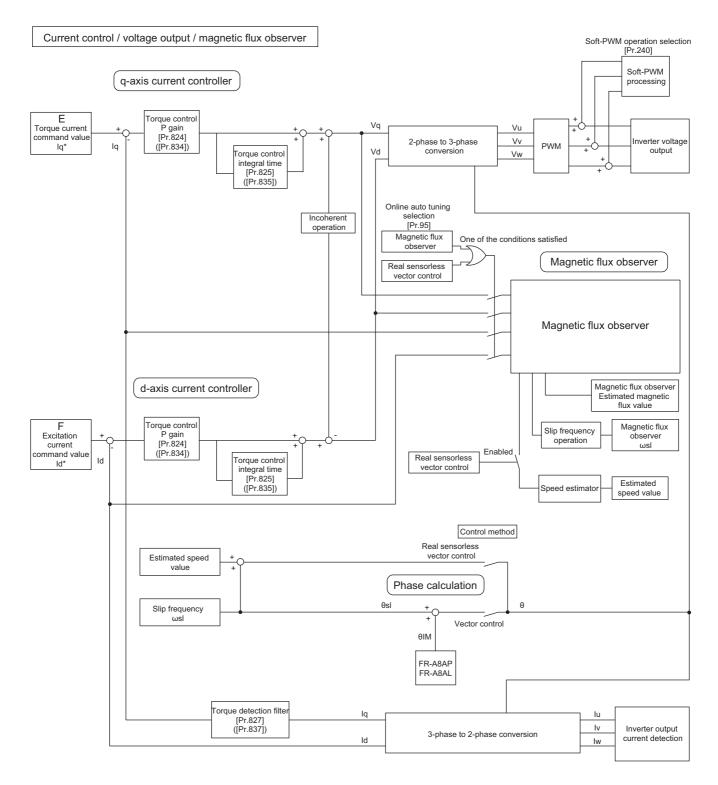
- The RT (Second function selection) signal and the X9 (Third function selection) signal are used to enable switching between
 acceleration/deceleration time settings. The acceleration/deceleration time after switching depends on the settings in Pr.44
 Second acceleration/deceleration time and Pr.45 Second deceleration time, or Pr.110 Third acceleration/deceleration
 time and Pr.111 Third deceleration time. The acceleration/deceleration time is a period of time taken to reach Pr.20
 Acceleration/deceleration reference frequency.
- · Pr.21 Acceleration/deceleration time increments is used to change the setting increment.
- When the automatic restart after instantaneous power failure is selected, the inverter accelerates the motor from the frequency search result frequency to the set frequency. (Pr.57 Restart coasting time ≠ 9999, Pr.162 Automatic restart after instantaneous power failure selection = "10, 12, 13, 1010, 1012, or 1013")
- Pr.811 Set resolution switchover is used to change the setting increment for speed setting, operation speed monitoring, and torque limit setting.
- **Pr.862 Encoder option selection** is used to change the Vector control compatible plug-in option or the control terminal option for the first and second motors.
- To avoid overdriving the motor due to incorrect encoder pulse settings, the output frequency can be limited with the set frequency plus the value set in Pr.873 Speed limit.



Speed controller P/PI selection







5.3.1 Setting procedure of Real sensorless vector control (speed control)

Sensorless

Operating procedure

- **1.** Perform secure wiring. (Refer to page 46.)
- 2. Set the motor (Pr.71). (Refer to page 528.)

 Set Pr.71 Applied motor to "0" (standard motor) or "1" (constant-torque motor).
- **3.** Set the overheat protection of the motor (**Pr.9**). (Refer to page 415.)

- **4.** Set the motor capacity and number of motor poles (**Pr.80** and Pr.81). (Refer to page 221.) V/F control is performed when the setting is "9999" (initial value).
- **5.** Set the rated motor voltage and the rated motor frequency (**Pr.83** and Pr.84). (Refer to page 532.)
- **6.** Select the control method (**Pr.800**). (Refer to page 221.)

 Select **Pr.800** = "10" (speed control) or "12" (speed/torque switchover) to enable speed control.
- 7. Set the operation command. (Refer to page 389.) Select the start command and speed command.
- **8.** Set the torque limit (**Pr.810**). (Refer to page 245.)
- **9.** Perform the offline auto tuning (**Pr.96**) (Refer to page 532.)
- **10.** Perform the test operation.

As required

- Select online auto tuning (Pr.95) (Refer to page 558.)
- Perform easy gain tuning. (Refer to page 256.)
- Adjust the speed control gain manually. (Refer to page 257.)

NOTE

- · During Real sensorless vector control, offline auto tuning must be performed properly before starting operations.
- The speed command setting range under Real sensorless vector control is 0 to 400 Hz.
- The carrier frequency is limited during Real sensorless vector control. (Refer to page 356.)
- Torque control is not available in a low-speed (about 10 Hz or lower) regenerative range, or with a low speed and light load (about 5 Hz or lower and rated torque about 20% or lower). Vector control must be selected.
- Performing pre-excitation (LX signal and X13 signal) under torque control may start the motor running at a low speed even when the start signal (STF or STR) is not input. The inverter at a start command ON may also rotate the motor at a low speed even though a speed limit value is set to zero. Therefore, confirm that the motor running does not cause any safety problem before performing pre-excitation.
- Switching between the forward rotation command (STF) and reverse rotation command (STR) must not be performed during operations under torque control. An overcurrent trip (E.OC[]) or opposite rotation deceleration fault (E.11) will occur.
- When performing continuous operations under Real sensorless vector control in the FR-A820-00250(3.7K) or lower or FR-A840-00126(3.7K) or lower, the speed fluctuation increases when the value is 20 Hz or less, and in the low-speed range of less than 1 Hz, there may be torque shortage. In such case, stop the inverter and restart it to improve the situation.
- In case of starting the motor while the motor is coasting under Real sensorless vector control, the frequency search must be set for the automatic restart after instantaneous power failure function (Pr.57 ≠ "9999", Pr.162 = "10"). (Refer to page 628.)
- When Real sensorless vector control is applied, there may not be enough torque provided in the ultra low-speed range of about 2 Hz or lower.

Generally, the speed control range is as follows.

For power driving, 1:200 (2, 4 or 6 poles) (available at 0.3 Hz or higher when the rating is 60 Hz), 1:30 (8 poles or more) (available at 2 Hz or higher when the rating is 60 Hz).

For regenerative driving, 1:12 (2 to 10 poles) (available at 5 Hz or higher when the rating is 60 Hz).

5.3.2 Setting procedure of Vector control (speed control)

Vector

◆ Using an induction motor

Operating procedure

- **1.** Perform secure wiring. (Refer to page 91.) Install a Vector control compatible option.
- 2. Set the option to be used (Pr.862).
 Set Pr.862 Encoder option selection according to the option to be used. (Refer to page 226.)
- 3. Set the applied motor and encoder (Pr.71, Pr.359 (Pr.852), and Pr.369 (Pr.851)). (Refer to page 94.)
- **4.** Set the overheat protection of the motor (**Pr.9**). (Refer to page 415.) When using the SF-V5RU or a motor equipped with a thermal sensor, set **Pr.9** = 0 A.
- **5.** Set the motor capacity and number of motor poles (**Pr.80** and Pr.81). (Refer to page 221.) V/F control is performed when the setting is "9999" (initial value).
- **6.** Set the rated motor voltage and the rated motor frequency (**Pr.83** and Pr.84). (Refer to page 532.)
- 7. Select the control method (Pr.800). (Refer to page 221.)
 Select Pr.800 = "0" (speed control), "2" (speed/torque switchover), or "4" (speed/position switchover) to enable speed control.
- **8.** Set the operation command. (Refer to page 389.) Select the start command and speed command.
- **9.** Set the torque limit (**Pr.810**). (Refer to page 245.)
- **10.** Perform the test operation.

As required

- Perform offline auto tuning (Pr.96) (Refer to page 532)
- Select online auto tuning (Pr.95) (Refer to page 558.)
- Perform easy gain tuning. (Refer to page 256.)
- · Adjust the speed control gain manually. (Refer to page 257.)

• NOTE

- The speed command setting range under Vector control is 0 to 400 Hz.
- The carrier frequency is limited during Vector control. (Refer to page 356.)
- Refer to the Instruction Manual of each option for details on Vector control using the FR-A8APR, FR-A8APS, or FR-A8APA.

◆ Using a PM motor

Operating procedure

- Set the applied encoder (Pr.359 (Pr.852), Pr.369 (Pr.851)).
 Refer to page 94 and set the parameters according to the option and the encoder to be used.
- 2. Set the applied motor (Pr.9, Pr.71, Pr.80, Pr.81, Pr.83, Pr.84).
 Set Pr.71 Applied motor, Pr.9 Rated motor current, Pr.80 Motor capacity, Pr.81 Number of motor poles, Pr.83
 Rated motor voltage, and Pr.84 Rated motor frequency according to the motor specifications. (Setting "9999 (initial value)" in Pr.80 or Pr.81 selects V/F control.) Set Pr.702, Pr.706, Pr.707, Pr.724 and Pr.725 as required.
- 3. Select Vector control (speed control). (Refer to page 221.)
- **4.** Perform offline auto tuning and encoder position tuning (**Pr.96**). (Refer to page 542.) Set **Pr.96**, and perform tuning.
- Configure the initial parameter setting for the applied motor using Pr.998.
 When the setting for the PM motor is selected in Pr.998 PM parameter initialization, Vector control for the PM
 - "8009": Parameter (rotations per minute) settings for an IPM motor other than MM-CF
 - "8109": Parameter (frequency) settings for an IPM motor other than MM-CF
 - "9009": Parameter (rotations per minute) settings for an SPM motor
 - "9109": Parameter (frequency) settings for an SPM motor
- **6.** Perform the test operation.

motor with an encoder is enabled.

• NOTE

• For PM motors, after performing offline auto tuning and encoder position tuning, first perform PM parameter initialization. If parameter initialization is performed after setting other parameters, some of those parameters are initialized too. (Refer to page 231 for the parameters that are initialized.)

5.3.3 Setting procedure of PM sensorless vector control (speed control)

PM

This inverter is set for a general-purpose motor in the initial setting. Follow the following procedure to change the setting for the PM sensorless vector control.

◆ Driving an MM-CF IPM motor

Operating procedure

1. Perform IPM parameter initialization. (Refer to page 230.)

Set "3003 or 3103" in Pr.998 PM parameter initialization, or select "3003" in "I PM" (IPM initialization).

| setting | Description |
|---------|---|
| .300.3 | Parameter settings for MM-CF IPM motor (rotations per minute) |
| | Parameter settings for MM-CF IPM motor (frequencies) |

- Set parameters such as the acceleration/deceleration time and multi-speed setting.
 Set parameters such as the acceleration/deceleration time and multi-speed setting as required.
- **3.** Set the operation command. (Refer to page 389.) Select the start command and speed command.
- **4.** Perform the test operation.

As required

Perform offline auto tuning for a PM motor. (Refer to page 551.)

NOTE

- To change to the PM sensorless vector control, perform PM parameter initialization at first. If parameter initialization is
 performed after setting other parameters, some of those parameters are initialized too. (Refer to page 231 for the parameters
 that are initialized.)
- To use a motor capacity that is one rank lower than the inverter capacity, set **Pr.80 Motor capacity** before performing PM parameter initialization.
- The speed setting range for an MM-CF IPM motor is between 0 and 200 Hz.
- The carrier frequency is limited during PM sensorless vector control. (Refer to page 356.)
- Constant-speed operation cannot be performed in the low-speed range of 200r/min or less under current synchronization operation. (Refer to page 233.)
- During PM sensorless vector control, the RUN signal is output about 100 ms after turning ON the start command (STF, STR). The delay is due to the magnetic pole detection.
- During PM sensorless vector control, the automatic restart after instantaneous power failure function operates only when an MM-CF IPM motor is connected
 - When a built-in brake or a regeneration unit is used, the frequency search may not be available at 2200 r/min or higher.

The restart operation cannot be performed until the motor speed drops to a frequency where the frequency search is available.

◆ Driving a PM motor other than MM-CF

Operating procedure

- Setting the applied motor (Pr.9, Pr.71, Pr.80, Pr.81, Pr.83, and Pr.84). (Refer to page 528, page 551.)
 Set "8093 (IPM motor other than MM-CF) or 9093 (SPM motor)" in Pr.71 Applied motor. Set Pr.9 Rated motor current, Pr.80 Motor capacity, Pr.81 Number of motor poles, Pr.83 Rated motor voltage, and Pr.84 Rated motor frequency according to the motor specifications. (Setting "9999 (initial value)" in Pr.80 or Pr.81 selects V/F control.)
- **2.** Performing the offline auto tuning for a PM motor (**Pr.96**) (Refer to page 551.)

 Set "1" (offline auto tuning without rotating motor (for other than MM-CF)) in **Pr.96**, and perform tuning.
- 3. Configure the initial setting for the PM sensorless vector control using Pr.998. (Refer to page 231.)
 When the setting for the PM motor is selected in Pr.998 PM parameter initialization, the PM sensorless vector control is selected. [PM] on the operation panel (FR-DU08) is lit when the PM sensorless vector control is set.

| setting | Description |
|---------|---|
| 8009 | Parameter settings for an IPM motor other than MM-CF (rotations per minute) |
| 8109 | Parameter settings for an IPM motor other than MM-CF (frequency) |
| 9009 | Parameter settings (in rotations per minute) for an SPM motor |
| 9109 | Parameter settings (in frequencies) for an SPM motor |

- **4.** Set parameters such as the acceleration/deceleration time and multi-speed setting. Set parameters such as the acceleration/deceleration time and multi-speed setting as required.
- **5.** Set the operation command. (Refer to page 389.) Select the start command and speed command.
- **6.** Perform the test operation.

NOTE

- To change to the PM sensorless vector control, perform PM parameter initialization at first. If parameter initialization is performed after setting other parameters, some of those parameters are initialized too. (Refer to page 231 for the parameters that are initialized.)
- To use a motor capacity that is one rank lower than the inverter capacity, set Pr.80 Motor capacity before performing PM
 parameter initialization.
- The carrier frequency is limited during PM sensorless vector control. (Refer to page 356.)
- Constant-speed operation cannot be performed in the low-speed range of 200r/min or less under current synchronization operation. (Refer to page 233.)
- During PM sensorless vector control, the RUN signal is output about 100 ms after turning ON the start command (STF, STR). The delay is due to the magnetic pole detection.

5.3.4 Setting the torque limit level

Sensorless Vector PM

Limit the output torque not to exceed the specified value.

The torque limit level can be set in a range of 0 to 400%. The TL signal can be used to switch between two types of torque limit. The torque limit level can be selected by setting it with a parameter, or by using analog input terminals (terminals 1, 4). Also, the torque limit levels of forward rotation (power driving/regenerative driving) and reverse rotation (power driving/regenerative driving) can be set individually.

| Pr. | Name | Initial value | Setting range | Description |
|------------|---|------------------------|---------------|--|
| 22 H500 | Stall prevention operation level (Torque limit level) | 150/200% ^{*1} | 0 to 400% | Set the torque limit level as a percentage with regards to the rated torque as 100%. |

| Pr. | Name | Initial value | Setting range | Description | |
|-------------|-------------------------------------|---------------|-----------------|--|---|
| | | | 0 to 400 Hz | Set a frequency of the low-speed range in the constant output range torque characteristic selection. | |
| 85 G201 | Excitation current break point | 9999 | 9999 | SF-PR/SF-HR/SF-HRCA motor: The predetermined frequency is applied. Motor other than the above: 10 Hz is applied. | |
| 86 | Excitation current low- | 9999 | 0 to 300% | Set a torque scaling factor applied to the operation in the low- speed range in the constant output range torque characteristic selection. | |
| G202 | speed scaling factor | | 9999 | is applied. Motor other than the above: 130 | |
| 157 M430 | OL signal output timer | 0 s | 0 to 25 s | operation. | ne at the activation of torque limit |
| | | | 9999 | No OL signal output. | |
| 801 | Output limit laval | 9999 | 0 to 400% | Set the torque current limit level. | 16 1: ::: 1 |
| H704 | Output limit level | 9999 | 9999 | level. | sed for limiting the torque current |
| | | | 0 | The torque rises in the low- speed range. | The motor power output is limited to be constant in the constant power range. |
| | | | 1 | The torque is kept constant in the low-speed range. | The torque is limited to be constant in the constant power range. |
| 803 G210 | tordile characteristic | 0 | 2 | The torque is kept constant in the low-speed range. (The torque current is limited.) | The torque is limited to be constant in the constant power range unless the output limit of the torque current is reached. (The torque current is limited.) |
| | | | 10 | The torque is kept constant in the low-speed range. | The motor power output is limited to be constant in the constant power range. |
| | | | 11 | The torque rises in the low- speed range. | The torque is limited to be constant in the constant power range. |
| | | | 0 | The internal torque limit 2 cannot be used. | |
| | | | 1 | Torque limit by the parameter setting (Pr.805 or Pr.806) (-400 to 400%) | |
| | | | 2 | The internal torque limit 2 cannot be used | |
| 804 D400 | Torque command source selection | 0 | 3 | Torque limit through the CC-Link / CC-Link IE Field Network Link IE TSN communication (FR-A8NC, FR-A8NCE, FR-A80 FR-A8NCG, FR-A800-GN) | |
| | | | 4 | The internal torque limit 2 cannot be used | |
| | | | 5 6 | Torque limit through the CC-Link / CC-Link IE Field Network / CC-Link IE TSN communication (FR-A8NC, FR-A8NCE, FR-A800-GF, FR-A8NCG, FR-A800-GN) | |
| 805 D401 | Torque command value (RAM) | 1000% | 600 to 1400% | Writes the torque limit value in R set torque command by an offse | AM. Regards 1000% as 0%, and t of 1000%. |
| 806 D402 | Torque command value (RAM, EEPROM) | 1000% | 600 to 1400% | Writes the torque limit value in RAM and EEPROM. Regards 1000% as 0%, and set torque command by an offset of 1000%. | |
| 040 | Tanana Badi baad | | 0 | Internal torque limit 1 (torque lim | ited by parameter settings) |
| 810 H700 | Torque limit input method selection | 0 | 1 | External torque limit (torque limit | • , |
| | | | 2 | Internal torque limit 2 (torque lim | ited by communication options) |
| | | 0 | 0 | Speed setting, running speed monitor increments 1 r/min | Torque limit setting increments |
| 811 | Set resolution switchover | | 1 | Speed setting, running speed monitor increments 0.1 r/min | 0.1% |
| D030 | Oct 10001dtion Switchtovel | | 10 | Speed setting, running speed monitor increments 1 r/min Speed setting, running speed | Torque limit setting increments 0.01% |
| | | | 11 | monitor increments 0.1 r/min | |
| 812 | Torque limit level | 9999 | 0 to 400% | Set the torque limit level for forw | ard rotation regenerative driving. |
| H701 | (regeneration) | 0000 | 9999 | Limit using Pr.22 or the analog to | erminal values. |

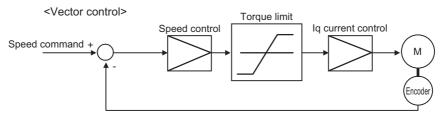
| Pr. | Name | Initial value | Setting range | Description | |
|-------------|--------------------------------|---------------|---------------|--|--|
| 813 | Torque limit level (3rd | 9999 | 0 to 400% | Set the torque limit level for reverse rotation power driving. | |
| H702 | quadrant) | 9999 | 9999 | Limit using Pr.22 or the analog terminal values. | |
| 814 | Torque limit level (4th | 9999 | 0 to 400% | Set the torque limit level for reverse rotation regenerative driving. | |
| H703 | quadrant) | 9999 | 9999 | Limit using Pr.22 or the analog terminal values. | |
| 815 H710 | Torque limit level 2 | 9999 | 0 to 400% | When the torque limit selection (TL) signal is ON, Pr.815 is the torque limit value regardless of Pr.810 . | |
| п/ 10 | , | | 9999 | The torque limit set to Pr.810 is valid. | |
| 816 | Torque limit level during | 9999 | 0 to 400% | Set the torque limit value during acceleration. | |
| H720 | acceleration | 9999 | 9999 | The same torque limit as constant speed. | |
| 817 | Torque limit level during | 9999 | 0 to 400% | Set the torque limit value during deceleration. | |
| H721 | deceleration | 9999 | 9999 | The same torque limit as constant speed. | |
| 858 T040 | Terminal 4 function assignment | 0 | 0, 1, 4, 9999 | The torque limit level can be changed with setting value "4" and the signal to terminal 4. | |
| 868 T010 | Terminal 1 function assignment | 0 | 0 to 6, 9999 | The torque limit level can be changed with setting value "4" and the signal to terminal 1. | |
| 874 H730 | OLT level setting | 150% | 0 to 400% | The inverter can be set to be shut off at activation of torque limit and stalling of the motor. Set the output to be shut off. | |

^{*1} When changing from V/F control or Advanced magnetic flux vector control to Real sensorless vector control or Vector control in the FR-A820-00250(3.7K) or lower or the FR-A840-00126(3.7K) or lower, 150% changes to 200%.

• NOTE

- The lower limit for the torque limit level under Real sensorless vector control is set to 30% even if a value lower than 30% is set.
- When the low-speed range high-torque characteristic is disabled under PM sensorless vector control (**Pr.788** = "0"), the torque limit is not activated in a low-speed range with a rated frequency of less than 10%.
- Under PM sensorless vector control, the torque limit level is reduced inversely proportional to the output frequency in the constant output range of the rated motor frequency or higher.

◆ Block diagram of torque limit



◆ Selecting the torque limit input method (Pr.810)

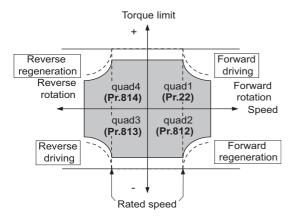
• Use **Pr.810 Torque limit input method selection** to select the method to limit the output torque for speed control. The method in the initial setting is use of the parameter settings.

| Pr.810 setting | Torque limit input method | Operation |
|-------------------|---------------------------|--|
| 0 (initial value) | Internal torque limit 1 | Perform the torque limit operation using the parameter (Pr.22 , Pr.812 to Pr.814) settings. If changing the torque limit parameters via communication is enabled, the torque limit input can be performed via communication. |
| 1 | External torque limit | Torque limit using analog voltage (current) to terminal 1 or terminal 4 is valid. |
| 2 | (Internal torque limit 2) | The torque limit through the CC-Link (FR-A8NC) or CC-Link IE Field Network (FR-A8NCE/FR-A800-GF) communication is valid. |

◆ Torque limit level using parameter settings (Pr.810 = "0", Pr.812 to Pr.814)

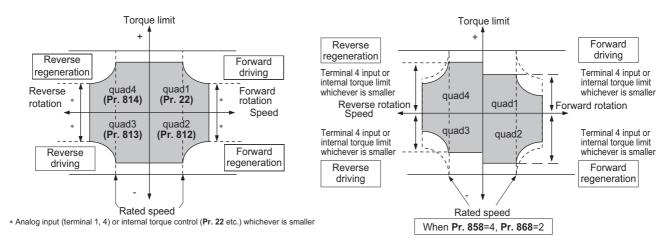
- The torque is limited by parameter setting (Internal torque limit 1).
- In the initial value, a limit is applied to all quadrants by Pr.22 Stall prevention operation level (Torque limit level).

• To set individually for each quadrant, use Pr.812 Torque limit level (regeneration), Pr.813 Torque limit level (3rd quadrant), Pr.814 Torque limit level (4th quadrant). When "9999" is set, Pr.22 setting is regarded as torque limit level in all the quadrants.

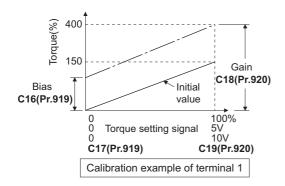


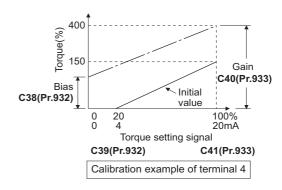
◆ Torque limit level using analog input (terminals 1, 4) (Pr.810 = "1", Pr.858, Pr.868)

- The torque is limited with the analog input of terminal 1 or terminal 4. (External torque limit)
- Torque limit using analog input is valid with a limit value lower than the internal torque limit (Pr.22, Pr.812 to Pr.814). (If the torque limit using analog input exceeds the internal torque limit, the internal torque limit is valid.)
- When inputting the torque limit value from terminal 1, set Pr.868 Terminal 1 function assignment = "4". When inputting from terminal 4, set Pr.858 Terminal 4 function assignment = "4".
- When **Pr.858** = "4" and **Pr.868** = "2", the torque for regenerative driving is limited with the terminal 1 analog input, and the torque for power driving is limited with the terminal 4 analog input.



• The torque limit using analog input can be corrected with the calibration parameters C16 (Pr.919) to C19 (Pr.920), and C38 (Pr.932) to C41 (Pr.933). (Refer to page 510.)







- When inputting an analog signal to the terminal 1, give a positive voltage (0 to +10 V (+5 V)).
 When a negative voltage (0 to -10 V (-5 V)) is input, the torque limit value set by the analog signal becomes "0".
- Functions of terminals 1 and 4 by control (— : no function)

| Pr.858 setting*1 | Terminal 4 function | Pr.868 setting ^{*2} | Terminal 1 function |
|-------------------|---|------------------------------|--|
| | | | Speed setting assistance |
| | | 1*4 | Magnetic flux command*4 |
| | | 2 | _ |
| 0 (initial value) | Speed command (AU signal-ON) | 3 | _ |
| o (iiiilai value) | Opeed command (Ao signal-ON) | 4 | Torque limit (Pr.810 = "1") |
| | | 5 | _ |
| | | 6 | Torque bias (Pr.840 = "1 to 3") |
| | | 9999 | _ |
| | Magnetic flux command*4 | 0 (initial value) | Speed setting assistance |
| | *3 | 1*4 | Magnetic flux command*4 |
| | | 2 | _ |
| 1*4 | | 3 | _ |
| 1 | Magnetic flux command*4 | 4 | Torque limit (Pr.810 = "1") |
| | | 5 | _ |
| | | 6 | Torque bias (Pr.840 = "1 to 3") |
| | | 9999 | _ |
| | Tanana linet (Da 040 - 11411) | 0 (initial value) | Speed setting assistance |
| | Torque limit (Pr.810 = "1") | 1*4 | Magnetic flux command*4 |
| | Power driving torque limit (Pr.810 = "1") | 2 | Regenerative torque limit (Pr.810 = "1") |
| 4*2 | Torque limit (Pr.810 = "1") | 3 | _ |
| | *3 | 4 | Torque limit (Pr.810 = "1") |
| | | 5 | _ |
| | Torque limit (Pr.810 = "1") | 6 | Torque bias (Pr.840 = "1 to 3") |
| | | 9999 | _ |
| 9999 | _ | _ | _ |

- *1 When Pr.868 ≠ "0", the other functions of terminal 1 (auxiliary input, override function, PID control) do not operate.
- *2 When **Pr.858** # "0", PID control and speed commands using terminal 4 do not operate even when the AU signal is ON.
- *3 When both **Pr.858** and Pr.868 are "1" (magnetic flux command) or "4" (torque limit), the function of terminal 1 has higher priority, and terminal 4 does not function.
- *4 Valid when Vector control compatible options are installed and the Vector control is selected.

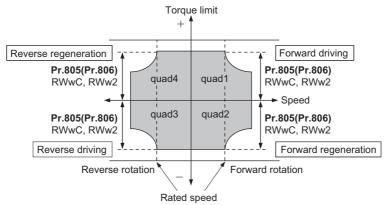
◆ Torque limit level through the CC-Link / CC-Link IE Field Network / CC-Link IE TSN communication (Pr.810 = "2", Pr.805, Pr.806)

- When the CC-Link (FR-A8NC), CC-Link IE Field network (FR-A8NCE/FR-A800-GF), or CC-Link IE TSN (FR-A8NCG/FR-A800-GN) communication is used, the Pr.805 or Pr.806 setting is used as the torque limit value. (Internal torque limit 2)
- When the CC-Link communication (Ver. 2) is used in the quadruple or octuple setting (**Pr.544** = "14, 18, 114, or 118"), the torque limit value can be input using a remote register (RWwC).
- When the CC-Link IE Field Network or CC-Link IE TSN is used, the torque limit value can be input using a remote register (RWw2).

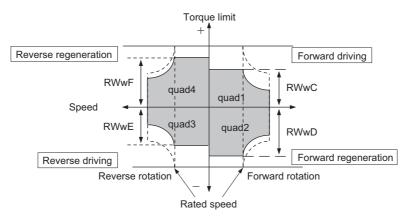
| Pr.804 | Torque lim | it input | | Setting increments |
|---------|--|---|------------------------------------|--------------------|
| setting | CC-Link/PLC function | CC-Link IE Field Network / CC- Link IE TSN | Setting range ^{*1} | |
| 1 | Torque limit by Pr.805 , Pr.806 *2 | Torque limit by remote register | 600 to 1400 (-400% to 400%) | 1% |
| 3 | Torque limit by remote register (RWw2)*3 | (RWw2)*3 | | |
| 5 | Torque limit by remote register (RWw2)*3 | Torque limit by remote register (RWw2)*3 | -32768 to 32767 (two's complement) | 0.01%*4 |
| 6 | Torque limit by Pr.805 , Pr.806 *2 | (KVVWZ) | (-327.68% to 327.67%)*4 | |

^{*1} The torque limit setting is defined as an absolute value.

- *2 Can also be set from operation panel or parameter unit.
- *3 The torque can also be limited by setting a value in Pr.805 or Pr.806.
- *4 If set by operation panel or parameter unit, setting range is "673 to 1327 (-327% to 327%)", setting increment is 1%.



When the CC-Link communication (Ver. 2) is used in the quadruple or octuple setting (Pr.544 = "24, 28, or 128"), the torque limit value can be input using a remote register (RWwC to RWwF) for each of the four quadrants.

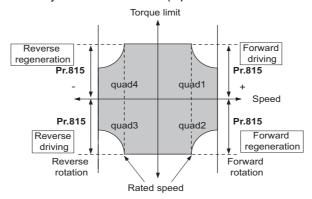




- When "2" is set in **Pr.810** while the communication option is not connected, a protective function (E.OPT) is activated. (PLC function disabled)
- For details on the FR-A8NC, FR-A8NCE, or FR-A8NCG, refer to the Instruction Manual of each option. For details on the CC-Link IE Field Network, refer to page 752. For details on CC-Link IE TSN communication, refer to the CC-Link IE TSN Function Manual.

◆ Second torque limit level (TL signal, Pr.815)

- For **Pr.815 Torque limit level 2**, when the Torque limit selection (TL) signal is ON, the setting value of **Pr.815** is the limit value regardless of the setting of **Pr.810 Torque limit input method selection**.
- To assign the TL signal, set "27" in any of Pr.178 to Pr.189 (Input terminal function selection).

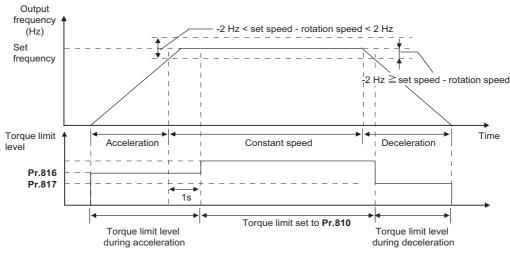




Changing the terminal assignment using Pr.178 to Pr.189 (Input terminal function selection) may affect the other functions.
 Set parameters after confirming the function of each terminal.

◆ Setting the torque limit values during acceleration/deceleration individually (Pr.816, Pr.817)

- The torque limit during acceleration and deceleration can be set individually. Torque limit using the setting values of Pr.816
 Torque limit level during acceleration and Pr.817 Torque limit level during deceleration is as follows.
- If 1 second elapses while the difference between the set speed and rotation speed is within ±2 Hz, the torque limit level during acceleration/deceleration (**Pr.816** or **Pr.817**) changes to the torque control level during constant speed (**Pr.22**).
- When the difference between the set speed and rotation speed is -2 Hz or less, the torque limit level during deceleration Torque limit level during deceleration (**Pr.817**) activates.





• The **Pr.816 and Pr.817** settings are invalid under position control.

◆ Changing the setting increments of the torque limit level (Pr.811)

• The setting increments of **Pr.22 Torque limit level**, **Pr.801 Output limit level**, and **Pr.812 to Pr.817 Torque limit level** can be changed to 0.01% by setting **Pr.811 Set resolution switchover** = "10 or 11".

| Pr.811 setting | Increments of speed setting and running speed monitoring*1 | Torque limit setting increments | |
|----------------|--|---------------------------------|--|
| 0 | 1 r/min | 0.1% | |
| 1 | 0.1 r/min | | |
| 10 | 1 r/min | 0.01% | |
| 11 | 0.1 r/min | 0.0170 | |

*1 For details on the increments of speed setting and running speed monitoring, refer to page 444.



- The internal resolution of the torque limit is 0.024% (100/212), and fractions below this resolution are rounded off.
- When Real sensorless vector control is selected, fractions below a resolution equivalent to 0.1% are rounded off even if **Pr.811** = "10 or 11" is set.
- For details on changing the speed setting increments, refer to page 444.

Changing the torque characteristic of the constant-power range (Pr.801, Pr.803)

• Under Real sensorless vector control or Vector control, the torque characteristic can be changed between in the low-speed range and in the constant power range.

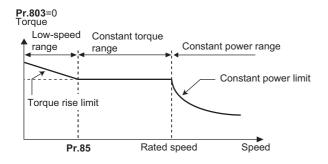
• Use **Pr.85 Excitation current break point** to change the low-speed range, and use **Pr.86 Excitation current low-speed scaling factor** to change the torque in the low-speed range. When **Pr.85** = "9999 (initial value)", a predetermined frequency is used. When **Pr.86** = "9999 (initial value)", a predetermined scaling factor is used (refer to page 711).

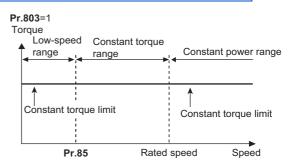
| Pr.803 setting | Torque characteristic in low- | Torque characteristic in constant-power range | | | |
|-------------------|--|---|--------------|--|--|
| Pr.ous Setting | speed range | Torque characteristic | Output limit | | |
| 0 (initial value) | The torque changes according to | Constant motor output | | | |
| o (ililiai value) | the scaling factor set in Pr.86 .*1 | Constant motor output | _ | | |
| 1 | Constant torque | Constant torque | Without | | |
| 2 | Constant torque | Constant torque | With | | |
| 10 | Constant torque | Constant motor output | _ | | |
| 11 | The torque changes according to | Constant torque | Without | | |
| 11 | the scaling factor set in Pr.86 .*1 | Constant torque | without | | |

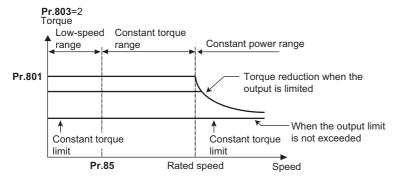
^{*1} This is applicable only under Real sensorless vector control. The upper limit of the torque at 0 Hz is determined by multiplying the torque limit in the constant-torque range by the scaling factor set in **Pr.86**.

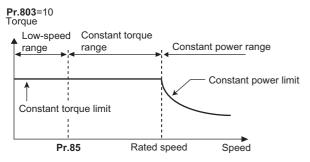
· To avoid overload or overcurrent of the inverter or motor, use Pr.801 Output limit level to limit the torque current.

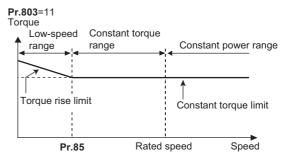
| Pr.801 setting | Description |
|----------------|---|
| 0 to 400% | Set the torque current limit level. |
| 9999 | The torque limit setting value (Pr.22, Pr.812 to Pr.817, etc.) is used for limiting the torque current. |











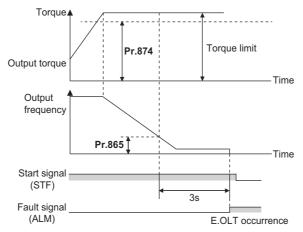


• When the torque limit setting value (**Pr.22**, **Pr.812 to Pr.817**, etc.) is less than the value set in **Pr.801**, the **Pr.801** setting is used for limiting the torque current.

◆ Trip during torque limit operation (Pr.874)

• The inverter can be set to be shut off at activation of torque limit and stalling of the motor.

When a high load is applied and the torque limit is activated under speed control or position control, the motor stalls. At
this time, if a state where the rotation speed is lower than the value set in Pr.865 Low speed detection and the output
torque exceeds the level set in Pr.874 OLT level setting continues for 3 seconds, Stall prevention stop (E.OLT) is
activated and the inverter output is shut off.





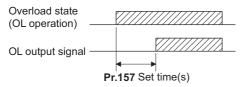
- Under V/F control or Advanced magnetic flux vector control, if the output frequency drops to 0.5 Hz due to the stall prevention
 operation and this state continues for 3 seconds, a fault indication (E.OLT) appears, and the inverter output is shut off. This
 operation is activated regardless of the Pr.874 setting.
- · This fault does not occur under torque control.

Adjusting the signal output under torque limit operation and output timing (OL signal, Pr.157)

- If the output torque exceeds the torque limit level and the torque limit is activated, the overload warning (OL signal) is turned ON for 100 ms or longer. When the output torque drops to the torque limit level or lower, the output signal also turns OFF.
- **Pr.157 OL signal output timer** can be used to set whether to output the OL signal immediately, or whether to output it after a certain time period has elapsed.

| Pr.157 setting value | Description |
|----------------------|--------------------------------|
| 0 (initial value) | Output immediately. |
| 0.1 to 25 | Output after the set time (s). |
| 9999 | Not output. |

• The OL signal is also output during the regeneration avoidance operation (" | display (overvoltage stall)).



NOTE

- The OL signal is assigned to terminal OL in the initial status. The OL signal can also be assigned to other terminals by setting "3 (positive logic) or 103 (negative logic)" in any of **Pr.190 to Pr.196** (Output terminal function selection).
- Changing the terminal assignment using **Pr.190 to Pr.196 (Output terminal function selection)** may affect the other functions. Set parameters after confirming the function of each terminal.

Parameters referred to

Pr.22 Stall prevention operation level ☐ page 431
Pr.178 to Pr.189 (Input terminal function selection) ☐ page 521
Pr.190 to Pr.196 (Output terminal function selection) ☐ page 473
Pr.840 Torque bias selection ☐ page 265
Pr.865 Low speed detection ☐ page 484

5.3.5 Performing high-accuracy, fast-response control (gain adjustment for Real sensorless vector control, Vector control, and PM sensorless vector control)

Sensorless Vector PM

The load inertia ratio (load moment of inertia) for the motor is calculated in real time from the torque command and rotation speed during motor driving by the Vector control. Because the optimum gain for speed control and position control is set automatically from the Load inertia ratio and the response level, the work required for gain adjustment is reduced. (Easy gain tuning)

If the load inertia ratio cannot be calculated due to load fluctuations, or under Real sensorless vector control or PM sensorless vector control, the control gain can be set automatically by entering the load inertia ratio manually.

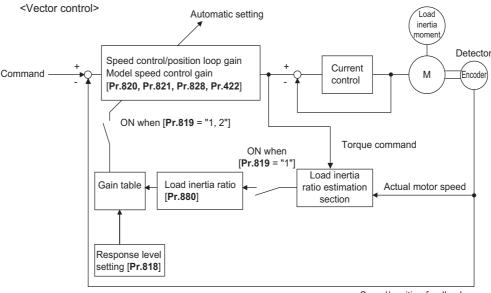
Manual gain adjustment is useful for achieving optimum machine performance or improving unfavorable conditions, such as vibration and acoustic noise during operation with high load inertia or gear backlash.

| Pr. | Name | Initial value | Setting range | Description |
|--------------|---|---------------------|---------------|---|
| 818 C112 | Easy gain tuning response level setting | 2 | 1 to 15 | Set the response level. 1 (Slowest) to 15 (Fastest) |
| | | | 0 | No easy gain tuning |
| 819 C113 | Easy gain tuning selection | 0 | 1 | Gain is calculated with load calculation (This function is valid under Vector control.) |
| | | | 2 | Gain is calculated with load (Pr.880) manual input |
| 820 G211 | Speed control P gain 1 | 60% | 0 to 1000% | The proportional gain during speed control is set. (Setting this parameter higher improves the trackability for speed command changes. It also reduces the speed fluctuation caused by external disturbance.) |
| 821 G212 | Speed control integral time 1 | 0.333 s | 0 to 20 s | The integral time during speed control is set. (Setting this parameter lower shortens the return time to the original speed when the speed fluctuates due to external disturbance.) |
| 830 | Smood control D main 2 | 9999 | 0 to 1000% | Second function of Pr.820 (valid when RT signal is ON) |
| G311 | Speed control P gain 2 | | 9999 | The Pr.820 setting is applied to the operation. |
| 831 | Speed control integral time 2 | 9999 | 0 to 20 s | Second function of Pr.821 (enabled when the RT signal is ON) |
| G312 | Speed Control Integral time 2 | | 9999 | The Pr.821 setting is applied to the operation. |
| 880 C114 | Load inertia ratio | 7-fold | 0 to 200-fold | Set the load inertia ratio for the motor. |
| 1115 G218 | Speed control integral term clear time | 0 ms | 0 to 9998 ms | Set time until the integral term is reduced and cleared after P control switching. |
| 1116 G206 | Constant output range speed control P gain compensation | 0% | 0 to 100% | Set a compensation amount of the speed control P gain in the constant output range (rated speed or higher). |
| 1117 | Speed control P gain 1 (per-unit | 9999 | 0 to 300 | Set a proportional gain under speed control in the per-unit system. |
| G261 | system) | 9999 | 9999 | The Pr.820 setting is applied to the operation. |
| 1118 | Speed control P gain 2 (per-unit | 9999 | 0 to 300 | Second function of Pr.1117 (valid when RT signal ON) |
| G361 | system) | 0000 | 9999 | The Pr.1117 setting is applied to the operation. |
| 1121 | Per-unit speed control | 120 Hz*1 | 0 to 400 Hz | Set the speed at 100% when setting speed control P gain or |
| G260 | reference frequency | 60 Hz ^{*2} | U 10 400 ⊓Z | model speed control gain in the per-unit system. |
| 1348 G263 | P/PI control switchover frequency | 0 Hz | 0 to 400 Hz | Set the motor speed for the P/PI control switchover. |

^{*1} For the FR-A820-03160(55K) or lower, and FR-A840-01800(55K) or lower.

^{*2} For the FR-A820-03800(75K) or higher, and FR-A840-02160(75K) or higher.

◆ Block diagram of easy gain tuning function



Speed/position feedback



· Easy gain tuning is valid for the first motor. When applying the second motor (RT signal is ON), tuning is not performed.

◆ Execution procedure for easy gain tuning (Pr.819 = "1" Load inertia ratio automatic calculation)

Easy gain tuning (load inertia ratio automatic calculation) is only valid in the speed control and position control modes of Vector control. It is invalid under torque control, V/F control, Advanced magnetic flux vector control, Real sensorless vector control, and PM sensorless vector control.

1. Set the response level in Pr.818 Easy gain tuning response level setting.
Setting this parameter higher improves the trackability for commands, but setting it too high causes vibration. The following figure shows the relationship between the setting and the response level.

| Pr. 818 setting | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
|--|------|----|----|-------|------|----|---------|---------|----|----|----|----|----|-----|-------|
| Response level | Slow | | | | | | | /liddle | | | | | - | | stest |
| Guideline of mechanical resonance frequency (Hz) | 8 | 10 | 12 | 15 | 18 | 22 | 28 | 34 | 42 | 52 | 64 | 79 | 98 | 122 | 150 |
| Inverter application | | | | Large | eyor | 11 | ool, co | machi | on | bl | | | | | |

2. The load inertia ratio is calculated during acceleration/deceleration, and from this value and the value of **Pr.818 Easy** gain tuning response level setting, the gain for each control is set automatically.

Pr.880 Load inertia ratio is used as the initial value of the load inertia ratio when performing tuning. During tuning, the estimated value is set in **Pr.880**.

The calculation of the load inertia ratio may take excessive time or otherwise not be performed properly if the following conditions are not satisfied.

- The time in acceleration/deceleration driving until 1500 r/min is reached in 5 seconds or less.
- The rotation speed in driving is 150 r/min or higher.
- The acceleration/deceleration torque is 10% or higher.
- · No sudden external disturbances during acceleration/deceleration.
- The load inertia ratio is about 30-fold or lower.
- · No gear backlash or belt sagging.
- **3.** Press FWD or REV to calculate the continuous load inertia ratio, or calculate the gain. (The operation command during External operation is the STF or STR signal.)

◆ Execution procedure for easy gain tuning (Pr.819 = "2" Load inertia ratio manual input)

Easy gain tuning (Load inertia ratio manual input) is valid in the speed control mode under Real sensorless vector control, the speed control and position control modes under Vector control, and the speed control mode under PM sensorless vector control.

- 1. Set the load inertia ratio for the motor in Pr.880 Load inertia ratio.
- 2. Set "2" (easy gain tuning enabled) in Pr.819 Easy gain tuning selection. After setting, Pr.820 Speed control P gain 1 and Pr.821 Speed control integral time 1 are set automatically.
 Operation is performed with the adjusted gain from the next operation.
- **3.** Perform the test operation, and set the response level in **Pr.818 Easy gain tuning response level setting**. Setting this parameter higher improves the trackability for commands, but setting it too high causes vibration. (The response level can be adjusted during operation when **Pr.77 Parameter write selection** ="2" (parameters can be written during operation).)



- When **Pr.819** = "1 or 2" is set, even if the **Pr.819** setting value is returned to "0" after tuning is performed, the data that was set in each parameter is retained in the tuning results.
- If good precision cannot be obtained even after executing easy gain tuning, because of external disturbances or other reasons, perform fine adjustment manually. At this time, set the setting value of **Pr.819** to "0" (no easy gain tuning).

◆ Parameters set automatically by easy gain tuning

The following table shows the relationship between the easy gain tuning function and gain adjustment parameters.

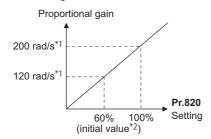
| | | Easy gain tuning selection (Pr.819) s | etting |
|--|--------------|---|--|
| | 0 | 1 | 2 |
| Pr.880 Load inertia ratio | Manual input | The inertia calculation result (RAM) using easy gain tuning is displayed. The parameter is set at the following times. Every hour after turning ON the power When Pr.819 is set to a value other than "1" After changing to a control other than Vector control (such as V/F control) using Pr.800 Write (manual input) is available only during a stop. | Manual input |
| Pr.820 Speed control P gain 1 Pr.821 Speed control integral time 1 Pr.828 Model speed control gain Pr.422 Position control gain Pr.446 Model position control gain | Manual input | The tuning result (RAM) is displayed. The parameter is set at the following times. • Every hour after turning ON the power • When Pr.819 is set to a value other than "1" • After changing to a control other than Vector control (such as V/F control) using Pr.800 Write (manual input) is not available | Gain is calculated when Pr.819 is set to "2", and the result is set in the parameter. When read, the tuning result (parameter setting value) is displayed. Write (manual input) is not available |



- If easy gain tuning is executed at an inertia equal to or higher than the specified value under Vector control, a fault such as hunting may occur. Also, if the motor shaft is fixed by the servo lock or position control, the bearing may be damaged. In this case, do not perform easy gain tuning. Adjust the gain manually.
- · The load inertia ratio is only calculated under Vector control.

Adjusting the speed control gain manually (Pr.819 = "0" No easy gain tuning)

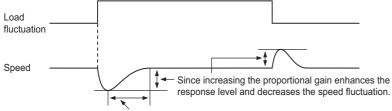
- The speed control gain can be adjusted for the conditions such as abnormal machine vibration, acoustic noise, slow response, and overshoot.
- Setting 60% (initial value) in **Pr.820 Speed control P gain 1** is equivalent to 120 rad/s (speed response of a single motor). (Equivalent to the half the rad/s value during Real sensorless vector control or with the FR-A820-03800(75K) or higher and the FR-A840-02160(75K) or higher during Vector control.) Setting this parameter higher speeds up the response, but setting this too high causes vibration and acoustic noise.
- Setting **Pr.821 Speed control integral time 1** lower shortens the return time to the original speed during speed fluctuation, but setting it too low causes overshoot.



*1 The following shows the response level to the proportional gain.

| | | Response l | level (rad/s) | | | |
|-------------------|----------------|------------------------------------|--------------------------------|--------------------------------|--|--|
| Pr.820 setting | | D(55K) or lower D(55K) or lower | FR-A820-03800 FR-A840-02160 | ` ' | | |
| Setting | Vector control | Real sensorless vector control | Vector control | Real sensorless vector control | | |
| 60 | 120 | 60 | 60 | 30 | | |
| 100 | 200 | 100 | 100 | 50 | | |

- *2 Performing PM parameter initialization changes the settings. (Refer to page 231.)
- · Actual speed gain is calculated as follows when load inertia is applied.



Decreasing the integral time shortens the return time taken.

Actual speed gain = Speed gain of a single motor $\times \frac{JM}{JM+JL}$

JM: Motor inertia

JL: Load inertia converted as the motor axis inertia

◆ Adjustment procedure

- 1. Change the **Pr.820** setting while checking the conditions.
- 2. If it cannot be adjusted well, change Pr.821 setting, and perform step 1 again.

| No. | Movement / condition | | Adjustment method | | | |
|-----|--|--|---|--|--|--|
| | | Set Pr.82 | Set Pr.820 and Pr.821 higher. | | | |
| 1 | Load inertia is too high. | Pr.820 | If acceleration is slow, raise the setting by 10% and then set the value to 80 to 90% of the setting immediately before vibration/noise starts occurring. | | | |
| | | Pr.821 | If overshoots occur, set about 80 to 90% of the maximum value without overshooting while increasing the setting value by twice. | | | |
| | | Set Pr.82 | lower and Pr.821 higher. | | | |
| 2 | Vibration or acoustic noise are generated from | Pr.820 | Set about 80 to 90% of the maximum value without any vibration/noise while decreasing the setting value by 10%. | | | |
| | machines. | Pr.821 | If overshoots occur, set about 80 to 90% of the maximum value without overshooting while increasing the setting value by twice. | | | |
| | | Set Pr.82 | D higher. | | | |
| 3 | Response is slow. | Pr.820 | If acceleration is slow, set about 80 to 90% of the maximum value without any vibration/ acoustic noise while increasing the setting value by 5%. | | | |
| | Poturn time (reenence | Set Pr.82 | l lower. | | | |
| 4 | Return time (response time) is long. | | Set about 80 to 90% of the maximum value without overshooting or unstable movements while decreasing the setting value of Pr.821 by half. | | | |
| | Overshoots or unstable | Set Pr.821 higher. | | | | |
| 5 | movements occur. | Set about 80 to 90% of the maximum value without overshooting or unstable movements while increasing the setting value of Pr.821 by double. | | | | |

NOTE

- When adjusting the gain manually, set Pr.819 Easy gain tuning selection to "0" (no easy gain tuning) (initial value).
- Pr.830 Speed control P gain 2 and Pr.831 Speed control integral time 2 are valid when terminal RT is ON. In this case, replace them for Pr.820 and Pr.821 in the description above.

♦ When using a multi-pole motor (8 poles or more)

- If the motor inertia is known, set Pr.707 Motor inertia (integer) and Pr.724 Motor inertia (exponent). (Refer to page 532.)
- Under Real sensorless vector control or Vector control, adjust Pr.820 Speed control P gain 1 and Pr.824 Torque control
 P gain 1 (current loop proportional gain) to suit the motor, by referring to the following methods.
- Setting the parameter of **Pr.820 Speed control P gain 1** higher speeds up the response, but setting this too high causes vibration and acoustic noise.
- Setting the parameter of **Pr.824 Torque control P gain 1 (current loop proportional gain)** too low causes current ripple, and a noise synchronous with this will be emitted from the motor.
- · Adjustment method:

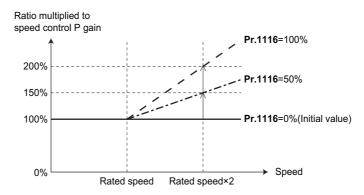
| No. | Movement / condition | Adjustment method |
|-----|---|---|
| 1 | Motor rotation speed in the low- speed range is unstable. | Pr.820 Speed control P gain 1 must be set higher according to the motor inertia. For multi-pole motors, because the inertia of the motor itself tends to be large, first perform broad adjustment to improve the unstable movements, and then perform fine adjustment by referring to the response level based on this setting. Also, for Vector control, gain adjustment appropriate for the inertia can be easily performed by using easy gain tuning (Pr.819 = "1"). |
| 2 | Rotation speed trackability is poor. | |
| 3 | Large fluctuation of the rotation speed relative to load fluctuation. | value that approximately 80% to 90% of the setting right before vibration/noise starts occurring. If it cannot be adjusted well, double Pr.821 Speed control integral time 1 and perform the adjustment of Pr.820 again. |
| 4 | Torque shortage or motor backlash occurs when starting or passing a low-speed range under Real sensorless vector control. | Set the speed control gain higher. (The same as No.1.) If this cannot be prevented through gain adjustment, raise Pr.13 Starting frequency for a fault that occurs when starting, or shorten the acceleration time and avoid continuous operation in a low-speed range. |
| 5 | Unusual vibration, noise and overcurrent of the motor or machine occurs. | Set Pr.824 Torque control P gain 1 (current loop proportional gain) lower. Lower the setting by 10% and set a value that is approximately 80% to 90% of the |
| 6 | Overcurrent or overspeed (E.OS) occurs when starting under Real sensorless vector control. | setting immediately before the condition improves. |

Compensating the speed control P gain in the constant output range (Pr.1116)

- In the constant output range (rated speed or higher), the response of speed control is reduced due to weak field. Thus, the speed control P gain is needed to be compensated using Pr.1116 Constant output range speed control P gain compensation.
- In **Pr.1116**, set a compensation amount for the doubled rated speed regarding the speed control P gain at the rated speed or lower as 100%.

(Speed control P gain at rated speed or higher) = (Speed control P gain at rated speed or lower) × (100% + compensation amount)

Compensation amount = Pr.1116/Rated speed × (Speed - Rated speed)



Setting the speed control P gain in the per-unit system (Pr.1117, Pr.1118, Pr.1121)

- The speed control P gain can be set in the per-unit (pu) system.
- · In the per-unit system:

When "1" is set, the torque (Iq) command is 100% (rated Iq) when the speed deviation is 100%.

When "10" is set, the torque (Iq) command is 10% (rated Iq) when the speed deviation is 100%.

Set the 100% speed in Pr.1121 Per-unit speed control reference frequency.

• The speed control P gain becomes as follows according to Pr.1117 Speed control P gain 1 (per-unit system), Pr.1118 Speed control P gain 2 (per-unit system), and the RT signal.

| Pr.1117 | Pr.1118 | Pr.830 | RT signal | Speed control P gain |
|--------------------|------------|--------------------|-----------|----------------------|
| | | _ | OFF | Pr.820 |
| 9999 | 9999 | 9999 | ON | Pr.820 |
| 0000 | 9999 | Other than 9999 | ON | Pr.830 |
| Other than 9999 | 9999 | _ | _ | Pr.1117 |
| 9999 | Other than | | OFF | Pr.820 |
| 9999 | 9999 | _ | ON | Pr.1118 |
| Other than | Other than | | OFF | Pr.1117 |
| 9999 | 9999 | | ON | Pr.1118 |



- The per-unit system setting is available only under Real sensorless vector control or Vector control.
- When the speed control P gain or model speed control gain is set in the per-unit system, the easy gain tuning selection (Pr.819 = "1 or 2") becomes invalid.

◆ Switching over P/PI control (Pr.1115, X44 signal)

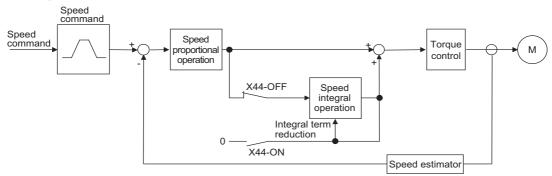
• In speed control under Real sensorless vector control or Vector control, whether or not to add the integral time (I) when performing gain adjustment with P gain and integral time can be performed with the P/PI control switchover signal (X44). When X44 signal is OFF...PI control

When X44 signal is ON...P control

- To input the X44 signal, set "44" in any of **Pr.178 to Pr.189 (Input terminal function selection)** to assign the function to a terminal.
- The shock of P/PI control switchover is absorbed by setting **Pr.1115 Speed control integral term clear time**. When the X44 signal is turned ON, integration is stopped and the accumulated integral term is reduced and cleared according to the setting of **Pr.1115 Speed control integral term clear time** (initial value is 0 ms).

In **Pr.1115**, set time when the integral term is reduced from 100% to 0% regarding the rated torque current (Iq) as 100%. Turning OFF the X44 signal resumes the integral operation.

[Function block diagram]





- Changing the terminal assignment using **Pr.178 to Pr.189 (Input terminal function selection)** may affect the other functions. Set parameters after confirming the function of each terminal.
- The speed loop integration can be disabled at the emergency stop using **Pr.1349 Emergency stop operation selection**. (Refer to page 367.)

◆ P/PI control switchover according to the motor speed (Pr.1348)

 When the motor speed falls below the Pr.1348 setting during speed control under Real sensorless vector control or Vector control, speed loop integration is stopped and the accumulated integral term is cleared.

Pr.1348 setting or more: PI control

Less than the Pr.1348 setting: P control

• The shock of P/PI control switchover is absorbed by setting Pr.1115 Speed control integral term clear time. When the motor speed falls below the Pr.1348 setting, speed loop integration is stopped and the accumulated integral term is reduced and cleared according to the Pr.1115 setting (initial value is 0 ms). In Pr.1115, set time when the integral term is reduced from 100% to 0% regarding the rated torque current (Iq) as 100%. When the motor speed is increased to the Pr.1348 setting plus 2 Hz or more, integral operation is resumed.



The speed loop integration can be disabled at the emergency stop using Pr.1349 Emergency stop operation selection.
 (Refer to page 367.)

Troubleshooting in the speed control 5.3.6

Sensorless Vector PM

| No. | Condition | Possible cause | Countermeasure |
|-----|---|---|--|
| | | Motor wiring is incorrect. | Check the wiring. Set V/F control (set Pr.80 Motor capacity or Pr.81 Number of motor poles to "9999") and check the motor rotation direction. For SF-V5RU (1500 r/min series), set Pr.19 Base frequency voltage to 170 V (340 V) when the value is 3.7 kW or lower, and set it to 160 V (320 V) when the value is higher, and set Pr.3 Base frequency to 50 Hz. When a forward signal is input, rotation in the counterclockwise direction as viewed from the motor shaft direction is correct. (Clockwise rotation means that the phase sequence of the inverter secondary side wiring is different.) |
| | | switch (Vector control compatible option) is incorrect. | Check the encoder specifications. Check the encoder type selection switch of differential/complementary (Vector control compatible option). |
| 1 | The motor does not rotate. (Vector control) | The wiring of the encoder is incorrect. | When using the system where the motor shaft can be rotated by an external force other than the motor without any safety troubles at Vector control setting, rotate the motor counterclockwise and check if FWD is indicated. If REV is indicated, the phase sequence of the encoder is incorrect. Check the wiring, and set Pr.359 (Pr.852) Encoder rotation direction in accordance with the motor specification. (Refer to page 87.) If the clockwise direction is forward as viewed from the motor shaft side, set Pr.359(Pr.852) = "0". If the counterclockwise direction is forward as viewed from the motor shaft side, set Pr.359 (Pr.852) = "1". |
| | | The parameter setting and the number of encoder pulses used are different. | If the parameter setting value is lower than the number of encoder pulses used, the motor does not rotate. Set Pr.369 (Pr.852) Number of encoder pulses correctly. (Refer to page 87.) |
| | | Encoder power specifications are incorrect. Alternatively, power is not input. | Check the encoder power specifications (5 V/12 V/15 V/24 V), and input the external power supply. When the encoder output is the differential line driver type, only 5 V can be input. Make the voltage of the external power supply same as the encoder output voltage, and connect the external power supply between PG and SD. |
| | | The option to be used and parameter settings do not match. | Correctly set Pr.862 Encoder option selection according to the option to be used. (Refer to page 226.) |
| | | Speed command from the controller is different from the actual speed. The speed command is affected by noise. | Check that the speed command sent from the controller is correct. (Take EMC measures.) Lower the setting of Pr.72 PWM frequency selection. |
| 2 | Motor does not run at the correct speed. (Command speed and actual speed | The command speed and the speed recognized by the inverter are different. | Adjust the bias and gain Pr.125, Pr.126, C2 to C7, C12 to C15 of the speed command again. |
| | differ.) | The setting for the number of encoder pulses is incorrect. | Check the settings of Pr.369 (Pr.851) (under Vector control). (Refer to page 87.) |
| | | The motor constant varies due to increase in the motor temperature. | Enable the online auto tuning at startup (set Pr.95 (Pr.574) = "1") (under Real sensorless vector control). (Refer to page 558.) To perform the online auto tuning at startup for a lift, use of the Start-time tuning start external input (X28) signal is recommended. |
| 3 | The speed does not accelerate to the | Torque shortage. The torque limit is operating. | Raise the torque limit. (Refer to the torque limit for speed control on page 245.) Increase the capacity. |
| | command speed. | Only P (proportional) control is performed. | Speed deviation occurs under P (proportional) control when the load is heavy. Select PI control. |

| No. | Condition | Possible cause | Countermeasure |
|-----|---|---|--|
| | | Speed command varies. | Check that the speed command sent from the controller is correct. (Take EMC measures.) Set Pr.72 lower. Set Pr.822 Speed setting filter 1 higher. (Refer to page 503.) |
| 4 | Motor speed fluctuates. | Torque shortage. | Raise the torque limit. (Refer to the torque limit for speed control on page 245.) |
| | | Speed control gain is not suitable for the machine. (Resonance occurs.) | Perform easy gain tuning. Adjust Pr.820 Speed control P gain 1 and Pr.821 Speed control integral time 1. Perform speed feed forward control or model adaptive speed control. |
| _ | Hunting (vibration or acoustic noise) | Speed control gain is too high. | Perform easy gain tuning. Set Pr.820 lower and Pr.821 higher. Perform speed feed forward control or model adaptive speed control. |
| 5 | occurs in the motor or the machine. | Torque control gain is too high. | Set Pr.824 Torque control P gain 1 (current loop proportional gain) lower. |
| | | Motor wiring is incorrect. | Check the wiring. |
| 6 | Acceleration/ deceleration time is different from the | Torque shortage. | Raise the torque limit. (Refer to the torque limit for speed control on page 245.) Perform speed feed forward control. |
| | setting. | Load inertia is too high. | Set acceleration/deceleration time suitable for the load. |
| | | Speed control gain is not suitable for the machine. | Perform easy gain tuning. Adjust Pr.820 and Pr.821. Perform speed feed forward control or model adaptive speed control. |
| 7 | Machine movement is unstable. | Response is slow because of the inverter's acceleration/ deceleration time setting. | Set the optimum acceleration/deceleration time. |
| 8 | Rotation ripple occurs during the | High carrier frequency is affecting the motor rotation. | • Set Pr.72 lower. |
| | low-speed operation. | Speed control gain is too low. | • Set Pr.820 higher. |

Parameters referred to

Pr.3 Base frequency, Pr.19 Base frequency voltage page 707
Pr.72 PWM frequency selection page 356
Pr.80 Motor capacity, Pr.81 Number of motor poles page 221
Pr.125 Terminal 2 frequency setting gain frequency, Pr.126 Terminal 4 frequency setting gain frequency page 505
Pr.359 Encoder rotation direction, Pr.369 Number of encoder pulses, Pr.851 Control terminal option-Number of encoder pulses, Pr.852 Control terminal option-Encoder rotation direction □ page 87
Pr.822 Speed setting filter 1 □ page 503
Pr.824 Torque control P gain 1 (current loop proportional gain) □ page 294

5.3.7 Speed feed forward control, model adaptive speed control

Sensorless Vector PM

Speed feed forward control or model adaptive speed control can be selected using parameter settings.
 Under speed feed forward control, the motor trackability for speed command changes can be improved.
 Under model adaptive speed control, the speed trackability and the response level to motor external disturbance torque can be adjusted individually.

| Pr. | Name | Initial value | Setting range | Description | |
|-------------|---------------------------------|---------------------|---------------|---|--|
| 828 G224 | Model speed control gain | 60% | 0 to 1000% | Set the gain for the model speed controller. | |
| 877 | Speed feed forward | | 0 | Perform normal speed control. | |
| G220 | control/model adaptive | 0 | 1 | Perform speed feed forward control. | |
| GZZU | speed control selection | | 2 | Model adaptive speed control becomes valid. | |
| 878 G221 | Speed feed forward filter | 0 s | 0 to 1 s | Set the primary delay filter for the result of the speed feed forward calculated from the speed command and load inertia ratio. | |
| 879 G222 | Speed feed forward torque limit | 150% | 0 to 400% | Set a maximum limit for the speed feed forward torque. | |
| 880 C114 | Load inertia ratio | 7-fold | 0 to 200-fold | Set the load inertia ratio for the motor. | |
| 881 G223 | Speed feed forward gain | 0% | 0 to 1000% | Set the calculation result for speed feed forward as the gain. | |
| 1119 | Model speed control gain | 9999 | 0 to 300 | Set the gain for the model speed controller in the per-unit system. | |
| G262 | (per-unit system) | שששש | 9999 | The Pr.828 setting is applied to the operation. | |
| 1121 | Per-unit speed control | 120 Hz*1 | 0.4- 400 11- | Set the speed at 100% when setting speed control P gain or model | |
| | | 60 Hz ^{*2} | 0 to 400 Hz | speed control gain in the per-unit system. | |

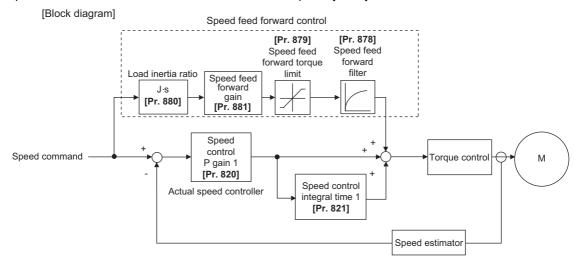
- *1 For the FR-A820-03160(55K) or lower, and FR-A840-01800(55K) or lower.
- *2 For the FR-A820-03800(75K) or higher, and FR-A840-02160(75K) or higher.



When using model adaptive speed control, use the data obtained from the easy gain tuning for Pr.828 Model speed control
gain setting. Make the setting with easy gain tuning (at the same time). (Refer to page 254.)

◆ Speed feed forward control (Pr.877 = "1")

- When the load inertia ratio is set in **Pr.880**, the required torque for the set inertia is calculated according to the acceleration and deceleration commands, and the torque is generated quickly.
- When the speed feed forward gain is 100%, the calculation result for speed feed forward is applied as is.
- If the speed command changes suddenly, the torque is increased by the speed feed forward calculation. The maximum limit for the speed feed forward torque is set in **Pr.879**.
- The speed feed forward result can also be lessened with a primary delay filter in Pr.878.





- · The speed feed forward control is enabled for the first motor.
- Even if the driven motor is switched to the second motor while Pr.877 = "1", the second motor is operated as Pr.877 = "0".
- Under PM sensorless vector control, the notch filter is available when low-speed range high-torque characteristic is enabled by **Pr.788 Low speed range torque characteristic selection** ="9999 (initial value)". (Refer to page 233.)

◆ Model adaptive speed control (Pr.877 = "2", Pr.828, Pr.1119)

- The model speed of the motor is calculated, and the feedback is applied to the speed controller on the model side. Also, this model speed is set as the command of the actual speed controller.
- The inertia ratio of **Pr.880** is used when the speed controller on the model side calculates the torque current command value.
- The torque current command of the speed controller on the model side is added to the output of the actual speed controller, and set as the input of the ig current control.

Pr.828 is used for the speed control on the model side (P control), and first gain **Pr.820** is used for the actual speed controller.

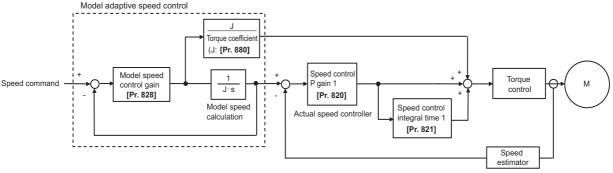
- The model speed control gain can be set in the per-unit (pu) system in Pr.1119.
- · In the per-unit system:

When "1" is set, the torque (Iq) command is 100% (rated Iq) when the speed deviation is 100%.

When "1" is set, the torque (Iq) command is 100% (rated Iq) when the speed deviation is 100%.

Set the 100% speed in Pr.1121 Per-unit speed control reference frequency.

[Block diagram]



NOTE

- The model adaptive speed control is enabled for the first motor.
- Even if the driven motor is switched to the second motor while Pr.877 ="2", the second motor is operated as Pr.877 = "0".
- Under PM sensorless vector control, the notch filter is available when low-speed range high-torque characteristic is enabled by **Pr.788 Low speed range torque characteristic selection** ="9999 (initial value)". (Refer to page 233.)
- Under model adaptive speed control, because the appropriate gain values for the model and actual loop sections are based
 on the response that was set for easy gain tuning, when raising the response level, Pr.818 Easy gain tuning response level
 setting must be re-evaluated (raised).
- The per-unit system setting (Pr.1119) is available only under Real sensorless vector control or Vector control.
- When the speed control P gain or model speed control gain is set in the per-unit system, the easy gain tuning selection (Pr.819 = "1 or 2") becomes invalid.

Combining with easy gain tuning

• The following table shows the relationship between speed feed forward and model adaptive speed control, and the easy gain tuning function.

| | Easy gain tuning selection (Pr.819) setting | | | | |
|------------------------------------|---|--|---|--|--|
| | 0 | 1 | 2 | | |
| Pr.880 Load inertia ratio . | Manual input | The inertia ratio value calculated by easy gain tuning is displayed. Manual input is available only during a stop. | Manual input | | |
| Pr.820 Speed control P gain 1 | Manual input | The tuning result is displayed. Write is not available. | The tuning result is displayed. Write is not available. | | |
| Pr.821 Speed control integral time | Manual input | The tuning result is displayed. Write is not available. | The tuning result is displayed. Write is not available. | | |
| Pr.828 Model speed control gain | Manual input | The tuning result is displayed. Write is not available. | The tuning result is displayed. Write is not available. | | |
| Pr.881 Speed feed forward gain | Manual input | Manual input | Manual input | | |

Parameters referred to

Pr.820 Speed control P gain 1, Pr.830 Speed control P gain 2 page 254
Pr.821 Speed control integral time 1, Pr.831 Speed control integral time 2 page 254
Pr.788 Low speed range torque characteristic selection page 233

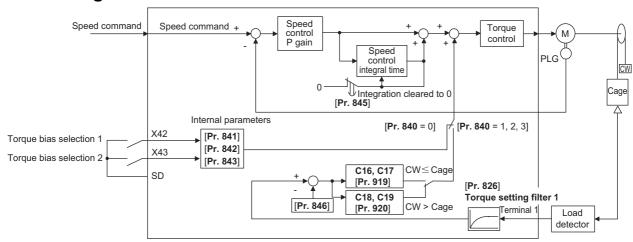
5.3.8 Torque bias

Sensorless Vector

The torque bias function can be used to make the starting torque start-up faster. At this time, the motor starting torque can be adjusted with a contact signal or analog signal.

| Pr. | Name | Initial value | Setting range | Description |
|-------------|-----------------------------------|---------------|------------------|---|
| | | | 0 | Set the torque bias amount using contact signals (X42, X43) in Pr.841 to Pr.843 . |
| | | | 1 | Set the torque bias amount using terminal 1 in any of C16 to C19 . (When the squirrel cage rises during forward motor rotation.) |
| 840 | | | 2 | Set the torque bias amount using terminal 1 in any of C16 to C19 . (When the squirrel cage rises during reverse motor rotation.) |
| G230 | Torque bias selection | 9999 | 3 | The torque bias amount using terminal 1 can be set automatically in C16 to C19 and Pr.846 according to the load. |
| | | | 24 | Torque bias command via PROFIBUS-DP communication (FR-A8NP) (-400% to 400%) |
| | | | 25 | Torque bias command via PROFIBUS-DP communication (FR-A8NP) (-327.68% to 327.67%) |
| | | | 9999 | No torque bias, rated torque 100% |
| 841 G231 | Torque bias 1 | | 600 to 999% | Negative torque bias amount (-400% to -1%) |
| 842 G232 | Torque bias 2 9999 Torque bias 3 | | 1000 to 1400% | Positive torque bias amount (0 to 400%) |
| 843 G233 | | | 9999 | No torque bias setting |
| 844 | Torque bias filter | 9999 | 0 to 5 s | The time until the torque starts up. |
| G234 | Torque bias inter | 9999 | 9999 | The same operation as 0 s. |
| 845 | Torque bias operation | 9999 | 0 to 5 s | The time for retaining the torque of the torque bias amount. |
| G235 | time | 3333 | 9999 | The same operation as 0 s. |
| 846 | Torque bias balance | 9999 | 0 to 10 V | Set the voltage for the balanced load. |
| G236 | compensation | | 9999 | The same operation as 0 V. (Fixed to 0 V/0%. |
| 847 | Fall-time torque bias | 9999 | 0 to 400% | The bias value setting in the torque command. |
| G237 | terminal 1 bias | 3333 | 9999 | The same as (C16, C17 (Pr.919)) when ascending |
| 848 | Fall-time torque bias | 9999 | 0 to 400% | The gain value setting in the torque command. |
| G238 | terminal 1 gain | 2200 | 9999 | The same as (C18, C19 (Pr.920)) when ascending |

♦ Block diagram



◆ Setting the torque bias amount using contact input (Pr.840 = "0", Pr.841 to Pr.843)

- · Select the torque bias amount shown in the following table using the corresponding contact signal combination.
- To input the X42 signal, set "42" in any of **Pr.178 to Pr.189 (Input terminal function selection)** to assign the function to a terminal, and to input the X43 signal, set "43".

| Torque bias selection 1 (X42) | Torque bias selection 2 (X43) | Torque bias amount |
|-------------------------------|----------------------------------|--|
| OFF | OFF | 0% |
| ON | OFF | Pr.841 -400% to +400% (Setting value: 600 to 1400%) |
| OFF | ON | Pr.842 -400% to +400% (Setting value: 600 to 1400%) |
| ON | ON | Pr.843 -400% to +400% (Setting value: 600 to 1400%) |

When **Pr.841** = "1025", the torque bias is 25%. When **Pr.842** = "975", the torque bias is -25%. When **Pr.843** = "925", the torque bias is -75%.

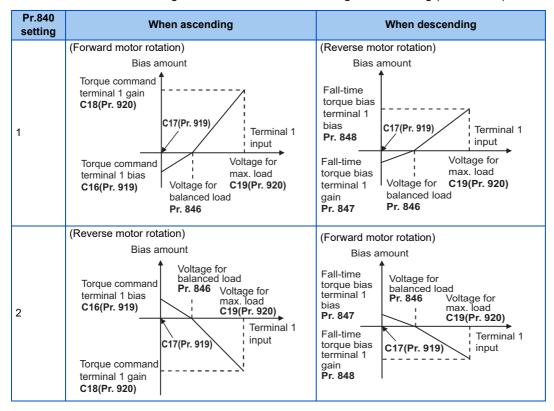


• Changing the terminal assignment using **Pr.178 to Pr.189 (Input terminal function selection)** may affect the other functions. Set parameters after confirming the function of each terminal.

◆ Setting the torque bias amount using terminal 1 (Pr.840 ="1, 2", Pr.847, Pr.848)

- Calculate the torque bias from the load input to terminal 1 as shown in the following diagram, and then apply the torque bias.
- To set the torque bias amount with a voltage input to terminal 1, set Pr.868 Terminal 1 function assignment ="6".

• The torque bias amount (**Pr.847**) and gain amount (**Pr.848**) when descending (reverse motor rotation when the **Pr.840** setting is "1", forward motor rotation when the setting is "2") can be set in a range of 0 to 400%. When **Pr.847** or **Pr.848** ="9999", the setting is the same for both descending and ascending (**C16** to **C19**).





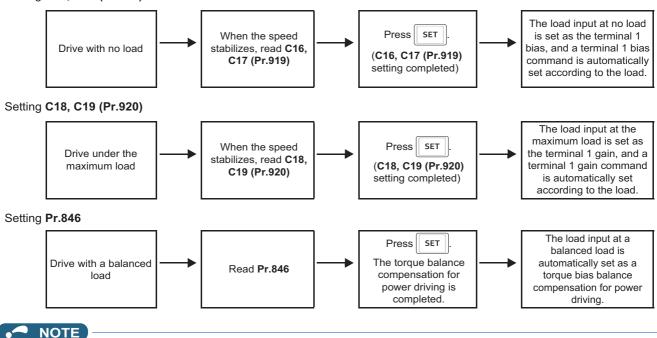
• Input 0 to 10 V (torque command) to the terminal 1 that is used for the torque bias function. Any negative input voltage is regarded as 0 V.

◆ Setting the torque bias amount automatically using terminal 1 (Pr.840 = "3", Pr.846)

- The settings of C16 Terminal 1 bias command (torque/magnetic flux), C17 Terminal 1 bias (torque/magnetic flux),
 C18 Terminal 1 gain command (torque/magnetic flux),
 C19 Terminal 1 gain (torque/magnetic flux) and Pr.846
 Torque bias balance compensation can be set automatically according to the load.
- To set the torque bias amount with a voltage input to terminal 1, set Pr.868 Terminal 1 function assignment = "6".

• Set the terminal 1 to accept inputs of load detection voltage, set "3" in **Pr.840 Torque bias selection**, and adjust the parameter settings according to the following procedures.

Setting C16, C17 (Pr.919)



• To perform a torque bias operation after the automatic setting is completed, set Pr.840 to "1" or "2".

◆ Torque bias command via PROFIBUS-DP communication (Pr.840 = "24 or 25")

· A torque bias command value can be set using the FR-A8NP (PROFIBUS-DP communication).

| Pr.840 setting | Method to give torque bias command | Setting range | Setting increments |
|-------------------|--|--|--------------------|
| 24 | Torque bias command from the buffer memory of PROFIBUS (REF1 to 7) | 600 to 1400 (-400% to 400%) | 1% |
| 25 | Torque bias command from the buffer memory of PROFIBUS (REF1 to 7) | -32768 to 32767 (two's complement) (-327.68% to 327.67%) | 0.01% |

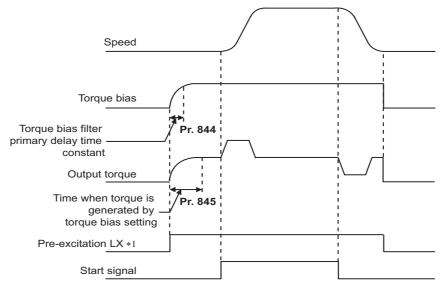


• For details on the FR-A8NP setting, refer to the Instruction Manual of the FR-A8NP.

◆ Torque bias operation (Pr.844, Pr.845)

• The torque start-up can be made slower by setting **Pr.844 Torque bias filter** ≠ "9999". The torque start-up operation at this time is the time constant of the primary delay filter.

Set the time for continuing the output torque simply by using the command value for the torque bias in Pr.845 Torque bias
operation time.



*1 When pre-excitation is not performed, the torque bias functions at the same time as the start signal.



- When torque bias is enabled and **Pr.868** = "6", terminal 1 operates as a torque command instead of a frequency setting auxiliary. When override compensation is selected using **Pr.73 Analog input selection** and terminal 1 is the main speed, no main speed (main speed = 0 Hz) is set.
- The torque bias is valid for the first motor. When applying the second motor (RT signal is ON), the torque bias function is not performed.
- Changing the terminal assignment using **Pr.178 to Pr.189 (Input terminal function selection)** may affect the other functions. Set parameters after confirming the function of each terminal.

5.3.9 Avoiding motor overrunning

Vector

Motor overrunning due to excessive load torque or an error in the setting of the number of encoder pulses can be avoided.

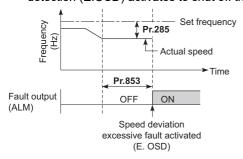
| Pr. | Name | Initial value | Setting range | Description |
|---------------------------|--|---------------|---------------|---|
| 285 H416 | Speed deviation excess detection frequency*1 | 9999 | 0 to 30 Hz | Set the speed deviation excess detection frequency (difference between the actual rotation speed and speed command value) at which the protective function (E.OSD) activates. |
| | | | 9999 | No speed deviation excess |
| 853 ^{*2} H417 | Speed deviation time | 1.0 s | 0 to 100 s | Set the time from when the speed deviation excess state is entered to when the protective function (E.OSD) activates. |
| 873 ^{*2} H415 | Speed limit 20 Hz | | 0 to 400 Hz | Set the frequency limit with the set frequency + Pr.873 value. |
| 690 H881 | Deceleration check time | 1.0 s | 0 to 3600 s | Set the time required to shut off output due to deceleration check after the start signal is OFF. |
| 11001 | | | 9999 | No deceleration check |

- *1 This is the overspeed detection frequency under encoder feedback control. (Refer to page 736.)
- *2 The setting is available when a Vector control compatible option is installed.

◆ Speed deviation excess detection (Pr.285, Pr.853)

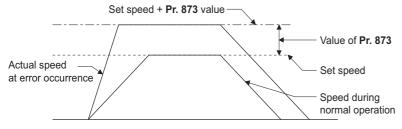
• A shutoff can be set for when the deviation between the set frequency and actual rotation speed is large, such as when the load torque is excessive.

 When the difference (absolute value) between the speed command value and actual rotation speed in speed control under Vector control is equal to or higher than the setting value in Pr.285 Speed deviation excess detection frequency for a continuous time equal to or longer than the setting value in Pr.853 Speed deviation time, the speed deviation excess detection (E.OSD) activates to shut off the inverter output.



◆ Speed limit (Pr.873)

• This function prevents overrunning even when the setting value for and the value of the actual number of pulses are different. When the setting value for the number of encoder pulses is lower than the actual number of pulses, because the motor may increase speed, the output frequency is limited with the frequency of (set frequency + Pr.873).

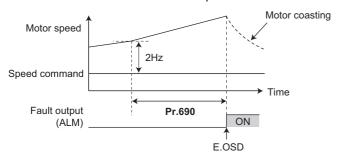


NOTE

- When the automatic restart after instantaneous power failure function is selected (**Pr.57 Restart coasting time** ≠ "9999") and the setting value for the number of encoder pulses is lower than the actual number of pulses, the output speed is limited with the synchronous speed of the value of **Pr.1 Maximum frequency** + **Pr.873**.
- When a regenerative driving torque limit is applied and the speed limit function activates, the output torque may drop suddenly.
 Also, when the speed limit function activates during pre-excitation operation, output phase loss (E.LF) may occur.
 If the setting for the number of encoder pulses is confirmed as correct, it is recommended that Pr.873 be set to the maximum value (400 Hz).
- Even if the set frequency is lowered after inverter operation, the speed limit value is not lowered. During deceleration, the speed is limited at frequency command value + Pr.873.

◆ Deceleration check (Pr.690)

- This function can stop the inverter output when the motor is accelerated accidentally during rotation. This prevents a malfunction due to incorrect encoder pulse settings.
- The function is activated when the difference between the actual motor speed and the speed command value exceeds 2 Hz.
- If the motor does not decelerate within the time period set in **Pr.690**, the speed deviation excess detection (E.OSD) is activated to shut off the inverter output.





- The deceleration check is enabled in the speed control of the Vector control.
- If the protective function (E.OSD) operates due to deceleration check, check whether the **Pr.369 Number of encoder pulses** setting is correct.

Parameters referred to

Pr.285 Overspeed detection frequency page 736

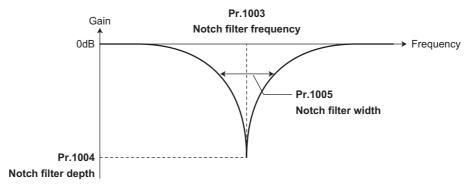
Pr.369 Number of encoder pulses, Pr.851 Control terminal option-Number of encoder pulses 3 page 94

5.3.10 Notch filter

Sensorless Vector PM

The response level of speed control in the resonance frequency band of mechanical systems can be lowered to avoid mechanical resonance.

| Pr. | Name | Initial value | Setting range | Description |
|--------------|------------------------|------------------|---------------|---|
| 1003 | Notch filter frequency | 0 | 0 | No notch filter |
| G601 | G601 Noter mequency | | 8 to 1250 Hz | Set the frequency for the center of gain attenuation. |
| 1004 G602 | Notch filter depth | 0 | 0 to 3 | 0 (Deep) → 3 (Shallow) |
| 1005 G603 | Notch filter width | 0 | 0 to 3 | 0 (Narrow) → 3 (Wide) |



◆ Pr.1003 Notch filter frequency

This sets the frequency for the center when attenuating the gain. If the mechanical resonance frequency is unknown, lower
the notch frequency in order from the highest. The point where the resonance is smallest is the optimum setting for the
notch frequency.

◆ Pr.1004 Notch filter depth

• A deeper notch depth has a greater effect in reducing mechanical resonance, but because the phase delay is larger, swinging may increase. Adjust by starting from the shallowest value.

| Setting | 3 | 2 | 1 | 0 |
|---------|-----------|-------|-------|--------|
| Gain | -4 dB | -8 dB | 114D | -40 dB |
| (depth) | (Shallow) | -0 UD | -14dB | (Deep) |

◆ Pr.1005 Notch filter width

- This sets the width of the frequency to which to apply the notch filter. The setting can be adjusted according to the width of the frequency range to be excluded.
- · If the width is too wide, the response level of speed control will drop, and the system may become unstable.



• If a value higher than 500 Hz is set in **Pr.1003** while the response speed is normal (**Pr.800** = any of "0 to 5 and 9 to 14"), the inverter operates at 500 Hz.

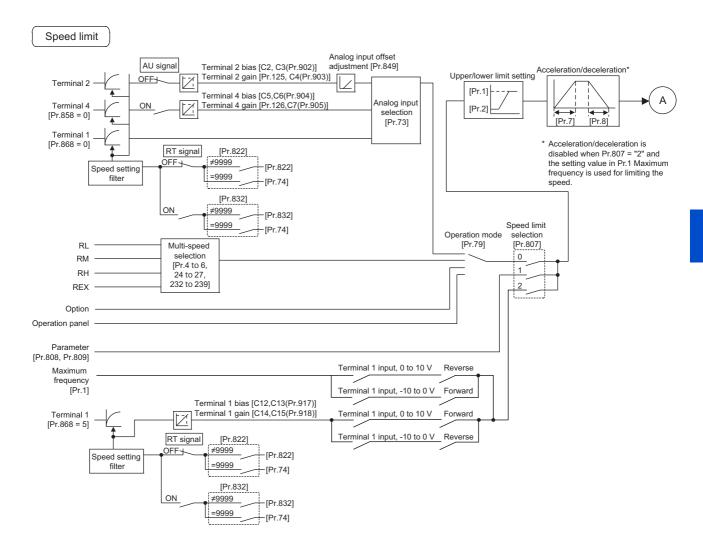
5.4 Torque control under Real sensorless vector control and Vector control

| Purpose | Parameter to set | | | Refer to page |
|---|--------------------------------|-------------------------------------|--------------------------------------|------------------|
| Torque command source selection or torque command value setting | Torque command | P.D400 to P.D403, P.G210, P.H704 | Pr.801, Pr.803 to Pr.806, Pr.1114 | 283 |
| To prevent the motor from overspeeding | Speed limit | P.H410 to P.H412, P.H414 | Pr.807 to Pr.809, Pr.1113 | 287 |
| To raise precision of torque control | Torque control gain adjustment | P.G213, P.G214, P.G313, P.G314 | Pr.824, Pr.825, Pr.834, Pr.835 | 294 |
| To stabilize torque detection signal | Torque detection filter | P.G216, P.G316 | Pr.827, Pr.837 | 332 |

Torque control 5.4.1

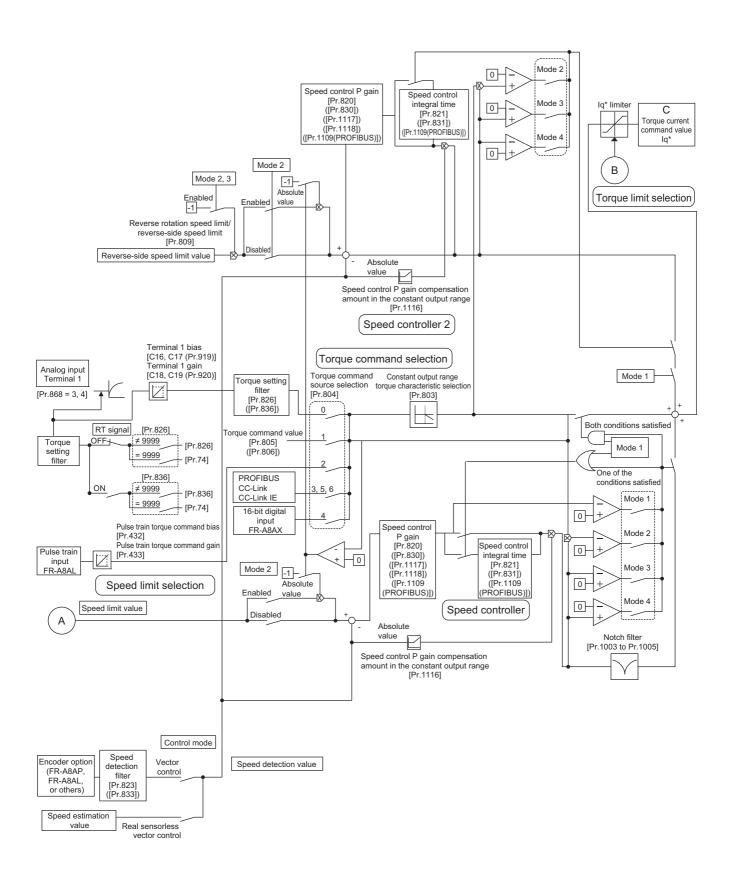
- · Under torque control, output torque is controlled to output the torque as commanded.
- Motor rotation speed is steady when the motor output torque and load torque are balanced. Thus, motor speed during torque control is determined by the load.
- Under torque control, motor speed accelerates so motor output torque does not exceed motor load. In order to prevent the motor from overspeeding, set a speed limit. (Speed control is performed instead of torque control during speed limit.)
- If speed limit is not set, speed limit value setting is regarded as 0 Hz and torque control is not enabled.

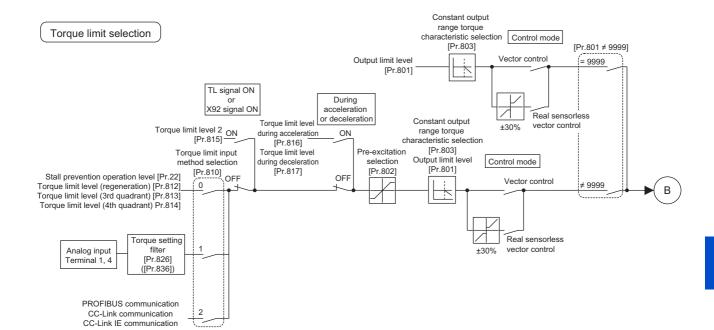
♦ Block diagram

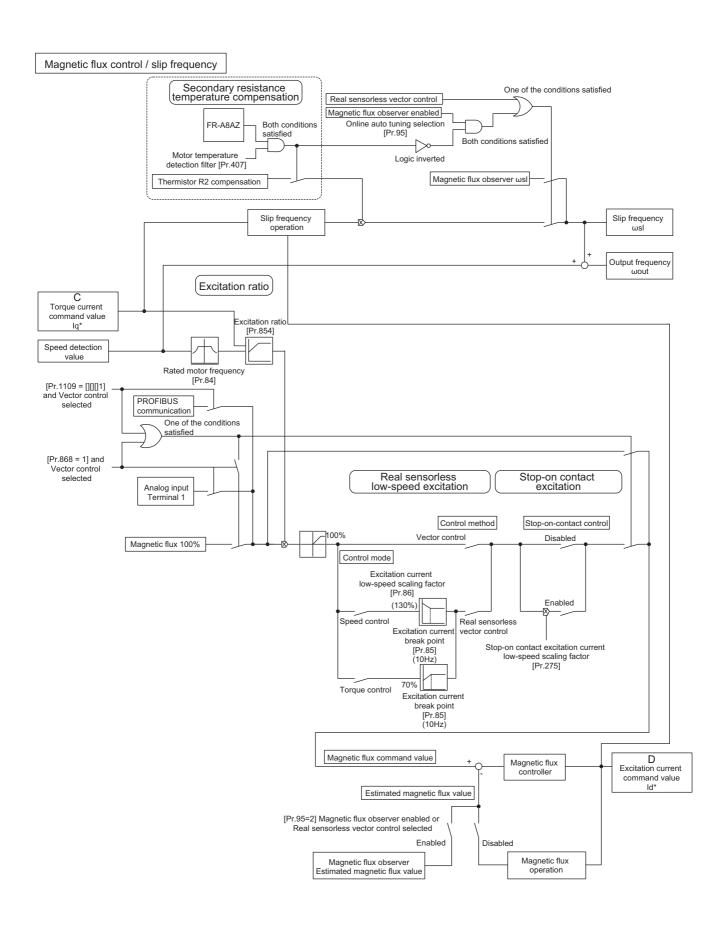


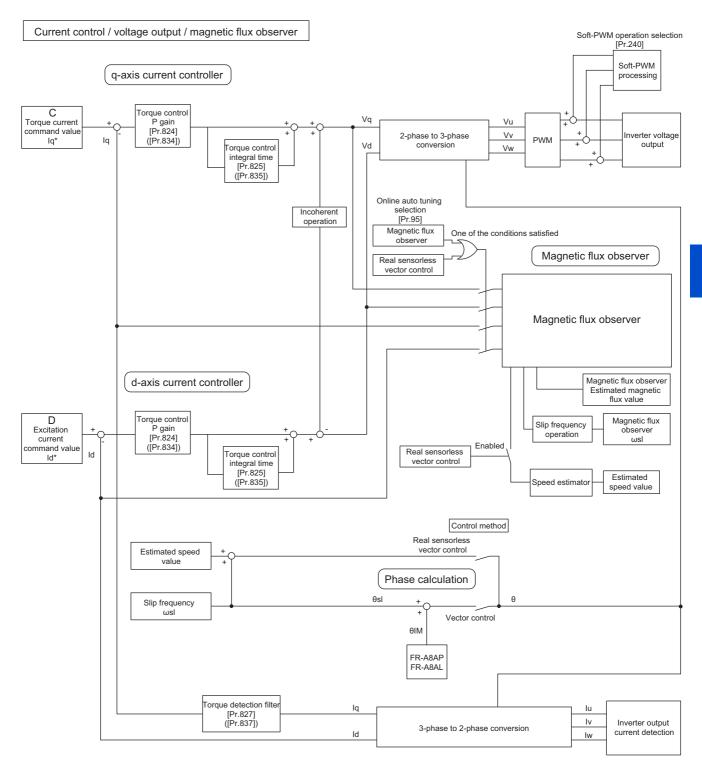


- To select coasting instead of deceleration stop with speed limit when the start command is turned OFF, set Pr.250 Stop selection.
- The RT (Second function selection) signal and the X9 (Third function selection) signal are used to enable switching between
 acceleration/deceleration time settings. The acceleration/deceleration time after switching depends on the settings in Pr.44
 Second acceleration/deceleration time and Pr.45 Second deceleration time, or Pr.110 Third acceleration/deceleration
 time and Pr.111 Third deceleration time. The acceleration/deceleration time is a period of time taken to reach Pr.20
 Acceleration/deceleration reference frequency.
- · Pr.21 Acceleration/deceleration time increments is used to change the setting increment.
- When the automatic restart after instantaneous power failure is selected, the inverter accelerates the motor from the frequency search result frequency to the set frequency. (Pr.57 Restart coasting time ≠ 9999, Pr.162 Automatic restart after instantaneous power failure selection = "10, 12, 13, 1010, 1012, or 1013")
- Pr.811 Set resolution switchover is used to change the setting increment for speed setting, operation speed monitoring, and torque limit setting.
- **Pr.862 Encoder option selection** is used to change the Vector control compatible plug-in option or the control terminal option for the first and second motors.
- **Pr.1113 Speed limit method selection** is used to change the direction of rotation, torque command polarity, and power driving / regenerative driving status.

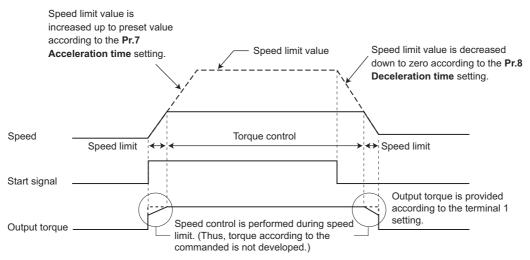




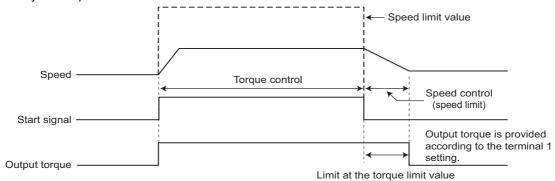




Operation transition



• If the setting value of **Pr.7 and Pr.8** is "0", turning OFF the start signal enables speed control, and the output torque is controlled by the torque limit value.



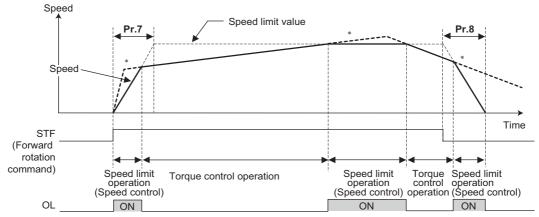
| Item | Description | | | | |
|---|--------------------------|---|--|--|--|
| Start signal | External operation | STF, STR signal | | | |
| Otart signal | PU operation | or REV of operation panel/ parameter unit | | | |
| Torque command | Select the metl command. | hod to give the torque command, and give the torque | | | |
| Speed limit Select the method to give the speed limit command, and input limit value. | | | | | |

◆ Operation example (when Pr.804 = "0")

Torque control is possible when actual rotation speed does not exceed the speed limit value.

When the actual speed reaches or exceeds the speed limit value, speed limit is activated, torque control is stopped and speed control (proportional control) is performed.

The following diagram indicates operation relative to commands given by analog input via terminal 1.



*When the speed limit activates, torque according to the commanded is not developed.

- · At the STF signal ON, the speed limit value is raised in accordance with the setting of Pr.7.
- · Speed control is performed when the actual speed exceeds the speed limit value.
- At the STF signal OFF, the speed limit value is lowered in accordance with the setting of Pr.8.
- Under torque control, the actual operation speed is a constant speed when the torque command and load torque are balanced.
- The direction of motor torque generation is determined by a combination of the input torque command polarity and the start signal, as given in the following table.

| Polarity of torque | Torque generation direction | | | |
|--------------------|--|--|--|--|
| command | STF signal ON | STR signal ON | | |
| + torque command | Forward direction (forward power driving / reverse regenerative driving) | Reverse direction (forward regenerative driving / reverse power driving) | | |
| - torque command | Reverse direction (forward regenerative driving / reverse power driving) | Forward direction (forward power driving / reverse regenerative driving) | | |



- Once the speed limit is activated, speed control is performed and internal torque limit (**Pr.22 Torque limit level**) is enabled. (Initial value) In this case, it may not be possible to return to torque control.
 - Torque limit should be external torque limit (terminals 1 and 4). (Refer to page 245.)
- Under torque control, the undervoltage avoidance function (**Pr.261** = "11" or "12"), which is one of the power failure time deceleration-to-stop function, is invalid.
 - When Pr.261 = "11 (12)", the operation is performed in the same manner as if Pr.261 = "1 (2)".
- Under torque control, perform linear acceleration/deceleration (**Pr.29** = "0 (initial value)"). When acceleration/deceleration patterns other than the linear acceleration/deceleration are selected, the protective function of the inverter may be activated. (Refer to page 372.)
- Performing pre-excitation (by using the LX or X13 signal) during torque control (under Real sensorless vector control) may
 rotate a motor at a low speed even though a start command (STF or STR) is not given. The inverter at a start command ON
 may also rotate the motor at a low speed even though a speed limit value is set to 0. It must be confirmed that the motor running
 does not cause any safety problem before performing pre-excitation.

5.4.2 Setting procedure of Real sensorless vector control (torque control)

Sensorless

Operating procedure

- **1.** Perform secure wiring. (Refer to page 46.)
- **2.** Make the motor setting (**Pr.71**). (Refer to page 528.) Set **Pr.71** Applied motor to "0" (standard motor) or "1" (constant-torque motor).
- **3.** Set the motor overheat protection (**Pr.9**). (Refer to page 415.)
- **4.** Set the motor capacity and the number of motor poles (**Pr.80** and **Pr.81**). (Refer to page 221.) V/F control is performed when the setting is "9999" (initial value).
- **5.** Set the rated motor voltage and frequency (**Pr.83** and **Pr.84**). (Refer to page 532.)
- Select the control method (Pr.800). (Refer to page 221.)
 Select Pr.800 Control method selection = "11" (torque control) or "12" (speed/torque switchover) to enable torque control.
- 7. Set the torque command (Pr.804). (Refer to page 283.)
- **8.** Set the speed limit (**Pr.807**). (Refer to page 287.)
- **9.** Perform the offline auto tuning (**Pr.96**). (Refer to page 532.)
- **10.** Set the acceleration time to "0" (Pr.7). (Refer to page 367.)
- **11.** Perform the test operation.

As required

- Select online auto tuning (Pr.95). (Refer to page 558.)
- Adjust the torque control gain manually. (Refer to page 294.)



- · During Real sensorless vector control, offline auto tuning must be performed properly before starting operations.
- The carrier frequency is limited during Real sensorless vector control. (Refer to page 356.)
- Torque control is not available in a low-speed (about 10 Hz or lower) regenerative range, or with a low speed and light load (about 5 Hz or lower and rated torque about 20% or lower).
- Performing pre-excitation (LX signal and X13 signal) under torque control may start the motor running at a low speed even when the start signal (STF or STR) is not input. The inverter at a start command ON may also rotate the motor at a low speed even though a speed limit value is set to 0. Confirm that the motor running does not cause any safety problem before performing pre-excitation.
- Switching between the forward rotation command (STF) and reverse rotation command (STR) must not be performed during operations under torque control. An overcurrent trip (E.OC[]) or opposite rotation deceleration fault (E.11) will occur.
- When performing continuous operations under Real sensorless vector control in the FR-A820-00250(3.7K) or lower or FR-A840-00126(3.7K) or lower, the speed fluctuation increases when the value is 20 Hz or less, and in the low-speed range of less than 1 Hz, there may be torque shortage. In such case, stop the inverter and restart it to improve the situation.
- If starting may occur while the motor is coasting under Real sensorless vector control, the frequency search must be set for the automatic restart after instantaneous power failure function (**Pr.57** ≠ "9999", **Pr.162** = "10").
- When Real sensorless vector control is applied, there may not be enough torque provided in the ultra low-speed range of about 2 Hz or lower.

Generally, the speed control range is as follows.

For power driving, 1:200 (2, 4 or 6 poles) (available at 0.3 Hz or higher when the rating is 60 Hz), 1:30 (8 poles or more) (available at 2 Hz or higher when the rating is 60 Hz).

For regenerative driving, 1:12 (2 to 10 poles) (available at 5 Hz or higher when the rating is 60 Hz).

- To give the constant torque command in the constant output range, set "1 or 11" in **Pr.803 Constant output range torque** characteristic selection. (Refer to page 283.)
- For the settings for the SF-V5RU, refer to page 94.

5.4.3 Setting procedure for Vector control (torque control)

Vector

Operating procedure

- **1.** Perform secure wiring. (Refer to page 91.) Install a Vector control compatible option.
- 2. Set the option to be used (Pr.862).
 Set Pr.862 Encoder option selection according to the option to be used. (Refer to page 226.)
- 3. Set the motor and the encoder (Pr.71, Pr.359 (Pr.852), and Pr.369 (Pr.851)). (Refer to page 94.)
- **4.** Set the overheat protection of the motor (**Pr.9**). (Refer to page 415.) When using the SF-V5RU or a motor equipped with a thermal sensor, set **Pr.9** = 0 A.
- **5.** Set the motor capacity and the number of motor poles (**Pr.80** and **Pr.81**). (Refer to page 221.) V/F control is performed when the setting is "9999" (initial value).
- **6.** Set the rated motor voltage and frequency (**Pr.83** and **Pr.84**). (Refer to page 94.)
- 7. Select the control method (Pr.800). (Refer to page 221.)
 Select Pr.800 Control method selection = "1" (torque control), "2" (speed/torque switchover), or "5" (position/torque switchover) to enable torque control.
- **8.** Set the torque command (**Pr.804**). (Refer to page 283.)
- **9.** Set the speed limit (**Pr.807**). (Refer to page 287.)
- 10. Set the acceleration time to "0" (Pr.7). (Refer to page 367.)
- **11.** Perform the test operation.

As required

- Perform offline auto tuning (**Pr.96**). (Refer to page 532.)
- Select the online auto tuning (Pr.95). (Refer to page 558.)
- Adjust the torque control gain manually. (Refer to page 294.)

NOTE

- The carrier frequency is limited during Vector control. (Refer to page 356.)
- Torque control is not available under the Vector control with PM motors.
- To give the constant torque command in the constant output range, set "1 or 11" in **Pr.803 Constant output range torque** characteristic selection. (Refer to page 283.)
- For the settings for the SF-V5RU, refer to page 94.

5.4.4 Torque command

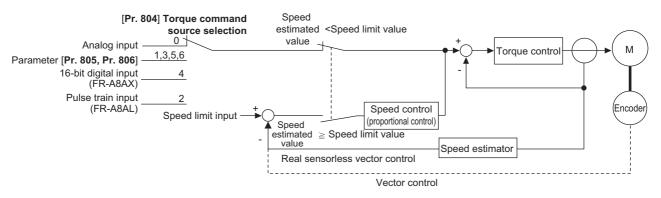
Sensorless Vector

For torque control selection, the torque command source can be selected.

| Pr. | Name | Initial value | Setting range | Description | | |
|---------------------------|------------------------------------|------------------|---------------|---|---|--|
| 432 D120 ^{*1} | Pulse train torque command bias | 0% | 0 to 400% | For 0 pulses/s, set the torque to be used during stall prevention operation. | | |
| 433 D121 ^{*1} | Pulse train torque command gain | 150% | 0 to 400% | For 400k pulses/s, set the torque command to be used during stall prevention operation. | | |
| 801 | Output limit level | 9999 | 0 to 400% | Set the torque current limit level. | | |
| H704 | Output minit level | 3333 | 9999 | The torque limit setting value is use | d for limiting the torque current level. | |
| | | | 0, 10 | Constant motor output command | | |
| | Constant output range | | 1, 11 | Constant torque command | In the torque command setting, | |
| 803 G210 | torque characteristic | 0 | 2 | The torque is constant unless the output limit of the torque current is reached. (The torque current is limited.) | select torque command for the constant output area. | |
| | | | 0 | Torque command given by analog input via terminal 1 | | |
| | | 0 | 1 | Torque command (-400% to 400%) given by the parameter setting (Pr.805 or Pr.806) | | |
| | Torque command source selection | | 2 | Torque command given by the pulse train input (FR-A8AL) | | |
| 804 D400 | | | 3 | | ink / CC-Link IE Field Network / CC-BNC, FR-A8NCE, FR-A800-GF, FR-ROFIBUS-DP communication (FR- | |
| | | | 4 | 12/16-bit digital input (FR-A8AX) | | |
| | | | 5 | | ink / CC-Link IE Field Network / CC- | |
| | | | 6 | Link IE TSN communication (FR-A8NC, FR-A8NCE, FR-A800-GF, IA8NCG, FR-A800-GN) Torque command given through PROFIBUS-DP communication (FRA8NP) | | |
| 805 D401 | Torque command value (RAM) | 1000% | 600 to 1400% | Writes the torque command value in RAM. Regards 1000% as 0%, and set torque command by an offset of 1000%. | | |
| 806 D402 | Torque command value (RAM, EEPROM) | 1000% | 600 to 1400% | Writes the torque command value in RAM and EEPROM. Regards 1000% as 0%, and set torque command by an offset of 1000%. | | |
| | | | 0 | Not reversed | Select whether to reverse the | |
| 1114 D403 | Torque command reverse selection | 1 | 1 | Reversed | torque command polarity or not when the reverse rotation command (STR) is turned ON. | |

^{*1} The setting is available when the FR-A8AL is installed.

◆ Control block diagram

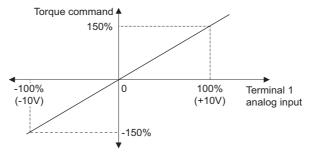


NOTE

[•] When the torque command exceeding the torque limit value (**Pr.22**, **Pr.810**, **Pr.812** to **Pr.817**) is given, the output torque is within the torque limit value. (Refer to page 272.)

◆ Torque command given by analog input (terminal 1) (Pr.804 = "0 (initial value)")

- Torque commands are given by voltage (current) input via terminal 1.
- Set Pr.868 Terminal 1 function assignment = "3 or 4" to give the torque command via terminal 1.
- Torque commands given by analog inputs can be calibrated by the calibration parameters C16 (Pr.919) to C19 (Pr.920) (Refer to page 510.)



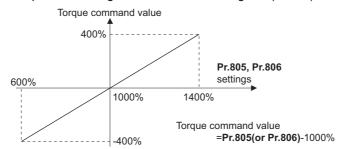
◆ Torque command given by parameter (Pr.804 = "1")

• Set Pr.805 Torque command value (RAM) or Pr.806 Torque command value (RAM, EEPROM) to set the torque command value.

For Pr.805 or Pr.806, regard 1000% as 0%, and set torque command by offset from 1000%.

The following diagram shows relation between the Pr.805 or Pr.806 setting and the actual torque command value.

- To change the torque command value frequently, write it in Pr.805. Writing values in Pr.806 frequently will shorten the life
 of the EEPROM.
- When the CC-Link IE Field Network (FR-A8NCE/FR-A800-GF) or CC-Link IE TSN (FR-A8NCG/FR-A800-GN) communication is used, the torque command given from the remote register (RWw2) is valid.





- When the torque command is set by Pr.805 (RAM), powering OFF the inverter erases the changed parameter value.
 Therefore, the parameter set value is the one saved by Pr.806 (EEPROM) when the power is turned back on.
- If giving torque command by parameter setting, set the speed limit value properly to prevent overspeeding. (Refer to page 287.)

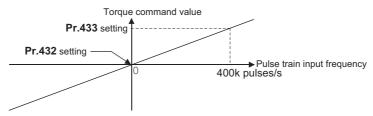
◆ Torque command using pulse train (Pr.804 = "2")

• Torque command given by the pulse train input to the FR-A8AL is available.

• Use Pr.428 Command pulse selection to select a type of pulse train input to the FR-A8AL.

| Pr.428 setting | Command pulse train type | | During forward rotation | During reverse rotation |
|-------------------|--------------------------|--|--------------------------------|-------------------------|
| 0 (initial value) | | Forward pulse train Reverse pulse train | Nb_ bb_flflfl | |
| 1 | Negative logic | Pulse train + sign | NP L | |
| 2 | | A phase pulse train B phase pulse train | PP | |
| 3 | | Forward pulse train Reverse pulse train | PP_FLFLFL NP | |
| 4 | Positive logic | Pulse train + sign | PP_TLFLTL NP H | |
| 5 | | A phase pulse train B phase pulse train | PP \ | |

• Use **Pr.432 Pulse train torque command bias** and **Pr.433 Pulse train torque command gain** to set the bias and gain values for the torque command respectively.



NOTE

• For details on the FR-A8AL, refer to the Instruction Manual of the FR-A8AL.

◆ Torque command given through the CC-Link / CC-Link IE Field Network / CC-Link IE TSN / PROFIBUS-DP (Pr.804 = "3, 5, 6")

- Set the torque command value through the CC-Link (FR-A8NC/PLC function), CC-Link IE Field Network (FR-A8NCE/FR-A800-GF), CC-Link IE TSN (FR-A8NCG/FR-A800-GN), or PROFIBUS-DP (FR-A8NP) communication.
- For speed limit when "3 or 5" is set in **Pr.804** through the CC-Link communication, **Pr.807 Speed limit selection** becomes invalid and **Pr.808 Forward rotation speed limit/speed limit** and **Pr.809 Reverse rotation speed limit/reverse-side speed limit** become valid. (When **Pr.544 CC-Link extended setting** = "0, 1, 12, 100, or 112")

• For the CC-Link communication, **Pr.807** is valid when the extended cyclic setting of CC-Link communication is quadruple or octuple. For CC-Link IE Field Network or CC-Link IE TSN, **Pr.807** is always valid.

| | | Torque command inp | | | |
|-------------------|--|---|--|---|--------------------|
| Pr.804 setting | CC-Link/PLC function | CC-Link IE Field Network / CC-Link IE TSN | PROFIBUS-DP | Setting range | Setting increments |
| 1 | Torque command by | | Torque command by | | 1% |
| · | Pr.805, Pr.806 ^{*1} | Torque command by | Pr.805, Pr.806 ^{*1} | | |
| 3 | Torque command by remote register (RWw1 or RWwC)*2 | remote register (RWw2)*2 | Torque command by the buffer memory of PROFIBUS-DP (REF1 to 7)*2 | 600 to 1400 (-400% to 400%) | |
| 5 | Torque command by remote register (RWw1 or RWwC)*2 | Torque command by remote register | Torque command by the buffer memory of PROFIBUS-DP (REF1 to 7)*2 | -32768 to 32767 (complement of 2) (-327.68% to 327.67%)*3 | 0.01%*3 |
| 6 | Torque command by | (RWw2)*2 | Torque command by | , , | |
| U | Pr.805, Pr.806 ^{*1} | | Pr.805, Pr.806 ^{*1} | | |

- *1 The torque command can also be given from operation panel or parameter unit.
- *2 The torque command can also be given by setting a value in **Pr.805** or **Pr.806**.
- *3 Setting range if set by operation panel or parameter unit is "673 to 1327 (-327% to 327%)"; setting increment is 1%.



- For details on the FR-A8NC, FR-A8NCE, FR-A8NCG, or FR-A8NP setting, refer to the Instruction Manual for each communication option. For details on the CC-Link IE Field Network, refer to page 752. For details on CC-Link IE TSN communication, refer to the CC-Link IE TSN Function Manual.
- For details on the setting using the PLC function, refer to the PLC Function Programming Manual.

◆ Torque command given by 16-bit digital input (Pr.804 = "4")

• Give the torque command by 12-bit or 16-bit digital input using FR-A8AX (plug-in option).



• For details on FR-A8AX setting, refer to the Instruction Manual of FR-A8AX

◆ Changing the torque characteristic of the constant-power range (Pr.801, Pr.803)

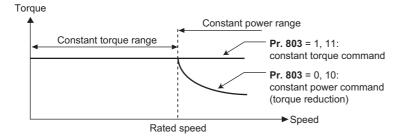
- According to the motor's characteristics, base frequency or higher decreases the torque. To give the constant torque command in base frequency or higher, set "1 or 11" in **Pr.803 Constant output range torque characteristic selection**.
- Torque in a low-speed range is constant during torque control regardless of the setting of **Pr.803**. However, when "2" is set in **Pr.803** under Real sensorless vector control, the torque may not be kept constant in the low-speed range.

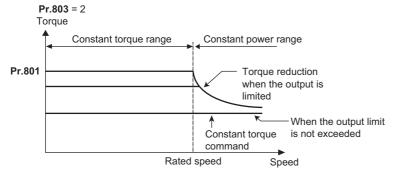
| Pr.803 setting | Torque characteristic in constant-power range | | |
|-----------------------|---|--------------|--|
| F1.003 Setting | Torque characteristic | Output limit | |
| 0 (initial value), 10 | Constant motor output | _ | |
| 1, 11 | Constant torque | Without | |
| 2 | Constant torque | With | |

To avoid overload or overcurrent of the inverter or motor, use Pr.801 Output limit level to limit the torque current in the
constant power range.

| Pr.801 setting | Description |
|----------------|---|
| 0 to 400% | Set the torque current limit level. |
| 9999 | The torque limit setting value (Pr.22, Pr.812 to Pr.817, etc.) is used for limiting the torque current. |

Pr.803 = 0, 1, 10, 11





Reverse selection of the torque command (Pr.1114)

• The Pr.1114 Torque command reverse selection setting determines whether or not the torque command polarity is reversed when the reverse rotation command (STR) is turned ON.

| Pr.1114 setting | Torque command polarity at STR signal ON (sign) | | | |
|-------------------|---|--|--|--|
| 0 | Not reversed | | | |
| 1 (Initial value) | Reversed | | | |

Parameters referred to

Pr.868 Terminal 1 function assignment page 500
Calibration parameter C16 (Pr.919) to C19 (Pr.920) (terminal 1 bias, gain torque) page 510

Speed limit 5.4.5

Sensorless Vector

When operating under torque control, motor overspeeding may occur if the load torque drops to a value less than the torque command value, etc. Set the speed limit value to prevent overspeeding.

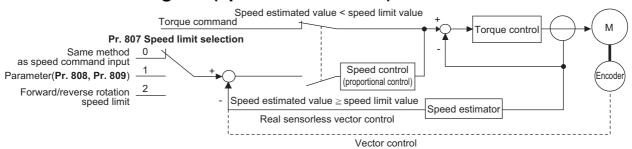
If the actual speed reaches or exceeds the speed limit value, the control method switches from torque control to speed control, preventing overspeeding.

| Pr. | Name | Initial value | | Setting | Description |
|-------------|---|---------------|-------|-------------|---|
| FI. | Name | FM | CA | range | Description |
| | Speed limit selection | | | 0 | Uses the speed command during speed control as the speed limit. |
| 807 H410 | | 0 | | 1 | Sets speed limits for forward and reverse directions individually by using Pr.808 and Pr.809 . |
| | | | | 2 | Forward/reverse rotation speed limit Applies speed limit by analog voltage input to the terminal 1. Speed limit for forward/reverse side is switched by its polarity. |
| 808 H411 | Forward rotation speed limit/speed limit | 60 Hz | 50 Hz | 0 to 400 Hz | Sets the forward side speed limit. |
| 809 | Reverse rotation speed | 9999 | | 0 to 400 Hz | Sets the reverse side speed limit. |
| H412 | limit/reverse-side speed limit | | | 9999 | Pr.808 setting value is effective. |
| 1 | | | | 9999 | Speed limit mode 1 |
| | Speed limit method selection | 0 | | 0 | Speed limit mode 2 |
| | | | | 1 | Speed limit mode 3 |
| | | | | 2 | Speed limit mode 4 |
| | | | | 10 | X93 signal OFF: Speed limit mode 3, X93 signal ON: Speed limit mode 4 |

◆ Speed limit method selection (Pr.1113)

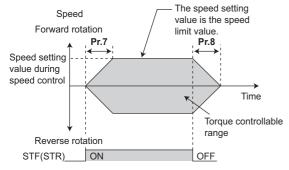
| Pr.1113 setting | Speed limit method | Speed limit value | |
|--------------------|---------------------------------|--|--|
| 9999 | Speed limit mode 1 | Forward rotation speed limit Pr.807 = "0": Speed command during speed control Pr.807 = "1": Pr.808 Pr.807 = "2": Analog input at analog input of 0 to 10 V, or Pr.1 at analog input of -10 to 0 V Reverse rotation speed limit Pr.807 = "0": Speed command during speed control Pr.807 = "1": Pr.809, or Pr.808 when Pr.809 = "9999" Pr.807 = "2": Pr.1 at analog input of 0 to 10 V, or analog input at analog input of -10 to 0 V | |
| 0 (initial value) | Speed limit mode 2 | Speed limit Pr.807 = "0 or 2": Speed command during speed control | |
| 1 | Speed limit mode 3 | Pr.807 = "1": Pr.808 Reverse-side speed limit | |
| 2 | Speed limit mode 4 | Pr.809 , or Pr.808 when Pr.809 = "9999" | |
| 10 | Switching by external terminals | X93 signal OFF: Speed limit mode 3, X93 signal ON: Speed limit mode 4 | |

◆ Control block diagram (speed limit mode 1)



◆ Using the speed command during speed control (Pr.1113 = "9999", Pr.807 = "0").

- Speed limit is set by the same method as speed setting during speed control. (Speed setting by PU (operation panel/parameter unit), multi-speed setting, plug-in option, etc.)
- When the start signal turns ON, the limit level increases from 0 Hz to the set speed by taking the time set in Pr.7
 Acceleration time. When the start signal turns OFF, the limit level at the time decreases to the operation start level of Pr.10 DC injection brake operation frequency, by taking the time set in Pr.8 Deceleration time.

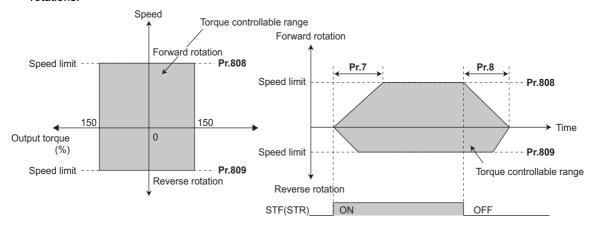


NOTE

- The second and third acceleration/deceleration time can be set.
- When speed limit command exceeds Pr.1 Maximum frequency setting, the speed limit value becomes Pr.1 setting. When
 speed limit command falls below Pr.2 Minimum frequency setting, the speed limit value becomes Pr.2 setting. Also, the
 speed limit command is smaller than Pr. 13 Starting frequency, the speed limit value becomes 0 Hz.
- To perform speed limit by analog input, calibrate analog input terminals 1, 2 and 4. (Refer to page 505.)
- To use analog inputs to perform speed limit, turn the external signals (RH, RM, RL) OFF. If any of the external signals (RH, RM, RL) is ON, speed limit by multi-speed are enabled.

◆ Setting separately for forward and reverse rotation (Pr.1113 = "9999", Pr.807 = "1")

- Sets speed limits for forward and reverse directions individually by using Pr.808 Forward rotation speed limit/speed limit Pr.809 Reverse rotation speed limit/reverse-side speed limit.
- When **Pr.809** = "9999" (initial value), speed limit is determined by the setting value of **Pr.808** for both forward and reverse rotations.

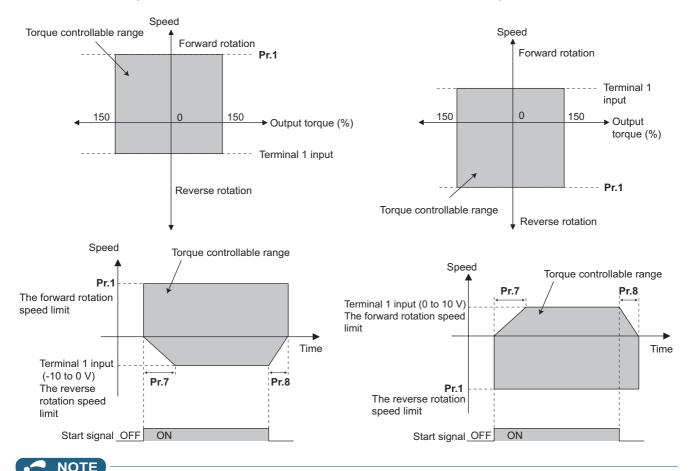


◆ Forward/reverse rotation speed limit using analog input (Pr.1113 = "9999", Pr.807 = "2")

- When performing speed limit by analog inputs to terminal 1, speed limit can be switched between forward and reverse rotation by its voltage polarity.
- When Pr.868 Terminal 1 function assignment = "5", forward/reverse speed limit is enabled.
- If 0 to 10 V is input, forward rotation speed limit is applied. Reverse rotation speed limit at this time is the value of **Pr.1**Maximum frequency.
- If -10 to 0 V is input, reverse rotation speed limit is applied. Forward rotation speed limit at this time is the value of **Pr.1**Maximum frequency.

- Upper speed limit is the value of Pr.1 for both forward and reverse rotations.
- When terminal 1 input is "-10 to 0 V"

• When terminal 1 input is "0 to 10 V"

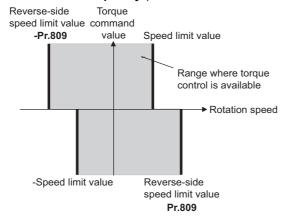


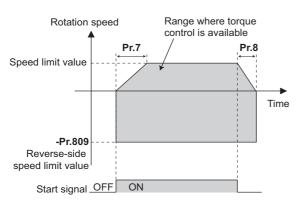
• To perform speed limit by using terminal 1, calibrate terminal 1. (Refer to page 505.)

◆ Speed limit mode 2 (Pr.1113 = "0" initial value)

- Following the polarity change in the torque command, the polarity of the speed limit value changes. This prevents the speed from increasing in the torque polarity direction. (When the torque command value is 0, the polarity of the speed limit value is positive.)
- When **Pr.807 Speed limit selection** = "0, 2", the setting during speed control is applied for the speed limit. When **Pr.807 Speed limit selection** = "1", **Pr.808 Forward rotation speed limit/speed limit** is applied for the speed limit.

 When the load has reversed the rotation opposite to the torque polarity, the setting of Pr.809 Reverse rotation speed limit/reverse-side speed limit is applied for the speed limit. (The speed limit value and reverse-side speed limit value are limited at Pr.1 Maximum frequency (maximum 400 Hz under Vector control).)





Range where torque control is available

Pr.809

Reverse-side speed limit value

Speed limit value

Pr.7

Pr.8

Start signal OFF

ON

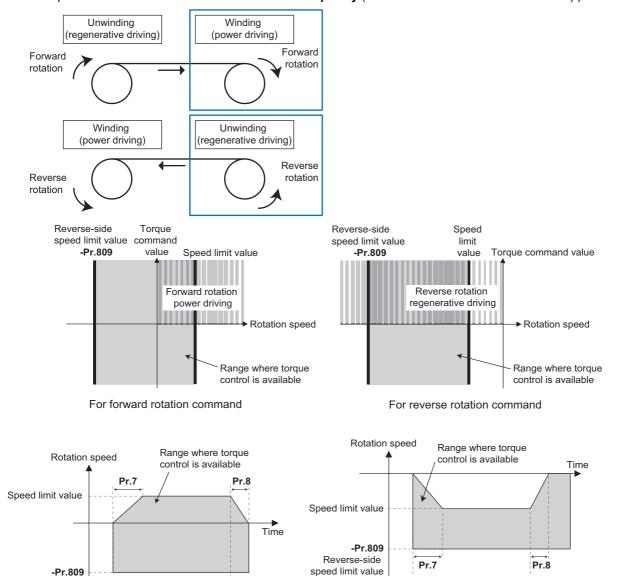
When the torque command value is positive

When the torque command value is negative

◆ Speed limit mode 3 (Pr.1113 = "1")

- Select this mode when the torque command is positive. The forward rotation command is for power driving (such as winding) and the reverse rotation command is for regenerative driving (such as unwinding). (Refer to each following figures.)
- When **Pr.807 Speed limit selection** = "0, 2", the setting during speed control is applied for the speed limit. When **Pr.807 Speed limit selection** = "1", **Pr.808 Forward rotation speed limit/speed limit** is applied for the speed limit.

• When the torque command becomes negative, the setting of **Pr.809 Reverse rotation speed limit/reverse-side speed limit** is applied to prevent the speed from increasing in the reverse rotation direction. (The speed limit value and reverse-side speed limit value are limited at **Pr.1 Maximum frequency** (maximum 400 Hz under Vector control).)



◆ Speed limit mode 4 (Pr.1113 = "2")

For power driving

by forward rotation command (winding)

• Select this mode when the torque command is negative. The forward rotation command is for regenerative driving (such as unwinding) and the reverse rotation command is for power driving (such as winding). (Refer to each following figures.)

Start signal OFF ON

For regenerative driving

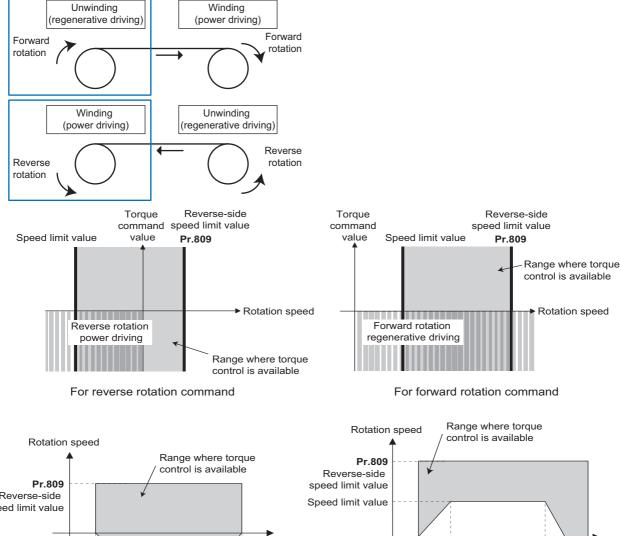
by reverse rotation command (unwinding)

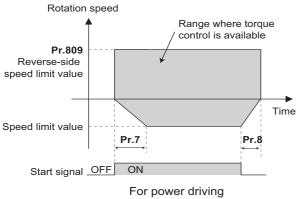
When Pr.807 Speed limit selection = "0, 2", the setting during speed control is applied for the speed limit. When Pr.807
Speed limit selection = "1", Pr.808 Forward rotation speed limit/speed limit is applied for the speed limit.

Reverse-side speed limit value

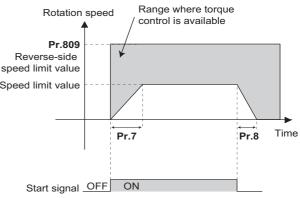
Start signal OFF ON

· When the torque command becomes negative, the setting of Pr.809 Reverse rotation speed limit/reverse-side speed limit is applied to prevent the speed from increasing in the reverse rotation direction. (The speed limit value and reverseside speed limit value are limited at Pr.1 Maximum frequency (maximum 400 Hz under Vector control).)





by reverse rotation command (winding)



For regenerative driving by forward rotation command (unwinding)

Speed limit mode switching via external terminals (Pr.1113 = "10")

- · The speed limit mode can be switched between 3 and 4 using the Torque control selection (X93) signal.
- To assign the X93 signal, set "93" in any of Pr.178 to Pr.189 (Input terminal function selection).

| X93 signal | Speed limit mode | | |
|------------|---|--|--|
| OFF | Mode 3 (positive torque command, same status as setting Pr.1113 = "1") | | |
| ON | Mode 4 (negative torque command, same status as setting Pr.1113 = "2") | | |



- During the speed limit operation, " (SL) is displayed on the operation panel and the OL signal is output.
- OL signal is assigned to terminal OL in the initial status. Set "3" in one of **Pr.190 to Pr.196 (Output terminal function selection)** to assign the RT signal to another terminal. Changing the terminal assignment using **Pr.190 to Pr.196** may affect the other functions. Set parameters after confirming the function of each terminal.
- Changing the terminal assignment using Pr.178 to Pr.189 (Input terminal function selection) may affect the other functions.
 Set parameters after confirming the function of each terminal.

Parameters referred to

Pr.1 Maximum frequency, Pr.2 Minimum frequency page 428
Pr.4 to Pr.6, Pr.24 to 27, Pr.232 to Pr.239 (multi-speed operation) page 411
Pr.7 Acceleration time, Pr.8 Deceleration time page 367
Pr.13 Starting frequency page 381
Pr.190 to Pr.196 (output terminal function selection) page 473
Pr.868 Terminal 1 function assignment page 500
Pr.125, Pr.126, C2 to C7, C12 to C15 (Frequency setting voltage (current) bias/gain) page 505

5.4.6 Torque control gain adjustment

Sensorless Vector

Operation is normally stable enough in the initial setting, but some adjustments can be made if abnormal vibration, noise or overcurrent occur for the motor or machinery.

| Pr. | Name | Initial value | Setting range | Description |
|-------------|--|---------------|---------------|--|
| 824 G213 | Torque control P gain 1 (current loop proportional gain) | 100% | 0 to 500% | Set the current loop proportional gain. |
| 825 G214 | Torque control integral time 1 (current loop integral time) | 5 ms | 0 to 500 ms | Set current loop integral compensation time. |
| 834 G313 | Torque control P gain 2 (current loop proportional gain) | 9999 | 0 to 500% | Sets the current loop proportional gain when RT signal is ON. |
| 9313 | | | 9999 | The Pr.824 setting is applied to the operation. |
| 835 | Torque control integral time 2 | 9999 | 0 to 500 ms | Sets the current loop integral compensation time when RT signal is ON. |
| G314 | (current loop integral time) | <i>ਬ</i> ਬਬਬ | 9999 | The Pr.825 setting is applied to the operation. |

◆ Current loop proportional (P) gain adjustment (Pr.824)

- The 100% current loop proportional gain is equivalent to 1000 rad/s during Real sensorless vector control, and to 1400 rad/s during Vector control.
- For ordinary adjustment, try to set within the range of 50 to 500%.
- · Set the proportional gain for during torque control.
- If setting value is large, changes in current command can be followed well and current fluctuation relative to external
 disturbance is smaller. If the setting value is however too large, it becomes unstable and high frequency torque pulse is
 produced.

◆ Current control integral time adjustment (Pr.825)

- · Set the integral time of current control during torque control.
- Torque response increases if set small; current however becomes unstable if set too small.
- If the setting value is small, it produces current fluctuation toward disturbance, decreasing time until it returns to original current value.

◆ Using two types of gain (Pr.834, Pr.835)

- Use Pr.834 Torque control P gain 2 (current loop proportional gain), Pr.835 Torque control integral time 2 (current loop integral time) if the gain setting needs to be switched according to application or if multiple motors are switched by a single inverter.
- Pr.834, Pr.835 is enabled when the second function selection (RT) signal is turned ON.



- The RT signal is a second function selection signal which also enables other second functions. (Refer to page 525.)
- The RT signal is assigned to terminal RT in the initial status. Set "3" in one of **Pr.178 to Pr.189 (Input terminal function selection)** to assign the RT signal to another terminal.

◆ Adjustment procedure

Adjust if any of phenomena such as unusual vibration, noise, current or overcurrent is produced by the motor or machinery.

- 1. Change the **Pr.824** setting while checking the conditions.
- **2.** If it cannot be adjusted well, change the **Pr.825** setting, and perform step **1** again.

| Adjustment method | | | | | |
|--|---|--|--|--|--|
| Set Pr.824 lower and Pr.825 longer. First, lower Pr.824 and then check of there is still any abnormal vibration, noise or current from the motor If it still requires improvement, make Pr.825 longer. | | | | | |
| Pr.824 | Lower the setting by 10% each time and set a value that is approximately 80 to 90% of the setting immediately before the abnormal noise or current improves. If set too low, current ripple is produced and produces a sound from the motor that synchronizes with it. | | | | |
| Pr.825 | Lengthen the current setting by doubling it each time and set a value that is approximately 80 to 90% of the setting value, immediately before abnormal noise or current is improved. If set too long, current ripple is produced and produces a sound from the motor that synchronizes with it. | | | | |

5.4.7 Troubleshooting in torque control

Sensorless Vector

| | Condition Possible cause | | Countermeasure | | |
|---|--|--|---|--|--|
| | | There is incorrect phase sequence between the motor wiring and encoder wiring. | Check the wiring. (Refer to page 91.) | | |
| | | • Pr.800 Control method selection is not appropriate. | Check the Pr.800 setting. (Refer to page 221.) | | |
| | | The speed limit value has not been input. | Set the speed limit value. (If speed limit value is not input, it becomes 0 Hz by default and the motor does not run.) | | |
| 1 | Torque control does not operate properly. | Torque command varies. | Check that the torque command sent from the controller is correct. Set Pr.72 PWM frequency selection lower. Set Pr.826 Torque setting filter 1 higher. | | |
| | | The torque command and the torque recognized by the inverter are different. | Re-calibrate the settings of C16 Terminal 1 bias command (torque/magnetic flux), C17 Terminal 1 bias (torque/magnetic flux), C18 Terminal 1 gain command (torque/magnetic flux), C19 Terminal 1 gain (torque/magnetic flux) (Refer to page 510.) | | |
| | | Torque fluctuation due to motor temperature variation | Select the magnetic flux observer by Pr.95 Online auto tuning selection. (Refer to page 558.) | | |
| | | The option to be used and parameter settings do not match. | Correctly set Pr.862 Encoder option selection according to the option to be used. (Refer to page 226.) | | |
| 2 | When a small torque command is given, the motor rotates in a direction opposite to the start signal. | Torque offset calibration is inaccurate. | Re-calibrate C16 and C17. (Refer to page 510.) | | |
| 3 | Torque control cannot operate normally during acceleration/ deceleration. The motor vibrates. * Speed limit is operating. (Speed limit may operate because the speed limit value will increase or decrease according to acceleration/ deceleration time setting of Pr.7 and Pr.8 when Pr.807 = "0 or 2".) | | Set the acceleration/deceleration time shorter. Alternatively, set "0" for the acceleration/deceleration time. (Forward/reverse rotation speed limit at this time is the value at a constant speed.) | | |
| 4 | Output torque is nonlinear for the torque command. | Torque shortage. | Return Pr.854 Excitation ratio to the initial value. | | |

Parameters referred to

Pr.72 PWM frequency selection ☞ page 356
Pr.178 to Pr.189 (Input terminal function selection) ☞ page 521

Pr.800 Control method selection apage 221

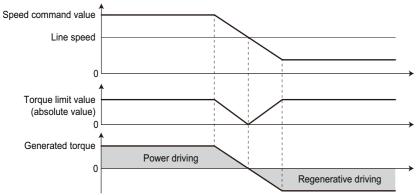
5.4.8 Torque control by variable-current limiter control

Vector

By changing the torque limit value for speed control, torque control can be performed.

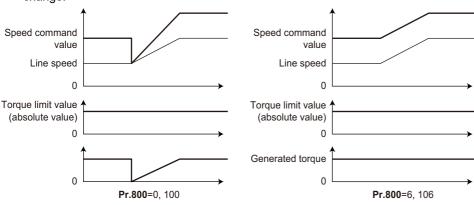
| Pr. | Name | Initial value | Setting range | Description | 1 |
|-------------|---------------------------------------|------------------|----------------------|--|--|
| | | | 6 | Vector control | |
| | | | 106 | Torque control under Vector control (fast-response operation) | Variable-current limiter torque control) |
| 000 | Comtract resorting of | | 0 to 5, 100 to 105 | Vector control | |
| 800 G200 | Control method selection | 20 | 9, 109 | Vector control test operation | |
| 0200 | | | 10 to 12, 110 to 112 | Real sensorless vector control | |
| | | | 13 to 14, 113, 114 | (PM sensorless vector control) | |
| | | | 20 | V/F control (Advanced magnetic flux vector control, PM sensorly vector control) | |
| 451 G300 | Second motor control method selection | 9999 | | Select the control method for the second motor. The second motor is enabled when the RT signal is ON. The setting range is the same as that of Pr.800 . | |
| | | | 9999 | The setting value of Pr.800 is used. | |

- By adding the bias amount to the line speed (master speed) as the speed command value to saturate the speed controller and changing the torque limit value, torque control can be performed.
- For a positive bias amount (the speed command value faster than the line speed), power driving is applied, and for a negative bias amount (the speed command value slower than the line speed), regenerative driving is applied.
- Speed control is the basic control. For how to set the speed command and torque limit value, refer to the description of speed control (page 235).



• Under speed control with **Pr.800** = "0 or 100", when the speed command value is changed by an external force, the torque limit is invalid during a change in the speed command value to adjust the internal speed command value to the actual speed.

Under variable speed limiter control with **Pr.800** = "6 or 106", the process to adjust the speed command value to the actual speed is not performed, and thus the torque limit remains valid. This prevents torque from suddenly changing at a speed change.





• When Pr.800 = "6 or 106" (torque control by a variable-current limiter), Pr.690 Deceleration check time and Pr.873 Speed limit are ignored.

Parameters referred to

Pr.690 Deceleration check time ☞ page 269
Pr.873 Speed limit ☞ page 269
Pr.800 Control method selection, Pr.451 Second motor control method selection ☞ page 221

5.5 Position control under vector control and PM sensorless vector control

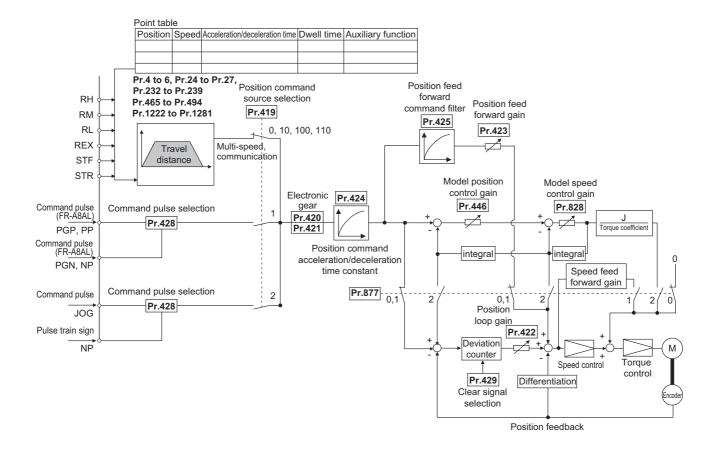
| Purpose | Parameter to set | | | | |
|--|--|--|---|-----|--|
| To perform Simple position control by setting parameters | Parameter position command | P.B000, P.B020 to P.B050, P.B101, P.B120 to P.B188, P.B190 to P.B195 | Pr.419, Pr.464 to Pr.494, Pr.1221 to Pr.1290, Pr.1292, Pr.1293 | 303 | |
| To perform position control by pulse input to the inverter | Simple pulse train position command | P.B000, P.B009, P.B010 | Pr.419, Pr.428, Pr.429 | 319 | |
| To adjust the gear ratio of the motor and machine | Electronic gear settings | P.B001, P.B002, P.B005 | Pr.420, Pr.421, Pr.424 | 325 | |
| To improve the precision of the | Position adjustment parameter settings | P.B007 to P.B008, P.B192 to P.B195 | Pr.426 to Pr.427, Pr.1294 to Pr.1297 | 327 | |
| To improve the precision of the position control | Position control gain adjustment | P.B003, P.B004, P.B006, P.B012, P.B013, P.G220, P.G224, P.C114 | Pr.422, Pr.423, Pr.425, Pr.446, Pr.828, Pr.877, Pr.880, Pr.1298 | 328 | |
| To monitor pulses | Pulse monitor selection | P.B011 | Pr.430 | 321 | |
| 10 monitor puises | Cumulative pulse monitoring | P.M610 to P.M613 | Pr.635 to Pr.638 | 321 | |

5.5.1 About position control

Vector PM

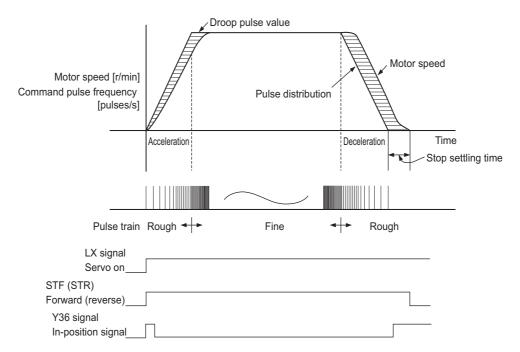
- In position control, speed commands, which are calculated to eliminate the difference between the command pulse (parameter setting) and the feedback pulse number, are output to rotate the motor.
- This inverter can perform simple positioning by contact input or position control by simple pulse input to the inverter.

◆ Control block diagram



Operation example

- Calculate the speed command so that the difference between the number of pulses of the internal pulse train (if **Pr.419** = "0", command pulses are used in the inverter from the number of pulses defined by parameters (**Pr.465 to Pr.494**)) and the number of pulses in the feedback from the motor terminal encoder (estimated value when PM sensorless vector control is used) is 0, and then rotate the motor based on the calculation.
 - 1) Once a pulse train is input, pulses are accumulated in the deviation counter, and the droop pulses in this counter become position control pulses and speed command.
 - 2) When the motor starts to rotate in response to the speed command from the inverter, feedback pulses are also generated by the encoder at the same time. Subtract the encoder feedback pulses or feedback estimate value from the droop pulses in the deviation counter. The deviation counter keeps rotating the motor while keeping a certain droop amount.
 - 3) If the command pulse input stops, the amount of droop pulses in the deviation counter decreases and thus the speed slows down. When there is no droop pulse, the motor stops.
 - 4) If the number of droop pulses becomes smaller than the value set in **Pr.426 In-position width**, the system determines that positioning is complete and the In-position (Y36) signal is turned ON.



 The pulses are slow during motor acceleration and fast at full speed. The pulses become slower during deceleration, and eventually reach 0 and the motor stops a little after the command pulse.

This time difference is necessary to ensure stop accuracy and is called stop setting time.

NOTE

- To assign the Pre-excitation/servo ON (LX) signal, set "23" in any of Pr.178 to Pr.189 (Input terminal function selection).
- To assign the In-position (Y36) signal, set "36" in any of Pr.190 to Pr.196 (Output terminal function selection).
- Changing the terminal functions with Pr.178 to Pr.189 and Pr.190 to Pr.196 may affect other functions. Set parameters after confirming the function of each terminal.

Parameters referred to

Pr.178 to Pr.189 (Input terminal function selection) page 521 Pr.190 to Pr.196 (Output terminal function selection) page 473

5.5.2 Setting procedure of Vector control (position control)

Vector

◆ Using an induction motor

Operating procedure

- **1.** Perform secure wiring. (Refer to page 87.) Install a Vector control compatible option.
- 2. Set the option to be used (Pr.862).

 Set Pr.862 Encoder option selection according to the option to be used. (Refer to page 221.)
- 3. Set the motor and the encoder (Pr.71, Pr.359 (Pr.852), Pr.369 (Pr.851)). (Refer to page 94.)
- **4.** Set the overheat protection of the motor (**Pr.9**). (Refer to page 415.)

 When using the SF-V5RU or a motor equipped with a thermal sensor, set **Pr.9** = 0 A.
- **5.** Set the motor capacity and number of motor poles (**Pr.80**, **Pr.81**). (Refer to page 221.) V/F control is performed when the setting is "9999" (initial value).
- **6.** Set the rated motor voltage and frequency (**Pr.83**, **Pr.84**). (Refer to page 95.)
- 7. Select the control method (Pr.800). (Refer to page 221.)
 Set Pr.800 = "3" (position control), "4" (speed position switching), or "5" (position torque switching) to enable position control.
- **8.** Select the position command source (**Pr.419**).
 - For position command given by point table, set **Pr.419** = "0 (initial value), 10, 100, or 110" to set the positioning parameters (**Pr.465 to Pr.494, Pr.1222 to Pr.1281**). (Refer to page 303.)
 - For position command given by inverter pulse train input, set **Pr.419** = "2" to select a pulse train type for commands (**Pr.428**). (Refer to page 320.)
 - For position command given from the positioning module of the programmable controller, set **Pr.419** = "1" to select a pulse train type for commands (**Pr.428**). (Refer to page 316.)
- **9.** Perform the test operation.

As required

- Set the electronic gear. (Refer to page 325.)
- Set the position adjustment parameters. (Refer to page 327.)
- · Adjust the position control gain. (Refer to page 328.)
- Set the torque limit. (Refer to page 245.)

NOTE

- The carrier frequency is limited during Vector control. (Refer to page 356.)
- Refer to the Instruction Manual of each option for details on Vector control using the FR-A8APR, FR-A8APS, or FR-A8APA.
- To perform operation in position control mode, the Pre-excitation/servo ON (LX) signal needs to be turned ON. To assign the LX signal, set "23" in any of **Pr.178 to Pr.189 (Input terminal function selection)**.

◆ Using a PM motor

Operating procedure

- Set the applied encoder (Pr.359 (Pr.852), Pr.369 (Pr.851)).
 Refer to page 94 and set the parameters according to the option and the encoder to be used.
- 2. Set the applied motor (Pr.9, Pr.71, Pr.80, Pr.81, Pr.83, Pr.84).

 Set Pr.71 Applied motor, Pr.9 Rated motor current, Pr.80 Motor capacity, Pr.81 Number of motor poles, Pr.83 Rated motor voltage, and Pr.84 Rated motor frequency according to the motor specifications. (Setting "9999 (initial value)" in Pr.80 or Pr.81 selects V/F control.) Set Pr.702, Pr.706, Pr.707, Pr.724 and Pr.725 as required.
- 3. Select Vector control (speed control). (Refer to page 221.)
- **4.** Perform offline auto tuning and encoder position tuning (**Pr.96**). (Refer to page 542.) Set **Pr.96**, and perform tuning.
- Configure the initial parameter setting for the applied motor using Pr.998.
 When the setting for the PM motor is selected in Pr.998 PM parameter initialization, Vector control for the PM
 - "8009": Parameter (rotations per minute) settings for an IPM motor other than MM-CF
 - "8109": Parameter (frequency) settings for an IPM motor other than MM-CF
 - "9009": Parameter (rotations per minute) settings for an SPM motor
 - "9109": Parameter (frequency) settings for an SPM motor
- **6.** Set **Pr.800** to position control.

motor with an encoder is enabled.

7. Perform the test operation.

NOTE

• For PM motors, after performing offline auto tuning and encoder position tuning, first perform PM parameter initialization. If parameter initialization is performed after setting other parameters, some of those parameters are initialized too. (Refer to page 231 for the parameters that are initialized.)

5.5.3 Setting procedure of PM sensorless vector control (position control)

PM

Operating procedure

1. Perform IPM parameter initialization. (Refer to page 230.)

Set "3003 or 3103" in **Pr.998 PM parameter initialization** or select "3003" in " | PM" (IPM parameter initial settings).

| Setting | Description |
|---------|---|
| 3003 | Parameter settings for MM-CF IPM motor (rotations per minute) |
| 3103 | Parameter settings for MM-CF IPM motor (frequencies) |

2. Select the control mode (**Pr.800**). (Refer to page 221.)

Set Pr.800 = "13" (position control) or "14" (speed/position switchover) to enable position control.

- **3.** Select the position command source (**Pr.419**).
 - For position command given by point table, set **Pr.419** = "0 (initial value), 10, 100, or 110" to set the positioning parameters (**Pr.465** to **Pr.494**, **Pr.1222** to **Pr.1281**). (Refer to page 303.)
 - For position command given by inverter pulse train input, set **Pr.419** = "2" to select a pulse train type for commands (**Pr.428**). (Refer to page 319.)
 - For position command given from the positioning module of the programmable controller, set **Pr.419** = "1" to select a pulse train type for commands (**Pr.428**). (Refer to page 316.)
- **4.** Perform the test operation.

As required

- Set the electronic gear. (Refer to page 325.)
- Set the position adjustment parameters. (Refer to page 327.)
- · Adjust the position control gain. (Refer to page 328)
- Set the torque limit. (Refer to page 245.)

NOTE

- The carrier frequency is limited during PM sensorless vector control. (Refer to page 356.)
- Position deviation may occur due to motor temperature changes. In such case, shut off the inverter outputs, and restart.
- Perform position control under PM sensorless vector control only when using an MM-CF IPM motor with low-speed range high-torque characteristic (**Pr.788** = "9999 (initial value)")
- Position control is performed on the assumption of 4096 pulses/motor rotation.
 The positioning accuracy is 200 pulses/rev for 1.5K or lower, and 100 pulses/rev for 2K or higher (under no load).
- To perform operation in position control mode, the Pre-excitation/servo ON (LX) signal needs to be turned ON. To assign the LX signal, set "23" in any of **Pr.178 to Pr.189 (Input terminal function selection)**.

Simple positioning function by parameters

Vector PM

Set positioning parameters such as the number of pulses (position) and acceleration/deceleration time in advance to create a point table (point table method). Positioning operation is performed by selecting the point table.

| Pr. | Name | Initial value | Setting range | Description |
|-------------|--|---------------|---|---|
| 419 | Position command | 0 | 0, 10, 100, 110, 200, 210, 300, 310, 1110, 1310 | Simple position control by point table (Settings are available for the home position data at servo-OFF, clearing of the current position 2 monitor value, and the absolute position control.) |
| B000 | source selection | 0 | 1 | Position command given by the pulse train input to the FR-A8AL*1 |
| | | | 2 | Simple pulse train position command given by the pulse train input to the inverter |
| 464 B020 | Digital position control sudden stop deceleration time | 0 s | 0 to 360 s | Set the time period until the inverter stops when the forward rotation (reverse rotation) command is turned OFF with the position feed forward function. |
| 465 B021 | First target position lower 4 digits | 0 | 0 to 9999 | Set the target position of the point table 1. |
| 466 B022 | First target position upper 4 digits | 0 | 0 to 9999 | oct the target position of the point table 1. |
| 467 B023 | Second target position lower 4 digits | 0 | 0 to 9999 | Set the target position of the point table 2. |
| 468 B024 | Second target position upper 4 digits | 0 | 0 to 9999 | 3 |
| 469 B025 | Third target position lower 4 digits | 0 | 0 to 9999 | Set the target position of the point table 3. |
| 470 B026 | Third target position upper 4 digits | 0 | 0 to 9999 | octatio target position of the point table of |
| 471 B027 | Fourth target position lower 4 digits | 0 | 0 to 9999 | Set the target position of the point table 4. |
| 472 B028 | Fourth target position upper 4 digits | 0 | 0 to 9999 | 3.,, |
| 473 B029 | Fifth target position lower 4 digits | 0 | 0 to 9999 | Set the target position of the point table 5. |
| 474 B030 | Fifth target position upper 4 digits | 0 | 0 to 9999 | or and tanger position or and point table of |
| 475 B031 | Sixth target position lower 4 digits | 0 | 0 to 9999 | Set the target position of the point table 6. |
| 476 B032 | Sixth target position upper 4 digits | 0 | 0 to 9999 | or and tanger position or the point table of |
| 477 B033 | Seventh target position lower 4 digits | 0 | 0 to 9999 | Set the target position of the point table 7. |
| 478 B034 | Seventh target position upper 4 digits | 0 | 0 to 9999 | J 1 |
| 479 B035 | Eighth target position lower 4 digits | 0 | 0 to 9999 | Set the target position of the point table 8. |
| 480 B036 | Eighth target position upper 4 digits | 0 | 0 to 9999 | |
| 481 B037 | Ninth target position lower 4 digits | 0 | 0 to 9999 | Set the target position of the point table 9. |
| 482 B038 | Ninth target position upper 4 digits | 0 | 0 to 9999 | anger permanent and point table of |
| 483 B039 | Tenth target position lower 4 digits | 0 | 0 to 9999 | Set the target position of the point table 10. |
| 484 B040 | Tenth target position upper 4 digits | 0 | 0 to 9999 | 25 augus poulaur or the point table 10. |
| 485 B041 | Eleventh target position lower 4 digits | 0 | 0 to 9999 | Set the target position of the point table 11. |
| 486 B042 | Eleventh target position upper 4 digits | 0 | 0 to 9999 | oct the target position of the point table 11. |

| Pr. | Name | Initial value | Setting range | Description |
|--------------|---|---------------|---|---|
| 487 B043 | Twelfth target position | 0 | 0 to 9999 | |
| 488 | lower 4 digits Twelfth target position | 0 | 0.4. 0000 | Set the target position of the point table 12. |
| B044 | upper 4 digits | 0 | 0 to 9999 | |
| 489 B045 | Thirteenth target position lower 4 digits | 0 | 0 to 9999 | Set the target position of the point table 13. |
| 490 B046 | Thirteenth target position upper 4 digits | 0 | 0 to 9999 | or the target position or the point tages for |
| 491 B047 | Fourteenth target position lower 4 digits | 0 | 0 to 9999 | Set the target position of the point table 14. |
| 492 B048 | Fourteenth target position upper 4 digits | 0 | 0 to 9999 | oct the target position of the point table 14. |
| 493 B049 | Fifteenth target position lower 4 digits | 0 | 0 to 9999 | Set the target position of the point table 15. |
| 494 B050 | Fifteenth target position upper 4 digits | 0 | 0 to 9999 | oet the target position of the point table 13. |
| 1221 | Start command edge | 0 | 0 | Turning OFF the forward (reverse) rotation command stops the motor in the setting time of Pr.464 . |
| B101 | detection selection | | 1 | Position forward is continued even if the forward (reverse) rotation command is turned OFF. |
| 1222 B120 | First positioning acceleration time | 5 s | 0.01 to 360 s | |
| 1223 B121 | First positioning deceleration time | 5 s | 0.01 to 360 s | Set the characteristics of the point table 1. |
| 1224 B122 | First positioning dwell time | 0 ms | 0 to 20000 ms | Set the characteristics of the point table 1. |
| 1225 B123 | First positioning sub- function | 10 | 0 to 2, 10 to 12, 100 to 102, 110 to 112 | |
| 1226 B124 | Second positioning acceleration time | 5 s | 0.01 to 360 s | |
| 1227 B125 | Second positioning deceleration time | 5 s | 0.01 to 360 s | Set the characteristics of the point table 2. |
| 1228 B126 | Second positioning dwell time | 0 ms | 0 to 20000 ms | oct the characteristics of the point table 2. |
| 1229 B127 | Second positioning sub- function | 10 | 0 to 2, 10 to 12, 100 to 102, 110 to 112 | |
| 1230 B128 | Third positioning acceleration time | 5 s | 0.01 to 360 s | |
| 1231 B129 | Third positioning deceleration time | 5 s | 0.01 to 360 s | Set the characteristics of the point table 3. |
| 1232 B130 | Third positioning dwell time | 0 ms | 0 to 20000 ms | Section of the point table of |
| 1233 B131 | Third positioning sub- function | 10 | 0 to 2, 10 to 12, 100 to 102, 110 to 112 | |
| 1234 B132 | Fourth positioning acceleration time | 5 s | 0.01 to 360 s | |
| 1235 B133 | Fourth positioning deceleration time | 5 s | 0.01 to 360 s | Set the characteristics of the point table 4. |
| 1236 B134 | Fourth positioning dwell time | 0 ms | 0 to 20000 ms | ook and orialization of the point table 4. |
| 1237 B135 | Fourth positioning sub- function | 10 | 0 to 2, 10 to 12, 100 to 102, 110 to 112 | |
| 1238 B136 | Fifth positioning acceleration time | 5 s | 0.01 to 360 s | |
| 1239 B137 | Fifth positioning deceleration time | 5 s | 0.01 to 360 s | Sat the characteristics of the point table F |
| 1240 B138 | Fifth positioning dwell time | 0 ms | 0 to 20000 ms | Set the characteristics of the point table 5. |
| 1241 B139 | Fifth positioning sub- function | 10 | 0 to 2, 10 to 12, 100 to 102, 110 to 112 | |

| Pr. | Name | Initial value | Setting range | Description |
|--------------|--|---------------|---|---|
| 1242 | Sixth positioning | 5 s | 0.01 to 360 s | |
| B140 1243 | acceleration time Sixth positioning | | | |
| B141 | deceleration time | 5 s | 0.01 to 360 s | Set the characteristics of the point table 6. |
| 1244 B142 | Sixth positioning dwell time | 0 ms | 0 to 20000 ms | ' ' |
| 1245 B143 | Sixth positioning sub- function | 10 | 0 to 2, 10 to 12, 100 to 102, 110 to 112 | |
| 1246 B144 | Seventh positioning acceleration time | 5 s | 0.01 to 360 s | |
| 1247 B145 | Seventh positioning deceleration time | 5 s | 0.01 to 360 s | Set the characteristics of the point table 7. |
| 1248 B146 | Seventh positioning dwell time | 0 ms | 0 to 20000 ms | oet the characteristics of the point table 7. |
| 1249 B147 | Seventh positioning sub-function | 10 | 0 to 2, 10 to 12, 100 to 102, 110 to 112 | |
| 1250 B148 | Eighth positioning acceleration time | 5 s | 0.01 to 360 s | |
| 1251 B149 | Eighth positioning deceleration time | 5 s | 0.01 to 360 s | Sat the characteristics of the point table 9 |
| 1252 B150 | Eighth positioning dwell time | 0 ms | 0 to 20000 ms | Set the characteristics of the point table 8. |
| 1253 B151 | Eighth positioning sub- function | 10 | 0 to 2, 10 to 12, 100 to 102, 110 to 112 | |
| 1254 B152 | Ninth positioning acceleration time | 5 s | 0.01 to 360 s | |
| 1255 B153 | Ninth positioning deceleration time | 5 s | 0.01 to 360 s | Set the characteristics of the point table 9. |
| 1256 B154 | Ninth positioning dwell time | 0 ms | 0 to 20000 ms | oct the orial acteristics of the point table 3. |
| 1257 B155 | Ninth positioning sub- function | 10 | 0 to 2, 10 to 12, 100 to 102, 110 to 112 | |
| 1258 B156 | Tenth positioning acceleration time | 5 s | 0.01 to 360 s | |
| 1259 B157 | Tenth positioning deceleration time | 5 s | 0.01 to 360 s | Set the characteristics of the point table 10. |
| 1260 B158 | Tenth positioning dwell time | 0 ms | 0 to 20000 ms | |
| 1261 B159 | Tenth positioning sub- function | 10 | 0 to 2, 10 to 12, 100 to 102, 110 to 112 | |
| 1262 B160 | Eleventh positioning acceleration time | 5 s | 0.01 to 360 s | |
| 1263 B161 | Eleventh positioning deceleration time | 5 s | 0.01 to 360 s | Set the characteristics of the point table 11. |
| 1264 B162 | Eleventh positioning dwell time | 0 ms | 0 to 20000 ms | 23. 3.3 Grandstonolida on the point table 11. |
| 1265 B163 | Eleventh positioning sub-function | 10 | 0 to 2, 10 to 12, 100 to 102, 110 to 112 | |
| 1266 B164 | Twelfth positioning acceleration time | 5 s | 0.01 to 360 s | |
| 1267 B165 | Twelfth positioning deceleration time | 5 s | 0.01 to 360 s | Set the characteristics of the point table 12. |
| 1268 B166 | Twelfth positioning dwell time | 0 ms | 0 to 20000 ms | ost and origination of the politiciable 12. |
| 1269 B167 | Twelfth positioning sub- function | 10 | 0 to 2, 10 to 12, 100 to 102, 110 to 112 | |
| 1270 B168 | Thirteenth positioning acceleration time | 5 s | 0.01 to 360 s | |
| 1271 B169 | Thirteenth positioning deceleration time | 5 s | 0.01 to 360 s | Set the characteristics of the resistable 42 |
| 1272 B170 | Thirteenth positioning dwell time | 0 ms | 0 to 20000 ms | Set the characteristics of the point table 13. |
| 1273 B171 | Thirteenth positioning sub-function | 10 | 0 to 2, 10 to 12, 100 to 102, 110 to 112 | |
| <u> </u> | | | · , · · - | I |

| Pr. | Name | Initial value | Setting range | Description |
|--------------|---|---------------|--|--|
| 1274 B172 | Fourteenth positioning acceleration time | 5 s | 0.01 to 360 s | |
| 1275 B173 | Fourteenth positioning deceleration time | 5 s | 0.01 to 360 s | |
| 1276 B174 | Fourteenth positioning dwell time | 0 ms | 0 to 20000 ms | Set the characteristics of the point table 14. |
| 1277 B175 | Fourteenth positioning sub-function | 10 | 0 to 2, 10 to 12, 100 to 102, 110 to 112 | |
| 1278 B176 | Fifteenth positioning acceleration time | 5 s | 0.01 to 360 s | |
| 1279 B177 | Fifteenth positioning deceleration time | 5 s | 0.01 to 360 s | Set the characteristics of the point table 15. |
| 1280 B178 | Fifteenth positioning dwell time | 0 ms | 0 to 20000 ms | Get the Gharacteristics of the politicable 13. |
| 1281 B179 | Fifteenth positioning sub-function | 10 | 0, 2, 10, 12, 100, 102, 110, 112 | |
| | | | 0 | Dog type |
| | | | 1 | Count type |
| | | | 2 | Data set type |
| 1282 | Home position return | 4 | 3 | Stopper type |
| B180 | method selection | | 4 | Ignoring the home position (servo-ON position as the home position) |
| | | | 5 | Dog type back end reference |
| | | | 6 | Count type with front end reference |
| 1283 B181 | Home position return speed | 2 Hz | 0 to 30 Hz | Set the speed for the home position return operation. |
| 1284 B182 | Home position return shifting speed | 0.5 Hz | 0 to 10 Hz | Set the speed immediately before the home position return. |
| 1285 B183 | Home position shift amount lower 4 digits | 0 | 0 to 9999 | Set the home position shift distance. Home position shift amount = Pr.1286 × 10000 digits + |
| 1286 B184 | Home position shift amount upper 4 digits | 0 | 0 to 9999 | Pr.1285 |
| 1287 B185 | Travel distance after proximity dog ON lower 4 digits | 2048 | 0 to 9999 | Set the travel distance after detecting the proximity dog. Travel distance after proximity dog = Pr.1288 × 10000 + |
| 1288 B186 | Travel distance after proximity dog ON upper 4 digits | 0 | 0 to 9999 | Pr.1287 |
| 1289 B187 | Home position return stopper torque | 40% | 0 to 200% | Set the activation level of torque limit operation for the stopper-type home position return. |
| 1290 B188 | Home position return stopper waiting time | 0.5 s | 0 to 10 s | Set the waiting time until home position return is started after the inverter detects the pressing status. |
| 1292 | Position control terminal | 0 | 0 | Sudden stop signal (X87) normally open input (NO contact input) |
| B190 | input selection | | 1 | Sudden stop signal (X87) normally closed input (NC contact input) |
| 1293 | Roll feeding mode | 0 | 0 | Roll feed disabled |
| B191 | selection | • | 1 | Roll feed enabled |

^{*1} During position control under Vector control, if **Pr.419** = "1" while the FR-A8AL is not installed (or is disabled), a protective function (E.OPT) is

◆ Selecting the position command input method (Pr.419)

- Use **Pr.419** to set simple position control by point table.
- Settings are available for the home position data at servo-OFF, clearing of the current position 2 monitor value, and the absolute position control.

| Item | Description |
|---------------------------|---|
| Position command | The position command input method can be selected. |
| Home position retention | Select whether to retain the home position data when the LX signal is OFF (servo-OFF). |
| Monitor value clearing | Select whether to clear the current position 2 monitor value when the home position return is completed or when position control is switched to other control mode. |
| Absolute position control | Select the availability of absolute position control. |

| | | | Monitor valu | ue clearing ^{*1} | |
|-------------------|---|-------------------------|--|---|--------------------------------------|
| Pr.419 setting | Position command | Home position retention | When home position return is completed | When position control is switched to other control mode | Absolute position control |
| 0 | Simple position control by point table (position command given by setting parameters) | | | | |
| 1 | Position command given by the pulse train input to the FR-A8AL*2 | Not retained | Not cleared | Cleared | Disabled |
| 2 | Simple pulse train position command given by the pulse train input to the inverter | | | | |
| 10 | | Retained | | | |
| 100 | Not retained Clears | | Cleared Cleared | |] |
| 110 | | Retained | Cleared | Cleared | |
| 200 | Circuit and it is a second and the second and | Not retained | Not cleared | Not cleared | |
| 210 | Simple position control by point table (position command given | Retained | Not cleared | Not cleared | |
| 300 | by setting parameters) | Not retained | Cleared | Not cleared | |
| 310 |] , 3,, | | Cicalcu | INUL CICALCU | |
| 1110 | | Retained | Cleared | Cleared | Enabled (with the |
| 1310 | | Totallou | Cleared | Not cleared | FR-A8APS installed) ^{*3} |

^{*1} Timing to clear the current position 2 monitor value differs depending on the setting value. (Refer to page 321.)

◆ Positioning by a point table (Pr.4 to Pr.6, Pr.24 to Pr.27, Pr.232 to Pr.239, Pr.465 to Pr.494, and Pr.1222 to Pr.1281)

· Create a the point table by setting the following parameters.

| Point table | [Com | on data mand de] | Maximum speed | Acceleration time | Deceleration time | Dwell time | Auxiliary function | Poin | t table se | election | signal |
|-------------|--------|------------------------|------------------|-------------------|-------------------|------------|--------------------|------|------------|----------|--------|
| | Upper | Lower | | | | | | REX | RH | RM | RL |
| 1 | Pr.466 | Pr.465 | Pr.4 | Pr.1222 | Pr.1223 | Pr.1224 | Pr.1225 | OFF | ON | OFF | OFF |
| 2 | Pr.468 | Pr.467 | Pr.5 | Pr.1226 | Pr.1227 | Pr.1228 | Pr.1229 | OFF | OFF | ON | OFF |
| 3 | Pr.470 | Pr.469 | Pr.6 | Pr.1230 | Pr.1231 | Pr.1232 | Pr.1233 | OFF | OFF | OFF | ON |
| 4 | Pr.472 | Pr.471 | Pr.24 | Pr.1234 | Pr.1235 | Pr.1236 | Pr.1237 | OFF | OFF | ON | ON |
| 5 | Pr.474 | Pr.473 | Pr.25 | Pr.1238 | Pr.1239 | Pr.1240 | Pr.1241 | OFF | ON | OFF | ON |
| 6 | Pr.476 | Pr.475 | Pr.26 | Pr.1242 | Pr.1243 | Pr.1244 | Pr.1245 | OFF | ON | ON | OFF |
| 7 | Pr.478 | Pr.477 | Pr.27 | Pr.1246 | Pr.1247 | Pr.1248 | Pr.1249 | OFF | ON | ON | ON |
| 8 | Pr.480 | Pr.479 | Pr.232 | Pr.1250 | Pr.1251 | Pr.1252 | Pr.1253 | ON | OFF | OFF | OFF |
| 9 | Pr.482 | Pr.481 | Pr.233 | Pr.1254 | Pr.1255 | Pr.1256 | Pr.1257 | ON | OFF | OFF | ON |
| 10 | Pr.484 | Pr.483 | Pr.234 | Pr.1258 | Pr.1259 | Pr.1260 | Pr.1261 | ON | OFF | ON | OFF |
| 11 | Pr.486 | Pr.485 | Pr.235 | Pr.1262 | Pr.1263 | Pr.1264 | Pr.1265 | ON | OFF | ON | ON |
| 12 | Pr.488 | Pr.487 | Pr.236 | Pr.1266 | Pr.1267 | Pr.1268 | Pr.1269 | ON | ON | OFF | OFF |
| 13 | Pr.490 | Pr.489 | Pr.237 | Pr.1270 | Pr.1271 | Pr.1272 | Pr.1273 | ON | ON | OFF | ON |
| 14 | Pr.492 | Pr.491 | Pr.238 | Pr.1274 | Pr.1275 | Pr.1276 | Pr.1277 | ON | ON | ON | OFF |
| 15 | Pr.494 | Pr.493 | Pr.239 | Pr.1278 | Pr.1279 | Pr.1280 | Pr.1281 | ON | ON | ON | ON |

Position data settings

- · Set the position feed length to Pr.465 to Pr.494.
- · The feed length set to each point table is selected by multi-speed terminals (RH, RM, RL and REX).
- · Under Vector control with encoder, set the value calculated with the following formula as the position feed length: (encoder resolution × number of rotations × 4).
- For example, to stop the motor after 100 times of rotations using the SF-V5RU,

The value is calculated with 2048 (pulses/rev) ×100 (rotations per minute) × 4 (multiplier) = 819200 (feed length)

^{*2} During position control under Vector control, if Pr.419 = "1" while the FR-A8AL is not installed (or is disabled), a protective function (E.OPT) is

^{*3} During position control under Vector control, if Pr.419 = "1110 or 1310" while the FR-A8APS is not installed (or is disabled), a protective function (E.OPT) is activated.

To set 819200 as the first feed length, separate the number into the upper and lower 4 digits as follows:

Pr.466 (upper digits) = 81 (decimal). **Pr.465** (lower digits) = 9200 (decimal)

• The position feed length of PM sensorless vector control is fixed at 4096 for each motor rotation.

Acceleration/deceleration time setting

- · Set the acceleration/deceleration time for parameters corresponding to each point table.
- The frequency which is the basis of acceleration/deceleration time is **Pr.20 Acceleration/deceleration reference**frequency. However, 1 Hz/s is the minimum acceleration/deceleration rate (acceleration/deceleration frequency divided by acceleration/deceleration time). If the acceleration/deceleration rate is smaller than 1, the motor runs at 1 Hz/s or in the deceleration time.
- The maximum acceleration/deceleration time is limited at 360 seconds.
- During position control, acceleration/deceleration pattern is always the liner acceleration/deceleration, and the Pr.29
 Acceleration/deceleration pattern selection setting is ignored.

◆ Setting the waiting (dwell) time

- Set the waiting (dwell) time which is the interval from the completion of the position command of a selected point table to the start of the position command of the next point table.
- Set the dwell time from 0 to 20000 ms for parameters corresponding to each point table.

◆ Auxiliary function setting

- Set the handling and operation methods of the position data in each point table.
- Set the auxiliary function for parameters corresponding to each point table.

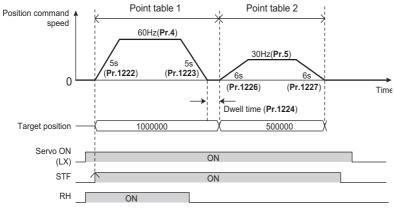
| Auxiliary function parameter setting | Sign (100s digit) | Command method (tens place) | Operation method (ones place) |
|--------------------------------------|-------------------|-----------------------------|---|
| 0 | | | Individual (0) |
| 1 | | Absolute position | Continuous (1) |
| 2 | Plue (0) | command (0) | Loop operation using the point table selected at the start of the operation (2) |
| 10 | Plus (0) | | Individual (0) |
| 11 | | Incremental position | Continuous (1) |
| 12 | | command (1) | Loop operation using the point table selected at the start of the operation (2) |
| 100 | | | Individual (0) |
| 101 | | Absolute position | Continuous (1) |
| 102 | Minus (1) | command (0) | Loop operation using the point table selected at the start of the operation (2) |
| 110 | Minus (1) | | Individual (0) |
| 111 | | Incremental position | Continuous (1) |
| 112 | | command (1) | Loop operation using the point table selected at the start of the operation (2) |

- · For the sign, select the sign of position data.
- For the command method, select the absolute position command or incremental position command. For the absolute
 position command, specify the distance from the home position. For the incremental position command, specify the
 distance from the current position command.
- · Position commands cannot be received until the completion of the home position return.
- For the operation method, select "individual", "continuous", or "loop operation using the point table selected at the start". When continuous operation is selected, next point table is executed after a command has been executed.
 - Set "individual" as the operation method for the point table which is the last of the continuous operation.
 - When "loop operation using the point table selected at the start" is selected, the positioning operation is the loop. To stop the operation, turn OFF the STF (STR) signal, or turn ON the X87 (sudden stop) input signal.
- Individual operation is only executed in the selected point table. The dwell time setting is disabled in individual operation.
- Continuous operation setting is not available for the point table 15 ("0, 2, 10, 12, 100, 102, 110 or 112" can be set to **Pr.1281**).

Example 1 of positioning operation using point table (automatic continuous positioning operation)

The following figure shows an operation example using the following point table.

| Point table | Target position | | Target position Maximum Acceleration Deceleration | | Deceleration | Dwell time | Auxiliary function |
|-------------|-----------------|-------|---|---------|--------------|------------|---------------------------------------|
| Point table | Upper | Lower | speed (Hz) | time(s) | time(s) | (ms) | Auxiliary function |
| 1 | 100 | 0 | 60 | 5 | 5 | 1000 | 1 (absolute position, continuous) |
| 2 | 50 | 0 | 30 | 6 | 6 | 0 | 10 (incremental position, individual) |



- NOTE
 - During continuous operation, the position command speed drops to 0 in each point table operation before starting the next point table operation.
 - During continuous operation, no point table selection signal is received. Select the position feed length using point table before turning ON the start command. Only the maximum frequency can be changed during operation.

◆ Example 2 of positioning operation using point table (Automatic loop positioning operation using the point table selected at the start of the operation)

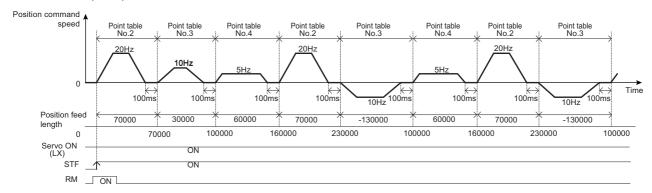
The following figure shows a loop operation example using the point table 2 to point table 4 in the following point table. The operation is started from the point table 2 (start point). Set "12" in the auxiliary function of the point table 4 (end point).

| Point table | Target position | Maximum speed (Hz) | Acceleration time (s) | Deceleration time (s) | Dwell time (ms) ^{*1} | Auxiliary function |
|-------------|-----------------|-----------------------|-----------------------|-----------------------|----------------------------------|---------------------------------------|
| 1 | 50000 | 60 | 1 | 1 | 100 | 1 (absolute position, continuous) |
| 2 | 70000 | 20 | 2 | 2 | 100 | 11 (incremental position, continuous) |
| 3 | 100000 | 10 | 4 | 4 | 100 | 1 (absolute position, continuous) |
| 4 | 60000 | 5 | 3 | 3 | 100 | 12 (incremental position, continuous) |

- *1 The positioning operation is the loop. To stop the operation, turn OFF the STF (STR) signal, or turn ON the X87 (sudden stop) input signal.

 Operation:
 - **1.** The operation is started from the point table 2 (start point).
 - **2.** The operation is switched to the one using the point table 3.
 - **3.** The operation is switched to the one using the point table 4 (end point).
 - **4.** According to the setting in the auxiliary function for the point table 4 (**Pr.1237** = "12"), the operation is switched to the one using the point table 2 selected at the start (loops back to the start point from the end point).

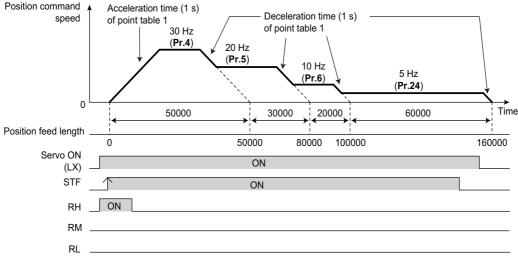
5. The loop of operations 1 to 4 executes.



◆ Example 3 of positioning operation using point table (variable speed operation)

- The maximum frequency can be changed during positioning operation. Use as many point tables as the number of maximum speeds to be set.
- The following figure shows an operation example using the following point table.

| Point table | Target position | | Maximum | Acceleration | Acceleration Deceleration | | Auxiliary function |
|-------------|-----------------|-------|------------|--------------|---------------------------|------|---------------------------------------|
| roint table | Upper | Lower | speed (Hz) | time (s) | time (s) | (ms) | Auxiliary fullction |
| 1 | 5 | 0 | 30 | 1 | 1 | 0 | 1 (absolute position, continuous) |
| 2 | 3 | 0 | 20 | Invalid | Invalid | 0 | 11 (incremental position, individual) |
| 3 | 10 | 0 | 10 | Invalid | Invalid | 0 | 1 (absolute position, continuous) |
| 4 | 6 | 0 | 5 | Invalid | Invalid | 0 | 10 (incremental position, individual) |



• Set "0" as the dwell time to perform variable speed operation.

◆ Return to home position during point table positioning

- Home position return is performed to match the command coordinates with the machine coordinates.
- The returned home position can be set as point 0, and positioning operation is available using this.

■ Home position return procedure

1. Set parameters related to home position return.

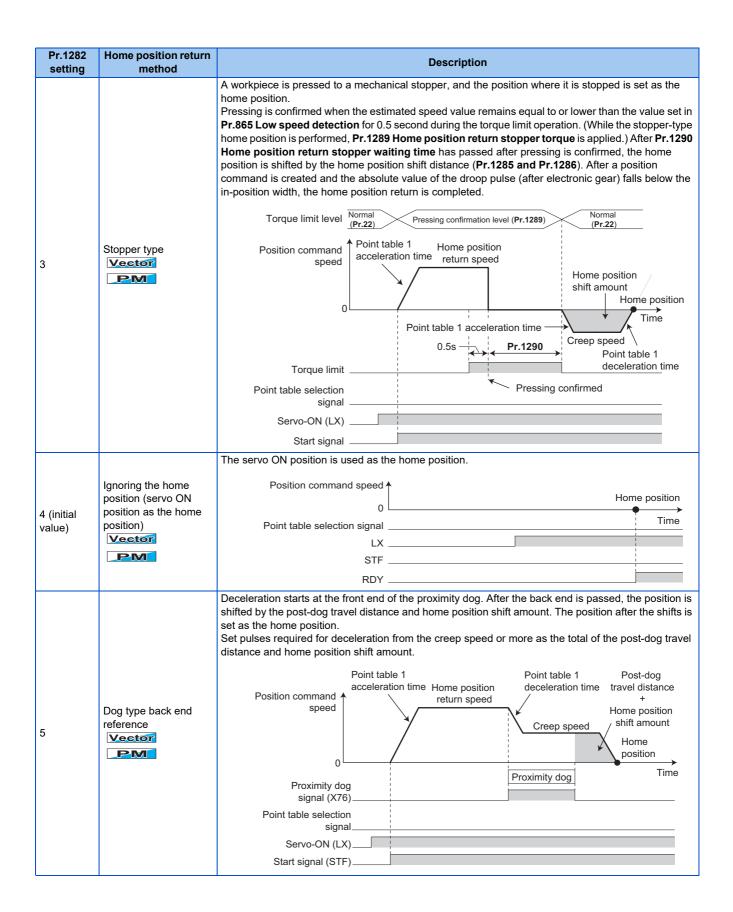
- Set the home position return method (Pr.1282).
- Set the home position return speed (Pr.1283)
- Set the home position creep speed (Pr.1284)
- Set the home position return shift amount if necessary(Pr.1286 × 10000 + Pr.1285).
- Set the post proximity dog travel distance if necessary. (Pr.1288 × 10000 + Pr.1287)
- **2.** Turn OFF all point table selections.
 - Turn OFF all RH, RM, RL and REX signals.
- **3.** Turn ON the Pre-excitation/servo ON (LX) signal.
- **4.** Turn ON the start signal (STF or STR).
 - · Home position return is performed according to the settings.

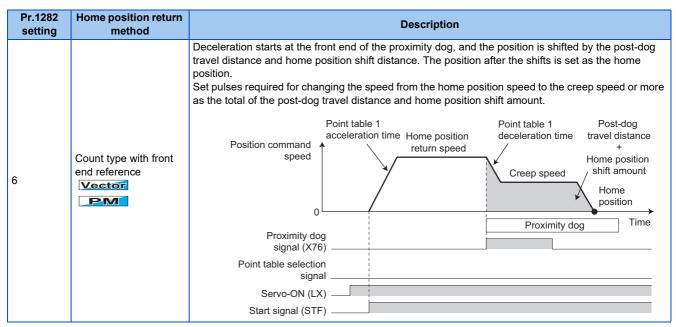
№ NOTE

- The setting values of the point table 1 are used as acceleration/deceleration time.
- After turning ON the start signal, only the setting values of **Pr.1283 Home position return speed**, **Pr.1284 Home position return shifting speed** can be changed.
- · Perform home position return at the motor switchover.

◆ Selecting the home position return method (Pr.1282 to Pr.1288)

| Pr.1282 setting | Home position return method | Description |
|--------------------|--------------------------------------|---|
| Setting | metriou | Deceleration starts when the Proximity dog signal is turned ON. For the home position after turn OFF |
| | | of the Proximity dog signal, the position specified by the first Z-phase signal shifted by the home position shift amount (Pr.1285 , Pr.1286) is used. |
| 0 | Dog type ^{*1} Vector | Position command speed Home position return speed Point table 1 deceleration time Home position creep speed shift amount Point table 1 deceleration time Home position shift amount Home position |
| | | Z-phase Time |
| | | X76 Proximity dog |
| | | Point table selection signal |
| | | LX — |
| | | STF |
| | Count type ^{*1} | Deceleration starts when the proximity dog signal is turned ON. After the proximity dog, the motor travels the specified travel distance (Pr.1287 , Pr.1288). Then, it uses the position specified by the first Z-phase signal or position of the Z-phase signal shifted by the home position shift amount (Pr.1285 , Pr.1286). |
| 1 | | Position command speed Home position return speed Point table 1 deceleration time Home position return speed Point table 1 deceleration time Home position shift amount Travel distance after proximity dog Home position |
| | | Z-phase |
| | | X76 Proximity dog |
| | | Point table selection signal |
| | | LX _ |
| | | STF |
| | | The position at which the start signal is input is used as the home position. |
| | Data set type | Position command speed Home position |
| 2 | Vector | Time |
| | | Point table selection signal |
| | | <u></u> |
| | | STF |



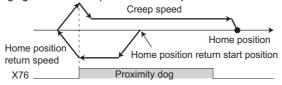


*1 If it is set under PM sensorless vector control, Home position return parameter setting error (HP3) occurs.

• NOTE

· Home position return automatic back-off function

In a system that uses home position return with proximity dog, if the home position return is commanded while the motor is in a position within the proximity dog, the motor moves out of the proximity dog once, then starts deceleration to stop when it comes to the proximity dog again. The home position return is performed automatically after that.



♦ Home position return error

· If home position return is not normally completed, the following warnings appear on the operation panel.

| Operation panel indication | Name | Possible cause |
|----------------------------|--|---|
| HP1 | Home position return setting error | The home position setting has failed. |
| HP2 | Home position return uncompleted | Start signal for the point table positioning has turned ON without completing the home position return. The proximity dog signal is turned OFF during transition from the home position return speed to the creep speed when home position return is performed in the dog type or dog type back end reference. The position command is given for the motor to reach the post-dog travel distance during transition from the home position return speed to the creep speed when home position return is performed in the count type. The position command is given for the motor to reach the total of the post-dog travel distance and home position shift distance during deceleration from the creep speed after the proximity dog signal is turned OFF in the dog type back end reference. The speed did not reach the creep speed in the count type with front end reference. |
| HP3 | Home position return parameter setting error | An unavailable home position return method is selected. |

The home position return failure (ZA) signal is output while the home position return warning is occurring. To use the ZA signal, set "56 (positive logic) or 156 (negative logic)" in any of Pr.190 to Pr.196 (Output terminal function selection) to assign the function.

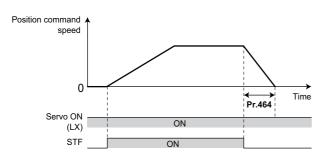
◆ Sudden stop (Pr.464, Pr.1221, and X87 signal)

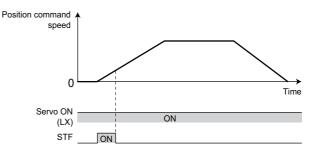
• The operation performed during STF(STR)-OFF can be selected with Pr.1221 Start command edge detection selection.

• If STF(STR) is turned OFF during positioning or home position returning when **Pr.1221** = "0 (initial value)" is set, it stops in the time set as **Pr.464 Digital position control sudden stop deceleration time**.

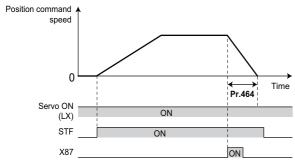
When Pr.1221="0 (initial value)" is set

When Pr.1221="1" is set





• Turning ON the Sudden stop signal (X87) during positioning operation or home position return operation, the motor stops in the setting time of **Pr.464**. To assign the X87 signal, set "87" in any of **Pr.178 to Pr.189 (Input terminal function selection)**.



• The input logic of the X87 signal Pr.1292 Position control terminal input selection can be set using.

| Pr.1292 setting | Input logic (X87) |
|-------------------|--|
| 0 (initial value) | Normally open input (NO contact input specification) |
| 1 | Normally closed input (NC contact input specification) |

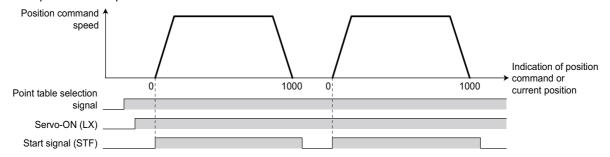


- When deceleration time longer than the normal deceleration time (including **Pr.1223**) is set in **Pr.464**, the normal deceleration time is applied.
- The X87 signal is effective during position control JOG operation.

◆ Roll feed mode (Pr.1293)

- If the roll feed mode is enabled in an application that needs repeated positioning in the same direction, such as a conveyor, positioning can be performed repeatedly without position command overflow.
- When the roll feed mode is enabled (**Pr.1293** = "1"), the position where the first position command is created is set as the home position and the droop pulses are cleared.
- When **Pr.1293** = "1", simple positioning is available even if home position return cannot be completed.
- Positioning modes which enables the roll feed mode are the point table mode, the home position return mode, and the JOG mode.

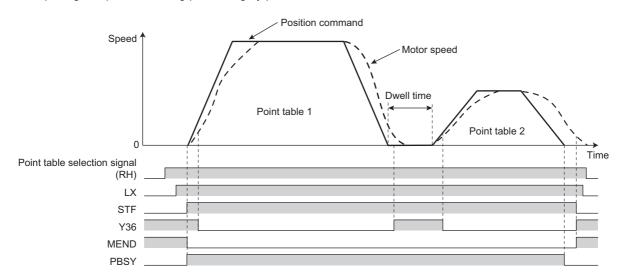
· Basic operation example



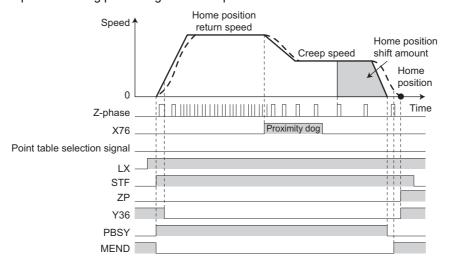
◆ Input/output signals for point table positioning

| Input/ | | | | Pr.178 to Pr.189 | Pr.190 to Pr.196 setting | |
|--------|------|-----------------------------------|---|------------------|--------------------------|-------------------|
| output | Si | ignal name | Function | setting | Positive logic | Negative logic |
| Input | X76 | Proximity dog | ON: dog ON, OFF: dog OFF | 76 | _ | |
| Input | X87 | Sudden stop | When turned ON, the motor decelerates and stops according to Pr.464 . | 87 | _ | |
| | MEND | Travel completed | Turns ON when the position command operation has completed while the number of droop pulses is within the positioning completion width. | _ | 38 | 138 |
| Output | ZA | Home position return failure | Turns ON while the home position return warning occurs. | _ | 56 | 156 |
| | PBSY | During position command operation | Turns ON during position command operation. | _ | 61 | 161 |
| | ZP | Home position return completed | Turns ON after home position return operation is complete. | _ | 63 | 163 |

· Output signal operation during positioning by point table



· Output signal operation during positioning with home position return





• When the LX signal is turned OFF, the home position return completed (ZP) signal is turned OFF. When the LX signal is turned ON again while **Pr.419** = "10", the ZP signal is also turned ON.

Parameters referred to

Pr.20 Acceleration/deceleration reference frequency ☞ page 367
Pr.29 Acceleration/deceleration pattern selection ☞ page 372

5.5.5 Position control by the FR-A8AL pulse train input

Vector PM

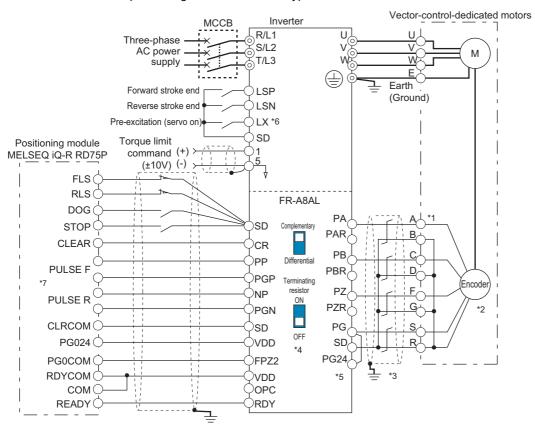
Position control by the command from the positioning module of the programmable controller is available using the FR-A8AL.

| Pr. | Name | Initial value | Setting range | Description | | |
|----------------|-------------------------|---|---------------|---|----------------|--|
| | | Position command source 0 1200, 210, 300, 310, 1110, 1310 the pos | | Simple position control by point table (Settings are available for the home position data at servo-OFF, clearing of the current position 2 monitor value, and the absolute position control.) | | |
| B000 selection | selection | | 1 | Position command given by the FR-A8AL pulse train input*1 | | |
| | | | 2 | Simple pulse train position command given by the pulse train input to the inverter | | |
| | | | 0 | Forward/Reverse pulse train | | |
| | | | 1 | Pulse train + rotation direction sign | Negative logic | |
| 428 | Command pulse selection | | 2 | A/B phase pulse train | | |
| B009 | Command puise selection | U | 3 | Forward/Reverse pulse train | | |
| | | | 4 | Pulse train + rotation direction sign | Positive logic | |
| | | | 5 | A/B phase pulse train | | |

^{*1} During position control under Vector control, if **Pr.419** = "1" while the FR-A8AL is not installed (or is disabled), a protective function (E.OPT) is activated.

Connection diagram

Connection with the positioning module of RD75P type MELSEC iQ-R series is also available.



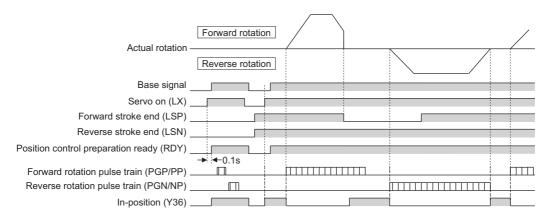
- *1 The pin number differs according to the encoder used. Speed control, torque control, and position control by pulse train input are available with or without the Z-phase being connected.
- *2 Connect the encoder so that there is no looseness between the motor and motor shaft. Speed ratio must be 1:1.
- *3 Earth (ground) the shield of the encoder cable to the enclosure using a tool such as a P-clip. (Refer to page 87.)
- *4 For the complementary, set the terminating resistor selection switch to the OFF position (initial status). (Refer to page 87.)
- *5 A separate external power supply of 15 V is necessary according to the encoder power specification. When the encoder output is the differential line driver type, only 5 V can be input. When the 24 V power supply of the FR-A8AL is used, the power is supplied to the encoder through terminal PG24. When the 5 V/12 V power supply of the FR-A8AL is used, the power is supplied to the encoder through terminal PGV. Do not use the external power supply simultaneously with the 5 V/12 V power supply or the 24 V power supply. Make the voltage of the external power supply the same as the encoder output voltage, and connect the external power supply between terminals PG and SD.
- *6 Assign the function using Pr.178 to Pr.184, Pr.187 to Pr.189 (Input terminal function selection).
- *7 The pulse signal from the position module is available for both open collector and differential line driver. However, the connections are different. (The following figure shows an example for differential line driver.) For the connection method, refer to the Instruction Manual of the FR-A8AL.

Operation outline

- If the pre-excitation/servo ON (LX) signal is turned ON, output shutoff is canceled and the position control preparation ready (RDY) signal is turned ON after 0.1 second. When the LSP signal (forward stroke end) or the LSN signal (reverse stroke end) is turned ON, the motor rotates according to the command pulse. When the forward (reverse) stroke end signal is turned OFF, the motor does not rotate in the corresponding direction.
- To use the LSP or LSN signal, set the corresponding number in the following table in any of Pr.178 to Pr.189 (Input terminal function selection) to assign the function to an input terminal. When the LSP and LSN signals are not assigned, the STF signal is used as the forward stroke end signal, and the STR signal is used as the reverse stroke end signal.

| Pr.178 to Pr.189 setting | Signal |
|--------------------------|--------|
| 88 | LSP |
| 89 | LSN |

• The LSP and LSN signals can be input via an external terminal only regardless of the setting in **Pr.338 Communication** operation command source or **Pr.339 Communication speed command source**.



♦ Interface between the position module and the inverter.

• To operate an inverter using a positioning module, the interfaces for the position command pulse train must agree with each other.

| Output form | Hardware | Input pulse frequency |
|--------------------------|---|-----------------------|
| Open collector | Command unit Connect externally +24 SD SD *: Wiring length : max. 2 m | Max 200k pulses/s |
| Differential line driver | Command unit Do not connect VDD +24 OPC OPC PGN) *: Wiring length : max. 10 m | Max 500k pulses/s |

◆ Selecting the pulse train type (Pr.428)

• To select the pulse train input to the FR-A8AL, set "1" in **Pr.419** after installing the FR-A8AL on the inverter.

• The command pulse is switchable according to the position module as shown in the following table.

| Comman | id pulse train type | During forward rotation | During reverse rotation | Setting of Pr.428 | Remarks |
|----------|--|-------------------------|-------------------------|----------------------|--|
| | Forward pulse train Reverse pulse train | Nb | | 0 (initial value) | RD75 (CW/CCW mode) Note: When (CW/CCW mode) and (PULSE/SIGN mode) are connected incorrectly, the motor moves only one direction. |
| Negative | Pulse train + sign | NPL | H | 1 | RD75 (PULSE/SIGN mode) |
| logic | A phase pulse train B phase pulse train | PP | | 2 | The number of pulses are multiplied by 4 to count. When differential line driver is used, the number of pulses after the number encoder pulses is quadruplicated should be 500k pulses/s or lower. When open collector is used, the number should be 200k pulses/s or lower. |
| | Forward pulse train Reverse pulse train | PP_flflfl | | 3 | |
| Positive | Pulse train + sign | PP_FLFLFL NP H L | FLFLFL_ L | 4 | |
| logic | A phase pulse train B phase pulse train | PPNP | | 5 | The number of pulses are multiplied by 4 to count. When differential line driver is used, the number of pulses after the number encoder pulses is quadruplicated should be 500k pulses/s or lower. When open collector is used, the number should be 200k pulses/s or lower. |

5.5.6 Position control by pulse train input to the inverter

Vector PM

The simple position pulse train command can be input by pulse train input and simple position pulse train signal (NP) to the JOG terminal.

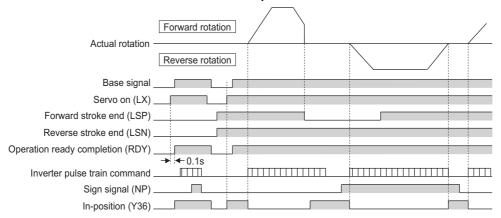
| Pr. | Name | Initial value | Setting range | Descr | ription | |
|------|---|---------------|--|---|----------------|--|
| 419 | 419 Position command source B000 selection | | 0, 10, 100, 110, 200, 210, 300, 310, 1110, 1310 | Simple position control by point table (Settings are available for the home position data at servo-OFF, clearing of the current position 2 monitor value, and the absolute position control.) | | |
| B000 | | | 1 | Position command given by the FR-A8AL pulse train input | | |
| | | | 2 | Simple pulse train position command given by the pulse train input to the inverter | | |
| 428 | Command nules selection | 0 to 2 | | Pulse train + rotation direction | Negative logic | |
| B009 | Command pulse selection | | 3 to 5 | sign | Positive logic | |

♦ Operation outline

- If the Pre-excitation/servo ON (LX) signal is turned ON, output shutoff is canceled and the Position control preparation ready (RDY) signal is turned ON after 0.1 second. When the LSP signal (forward stroke end) or the LSN signal (reverse stroke end) is turned ON, the motor rotates according to the command pulse. When the forward (reverse) stroke end signal is turned OFF, the motor does not rotate in the corresponding direction.
- To use the LSP or LSN signal, set the corresponding number in the following table in any of **Pr.178 to Pr.189 (Input terminal function selection)** to assign the function to an input terminal. When the LSP and LSN signals are not assigned, the STF signal is used as the forward stroke end signal, and the STR signal is used as the reverse stroke end signal.

| Pr.178 to Pr.189 setting | Signal |
|--------------------------|--------|
| 88 | LSP |
| 89 | LSN |

• The LSP and LSN signals can be input via an external terminal only regardless of the setting in **Pr.338 Communication** operation command source or **Pr.339 Communication speed command source**.



◆ Selecting the pulse train type (Pr.428 and NP signal)

- Set Pr.419 Position command source selection = "2" (simple pulse train position command).
- Set "68" in any of **Pr.178 to Pr.189 (Input terminal function selection)** to assign the Simple position pulse train sign (NP) to the input terminal.
- Select the command pulse train with Pr.428 Command pulse selection.

| Pr.428 setting | Com | mand pulse train type | During forward rotation | During reverse rotation |
|----------------|-------------------|---------------------------------------|-------------------------|-------------------------|
| 0 to 2 | Negative logic | Pulse train + rotation direction sign | JOG V V V | H |
| 3 to 5 | Positive logic | Pulse train + rotation direction sign | JOG_FLFLFLFL NP H | |

· Select Vector control or PM sensorless vector control to select the position control method.



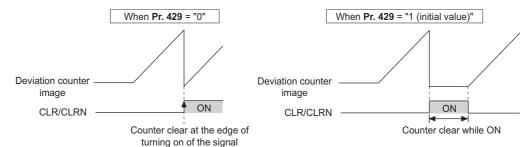
• If **Pr.419** = "2" (simple pulse train position command) is set, terminal JOG is used for the simple position pulse train input regardless of the **Pr.291 Pulse train I/O selection** pulse train input/output selection setting.

5.5.7 Clear signal selection

| Pr. | Name | Initial value | Setting range | Description |
|-------------|------------------------|---------------|---------------|---|
| 429 B010 | Clear signal selection | | 0 | The values of the position pulse (command pulse, droop pulse, current position, and current position 2) are cleared at the rising edge when the clear (CLR/CLRN) signal is switched from OFF to ON. |
| | | | 1 | The values of the position pulse are cleared while the clear (CLR/CLRN) signal is turned ON. |

- · This function is useful to reset the number of droop pulses to 0 when home position return is performed.
- The Simple position droop pulse clear (CLR) signal is valid when the inverter is in the External operation mode. The NET position pulse clear (CLRN) signal is valid when the inverter is in the Network operation mode (not applicable when the FR-A8NS is installed).
- If the simple position droop pulse clear (CLR) signal is turned ON when **Pr.429 Clear signal selection** = "0", the deviation counter is cleared at the edge of the signal. The CLR/CLRN signal is also turned ON in synchronization with the zero pulse signal of the encoder such as the home position return signal, and the deviation counter is cleared.
- For a terminal used for the CLR signal, set "69" in any of **Pr.178 to Pr.189 (Input terminal function selection)** to assign the function.

• For a terminal used for the CLR signal, set "59" in any of **Pr.178 to Pr.189 (Input terminal function selection)** to assign the function.





- The accumulated number of pulses is cleared at base shutoff or when the CLR/CLRN signal is turned ON.
- Refer to page 321 for the condition to clear the values of the position pulse.
- Changing the terminal assignment using **Pr.178 to Pr.189 (Input terminal function selection)** may affect the other functions. Set parameters after confirming the function of each terminal.

Parameters referred to

Pr.178 to Pr.189 (Input terminal function selection) page 521

5.5.8 Pulse monitor

Vector PM

Various pulses can be monitored.

| Pr. | Name | Initial value | Setting range | Description |
|---------------------------|---|---------------|--|--|
| 430 B011 | Pulse monitor selection 9999 | | 0 to 5, 12, 13, 100 to 105, 112, 113, 1000 to 1005, 1012, 1013, 1100 to 1105, 1112, 1113, 2000 to 2005, 2012, 2013, 2100 to 2105, 2112, 2113, 3000 to 3005, 3012, 3013, 3100 to 3105, 3112, 3113 | Shows the various pulse conditions during operation as the number of pulses. |
| | | | 8888, 9999 | Shows the frequency monitor. |
| 635 ^{*1} M610 | Cumulative pulse clear signal selection | 0 | 0 to 3 | Select the clearing method for the cumulative pulse monitor. |
| 636 ^{*1} M611 | Cumulative pulse division scaling factor | 1 | 1 to 16384 | Set the division scaling factor on the cumulative pulse for the Vector control compatible plug-in option. |
| 637 ^{*1} M612 | Control terminal option- Cumulative pulse division scaling factor | 1 | 1 to 16384 | Set the division scaling factor on the cumulative pulse for the control terminal option (FR-A8TP). |
| 638 ^{*1} M613 | Cumulative pulse storage | 0 | 0 to 3 | Select the processing method for the cumulative pulse monitor value when the power is turned OFF or the inverter is reset. |

^{*1} The setting is available when a Vector control compatible option is installed.

◆ Pulse monitor selection (Pr.430)

• Shows the various pulse conditions during operation as the number of pulses. Set "0" in **Pr.52 Operation panel main monitor selection** to display the output frequency monitor.

• Also, setting "26 to 31" in Pr.52, Pr.774 to Pr.776, Pr.992 (multifunction monitor) changes the electronic gear operation setting in the case of monitoring pulses. (Refer to page 446.)

| Pr.430 setting | Description | | | | | | |
|----------------|-----------------------------|--|--|--|--|--|--|
| [][][]0 | | Displays the lower of the position command (accumulated value of command pulses). | | | | | |
| 0001 | | Displays the upper of the position command (accumulated value of command pulses). | | | | | |
| 0002 | | Displays the lower of the current position (accumulated value of feedback pulses*1). | | | | | |
| [][][]3 | Pulse monitor | Displays the upper of the current position (accumulated value of feedback pulses*1). | | | | | |
| [][][]4 | selection | Displays the lower of the accumulated value of droop pulses. | | | | | |
| [][][5 | | Displays the upper of the accumulated value of droop pulses. | | | | | |
| [][]12 | | Displays the lower of the current position 2 (accumulated value of feedback pulses*1). | | | | | |
| [][]13 | | Displays the upper of the current position 2 (accumulated value of feedback pulses*1). | | | | | |
| []0[][] | For pulse meniter | Displays the monitor item selected in the pulse monitor selection after the electronic gear operation. | | | | | |
| 0100 | For pulse monitor selection | Displays the monitor item selected in the pulse monitor selection before the electronic gear operation. | | | | | |
| OUUU | | Displays the monitor item selected in the multifunction monitor (position command, current position, and droop pulse) before the electronic gear operation. | | | | | |
| 0[[[[| For the multifunction | Displays the item in the PLC function special register (position command, current position, droop | | | | | |
| | | pulse, and current position 2) before the electronic gear operation. | | | | | |
| 1000 | | Displays the monitor item selected in the multifunction monitor (position command, current position, and droop pulse) after the electronic gear operation. | | | | | |
| 1[][[] | | Displays the item in the PLC function special register (position command, current position, droop | | | | | |
| | monitor / PLC | pulse, and current position 2) after the electronic gear operation. | | | | | |
| 2000 | function special register | Displays the monitor item selected in the multifunction monitor (position command, current position, and droop pulse) before the electronic gear operation. | | | | | |
| 2000 | | Displays the item in the PLC function special register (position command, current position, droop pulse, and current position 2) before the electronic gear operation. | | | | | |
| onna | | Displays the monitor item selected in the multifunction monitor (position command, current position, and droop pulse) after the electronic gear operation. | | | | | |
| 3[[[[] | | Displays the item in the PLC function special register (position command, current position, droop pulse, and current position 2) after the electronic gear operation. | | | | | |
| 0000 | | Displays the monitor item selected in the multifunction monitor (position command, current position, and droop pulse) after the electronic gear operation. | | | | | |
| 8888 | Output frequency | Displays the item in the PLC function special register (position command, current position, droop pulse, and current position 2) after the electronic gear operation. | | | | | |
| 0000 | display | Displays the monitor item selected in the multifunction monitor (position command, current position, and droop pulse) before the electronic gear operation. | | | | | |
| 9999 | | Displays the item in the PLC function special register (position command, current position, droop pulse, and current position 2) before the electronic gear operation. | | | | | |

^{*1} Accumulated value of estimated feedback pulses when PM sensorless vector control is used

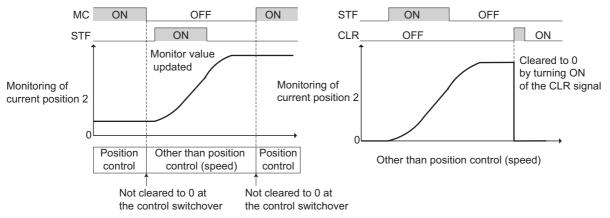
• Position pulses are cleared according to the following conditions.

| | Position command / current position / droop pulse | | | | | | | | |
|--|---|-------------------|------|------------|--|--|--|--|--|
| Clearing condition | Pr.419 setting | | | | | | | | |
| | 0, 100, 200, 300 | 10, 110, 210, 310 | 1, 2 | 1110, 1310 | | | | | |
| Servo-OFF (LX-OFF) (output shutoff) | 0 | × | o | × | | | | | |
| Clear signal input*2 | 0 | o*3 | 0 | x*5 | | | | | |
| Home position return completed | o*1 | o*1*4 | *6 | o*1*4 | | | | | |
| When position control is switched to other control mode | 0 | 0 | 0 | 0 | | | | | |
| Clear signal input (under the control mode other than position control) | × | × | × | × | | | | | |

| | Current position 2 | | | | | | | | | | |
|--|--------------------|----------------|-----|-----|------|------|-----|-----|-----|-----|------|
| Clearing condition | | Pr.419 setting | | | | | | | | | |
| | 0 | 10 | 100 | 110 | 1, 2 | 1110 | 200 | 210 | 300 | 310 | 1310 |
| Servo-OFF (LX-OFF) (output shutoff) | × | × | × | × | × | × | × | × | × | × | × |
| Clear signal input*2 | 0 | o*3 | 0 | o*3 | 0 | ×*5 | 0 | 0 | 0 | 0 | x*5 |
| Home position return completed | × | × | 0 | 0 | *6 | 0 | × | × | 0 | 0 | 0 |
| When position control is switched to other control mode | 0 | 0 | 0 | 0 | 0 | 0 | ×*7 | x*7 | x*7 | x*7 | ×*7 |
| Clear signal input (under the control mode other than position control) | × | × | × | × | × | × | o*7 | o*7 | °*7 | °*7 | o*7 |

o: cleared, x: not cleared

- *1 The droop pulses are not cleared.
- *2 The CLR/CLRN signal is input when a value other than "1" is set in **Pr.419**, and the signal is input through terminal CR of the FR-A8AL when **Pr.419** = "1".
- *3 Pulses are cleared when a clear signal is input. (The home position information is not retained.)
- *4 Pulses are cleared only when the home position return is completed. Once the pulses are cleared, they are not cleared even if the LX signal is turned ON
- *5 The data is cleared when absolute position control is disabled.
- *6 The home position return is not available.
- *7 The following shows the example of the clearing the value of the current position 2 monitor under the control mode other than the position control mode.



■ NOTE

- The monitor value of the current position 2 is not cleared when switching between the first and second motors.
- · For details on the special register for the PLC function, refer to the PLC Function Programming Manual.

◆ Pulse monitoring on the operation panel (FR-DU08)

- The position command, current position and the status of droop pulses can be displayed on the operation panel.
- If displayed data has signs, minus signs appear for both upper and lower digits.
- If -99999999 or 99999999 is exceeded on the pulse monitor, the monitor value is reset to 0.

| Display data | | Monitor display without signs | Monitor display with signs |
|--------------|---------------|-------------------------------|----------------------------|
| -10000 | Lower monitor | 0000 | -0000 |
| -10000 | Upper monitor | 1 | - 1 |
| -100 | Lower monitor | 100 | - 100 |
| -100 | Upper monitor | | - 🛚 |



· The pulse count starts at servo on.

♦ Cumulative pulse monitoring

- When the Vector control compatible plug-in option or the control terminal option (FR-A8TP) is used, the accumulated value
 of the encoder pulses can be monitored.
- The cumulative pulse monitor is available when "71 to 74" is set in the monitor selection parameters (**Pr.52**, **Pr.774**, **Pr.775**, **Pr.776**, **and Pr.992**).

| Monitor item | Pr.52, Pr.774 to Pr.776, Pr.992 | Display with minus sign | Description |
|---|------------------------------------|-------------------------|--|
| Cumulative pulse | 71 | o*1 | The cumulative number of pulses is displayed (for Vector control compatible plug-in option). (Monitoring range: -32767 to 32767) |
| Cumulative pulse overflow times | 72 | o*1 | The number of the cumulative pulses carrying overflow times is displayed (for Vector control compatible plug-in option). |
| Cumulative pulse (control terminal option) | 73 | o*1 | The cumulative number of pulses is displayed (for the FR-A8TP). (Monitoring range: -32767 to 32767) |
| Cumulative pulse overflow times (control terminal option) | 74 | o*1 | The number of the cumulative pulse overflow times is displayed (for FR-A8TP). |

^{*1} Negative values are not displayed on the operation panel. The values "-1 to -32767" are displayed as "65535 to 32769" on the operation panel.

♦ Cumulative pulse division scaling factor (Pr.636, Pr.637)

- Set the division scaling factor on the cumulative pulse in Pr.636 or Pr.637.
- · Cumulative pulse count value calculation method

Cumulative pulse count value = Cumulative pulse division scaling factor × (Cumulative pulse overflow times × 32768 + Cumulative pulse monitor value)

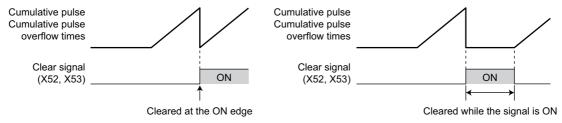
Cumulative pulse count value: Number of pulses multiplied by 4

Cumulative pulse division scaling factor: Pr.636, Pr.637

◆ Cumulative pulse monitor value clear (Pr.635)

- The cumulative pulse monitor and the cumulative pulse overflow times can be cleared by X52 signal or X53 signal.
- To input the X52 or X53 signal, set "52 (X52)" or "53 (X53)" in any of **Pr.178 to Pr.189 (Input terminal function selection)** to assign the function to a terminal.
- Use **Pr.635 Cumulative pulse division scaling factor** to select the clearance method for the cumulative pulse monitor and the cumulative pulse overflow times.

| Pr.635 setting | X52 signal Cumulative pulse monitor value clear | X53 signal Cumulative pulse monitor clear (control terminal option) |
|----------------|--|---|
| 0 | Cleared at the edge when the signal is switched to ON. | Cleared at the edge when the signal is switched to ON. |
| 1 | Cleared while the signal is ON. | Cleared at the edge when the signal is switched to ON. |
| 2 | Cleared at the edge when the signal is switched to ON. | Cleared while the signal is ON. |
| 3 | Cleared while the signal is ON. | Cleared while the signal is ON. |



◆ Cumulative pulse storage

The cumulative pulse monitor value and cumulative pulse overflow times can be retained when the power is turned OFF
or the inverter is reset.

| Pr.638 setting | Cumulative pulse monitor / Cumulative pulse overflow times | | Cumulative pulse monitor / Cumulative pulse overflow times (Control terminal option) | | |
|-------------------|--|----------|--|----------|--|
| Setting | At power-OFF | At reset | At power-OFF | At reset | |
| 0 | Not stored in the EEPROM | Cleared | Not stored in the EEPROM | Cleared | |
| 1 | Stored in the EEPROM | Retained | Not stored in the EEPROM | Cleared | |
| 2 | Not stored in the EEPROM | Cleared | Stored in the EEPROM | Retained | |
| 3 | Stored in the EEPROM | Retained | Stored in the EEPROM | Retained | |



- When the power is turned OFF during the reset process, the cumulative pulse monitor value and the cumulative pulse overflow times are not stored in the EEPROM.
- · For storing the cumulative pulse monitor value and the cumulative pulse overflow times in the EEPROM at power OFF, connect R1/L11 with P/+, and S1/L21 with N/- so that the control power is retained. When connecting the FR-HC2 high power factor converter or the converter unit (FR-CC2), assign the FR-HC2/FR-CC2 instantaneous power failure detection (X11) signal to an input terminal to input the IPF signal from the FR-HC2/FR-CC2 to the terminal for X11 signal.

Parameters referred to

Pr.52 Operation panel main monitor selection page 446

Electronic gear settings

Vector PM

Set the gear ratio between the machine gear and motor gear.

| Pr. | Name | Initial value | Setting range | Description |
|-------------|--|---------------|---------------|--|
| 420 B001 | Command pulse scaling factor numerator (electronic gear numerator) | 1 | 1 to 32767 | Set the electronic gear. |
| 421 B002 | Command pulse multiplication denominator (electronic gear denominator) | 1 | 1 to 32767 | Pr.420 is the numerator and Pr.421 is the denominator. |
| 424 B005 | Position command acceleration/ deceleration time constant | 0 s | 0 to 50 s | Use it when the rotation is not smooth because the electronic gear ratio is large (10 times or larger) and the rotation speed is slow. |

Gear ratio calculation (Pr.420, Pr.421)

The position resolution (travel distance per pulse $\Delta \ell$ [mm]) is the travel distance per motor rotation Δs [mm] and the feedback pulse Pf [pulses/rev] of the detector.

$$\Delta \ell = \frac{\Delta s}{Pf}$$

 $\Delta \ell$: Travel distance per pulse [mm]

 $\Delta \ell = \frac{\Delta s}{Pf}$ As: Travel distance in one motor rotation [mm] of Number of feedback pulses [pulse/rev] (the pf: Number of feedback pulses [pulse/rev] (the number of pulses after the number encoder pulses is quadruplicated)

The travel distance in 1 command pulse can be separately specified with a parameter and so an integer can be set as the travel distance in 1 command pulse.

$$\Delta \ell = \frac{\Delta s}{Pf} \times \frac{Pr.420}{Pr.421}$$

The following formula shows the relationship between the motor speed and internal command pulse frequency.

fo
$$\times$$
 $\frac{\text{Pr.420}}{\text{Pr.421}}$ = Pf \times $\frac{\text{No}}{\text{60}}$ fo: internal command pulse frequency [pulses/s] No: motor rotation speed [r/min]



• Set the electronic gear ratio in the range of 1/50 to 20. Note that, if the setting value is too small, the speed command will also be too small; while if it is too large, the speed ripple will be too large.

Setting example 1 Setting example 2 In a driving system whose ball screw pitch is PB = 10 (mm) and the reduction ratio is 1/n = 1, the electronic gear ratio is $\Delta s = 10$ (mm)

when $\Delta \ell$ = 0.01 (mm) and Pf = 4000 (pulses/rev) is set as the number of feedback pulses. Based on this, use the following formula:

$$\Delta \ell = \frac{\Delta s}{Pf} \times \frac{Pr.420}{Pr.421}$$

$$\frac{Pr.420}{Pr.421} = \Delta \ell \times \frac{Pf}{\Delta s}$$

$$= 0.01 \times \frac{4000}{10} = \frac{4}{1}$$

Thus, set the parameters as follows: Pr.420 = "4", Pr.421 = "1".

Find the internal command pulse frequency for the rated motor speed

Where the command pulse ratio (Pr.420/ Pr.421) = 1,

the number of encoder pulses = 2048 (pulses/rev), and the feedback pulse pf = 2048×4 .

fo =
$$2048 \times 4 \times \frac{\text{No}}{60} \times \frac{\text{Pr.421}}{\text{Pr.420}}$$

= 204800

The internal command pulse is 204800 (pulses/s) in accordance with the above formula.

■ Relationship between the position resolution and system accuracy

The system accuracy (the positioning accuracy of the machine) is the sum of electric deviation and mechanical deviation. Normally try to prevent the total deviation from being affected by the electronic deviation. Refer to the following relationship as a reference.

$$\Delta \ell < (\frac{1}{5} \text{ to } \frac{1}{10}) \times \Delta \varepsilon$$
 $\Delta \varepsilon$: positioning accuracy

■ Motor stop characteristics

When running the motor by the parameter settings, the relationship between the internal command pulse frequency and the number of motor rotations is as shown in the figure on page 299. Pulses as much as the motor speed delay are accumulated in the deviation counter. These pulses are called droop pulses (ε). The relationship between the command frequency (fo) and position loop gain (Kp: Pr.422) is shown in the following formula.

The number of droop pulses (ϵ) is 8192 with the initial value Kp = 25 s⁻¹.

Since the inverter has droop pulses during operation, a stop settling time (ts), which is the time between the zero command output and the motor stop, is required. Set the operation pattern taking into the account the stop setting time.

$$ts = 3 \times \frac{1}{Kp}$$
 [s]

The stop settling time (ts) is 0.12 second for the initial value $Kp = 25 \text{ s}^{-1}$.

The accuracy of positioning $\Delta \varepsilon$ is (5 to 10) × $\Delta \ell = \Delta \varepsilon$ [mm]

◆ Position command acceleration/deceleration time constant (Pr.424)

- If the electronic gear ratio is large (1:10 or larger) and the rotation speed is slow, the rotation is not smooth and the rotation shape becomes like a pulse.
 - Set this option in such a case to smoothen the rotation.
- · If the command pulse frequency varies rapidly when no acceleration time can be assigned to the command pulse, overshoot or excessive error alarms may occur. Set this option in such a case to set the acceleration/deceleration time. Normally it is set to 0.

Parameters referred to

Pr.422 Position control gain page 328

5.5.10 Position adjustment parameter settings

Vector PM

| Pr. | Name | Initial value | Setting range | Description | |
|--------------|-------------------------------------|---------------|-------------------|---|--|
| 426 B007 | In-position width | 100 pulses | 0 to 32767 pulses | Set the number of droop pulses that triggers the In-position (Y36) signal. | |
| 427 B008 | Excessive level error | 40K | 0 to 400K | Set the number of droop pulses that activates Excessive position fault (E.OD). | |
| Бооо | | | 9999 | Function disabled | |
| 1294 B192 | Position detection lower 4 digits | 0 | 0 to 9999 | Set the lower four digits of the position detection value. | |
| 1295 B193 | Position detection upper 4 digits | 0 | 0 to 9999 | Set the upper four digits of the position detection value. | |
| 4000 | 5 | | 0 | The position is detected on both the plus and minus sides. | |
| 1296 B194 | Position detection selection | 0 | 1 | The position is detected on the plus side only. | |
| D 134 | Selection | | 2 | The position is detected on the minus side only. | |
| 1297 B195 | Position detection hysteresis width | 0 | 0 to 32767 | Set the hysteresis width for the detected position where the Position detection level (FP) signal turns ON. | |

◆ In-position width (Pr.426, Y36 signal)

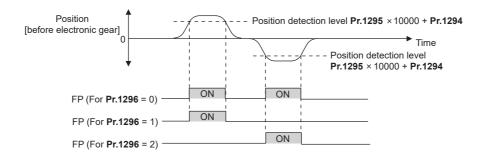
- The Y36 signal is used as the in-position signal.
- If the number of droop pulses is equal to or smaller than the Pr.426 setting value, the In-position (Y36) signal turns ON.
- To use the Y36 signal, set "36 (positive logic) or 136 (negative logic)" in any of **Pr.190 to Pr.196 (Output terminal function selection)** to assign the function.

◆ Excessive level error (Pr.427)

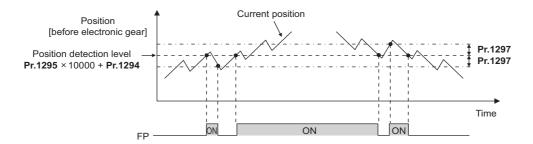
- If the number of droop pulses exceeds the Pr.427 setting, a position error is detected, Excessive position fault (E.OD) is
 activated and the inverter output is shut off. Increase the error threshold level when a small value is set as the Pr.422
 Position control gain setting value. Set a small value for early detection even when the load is heavy.
- If Pr.427 = "9999", E.OD is not activated regardless of the amount of droop pulses.

◆ Position detection signal (Pr.1294 to Pr.1297, FP signal)

- The Position detection level (FP) signal is turned ON when the current position [before the electronic gear] exceeds the
 Pr.1295 × 10000 + Pr.1294 position detected. To use the FP signal, set "60 (positive logic) or 160 (negative logic)" in any of Pr.190 to Pr.196 (Output terminal function selection) to assign the function.
- Whether the position detection is determined on the plus side or minus side can be selected by **Pr.1296 Position** detection selection. When "0" is set, the position is detected on both the plus and minus sides. When "1" is set, the position is detected on the minus side only.



When a current position varies, the Position detection level (FP) signal may repeat ON/OFF (chatter). Setting hysteresis
to the detected position prevents chattering of the signal. Use Pr.1297 Position detection hysteresis width to set a
hysteresis width.



5.5.11 Position control gain adjustment

Vector PM

Easy gain tuning is provided as an easy tuning method. For details about easy gain tuning, refer to page 254.

If easy gain tuning does not produce any effect, make fine adjustments by using the following parameters.

Set "0" to Pr.819 Easy gain tuning selection before setting the following parameters.

| Pr. | Name | Initial value | Setting range | Description |
|--------------|--------------------------------------|--------------------|--------------------------|---|
| 422 B003 | Position control gain | 25 s ⁻¹ | 0 to 150 s ⁻¹ | Set the gain for the position loop. |
| 1298 B013 | Second position control gain | 25 s ⁻¹ | 0 to 150 s ⁻¹ | Set the position loop gain for the second motor. |
| 423 B004 | Position feed forward gain | 0% | 0 to 100% | Function to cancel a delay caused by the droop pulses in the deviation counter. |
| 425 B006 | Position feed forward command filter | 0 s | 0 to 5 s | Input the primary delay filter for the feed forward command. |
| 446 B012 | Model position control gain | 25 s ⁻¹ | 0 to 150 s ⁻¹ | Set the gain for the model position controller. |
| 828 G224 | Model speed control gain | 60% | 0 to 1000% | Set the gain for the model speed controller. |
| 877 | Speed feed forward control/ | | 0, 1 | Perform position feed forward control. |
| G220 | model adaptive speed | 0 | 2 | Model adaptive position control becomes valid. |
| 880 C114 | Load inertia ratio | 7-fold | 0 to 200-fold | Set the load inertia ratio for the motor. |

◆ Position loop gain (Pr.422, Pr.1298)

- Make adjustment when any of such a phenomena as unusual vibration, noise and overcurrent of the motor/machine occurs.
- Increasing the setting improves traceability for the position command and also improves servo rigidity at a stop, but oppositely makes an overshoot and vibration more liable to occur.
- · Normally set this parameter within the range about 5 to 50.

| Movement/ condition | How to adjust Pr.422 | | | |
|---|---|--|--|--|
| Response is slow. | Increase the setting value. Increase the setting value by 3 s ⁻¹ until immediately before an overshoot, stop-time vibration or other instable phenomenon does not occur, and set about 80 to 90% of that value. | | | |
| Overshoot, stop-time vibration or other instable phenomenon occurs. | Lower the setting value. Lower the setting value by 3 s ⁻¹ until immediately before an overshoot, stoptime vibration or other instable phenomenon does not occur, and set about 80 to 90% of that value. | | | |

◆ Position feed forward gain (Pr.423)

- This function is designed to cancel a delay caused by the droop pulses in the deviation counter. Set this parameter when a sufficient position response cannot be obtained after setting **Pr.422**.
- When a tracking delay for command pulses poses a problem, increase the setting gradually and use this parameter within the range where an overshoot or vibration will not occur.
- · This function has no effects on servo rigidity at a stop.
- Normally set this parameter to 0.
- When setting Pr.423, set Pr.877 = "0 or 1" to enable position feed forward control.

♦ Model adaptive position control (Pr.446)

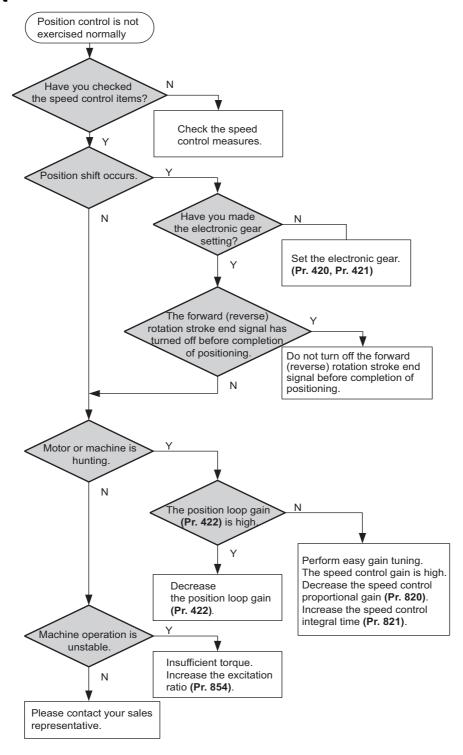
- · Set each response for position commands and for load and external disturbances individually.
- · Set this parameter when a sufficient position response cannot be obtained after setting Pr.422.
- When setting Pr.446, set Pr.877 = "2" to enable the model adaptive position control, Pr.828 Model speed control gain ≠ "0", and a load inertia ratio in Pr.880 Load inertia ratio.
- Set a small value in **Pr.446** first, and then increase the setting gradually and use this parameter within the range where an overshoot or vibration will not occur.

5.5.12 Troubleshooting in position control

Vector PM

| Condition | Possible cause | Countermeasure | |
|---|---|--|--|
| | There is incorrect phase sequence between the motor wiring and encoder wiring. | Check the wiring. (Refer to page 87.) | |
| | The setting of Pr.800 Control method selection is not appropriate. | Check the Pr.800 setting. (Refer to page 221.) | |
| | No LX signal or STF/STR signal is input. | Check if the signals are properly input. | |
| The motor does not rotate. | A command pulse or NP signal is not correctly input. | Check if the command pulse is properly input (check the accumulated value for command pulses in Pr.430 Pulse monitor selection). Check the command pulse type in Pr.428 Command pulse selection . Check that the position pulse sign (NP) is assigned to an input terminal (inverter pulse input). | |
| | The setting in Pr.419 Position command source selection is incorrect. | Check the Pr.419 Position command source selection. | |
| | When simple position control by a point table (Pr.419 = "0") is used, the position feed length set by Pr.465 to Pr.494 is not correct. | Check the position feed length in Pr.465 to Pr.494 . | |
| | The option to be used and parameter settings do not match. | Correctly set Pr.862 Encoder option selection according to the option to be used. (Refer to page 226.) | |
| The position is unfavorably shifted. | A command pulse is not correctly input. | Check the command pulse type in Pr.428 Command pulse selection. Check if the command pulse is properly input (check the accumulated value of command pulses in Pr.430). Check that the position pulse sign (NP) is assigned to an input terminal (inverter pulse input). | |
| | The command is affected by noise. Noise is superpositioned on the encoder feedback signals. | Set Pr.72 PWM frequency selection lower. Change the earthing (grounding) position of the shielded cable. Alternatively, do not connect it. | |
| | Position loop gain is too high. | Set Pr.422 Position control gain lower. | |
| Hunting occurs in the motor or the machine. | Speed loop gain is too high. | Perform easy gain tuning. Set Pr.821 Speed control integral time 1 lower and Pr.821 Speed control integral time 1 higher. | |
| Machine movement is unstable. | Acceleration/deceleration time settings are affecting adversely. | Set Pr.7 Acceleration time, Pr.8 Deceleration time lower. | |

◆ Flowchart





• The speed command of position control is related to speed control. (Refer to page 235.)

Parameters referred to

Pr.7 Acceleration time page 367
Pr.8 Deceleration time page 367
Pr.72 PWM frequency selection page 356
Pr.800 Control method selection page 221
Pr.802 Pre-excitation selection page 254
Pr.819 Easy gain tuning selection page 254
Pr.820 Speed control P gain 1 page 254
Pr.821 Speed control integral time 1 page 254

5.6 Adjustment during Real sensorless vector control, Vector control, PM sensorless vector control

| Purpose | Р | Refer to page | | |
|---|---|-----------------------------------|-----------------------------------|-----|
| To stabilize speed and torque feedback signal | Speed detection filter, torque detection filter | P.G215, P.G216, P.G315, P.G316 | Pr.823, Pr.827, Pr.833, Pr.837 | 332 |
| To change excitation ratio | Excitation ratio | P.G217 | Pr.854 | 332 |

5.6.1 Speed detection filter and torque detection filter

Sensorless Vector PM

Set time constant of primary delay filter for speed feedback signal and torque feedback signal.

Speed loop response is reduced. Under ordinary circumstances, therefore, use the initial value as it is.

| Pr. | Name | Initial value | Setting range | Description |
|--------------------|---------------------------|---------------|----------------|--|
| 823 | | | 0 | Without filter |
| G215 ^{*1} | Speed detection filter 1 | 0.001 s | 0.001 to 0.1 s | Set the time constant of primary delay filter for speed feedback signal. |
| 827 | | | 0 | Without filter |
| G216 | Torque detection filter 1 | 0 s | 0.001 to 0.1 s | Set the time constant of primary delay filter torque feedback signal. |
| 833 | Speed detection filter 2 | 9999 | 0 to 0.1 s | Second function of Pr.823 (enabled when the RT signal is ON) |
| G315 ^{*1} | | | 9999 | Same as Pr.823 setting |
| 837 G316 | Torque detection filter 2 | 9999 | 0 to 0.1 s | Second function of Pr.827 (enabled when the RT signal is ON) |
| 9310 | | | 9999 | Same as Pr.827 setting |

^{*1} The setting is available when a Vector control compatible option is installed.

◆ Stabilizing speed detection (Pr.823, Pr.833)

- Speed loop response is reduced. Under ordinary circumstances, therefore, use the initial value as it is.
 If there is speed ripple due to high frequency disturbance, adjust until speed stabilizes by gradually raising the setting.
 Speed is oppositely destabilized if the setting value is too large.
- This setting is valid under Vector control only.

◆ Stabilizing torque detection (Pr.827, Pr.837)

• Current loop response is reduced. Under ordinary circumstances, therefore, use the initial value as it is.

If there is torque ripple due to high frequency disturbance, adjust until speed stabilizes by gradually raising the setting.

Speed is oppositely destabilized if the setting value is too large.

♦ Employing multiple primary delay filters

• Use **Pr.833 and Pr.837** if changing filter according to application. **Pr.833**, **Pr.837** is enabled when the Second function selection (RT) signal is turned ON.



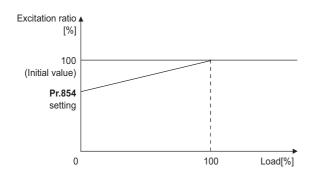
- The RT signal is a second function selection signal which also enables other second functions. (Refer to page 525.)
- The RT signal is assigned to the terminal RT in the initial status. Set "3" in one of Pr.178 to Pr.189 (Input terminal function selection) to assign the RT signal to another terminal.

5.6.2 Excitation ratio

Sensorless Vector

The excitation ratio can be lowered to enhance efficiency for light loads. (Motor magnetic noise can be reduced.)

| Pr. | Name | Initial value | Setting range | Description |
|-------------|------------------|---------------|---------------|--|
| 854 G217 | Excitation ratio | 100% | 0 to 100% | Set an excitation ratio when there is no load. |





- When excitation ratio is reduced, output torque startup is less responsive.
- The setting of **Pr.854** is invalid if **Pr.858 Terminal 4 function assignment** or **Pr.868 Terminal 1 function assignment** is set to "1" (flux command according to terminal).

5.6.3 Gain adjustment of current controllers for the d axis and the q axis

PM

The gain of the current controller can be adjusted.

| Pr. | Name | Initial value | Setting range | Description |
|-------------|---|------------------|---------------|---|
| 824 G213 | Torque control P gain 1 (current loop proportional gain) | 100% | 0% to 500% | The proportional gain of the current controller is set. |
| 825 G214 | Torque control integral time 1 (current loop integral time) | 5 ms | 0 to 500 ms | The integral time of the current controller is set. |

- Use **Pr.824 Torque control P gain 1 (current loop proportional gain)** to adjust the proportional gain of current controllers for the d axis and the q axis. The 100% gain is equivalent to 1000 rad/s. Setting this parameter higher improves the trackability for current command changes. It also reduces the current fluctuation caused by external disturbances.
- Use **Pr.825 Torque control integral time 1 (current loop integral time)** to set the integral time of current controllers for the d axis and the q axis. If the setting value is small, it produces current fluctuation against external disturbances, decreasing time until it returns to original current value.



- Pr.834 Torque control P gain 2 (current loop proportional gain) and Pr.835 Torque control integral time 2 (current loop integral time) are valid when the RT signal turns ON.
 - In this case, replace them for Pr.824 and Pr.825 in the description above.

5.7 (E) Environment setting parameters

| Purpose | Pa | arameter to set | | Refer to page |
|---|---|-----------------------------|---------------------------------------|---------------|
| To set the time | Real time clock function | P.E020 to P.E022 | Pr.1006 to Pr.1008 | 334 |
| To set a limit for the reset function. To shut off output if the operation panel disconnects. To force deceleration to a stop on the operation panel. | Reset selection/ disconnected PU detection/PU stop selection/reset limit | P.E100 to P.E102, P.E107 | Pr.75 | 336 |
| To select the display language of the parameter unit | PU display language selection | P.E103 | Pr.145 | 339 |
| To control the buzzer of the parameter unit and operation panel | PU buzzer control | P.E104 | Pr.990 | 340 |
| To adjust the LCD contrast of the parameter unit | PU contrast adjustment | P.E105 | Pr.991 | 340 |
| To turn OFF the operation panel when not using it for a certain period of time | Display-off setting | P.E106 | Pr.1048 | 340 |
| To switch the monitor display of the operation panel to the PID set point setting screen by simply turning the setting dial | Direct setting | P.E108 | Pr.1000 | 340 |
| To use the USB memory | USB host reset | P.E110 | Pr.1049 | 341 |
| To use the setting dial of the operation panel like a potentiometer to set the frequency. To disable the operation panel. | Operation panel operation selection | P.E200 | Pr.161 | 341 |
| To change the frequency change increments which changes when using the setting dial of the operation panel | Frequency change increment amount setting | P.E201 | Pr.295 | 342 |
| To use the regeneration unit to increase the motor braking torque | Regenerative brake selection | P.E300, P.G107 | Pr.30, Pr.70 | 724 |
| To change the overload current rating specification | Multiple rating setting | P.E301 | Pr.570 | 343 |
| To input a voltage between 480 V and 500 V | Input voltage mode selection | P.E302 | Pr.977 | 345 |
| To prevent parameter rewriting | Parameter write disable selection | P.E400 | Pr.77 | 345 |
| To restrict parameters with a password | Password | P.E410, P.E411 | Pr.296, Pr.297 | 348 |
| To use parameters freely | Free parameter | P.E420, P.E421 | Pr.888, Pr.889 | 350 |
| To change parameter settings for an IPM motor as a batch | IPM parameter initialization | P.E430 | Pr.998 | 231 |
| To set multiple parameters by batch | Automatic parameter setting | P.E431 | Pr.999 | 350 |
| To display the required parameters | Applicable parameter display and user group function | P.E440 to P.E443 | Pr.160, Pr.172 to Pr.174 | 354 |
| To release the Parameter copy warning (CP) | Parameter copy alarm release | P.E490 | Pr.989 | 744 |
| To reduce the motor noise and EMI | PWM carrier frequency changing | P.E600 to P.E602 | Pr.72, Pr.240, Pr.260 | 356 |
| To understand the maintenance time of | Inverter parts life display | P.E700 to P.E705 | Pr.255 to Pr.259, Pr.506 | 359 |
| inverter parts and peripheral devices | Maintenance output function | P.E710 to P.E715 | Pr.503 to Pr.504, Pr.686 to Pr.689 | 363 |
| | Current average monitor | P.E720 to P.E722 | Pr.555 to Pr.557 | 363 |

5.7.1 Real time clock function

The time can be set. The time can only be updated while the inverter power is ON.

The real time clock function is enabled using an optional LCD operation panel (FR-LU08).

| Pr. | Name | Initial value | Setting range | Description |
|--------------|-------------------------|--------------------|---|---|
| 1006 E020 | Clock (year) | 2000 (year) | 2000 to 2099 | Set the year. |
| 1007 E021 | Clock (month, day) | 101 (January 1) | 101 to 131, 201 to 228, (229), 301 to 331, 401 to 430, 501 to 531, 601 to 630, 701 to 731, 801 to 831, 901 to 930, 1001 to 1031, 1101 to 1130, 1201 to 1231 | Set the month and day. 1000's and 100's digits: Month (1 (January) to 12 (December)). 10's and 1's digits: Day (1 to the last day of the month (28, 29, 30, or 31)). For December 31, set "1231". |
| 1008 E022 | Clock (hour, minute) | 0 (00:00) | 0 to 59, 100 to 159, 200 to 259, 300 to 359, 400 to 459, 500 to 559, 600 to 659, 700 to 759, 800 to 859, 900 to 959, 1000 to 1059, 1100 to 1159, 1200 to 1259, 1300 to 1359, 1400 to 1459, 1500 to 1559, 1600 to 1659, 1700 to 1759, 1800 to 1859, 1900 to 1959, 2000 to 2059, 2100 to 2159, 2200 to 2259, 2300 to 2359 | Set the hour and minute using the 24-hour clock. 1000's and 100's digits: 0 to 23 hours, 10's and 1's digits: 0 to 59 minutes. For 23:59, set "2359". |

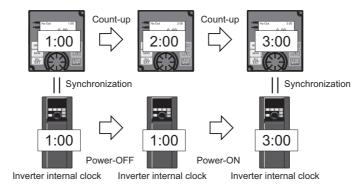
Simple clock function

• When the current year, month, day, hour and minute are set in the parameters above, the inverter internal clock starts ticking. The set date and time can be checked by reading the parameters.



- The time data of the internal clock is saved in the inverter's EEPROM every 10 minutes.
- The clock does not run while the control circuit power is OFF. The clock needs to be set every time after turning ON the inverter power. Prepare separate power supply, such as an external 24 V power supply, to supply power continuously to the control circuit for the simple clock function.
- However, if the power to the main circuit of the inverter is turned ON with the control circuit power already ON, the clock data
 is reset to the data stored in EEPROM because the Inverter reset is performed whenever the power is supplied to the main
 circuit of the inverter in the initial setting. To prevent the clock from resetting, set Pr.30 Regenerative function selection.
 (Refer to page 724.)
- The set time is used for functions such as the Fault history.

Real time clock function



- When the FR-LU08 is connected to the inverter, the internal clock of the inverter can be synchronized with the clock in the FR-LU08 (Real time clock function). The FR-LU08 with battery (CR1216) backup can keep its clock function running even if the main power of the inverter is turned OFF. (The inverter internal clock stops running when the inverter power is turned OFF.)
- To adjust the clock in the FR-LU08, set Pr.1006 to Pr.1008 on the FR-LU08.

NOTE

- Time synchronization between the inverter internal clock and the clock in the FR-LU08 is performed every one minute.
- If the FR-LU08 clock is reset due to dead battery for example, the data in the inverter internal clock is used.

5.7.2 Reset selection / disconnected PU detection / PU stop selection

The acceptance of reset command, the inverter operation in the event of detection of the PU (operation panel / parameter unit) disconnected, and the acceptance of stop command from the PU (PU stop function) can be selected using Pr.E100 (Reset selection), Pr.E101 (Disconnected PU detection), and Pr.E102 (PU stop selection), respectively, or using Pr.75 alone.

| Pr. | Name | Initial value | Setting range | Description | |
|------|--|-------------------|---|---|--|
| | Reset selection/ | | 0 to 3, 14 to 17, 1000 to 1003, 1014 to 1017*1 | In the initial setting, the reset command input is always enabled, | |
| 75 | 75 disconnected PU detection/PU stop selection | 14 | 0 to 3, 14 to 17, 100 to 103, 114 to 117, 1000 to 1003, 1014 to 1017, 1100 to 1103, 1114 to 1117 ^{*2} | the inverter operation continues even when PU is disconnected, and the operation can be stopped on the PU. | |
| | | | 0 | Reset input is always enabled. | |
| E100 | 00 Reset selection | Poset colection 0 | set selection 0 | 1 | Reset input is enabled only when the protective function is activated. |
| E100 | | teset selection | 2 | Reset input is enabled only when the start signal is OFF. | |
| | | | 3 | Reset input is enabled when the protective function is activated and the start signal is OFF. | |
| E101 | Disconnected PU | 0 | 0 | Operation continues even when the PU is disconnected. | |
| EIVI | detection | U | 1 | The inverter output is shut off when the PU is disconnected. | |
| E102 | Dil stan asladian | | 0 | The inverter decelerates to a stop when the STOP key on the PU is pressed in PU operation mode. (The PU stop function is disabled.) | |
| _102 | PU stop selection | o stop selection | 1 | The inverter decelerates to a stop when the STOP key on the PU is pressed in any operation mode of the PU, external, or Network. (The PU stop function is enabled.) | |
| E107 | Reset limit | 0 | 0 | Reset limit is disabled. | |
| E10/ | Reset iiiiit | 0 | 1*2 Reset limit is enabled. | | |

The parameters above do not return to their initial values even if Parameter clear/All parameter clear is executed.

^{*1} The setting range of the FR-A820-03160(55K) or lower and the FR-A840-01800(55K) or lower

^{*2} The setting range of the FR-A820-03800(75K) or higher and the FR-A840-02160(75K) or higher

| Pr.75 setting | Reset input | Operation after PU disconnection is detected | PU stop function | Reset limit function |
|-----------------------|--|--|------------------|-----------------------|
| 0 | Always enabled. | Operation continues. | Disabled | Disabled |
| 1 | When the protective function is activated. | Operation continues. | Disabled | Disabled |
| 2 | Always enabled. | Inverter output shutoff | Disabled | Disabled |
| 3 | When the protective function is activated. | Inverter output shutoff | Disabled | Disabled |
| 14 (initial value) | Always enabled. | Operation continues. | Enabled | Disabled |
| 15 | When the protective function is activated. | Operation continues. | Enabled | Disabled |
| 16 | Always enabled. | Inverter output shutoff | Enabled | Disabled |
| 17 | When the protective function is activated. | Inverter output shutoff | Enabled | Disabled |
| 100 | Always enabled. | Operation continues. | Disabled | Enabled*3 |
| 101 | When the protective function is activated. | Operation continues. | Disabled | Enabled*3 |
| 102 | Always enabled. | Inverter output shutoff | Disabled | Enabled ^{*3} |
| 103 | When the protective function is activated. | Inverter output shutoff | Disabled | Enabled ^{*3} |
| 114 | Always enabled. | Operation continues. | Enabled | Disabled |
| 115 | When the protective function is activated. | Operation continues. | Enabled | Disabled |
| 116 | Always enabled. | Inverter output shutoff | Enabled | Disabled |
| 117 | When the protective function is activated. | Inverter output shutoff | Enabled | Disabled |
| 1000 | When the start signal is OFF. | Operation continues. | Disabled | Disabled |
| 1001 | When the protective function is activated and the start signal is OFF. | Operation continues. | Disabled | Disabled |
| 1002 | When the start signal is OFF. | Inverter output shutoff | Disabled | Disabled |
| 1003 | When the protective function is activated and the start signal is OFF. | Inverter output shutoff | Disabled | Disabled |
| 1014 | When the start signal is OFF. | Operation continues. | Enabled | Disabled |
| 1015 | When the protective function is activated and the start signal is OFF. | Operation continues. | Enabled | Disabled |
| 1016 | When the start signal is OFF. | Inverter output shutoff | Enabled | Disabled |
| 1017 | When the protective function is activated and the start signal is OFF. | Inverter output shutoff | Enabled | Disabled |
| 1100 | When the start signal is OFF. | Operation continues. | Disabled | Enabled ^{*3} |
| 1101 | When the protective function is activated and the start signal is OFF. | Operation continues. | Disabled | Enabled*3 |
| 1102 | When the start signal is OFF. | Inverter output shutoff | Disabled | Enabled ^{*3} |
| 1103 | When the protective function is activated and the start signal is OFF. | Inverter output shutoff | Disabled | Enabled ^{*3} |
| 1114 | When the start signal is OFF. | Operation continues. | Enabled | Enabled ^{*3} |
| 1115 | When the protective function is activated and the start signal is OFF. | Operation continues. | Enabled | Enabled ^{*3} |
| 1116 | When the start signal is OFF. | Inverter output shutoff | Enabled | Enabled ^{*3} |
| 1117 | When the protective function is activated and the start signal is OFF. | Inverter output shutoff | Enabled | Enabled ^{*3} |

^{*3} The setting is available for the FR-A820-03800(75K) or higher and FR-A840-02160(75K) or higher.

◆ Reset selection (P.E100)

- While **P.E100** = "1", or **Pr.75** = "1, 3, 15, 17, 101, 103, 115, or 117", the reset command input is enabled (using the RES signal or through communication) only when the protective function is activated.
- While **P.E100** = "2" or **Pr.75** = "1000, 1002, 1014, 1016, 1100, 1102, 1114, or 1116", the reset command input is enabled (using the RES signal or through communication) only when the start signal is OFF.
- While **P.E100** = "3" or **Pr.75** = "1001, 1003, 1015, 1017, 1101, 1103, 1115, or 1117", the reset command input is enabled (using the RES signal or through communication) only when the protective function is activated with the start signal OFF.



- When the RES signal is input during operation, the motor coasts since the inverter being reset shuts off the output. Also, the cumulative values of electronic thermal O/L relay and regenerative brake duty are cleared.
- When "reset input always enabled" is selected, the reset key on the PU is enabled only when the protective function is activated.
- The following table shows applicable start commands. (When both the STF and STR signals are ON, the start signal status is OFF.)

| Start signal input interface | Applicable start signal |
|------------------------------|--|
| External terminal | X13, X22, LX, X28, JOGF, JOGR, STF, or STR |
| PU | Forward/reverse rotation command given by pressing the FWD/REV key |
| Communication | X13, X22, LX, X28, STF, or STR |

◆ Disconnected PU detection (P.E101)

When the inverter detects that the PU (FR-DU08/FR-PU07) is disconnected from the inverter for 1 second or more while
 P.E101 or Pr.75 is set to shut off the inverter output upon disconnection of the PU, the PU disconnection ("E.PUE") indication is displayed and the inverter output is shut off.



- When the PU has been disconnected before power-ON, the output is not shut off.
- · To restart the inverter operation, confirm that the PU is connected before reset.
- When the inverter detects that the PU is disconnected during PU JOG operation while **P.E101** or **Pr.75** is set to continue the inverter operation even when the PU is disconnected, the inverter decelerates the motor to a stop.
- During RS-485 communication operation via the PU connector, the Reset selection function and the PU stop selection function
 are enabled but the Disconnected PU detection function is disabled. (The communication is checked according to Pr.122 PU
 communication check time interval.)

◆ PU stop selection (P.E102)

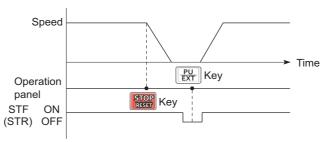
- When the PU stop function is enabled, the motor can be decelerated to a stop by pressing on the PU in either PU, External, or Network operation mode.
- The table below describes situations in which the PU stop function is activated. The indication " is displayed on the PU, and the operation cannot be restarted while the indication remains on. However, the Fault signal is not output.

| Operation mode | Operation |
|---|---|
| External External/PU combined 1 Network | on the PU is pressed during operation. |
| PU operation mode | on the PU is pressed while the inverter is operated by a command source other than the PU. (The command interface/source is selected by setting Pr.551 PU mode operation command source selection .) |

◆ How to restart the inverter which has been stopped in the External operation mode by using ion the PU ("PS" (PU stop) warning reset method)

- For the operation panel (FR-DU08)
 - **1.** After completion of deceleration stop, turn OFF the STF and STR signals.
 - 2. Press PU three times ("PU " is cleared)
 when Pr.79 Operation mode selection = "0 (initial value) or 6".
 When Pr.79 = "2, 3, or 7", the PU stop warning can be cleared with one keystroke.
- · For the parameter unit (FR-PU07)

- **1.** After completion of deceleration stop, turn OFF the STF or STR signal.
- 2. Press EXT (" F 5 " is cleared).



Stop/restart example for External operation

• The inverter can be restarted by performing the reset operation (by turning OFF and ON the power or inputting the RES signal).



• Even when **Pr.250 Stop selection** ≠ "9999" is set and coasting stop is selected, using the PU stop function in the External operation mode does not provide coasting stop but deceleration stop.

◆ Reset limit (P.E107)

- Setting **P.E107** = "1" or **Pr.75** = any of "100 to 103, 114 to 117, 1100 to 1103, or 1114 to 1117" will make the inverter to refuse any reset operation (RES signal input, etc.) for 3 minutes after the first activation of an electronic thermal O/L relay or protective function (E.THM, E.THT, E.OC[]).
- The reset limit function is available with the FR-A820-03800(75K) or higher and the FR-A840-02160(75K) or higher.



- Resetting the inverter power (turning OFF the control power) clears the accumulated thermal value.
- When the retry function is set enabled (Pr.67 Number of retries at fault occurrence ≠ "0"), the reset limit function is disabled.

CAUTION

• Do not perform a reset while a start signal is being input. Doing so will cause a sudden start of the motor, which is dangerous.

Parameters referred to

Pr.67 Number of retries at fault occurrence ☐ page 426

Pr.79 Operation mode selection ☞ page 389 Pr.250 Stop selection ☞ page 722

Pr.551 PU mode operation command source selection ☐ page 400

5.7.3 PU display language selection

You can switch the display language of the parameter unit (FR-PU07) to another.

| Pr. | Name | Initial value | Setting range | Description |
|------|-----------|---------------|---------------|-------------|
| | . , , , _ | | 0 | Japanese |
| | | | 1 | English |
| | | | 2 | German |
| 145 | | | 3 | French |
| E103 | | _ | 4 | Spanish |
| | | | 5 | Italian |
| | | | 6 | Swedish |
| | | | 7 | Finnish |

5.7.4 Buzzer control

The PU (operation panel or parameter unit) key sound and buzzer can be turned ON/OFF.

| Pr. | Name | Initial value | Setting range | Description |
|------|-------------------|---------------|---------------|-------------------------------------|
| 990 | PU buzzer control | 1 | 0 | Turns the key sound and buzzer OFF. |
| E104 | | ' | 1 | Turns the key sound and buzzer ON. |



· When the buzzer is set to ON, a warning sound will be audible when a fault occurs.

5.7.5 PU contrast adjustment

Contrast of the LCD display on the LCD operation panel (FR-LU08) or the parameter unit (FR-PU07) can be adjusted. Decreasing the setting value lowers the contrast.

| Pr. | Name | Initial value | Setting range | Description |
|-------------|------------------------|---------------|---------------|-------------------|
| 991 E105 | PU contrast adjustment | 58 | 0 to 63 | 0: Low → 63: High |

This parameter can be selected from among simple mode parameters only when the LCD operation panel (FR-LU08) or the parameter unit (FR-PU07) is connected to the inverter.

5.7.6 Display-off setting

The LED display of the operation panel (FR-DU08) can be turned OFF when the operation panel has not been used for a certain period of time.

| Pr. | Name | Initial value | Setting range | Description |
|------|--------------------------|---------------|-------------------|--|
| 1048 | | 0 | 0 | Display-off setting is disabled. |
| E106 | Display-off waiting time | 0 | 1 to 60 (minutes) | Set time until the LED of the operation panel is turned OFF. |

- When the operation panel has not been operated for the time set in Pr.1048, the display-off setting is activated and the LED display turns OFF.
- In the display-off state, the [MON] indicator blinks slowly.
- The time interval counting for display-off is reset at removal/reinstallation of the operation panel, power-ON/OFF of the inverter, or the Inverter reset.
- · The triggers for display-on are as follows:
 - Operation of the operation panel,
 - Occurrence of a warning, alarm, or fault,
 - Removal/reinstallation of the operation panel, power-ON/OFF of the inverter, or the Inverter reset,
 - Connection/disconnection at the USB A connector.



• The [P.RUN] indicator is ON even if the operation panel is in the display-off state (while the PLC function is enabled).

5.7.7 Direct setting

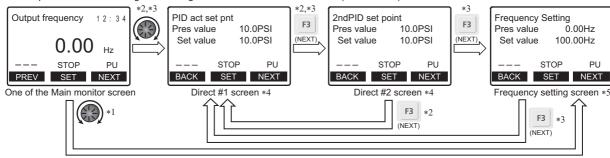
The PID set point setting screen (direct setting screen) can be displayed first on the LCD operation panel (FR-LU08) according to the parameter setting.

| Pr. | Name | Initial value | Setting range | Description |
|------|--------------------------|----------------------------|---------------|--|
| | Direct setting selection | Direct setting selection 0 | 0 | Displays the Frequency setting screen. |
| 1000 | | | 1 | Displays the direct setting screen (for set point setting). |
| E108 | Direct Setting Selection | · | 2 | Displays the direct setting screen (for set point setting) and the frequency setting screen. |

· This function is useful for setting the PID set point on the LCD operation panel.

• The monitor display can be switched from the main monitor screen to the set point setting screen for the PID action simply by turning according to the setting of **Pr.1000 Direct setting selection**. On each setting screen, turn a setting value, and press (SET) to confirm the setting.

Example of screen switching and shifting when the PID control is enabled (Pr.128 ≠ "0")



- *1 When **Pr.1000** = "0"
- *2 When **Pr.1000** = "1"
- *3 When Pr.1000 = "2"
- *4 Not displayed when PID control is disabled (Pr.128 = "0").
- *5 Indication of "NEXT" is not displayed when Pr.1000 = "0".
- To switch back the monitor display from the Extended direct screen or the Frequency setting screen to the Main monitor screen, press (BACK).



5.7.8 Resetting USB host errors

When a USB device is connected to the USB connector (connector A), the USB host error can be canceled without performing the Inverter reset.

| Pr. | Name | Initial value | Setting range | Description |
|------|----------------|---------------|---------------|----------------------|
| 1049 | USB host reset | 0 | 0 | Read only |
| E110 | | U | 1 | Resets the USB host. |

- Parameter copy (refer to page 744) or the trace function (refer to page 649) is available when a USB device (such as a USB memory) is connected to the USB connector (connector A).
- When a device such as a USB charger is connected to the USB connector and an excessive current (500 mA or higher) flows, USB host error " (UF warning) is displayed on the operation panel.
- When the UF warning appears, the USB error can be canceled by removing the USB device and setting **Pr.1049** = "1". (The UF warning can also be canceled by resetting the inverter power or resetting with the RES signal.)

5.7.9 Easy frequency setting (Volume-knob-like setting) and key lock function selection

The frequency can be easily set with the setting dial on the operation panel (FR-DU08) like a volume knob. The key operation of the operation panel can be disabled.

| Pr. | Name | Initial value | Setting range | Description | | |
|------|--|---------------|---------------|---|-------------------|--|
| | | | 0 | Normal frequency setting | Key lock function | |
| 161 | Frequency setting/key lock operation selection | 0 | 1 | Easy frequency setting (Volume-knob-like setting) | disabled. | |
| E200 | | | 10 | Normal frequency setting | Key lock function | |
| | | | 11 | Easy frequency setting (Volume-knob-like setting) | enabled. | |

◆ Setting the frequency by turning the setting dial like a volume knob

• The frequency can be set by simply turning the setting dial on the operation panel (FR-DU08) during operation (Volume-knob-like setting).



- If the display changes from blinking "60.00" to "0.00", the setting value of Pr.161 may not be "1".
- The newly-set frequency is be saved as the set frequency in EEPROM after 10 seconds.
- When setting the frequency by turning the setting dial, the frequency goes up to the set value of **Pr.1 Maximum frequency**.

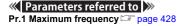
 Be aware of what frequency **Pr.1** is set to, and adjust the setting of **Pr.1** according to the application.

Disabling the setting dial and keys on the operation panel (by holding down the MODE key for 2 seconds)

- The setting dial and keys on the operation panel (FR-DU08) can be disabled to prevent parameter changes, unexpected starts or frequency changes.
- Set **Pr.161** to "10 or 11" and then press MODE for 2 seconds to disable setting dial and keys.
- When setting dial and keys are disabled, " | appears on the operation panel. If setting dial or key operation is attempted while dial and keys are disabled, " | appears. (After no setting dial or key operation for 2 seconds, the display returns to the monitoring screen.)
- To enable the setting dial and keys again, press MODE for 2 seconds.



- Even if setting dial and keys are disabled, the monitor indicator and RESET are enabled.
- The PU stop warning cannot be reset by using keys while the key lock function is enabled.



5.7.10 Frequency change increment amount setting

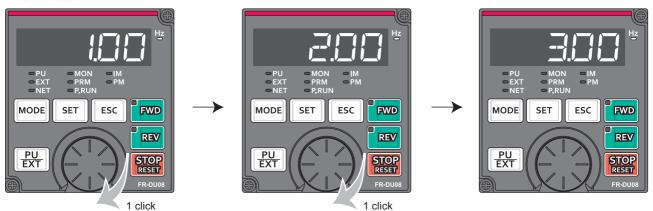
When setting the set frequency with the setting dial of the operation panel (FR-DU08), the frequency changes in 0.01 Hz increments in the initial status. Setting this parameter to increase the frequency increment amount that changes when the setting dial is rotated can improve usability.

| Pr. | Name | Initial value | Setting range | Description |
|-------------|---|---------------|---------------|--|
| | | | 0 | Function disabled |
| 295 E201 | Frequency change increment amount setting | 0 | 0.01 | |
| | | | 0.10 | The minimum change width when the set frequency is |
| | | | 1.00 | changed with the setting dial can be set. |
| | | | 10.00 | |

Basic operation

• When **Pr.295** ≠ "0", the minimum increment when the set frequency is changed with the setting dial can be set. For example, when **Pr.295** = 1.00 Hz, one click (one dial gauge) of the setting dial changes the frequency in increments of 1.00 Hz, such as 1.00 Hz → 2.00 Hz → 3.00 Hz.

When Pr.295="1"





- When machine speed display is selected in Pr.37 Speed display, the minimum increments of change are determined by Pr.295 as well. Note that the setting value may differ as speed setting changes the set machine speed and converts it to the speed display again.
- For Pr.295, the increments are not displayed.
- The Pr.295 setting is enabled only for the changes to the set frequency. It does not apply to the settings of other parameters related to frequency.
- When 10 is set, the frequency setting changes in 10 Hz increments. Be cautious of excessive speed (in potentiometer mode).



5.7.11 Multiple rating setting

Four rating types of different rated current and permissible load can be selected. The optimal inverter rating can be chosen in accordance with the application, enabling equipment size to be reduced.

| Pr. | Name | Initial value | Setting range | Description (overload current rating, surrounding air temperature) |
|-------------|-------------------------|---------------|---------------|--|
| | | | 0*1 | SLD rating. 110% for 60 seconds, 120% for 3 seconds (inverse- time characteristics) at surrounding air temperature of 40°C. |
| 570 E301 | Multiple rating setting | 2 | 1 | LD rating. 120% for 60 seconds, 150% for 3 seconds (inverse- time characteristics) at surrounding air temperature of 50°C. |
| | | | 2 | ND rating. 150% for 60 seconds, 200% for 3 seconds (inverse- time characteristics) at surrounding air temperature of 50°C. |
| | | | 3*1 | HD rating. 200% for 60 seconds, 250% for 3 seconds (inverse-time characteristics) at surrounding air temperature of 50°C. |

^{*1} Not compatible with the IP55 compatible model.

Changing the parameter initial values and setting ranges

• When inverter reset and all parameter clear are performed after setting Pr.570, the parameter initial values are changed according to each rating, as shown below.

| Pr. | Name | Pr.570 setting | | | | | | |
|-----|---|----------------------------|---------------------------|---------------------------|--------------------------------|----------|--|--|
| Pr. | Name | 0 | 1 | 2 (initial value) | 3 | page | | |
| 0 | Torque boost | *1 | *1 | *1 | *1 | 706 | | |
| 7 | Acceleration time | *1 | *1 | *1 | *1 | 367 | | |
| 8 | Deceleration time | *1 | *1 | *1 | *1 | 367 | | |
| 9 | Electronic thermal O/L relay | SLD rated current*2 | LD rated current*2 | ND rated current*2*3 | HD rated current*2*3 | 415 | | |
| 12 | DC injection brake operation voltage | *1 | *1 | *1 | *1 | 715 | | |
| 22 | Stall prevention operation level | 110% | 120% | 150% | 200% | 245, 431 | | |
| 48 | Second stall prevention operation level | 110% | 120% | 150% | 200% | 431 | | |
| 56 | Current monitoring reference | SLD rated current*2 | LD rated current*2 | ND rated current*2 | HD rated current*2 | 457 | | |
| 114 | Third stall prevention operation level | 110% | 120% | 150% | 200% | 431 | | |
| 148 | Stall prevention level at 0 V input | 110% | 120% | 150% | 200% | 431 | | |
| 149 | Stall prevention level at 10 V input | 120% | 150% | 200% | 250% | 431 | | |
| 150 | Output current detection level | 110% | 120% | 150% | 200% | 487 | | |
| 165 | Stall prevention operation level for restart | 110% | 120% | 150% | 200% | 628 | | |
| 557 | Current average value monitor signal output reference current | SLD rated current*2 | LD rated current*2 | ND rated current*2 | HD rated current ^{*2} | 363 | | |
| 874 | OLT level setting | 110% | 120% | 150% | 200% | 245 | | |
| 893 | Energy saving monitor reference (motor capacity) | SLD rated motor capacity*2 | LD rated motor capacity*2 | ND rated motor capacity*2 | HD rated motor capacity*2 | 467 | | |

^{*1} Initial values differ depending on the rating as follows.

| | | | | | | | | 2 | 00 V cl | ass FR | -A820- | | | | | | | |
|-------------|-----------------|------------------|------------------|-----------------|-----------------|-----------------|-----------------|---------------------------|----------------|------------------|------------------|----------------|----------------|----------------|----------------|----------------|--------------------------------|----------------|
| | Pr.570 | 00046 (0.4K) | 00077 (0.75K) | 00105 (1.5K) | 00167 (2.2K) | 00250 (3.7K) | 00340 (5.5K) | 00490 (7.5K) | 00630 (11K) | | 00930 (18.5K) | | 01540 (30K) | 01870 (37K) | 02330 (45K) | 03160 (55K) | 03800 (75K) | 04750 (90K) |
| Pr. setting | 00023 (0.4K) | 00038 (0.75K) | 00052 (1.5K) | 00083 (2.2K) | 00126 (3.7K) | 00170 (5.5K) | 00250 (7.5K) | 00 V cl 00310 (11K) | 00380 (15K) | 00470 (18.5K) | 00620 | 00770 (30K) | 00930 (37K) | 01160 (45K) | 01800 (55K) | 02160 (75K) | 02600 (90K) or higher | |
| | 0, 1 | ~ | 4 | 4 | • | - | 3 | 2 | 2 | 2 | 2 | 2 | 2 | 1.5 | 1.5 | 1 | 1 | 1 |
| 0 (%) | 2 | ~ | 6 | 4 | 1 | - | 3 | 3 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 1 |
| | 3 | 6 | 6 | 6 | 4 | 4 | 4 | 3 | 3 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 1 |
| | 0, 1 | 5 | 5 | 5 | 5 | 5 | 5 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 |
| 7 (s) | 2 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 |
| | 3 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 |
| | 0, 1 | 10 | 10 | 10 | 10 | 10 | 10 | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 30 |
| 8 (s) | 2 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 |
| | 3 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 |
| | 0, 1 | 4 | 4 | 4 | 4 | 4 | 4 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 1 | 1 |
| 12 (%) | 2 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 1 |
| | 3 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 1 |

- *2 The rated current and motor capacity differ depending on the inverter capacity. Refer to the inverter rated specifications (page 826).
- $^{*}3$ The initial value for the FR-A820-00077(0.75K) or lower and the FR-A840-00038(0.75K) or lower is set to the 85% of the inverter rated current.
- Setting Pr.292 Automatic acceleration/deceleration = "5 or 6 (lift mode)" changes the stall prevention operation level as shown below.

| Pr. | setting | Pr.570 setting | | | | | | | |
|-----|---------|----------------|------|-------------------|------|------|--|--|--|
| FI. | Setting | 0 | 1 | 2 (initial value) | 3 | page | | | |
| 292 | 5 | 110% | 120% | 150% | 200% | 384 | | | |
| 292 | 6 | 115% | 140% | 180% | 230% | 304 | | | |



- When Pr.570 = "0" (SLD rating), carrier frequency automatic reduction is enabled regardless of the setting in Pr.260.
- To use the FR-A820-03160(55K) and the FR-A840-01800(55K) in the LD and SLD ratings, a DC reactor, which is available as an option, corresponding to the applied motor is required.
- Setting the LD or SLD rating to the FR-A820-03160(55K) and the FR-A840-01800(55K) changes their parameter setting increments and setting ranges in the same way as for the FR-A820-03800(75K) and the FR-A840-02160(75K) or higher. In an example of **Pr.9**, the setting increment changes from "0.01 A" to "0.1 A" and the setting range changes from "0 to 500 A" to "0 to 3600 A". For the setting of each parameter, refer to the parameter list (on page 166).

Parameters referred to

Pr.260 PWM frequency automatic switchover page 356

5.7.12 Using the power supply exceeding 480 VAC

To input a voltage between 480 VAC and 500 VAC to the 400 V class inverter, change the voltage protection level.

| Pr. | Name | Initial value | Setting range | Description |
|-------------|------------------------------|---------------|---------------|---------------------------------------|
| 077 | | | 0 | 400 V class voltage protection level |
| 977 E302 | Input voltage mode selection | 0 | 1 | 500 V class voltage protection level |
| 2002 | | | 2 | For manufacturer setting. Do not set. |

- To use a voltage between 480 VAC and 500 VAC, set **Pr.977 Input voltage mode selection** = "1". The setting is applied after a reset.
- Setting Pr.977 = "1" changes the voltage protection level to the one for the 500 V class.
- The increased magnetic excitation deceleration operation level is 740 V. Use **Pr.660 Increased magnetic excitation deceleration operation selection** to select the increased magnetic excitation deceleration.)



- To check availability of stand-alone options when the input voltage is between 480 and 500 VAC, refer to the Instruction Manual or catalog of each option for details on the ratings.
- · Changing the Pr.977 setting does not affect the voltage level to activate the regenerative overvoltage trip (E.OV1 to E.OV3).
- Changing the Pr.977 setting does not affect the voltage level set in Pr.883 Regeneration avoidance operation level.
- The setting of Pr.977 is invalid for the 200 V class inverter.

Parameters referred to

Pr.660 Increased magnetic excitation deceleration operation selection ☐ page 735

5.7.13 Parameter write selection

Whether to enable the writing to various parameters or not can be selected. Use this function to prevent parameter values from being rewritten by misoperation.

| Pr. | Name | Initial value | Setting range | Description |
|------------|---------------------------|---------------|---------------|--|
| 77 E400 | Parameter write selection | 0 | 0 | Parameter write is enabled only during stop. |
| | | | 1 | Parameter writing is disabled. |
| | | | 2 | Parameter writing is enabled in any operation mode regardless of the operation status. |

• **Pr.77** can be set at any time regardless of the operation mode or operation status. (Setting through communication is unavailable.)

◆ Parameter write enabled only during stop (Pr.77 = "0 (initial value)")

- · Parameters can be written only during a stop in the PU operation mode.
- · The following parameters can always be written regardless of the operation mode or operation status.

| Pr. | Name | | | | |
|-------------------|---|--|--|--|--|
| | (Multi-speed setting high-speed, middle-speed, | | | | |
| 4 to 6 | low-speed) | | | | |
| 22 | Stall prevention operation level | | | | |
| 24 to 27 | (Multi-speed setting speed 4 to speed 7) | | | | |
| 52 | Operation panel main monitor selection | | | | |
| 54 | FM/CA terminal function selection | | | | |
| 55 | Frequency monitoring reference | | | | |
| 56 | Current monitoring reference | | | | |
| 72 ^{*1} | PWM frequency selection | | | | |
| 75 | Reset selection/Disconnected PU detection/PU stop selection | | | | |
| 77 | Parameter write selection | | | | |
| 79 ^{*2} | Operation mode selection | | | | |
| 129 | PID proportional band | | | | |
| 130 | PID integral time | | | | |
| 133 | PID action set point | | | | |
| 134 | PID differential time | | | | |
| 158 | AM terminal function selection | | | | |
| 160 | User group read selection | | | | |
| 232 to 239 | (Multi-speed setting speed 8 to speed 15) | | | | |
| 240 ^{*1} | Soft-PWM operation selection | | | | |
| 241 | Analog input display unit switchover | | | | |
| 268 | Monitor decimal digits selection | | | | |
| 271 | High-speed setting maximum current | | | | |
| 272 | Middle-speed setting minimum current | | | | |
| 273 | Current averaging range | | | | |
| 274 | Current averaging filter time constant | | | | |
| 275 ^{*1} | Stop-on contact excitation current low-speed scaling factor | | | | |
| 290 | Monitor negative output selection | | | | |
| 295 | Frequency change increment amount setting | | | | |
| 296, 297 | (Password setting) | | | | |
| 306 | Analog output signal selection | | | | |
| 310 | Analog meter voltage output selection | | | | |
| 340 ^{*2} | Communication startup mode selection | | | | |
| 345, 346 | (DeviceNet communication) | | | | |
| 416, 417 | (PLC) | | | | |
| 434, 435 | (CC-Link communication) | | | | |
| 496, 497 | (Remote output) | | | | |
| 498 | PLC function flash memory clear | | | | |
| 550 ^{*2} | NET mode operation command source selection | | | | |

| Pr. | Name |
|-------------------|---|
| 551 ^{*2} | PU mode operation command source selection |
| 555 to 557 | (Current average value monitoring) |
| 656 to 659 | (Analog remote output) |
| 663 | Control circuit temperature signal output level |
| 675 | User parameter auto storage function selection |
| 750, 751 | Motor thermistor interface |
| 759 | PID unit selection |
| 774 to 776 | (PU/DU monitor selection) |
| 805 | Torque command value (RAM) |
| 806 | Torque command value (RAM, EEPROM) |
| 838 | DA1 terminal function selection |
| 866 | Torque monitoring reference |
| 888, 889 | (Free parameter) |
| 891 to 899 | (Energy saving monitoring) |
| C0 (900) | FM/CA terminal calibration |
| C1 (901) | AM terminal calibration |
| C8 (930) | Current output bias signal |
| C9 (930) | Current output bias current |
| C10 (931) | Current output gain signal |
| C11 (931) | Current output gain current |
| 990 | PU buzzer control |
| 991 | PU contrast adjustment |
| 992 | Operation panel setting dial push monitor selection |
| 997 | Fault initiation |
| 998 ^{*2} | PM parameter initialization |
| 999*2 | Automatic parameter setting |
| 1000 | Direct setting selection |
| 1006 | Clock (year) |
| 1007 | Clock (month, day) |
| 1008 | Clock (hour, minute) |
| 1018 | Monitor with sign selection |
| 1019 | Analog meter voltage negative output selection |
| 1048 | Display-off waiting time |
| 1142 | Second PID unit selection |
| 1150 to 1199 | (PLC function user parameters) |
| 1283 | Home position return speed |
| 1284 | Home position return shifting speed |

- *1 Writing during operation is enabled in PU operation mode, but disabled in External operation mode.
- *2 Writing during operation is disabled. To change the parameter setting value, stop the operation.

◆ Parameter write disabled (Pr.77 = "1")

- Parameter write, Parameter clear, and All parameter clear are disabled. (Parameter read is enabled.)
- The following parameters can be written even if **Pr.77** = "1".

| Pr. | Name |
|------------------|---|
| 22 | Stall prevention operation level |
| 75 | Reset selection/Disconnected PU detection/PU stop selection |
| 77 | Parameter write selection |
| 79 ^{*1} | Operation mode selection |
| 160 | User group read selection |
| 296 | Password lock level |
| 297 | Password lock/unlock |

| Pr. | Name |
|------------|------------------------------------|
| 345, 346 | (DeviceNet communication) |
| 496, 497 | (Remote output) |
| 656 to 659 | (Analog remote output) |
| 805 | Torque command value (RAM) |
| 806 | Torque command value (RAM, EEPROM) |
| 997 | Fault initiation |

^{*1} Writing during operation is disabled. To change the parameter setting value, stop the operation.

◆ Parameter write enabled during operation (Pr.77 = "2")

- These parameters can always be written.
- The following parameters cannot be written during operation even if **Pr.77** = "2". To change the parameter setting value, stop the operation.

| Pr. | Name | | |
|------------|---|--|--|
| 23 | Stall prevention operation level compensation | | |
| | factor at double speed | | |
| 48 | Second stall prevention operation level | | |
| 49 | Second stall prevention operation frequency | | |
| 60 | Energy saving control selection | | |
| 61 | Reference current | | |
| 66 | Stall prevention operation reduction starting frequency | | |
| 71 | Applied motor | | |
| 79 | Operation mode selection | | |
| 80 | Motor capacity | | |
| 81 | Number of motor poles | | |
| 82 | Motor excitation current | | |
| 83 | | | |
| 03 | Rated motor voltage | | |
| 84 | Rated motor frequency | | |
| 90 to 94 | (Motor constant) | | |
| 95 | Online auto tuning selection | | |
| 96 | Auto tuning setting/status | | |
| 135 to 139 | (Electronic bypass sequence parameter) | | |
| 178 to 196 | (Input and output terminal function selection) | | |
| 248 | Self power management selection | | |
| 254 | Main circuit power OFF waiting time | | |
| 261 | Power failure stop selection | | |
| 289 | Inverter output terminal filter | | |
| 291 | Pulse train I/O selection | | |
| 292 | Automatic acceleration/deceleration | | |
| 293 | Acceleration/deceleration separate selection | | |
| 298 | Frequency search gain | | |
| 313 to 322 | (Extended output terminal function selection) | | |
| 329 | Digital input unit selection | | |
| 373 | Encoder position tuning setting/status | | |
| 406 | High resolution analog input selection | | |
| 414 | PLC function operation selection | | |
| 415 | Inverter operation lock mode setting | | |
| 418 | Extension output terminal filter | | |
| 419 | Position command source selection | | |
| 420, 421 | (Electronic gear) | | |
| 450 | Second applied motor | | |
| 451 | Second motor control method selection | | |
| 453 | Second motor control metriod selection Second motor capacity | | |
| 454 | Number of second motor poles | | |
| 704 | riamber of second motor poles | | |

| Pr. | Name | |
|------------------|--|--|
| 455 | Second motor excitation current | |
| 456 | Rated second motor voltage | |
| 457 | Rated second motor frequency | |
| 458 to 462 | (Second motor constant) | |
| 463 | Second motor auto tuning setting/status | |
| 507, 508 | (Display/reset ABC relay contact life) | |
| 541 | Frequency command sign selection | |
| 560 | Second frequency search gain | |
| 561 | PTC thermistor protection level | |
| 570 | Multiple rating setting | |
| 574 | Second motor online auto tuning | |
| 598 | Undervoltage level | |
| 606 | Power failure stop external signal input selection | |
| 639, 640 | (Brake sequence) | |
| 641, 650, 651 | (Second brake sequence) | |
| 660 to 662 | Increased magnetic excitation deceleration | |
| 673 | SF-PR slip amount adjustment operation selection | |
| 699 | Input terminal filter | |
| 702 | Maximum motor frequency | |
| 706, 707, 711, | , , | |
| 712, 717, 721, | (PM motor tuning) | |
| 724, 725, 1412 | | |
| 738 to 746, 1413 | (Second PM motor tuning) | |
| 747 | Second motor low-speed range torque characteristic selection | |
| 788 | Low speed range torque characteristic selection | |
| 800 | Control method selection | |
| 819 | Easy gain tuning selection | |
| 858 | Terminal 4 function assignment | |
| 859 | Torque current/Rated PM motor current | |
| 860 | Second motor torque current/Rated PM motor current | |
| 862 | Encoder option selection | |
| 868 | Terminal 1 function assignment | |
| 977 | Input voltage mode selection | |
| 998 | PM parameter initialization | |
| 999 | Automatic parameter setting | |
| 1002 | Lq tuning target current adjustment coefficient | |
| 1105 | Encoder magnetic pole position offset | |
| 1292 | Position control terminal input selection | |
| 1293 | Roll feeding mode selection | |
| | | |
| 1348 | P/PI control switchover frequency | |

5.7.14 Password

Registering a 4-digit password can restrict access to parameters (reading/writing).

| Pr. | Name | Initial value | Setting range | Description |
|-------------|----------------------|---------------|--------------------------------|---|
| 296 E410 | Password lock level | 9999 | 0 to 6, 99, 100 to 106, 199 | Password protection enabled. Setting the access (reading/writing) restriction level to parameters locked with a password enables writing to Pr.297 . |
| | | | 9999 | No password protection |
| | | | 1000 to 9998 | Input a 4-digit password to lock parameters, or input the valid password to unlock the locked parameters. |
| 297 E411 | Password lock/unlock | 9999 | (0 to 5)*1 | Number of failed password attempts (read only, displayed after any of "100 to 106, or 199" is set in Pr.296 and a password to lock parameters is input). |
| | | | 9999 ^{*1} | No password protection |

These parameters can be set when **Pr.160 User group read selection** = "0". However, when **Pr.296** ≠ 9999 (password lock is set), **Pr.297** can always be set, regardless of the setting in **Pr.160**.

*1 Although "0 or 9999" can be input in **Pr.297**, the value is invalid. (The display cannot be changed.)

◆ Parameter reading/writing restriction level (Pr.296)

• The access (reading/writing) restriction level to parameters in the PU operation mode or NET operation mode can be selected with **Pr.296**.

| | PU operation r | node operation | NET operation mode operation command*4 | | | |
|----------------------|--|---------------------|--|---------------------|--------------------------|---------------------|
| Pr.296 setting | command ^{*3} | | RS-485 terminals / PLC function*7 | | via communication option | |
| | Read ^{*1} | Write ^{*2} | Read | Write ^{*2} | Read | Write ^{*2} |
| 9999 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0, 100 ^{*6} | × | × | × | × | × | × |
| 1, 101 | 0 | × | 0 | × | 0 | × |
| 2, 102 | 0 | × | 0 | 0 | 0 | 0 |
| 3, 103 | 0 | 0 | 0 | × | 0 | × |
| 4, 104 | × | × | × | × | 0 | × |
| 5, 105 | × | × | 0 | 0 | 0 | 0 |
| 6, 106 | 0 | 0 | × | × | 0 | × |
| 99, 199 | Only the parameters registered in the user group can be read/written. (For the parameters not registered in the user | | | | | |
| 99, 199 | group, the restriction level when "4 or 104" is set applies.)*5 | | | | | |

o: Enabled, x: Disabled

- *1 If the parameter reading is restricted by the setting of **Pr.160 User group read selection**, those parameters cannot be read even when "o" is indicated
- *2 If the parameter writing is restricted by the setting of Pr.77 Parameter write selection, those parameters cannot be written even when "o" is indicated
- *3 Access from the command source in the PU operation mode (the operation panel (FR-DU08) or the parameter unit in the initial setting) is restricted. (For the PU operation mode command source selection, refer to page 400.)
- *4 Access from the command source in the Network operation mode (the RS-485 terminals or a communication option in the initial setting) is restricted. (For the NET operation mode command source selection, refer to page 400.)
- *5 Read/write is enabled only for the simple mode parameters registered in the user group when **Pr.160** = "9999". **Pr.296** and **Pr.297** can be read or written regardless of whether they are registered to the user group.
- *6 If a communication option is installed, the Option fault (E.OPT) occurs, and the inverter output shuts off. (Refer to page 791.)
- *7 The PLC function user parameters (Pr.1150 to Pr.1199) can be written and read by the PLC function regardless of the Pr.296 setting.

◆ Locking parameters with a password (Pr.296, Pr.297)

- · The procedure of locking parameters with a password is as follows.
 - Set the parameter reading/writing restriction level to enable the password protection. (Set a value other than "9999" in Pr.296.)

| Pr.296 setting | Allowable number of failed password attempts | Pr.297 readout |
|-------------------|--|---|
| 0 to 6 or 99 | Unlimited | Always 0 |
| 100 to 106, 199*1 | Limited to 5 times | Number of failed password attempts (0 to 5) |

^{*1} If an invalid password is input 5 times while any of "100 to 106, or 199" is set in **Pr.296**, the password is locked up afterward (the locked parameters cannot be unlocked even with the valid password). All parameter clear is required to reset the password. (After All parameter clear is performed, the parameters are returned to their initial values.)

2. Write a four-digit number (1000 to 9998) to **Pr.297** as a password (writing is disabled when **Pr.296** = "9999"). After a password is set, parameters are locked and access (reading/writing) to the parameters is limited at the level set in **Pr.296** until the valid password is input to unlock the locked parameters.

NOTE

- After a password is set, the Pr.297 readout is always any of "0 to 5".
- " appears when a password-protected parameter is attempted to be read/written.
- Even if a password is set, the parameters which are written by the inverter, such as parameters related to the life check of inverter parts, are overwritten as needed.
- Even if a password is set, Pr.991 PU contrast adjustment can be read/written when the parameter unit (FR-PU07) is connected.

◆ Unlocking the locked parameters (Pr.296, Pr.297)

- · There are two ways to unlock the locked parameters.
- Enter the password in **Pr.297**. When a valid password is input, the locked parameters can be unlocked. When an invalid password is input, an error indication appears and the parameters cannot be unlocked. If an invalid password is input 5 times while any of "100 to 106, or 199" is set in **Pr.296**, the locked parameters cannot be unlocked afterward even with the valid password (the password is locked up).
- · Perform All parameter clear.

NOTE

- If the password is forgotten, it can be reset by performing All parameter clear, but the other parameters are also reset.
- All parameter clear cannot be performed during the inverter operation.
- When using FR Configurator2 in the PU operation mode, do not set "0, 4, 5, 99, 100, 104, 105, or 199" (parameter read is disabled) in **Pr.296**. Doing so may cause abnormal operation.
- The means to reset the password varies according to how the reset command is sent (from the PU, through RS-485 communication, or via a communication option).

| | PU (operation panel or parameter unit) | RS-485 communication | Communication option |
|---------------------|--|----------------------|----------------------|
| All parameter clear | 0 | 0 | 0 |
| Parameter clear | × | × | 0 |

- o: Password reset enabled, x: Password reset disabled
- For the information how to perform Parameter clear or All parameter clear with the parameter unit or via a communication option, refer to the Instruction Manual of the parameter unit or the option. (For the operation panel (FR-DU08), refer to page 743. For RS-485 communication using the Mitsubishi inverter protocol, refer to page 672. For RS-485 communication using the MODBUS RTU communication protocol, refer to page 686.)

◆ Access to parameters according to the password status

| Parameter | | · · | disabled / Parameters cked | Parameters locked | Password locked up | |
|----------------|---------------------|-------------------------------------|-------------------------------------|--|---|--|
| Fala | meter | Pr.296 = "9999", Pr.297 = "9999" | Pr.296 ≠ "9999", Pr.297 = "9999" | Pr.296 ≠ "9999", Pr.297 = "0 to 4" (read value) | Pr.296 = "100 to 106, 199" Pr.297 = "5" (read value) | |
| Pr.296 | Read | o*1 | 0 | 0 | 0 | |
| F1.230 | Write | o*1 | o*1 | × | × | |
| Pr.297 | Read | o*1 | 0 | 0 | 0 | |
| P1.291 | Write | × | 0 | 0 | o*3 | |
| Pr.CLR (Parame | write ter clear) | 0 | 0 | x*4 | ×*4 | |
| ALL.C w | ` | 0 | 0 | o*2 | °*2 | |
| Pr.CPY (Parame | write ter copy) | 0 | 0 | × | × | |

o: Enabled, x: Disabled

- *1 Reading/writing is disabled if reading is restricted by the **Pr.160** setting. (Reading is available in the Network operation mode regardless of the **Pr.160** setting.)
- *2 All parameter clear cannot be performed during the operation.

- *3 Inputting a password is possible but the locked-up password cannot be unlocked or reset even with the valid password.
- *4 Parameter clear can be performed only via a communication option.



- When "4, 5, 104, or 105" is set in Pr.296 and a password is set, Pr.15 Jog frequency is not listed on the parameter unit (FR-PU07).
- · When a password has been set and parameters are locked, Parameter copy cannot be performed using the operation panel, parameter unit, or a USB memory device.

Parameters referred to Pr.77 Parameter write selection page 345

Pr.150 User group read selection page 354
Pr.550 NET mode operation command source selection page 400

Pr.551 PU mode operation command source selection page 400

5.7.15 Free parameter

Any number within the setting range of 0 to 9999 can be input.

For example, these numbers can be used:

- · As a unit number when multiple units are used.
- As a pattern number for each operation application when multiple units are used.
- · As the year and month of introduction or inspection.

| Pr. | Name | Initial value | Setting range | Description |
|-------------|------------------|---------------|---------------|--|
| 888 E420 | Free parameter 1 | 9999 | 0 to 9999 | Any value can be input. The settings are retained even if the inverter power is turned |
| 889 E421 | Free parameter 2 | 9999 | 0 to 9999 | OFF. |



· Pr.888 and Pr.889 do not influence the operation of the inverter.

5.7.16 Setting multiple parameters by batch

The setting of particular parameters is changed by batch, such as communication parameters for connection with the Mitsubishi Electric human machine interface (GOT), the parameters for the rated frequency (50/60 Hz) setting, or the parameters for acceleration/deceleration time increment.

Multiple parameters are changed automatically. Users do not have to consider each parameter number (automatic parameter setting).

| Pr. | Name | Initial value | Setting range | Descripti | on |
|-------------|-------------|---------------------------|---------------|---------------------------------------|--|
| | | | 1 | Standard PID display setting | |
| | | | 2 | Extended PID display setting | |
| | | | 10 | GOT initial setting (PU connector) | "Controller Type" in GOT: |
| 000 | | tomatic parameter ting | 11 | GOT initial setting (RS-485 terminal) | FREQROL 500/700/800, SENSORLESS SERVO |
| 999 E431 | setting | | 12 | GOT initial setting (PU connector) | "Controller Type" in GOT: |
| L401 | 451 Setting | | 13 | GOT initial setting (RS-485 terminal) | FREQROL 800 (Automatic Negotiation) |
| | | | 20 | 50 Hz rated frequency | |
| | | | 21 | 60 Hz rated frequency | |
| | | | 9999 | No action | |

^{*1} The read value is always "9999"

♦ Automatic parameter setting (Pr.999)

• Select which parameters to automatically set from the following table, and set them in **Pr.999**. Multiple parameter settings are changed automatically. Refer to page 352 for the list of parameters that are changed automatically.

| Pr.999 setting | | Description | Operation in the automatic parameter setting mode |
|-------------------|-----------------------|--|---|
| 1 | Sets the standar | d monitor indicator setting of PID control. | "1". (AUTO) \rightarrow " (PID) \rightarrow Write |
| 2 | Automatically se | ts the monitor indicator for PID control. | "2". (AUTO) \rightarrow " (PID) \rightarrow Write |
| 10 | connection with | ts the communication parameters for the GOT a PU connector ("Controller Type" in GOT: 700/800, SENSORLESS SERVO) | " |
| 11 | connection with | ts the communication parameters for the GOT RS-485 terminals ("Controller Type" in GOT: 700/800, SENSORLESS SERVO) | _ |
| 12 | connection with | ts the communication parameters for the GOT a PU connector ("Controller Type" in GOT: (Automatic Negotiation)) | "AUTO) \rightarrow "GOT) \rightarrow Write "2". |
| 13 | connection with | ts the communication parameters for the GOT RS-485 terminals ("Controller Type" in GOT: (Automatic Negotiation)) | _ |
| 20 | 50 Hz rated frequency | Sets the related parameters of the rated frequency according to the power supply | " |
| 21 | 60 Hz rated frequency | frequency | _ |

NOTE

• If the automatic setting is performed with **Pr.999** or the automatic parameter setting mode, the settings including the changed parameter settings (changed from the initial setting) will be automatically changed. Before performing the automatic setting, confirm that changing the parameters will not cause any problem.

◆ PID monitor indicator setting (Pr.999 = "1 or 2")

| Pr. | Name | Initial value | Pr.999 = "1" | Pr.999 = "2" | Refer to page |
|-----------|-------------------------------------|---------------|--------------|-----------------------|---------------|
| 759 | PID unit selection | 9999 | 9999 | 4 | 615 |
| 1142 | Second PID unit selection | 9999 | 9999 | 4 | 013 |
| 774 | Operation panel monitor selection 1 | 9999 | 9999 | 52 | |
| 775 | Operation panel monitor selection 2 | 9999 | 9999 | 53 | 446 |
| 776 | Operation panel monitor selection 3 | 9999 | 9999 | 54 | |
| C42 (934) | PID display bias coefficient | 9999 | 9999 | 0 | |
| C44 (935) | PID display gain coefficient | 9999 | 9999 | 100 | 615 |
| 1136 | Second PID display bias coefficient | 9999 | 9999 | 0 | 013 |
| 1138 | Second PID display gain coefficient | 9999 | 9999 | 100 | |
| _ | 3-line monitor setting | _ | Invalid | Enabled*1*2*3 | _ |
| _ | Direct setting | _ | Invalid | Enabled ^{*3} | _ |
| _ | Dedicated parameter list function | _ | Invalid | Enabled ^{*3} | _ |

^{*1} Enabled when the FR-LU08 (-01) is used.

■ 3-line monitor setting

On the operation panel or parameter unit, the 3-line monitor is used as the first monitor.

■ Direct setting

Pressing the [FUNC] key on the FR-PU07-01 displays the direct setting screen. The PID action set point can be directly set regardless of the operation mode or **Pr.77 Parameter write selection** setting.

^{*2} Enabled when the FR-PU07 is used.

^{*3} Enabled when the FR-PU07-01 is used.

Pressing the [FUNC] key on the direct setting screen displays the function menu.

| Direct setting | Parameter to be set |
|------------------|------------------------------------|
| Direct setting 1 | Pr.133 PID action set point |
| Direct setting 2 | Pr.755 Second PID action set point |

■ Dedicated parameter list function

Pressing the [PrSET] key of the FR-PU07-01 displays the dedicated parameter list. Parameters that need to be set first for the PID extended display setting are listed.

| Dedicated parameter list | Parameter to be set |
|--------------------------|--------------------------------------|
| No.1 | Pr.999 Automatic parameter setting |
| No.2 | Pr.934 PID display bias coefficient |
| No.3 | Pr.935 PID display bias analog value |



- The display of parameters other than the above may be changed due to changes in **C42 or C44**. Set the PID monitor indicator before changing the settings of other parameters.
- To use the direct setting on the LCD operation panel, set Pr.1000 Direct setting selection. (Refer to page 340.)

◆ GOT initial setting (PU connector) (Pr.999 = "10, 12")

| Pr. | Name | Initial value | Pr.999 = "10" | Pr.999 = "12" | Refer to page |
|-----|--|---------------|---------------|-----------------|---------------|
| 79 | Operation mode selection | 0 | 1 | 1 | 389 |
| 118 | PU communication speed | 192 | 192 | 1152 | |
| 119 | PU communication stop bit length / data length | 1 | 10 | 0 | |
| 120 | PU communication parity check | 2 | 1 | 1 | |
| 121 | PU communication retry count | 1 | 9999 | 9999 | 670 |
| 122 | PU communication check time interval | | 9999 | 9999 | |
| 123 | 123 PU communication waiting time setting | | 0 ms | 0 ms | |
| 124 | PU communication CR/LF selection | 1 | 1 | 1 | |
| 340 | Communication startup mode selection | 0 | 0 | 0 | 398 |
| 414 | PLC function operation selection | 0 | _ | 2 ^{*1} | 646 |

^{*1} The setting is changed when **Pr.414** = "0" (initial setting).

■ Initial setting with the GOT2000 series

- When "FREQROL 500/700/800, SENSORLESS SERVO" is selected for "Controller Type" in the GOT setting, set **Pr.999** = "10" to configure the GOT initial setting.
- When "FREQROL 800 (Automatic Negotiation)" is selected for "Controller Type" in the GOT setting, the GOT automatic connection can be used. When "FREQROL 800 (Automatic Negotiation)" is selected for "Controller Type" in the GOT setting and the GOT automatic connection is not used, set **Pr.999** = "12" to configure the GOT initial setting. (Refer to page 701.)

■ Initial setting with the GOT1000 series

• Set Pr.999 = "10" to configure the GOT initial setting.



- · Always perform an inverter reset after the initial setting.
- For details on connection with GOT, refer to the Instruction Manual of GOT.

◆ GOT initial setting (RS-485 terminals) (Pr.999 = "11, 13")

| Pr. | Name | Initial value | Pr.999 = "11" | Pr.999 = "13" | Refer to page |
|-----|--|---------------|---------------|---------------|---------------|
| 79 | Operation mode selection | 0 | 0 | 0 | 389 |
| 332 | RS-485 communication speed | 96 | 192 | 1152 | |
| 333 | RS-485 communication stop bit length / data length | | 10 | 0 | |
| 334 | RS-485 communication parity check selection | 2 | 1 | 1 | 670 |
| 335 | RS-485 communication retry count | 1 | 9999 | 9999 | |
| 336 | RS-485 communication check time interval | | 9999 | 9999 | |
| 337 | RS-485 communication waiting time setting | 9999 | 0 ms | 0 ms | |
| 340 | Communication startup mode selection | 0 | 1 | 1 | 398 |
| 341 | RS-485 communication CR/LF selection | 1 | 1 | 1 | 670 |
| 414 | PLC function operation selection | 0 | _ | 2*1 | 646 |
| 549 | Protocol selection | 0 | 0 | 0 | 686 |

^{*1} The setting is changed when **Pr.414** = "0" (initial setting).

■ Initial setting with the GOT2000 series

- When "FREQROL 500/700/800, SENSORLESS SERVO" is selected for "Controller Type" in the GOT setting, set Pr.999 = "11" to configure the GOT initial setting.
- When "FREQROL 800 (Automatic Negotiation)" is selected for "Controller Type" in the GOT setting, the GOT automatic connection can be used. When "FREQROL 800 (Automatic Negotiation)" is selected for "Controller Type" in the GOT setting and the GOT automatic connection is not used, set Pr.999 = "13" to configure the GOT initial setting. (Refer to page 701.)

■ Initial setting with the GOT1000 series

• Set Pr.999 = "11" to configure the GOT initial setting.



- · Always perform an inverter reset after the initial setting.
- For details on connection with GOT, refer to the Instruction Manual of GOT.

Rated frequency (Pr.999 = "20" (50 Hz) or "21" (60 Hz))

| Pr. | Name | Initial value | | Pr.999 = "21" | Pr.999 = "20" | Refer to |
|-----------|---|---------------|---------|---------------|---------------|----------|
| FI. | Name | FM type | CA type | P1.999 - 21 | P1.333 - 20 | page |
| 3 | Base frequency | 60 Hz | 50 Hz | 60 Hz | 50 Hz | 707 |
| 4 | Multi-speed setting (high speed) | 60 Hz | 50 Hz | 60 Hz | 50 Hz | 411 |
| 20 | Acceleration/deceleration reference frequency | 60 Hz | 50 Hz | 60 Hz | 50 Hz | 367 |
| 37 | Speed display | 0 | | 0 | • | 444 |
| 55 | Frequency monitoring reference | 60 Hz | 50 Hz | 60 Hz | 50 Hz | 457 |
| 66 | Stall prevention operation reduction starting frequency | 60 Hz | 50 Hz | 60 Hz | 50 Hz | 431 |
| 116 | Third output frequency detection | 60 Hz | 50 Hz | 60 Hz | 50 Hz | 431 |
| 125 (903) | Terminal 2 frequency setting gain frequency | 60 Hz | 50 Hz | 60 Hz | 50 Hz | - 505 |
| 126 (905) | Terminal 4 frequency setting gain frequency | 60 Hz | 50 Hz | 60 Hz | 50 Hz | 303 |
| 263 | Subtraction starting frequency | 60 Hz | 50 Hz | 60 Hz | 50 Hz | |
| 266 | Power failure deceleration time switchover frequency | 60 Hz | 50 Hz | 60 Hz | 50 Hz | 642 |
| 386 | Frequency for maximum input pulse | 60 Hz | 50 Hz | 60 Hz | 50 Hz | 406 |
| 505 | Speed setting reference | 60 Hz | 50 Hz | 60 Hz | 50 Hz | 444 |
| 808 | Forward rotation speed limit/speed limit | 60 Hz | 50 Hz | 60 Hz | 50 Hz | 287 |
| C14 (918) | Terminal 1 gain frequency (speed) | 60 Hz | 50 Hz | 60 Hz | 50 Hz | 505 |

Extended parameter display and user group 5.7.17 **function**

This function restricts the parameters that are read by the operation panel and parameter unit.

| Pr. | Name | Initial value | Setting range | Description |
|-------------|---------------------------|--------------------|-----------------|---|
| 460 | | | 9999 | Only simple mode parameters are displayed. |
| 160 E440 | User group read selection | 0 | 0 | Displays simple mode and extended parameters. |
| 2440 | Sciedion | | 1 | Only parameters registered in user groups are displayed. |
| 172 E441 | | | (0 to 16) | Displays the number of parameters that are registered in the user groups. (Read-only) |
| E441 | display/batch clear | | 9999 | Batch clear of user group registrations |
| 173 E442 | User group registration | 9999 ^{*1} | 0 to 1999, 9999 | Sets the parameter number to register for the user group. |
| 174 E443 | User group clear | 9999 ^{*1} | 0 to 1999, 9999 | Sets the parameter number to clear from the user group. |

^{*1} The read value is always "9999".

◆ Display of simple mode parameters and extended parameters (Pr.160)

- When **Pr.160** = "9999", only the simple mode parameters are displayed on the operation panel (FR-DU08) and parameter unit (FR-PU07). (For the simple mode parameters, refer to the parameter list on page 166.)
- With the initial value (Pr.160 = "0", simple mode parameters and extended parameters can be displayed.



- · When a plug-in option in installed on the inverter, the option parameters can also be read.
- Every parameter can be read regardless of the Pr.160 setting when reading parameters via a communication option.
- When reading the parameters using the RS-485 terminals, all parameters can be read regardless of the Pr.160 setting by setting Pr.550 NET mode operation command source selection and Pr.551 PU mode operation command source selection.

| Pr.551 | Pr.550 | Pr.160 enabled/disabled | |
|--------------------------------|--------------------------------|--|--|
| 1 (RS-485) | _ | Enabled | |
| 0 (DLI) | 0 (Communication option) | Enabled | |
| 2 (PU), 3 (USB), | 1 (RS-485) | Disabled (All can be read) | |
| 9999 (Automatic determination) | 9999 (Automatic determination) | With communication option: Enabled | |
| (initial value) | (initial value) | Without communication option: Disabled (All can be read) | |

When the LCD operation panel (FR-LU08) or the parameter unit (FR-PU07) is installed, Pr.15 Jog frequency, Pr.16 Jog acceleration/deceleration time, C42 (Pr.934) PID display bias coefficient, C43 (Pr.934) PID display bias analog value, C44 (Pr.935) PID display gain coefficient, C45 (Pr.935) PID display gain analog value, Pr.991 PU contrast adjustment, Pr.1136 Second PID display bias coefficient, Pr.1137 Second PID display bias analog value, Pr.1138 Second PID display gain coefficient, and Pr.1139 Second PID display gain analog value are displayed as simple mode parameters.

◆ User group function (Pr.160, Pr.172 to Pr.174)

- The user group function is a function for displaying only the parameters required for a setting.
- A maximum of 16 parameters from any of the parameters can be registered in a user group. When Pr.160 = "1", reading/writing is enabled only for the parameters registered in user groups. (Parameters not registered in user groups can no longer be read.)
- To register a parameter in a user group, set the parameter number in Pr.173.
- To clear a parameter from a user group, set the parameter number in **Pr.174**. To batch clear all the registered parameters, set **Pr.172** = "9999".

◆ Registering a parameter in a user group (Pr.173)

· To register Pr.3 in a user group

Operating procedure

- Power ON
 Make sure the motor is stopped.
- **2.** Changing the operation mode

Press PU to choose the PU operation mode. [PU] indicator turns ON.

3. Selecting the parameter setting mode

Press Mode to choose the parameter setting mode. (The parameter number read previously appears)

4. Selecting a parameter

5. Parameter read

Press SET . "9999" appears.

6. Parameter registration

"P. $\Pi =$ " and $\Pi =$ " are displayed alternately.

To continue adding parameters, repeat steps 5 and 6.

◆ Clearing a parameter from a user group (Pr.174)

· To delete Pr.3 from a user group.

Operating procedure

1. Power ON

Make sure the motor is stopped.

2. Changing the operation mode

Press PU to choose the PU operation mode. [PU] indicator turns ON.

3. Selecting the parameter setting mode

Press Model to choose the parameter setting mode. (The parameter number read previously appears)

4. Selecting a parameter

Turn (a) until " | '| '| '| (Pr.174) appears.

5. Parameter read

Press SET . "9999" appears.

6. Clearing the parameter

Turn 😜 until "∃" (**Pr.3**) appears. Press set to delete the parameter.

" |- | '| and " |- are displayed alternately."

To continue deleting parameters, repeat steps 5 and 6.

NOTE

- Pr.77 Parameter write selection, Pr.160, Pr.296 Password lock level, Pr.297 Password lock/unlock and Pr.991 PU
 contrast adjustment can always be read regardless of the user group setting. (For Pr.991, only when the FR-LU08 or the
 FR-PU07 is connected.)
- Pr.77, Pr.160, Pr.172 to Pr.174, Pr.296, and Pr.297 cannot be registered in a user group.
- When Pr.174 is read, "9999" is always displayed. "9999" can be written, but it does not function.
- Pr.172 is disabled if set to a value other than "9999".

Parameters referred to

Pr.15 Jog frequency, Pr.16 Jog acceleration/deceleration time 🖾 page 410

Pr.77 Parameter write selection page 345

Pr.296 Password lock level, Pr.297 Password lock/unlock ☞ page 348 Pr.550 NET mode operation command source selection ☞ page 400

Pr.551 PU mode operation command source selection ☐ page 400

Pr.991 PU contrast adjustment □ page 340

5.7.18 PWM carrier frequency and Soft-PWM control

The motor sound can be changed.

| Pr. | Name | Initial value | Setting range | Description |
|-------------|------------------------------------|-----------------------|--------------------------|---|
| 72 E600 | PWM frequency selection | frequency selection 2 | | The PWM carrier frequency can be changed. The setting value represents the frequency in kHz. However, "0" indicates 0.7 kHz, "15" indicates 14.5 kHz, and "25" indicates 2.5 kHz. |
| | 2000 | | 0 to 6, 25 ^{*2} | (The setting value "25" is for the sine wave filter only.) |
| 240 | Soft-PWM operation | oft-PWM operation | | Soft-PWM control disabled. |
| E601 | selection | 1 | 1 | Soft-PWM control enabled. |
| 260 E602 | PWM frequency automatic switchover | 1 | 0 | PWM carrier frequency automatic reduction function disabled (for the LD, ND, or HD rating) |
| EUUZ | SWILCHOVE | | 1 | PWM carrier frequency automatic reduction function enabled |

 $^{^{*}1}$ The setting range of the FR-A820-03160(55K) or lower and the FR-A840-01800(55K) or lower

^{*2} The setting range of the FR-A820-03800(75K) or higher and the FR-A840-02160(75K) or higher

♦ Changing the PWM carrier frequency (Pr.72)

- · The PWM carrier frequency of the inverter can be changed.
- Changing the PWM carrier frequency can be effective for avoiding the resonance frequency of the mechanical system or motor, as a countermeasure against EMI generated from the inverter, or for reducing leakage current caused by PWM switching
- Under Real sensorless vector control, vector control, and PM sensorless vector control, the following carrier frequencies
 are used

(For the control method and fast-response mode selection, refer to Pr.800 Control method selection on page 221.)

| | | Carrier frequency (kHz) | | |
|---------------|---|-------------------------------|--------------------|--|
| Pr.72 setting | Real sensorless vector control, Vector control | PM sensorless vector control, | Fast-response mode | |
| 0 | | | | |
| 1 | | | | |
| 2 | 2 | 6*1 | | |
| 3 | | O | 4 | |
| 4 | | | | |
| 5 | | | | |
| 6 | | 6 | | |
| 7 | 6 ^{*2} | | | |
| 8 | 0 | | - 8 | |
| 9 | | | | |
| 10 | | | 0 | |
| 11 | 10 ^{*2} | 10 | | |
| 12 | IU | | | |
| 13 | | | 12 | |
| 14 | 14*2 | 14 | - 12 | |
| 15 | 14 | 17 | | |

- *1 When low-speed range high-torque characteristic is disabled (Pr.788 = "0"), 2 kHz is used.
- *2 In the low-speed range (less than 3 Hz) under Real sensorless vector control, the carrier frequency is automatically changed to 2 kHz. (For the FR-A820-00490(7.5K) or lower and the FR-A840-00250(7.5K) or lower)
- When using an optional sine wave filter (MT-BSL/BSC), set "25" (2.5 kHz) in Pr.72. (FR-A820-03800(75K) or higher, FR-A840-02160(75K) or higher.)

NOTE

- In the low-speed range (less than about 10 Hz), the carrier frequency may be automatically lowered. Motor noise increases, but not to the point of failure.
- When Pr.72 = "25", the following limitations apply.
 - V/F control is forcibly set.
 - Soft-PWM control is disabled.
 - The maximum output frequency is 60 Hz.

◆ Soft-PWM control (Pr.240)

- Soft-PWM control is a function that changes the motor noise from a metallic sound into an inoffensive, complex tone.
- Setting **Pr.240** = "1" will enable the Soft-PWM control.
- To enable the Soft-PWM control, set Pr.72 to 5 kHz or less for the FR-A820-03160(55K) or lower or the FR-A840-01800(55K) or lower. For the FR-A820-03800(75K) or higher or the FR-A840-02160(75K) or higher, set Pr.72 to 4 kHz or less.



• While a sine wave filter (**Pr.72** = "25") is being used, the Soft-PWM control is disabled.

◆ PWM carrier frequency automatic reduction function (Pr.260)

- Setting **Pr.260** = "1 (initial value)" will enable the PWM carrier frequency auto-reduction function. If a heavy load is continuously applied while the inverter carrier frequency is set to 3 kHz or higher (**Pr.72** ≥ "3"), the carrier frequency is automatically reduced to prevent occurrence of the inverter overload trip (electronic thermal O/L relay function) (E.THT). The carrier frequency is reduced to as low as 2 kHz. Motor noise increases, but not to the point of failure.
- When the carrier frequency automatic reduction function is used, operation with the carrier frequency set to 3 kHz or higher (Pr.72 ≥ 3) automatically reduces the carrier frequency for heavy-load operation as shown below.

| Pr.260 | | Carrier frequency automatic reduction operation | | | | |
|---------|-----------------|---|--|--|--|--|
| setting | Pr.570 setting | FR-A820-04750(90K) or lower, FR-A840- 02600(90K) or lower | FR-A840-03250(110K) or higher | | | |
| | 0 (SLD), 1 (LD) | The carrier frequency will reduce automatically with current or higher. | continuous operation of 85% of the inverter rated | | | |
| 1 | 2 (ND), 3 (HD) | The carrier frequency will reduce automatically with operation of 150% of the inverter ND rated current or higher. | Continuous operation with the 85% or higher inverter rated current for the ND rating reduces the carrier frequency automatically. | | | |
| | 0 (SLD) | The carrier frequency will reduce automatically with continuous operation of 85% of the inverter rated current or higher. | | | | |
| 0 | 1 (LD) | Without carrier frequency automatic reduction (Perfoset to 2 kHz or lower or with less than 85% of the in | | | | |
| | 2 (ND), 3 (HD) | Without carrier frequency automatic reduction | Without carrier frequency automatic reduction (Perform continuous operation with the carrier frequency set to 2 kHz or lower or with less than 85% of the inverter rated current for the ND rating.) | | | |



- Reducing the PWM carrier frequency is effective as a countermeasure against EMI from the inverter or for reducing leakage current, but doing so increases the motor noise.
- When the PWM carrier frequency is set to 1 kHz or lower (Pr.72 ≤ 1), the increase in the harmonic current causes the fast-response current limit to activate before the stall prevention operation, which may result in torque shortage. In this case, disable the fast-response current limit in Pr.156 Stall prevention operation.
- The lower limit of carrier frequency after the reduction under PM sensorless vector control (low-speed range high-torque characteristic enabled) is 6 kHz.
- During fast-response operation, the carrier frequency automatic reduction function is disabled.

Parameters referred to

Pr.156 Stall prevention operation selection ☐ page 431

Pr.570 Multiple rating setting page 343

Pr.788 Low speed range torque characteristic selection page 233

Pr.800 Control method selection page 221

5.7.19 Inverter parts life display

The degree of deterioration of the control circuit capacitor, main circuit capacitor, cooling fan, inrush current limit circuit, and relay contacts of terminals A, B, and C can be diagnosed on the monitor. When a part approaches the end of its life, an alarm can be output by self diagnosis to prevent a fault. (Note that the life diagnosis of this function should be used as a guideline only, because with the exception of the main circuit capacitor, the life values are theoretical calculations.)

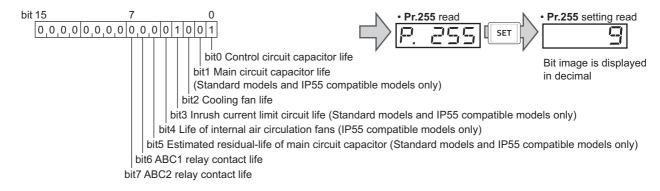
| Pr. | Name | Initial value | Setting range | Description |
|---------------------------|--|---------------|------------------------|--|
| 255 E700 | Life alarm status display | 0 | (0 to 255)*1 | Displays whether or not the parts of the control circuit capacitor, main circuit capacitor, cooling fan, and inrush current limit circuit have reached the life alarm output level. Read-only. |
| 256 E701 ^{*2} | Inrush current limit circuit life display | 100% | (0 to 100%) | Displays the degree of deterioration for the inrush current limit circuit. Read-only. |
| 257 E702 | Control circuit capacitor life display | 100% | (0 to 100%) | Displays the degree of deterioration for the control circuit capacitor. Read-only. |
| 258 E703 ^{*2} | Main circuit capacitor life display | 100% | (0 to 100%) | Displays the degree of deterioration for the main circuit capacitor. Read-only. |
| E703 | | | | The value measured by Pr.259 is displayed. |
| 259 M | Main circuit capacitor life | | 0, 1 (2, 3, 8, 9) | Setting "1" and turning the power supply OFF starts the measurement of the main circuit capacitor life. If the setting value of Pr.259 becomes "3" after turning the power supply ON again, it means that the measurement is completed. The degree of deterioration is read to Pr.258 . |
| E704 ^{*2} | measuring | 0 | 11 (12, 13, 18, 19) | When "11" is set, turning OFF the power supply starts the measurement of the main circuit capacitor life. If the setting value of Pr.259 becomes "13" after turning the power supply ON again, it means that the measurement is completed. The degree of deterioration is read to Pr.258 . |
| 506 E705 ^{*2} | Display estimated main circuit capacitor residual life | 100% | (0 to 100%) | Displays the estimated residual life of the main circuit capacitor. Read-only. |
| 507 E706 | Display/reset ABC1 relay contact life | 100% | 0 to 100% | Displays the degree of deterioration of the relay contacts of terminals A1, B1, and C1. |
| 508 E707 | Display/reset ABC2 relay contact life | 100% | 0 to 100% | Displays the degree of deterioration of the relay contacts of terminals A2, B2, and C2. |

- The setting range (read-only) differs depending on the inverter model (standard model, separate converter type, or IP55 compatible model).
- *2 The setting is available for the standard structure model and the IP55 compatible model.

◆ Life alarm display and signal output (Y90 signal, Pr.255)



- In the life diagnosis of the main circuit capacitor, the Life alarm (Y90) signal is not output unless measurement by turning OFF
 the power supply is performed.
- Whether or not the parts of the control circuit capacitor, main circuit capacitor, cooling fan, inrush current limit circuit, internal air circulation fans, or relay contacts of terminals A, B, and C have reached the life alarm output level can be checked with Pr.255 Life alarm status display and the Life alarm (Y90) signal. (Internal air circulation fans are equipped with IP55 compatible models.)



When the parts have reached the life alarm output level, the corresponding bits of Pr.255 turns ON. The ON/OFF state of
the bits can be checked with Pr.255. The following table shows examples.

| Pr. | Pr.255 | | bit 7 bit 6 | | 7 bit 6 bit 5 l | bit 4 bit 3 | bit 2 bit | bit 1 | oit 1 bit 0 | Remarks | |
|---------|----------|-------|-------------|-------|-----------------|-------------|-----------|-------|-------------|--|--|
| Decimal | Binary | DIL 7 | DIL 0 | DIL 3 | DIL 4 | DIL 3 | DIL 2 | DIL I | DIL U | Remarks | |
| 239 | 11101111 | 0 | 0 | 0 | × | 0 | 0 | 0 | 0 | All parts have reached alarm output level for standard structure models. | |
| 5 | 101 | × | × | × | × | × | 0 | × | 0 | Control circuit capacitor and cooling fan have reached alarm output level. | |
| 0 | 0 | × | × | × | × | × | × | × | × | No parts have reached alarm output level. | |

- o: Parts reaching alarm output level x: Parts not reaching alarm output level
 - · Diagnosable parts differ depending on the type of the inverter.

| Part | Applicable inverter | | | | | | |
|--|---------------------|--------------------------|-----------------------|--|--|--|--|
| Fait | Standard model | Separated converter type | IP55 compatible model | | | | |
| Control circuit capacitor | 0 | 0 | 0 | | | | |
| Main circuit capacitor | 0 | × | 0 | | | | |
| Cooling fan | 0 | 0 | 0 | | | | |
| Inrush current limit circuit | 0 | × | 0 | | | | |
| Internal air circulation fan | × | × | 0 | | | | |
| Main circuit capacitor (estimated residual life) | 0 | × | 0 | | | | |
| ABC relay contact | 0 | 0 | 0 | | | | |

- o: Diagnosable, x: Undiagnosable
 - The Life alarm (Y90) signal turns ON when the life alarm output level is reached for either of the following: the control circuit capacitor life, main circuit capacitor life, cooling fan life, inrush current limit circuit life, internal air circulation fan life, estimated residual-life of the main circuit capacitor, ABC1 relay contact life, or ABC2 relay contact life.
 - For the terminal used for the Y90 signal, set "90" (positive logic) or "190" (negative logic) in any of **Pr.190 to Pr.196 (Output terminal function selection)**.



- When using an option (FR-A8AY, FR-A8AR, FR-A8NC, FR-A8NCE, or FR-A8NCG), warning signals can be output
 individually: the Control circuit capacitor life (Y86) signal, Main circuit capacitor life (Y87) signal, Cooling fan life (Y88) signal,
 Inrush current limit circuit life (Y89) signal, Estimated residual-life of main circuit capacitor (Y248) signal, ABC1 relay contact
 life (Y249) signal, and ABC2 relay contact life (Y250) signal.
- Changing the terminal assignment using **Pr.190 to Pr.196 (Output terminal function selection)** may affect the other functions. Set parameters after confirming the function of each terminal.

◆ Life display of the inrush current limit circuit (Pr.256) (Standard models and IP55 compatible models)

- · The life of the inrush current limit circuit (relay, contactor and inrush resistor) is displayed in Pr.256.
- The number of contact (relay, contactor, thyristor) ON times is counted, and it is counted down from 100% (0 time) every 1%/10,000 times. When the counter reaches 10% (900,000 times), bit 3 of **Pr.255** is turned ON (set to 1) and the Y90 signal is also output as an alert.

♦ Life display of the control circuit capacitor (Pr.257)

- The degree of deterioration for the control circuit capacitor is displayed in Pr.257.
- In the operating status, the control circuit capacitor life is calculated from the energization time and temperature, and is
 counted down from 100%. When the counter goes down from 10%, bit 0 of Pr.255 is turned ON (set to 1) and the Y90
 signal is also output as an alert.

◆ Life display of the main circuit capacitor (Pr.258, Pr.259) (Standard models and IP55 compatible models)

Point P

- For accurate life measurement of the main circuit capacitor, wait three hours or longer after turning OFF. The temperature left in the main circuit capacitor affects measurement.
- The degree of deterioration for the main circuit capacitor is displayed in Pr.258.
- With the main circuit capacitor capacity at factory shipment as 100%, the capacitor life is displayed in Pr.258 every time
 measurement is made. When the measured value falls to 85% or lower, bit 1 of Pr.255 is turned ON (set to 1) and the Y90
 signal is also output as an alert.
- Measure the capacitor capacity according to the following procedure and check the degree of deterioration for the capacitor capacity.
 - **1.** Check that the motor is connected and at a stop.
 - **2.** Set "1 or 11" (measuring start) in **Pr.259**.
 - **3.** Switch the power OFF. The inverter applies DC voltage to the motor to measure the capacitor capacity while the inverter is OFF.
 - **4.** After confirming that the power lamp is OFF, turn ON the power again.
 - **5.** Check that "3 or 13" (measurement complete) is set in **Pr.259**, read **Pr.258**, and check the degree of deterioration for the main circuit capacitor.

| Pr.259 | Description | Remarks |
|--------|----------------------|---|
| 0 | No measurement | Initial value |
| 1, 11 | Start measurement | Measurement starts when the power supply is switched OFF. (Only once when Pr.259 = "1") When Pr.259 = "11", the measurement starts every time the power supply is turned OFF. |
| 2, 12 | During measurement | |
| 3, 13 | Measurement complete | Only displayed and cannot be set. (When "11" is set in Pr.259, "12, |
| 8, 18 | Forced end | 13, 18, or 19" is displayed.) |
| 9, 19 | Measurement error | |

NOTE

- When the main circuit capacitor life is measured under the following conditions, "forced end" (**Pr.259** = "8 or 18"), or "measurement error" (**Pr.259** = "9 or 19") may occur, or the status may remain in "measurement start" (**Pr.259** = "1 or 11"). To perform measurement, first eliminate the following conditions. Under the following conditions, even if "measurement complete" (**Pr.259** = "3 or 13") is reached, measurement cannot be performed correctly.
 - FR-HC2, FR-XC (common bus regeneration mode), FR-CV, MT-RC, or a sine wave filter (when Pr.72 = "25") is connected.
 - Terminals R1/L11, S1/L21 or DC power supply is connected to terminals P/+ and N/-.
 - The power supply is switched ON during measurement.
 - The motor is not connected to the inverter.
 - The motor is running (coasting).
 - The motor capacity is smaller than the inverter capacity by two ranks or more.
 - The inverter output is shut off or a fault occurred while the power was OFF.
 - The inverter output is shut off with the MRS signal.
 - The start command is given while measuring.
 - The applied motor setting is incorrect.
- Operation environment: Surrounding air temperature (annual average of 40°C (free from corrosive gas, flammable gas, oil mist, dust and dirt)).
 - Output current: 80% of the inverter rating
- Since repeated inrush currents at power ON will shorten the life of the converter circuit, frequent starts and stops of the magnetic contactor must be avoided.

^WARNING

• When measuring the main circuit capacitor capacity (**Pr.259** = "1 or 11"), the DC voltage is applied to the motor for about 1 second at power OFF. Never touch the motor terminal, etc. right after powering OFF to prevent an electric shock.

♦ Life display of the cooling fan

- If a cooling fan speed of less than the specified speed is detected, Fan alarm " \ " (FN) is displayed on the operation panel or the parameter unit. As an alert output, bit 2 of **Pr.255** is turned ON (set to 1), and the Y90 signal and Alarm (LF) signal are also output.
- For the terminal used for the LF signal, set "98" (positive logic) or "198" (negative logic) in any of **Pr.190 to Pr.196 (Output terminal function selection)**.



- · When the inverter is mounted with two or more cooling fans, "FN" is displayed even only one of the fans is detected.
- Changing the terminal assignment using **Pr.190 to Pr.196 (Output terminal function selection)** may affect the other functions. Set parameters after confirming the function of each terminal.
- · For replacement of each part, contact the nearest Mitsubishi FA center.

Estimated residual life display of the main circuit capacitor (Pr.506) (Standard models and IP55 compatible models)

- Even when the power supply cannot be turned OFF, the remaining life of the main circuit capacitor can be estimated without stopping the operation. Note that the remaining life of the main circuit capacitor estimated by this function is theoretical, and should be used as a guideline only.
- · The estimated residual life of the main circuit capacitor is displayed in Pr.506.
- The remaining life of the main circuit capacitor is calculated from the energization time and the inverter output power (100% = Start of service life). When the remaining life of the main circuit capacitor falls below 10%, bit 5 of Pr.255 Life alarm status display turns ON and a warning is output by the Y90 signal.

◆ Life display of the relay contacts of terminals A, B, and C (Pr.507, Pr.508)

- The degree of deterioration of the relay contacts of terminals A1, B1, and C1 is displayed in **Pr.507**, and that for terminals A2, B2, and C2 is displayed in **Pr.508**.
- The number of times the contacts of relay turn ON is counted down from 100% (0 time) by 1% (500 times). When the counter reaches 10% (45,000 times), bit 6 or bit 7 of **Pr.255** turns ON and a warning is output by the Y90 signal.
- Any value can be set in **Pr.507** and **Pr.508**. After replacement of the control circuit terminal block or installation of a control terminal option, set **Pr.507** and **Pr.508** again.

◆ Life display of internal air circulation fans (IP55 compatible models)

- IP55 compatible models are equipped with the internal air circulation fan inside the inverter other than the cooling fan. The internal fan fault " [FN2] appears on the operation panel (FR-DU08) when the rotations per minute is less than 70% of the rated value for the internal air circulation fan. (FN is displayed on the parameter unit (FR-PU07).) As an alarm display, Pr.255 bit 4 is turned ON and also a warning is output to the Y90 signal and Alarm (LF) signal.
- For the terminal used for the LF signal, set "98" (positive logic) or "198" (negative logic) in any of **Pr.190 to Pr.196 (Output terminal function selection)**.

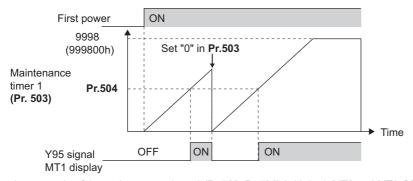


- Changing the terminal assignment using Pr.190 to Pr.196 (Output terminal function selection) may affect the other functions. Set parameters after confirming the function of each terminal.
- For replacement of each part, contact the nearest Mitsubishi FA center.

5.7.20 Maintenance timer alarm

The Maintenance timer (Y95) signal is output when the inverter's cumulative energization time reaches the time period set with the parameter. MT1, MT2 or MT3 is displayed on the operation panel. This can be used as a guideline for the maintenance time of peripheral devices.

| Pr. | Name | Initial value | Setting range | Description | |
|-------------|---|---------------|---------------|--|--|
| 503 E710 | Maintenance timer 1 | 0 | 0 (1 to 9998) | Displays the inverter's cumulative energization time in increments of 100 h (read-only). Writing the setting of "0" clears the cumulative energization time while Pr.503 = "1 to 9998". (Writing is disabled when Pr.503 = "0".) | |
| 504 E711 | Maintenance timer 1 warning output set time | 9999 | 0 to 9998 | Set the time until the Maintenance timer (Y95) signal is output. "MT1" is displayed on the operation panel. | |
| | warming output set time | | 9999 | Without the function | |
| 686 E712 | Maintenance timer 2 | 0 | 0 (1 to 9998) | The same function as Pr.503 . | |
| 687 | Maintenance timer 2 | 9999 | 0 to 9998 | The same function as Pr.504 . | |
| E713 | warning output set time | 9999 | 9999 | "MT2" is displayed on the operation panel. | |
| 688 E714 | Maintenance timer 3 | 0 | 0 (1 to 9998) | The same function as Pr.503 . | |
| 689 | Maintenance timer 3 | 9999 | 0 to 9998 | The same function as Pr.504 . | |
| E715 | warning output set time | 3333 | 9999 | "MT3" is displayed on the operation panel. | |



Operation example of the maintenance timer 1 (Pr.503, Pr.504) (with both MT2 and MT3 OFF)

- The cumulative energization time of the inverter is stored in the EEPROM every hour and displayed in **Pr.503 (Pr.686, Pr.688)** in 100 h increments. **Pr.503 (Pr.686, Pr.688)** is clamped at 9998 (999800 h).
- When the value in **Pr.503** (**Pr.686**, **Pr.688**) reaches the time (100 h increments) set in **Pr.504** (**Pr.687**, **Pr.689**), the Maintenance timer (Y95) signal is output, and also " (MT1), " (MT1), " (MT2), or " (MT2), or " (MT3) is displayed on the operation panel.
- For the terminal used for the Y95 signal output, assign the function by setting "95 (positive logic)" or "195 (negative logic)" in any of **Pr.190 to Pr.196 (Output terminal function selection)**.

→ NOTE

- The Y95 signal turns ON when any of MT1, MT2 or MT3 is activated. It does not turn OFF unless all of MT1, MT2 and MT3
 are cleared
- If all of MT1, MT2 and MT3 are activated, they are displayed in the priority of "MT1 > MT2 > MT3".
- The cumulative energization time is counted every hour. Energization time of less than 1 h is not counted.
- Changing the terminal assignment using Pr.190 to Pr.196 (Output terminal function selection) may affect the other functions. Set parameters after confirming the function of each terminal.

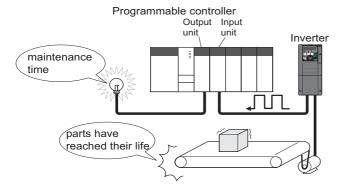
Parameters referred to

Pr.190 to Pr.196 (Output terminal function selection) page 473

5.7.21 Current average value monitor signal

The output current average value during constant-speed operation and the maintenance timer value are output to the Current average monitor (Y93) signal as a pulse. The output pulse width can be used in a device such as the I/O unit of a programmable controller as a guideline for the maintenance time for mechanical wear, belt stretching, or deterioration of devices with age.

The pulse is repeatedly output during constant-speed operation in cycles of 20 seconds to the Current average monitor (Y93) signal.

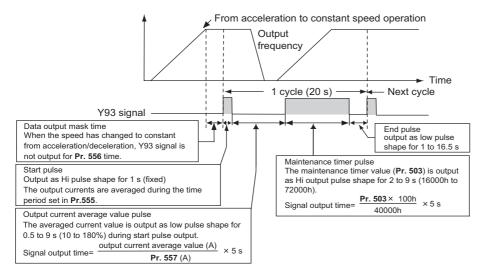


| Pr. | Name | Initial value | Setting range | Description |
|-------------|---|----------------|--------------------------|--|
| 555 E720 | Current average time | 1 s | 0.1 to 1 s | Set the time for calculating the average current during start pulse output (1 second). |
| 556 E721 | Data output mask time | 0 s | 0 to 20 s | Set the time for not obtaining (masking) transitional state data. |
| 557 | Current average value | Inverter rated | 0 to 500 A ^{*1} | Set the reference (100%) for outputting the output current |
| E722 | monitor signal output reference current | current | 0 to 3600 A*2 | average value signal. |

- *1 For the FR-A820-03160(55K) or lower, and FR-A840-01800(55K) or lower.
- *2 For the FR-A820-03800(75K) or higher, and FR-A840-02160(75K) or higher.

◆ Operation example

- The pulse output of the Current average monitor (Y93) signal is indicated below.
- For the terminal used for the Y93 signal output, assign the function by setting "93 (positive logic)" or "193 (negative logic)" in any of Pr.190 to Pr.194 (Output terminal function selection). (This cannot be assigned by setting in Pr.195 ABC1 terminal function selection or Pr.196 ABC2 terminal function selection.)



◆ Pr.556 Data output mask time setting

• Immediately after acceleration/deceleration is shifted to constant-speed operation, the output current is unstable (transitional state). Set the time for not obtaining (masking) transitional state data in **Pr.556**.

♦ Pr.555 Current average time setting

• The output current average is calculated during start pulse (1 second) HIGH output. Set the time for calculating the average current during start pulse output in **Pr.555**.

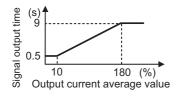
◆ Pr.557 Current average value monitor signal output reference current setting

Set the reference (100%) for outputting the output current average value signal. The signal output time is calculated with the following formula.

The output time range is 0.5 to 9 seconds. When the output current average value is less than 10% of the setting value in **Pr.557**, the output time is 0.5 seconds, and when it is more than 180%, the output time is 9 seconds.

For example, when **Pr.557** = 10 A and the output current average value is 15 A:

15 A/10 A × 5 s = 7.5 s, thus the Current average monitor signal maintains LOW output for 7.5 seconds.



◆ Pr.503 Maintenance timer 1 output

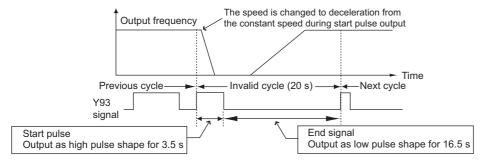
After LOW output of the output current value is performed, HIGH output of the maintenance timer value is performed. The maintenance timer value output time is calculated with the following formula.

The output time range is 2 to 9 seconds. When **Pr.503** is less than 16000 hours, the output time is 2 seconds. When it is more than 72000 hours, the output time is 9 seconds.





- Masking of the data output and sampling of the output current are not performed during acceleration/deceleration.
- If constant speed changes to acceleration or deceleration during start pulse output, it is judged as invalid data, and the signal maintains HIGH start pulse output for 3.5 seconds and LOW end pulse output for 16.5 seconds. After the start pulse output is completed, minimum 1-cycle signal output is performed even if acceleration/deceleration is performed.



- If the output current value (inverter output current monitor) is 0 A at the completion of the 1-cycle signal output, no signal is output until the next constant-speed state.
- Under the following conditions, the Y93 signal maintains LOW output for 20 seconds (no data output).
 - When acceleration or deceleration is operating at the completion of the 1-cycle signal output
 - When automatic restart after instantaneous power failure (**Pr.57 Restart coasting time** ≠ "9999") is set, and the 1-cycle signal output is completed during the restart operation.
 - When automatic restart after instantaneous power failure (**Pr.57** ≠ "9999") is set, and the restart operation was being performed at the completion of data output masking.
- · Pr.686 Maintenance timer 2 and Pr.688 Maintenance timer 3 cannot be output.
- Changing the terminal assignment using Pr.190 to Pr.196 (Output terminal function selection) may affect the other functions. Set parameters after confirming the function of each terminal.

Parameters referred to

Pr.57 Restart coasting time page 628, page 635

Pr.190 to Pr.196 (Output terminal function selection) page 473

Pr.503 Maintenance timer 1, Pr.686 Maintenance timer 2, Pr.688 Maintenance timer 3 page 363

5.8 (F) Setting of acceleration/deceleration time and acceleration/deceleration pattern

| Purpose | Par | Refer to page | | |
|--|---|---|---|----------|
| To set the motor acceleration/ deceleration time | Acceleration/deceleration time | P.F000 to P.F003, P.F010, P.F011, P.F020 to P.F022, P.F030, P.F031, P.F040, P.F070, P.F071, P.G264 | Pr.7, Pr.8, Pr.16, Pr.20, Pr.21, Pr.44, Pr.45, Pr.110, Pr.111, Pr.147, Pr.611, Pr.791, Pr.792, Pr.1103, Pr.1349 | 367 |
| To set the acceleration/deceleration pattern suitable for an application | Acceleration/deceleration pattern and backlash measures | P.F100, P.F200 to P.F203, P.F300 to P.F303, P.F400 to P.F403 | Pr.29, Pr.140 to Pr.143, Pr.380 to Pr.383, Pr.516 to Pr.519 | 372 |
| To command smooth speed transition with terminals | Remote setting function | P.F101 | Pr.59 | 377 |
| To set the starting frequency | Starting frequency and start- time hold | P.F102, P.F103 | Pr.13, Pr.571 | 381, 382 |
| To set optimum acceleration/ deceleration time automatically | Automatic acceleration/ deceleration | P.F500, P.F510 to P.F513 | Pr.61 to Pr.63, Pr.292 | 384 |
| To set V/F pattern for lift automatically | Lift operation (Automatic acceleration/deceleration) | P.F500 to P.F510, P.F520 | Pr.61 to Pr.64, Pr.292 | 387 |

5.8.1 Setting the acceleration and deceleration time

The following parameters are used to set motor acceleration/deceleration time.

Set a larger value for a slower acceleration/deceleration, or a smaller value for a faster acceleration/deceleration.

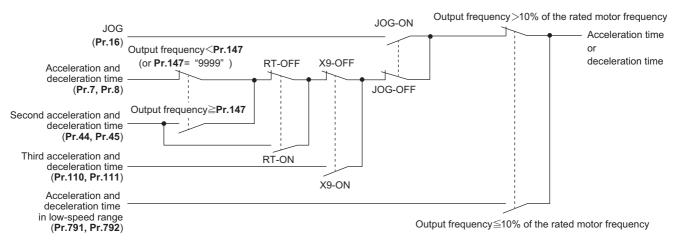
For the acceleration time at automatic restart after instantaneous power failure, refer to Pr.611 Acceleration time at a restart (page 628, page 635).

| D. | Name Initial value | | value | Catting rooms | Description | | | |
|--------------|---|-------------------|-------|---|--|---|---|--|
| Pr. | Name | FM | CA | Setting range | · · | | | |
| 20 F000 | Acceleration/ deceleration reference frequency | 60 Hz 50 Hz | | 1 to 590 Hz | Set the frequency that is the basis of acceleration/deceleration time. As acceleration/deceleration time, set the time required to change the frequency from a stop status (0 Hz) to the frequency set in Pr. and vice versa. | | | |
| 21 | Acceleration/ | 0 | | 0 | Increment: 0.1 s Select the increment for | | | |
| F001 | deceleration time increments | | | 1 | Increment: 0.01 s | the acceleration/ deceleration time setting. | | |
| 16 F002 | Jog acceleration/ deceleration time | 0.5 s | | 0 to 3600 s | Set the acceleration/deceleration time for status to Pr.20). Refer to page 410. | or JOG operation (from stop | | |
| 611 | Acceleration time | | | 0 to 3600 s | Set the acceleration time for restart (from | | | |
| F003 | at a restart | 9999 | | 9999 | Standard acceleration time (for example acceleration time at restart. Refer to page | | | |
| 7 | Acceleration time | 5s ^{*1} | | 0 to 3600 s | Set the motor acceleration time (time re | quired to change the | | |
| F010 | Acceleration time | 15s ^{*2} | | 0 10 3000 \$ | frequency from a stop status (0 Hz) to the | ne frequency set in Pr.20). | | |
| 8 | 5 | 5s ^{*1} | | 0.10000 | | | | |
| F011 | Deceleration time | 15s ^{*2} | | 0 to 3600 s | Set the motor deceleration time (from P | r.20 to stop status). | | |
| 44 F020 | Second acceleration/ deceleration time | 5 s | | 0 to 3600 s | Set the acceleration/deceleration time used while the RT signal is ON. | | | |
| 45 | Second | 9999 | | 0 to 3600 s | Set the deceleration time used while the RT signal is ON. | | | |
| F021 | deceleration time | 3333 | | 9999 | The acceleration time applies to the deceleration time. | | | |
| 147 | Acceleration/ deceleration time | 9999 | | 0 to 590 Hz | Set the frequency where the acceleration/deceleration time switches to the time set in Pr.44 and Pr.45. | | | |
| F022 | switching frequency | | | 9999 | Function disabled. | | | |
| 110 | Third acceleration/ | 9999 | | 0 to 3600 s | Set the acceleration/deceleration time when the X9 signal is ON. | | | |
| F030 | deceleration time | 9999 | | 9999 | Third acceleration/deceleration is disabled. | | | |
| 111 | Third deceleration | 9999 | | 0 to 3600 s | Set the deceleration time when the X9 signal is ON. | | | |
| F031 | time | | | 9999 | The acceleration time applies to the deceleration time. | | | |
| 791 | Acceleration time in low-speed | | | 0 to 3600 s | Set the acceleration time in a low-speed range (less than 1/10 of the rated motor frequency). | | | |
| F070 | range | | | 9999 | The acceleration time set in Pr.7 is applied. (While the RT signal of the X9 signal is ON, the second or third function is enabled.) | | | |
| 792 | Deceleration time in low-speed | 9999 | | 0 to 3600 s | Set the deceleration time in a low-speed range (less than 1/10 of the rated motor frequency). | | | |
| F071 | range 9999 | | 9999 | The deceleration time set in Pr.8 is applied. (While the RT signal or the X9 signal is ON, the second or third function is enabled.) | | | | |
| 1103 F040 | Deceleration time at emergency stop | 5 s | | 0 to 3600 s | Set the motor deceleration time at a dec X92 signal. | eleration by turning ON the | | |
| | | | | 0 | Droop control enabled. | Speed loop integration enabled. | | |
| 1349 | Emergency stop | | | | | 1 | Droop control enabled. Speed loop integral disabled. | |
| G264 | operation selection | 0 | | 10 | Droop control disabled. | Speed loop integration enabled. | | |
| | | | | 11 | Droop control disabled. | Speed loop integration disabled. | | |

 $^{^{*}1}$ The initial value for the FR-A820-00490(7.5K) or lower and FR-A840-00250(7.5K) or lower.

 $^{^{\}star}2$ $\,$ Initial value for the FR-A820-00630(11K) or higher and FR-A840-00310(11K) and higher.

Control block diagram



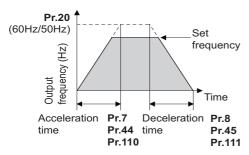
Acceleration time setting (Pr.7, Pr.20)

- Use Pr.7 Acceleration time to set the acceleration time required to change the frequency to the frequency set in Pr.20
 Acceleration/deceleration reference frequency from stop status.
- · Set the acceleration time according to the following formula.

Acceleration time setting = Pr.20 setting × (Acceleration time to change the frequency from stop status to maximum frequency) / (Maximum frequency - Pr.13 setting)

• For example, the following calculation is performed to find the setting value for **Pr.7** when increasing the output frequency to the maximum frequency of 50 Hz in 10 seconds with **Pr.20** = 60 Hz (initial value) and **Pr.13** = 0.5 Hz.

Pr.7 setting = 60 Hz × 10 s / (50 Hz - 0.5 Hz)
$$\approx$$
 12.1 s



◆ Deceleration time setting (Pr.8, Pr.20)

- Use **Pr.8 Deceleration time** to set the deceleration time required to change the frequency to a stop status from the frequency set in **Pr.20 Acceleration/deceleration reference frequency**.
- · Set the deceleration time according to the following formula.

Deceleration time setting = **Pr.20** setting × (Deceleration time to change the frequency from maximum frequency to stop status) / (Maximum frequency - **Pr.10** setting)

• For example, the following calculation is used to find the setting value for **Pr.8** when decreasing the output frequency from the maximum frequency of 50 Hz in 10 seconds with **Pr.20** = 120 Hz and **Pr.10** = 3 Hz.

Pr.8 setting = 120 Hz × 10 s / (50 Hz - 3 Hz) \approx 25.5 s

NOTE

- If the acceleration/deceleration time is set, the actual motor acceleration/deceleration time cannot be made shorter than the shortest acceleration/deceleration time determined by the mechanical system J (moment of inertia) and motor torque.
- If the Pr.20 setting is changed, the Pr.125 and Pr.126 (frequency setting signal gain frequency) settings do not change. Set Pr.125 and Pr.126 to adjust the gains.
- Under PM sensorless vector control, if the protective function (E.OLT) is activated due to insufficient torque in the low-speed range, set longer acceleration/deceleration times only in the low-speed range in Pr.791 Acceleration time in low-speed range and Pr.792 Deceleration time in low-speed range.

Changing the minimum increment of the acceleration/deceleration time (Pr.21)

- Use Pr.21 to set the minimum increment of the acceleration/deceleration time.
 Setting value "0" (initial value): minimum increment 0.1 s
 Setting value "1": minimum increment 0.01 s
- Pr.21 setting allows the minimum increment of the following parameters to be changed.
 Pr.7, Pr.8, Pr.16, Pr.44, Pr.45, Pr.110, Pr.111, Pr.264, Pr.265, Pr.791, Pr.792, Pr.1103

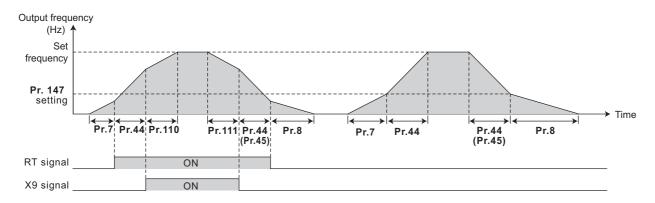
■ NOTE

- · Pr.21 setting does not affect the minimum increment setting of Pr.611 Acceleration time at a restart.
- The FR-DU08 and the FR-PU07 provide a five-digit readout (including the number of decimal places) on a value of parameters. Therefore, a value of "1000" or larger is set/displayed only in increments of 0.1 second even if **Pr.21** = "1".

◆ Setting multiple acceleration/deceleration times (RT signal, X9 signal, Pr.44, Pr.45, Pr.110, Pr.111, Pr.147)

- Pr.44 and Pr.45 are valid when the RT signal is ON or when the output frequency is equal to or higher than the frequency set in Pr.147 Acceleration/deceleration time switching frequency. Pr.110 and Pr.111 are valid when the X9 signal is ON.
- Even at the frequency lower than the Pr.147 setting, turning ON the RT signal (X9 signal) switches the acceleration/deceleration time to the second (third) acceleration/deceleration time. The priority of the signals and settings is X9 signal > RT signal > Pr.147 setting.
- To input the X9 signal, set "9" in any of **Pr.178 to Pr.189 (Input terminal function selection)** to assign the function to the terminal.
- When "9999" is set in Pr.45 and Pr.111, the deceleration time becomes equal to the acceleration time (Pr.44, Pr.110).
- When Pr.110 = "9999" is set, the third acceleration/deceleration function is disabled.
- If the Pr.147 setting is equal to or less than the Pr.10 DC injection brake operation frequency or the Pr.13 Starting frequency setting, the acceleration/deceleration time switches to the Pr.44 (Pr.45) when the output frequency reaches or exceeds the Pr.10 or Pr.13 setting.

| Pr.147 setting | Acceleration/deceleration time | Description | |
|---|---|--|--|
| 9999 (initial value) | Pr.7, Pr.8 | Acceleration/deceleration time is not automatically changed. | |
| 0.00 Hz | Pr.44, Pr.45 | Second acceleration/deceleration time is applied from the start. | |
| 0.01 Hz ≤ Pr.147 ≤ Set frequency | Output frequency < Pr.147: Pr.7, Pr.8 Pr.147 ≤ Output frequency: Pr.44, Pr.45 | Acceleration/deceleration time is automatically changed. | |
| Set frequency < Pr.147 | Pr.7, Pr.8 | Not changed as the frequency has not reached the switchover frequency. | |

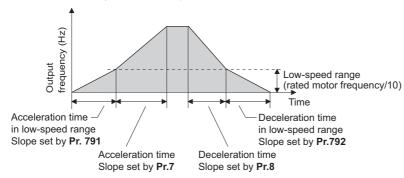




- The reference frequency during acceleration/deceleration depends on the Pr.29 Acceleration/deceleration pattern selection setting. (Refer to page 372.)
- The RT and X9 signals can be assigned to an input terminal by setting Pr.178 to Pr.189 (Input terminal function selection).
 Changing the terminal assignment may affect other functions. Set parameters after confirming the function of each terminal.
- The RT (X9) signal acts as the second (third) function selection signal and makes the other second (third) functions valid. (Refer to page 525.)
- The RT signal is assigned to terminal RT in the initial status. Set "3" in one of **Pr.178 to Pr.189 (Input terminal function selection)** to assign the RT signal to another terminal.

Setting the acceleration/deceleration time in the low-speed range (Pr.791, Pr.792)

• If torque is required in the low-speed range (less than 10% of the rated motor frequency) under PM sensorless vector control, set the Pr.791 Acceleration time in the low-speed range and Pr.792 Deceleration time in low-speed range settings higher than the Pr.7 Acceleration time and Pr.8 Deceleration time settings so that the mild acceleration/ deceleration is performed in the low-speed range. Such a setting is especially effective when the low-speed range high-torque characteristic is disabled (Pr.788 = "0"). (When RT signal or X9 signal is turned ON, the second or third acceleration/ deceleration time setting is prioritized.)

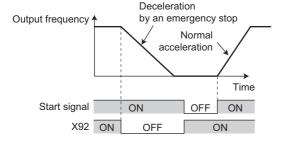




- Set Pr.791 (Pr.792) to a value larger than the Pr.7 (Pr.8) setting. If set as Pr.791 < Pr.7, the operation is performed as Pr.791 = Pr.7. If set as Pr.792 < Pr.8, the operation is performed as Pr.792 = Pr.8.
- Refer to page 833 for the rated motor frequency of MM-CF.

♦ Emergency stop function (Pr.1103)

- When the Emergency stop (X92) signal is ON, the deceleration stop is performed according to the settings in the **Pr.1103**Deceleration time at emergency stop and **Pr.815 Torque limit level 2**.
- To input the X92 signal, set "92" in any of **Pr.178 to Pr.189 (Input terminal function selection)** to assign the function to a terminal.
- The X92 signal is a normally closed input (NC contact input).
- "PS" is displayed on the operation panel during activation of the emergency stop function.



• The droop control and the speed loop integration at the emergency stop by the Emergency stop (X92) signal can be enabled/disabled using Pr.1349 Emergency stop operation selection.

| Pr.1349 | Description | | |
|---------|---------------|------------------------|--|
| setting | Droop control | Speed loop integration | |
| 0 | Enabled | Enabled | |
| 1 | Enabled | Disabled | |
| 10 | Disabled | Enabled | |
| 11 | Disabled | Disabled | |



- The X92 signals can be assigned to an input terminal by setting Pr.178 to Pr.189 (Input terminal function selection). Changing the terminal assignment may affect other functions. Set parameters after confirming the function of each terminal.
- Refer to page 738 for details on the droop control.
- Refer to page 254 for details on the speed loop integration.

Parameters referred to

Pr.3 Base frequency page 707
Pr.10 DC injection brake operation frequency page 715
Pr.29 Acceleration/deceleration pattern selection page 372
Pr.125, Pr.126 (frequency setting gain frequency) page 505

Pr.178 to Pr.189 (Input terminal function selection) page 521 Pr.264 Power-failure deceleration time 1, Pr.265 Power-failure deceleration time 2 page 505

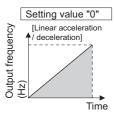
Acceleration/deceleration pattern

The acceleration/deceleration pattern can be set according to the application. In addition, the backlash measures that stop acceleration/deceleration by the frequency or time set with parameters at acceleration/deceleration can be set.

| Pr. | Name | Initial value | Setting range | Description |
|-------------|--|------------------|---------------|--|
| | | | 0 | Linear acceleration/deceleration |
| | | | 1 | S-pattern acceleration/deceleration A |
| 20 | A cooleyation/decoleyations wattown | | 2 | S-pattern acceleration/deceleration B |
| 29 F100 | Acceleration/deceleration pattern selection | 0 | 3 | Backlash measure |
| | | | 4 | S-pattern acceleration/deceleration C |
| | | | 5 | S-pattern acceleration/deceleration D |
| | | | 6 | Variable-torque acceleration/deceleration |
| 140 F200 | Backlash acceleration stopping frequency | 1 Hz | 0 to 590 Hz | |
| 141 F201 | Backlash acceleration stopping time | 0.5 s | 0 to 360 s | Set the stopping frequency and time during backlash measures. |
| 142 F202 | Backlash deceleration stopping frequency | 1 Hz | 0 to 590 Hz | Valid by backlash measures (Pr.29 = "3"). |
| 143 F203 | Backlash deceleration stopping time | 0.5 s | 0 to 360 s | |
| 380 F300 | Acceleration S-pattern 1 | 0 | 0 to 50% | Set the time for drawing the S-pattern from acceleration/ |
| 381 F301 | Deceleration S-pattern 1 | 0 | 0 to 50% | deceleration start to linear acceleration as a ratio (%) of acceleration/deceleration time (Pr.7 , 8 , etc.). The |
| 382 F302 | Acceleration S-pattern 2 | 0 | 0 to 50% | acceleration/deceleration curve can be switched by the X20 signal. |
| 383 F303 | Deceleration S-pattern 2 | 0 | 0 to 50% | Valid by S-pattern acceleration/deceleration C (Pr.29 = "4"). |
| 516 F400 | S-pattern time at a start of acceleration | 0.1 s | 0.1 to 2.5 s | |
| 517 F401 | S-pattern time at a completion of acceleration | 0.1 s | 0.1 to 2.5 s | Set the time required for acceleration (S-pattern) of S- |
| 518 F402 | S-pattern time at a start of deceleration | 0.1 s | 0.1 to 2.5 s | pattern acceleration/deceleration. Valid by S-pattern acceleration/deceleration D (Pr.29 = "5"). |
| 519 F403 | S-pattern time at a completion of deceleration | 0.1 s | 0.1 to 2.5 s | |

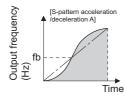
◆ Linear acceleration/deceleration (Pr.29 = "0 (initial value)")

• When the frequency is changed for acceleration, deceleration, etc. during inverter operation, the output frequency is changed linearly (linear acceleration/deceleration) to reach the set frequency without straining the motor and inverter. Linear acceleration/deceleration has a uniform frequency/time slope.



◆ S-pattern acceleration/deceleration A (Pr.29 = "1")

- Use this when acceleration/deceleration is required for a short time until a high-speed area equal to or higher than the base frequency, such as for the main shaft of the machine.
- The acceleration/deceleration pattern has the **Pr.3 Base frequency** (**Pr.84 Rated motor frequency** under PM motor control) (fb) as the point of inflection in an S-pattern curve, and the acceleration/deceleration time can be set to be suitable for the motor torque reduction in the constant-power operation range at the base frequency (fb) or more.



· Acceleration/deceleration time calculation method when the set frequency is equal to or higher than the base frequency

Acceleration time $t = (4/9) \times (T/fb^2) \times f^2 + (5/9) \times T$ Where T is the acceleration/deceleration time (s), f is the set frequency (Hz), and fb is the base frequency (rated motor frequency)

• Reference (0 Hz to set frequency) of acceleration/deceleration time when Pr.3 = 60 Hz

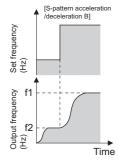
| Acceleration/deceleration | Set frequency (Hz) | | | | | |
|---------------------------|--------------------|-----|-----|-----|--|--|
| time (s) | 60 | 120 | 200 | 400 | | |
| 5 | 5 | 12 | 27 | 102 | | |
| 15 | 15 | 35 | 82 | 305 | | |



• For the acceleration/deceleration time setting of the S-pattern acceleration/deceleration A, set the time to **Pr.3** (**Pr.84** under PM sensorless vector control) instead of **Pr.20 Acceleration/deceleration reference frequency**.

◆ S-pattern acceleration/deceleration B (Pr.29 = "2")

• This is useful for preventing collapsing stacks such as on a conveyor. S-pattern acceleration/deceleration B can reduce the impact during acceleration/deceleration by accelerating/decelerating while maintaining an S-pattern from the present frequency (f2) to the target frequency (f1).

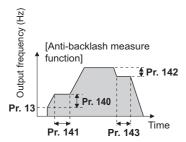




• When the RT or X9 signal turns ON during acceleration or deceleration with the S-pattern acceleration/deceleration B enabled, a pattern of acceleration or deceleration changes to linear at the moment.

◆ Backlash measures (Pr.29 = "3", Pr.140 to Pr.143)

- Reduction gears have an engagement gap and have a dead zone between forward rotation and reverse rotation. This dead
 zone is called backlash, and this gap disables a mechanical system from following motor rotation. More specifically, a
 motor shaft develops excessive torque when the direction of rotation changes or when constant-speed operation shifts to
 deceleration, resulting in a sudden motor current increase or regenerative status.
- To avoid backlash, acceleration/deceleration is temporarily stopped. Set the acceleration/deceleration stopping frequency and time in Pr.140 to Pr.143.



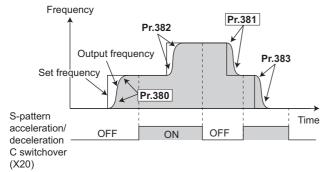


· Setting the backlash measures increases the acceleration/deceleration time by the stopping time.

◆ S-pattern acceleration/deceleration C (Pr.29 = "4", Pr.380 to Pr.383)

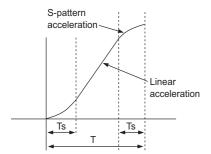
- Switch the acceleration/deceleration curve by the S-pattern acceleration/deceleration C switchover (X20) signal.
- To input the X20 signal, set "20" in any of Pr.178 to Pr.189 (Input terminal function selection) to assign the function to the terminal.

| X20 signal | During acceleration | During deceleration |
|------------|---------------------------------|---------------------------------|
| OFF | Pr.380 Acceleration S-pattern 1 | Pr.381 Deceleration S-pattern 1 |
| ON | Pr.382 Acceleration S-pattern 2 | Pr.383 Deceleration S-pattern 2 |



• Set the ratio (%) of time for drawing an S-shape in Pr.380 to Pr.383 with the acceleration time as 100%.

Parameter setting (%) = Ts / T × 100%





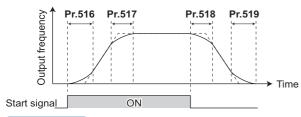
- At a start, the motor starts at Pr.13 Starting frequency when the start signal turns ON.
- If there is a difference between the speed command and speed at a start of deceleration due to torque limit operation etc., the speed command is matched with the speed to make deceleration.
- Change the X20 signal after the speed becomes constant. S pattern operation before switching continues even if the X20 signal is changed during acceleration or deceleration.
- The X20 signal can be assigned to an input terminal by setting any of **Pr.178 to Pr.189 (Input terminal function selection)**. Changing the terminal assignment may affect other functions. Set parameters after confirming the function of each terminal.
- When the RT or X9 signal turns ON during acceleration or deceleration with the S-pattern acceleration/deceleration C enabled, a pattern of acceleration or deceleration changes to linear at the moment.

◆ S-pattern acceleration/deceleration D (Pr.29 = "5", Pr.516 to Pr.519)

- Set the time required for S-pattern operation part of S-pattern acceleration/deceleration with **Pr.516 to Pr.519**. Set each S-pattern operation time for acceleration start (**Pr.516**), acceleration completion (**Pr.517**), deceleration start (**Pr.518**), and deceleration completion (**Pr.519**).
- When S-pattern acceleration/deceleration D is set, the acceleration/deceleration time becomes longer, as shown below.
 The set acceleration/deceleration time T1 indicates the actual time taken for linear acceleration/deceleration as calculated based on Pr.7, Pr.8, Pr.44, Pr.45, Pr.110, and Pr.111.

Actual acceleration time T2 = set acceleration time T1 + (S-pattern time at start of acceleration + S-pattern time at completion of acceleration) / 2

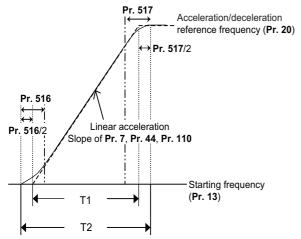
Actual deceleration time T2 = set deceleration time T1 + (S-pattern time at start of deceleration + S-pattern time at completion of deceleration) / 2





• Even if the start signal is turned OFF during acceleration, the inverter does not decelerate immediately to avoid sudden frequency change. (Likewise, the inverter does not immediately accelerate when deceleration is changed to re-acceleration by turning the start signal ON during deceleration, etc.)

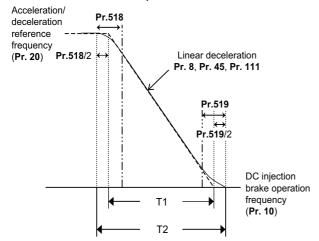
• For example, the following table shows the actual acceleration time when starting the inverter by selecting S-pattern acceleration/deceleration D from a stop to 60 Hz, as shown below, with the initial parameter settings.



```
Set acceleration time T1 = (set frequency - Pr.13) × Pr.7 / Pr.20
= (60 Hz - 0.5 Hz) × 5 s / 60 Hz
\rightleftharpoons 4.96s (actual acceleration time at linear acceleration)

Actual acceleration time T2 = set acceleration time T1 + (Pr.516 + Pr.517) / 2
= 4.96 s + (0.1 s + 0.1 s) / 2
= 5.06 s (acceleration time at S-pattern acceleration)
```

 The following table shows the actual deceleration time when stopping the inverter by selecting S-pattern acceleration/ deceleration D from operation to 0 Hz, as shown below, with the initial parameter settings.

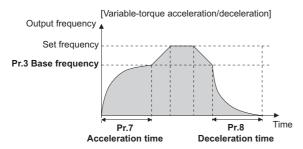


NOTE

- When acceleration/deceleration time (such as Pr.7 and Pr.8) is set to "0 s" under Real sensorless vector control, Vector control, and PM sensorless vector control (with MM-CF and Pr.788 Low speed range torque characteristic selection = "9999 (initial value)"), linear acceleration and deceleration are performed for the S-pattern acceleration/deceleration A to D and backlash measures (Pr.29 = "1 to 5").
- Set linear acceleration/deceleration (Pr.29 = "0 (initial setting)") when torque control is performed under Real sensorless vector
 control or Vector control. When acceleration/deceleration patterns other than the linear acceleration/deceleration are selected,
 the protective function of the inverter may be activated.

◆ Variable-torque acceleration/deceleration (Pr.29 = "6")

• This function is useful for variable-torque load such as a fan and blower to accelerate/decelerate in short time. Linear acceleration/deceleration is performed in the area where the output frequency > base frequency.



NOTE

- When the base frequency is out of the range 45 to 65 Hz, the linear acceleration/deceleration is performed even if Pr.29 = "6".
- Even if **Pr.14 Load pattern selection** = "1 (variable torque load)", variable torque acceleration/deceleration setting is prioritized and the inverter operates as **Pr.14** = "0 (constant torque load)".
- For the variable torque acceleration/deceleration time setting, set the time period to reach **Pr.3 Base frequency**. (Not the time period to reach **Pr.20 Acceleration/deceleration reference frequency**.)
- The variable torque acceleration/deceleration is disabled during PM sensorless vector control. (Linear acceleration/deceleration/deceleration)

Parameters referred to

Pr.3 Base frequency page 707

Pr.7 Acceleration time, Pr.8 Deceleration time, Pr.20 Acceleration/deceleration reference frequency page 367

Pr.10 DC injection brake operation frequency 🖙 page 715

Pr.14 Load pattern selection page 708

Pr.178 to Pr.189 (Input terminal function selection) F page 521

5.8.3 Remote setting function

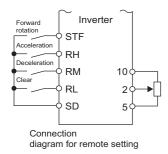
Even if the operation panel is located away from the enclosure, contact signals can be used to perform continuous variablespeed operation, without using analog signals.

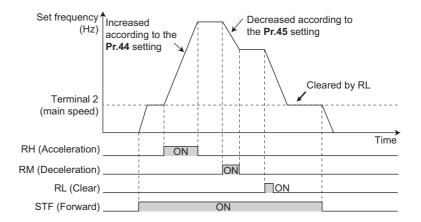
| | | Initial | Setting | | Description | |
|------------|---------------------------|--------------------------|----------------|--|--|---|
| Pr. | Name | | range | RH, RM, RL signal function | Frequency setting storage | Deceleration to the main speed or lower |
| | | | 0 | Multi-speed setting | _ | |
| | | | 1 | Remote setting | Enabled | Not available |
| | Remote function selection | 3 0 11 12 13 | 2 | Remote setting | Disabled | |
| 59 F101 | | | 3 | Remote setting | Disabled (Turning OFF the STF/STR signal clears the remotely- set frequency.) | |
| | | | 11 | Remote setting | Enabled | |
| | | | 12 | Remote setting | Disabled | |
| | | | Remote setting | Disabled (Turning OFF the STF/STR signal clears the remotely- set frequency.) | Available | |

◆ Remote setting function

• When **Pr.59** ≠ "0" (remote setting enabled), the functions of the signals are as shown in the following table.

| Signal name | Function | Description |
|----------------------------|-----------------|--|
| STF/STR | Forward/Reverse | The inverter accelerates the motor in the forward or reverse direction up to the main speed or to the frequency stored by the remote setting function. |
| RH | Acceleration | The set frequency increases according to the Pr.44 setting. |
| RM | Deceleration | The set frequency decreases according to the Pr.45 setting. |
| RL | Clear | The set frequency is cleared and the main speed is applied. |
| Terminal 2 (analog signal) | Main speed | The setting of the main speed is used as a base. The main speed is increased by the RH signal and decreased by the RM signal. |





◆ Main speed

· The main speed used in the remote setting corresponds with each of the following operation modes.

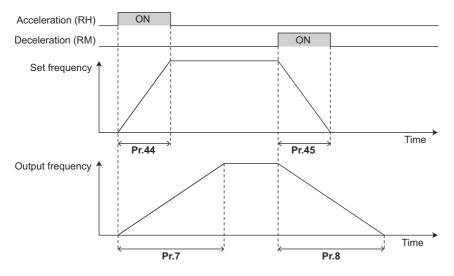
| Operation mode | Main speed |
|---|--|
| PU operation mode / NET operation mode | Digital setting |
| External operation mode / PU/External combined operation mode 2 (Pr.79 = "4") | Analog input ^{*1} |
| PU/External combined operation mode 1 (Pr.79 = "3") | Analog input via terminal 4 (AU signal ON) ^{*1} |

^{*1} Set Pr.28 Multi-speed input compensation selection to "1" when enabling compensation for input via terminal 1.

◆ Acceleration/deceleration operation

• The output frequency changes as follows when the set frequency is changed by the remote setting function.

| Frequency | Time setting | Description |
|------------------|--------------|--|
| Set frequency | Pr.44/Pr.45 | The set frequency increases/decreases by remote setting according to the Pr.44/Pr.45 setting. |
| Output frequency | Pr.7/Pr.8 | The output frequency increases/decreases by the set frequency according to the Pr.7/Pr.8 setting. |

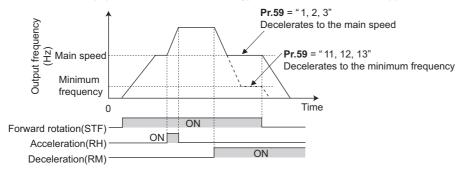


NOTE

• If the time setting of the output frequency is longer than the time setting of the set frequency, the motor accelerates/decelerates according to the time setting of the output frequency.

· Deceleration to the main speed or lower

By setting **Pr.59** = "11 to 13", the speed can be decelerated to the frequency lower than the main speed (set by the External operation frequency (except multi-speed setting) or PU operation frequency).



- Regardless of whether the remote setting is enabled or disabled, the acceleration/deceleration time set for the output frequency can be changed to the second or third acceleration/deceleration time by turning ON the RT or X9 signal.
- The acceleration/deceleration time setting of the set frequency is fixed at the Pr.44/Pr.45 setting.

Frequency setting storage

• The remotely set frequency is stored, held, or cleared according to the **Pr.59** setting. When the inverter is turned ON again and the operation is resumed, the setting shown in the parentheses will be applied.

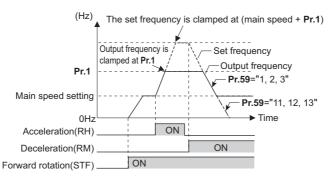
| Pr.59 setting | Power OFF | STF/STR signal OFF |
|---------------|---------------------------|-------------------------|
| 1, 11 | Stored (stored frequency) | Held (stored frequency) |
| 2, 12 | Cleared (main speed) | Held (stored frequency) |
| 3, 13 | Clear (main speed) | Cleared (main speed) |

· Storage conditions

The remotely-set frequency is stored at the point when the start signal (STF or STR) turns OFF. The remotely-set frequency is stored every minute after turning OFF (ON) the RH and RM signals together. Every minute, the frequency is overwritten in the EEPROM if the latest frequency is different from the previous one when comparing the two. This cannot be written using the RL signal.



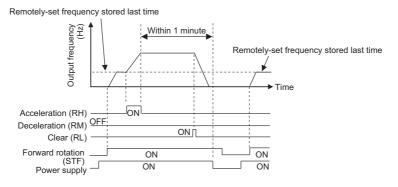
- When switching the start signal from ON to OFF, or changing frequency by the RH or RM signal frequently, set the frequency setting value storage function (write to EEPROM) invalid (**Pr.59** = "2, 3, 12, 13"). If the frequency setting value storage function is valid (**Pr.59** = "1, 11"), the frequency is written to EEPROM frequently, and this will shorten the life of the EEPROM.
- The range of frequency changeable using the acceleration (RH) signal and the deceleration (RM) signal is 0 to the maximum frequency (set in Pr.1 or Pr.18). Note that the maximum value of set frequency is equal to the total of the main speed and the maximum frequency.



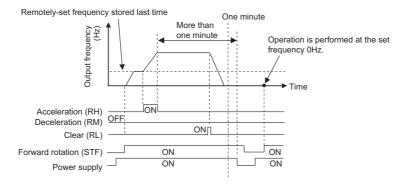
- Even if the start signal (STF or STR) is OFF, turning ON the RH or RM signal varies the preset frequency.
- The RH, RM, or RL signal can be assigned to an input terminal by setting Pr.178 to Pr.189 (Input terminal function selection). Changing the terminal assignment may affect other functions. Set parameters after confirming the function of each terminal.
- The inverter can be used in the Network operation mode.
- The remote setting function is invalid during JOG operation and PID control operation.
- · The multi-speed operation function is invalid when remote setting function is selected.

When the setting frequency is "0"

• Even when the remotely-set frequency is cleared by turning ON the clear (RL) signal after turning OFF (ON) both the RH and RM signals, the inverter operates at the remotely-set frequency stored in the last operation if power is reapplied before one minute has elapsed since turning OFF (ON) both the RH and RM signals.



• When the remotely-set frequency is cleared by turning ON the clear (RL) signal after turning OFF (ON) both the RH and RM signals, the inverter operates at the frequency in the remotely-set frequency cleared state if power is reapplied before one minute has elapsed since turning OFF (ON) both the RH and RM signals.



^CAUTION

· When using the remote setting function, set the maximum frequency again according to the machine.

Parameters referred to

Pr.1 Maximum frequency, Pr.18 High speed maximum frequency page 428

Pr.7 Acceleration time, Pr.8 Deceleration time, Pr.44 Second acceleration/deceleration time, Pr.45 Second deceleration time Fr.9 page 367

Pr.28 Multi-speed input compensation selection ☐ page 411

Pr.178 to Pr.189 (Input terminal function selection) F page 521

5.8.4 Starting frequency and start-time hold function

Magnetic flux Sensorless Vector

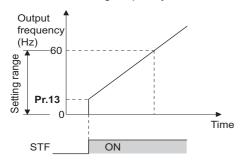
It is possible to set the starting frequency and hold the set starting frequency for a certain period of time.

Set these functions when a starting torque is needed or the motor drive at start needs smoothing.

| Pr. | Name | Initial value | Setting range | Description |
|------------|----------------------------|---------------|---------------|--|
| 13 F102 | Starting frequency | 0.5 Hz | 0 to 60 Hz | Set the starting frequency at which the start signal is turned ON. |
| 571 | Holding time at a start | 9999 | 0 to 10 s | Set the holding time of the frequency set in Pr.13. |
| F103 | 03 Holding time at a start | | 9999 | The holding function at start is disabled. |

◆ Starting frequency setting (Pr.13)

- The frequency at start can be set in the range of 0 to 60 Hz.
- · Set the starting frequency at which the start signal is turned ON.



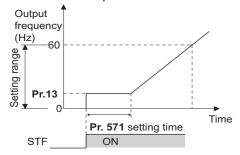
NOTE

The inverter does not start if the frequency setting signal has a value lower than that of Pr.13.
 For example, while Pr.13 = 5 Hz, the inverter output starts when the frequency setting signal reaches 5 Hz.

◆ Start-time hold function (Pr.571)

• This function holds during the period set in Pr.571 and the output frequency set in Pr.13 Starting frequency.

· This function performs initial excitation to smooth the motor drive at a start.



NOTE

- When Pr.13 = 0 Hz, the starting frequency is held at 0.01 Hz.
- · When the start signal was turned OFF during start-time hold, deceleration is started at that point.
- At switching between forward rotation and reverse rotation, the starting frequency is valid but the start-time hold function is disabled.

♠ CAUTION

Note that when Pr.13 is set to a value equal to or lower than the setting of Pr.2 Minimum frequency, simply turning ON
the start signal runs the motor at the frequency set in Pr.2 even if the command frequency is not given.



5.8.5 Minimum motor speed frequency and hold function at the motor start up

PM

Set the frequency where the PM motor starts running.

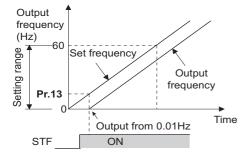
Set the deadband in the low-speed range to eliminate noise and offset deviation when setting a frequency with analog input.

| Pr. | Name | Initial value | Setting range | Description |
|------------|-------------------------|--|---------------|---|
| 13 F102 | Starting frequency | tarting frequency Minimum frequency / minimum rotations per minute | | Set the frequency where the motor starts running. |
| 571 | Holding time at a start | 9999 | 0 to 10 s | Set the time to hold 0.01 Hz. |
| F103 | Holding time at a start | 3333 | 9999 | The holding function at start is disabled. |

◆ Starting frequency setting (Pr.13)

- The frequency where the PM motor starts running can be set in the range of 0 to 60 Hz.
- When the frequency command specifies the frequency less than the one set in Pr.13 Starting frequency, the PM motor is stopped.

When the frequency command specifies the frequency equal to the set frequency or higher, the PM motor accelerates according to the setting of **Pr.7 Acceleration time**.

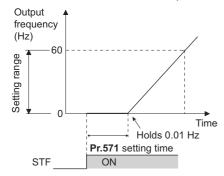




- Under induction motor control (under V/F control, Advanced magnetic flux vector control, Real sensorless vector control, and Vector control), the output starts at the frequency set in **Pr.13**. Under PM sensorless vector control, the output always starts at 0.01 Hz.
- The inverter does not start if the frequency setting signal has a value lower than that of **Pr.13**. For example, while **Pr.13** = "20 Hz", the inverter output starts when the frequency setting signal reaches 20 Hz.

◆ Start-time hold function (Pr.571)

- This function holds 0.01 Hz during the period set in **Pr.571**.
- Pr.571 is active when the low-speed range high-torque characteristic is enabled (Pr.788 = "9999").



∴ CAUTION

• Note that when **Pr.13** is set to a value equal to or lower than **Pr.2 Minimum frequency**, simply turning ON the start signal runs the motor at the frequency set in **Pr.2** even if the command frequency is not given.

Parameters referred to

Pr.2 Minimum frequency page 428
Pr.7 Acceleration time page 367

5.8.6 Shortest acceleration/deceleration and optimum acceleration/deceleration (automatic acceleration/deceleration)

Magnetic flux Sensorless Vector

The inverter can be operated with the same conditions as when the appropriate value is set to each parameter even when acceleration/deceleration time and V/F pattern are not set. This function is useful for operating the inverter without setting detailed parameters.

| Pr. | Name | Initial value | Setting range | Description |
|-------------|--|------------------|---------------|---|
| | | 0 | 0 | Normal operation |
| | Automatic acceleration/ | | 1 | Shortest acceleration/deceleration (without brakes) |
| 292 | | | 11 | Shortest acceleration/deceleration (with brakes) |
| F500 | deceleration | 0 | 3 | Optimum acceleration/deceleration |
| | | | 5, 6 | Lift operation 1, 2 (Refer to page 387.) |
| | | | 7, 8 | Brake sequence 1, 2 (Refer to page 572.) |
| 61 | | | 0 to 500 A*1 | Set the reference current during shortest (optimum) |
| F510 | Reference current | 9999 | 0 to 3600 A*2 | acceleration/deceleration. |
| | | | 9999 | Rated output current value reference of the inverter |
| 62 | Reference value at | 9999 | 0 to 400% | Set the speed limit value (optimum value) during shortest (optimum) acceleration. |
| F511 | acceleration | | 9999 | Shortest acceleration/deceleration: 150% as the limit value, optimum acceleration/deceleration: 100% as the optimum value |
| 63 | Reference value at | | 0 to 400% | Set the speed limit value (optimum value) during shortest (optimum) deceleration. |
| F512 | deceleration | 9999 | 9999 | Shortest acceleration/deceleration: 150% as the limit value, optimum acceleration/deceleration: 100% as the optimum value |
| | | 0 | 0 | Shortest (optimum) acceleration/deceleration for both acceleration and deceleration |
| 293 F513 | Acceleration/deceleration separate selection | | 1 | Shortest (optimum) acceleration/deceleration for acceleration only |
| | | | 2 | Shortest (optimum) acceleration/deceleration for deceleration only |

- *1 The setting range of the FR-A820-03160(55K) or lower and the FR-A840-01800(55K) or lower
- *2 The setting range of the FR-A820-03800(75K) or higher and the FR-A840-02160(75K) or higher

◆ Shortest acceleration/deceleration (Pr.292 = "1, 11", Pr.293)

- Set this parameter to accelerate/decelerate the motor at the shortest time. This function is useful when the motor needs to be accelerated/decelerated at a shorter time, such as for a machine, but the designed value of the machine constant is not known.
- At acceleration/deceleration, this function adjusts the motor to accelerate/decelerate with the maximum inverter output
 torque using the Pr.7 Acceleration time and Pr.8 Deceleration time setting as reference. (Pr.7 and Pr.8 settings are not
 changed.)
- Use **Pr.293 Acceleration/deceleration separate selection** to apply the shortest acceleration/deceleration to one of acceleration and deceleration only.
 - When "0 (initial value)" is set, the shortest acceleration/deceleration is performed for both acceleration and deceleration.
- Since the FR-A820-00490(7.5K) or lower, FR-A840-00250(7.5K) or lower capacity inverters are equipped with built-in brake resistors, set **Pr.292** to "11". Set "11" also when a high-duty brake resistor or brake unit is connected. The deceleration time can further be shortened.

- When the shortest acceleration/deceleration is selected under V/F control and Advanced magnetic flux vector control, the stall prevention operation level during acceleration/deceleration becomes 150% (adjustable using Pr.61 to Pr.63). The setting of Pr.22 Stall prevention operation level and stall level by analog input are used only during a constant speed operation.
 - Under Real sensorless vector control and Vector control, the torque limit level (**Pr.22**, etc.) is applied during acceleration/deceleration. The adjustments by **Pr.61** to **Pr.63** are disabled.
- It is inappropriate to use for the following applications.
 - Machines with large inertia (10 times or more), such as a fan. Since stall prevention operation is activated for a long time, this type of machine may be shut off due to motor overloading, etc.
 - When the inverter is always operated at a specified acceleration/deceleration time.



- Even if automatic acceleration/deceleration has been selected, inputting the JOG signal (JOG operation), RT signal (Second function selection) or X9 signal (Third function selection) during an inverter stop switches to the normal operation and give priority to JOG operation, second function selection or third function selection. Note that during operation, an input of JOG and RT signal does not have any influence even when the automatic acceleration/deceleration is enabled.
- Since acceleration/deceleration is made with the stall prevention operation being activated, the acceleration/deceleration speed always varies according to the load conditions.
- By setting **Pr.7** and **Pr.8** appropriately, it is possible to accelerate/decelerate with a shorter time than when selecting the shortest acceleration/deceleration.

◆ Optimum acceleration/deceleration (Pr.292 = "3", Pr.293)

- The inverter operates at the most efficient level within the rated range that can be used continuously with reasonable inverter capacity. Using self-learning, the average current during acceleration/deceleration is automatically set so as to become the rated current. This is ideal for applications operated with a predetermined pattern and minimal load fluctuations, such as by an automatically operated conveyor.
- When the optimum acceleration/deceleration is selected, at first, the operation is performed with the values set in **Pr.0 Torque boost**, **Pr.7 Acceleration time**, and **Pr.8 Deceleration time**. After the first operation is completed, average and peak currents are calculated based on the motor current during acceleration/deceleration, and the obtained values are compared with the reference current (initially set to the rated inverter current) to adjust the **Pr.0**, **Pr.7**, **and Pr.8** settings to their optimal values. The operation is the performed with the updated **Pr.0**, **Pr.7**, **and Pr.8** values onwards, and those parameters settings are adjusted each time. Under Advanced magnetic flux vector control, Real sensorless vector control and Vector control, however, the **Pr.0** setting is not changed.
- When a Regenerative overvoltage trip during deceleration or stop (E.OV3) occurs during deceleration, the setting of **Pr.8** is multiplied by 1.4.
- The optimum values of **Pr.0**, **Pr.7** and **Pr.8** are written to both the parameter RAM and EEPROM only three times of acceleration (deceleration) after the optimum acceleration/deceleration has been selected or after the power is switched ON or the inverter is reset. At or after the fourth attempt, they are not stored into EEPROM. Hence, after power-ON or inverter reset, the values changed at the third time are valid. However, the optimum values are calculated even for the fourth time and later, and **Pr.0**, **Pr.7**, **and Pr.8** are set to the RAM; therefore, these can be stored to the EEPROM by reading and writing the settings with the operation panel (FR-DU08).

| Number of optimum value | Pr.0, Pi | Operating condition | |
|-------------------------|------------------------------|---------------------|---------------------|
| changes | EEPROM value | RAM value | Operating condition |
| 1 to 3 times | Updated | Updated | Updated |
| 4 and more times | Unchanged from the 3rd value | Updated | Updated |

- Either acceleration or deceleration can be made in the optimum acceleration/deceleration using **Pr.293 Acceleration/ deceleration separate selection**. When the setting value is "0" (initial value), both acceleration and deceleration are made in the optimum acceleration/deceleration.
- It is inappropriate for machines which change in load and operation conditions. Optimum values are saved for the next operation. If the operating condition changes before the next operation, a fault such as overcurrent trip or a lack of acceleration/deceleration may occur.



- Even if automatic acceleration/deceleration has been selected, inputting the JOG signal (JOG operation), RT signal (Second function selection) or X9 signal (Third function selection) during an inverter stop will switch to the normal operation and give priority to JOG operation, second function selection or third function selection. Note that JOG and RT signal input is invalid even if JOG signal and RT signal are input during operation in the optimum acceleration/deceleration mode.
- · Because of the learning method, the impact of the optimum acceleration/deceleration is not apparent in the first operation after setting to the optimum acceleration/deceleration mode.
- The optimum value are calculated for only acceleration from 0 to 30 Hz or higher or deceleration from 30 Hz or higher to 0 Hz.
- The optimum acceleration/deceleration will not operate if the motor was not connected or the output current is less than 5% of the rated current of the inverter.
- · A Regenerative overvoltage trip during deceleration or stop (E.OV3) may occur during deceleration even if the optimum acceleration/deceleration is selected with Pr.293 ="1 (optimum acceleration/deceleration during acceleration only)" setting. In such case, set Pr.8 setting longer.

Shortest and optimum acceleration/deceleration mode adjustment (Pr.61) to Pr.63)

• The application range can be expanded by setting the parameters for adjustment of Pr.61 to Pr.63.

| Pr. | Name | Setting range | Description |
|-----------|--|-------------------------|--|
| | | 0 to 500 A*1 | Set the rated motor current value such as when the motor capacity and inverter capacity differ. |
| 61 | Reference current | 0 to 3600 A*2 | Shortest acceleration/deceleration: Set the reference current (A) of the stall prevention operation level during acceleration/deceleration. Optimum acceleration/deceleration: Set the reference current (A) of the optimum current during acceleration/deceleration. |
| | | 9999 (initial value) | The rated inverter current value is the reference. |
| 62, 63 | Reference value at acceleration, Reference value | | Set this when changing the reference level of acceleration and deceleration. Shortest acceleration/deceleration: Set the stall prevention operation level (percentage of current value of Pr.61) during acceleration/deceleration. Optimum acceleration/deceleration: Set the optimum current level (percentage of current value of Pr.61) during acceleration/deceleration. |
| | at deceleration | 9999 (initial value) | Shortest acceleration/deceleration: Stall prevention operation level is 150% for the shortest acceleration/deceleration. Optimum acceleration/deceleration: 100% as the optimum value. |

- The setting range of the FR-A820-03160(55K) or lower and the FR-A840-01800(55K) or lower
- The setting range of the FR-A820-03800(75K) or higher and the FR-A840-02160(75K) or higher



- · When Real sensorless vector control or Vector control is selected with the shortest acceleration/deceleration, Pr.61 to Pr.63 are invalid.
- Even if Pr.61 to Pr.63 are set once, changing the setting to other than the shortest acceleration/deceleration (Pr.292 ≠ "1 or 11") automatically resets to the initial setting (9999). Set Pr.61 to Pr.63 after setting Pr.292.

Parameters referred to

Pr.0 Torque boost □ page 706 Pr.7 Acceleration time, Pr.8 Deceleration time □ page 367

Pr.22 Stall prevention operation level page 431
Pr.22 Torque limit level page 245

5.8.7 Lift operation (automatic acceleration/ deceleration)

V/F

The inverter can be operated according to the load pattern of the lift with counterweight.

| Pr. | Name | Initial value | Setting range | Description | |
|------|---|------------------|--------------------------|--|----------------------|
| | | | 0 | Normal operation | |
| 292 | Automatic acceleration/ deceleration | 0 | 1 | Shortest acceleration/deceleration (without brakes) | (Defende new |
| | | | 11 | Shortest acceleration/deceleration (with brakes) | (Refer to page 384.) |
| F500 | | | 3 | Optimum acceleration/deceleration | |
| | | | 5 | Lift operation 1 (stall prevention operation level 150%) | |
| | | | 6 | Lift operation 2 (stall prevention operation level 180%) | |
| | | | 7, 8 | Brake sequence 1, 2 (Refer to page 572.) | |
| 61 | | | 0 to 500 A ^{*1} | Set the reference current during shortest (optimum) | |
| F510 | Reference current | 9999 | 0 to 3600 A*2 | acceleration/deceleration. | |
| 1010 | | | 9999 | Rated output current value reference of the inverter | |
| 64 | - tuning quenty | | 0 to 10 Hz | Set the starting frequency for the lift of | peration. |
| F520 | | | 9999 | The starting frequency is 2 Hz. | |

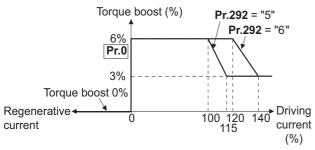
- *1 The setting range of the FR-A820-03160(55K) or lower and the FR-A840-01800(55K) or lower
- *2 The setting range of the FR-A820-03800(75K) or higher and the FR-A840-02160(75K) or higher

♦ Lift operation (Pr.292 = "5, 6")

- When **Pr.292 Automatic acceleration/deceleration** is set to "5" or "6", the lift operation is selected, and each setting is changed, as shown in the following table.
- During power driving, sufficient torque is generated, and during regenerative driving and during driving with no load, the torque boost setting is adjusted automatically so as not to activate the overcurrent protective function by overexcitation.

| Name | Normal aparation | Multi-rating | Lift operation (Pr.292) | | |
|----------------------------------|---------------------------|----------------------|--|------|--|
| Name | Normal operation | (Pr.570) | 5 | 6 | |
| Torque boost | Pr.0 (6/4/3/2/1%) | | Changes according to the output current (as shown below) | | |
| Starting frequency | Pr.13 (0.5 Hz) | | Pr.64 (2 Hz) Accelerate after 100 ms hold. | | |
| Base frequency voltage | Pr.19 (9999) | | 220 V class (440 V class) | | |
| | | 0 (SLD) | 110% | 115% | |
| | Pr.22 (150%), etc. | 1 (LD) | 120% | 140% | |
| Stall prevention operation level | | 2 (ND) initial value | 150% | 180% | |
| | | 3 (HD) | 200% | 230% | |





If the lift has a load in which the rated current of the inverter is exceeded, the maximum torque may be insufficient.
 For a lift without counterweight, setting Pr.14 Load pattern selection to "2 or 3" (for lift load) and setting Pr.19 Base frequency voltage appropriately give the maximum torque a greater advantage than when selecting the lift operation.



• The stall prevention operation level is automatically lowered according to the cumulative value of the electronic thermal O/L relay so as to prevent an inverter overload trip (E.THT) and the motor overload trip (E.THM) from occurring.

◆ Lift operation adjustment (Pr.61, Pr.64)

· The application range can be expanded by setting the parameters for adjustment of Pr.61 and Pr.64.

| Pr. | Name | Setting range | Description | |
|-----|--------------------------------------|--------------------------|--|--|
| 61 | | 0 to 500 A ^{*1} | Set the rated motor current value such as when the motor capacity and | |
| | | 0 to 3600 A*2 | inverter capacity differ. Set the reference current (A) of the stall prevention operation level. | |
| | | 9999 (initial value) | The rated inverter output current value is the reference. | |
| 64 | Starting frequency for elevator mode | 0 to 10 Hz | Set the starting frequency for the lift operation. | |
| | | 9999 (initial value) | The starting frequency is 2 Hz. | |

- *1 The setting range of the FR-A820-03160(55K) or lower and the FR-A840-01800(55K) or lower
- *2 The setting range of the FR-A820-03800(75K) or higher and the FR-A840-02160(75K) or higher



- Even if the lift operation has been selected, inputting the JOG signal (JOG operation), RT signal (Second function selection) or X9 signal (Third function selection) during an inverter stop will disable the automatic acceleration/deceleration and give priority to JOG operation, second function selection or third function selection. Note that during operation, an input of JOG and RT signal does not have any influence even when the automatic acceleration/deceleration is enabled.
- Even if **Pr.61 and Pr.64** are set, changing **Pr.292** automatically resets to the initial setting (9999). Set **Pr.61 and Pr.64** after setting **Pr.292**.

Parameters referred to

Pr.0 Torque boost page 706
Pr.13 Starting frequency page 381
Pr.14 Load pattern selection page 708
Pr.19 Base frequency voltage page 707
Pr.22 Stall prevention operation level page 431

Pr.570 Multiple rating setting page 343

5.9 (D) Operation command and frequency command

| Purpose | Parameter to set | | | Refer to page |
|--|--|-------------------------------------|---|---------------|
| To select the operation mode | Operation mode selection P.D000 | | Pr.79 | 389 |
| To start up the inverter in Network operation mode at power-ON | Communication startup mode selection | P.D000, P.D001 | Pr.79, Pr.340 | 398 |
| To select the command source during communication operation | Operation and speed command sources during communication operation, command source selection | P.D010 to P.D013 | Pr.338, Pr.339, Pr.550, Pr.551 | 400 |
| To prevent the motor from rotating reversely | Reverse rotation prevention selection | P.D020 | Pr.78 | 406 |
| To change the setting resolution of speed | Set resolution switchover | P.D030 | Pr.811 | 444 |
| To change the setting resolution of the torque limit | Set resolution switchover | P.D030 | Pr.811 | 444 |
| To set the frequency using pulse train input | Pulse train input | P.D100, P.D101, P.D110, P.D111 | Pr.291, Pr.384 to Pr.386 | 406 |
| To perform JOG (inching) operation | JOG operation | P.D200, P.F002 | Pr.15, Pr.16 | 410 |
| To control the frequency with combinations of terminals | Multi-speed operation | P.D300 to P.D315 | Pr.28, Pr.4 to Pr.6, Pr.24 to Pr.27, Pr.232 to Pr.239 | 411 |
| To select the torque command method during torque control | Torque command source selection | P.D120, P.D121, P.D400 to P.D402 | Pr.432, Pr.433, Pr.804 to Pr.806 | 283 |

5.9.1 Operation mode selection

Select the operation mode of the inverter.

The mode can be changed among operations using external signals (External operation), operation by the operation panel or the parameter unit (PU operation), combined operation of PU operation and External operation (External/PU combined operation), and Network operation (when RS-485 terminals or a communication option is used).

| Pr. | Name | Initial value | Setting range | Description |
|------------|--------------------------|---------------|---------------|-----------------------------|
| 79 D000 | Operation mode selection | 0 | 0 to 4, 6, 7 | Selects the operation mode. |

The following table lists valid and invalid commands in each operation mode.

| Pr.79 setting | Description | | | LED indicator ■: OFF □: ON | Refer to page |
|----------------------|---|--|---|---|---------------|
| 0 (initial value) | External/PU switchover mode. The inverter operation mode can be switched between PU and External by pressing PU EXT. At power ON, the inverter is in the External operation mode. | | | PU operation mode PU EXT NET External operation mode PU EXT NET Operation mode PU EXT NET | 394 |
| | Operation mode | Frequency command | Start command | 511 # | |
| 1 | Fixed at PU operation mode. | Sent from the operation panel or parameter unit. | Sent by pressing FWD or on operation panel or parameter unit. | PU operation mode PU EXT NET | 394 |
| 2 | Fixed at External operation mode. However, the inverter operation mode can also be changed to the Network operation mode. | Sent using external signals (input via terminal 2 or 4, using the JOG signal, using the multi-speed setting function, etc.). | Sent using external signals (via terminal STF or STR). | External operation mode PU EXT NET operation mode PU EXT NET | 394 |
| 3 | External/PU combined operation mode 1 | Sent from the operation panel or parameter unit or sent using external signals (input using the multi-speed setting function or via terminal 4).*1 | Sent using external signals (via terminal STF or STR). | External/PU combined operation mode | 394 |
| 4 | External/PU combined operation mode 2 | Sent using external signals (input via terminal 2 or 4, using the JOG signal, using the multi-speed setting function, etc.). | Sent by pressing FWD or on operation panel or parameter unit. | PU EXT NET | 395 |
| 6 | Operation mode switchover during operation. Switching from among the PU, External, and NET operation modes can be performed during operation. | | | PU operation mode PU EXT NET External operation | 395 |
| 7 | External operation mode (PU operation interlock). X12 signal ON: Switchover to PU operation mode enabled (signal is OFF during External operation). X12 signal OFF: Switchover to PU operation mode disabled. | | | mode PU EXT NET Operation mode PU EXT NET | 395 |

^{*1} The following is the frequency commands listed in descending order of priority when "3" is set in Pr.79: Multi-speed setting function (RL/RM/RH/ REX signal) > PID control (X14 signal) > terminal 4 analog input (AU signal) > digital input from the operation panel.

Operation mode basics

• The operation mode specifies the source of the start command and the frequency command for the inverter.

· Basic operation modes are as follows.

External operation mode: For giving a start command and a frequency command with an external potentiometer or switches which are

connected to the control circuit terminal.

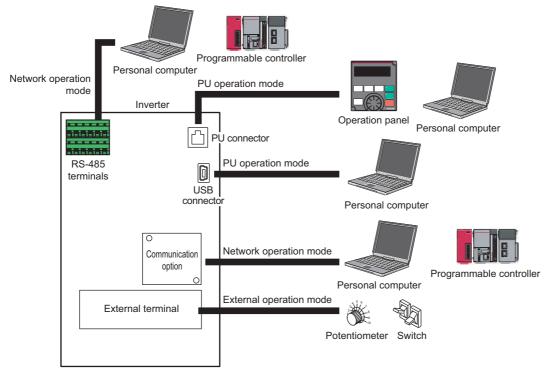
PU operation mode : For giving a start command and a frequency command from the operation panel, parameter unit, or through

RS-485 communication via the PU connector.

Network operation mode: For giving a start command and a frequency command via the RS-485 terminals or communication option.

(NET operation mode)

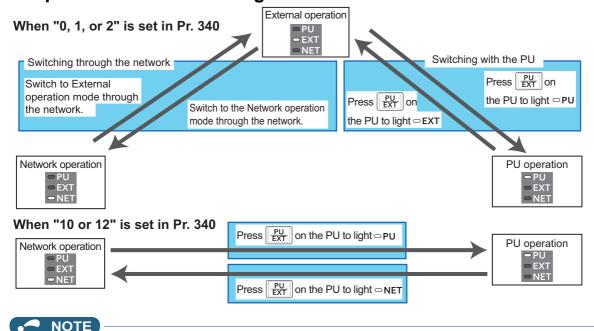
The operation mode can be selected from the operation panel or with the communication instruction code.



NOTE

- There is a choice of two settings, "3" and "4", for the External/PU combined operation mode. The startup method differs according to the setting value.
- In the initial setting, the PU stop selection (function to stop the inverter operation by pressing on the operation panel or the parameter unit) is enabled even in the operation mode other than the PU operation mode. (Refer to **Pr.75** on page 336.)

Operation mode switching method



• For details on switching by external terminals, refer to the following pages.

PU operation external interlock (X12 signal) page 395

PU/External operation switchover (X16 signal) page 396

PU/NET operation switchover (X65 signal), External/NET operation switchover (X66 signal) = page 397

Pr.340 Communication startup mode selection page 398

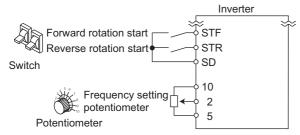
♦ Operation mode selection flow

Referring to the following table, select the basic parameter settings or terminal wiring related to the operation mode.

| Method to give frequency setting command command | | Parameter setting | Operation method | | |
|--|---|---|--|--|--|
| | Using external signals (input via terminal 2/4, using the JOG signal, using the multi-speed setting function, etc.) | Terminal STF (forward rotation) / STR (reverse rotation). (Refer to page page 722.) Terminal 2 and 4 (analog), RL, RM, RH, JOG, etc. | at External trequency setting. | | |
| Using external signals (via terminal | From PU (digital setting) | Terminal STF (forward rotation) / STR (reverse rotation). (Refer to page 722.) | Pr.79 = "3" (External/PU combined operation mode 1) | Frequency setting: Use the DU (digital setting). Start command: Turn ON terminal STF/STR. | |
| STF/STR) | Through communication (via RS-485 terminals) | rotation). (Refer to page 722.) RS-485 terminals (Refer to Pr.340 = "1 or 2" through communicat • Start command: | | Transmit a frequency command through communication. • Start command: Turn ON terminal STF/STR. | |
| | Through communication (via communication option) | Terminals for communication option (Refer to the Instruction Manual of the communication option.) | Pr.338 = "1" Pr.340 = "1" | Frequency setting: Transmit a frequency command through communication. Start command: Turn ON terminal STF/STR. | |
| | Using external signals (input via terminal 2/4, using the JOG signal, using the multi-speed setting function, etc.) | Terminals 2/4 (analog), RL, RM, RH, JOG, etc. | Pr.79 = "4" (External/PU combined operation mode 2) | Frequency setting: Turn ON a terminal used for frequency setting. Start command: Press the FWD/REV key. | |
| From PU (using FWD/REV key) | From PU (digital setting) | _ | Pr.79 = "1" (Fixed at PU operation mode) | Frequency setting: Use the PU (digital setting). Start command: Press the FWD/REV key. | |
| | Through communication (via RS-485 terminals / communication option) | Not available. | | | |
| Through | Using external signals (input via terminal 2/4, using the JOG signal, using the multi-speed setting function, etc.) | RS-485 terminals (Refer to page 661.) Terminal 2 and 4 (analog), RL, RM, RH, JOG, etc. | Pr.339 = "1" Pr.340 = "1 or 2" | Frequency setting: Turn ON a terminal used for frequency setting. Start command: Transmit a start command through communication. | |
| communication (via | From PU (digital setting) | Not available. | | | |
| RS-485 terminals) | Through communication (via RS-485 terminals) | RS-485 terminals (refer to page 661) | Pr.340 = "1 or 2" | Frequency setting: Transmit a frequency command through communication. Start command: Transmit a start command through communication. | |
| Through communication (via | Using external signals (input via terminal 2/4, using the JOG signal, using the multi-speed setting function, etc.) | Terminals on communication option (Refer to the Instruction Manual of the communication option.) Terminal 2 and 4 (analog), RL, RM, RH, JOG, etc. | Pr.339 = "1" Pr.340 = "1" | Frequency setting: Turn ON a terminal used for frequency setting. Start command: Transmit a start command through communication. | |
| communication | From PU (digital setting) | Not available. | | | |
| option) | Through communication (via communication option) | Terminals on communication option (Refer to the Instruction Manual of the communication option.) | Pr.340 = "1" | Frequency setting: Transmit a frequency command through communication. Start command: Transmit a start command through communication. | |

◆ External operation mode (Pr.79 = "0 (initial value) or 2")

- Select the External operation mode when the start command and the frequency command are applied from a frequency setting potentiometer, start switch, etc. which are provided externally and connected to the control circuit terminals of the inverter.
- Generally, parameter change cannot be performed in the External operation mode. (Some parameters can be changed.
 Refer to Pr.77 on page 345.)
- When **Pr.79** = "0 or 2", the inverter starts up in the External operation mode at power-ON. (When using the Network operation mode, refer to page 398.)
- When parameter changing is seldom necessary, setting "2" fixes the operation mode to the External operation mode.
 When frequent parameter changing is necessary, setting "0 (initial value)" allows the operation mode to be changed easily to the PU operation mode by pressing PU on the operation panel. After switching to the PU operation mode, always return to the External operation mode.
- The STF or STR signal is used as a start command. The input voltage or current via terminal 2 or 4, multi-speed setting signal, or JOG signal is used as a frequency command.



◆ PU operation mode (Pr.79 = "1")

- Select the PU operation mode when giving start and frequency commands by only the key operation of the operation panel or the parameter unit.
 - Also select the PU operation mode when giving commands through communication via the PU connector.
- When **Pr.79** ="1", the inverter starts up in the PU operation mode at power-ON. The mode cannot be changed to other operation modes.
- The frequency can also be set by simply turning the setting dial on the operation panel like a volume knob. (Refer to **Pr.161 Frequency setting/key lock operation selection** on page 341.)
- When the PU operation mode is selected, the PU operation mode (PU) signal can be output.

 For the terminal used for the PU signal, set "10 (positive logic)" or "110 (pegative logic)" in any of **Pr 190 to P**

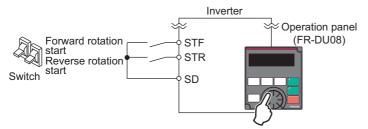
For the terminal used for the PU signal, set "10 (positive logic)" or "110 (negative logic)" in any of **Pr.190 to Pr.196 (Output terminal function selection)** to assign the function.

Operation panel (FR-DU08)



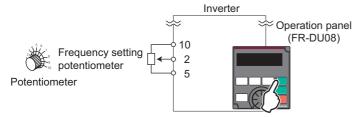
◆ PU/External combined operation mode 1 (Pr.79 = "3")

- Select the PU/External combined operation mode 1 when giving a frequency command from the operation panel or the parameter unit and giving a start command with the external start switches.
- Set "3" in Pr.79. The mode cannot be changed to other operation modes.
- When the frequency commands are given using the multi-speed setting signals (external signals), they have a higher priority than the frequency commands given from the PU. When the AU signal is ON, inputting the command signals via terminal 4 is enabled.



◆ PU/External combined operation mode 2 (Pr.79 = "4")

- Select the PU/External combined operation mode 2 when giving a frequency command from the external potentiometer, or using the multi-speed setting signals or the JOG signal, and giving a start command by key operation of the operation panel or the parameter unit.
- Set "4" in Pr.79. The mode cannot be changed to other operation modes.



◆ Operation mode switchover during operation (Pr.79 = "6")

• During operation, the inverter operation mode can be switched from among the PU, External, and Network (Network operation mode is selectable when RS-485 terminals or communication option is used).

| Operation mode switchover | Operation/operating status | |
|---|--|--|
| External operation →PU operation between the pullibration of motor rotation does not change due to the operation mode change from the External operation operation mode. • The direction of motor rotation does not change due to the operation mode change from the External operation mode. • The previous setting of frequency which has been set using a potentiometer (frequency commoder.) (However, note that the setting disappears when the power is turned OFF or when the investigation in the power is turned OFF or when the investigation in the power is turned OFF or when the investigation in the power is turned OFF or when the investigation in the power is turned OFF or when the investigation in the power is turned OFF or when the investigation in the power is turned OFF or when the investigation in the power is turned OFF or when the power is turned OFF | | |
| External operation→NET operation Operation Give the command through communication to change the operation mode to the Network operation The direction of motor rotation does not change due to the operation mode change from the External operation mode. The previous setting of frequency which has been set using a potentiometer (frequency comman over. (However, note that the setting disappears when the power is turned OFF or when the inverted.) | | |
| Press the key on the operation panel or parameter unit to change the operation mode to the External mode. • The direction of operation is determined by external input signals used in the External operation • The setting frequency is determined by the external frequency command signal. | | |
| PU operation→NET operation Give the command through communication to change the operation mode to the Network of the Operation of the Operation and the frequency setting does not change due to the operation to the Operation of the Operation o | | |
| NET operation → External operation operation Give the command through communication to change the operation mode to the External operation • The direction of operation is determined by external input signals used in the External operation • The setting frequency is determined by the external frequency command signal. | | |
| NET operation→PU operation | Use the operation panel or parameter unit to change to the PU operation mode. • The direction of motor rotation and the frequency setting does not change due to the operation mode change from the Network operation mode. | |

◆ PU operation interlock (Pr.79 = "7")

- The operation mode can be forcibly switched to the External operation mode by turning OFF the PU operation external
 interlock (X12) signal. This function will be usable in a case where the inverter does not reply to external command signals
 during operation due to the operation mode accidentally unswitched from the PU operation mode to the External operation
 mode.
- To input the X12 signal, set "12" in any of **Pr.178 to Pr.189 (Input terminal function selection)** to assign the function. (For details on **Pr.178 to Pr.189**, refer to page 521.)
- Set Pr.79 = "7" (PU operation interlock).

· If the X12 signal is not assigned, the function of the MRS signal is switched to the PU operation interlock signal from MRS (output stop).

| X12 (MRS) signal | Function/Operation | | | | | | |
|-------------------|---|------------------------------------|--|--|--|--|--|
| X12 (WIKS) Signal | Operation mode | Parameter writing ^{*1} | | | | | |
| ON | Switching of the operation mode (External, PU, and NET) is enabled. The signal is OFF during External operation. | Enabled. | | | | | |
| OFF | Operation mode is forcefully changed to the External operation mode. External operation is enabled. Switching to the PU or NET operation mode from the External operation mode is disabled. | Disabled except for Pr.79 . | | | | | |

^{*1} Depends on the Pr.77 Parameter write selection setting and other parameter write conditions. (Refer to page 345.)

· Functions/operations by X12 (MRS) signal ON/OFF

| Operating status Operation Status | | | Operation | | Switching to PU or |
|-----------------------------------|----------------|----------------------|------------------------|--|--------------------|
| | | X12 (MRS) signal | mode | Operating status | NET operation mode |
| | During stop | ON→OFF ^{*1} | | If frequency and start commands are given | Disabled |
| PU/NET | During running | ON→OFF*1 | External ^{*2} | from external source, the inverter runs by those commands. | Disabled |
| | During stop | OFF→ON | | During stop | Enabled |
| External | During stop | ON→OFF | External*2 | During stop | Disabled |
| External | During | OFF→ON | External - | Running→Output stop | Disabled |
| | running | ON→OFF | | Output stop→Running | Disabled |

^{*1} The mode is switched to the External operation mode regardless of the ON/OFF state of the start signal (STF/STR). Thus, the motor runs under the External operation mode when the X12 (MRS) signal turns OFF while the STF or STR signal is ON.

*2 When a fault occurs, the inverter can be reset by pressing STOP on the operation panel





- The operation mode cannot be switched to the PU operation mode with the start signal (STF/STR) ON state even if the X12 (MRS) signal turns ON.
- If the MRS signal is ON and Pr.79 is written to a value other than "7" when the MRS signal is used as the PU interlock signal, the MRS signal will act as a regular MRS function (output stop). Also, when Pr.79 = "7", the MRS signal becomes the PU interlock signal.
- The logic of the signal follows the setting of Pr.17 MRS input selection also when the MRS signal is used as the PU operation interlock signal. When Pr.17 = "2", ON and OFF in the above explanation are reversed.
- Changing the terminal assignment using Pr.178 to Pr.189 (Input terminal function selection) may affect the other functions. Set parameters after confirming the function of each terminal.

Switching operation mode by external signal (X16 signal)

- · When External operation and the operation from the operation panel are used together, the PU operation mode and External operation mode can be switched during a stop (during motor stop, start command OFF) by using the PU/External operation switchover (X16) signal.
- When Pr.79 = "0, 6, or 7", switching between the PU operation mode and External operation mode is possible. (When **Pr.79** ="6", switchover is enabled during operation.)

• To input the X16 signal, set "16" in any of **Pr.178 to Pr.189 (Input terminal function selection)** to assign the function to a terminal.

| Dr 7 | 79 setting | X16 signal status a | nd operation mode | Remarks | | |
|------------------|---------------------------|-------------------------|-------------------|---|--|--|
| P1.7 | r a setting | ON (External) | OFF (PU) | Remarks | | |
| 0 (initia | ıl value) | External operation mode | PU operation mode | Switching among the External, PU, and NET operation modes is enabled. | | |
| 1 | | PU operation mode | | Fixed at PU operation mode. | | |
| 2 | 2 External operation mode | | e | Fixed at External operation mode (Switching to NET operation mode enabled). | | |
| 3, 4 | | External/PU combined | operation mode | Fixed at External/PU combined operation mode. | | |
| 6 | | External operation mode | PU operation mode | Switching among the External, PU, and NET operation mode is enabled during operation. | | |
| 7 | X12 (MRS) ON | ` ' PU operation mode | | Switching among the External, PU, and NET operation mode is enabled (signal is OFF in the External operation mode). | | |
| X12 (MRS) OFF | | External operation mode | | Fixed at External operation mode (forcibly switched to External operation mode). | | |

NOTE

- The operation mode is determined by the setting of **Pr.340 Communication startup mode selection** and the ON/OFF state of the X65 and X66 signals. (For the details, refer to page 397.)
- The priority of Pr.79 and Pr.340 and signals is Pr.79 > X12 > X66 > X65 > X16 > Pr.340.
- Changing the terminal assignment using Pr.178 to Pr.189 (Input terminal function selection) may affect the other functions.
 Set parameters after confirming the function of each terminal.

◆ Switching the operation mode by external signals (X65, X66 signals)

- When **Pr.79** = "0, 2 or 6", the PU operation mode and External operation modes can be changed to the Network operation mode during a stop (during motor stop, start command OFF) by the PU/NET operation switchover (X65) signal, or the External/NET operation switchover (X66) signal. (When **Pr.79** = "6", switchover is enabled during operation.)
- · To switch between the Network operation mode and the PU operation mode
 - **1.** Set **Pr.79** = "0 (initial value) or 6".
 - 2. Set Pr.340 Communication startup mode selection = "10 or 12".
 - 3. Set "65" in any of **Pr.178 to Pr.189** to assign the PU/NET operation switchover (X65) signal to a terminal.
 - **4.** When the X65 signal is ON, the PU operation mode is selected. When the X65 signal is OFF, the NET operation mode is selected.

| Pr.340 | Pr.79 setting | | X65 sig | nal state | Remarks | |
|---------|---------------|-----------------------------------|---|----------------------------------|---|--|
| setting | FI. | ra setting | ON (PU) | OFF (NET) | Remarks | |
| | 0 (initia | al value) | PU operation mode ^{*1} | NET operation mode ^{*2} | _ | |
| | 1 | | PU operation mode | | Fixed at PU operation mode. | |
| | 2 | | NET operation mode | | Fixed at NET operation mode. | |
| | 3, 4 | | External/PU combined operation mode | | Fixed at External/PU combined operation mode. | |
| 10, 12 | 6 | | PU operation mode ^{*1} NET operation mode ^{*2} | | The operation mode can be changed during operation. | |
| | 7 | X12 (MRS) ON | Switching between the External operation mode and PU operation mode is enabled.*2 | | The signal is OFF during operation in the External operation mode. | |
| | | X12 (MRS) External operation mode | | e | The operation mode is forcibly switched to the External operation mode. | |

- *1 When the X66 signal is ON, the NET operation mode is selected.
- *2 When the X16 signal is OFF, the PU operation mode is selected. Also, when "0" is set for **Pr.550 NET mode operation command source selection** and the communication option is not connected (communication option is the command source), the PU operation mode is selected. When the X16 signal is ON, the External operation mode is selected.
- · To switch between the Network operation mode and the External operation mode
 - 1. Set Pr.79 = "0 (initial value), 2, 6, or 7". (When Pr.79 = "7" and the X12 (MRS) signal is ON, the operation mode can be switched.)
 - 2. Set Pr.340 Communication startup mode selection = "0" (initial value), "1" or "2".

- 3. Set "66" in one of **Pr.178 to Pr.189** to assign the NET-External operation switching signal (X66) to a terminal.
- **4.** When the X66 signal is ON, the NET operation mode is selected. When the X66 signal is OFF, the External operation mode is selected.

| Pr.340 | Pr.79 setting | | X66 sig | nal state | Remarks | |
|--------------|-------------------|------------------|--|---------------------------------------|---|--|
| setting | | | ON (NET) | OFF (External) | ixema ka | |
| | 0 (initial value) | | NET operation mode*1 External operation mode*2 | | _ | |
| | 1 | | PU operation mode | | Fixed at PU operation mode. | |
| | 2 | | NET operation mode *1 External operation mode | | Switching to PU operation mode is disabled. | |
| 0 (initial | 3, 4 | | External/PU combined operation mode | | Fixed at External/PU combined operation mode. | |
| value), 1, 2 | 6 | | NET operation mode ^{*1} External operation mode ^{*2} | | The operation mode can be changed during operation. | |
| | 7 | X12 (MRS) ON | NET operation mode ^{*1} | External operation mode ^{*2} | The signal is OFF during operation in the External operation mode. | |
| | • | X12 (MRS) OFF | External operation mod | е | The operation mode is forcibly switched to the External operation mode. | |

- *1 When **Pr.550 NET mode operation command source selection** = "0" (communication option control source) and no communication option is connected, the External operation mode is selected.
- *2 When the X16 signal is OFF, the PU operation mode is selected. Also, when the X65 signal is assigned, the operation mode follows the ON/OFF state of the X65 signal.



- The priority of Pr.79 and Pr.340 and signals is as follows: Pr.79 > X12 > X66 > X65 > X16 > Pr.340.
- Changing the terminal assignment using Pr.178 to Pr.189 (Input terminal function selection) may affect the other functions.
 Set parameters after confirming the function of each terminal.

Pr.15 Jog frequency page 410 Pr.4 to Pr.6, Pr.24 to Pr.27, Pr.232 to Pr.239 Multi-speed operation page 411 Pr.75 Reset selection/disconnected PU detection/PU stop selection page 336 Pr.161 Frequency setting/key lock operation selection page 341 Pr.178 to Pr.189 (Input terminal function selection) page 521 Pr.190 to Pr.196 (Output terminal function selection) page 473 Pr.340 Communication startup mode selection page 398 Pr.550 NET mode operation command source selection page 400

5.9.2 Startup of the inverter in Network operation mode at power-ON

When power is switched ON or when power comes back ON after an instantaneous power failure, the inverter can be started up in the Network operation mode.

After the inverter starts up in the Network operation mode, parameter writing and operation can be commanded from programs. Set this mode when performing communication operation using the RS-485 terminals or a communication option.

| Pr. | Name Initial value Setting | | Setting range | Description |
|------------|----------------------------|---|---------------|---|
| 79 D000 | Operation mode selection | 0 | 0 to 4, 6, 7 | Selects the operation mode. (Refer to page 389.) |
| | | | 0 | The inverter starts up in an operation mode selected in Pr.79 . |
| 340 | Communication startup mode | 0 | 1, 2 | The inverter starts up in the Network operation mode. If an instantaneous power failure occurs when "2" is set, the operating status before the instantaneous power failure is maintained. |
| D001 | selection | Ü | 10, 12 | The inverter starts up in the Network operation mode. The operation mode can be changed between the PU operation mode and Network operation mode from the operation panel. If an instantaneous power failure occurs when "12" is set, running is continued at the condition before the instantaneous power failure. |

Selecting the operation mode for power-ON (Pr.340)

• Depending on the Pr.79 and Pr.340 settings, the operation mode at power-ON (reset) changes as described below.

| Pr.340 setting | Pr.79 setting | Operation mode at power-ON, at power restoration, or after a reset | Operation mode switching | | | |
|----------------------|-------------------|--|--|--|--|--|
| | 0 (initial value) | External operation mode | Switching among the External, PU, and NET operation modes is enabled*2 | | | |
| | 1 | PU operation mode | Fixed at PU operation mode. | | | |
| | 2 | External operation mode | Switching between the External and NET operation modes is enabled. Switching to PU operation mode is disabled. | | | |
| 0 (initial | 3, 4 | External/PU combined operation mode | Operation mode switching is disabled. | | | |
| value) | 6 | External operation mode | Switching among the External, PU, and NET operation mode is enabled while running. | | | |
| | 7 | X12 (MRS) signal ON: External operation mode | Switching among the External, PU, and NET operation modes is enabled*2 | | | |
| | , | X12 (MRS) signal OFF: External operation mode | Fixed at External operation mode (forcibly switched to External operation mode). | | | |
| | 0 | NET operation mode | | | | |
| | 1 | PU operation mode | 1 | | | |
| | 2 | NET operation mode | | | | |
| | 3, 4 | External/PU combined operation mode | | | | |
| 1, 2 ^{*1} | 6 | NET operation mode | Same as Pr.340 = "0". | | | |
| | 7 | X12 (MRS) signal ON: NET operation mode | | | | |
| | / | X12 (MRS) signal OFF: External operation mode | | | | |
| | 0 | NET operation mode | Switching between the PU and NET operation mode is enabled.*3 | | | |
| | 1 | PU operation mode | Same as Pr.340 = "0". | | | |
| | 2 | NET operation mode | Fixed at NET operation mode. | | | |
| 10, 12 ^{*1} | 3, 4 | External/PU combined operation mode | Same as Pr.340 = "0". | | | |
| | 6 | NET operation mode | Switching between the PU and NET operation mode is enabled while running.*3 | | | |
| | 7 | External operation mode | Same as Pr.340 = "0". | | | |

^{*1} Use Pr.340 = "2 or 12" setting to perform communication with the RS-485 terminals. Even if an instantaneous power failure occurs while Pr.57 Restart coasting time # "9999", the inverter continues running at the condition before the instantaneous failure. When Pr.340 = "1 or 10", if a power failure occurs while the start signal is being input through communication, the start signal is OFF at power restoration.

Parameters referred to

Pr.57 Restart coasting time ☐ page 628, page 635 Pr.79 Operation mode selection ☐ page 389

^{*2} The operation mode cannot be directly changed between the PU operation mode and Network operation mode.

^{*3} Switching between the PU and NET operation modes is available with the PU and NET operation modes are provided in the PU and NET operation modes are provided in the PU and NET operation modes are provided in the PU and NET operation modes are provided in the PU and NET operation modes are provided in the PU and NET operation modes are provided in the PU and NET operation modes are provided in the PU and NET operation modes are provided in the PU and NET operation modes are provided in the PU and NET operation modes are provided in the PU and NET operation modes are provided in the PU and NET operation modes are provided in the PU and NET operation modes are provided in the PU and NET operation modes are provided in the PU and NET operation modes are provided in the PU and NET operation modes are provided in

5.9.3 Start command source and frequency command source during communication operation

The start and frequency commands given from an external device can be made valid when using the RS-485 terminals or the communication option. The command source in the PU operation mode can also be selected.

| Pr. | Name | Initial value | Setting range | Description |
|-------------|-----------------------------------|------------------|---------------|--|
| 338 | Communication | | 0 | Start command source is communication. |
| D010 | operation command source | 0 | 1 | Start command source is external. |
| | | | 0 | Frequency command source is communication. |
| 339 | Communication speed | | 1 | Frequency command source is external. |
| D011 | command source | 0 | 2 | Frequency command source is external. (When there is no external input, the frequency command given via communication is valid, and the frequency command given via terminal 2 is invalid.) |
| | | | 0 | The communication option is the command source when in the NET operation mode. |
| 550 D012 | NET mode operation command source | 9999 | 1 | The RS-485 terminals are the command source when in the NET operation mode. |
| 5012 | selection | | 9999 | The communication option is recognized automatically. Normally, the RS-485 terminals are the command source. When the communication option is mounted, the communication option is the command source. |
| | | | 1 | The RS-485 terminals are the command source when in the PU operation mode. |
| 551 | PU mode operation | | 2 | The PU connector is the command source when in the PU operation mode. |
| D013 | command source selection | 9999 | 3 | The USB connector is the command source when in the PU operation mode. |
| | | | 9999 | USB automatic recognition. Normally, the PU connector is the command source. When the USB is connected, the USB connector is the command source. |

◆ Selection of command source in the network (NET) operation mode (Pr.550)

- Either of the RS-485 terminals or the communication option can be specified for the command source in the Network operation mode.
- For example, whether or not the communication option is installed, set **Pr.550** = "1" to write parameters or give the start and frequency commands via RS-485 terminals in the Network operation mode.



• In the initial setting, "9999" (communication option automatic recognition) is set for **Pr.550**. Thus, if the communication option is mounted, parameters cannot be written or the start and frequency commands cannot be sent by communications that use the RS-485 terminals. (Monitoring or parameter reading can be performed.)

◆ Selection of the command source of the PU operation mode (Pr.551)

- Any of the PU connector, RS-485 terminals, or USB connector can be specified as the command source in the PU operation mode.
- To write parameters or execute the start and frequency commands through communication in the PU operation mode, set **Pr.551** = "1" for communication via the RS-485 terminals, or set **Pr.551** = "3" or "9999" for communication via the USB connector.



- When **Pr.550** = "1" (NET mode RS-485 terminals) and **Pr.551** = "1" (PU mode RS-485 terminals), the PU operation mode has a precedence. For this reason, if the communication option is not mounted, switching to the Network operation mode is no longer possible.
- · Changed setting values are enabled at power-ON or inverter reset.

| Pr.550 | Pr.551 | | Comman | | | |
|-----------------|----------------------------|--------------------|-------------------------|-------------------------|----------------------------------|--|
| setting | setting | PU connector | USB connector | RS-485 terminals | Communication option | Remarks |
| | 1 | × | × | PU operation mode *1 | NET operation mode ^{*2} | |
| | 2 | PU operation mode | × | × | NET operation mode ^{*2} | |
| 0 | 3 | × | PU operation mode | × | NET operation mode ^{*2} | |
| | 9999 (initial value) | PU operation mode | PU operation mode *3 | × | NET operation mode ^{*2} | |
| | 1 | × | × | PU operation mode *1 | × | Switching to NET operation mode disabled |
| | 2 | PU operation mode | × | NET operation mode | × | |
| 1 | 3 | × | PU operation mode | NET operation mode | × | |
| | 9999 (initial value) | PU operation mode | PU operation mode *3 | NET operation mode | × | |
| | 1 | × | × | PU operation mode *1 | NET operation mode ^{*2} | |
| | 2 | PU operation mode | × | × | NET operation mode ^{*2} | With communication option |
| 9999 | 2 | T o operation mode | ^ | NET operation mode | × | Without communication option |
| (initial value) | 3 | × | PU operation mode | × | NET operation mode ^{*2} | With communication option |
| , | Ü | | T o operation mode | NET operation mode | × | Without communication option |
| | 9999 (initial | PU operation mode | PU operation mode | × | NET operation mode ^{*2} | With communication option |
| | value) | *3 | *3 | NET operation mode | × | Without communication option |

- *1 The MODBUS RTU protocol cannot be used in the PU operation mode. To use the MODBUS RTU protocol, set Pr.551 = "2".
- *2 If the communication option is not mounted, switching to the NET operation mode is not possible.
- $^{\star}3$ When **Pr.551** = "9999", the priority of the PU command source is USB connector > PU connector.

♦ Controllability through communication

| | | | Controllability in each operation mode | | | | | | |
|-------------------|-----------------------------------|---------------------------------|--|--------------------|---|---|--|---------------------------------|--|
| Command interface | Conditions (Pr.551 setting) | ltem | PU operation | External operation | Combined operation mode 1 (Pr.79 = "3") | Combined operation mode 2 (Pr.79 = "4") | NET operation (via RS-485 terminals)*7 | NET operation (via option)*8 | |
| | 0 (511 | Operation (start) command | 0 | × | × | 0 | × | | |
| | 2 (PU connector), 9999 | Operation (stop) command | 0 | Δ*4 | Δ*4 | 0 | Δ*4 | | |
| | (automatic | Frequency setting | 0 | × | 0 | × | × | | |
| | recognition, | Monitor | 0 | 0 | 0 | 0 | 0 | | |
| | without USB | Parameter write | o*5 | ×*6 | o*5 | o*5 | ×*6 | | |
| | connection) | Parameter read | 0 | 0 | 0 | 0 | 0 | | |
| PU | | Inverter reset | 0 | 0 | 0 | 0 | 0 | | |
| connector*1 | | Operation (start) command | × | × | × | × | × | | |
| | Terminals | Operation (stop) command | Δ*4 | Δ*4 | Δ*4 | Δ*4 | Δ*4 | | |
| | other than | Frequency setting | × | × | × | × | × | | |
| | the above | Monitor | 0 | 0 | 0 | 0 | 0 | | |
| | | Parameter write | x*6 | ×*6 | x*6 | x*6 | ×*6 | | |
| | | Parameter read | 0 | 0 | 0 | 0 | 0 | | |
| | | Inverter reset | 0 | 0 | 0 | 0 | 0 | | |
| | | Operation command (start, stop) | 0 | × | × | 0 | × | | |
| | === | Frequency setting | 0 | × | 0 | × | × | | |
| | 1 (RS-485 terminals) | Monitor | 0 | 0 | 0 | 0 | 0 | | |
| | | Parameter write | o*5 | ×*6 | o*5 | o*5 | ×*6 | | |
| | | Parameter read | 0 | 0 | 0 | 0 | 0 | | |
| RS-485 | | Inverter reset | 0 | 0 | 0 | 0 | 0 | | |
| terminals | Terminals | Operation command (start, stop) | × | × | × | × | o*2 | × | |
| | | Frequency setting | × | × | × | × | o ^{*2} | × | |
| | other than | Monitor | 0 | 0 | 0 | 0 | 0 | 0 | |
| | the above | Parameter write | ×*6 | ×*6 | ×*6 | ×*6 | o*5 | ×*6 | |
| | | Parameter read | 0 | 0 | 0 | 0 | 0 | 0 | |
| | | Inverter reset | × | × | × | × | o*3 | × | |
| | 3 (USB | Operation command (start, stop) | 0 | × | × | 0 | × | | |
| | connector), 9999 | Frequency setting | 0 | × | 0 | × | × | | |
| | (automatic | Monitor | 0 | 0 | 0 | 0 | 0 | | |
| | recognition, | Parameter write | o*5 | ×*6 | ×*6 | ×*6 | ×*6 | | |
| | with USB connection) | Parameter read | 0 | 0 | 0 | 0 | 0 | | |
| USB | connection) | Inverter reset | 0 | 0 | 0 | 0 | 0 | | |
| connector | | Operation command (start, stop) | × | × | × | × | × | | |
| | Terminals | Frequency setting | × | × | × | × | × | | |
| | other than | Monitor | 0 | 0 | 0 | 0 | 0 | | |
| | the above | Parameter write | ×*6 | ×*6 | x*6 | ×*6 | ×*6 | | |
| | | Parameter read | 0 | 0 | 0 | 0 | 0 | | |
| | | Inverter reset | 0 | 0 | 0 | 0 | 0 | T | |
| | | Operation command (start, stop) | × | × | × | × | × | o* 2 | |
| | | Frequency setting | × | × | × | × | × | o*2 | |
| Option | _ | monitor | 0 | 0 | 0 | 0 | 0 | 0 | |
| • | | Parameter write | x*6 | ×*6 | x*6 | ×*6 | ×*6 | o*5 | |
| | | Parameter read | 0 | 0 | 0 | 0 | 0 | 0 | |
| | | Inverter reset | × | × | × | × | × | o*3 | |

| | | | Controllability in each operation mode | | | | | | |
|--------------------------------|-----------------------------------|---------------------------------|--|--------------------|---|---|--|---------------------------------|--|
| Command interface | Conditions (Pr.551 setting) | ltem | PU operation | External operation | Combined operation mode 1 (Pr.79 = "3") | Combined operation mode 2 (Pr.79 = "4") | NET operation (via RS-485 terminals)*7 | NET operation (via option)*8 | |
| External | _ | Inverter reset | 0 | 0 | 0 | 0 | 0 | | |
| control circuit terminal | | Operation command (start, stop) | × | 0 | 0 | × | x*2 | | |
| | | Frequency setting | × | 0 | × | 0 | x*2 | | |

o: Valid, ×: Invalid, Δ: Partially valid

- *1 RS-485 communication via PU connector
- *2 Follows the Pr.338 Communication operation command source and Pr.339 Communication speed command source settings. (Refer to page 400.)
- *3 At occurrence of RS-485 communication error, the inverter cannot be reset from the computer.
- *4 Only PU stop is enabled. "PS" is displayed on the operation panel during PU stop. The operation follows the Pr.75 Reset selection/ disconnected PU detection/PU stop selection setting. (Refer to page 336.)
- Writing of some parameters may be disabled by the Pr.77 Parameter write selection setting and the operating condition. (Refer to page 345.)
- Some parameters are write-enabled independently of the operation mode and command source presence/absence. Writing is also enabled when **Pr.77** = "2"
 - (refer to page 345). Parameter clear is disabled.
- *7 When Pr.550 NET mode operation command source selection = "1" (RS-485 terminals enabled), or Pr.550 NET mode operation command **source selection** = "9999" with no communication option connected.
- *8 When Pr.550 NET mode operation command source selection = "0" (communication option enabled), or Pr.550 NET mode operation **command source selection** = "9999" with communication option connected.

Operation when a communication error occurs

| | | | Operation i | in each operat | ion mode at er | ror occurrences | |
|---|---|---|-----------------------------|---|---|--|------------------------------------|
| Fault type | Conditions (Pr.551 setting) | PU operation | External operation | Combined operation mode 1 (Pr.79 = "3") | Combined operation mode 2 (Pr.79 = "4") | NET operation (via RS-485 terminals)*5 | NET operation (via option)*6 |
| Inverter fault | _ | Stop | | | | | |
| PU connector disconnection | 2 (PU connector), 9999 (automatic recognition) | Stop/continued* | 1*4 | | | | |
| | Other than 2 | Stop/continued* | 1 | | | | |
| Communication error | 2 (PU connector) | Stop/ continued*2 | Continued Stop/ continued*2 | | | Continued | |
| at i o connector | Other than 2 | Continued | | | | | |
| Communication error | 1 (RS-485 terminals) | Stop/ continued*2 Continued Stop/ continued*2 Continued*2 Continued | | | | | |
| at RS-485 terminals | Other than 1 | Continued | | Stop/ continued*2 | Continued | | |
| Communication error at USB connector | 3 (USB connector), 9999 (automatic recognition) | Stop/ continued ^{*2} | Continued | | | | |
| | Other than 3 | Continued | • | | | | |
| Communication error at communication option | _ | Continued | | | | | Stop/ continued*3 |

- *1 Selectable with Pr.75 Reset selection/disconnected PU detection/PU stop selection.
- *2 Selectable with Pr.122 PU communication check time interval, Pr.336 RS-485 communication check time interval, and Pr.548 USB communication check time interval.
- *3 The operation depends on the communication option setting.
- *4 In the PU JOG operation mode, operation always stops when the PU is disconnected. The operation at a PU disconnection fault (E.PUE) occurrence is as set in Pr.75 Reset selection/disconnected PU detection/PU stop selection.
- When Pr.550 NET mode operation command source selection = "1" (RS-485 terminals enabled), or Pr.550 NET mode operation command source selection = "9999" with no communication option connected.
- *6 When Pr.550 NET mode operation command source selection = "0" (communication option enabled), or Pr.550 NET mode operation command source selection = "9999" with communication option connected.

◆ Selecting the command interface in the Network operation mode (Pr.338, Pr.339)

- Selecting a command interface is required for the following two types of commands: the operation command using the start signals and the signals related to the inverter function selection, and the speed command using signals related to the frequency setting.
- · The following table shows the command interface for each function in the Network operation mode, determined by the parameter settings: an external terminal or a communication interface (RS-485 terminals or communication option).

| Pr.338 Communication operation command source | | 0: NET | | 1: EXT | | | | |
|---|--|-----------------|-----------------|-----------|-----------------------------------|-----------|---|--|
| Pr.33 | 39 Communication speed command source | 0: NET | 1: EXT | 2: EXT | 0: NET | 1: EXT | 2: EXT | Remarks |
| Frequency | setting through communication | NET | _ | NET | NET | _ | NET | |
| Terminal 2 | | _ | EXT | _ | _ | EXT | _ | |
| Terminal 4 | | _ | EXT ensatior | | _ | EXT | | |
| Terminal 1 | | | | | | | | |
| RL*1 | Low-speed operation command/Remote setting (setting clear)/Stop-on-contact selection 0 | NET EXT NET EXT | | | Pr.59 = "0" (multi-speed), | | | |
| RM ^{*1} | Middle-speed operation command/Remote setting (deceleration) | NET EXT | | NET | EXT | | Pr.59 ≠ "0" (remote), Pr.270 ="1, 3, 11, or 13" (stop-on- | |
| RH ^{*1} | High-speed operation command/ Remote setting (acceleration) | NET | EXT | | NET | EXT | | contact) |
| RT ^{*1} | Second function selection/ Stop-on-contact selection 1 | NET | | | EXT | | | Pr.270 ="1, 3, 11, or 13" (stopon-contact) |
| AU ^{*1} | Terminal 4 input selection | _ | Combi | ned | _ | Combi | ned | |
| JOG*1 | Jog operation selection | _ | • | | EXT | | | |
| CS*1 | Selection of automatic restart after instantaneous power failure / flying start | EXT o | r NET | | EXT | | | EXT or NET is selected according to the setting in Pr.162.*2 |
| OH ^{*1} | External thermal relay input | EXT | | | | | | |
| REX ^{*1} | 15-speed selection | NET EXT | | NET | EXT | | Pr.59 ="0" (multi-speed) | |
| X9 ^{*1} | Third function selection | NET | | | EXT | | | |
| X10 ^{*1} | Inverter run enable | EXT | | | | | | |
| X11*1 | FR-HC2/FR-CC2 connection, instantaneous power failure detection | EXT | EXT | | | | | |
| X12*1 | PU operation external interlock | EXT | | | | | | |
| X13 ^{*1} | External DC injection brake operation start | NET | | | EXT | | | |
| X14 ^{*1} | PID control valid | NET | EXT | | NET EXT | | | |
| BRI*1 | Brake opening completion | NET | | | EXT | | | |
| X16 ^{*1} | PU/External operation switchover | EXT | | | | | | |
| X17*1 | Load pattern selection forward/reverse rotation boost | NET | | | EXT | | | |
| X18 ^{*1} | V/F switchover | NET | | | EXT | | | |
| X19 ^{*1} | Load torque high-speed frequency | NET | | | EXT | | | |
| X20 ^{*1} | S-pattern acceleration/deceleration C switchover | NET | | | EXT | | | |
| X22*1 | Orientation command | NET | | | EXT | | | |
| LX ^{*1} | Pre-excitation/servo ON | NET | | | EXT | | | |
| | Output stop | Comb | ined | | EXT | | | Pr.79 ≠ "7" |
| MRS*1 | | | EXT | | | | | Pr.79 = "7". When X12 signal is not assigned. |
| STP (STOP)*1 | Start self-holding selection | _ | | | EXT | | | |
| MC ^{*1} | Control mode switchover | NET | | | EXT | | | |
| TL*1 | Torque limit selection | NET | | | EXT | | | |
| X28 ^{*1} | Start-time tuning start external input | NET | | | EXT | | | |
| X32*1 | External fault input | EXT | | | • | | | |
| X37 ^{*1} | Traverse function selection | NET | | | EXT | | | |
| | ı | | | | | | | I |

| Pr.338 Communication operation command source | | 0: NET | | 1: EXT | | | | |
|---|--|-----------|-----------|-----------|--------------|-----------|-----------|---|
| Pr.33 | 39 Communication speed command source | 0: NET | 1: EXT | 2: EXT | 0: NET | 1: EXT | 2: EXT | Remarks |
| X42 ^{*1} | Torque bias selection 1 | NET | | | EXT | | | |
| X43 ^{*1} | Torque bias selection 2 | NET | | | EXT | | | |
| X44 ^{*1} | P/PI control switchover | NET | | EXT | | | | |
| BRI2*1 | Second brake sequence open completion | NET | | | EXT | | | |
| TRG*1 | Trace trigger input | Combi | ned | | EXT | | | |
| TRC*1 | Trace sampling start/end | Combi | ned | | EXT | | | |
| X48 ^{*1} | Power failure stop external | EXT | | | | | | |
| SQ*1 | Sequence start | EXT o | r NET* | | EXT | | | Pr.414 = "1": Valid when there is EXT or NET input. Pr.414 = "2": EXT |
| X51 ^{*1} | Fault clear | Combi | ned | | EXT | | | |
| X52 ^{*1} | Cumulative pulse monitor clear | NET | | | EXT | | | |
| X53 ^{*1} | Cumulative pulse monitor clear (control terminal option) | NET | | | EXT | | | |
| JOGF*1 | JOG forward rotation command | _ | | | EXT | | | |
| JOGR*1 | JOG reverse rotation command | _ | | | EXT | | | |
| CLRN*1 | NET position pulse clear | NET | | | | | | |
| STF*1 | Forward rotation command | NET | | | EXT | | | |
| STR*1 | Reverse rotation command | NET | | | EXT | | | |
| RES ^{*1} | Inverter reset | EXT | | | | | | |
| X64 ^{*1} | PID forward/reverse action switchover | NET | EXT | | NET | EXT | | |
| X65 ^{*1} | PU/NET operation switchover | EXT | | | | | | |
| X66 ^{*1} | External/NET operation switchover | EXT | | | | | | |
| X67 ^{*1} | Command source switchover | EXT | | | | | | |
| NP*1 | Simple position pulse train sign | EXT | | | | | | |
| CLR*1 | Simple position droop pulse clear | EXT | | | | | | |
| X70 ^{*1} | DC feeding operation permission signal | NET | | | EXT | | | |
| X71 ^{*1} | DC feeding cancel signal | NET | | | EXT | | | |
| X72 ^{*1} | PID P control switchover | NET | EXT | | NET | EXT | | |
| X73 ^{*1} | Second PID P control switchover | NET | EXT | | NET External | | al | |
| X74 ^{*1} | Magnetic flux decay output shutoff | NET | | | EXT | | | |
| X76 ^{*1} | Proximity dog | EXT | | | | | | |
| X77 ^{*1} | Pre-charge end command | NET | EXT | | NET | EXT | | |
| X78 ^{*1} | Second pre-charge end command | NET | EXT | | NET | EXT | | |
| X79 ^{*1} | Second PID forward/reverse action switchover | NET | EXT | | NET | EXT | | |
| X80 ^{*1} | Second PID control valid | NET | EXT | | NET | EXT | | |
| X85 ^{*1} | SSCNET III communication disabled | EXT | | | | | | |
| X87 ^{*1} | Sudden stop | Combined | | EXT | | | | |
| LSP*1 | Forward stroke end | EXT | | | | | | |
| LSN ^{*1} | Reverse stroke end | EXT | | | | | | |
| X92*1 | Emergency stop | EXT | | | | | | |
| X93 ^{*1} | Torque control selection | NET | | EXT | | | | |
| X94*1 | Control signal input for main circuit power supply MC | EXT | | | | | | |
| X95 ^{*1} | Converter unit fault input | EXT | | | | | | |
| X96 ^{*1} | Converter unit fault (E.OHT, E.CPU) input | EXT | | | | | | |
| RLF*1 | Low-speed forward rotation command | _ | | | _ | EXT | | |
| RLR*1 | Low-speed reverse rotation command | _ | | | _ | EXT | | |

^{*1} Use Pr.178 to Pr.189 (Input terminal function selection) to assign the function to an input terminal. (Refer to page 521.)

^{*2} When **Pr.77** = "2", **Pr.162** setting can be changed during operation. The new setting is applied after stop. Until the inverter has stopped, the previous setting of the interface for the operation command and the speed command in the Network operation mode is valid.

[Explanation of Terms in Table]

EXT: External terminal only

NET: Communication interface only

Combined: Either external terminal or communication interface

-: Neither external terminal nor communication interface

Compensation: Only commands given via the external terminal are valid when Pr.28 Multi-speed input compensation selection = "1".



- The communication interface selection is determined by the setting of Pr.550 and Pr.551.
- The setting of Pr.338 and Pr.339 can be changed during operation when Pr.77 = "2". Note that the changed setting is applied after the inverter has stopped. Until the inverter has stopped, the previous setting of the interface for the operation command and the speed command in the Network operation mode is valid.

Changing the command interface using a signal input via external terminal (X67 signal)

- · In the Network operation mode, the command interface for the operation command and the speed command can be changed using the Command source switchover (X67) signal. This method may be useful to use both external terminal and communication interface by using a different interface according to the command type.
- For the X67 signal, set "67" to any of Pr.178 to Pr.189 (Input terminal function selection) to assign the function to a control terminal.
- · When the X67 signal is OFF, the command interface for the operation command and the speed command is the control terminal

| X67 signal state | Interface for the operation command | Interface for the speed command | |
|---------------------|-------------------------------------|-------------------------------------|--|
| Signal not assigned | Determined by Pr.338 setting | Determined by Pr.339 setting | |
| ON | Determined by F1.336 Setting | Determined by F1.339 Setting | |
| OFF | Control terminal only | | |



- The ON/OFF state of the X67 signal is applied only during a stop. When the terminals are switched during operation, the ON/ OFF state is reflected after a stop.
- · When the X67 is OFF, a reset via communication is disabled.
- Changing the terminal assignment using Pr.178 to Pr.189 (Input terminal function selection) may affect the other functions. Set parameters after confirming the function of each terminal.

Parameters referred to

Pr.28 Multi-speed input compensation selection page 411

Pr.59 Remote function selection page 367
Pr.79 Operation mode selection page 389

Reverse rotation prevention selection 5.9.4

This function can prevent reverse rotation fault resulting from the incorrect input of the start signal.

| Pr. | Name | Initial value | Setting range | Description |
|----------------------|---------------------------------------|---------------|---------------|--|
| 70 | Deverse retetion | | 0 | Both forward and reverse rotations allowed |
| 78 D020 | Reverse rotation prevention selection | 0 | 1 | Reverse rotation disabled |
| prevention selection | prevention selection | | 2 | Forward rotation disabled |

- · Set this parameter to limit the motor rotation to only one direction.
- This parameter is valid for all of the reverse rotation and forward rotation keys of the operation panel and of the parameter unit, the start signals (STF, STR signals) via external terminals, and the forward and reverse rotation commands through communication.

Frequency setting using pulse train input 5.9.5

A pulse train input via terminal JOG can be used to set the inverter's speed command.

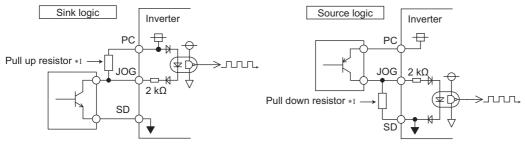
Moreover, speed synchronized operation of an inverter can be performed by using the pulse train input and output together.

| | | | value | | Description | | |
|-------------|-----------------------------------|-------|-------|---|--|--|--------------------------|
| Pr. | Name | FM | CA | Setting range | Pulse train input (terminal JOG) | Pulse train output (terminal FM) | |
| | | | | 0 | JOG signal ^{*1} | FM output*2 | |
| | | | | 1 | Pulse train input | FM output ^{*2} | |
| | | 0 | | 10 ^{*2} | JOG signal ^{*1} | High-speed pulse train output (50% duty) | |
| | | | | 11 ^{*2} | Pulse train input | High-speed pulse train output (50% duty) | |
| 291 D100 | Pulse train I/O selection | | | 0 | | 20 ^{*2} | JOG signal ^{*1} |
| | | | | 21 ^{*2} | Pulse train input | High-speed pulse train output (ON width fixed) | |
| | | | | 100 ^{*2} | Pulse train input High-speed pulse train output (ON width fixed). Output the pulse train input withe changes. | | |
| 384 | Input pulse division | | | 0 | Pulse train input disabled | | |
| D101 | scaling factor | 0 | | 1 to 250 | Division ratio on the input pulse. The frequency resolution on input pulse changes according to this setting. | | |
| 385 D110 | Frequency for zero input pulse | 0 Hz | | 0 to 590 Hz Set the frequency applicable to the time when the in zero (bias). | | cable to the time when the input pulse is | |
| 386 D111 | Frequency for maximum input pulse | 60 Hz | 50 Hz | 0 to 590 Hz | Set the frequency applicable to the time when the input pulse is maximum (gain). | | |

- *1 Function assigned to Pr.185 JOG terminal function selection.
- *2 Valid only for the FM type inverters.

◆ Selection of pulse train input (Pr.291)

- Setting Pr.291 Pulse train I/O selection = "1, 11, 21, or 100" and Pr.384 Input pulse division scaling factor ≠ "0" allows the function of terminal JOG to change into a pulse train input for setting of the inverter frequency. In the initial setting, the JOG signal is assigned to terminal JOG. A maximum pulse train of 100k pulses/s can be input.
- · Connection with an open collector output system pulse generator

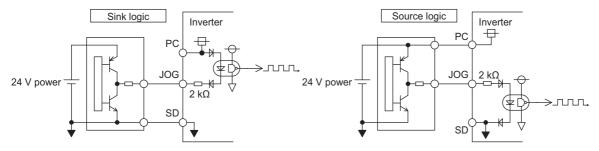


*1 When the wiring length is long with open collector outputs, the influence of stray capacitance causes the pulse to flatten out and prevents the input pulse from being recognized.

When the wiring length is long (10 m or longer of shielded twisted pair cable with a recommended cable gauge of 0.75 mm²), connect the open collector output signal to the power supply by an external pull-up resistor. The following table shows the reference resistance values for wiring length. The stray capacitance of the wiring changes considerably according to how the cable is laid, thus the above wiring lengths are not guaranteed values. When using a pull-up/down resistor, check the permissible power of the resistor and the permissible load current of the output transistor, and use within the permissible range.

| Wiring length | Less than 10 m | 10 to 50 m | 50 to 100 m |
|--------------------------|----------------|------------|-------------|
| Pull-up/down resistor | Not required | 1 kΩ | 470 Ω |
| Load current (reference) | 10 mA | 35 mA | 65 mA |

· Connection with a complementary output system pulse generator



NOTE

- When pulse train input is selected, the function assigned to terminal JOG by Pr.185 JOG terminal function selection is invalid.
- When "2" (simple position pulse train command given by pulse train input) is set to Pr.419 Position command source selection, the JOG terminal becomes the simple position pulse train terminal regarding of the Pr.291 setting.
- **Pr.291** is the selection parameter for pulse train output/FM output. Thus, before changing the setting, check the specifications of the device connected to the terminal FM. (For the pulse train output, refer to page 461.)

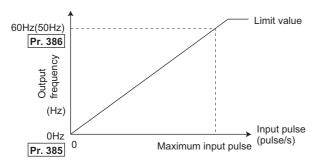
◆ Pulse train input specification

| | Item | Specification | | |
|--|-----------------------------|--|--|--|
| Supported hulse method | | Open collector output / complementary output (24 V power supply voltage) | | |
| HIGH input level | | 20 V or more (voltage between JOG and SD) | | |
| LOW input level | | 5 V or less (voltage between JOG and SD) | | |
| Maximum input pulse rate | | 100k pulses/s | | |
| Minimum input pulse width | | 2.5 μs | | |
| Input resistance/load current | | 2 kΩ (typ) / 10 mA (typ) | | |
| Maximum wiring length Open collector output method | | 10 m (0.75 mm ² /twisted pair) | | |
| (reference value) | Complementary output method | 100 m (output resistance 50 Ω) ^{*1} | | |
| Detection resolution | | 1/3750 | | |

^{*1} The wiring length of complementary output is dependent on the output wiring specification of the complementary output unit. The stray capacitance of the wiring changes considerably according to how the cable is laid, so the maximum wiring length is not a guaranteed value.

◆ Adjustment of pulse train and frequency (Pr.385, Pr.386)

• The frequency during zero input pulse and maximum input pulse can be set with **Pr.385 Frequency for zero input pulse** and **Pr.386 Frequency for maximum input pulse**, respectively.



*1 Limit value = (Pr.386 - Pr.385) × 1.1 + Pr.385

♦ How to calculate the input pulse division scaling factor (Pr.384)

The maximum number of input pulses can be calculated by the following formula with **Pr.384 Input pulse division scaling factor**:

Maximum number of pulses (pulse/s) = Pr.384 × 400 (maximum 100k pulses/s)

(number of detectable pulses = 11.45 pulses/s)

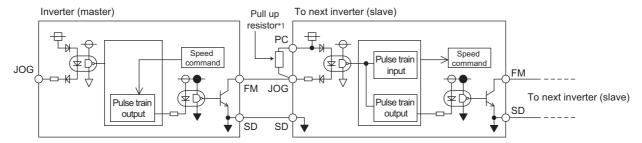
For example, to run the invert at 0 Hz when pulse train input is zero and at 30 Hz when pulse train is 4000 pulses/sec, set the inverter as follows:

Pr.384 = "10" (maximum number of input pulses 4000 pulses/s)



• The priority of the frequency command given by the external signals is as follows: JOG operation > multi-speed operation > terminal 4 analog input > pulse train input. When pulse train input is enabled (**Pr.291** = "1, 11, 21, or 100" and **Pr.384** ≠ "0"), terminal 2 analog input becomes disabled.

Speed synchronized operation by pulse input/output



*1 When the wiring length between FM and JOG is long, the influence of stray capacitance causes the pulse to flatten out and prevents the input pulse from being recognized. When the wiring length is long (10 m or longer of shielded twisted pair cable with a recommended cable size of 0.75 mm²), connect between terminal JOG and terminal PC with an external pull-up resistor. The following table shows the reference resistance values for wiring length.

| Wiring length | Less than 10 m | 10 to 50 m | 50 to 100 m |
|--------------------------|----------------|------------|-------------|
| Pull-up resistor | Not required | 1 kΩ | 470 Ω |
| Load current (reference) | 10 mA | 35 mA | 65 mA |

The stray capacitance of the wiring changes considerably according to how the cable is laid, thus the above wiring lengths are not guaranteed values.

When using a pull-up/down resistor, check the permissible power of the resistor and the permissible load current (terminal PC: 100 mA, high-speed pulse train output: 85 mA), and use within the permissible range.

Setting "100" in Pr.291 allows the use of the entire pulse train input for the pulse train output (via terminal FM) just as they
are.

Connecting in a daisy chain enables speed synchronized operation of multiple inverters.

- Set **Pr.384** to "125" for inverters that receive pulse train since the maximum pulse train output is 50k pulses/s.
- The maximum number of input pulses should be 50k pulses/s.
- When performing synchronized operation, wire according to the following procedure. (This is to prevent contact input of 24
 V being applied to terminal FM.)
 - 1. Set pulse train output (setting other than "0 or 1") to Pr.291 on the master side inverter.
 - **2.** Inverter power OFF
 - **3.** Wire the slave side terminal JOG-SD to the master side terminal FM-SD.
 - **4.** Turn the inverter power supply ON.

NOTE

- After changing the Pr.291 setting, connect the JOG terminal to the terminal FM-SD. When FM output (voltage output) is taken
 as the pulse train, take caution to prevent voltage from being applied to the terminal FM.
- · Use sink logic (factory setting) for the slave side inverter. The inverter does not operate properly with source logic.

Speed synchronized operation specification

| Item | Specification |
|-------------------------|----------------------------------|
| Output pulse format | Pulse width fixed (10 µs) |
| Pulse rate | 0 to 50k pulses/s |
| Pulse propagation delay | 1 to 2 µs per unit ^{*1} |

*1 A pulse propagation delay of about 1 to 2 µs in the slave occurs and further increases when the wiring length is long.

Parameters referred to

Pr.291 (Pulse train output) page 457

Pr.419 Position command source selection page 319

5.9.6 JOG operation

The frequency and acceleration/deceleration time for JOG operation can be set. JOG operation is possible in both External operation and PU.

JOG operation can be used for conveyor positioning, test operation, etc.

| Pr. | Name | Initial value | Setting range | Description |
|------------|--|------------------|---------------|--|
| 15 D200 | Jog frequency | 5 Hz | 0 to 590 Hz | Set the frequency for JOG operation. |
| 16 F002 | Jog acceleration/ deceleration time | 0.5 s | 0 to 3600 s | Set the motor acceleration/deceleration time during JOG operation. For the acceleration/deceleration time, set the time until the frequency*1 set in Pr.20 Acceleration/deceleration reference frequency is reached. The acceleration/deceleration times cannot be set separately. |

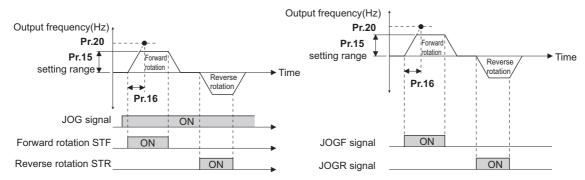
Note that these parameters are categorized as a simple mode parameter when the LCD operation panel (FR-LU08) or the parameter unit (FR-PU07) is used. Setting of this parameter is enabled when the operation panel (FR-DU08) is connected and "0" is set to **Pr.160 User group read selection**. (Refer to page 354.)

*1 The **Pr.20** initial value is set to 60 Hz for the FM type and to 50 Hz for the CA type.

♦ JOG operation using the external signals

- Operation can be started and stopped by the start signals (STF and STR signals) when the Jog operation selection (JOG) signal is ON. (For the operation method, refer to page 162.)
- While the JOGF or JOGR signal is input, Jog frequency setting (**Pr.15**) is used for operation. The rotation is forward while the JOGF signal is input, and the rotation is reverse while the JOGR signal is input. (Direct JOG function)
- Use the JOG acceleration/deceleration time function (**Pr.16**) to set the acceleration/deceleration time for JOG operation.
- To use each signal, set the corresponding number selected from the following table in any of Pr.178 to Pr.189 (Input terminal function selection) to assign the function to an output terminal.

| Input signal | Pr.178 to Pr.189 settings |
|--------------|----------------------------------|
| JOG | 5 (Pr.185 initial value) |
| JOGF | 57 |
| JOGR | 58 |



♦ JOG operation using the PU

• When the operation panel or parameter unit is in the JOG operation mode, the motor jogs only while the start button is pressed. (For the operation method, refer to page 163.)



- The reference frequency during acceleration/deceleration depends on the Pr.29 Acceleration/deceleration pattern selection setting. (Refer to page 372.)
- The Pr.15 setting should be equal to or higher than the Pr.13 Starting frequency setting.
- The JOG signal can be assigned to an input terminal by setting Pr.178 to Pr.189 (Input terminal function selection).
 Changing the terminal assignment may affect other functions. Set parameters after confirming the function of each terminal.
- During JOG operation, the second acceleration/deceleration function using the RT signal is disabled. (Other second functions are enabled (refer to page 525).)
- · When the JOGR or STR signal is input while the JOGF signal is input, the motor is decelerated to stop.
- · When the JOGF or STF signal is input while the JOGR signal is input, the motor is decelerated to stop.
- The three-wire type connection is not available for the JOGF and JOGR signals.
- When **Pr.79 Operation mode selection** = "4", JOG operation is started by one push of FWD / REV on the operation panel

and stopped by RESET

- This function is invalid when Pr.79 = "3".
- Under the position control, when the position command speed creation is completed and the droop pulse is within in-position width, the external JOG operation can be operated. (The JOG operation cannot be performed from PU.)
- To perform the JOG operation using the external signals, select the setting of "JOG signal" for the input via terminal JOG in **Pr.291 Pulse train I/O selection**. (Refer to page 406.)

Pr.13 Starting frequency □ page 381
Pr.20 Acceleration/deceleration reference frequency, Pr.21 Acceleration/deceleration time increments □ page 367
Pr.29 Acceleration/deceleration pattern selection □ page 372
Pr.79 Operation mode selection □ page 389
Pr.178 to Pr.189 (Input terminal function selection) □ page 521

5.9.7 Operation by multi-speed setting

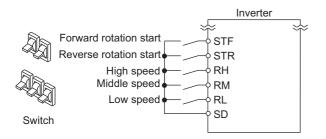
Use these parameters to change among pre-set operation speeds with the terminals. The speeds are pre-set with parameters.

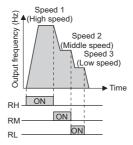
Any speed can be selected by simply turning ON/OFF the contact signals (RH, RM, RL, and REX signals).

| 5 | No. | Initial | value | 0-44 | Barandada. |
|-------------|------------------------------------|---------|---------|-------------------|--|
| Pr. | Name | FM | CA | Setting range | Description |
| 28 | Multi-speed input compensation | 0 | • | 0 | Without compensation |
| D300 | selection | U | | 1 | With compensation |
| 4 D301 | Multi-speed setting (high speed) | 60 Hz | 50 Hz | 0 to 590 Hz | Sets the frequency when RH is ON. |
| 5 D302 | Multi-speed setting (middle speed) | 30 Hz | | 0 to 590 Hz | Sets the frequency when RM is ON. |
| 6 D303 | Multi-speed setting (low speed) | 10 Hz | | 0 to 590 Hz | Sets the frequency when RL is ON. |
| 24 D304 | Multi-speed setting (speed 4) | | | | |
| 25 D305 | Multi-speed setting (speed 5) | | | | |
| 26 D306 | Multi-speed setting (speed 6) | | | | |
| 27 D307 | Multi-speed setting (speed 7) | | | | |
| 232 D308 | Multi-speed setting (speed 8) | | | | |
| 233 D309 | Multi-speed setting (speed 9) | 9999 | | 0 to 590 Hz. 9999 | Frequency from 4th speed to 15th speed can be set according to the combination of the RH, RM, RL and REX signals. 9999: Not selected |
| 234 D310 | Multi-speed setting (speed 10) | 9999 | 999 0 1 | 0 to 590 Hz, 9999 | |
| 235 D311 | Multi-speed setting (speed 11) | | | | |
| 236 D312 | Multi-speed setting (speed 12) | | | | |
| 237 D313 | Multi-speed setting (speed 13) | | | | |
| 238 D314 | Multi-speed setting (speed 14) | | | | |
| 239 D315 | Multi-speed setting (speed 15) | | | | |

◆ Multi-speed setting (Pr.4 to Pr.6)

• The inverter operates at frequencies set in **Pr.4** when the RH signal is ON, **Pr.5** when the RM signal is ON, or **Pr.6** when the RL signal is ON.





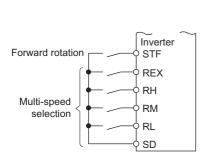
• NOTE

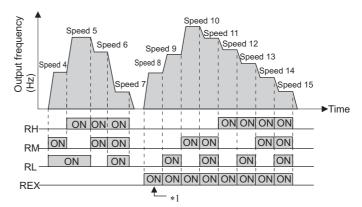
- In the initial setting, if two or more speed switches (signals) are simultaneously turned ON, priority is given to the switch (signal) for the lower speed. For example, when both RH and RM signals turn ON, the RM signal (**Pr.5**) has the higher priority.
- The RH, RM and RL signals are assigned to the terminals RH, RM and RL, respectively, in the initial status. To assign each signal to a different terminal, set "0" (RL signal), "1" (RM signal), or "2" (RH signal) in any of **Pr.178 to Pr.189 (Input terminal function selection)**.

◆ Multi-speed setting for 4th speed or more (Pr.24 to Pr.27, Pr.232 to Pr.239)

• The frequency from 4th speed to 15th speed can be set according to the combination of the RH, RM, RL, and REX signals. Set the running frequencies in **Pr.24 to Pr.27**, **Pr.232 to Pr.239**. (In the initial status, 4th to 15th speeds are invalid.)

• For the terminal used for REX signal input, set "8" in any of **Pr.178 to Pr.189 (Input terminal function selection)** to assign the function.

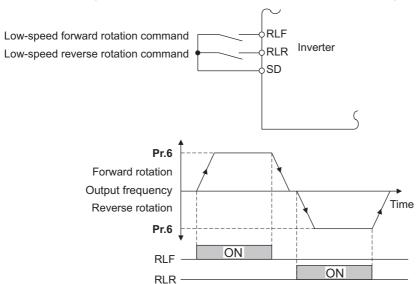




*1 When the RH, RM and RL signals are OFF and the REX signal is ON while "9999" is set to **Pr.232 Multi-speed setting (speed 8)**, the inverter operates at the frequency set in **Pr.6**.

◆ Direct multi-speed setting

• While the RLF or RLR signal is input, the operation is according to **Pr.6 Multi-speed setting (low-speed)**. The rotation is forward while the RLF signal is input, and the rotation is reverse while the RLR signal is input.



№ NOTE

- The Pr.6 setting should be equal to or higher than the Pr.13 Starting frequency setting.
- To assign the RLF and RLR signals to input terminals, set "128 (RLF)" and "129 (RLR)" in any two parameters from **Pr.178 to Pr.189 (Input terminal function selection)**.
- The direct multi-speed operation is enabled when the inverter operates in External operation mode or External/PU combined operation mode 1.
- When the RLR or STR signal is input while the RLF signal is input, the motor is decelerated to stop.
- When the RLF or STF signal is input while the RLR signal is input, the motor is decelerated to stop.
- When **Pr.59 Remote function selection** ≠ "0", the RLF signal is used as the STF signal, and the RLR signal is used as the STR signal.
- When the stop-on-contact function is enabled, the RLF signal is used as the STF signal, and the RLR signal is used as the STR signal.

◆ Input compensation of multi-speed setting (Pr.28)

• Speed (frequency) can be compensated for the multi-speed setting and the remote setting by inputting the frequency setting compensation signal (terminals 1, 2).



- The priority of the frequency commands given by the external signals is as follows: JOG operation > multi-speed operation > terminal 4 analog input > pulse train input > terminal 2 analog input. (For details on frequency commands given by analog input, refer to page 505.)
- The input compensation of multi-speed setting is enabled when the inverter is in the External operation mode or PU/External combined operation mode (**Pr.79** = "3 or 4").
- Multi-speed parameters can also be set during PU operation or External operation.
- The Pr.24 to Pr.27 and Pr.232 to Pr.239 settings have no priority among them.
- When Pr.59 Remote function selection ≠ "0", the multi-speed setting is invalid since the RH, RM, and RL signals are for remote setting.
- · When performing analog input compensation, set Pr.28 Multi-speed input compensation selection to "1".
- Select the terminals (terminals 1, 2) to use for compensation input voltage (0 to ± 5 V, 0 to ± 10 V) at Pr.73 Analog input selection.
- When using terminal 1 for compensation input, set Pr.868 Terminal 1 function assignment = "0 (initial value)".
- Changing the terminal assignment using Pr.178 to Pr.189 (Input terminal function selection) may affect the other functions.
 Set parameters after confirming the function of each terminal.

Parameters referred to

Pr.15 Jog frequency page 410
Pr.59 Remote function selection page 377
Pr.73 Analog input selection page 496
Pr.79 Operation mode selection page 389
Pr.178 to Pr.189 (Input terminal function selection) page 521
Pr.868 Terminal 1 function assignment page 500

5.10 (H) Protective function parameter

| Purpose | Pa | Refer to page | | |
|--|---|---|--|-----|
| To protect the motor from overheating | Electronic thermal O/L relay | P.H000, P.H006, P.H010, P.H016, P.H020 to P.H022 | Pr.9, Pr.51, Pr.561, Pr.607, Pr.608, Pr.876, Pr.1016 | 415 |
| To set the overheat protection characteristics for the motor | Free thermal O/L relay | P.H001 to P.H005, P.H011 to P.H015 | Pr.600 to Pr.604, Pr.692 to Pr.696 | 422 |
| To decelerate and stop when the motor thermal protection is activated | Fault definition | P.H030 | Pr.875 | 422 |
| To extend the life of the cooling fan | Cooling fan operation selection | P.H100 | Pr.244 | 423 |
| To detect an earth (ground) fault at start | Earth (ground) fault detection at start | P.H101 | Pr.249 | 425 |
| To vary the operating level of the undervoltage protective function | Undervoltage level | P.H102 | Pr.598 | 425 |
| To initiate an inverter protective function | Fault initiation | P.H103 | Pr.997 | 425 |
| To disable the I/O phase loss protective function | I/O phase loss | P.H200, P.H201 | Pr.251, Pr.872 | 426 |
| To restart using the retry function when the protective function is activated | Retry operation | P.H300 to P.H303 | Pr.65, Pr.67 to Pr.69 | 426 |
| To set the upper and lower limits of the output frequency | Maximum/minimum frequency | P.H400 to P.H402 | Pr.1, Pr.2, Pr.18 | 428 |
| To prevent the motor from overspeeding under torque control | Speed limit | P.H410 to P.H412 | Pr.807 to Pr.809 | 287 |
| To avoid overdriving the motor during speed control | Overdriving prevention | P.H415 to P.H417 | Pr.285 to Pr.853, Pr.873 | 269 |
| To operate avoiding resonance points | Frequency jump | P.H420 to P.H425, P.H429 | Pr.31 to Pr.36, Pr.552 | 429 |
| To limit the output current so that the inverter protective function does not activate | Stall prevention | P.H500, P.H501, P.H600 to P.H603, P.H610, P.H611, P.H620, P.H621, P.H631, P.M430, P.T010, P.T040 | Pr.22, Pr.23, Pr.48, Pr.49, Pr.66, Pr.114, Pr.115, Pr.148, Pr.149, Pr.154, Pr.156, Pr.157, Pr.858, Pr.868 | 431 |
| To limit the torque during speed control | Torque limit | P.H500, P.H700 to P.H704, P.H710, P.H720, P.H721, P.H730, P.T010, P.T040, P.G210 | Pr.22, Pr.801, Pr.803, Pr.810, Pr.812 to Pr.817, Pr.858, Pr.868, Pr.874 | 245 |
| To monitor for load faults | Load characteristics fault detection | P.H520 to P.H527, P.H531 to P.H535 | Pr.1480 to Pr.1492 | 439 |
| To shut off output if the operation panel disconnects | Overspeed detection level | P.H800 | Pr.374 | 443 |
| To shut off output if the operation panel disconnects | Deceleration check | P.H881 | Pr.690 | 270 |

5.10.1 Motor overheat protection (electronic thermal O/L relay)

Set the current of the electronic thermal relay function to protect the motor from overheating. Such settings provide the optimum protective characteristic considering the low cooling capability of the motor during low-speed operation.

| Pr. | Name | Initial value | Setting range | Description |
|--------------------|--|-----------------------|--------------------------|--|
| 9 | Flootmania thannal O/L valou | Inverter rated | 0 to 500 A ^{*2} | Cat the material market summant |
| H000 | Electronic thermal O/L relay | current ^{*1} | 0 to 3600 A*3 | Set the rated motor current. |
| 600 | First free thermal reduction | 9999 | 0 to 590 Hz | |
| H001 | frequency 1 | 9999 | 9999 | |
| 601 | First free thermal reduction | 100% | 1 to 100% | The electronic thermal O/L relay operation level can |
| H002 | ratio 1 | 10070 | 9999 | be changed to match the motor temperature |
| 602 | First free thermal reduction | 9999 | 0 to 590 Hz | characteristics with the combination of these three |
| H003 | frequency 2 | 0000 | 9999 | points (Pr.600, Pr.601), (Pr.602, Pr.603), (Pr.604, |
| 603 | First free thermal reduction | 100% | 1 to 100% | Pr.9). 9999: Free thermal O/L relay invalid |
| H004 | ratio 2 | | 9999 | - Coop. 1 100 the man of E relay invalid |
| 604 | First free thermal reduction | 9999 | 0 to 590 Hz | |
| H005 | frequency 3 | | 9999 | |
| 607 H006 | Motor permissible load level | 150% | 110 to 250% | Set the permissible load according to the motor characteristics. |
| 51 | Second electronic thermal O/I | | 0 to 500 A*2 | Enabled when the RT signal is ON. |
| H010 | Second electronic thermal O/L relay | 9999 | 0 to 3600 A*3 | Set the rated motor current. |
| | y | | 9999 | Second electronic thermal O/L relay invalid |
| 692 | Second free thermal reduction | 9999 | 0 to 590 Hz | |
| H011 | frequency 1 | 9999 | 9999 | |
| 693 | Second free thermal reduction | 100% 9999 | 1 to 100% | The electronic thermal O/L relay operation level can |
| H012 | ratio 1 | | 9999 | be changed to match the second motor temperature |
| 694 | Second free thermal reduction | | 0 to 590 Hz | characteristics with the combination of these three |
| H013 | frequency 2 | | 9999 | points (Pr.692, Pr.693), (Pr.694, Pr.695), (Pr.696, Pr.51) when the RT signal is ON. |
| 695 | Second free thermal reduction | 100% | 1 to 100% | 9999: Second free thermal O/L relay invalid |
| H014 | ratio 2 | | 9999 | |
| 696 | Second free thermal reduction | 9999 | 0 to 590 Hz | |
| H015 | frequency 3 | | 9999 | 0.111 |
| 608 | Second motor permissible load | 9999 | 110 to 250% | Set the permissible frequency when the RT signal is ON. |
| H016 | level | | 9999 | The Pr.607 setting is applied even when the RT signal is ON. |
| 561 | PTC thermistor protection level | 9999 | 0.5 to 30 kΩ | Set the PTC thermistor protection level (resistance). |
| H020 | Fig thermistor protection level | 9999 | 9999 | PTC thermistor protection disabled |
| 1016 H021 | PTC thermistor protection detection time | 0 s | 0 to 60 s | Set the time from when the resistance of the PTC thermistor reaches the protection level until the protective function is activated. |
| 876 | Thormal protector input | 1 | 0 | Terminal OH of the control terminal option (FR-A8TP) is invalid. |
| H022 ^{*4} | Thermal protector input | 1 | 1 | Terminal OH of the control terminal option (FR-A8TP) is valid. |

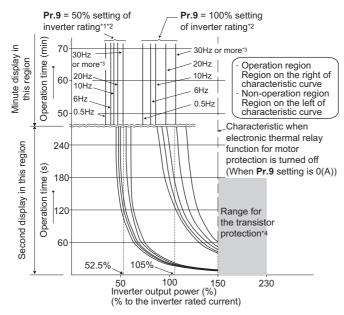
- *1 The initial value for the FR-A820-00077(0.75K) or lower and FR-A840-00038(0.75K) or lower is set to the 85% of the inverter rated current.
- *2 The setting range of the FR-A820-03160(55K) or lower and the FR-A840-01800(55K) or lower The minimum setting increment is 0.01 A.
- The setting range of the FR-A820-03800(75K) or higher and the FR-A840-02160(75K) or higher The minimum setting increment is 0.1 A.
- The setting is available when the FR-A8TP is installed.

◆ Electronic thermal O/L relay operation characteristic for induction motor (Pr.9)

- · This function detects the overload (overheat) of the motor and shut off the inverter output by stopping the operation of the transistor at the inverter output side.
- Set the rated current (A) of the motor in Pr.9 Electronic thermal O/L relay. (If the motor has both 50 Hz and 60 Hz ratings and the Pr.3 Base frequency is set to 60 Hz, set to 1.1 times the 60 Hz rated motor current.)
- · Set "0" in Pr.9 to avoid activating the electronic thermal relay function; for example, when using an external thermal relay for the motor.

(Note that the output transistor protection of the inverter is activated. (E.THT))

• When using the Mitsubishi Electric constant-torque motor, set **Pr.71 Applied motor** = "1, 13 to 16, 50, 53, 54". (This setting enables the 100% constant-torque characteristic in the low-speed range.)



- *1 When setting Pr.9 to a value (current value) of 50% of the inverter rated current
- *2 The % value denotes the percentage to the rated inverter current. It is not the percentage to the rated motor current.
- *3 When you set the electronic thermal relay function dedicated to the Mitsubishi Electric constant-torque motor, this characteristic curve applies to operation at 6 Hz or higher. (For selection of the operation characteristic, refer to page 528.)
- *4 Transistor protection is activated depending on the temperature of the heat sink. The protection may be activated even with less than 150% depending on the operating conditions.

NOTE

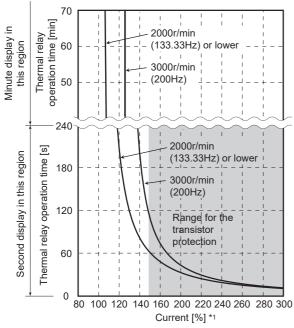
- The internal accumulated heat value of the electronic thermal relay function is reset to the initial value by the inverter's power reset or reset signal input. Avoid unnecessary reset and power-OFF.
- Install an external thermal relay (OCR) between the inverter and motors to operate several motors, a multi-pole motor or a
 dedicated motor with one inverter. When setting an external thermal relay, note that the current indicated on the motor rating
 plate is affected by the line-to-line leakage current. (Refer to page 116.) The cooling effect of the motor drops during low-speed
 operation. Use a thermal protector or a motor with built-in thermistor.
- The protective characteristic of the electronic thermal O/L relay is degraded when there is a large difference in capacity between the inverter and motor, and when the set value is small. In such case, use an external thermal relay.
- · A dedicated motor cannot be protected by an electronic thermal O/L relay. Use an external thermal relay.
- Set Pr.9 = "0" for Vector-control-dedicated motors (SF-V5RU) because they are equipped with thermal protectors.
- The transistor protection thermal O/L relay is activated early when the Pr.72 PWM frequency selection setting is increased.

◆ Electronic thermal O/L relay when using IPM motor (Pr.9)

- This function detects the overload (overheat) of the motor and shut off the inverter output by stopping the operation of the transistor at the inverter output side.
- Set the rated current (A) of the motor in **Pr.9 Electronic thermal O/L relay**. Performing IPM parameter initialization automatically sets the rated current of the IPM motor. (Refer to page 231.)
- Set "0" in **Pr.9** to avoid activating the electronic thermal relay function; for example, when using an external thermal relay for the motor.

(Note that the output transistor protection of the inverter is activated. (E.THT))

• Operational characteristic of the electronic thermal O/L relay when MM-CF is used.



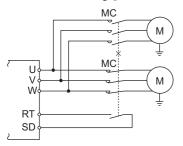
Protective function activated area: the area right of the characteristic curve Normal operation area: the area left of the characteristic curve

*1 The % value denotes the percentage to the rated motor current.



- The internal accumulated heat value of the electronic thermal relay function is reset to the initial value by the inverter's power reset or reset signal input. Avoid unnecessary reset and power-OFF.
- When using a PM motor other than MM-CF, set the free thermal parameters (Pr.600 to Pr.604) in accordance with the motor characteristic.
- The transistor protection thermal O/L relay is activated early when the Pr.72 PWM frequency selection setting is increased.

◆ Set two types of electronic thermal O/L relays (Pr.51)



- These settings are used when rotating two motors with different rated current separately by a single inverter. (When rotating two motors together, use an external thermal relay.)
- · Set the rated motor current for the second motor in Pr.51 Second electronic thermal O/L relay.

· While the RT signal is ON, the setting values of Pr.51 is referred to provide thermal protection.

| Pr.450 | Pr.9 | Pr.51 | RT sigr | nal OFF | RT signal ON | |
|----------------------|------------------------------|-------------------------------------|-------------|-------------------|--------------|-------------------|
| Second applied motor | Electronic thermal O/L relay | Second electronic thermal O/L relay | First motor | Second monitor | First motor | Second monitor |
| | | 9999 | × | × | × | × |
| 9999 | 0 | 0 | × | × | × | × |
| | | 0.01 to 500 (0.1 to 3600) | × | Δ | × | 0 |
| | | 9999 | 0 | × | 0 | × |
| 9999 | Other than 0 | 0 | 0 | × | Δ | × |
| | | 0.01 to 500 (0.1 to 3600) | 0 | Δ | Δ | 0 |
| | | 9999 | × | × | × | × |
| Other than 9999 | 0 | 0 | × | × | × | × |
| | | 0.01 to 500 (0.1 to 3600) | × | Δ | × | 0 |
| | Other than 0 | 9999 | 0 | Δ | Δ | 0 |
| Other than 9999 | | 0 | 0 | × | Δ | × |
| | | 0.01 to 500 (0.1 to 3600) | 0 | Δ | Δ | 0 |

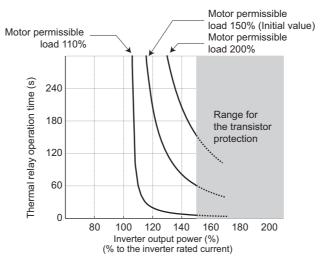
- : Values are accumulated by using the output current.
 Δ: Values are accumulated by assuming the output current is 0 A (cooling processing).
- ×: Electronic thermal O/L relay does not operate.



- The RT signal is the Second function selection signal. The RT signal also enables other second functions. (Refer to page 525.)
- The RT signal is assigned to the terminal RT in the initial status. Set "3" in one of **Pr.178 to Pr.189 (Input terminal function selection)** to assign the RT signal to another terminal.

◆ Acceleration time setting (Pr.607, Pr.608)

The electronic thermal O/L relay operation characteristic can be changed by setting the permissible load level according to the motor characteristics.

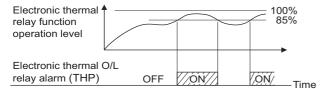


Example of motor permissible load setting (when Pr.9="100% of the inverter rating")

◆ Electronic thermal O/L relay pre-alarm (TH) and warning signal (THP signal)

• If the accumulated electronic thermal value reaches 85% of the **Pr.9** or **Pr.51** setting, electronic thermal O/L relay function pre-alarm (TH) is displayed and the electronic thermal O/L relay pre-alarm (THP) signal is output. If the value reaches 100% of the **Pr.9** setting, the motor thermal protection (E.THM/E.THT) is activated to shut off the inverter output. The inverter output is not shut off with the TH display.

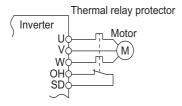
• For the terminal used for the THP signal output, assign the function by setting "8 (positive logic) or 108 (negative logic)" in any of **Pr.190 to Pr.196 (Output terminal function selection)**.





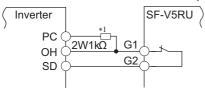
• Changing the terminal assignment using **Pr.190 to Pr.196 (Output terminal function selection)** may affect the other functions. Set parameters after confirming the function of each terminal.

◆ External thermal relay input (OH signal, E.OHT)



External thermal relay input connection diagram

- The External thermal relay input (OH) signal is used when using the external thermal relay or the thermal protector built into the motor to protect the motor from overheating.
- · When the thermal relay is activated, the inverter output is shut off by the external thermal relay (E.OHT).
- For the terminal used for the OH signal input, set "7" in any of **Pr.178 to Pr.189 (Input terminal function selection)** to assign the function.
- Vector-control-dedicated motors (SF-V5RU) are equipped with thermal protectors.



Connecting the SF-V5RU thermal protector

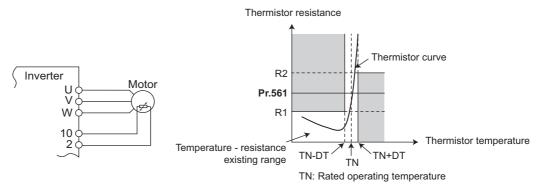
- *1 Connect the recommended 2 W 1 kΩ resistor between terminals PC and OH. (Refer to page 91.)
- When the control terminal option (FR-A8TP) is used, valid/invalid setting of the terminal OH can be changed using Pr.876 thermal protector input.



Changing the terminal assignment using Pr.178 to Pr.189 (Input terminal function selection) may affect the other functions.
 Set parameters after confirming the function of each terminal.

◆ PTC thermistor input (Pr.561, Pr.1016, E.PTC)

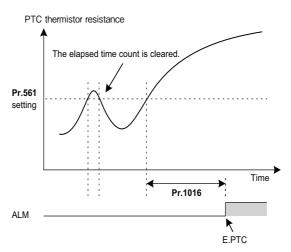
This function is used to protect the motor from overheating by inputting outputs from the motor's built-in PTC thermistor to the inverter. It is recommended that a PTC thermistor whose resistance increases most rapidly around the rated activating temperature (TN±DT) is used.



PTC thermistor input connection diagram

Example of PTC thermistor characteristics

- Output from the PTC thermistor, which is built into the motor, can be input to terminals 2 and 10. If the input from the PTC thermistor reaches the resistor value set in Pr.561 PTC thermistor protection level, the PTC thermistor operation (E.PTC) shuts off the inverter output.
- To use the PTC thermistor input function, select voltage input (initial setting) for terminal 2 using the voltage/current input selection switch. (For details on the voltage/current input switch assembly, refer to page 496.)
- Confirm the characteristic of the PTC thermistor to be used, and set the resistance for Pr.561 around the center of the R1 and R2 values shown on the figure above so that it does not deviate from the protective function activating temperature TN. If the Pr.561 setting becomes too close to R1 or R2, the protective function activating temperature may be too hot (protection is delayed), or too cold (too much protection).
- When the PTC thermistor protection is enabled (**Pr.561** ≠ "9999"), the resistance value for the PTC thermistor can be displayed on the operation panel or via RS-485 communication. (Refer to page 446.)
- When the PTC thermistor protection level setting is used, use Pr.1016 PTC thermistor protection detection time to set
 the time from when the resistance of the PTC thermistor reaches the protection level until the protective function (E.PTC)
 is activated.
- If the resistance of the PTC thermistor falls below the protection level within the protection detection time, the elapsed time count is cleared.

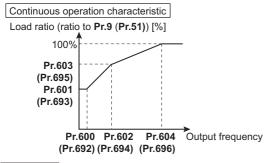


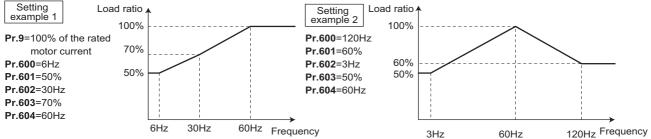


- When using terminal 2 for PTC thermistor input (**Pr.561** ≠ "9999"), the terminal 2 does not operate as an analog frequency command terminal. The PID and dancer control functions assigned to the terminal 2 is also disabled. Use **Pr.133 PID** action set point to set the set point for the PID function.
- To input power to the PTC thermistor power supply, always use the terminal 10 and do not use any other terminals or an external power supply. Otherwise, the PTC thermistor protection (E.PTC) does not operate properly.
- When E.PTC is activated, the alarm display, "External protection (AU terminal)", may appear on the parameter unit (FR-PU07), but it is not a fault.

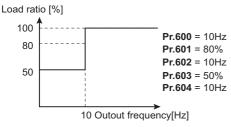
Overheat protection to match the characteristic of the motor (Pr.600 to Pr.604, Pr.692 to Pr.696)

- The activation level of the electronic thermal O/L relay can be varied to match the motor temperature characteristic.
- The electronic thermal O/L relay operation level can be set with the combination of three points (Pr.600, Pr.601), (Pr.602, Pr.603), (Pr.604, Pr.9). Two or more points are required for setting.
- The electronic thermal O/L relay operation level can be set with the combination of three points (Pr.692, Pr.693), (Pr.694, Pr.695), (Pr.696, Pr.51) when the RT signal is ON.





When setting Pr.600, Pr.602, and Pr.604 (Pr.692, Pr.694, and Pr.696) to the same frequency, the graph shows a step
plot.





• Make sure to set the parameters according to the temperature characteristic of the motor used.

W Parameters referred to Pr.71 Applied motor □ page 528 Pr.72 PWM frequency selection □ page 356 Pr.178 to Pr.189 (Input terminal function selection) □ page 521 Pr.190 to Pr.196 (Output terminal function selection) □ page 473

5.10.2 Fault definition

Fault output can be done after deceleration stop when motor thermal protection is activated.

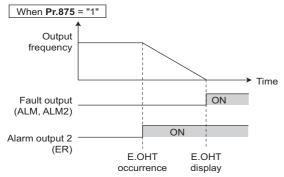
| Pr. | Name | Initial value | Setting range | Description | |
|------|------------------|---------------|---------------|--|--|
| 875 | Eault definition | 0 | 0 | Normal operation | |
| H030 | Fault definition | U | 1 | Decelerates to stop at activation of motor thermal protection. | |

◆ Output shutoff at activation of any protective function (Pr.875 = "0" initial value)

• At activation of a protective function, output is shutoff, and the alarm output 2 signal (ER) and the fault signal (ALM) are output.

◆ Deceleration stop at motor thermal protection activation (Pr.875 = "1")

- At activation of the external thermal relay (E.OHT), motor load (electronic thermal O/L relay) (E.THM) and PTC thermistor (E.PTC) protective functions, the alarm output 2 (ER) signal is displayed, and the motor decelerates to stop. After it stops, a fault signal (ALM) is output.
- · When the ER signal comes ON, reduce the load or take other measures to allow the inverter to decelerate.
- During fault occurrence aside from the E.OHT, THM and E.PTC, the output is immediately shut off, and the fault is signal (ALM) is output.
- To use the ER signal, set "97 (positive logic)" or "197 (negative logic)" in any of **Pr.190 to Pr.196 (Output terminal function selection)** to assign the function to the output terminal.



NOTE

- Regardless of the **Pr.875** setting, when the protective function is operating during position control, output is immediately shut off. (No deceleration stop)
- For systems with a large load-side torque that prevents deceleration, setting value "0" is recommended.
- Changing the terminal assignment using Pr.190 to Pr.196 (Output terminal function selection) may affect the other functions. Set parameters after confirming the function of each terminal.

Parameters referred to

Pr.190 to Pr.196 (Output terminal function selection) 🗐 page 473

5.10.3 Cooling fan operation selection

A cooling fan is built into the inverter and its operation can be controlled.

| Pr. | Name | Initial value | Setting range | Description | | |
|------|--|---------------|---------------|---|---|--|
| | | | 0 | Cooling fan ON/OFF control is invalid. (The power ON) A cooling fan operates at power ON. | cooling fan is always ON at | |
| | | | 1 | Cooling fan ON/OFF control enabled. The fan is always ON while the inverter is r inverter status is monitored and the fan swit the temperature. | 0 17 | |
| | | | 101 to 105 | Cooling fan ON/OFF control enabled. Set the cooling fan stop delay time within 1 | to 5 seconds. | |
| 244 | Cooling fan operation selection | 1 | 1000 | Cooling fan ON/OFF control is invalid. (The cooling fan is always ON at power ON) A cooling fan operates at power ON. | The coefficient on the coefficient | |
| | | | 1001 | Cooling fan ON/OFF control enabled. The fan is always ON while the inverter is running. During a stop, the inverter status is monitored and the fan switches ON/OFF according to the temperature. | The cooling fan can be set to always OFF during Vector control test operation or PM sensorless vector control test operation. | |
| | | | 1101 to 1105 | Cooling fan ON/OFF control enabled. Set the cooling fan stop delay time within 1 to 5 seconds. | | |
| | | | | Cooling fan ON/OFF control is invalid. (The cooling fan is always ON power ON) A cooling fan operates at power ON. | | |
| H100 | Cooling fan operation selection | 1 1 | 1 | Cooling fan ON/OFF control enabled. The fan is always ON while the inverter is running. During a stop, the inverter status is monitored and the fan switches ON/OFF according to the temperature. | | |
| | | | 101 to 105 | Cooling fan ON/OFF control enabled. Set the cooling fan stop delay time within 1 to 5 seconds. | | |
| H106 | Cooling fan operation selection during the test operation | | 0 | The cooling fan operates according to the I control test operation or PM sensorless vec | | |
| 1100 | | 0 | 1 | The cooling fan can be set to always OFF during Vector control test operation or PM sensorless vector control test operation. | | |

◆ Cooling fan always ON (Pr.244 = "0")

- For the terminal used for the FAN signal output, set "25 (positive logic)" or "125 (negative logic)" in any of **Pr.190 to Pr.196** (Output terminal function selection) and for LF signal, set "98 (positive logic)" or "198 (negative logic)".

◆ Cooling fan operation control (Pr.244 (P.H100) = "1" (initial value), "101 to 105")

- The cooling fan operation is controlled when **Pr.244** = "1". When the inverter is running, the cooling fan operates constantly. When the inverter is stopped, the cooling fan operates depending on the temperature of the inverter heat sink. If the fan stops although it meets the conditions for running, fan operation is regarded as faulty, [FN] is displayed on the operation panel, and the fan signal and LF signals are output.
- To prevent the cooling fan from turning ON and OFF repeatedly during frequent starts/stops (inching), the cooling fan stop waiting time can be set. The waiting time when **Pr.244** = "101 to 105" is **Pr.244** 100 (or 1 second, if the **Pr.244** = "101").

◆ Cooling fan operation command (Y206) signal

- The Cooling fan operation command (Y206) signal can be output when the inverter cooling fan meets the conditions for running. The function can be used when the fan installed on the enclosure is synchronized with the inverter cooling fan.
- The Y206 signal indicates the operating command condition of the inverter cooling fan depending on the power supply ON/
 OFF or the Pr.244 settings. The signal does not indicate the actual operation of the cooling fan. (The signal is output even
 if the cooling fan is stopped due to a fault.)
- To use the Y206 signal, set "206 (positive logic) or 306 (negative logic)" in one of Pr.190 to Pr.196 (Output terminal function selection) to assign function to an output terminal.

◆ Cooling fan operation selection during the test operation (Pr.244 = "1000, 1001, 1101 to 1105" (P.H106 = "1"))

• When **P.H106** = "1" or **Pr.244** = "1000, 1001, or 1101 to 1105", the cooling fan can be set to always OFF during Vector control test operation or PM sensorless vector control test operation.



- The cooling fan is installed on the FR-A820-00105(1.5K) or higher and the FR-A840-00083(2.2K) or higher.
- Changing the terminal assignment using Pr.190 to Pr.196 (Output terminal function selection) may affect the other functions. Set parameters after confirming the function of each terminal.

Parameters referred to

Pr.190 to Pr.196 (Output terminal function selection) F page 473

5.10.4 Earth (ground) fault detection at start



Select whether to make earth (ground) fault detection at start. When enabled, earth (ground) fault detection is performed immediately after a start signal input to the inverter.

| Pr. | Name | Initial value | Setting range | Description |
|---------------------------------------|-----------------------------------|---------------|---------------|---|
| 249 Earth (ground) faul H101 start | Earth (ground) fault detection at | at 0 | 0 | Without the earth (ground) fault detection at start |
| | start | | 1 | With the earth (ground) fault detection at start |

- If a ground fault is detected at start while **Pr.249** = "1", the output-side earth (ground) fault overcurrent (E.GF) is displayed and the outputs are shut off. (Refer to page 790.)
- Pr.249 setting is enabled during V/F control and Advanced magnetic flux vector control.
- · When the Pr.72 PWM frequency selection setting is high, enable the ground fault detection at start.



- · Because the detection is performed at start, output is delayed for approx. 20 ms every start.
- Use Pr.249 to enable/disable ground fault detection at operation start. Ground faults are detected always during operation regardless of the Pr.249 setting.

5.10.5 Varying the activation level of the undervoltage protective function

If the undervoltage protection (E.UVT) activates due to unstable voltage in the power supply, the undervoltage level (DC bus voltage value) can be changed.

| Pr. | Name | Initial value | Setting range | Description |
|-------------|--------------------|---------------|------------------|--|
| 598 H102 | Undervoltage level | | 175 to 215 VDC*1 | Set the DC voltage value at which E.UVT occurs. |
| | | | 350 to 430 VDC*2 | Set the DC voltage value at which E.Ov i occurs. |
| | | | 9999 | E.UVT occurs at 215 VDC (200 V class) / 430 VDC (400 V class). |

- *1 For the 200 V class
- *2 For the 400 V class



- Do not use this function when switching to an external battery, since the inrush current when power is restored increases, as the undervoltage level is decreased.
- For the 200 V class inverters, the setting is available for the FR-A820-02330(45K) or lower.
- The Pr.598 setting is valid for induction motors. When either of the first or second motor is a PM motor, the Pr.598 setting is
 invalid.

5.10.6 Initiating a protective function

A fault (protective function) is initiated by setting the parameter.

This function can be used to check how the system operates at activation of a protective function.

| Pr. | Name | Initial value | Setting range | Description |
|-------------|------------------|---------------|---------------|--|
| 997 H103 | Fault initiation | 9999 | | The setting range is same with the one for fault data codes of the inverter (which can be read through communication). Written data is not stored in EEPROM. |
| 11103 | | | 9999 | The read value is always "9999". The protective function is not activated with this setting. |

- · To initiate a fault (protective function), set the assigned number of the protective function to be initiated in Pr.997.
- The value set in Pr.997 is not stored in EEPROM.
- When a protective function activates, the inverter output is shut off, a fault is displayed, and a fault signal (ALM, ALM2) is output.
- The latest fault in the fault history is displayed while the fault initiation function is in operation. After a reset, the fault history goes back to the previous status. (The protective function generated by the fault is not saved in the fault history.)
- · Perform inverter reset to cancel the protective function.
- For the selectable parameter by Pr.997 and the corresponding protective functions, refer to page 776.



- If a protective function is already operating, no fault can be activated by Pr.997.
- The retry function is disabled when a protective function has been initiated by the fault initiation function.
- If a fault occurs after a protective function has been activated, the protective function indication does not change. The fault is not saved in the fault history either.

5.10.7 I/O phase loss protection selection

The output phase loss protection function, which stops the inverter output if one of the three phases (U, V, W) on the inverter's output side (load side) is lost, can be disabled.

The input phase loss protective function on the inverter input side (R/L1, S/L2, T/L3) can be enabled.

| Pr. | Name | Initial value | Setting range | Description |
|--------------------|---------------------------|---------------|---------------|---------------------------------------|
| 251 | 251 Output phase loss | | 0 | Output phase loss protection disabled |
| H200 | 1200 protection selection | ' | 1 | Output phase loss protection enabled |
| 872 | Input phase loss | 0 | 0 | Input phase loss protection disabled |
| H201 ^{*1} | protection selection | U | 1 | Input phase loss protection enabled |

^{*1} The setting is available for the standard structure model and the IP55 compatible model.

◆ Output phase loss protection selection (Pr.251)

• When Pr.251 is set to "0", output phase loss protection (E.LF) becomes invalid.

◆ Input phase loss protection selection (Pr.872) (Standard models and IP55 compatible models)

• When Pr.872 is set to "1", Input phase loss (E.ILF) protection is activated if one of three phases is lost for 1 second.



- When several motors are connected, output phase loss cannot be detected even if the wiring to one motor loses phase.
- If an input phase is lost while **Pr.872** = "1" (with input phase loss protection), **Pr.261 Power failure stop selection** ≠ "0" (power failure stop function enabled), the motor decelerates to stop without outputting E.ILF.
- In the case of R/L1, S/L2 phase loss, the input phase loss protection does not operate, and the inverter output is shut off.
- · If an input phase loss continues for a long time, the lives of converter section and capacitor of the inverter become shorter.

Parameters referred to

Pr.261 Power failure stop selection page 642

5.10.8 Retry function

This function allows the inverter to reset itself and restart at activation of the protective function (fault indication). The retry generating protective functions can also be selected.

When the automatic restart after instantaneous power failure function is selected (**Pr.57 Restart coasting time** \neq 9999), the restart operation is also performed after a retry operation as well as after an instantaneous power failure. (For restart operation, refer to page 628 and page 635 for selection.)

| Pr. | Name | Initial value | Setting range | Description | |
|------------|---------------------------------------|-------------------------------------|---------------|---|--|
| 65 H300 | Retry selection 0 | | 0 to 5 | Faults which trigger the retry operation can be selected. | |
| | | | 0 | The retry function disabled. | |
| 67 | Number of retries at fault occurrence | 0 | 1 to 10 | Set the number of retries at a fault occurrence. A fault output is not provided during the retry operation. | |
| H301 | | | 101 to 110 | Set the number of retries at a fault occurrence. (The setting value minus 100 is the number of retries.) A fault output is provided during the retry operation. | |
| 68 H302 | Retry waiting time | Retry waiting time 1 s 0.1 to 600 s | | Set the time delay from when an inverter fault occurs until the retry operation starts. | |
| 69 H303 | Retry count display erase | 0 | 0 | Setting "0" clears the retry success counter ("retry success" means that the inverter successfully restarts). | |

◆ Setting the retry function (Pr.67, Pr.68)

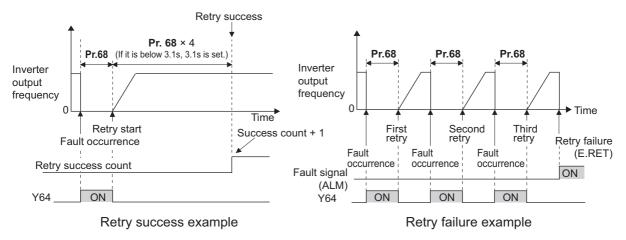
- When the inverter protective function is operating (fault indication), the retry function automatically cancels (resets) the protective function after the time set in **Pr.68**. The retry function then restarts the operation from the starting frequency.
- The retry function is enabled when the **Pr.67** setting is other than "0". Set the number of retries at activation of the protective function in **Pr.67**.

| Pr.67 setting | Fault output during retry operation | Retry count |
|---------------|-------------------------------------|-------------------|
| 0 | _ | No retry function |
| 1 to 10 | Not available | 1 to 10 times |
| 101 to 110 | Available | 1 to 10 times |

- When retries fail consecutively more than the number of times set in **Pr.67**, a retry count excess (E.RET) occurs, resulting in an inverter retries. (Refer to the Retry failure example.)
- Use Pr.68 to set the waiting time from a protective function activation to a retry in the range of 0.1 to 600 seconds.
- During retry operation, the During retry (Y64) signal is ON. For the Y64 signal, set "64 (positive logic)" or "164 (negative logic)" in any of **Pr.196 to Pr.196 (Output terminal function selection)** to assign the function.

◆ Retry count check (Pr.69)

- Reading the **Pr.69** value provides the cumulative number of successful restart times made by retries. The cumulative count in **Pr.69** increases by 1 when a retry is successful. Retry is regarded as successful when normal operation continues without a fault for the **Pr.68** setting multiplied by four or longer (3.1 seconds at the shortest). (When retry is successful, the cumulative number of retry failures is cleared.)
- Writing "0" in Pr.69 clears the cumulative count.



◆ Selecting retry generating faults (Pr.65)

Using Pr.65, the fault that causes a retry is selectable. No retry is made for the fault not indicated. (For the fault details, refer to page 779.) • indicates the faults selected for retry.

| Retry-making | | | | | | |
|--------------|---|---|---|---|---|---|
| fault | 0 | 1 | 2 | 3 | 4 | 5 |
| E.OC1 | • | • | | • | • | • |
| E.OC2 | • | • | | • | • | |
| E.OC3 | • | • | | • | • | • |
| E.OV1 | • | | • | • | • | |
| E.OV2 | • | | • | • | • | |
| E.OV3 | • | | • | • | • | |
| E.THM | • | | | | | |
| E.THT | • | | | | | |
| E.IPF | • | | | | • | |
| E.UVT | • | | | | • | |
| E. BE | • | | | | • | |
| E. GF | • | | | | • | |
| E.OHT | • | | | | | |
| E.OLT | • | | | | • | |
| E.OPT | • | | | | • | |
| E.OP1 | • | | | | • | |
| E. PE | • | | | | • | |
| E.MB1 | • | | | | • | |
| E.MB2 | • | | | | • | |

| Retry-making | Pr.65 setting | | | | | |
|--------------|---------------|---|---|---|---|---|
| fault | 0 | 1 | 2 | 3 | 4 | 5 |
| E.MB3 | • | | | | • | |
| E.MB4 | • | | | | • | |
| E.MB5 | • | | | | • | |
| E.MB6 | • | | | | • | |
| E.MB7 | • | | | | • | |
| E.OS | • | | | | • | |
| E.OSD | • | | | | • | |
| E.PTC | • | | | | | |
| E.CDO | • | | | | • | |
| E.SER | • | | | | • | |
| E.USB | • | | | | • | |
| E.ILF | • | | | | • | |
| E.PID | • | | | | • | |
| E.PCH | • | | | | • | |
| E.SOT | • | • | | • | • | • |
| E.LCI | • | | | | • | |
| E.LUP | • | | | | • | |
| E.LDN | • | | | | • | |



- Use the retry function only when the operation can be resumed after resetting a protective function activation. Making a retry against the protective function, which is activated by an unknown condition, will lead the inverter and motor to be faulty. Identify and remove the cause of the protective function activation before restarting the operation.
- If the retry function operates during PU operations, the operating conditions (forward/reverse rotation) are stored; and operations resume after retry reset.
- Only the fault details for the first fault that occurred during retry are stored in the fault history.
- The reset by the retry function does not clear the accumulated data of the electronic thermal O/L relay, regenerative brake duty, etc. (This is different from power supply reset or reset by RES signal.)
- When the parameter storage device fault (E.PE) is occurring and reading of the retry-function-related parameters is not possible, retry cannot be operated.
- Changing the terminal assignment using Pr.190 to Pr.196 (Output terminal function selection) may affect the other functions. Set parameters after confirming the function of each terminal.

∴ CAUTION

• When the retry function is set enabled, stay away from the motor and machine in the case of an output shutoff. The motor and machine will start suddenly (after the reset time has elapsed) after the shutoff. When the retry function is selected, apply the supplied CAUTION stickers to easily visible places.

Parameters referred to

Pr.57 Restart coasting time page 628, page 635

5.10.9 Limiting the output frequency (maximum/minimum frequency)

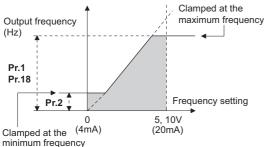
Motor speed can be limited. Clamp the upper and lower limits of the output frequency.

| Pr. | Name | Initial value | Setting range | Description | |
|------------------------|---------------------|----------------------|---------------|--|--|
| 1 Maximum frequency | | 120 Hz ^{*1} | 0 to 120 Hz | Set the upper limit of the output frequency. | |
| H400 Maximum frequency | 60 Hz ^{*2} | 0 to 120 Hz | | | |
| 2 H401 | Minimum frequency | 0 Hz | 0 to 120 Hz | Set the lower limit of the output frequency. | |
| 18 | High speed maximum | 120 Hz ^{*1} | 0 to 590 Hz | Set when operating at 120 Hz or higher. | |
| H402 fr | frequency | 60 Hz ^{*2} | 0 10 390 112 | | |

^{*1} For the FR-A820-03160(55K) or lower, and FR-A840-01800(55K) or lower.

◆ Setting the maximum frequency (Pr.1, Pr.18)

- Set **Pr.1 Maximum frequency** to the upper limit of the output frequency. If the value of the frequency command given is higher than the setting, the output frequency is clamped at the maximum frequency.
- To operate at a frequency higher than the 120 Hz, adjust the upper output frequency limit with **Pr.18 High speed maximum frequency**. (When setting a frequency in **Pr.18**, the **Pr.1** setting automatically changes to the frequency set in **Pr.18**. Also, when setting a frequency in **Pr.1**, the **Pr.18** setting automatically changes to the frequency set in **Pr.1**.)



◆ Setting the minimum frequency (Pr.2)

- Set Pr.2 Minimum frequency to the lower limit of the output frequency.
- If the set frequency is Pr.2 or less, the output frequency is clamped at Pr.2 (does not fall below Pr.2).



- To operate with a frequency higher than 60 Hz using frequency-setting analog signals, change the Pr.125 (Pr.126) (frequency setting gain) setting. Simply changing the Pr.1 and Pr.18 settings does not enable the operation at a frequency higher than 60 Hz.
- During Real sensorless vector control, Vector control, and PM sensorless vector control, the upper and lower limits are for the commanded frequency. The final output frequency that is decided by each control may exceed the lower or upper limits.
- When Pr.15 Jog frequency is equal to or less than Pr.2, the Pr.15 setting takes precedence.
- If a jump frequency that exceeds **Pr.1** (**Pr.18**) is set for the 3-point frequency jump, the maximum frequency setting is the set frequency. If the jump frequency is less than the setting of **Pr.2**, the jump frequency is the set frequency. (The set frequency can be equal to or lower than the frequency lower limit.) When stall prevention is activated to decrease the output frequency, the output frequency may drop to **Pr.2** or below.

.♠CAUTION

• Note that when **Pr.2** is set to any value equal to or higher than **Pr.13 Starting frequency**, simply turning ON the start signal runs the motor at the frequency set in **Pr.2** even if the command frequency is not given.

Parameters referred to

Pr.13 Starting frequency page 381, page 382

Pr.15 Jog frequency page 410

Pr.125 Terminal 2 frequency setting gain frequency, Pr.126 Terminal 4 frequency setting gain frequency 🖙 page 505

5.10.10 Avoiding machine resonance points (frequency jump)

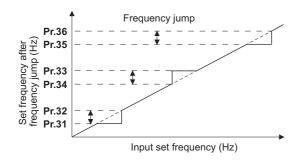
When it is desired to avoid resonance attributable to the natural frequency of a mechanical system, these parameters allow resonant frequencies to be jumped.

^{*2} For the FR-A820-03800(75K) or higher, and FR-A840-02160(75K) or higher.

| Pr. | Name | Initial value | Setting range | Description |
|-------------|----------------------|---------------|----------------------|--|
| 31 H420 | Frequency jump 1A | | | |
| 32 H421 | Frequency jump 1B | - 9999 | 0 to 590 Hz, 9999 | 1A to 1B, 2A to 2B, 3A to 3B are frequency jumps (3-point jum 9999: Function disabled |
| 33 H422 | Frequency jump 2A | | | |
| 34 H423 | Frequency jump 2B | | | |
| 35 H424 | Frequency jump 3A | | | |
| 36 H425 | Frequency jump 3B | | | |
| 552 H429 | Frequency jump range | 9999 | 0 to 30 Hz | Set the jump range for the frequency jumps (6-point jump). |
| | | | 9999 | 3-point jump |

◆ 3-point frequency jump (Pr.31 to Pr.36)

- Up to three areas may be set, with the jump frequencies set to either the top or bottom point of each area.
- The settings of frequency jumps 1A, 2A, 3A are jump points, and operation is performed at these frequencies in the jump areas.



Example 1) To fix the frequency to 30 Hz in the range of 30 Hz to 35 Hz, set 35 Hz in Pr.34 and 30 Hz in Pr.33.

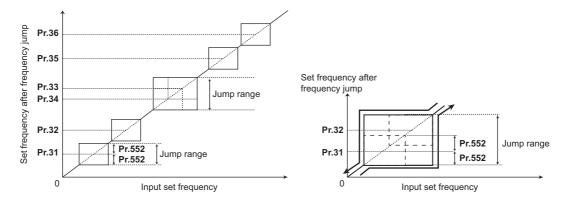
Example 2) To jump the frequency to 35 Hz in the range of 30 Hz to 35 Hz, set 35 Hz in Pr.33 and 30 Hz in Pr.34.

Pr.33: 35 Hz ---Pr.34: 30 Hz ---

◆ 6-point frequency jump (Pr.552)

- · A total of six jump areas can be set by setting the common jump range for the frequencies set in Pr.31 to Pr.36.
- When frequency jump ranges overlap, the lower limit of the lower jump range and the upper limit of the upper jump range are used.

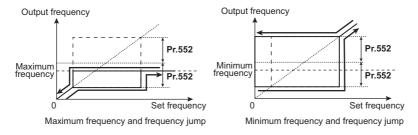
• When the set frequency decreases and falls within the jump range, the upper limit of the jump range is the set frequency. When the set frequency increases and falls within the jump range, the lower limit of the jump range is the set frequency.





- During acceleration/deceleration, the frequency within the set area is valid.
- If the setting ranges of individual groups (1A and 1B, 2A and 2B, 3A and 3B) overlap, Parameter write error (Er1) occurs.
- Setting Pr.552 = "0" disables frequency jumps.
- If a jump frequency that exceeds **Pr.1** (**Pr.18**) **Maximum frequency** is set for the 3-point frequency jump, the maximum frequency setting is the set frequency. If the jump frequency is less than the setting of **Pr.2 Minimum frequency**, the jump frequency is the set frequency. (The set frequency can be equal to or lower than the frequency lower limit.)

 Example with 6-point frequency jump



Parameters referred to

Pr.1 Maximum frequency, Pr.2 Minimum frequency, Pr.18 High speed maximum frequency □ page 428

5.10.11 Stall prevention operation



This function monitors the output current and automatically changes the output frequency to prevent the inverter from shutting off due to overcurrent, overvoltage, etc. It can also limit the stall prevention and fast-response current limit operation during acceleration/deceleration and power/regenerative driving.

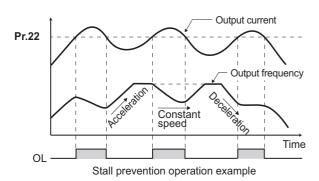
This function is disabled during Real sensorless vector control, Vector control and PM sensorless vector control.

- · Stall prevention:
 - If the output current exceeds the stall prevention operation level, the output frequency of the inverter is automatically changed to reduce the output current. Also, the second stall prevention function can limit the output frequency range in which the stall prevention function is enabled.
- Fast-response current limit:
 If the current exceeds the limit value, the output of the inverter is shut off to prevent an overcurrent.

| Pr. | Name | Initial FM | value | Setting range | Description | | |
|-------------|---|----------------|-------|---------------------------|---|--|--|
| | | LIAI | CA | 0 | Stall prevention operation | disabled. | |
| 22 H500 | Stall prevention operation level | 150% | | 0.1 to 400% ^{*1} | Set the current limit at which the stall prevention operation starts. | | |
| 156 H501 | Stall prevention operation selection | 0 | | 0 to 31, 100, 101 | Enable/disable the stall prevention operation and the fast-response current limit operation. | | |
| 48 | Second stall | | | 0 | Second stall prevention op | eration disabled. | |
| H600 | prevention operation level | 150% | | 0.1 to 400%*1 | The stall prevention operat RT signal. | ion level can be changed using the | |
| | Second stall | | | 0 | Second stall prevention op | | |
| 49 H601 | prevention operation frequency | 0 Hz | | 0.01 to 590 Hz | Set the frequency at which operation starts. | the Pr.48 stall prevention | |
| | Hoquonoy | | | 9999 | Pr.48 is enabled when the | RT signal is ON. | |
| 114 | Third stall prevention | | | 0 | Third stall prevention operation | ation disabled. | |
| H602 | operation level | 150% | | 0.1 to 400% ^{*1} | The stall prevention operat X9 signal. | ion level can be changed using the | |
| 115 | Third stall prevention | | | 0 | Third stall prevention operation disabled. | | |
| H603 | operation frequency | 0 Hz | | 0.01 to 590 Hz | Set the frequency at which the stall prevention operation starts when the X9 signal turns ON. | | |
| 23 | Stall prevention operation level | | | 0 to 200% | The stall operation level when running at high speeds above the rated frequency can be reduced. | | |
| H610 | compensation factor at double speed | 0000 | | 9999 | Stall prevention operation disabled at double speed. | | |
| 66 H611 | Stall prevention operation reduction starting frequency | 60 Hz | 50 Hz | 0 to 590 Hz | Set the frequency at which the stall operation level reduc starts. | | |
| 148 H620 | Stall prevention level at 0 V input | 150% | | 0 to 400% ^{*1} | The stall prevention opera | tion level can be changed by the | |
| 149 H621 | Stall prevention level at 10 V input | 200% | | 0 to 400% ^{*1} | analog signal input to the t | erminal 1 (terminal 4). | |
| | | | | 0 | Output voltage reduction enabled | Enable/disable the output voltage reduction during stall | |
| | Voltage reduction | during stall 1 | | 1 | Output voltage reduction disabled. | prevention operation. | |
| 154 H631 | selection during stall prevention | | | 10 | Output voltage reduction enabled | Use this setting when the overvoltage protective function | |
| | | | | 11 | Output voltage reduction disabled. | (E.OV[]) is activated during stall prevention operation in an application with large load inertia. | |
| 157 M430 | OL signal output timer | 0 s | | 0 to 25 s | Set the OL signal output start time when stall prevention is activated. | | |
| M430 | | | | 9999 | No OL signal output. | | |
| 858 T040 | Terminal 4 function assignment | 0 | | 0, 1, 4, 9999 | When set "4", the stall pret the signal to the terminal 4 | vention level can be changed with | |
| 868 T010 | Terminal 1 function assignment | 0 | | 0 to 6, 9999 | When set "4", the stall pret the signal to the terminal 1 | vention level can be changed with | |

^{*1} The upper limit of stall prevention operation is limited internally to the following. 120% (SLD rating), 150% (LD rating), 220% (ND rating), or 280% (HD rating)

◆ Setting of stall prevention operation level (Pr.22)



- For Pr.22 Stall prevention operation level, set the ratio
 of the output current to the inverter's rated current at which
 the stall prevention operation is activated. Normally, use
 this parameter in the initial setting.
- Stall prevention operation stops acceleration (makes deceleration) during acceleration, makes deceleration during constant speed, and stops deceleration during deceleration.
- When the stall prevention operation is performed, the Overload warning (OL) signal is output.

■ NOTE

- A continuous overloaded condition may activate a protective function such as motor overload trip (electronic thermal O/L relay function) (E.THM).
- When **Pr.156** has been set to activate the fast response current limit (initial value), the **Pr.22** setting should not be higher than 170%. Such setting prevents torque generation.
- When Real sensorless vector control or Vector control is selected using **Pr.800 Control method selection**, **Pr.22** serves as the torque limit level.
 - For the FR-A820-00250(3.7K) or lower and the FR-A840-00126(3.7K) or lower, the initial value of **Pr.22** is 200% instead of 150%.

◆ Disabling the stall prevention operation and fast-response current limit according to operating conditions (Pr.156)

• Referring to the following table, enable/disable the stall prevention operation and the fast-response current limit operation, and also set the operation at OL signal output.

| Pr.156 setting | | Fast-response current limit o: enabled | Stall p | election | OL signal output o: enabled •: disabled*1 | |
|-------------------|----------------------|--|--------------|----------------|---|-------------|
| | | •: disabled | Acceleration | Constant speed | Deceleration | •: disabled |
| 0 (initia | al value) | 0 | 0 | 0 | 0 | 0 |
| 1 | | • | 0 | 0 | 0 | 0 |
| 2 | | 0 | • | 0 | 0 | 0 |
| 3 | | • | • | 0 | 0 | 0 |
| 4 | | 0 | 0 | • | 0 | 0 |
| 5 | | • | 0 | • | 0 | 0 |
| 6 | | 0 | • | • | 0 | 0 |
| 7 | | • | • | • | 0 | 0 |
| 8 | | 0 | 0 | 0 | • | 0 |
| 9 | | • | 0 | 0 | • | 0 |
| 10 | | 0 | • | 0 | • | 0 |
| 11 | | • | • | 0 | • | 0 |
| 12 | | 0 | 0 | • | • | 0 |
| 13 | | • | 0 | • | • | 0 |
| 14 | | 0 | • | • | • | 0 |
| 15 | | • | • | • | • | _*2 |
| 16 | | 0 | 0 | 0 | 0 | • |
| 17 | | • | 0 | 0 | 0 | • |
| 18 | | 0 | • | 0 | 0 | • |
| 19 | | • | • | 0 | 0 | • |
| 20 | | 0 | 0 | • | 0 | • |
| 21 | | • | 0 | • | 0 | • |
| 22 | | 0 | • | • | 0 | • |
| 23 | | • | • | • | 0 | • |
| 24 | | 0 | 0 | 0 | • | • |
| 25 | | • | 0 | 0 | • | • |
| 26 | | 0 | • | 0 | • | • |
| 27 | | • | • | 0 | • | • |
| 28 | | 0 | 0 | • | • | • |
| 29 | | • | 0 | • | • | • |
| 30 | | 0 | • | • | • | • |
| 31 | | • | • | • | • | _*2 |
| | Power driving | 0 | 0 | 0 | 0 | 0 |
| 100 ^{*3} | Regenerative driving | • | • | • | • | *2 |
| | Power driving | • | 0 | 0 | 0 | 0 |
| 101 ^{*3} | Regenerative driving | • | • | • | • | *2 |

^{*3} Setting values "100, 101" can be individually set for power driving and regenerative driving. The setting value "101" disables the fast-response current limit during power driving.



[·] When the load is heavy or the acceleration/deceleration time is short, stall prevention operates and acceleration/deceleration may not be performed according to the time set. Set Pr.156 and stall prevention operation level to the optimum values.

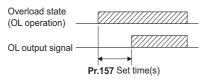
^{*2} The OL signal and E.OLT are not outputted because fast-response current limit and stall prevention are not operating.

[·] For lift applications, make settings to disable the fast-response current limit. Otherwise, the torque may be insufficient, causing the load to drop.

Adjusting the stall prevention operation signal and output timing (OL signal, Pr.157)

- If the output current exceeds the stall prevention operation level and stall prevention is activated, Overload warning (OL) signal turns ON for 100 ms or more. The output signal turns OFF when the output current falls to the stall prevention operation level or less.
- Pr.157 OL signal output timer can be used to set whether to output the OL signal immediately, or whether to output it after a certain time period has elapsed.
- This function also operates during regeneration avoidance operation " [" (overvoltage stall).

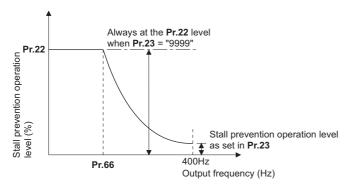
| Pr.157 setting | Description |
|-------------------|--------------------------------|
| 0 (initial value) | Output immediately. |
| 0.1 to 25 | Output after the set time (s). |
| 9999 | Not output. |

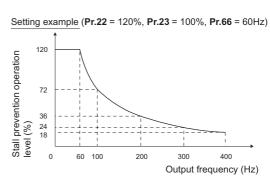




- OL signal is assigned to the terminal OL in the initial status. The OL signal can be assigned to other terminals by setting "3 (positive logic) or 103 (negative logic)" in any of **Pr.190 to Pr.196 (Output terminal function selection)**.
- If the stall prevention operation has lowered the output frequency to 0.5 Hz and kept the level for 3 seconds, the stall prevention stop (E.OLT) is activated to shut off the inverter output.
- Changing the terminal assignment using **Pr.190 to Pr.196 (Output terminal function selection)** may affect the other functions. Set parameters after confirming the function of each terminal.

♦ Setting for stall prevention operation in the high-frequency range (Pr.22, Pr.23, Pr.66)





- When operating at the rated motor frequency or higher, acceleration may not be made because the motor current does not increase. Also, when operating in the high-frequency range, the current flowing to the locked motor becomes less than the rated output current of the inverter; and even if the motor is stopped, the protective function does not operate (OL). In a case like this, the stall prevention level can be reduced in the high-frequency range to improve the motor's operating characteristics. This is useful when operating up to the high speed range, such as when using a centrifuge. Normally, set Pr.66 Stall prevention operation reduction starting frequency to 60 Hz, and Pr.23 Stall prevention operation level compensation factor at double speed to 100%.
- Calculation formula for stall prevention operation level

Stall prevention operation level (%) in the high-frequency range = A + B ×
$$\left[\begin{array}{c} Pr.22 - A \\ Pr.22 - B \end{array}\right] \times \left[\begin{array}{c} Pr.23 - 100 \\ 100 \end{array}\right]$$

Where,
$$A = \frac{\text{Pr.66 (Hz)} \times \text{Pr.22 (\%)}}{\text{Output frequency (Hz)}}$$
, $B = \frac{\text{Pr.66 (Hz)} \times \text{Pr.22 (\%)}}{400 \text{ Hz}}$

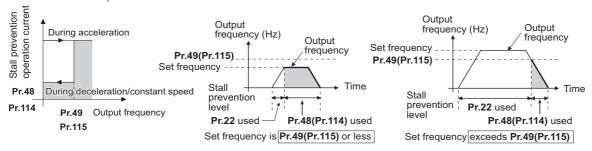
• When Pr.23 = "9999" (initial value), the stall prevention operation level is constant at the Pr.22 level up to 590 Hz.

◆ Setting multiple stall prevention operation levels (Pr.48, Pr.49, Pr.114, Pr.115)

- Setting **Pr.49 Second stall prevention operation frequency** = "9999" and turning ON the RT signal enables **Pr.48**Second stall prevention operation level.
- For **Pr.48 (Pr.114)**, set the stall prevention operation level that is effective in the output frequency range between 0 Hz and **Pr.49 (Pr.115)**. However, the operation level is **Pr.22** during acceleration.
- Stop-on-contact operation can be used by decreasing the Pr.48 (Pr.114) setting and loosening the reduction torque.
- Pr.114 and Pr.115 are enabled when the X9 signal is ON. To input the X9 signal, set "9" in any of Pr.178 to Pr.189 Input terminal function selection to assign the function to the terminal.

| Pr.49 setting | Pr.115 setting | Operation | | | | |
|-------------------|-----------------------|--|--|--|--|--|
| 0 (initial value) | | The second (third) stall prevention function disabled. | | | | |
| 0.01 Hz to 590 Hz | | The second (third) stall prevention function operates according to the frequency.*1 | | | | |
| 9999*2 | Setting not available | The second stall prevention function operates according to the RT signal. RT signal ON: stall level set in Pr.48 , RT signal OFF: stall level set in Pr.22 | | | | |

- *1 For the stall prevention operation level, the smaller of Pr.22 and Pr.48 (Pr.115) has precedence.
- *2 When Pr.858 = "4 (analog input to terminal 4 for stall prevention operation level)" or Pr.868 = "4 (analog input to terminal 1 for stall prevention operation level)", turning ON the RT (X9) signal does not enable the second (third) stall prevention function. (Input to the terminal 4 or terminal 1 is valid.)



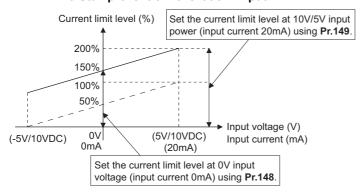


- When Pr.49 ≠ "9999" (level change according to frequency) and Pr.48 = "0%", the stall prevention function is disabled at or lower than the frequency set in Pr.49.
- The RT signal is assigned to the terminal RT in the initial status. Set "3" in one of **Pr.178 to Pr.189 (Input terminal function selection)** to assign the RT signal to another terminal.
- Changing the terminal assignment using **Pr.178 to Pr.189 (Input terminal function selection)** may affect the other functions. Set parameters after confirming the function of each terminal.
- The RT (X9) signal acts as the second (third) function selection signal and makes the other second (third) functions valid. (Refer to page 525.)

◆ Stall prevention operation level setting (analog variable) from terminal 1 (terminal 4) (Pr.148, Pr.149, Pr.858, Pr.868)

- To use the terminal 1 (analog voltage input) to set the stall prevention operation level, set **Pr.868 Terminal 1 function** assignment = "4". Then, input a 0 to 5 V (or 0 to 10 V) to the terminal 1. To choose whether 5 V or 10 V, use **Pr.73 Analog** input selection. In the initial status, **Pr.73** = "1 (initial value)" is set to choose 0 to ±10 V input.
- When setting the stall prevention operation level from terminal 4 (analog current input), set **Pr.858 Terminal 4 function** assignment = "4". Input a 0 to 20 mA to the terminal 4. There is no need to turn ON the AU signal.
- Set Pr.148 Stall prevention level at 0 V input to the current limit level when input voltage is 0 V (0 mA).

• Set Pr.149 Stall prevention level at 0 V input to the current limit level when input voltage is 10 V/5 V (20 mA).



| Dr 959 potting | Dr 969 potting | V/F, Advanced magnetic flux vector control | | | | |
|--------------------|-------------------|--|---------------------|--|--|--|
| Pr.858 setting | Pr.868 setting | Terminal 4 function | Terminal 1 function | | | |
| | 0 (initial value) | | Auxiliary frequency | | | |
| | 1 | | _ | | | |
| | 2 | | _ | | | |
| \(\initial\value\) | 3 | Fraguency command (All signal ON) | _ | | | |
|) (initial value) | 4*1 | Frequency command (AU signal-ON) | Stall prevention | | | |
| | 5 | | _ | | | |
| | 6 | | _ | | | |
| | 9999 | | _ | | | |
| | 0 (initial value) | | _ | | | |
| | 1 | | _ | | | |
| | 2 | | _ | | | |
| 4 | 3 | | _ | | | |
| 1 | 4*1 | _ | Stall prevention | | | |
| | 5 | | _ | | | |
| | 6 | | _ | | | |
| | 9999 | | _ | | | |
| | 0 (initial value) | | Auxiliary frequency | | | |
| | 1 | Stall prevention | _ | | | |
| | 2 | | _ | | | |
| 4 ^{*2} | 3 | _ | _ | | | |
| 4 - | 4*1 | *3 | Stall prevention | | | |
| | 5 | | _ | | | |
| | 6 | Stall prevention | _ | | | |
| | 9999 | | _ | | | |
| 9999 | _ | _ | _ | | | |

- *1 When Pr.868 = "4" (analog stall prevention), the other functions of terminal 1 (auxiliary input, override function, PID control) do not operate.
- *2 When Pr.858 = "4" (analog stall prevention), PID control and speed commands via terminal 4 do not operate even when the AU signal is ON.
- When both Pr.858 and Pr.868 are set to "4" (stall prevention), terminal 1 functions take priority and terminal 4 has no function.



The fast-response current limit cannot be set.

◆ Further prevention of a trip (Pr.154)

• **Pr.154 Voltage reduction selection during stall prevention operation** = "0, 10", the output voltage is reduced during stall prevention operation. By making this setting, an overcurrent trip becomes less likely to occur. Use this setting when torque reduction does not pose a problem. (Under V/F control, the output voltage is reduced only during the stall prevention operation is activated.)

• Set Pr.154 = "10 or 11" when the overvoltage protective function (E.OV[]) is activated during stall prevention operation in an application with large load inertia. Note that turning OFF the start signal (STF/STR) or varying the frequency command during stall prevention operation may delay the acceleration/deceleration start.

| Pr.154 | E.OC[] countermeasure | E.OV[] countermeasure |
|-------------------|-----------------------|-----------------------|
| 0 | Enabled | _ |
| 1 (initial value) | _ | _ |
| 10 | Enabled | Enabled |
| 11 | _ | Enabled |

♠ CAUTION

· Do not set the stall prevention operation current too low.

Doing so will reduce the generated torque.

· Be sure to perform the test operation.

Stall prevention operation during acceleration may extend the acceleration time.

Stall prevention operation during constant-speed operation may cause sudden speed changes.

Stall prevention operation during deceleration may extend the deceleration time.

Parameters referred to

Pr.22 Torque limit level page 245
Pr.73 Analog input selection page 496

Pr.178 to Pr.189 (Input terminal function selection) page 521
Pr.190 to Pr.196 (Output terminal function selection) page 473

Pr.858 Terminal 4 function assignment, Pr.868 Terminal 1 function assignment ☞ page 500

5.10.12 Load characteristics fault detection

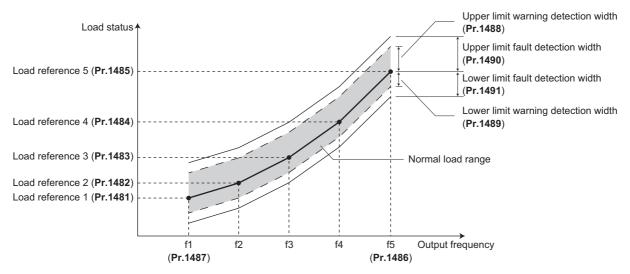
This function is used to monitor whether the load is operating in normal condition by storing the speed/torque relationship in the inverter to detect mechanical faults or for maintenance. When the load operating condition deviates from the normal range, the protective function is activated or the warning is output to protect the inverter or the motor.

| D.: | Name | Initial | value | Setting | Description . |
|--------------|---|---------|-------|--------------------------------------|--|
| Pr. | Name | FM | CA | range | Description |
| | | | | 0 | Load characteristics measurement mode does not start. (Measurement of load characteristics complete without fault.) |
| 1480 | 1480 Load characteristics | | | 1 | Load characteristics measurement mode starts. |
| H520 | measurement mode | 0 | | 2, 3, 4, 5, 81, 82, 83, 84, 85 | The load characteristics measurement status is displayed. (Read-only) |
| 1481 H521 | Load characteristics load reference 1 | 9999 | | | |
| 1482 H522 | Load characteristics load reference 2 | 9999 | | | Cat the unfavored value of manual lead above to within |
| 1483 H523 | Load characteristics load reference 3 | 9999 | | 0 to 400% | Set the reference value of normal load characteristics. 8888: The present load status is written as reference status. 9999: The load reference is invalid. |
| 1484 H524 | Load characteristics load reference 4 | 9999 | | | 3333. The load reference is invalid. |
| 1485 H525 | Load characteristics load reference 5 | | | | |
| 1486 H526 | Load characteristics maximum frequency | 60 Hz | 50 Hz | 0 to 590 Hz | Set the maximum frequency of the load characteristics fault detection range. |
| 1487 H527 | Load characteristics minimum frequency | 6 Hz | | 0 to 590 Hz | Set the minimum frequency of the load characteristics fault detection range. |
| 1488 | Upper limit warning | 20% | | 0 to 400% | Set the detection width when the upper limit load fault warning is output. |
| H531 | detection width | 2070 | | 9999 | Function disabled |
| 1489 | Lower limit warning | 20% | | 0 to 400% | Set the detection width when the lower limit load fault warning is output. |
| H532 | detection width | 2070 | | 9999 | Function disabled |
| 1490 H533 | Upper limit fault | 9999 | | 0 to 400% | Set the detection width when output is shut off when the upper limit load fault occurs. |
| 11000 | dotodion width | | | 9999 | Function disabled |
| 1491 H534 | Lower limit fault detection width | 9999 | | 0 to 400% | Set the detection width when output is shut off when the lower limit load fault occurs. |
| 11334 | detection width | | | 9999 | Function disabled |
| 1492 H535 | Load status detection signal delay time / load reference measurement waiting time | 1 s | | 0 to 60 s | Set the waiting time after the load fault is detected until warning output or output shutoff. In the load characteristics measurement mode, set the waiting time after the load measurement frequency is reached until the load reference is set. |

♦ Load characteristics reference setting (Pr.1481 to Pr.1487)

• Use Pr.1481 to Pr.1485 to set the reference value of load characteristics.

• Use **Pr.1486 Load characteristics maximum frequency** and **Pr.1487 Load characteristics minimum frequency** to set the output frequency range for load fault detection.



◆ Automatic measurement of the load characteristics reference (Load characteristics measurement mode) (Pr.1480)



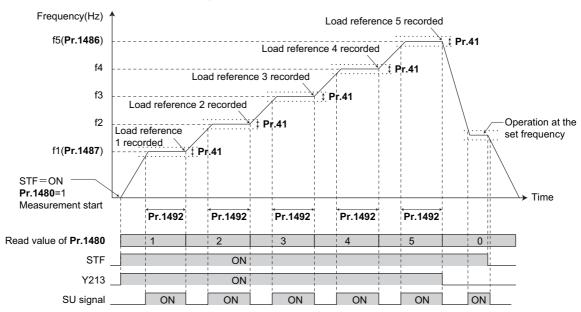
- Perform measurement under actual environment with the motor connected.
- Set Pr.1487 Load characteristics minimum frequency to a value higher than the Pr.13 Starting frequency setting.
- Setting **Pr.1480 Load characteristics measurement mode** = "1" enables automatic measurement of the load characteristics reference. (Load characteristics measurement mode)
- Use **Pr.1486** and **Pr.1487** to set the frequency band for the measurement, and set **Pr.1480** = "1". After setting, when the inverter is started, the measurement starts. (When the value set in **Pr.1486** is smaller than the value set in **Pr.1487**, the measurement does not start.)
- The automatically measured load characteristics reference is written in Pr.1481 to Pr.1485.
- After the measurement is started, read **Pr.1480** to display the status of the measurement. If "8" appears in the tens place, the measurement has not properly completed.

| Read value | of Pr.1480 | Status | | | | | |
|------------|------------|---|--|--|--|--|--|
| Tens place | Ones place | Status | | | | | |
| _ | 1 | During measurement from the starting point to Point 1 | | | | | |
| _ | 2 | During measurement from Point 1 to Point 2 | | | | | |
| _ | 3 | During measurement from Point 2 to Point 3 | | | | | |
| _ | 4 | During measurement from Point 3 to Point 4 | | | | | |
| _ | 5 | During measurement from Point 4 to Point 5 | | | | | |
| _ | 0 | Normal completion | | | | | |
| 8 | 1 to 5 | Termination of measurement by an activation of a protective function, Inverter reset, turning ON of MRS signal, turning OFF of the start command, or timeout. (The value in the ones place represents the above-mentioned measurement point.) | | | | | |

While measuring automatically, the During load characteristics measurement (Y213) signal is output. For the Y213 signal, assign the function by setting "213 (positive logic)" or "313 (negative logic)" in any of in any of Pr.190 to Pr.196 (Output terminal function selection).

• Setting "8888" in **Pr.1481 to Pr.1485** enables fine adjustment of load characteristics. When setting **Pr.1481 to Pr.1485** = "8888" during operation, the load status at that point is set in the parameter. (Only when the set frequency is within ±2 Hz of the frequency of the measurement point, and SU signal is in the ON state.)





NOTE

- Even if the load measurement is not properly completed, the load characteristics fault is detected based on the load characteristics found by the already-completed portion of the measurement.
- · During the load characteristics measurement, the load characteristics fault detection is not performed.
- During the load characteristics measurement, linear acceleration/deceleration is performed even if the S-pattern acceleration/ deceleration is set.
- Changing the terminal assignment using Pr.190 to Pr.196 (Output terminal function selection) may affect the other functions. Set parameters after confirming the function of each terminal.

◆ Setting the load characteristics reference manually (Pr.1481 to Pr.1485)

- Set Pr.1480 Load characteristics measurement mode = "0" (initial value).
- Set **Pr.1486** and **Pr.1487** to specify the frequency band for the measurement, and calculate the frequency as the load characteristics reference (f2 to f4) using the following table.
- Start the inverter operation, and set **Pr.1481** = "8888" during operation at the frequency of the load characteristics reference 1 (f1). The load status at that point is set in **Pr.1481** (only when the set frequency is within ±2 Hz of the frequency of the measurement point, and the SU signal is ON).
- Set load references in Pr.1482 to Pr.1485 in the same way as Pr.1481.

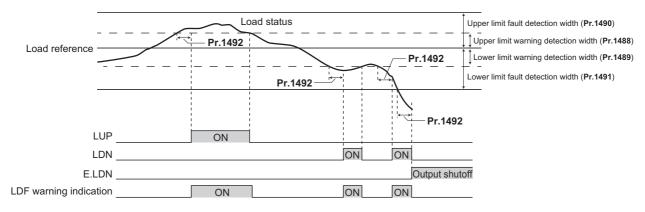
| Reference | Frequency | Load reference |
|----------------------------------|--|----------------|
| Load characteristics reference 1 | f1: load characteristics minimum frequency (Pr.1487) | Pr.1481 |
| Load characteristics reference 2 | f2 = (f5 - f1)/4 + f1 | Pr.1482 |
| Load characteristics reference 3 | f3 = (f5 - f1)/2 + f1 | Pr.1483 |
| Load characteristics reference 4 | f4 = (f5 - f1) × 3/4 + f1 | Pr.1484 |
| Load characteristics reference 5 | f5: load characteristics maximum frequency (Pr.1486) | Pr.1485 |

NOTE

- When inputting values directly in **Pr.1481 to Pr.1485** under V/F control or Advanced magnetic flux vector control, input the load meter value monitored at each reference frequency.
- When inputting values directly in **Pr.1481 to Pr.1485** under Real sensorless vector control, Vector control, or PM sensorless vector control, input the motor torque value monitored at each reference frequency.

◆ Load fault detection setting (Pr.1488 to Pr.1491)

- When the load is deviated from the detection width set in Pr.1488 Upper limit warning detection width, the Upper limit warning detection (LUP) signal is output. When the load is deviated from the detection width set in Pr.1489 Lower limit warning detection width, the Lower limit warning detection (LDN) signal is output. At the same time, the Load fault warning (LDF) appears on the operation panel.
- For the LUP signal, assign the function by setting "211 (positive logic)" or "311 (negative logic)" in any of **Pr.190 to Pr.190 to Pr.**
- When the load is deviated from the detection width set in Pr.1490 Upper limit fault detection width, the protective
 function (E.LUP) is activated and the inverter output is shut off. When the load is deviated from the detection width set in
 Pr.1491 Lower limit fault detection width, the protective function (E.LDN) is activated and the inverter output is shut off.
- To prevent the repetitive on/off operation of the signal due to load fluctuation near the detection range, Pr.1492 Load
 status detection signal delay time / load reference measurement waiting time can be used to set the delay time. Even
 when a fault is detected out of the detection range once, the warning is not output if the characteristics value returns to the
 normal range from a fault state within the output delay time.



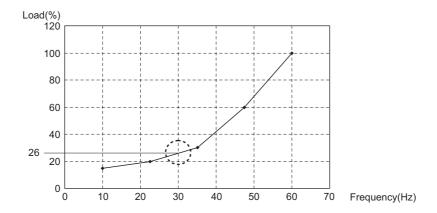


 Changing the terminal assignment using Pr.190 to Pr.196 (Output terminal function selection) may affect the other functions. Set parameters after confirming the function of each terminal.

♦ Setting example

- The load characteristics are calculated from the parameter setting and the output frequency.
- A setting example is as follows. The reference value is linearly interpolated from the parameter settings. For example, the
 reference when the output frequency is 30 Hz is 26%, which is linearly interpolated from values of the reference 2 and the
 reference 3.

| Reference | Frequency | Load reference |
|----------------------------------|---|-----------------------|
| Load characteristics reference 1 | f1: Load characteristics minimum frequency (Pr.1487) = 10 Hz | Pr.1481 = 15% |
| Load characteristics reference 2 | f2 = (f5 - f1)/4 + f1 = 22.5 Hz | Pr.1482 = 20% |
| Load characteristics reference 3 | f3 = (f5 - f1)/2 + f1 = 35 Hz | Pr.1483 = 30% |
| Load characteristics reference 4 | f4 = (f5 - f1) × 3/4 + f1 = 47.5 Hz | Pr.1484 = 60% |
| Load characteristics reference 5 | f5: Load characteristics maximum frequency (Pr.1486) = 60 Hz | Pr.1485 = 100% |



NOTE

 When the load reference is not set for five points, the load characteristics value is determined by linear interpolation of the set load reference values only. If there is only one load reference setting, the set load reference is used as the load reference all through the range.

Parameters referred to

Pr.41 Up-to-frequency sensitivity page 484

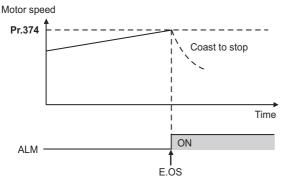
Pr.190 to Pr.196 (Output terminal function selection) page 473

5.10.13 Motor overspeeding detection

The Overspeed occurrence (E.OS) is activated when the motor speed exceeds the overspeed detection level. This function prevents the motor from accidentally speeding over the specified value, due to an error in parameter setting, etc.

| Pr. | Name | Initial value | Setting range | Description |
|-------------|---------------------------|---------------|---------------|--|
| 274 | | | 0 to 590 Hz | If the motor rotation speed exceeds the speed set in Pr.374 during encoder feedback control, Real sensorless vector control, Vector control or PM sensorless vector control, Overspeed occurrence (E.OS) occurs, the inverter output is shut off. |
| 374 H800 | Overspeed detection level | 9999 | 9999 | If the speed exceeds "the maximum speed (Pr.1, Pr.18) + 20 Hz" during encoder feedback control, Real sensorless vector control, or Vector control, E.OS occurs. During PM sensorless vector control, E.OS occurs when the speed exceeds the "maximum motor frequency + 10 Hz"*1. |

*1 The motor maximum frequency is set in **Pr.702 Maximum motor frequency**. When **Pr.702** = "9999 (initial value)", the **Pr.84 Rated motor frequency** is used as the maximum motor frequency.



NOTE

 During the encoder feedback control operation or under Vector control, the motor speed is compared against Pr.374. Under Real sensorless vector control or PM sensorless vector control, the output frequency is compared against Pr.374.

5.11 (M) Item and output signal for monitoring

| Purpose | P | arameter to set | | Refer to page |
|--|---|--|--|---------------|
| To display the motor speed (the number of rotations per minute). To switch the unit of measure to set the operation speed from frequency to motor speed. | Speed indication and its setting change to rotations per minute | P.M000 to P.M002, P.D030 | Pr.37, Pr.144, Pr.505, Pr.811 | 444 |
| To change the item monitored on the operation panel and parameter unit | Operation panel monitor item selection, clearing the cumulative value during monitoring | P.M020 to P.M023, P.M030, P.M031, P.M044, P.M045, P.M050 to P.M052, P.M100 to P.M104 | Pr.52, Pr.170, Pr.171, Pr.268, Pr.290, Pr.563, Pr.564, Pr.774 to Pr.776, Pr.891, Pr.992, Pr.1018, Pr.1106 to Pr.1108 | 446 |
| To change the monitor item whose data is output via terminal FM (CA) or AM | Terminal FM (CA) function selection | P.M040 to P.M042, P.M044, P.M300, P.M301, P.D100 | Pr.54, Pr.55, Pr.56, Pr.158, Pr.290, Pr.291, Pr.866 | 457 |
| To adjust the output via terminal FM (CA) or AM | Terminal FM (CA)/AM calibration | P.M310, P.M320, P.M321, P.M330 to P.M334 | Pr.867, Pr.869, C0 (Pr.900), C1 (Pr.901), C8 (Pr.930) to C11 (Pr.931) | 463 |
| To check the effects of energy saving | Energy saving monitoring | P.M023, P.M100, P.M200 to P.M207, P.M300, P.M301 | Pr.52, Pr.54, Pr.158, Pr.891 to Pr.899 | 467 |
| To assign functions to the output terminals | Output terminal function assignment | P.M400 to P.M406, P.M410 to P.M416, P.M420 to P.M422, P.M431 | Pr.190 to Pr.196, Pr.289, Pr.313 to Pr.322 | 473 |
| To detect the output frequency | Up-to-frequency sensitivity Output frequency detection Low speed detection | P.M440 to P.M446 | Pr.41 to Pr.43, Pr.50, Pr.116, Pr.865, Pr.870 | 484 |
| To detect the output current | Output current detection Zero current detection | P.M433, P.M460 to P.M464 | Pr.150 to Pr.153, Pr.166, Pr.167 | 487 |
| To detect the output torque | Output torque detection | P.M470 | Pr.864 | 488 |
| To use the remote output function | Remote output | P.M500 to P.M502 | Pr.495 to Pr.497 | 489 |
| To use the analog remote output function | Analog remote output | P.M530 to P.M534 | Pr.655 to Pr.659 | 490 |
| To output the fault code via a terminal | Fault code output function | P.M510 | Pr.76 | 492 |
| To detect the specified output power | Pulse train output of output power | P.M520 | Pr.799 | 493 |
| To detect the control circuit temperature | Control circuit temperature monitoring | P.M060 | Pr.663 | 494 |
| To monitor pulses | Cumulative pulse monitoring | P.M610 to P.M613 | Pr.635 to Pr.638 | 321 |
| To output divided encoder pulses | Encoder pulse dividing output | P.M600, P.M601 | Pr.413, Pr.863 | 495 |

Speed indication and its setting change to 5.11.1 rotations per minute

The frequency monitored or set on the operation panel can be changed to the motor speed or the machine speed.

| Pr. | Name | Initial | value | Catting range | Descripti | | | | |
|-------------|--------------------------|-------------|-------|---|---|--------------------------|--|--|--|
| FI. | Name | FM | CA | Setting range | Description | | | | |
| 37 | | | | 0 | Monitoring and setting of frequency | | | | |
| M000 | Speed display | 0 | | 1 to 9998 ^{*1} | Set a number for the speed of machine operated at th speed (frequency) set in Pr.505 . | | | | |
| 505 M001 | Speed setting reference | 60 Hz 50 Hz | | 1 to 590 Hz | Set the reference speed (frequ | ency) for Pr.37 . | | | |
| 144 M002 | Speed setting switchover | 4 | | 0, 2, 4, 6, 8, 10, 12, 102, 104, 106, 108, 110, 112 | Set the number of motor poles for the indication of th motor speed. | | | | |
| | | | | 0 | Speed setting, running speed monitor increments 1 r/min | Torque limit setting | | | |
| 811 | Set resolution | 0 | | 1 | Speed setting, running speed monitor increments 0.1 r/min | increments 0.1% | | | |
| D030 | switchover | U | | 10 | Speed setting, running speed monitor increments 1 r/min | Torque limit setting | | | |
| | | | | 11 | Speed setting, running speed monitor increments 0.1 r/min increments 0.1 r/min | | | | |

^{*1} The maximum value of the setting range differs according to the **Pr.1 Maximum frequency**, **Pr.505 Speed setting reference**, and it can be calculated from the following formula.

The maximum value of Pr.37 < 65535 × Pr.505 / Pr.1 setting value (Hz).

The maximum setting value of Pr.37 is 9998 if the result of the above formula exceeds 9998.

◆ Indication of motor speed (Pr.37, Pr.144)

- To change the indication to the motor speed, set the number of motor poles (2, 4, 6, 8, 10, or 12) or the number of motor poles with the addition of 100 (102, 104, 106, 108, 110, or 112) in **Pr.144**.
- Whenever the number of motor poles set in Pr.81 Number of motor poles is changed, the Pr.144 setting changes
 automatically in conjunction with Pr.81. However, the Pr.81 setting does not automatically change when the Pr.144 setting
 is changed.

Example 1) Changing the initial value of Pr.81 to "2" will change the Pr.144 setting from "4" to "2".

Example 2) Changing the Pr.81 setting to "2" while Pr.144 = "104" will change the Pr.144 setting from "104" to "102".

◆ Indication of machine speed (Pr.37, Pr.505)

- To change the indication to the machine speed, set a number in **Pr.37** which corresponds to the speed of machine operated at the frequency set in **Pr.505**.
- For example, when **Pr.505** is set to 60 Hz and **Pr.37** is set to "1000", the operation panel indicates "1000" as the monitor value of machine speed while the output frequency is 60 Hz. "500" is displayed while the output frequency is 30 Hz.

◆ Changing the increment of the speed monitoring and setting (Pr.811)

- When **Pr.811** = "1 or 11", the speed can be set in increments of 0.1 r/min on the PU, or can be set and monitored in increments of 0.1 r/min via RS-485 communication or other communication with a corresponding communication option installed. (The parameter setting is in 1 r/min increments.)
- For the information of the availability of changing the increments of speed setting on communication options, refer to the Instruction Manual of each communication option.
- Refer to page 245 for details on the setting increments for the torque limit level.

Monitoring/setting items and its increments

• When both settings of **Pr.37** and **Pr.144** are changed from the initial values, a precedence order for these settings is as follows:

Pr.144 = "102 to 112" > Pr.37 = "1 to 9998" > Pr.144 = "2 to 12".

The monitoring/setting items and its increments are listed with the following matrix to show the combination of the Pr.37
and Pr.144 settings.

| Pr.37 setting | Pr.144 setting | Output frequency indication | Set frequency indication | Running speed indication | Indication of frequency setting parameter | | |
|----------------------|-----------------------------|-----------------------------|----------------------------------|---|---|--|--|
| | 0 | 0.01 Hz | 0.01 Hz | 1 r/min*1*2 | 0.01 Hz. | | |
| 0 (initial value) | 2 to 12 | 0.01 Hz (initial setting) | 0.01 Hz (initial setting) | 1 r/min ^{*1*2} (initial setting) | 0.01 Hz (initial setting) | | |
| | 102 to 112 | 1 r/min*1*2 | 1 r/min*1*2 | 1 r/min*1*2 | 1 r/min ^{*1} | | |
| | 0 | 0.01 Hz | 0.01 Hz | 1 (machine speed*1) | 0.01 Hz. | | |
| 1 to 9998 | 2 to 12 1 (machine speed*1) | | 1 (machine speed ^{*1}) | 1 (machine speed*1) | 1 (machine speed ^{*1}) | | |
| | 102 to 112 0.01 Hz | | 0.01 Hz | 1 r/min*1*2 | 0.01 Hz. | | |

*1 Motor speed r/min conversion formula: frequency × 120 / number of motor poles (Pr.144)

Machine speed conversion formula: Pr.37 × frequency / Pr.505

The Pr.144 value in the above formula is "Pr.144 - 100" when any of "102 to 112" is set in Pr.144. The value is "4" when Pr.37 = 0 and Pr.144 = 0. The item set in **Pr.505** is consistently a frequency (Hz).

*2 The increment can be changed in **Pr.811** from 1 r/min to 0.1 r/min.



- The inverter's output frequency is displayed as synchronous speed under V/F control. The displayed value is "actual motor speed" + "motor slip". When Advanced magnetic flux vector control, Real sensorless vector control, or PM sensorless vector control is selected, the actual motor speed (estimated value by motor slip calculation) is used. When the encoder feedback control or vector control is selected, the actual motor speed from the encoder is used.
- When Pr.37 = "0" and Pr.144 = "0", the running speed monitor is displayed with the number of motor poles 4. (Displays 1800 r/min at 60 Hz)
- To change the PU main monitor (PU main display), refer to Pr.52.
- If the setting increment is changed to 1 r/min (Pr.811 = "0 or 10") after setting the running speed in 0.1 r/min (Pr.811 = "1 or 11"), the 0.1 r/min increment may be dropped, in order for the rotations per minute resolution to change from 0.1 r/min to 0.3 r/min (when using four poles).
- · When using the machine speed display for the parameter unit (FR-PU07), do not change the speed with the up/down key if a set speed above 65535 is displayed. The set speed may become an undetermined value.
- · When a certain type of communication option is used, the frequency display (setting) is used regardless of the Pr.37 and Pr.144 settings. Refer to the Instruction Manual of each communication option for details. (The frequency display (setting) is always used for HMS network options.)
- When **Pr.811** = "1 or 11" with the 0.1 r/min increment, the upper limit is as follows. Speed command setting range: 6000 r/min for 2 to 10 motor poles, 5900 r/min for 12 motor poles Running speed monitor such as the operation panel: 6553.5 r/min Full scale of the running speed motor for analog output (terminals FM, CA and AM): 6000 r/min

∕<u>N</u> CAUTION

Make sure to set the running speed and the number of motor poles.

Otherwise, the motor might run at extremely high speed, damaging the machine.

Parameters referred to

Pr.1 Maximum frequency page 428 Pr.22 Torque limit level page 245

Pr.52 Operation panel main monitor selection page 446

Pr.81 Number of motor poles ☐ page 221 Pr.800 Control method selection ☐ page 221

Pr.811 Set resolution switchover page 245

Monitor item selection on operation panel or via 5.11.2 communication

The monitor item to be displayed on the operation panel or the parameter unit can be selected.

| Pr. | Name | Initial value | Setting range | Description |
|------------|--|---|--|-------------|
| 52 M100 | Operation panel main monitor selection | • | 0, 5 to 14, 17 to 20, 22 to 36, 38 to 46, 50 to 57, 61, 62, 64, 67, 71 to 75, 87 to 98, 100 | |

| Pr. | Name | Initial value | Setting range | Description | | | | | |
|--------------|---|-------------------|---|---|--|--|--|--|--|
| 774 M101 | Operation panel monitor selection 1 | | 1 to 3, 5 to 14, 17 to 20, 22 to | Each of the initial items monitored on the operation panel or | | | | | |
| 775 | Operation panel monitor | 0000 | 36, 38 to 46, 50 | parameter unit in the monitor mode (output frequency, | | | | | |
| M102 | selection 2 | 9999 | to 57, 61, 62, 64, 67, 71 to 75, | output current, and output voltage) can be switched to a user-designated item. | | | | | |
| 776 M103 | Operation panel monitor selection 3 | | 87 to 98, 100, 9999 | 9999: Follows the Pr.52 setting. | | | | | |
| 992 M104 | Operation panel setting dial push monitor selection | 0 (set frequency) | 0 to 3, 5 to 14, 17 to 20, 22 to 36, 38 to 46, 50 to 57, 61, 62, 64, 67, 71 to 75, 87 to 98, 100 | Select the monitor item displayed on the operation panel at the time when the setting dial is pressed. | | | | | |
| | | | 0 | Set "0" to clear the watt-hour meter. | | | | | |
| 170 M020 | Watt-hour meter clear | 9999 | 10 | Set "10" to monitor the cumulative power in the range of 0 to 9999 kWh via communication. | | | | | |
| Mozo | | | 9999 | Set "9999" to monitor the cumulative power in the range of 0 to 65535 kWh via communication. | | | | | |
| 563 M021 | Energization time carrying- over times | 0 | (0 to 65535) (Read-only) | The number of times that the cumulative energization time exceeded 65535 hours is displayed (read-only). | | | | | |
| | | | 0 | Value is displayed in 1 increments (an integer). | | | | | |
| 268 M022 | Monitor decimal digits selection | 9999 | 1 | Value is displayed in 0.1 increments. | | | | | |
| WUZZ | Selection | | 9999 | No function | | | | | |
| 891 M000 | Cumulative power monitor | 9999 | 0 to 4 | Set the number of digits to move the decimal point of the cumulative energy monitored value to the left. The readout peaks out at the upper limit of readout. | | | | | |
| M023 | digit shifted times | | 9999 | The function of moving the decimal point is not available. The readout is reset to 0 when it exceeds the upper limit. | | | | | |
| 171 | | | 0 | Set "0" to clear the operation hour meter. | | | | | |
| M030 | Operation hour meter clear | 9999 | 9999 | The readout is always 9999. Nothing changes when "9999" is set. | | | | | |
| 564 M031 | Operating time carrying- over times | 0 | (0 to 65535) (Read-only) | The number of times that the operating time reaches 65535 hours is displayed. Read-only. | | | | | |
| 290 M044 | Monitor negative output selection | 0 | 0 to 7 | Set the availability of negative signals output via terminal AM, to the operation panel, and through communication. (Refer to page 455.) | | | | | |
| 1018 M045 | Monitor with sign selection | 9999 | 0, 1, 9999 | Select the item group to enable the indication of negative signed numbers. | | | | | |
| 1106 M050 | Torque monitor filter | 9999 | 0 to 5 s | The filter time constant is selectable for monitoring of the torque. A larger setting results in slower response. | | | | | |
| | | | 9999 | 0.3 s filter | | | | | |
| 1107 M051 | Running speed monitor filter | 9999 | 0 to 5 s | The filter time constant is selectable for monitoring of the running speed. A larger setting results in slower response. | | | | | |
| | | | 9999 | 0.08 s filter | | | | | |
| 1108 M052 | Excitation current monitor filter | 9999 | 0 to 5 s | The filter time constant is selectable for monitoring of the motor excitation current. A larger setting results in slower response. | | | | | |
| | | | 9999 | 0.3 s filter | | | | | |

◆ Monitor item list (Pr.52, Pr.774 to Pr.776, Pr.992)

- Use Pr.52, Pr.774 to Pr.776, or Pr.992 to select the item to monitor on the operation panel or the parameter unit.
- Refer to the following table to find the setting value for each monitoring. The value in the Pr. setting column is set in each of the parameters for monitoring (Pr.52, Pr.774 to Pr.776, and Pr.992) to determine the monitored item. The value in the RS-485 column is used for the RS-485 communication special monitor selection. The value in the MODBUS RTU column is used for the MODBUS RTU real time monitor. (The items marked with "—" cannot be selected. The circle in the negative indication (-) column indicates that the indication of negative signed numbers is available.)

| Monitor item | Increment and unit | Pr. setting | RS-485 | MODBUS RTU | Negative indication (-)*1 | Description |
|-----------------------------|--------------------------|----------------|--------|---------------|---------------------------|---|
| Output frequency (speed)*18 | 0.01 Hz*17 | 1/0/100 | H01 | 40201 | o*21 | The inverter output frequency is displayed. |
| Output current*7*9*18 | 0.01/0.1 A ^{*6} | 2/0/100 | H02 | 40202 | | The inverter output current effective value is displayed. |

| Monitor item | Increment and unit | Pr. setting | RS-485 | MODBUS RTU | Negative indication (-)*1 | Description |
|--|---------------------------------|------------------|--------|---------------|---------------------------|--|
| Output voltage*7*18 | 0.1 V | 3/0/100 | H03 | 40203 | | The inverter output voltage is displayed. |
| Fault indication | _ | 0/100 | _ | _ | | Each of the last 8 faults is displayed individually. |
| Set frequency / motor speed setting | 0.01 Hz*17 | 5 ^{*2} | H05 | 40205 | | The set frequency is displayed. |
| Operation speed | 1 (r/min) | 6*2 | H06 | 40206 | o*21 | The motor speed is displayed (depending on the settings of Pr.37 and Pr.144). (Refer to page 444.) During encoder feedback control operation or under Vector control, the actual motor speed according to encoder signals is displayed. |
| Motor torque | 0.1% | 7*2 | H07 | 40207 | 0 | The motor torque is displayed as a percentage (0% under V/F control), considering the rated torque as 100%. |
| Converter output voltage*7 | 0.1 V | 8 ^{*2} | H08 | 40208 | | The DC bus voltage value is displayed. |
| Regenerative brake duty*8 | 0.1% | 9*2 | H09 | 40209 | | Brake duty set in Pr.70 for the regeneration unit set in Pr.30 is displayed. |
| Electronic thermal O/ L relay load factor | 0.1% | 10 ^{*2} | Н0А | 40210 | | The motor thermal cumulative value is displayed, considering the thermal operation level as 100%. |
| Output current peak value*7 | 0.01/0.1 A ^{*6} | 11 ^{*2} | Н0В | 40211 | | The peak value of output current, which is constantly stored, is displayed. (It is reset with every startup of the inverter.) |
| Converter output voltage peak value*7 | 0.1 V | 12 ^{*2} | H0C | 40212 | | The DC bus voltage peak value, which is constantly stored, is displayed. (It is reset with every startup of the inverter.) |
| Input power | 0.01/0.1 kW ^{*6} | 13 ^{*2} | H0D | 40213 | | The power at the inverter input side is displayed. |
| Output power*9 | 0.01/0.1 kW ^{*6} | 14 ^{*2} | H0E | 40214 | | The power at the inverter output side is displayed. |
| Load meter | 0.1% | 17 | H11 | 40217 | | Torque current is displayed as a percentage, considering Pr.56 setting value as 100% (considering the motor rated torque as 100% under Real sensorless vector control or Vector control). |
| Motor excitation current*7 | 0.01 A/0.1 A ^{*6} | 18 | H12 | 40218 | | The motor excitation current is displayed. |
| Position pulse*11 | _ | 19 | H13 | 40219 | | The number of pulses per motor rotation during orientation control operation or in the position control mode is displayed. (The output voltage is displayed when a Vector control option is not installed.) |
| Cumulative energization time*3 | 1h | 20 | H14 | 40220 | | The cumulative energization time since the inverter shipment is displayed. The number of times an integrated value has reached the maximum value of 65535 hours can be checked in Pr.563 . |
| Orientation status*11 | 1 | 22 | H16 | 40222 | | Monitoring is enabled only during orientation control operation. (The output voltage is displayed when a Vector control option is not installed.) (Refer to page 585.) |
| Actual operation time*3*4 | 1 h | 23 | H17 | 40223 | | The cumulative operation time is displayed. The number of times an integrated value has reached the maximum value of 65535 hours can be checked in Pr.564 . Use Pr.171 to reset the cumulative operation time. (Refer to page 454.) |
| Motor load factor | 0.1% | 24 | H18 | 40224 | | The output current value is displayed as a percentage, considering the inverter rated current value as 100%. Readout (%) = present output current value / inverter rated current value × 100 |
| Cumulative energy*7 | 0.01/0.1 kWh ^{*5*6} | 25 | H19 | 40225 | | The cumulative energy based on the monitored output power is displayed. Use Pr.170 to reset it. (Refer to page 454.) |
| Position command (lower digits) | 1 | 26 | H1A | 40226 | 0 | The position command (decimal) before the electronic |
| Position command (upper digits) | 1 | 27 | H1B | 40227 | 0 | gear is set is displayed. ^{*10} |

| Monitor item | Increment and unit | Pr. setting | RS-485 | MODBUS RTU | Negative indication (-)*1 | Description |
|--|---|----------------|--------|---------------|---------------------------|---|
| Current position (lower digits) | 1 | 28 | H1C | 40228 | 0 | The converted number of the position feedback pulse into the number of pulses before the electronic gear is set |
| Current position (upper digits) | 1 | 29 | H1D | 40229 | 0 | is displayed.*10 |
| Droop pulse (lower digits) | 1 | 30 | H1E | 40230 | 0 | The droop pulse before the electronic gear is set is |
| Droop pulse (upper digits) | 1 | 31 | H1F | 40231 | 0 | displayed. ^{*10} |
| Torque command | 0.1% | 32 | H20 | 40232 | 0 | The torque command value adjusted with Vector control is displayed. |
| Torque current command | 0.1% | 33 | H21 | 40233 | 0 | The command value of the current for torque is displayed. |
| Motor output | 0.01/0.1 kW ^{*6} | 34 | H22 | 40234 | | The output of a machine connected to the motor shaft is displayed. It is determined by multiplying the present output torque with the present motor speed. |
| Feedback pulse*11 | _ | 35 | H23 | 40235 | | The number of pulses fed back from the encoder in one cycle of the sampling is displayed (kept displayed during a stop). (The output voltage is displayed when a Vector control option is not installed.) The sampling time period varies depending on the Pr.369 Number of encoder pulses setting. 1050 or less: 1 s, 1051 to 2100: 0.5 s, 2101 to 4096: 0.25 s |
| Torque (positive polarity for driving torque/negative polarity for regenerative braking torque) | 0.1% | 36 | H24 | 40236 | 0 | The value equal to the motor torque is displayed. A positive value for driving torque or a negative value for regenerative braking torque is displayed. |
| Trace status | 1 | 38 | H26 | 40238 | | The trace status is displayed. (Refer to page 649.) |
| SSCNET III communication status*11 | 1 | 39 | H27 | 40239 | | The SSCNET III communication status between the inverter and the controller is displayed. The output voltage is displayed when the FR-A8NS is not installed. |
| PLC function user monitor 1 | | 40 | H28 | 40240 | | The user-designated monitor item is displayed using the PLC function. |
| PLC function user monitor 2 | Increment set in the register | 41 | H29 | 40241 | | Each value of the following special registers is displayed. SD1216: displayed with the setting value "40", |
| PLC function user monitor 3 | SD1215 | 42 | H2A | 40242 | | SD1217: displayed with the setting value "41", SD1218: displayed with the setting value "42" (Refer to the PLC Function Programming Manual.) |
| Station number (RS- 485 terminals) | 1 | 43 | H2B | 40243 | | The station number of the inverter enabling communication via the RS-485 terminals is displayed. |
| Station number (PU) | 1 | 44 | H2C | 40244 | | The station number of the inverter enabling communication via the PU connector is displayed. |
| Station number (CC-Link) | 1 | 45 | H2D | 40245 | | The station number of the inverter enabling CC-Link communication is displayed. ("0" is displayed when the FR-A8NS is not installed.) |
| Motor temperature*11 | 1°C | 46 | H2E | 40246 | 0 | The temperature of the Vector control dedicated motor with thermistor (SF-V5RU[]T/A) is displayed (for the FR-A8AZ). |
| Power saving effect | Increment | 50 | H32 | 40250 | | The energy saving effect monitoring is enabled. The item |
| Cumulative energy saving | and unit vary depending on the parameter settings. | 51 | H33 | 40251 | | to monitor is selectable from among the saved power, the average energy saving, and the energy cost savings. Some of them can be displayed as a percentage according to the parameter settings. (Refer to page 467.) |
| PID set point | 0.1% | 52 | H34 | 40252 | | The set point, measured value, and deviation during PID |
| PID measured value | 0.1% | 53 | H35 | 40253 | | control operation is displayed. (Refer to page 610.) |
| PID deviation | 0.1% | 54 | H36 | 40254 | 0 | |

| Monitor item | Increment and unit | Pr. setting | RS-485 | MODBUS RTU | Negative indication (-)*1 | Description |
|--|--------------------|---------------------|--------------------|----------------------|---------------------------|---|
| Input terminal status | _ | - 55 ^{*19} | H0F*12 | 40215 ^{*12} | ,, | The ON/OFF state of the input terminals on the inverter is displayed. (Refer to page 453 for details on indication on the DU.) |
| Output terminal status | _ | 55 13 | H10 ^{*13} | 40216 ^{*13} | | The ON/OFF state of the output terminals on the inverter is displayed. (Refer to page 453 for details on indication on the DU.) |
| Option input terminal status*11 | _ | 56 | _ | _ | | The ON/OFF state of the input terminals on the digital input option (FR-A8AX) is displayed on the DU. (Refer to page 453 for details.) |
| Option output terminal status*11 | _ | 57 | _ | _ | | The ON/OFF state of the output terminals on the digital output option (FR-A8AY) or the relay output option (FR-A8AR) is displayed on the DU. (Refer to page 453 for details.) |
| Option input terminal status 1 (for communication)*11 | _ | _ | H3A ^{*14} | 40258 ^{*14} | | The ON/OFF state of the input terminals X0 to X15 on the digital input option (FR-A8AX) is monitored via RS-485 communication or other communication when the communication option is installed. |
| Option input terminal status 2 (for communication)*11 | _ | _ | H3B ^{*15} | 40259 ^{*15} | | The ON/OFF state of the input terminal DY on the digital input option (FR-A8AX) is monitored via RS-485 communication or other communication when the communication option is installed. |
| Option output terminal status (for communication)*11 | _ | _ | H3C* ¹⁶ | 40260 ^{*16} | | The ON/OFF state of the output terminals on the digital output option (FR-A8AY) or the relay output option (FR-A8AR) is monitored via RS-485 communication or other communication when the communication option is installed. |
| Motor thermal load factor | 0.1% | 61 | H3D | 40261 | | The accumulated heat value of the motor thermal O/L relay is displayed. The Motor overload trip (electronic thermal relay function) (E.THM) occurs at 100%. |
| Inverter thermal load factor | 0.1% | 62 | Н3Е | 40262 | | The accumulated heat value of the inverter thermal O/L relay is displayed. The Inverter overload trip (electronic thermal relay function) (E.THT) occurs at 100%. |
| PTC thermistor resistance | 0.01 kΩ | 64 | H40 | 40264 | | The PTC thermistor resistance is displayed when Pr.561 PTC thermistor protection level ≠ 9999. (The output voltage is displayed when Pr.561 = 9999.) |
| PID measured value 2 | 0.1% | 67 | H43 | 40267 | | The PID measured value is displayed while the PID control is enabled (Pr.128 ≠ "0"), even if PID control operating conditions are not satisfied. (Refer to page 610.) |
| Cumulative pulse*11 | _ | 71 | H47 | 40271 | o*20 | The cumulative number of pulses is displayed (for Vector control compatible plug-in option). (Monitoring range: - 32767 to 32767) |
| Cumulative pulse overflow times*11 | _ | 72 | H48 | 40272 | o*20 | The number of the cumulative pulses carrying overflow times is displayed (for Vector control compatible plug-in option). |
| Cumulative pulse (control terminal option)*11 | _ | 73 | H49 | 40273 | o*20 | The cumulative number of pulses is displayed (for the FR-A8TP). (Monitoring range: -32767 to 32767) |
| Cumulative pulse overflow times (control terminal option)*11 | _ | 74 | H4A | 40274 | ₀ *20 | The number of the cumulative pulse overflow times is displayed (for the FR-A8TP). |
| Multi-revolution counter*11 | 1 | 75 | H4B | 40275 | | The multi-revolution encoder counter is monitored when the FR-A8APS is installed. (The output voltage is monitored when the FR-A8APS is not installed.) |

| Monitor item | Increment and unit | Pr. setting | RS-485 | MODBUS RTU | Negative indication (-)*1 | Description |
|--|-----------------------------------|----------------|-----------|---------------|---------------------------|--|
| 32-bit cumulative energy (lower 16 bits) | 1 kWh | _ | H4D | 40277 | | The upper or lower 16 bits of the 32-bit cumulative |
| 32-bit cumulative energy (upper 16 bits) | 1 kWh | _ | H4E | 40278 | | energy is displayed on each indication. It is monitored via RS-485 communication or other |
| 32-bit cumulative energy (lower 16 bits) | 0.01 kWh/0.1 kWh ^{*6} | _ | H4F 40279 | | | communication with a communication option installed. (To find the monitor codes for each communication option, refer to the Instruction Manual of each |
| 32-bit cumulative energy (upper 16 bits) | 0.01 kWh/0.1 kWh ^{*6} | _ | H50 | 40280 | | communication option.) |
| Remote output value 1 | 0.1% | 87 | H57 | 40287 | | |
| Remote output value 2 | 0.1% | 88 | H58 | 40288 | 0 | Each setting value of Pr.656 to Pr.659 (Analog remote |
| Remote output value 3 | 0.1% | 89 | H59 | 40289 | | output 1 to 4) is displayed. (Refer to page 490.) |
| Remote output value 4 | 0.1% | 90 | Н5А | 40290 | | |
| PID manipulated amount | 0.1% | 91 | Н5В | 40291 | 0 | The PID control manipulated amount is displayed. (Refer to page 610.) |
| Second PID set point | 0.1% | 92 | H5C | 40292 | | |
| Second PID measured value | 0.1% | 93 | H5D | 40293 | | The set point, measured value, or deviation is displayed during the second PID control operation. (Refer to page 610.) |
| Second PID deviation | 0.1% | 94 | H5E | 40294 | 0 | 010.) |
| Second PID measured value 2 | 0.1% | 95 | H5F | 40295 | | The PID measured value is displayed while the second PID control is enabled (Pr.753 ≠ "0"), even if PID control operating conditions are not satisfied. (Refer to page 610.) |
| Second PID manipulated amount | 0.1% | 96 | H60 | 40296 | 0 | The second PID control manipulated amount is displayed. (Refer to page 610.) |
| Dancer main set speed | 0.01 Hz. | 97 | H61 | 40297 | | The set speed for main speed during the dancer control operation is displayed. |
| Control circuit temperature | 1°C | 98 | H62 | 40298 | 0 | The temperature of the control circuit board is displayed. (Refer to page 494.) When negative number not displayed: 0 to 100°C When negative number displayed: -20 to 100°C |

- *1 Indication with a minus sign is not possible via RS-485 or MODBUS RTU communication.
- *2 To monitor the item on the LCD operation panel (FR-LU08) or the parameter unit (FR-PU07) in the monitor mode, use **Pr.774 to Pr.776** or the monitor function of the FR-LU08 or the FR-PU07 for setting.
- *3 The cumulative energization time and actual operation time are accumulated from 0 to 65535 hours, then cleared, and accumulated again from 0.
- *4 The actual operation time does not increase if the cumulative running time before power OFF is less than an hour.
- *5 On the parameter unit (FR-PU07), the unit "kW" is displayed.
- *6 The increment differs according to the inverter capacity. (Increment left of a slash for FR-A820-03160(55K) or lower, FR-A840-01800(55K) or lower. Increment right of a slash for FR-A820-03800(75K) or higher, FR-A840-02160(75K) or higher.)
- *7 Since each readout of the output voltage and output current displayed on the operation panel (FR-DU08) is a four-digit number, a value of more than 9999 is displayed as "----".
- *8 The setting is available for the standard model.
- *9 The inverter regards the output current which is less than the specified current level (5% of the rated inverter current) as 0 A. Therefore, each readout of an output current and output power may show "0" if a too small-capacity motor is used as contrasted with the inverter capacity and the output current falls below the specified value.
- *10 The displayed item can be changed to the pulse after the electronic gear is set by using **Pr.430 Pulse monitor selection**. (Refer to page 321.)
- *11 Monitoring is available when the compatible plug-in option or control terminal option is installed.
- *12 The details of bits for the input terminal status are as follows. (1: ON state, 0: OFF state of a terminal on the inverter. "—" denotes an indefinite (null) value.)

| b15 | | | | | | | | | | | | | | | b0 |
|-----|----|---|---|----|-----|---------------|-----|-----|----|----|----|----|----|-----|-----|
| S1 | S2 | - | - | CS | RES | STP (STOP) | MRS | JOG | RH | RM | RL | RT | AU | STR | STF |

*13 The details of bits for the output terminal status are as follows. (1: ON state, 0: OFF state of a terminal on the inverter. "—" denotes an indefinite (null) value.)

| b15 | | | | | | | | | | | | | | | bU |
|-----|---|---|---|---|---|---|---|---------|------|------|----|----|-----|----|-----|
| - | - | - | - | - | - | - | - | So (SO) | ABC2 | ABC1 | FU | OL | IPF | SU | RUN |

*14 The details of bits for the option input terminal status 1 are as follows. (1: ON state, 0: OFF state of a terminal on the FR-A8AX.) Every bit is 0 (OFF) when the option is not installed.

| b15 | | | | | | | | | | | | | | | b0 |
|-----|-----|-----|-----|-----|-----|----|----|----|----|----|----|----|----|----|----|
| X15 | X14 | X13 | X12 | X11 | X10 | X9 | X8 | X7 | X6 | X5 | X4 | Х3 | X2 | X1 | X0 |

*15 The details of bits for the option input terminal status 2 are as follows. (1: ON state, 0: OFF state of a terminal on the FR-A8AX. "—" denotes an indefinite (null) value.) Every bit is 0 (OFF) when the option is not installed.

| b15 | | | | | | | | | | | | | | | b0 |
|-----|---|---|---|---|---|---|---|---|---|---|---|---|---|---|----|
| - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | DY |

*16 The details of bits for the option output terminal status are as follows. (1: ON state, 0: OFF state of a terminal on the FR-A8AY/A8AR. "—" denotes an indefinite (null) value.) Every bit is 0 (OFF) when the option is not installed.

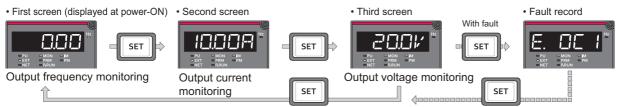
| b15 | | | | | | | | | | | | | | | b0 |
|-----|---|---|---|---|---|-----|-----|-----|----|----|----|----|----|----|----|
| - | - | - | - | - | - | RA3 | RA2 | RA1 | Y6 | Y5 | Y4 | Y3 | Y2 | Y1 | Y0 |

- *17 The increment is 1 when Pr.37 = "1 to 9998" or when Pr.144 = "2 to 12" or "102 to 112". (Refer to page 444.)
- *18 The monitored values are retained even if an inverter fault occurs. Resetting clears the retained values.
- *19 Parameter setting is not available for setting the item as the main monitor item on the LCD operation panel (FR-LU08) or the parameter unit (FR-PU07). Use the monitor function of the FR-LU08 or the FR-PU07 for setting.
- *20 Negative values are not displayed on the operation panel. The values "-1 to -32767" are displayed as "65535 to 32769" on the operation panel.
- *21 Setting of **Pr.1018 Monitor with sign selection** is required. Also, it will be displayed without a minus sign on the operation panel. Confirm the rotation direction with the [FWD] or [REV] indicator.

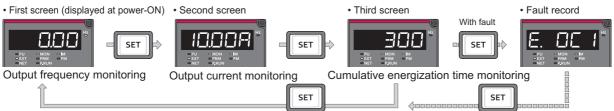
◆ Monitor display for operation panel (Pr.52, Pr.774 to Pr.776)

- When **Pr.52** = "0" (initial value), the monitoring of output frequency, output current, output voltage and fault display can be selected in sequence by pressing set.
- Among the items set in **Pr.52**, the load meter and motor load factor are displayed in the second screen (initially set to monitor the output current). Other items are displayed in the third screen (initially set to monitor the output voltage).
- The first screen (initially set to monitor the output frequency) is displayed at power-ON in the initial setting. To change the screen displayed at power-ON, display the screen you want to display at power-ON, and hold down SET for 1 second.

To monitor the output frequency at power-ON again, display the screen of output frequency, and hold down second.



The following is the screen flow diagram when Pr.52 = "20" (cumulative energization time).



• The monitor item to be displayed is set using **Pr.774** for the first screen, **Pr.775** for the second screen, and **Pr.776** for the third screen. When **Pr.774 to Pr.776** = "9999" (initial value), the **Pr.52** setting value is used.



 On the operation panel (FR-DU08), the "Hz" unit indicator is lit while displaying the output frequency, the "Hz" blinks when displaying the set frequency.

♦ Displaying the set frequency during stop (Pr.52)

• When **Pr.52** = "100", the set frequency is displayed during stop, and output frequency is displayed during running. (LED of Hz blinks during stop and is lit during operation.)

| Pr.52 setting | Status | Output frequency | Output current | Output voltage | Fault monitor | |
|---------------|-------------------------|------------------|----------------|----------------|---------------|--|
| 0 | During running/ stop | Output frequency | | 0 1 1 1 | | |
| 100 | During stop | Set frequency*1 | Output current | Output voltage | Fault monitor | |
| 100 | During running | Output frequency | | | | |

^{*1} Displays the frequency that is output when the start command is ON. The value considers the maximum/minimum frequency and frequency jumps. It is different from the frequency setting displayed when **Pr.52** = "5".



- During an error, the output frequency at error occurrence appears.
- During output shutoff by the MRS signal, the values displayed are the same as during a stop.
- · During offline auto tuning, the tuning state monitor takes priority.

◆ Operation panel setting dial push display (Pr.992)

- Use Pr.992 to select the monitor that appears when the setting dial on the operation panel (FR-DU08) is pushed.
- When **Pr.992** = "0 (initial value)", keep pressing the setting dial when in PU operation mode or External/PU combined operation mode 1 (**Pr.79 Operation mode selection** = "3") to show the presently set frequency.
- When Pr.992 = "100", the set frequency is displayed during stop, and output frequency is displayed during running.

| Pr.992 setting | Status | Monitor displayed by the setting dial push |
|----------------|---------------------|--|
| 0 | During running/stop | Set frequency (PU direct-in frequency) |
| 100 | During stop | Set frequency*1 |
| 100 | During running | Output frequency |

¹¹ Displays the frequency that is output when the start command is ON. The value considers the maximum/minimum frequency and frequency jumps. It is different from the frequency setting displayed when **Pr.992** = "5".

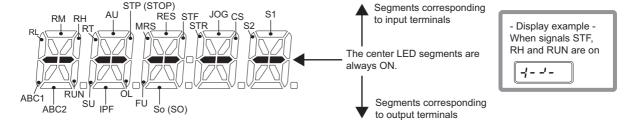
◆ Monitoring I/O terminals on the operation panel (FR-DU08) (Pr.52, Pr.774 to Pr.776, Pr.992)

- When Pr.52 (Pr.774 to Pr.776, Pr.992) = "55 to 57", the I/O terminal state can be monitored on the operation panel (FR-DU08).
- When a terminal is ON, the corresponding LED segment is ON. The center LED segments are always ON.

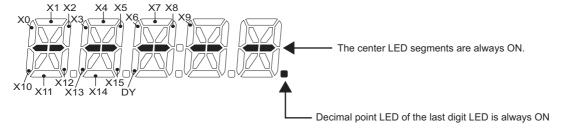
| Pr.52, Pr.774 to Pr.776, Pr.992 setting | Monitor item | Monitor description |
|--|-------------------------------|--|
| 55 | I/O terminal status | Displays the I/O terminal ON/OFF state of the inverter. |
| 56 ^{*1} | Option input terminal status | Displays input terminal ON/OFF state of the digital input option (FR-A8AX) |
| 57 ^{*1} | Option output terminal status | Displays output terminal ON/OFF state of the digital output option (FR-A8AY) or the relay output option (FR-A8AR). |

^{*1} The setting value "56 or 57" can be set even if the option is not installed. All are OFF when the option is not connected.

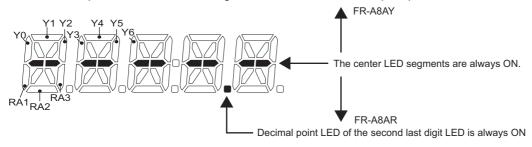
• On the I/O terminal monitor, the upper LEDs indicate the input terminal status, and the lower LEDs indicate the output terminal status.



The decimal point of the last digit on the LED is lit for the input option terminal monitor.



• The decimal point of the second last digit on the LED is lit for the output option terminal monitor.



◆ Monitoring and resetting cumulative power (Pr.170, Pr.891)

- When the cumulative power is monitored (**Pr.52** = "25"), the output power monitor value is added up and is updated in 100 ms increments.
- The values are stored in EEPROM every 10 minutes. The values are also stored in EEPROM at power OFF or inverter reset
- Increments and ranges of monitoring on the operation panel or parameter unit and via communication (RS-485 communication or other communication with communication option installed) are as follows (when **Pr.891** = "9999 (initial value)").

| On operation panel or | parameter unit ^{*1} | Via communication | | | | | |
|-----------------------|------------------------------|-------------------|-----------------|----------|--|--|--|
| Range | Increment | Rai | Increment | | | | |
| Kange | mcrement | Pr.170 = "10" | Pr.170 = "9999" | mcrement | | | |
| 0 to 999.99 kWh | 0.01 kWh ^{*2} | | 0 to 65535 kWh | | | | |
| 1000.0 to 9999.9 kWh | 0.1 kWh | 0 to 9999 kWh | (initial value) | 1 kWh | | | |
| 10000 to 99999 kWh | 1 kWh | | (iiiidi valao) | | | | |

- *1 For the FR-A820-03160(55K) or lower and FR-A840-01800(55K) or lower, the value is measured in 0.01 kWh increments and the upper five digits are displayed. For the FR-A820-03800(75K) or higher and FR-A840-02160(75K) or higher, the value is measured in 0.1 kWh increments and the upper five digits are displayed.
 - For the FR-A820-03160(55K) or lower and FR-A840-01800(55K) or lower, the cumulative energy up to 999.99 kWh is displayed in 0.01 increments such as "999.99", and that of 1000 kWh or more is displayed in 0.1 increments such as "1000.0".
- *2 The display in 0.01 kWh increments is available only for the FR-A820-03160(55K) or lower and FR-A840-01800(55K) or lower.
- The decimal point position on the watt-hour meter can be shifted to left. The number of digits to be shifted is equal to the setting of **Pr.891 Cumulative power monitor digit shifted times**. For example, when **Pr.891** = "2", the cumulative power value 1278.56 kWh is displayed as 12.78 (in 100 kWh increments) on the operation panel, or displayed as 12 on a display used for monitoring via communication.
- When **Pr.891** = "0 to 4", the meter stops at the maximum number. When **Pr.891** = "9999", the meter returns to 0 and the counting starts again.
- Writing "0" in **Pr.170** clears the cumulative power monitor.



• When Pr.170 is read just after "0" has been written in Pr.170, the setting "9999" or "10" is displayed.

♦ Monitoring cumulative energization time (Pr.563)

- When the cumulative energization time is selected as a monitor item (**Pr.52** = "20"), the counter of cumulative energization time since the inverter shipment accumulated every hour is displayed.
- The cumulative energization time is displayed in 0.001-hour increments until the cumulative time reaches one hour, and then the time is displayed in 1-hour increments.

- The EEPROM is updated every minute until the cumulative energization time reaches one hour, and then the EEPROM is updated every 10 minutes. The EEPROM is also updated at power OFF.
- When the cumulative energization time counter reaches 65535, it starts from 0 again. The number of times the cumulative energization time counter reaches 65535 can be checked with **Pr.563**.



· The cumulative energization time does not increase if the power is turned OFF after less than an hour.

◆ Actual operation time monitoring (Pr.171, Pr.564)

- On the actual operation time monitoring (**Pr.52** = "23"), the inverter running time is added up every hour. (Time is not added up during a stop.)
- The time is displayed in 1-hour increments.
- The values are stored in EEPROM every 10 minutes. The EEPROM is also updated at power OFF.
- When the cumulative energization time counter reaches 65535, it starts from 0 again. The number of times the actual operation time counter reaches 65535 can be checked with **Pr.564**.
- Setting "0" in Pr.171 clears the actual operation time meter.



- The actual operation time does not increase if the cumulative running time before power OFF is less than an hour.
- Once "0" is set in Pr.171, the setting of Pr.171 is always turned to "9999" afterwards. Setting "9999" does not clear the actual
 operation time meter.

Hiding the decimal places for the monitors (Pr.268)

• The numerical figures after a decimal point displayed on the operation panel may fluctuate during analog input, etc. The decimal places can be hidden by selecting the decimal digits with **Pr.268**.

| Pr.268 setting | Description |
|----------------------|---|
| 9999 (initial value) | No function |
| 0 | For the first or second decimal places (0.1 increments or 0.01 increments) of the monitor, numbers in the first decimal place and smaller are rounded to display an integral value (1 increments). The monitor value equal to or smaller than 0.99 is displayed as 0. |
| 1 | When monitoring with the second decimal place (0.01 increments), the 0.01 decimal place is dropped and the monitor displays the first decimal place (0.1 increments). When monitoring with the first decimal place, the display will not change. |



• The number of readout digits of the cumulative energization time (**Pr.52** = "20"), actual operation time (**Pr.52** = "23"), cumulative energy (**Pr.52** = "25"), and cumulative energy saving (**Pr.52** = "51") does not change.

◆ Enabling display of negative numbers during monitoring (Pr.290)

Negative signal outputs can be selected for the items monitored via terminal AM (analog voltage output), via a
communication option, and on the operation panel. To check which items can be monitored with indication of negative
numbers, refer to the monitor items list (on page 447).

| Pr.290 setting | | Negative ir | ndication (-) | |
|-------------------|-------------|-----------------|------------------------|-------------------------|
| P1.290 Setting | Terminal AM | Operation panel | Communication option*1 | FR Configurator2 etc.*2 |
| 0 (initial value) | _ | _ | _ | _ |
| 1 | Enabled | _ | _ | _ |
| 2 | _ | Enabled | _ | _ |
| 3 | Enabled | Enabled | _ | _ |
| 4 | _ | _ | Enabled | Enabled |
| 5 | Enabled | _ | Enabled | Enabled |
| 6 | _ | Enabled | Enabled | Enabled |
| 7 | Enabled | Enabled | Enabled | Enabled |

^{-:} Negative numbers indication disabled (positive only)

^{*1} Indication with a minus sign is not possible via the following communication methods.

RS-485 communication (Mitsubishi inverter protocol, MODBUS RTU), SLMP communication

- Under the condition that the high-speed sampling and the negative output are selected for FR Configurator2, the display range of the output frequency (Monitor No.1) is -300.00 to 300.00 Hz.
 - A value outside the range is clamped at -300.00 Hz or 300.00 Hz. Under the same condition, the display range of the running speed (Monitor No.6) is -30000 to 30000 r/min. A value outside the range is clamped at -30000 r/min or 30000 r/min. During the trace sampling, the same display ranges are applied. A value outside the ranges is clamped.
- Select the item group to enable the indication of negative signed numbers by setting Pr.1018 Monitor with sign selection.

| Monitor item | Pr.1018 setting | | | | | | |
|---|-----------------|-----|-----|--|--|--|--|
| Monitor item | 9999 | 0 | 1 | | | | |
| Output frequency | _ | o*1 | o*1 | | | | |
| Motor speed | _ | o*1 | o*1 | | | | |
| Motor torque | 0 | 0 | 0 | | | | |
| Position command (lower) ^{*4} | o*2 | o*2 | o*3 | | | | |
| Position command (upper)*4 | o*2 | o*2 | °*3 | | | | |
| Current position (lower)*4 | o*2 | o*2 | o*3 | | | | |
| Current position (upper)*4 | o*2 | o*2 | o*3 | | | | |
| Droop pulse (lower)*4 | o ^{*2} | o*2 | o*3 | | | | |
| Droop pulse (upper)*4 | o*2 | o*2 | o*3 | | | | |
| Torque command | 0 | 0 | 0 | | | | |
| Torque current command | 0 | 0 | 0 | | | | |
| Torque (positive polarity for driving torque/negative polarity for regenerative braking torque) | 0 | 0 | 0 | | | | |
| Motor temperature | 0 | 0 | 0 | | | | |
| PID deviation | 0 | 0 | 0 | | | | |
| Cumulative pulse | 0 | 0 | 0 | | | | |
| Cumulative pulse overflow times | 0 | 0 | 0 | | | | |
| Cumulative pulse (control terminal option) | 0 | 0 | 0 | | | | |
| Cumulative pulse overflow times (control terminal option) | 0 | 0 | 0 | | | | |
| Remote output 1 | 0 | 0 | 0 | | | | |
| Remote output 2 | 0 | 0 | 0 | | | | |
| Remote output 3 | 0 | 0 | 0 | | | | |
| Remote output 4 | 0 | 0 | 0 | | | | |
| PID manipulated amount | 0 | 0 | 0 | | | | |
| Second PID deviation | 0 | 0 | 0 | | | | |
| Second PID manipulated amount | 0 | 0 | 0 | | | | |
| Control circuit temperature | 0 | 0 | 0 | | | | |

- o: Negative numbers displayed with minus sign, —: Negative numbers not displayed (positive only)
 - *1 Negative numbers are not displayed on the operation panel. Confirm the rotation direction with the [FWD] or [REV] indicator.
 - *2 Signed values are displayed only on the FR-DU08 (-9999 to 9999). Unsigned values (0 to 9999) are displayed on other devices.
 - Full 32-bit data (-2147483648 to 2147483647) is displayed during monitoring via the communication option.
 - *4 Monitor the lower and upper digits at the same timing. Otherwise, the data may not be reliable.



- · When the output via terminal AM (analog voltage output) is set to "Negative numbers indication enabled", the output is within the range of -10 to +10 VDC. Connect the meter with which output level is matched.
- · Parameter unit (FR-PU07) displays only positive values.

♦ Monitor filter (Pr.1106 to Pr.1108)

• The response level (filter time constant) of the following monitor indicators can be adjusted. Increase the setting when a monitor indicator is unstable, for example.

| Pr. | Monitor number | Monitor indicator name | | |
|------|----------------|--------------------------|--|--|
| | 7 | Motor torque | | |
| | 17 | Load meter | | |
| 1106 | 32 | Torque command | | |
| | 33 | Torque current command | | |
| | 36 | Torque monitor | | |
| 1107 | 6 | Motor speed | | |
| 1108 | 18 | Motor excitation current | | |

Parameters referred to

Pr.30 Regenerative function selection, Pr.70 Special regenerative brake duty ☞ page 724

Pr.37 Speed display, Pr.144 Speed setting switchover page 444

Pr.55 Frequency monitoring reference, Pr.56 Current monitoring reference, Pr.866 Torque monitoring reference 🖙 page 457

5.11.3 Monitor display selection for terminals FM/CA and AM

Monitored values are output in either of the following: analog voltage (terminal AM), pulse train (terminal FM) for the FM type inverter, or analog current (terminal CA) for the CA type inverter.

The signal (monitor item) to be output to terminal FM/CA and terminal AM can be selected.

| Pr. | Name | Initia | l value | Catting your as | Description | | | |
|-------------|-----------------------------------|------------|---------|---|--|--|-------------------|---|
| Pr. | Name | FM | CA | Setting range | Desc | ription | | |
| 54 M300 | FM/CA terminal function selection | 1 (outpu | | 1 to 3, 5 to 14, 17, 18, 21, 24, 32 to 34, 36, 46, 50, 52 to 53, 61, 62, 67, 70, 87 to 90, 92, 93, 95, 97, 98 | Select the item monitored via terminal FM or CA | | | |
| 158 M301 | AM terminal function selection | frequency) | | 1 to 3, 5 to 14, 17, 18, 21, 24, 32 to 34, 36, 46, 50, 52 to 54, 61, 62, 67, 70, 87 to 98 | Select the item monitored via terminal AM. | | | |
| 55 M040 | Frequency monitoring reference | 60 Hz | 50 Hz | 0 to 590 Hz | Set the full-scale value value frequency monitor value AM. | vhen outputting the to terminals FM, CA and | | |
| 56 | | Inverter | rated | 0 to 500 A*1 | Enter the full-scale value | | | |
| M041 | Current monitoring reference | current | | 0 to 3600 A*2 | corresponds to the output via terminal FM/CA or terminal AM to monitor the output current. | | | |
| 866 M042 | Torque monitoring reference | | | 0 to 400% | Enter the full-scale value of a meter which corresponds to the output via terminal FM/CA or terminal AM to monitor the motor torque. | | | |
| 290 M044 | Monitor negative output selection | 0 | | 0 to 7 | Set the availability of negative signals output via terminal AM, to the operation panel, and through communication. (Refer to page 455.) | | | |
| | | | | | Pulse train input (terminal JOG) | Pulse train output (terminal FM) | | |
| | | | | 0 | JOG signal*3 | FM output*4 | | |
| | | | | 1 | Pulse train input | FM output*4 | | |
| | | | | 10 ^{*4} | JOG signal ^{*3} | High-speed pulse train output (50% duty) | | |
| 291 | Pulse train I/O selection | 0 | | 11 ^{*4} | Pulse train input | High-speed pulse train output (50% duty) | | |
| D100 | Pulse trail 1/0 selection | 0 | | 20 ^{*4} | JOG signal ^{*3} | High-speed pulse train output (ON width fixed) | | |
| | | | | | | 21 ^{*4} | Pulse train input | High-speed pulse train output (ON width fixed) |
| | | | | | | 100*4 | Pulse train input | High-speed pulse train output (ON width fixed). Output the pulse train input without changes. |

- For the FR-A820-03160(55K) or lower, and FR-A840-01800(55K) or lower.
- For the FR-A820-03800(75K) or higher, and FR-A840-02160(75K) or higher.
- Function assigned to Pr.185 JOG terminal function selection.
- Valid only for the FM type inverters.

▶ Monitor description list (Pr.54, Pr.158)

- Set Pr.54 FM/CA terminal function selection for monitoring via terminal FM (pulse train output) or terminal CA (analog current output).
- Set Pr.158 AM terminal function selection for monitoring via terminal AM (analog voltage output). Negative signals can be output via terminal AM (in the range of -10 to +10 VDC). The circle in the Negative output column indicates that the output of negative signals is available via terminal AM. (To enable or disable the output of negative signals, refer to page 446.)
- Refer to the following table and select the item to be monitored. (Refer to page 447 for the list of monitor items.)

| Monitor item | Increment and unit | Pr.54 (FM/CA), Pr.158 (AM) setting | Terminal FM, CA, AM full-scale value | Negative (-) output | Remarks |
|-------------------------|--------------------------|---------------------------------------|---|---------------------------|---------|
| Output frequency | 0.01 Hz | 1 | Pr.55 | o*3 | |
| Output current*2 | 0.01/0.1 A ^{*1} | 2 | Pr.56 | | |
| Output voltage | 0.1 V | 3 | 200 V class: 400 V, 400 V class: 800 V | | |
| Frequency setting value | 0.01 Hz | 5 | Pr.55 | | |

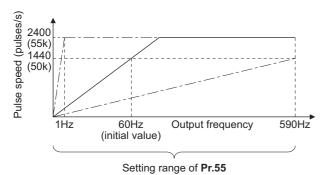
| Monitor item | Increment and unit | Pr.54 (FM/CA), Pr.158 (AM) setting | Terminal FM, CA, AM full-scale value | Negative (-) output | Remarks |
|--|--|---------------------------------------|---|---------------------------|--|
| Motor speed | 1 (r/min) | 6 | The value converted with the Pr.37 , Pr.144 value from Pr.55 . | o*3 | Refer to page 444 for the monitoring of the operation speed. |
| Motor torque | 0.1% | 7 | Pr.866 | 0 | |
| Converter output voltage ^{*2} | 0.1 V | 8 | 200 V class: 400 V, 400 V class: 800 V | | |
| Regenerative brake duty*4 | 0.1% | 9 | Brake duty decided by Pr.30, Pr.70 . | | |
| Electronic thermal O/L relay load factor | 0.1% | 10 | Electronic thermal O/L relay (100%) | | |
| Output current peak value | 0.01/0.1 A ^{*1} | 11 | Pr.56 | | |
| Converter output voltage peak value | 0.1 V | 12 | 200 V class: 400 V, 400 V class: 800 V | | |
| Input power | 0.01/0.1 kW ^{*1} | 13 | Inverter rated power × 2 | | |
| Output power*2 | 0.01/0.1 kW ^{*1} | 14 | Inverter rated power × 2 | | |
| Load meter | 0.1% | 17 | Pr.866 | | |
| Motor excitation current | 0.01 A/0.1 A ^{*1} | 18 | Pr.56 | | |
| Reference voltage output | _ | 21 | _ | | Terminal FM: When Pr.291 = "0 or 1", output is 1440 pulses/s. When Pr.291 ≠ "0 or 1", output is 50k pulses/s. Terminal CA: Output is 20 mA. Terminal AM: Output is 10 V. |
| Motor load factor | 0.1% | 24 | 200% | | |
| Torque command | 0.1% | 32 | Pr.866 | 0 | |
| Torque current command | 0.1% | 33 | Pr.866 | 0 | |
| Motor output | 0.01/0.1 kW ^{*1} | 34 | Rated motor capacity | | |
| Torque (positive polarity for driving torque/ negative polarity for regenerative braking torque) | 0.1% | 36 | Pr.866 | 0 | |
| Motor temperature | 1°C | 46 | Pr.751 | 0 | Enabled when the FR-A8AZ is used. |
| Energy saving effect | Increment and unit vary depending on the parameter settings. | 50 | Inverter capacity | | For the information of the power saving effect monitoring, refer to page 467. |
| PID set point | 0.1% | 52 | 100% | | |
| PID measured value | 0.1% | 53 | 100% | | Refer to page 610 for the PID control. |
| PID deviation | 0.1% | 54 ^{*5} | 100% | 0 | |
| Motor thermal load factor | 0.1% | 61 | Motor thermal activation level (100%) | | |
| Inverter thermal load factor | 0.1% | 62 | Inverter thermal activation level (100%) | | |
| PID measured value 2 | 0.1% | 67 | 100% | | Refer to page 610 for the PID control. |
| PLC function analog output | 0.1% | 70 | 100% | 0 | Enabled by Pr.414 = "1 or 2". Refer to page 646 for the PLC function. |
| Remote output value 1 | 0.1% | 87 | 1000% | | |
| Remote output value 2 | 0.1% | 88 | 1000% | | Refer to page 490 for the analog |
| Remote output value 3 | 0.1% | 89 | 1000% | | remote output. |
| Remote output value 4 0.1% | | 90 | 1000% | | |

| Monitor item | Increment and unit | Pr.54 (FM/CA), Pr.158 (AM) setting | Terminal FM, CA, AM full-scale value | Negative (-) output | Remarks |
|-------------------------------|--------------------|---------------------------------------|--------------------------------------|---------------------------|--|
| PID manipulated amount | 0.1% | 91 ^{*5} | 100% | 0 | |
| Second PID set point | 0.1% | 92 | 100% | | |
| Second PID measured value | 0.1% | 93 | 100% | | |
| Second PID deviation | 0.1% | 94 ^{*5} | 100% | 0 | Refer to page 610 for the PID control. |
| Second PID measured value 2 | 0.1% | 95 | 100% | | |
| Second PID manipulated amount | 0.1% | 96 ^{*5} | 100% | 0 | |
| Dancer main speed setting | 0.01 Hz. | 97 | Pr.55 | | For details on dancer control, refer to page 622. |
| Control circuit temperature | 1°C | 98 | 100°C | 0 | Terminal FM/CA: 0 to 100°C, Terminal AM: -20 to 100°C |

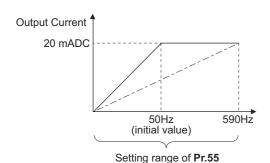
- *1 The increment differs according to the inverter capacity. (Increment left of a slash for FR-A820-03160(55K) or lower, FR-A840-01800(55K) or lower. Increment right of a slash for FR-A820-03800(75K) or higher, FR-A840-02160(75K) or higher.)
- *2 The inverter regards the output current which is less than the specified current level (5% of the rated inverter current) as 0 A. Therefore, each readout of an output current and output power may show "0" if a too small-capacity motor is used as contrasted with the inverter capacity and the output current falls below the specified value.
- *3 Setting of Pr.1018 Monitor with sign selection is required.
- *4 This signal is available only for the standard model.
- *5 The setting is available only in **Pr.158** (terminal AM).

◆ Frequency monitor reference (Pr.55)

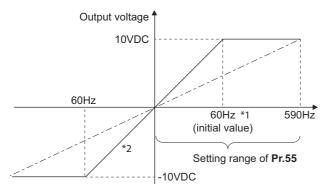
- Enter the full scale value of a meter used to monitor the output frequency, the frequency setting value, or the dancer main speed setting via terminal FM/CA or terminal AM.
- For the FM type inverter, enter the full-scale value of the meter corresponding to a pulse train of 1440 pulses/s (or 50k pulses/s) output via terminal FM. Enter the frequency value (for example, 60 Hz or 120 Hz) at full scale of the meter (1 mA analog meter) installed between terminal FM and terminal SD. Pulse speed is proportional to the output frequency of the inverter. (The maximum output pulse train is 2400 pulses/s (or 55k pulses/s).)



• For the CA type inverter, enter the full-scale value of the meter corresponding to a current of 20 mADC output via terminal CA. Enter the current value (for example, 60 Hz or 120 Hz) at full scale of the meter (20 mADC ammeter) installed between terminal CA and terminal 5. Output current is proportional to the frequency. (The maximum output current is 20 mADC.)



• Enter the full-scale value of the meter corresponding to a voltage of 10 VDC output via terminal AM. Enter the current value (for example, 60 Hz or 120 Hz) at full scale of the meter (10 VDC voltmeter) installed between terminal AM and terminal 5. Output voltage is proportional to the frequency. (The maximum output voltage is 10 VDC.)



- *1 FM type: 60 Hz, CA type: 50 Hz
- *2 Output of negative signals enabled when Pr.290 Monitor negative output selection = "1 or 3"

♦ Current monitor reference (Pr.56)

- Enter the full scale value of a meter used to monitor the output current, the output current peak value, or the motor excitation current via terminal FM/CA or terminal AM.
- For the FM type inverter, enter the full-scale value of the meter corresponding to a pulse train of 1440 pulses/s (or 50k pulses/s) output via terminal FM. Enter the current value at full scale of the meter (1 mA analog meter) installed between terminal FM and terminal SD. Pulse speed is proportional to the output current monitored. (The maximum output pulse train is 2400 pulses/s (or 55k pulses/s).)
- For the CA type inverter, enter the full-scale value of the current meter corresponding to a current of 20 mADC output via terminal CA. Enter the current value at full scale of the meter (20 mADC ammeter) installed between terminal CA and terminal 5. Output current is proportional to the output current monitored. (The maximum output current is 20 mADC.)
- Enter the full-scale value of the current meter corresponding to a voltage of 10 VDC output via terminal AM. Enter the current value at full scale of the meter (10 VDC voltmeter) installed between terminal AM and terminal 5. Output voltage is proportional to the output current monitored. (The maximum output voltage is 10 VDC.)

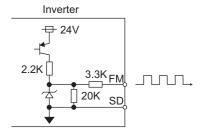
♦ Torque monitor reference (Pr.866)

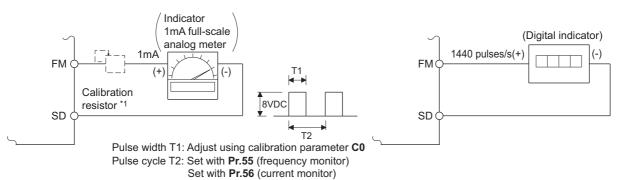
- Enter the full scale value of a meter used to monitor the output torque via terminal FM/CA or terminal AM.
- For the FM type inverter, enter the full-scale value of the torque meter corresponding to a pulse train of 1440 pulses/s (or 50k pulses/s) output via terminal FM. Enter the torque value at full scale of the meter (1 mA analog meter) installed between terminal FM and terminal SD. Pulse speed is proportional to the torque monitored. (The maximum output pulse train is 2400 pulses/s (or 55k pulses/s).)
- For the CA type inverter, enter the full-scale value of the torque meter corresponding to a current of 20 mADC output via terminal CA. Enter the torque value at full scale of the meter (20 mADC ammeter) installed between terminal CA and terminal 5. Output current is proportional to the torque monitored. (The maximum output voltage is 20 mADC.)
- Enter the full-scale value of the torque meter corresponding to a voltage of 10 VDC output via terminal AM. Enter the torque value at full scale of the meter (10 VDC voltmeter) installed between terminal AM and terminal 5. Output voltage is proportional to the torque monitored. (The maximum output voltage is 10 VDC.)

◆ Terminal FM pulse train output (Pr.291)

- Two kinds of pulse trains can be outputted via terminal FM.
- When **Pr.291 Pulse train I/O selection** = "0 (initial value) or 1", pulse train is output via terminal FM, with a maximum output of 8 VDC and 2400 pulses/s.
 - The pulse width can be adjusted on the operation panel or the parameter unit by using the calibration parameter **C0** (**Pr.900**) **FM/CA** terminal calibration.
- A 1 mA full-scale DC ammeter or a digital meter can be used to give commands (such as inverter output frequency command).

FM output circuit

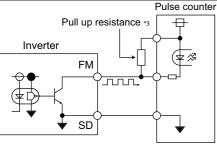




- *1 Not needed when the operation panel or the parameter unit is used for calibration.
 - Use a calibration resistor when the indicator (frequency meter) needs to be calibrated by a neighboring device because the indicator is located far from the inverter.
 - However, the frequency meter needle may not deflect to full-scale if the calibration resistor is connected. In this case, calibrate additionally with the operation panel or parameter unit.
- *2 In the initial setting, 1 mA full-scale and 1440 pulses/s terminal FM are used at 60 Hz.
- When **Pr.291 Pulse train I/O selection** = "10, 11, 20, 21, or 100", this is high-speed pulse train output for open collector output. A maximum pulse train of 55k pulses/s is outputted.

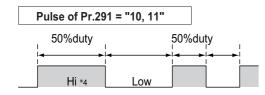
There are two types of pulse width: "50% duty" and "fixed ON width"; this cannot be adjusted with the calibration parameter **C0 (Pr.900) FM/CA terminal calibration**.

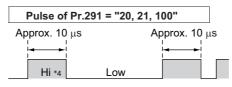
High-speed pulse train output circuit (example of connection to pulse counter)



- *1 The pulses may weaken due to stray capacitance in the wiring if the wiring is long, and the pulse counter will be unable to recognize the pulses. Connect the open collector output to the power source with a pull-up resistor if the wiring is too long.

 Check the pulse counter specs for the pull-up resistance.
 - The resistance should be at 80 mA of the load current or less.
- When Pr.291 = "10, or 11", the pulse cycle is 50% duty (ON width and OFF width are the same).
- When **Pr.291** = "20, 21, or 100", the pulse ON width is output at a fixed width (approx. 10 μs).
- At the "100" setting, the same pulse train from the pulse train input (terminal JOG) will be outputted. This is used when running at a synchronized speed with more than one inverter. (Refer to page 406.)





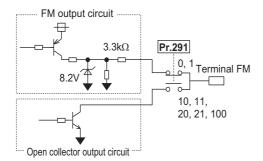
*1 "HIGH" indicates when the open collector output transistor is OFF.

| Item | High-speed pulse train output specifications | | |
|-----------------------------------|--|--|--|
| Output method | NPN open collector output | | |
| Voltage between collector-emitter | 30 V (max.) | | |
| Maximum permissible load current | 80 mA | | |
| Output pulse rate | 0 to 55k pulses/s*1 | | |
| Output resolution | 3 pulses/s (excluding jitter) | | |

*1 50k pulses/s when the monitor output value is 100%.



- Terminal JOG input specifications (pulse train input or contact input) can be selected with **Pr.291**. When changing the setting value, be careful not to change the terminal JOG input specifications. (Refer to page 406 for pulse train input.)
- Install a meter between terminals FM and SD after changing the **Pr.291** setting value. During output the pulse train via terminal FM (voltage output), be careful that voltage is not added to terminal FM.
- The meter cannot be used for the pulse input in a source logic type.
- If the All parameter clear is performed when the high-speed pulse train output is selected (**Pr.291** = "10, 11, 20, 21, or 100"), the output via terminal FM is changed from high-speed pulse train output to the voltage output because the **Pr.291** setting resets to the initial value "0". To perform the All parameter clear, remove the device connected to terminal FM first.



5.11.4 Adjustment of terminal FM/CA and terminal AM

The output via terminal FM/CA or terminal AM corresponding to the full-scale value of a meter can be adjusted (calibrated) on the operation panel or the parameter unit.

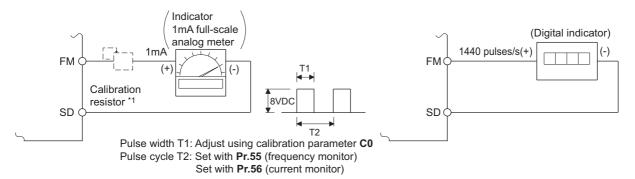
| Pr. | Name | Initial value | Setting range | Description |
|-----------------------------------|-----------------------------|---------------|---------------|---|
| C0 (900) M310 ^{*1} | FM/CA terminal calibration | _ | _ | Calibrates the scale of the meter connected to terminals FM and CA. |
| C1 (901) M320 ^{*1} | AM terminal calibration | _ | _ | Calibrates the scale of the analog meter connected to terminal AM. |
| C8 (930) M330*1 | Current output bias signal | 0% | 0 to 100% | Set the signal value at the minimum analog current output. |
| C9 (930) M331*1 | Current output bias current | 0% | 0 to 100% | Set the current value at the minimum analog current output. |
| C10 (931) M332*1 | Current output gain signal | 100% | 0 to 100% | Sets the signal value when the analog current output is at maximum. |
| C11 (931) M333*1 | Current output gain current | 100% | 0 to 100% | Set the current value at the maximum analog current output. |
| 867 M321 | AM output filter | 0.01 s | 0 to 5 s | Set a filter for output via terminal AM. |
| 869 M334 | Current output filter | 0.01 s | 0 to 5 s | Set a filter for output via terminal CA. |

^{*1} The parameter number in parentheses is that used (displayed) on the LCD operation panel and the parameter unit.

◆ Terminal FM calibration (C0 (Pr.900))

• The output via terminal FM is set to the pulse output. By setting **C0 (Pr.900)**, the meter connected to the inverter can be calibrated by parameter setting without use of a calibration resistor.

• The pulse train output via terminal FM can be used for digital display on a digital counter. The output is 1440 pulses/s at full scale. (Refer to page 457 for the full-scale value of each monitor item.)



- *1 Not needed when the operation panel or the parameter unit is used for calibration.
 - Use a calibration resistor when the indicator (frequency meter) needs to be calibrated by a neighboring device because the indicator is located far from the inverter.
 - However, the frequency meter needle may not deflect to full-scale if the calibration resistor is connected. In this case, perform calibration using the operation panel or parameter unit.
- *2 In the initial setting, 1 mA full-scale and 1440 pulses/s terminal FM are used at 60 Hz.
- · Calibrate the output via terminal FM in the following procedure.
 - 1. Connect an indicator (frequency meter) across terminals FM and SD on the inverter. (Note the polarity. Terminal FM is positive.)
 - 2. When a calibration resistor has already been connected, adjust the resistance to "0" or remove the resistor.
 - 3. Set a monitor item in Pr.54 AM terminal function selection. (Refer to page 457.)

 When the output frequency or inverter output current is selected on the monitor, set the output frequency or current value at which the output signal will be 1440 pulses/s, using Pr.55 Frequency monitoring reference or Pr.56 Current monitoring reference beforehand. Normally, at 1440 pulses/s the meter deflects to full-scale.
 - 4. If the meter needle does not point to maximum even at maximum output, calibrate it with C0 (Pr.900).



- When outputting an item such as the output current, which cannot reach a 100% value easily by operation, set **Pr.54** to "21" (reference voltage output) and calibrate. A pulse train of 1440 pulses/s are output via terminal FM.
- When **Pr.310 Analog meter voltage output selection** = "21", the output via terminal AM cannot be calibrated. For details on **Pr.310**, refer to the Instruction Manual of the FR-A8AY.
- The wiring length to terminal FM should be 200 m at maximum.
- The initial value of the calibration parameter **C0** (**Pr.900**) is set to 1 mA full-scale and 1440 pulses/s terminal FM pulse train output at 60 Hz. The maximum pulse train output of terminal FM is 2400 pulses/s.
- When connecting a frequency meter between terminals FM-SD and monitoring the output frequency, it is necessary to change
 Pr.55 to the maximum frequency, since the FM terminal output will be saturated at the initial value when the maximum frequency reaches 100 Hz or greater.
- Calibration with the calibration parameter **C0** (**Pr.900**) cannot be done when **Pr.291 Pulse train I/O selection** = "10, 11, 20, 21, or 100" (high-speed pulse train output).

Calibration procedure for terminal FM when using the operation panel (FR-DU08)

Operating procedure

- **1.** Turning ON the power of the inverter The operation panel is in the monitor mode.
- **2.** Changing the operation mode

Press PU to choose the PU operation mode. [PU] indicator turns ON.

Calibration is also possible in the External operation mode.

3. Selecting the parameter setting mode

Press MODE to choose the parameter setting mode. (The parameter number read previously appears.)

4. Calibration parameter selection

Turn until "L. . . . " appears. Press set to display "L - - - - - ".

5. Selecting a parameter

Turn until "[(C0 (Pr.900) FM/CA terminal calibration) appears. Press FET to enable the parameter setting.

The monitored value of the item (initially the output frequency) selected by **Pr.54 FM/CA terminal function** selection will appear.

6. Pulse output via terminal FM

If stopped, press or required.) to start the inverter operation. (To monitor the output frequency, motor connection is not required.)

When a monitor that does not require inverter operation is set in **Pr.54**, calibration is also possible during a stop status.

7. Scale adjustment

Turn to move the meter needle to a desired position.

8. Setting completed

Press SET to confirm the selection. The monitored value and " U" blink alternately.

- Turn to read another parameter.
- Press SET to return to the "[---- display.
- Press SET twice to show the next parameter.

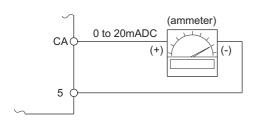
• NOTE

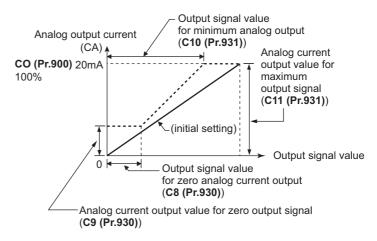
- Calibration can also be made for External operation. Set the frequency in the External operation mode, and make calibration
 in the above procedure.
- Calibration can be performed during operation.
- For the operation from the parameter unit, refer to the Instruction Manual of the parameter unit.

◆ Terminal CA calibration (C0 (Pr.900), C8 (Pr.930) to C11 (Pr.931))

• Terminal CA is initially set to provide a 20 mADC output in the full-scale state of the corresponding monitor item. The calibration parameter **C0** (**Pr.900**) allows the output current ratio (gains) to be adjusted according to the meter scale. Note that the maximum output current is 20 mADC.

- Set a value at the minimum current output in the calibration parameters C8 (Pr.930) and C9 (Pr.930). The calibration parameters C10 (Pr.931) and C11 (Pr.931) are used to set a value at the maximum current output.
- Set the output signal values (output monitor set with **Pr.54**) at zero or at the maximum current output via terminal CA using the calibration parameters **C8** (**Pr.930**) and **C10** (**Pr.931**). The full scale for each monitor is 100% at this time.
- Set the output current values (output monitor set with **Pr.54**) at zero and at the maximum current output via terminal CA (using the calibration parameters **C9** (**Pr.930**) and **C11** (**Pr.931**). The output current calibrated by the calibration parameter **C0** (**Pr.900**) is 100% at this time.





- · Calibrate the output via terminal CA in the following procedure.
 - **1.** Connect a 0-20 mADC indicator (frequency meter) across terminals CA and 5 on the inverter. (Note the polarity. Terminal CA is positive.)
 - 2. Set the initial value of the calibration parameter C8 (Pr.930) to C11 (Pr.931). If the meter needle does not indicate zero when the current input is at zero, calibrate the meter using C8 (Pr.930) and C9 (Pr.930).
 - 3. Set a monitor item in **Pr.54 FM/CA terminal function selection**. (Refer to page 457.)

 When the output frequency or inverter output current is selected on the monitor, set the output frequency or current value at which the output signal will be 20 mA, using **Pr.55** or **Pr.56** beforehand.
 - 4. If the meter needle does not point to maximum even at maximum output, calibrate it with C0 (Pr.900).



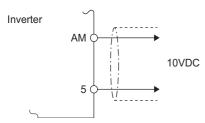
- When outputting an item such as output current, which cannot reach a 100% value easily by operation, set **Pr.54** to "21" (reference voltage output) and calibrate. A current of 20 mADC is output via terminal CA.
- When **Pr.310** Analog meter voltage output selection = "21", the output via terminal CA cannot be calibrated. For details on **Pr.310**, refer to the Instruction Manual of the FR-A8AY.
- The output via terminal CA is enabled even if C8 (Pr.930) ≥ C10 (Pr.931), C9 (Pr.930) ≥ C11 (Pr.931).

◆ Adjusting the response of terminal CA (Pr.869)

- Using **Pr.869**, the output voltage response of terminal CA can be adjusted in the range of 0 to 5 seconds.
- Increasing the setting stabilizes the output via terminal CA more but reduces the response level. (Setting "0" sets the response level to 7 ms.)

◆ Calibration of terminal AM (C1 (Pr.901))

Terminal AM is initially set to provide a 10 VDC output in the full-scale state of the corresponding monitor item. The
calibration parameter C1 (Pr.901) AM terminal calibration allows the output voltage ratio (gains) to be adjusted according
to the meter scale. Note that the maximum output voltage is 10 VDC.



- · Calibrate the output via terminal AM in the following procedure.
 - **1.** Connect a 0-10 VDC indicator (frequency meter) across terminal AM and terminal 5 on the inverter. (Note the polarity. Terminal AM is positive.)
 - 2. Set a monitor item in **Pr.158 AM terminal function selection**. (Refer to page 457.)

 When the output frequency or inverter output current is selected on the monitor, set the output frequency or current value at which the output signal is 10 V, using **Pr.55** or **Pr.56** beforehand.
 - 3. If the meter needle does not point to maximum even at maximum output, calibrate it with C1 (Pr.901).

• NOTE

- When outputting an item such as the output current, which cannot reach a 100% value easily by operation, set **Pr.158** to "21" (reference voltage output) and calibrate. A voltage of 10 VDC is output via terminal AM.
- When **Pr.306 Analog output signal selection** = "21", the output via terminal AM cannot be calibrated. For details on **Pr.306**, refer to the Instruction Manual of the FR-A8AY.
- Use **Pr.290 Monitor negative output selection** to enable negative signals output via terminal AM. The output voltage range is -10 to +10 VDC. Calibrate the maximum positive value output via terminal AM.

◆ Adjusting the response of terminal AM (Pr.867)

- Use **Pr.867** to adjust the output voltage response of the terminal AM in the range of 0 to 5 seconds.
- Increasing the setting stabilizes the output via terminal AM more but reduces the response level. (Setting "0" means the setting of the response level to 7 ms.)

Parameters referred to

Pr.54 FM/CA terminal function selection ☐ page 457
Pr.55 Frequency monitoring reference ☐ page 457
Pr.56 Current monitoring reference ☐ page 457
Pr.158 AM terminal function selection ☐ page 457
Pr.290 Monitor negative output selection ☐ page 457
Pr.291 Pulse train I/O selection ☐ page 406

5.11.5 Energy saving monitoring

From the power consumption estimated value during commercial power supply operation, the energy saving effect by use of the inverter can be monitored and output.

| Pr. | Name | Initial value | Setting range | Description | | |
|-------------|---|-------------------|----------------------------|--|--|--|
| 52 | Operation panel main | 0 (output | | | | |
| M100 | monitor selection | frequency) | | | | |
| 774 | Operation panel monitor | | | | | |
| M101 | selection 1 | | | | | |
| 775 M102 | Operation panel monitor selection 2 | 9999 | Refer to page 446. | 50: Energy saving effect monitoring, | | |
| 776 | Operation panel monitor | - | | 51: Cumulative energy saving monitoring | | |
| M103 | selection 3 | | | | | |
| 992 M104 | Operation panel setting dial push monitor selection | 0 (set frequency) | | | | |
| 54 | FM/CA terminal function | | | | | |
| M300 | selection | 1 (output | Refer to page | FO. Therew eaving offeet monitoring | | |
| 158 | AM terminal function | frequency) | 457. | 50: Energy saving effect monitoring | | |
| M301 | selection | | | | | |
| 891 M023 | Cumulative power monitor digit shifted | 9999 | 0 to 4 | Set the number of times to move the digit of cumulative power monitored value. The readout peaks out at the upper limit of readout. | | |
| WIU23 | times | | 9999 | The function of moving the decimal point is not available. T readout is reset to 0 when it exceeds the upper limit. | | |
| 892 M200 | Load factor | 100% | 30 to 150% | Set the load factor for the commercial power supply operation. The setting is used for calculation of the estimated power consumption during commercial power supply operation by being multiplied by the power consumption rate (page 472). | | |
| 893 | Energy saving monitor | Inverter rated | 0.1 to 55 kW ^{*1} | Set the motor capacity (pump capacity). Setting this parameter | | |
| M201 | reference (motor capacity) | capacity | 0 to 3600 kW*2 | is required for calculating the rate of saved power, the rate of average energy saving, and the commercial power. | | |
| | Control selection during | | 0 | Discharge damper control (fan) | | |
| 894 | commercial power- | 0 | 1 | Inlet damper control (fan) | | |
| M202 | supply operation | | 2 | Valve control (pump) | | |
| | | | 3 | Commercial power supply drive (fixed value) | | |
| 895 | Power saving rate | 0000 | 0 | Consider the commercial power as 100%. | | |
| M203 | reference value | 9999 | 9999 | Consider the power set in Pr.893 as 100% No function | | |
| 896 M204 | Power unit cost | 9999 | 0 to 500 | Set the power unit cost. Setting this parameter is required for displaying the energy cost savings in the energy saving monitoring. | | |
| | | | 9999 | No function | | |
| 907 | Bower coving manita: | | 0 | The time period for averaging is 30 minutes. | | |
| 897 M205 | Power saving monitor average time | 9999 | 1 to 1000 h | Set the number of hours for averaging. | | |
| | | | 9999 | No function | | |
| | | | 0 | Clear the cumulative monitor value | | |
| 898 | Power saving cumulative | | 1 | Hold the cumulative monitor value | | |
| M206 | monitor clear | 9999 | 10 | Continue accumulation (upper limit communication data is 9999) | | |
| | | | 9999 | Continue accumulation (upper limit communication data is 65535) | | |
| 899 M207 | Operation time rate (estimated value) | 9999 | 0 to 100% | Setting this parameter is required for calculating the annual energy saving. Set an annual operating rate (considering a 24-hours-a-day and 365-days-a-year operation as 100%). | | |
| | · , | | 9999 | No function | | |

^{*1} For the FR-A820-03160(55K) or lower, and FR-A840-01800(55K) or lower.
*2 For the FR-A820-03800(75K) or higher, and FR-A840-02160(75K) or higher.

♦ Energy saving monitoring list

• The items in the energy saving effect monitoring (items which can be monitored when "50" is set in Pr.52, Pr.54, Pr.158, Pr.774 to Pr.776, and Pr.992) are listed below.

(The items which can be monitored via terminal FM or CA (Pr.54 setting) and via terminal AM (Pr.158 setting) are limited to [1 Power saving] and [3 Average power saving].)

| | Energy saving | Description and formula | Unit and | | Paramet | er setting | |
|---|----------------------------|--|-------------------------------|--------|----------|-------------|--------|
| | monitor item | Description and formula | increment | Pr.895 | Pr.896 | Pr.897 | Pr.899 |
| 1 | Power saving | The difference between the input power calculated by the inverter and the estimated power required to run a motor off a commercial power supply. [Input power for commercial power supply operation] - [Monitored value of inverter input power] | 0.01/0.1 kW ^{*3} | 9999 | | | |
| 2 | Power saving rate | It is defined as the power saving expressed as a percentage. The rate of the power saving with respect to the estimated input power for the commercial power supply operation is determined using the following formula. [1 Power saving] Power during commercial power supply operation | 0.1% | 0 - | 9999 | | |
| | | The rate of the power saving with respect to the Pr.893 setting is determined using the following formula. [1 Power saving] Pr.893 × 100 | | 1 | | | |
| 3 | Average power saving | It is defined as the average hourly energy saving during a monitoring time (set in Pr.897). $ \underline{\sum ([1 \text{ Power saving}] \times \Delta t)} $ Pr.897 | 0.01/0.1 kWh ^{*3} | 9999 | | | _ |
| 4 | Average power saving rate | It is defined as the average hourly energy saving expressed as a percentage. The rate of the average hourly energy saving with respect to the estimated input power for the commercial power supply operation is determined using the following formula. $\frac{\sum ([2 \text{ Power saving rate}] \times \Delta t)}{\text{Pr.897}} \times 100$ | 0.1% | 0 | 9999 | 0 to 1000 h | |
| | | The rate of the average hourly energy saving with respect to the Pr.893 setting is determined using the following formula. [3 Average power saving] Pr.893 Pr.893 | | 1 | | | |
| 5 | Average power cost savings | It is defined as a monetary value of the average hourly energy saving, determined using the following formula. [3 Average power saving] × Pr.896 setting | 0.01/0.1*3 | _ | 0 to 500 | | |

• The items in the cumulative energy saving monitoring (items which can be monitored when "51" is set in **Pr.52**, **Pr.774 to Pr.776**, and **Pr.992**) are listed below.

(The digit of the cumulative energy saving monitored value can be moved to the right according to the setting of **Pr.891 Cumulative power monitor digit shifted times**.)

| | Energy saving | Description and formula | Unit and | Parameter setting | | | |
|---|----------------------------|--|---|-------------------|----------|--------|--------------|
| | monitor item | Description and formula | increment | Pr.895 | Pr.896 | Pr.897 | Pr.899 |
| 6 | Power saving amount | It is defined as a cumulative energy saving during monitoring, determined by multiplying the saved power by the number of inverter operating hours. $\Sigma \mbox{ ([1 Power saving]} \times \Delta t)$ | 0.01 kWh/ 0.1 kWh *1*2*3 | _ | 9999 | | 9999 |
| 7 | Power cost savings | It is defined as a monetary value of the cumulative energy saving. [6 Power saving amount] × Pr.896 setting [7.01/ 0.1*1*3 | | | | | |
| 8 | Annual power saving amount | It is defined as an estimated annual energy saving. [6 Power saving amount] Operation time during power saving accumulation Pr.899 100 1 | 0.01 kWh/ 0.1 kWh ^{*1*2*3} | _ | 9999 | _ | 0 to 100% |
| 9 | Annual power cost savings | It is defined as a monetary value of annual energy saving. [8 Annual power saving amount] × Pr.896 setting | 0.01/ 0.1 ^{*1*3} | _ | 0 to 500 | | 10070 |

- *1 For monitoring via communication (RS-485 communication, or other communication using a communication option), the increments are 1 in no units. For example, a value "10.00 kWh" is converted into "10" for communication data.
- *2 On the LCD operation panel or the parameter unit, a readout is displayed in units of kilowatt-hours (kW).
- *3 The increment differs according to the inverter capacity. (Increment left of a slash for FR-A820-03160(55K) or lower, FR-A840-01800(55K) or lower. Increment right of a slash for FR-A820-03800(75K) or higher, FR-A840-02160(75K) or higher.)



- The operation panel and the parameter unit have a 5-digit display. This means, for example, that a monitored value up to 999.99 is displayed in 0.01 increments and a monitor value of 1000 or more is displayed in 0.1 increments as "1000.0". The maximum monitored value displayed is "99999".
- The maximum monitored value via communication (RS-485 communication or other communication with communication option installed) is 65535 when Pr.898 Power saving cumulative monitor clear = "9999". The maximum monitored value on monitoring in 0.01 increments is "655.35", and that on monitoring in 0.1 increments is "6553.5".

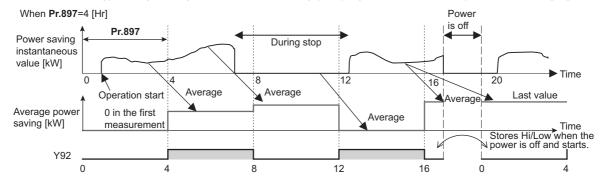
Power saving real-time monitoring ([1 Power saving], [2 Power saving rate])

- During [1 Power saving] monitoring, an energy saving effect (power difference) of using the inverter as compared to the commercial power supply operation is calculated and displayed on the main monitor.
- In the following cases, the monitored value of [1 Power saving] is "0".
 - The result of calculating the saved power is negative value.
 - DC injection brake works.
 - The motor is not connected with the inverter (monitored value of output current is 0 A).
- On [2 Power saving rate] monitoring, the rate of the saved power considering the consumed power (estimate) during the
 power supply operation as 100% is displayed when Pr.895 Power saving rate reference value is set to "0". When Pr.895
 is set to "1", the rate of the saved power with respect to the setting of Pr.893 Energy saving monitor reference (motor
 capacity) that is referenced as 100% is displayed.

Average power saving monitoring ([3 Average power saving], [4 Average power saving rate], [5 Average power cost savings])

- The average power saving monitors are displayed by setting a value other than 9999 in **Pr.897 Power saving monitor** average time.
- · On [3 Average power saving] monitoring, the average hourly energy saving every preset time period is displayed.

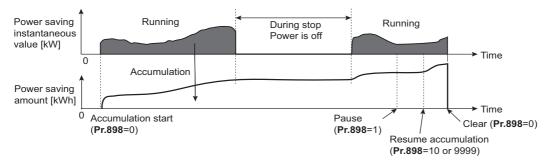
• When the setting of **Pr.897** is changed, when the inverter is powered ON, or when the inverter is reset, the averaging is restarted. The Energy saving average value updated timing (Y92) signal is inverted every time the averaging is restarted.



- On [4 Average power saving rate] monitoring, the average hourly monitored value of [2 Power saving rate]) is displayed when Pr.895 Power saving rate reference value is set to "0 or 1".
- On [5 Average power cost savings] monitoring, a monetary value of the average hourly energy saving ([3 Average power saving] × Pr.896 setting) is displayed when the unit price, power cost per kilowatt (hour), is set in Pr.896 Power unit cost.

◆ Cumulative energy saving monitoring ([6 Power saving amount], [7 Power cost saving], [8 Annual power saving amount], [9 Annual power cost savings])

- The digit of the cumulative energy monitored value can be moved to the right by the number set in **Pr.891 Cumulative power monitor digit shifted times**. For example, when the cumulative energy is 1278.56 kWh and **Pr.891** is set to "2", "12.78" is displayed (in 100's of units) on the PU/DU and the communication data is converted into "12". When **Pr.891** = "0 to 4" and the cumulative energy reaches more than the upper limit of readout, the readout peaks out at the upper limit, which indicates that moving digit is necessary. When **Pr.891** = "9999" and the cumulative energy reaches more than the upper limit of readout, cumulative value is reset to 0 and the metering restarts. The readout of other items in the cumulative energy saving monitoring peaks out at the upper limit of readout.
- With the monitored value of **[6 Power saving amount]**, a cumulative energy saving during a desired time period can be measured. Follow this procedure.
 - 1. Set "10" or "9999" in Pr.898 Power saving cumulative monitor clear.
 - **2.** Change the setting of **Pr.898** to "0" when you want to start measuring the energy saving. The cumulative value is cleared and the cumulative energy saving meter restarts.
 - **3.** Change the setting of **Pr.898** to "1" when you want to stop measuring the energy saving. The meter stops and the cumulative value is fixed.

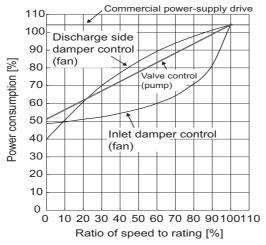


NOTE

The cumulative value of energy saving is refreshed every hour. This means that the last cumulative value is displayed at a
restart of the inverter and the cumulative meter restarts if the time elapsed between turning OFF and re-turning ON of the
inverter is shorter than an hour. (In some cases, the cumulative energy value may decrease.)

◆ Estimated input power for the commercial power supply operation (Pr.892, Pr.893, Pr.894)

- Select the pattern of the commercial power supply operation from among four patterns (discharge damper control (fan), suction damper control (fan), valve control (pump) and commercial power drive), and set it in Pr.894 Control selection during commercial power-supply operation.
- Set the motor capacity (pump capacity) in Pr.893 Energy saving monitor reference (motor capacity).
- Refer to the following graph to find the rate of power consumption (%) during commercial power supply operation based on the selected pattern and the rate of motor rotations per minute with respect to the rated speed (the result of dividing the present output frequency by **Pr.3 Base frequency** setting).



• The estimated input power (kW) for the commercial power supply operation is calculated from the motor capacity set in **Pr.893**, the setting of **Pr.892 Load factor**, and the rate of power consumption using the following formula.

Estimated consumed power during commercial power supply operation (kW) =
$$Pr.893$$
 (kW) × $\frac{Consumed power (\%)}{100}$ × $\frac{Pr.892 (\%)}{100}$



• If the output frequency rises to the setting of **Pr.3 Base frequency** or higher, it stays at a constant value because the rotations per minute cannot rise higher than the power supply frequency during commercial power supply operation.

◆ Annual energy saving and its monetary value (Pr.899)

- When the operation time rate (ratio of the time period in year when the inverter drives the motor) [%] is set in **Pr.899**, the annual energy saving effect can be estimated.
- When the inverter is operated in specific patterns, the estimate annual energy saving can be calculated by measuring the energy saving in a certain period.
- Refer to the following procedure to set the operation time rate.
 - **1.** Estimate the average operation time per day (h/day).
 - **2.** Calculate the operation days per year (days/year) using the following formula: Average operation days per month × 12 (months).
 - **3.** Calculate the annual operation time (h/year) from values determined in Step 1 and Step 2, using the following formula.

Annual operation time (h/year) = average time (h/day) × number of operation days (days/year)

4. Calculate the operation time rate using the following formula, and set it in **Pr.899**.

Operation time rate (%) =
$$\frac{\text{Annual operation time (h/year)}}{24 \text{ (h/day)} \times 365 \text{ (days/year)}} \times 100(\%)$$



• Setting example for operation time rate: In the case where the average operation time per day is about 21 hours and the average operation days per month is 16 days.

Annual operation time = 21 (h/day) × 16 (days/month) × 12 (months) = 4032 (h/year)

Operation time rate (%) =
$$\frac{4032 \text{ (h/year)}}{24 \text{ (h/day)} \times 365 \text{ (days/year)}} \times 100(\%) = \frac{46.03\%}{24 \text{ (h/day)}} \times 100(\%)$$

Therefore, set 46.03% in Pr.899.

 Calculate the annual energy saving from the value of [3 Average power saving] cumulated according to the setting of Pr.899 Operation time rate (estimated value).

• When the power cost per hour is set in **Pr.896 Power unit cost**, the annual energy cost savings can be monitored. The annual energy cost savings is determined by calculation using the following formula.

Annual power cost saving = annual power saving amount (kWh/year) × Pr.896



• During regenerative driving, substitute the output power during the commercial power supply operation for the saved power (therefore, input power = 0).

Parameters referred to

Pr.3 Base frequency page 707
Pr.52 Operation panel main monitor selection page 446
Pr.54 FM/CA terminal function selection page 457
Pr.158 AM terminal function selection page 457

5.11.6 Output terminal function selection

Use the following parameters to change the functions of the open collector output terminals and relay output terminals.

| Pr. | Name | | Initial value | Signal name | Setting range |
|-----------------------------|----------------------------------|---------------------------------|--------------------|--|---|
| 190 M400 | RUN terminal function selection | | 0 | RUN (Inverter running) | |
| 191 M401 | SU terminal function selection | | 1 | SU (Up to frequency) | 0 to 8, 10 to 20, 22, 25 to 28, 30 to 36, 38 to 57, 60, 61, 63, 64, 67, 68, 70, 79, 80, 84, 85, 90 to |
| 192 | IPF terminal function | For open collector | 2*1 | IPF (Instantaneous power failure/undervoltage) | 99, 100 to 108, 110 to 116, 120, 122, 125 to 128, 130 to 136, 138 to 157, 160, 161, 163, |
| M402 | selection | output terminal | 9999 ^{*2} | No function | 164, 167, 168, 170, 179, 180, 184, 185, 190 to |
| 193 M403 | OL terminal function selection | | 3 | OL (Overload warning) | 199, 200 to 208, 211 to 213, 247, 300 to 308, 311 to 313, 347, 9999 |
| 194 M404 | FU terminal function selection | | 4 | FU (Output frequency detection) | |
| 195 M405 | ABC1 terminal function selection | | 99 | ALM (Fault) | 0 to 8, 10 to 20, 22, 25 to 28, 30 to 36, 38 to 57, 60, 61, 63, 64, 67, 68, 70, 79, 80, 84, 85, 90, 91, |
| 196 M406 | ABC2 terminal function selection | For relay output terminal | 9999 | No function | 94 to 99, 100 to 108, 110 to 116, 120, 122, 125 to 128, 130 to 136, 138 to 157, 160, 161, 163, 164, 167, 168, 170, 179, 180, 184, 185, 190, 191, 194 to 199, 200 to 208, 211 to 213, 247, 300 to 308, 311 to 313, 347, 9999 |
| 313 M410 ^{*3*4} | DO0 output selection | | 9999 | No function | |
| 314 M411*3*4 | DO1 output selection | | 9999 | No function | |
| 315 M412 ^{*3*4} | DO2 output selection | | 9999 | No function | 0 to 8, 10 to 20, 22, 25 to 28, 30 to 36, 38 to 57, 60, 61, 63, 64, 68, 70, 79, 80, 84 to 99, 100 to |
| 316 M413 ^{*3} | DO3 output selection | | 9999 | No function | 108, 110 to 116, 120, 122, 125 to 128, 130 to 136, 138 to 157, 160, 161, 163, 164, 168, 170, 179, 180, 184 to 199, 200 to 208, 211 to 213. |
| 317 M414 ^{*3} | DO4 output selection | For | 9999 | No function | 247, 248, 300 to 308, 311 to 313, 347, 348, 9999 |
| 318 M415 ^{*3} | DO5 output selection | terminal on the option | 9999 | No function | |
| 319 M416 ^{*3} | DO6 output selection | , | 9999 | No function | |
| 320 M420 ^{*3} | RA1 output selection | | 0 | RUN (Inverter running) | |
| 321 M421 ^{*3} | RA2 output selection | | 1 | SU (Up to frequency) | 0 to 8, 10 to 20, 22, 25 to 28, 30 to 36, 38 to 57, 60, 61, 63, 64, 68, 70, 79, 80, 84 to 91, 94 to 99, |
| 322 | RA3 output selection | | 2*1 | IPF (Instantaneous power failure/undervoltage) | 200 to 208, 211 to 213, 247, 248, 9999 |
| M422 ^{*3} | | | 9999 ^{*2} | No function | |

| Pr. | Name | Initial Setting range | | Description |
|------|------|-----------------------|------------|--|
| 289 | | 9999 | 5 to 50 ms | Set the time delay for the output terminal response. |
| M431 | | 3338 | 9999 | No filtering of the output terminal. |

^{*1} The initial value is for standard models and IP55 compatible models.

♦ Output signal list

- A function listed below can be set to each output terminal.
- Refer to the following table and set the parameters. (0 to 99, 200 to 299: Positive logic, 100 to 199, 300 to 399: Negative logic)

| Positive logic | Negative logic | Signal name | Function | Operation | Related parameter | Refer to page |
|----------------|----------------|-------------|------------------|--|----------------------|---------------------|
| 0 | 100 | RUN | Inverter running | Outputted during operation when the inverter output frequency reaches Pr.13 Starting frequency or higher. | _ | 479 |

The initial value is for separated converter types.

^{*3} The setting is available when the PLC function is enabled or when a compatible plug-in option is installed.

^{*4} The setting is available for the FR-A800-GF.

| Set | Setting Negative | | | | Delete d | Refer |
|----------------|-------------------|----------------|--|---|---|-------------|
| Positive logic | Negative logic | Signal name | Function | Operation | Related parameter | to page |
| 1 | 101 | SU | Up to frequency *1 | Outputted when the output frequency reaches the set frequency. | Pr.41 | 484 |
| 2 | 102 | IPF | Instantaneous power failure/ undervoltage ^{*5} | Outputted when an instantaneous power failure or undervoltage protection operation occurs. | Pr.57 | 628, 635 |
| 3 | 103 | OL | Overload warning | Outputted while the stall prevention function works. | Pr.22, Pr.23, Pr.66, Pr.148, Pr.149, Pr.154 | 431 |
| 4 | 104 | FU | Output frequency detection | Outputted when the output frequency reaches the frequency set in Pr.42 (Pr.43 during reverse rotation) or higher. | Pr.42, Pr.43 | 484 |
| 5 | 105 | FU2 | Second output frequency detection | Outputted when the output frequency reaches the frequency set in Pr.50 or higher. | Pr.50 | 484 |
| 6 | 106 | FU3 | Third output frequency detection | Outputted when the output frequency reaches the frequency set in Pr.116 or higher. | Pr.116 | 484 |
| 7 | 107 | RBP | Regenerative brake prealarm*2 | Outputted when the regenerative brake duty reaches 85% of the setting of Pr.70 . | Pr.70 | 724 |
| 8 | 108 | THP | Electronic thermal O/L relay pre-alarm | Outputted when the cumulative electronic thermal O/L relay value reaches 85% of the trip level. (The electronic thermal O/L relay function (E.THT/E.THM) is activated when the value reaches 100%.) | Pr.9 | 415 |
| 10 | 110 | PU | PU operation mode | Outputted when the PU operation mode is selected. | Pr.79 | 389 |
| 11 | 111 | RY | Inverter operation ready | Outputted when the reset process is completed after powering ON the inverter or when the inverter is ready to start operation with the start signal ON or during operation. | _ | 479 |
| 12 | 112 | Y12 | Output current detection | Outputted when the output current is higher than the Pr.150 setting for the time set in Pr.151 or longer. | Pr.150, Pr.151 | 487 |
| 13 | 113 | Y13 | Zero current detection | Outputted when the output current is lower than the Pr.152 setting for the time set in Pr.153 or longer. | Pr.152, Pr.153 | 487 |
| 14 | 114 | FDN | PID lower limit | Outputted when the input value is lower than the lower limit set for the PID control operation. | | |
| 15 | 115 | FUP | PID upper limit | Outputted when the input value is higher than the upper limit set for the PID control operation. | Pr.127 to Pr.134, Pr.575 to Pr.577 | 601 |
| 16 | 116 | RL | PID forward/reverse rotation output | Outputted during forward rotation operation in the PID control operation. | | |
| 17 | _ | MC1 | Electronic bypass MC1 | | D: 405 to D: 400 | |
| 18 | _ | MC2 | Electronic bypass MC2 | Used to work the electronic bypass function. | Pr.135 to Pr.139, Pr.159 | 563 |
| 19 | _ | MC3 | Electronic bypass MC3 | | | |
| 20 | 120 | BOF | Brake opening request | Outputted to release the brake while the brake sequence function is enabled. | Pr.278 to Pr.285, Pr.292 | |
| 22 | 122 | BOF2 | Second brake opening request | Outputted to release the brake while the second brake sequence function is enabled (while the RT signal is ON). | Pr.641 to Pr.648 | 572 |
| 25 | 125 | FAN | Fan fault output | Outputted when a fan fault occurs. | Pr.244 | 423 |
| 26 | 126 | FIN | Heat sink overheat pre-alarm | Outputted when the heat sink temperature rises to 85% of temperature at which the protective function of the Heat sink overheat is activated. | _ | 788 |
| 27 | 127 | ORA | Orientation complete (output for a Vector control compatible option)*4 | Outputted while the orientation control | Pr.350 to Pr.366, Pr.369, Pr.393, | 585 |
| 28 | 128 | ORM | Orientation fault (output for a Vector control compatible option)*4 | operation is enabled. | Pr.396 to Pr.399 | |

| Setting Positive Negative Signal | | Cienal | | | Poloted | Refer |
|-----------------------------------|----------------|--------|---|---|---------------------------------------|------------|
| Positive logic | Negative logic | name | Function | Operation | Related parameter | to page |
| 30 | 130 | Y30 | Forward rotation output (output for a Vector control compatible option)*4 | Outputted while a motor rotates in forward direction. | | 482 |
| 31 | 131 | Y31 | Reverse rotation output (output for a Vector control compatible option)*4 | Outputted while a motor rotates in reverse direction. | _ | 482 |
| 32 | 132 | Y32 | Regenerative status output (output for a Vector control compatible option)*4 | Outputted while the motor is in a regenerative braking state under Vector control. | | 482 |
| 33 | 133 | RY2 | Operation ready 2 | Outputted while pre-excitation is enabled or during normal operation under Real sensorless vector control, Vector control, or PM sensorless vector control. | _ | 479 |
| 34 | 134 | LS | Low speed detection | Outputted when the output frequency drops to the Pr.865 setting or lower. | Pr.865 | 484 |
| 35 | 135 | TU | Torque detection | Outputted when the motor torque is higher than the Pr.864 setting. | Pr.864 | 488 |
| 36 | 136 | Y36 | In-position | Outputted when the number of droop pulses drops below the setting. | Pr.426 | 327 |
| 38 | 138 | MEND | Outputted when the droop pulse is within the in-position width and the position command operation is completed. | | Pr.426 | 327 |
| 39 | 139 | Y39 | Start time tuning completion | Cart time tuning completion Outputted when tuning at start-up is completed. | | 558 |
| 40 | 140 | Y40 | Trace status | Outputted during trace operation. | | 649 |
| 41 | 141 | FB | Speed detection | Outputted when the actual motor rotations | D 404 D 50 | |
| 42 | 142 | FB2 | Second speed detection | per minute (estimate) reaches the setting of | Pr.42 to Pr.50, Pr.116 | 484 |
| 43 | 143 | FB3 | Third speed detection | Pr.42, Pr.50, or Pr.116. | F1.110 | |
| 44 | 144 | RUN2 | Inverter running 2 | Outputted while the Forward rotation command signal or Reverse rotation command signal is ON. Outputted during deceleration even while the Forward rotation command signal or Reverse rotation command signal is OFF (except while pre-excitation is enabled (the LX signal is ON)). Also outputted while the Orientation command (X22) signal is ON. Outputted while the servo-lock function is working (the LX signal is ON) in the position control mode. (The signal output stops when the servo-lock function stops (the LX signal is OFF).) | _ | 479 |
| 45 | 145 | RUN3 | Inverter running and start command ON | Outputted while the inverter is running or while the start command signal is ON. | _ | 479 |
| 46 | 146 | Y46 | During deceleration at occurrence of power failure | Outputted when the power-failure deceleration function is activated. (The signal output is retained until the function stops.) | Pr.261 to Pr.266 | 642 |
| 47 | 147 | PID | During PID control activated | Outputted during the PID control operation. | Pr.127 to Pr.134, Pr.575 to Pr.577 | 601 |
| 48 | 148 | Y48 | PID deviation limit | Outputted when the absolute deviation value exceeds the limit value. | Pr.127 to Pr.134, Pr.553, Pr.554 | 601 |
| 49 | 149 | Y49 | During pre-charge operation | Outputted while the are charge for the terminal | | |
| 50 | 150 | Y50 | During second pre-charge operation | Outputted while the pre-charge function is working. | D:: 407 4: P: 401 | |
| 51 | 151 | Y51 | Pre-charge time over | Outputted when the time period while the pre- | Pr.127 to Pr.134, Pr.241, Pr.553, | |
| 52 | 152 | Y52 | Second pre-charge time over | charge function is working reaches the time | | 618 |
| 53 | 153 | Y53 | Pre-charge level over | Outputted when the value higher than the | Pr.577, Pr.753 to Pr.769, C42, C45 | |
| 54 | 154 | Y54 | Second pre-charge level over | detection level set in Pr.763 or Pr.768 is measured until the pre-charge function stops during pre-charge operation. | | |

| Set | ting | Signal | | | Related | Refer |
|----------------|-------------------|--------|---|---|--|---------|
| Positive logic | Negative logic | name | Function | Operation | parameter | to page |
| 55 | 155 | Y55 | Motor temperature detection (for FR-A8AZ)*4 | Outputted when the temperature of the thermistor-equipped vector control motor (SF-V5RU[]T/A) exceeds the detection level. | Pr.750 | _ |
| 56 | 156 | ZA | Home position return failure | Outputted while the Home position return failure warning is output. | _ | 303 |
| 57 | 157 | IPM | During PM sensorless vector control | Outputted while the operation is performed under PM sensorless vector control. | Pr.71 to Pr.80, Pr.998 | 230 |
| 60 | 160 | FP | Position detection level | Outputted when the current position exceeds the position detection judgment value (set in Pr.1294 and Pr.1295). | Pr.1294 to Pr.1297 | 327 |
| 61 | 161 | PBSY | During position command operation | Outputted during the position command operation. | | 000 |
| 63 | 163 | ZP | Home position return completed | Outputted when the home position return operation is completed. | _ | 303 |
| 64 | 164 | Y64 | During retry | Outputted during retry operation. | Pr.65 to Pr.69 | 426 |
| 67 | 167 | Y67 | Power failed*3 | Outputted when the inverter power output is shut off due to power failure or undervoltage or when the power failure time deceleration-to-stop function is activated. | Pr.261 to Pr.266 | 642 |
| 68 | 168 | EV | 24 V external power supply operation | Outputted while the inverter operated with a 24 V power supplied from an external source. | _ | 80 |
| 70 | 170 | SLEEP | PID output interruption Outputted while PID output suspension function is activated. | | Pr.127 to Pr.134, Pr.575 to Pr.577 | 601 |
| 79 | 179 | Y79 | Pulse train output of output power | Outputted in pulses every time the cumulative value of energy outputted from the inverter reaches the Pr.799 setting. | | 493 |
| 80 | 180 | SAFE | Safety monitor output | Outputted while the safety stop function is activated. | | 82 |
| 84 | 184 | RDY | Position control preparation ready | Outputted when the servo-lock function is working (the LX signal turns ON) and the inverter is ready to operate. | Pr.419, Pr.428 to Pr.430 | 319 |
| 85 | 185 | Y85 | DC current feeding*5 | Outputted during power failure or undervoltage of the AC power supply. | Pr.30 | 724 |
| 86 | 186 | Y86 | Control circuit capacitor life (for Pr.313 to Pr.322)*6 | Outputted when the control circuit capacitor approaches the end of its life. | | |
| 87 | 187 | Y87 | Main circuit capacitor life (for Pr.313 to Pr.322)*5*6 | Outputted when the main circuit capacitor approaches the end of its life. | | |
| 88 | 188 | Y88 | Cooling fan life (for Pr.313 to Pr.322)*6 | Outputted when the cooling fan approaches the end of its life. | Pr.255 to Pr.259 | 359 |
| 89 | 189 | Y89 | Inrush current limit circuit life (for Pr.313 to Pr.322)*5*6 | Outputted when the inrush current limit circuit approaches the end of its life. | F1.233 to F1.233 | 333 |
| 90 | 190 | Y90 | Life alarm | Outputted when any of the control circuit capacitor, main circuit capacitor, inrush current limit circuit, or the cooling fan approaches the end of its life. | | |
| 91 | 191 | Y91 | Fault output 3 (Power-OFF signal) | Outputted when the Fault occurs due to an inverter circuit fault or connection fault. | _ | 483 |
| 92 | 192 | Y92 | Energy saving average value updated timing | Switches between ON and OFF every time the average energy saving is updated during the energy saving monitoring. This signal cannot be assigned to any of the relay output terminal (Pr.195, Pr.196, Pr.320 to Pr.322). | Pr.52, Pr.54, Pr.158, Pr.891 to Pr.899 | 467 |
| 93 | 193 | Y93 | Current average monitor | Outputted in pulses for transmission of the average current value and the maintenance timer value. This signal cannot be assigned to any of the relay output terminal (Pr.195 , Pr.196 , Pr.320 to Pr.322). | Pr.555 to Pr.557 | 363 |
| 94 | 194 | ALM2 | Fault output 2 | Outputted when the inverter's protective function is activated to stop the power output (when the Fault occurs). The signal output continues during the inverter reset and stops after the inverter reset finishes. *7 | _ | 483 |

| Set | ting | Signal | | | Related | Refer |
|----------------|-------------------|--------|--|--|--|-------------|
| Positive logic | Negative logic | name | Function | Operation | parameter | to page |
| 95 | 195 | Y95 | Maintenance timer | Outputted when the value of Pr.503 reaches the Pr.504 setting or higher. | Pr.503, Pr.504 | 363 |
| 96 | 196 | REM | Remote output | Outputted via a terminal by setting a proper number in a relative parameter. | Pr.495 to Pr.497 | 489 |
| 97 | 197 | ER | Alarm output 2 | The ER signal output follows the ALM signal output when Pr.875 = "0 (initial value)". When Pr.875 = "1" and when any of E.OHT, E.THM, or E.PTC occurs, the inverter decelerates the motor to a stop at a time of the ER signal ON. When any of other faults occurs, the ER signal outputs when the inverter output stops. | Pr.875 | 422 |
| 98 | 198 | LF | Alarm | Outputted when an Alarm fault (fan fault or a communication error) occurs. | Pr.121, Pr.244 | 423, 663 |
| 99 | 199 | ALM | Fault | Outputted when the inverter's protective function is activated to stop the power output (when the Fault occurs). The signal output stops when the inverter reset starts. | _ | 483 |
| 200 | 300 | FDN2 | Second PID lower limit | Outputted when the input value is lower than the lower limit set for the second PID control operation. | | |
| 201 | 301 | FUP2 | operation. | | Pr.753 to Pr.758 | |
| 202 | 302 | RL2 | Second PID forward/reverse rotation output | Outputted during forward rotation operation in the second PID control operation. | | 601 |
| 203 | 303 | PID2 | During second PID control activated | Outputted during the second PID control operation. | | 001 |
| 204 | 304 | SLEEP2 | During second PID output shutoff | Outputted while the second PID output suspension function is activated. | Pr.753 to Pr.758, Pr.1147 to Pr.1149 | |
| 205 | 305 | Y205 | Second PID deviation limit | Outputted when the absolute deviation value exceeds the limit value during the second PID control operation. | Pr.753 to Pr.758, Pr.1145, Pr.1146 | |
| 206 | 306 | Y206 | Cooling fan operation command | Outputted when the cooling fan operation is commanded. | Pr.244 | 423 |
| 207 | 307 | Y207 | Control circuit temperature | Outputted when the temperature of the control circuit board reaches the detection level or higher. | Pr.663 | 494 |
| 208 | 308 | PS | PU stopped | Outputted while the PU is stopped. | Pr.75 | 336 |
| 211 | 311 | LUP | Upper limit warning detection | Outputted when the load fault upper limit warning is detected. | | |
| 212 | 312 | LDN | Lower limit warning detection | Outputted when the load fault lower limit warning is detected. | Pr.1480 to Pr.1492 | 439 |
| 213 | 313 | Y213 | During load characteristics measurement | Outputted during measurement of the load characteristics. | | |
| 247 | 347 | LSYN | Phase synchronization completion | Output when phase synchronization for bypass switching has completed (for FR-A8AVP).*4 | Pr.139 | _ |
| 248 | 348 | Y248 | Estimated residual-life of main circuit capacitor (for Pr.313 to Pr.322)*5*6 | Output when the main circuit capacitor approaches the end of its estimated life. | Pr.255, Pr.506 | 359 |
| 9999 | | _ | No function | | - | _ |

^{*1} Note that changing the frequency setting with an analog signal or the setting dial on the operation panel (FR-DU08) may cause the turning ON and OFF of Up to frequency (SU) signal depending on its changing speed and the timing of the speed change determined by the acceleration/ deceleration time setting. (The signal state changing does not occur when the acceleration/deceleration time is set to 0 seconds.)

^{*2} This signal is available only for the standard model.

^{*3} This signal cannot be assigned to any of the output terminals for plug-in options (FR-A8AY and FR-A8AR).

^{*4} This signal is available when the compatible plug-in option or control terminal option is installed.

^{*5} The setting is available for the standard structure model and the IP55 compatible model.

^{*6} This signal is available for the FR-A800-GF, when the PLC function is enabled, or when an option (FR-A8AY, FR-A8AR, FR-A8NC, or FR-A8NCE) is installed. Use **Pr.313 to Pr.322** to assign the function to the terminal. For the information of the availability of these parameters for each option, refer to the Instruction Manual of the option.

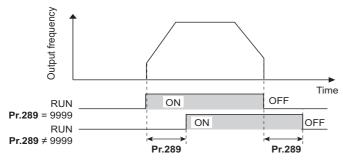
^{*7} On restarting the inverter, the Fault output 2 (ALM2) signal turns OFF at the time the inverter power turns OFF.



- · One function can be assigned to more than one terminal.
- The function works during the terminal conducts when the parameter setting is any of "0 to 99, 200 to 299", and the function works during the terminal does not conduct when the setting is "100 to 199, 300 to 399".
- When **Pr.76 Fault code output selection** = "1", the outputs of terminals SU, IPF, OL, and FU are used only for outputting the fault code according to the **Pr.76** setting. (When the inverter's protective function is activated, the signal for the fault code is output.)
- The output of terminal RUN and the outputs of the relay output terminals are not affected by the Pr.76 setting.
- Changing the terminal assignment using **Pr.190 to Pr.196 (Output terminal function selection)** may affect the other functions. Set parameters after confirming the function of each terminal.
- Do not assign the signal to terminals A1, B1, and C1 or terminals A2, B2, and C2 which frequently changes its state between ON and OFF. Otherwise, the life of the relay contact may be shortened.

◆ Adjusting the output terminal response level (Pr.289)

• The responsivity of the output terminals can be delayed in a range between 5 to 50 ms. (The following is the operation example of the RUN signal.)



NOTE

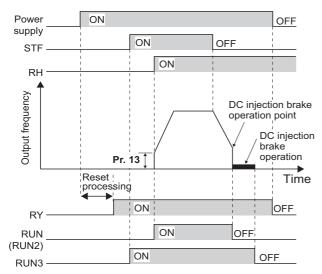
- When **Pr.157 OL signal output timer** is set for the Overload warning (OL) signal output, the OL signal is output when the set time of (**Pr.157 + Pr.289**) elapses.
- The signal output for the PLC function (see page 646) and for the fault code output (see page 492) are not affected by the **Pr.289** setting (not filtered for responsivity).

♦ Inverter operation ready signals (RY, RY2 signals) and inverter running signals (RUN, RUN2, RUN3 signals)

■ Operation under V/F control and Advanced magnetic flux vector control

- When the inverter is ready for operation, the Inverter operation ready (RY) signal turns ON (and stays ON during operation).
- When the inverter output frequency reaches the setting of **Pr.13 Starting frequency** or higher, the inverter running signals (RUN, RUN2 signals) turn ON. The signals are OFF while the inverter is stopped or during the DC injection brake operation.

• The Inverter running and start command ON (RUN3) signal is ON while the inverter is running or while the start command signal is ON (When the start command signal is ON, the RUN3 signal is ON even while the inverter's protective function is activated or while the MRS signal is ON.) The RUN3 signal is ON even during the DC injection brake operation, and the signal is OFF when the inverter stops.



· The ON/OFF state of each signal according to the inverter operating status is shown in the matrix below.

| Output | Start signal | Start signal | Start signal ON | During DC injection | Inverter output shutoff ^{*2} | | instanta | after r failure | |
|------------------|------------------------|-----------------------|-----------------------|---------------------|--|---------------------|--------------------|---------------------|---|
| Output signal | OFF (inverter stopped) | ON (inverter stopped) | (inverter running) | brake operation | Start signal ON | Start signal OFF | Start signal ON | Start signal OFF | Inverter running after restart |
| RY*3 | ON | ON | ON | ON | OFF | | ON*1 | | ON |
| RY2 | OFF | OFF | OFF | OFF | OFF | | OFF | | OFF |
| RUN | OFF | OFF | ON | OFF | OFF | | OFF | | ON |
| RUN2 | OFF | OFF | ON | OFF | OFF | | OFF | | ON |
| RUN3 | OFF | ON | ON | ON | ON | OFF | ON | OFF | ON |

^{*1} The signal is OFF during power failure or undervoltage.

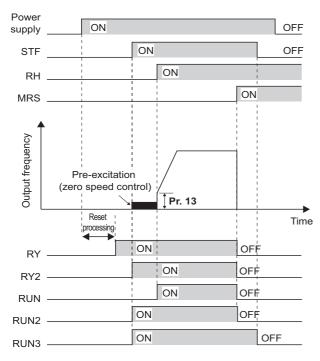
■ Operation under Real sensorless vector control, Vector control, and PM sensorless vector control

- When the inverter is ready for operation, the Inverter operation ready (RY) signal turns ON (and stays ON during operation).
- When the inverter output frequency reaches the setting of **Pr.13 Starting frequency** or higher, the Inverter running (RUN) turns ON. The signal is OFF during an inverter stop, during the DC injection brake operation, during tuning at start-up, or during pre-excitation.
- The Inverter running 2 (RUN2) signal is ON while the inverter is running or while the start command signal is ON. (When the inverter's protective function is activated or the MRS signal is ON, the RUN2 signal turns OFF.)
- The Inverter running and start command ON (RUN3) signal is ON while the inverter is running or while the start command signal is ON.
- The RUN2 and RUN3 signals are also ON when the start command signal is ON or during pre-excitation with the speed command value 0. (However, the RUN2 signal is OFF during pre-excitation with the LX signal ON.)

^{*2} This means the state during a fault occurrence or while the MRS signal is ON, etc.

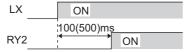
^{*3} The signal is OFF while power is not supplied to the main circuit.

• The Operation ready 2 (RY2) signal turns ON when the pre-excitation starts. The signal is ON during pre-excitation even while the inverter stops its output. The signal is OFF during the inverter output shutoff.





• When pre-excitation works with the Pre-excitation/servo ON (LX) signal ON, the RY2 signal turns ON after 100 ms (500 ms for FR-A820-03800(75K) or higher, FR-A840-02160(75K) or higher) from the time the LX signal turns ON. (When online auto tuning at start-up is selected (**Pr.95** = "1"), the time the signal turns ON is delayed by the tuning time.)



• The ON/OFF state of each signal according to the inverter operating status is shown in the matrix below.

| Output signal | Start signal Start signal ON*1 (during | | Start signal ON | LX signal ON (during | During DC injection brake | Inverter output shutoff ^{*5} | | Automatic resta instantaneous pov During coasting | | |
|------------------|--|---------------------|--------------------|-------------------------|---|--|------------------------|---|------------------------|-----------------------------|
| | OFF (inverter stopped) | pre- excitation) | (inverter running) | pre- excitation) | operation (during pre- excitation) | Start signal ON | Start signal OFF | Start signal ON | Start signal OFF | running after restart |
| RY*6 | ON | ON | ON | ON | ON | OFF | | ON ^{*2} | | ON |
| RY2 | OFF | ON | ON | ON ^{*3} | ON | OFF | | OFF | | ON |
| RUN | OFF | OFF | ON | OFF*4 | OFF | OFF OFF | | | ON | |
| RUN2 | OFF | ON | ON | OFF*4 | OFF | OFF | | OFF | | ON |
| RUN3 | OFF | ON | ON | ON | ON | ON | OFF | ON | OFF | ON |

- *1 When the start signal is ON and the frequency command is 0 Hz, such state is designated as "during pre-excitation".
- *2 The signal is OFF during power failure or undervoltage.
- *3 The RY2 signal turns ON after 100 ms (500 ms for FR-A820-03800(75K) or higher, FR-A840-02160(75K) or higher) from the time the LX signal turns ON.
- *4 The signal is ON while the servo-lock function is ON (the LX signal is ON) in the position control mode.
- This means the state during a fault occurrence or while the MRS signal is ON, etc.
- *6 The signal is OFF while power is not supplied to the main circuit.

• To use the RY, RY2, RUN, RUN2, or RUN3 signal, set the corresponding number selected from the following table in any of **Pr.190 to Pr.196 (Output terminal function selection)** to assign the function to an output terminal.

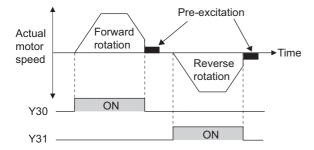
| Output signal | Pr.190 to Pr.196 settings | | | | | |
|---------------|---------------------------|----------------|--|--|--|--|
| Output signal | Positive logic | Negative logic | | | | |
| RY | 11 | 111 | | | | |
| RY2 | 33 | 133 | | | | |
| RUN | 0 | 100 | | | | |
| RUN2 | 44 | 144 | | | | |
| RUN3 | 45 | 145 | | | | |



• The RUN signal (positive logic) is initially assigned to the terminal RUN.

Forward rotation output (Y30) signal and Reverse rotation output (Y31) signal

- Under Vector control, the Forward rotation output (Y30) signal or the Reverse rotation output (Y31) signal is output according to the actual rotation direction of the motor.
- During pre-excitation (zero-speed or servo-lock function ON) in the speed or torque control mode, the Y30 signal and the Y31 signal are OFF. During the servo-lock function ON in the position control mode, however, the Y30 signal or the Y31 signal is ON according to the actual rotation direction of the motor, as well as during normal operation.
- To use the Y30 signal, set "30 (positive logic) or 130 (negative logic)" in any of **Pr.190 to Pr.196 (Output terminal function selection)** to assign the function to the output terminal.
- To use the Y31 signal, set "31 (positive logic) or 131 (negative logic)" in any of **Pr.190 to Pr.196 (Output terminal function selection)** to assign the function to the output terminal.



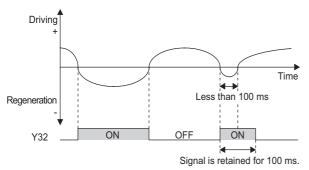
NOTE

- The Y30 and Y31 signals are always OFF under V/F control, Advanced magnetic flux vector control, Real sensorless vector control, and PM sensorless vector control.
- If the motor is rotated by an external force while the inverter is stopped, the Y30 signal and the Y31 signal keep OFF state.

◆ Regenerative status output (Y32) signal

- When the motor gets in a regenerative braking (dynamic braking) state under Vector control, the Regenerative status output (Y32) signal turns ON. Once the signal turns ON, the signal is retained ON for at least 100 ms.
- · The signal is OFF during an inverter stop or during pre-excitation.

• To use the Y32 signal, set "32 (positive logic) or 132 (negative logic)" in any of **Pr.190 to Pr.196 (Output terminal function selection)** to assign the function to the output terminal.

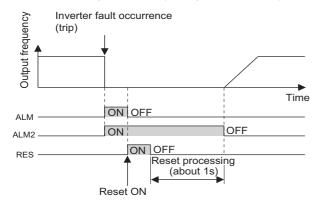




• The Y32 signal is always OFF under V/F control, Advanced magnetic flux vector control, Real sensorless vector control, and PM sensorless vector control.

◆ Fault (ALM) signal and Fault output 2 (ALM2) signal

- The fault signal (ALM or ALM2 signal) is output when an inverter protective function is activated.
- · The ALM2 signal stays ON during the resetting the inverter after the Fault occurs.
- To use the ALM2 signal, set "94 (positive logic) or 194 (negative logic)" in any of **Pr.190 to Pr.196 (Output terminal function selection)** to assign the function to an output terminal.
- The ALM signal is initially assigned to the relay terminals A1, B1, and C1.



NOTE

• For details on the inverter faults, refer to page 779.

◆ Input power shutoff like magnetic contactor (Y91 signal)

- The Fault output 3 (Y91) signal is output when a fault originating in the inverter circuit or a connection fault occurs.
- To use the Y91 signal, set "91 (positive logic) or 191 (negative logic)" in any of **Pr.190 to Pr.196 (Output terminal function selection)** to assign the function to an output terminal.

• The following is the list of faults that output the Y91 signal. (For details on faults, refer to page 779.)

| Fault type |
|--|
| Inrush current limit circuit fault (E.IOH) |
| CPU fault (E.CPU) |
| CPU fault (E.6) |
| CPU fault (E.7) |
| Parameter storage device fault (control circuit board) (E.PE) |
| Parameter storage device fault (main circuit board) (E.PE2) |
| 24 VDC power fault (E.P24) |
| Operation panel power supply short circuit/RS-485 terminals power supply short circuit (E.CTE) |
| Output side earth (ground) fault overcurrent (E.GF) |
| Output phase loss (E.LF) |
| Brake transistor alarm detection (E.BE) |
| Internal circuit fault (E.13/E.PBT) |

Changing the special relay function for the PLC function

• For the PLC function, the function of special relays (SM1225 to SM1234) can be changed by setting **Pr.313 to Pr.322**. (For details on the PLC function, refer to the PLC Function Programming Manual.)

Pr.13 Starting frequency page 381, page 382 Pr.76 Fault code output selection page 492

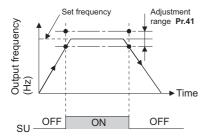
5.11.7 Output frequency detection

If the inverter output frequency which reaches a specific value is detected, the relative signal is output.

| Pr. | Name | Initia | l value | Setting | Description |
|-------------|--|-------------|---------|-------------|--|
| PI. | Name | FM | CA | range | Description |
| 41 M441 | Up-to-frequency sensitivity | 10% | | 0 to 100% | Set the level where the SU signal turns ON. |
| 42 M442 | Output frequency detection | 6 Hz | | 0 to 590 Hz | Set the frequency at which the FU (or FB) signal turns ON. |
| 43 M443 | Output frequency detection for reverse | 9999 | | 0 to 590 Hz | Set the frequency at which the FU (or FB) signal turns ON only while the motor rotates in reverse direction. |
| 14443 | rotation | | | 9999 | The frequency same as the Pr.42 setting is set. |
| 50 M444 | Second output frequency detection | 30 Hz | | 0 to 590 Hz | Set the frequency at which the FU2 (or FB2) signal turns ON. |
| 116 M445 | Third output frequency detection | 60 Hz 50 Hz | | 0 to 590 Hz | Set the frequency at which the FU3 (or FB3) signal turns ON. |
| 865 M446 | Low speed detection | 1.5 Hz | | 0 to 590 Hz | Set the frequency at which the LS signal turns ON. |
| 870 M400 | Speed detection hysteresis | 0 Hz | | 0 to 5 Hz | Set the hysteresis width for the detected frequency. |

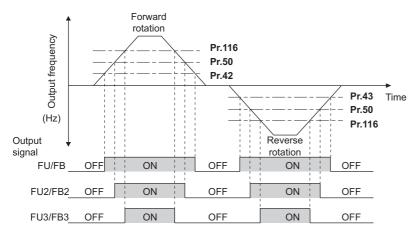
◆ Setting the notification zone of the output frequency reaching the set point (SU signal, Pr.41)

- The Up to frequency (SU) signal is output when the output frequency reaches the set frequency.
- Set the value in the range of 1 to 100% in Pr.41 to determine tolerance for the set frequency (considered as 100% point).
- It may be useful to use this signal to start operating related equipment after checking that the set frequency has been reached.



◆ Output frequency detection (FU, FU2, FU3 signals, FB, FB2, FB3 signals, Pr.42, Pr.43, Pr.50, Pr.116)

- The Output frequency detection (FU) signal and the Speed detection (FB) signal are output when the output frequency reaches or exceeds the **Pr.42** setting.
- The FU, FU2, and FU3 signals are useful for applying or releasing electromagnetic brake, etc.
- The FU, FU2, and FU3 signal is output when the output frequency (frequency command) reaches the set frequency. On the other hand, the FB, FB2, and FB3 signal is output when the detected actual speed (estimated speed under Real sensorless vector control, or feedback value under Vector control) of the motor reaches the set frequency. The FU signal and the FB signal are output at the same manner under V/F control or Advanced magnetic flux vector control or during the encoder feedback control operation.
- The frequency detection dedicated to motor rotation in reverse direction is enabled by setting the frequency in **Pr.43**. This setting is useful when the timing of the electromagnetic braking during forward rotation operation (for example, during lifting up in the lifts operation) is different from that during reverse rotation operation (lifting down).
- When **Pr.43** ≠ "9999", the **Pr.42** setting is for the forward rotation operation and the **Pr.43** setting is for the reverse rotation operation.
- When a different detection point of the frequency is required, **Pr.50** and **Pr.116** are available. The FU2 (or FB2) signal can be set to be output when the output frequency reaches the **Pr.50** setting or higher, and the FU3 (or FB3) signal can be set to be output when the output frequency reaches the **Pr.116** setting or higher.



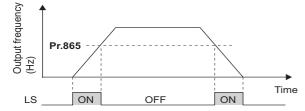
• To use each signal, set the corresponding number selected from the following table in any of **Pr.190 to Pr.196 (Output terminal function selection)** to assign the function to an output terminal.

| Output signal | Pr.190 to Pr. | Related | |
|---------------|----------------|-----------|--------|
| Output signal | Positive logic | Parameter | |
| FU | 4 | 104 | 42, 43 |
| FB | 41 | 141 | 42, 43 |
| FU2 | 5 | 105 | 50 |
| FB2 | 42 | 142 | 30 |
| FU3 | 6 | 106 | 116 |
| FB3 | 43 | 143 | 110 |

Low speed detection (LS signal, Pr.865)

- When the output frequency drops to the setting of **Pr.865 Low speed detection** or lower, the Low speed detection (LS) signal is output.
- In the speed control mode under Real sensorless vector control, Vector control, or PM sensorless vector control, the fault
 occurs, the indication "E.OLT" appears, and the inverter output power shuts off if the inverter condition that the output
 frequency drops to the Pr.865 setting and the output torque exceeds the setting of Pr.874 OLT level setting by torque
 limit operation continues for 3 seconds or longer.

• To use the LS signal, set "34 (positive logic) or 134 (negative logic)" in any of Pr.190 to Pr.196 (Output terminal function selection) to assign the function to the output terminal.

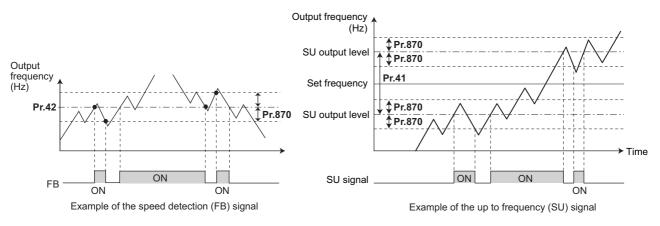


◆ Speed detection hysteresis (Pr.870)

Setting the hysteresis width for the detected frequency prevents chattering of the Speed detection (FB) signal. When an output frequency fluctuates, the following signals may chatter (turns ON and OFF repeatedly).

- Up to frequency (SU) signal
- · Speed detection (FB, FB2, FB3) signals
- · Low speed detection (LS) signal

Setting hysteresis to the detected frequency prevents chattering of these signals.



NOTE

- · In the initial setting, the FU signal is assigned to terminal FU, and the SU signal is assigned to terminal SU.
- · All signals shown in the following table are OFF during the DC injection brake operation, during the pre-excitation (zero speed control or servo lock) operation, and during tuning at start-up.
- The reference frequency in comparison with the set frequency differs depending on the control method.

| Control method or function | Reference frequency | | | | | |
|---------------------------------------|---|---|--|--|--|--|
| Control method of function | FU, FU2, FU3 | FB, FB2, FB3, SU, LS | | | | |
| V/F control | Output frequency | Output frequency | | | | |
| Advanced magnetic flux vector control | Output frequency before the slip compensation | Output frequency before the slip compensation | | | | |
| Real sensorless vector control | Frequency command value | Estimated frequency (actual motor speed) | | | | |
| Encoder feedback control | Frequency converted from actual motor speed | Frequency converted from actual motor speed | | | | |
| Vector control | Frequency command value | Frequency converted from actual motor speed | | | | |
| PM sensorless vector control | Frequency command value | Estimated frequency (actual motor speed) | | | | |

- Setting a higher value in Pr.870 causes a lower responsivity of the signals for frequency detection (SU, FB, FB2, FB3, and LS signals).
- The logic (ON/OFF switching) of the LS signal is the reverse of that of the FB signal.
- Changing the terminal assignment using Pr.190 to Pr.196 (Output terminal function selection) may affect the other functions. Set parameters after confirming the function of each terminal.

Parameters referred to

Pr.190 to Pr.196 (Output terminal function selection) page 473

Pr.874 OLT level setting page 245

5.11.8 Output current detection function

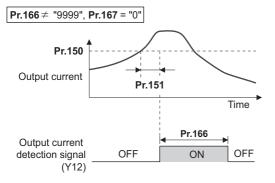
If the inverter output current which reaches a specific value is detected, the relative signal is output via an output terminal.

| Pr. | Name | Initial value | Setting range | Description |
|-------------|--|------------------|---------------|---|
| 150 M460 | Output current detection level | 150% | 0 to 400% | Set the level to detect the output current. Consider the value of the rated inverter current as 100%. |
| 151 M461 | Output current detection signal delay time | 0 s | 0 to 10 s | Set the timing to detect the output current. Enter the delay time between the time when the output current reaches the set current or higher and the time when the Output current detection (Y12) signal is output. |
| 152 M462 | Zero current detection level | 5% | 0 to 400% | Set the level to detect the zero current. Consider the value of the inverter rated current as 100%. |
| 153 M463 | Zero current detection time | 0.5 s 0 to 10 s | | Set the time from the time when the output current drops to the Pr.152 setting or lower to the time when the Zero current detection (Y13) signal is output. |
| 166 | Output current detection | | 0 to 10 s | Set the retention time period during which the Y12 signal is ON. |
| M433 | | | 9999 | The Y12 signal is retained ON. The signal turns OFF at the next start-up of the inverter. |
| 167 M464 | Output current detection operation selection | 0 | 0, 1, 10, 11 | Select the inverter operation at the time when the Y12 signal and the Y13 signal turn ON. |

◆ Output current detection (Y12 signal, Pr.150, Pr.151, Pr.166, Pr.167)

- · The output current detection function is useful for overtorque detection.
- If the inverter output during inverter running remains higher than the **Pr.150** setting for the time set in **Pr.151** or longer, the Output current detection (Y12) signal is output from the inverter's open collector or the relay output terminal.
- When the Y12 signal turns ON, the ON state is retained for the time set in Pr.166.
- When Pr.166 = "9999", the ON state is retained until the next start-up of the inverter.
- Setting Pr.167 = "1" while the Y12 signal is ON does not cause the fault E.CDO. The Pr.167 setting becomes valid after the Y12 signal is turned OFF.
- To use the Y12 signal, set "12 (positive logic) or 112 (negative logic)" in any of **Pr.190 to Pr.196 (Output terminal function selection)** to assign the function to the output terminal.
- Use **Pr.167** to select the inverter operation at the time when Y12 signal turns ON, whether the inverter output stops or the inverter operation continues.

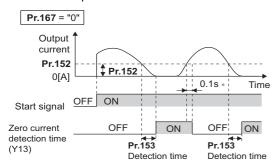
| Pr.167 setting | When the Y12 signal turns ON | When the Y13 signal turns ON | | |
|-------------------|-----------------------------------|-----------------------------------|--|--|
| 0 (initial value) | Operation continues. | Operation continues. | | |
| 1 | Operation stops by fault (E.CDO). | Operation continues. | | |
| 10 | Operation continues. | Operation stops by fault (E.CDO). | | |
| 11 | Operation stops by fault (E.CDO). | Operation stops by fault (E.CDO). | | |



◆ Zero current detection (Y13 signal, Pr.152, Pr.153)

- If the inverter output during inverter running remains higher than the **Pr.152** setting for the time set in **Pr.153** or longer, the Zero current detection (Y13) signal is output from the inverter's open collector or the relay output terminal.
- Once the Zero current detection (Y13) signal turns ON, the signal is retained ON for at least 0.1 second.

- If the inverter output current drops to zero, slippage due to gravity may occur, especially in a lift application, because the
 motor torque is not generated. To prevent this, the Y13 signal can be output from the inverter to apply the mechanical brake
 at zero current output.
- To use the Y13 signal, set "13 (positive logic) or 113 (negative logic)" in any of **Pr.190 to Pr.196 (Output terminal function selection)** to assign the function to the output terminal.
- Use **Pr.167** to select the inverter operation at the time when Y13 signal turns ON, whether the inverter output stops or the inverter operation continues.



* When the output is restored to the **Pr.152** level, the Y13 signal is turned OFF after 0.1 s.



- · This function is enabled during online or offline auto tuning.
- The response time of the Y12 and Y13 signals is approximately 0.1 second. However, the response time varies according to the load condition.
- When **Pr.152** = "0", the zero current detection function is disabled.
- Changing the terminal assignment using Pr.190 to Pr.196 (Output terminal function selection) may affect the other functions. Set parameters after confirming the function of each terminal.

↑ CAUTION

- The setting of the zero current detection level should not be too low, and the setting of the zero current detection time should not be too long. Doing so may cause the signal for the zero current detection not to be outputted when the output current is very low and the motor torque is not generated.
- A safety backup such as an emergency brake must be provided to prevent machines or equipment in hazardous conditions even if the Zero current detection is used.

5.11.9 Output torque detection function

Magneticiflux Sensorless Vector PM

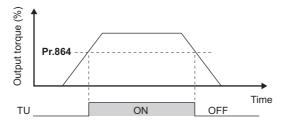
If the motor torque which reaches a specific value is detected, the relative signal is output.

The signal is useful for applying or releasing electromagnetic brake, etc.

| Pr. | Name | Initial value | Setting range | Description |
|-------------|------------------|---------------|---------------|--|
| 864 M470 | Torque detection | 150% | 0 to 400% | Set a value of the torque at which the TU signal turns ON. |

- The Torque detection (TU) signal turns ON when the motor output torque reaches the value of torque set in **Pr.864** or higher. The TU signal turns OFF when the motor output torque drops lower than the set value.
- Pr.864 is not available under V/F control.

• To use the TU signal, set "35 (positive logic) or 135 (negative logic)" in one of **Pr.190 to Pr.196 (Output terminal function selection)** to assign the function to the output terminal.





• Changing the terminal assignment using **Pr.190 to Pr.196 (Output terminal function selection)** may affect the other functions. Set parameters after confirming the function of each terminal.

Parameters referred to

Pr.190 to Pr.196 (Output terminal function selection) F page 473

5.11.10 Remote output function

The signal can be turned ON or OFF via the output terminal on the inverter as if the terminal is the remote output terminal for a programmable controller.

| Pr. | Name | Initial value | Setting range | Description | | |
|-------------|-------------------------|---------------|---------------|--|---|--|
| | | | 0 | Remote output data is cleared when the inverter power is turned OFF. | Remote output data is cleared during an inverter | |
| 495 | Remote output selection | | | Remote output data is retained even after the inverter power is turned OFF. | reset. | |
| M500 | | U | 10 | Remote output data is cleared when the inverter power is turned OFF. | Remote output data is retained during an inverter | |
| | | | 11 | Remote output data is retained even after the inverter power is turned OFF. | reset | |
| 496 M501 | Remote output data 1 | 0 | 0 to 4095 | Set a decimal number to enter a binary number in every bit corresponding to each of the output terminals on the inverter. | | |
| 497 M502 | Remote output data 2 | 0 | 0 to 4095 | Set a decimal number to enter a binary number in every bit corresponding to each of the output terminals on the option FR-A8AY or FR-A8AR. | | |

◆ Remote output setting (REM signal, Pr.496, Pr.497)

- The signal assigned to each of the output terminal can be turned ON or OFF according to the settings of **Pr.496** and **Pr.497**. The signal assigned to each of the remote output terminal can be turned ON or OFF through communication via the PU connector, via the RS-485 terminals, or via a communication option.
- To use the Remote output (REM) signal, set "96 (positive logic) or 196 (negative logic)" in any of **Pr.190 to Pr.196 (Output terminal function selection)** to assign the function to the terminal.
- Refer to the following figures to check correspondences between the bit and the actual terminal. When "1" is set in the bit
 corresponding to the terminal to which the REM signal assigned by setting a number in Pr.496 and Pr.497 each, the signal
 turns ON (or OFF in negative logic setting). Also, setting "0" allows the signal to turn OFF (or ON in negative logic setting).
- For example, when **Pr.190 RUN terminal function selection** = "96" (positive logic) and "1" (H01) is set in **Pr.496**, the REM signal assigned to terminal RUN turns ON.

Pr.496



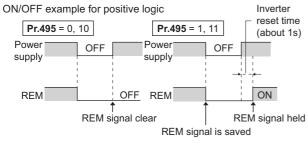
Pr.497

| b11 | | | | | | | | | | | b0 |
|-----|----|--------|--------|--------|-------|-------|-------|-------|-------|-------|-------|
| *1 | *1 | RA3 *3 | RA2 *3 | RA1 *3 | Y6 *2 | Y5 *2 | Y4 *2 | Y3 *2 | Y2 *2 | Y1 *2 | Y0 *2 |

- *1 Any value
- *2 Y0 to Y6 are available when the output-extending option (FR-A8AY) is installed.
- *3 RA1 to RA3 are available when the relay output option (FR-A8AR) is installed.

◆ Remote output data retention (REM signal, Pr.495)

- When the inverter power is reset (or a power failure occurs) while **Pr.495** = "0 (initial value) or 10", the REM signal setting is cleared. (The ON/OFF state of the signal assigned to each terminal is determined by the settings in **Pr.190 to Pr.196**.) The settings in **Pr.496** and **Pr.497** are reset to "0".
- When **Pr.495** = "1 or 11", the remote output data is stored in EEPROM before the inverter power is turned OFF. This means that the signal output setting after power restoration is the same as that before the power was turned OFF. However, when **Pr.495** = "1", the data during an inverter reset (terminal reset or reset request via communication) is not saved.
- When Pr.495 = "10 or 11", the remote output data in the signal before the reset is stored even during an inverter reset.



Signal condition during a reset



* When **Pr.495** = "1", the signal condition saved in EEPROM (condition of the last power OFF) is applied.



- The output terminal to which the REM signal is not assigned by using **Pr.190** to **Pr.196** does not turn ON or OFF when "1 or 0" is set in bit corresponding to each of the terminals by using **Pr.496** and **Pr.497**. (ON/OFF command affects only the terminal to which the REM signal is assigned.)
- When Pr.495 = "1 or 11" (remote output data retained at power OFF), take measures to keep the control circuit power ON, such as connecting terminal R1/L11 with terminal P/+ and connecting terminal S1/L21 with terminal N/-. If the control power is not retained, the output signal after the inverter power turns ON is not guaranteed to work. When the high power factor converter (FR-HC2) or the converter unit (FR-CC2) is connected to the inverter, assign the FR-HC2/FR-CC2 connection, instantaneous power failure detection (X11) signal to an input terminal and input the IPF signal from the FR-HC2/FR-CC2 to the inverter via the terminal to which the X11 signal is assigned.

Parameters referred to

Pr.190 to Pr.196 (Output terminal function selection) 🖙 page 473

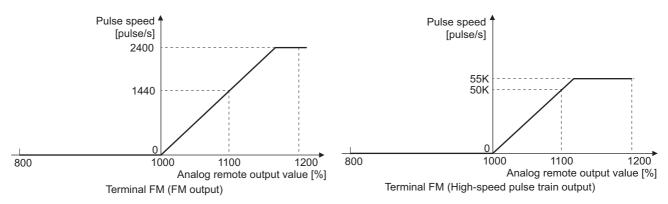
5.11.11 Analog remote output function

An analog value can be output via the analog output terminal on the inverter.

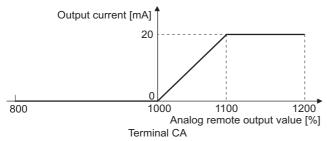
| Pr. | Name | Initial value | Setting range | Description | | |
|-------------|--------------------------------|----------------------------------|-----------------|---|--|--|
| | | | 0 | Remote output data is cleared when the inverter power is turned OFF. | Remote output data is cleared | |
| 655 | Analog remote output | 0 | 1 | Remote output data is retained even after the inverter power is turned OFF. | during an inverter reset. | |
| M530 | selection | U | 10 | Remote output data is cleared when the inverter power is turned OFF. | Remote output data is retained during an inverter | |
| | | | 11 | Remote output data is retained even after the inverter power is turned OFF. | reset. | |
| 656 M531 | Analog remote output 1 | 1000% | 800 to 1200% | Value output via the terminal for which "87" is set in the terminal function selection parameter (Pr.54 or Pr.158) | | |
| 657 M532 | Analog remote output 2 1000% | | 800 to 1200% | Value output via the terminal for which "88" is set in the terminal function selection parameter (Pr.54 or Pr.158) | Set the analog value outputted via terminal FM or CA, via terminal AM, and via the | |
| 658 M533 | Analog remote output 3 1000% | | 800 to 1200% | Value output via the terminal for which "89" analog output terminal set in the terminal function selection parameter (Pr.54 or Pr.158) | | |
| 659 M534 | Analog remote output 4 | Analog remote output 4 1000% 800 | | Value output via the terminal for which "90" is set in the terminal function selection parameter (Pr.54 or Pr.158) | | |

◆ Analog remote output (Pr.656 to Pr.659)

- The analog signal of the value set in **Pr.656 to Pr.659 (Analog remote output)** can be output via terminal FM or CA, terminal AM and the analog output terminal on the option FR-A8AY.
- When **Pr.54 FM/CA terminal function selection** = "87, 88, 89, or 90" (Remote output value), the type FM inverter can output a pulse train via terminal FM.
- For FM output (when Pr.291 Pulse train I/O selection = "0 (initial value) or 1"):
 Terminal FM output [pulses/s] = 1440 [Hz] × (Analog remote output value 1000)/100
 Where the output range is 0 to 2400 pulses/s.
- For high-speed pulse output (when Pr.291 Pulse train I/O selection = "10, 11, 20, or 21"):
 Terminal FM output [pulses/s] = 50k [Hz] × (Analog remote output value 1000)/100
 Where the output range is 0 to 55k pulses/s.

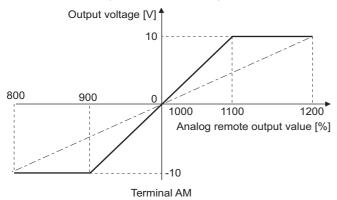


- When **Pr.54 FM/CA terminal function selection** = "87, 88, 89, or 90" (remote output), the type CA inverter can output any analog current via terminal CA.
- Terminal CA output [mA] = 20 [mA] × (Analog remote output value 1000)/100
 Where the output range is 0 to 20 mA.



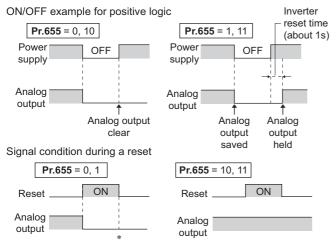
- When Pr.158 AM terminal function selection = "87, 88, 89, or 90", an analog voltage can be output via terminal AM.
- Terminal AM output [V] = 10 [V] × (Analog remote output value 1000)/100

The output range is -10 to +10 V regardless of the Pr.290 Monitor negative output selection setting.



◆ Analog remote output data retention (Pr.655)

- When the power supply is reset (including a power failure) while **Pr.655 Analog remote output selection** = "0" (initial value) or 10" and, the remote analog output (**Pr.656 to Pr.659**) returns to its initial value (1000%).
- When Pr.655 = "1 or 11", the remote output data is stored in EEPROM before the inverter power is turned OFF. This means
 that the signal output setting after power restoration is the same as that before the power was turned OFF. However, when
 Pr.655 = "1", the data during an inverter reset (terminal reset or reset request via communication) is not saved.
- When **Pr.655** = "10 or 11", the remote output data in the signal before the reset is stored even during an inverter reset.
- When the setting in Pr.655 is changed, the remote analog output (Pr.656 to Pr.659) returns to its initial value (1000%).



* When **Pr.655** = "1", the signal condition saved in EEPROM (condition of the last power OFF) is applied.



• When **Pr.655** = "1 or 11" (remote output data retained at power OFF), take measures to keep the control circuit power ON, such as connecting terminal R1/L11 with terminal P/+ and connecting terminal S1/L21 with terminal N/- (while power is supplied via input terminals R/L1, S/L2 and T/L3). If the control power is not retained, the output signal after the inverter power turns ON is not guaranteed to work. When connecting the high power factor converter FR-HC2, assign the instantaneous power failure detection (X11) signal to an input terminal to input the IPF signal from the FR-HC2 to the terminal for X11 signal.

Parameters referred to

Pr.54 FM/CA terminal function selection ☐ page 457
Pr.158 AM terminal function selection ☐ page 457
Pr.290 Monitor negative output selection ☐ page 457
Pr.291 Pulse train I/O selection ☐ page 457

5.11.12 Fault code output selection

When a fault occurs, the corresponding data can be output as a 4-bit digital signal using via an open collector output terminal. The fault code can be read using an input module of programmable controller, etc.

| Pr. | Name | Initial value | Setting range | Description |
|------------|-----------------------------|---------------|---------------|---|
| 76 | | | 0 | Without fault code output |
| 76 M510 | Fault code output selection | 0 | 1 | With fault code output |
| MISTU | | | 2 | Fault code is output only when a fault occurs |

- Fault codes can be output to the output terminals by setting Pr.76 Fault code output selection = "1 or 2".
- When the setting is "2", a fault code is only output when a fault occurs. In normal operation the terminal outputs the signal assigned in **Pr.191 to Pr.194 (Output terminal function selection)**.
- The fault codes that can be output are shown in the following table. (0: Output transistor OFF, 1: Output transistor ON)

| Operation panel | | Output terminal operation | | | | |
|--------------------------------|----|---------------------------|----|----|------------|--|
| indication (FR-DU08) | SU | IPF | OL | FU | Fault code | |
| Normal*1 | 0 | 0 | 0 | 0 | 0 | |
| E.OC1 | 0 | 0 | 0 | 1 | 1 | |
| E.OC2 | 0 | 0 | 1 | 0 | 2 | |
| E.OC3 | 0 | 0 | 1 | 1 | 3 | |
| E.OV1 to E.OV3 | 0 | 1 | 0 | 0 | 4 | |
| E.THM | 0 | 1 | 0 | 1 | 5 | |
| E.THT | 0 | 1 | 1 | 0 | 6 | |
| E.IPF | 0 | 1 | 1 | 1 | 7 | |
| E.UVT | 1 | 0 | 0 | 0 | 8 | |
| E.FIN | 1 | 0 | 0 | 1 | 9 | |
| E.BE | 1 | 0 | 1 | 0 | Α | |
| E. GF | 1 | 0 | 1 | 1 | В | |
| E.OHT | 1 | 1 | 0 | 0 | С | |
| E.OLT | 1 | 1 | 0 | 1 | D | |
| E.OPT, E.OP1 to E.OP3 | 1 | 1 | 1 | 0 | Е | |
| Terminals other than the above | 1 | 1 | 1 | 1 | F | |

^{*1} When Pr.76 = "2", the terminal outputs the signal assigned by Pr.191 to Pr.194.



• If an error occurs while Pr.76 ≠ "0", the output terminals SU, IPF, OL, and FU output the signals in the table above regardless of the settings in Pr.191 to Pr.194 (Output terminal function selection). Take caution when controlling the inverter with the output signals set by Pr.191 to Pr.194.

Parameters referred to

Pr.190 to Pr.196 (Output terminal function selection) 🖙 page 473

5.11.13 Pulse train output to announce cumulative output energy

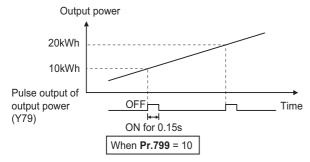
Every time when the output energy cumulated from the time at power ON or at an inverter reset or when the setting of **Pr.799 Pulse increment setting for output power** has been changed increments by the set value, the Pulse train output of output power (Y79) signal is output in pulses.

| Pr. | Name | Initial value | Setting range | Description |
|-------------|--|---------------|------------------|---|
| 799 M520 | Pulse increment setting for output power | 1 kWh | 10 kWh, 100 kWh, | The Pulse train output of output power (Y79) signal is output in pulses every time when the output energy increments by the set amount of energy (kWh). |

◆ Pulse increment setting for output power (Y79 signal, Pr.799)

• Every time when the output energy cumulated from the time at power ON or at an inverter reset increments by the set value of **Pr.799 Pulse increment setting for output power**, the Pulse train output of output power (Y79) signal is output in pulses.

- The inverter does not stop cumulating (can continue to cumulate) the output energy even if the retry function or the
 automatic restart after instantaneous power failure function works because the cause of the function activation is a mini
 power failure which is too short to cause an inverter reset.
- · If a power failure occurs, the cumulative value is reset to 0 kWh and restart cumulating.
- To use the Y79 signal, set "79 (positive logic) or 179 (negative logic)" in any of **Pr.190 to Pr.196 (Output terminal function selection)** to assign the function to the output terminal.



NOTE

- Because the accumulated data in the inverter is cleared when control power is lost by power failure or at an inverter reset, the value on the monitor cannot be used to charge electricity bill.
- Changing the terminal assignment using Pr.190 to Pr.196 (Output terminal function selection) may affect the other functions. Set parameters after confirming the function of each terminal. (Refer to page 473.)
- Do not assign the signal to terminal ABC1 or terminal ABC2 whose pulse outputs are frequently turned ON/OFF. Otherwise, the life of the relay contact may be shortened.

Parameters referred to

Pr.190 to Pr.196 (Output terminal function selection) page 473

5.11.14 Detection of control circuit temperature

The temperature of the control circuit board can be monitored, and a signal can be output according to a predetermined temperature setting.

| Pr. | Name | Initial value | Setting range | Description |
|-------------|---|---------------|---------------|---|
| 663 M060 | Control circuit temperature signal output level | 0°C | 0 to 100°C | Set the temperature where the Y207 signal turns ON. |

◆ Control circuit temperature monitoring

- The temperature of the control circuit board can be monitored within the range of 0 to 100°C on the operation panel, or via terminal FM/CA, or terminal AM. Refer to page 446 for information on how to select the monitor item.
- When **Pr.290 Monitor negative output selection** is set to enable display of the negative numbers for monitoring on the operation panel or via terminal AM, the range of monitoring is -20 to 100°C.
- The monitor value is a rough approximation of the change in the surrounding air temperature of the inverter. Use this parameter to grasp the operating environment of the inverter.

◆ Control circuit temperature detection (Pr.663, Y207 signal)

- The Y207 signal can be output when the control circuit temperature reaches the Pr.663 setting or higher.
- To use the Y207 signal, set "207 (positive logic) or 307 (negative logic)" in any of **Pr.190 to Pr.196 (Output terminal function selection)** to assign the function to the output terminal.



- The Y207 signal is turned OFF when the control circuit temperature becomes 5°C or more lower than the Pr.663 setting.
- Changing the terminal assignment using Pr.190 to Pr.196 (Output terminal function selection) may affect the other functions. Set parameters after confirming the function of each terminal.

Parameters referred to

Pr.54 FM/CA terminal function selection page 457
Pr.158 AM terminal function selection page 457
Pr.190 to Pr.196 (Output terminal function selection) page 473
Pr.290 Monitor negative output selection page 457

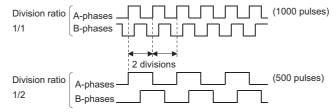
5.11.15 Encoder pulse dividing output

The encoder pulse signal at the motor end can be divided in division ratio set in the parameter and be output.

Use this parameter to make the response of the machine to be input slower, etc. The FR-A8AL or the FR-A8TP is required to be installed.

| Pr. | Name | Initial value | Setting range | Description | |
|---------------------------|--|---------------|---------------|--|--|
| 413 M601 ^{*1} | Encoder pulse division ratio | 1 | 1 to 32767 | Set a numerical value by which nulses are divided | |
| 863 M600 ^{*2} | Control terminal option- Encoder pulse division ratio | 1 | 1 10 32101 | Set a numerical value by which pulses are divided. | |

- *1 This parameter is available when the FR-A8AL (option) is installed.
- *2 This parameter is available when the FR-A8TP (option) is installed.
- Division waveform by division ratio
 Both ON-OFF width is division times (50% duty).
- Pulse waveform example at 1000 pulse input when Pr.413 or Pr.863 = "2"





Control of motor rotation (forward or reverse) by phase difference between A phase and B phase is as follows.
 When A phase is 90° advanced as compared to B phase: Forward rotation
 When A phase is 90° behind as compared to B phase: Reverse rotation

5.12 (T) Multi-function input terminal parameters

| Purpose | Para | meter to set | | Refer to page |
|---|--|---|--|---------------|
| To inverse the rotation direction with the voltage/current analog input selection (terminals 1, 2, and 4) | Analog input selection | P.T000, P.T001 | Pr.73, Pr.267 | 496 |
| To assign functions to analog input terminals | Terminal 1 and terminal 4 function assignment | P.T010, P.T040 | Pr.858, Pr.868 | 500 |
| To adjust the main speed by the analog auxiliary input | Analog auxiliary input and compensation (addition compensation and override functions) | P.T000, P.T021, P.T041, P.T050, P.T051 | Pr.73, Pr.242, Pr.243, Pr.252, Pr.253 | 501 |
| To eliminate noise on analog inputs | Analog input filter | P.T002 to P.T007 | Pr.74, Pr.822, Pr.826, Pr.832, Pr.836, Pr.849 | 503 |
| To adjust analog input frequency/voltage (current) (calibration) | Frequency setting voltage (current) bias and gain | P.T100 to P.T103, P.T200 to P.T203, P.T400 to P.T403, P.M043 | Pr.125, Pr.126, Pr.241, C2 to C7 (Pr.902 to Pr.905), C12 to C15 (Pr.917 to Pr.918) | 505 |
| To adjust analog input torque/voltage (current) (calibration) | Torque setting voltage (current) bias and gain | P.T110 to P.T113, P.T410 to P.T413, P.M043 | Pr.241, C16 to C19 (Pr.919 to Pr.920), C38 to C41 (Pr.932 to Pr.933) | 510 |
| To continue operating at analog current input loss | 4 mA input check | P.T052 to P.T054 | Pr.573, Pr.777, Pr.778 | 517 |
| To assign functions to input terminals | Input terminal function selection | P.T700 to P.T711, P.T740 | Pr.178 to Pr.189, Pr.699 | 521 |
| | Output stop (MRS) signal input selection | P.T720 | Pr.17 | 524 |
| To change the input specification (NO/NC contact) of input signals | Inverter run enable (X10) signal input selection | P.T721 | Pr.599 | 727 |
| | Power failure stop external (X48) signal input selection | P.T722 | Pr.606 | 642 |
| To enable the second function only during the constant speed | RT signal function validity condition selection | | Pr.155 | 525 |
| To assign start and forward/reverse commands to different signals | Start signal (STF/STR) operation selection | P.G106 | Pr.250 | 722 |

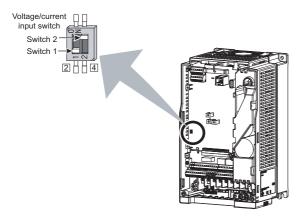
5.12.1 **Analog input selection**

The functions to switch the analog input terminal specifications, override function, forward/reverse rotation by the input signal polarity are selectable.

| Pr. | Name | Initial value | Setting range | | Description |
|-----------------------------|------------------|-------------------|---------------------|--|--|
| 73 | 73 | | 0 to 5, 10 to 15 | Switch 1 - OFF (initial status) | The terminal 2 input specification (0 to 5 V, 0 to 10 V, 0 to 20 mA) and terminal 1 input specification (0 |
| T000 Analog input selection | 1 | 6 to 7, 16, 17 | Switch 1 - ON | to ±5 V, 0 to ±10 V) are selectable. Also the override and reversible operation settings are selectable. | |
| 267 | Terminal 4 input | 0 | 0 | Switch 2 - ON (initial status) | Terminal 4 input, 4 to 20 mA |
| T001 selection | 0 1 | 1 | Switch 2 - OFF | Terminal 4 input, 0 to 5 V | |
| | | | 2 | SWILCTI Z - OFF | Terminal 4 input, 0 to 10 V |

◆ Analog input specification selection

• For terminals 2 and 4 used for analog input, the voltage input (0 to 5 V, 0 to 10 V) and current input (0 to 20 mA) are selectable. To change the input specification, change the setting of **Pr.73 (Pr.267)** and the voltage/current input selection switch (switch 1 or switch 2).



| Switch state Input sp | | Input specification | Input terminal | Rated specification |
|-----------------------|-----|--------------------------------|-------------------|---|
| Switch 1 | ON | Current input | Terminal 2 | For voltage input, the input resistance is $10\pm1~k\Omega$ and the |
| SWILCH | OFF | Voltage input (initial status) | | maximum permissible voltage is 20 VDC. |
| Switch 2 | ON | Current input (initial status) | Ti 1 1 | For current input, the input resistance is 245±5 Ω and the |
| SWILCH 2 | OFF | Voltage input | | maximum permissible current is 30 mA. |

- · Change the setting of the voltage/current input selection switch to change the rated specification of terminal 2 or 4.
- Set **Pr.73** (**Pr.267**) and the voltage/current input selection switch according to the analog signal input. The incorrect settings shown in the following table cause a failure. The inverter does not operate properly with other incorrect settings.

| Setting causing a failure | | Operation | |
|---------------------------|----------------|--|--|
| Switch setting | Terminal input | Operation | |
| ON (Current input) | Voltage input | Causes an analog signal output circuit failure in an external device (due to increased loads on the signal output circuit of the external device). | |
| OFF (Voltage input) | Current input | Causes an input circuit failure in the inverter (due to an increased output power in the analog signal output circuit of an external device). | |

MOTE

• Check the number of the voltage/current input selection switch before setting, because it is different from the switch number indicated on the FR-A700 series inverter.

Set Pr.73 and the voltage/current input selection switch according to the following table.

| Pr.73 setting | Terminal 2 input | Switch 1 | Terminal 1 input | Compensation input terminal compensation method | Reversible polarity |
|-------------------|-------------------------|----------|-------------------------|---|--|
| 0 | 0 to 10 V ^{*1} | OFF | 0 to ±10 V | | |
| 1 (initial value) | 0 to 5 V*1 | OFF | 0 to ±10 V | Terminal 1 addition | |
| 2 | 0 to 10 V ^{*1} | OFF | 0 to ±5 V | compensation | |
| 3 | 0 to 5 V ^{*1} | OFF | 0 to ±5 V | | Not applied (state in which a negative |
| 4 | 0 to 10 V | OFF | 0 to ±10 V*1 | Terminal 2 override | polarity frequency command signal is not accepted) |
| 5 | 0 to 5 V | OFF | 0 to ±5 V ^{*1} | Terminal 2 override | . , |
| 6 | 0 to 20 mA*1 | ON | 0 to ±10 V | | |
| 7 | 0 to 20 mA*1 | ON | 0 to ±5 V | | |
| 10 | 0 to 10 V ^{*1} | OFF | 0 to ±10 V | Terminal 1 addition | |
| 11 | 0 to 5 V*1 | OFF | 0 to ±10 V | compensation | |
| 12 | 0 to 10 V*1 | OFF | 0 to ±5 V | | |
| 13 | 0 to 5 V ^{*1} | OFF | 0 to ±5 V | | Analiad |
| 14 | 0 to 10 V | OFF | 0 to ±10 V*1 | Tamainal O avamida | Applied |
| 15 | 0 to 5 V | OFF | 0 to ±5 V*1 | Terminal 2 override | |
| 16 | 0 to 20 mA*1 | ON | 0 to ±10 V | Terminal 1 addition | |
| 17 | 0 to 20 mA*1 | ON | 0 to ±5 V | compensation | |

^{*1} The main speed setting is indicated.

- When the Terminal 4 input selection (AU) signal is turned ON, terminal 4 is used to set the main speed. In this case, terminals 1 and 2 are not used to set the main speed.
- Set Pr.267 and the voltage/current input selection switch according to the following table.

| Pr.267 setting | Terminal 4 input | Switch 2 |
|-------------------|------------------|----------|
| 0 (initial value) | 4 to 20 mA | ON |
| 1 | 0 to 5 V | OFF |
| 2 | 0 to 10 V | OFF |

• NOTE

- To enable terminal 4, turn ON the AU signal.
- Set the parameters and the switch settings so that they agree. Incorrect setting may cause a fault, failure, or malfunction.
- The frequency setting auxiliary input through terminal 1 is added to the main speed setting signal input through terminal 2 or 4.
- When the override setting is selected, terminal 1 or 4 is set to the main speed setting, and terminal 2 is set to the override signal (0 to 5 V or 0 to 10 V, and 50% to 150%). (If the main speed signal is not input through terminal 1 or 4, the compensation by terminal 2 is disabled.)
- Use Pr.125 (Pr.126) (frequency setting gain) to change the maximum output frequency at the input of the maximum output frequency command voltage (current). At this time, the command voltage (current) need not be input. Also, the acceleration/ deceleration time, which is a slope up/down to the acceleration/deceleration reference frequency, is not affected by the change in Pr.73 setting.
- When "4" is set in Pr.858 Terminal 4 function assignment (Pr.868 Terminal 1 function assignment), the stall prevention
 operation level is input through terminal 1 (4). To input frequency through terminal 1 (4), set "0 (initial value)" in Pr.858 (Pr.868).
- Always calibrate the input after changing the voltage/current input signal with **Pr.73** (**Pr.267**) and the voltage/current input selection switch.
- When Pr.561 PTC thermistor protection level ≠ "9999", terminal 2 is not used for the analog frequency command.

◆ Running with analog input voltage

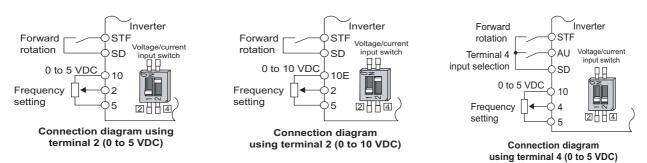
• For the frequency setting signal, input 0 to 5 VDC (or 0 to 10 VDC) between terminals 2 and 5. The 5 V (10 V) input is the maximum output frequency.

• The power supply 5 V (10 V) can be input by either using the internal power supply or preparing an external power supply.

The internal power supply is 5 VDC output between terminals 10 and 5, and 10 VDC output between terminals 10E and 5.

| Terminal | Inverter internal power source voltage | Frequency setting resolution | Pr.73 (terminal 2 input voltage) |
|----------|--|------------------------------|----------------------------------|
| 10 | 5 VDC | 0.030/60 Hz | 0 to 5 VDC input |
| 10E | 10 VDC | 0.015/60 Hz | 0 to 10 VDC input |

- To supply the 10 VDC input to terminal 2, set "0, 2, 4, 10, 12, or 14" in Pr.73. (The initial value is 0 to 5 V.)
- Set "1 (0 to 5 VDC)" or "2 (0 to 10 VDC)" in **Pr.267** and turn OFF the voltage/current input selection switch to input voltage through terminal 4. Turning ON the AU signal activates the terminal 4 input.

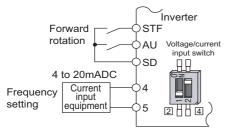




• The wiring length of terminal 10, 2, and 5 should be 30 m at maximum.

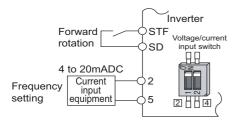
◆ Running with analog input current

- For constant pressure or temperature control with fans, pumps, or other devices, automatic operation is available by setting the regulator output signal 4 to 20 mADC to between terminals 4 and 5.
- To use terminal 4, the AU signal needs to be turned ON.



Connection diagram using terminal 4 (4 to 20mADC)

• Set "6, 7, 16, or 17" in **Pr.73** and turn ON the voltage/current input selection switch to input current through terminal 2. In this case, the AU signal does not need to be turned ON.

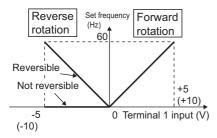


Connection diagram using terminal 2 (4 to 20mADC)

Performing forward/reverse rotation with the analog input (polarity reversible operation)

• Setting "10 to 17" in Pr.73 enables the polarity reversible operation.

• Set a positive or negative input (0 to ±5 V or 0 to ±10 V) to terminal 1 to allow the operation of forward/reverse rotation according to the polarity of the input value.



Compensation input characteristics when STF is ON

Parameters referred to

Pr.22 Stall prevention operation level page 431

Pr.125 Terminal 2 frequency setting gain frequency, Pr.126 Terminal 4 frequency setting gain frequency 🖙 page 505

Pr.252, Pr.253 Override bias/gain ☐ page 501 Pr.561 PTC thermistor protection level ☐ page 415

Pr.858 Terminal 4 function assignment, Pr.868 Terminal 1 function assignment ☐ page 500

Analog input terminal (terminal 1, 4) function assignment

The analog input terminal 1 and terminal 4 functions are set and changeable with parameters.

| Pr. | Name | Initial value | Setting range | Description |
|-------------|--------------------------------|---------------|---------------|---------------------------------|
| 868 T010 | Terminal 1 function assignment | 0 | 0 to 6, 9999 | Select the terminal 1 function. |
| 858 T040 | Terminal 4 function assignment | 0 | 0, 1, 4, 9999 | Select the terminal 4 function. |

- · For terminals 1 and 4 used for analog input, the frequency (speed) command, magnetic flux command, torque command, and other similar commands are usable. The functions available are different depending on the control method and control mode as shown in the following table. (For details on the control methods, refer to page 221.)
- · Functions of terminal 1 under different control modes

| Pr.868 setting | V/F control, Advanced magnetic flux vector control | Real sensorless vector control, Vector control, PM sensorless vector control | | | |
|-------------------|--|--|---|--|--|
| | | Speed control | Torque control | Position control | |
| 0 (initial value) | Auxiliary frequency setting | Auxiliary speed setting | Auxiliary speed limit | _ | |
| 1 | _ | Magnetic flux command*1 | Magnetic flux command*1 | Magnetic flux command*1 | |
| 2 | _ | Regenerative torque limit (Pr.810 = "1") | _ | Regenerative torque limit (Pr.810 = "1") | |
| 3 | _ | _ | Torque command (Pr.804 = "0") | _ | |
| 4 | Stall prevention operation level input | Torque limit (Pr.810 = "1") | Torque command (Pr.804 = "0") | Torque limit (Pr.810 = "1") | |
| 5 | _ | _ | Forward/reverse rotation speed limit (Pr.807 = "2") | _ | |
| 6 | _ | Torque bias input (Pr.840 = "1, 2, or 3") | _ | _ | |
| 9999 | _ | _ | _ | _ | |

· Functions of terminal 4 under different control modes

| Pr.858 setting | V/F control, Advanced magnetic flux vector control | Real sensorless vector control, Vector control, PM sensorless vector control | | | |
|-------------------|--|--|----------------------------|---|--|
| | | Speed control | Torque control | Position control | |
| 0 (initial value) | Frequency command (AU signal-ON) | Speed command (AU signal-ON) | Speed limit (AU signal-ON) | _ | |
| 1 | _ | Magnetic flux command *1*2 | Magnetic flux command *1*2 | Magnetic flux command *1*2 | |
| 4 | Stall prevention operation level input | Torque limit (Pr.810 = "1") ^{*3} | _ | Torque limit (Pr.810 = "1") ^{*3} | |
| 9999 | _ | _ | _ | — | |

-: No function

- *1 This function is valid under Vector control.
- *2 Invalid when Pr.868 = "1".
- *3 Invalid when Pr.868 = "4".



• When **Pr.868** = "1" (magnetic flux command) or "4" (stall prevention / torque limit), the terminal 4 function is enabled regardless of the ON/OFF state of the AU signal.

Parameters referred to

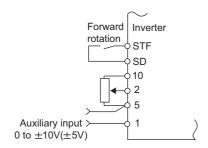
Advanced magnetic flux vector control page 228
Real sensorless vector control page 221
Pr.804 Torque command source selection page 283
Pr.807 Speed limit selection page 287
Pr.810 Torque limit input method selection page 245
Pr.840 Torque bias selection page 265

5.12.3 Analog input compensation

The analog input for multi-speed operation or speed setting (main speed) through terminal 2 or 4 can be compensated by adding an input, or terminal 2 can be used for an auxiliary input to compensate the analog input at a fixed ratio using the override function.

| Pr. | Name | Initial value | Setting range | Description |
|-------------|---|---------------|--------------------------------|---|
| 73 | Analog input selection | 1 | 0 to 3, 6, 7, 10 to 13, 16, 17 | Compensation by addition |
| T000 | Alialog iliput selection | | 4, 5, 14, 15 | Compensation using the override function |
| 242 T021 | Terminal 1 added compensation amount (terminal 2) | 100% | 0 to 100% | Set the percentage of addition when terminal 2 is used to set the main speed. |
| 243 T041 | Terminal 1 added compensation amount (terminal 4) | 75% | 0 to 100% | Set the percentage of addition when terminal 4 is used to set the main speed. |
| 252 T050 | Override bias | 50% | 0 to 200% | Set bias compensation for the override function. |
| 253 T051 | Override gain | 150% | 0 to 200% | Set gain compensation for the override function. |

◆ Compensation by addition (Pr.242, Pr.243)



Example of addition compensation connection

- A compensation signal can be added to the main speed setting for such as synchronous or continuous speed control
 operation.
- Set "0 to 3, 6, 7, 10 to 13, 16, or 17" in **Pr.73** to add the voltage determined by the terminal 1 input when the main speed setting is input through terminal 2.
- When a negative voltage obtained from the addition, it is regarded as 0 and the operation is stopped when **Pr.73** = "0 to 3, 6, or 7", and the operation is reversed (polarity reversible operation) after the STF signal is turned ON when **Pr.73** = "10 to 13, 16, or 17".
- The terminal 1 compensation input can be added to the multi-speed setting or terminal 4 (initial value: 4 to 20 mA).

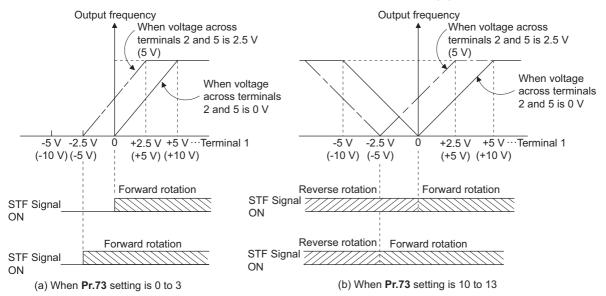
• The degree of addition to terminal 2 is adjustable with **Pr.242** and the degree of addition to terminal 4 is adjustable with **Pr.243**.

Analog command value with use of terminal 2 = terminal 2 input + terminal 1 input × Pr.242

100(%)

Analog command value with use of terminal 4= terminal 4 input + terminal 1 input × Pr.243

100(%)

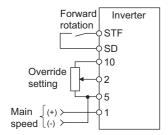


Auxiliary input characteristics



• After changing the **Pr.73** setting, check the setting of the voltage/current input selection switch. Incorrect setting may cause a fault, failure, or malfunction. (Refer to page 496 for the setting.)

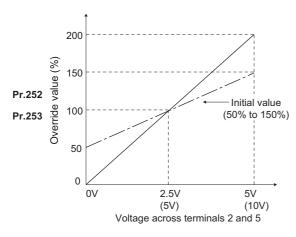
◆ Override function (Pr.252, Pr.253)



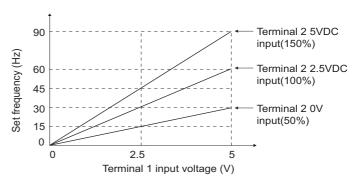
Connection example for the override function

- Use the override function to make the main speed changed at a specified rate.
- Set "4, 5, 14, or 15" in Pr.73 to select the override function.
- When the override function is selected, terminal 1 or 4 is used for the main speed setting, and terminal 2 is used for the override signal. (If the main speed signal is not input through terminal 1 or 4, the compensation by terminal 2 is disabled.)
- Specify the scope of override by using Pr.252 and Pr.253.
- How to calculate the set frequency when the override function is used:
 Main speed setting frequency (Hz): Terminals 1 or 4 input, multi-speed setting
 Compensation (%): Terminal 2 input

Set frequency (Hz) = Main speed setting frequency (Hz) × $\frac{\text{Compensation (\%)}}{100(\%)}$



Example) When Pr.73 = "5"
 By the terminal 1 (main speed) and terminal 2 (auxiliary) input, the setting frequency is set as shown in the figure below.



NOTE

- To use terminal 4, the AU signal needs to be turned ON.
- To make compensation input for multi-speed operation or remote setting, set **Pr.28 Multi-speed input compensation** selection = "1" (with compensation) (initial value "0").
- After changing the **Pr.73** setting, check the setting of the voltage/current input selection switch. Incorrect setting may cause a fault, failure, or malfunction. (Refer to page 496 for the setting.)

Parameters referred to

Pr.28 Multi-speed input compensation selection 🖙 page 411

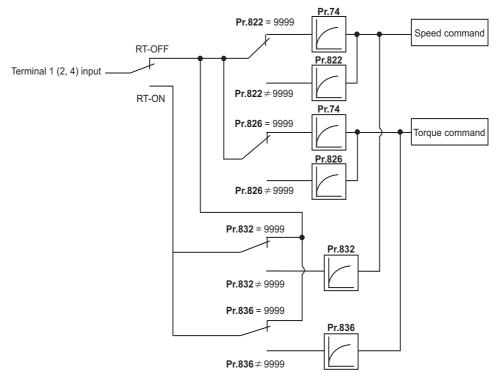
Pr.73 Analog input selection page 496

5.12.4 Response level of analog input and noise elimination

The response level and stability of frequency command/torque command using the analog input signal (terminal 1, 2, or 4) can be adjusted.

| Pr. | Name | Initial value | Setting range | Description |
|-----------------------|--------------------------------|---------------|----------------|--|
| 74 T002 | Input filter time constant | 1 | 0 to 8 | Set the primary delay filter time constant to the analog input command. If the setting is too large, response becomes slow. |
| 822 T003 Speed set | Speed setting filter 1 | 9999 | 0 to 5 s | Set the primary delay filter time constant to the external speed command (analog input command). |
| | | | 9999 | As set in Pr.74 . |
| 826 T004 | Torque setting filter 1 | 9999 | 0 to 5 s | Set the primary delay filter time constant to the external torque command (analog input command). |
| | | | 9999 | As set in Pr.74 . |
| 832 T005 | Speed setting filter 2 | 9999 | 0 to 5 s, 9999 | Second function of Pr.822 (enabled when the RT signal is ON) |
| 836 T006 | Torque setting filter 2 | 9999 | 0 to 5 s, 9999 | Second function of Pr.826 (enabled when the RT signal is ON) |
| 849 T007 | Analog input offset adjustment | 100% | 0 to 200% | Set offset for the analog speed input (terminal 2). The motor is prevented from rotating due to noise in the analog input or other factors when a zero speed command is given. |

Block diagram



◆ Analog input time constant (Pr.74)

- Use this parameter to eliminate noise on the frequency setting circuit.
- Increase the filter time constant if the operation is unstable due to noise or other factors.
 If the setting is too large, response becomes slow. (The time constant can be between 0 and 8, which are about 2 ms to 1 second.)

◆ Analog speed command input time constant (Pr.822, Pr.832)

- Use Pr.822 Speed setting filter 1 to set the primary delay filter time constant to the external speed command (analog input command). Increase the setting of the time constant to allow delays in follow-up of the speed command or when the analog input voltage is unstable.
- Use Pr.832 Speed setting filter 2 to change the time constant to use one inverter to switch operation between two or more
 motors.
- Pr.832 Speed setting filter 2 is enabled when the RT signal is ON.

◆ Analog torque command input time constant (Pr.826, Pr.836)

- Use Pr.826 Torque setting filter 1 to set the primary delay filter time constant to the external torque command (analog
 input command). Increase the setting of the time constant to allow delays in follow-up of the torque command or when the
 analog input voltage is unstable.
- Use Pr.836 Torque setting filter 2 to change the time constant to use one inverter to switch operation between two or more motors.
- Pr.836 Torque setting filter 2 is enabled when the RT signal is ON.

◆ Analog speed command input offset adjustment (Pr.849)

- Use this parameter to set a range in which the motor is stopped for prevention of incorrect motor operation in a very low speed rotation when the speed command is an analog input.
- The voltage range is offset according to the setting in Pr.849 Analog input offset adjustment, assuming that 100% corresponds to zero.

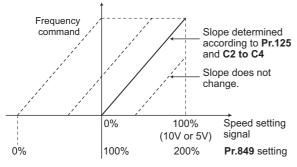
```
100% < Pr.849 ..... Positive side
```

100% > **Pr.849** Negative side

The detailed calculation of the offset voltage is as described below:

Offset voltage [V] = Voltage at the time of 100% (5 V or 10 V^{*1}) × (**Pr.849** - 100) / 100

It depends on the Pr.73 setting



■ NOTE

• The analog input filter is invalid (no filter) during PID control operation.

Parameters referred to

Pr.73 Analog input selection page 496
Pr.125, C2 to C4 (bias and gain of the terminal 2 frequency setting) page 505

Frequency setting voltage (current) bias and gain 5.12.5

The magnitude (slope) of the output frequency can be set as desired in relation to the frequency setting signal (0 to 5 VDC, 0 to 10 VDC, or 4 to 20 mA). Use Pr.73 Analog input selection (Pr.267 Terminal 4 input selection) and the voltage/current input selection switch to switch among input of 0 to 5 VDC, 0 to 10 V, and 4 to 20 mA. (Refer to page 496.)

| Pr. | Name Initial value Setting | | | Description | | |
|---|---|-------|-------|--|--|--|
| FI. | Name | FM | CA | range | | Description |
| C2 (902) T200 ^{*1} | Terminal 2 frequency setting bias frequency | 0 Hz | | 0 to 590 Hz | Set the bias frequency | for the terminal 2 input. |
| C3 (902) T201 ^{*1} | Terminal 2 frequency setting bias | 0% | | 0 to 300% | Set the converted % of 2 input. | the bias voltage (current) for the terminal |
| 125 (903) T202 T022 ^{*1} | Terminal 2 frequency setting gain frequency | 60 Hz | 50 Hz | 0 to 590 Hz | Set the gain (maximum | n) frequency for the terminal 2 input. |
| C4 (903) T203 ^{*1} | Terminal 2 frequency setting gain | 100% | | 0 to 300% | Set the converted % of 2 input. | the gain voltage (current) for the terminal |
| C5 (904) T400 ^{*1} | Terminal 4 frequency setting bias frequency | 0 Hz | | 0 to 590 Hz | Set the bias frequency for the terminal 4 input. | |
| C6 (904) T401 ^{*1} | Terminal 4 frequency setting bias | 20% | | 0 to 300% | Set the converted % of 4 input. | the bias current (voltage) for the terminal |
| 126 (905) T402 T042 ^{*1} | Terminal 4 frequency setting gain frequency | 60 Hz | 50 Hz | 0 to 590 Hz | Set the gain (maximum | n) frequency for the terminal 4 input. |
| C7 (905) T403 ^{*1} | Terminal 4 frequency setting gain | 100% | | 0 to 300% | Set the converted % of the gain current (voltage) for the termina 4 input. | |
| C12 (917) T100 ^{*1} | Terminal 1 bias frequency (speed) | 0 Hz | | 0 to 590 Hz | Set the bias frequency limit) | (speed) for the terminal 1 input. (Speed |
| C13 (917) T101 ^{*1} | Terminal 1 bias (speed) | 0% | | 0 to 300% | Set the converted % of (Speed limit) | f the bias voltage for the terminal 1 input. |
| C14 (918) T102 ^{*1} | Terminal 1 gain frequency (speed) | 60 Hz | 50 Hz | Set the gain (maximum) frequency (speed) for the termin input. (Speed limit) | | n) frequency (speed) for the terminal 1 |
| C15 (918) T103 ^{*1} | Terminal 1 gain (speed) | 100% | | 0 to 300% | Set the converted % of (Speed limit) | the gain voltage for the terminal 1 input. |
| 241 | Analog input display unit | 0 | | 0 | % display | Select the unit for analog input display. |
| M043 | switchover | Ü | | 1 | V/mA display | ocioci the unit for analog input display. |

^{*1} The parameter number in parentheses is the one for use with the LCD operation panel and the parameter unit.

◆ Relationship between the analog input terminal function and the calibration parameter

· Calibration parameter according to the terminal 1 function

| Pr.868 | Terminal function | Calibration | Calibration parameter | | | | |
|----------------------|---|--|--|--|--|--|--|
| setting | Terminal function | Bias setting | Gain setting | | | | |
| 0 (initial value) | Auxiliary frequency (speed) setting | C2 (Pr.902) Terminal 2 frequency setting bias frequency, C3 (Pr.902) Terminal 2 frequency setting bias, C5 (Pr.904) Terminal 4 frequency setting bias frequency, C6 (Pr.904) Terminal 4 frequency setting bias | Pr.125 Terminal 2 frequency setting gain frequency, C4 (Pr.903) Terminal 2 frequency setting gain, Pr.126 Terminal 4 frequency setting gain frequency, C7 (Pr.905) Terminal 4 frequency setting gain | | | | |
| 1 | Magnetic flux command | C16 (Pr.919) Terminal 1 bias command (torque/magnetic flux), C17 (Pr.919) Terminal 1 bias (torque/magnetic flux) | C18 (Pr.920) Terminal 1 gain command (torque/magnetic flux), C19 (Pr.920) Terminal 1 gain (torque/magnetic flux) | | | | |
| 2 | Regenerative driving torque limit | C16 (Pr.919) Terminal 1 bias command | C18 (Pr.920) Terminal 1 gain command | | | | |
| 3 | Torque command | (torque/magnetic flux), | (torque/magnetic flux), | | | | |
| 4 | Stall prevention operation level*1/ torque limit / torque command | C17 (Pr.919) Terminal 1 bias (torque/ magnetic flux) | C19 (Pr.920) Terminal 1 gain (torque/ magnetic flux) | | | | |
| 5 | Forward/reverse rotation speed limit | C12 (Pr.917) Terminal 1 bias frequency (speed), C13 (Pr.917) Terminal 1 bias (speed) | C14 (Pr.918) Terminal 1 gain frequency (speed), C15 (Pr.918) Terminal 1 gain (speed) | | | | |
| 6 | Torque bias input | C16 (Pr.919) Terminal 1 bias command (torque/magnetic flux), C17 (Pr.919) Terminal 1 bias (torque/magnetic flux) | C18 (Pr.920) Terminal 1 gain command (torque/magnetic flux), C19 (Pr.920) Terminal 1 gain (torque/magnetic flux) | | | | |
| 9999 | No function | _ | _ | | | | |

• Calibration parameter according to the terminal 4 function

| Pr.858 | Terminal function | Calibration parameter | | | | |
|-------------------|--|--|--|--|--|--|
| setting | Terminal function | Bias setting | Gain setting | | | |
| 0 (initial value) | Frequency command | C5 (Pr.904) Terminal 4 frequency setting bias frequency, C6 (Pr.904) Terminal 4 frequency setting bias | Pr.126 Terminal 4 frequency setting gain frequency, C7 (Pr.905) Terminal 4 frequency setting gain | | | |
| 1 | Magnetic flux command | C38 (Pr.932) Terminal 4 bias command (torque/magnetic flux), C39 (Pr.932) Terminal 4 bias (torque/magnetic flux) | C40 (Pr.933) Terminal 4 gain command (torque/magnetic flux), C41 (Pr.933) Terminal 4 gain (torque/magnetic flux) | | | |
| 4 | Stall prevention operation level*1/ torque limit | C38 (Pr.932) Terminal 4 bias command (torque/magnetic flux), C39 (Pr.932) Terminal 4 bias (torque/magnetic flux) | C40 (Pr.933) Terminal 4 gain command (torque/magnetic flux), C41 (Pr.933) Terminal 4 gain (torque/magnetic flux) | | | |
| 9999 | No function | _ | _ | | | |

^{*1} Use Pr.148 Stall prevention level at 0 V input or Pr.149 Stall prevention level at 10 V input to adjust bias or gain for setting the stall prevention

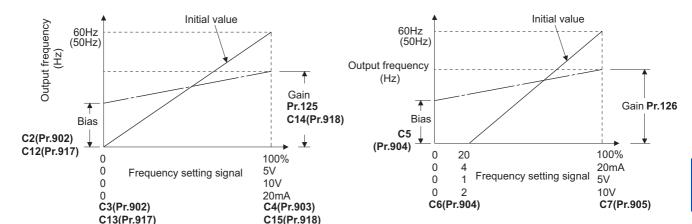
◆ Changing the frequency for the maximum analog input (Pr.125, Pr.126)

• Use Pr.125 (Pr.126) to change the frequency setting (gain) for the maximum analog input voltage (current). (C2 (Pr.902) to C7 (Pr.905) settings do not need to be changed.)

◆ Analog input bias/gain calibration (C2 (Pr.902) to C7 (Pr.905), C12 (Pr.917) to C15 (Pr.918))

- The "bias" and "gain" functions serve to adjust the relationship between a setting input signal and the output frequency. A setting input signal is such as a 0 to 5 VDC, 0 to 10 VDC, or 4 to 20 mADC signal externally input to set the output
- Set the bias frequency of the terminal 2 input using C2 (Pr.902). (It is initially set to the frequency at 0 V.)
- Use Pr.125 to set the output frequency to the frequency command voltage (current) set by Pr.73 Analog input selection.

- Set the bias frequency of the terminal 1 input using C12 (Pr.917). (It is initially set to the frequency at 0 V.)
- Set the gain frequency of the terminal 1 input using C14 (Pr.918). (It is initially set to the frequency at 10 V.)
- Set the bias frequency of the terminal 4 input using C5 (Pr.904). (It is initially set to the frequency at 4 mA.)
- Use Pr.126 to set the output frequency to the 20 mA input of the frequency command current (4 to 20 mA).



There are three methods to adjust the bias/gain frequency setting voltage (current).

Adjustment by applying voltage (current) between terminals 2 and 5 (4 and 5) to set the voltage (current) at the bias/gain frequency. Frage 508

Adjustment by selecting the voltage (current) at the bias/gain frequency without applying voltage (current) between terminals 2 and 5 (4 and 5). Figure 508

Adjustment by changing the frequency without adjusting the voltage (current). 🖙 page 510



- When the slope of the frequency is changed after calibration of terminal 2, the slope of the frequency is also changed for terminal 1.
- When voltage is applied to terminal 1 while calibration of terminal 2 or terminal 4 is in progress, the terminal 1 input value is added to the terminal 2 (4) input value.
- Always calibrate the input after changing the voltage/current input signal with Pr.73 (Pr.267) and the voltage/current input selection switch.

◆ Display unit changing for analog input (Pr.241)

- The analog input display unit (%/V/mA) can be changed for analog input bias/gain calibration.
- Depending on the terminal input specification setting of Pr.73 (Pr.267) and the voltage/current input switch, the unit of the displayed value of C3 (Pr.902), C4 (Pr.903), C6 (Pr.904) and C7 (Pr.905) changes as shown below:

| Analog command (via terminal 2 or 4) (depending on the settings of Pr.73 (Pr.267) and the voltage/current input selection switch) | Pr.241 = "0 (initial value)" | Pr.241 = "1" |
|--|------------------------------|----------------------|
| 0 to 5 V input | 0 to 100% (0.1%) | 0 to 5 V (0.01 V) |
| 0 to 10 V input | 0 to 100% (0.1%) | 0 to 10 V (0.01 V) |
| 0 to 20 mA input | 0 to 100% (0.1%) | 0 to 20 mA (0.01 mA) |

NOTE

When voltage is applied to terminal 1 while the terminal 1 input specification (0 to ±5 V, 0 to ±10 V) does not agree with the main speed (terminal 2 or terminal 4 input) specification (0 to 5 V, 0 to 10 V, 0 to 20 mA), the analog input is not correctly displayed. (For example, when 0 V is applied to terminal 2 and 10 V is applied to terminal 1 in the initial status, the value is indicated as 5 V (100%).)

Set "0 (initial value)" in Pr.241 to use the % display.

◆ Frequency setting voltage (current) bias/gain adjustment method

■ Adjustment by applying voltage (current) between terminals 2 and 5 (4 and 5) to set the voltage (current) at the bias/gain frequency (Example of adjustment at the gain frequency)

Operating procedure

1. Turning ON the power of the inverter The operation panel is in the monitor mode.

2. Changing the operation mode

Press PU to choose the PU operation mode. The [PU] indicator turns ON.

3. Selecting the parameter setting mode

Press Mode to choose the parameter setting mode. (The parameter number read previously appears.)

4. Calibration parameter selection

Turn until "[. . . . " appears. Press set to display "[-- -- -- ".

5. Selecting a parameter

Turn until "[(C4 (Pr.903) Terminal 2 frequency setting gain) appears for terminal 2, or "[(C7 (Pr.905) Terminal 4 frequency setting gain) for terminal 4.

6. Analog voltage (current) display

Press | SET | to display the analog voltage (current) value (%) currently applied to terminal 2 (4).

Do not touch until calibration is completed.

7. Voltage (current) application

Apply a 5 V (20 mA). (Turn the external potentiometer connected between terminals 2 and 5 (terminals 4 and 5) to a desired position.)

8. Setting completed

- Turn to read another parameter.
- Press SET to return to the "[-- -- -- " display.
- Press | SET | twice to show the next parameter.
- Adjustment by selecting the voltage (current) at the bias/gain frequency without applying voltage (current) between terminals 2 and 5 (4 and 5) (Example of adjustment at the gain frequency)

Operating procedure

1. Turning ON the power of the inverter The operation panel is in the monitor mode.

2. Changing the operation mode

Press PU to choose the PU operation mode. The [PU] indicator turns ON.

3. Selecting the parameter setting mode

Press Mode to choose the parameter setting mode. (The parameter number read previously appears.)

4. Calibration parameter selection

Turn until "[. . . . " appears. Press set to display "[----".

5. Selecting a parameter

Turn until "['4" (C4 (Pr.903) Terminal 2 frequency setting gain) appears for terminal 2, or "['7" (C7 (Pr.905) Terminal 4 frequency setting gain) for terminal 4.

6. Analog voltage (current) display

Press SET to display the analog voltage (current) value (%) currently applied to terminal 2 (4).

7. Analog voltage (current) adjustment

When is turned, the gain voltage (current) value (%) currently set to the parameter appears.

Turn until the desired gain voltage (current) value (%) appears.

8. Setting completed

- Turn to read another parameter.
- Press SET to return to the "[-- -- -- " display.
- Press | SET | twice to show the next parameter.

■ NOTE

Press after step 6 to check the present bias/gain frequency setting. The setting cannot be checked after step 7.

■ Adjustment by changing the frequency without adjusting the voltage (current) (Example of changing the gain frequency from 60 Hz to 50 Hz)

Operating procedure

1. Selecting the parameter

Turn in until "P. 125" (Pr.125) appears for terminal 2, or "P. 125" (Pr.126) for terminal 4.

Press SET to read the present set value. (60.00 Hz)

2. Changing the maximum frequency

Turn (3) to change the set value to " 5 [] [] ". (50.00 Hz)

Press SET to confirm the selection. "SDDD" and "P. 125 (P. 126)" are displayed alternately.

3. Selecting the mode and the monitor item

Press Model three times to select the monitor mode, and change the monitor item to the frequency.

4. Start

Turn ON the start switch (STF/STR signal), and turn the frequency setting potentiometer clockwise slowly to full. (Refer to steps 2 and 3 in page 157.)

The motor is operated at 50 Hz.

NOTE

- If the frequency meter (display meter) connected between terminal FM and SD (CA and 5) does not indicate exactly 60 Hz, set the calibration parameter C0 FM/CA terminal calibration. (Refer to page 463.)
- If the voltage (current) values at the gain and bias frequencies are too close to each other, an error " = = " may be indicated.
- Changing C4 (Pr.903) or C7 (Pr.905) (gain adjustment) will not change Pr.20.
 Input to terminal 1 (frequency setting auxiliary input) is added to the frequency setting signal.
- For operation outline of the parameter unit (FR-PU07), refer to the Instruction Manual of the FR-PU07.
- To set the value to 120 Hz or higher, the **Pr.18 High speed maximum frequency** needs to be 120 Hz or higher. (Refer to page 428.)
- Use the calibration parameter C2 (Pr.902) or C5 (Pr.904) to set the bias frequency. (Refer to page 506.)

∴CAUTION

• Be cautious when setting any value other than "0" as the bias frequency at 0 V (0 mA). Even if a speed command is not given, simply turning ON the start signal will start the motor at the preset frequency.

Parameters referred to

Pr.1 Maximum frequency, Pr.18 High speed maximum frequency page 428 Pr.20 Acceleration/deceleration reference frequency page 367 Pr.73 Analog input selection, Pr.267 Terminal 4 input selection page 496 Pr.79 Operation mode selection page 389

Pr.858 Terminal 4 function assignment, Pr.868 Terminal 1 function assignment page 500

5.12.6 Torque (magnetic flux) setting voltage (current) bias and gain

Sensorless Vector PM

The magnitude (slope) of the torque can be set as desired in relation to the torque setting signal (0 to 5 VDC, 0 to 10 VDC, or 4 to 20 mA).

Use Pr.73 Analog input selection or Pr.267 Terminal 4 input selection to switch among input 0 to 5 VDC, 0 to 10 V, and 4 to 20 mA. (Refer to page 496.)

| Pr. | Name | Initial value | Setting range | | Description |
|------------------------------------|--|------------------|---------------|---|---|
| C16 (919) T110 ^{*1} | Terminal 1 bias command (torque/ magnetic flux) | 0% | 0 to 400% | Set the bias torquinput. | ue (magnetic flux) for the terminal 1 |
| C17 (919) T111 ^{*1} | Terminal 1 bias (torque/magnetic flux) | 0% | 0 to 300% | Set the converted 1 input. | d % of the bias voltage for the terminal |
| C18 (920) T112 ^{*1} | Terminal 1 gain command (torque/ magnetic flux) | 150% | 0 to 400% | Set the gain (max terminal 1 input. | ximum) torque (magnetic flux) for the |
| C19 (920) T113 ^{*1} | Terminal 1 gain (torque/magnetic flux) | 100% | 0 to 300% | Set the converted 1 input. | d % of the gain voltage for the terminal |
| C38 (932) T410 ^{*1} | Terminal 4 bias command (torque/ magnetic flux) | 0% | 0 to 400% | Set the bias torquinput. | ue (magnetic flux) for the terminal 4 |
| C39 (932) T411 ^{*1} | Terminal 4 bias (torque/magnetic flux) | 20% | 0 to 300% | Set the converted terminal 4 input. | d % of the bias current (voltage) for the |
| C40 (933) T412 ^{*1} | Terminal 4 gain command (torque/ magnetic flux) | 150% | 0 to 400% | Set the gain (maximum) torque (magnetic flux) for the terminal 4 input. | |
| C41 (933) T413 ^{*1} | Terminal 4 gain (torque/magnetic flux) | 100% | 0 to 300% | Set the converted terminal 4 input. | d % of the gain current (voltage) for the |
| 241 M043 | Analog input display unit switchover | 0 | 0 | % display V/mA display | Select the unit for analog input display. |

^{*1} The parameter number in parentheses is the one for use with the LCD operation panel and the parameter unit.

◆ Changing the function of analog input terminal

• In the initial setting, terminal 1 is used for analog input of the auxiliary speed setting (auxiliary speed limit), and terminal 4 is used for the speed command (speed limit). To use the analog input terminal to input the torque command, torque limit, or magnetic flux command, set Pr.868 Terminal 1 function assignment or Pr.858 Terminal 4 function assignment to change the function. (Refer to page 500.) The magnetic flux command is valid under Vector control only.

◆ Relationship between the analog input terminal function and the calibration parameter

· Calibration parameter according to the terminal 1 function

| Pr.868 | Terminal function | Calibration | n parameter |
|----------------------|---|--|--|
| setting | Terminal function | Bias setting | Gain setting |
| 0 (initial value) | Auxiliary Frequency (speed) setting | C2 (Pr.902) Terminal 2 frequency setting bias frequency, C3 (Pr.902) Terminal 2 frequency setting bias, C5 (Pr.904) Terminal 4 frequency setting bias frequency, C6 (Pr.904) Terminal 4 frequency setting bias | Pr.125 Terminal 2 frequency setting gain frequency, C4 (Pr.903) Terminal 2 frequency setting gain, Pr.126 Terminal 4 frequency setting gain frequency, C7 (Pr.905) Terminal 4 frequency setting gain |
| 1 | Magnetic flux command | C16 (Pr.919) Terminal 1 bias command (torque/magnetic flux), C17 (Pr.919) Terminal 1 bias (torque/magnetic flux) | C18 (Pr.920) Terminal 1 gain command (torque/magnetic flux), C19 (Pr.920) Terminal 1 gain (torque/magnetic flux) |
| 2 | Regenerative driving torque limit | 040 (D 040) T | 242 (7 222) 7 |
| 3 | Torque command | C16 (Pr.919) Terminal 1 bias command (torque/magnetic flux). | C18 (Pr.920) Terminal 1 gain command (torque/magnetic flux), |
| 4 | Stall prevention operation level*1/ torque limit / torque command | C17 (Pr.919) Terminal 1 bias (torque/ magnetic flux) | C19 (Pr.920) Terminal 1 gain (torque/ magnetic flux) |
| 5 | Forward/reverse rotation speed limit | C12 (Pr.917) Terminal 1 bias frequency (speed), C13 (Pr.917) Terminal 1 bias (speed) | C14 (Pr.918) Terminal 1 gain frequency (speed), C15 (Pr.918) Terminal 1 gain (speed) |
| 6 | Torque bias input | C16 (Pr.919) Terminal 1 bias command (torque/magnetic flux), C17 (Pr.919) Terminal 1 bias (torque/magnetic flux) | C18 (Pr.920) Terminal 1 gain command (torque/magnetic flux), C19 (Pr.920) Terminal 1 gain (torque/magnetic flux) |
| 9999 | No function | _ | |

^{*1} Use Pr.148 Stall prevention level at 0 V input and Pr.149 Stall prevention level at 10 V input to adjust bias and gain for setting the stall prevention operation level.

Calibration parameter according to the terminal 4 function

| Pr.858 | Terminal function | Calibration parameter | | | | |
|-------------------|--|--|--|--|--|--|
| setting | Terminal function | Bias setting | Gain setting | | | |
| 0 (initial value) | Frequency (speed) command / speed limit | C5 (Pr.904) Terminal 4 frequency setting bias frequency, C6 (Pr.904) Terminal 4 frequency setting bias | Pr.126 Terminal 4 frequency setting gain frequency, C7 (Pr.905) Terminal 4 frequency setting gain | | | |
| 1 | Magnetic flux command | C38 (Pr.932) Terminal 4 bias command (torque/magnetic flux), C39 (Pr.932) Terminal 4 bias (torque/magnetic flux) | C40 (Pr.933) Terminal 4 gain command (torque/magnetic flux), C41 (Pr.933) Terminal 4 gain (torque/magnetic flux) | | | |
| 4 | Stall prevention operation level*2/ torque limit | C38 (Pr.932) Terminal 4 bias command (torque/magnetic flux), C39 (Pr.932) Terminal 4 bias (torque/magnetic flux) | C40 (Pr.933) Terminal 4 gain command (torque/magnetic flux), C41 (Pr.933) Terminal 4 gain (torque/ magnetic flux) | | | |
| 9999 | No function | _ | _ | | | |

^{*2} Use Pr.148 Stall prevention level at 0 V input and Pr.149 Stall prevention level at 10 V input to adjust bias and gain for setting the stall

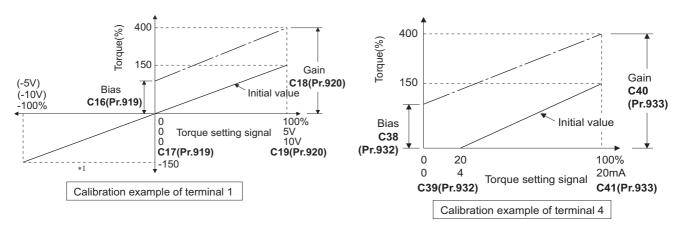
◆ Changing the torque for the maximum analog input (C18 (Pr.920), C40 (Pr.933))

• Use C18 (Pr.920) or C40 (Pr.933) to change the torque setting (gain) for the maximum analog input voltage (current).

◆ Analog input bias/gain calibration (C16 (Pr.919) to C19 (Pr.920), C38 (Pr.932) to C41 (Pr.933))

- The "bias" and "gain" functions serve to adjust the relationship between a setting input signal and the torque. A setting input signal is such as a 0 to 5 VDC, 0 to 10 VDC, or 4 to 20 mADC signal externally input to set the torque command or the torque limit.
- Set the bias torque of the terminal 1 input using C16 (Pr.919). (The initial value is the torque for 0 V.)

- Use C18 (Pr.920) to set the torque to the torque command voltage set by Pr.73 Analog input selection. (The initial value is 10 V.)
- Set the bias torque of the terminal 4 input using C38 (Pr.932). (The initial value is the torque for 4 mA.)
- Use C40 (Pr.933) to set the torque to the 20 mA input of the torque command current (4 to 20 mA).



- *1 A negative voltage (0 to -10 V (-5 V)) is valid as a torque command. However, when a negative voltage is input as a torque limit value, the torque limit is regarded as "0".
- There are three methods to adjust the bias/gain torque setting voltage (current).

Adjustment by applying voltage (current) between terminals 1 and 5 (4 and 5) to set the voltage (current) at the bias/gain level. page 513

Adjustment by selecting the voltage (current) at the bias/gain level without applying voltage (current) between terminals 1 and 5 (4 and 5). page 515

Adjustment by changing the torque without adjusting the voltage (current). Frage 516



Always calibrate the input after changing the voltage/current input signal with Pr.73 (Pr.267) and the voltage/current input selection switch.

Display unit changing for analog input (Pr.241)

- The analog input display unit (%/V/mA) can be changed for analog input bias/gain calibration.
- Depending on the terminal input specification setting of Pr.73 (Pr.267), the unit of the displayed value of C17 (Pr.919), C19 (Pr.920), C39 (Pr.932), and C41 (Pr.933) changes as shown below:

| Analog command (via terminal 1 or 4) (depending on the settings of Pr.73 (Pr.267)) | Pr.241 = "0" (initial value) | Pr.241 = "1" |
|--|------------------------------|----------------------|
| 0 to 5 V input | 0 to 100% (0.1%) | 0 to 5 V (0.01 V) |
| 0 to 10 V input | 0 to 100% (0.1%) | 0 to 10 V (0.01 V) |
| 0 to 20 mA input | 0 to 100% (0.1%) | 0 to 20 mA (0.01 mA) |

◆ Torque setting voltage (current) bias/gain adjustment method

■ Adjustment by applying voltage (current) between terminals 1 and 5 (4 and 5) to set the voltage (current) at the bias/gain torque

Operating procedure

- **1.** Turning ON the power of the inverter The operation panel is in the monitor mode.
- 2. Changing the operation mode

Press $\begin{bmatrix} PU \\ EXT \end{bmatrix}$ to choose the PU operation mode. [PU] indicator turns ON.

3. Selecting the parameter setting mode

Press MODE to choose the parameter setting mode. (The parameter number read previously appears)

4. Calibration parameter selection

Turn until "[..." appears. Press SET to display "[----".

5. Selecting a parameter

Turn until "[(C19 (Pr.920) Terminal 1 gain (torque/magnetic flux)) appears for terminal 1, or "[(C41 (Pr.933) Terminal 4 gain (torque/magnetic flux)) for terminal 4.

6. Analog voltage (current) display

Press SET to display the analog voltage (current) % currently applied to the terminal 1 (4).

Do not touch until calibration is completed.

7. Voltage (current) application

Apply a 5 V (20 mA). (Turn the external potentiometer connected between terminals 1 and 5 (terminals 4 and 5) to a desired position.)

8. Setting completed

- Turn to read another parameter.
- Press SET to return to the "[-- -- -- " display.
- Press | SET | twice to show the next parameter.

■ Adjustment by selecting the voltage (current) at the bias/gain torque without applying voltage (current) between terminals 1 and 5 (4 and 5)

Operating procedure

- **1.** Turning ON the power of the inverter The operation panel is in the monitor mode.
- 2. Changing the operation mode

Press PU to choose the PU operation mode. [PU] indicator turns ON.

3. Selecting the parameter setting mode

Press Model to choose the parameter setting mode. (The parameter number read previously appears)

4. Calibration parameter selection

Turn until "[..." appears. Press set to display "[-----".

5. Selecting a parameter

Turn until "[(C19 (Pr.920) Terminal 1 gain (torque/magnetic flux)) appears for terminal 1, or "[(C41 (Pr.933) Terminal 4 gain (torque/magnetic flux)) for terminal 4.

6. Analog voltage (current) display

Press | SET | to display the analog voltage (current) % currently applied to the terminal 1 (4).

7. Analog voltage (current) adjustment

When is turned, the gain voltage (current) value (%) currently set to the parameter appears.

Turn until the desired gain voltage (current) value (%) appears.

8. Setting completed

- Turn to read another parameter.
- Press SET to return to the " ---- display.
- Press | SET | twice to show the next parameter.

№ NOTE

• Press after step 6 to check the present bias/gain torque setting. The setting cannot be checked after step 7.

■ Adjustment by changing the torque without adjusting the voltage (current) (Example of changing the gain torque from 150% to 130%)

Operating procedure

1. Selecting the parameter

2. Torque setting change

3. Selecting the mode and the monitor item

Press Model three times to select the monitor mode, and change the monitor item to the frequency.

4. Start

Turn ON the start switch (STF or STR) to apply a voltage across terminals 1 and 5 (4 and 5), Operation is performed with 130% torque.

NOTE

- If the voltage (current) values at the gain and bias torques are too close to each other, an error (" ") may be indicated.
- For operation outline of the parameter unit (FR-PU07), refer to the Instruction Manual of the FR-PU07.
- Use the calibration parameter C16 (Pr.919) or C38 (Pr.932) to set the bias torque. (Refer to page 512.)

A CAUTION

• Be cautious when setting any value other than "0" as the bias torque at 0 V (0 mA). Even if a torque command is not given, simply turning ON the start signal will supply torque to the motor.

Parameters referred to

Pr.20 Acceleration/deceleration reference frequency → page 367
Pr.73 Analog input selection, Pr.267 Terminal 4 input selection → page 496
Pr.79 Operation mode selection → page 389
Pr.858 Terminal 4 function assignment, Pr.868 Terminal 1 function assignment → page 500

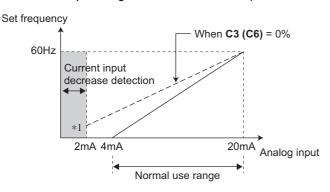
5.12.7 Checking of current input on analog input terminal

When current is input to the analog input terminal 2 or terminal 4, the input current can be checked and the operation when the input falls below the specified level (the analog current input is lost) can be selected. The operation can be continued even when the analog current input is lost.

| Pr. | Name | Initial value | Setting range | Description | |
|---------------------|----------------------------|------------------|---------------|---|---|
| | | | 1 | Operation continues with output frequency before the current input loss. | |
| | | | 2 | 4 mA input fault (E.LCI) is activated when the current input loss is detected. | Check the |
| | | | 3 | The inverter output decelerates the motor to a stop when the current input loss is detected. After the motor is stopped, 4 mA input fault (E.LCI) is activated. | current input on terminals 2 and 4. |
| | | | 4 | Operation continues at the frequency set in Pr.777 . | |
| | | | 11 | Operation continues at the output frequency before the current input loss. | |
| | 4 mA input check selection | 9999 | 12 | 4 mA input fault (E.LCI) is activated when the current input loss is detected. | Check the current input on terminal 4. |
| 573 T052 | | | 13 | The inverter output decelerates the motor to a stop when the current input loss is detected. After the motor is stopped, 4 mA input fault (E.LCI) is activated. | |
| | | | 14 | Operation continues at the frequency set in Pr.777 . | |
| | | | 21 | Operation continues at the output frequency before the current input loss. | |
| | | | 22 | 4 mA input fault (E.LCI) is activated when the current input loss is detected. | Check the current input on terminal 2. |
| | | | 23 | The inverter output decelerates the motor to a stop when the current input loss is detected. After the motor is stopped, 4 mA input fault (E.LCI) is activated. | |
| | | | 24 | Operation continues at the frequency set in Pr.777 . | |
| | | | 9999 | No current input check | |
| 777 T053 | 4 mA input fault operation | 9999 | 0 to 590 Hz | Set the frequency to continue operation when lost. (Valid when Pr.573 = "4") | current input is |
| A681 | frequency | | 9999 | No current input check when Pr.573 = "4" | |
| 778 T054 A682 | 4 mA input check filter | 0 s | 0 to 10 s | Set the current input loss detection time. | |

Analog current input loss condition (Pr.778)

- When the current input to terminal 4 (terminal 2) continues to be 2 mA or less for the period set in **Pr.778**, it is considered as loss of analog current input and the Alarm (LF) signal is turned ON. The LF signal turns OFF when the current input becomes 3 mA or higher.
- For the LF signal, set "98 (positive logic) or 198 (negative logic)" in any of **Pr.190 to Pr.196 (Output terminal function selection)** to assign the function to the output terminal.



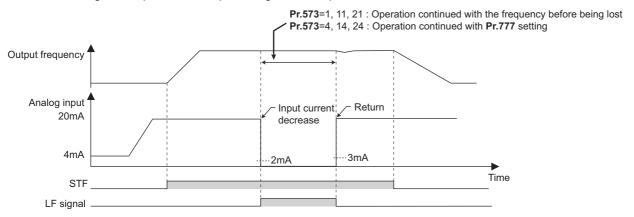
*1 When Pr.573 ≠ "9999" and the terminal 4 (terminal 2) input is calibrated to 2 mA or less in C2 (Pr.902) (C5 (Pr.904)), the operation set in Pr.573 is applied to the frequency at the input of 2 mA or less.



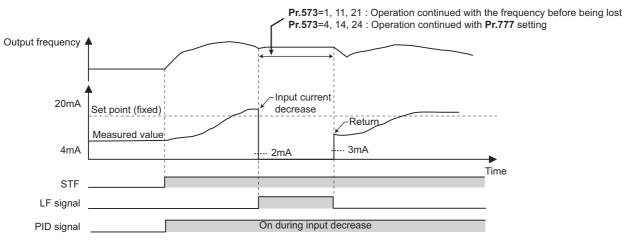
 Changing the terminal assignment using Pr.190 to Pr.196 (Output terminal function selection) may affect the other functions. Set parameters after confirming the function of each terminal.

◆ Continuing operation when the analog current input is lost (Pr.573 = "1, 4, 11, 14, 21, or 24", and Pr.777)

- When Pr.573 = "1, 11, or 21", operation continues at the output frequency before the current input loss.
- When Pr.573 = "4, 14, or 24" and Pr.777 ≠ "9999", operation continues at the frequency set in Pr.777.
- When the start command is turned OFF during current input loss, the inverter output decelerates the motor to a stop immediately, and the operation is not restarted even if a start command is input again.
- · When the current input is restored, the LF signal is turned OFF, and operation is performed according to the current input.
- · The following is the operation example during External operation.



• The following is the operation example during PID control (reverse action) operation.



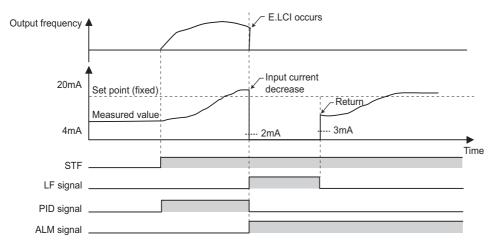


• When the setting is changed to the continuous operation (**Pr.573** = "1, 4, 11, 14, 21, or 24") after the input current loss, the frequency before loss is regarded as 0 Hz.

◆ Fault output (Pr.573 = "2, 12, or 22")

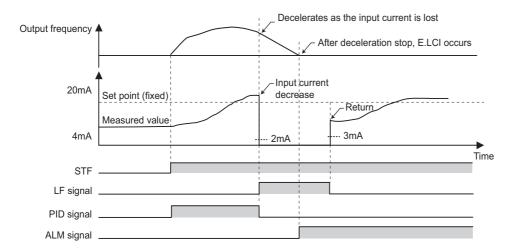
• When the analog current input becomes 2 mA or lower, the protective function E.LCI (4 mA input fault) is activated and the output is shut off.

· The following is the operation example during PID control (reverse action) operation.

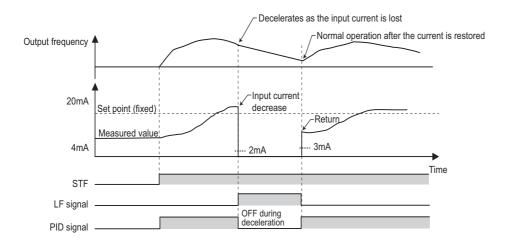


◆ Fault output after deceleration to stop (Pr.573 = "3, 13, or 23")

- When the analog current input becomes 2 mA or lower, the inverter output decelerates the motor to a stop, and then the protective function E.LCI (4 mA input fault) is activated and the output is shut off.
- When the analog current input is restored during the deceleration, the motor is accelerated again and operates according
 to the current input.
- The following is the operation example during PID control (reverse action) operation.



• The following is the operation example when the analog input current is restored during deceleration under PID control (reverse action).



♦ Functions related to current input check

| Function | Operation | Refer to page |
|---|--|---------------|
| Minimum frequency | When the operation continues, the minimum frequency setting is valid even during current input loss. | 428 |
| Multi-speed operation | The multi-speed setting signal is prioritized even during current input loss (the motor operates according to the multi-speed setting even during continuous operation at the predetermined frequency or during deceleration to a stop). When the multi-speed setting signal is turned OFF while the input current is lost during the multi-speed operation, the motor is decelerated to a stop even if the parameter is set to continue operation when the current input is lost. | 411 |
| JOG operation | JOG operation is prioritized even during current input loss (the motor operation switches to JOB operation even during continuous operation at the predetermined frequency or during deceleration to a stop). When the JOG signal is turned OFF while the input current is lost during the JOG operation, the motor is decelerated to a stop even if the parameter is set to continue operation when the current input is lost. | 410 |
| MRS signal | The MRS signal is enabled even during current input loss (output is shut off by turning ON the MRS signal even during continuous operation at the predetermined frequency or during deceleration to a stop). | 524 |
| Remote setting | When the operation using the remote setting function is changed to the continuous operation after the current input is lost, acceleration, deceleration, and clear operations by the remote setting are disabled. The operations are enabled after restoration of current input. | 377 |
| Retry function | When the protective function is activated during continuous operation after the current input is lost and the retry function is used successfully, operation continues without clearing the frequency setting. | 426 |
| Compensation by addition, override compensation | When the operation using compensation by addition or override compensation is changed to the continuous operation after the current input is lost, compensation by addition or override compensation is disabled. The operations are enabled after restoration of current input. | 501 |
| Input filter time constant | The current before the filter time is applied is used for input loss detection. The current after the filter time is applied is used for continuous operation at the output frequency before the input loss. | 517 |
| PID control | PID calculation is stopped during current input loss. However, PID control is not disabled (the operation does not return to normal). During the pre-charge, end determination or fault determination by the pre-charge function is not performed when the current input is lost. The sleep function is prioritized even during current input loss. When the clearing condition of the sleep function is met during current input loss, continuous operation at the predetermined frequency is restored. | 601 |
| Power failure stop | The power failure stop function is prioritized even if current input loss is detected during power failure. After the power failure stop and re-acceleration, operation continues at the output frequency before the input loss. When the protective function E.LCI is selected when the current input is lost, E.LCI is activated after the power failure stop. | 642 |
| Traverse function | Traverse operation is performed based on the frequency even during continuous operation during current input loss. | 582 |

Pr.73 Analog input selection, Pr.267 Terminal 4 input selection page 496

5.12.8 Input terminal function selection

Use the following parameters to select or change the input terminal functions.

| Pr. | Name | Initial value | Initial signal | Setting range |
|-------------|----------------------------------|------------------|--|---|
| 178 T700 | STF terminal function selection | 60 | STF (Forward rotation command) | 0 to 20, 22 to 28, 32, 37, 42 to 48, 50 to 53, 57 to 60, 62, 64 to 74, 76, 77 to 80, 85, 87 to 89, 92 to 96, 128, 129, 9999 |
| 179 T701 | STR terminal function selection | 61 | STR (Reverse rotation command) | 0 to 20, 22 to 28, 32, 37, 42 to 48, 50 to 53, 57 to 59, 61, 62, 64 to 74, 76, 77 to 80, 85, 87 to 89, 92 to 96, 128, 129, 9999 |
| 180 T702 | RL terminal function selection | 0 | RL (Low-speed operation command) | |
| 181 T703 | RM terminal function selection | 1 | RM (Middle-speed operation command) | |
| 182 T704 | RH terminal function selection | 2 | RH (High-speed operation command) | |
| 183 T705 | RT terminal function selection | 3 | RT (Second function selection) | 0 to 20, 22 to 28, 32, 37, 42 to 48, 50 to 53, 57 |
| 184 T706 | AU terminal function selection | 4 | AU (Terminal 4 input selection) | |
| 185 T707 | JOG terminal function selection | 5 | JOG (Jog operation selection) | to 59, 62, 64 to 74, 76, 77 to 80, 85, 87 to 89, 92 to 96, 128, 129, 9999 |
| 186 T708 | CS terminal function selection | 6 | CS (Selection of automatic restart after instantaneous power failure / flying start) | |
| 187 | | | MRS (Output stop) | |
| T709 | | | X10 (Inverter run enable) | |
| 188 T710 | STOP terminal function selection | 25 | STP (STOP) (Start self-holding selection) | |
| 189 T711 | RES terminal function selection | 62 | RES (Inverter reset) | |

| Pr. | Name | Initial value | Setting range | Description |
|----------------------------|---------------------------|------------------|----------------------------------|---|
| 699 | 699 Input terminal filter | 9999 | 5 to 50 ms | Set the time delay for the input terminal response. |
| T740 Input terminal litter | 9999 | 9999 | No filter for the input terminal | |

^{*1} The initial value is for standard models and IP55 compatible models.

♦ Input terminal function assignment

- Use Pr.178 to Pr.189 to set the functions of the input terminals.
- Refer to the following table and set the parameters.

| Setting | Signal name | Fun | Related parameter | Refer to page | |
|---------|-------------|--|--------------------------------|---|-----|
| | | Pr.59 = 0 (initial value) | Low-speed operation command | Pr.4 to Pr.6, Pr.24 to Pr.27, Pr.232 to Pr.239 | 411 |
| 0 | RL | Pr.59 ≠ 0 *1 | Remote setting (setting clear) | Pr.59 | 377 |
| | | Pr.270 = "1, 3, 11, 13"*2 | Stop-on-contact selection 0 | Pr.270, Pr.275, Pr.276 | 577 |
| 1 | RM | Pr.59 = 0 (initial value) | Middle-speed operation command | Pr.4 to Pr.6, Pr.24 to Pr.27, Pr.232 to Pr.239 | 411 |
| | | Pr.59 ≠ 0 *1 | Remote setting (deceleration) | Pr.59 | 377 |
| 2 | RH | Pr.59 = 0 (initial value) High-speed operation comma | | Pr.4 to Pr.6, Pr.24 to Pr.27, Pr.232 to Pr.239 | 411 |
| | | Pr.59 ≠ 0*1 | Remote setting (acceleration) | Pr.59 | 377 |
| 3 | RT | Second function selection | Second function selection | | 525 |
| | | Pr.270 = "1, 3, 11, 13"*2 | Stop-on-contact selection 1 | Pr.270, Pr.275, Pr.276 | 577 |
| 4 | AU | Terminal 4 input selection | | Pr.267 | 496 |
| 5 | JOG | Jog operation selection | | Pr.15, Pr.16 | 410 |

^{*2} The initial value is for separated converter types.

| Setting | Signal name | Function | Related parameter | Refer to |
|------------|---------------|---|---|----------|
| • | | Selection of automatic restart after instantaneous power failure / flying start | Pr.57, Pr.58, Pr.162 to Pr.165, Pr.299, Pr.611 | 628, 635 |
| 6 | CS | Electronic bypass function | Pr.57, Pr.58, Pr.135 to Pr.139, Pr.159 | 563 |
| 7 | ОН | External thermal relay input*3 | Pr.9 | 415 |
| 3 | REX | 15-speed selection (Combination with multi-speeds of RL, RM, and RH) | Pr.4 to Pr.6, Pr.24 to Pr.27, Pr.232 to Pr.239 | 411 |
|) | X9 | Third function selection | Pr.110 to Pr.116 | 525 |
| 10 | X10 | Inverter run enable (FR-HC2/FR-XC/FR-CV/FR-CC2 connection) | Pr.30, Pr.70, Pr.599 | 724 |
| 11 | X11 | FR-HC2/FR-CC2 connection, instantaneous power failure detection | Pr.30, Pr.70 | 724 |
| 12 | X12 | PU operation external interlock | Pr.79 | 389 |
| 13 | X13 | External DC injection brake operation start | Pr.10 to Pr.12 | 715 |
| 14 | X14 | PID control valid | Pr.127 to Pr.134, Pr.575 to Pr.577 | 601 |
| 15 | BRI | Brake opening completion | Pr.278 to Pr.285 | 572 |
| 16 | X16 | PU/External operation switchover (External operation with X16-ON) | Pr.79, Pr.340 | 389 |
| 17 | X17 | Load pattern selection forward/reverse rotation boost (For constant-torque with X17-ON) | Pr.14 | 708 |
| 18 | X18 | V/F switchover (V/F control with X18-ON) | Pr.80, Pr.81, Pr.800 | 221 |
| 19 | X19 | Load torque high-speed frequency | Pr.270 to Pr.274 | 580 |
| 20 | X20 | S-pattern acceleration/deceleration C switchover | Pr.380 to Pr.383 | 372 |
| 22 | X22 | Orientation command (for Vector control compatible options)*4*6 | Pr.350 to Pr.369 | 585 |
| 23 | LX | Pre-excitation/servo ON *5 | Pr.850 | 715 |
| | LA | Output stop | Pr.17 | 524 |
| 24 | MRS | Electronic bypass function | Pr.57, Pr.58, Pr.135 to Pr.139, Pr.159 | 563 |
| 25 | STP (STOP) | Start self-holding selection | Pr.250 | 722 |
| 26 | MC | Control mode switchover | Pr.800 | 221 |
| 27 | TL | Torque limit selection | Pr.815 | 245 |
| 28 | X28 | Start-time tuning start external input | Pr.95 | 558 |
| 32 | X32 | External fault input | _ | 525 |
| 37 | X37 | Traverse function selection | Pr.592 to Pr.597 | 582 |
| 42 | X42 | Torque bias selection 1 | Pr.840 to Pr.845 | 265 |
| 43 | X43 | Torque bias selection 2 | Pr.840 to Pr.845 | 265 |
| 44 | X44 | P/PI control switchover (P control with X44-ON) | Pr.820, Pr.821, Pr.830, Pr.831 | 254 |
| 1 5 | BRI2 | Second brake sequence open completion | Pr.641 to Pr.648 | 572 |
| 16 | TRG | Trace trigger input | Pr.1020 to Pr.1047 | 649 |
| 17 | TRC | Trace sampling start/end | Pr.1020 to Pr.1047 | 649 |
| 48 | X48 | Power failure stop external | Pr.261 to Pr.266, Pr.294, Pr.668 | 642 |
| 50 | SQ | Sequence start | Pr.414 | 646 |
| 51 | X51 | Fault clear | Pr.414 | 646 |
| 52 | X52 | Cumulative pulse monitor clear (for Vector control compatible plugin options) | Pr.635 | 321 |
| 53 | X53 | Cumulative pulse monitor clear (control terminal option) (for FR-A8TP) | F1.030 | JZ 1 |
| 57 | JOGF | JOG forward rotation command | Pr.15, Pr.16 | 410 |
| 58 | JOGR | JOG reverse rotation command | Pr.15, Pr.16 | 410 |
| 59 | CLRN | NET position pulse clear | Pr.291, Pr.419 to Pr.430, Pr.464 | 320 |
| 60 | STF | Forward rotation command (assignable to the STF terminal (Pr.178) only) | Pr.250 | 722 |
| 61 | STR | Reverse rotation command (assignable to the STR terminal (Pr.179) only) | Pr.250 | 722 |
| 62 | RES | Inverter reset | Pr.75 | 336 |
| 64 | X64 | PID forward/reverse action switchover | Pr.127 to Pr.134 | 601 |
| 65 | X65 | PU/NET operation switchover (PU operation with X65-ON) | Pr.79, Pr.340 | 389 |

| Setting | Signal name | Function | Related parameter | Refer to page |
|---------|-------------|---|---------------------------------------|---------------|
| 66 | X66 | External/NET operation switchover (NET operation with X66-ON) | Pr.79, Pr.340 | 389 |
| 67 | X67 | Command source switchover (command by Pr.338 or Pr.339 enabled with X67-ON) | Pr.338, Pr.339 | 400 |
| 68 | NP | Simple position pulse train sign | Pr.291, Pr.419 to Pr.430, Pr.464 | 320 |
| 69 | CLR | Simple position droop pulse clear | Pr.291, Pr.419 to Pr.430, Pr.464 | 320 |
| 70 | X70 | DC feeding operation permission*7 | Pr.30 | 724 |
| 71 | X71 | DC feeding cancel *7 | Pr.30 | 724 |
| 72 | X72 | PID P control switchover | Pr.127 to Pr.134, Pr.575 to Pr.577 | 601 |
| 73 | X73 | Second PID P control switchover | Pr.127 to Pr.134, Pr.575 to Pr.577 | 601 |
| 74 | X74 | Magnetic flux decay output shutoff | Pr.850 | 717 |
| 76 | X76 | Proximity dog | Pr.1282 to Pr.1288 | 303 |
| 77 | X77 | Pre-charge end command | Pr.760 to Pr.764 | 618 |
| 78 | X78 | Second pre-charge end command | Pr.765 to Pr.769 | 618 |
| 79 | X79 | Second PID forward/reverse action switchover | Pr.753 to Pr.758 | 601 |
| 80 | X80 | Second PID control valid | Pr.753 to Pr.758 | 601 |
| 85 | X85 | SSCNET III communication disabled (for FR-A8NS)*6 | Pr.499 | _ |
| 87 | X87 | Sudden stop | Pr.464 to Pr.494 | 303 |
| 88 | LSP | Forward stroke end | D:: 440 | 040 040 |
| 89 | LSN | Reverse stroke end | - Pr.419 | 316, 319 |
| 92 | X92 | Emergency stop | Pr.1103 | 367 |
| 93 | X93 | Torque control selection | Pr.1113 | 287 |
| 94 | X94 | Control signal input for main circuit power supply MC | Pr.30, Pr.137, Pr.248, Pr.254 | 569 |
| 95 | X95 | Converter unit fault input | Pr.57, Pr.58, Pr.135 to | 563 |
| 96 | X96 | Converter unit fault (E.OHT, E.CPU) input | Pr.139, Pr.159 | 303 |
| 128 | RLF | Low-speed forward rotation command | Pr.6 | 411 |
| 129 | RLR | Low-speed reverse rotation command | F1.0 | 411 |
| 9999 | - | No function | _ | _ |

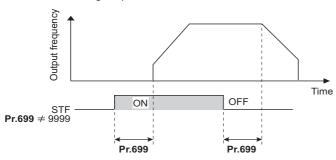
- *1 When Pr.59 Remote function selection ≠ "0", functions of the RL, RM, and RH signals are changed as shown in the table.
- *2 When **Pr.270 Stop-on contact/load torque high-speed frequency control selection** = "1, 3, 11, or 13", functions of the RL and RT signals are changed as shown in the table.
- *3 The OH signal is activated when the relay contact is open.
- *4 When a stop position command is input from outside for orientation control, the FR-A8AX (16-bit digital input option) is required.
- *5 Servo ON is enabled in the position control mode.
- *6 Available when the plug-in option is connected. For details, refer to the Instruction Manual of each option.
- *7 The setting is available for the standard structure model and the IP55 compatible model.

NOTE

- The same function can be assigned to two or more terminals. In this case, the logic of terminal input is OR.
- The priorities of the speed commands are defined as follows: JOG > multi-speed setting (RH, RM, RL, REX) > PID (X14).
- When the Inverter run enable (X10) signal is not assigned, or when the PU operation external interlock (X12) signal is not assigned while **Pr.79 Operation mode selection** = "7", the MRS signal performs the same function.
- The same terminals are used to assign the multi-speed (7-speed) setting and the remote setting. The multi-speed setting and the remote setting cannot be assigned separately.
- When the Load pattern selection forward/reverse rotation boost (X17) signal is not assigned, the RT signal performs the same function.
- When **Pr.419** = "2" (simple pulse train position command), the terminal JOG is used for the simple position pulse train input regardless of the setting in **Pr.291 Pulse train I/O selection**.
- When the terminal assignment is changed using **Pr.178 to Pr.189 (Input terminal function selection)**, wiring may be mistaken due to different terminal name and signal contents, or may affect other functions. Set parameters after confirming the function of each terminal.

♦ Adjusting the response of input terminals (Pr.699)

Response of the input terminals can be delayed in a range between 5 to 50 ms. (The following is the operation example
of the STF signal.)





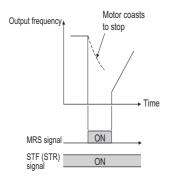
- The Pr.699 setting is invalid (no filter) for the following signals.
 - Input signals which are already in the ON state when the power is turned ON
 - Input signals used for the PLC function
 - Inverter run enable (X10) signal, Simple position pulse train sign (NP) signal, Simple position droop pulse clear (CLR) signal

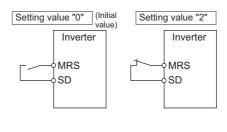
5.12.9 Inverter output shutoff

The inverter output can be shut off with the MRS signal. The logic of the MRS signal can also be selected.

| Pr. | Name | Initial value | Setting range | Description |
|------------|---------------------|------------------|---------------|--|
| 17 T720 | | | 0 | Normally open input |
| | | | 2 | Normally closed input (NC contact input specification) |
| | MRS input selection | 0 | 4 | External terminal: Normally closed input (NC contact input specification) Communication: Normally open input |

◆ Output shutoff signal (MRS signal)





- When the Output stop (MRS) signal is turned ON while operating the inverter, the inverter output is instantaneously shut
 off.
- The response time of the MRS signal is within 2 ms.
- · The MRS signal is used in the following cases.

| Application | Description |
|---|--|
| To stop the motor using a mechanical brake (e.g. electromagnetic brake) | The inverter output is shut off when the mechanical brake operates. |
| To provide interlock to disable the motor operation by the inverter | With the MRS signal ON, the motor cannot be driven by the inverter even if the start signal is input to the inverter. |
| To coast the motor to a stop | When the start signal is turned OFF, the inverter decelerates the motor to a stop in the preset deceleration time, but when the MRS signal is turned ON, the motor coasts to a stop. |

◆ MRS signal logic inversion (Pr.17 = "2")

• When "2" is set in **Pr.17**, the input specification of the MRS signal is changed to normally closed (NC contact). The inverter will shut off the output when the MRS signal is turned OFF (when the contact is opened).

◆ Assigning a different action for each MRS signal input via communication and external terminal (Pr.17 = "4")

• When **Pr.17** = "4", the MRS signal input from an external terminal is normally closed (NC contact), and the MRS signal input from communication is normally open (NO contact). This function is useful to perform operation via communication while keeping the ON state of the MRS signal input from the external terminal.

| External MRS | Communication MRS | Pr.17 setting | | | |
|---------------|--------------------|-------------------|-------------------|-------------------|--|
| External wing | Communication wiks | 0 | 2 | 4 | |
| OFF | OFF | Operation enabled | Output shutoff | Output shutoff | |
| OFF | ON | Output shutoff | Output shutoff | Output shutoff | |
| ON | OFF | Output shutoff | Output shutoff | Operation enabled | |
| ON | ON | Output shutoff | Operation enabled | Output shutoff | |



- The MRS signal is assigned to terminal MRS in the initial status. By setting "24" in any of **Pr.178 to Pr.189 (Input terminal function selection)**, the MRS signal can be assigned to the other terminal.
- When using an external terminal to input the MRS signal, the MRS signal shuts off the output in any of the operation modes.
- The MRS signal is valid regardless of whether it is input through the external terminal or via network, but when the MRS signal is used as the Inverter run enable (X10) signal, input the signal through the external terminal.
- When the terminal assignment is changed using **Pr.178 to Pr.189 (Input terminal function selection)**, wiring may be mistaken due to different terminal name and signal contents, or may affect other functions. Set parameters after confirming the function of each terminal.

Parameters referred to

Pr.178 to Pr.189 (Input terminal function selection) page 521

5.12.10 External fault input signal

The inverter output can be shut off by inputting the External fault input (X32) signal when an external fault occurs. To assign the X32 signal, set "32" in any of **Pr.178 to Pr.189 (Input terminal function selection).**

◆ Details of the operation

- When the External fault input (X32) signal turns OFF during operation, the inverter activates the protective function with the indication "E.EF" displayed to shut off the output.
- When the X32 signal turns OFF during a stop, the protective function is not activated ("E.EF" is not displayed).
- When the inverter operation is started with the X32 signal OFF, the inverter activates the protective function immediately to shut off the output.

NOTE

- When the X32 signal turns OFF during zero speed control or pre-excitation while the start signal is OFF, the inverter output is shut off.
- When the inverter operation is started with the X32 signal OFF, the inverter may output the AC voltage for an extremely brief
 moment.

5.12.11 Selecting the condition to activate the Second function selection (RT) signal or the Third function selection (X9) signal

The second function can be selected using the RT signal, and the third function can be selected using the X9 signal.

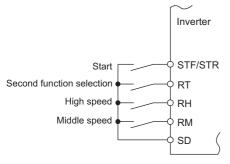
The condition to activate the second or third function can be also set.

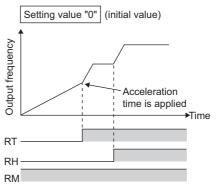
| Pr. | Name | Initial value | Setting range | Description |
|-------------|---------------------------------|---------------|---------------|--|
| 155 T730 | RT signal function | | 0 | The second function is immediately enabled when the RT signal is turned ON, and the third function is immediately enabled when the X9 signal is turned ON. |
| | validity condition selection | 0 | 10 | The function cannot be changed to the second or third function during acceleration/deceleration. When the signal is turned ON during acceleration/deceleration, the function is changed after the acceleration/deceleration is finished. |

- Turning ON the Second function selection (RT) signal enables the second functions.
- Turning ON the Third function selection (X9) signal enables the third functions. For the X9 signal, set "9" in any of **Pr.178** to **189** (Input terminal function selection) to assign the function.
- The following are the examples of the applications of the second (third) functions.
 - Switching between regular use and emergency use
 - Switching between heavy load and light load
 - Changing the acceleration/deceleration time by break point acceleration/deceleration
 - Switching characteristics of main motor and sub motor

Connection diagram example for the second function

Example of the second acceleration/deceleration time





• Turning ON the RT signal enables the second function, and turning ON the X9 signal enables the third function. The following table shows the functions which can be changed to the second or third function.

| Function | First function parameter number | Second function parameter number | Third function parameter number | Refer to page |
|--|--|--|---------------------------------|---------------|
| Torque boost | Pr.0 | Pr.46 | Pr.112 | 706 |
| Base frequency | Pr.3 | Pr.47 | Pr.113 | 707 |
| Acceleration time | Pr.7 | Pr.44 | Pr.110 | 367 |
| Deceleration time | Pr.8 | Pr.44, Pr.45 | Pr.110, Pr.111 | 367 |
| Electronic thermal O/L relay | Pr.9 | Pr.51 | *2 | |
| Free thermal | Pr.600 to Pr.604 | Pr.692 to Pr.696 | *2 | 415 |
| Motor permissible load level *1 | Pr.607 | Pr.608 | *2 | |
| Stall prevention | Pr.22 | Pr.48, Pr.49 | Pr.114, Pr.115 | 431 |
| Applied motor *1 | Pr.71 | Pr.450 | *2 | 528 |
| Motor constant ^{*1} | Pr.80 to Pr.84, Pr.90 to Pr.94, Pr.298, Pr.702, Pr.706, Pr.707, Pr.711, Pr.712, Pr.717, Pr.721, Pr.724, Pr.725, Pr.859 | Pr.453 to Pr.457, Pr.560, Pr.458 to Pr.462, Pr.738 to Pr.747, Pr.860 | *2 | 532, 551 |
| Excitation current low-speed scaling factor | Pr.85, Pr.86 | Pr.565, Pr.566 | *2 | 711 |
| Speed control gain (Advanced magnetic flux vector) | Pr.89 | Pr.569 | *2 | 228 |
| Offline auto tuning*1 | Pr.96 | Pr.463 | *2 | 532, 551 |
| Online auto tuning *1 | Pr.95 | Pr.574 | *2 | 558 |
| PID control | Pr.127 to Pr.134 | Pr.753 to Pr.758 | *2 | 601 |
| PID pre-charge function | Pr.760 to Pr.764 | Pr.765 to Pr.769 | *2 | 618 |
| Brake sequence*1 | Pr.278 to Pr.285, Pr.639, Pr.640 | Pr.641 to Pr.648, Pr.650 to Pr.651 | *2 | 572 |
| Droop control | Pr.286 to Pr.288, Pr.994 to Pr.995 | Pr.679 to Pr.683 | *2 | 738 |
| Low-speed range torque characteristics*1 | Pr.788 | Pr.747 | *2 | 233 |
| Motor control method *1 | Pr.800 | Pr.451 | *2 | 221 |
| Speed control gain | Pr.820, Pr.821 | Pr.830, Pr.831 | *2 | 254 |
| Analog input filter | Pr.822, Pr.826 | Pr.832, Pr.836 | *2 | 503 |
| Speed detection filter | Pr.823 | Pr.833 | *2 | 332 |
| Torque control gain | Pr.824, Pr.825 | Pr.834, Pr.835 | *2 | 294 |
| Torque detection filter | Pr.827 | Pr.837 | *2 | 332 |

^{*1} The function can be changed by switching the RT signal ON/OFF while the inverter is stopped. If a signal is switched during operation, the operation method changes after the inverter stops. (Pr.450 ≠ 9999)

■ NOTE

- The RT signal is assigned to terminal RT in the initial status. By setting "3" in any of Pr.178 to Pr.189 (Input terminal function **selection)**, the RT signal can be assigned to the other terminal.
- When both the RT and X9 signals are ON, the X9 signal (third function) is valid.
- · Changing the terminal assignment using Pr.178 to Pr.189 (Input terminal function selection) may affect the other functions. Set parameters after confirming the function of each terminal.

Parameters referred to

Pr.178 to Pr.189 (Input terminal function selection) Frage 521

^{*2} When the RT signal is OFF, the first function is valid. When it is ON, the second function is valid.

5.13 (C) Motor constant parameters

| Purpose | | Parameter to set | | Refer to page |
|--|---|--|---|---------------|
| To select the motor to be used | Applied motor | P.C100, P.C200 | Pr.71, Pr.450 | 528 |
| To maximize the performance of the induction and vector motors | Offline auto tuning | P.C000, P.C100 to P.C105, P.C107, P.C108, P.C110, P.C120 to P.C126, P.C200 to P.C205, P.C207, P.C208, P.C210, P.C220 to P.C226 | Pr.9, Pr.51, Pr.71, Pr.80 to Pr.84, Pr.90 to Pr.94, Pr.96, Pr.450, Pr.453 to Pr.463, Pr.684, Pr.707, Pr.724, Pr.744, Pr.745, Pr.859, Pr.860 | 532 |
| To maximize the performance of the PM motor to perform Vector control operation | PM motor offline auto tuning (under Vector control) | P.C000, P.C100 to P.C108, P.C110, P.C120, P.C122, P.C123, P.C126, P.C130 to P.C133, P.C135, P.C150, P.C200 to P.C208, P.C210, P.C220, P.C222, P.C223, P.C226, P.C230 to P.C233, P.C235 | Pr.9, Pr.51, Pr.71, Pr.80, Pr.81, Pr.83, Pr.84, Pr.90, Pr.92, Pr.93, Pr.96, Pr.450, Pr.453, Pr.454, Pr.456 to Pr.458, Pr.460, Pr.461, Pr.463, Pr.684, Pr.702, Pr.706, Pr.707, Pr.711, Pr.712, Pr.724, Pr.725, Pr.738 to Pr.740, Pr.743 to Pr.746, Pr.859, Pr.860, Pr.1002, Pr.1412, Pr.1413 | 542 |
| To maximize the performance of the PM motor to perform PM sensorless vector control operation | PM motor offline auto tuning | P.C000, P.C100 to P.C108, P.C110, P.C120, P.C122, P.C123, P.C126, P.C130 to P.C133, P.C135, P.C150, P.C182, P.C185, P.C200 to P.C208, P.C210, P.C220, P.C222, P.C223, P.C226, P.C230 to P.C233, P.C235, P.C282, P.C285 | Pr.9, Pr.51, Pr.71, Pr.80, Pr.81, Pr.83, Pr.84, Pr.90, Pr.92, Pr.93, Pr.96, Pr.450, Pr.453, Pr.454, Pr.456 to Pr.458, Pr.460, Pr.461, Pr.463, Pr.684, Pr.702, Pr.706, Pr.707, Pr.711, Pr.712, Pr.717, Pr.721, Pr.724, Pr.725, Pr.738 to Pr.747, Pr.788, Pr.859, Pr.860, Pr.1002, Pr.1412, Pr.1413 | 551 |
| To perform high accuracy operation without being affected by temperature and high-torque/ultra-low speed | Online auto tuning | P.C111, P.C211 | Pr.95, Pr.574 | 558 |
| To use the motor with encoder | Encoder specifications | P.C140, P.C141, P.C240, P.C241 | Pr.359, Pr.369, Pr.851, Pr.852 | 94 |
| To detect loss of encoder signals | Signal loss detection | P.C148, P.C248 | Pr.376, Pr.855 | 561 |

5.13.1 **Applied motor**

By setting the applied motor type, the thermal characteristic appropriate for the motor can be selected.

When using a constant-torque or PM motor, the electronic thermal O/L relay function is set according to the motor.

When the Advanced magnetic flux vector control, Real sensorless vector control, Vector control, or PM sensorless vector control is selected, the motor constant necessary for control (SF-PR, SF-JR, SF-HR, SF-JRCA, SF-HRCA, SF-V5RU (1500 r/ min series), MM-CF, etc.) is also selected at the same time.

| Pr. | Name | Initial value | Setting range | Description |
|-------------|----------------------|---------------|---|--|
| 71 C100 | Applied motor | 0 | 0 to 6, 13 to 16, 20, 23, 24, 30, 33, 34, 40, 43, 44, 50, 53, 54, 70, 73, 74, 330, 333, 334, 8090, 8093, 8094, 9090, 9093, 9094 | By selecting a motor, the thermal characteristic and motor constant of each motor are set. |
| 450 C200 | Second applied motor | 9999 | 0, 1, 3 to 6, 13 to 16, 20, 23, 24, 30, 33, 34, 40, 43, 44, 50, 53, 54, 70, 73, 74, 330, 333, 334, 8090, 8093, 8094, 9090, 9093, 9094 | Set this parameter when using the second motor (the same specifications as Pr.71). |
| | | | 9999 | The function is disabled. |

◆ Setting the applied motor

• Refer to the following list and set the parameters according to the applied motor.

| Pr.71 Pr.450 | | Motor | Motor constant value range when performing | Electronic thermal O/L relay function | | |
|------------------------------|--------|--|--|---------------------------------------|---------------------|----|
| Pr./1 | Pr.450 | MOLOF | offline auto tuning (increment) | Standard | Constant- torque | РМ |
| 0 (Pr.71 i value) | nitial | Standard motor (such as SF-JR) | | 0 | | |
| 1 | | Constant-torque motor (SFJRCA, etc.) SF-V5RU (other than the 1500 r/min series) | Pr.82 (Pr.455) and Pr.859 (Pr.860) • 0 to 500 A, 9999 (0.01 A)*2 • 0 to 3600 A, 9999 (0.1 A)*3 | | 0 | |
| 2 | _ | Standard motor (such as SF-JR) Adjustable 5 points V/F (refer to page 713) | Pr.90 (Pr.458), Pr.91 (Pr.459) • 0 to 50 Ω, 9999 (0.001 Ω)*2 | 0 | | |
| 20 | • | Mitsubishi Electric standard motor (SF-JR 4P 1.5kW or lower) | • 0 to 400 mΩ, 9999 (0.01 mΩ) ^{*3} Pr.92 (Pr.460), Pr.93 (Pr.461) (Induction motor) | | 0 | |
| 30 | | Vector control dedicated motor SF-V5RU (1500 r/min series) SF-THY | • 0 to 6000 mH, 9999 (0.1 mH)*2 • 0 to 400 mH, 9999 (0.1 mH)*3 Pr.92 (Pr.460), Pr.93 (Pr.461) (PM motor) | | 0 | |
| 40 | | Mitsubishi Electric high-efficiency motor SF-HR | • 0 to 500 mH, 9999 (0.01 mH)*2 • 0 to 50 mH, 9999 (0.001 mH)*3 | 0 | | |
| 50 | | Mitsubishi Electric constant- torque motor SF-HRCA | Pr.94 (Pr.462) • 0 to 100%, 9999 (0.1%)*2 | | 0 | |
| 70 | | Mitsubishi Electric high- performance energy-saving motor SF-PR | • 0 to 100%, 9999 (0.01%)*3 Pr.706 (Pr.738) • 0 to 5000 mV (rad/s), 9999 (0.1 mV/(rad/s)) | | 0 | |
| 330 ^{*1} | | IPM motor MM-CF | | | | 0 |
| 8090 | | IPM motor (other than MM-CF) | | | 0 | |
| 9090 | | SPM motor | | | 0 | |

| Pr.71 | Pr.450 | Motor | Motor cons | tant value range when performing | Electronic thermal O/L relay function | | |
|-----------------------|----------------------------|--|---|--|---------------------------------------|---------------------|----|
| Pr./1 | Pr.450 | Motor | offli | ne auto tuning (increment) | Standard | Constant- torque | PM |
| 3 (4)*4 | | Standard motor (such as SF-JR) | | | 0 | | |
| 13 (14)*4 | | Constant-torque motor (SFJRCA, etc.) SF-V5RU (other than the 1500 r/min series) | | | | 0 | |
| 23 (24)*4 | | Mitsubishi Electric standard motor (SF-JR 4P 1.5kW or lower) | | | | 0 | |
| 33 (34) ^{*4} | | Vector control dedicated motor SF-V5RU (1500 r/min series) SF-THY | Pr.91 (Pr.45 | 5), Pr.859 (Pr.860), Pr.90 (Pr.458), 9), Pr.92 (Pr.460), Pr.93 (Pr.461), | | 0 | |
| 43 (44)*4 | | Mitsubishi Electric high-efficiency motor SF-HR | Internal dat | 2), Pr.706 (Pr.738) a value 0 to 65534, 9999 (1) | 0 | | |
| 53 (54)*4 | | Mitsubishi Electric constant- torque motor SF-HRCA | The display increment can be changed in Pr.684 | | | 0 | |
| 73 (74) ^{*4} | | Mitsubishi Electric high- performance energy-saving motor SF-PR | | | | 0 | |
| 333 (334) | *1*4 | IPM motor MM-CF | | | | | 0 |
| 8093 (809 | 94) ^{*4} | IPM motor (other than MM-CF) | | | | 0 | |
| 9093 (909 | 94) ^{*4} | SPM motor | | | | 0 | |
| 5 | | Standard motor | Wye connection | ′ Ι• Λ το 36ΛΛ Δ 9999 (Λ 1 Δ) 3 | 0 | | |
| 15 | | Constant-torque motor | | | | 0 | |
| 6 | | Standard motor | Delta | Pr.92 (Pr.460), Pr.93 (Pr.461) 0 to 50 Ω, 9999 (0.001 Ω)*2 0 to 3600 mΩ, 9999 (0.1 mΩ)*3 | 0 | | |
| 16 | | Constant-torque motor | connection | Pr.94 (Pr.462) 0 to 500 Ω, 9999 (0.01 Ω)*2 0 to 100 Ω, 9999 (0.01 Ω)*3 | | 0 | |
| _ | 9999 (initial value) | No second applied motor | ı | I | I | I | |

- *1 The setting is available for the FR-A820-00630(11K) or lower.
- *2 For the FR-A820-03160(55K) or lower, and FR-A840-01800(55K) or lower.
- *3 For the FR-A820-03800(75K) or higher, and FR-A840-02160(75K) or higher.
- *4 The same operation is performed for the both settings.

• NOTE

Regardless of the Pr.71 (Pr.450) setting, offline auto tuning can be performed according to Pr.96 (Pr.463) Auto tuning setting/status. (Refer to page 532 for offline auto tuning.)

◆ Using two types of motors (RT signal, Pr.450)

- When using two types of motors with one inverter, set Pr.450 Second applied motor.
- The setting value "9999" (initial value) disables the second motor.
- If **Pr.450** ≠ 9999, the following parameters will be enabled by turning ON the Second function selection (RT) signal.

| Function | RT signal ON (second motor) | RT signal OFF (first motor) |
|---|-----------------------------|-----------------------------|
| Electronic thermal O/L relay | Pr.51 | Pr.9 |
| Applied motor | Pr.450 | Pr.71 |
| Control method selection | Pr.451 | Pr.800 |
| Motor capacity | Pr.453 | Pr.80 |
| Number of motor poles | Pr.454 | Pr.81 |
| Motor excitation current | Pr.455 | Pr.82 |
| Rated motor voltage | Pr.456 | Pr.83 |
| Rated motor frequency | Pr.457 | Pr.84 |
| Motor constant (R1) | Pr.458 | Pr.90 |
| Motor constant (R2) | Pr.459 | Pr.91 |
| Motor constant (L1)/d-axis inductance (Ld) | Pr.460 | Pr.92 |
| Motor constant (L2)/q-axis inductance (Lq) | Pr.461 | Pr.93 |
| Motor constant (X) | Pr.462 | Pr.94 |
| Auto tuning setting/status | Pr.463 | Pr.96 |
| Frequency search gain | Pr.560 | Pr.298 |
| Online auto tuning selection | Pr.574 | Pr.95 |
| Induced voltage constant (phi f) | Pr.738 | Pr.706 |
| Motor Ld decay ratio | Pr.739 | Pr.711 |
| Motor Lq decay ratio | Pr.740 | Pr.712 |
| Starting resistance tuning compensation | Pr.741 | Pr.717 |
| Starting magnetic pole position detection pulse width | Pr.742 | Pr.721 |
| Maximum motor frequency | Pr.743 | Pr.702 |
| Motor inertia (integer) | Pr.744 | Pr.707 |
| Motor inertia (exponent) | Pr.745 | Pr.724 |
| Motor protection current level | Pr.746 | Pr.725 |
| Torque current/Rated PM motor current | Pr.860 | Pr.859 |

NOTE

- The RT signal is the Second function selection signal. The RT signal also enables other second functions. (Refer to page 525.)
- The RT signal is assigned to terminal RT in the initial status. Set "3" in one of **Pr.178 to Pr.189 (Input terminal function selection)** to assign the RT signal to another terminal.
- Changing the terminal assignment using **Pr.178 to Pr.189 (Input terminal function selection)** may affect the other functions. Set parameters after confirming the function of each terminal.

◆ Automatic change of torque boost for the SF-PR motor

• When the SF-PR motor is selected (**Pr.71** = "70, 73, or 74"), the **Pr.0 Torque boost** is automatically changed to enable output of the 6 Hz 150% torque under V/F control by setting **Pr.81 Number of motor poles** according to the number of the SF-PR motor poles.



- When selecting the automatic change of torque boost for the SF-PR motor, set Pr.14 Load pattern selection = "0 (initial value)".
- When the **Pr.0** setting is changed from its initial value, the automatic change is not performed.

◆ Automatic change of Pr.0 Torque boost and Pr.12 DC injection brake operation voltage

• When initial values are set in **Pr.0** and **Pr.12**, the **Pr.0** and **Pr.12** settings are automatically changed to the values in the following table by changing the **Pr.71** setting.

| Inve | erter | | Pr.0 value (%) after automatic change | | | Pr.12 value (%) after automatic change | | | | | | |
|--------------------------|--------------------------|------------|---------------------------------------|----------------------|-----------|--|-----------|------------------|-----------|------------------|---------------------|----------|
| FR-A820-[] | FR-A840-[] | Stand | | Cons tord mote | que | | SF-I | PR ^{*3} | | Standard motor*1 | Constant- torque | SF-PR *3 |
| | | SLD/ LD | ND/ HD | SLD/ LD | ND/ HD | Pr.81 ≠ 2, 4, 6 | Pr.81 = 2 | Pr.81 = 4 | Pr.81 = 6 | motor | motor*2 | |
| 00046 (0.4K) | 00023 (0.4K) | 6 | | 6 | | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
| 00077(0.75K) | 00038(0.75K) | 6 | | 6 | | 4 | 7.4 | 6 | 6.4 | 4 | 4 | 4 |
| 00105(1.5K) | 00052(1.5K) | 4 | | 4 | | 3 | 5.8 | 5 | 3.7 | 4 | 4 | 2.5 |
| 00167(2.2K) | 00083(2.2K) | 4 | | 4 | | 2.5 | 6 | 4.5 | 3.3 | 4 | 4 | 2.5 |
| 00250(3.7K) | 00126(3.7K) | 4 | | 4 | | 2.5 | 6.4 | 4.5 | 4.2 | 4 | 4 | 2.5 |
| 00340(5.5K) | 00170(5.5K) | 3 | | 2 | | 2 | 4.5 | 3.7 | 3.3 | 4 | 2 | 2 |
| 00490(7.5K) | 00250(7.5K) | 3 | | 2 | | 2 | 4.4 | 4.5 | 3.8 | 4 | 2 | 2 |
| 00630(11K) | 00310(11K) | 2 | | 2 | | 1.5 | 3.5 | 3.3 | 3.5 | 2 | 2 | 1.5 |
| 00770(15K) | 00380(15K) | 2 | | 2 | | 1.5 | 4.5 | 3 | 3.5 | 2 | 2 | 1.5 |
| 00930(18.5K) | 00470(18.5K) | 2 | | 2 | | 1.5 | 4 | 3.2 | 3 | 2 | 2 | 1.5 |
| 01250(22K) | 00620(22K) | 2 | | 2 | | 1.5 | 2.5 | 3.4 | 3 | 2 | 2 | 1 |
| 01540(30K) | 00770(30K) | 2 | | 2 | | 1 | 3 | 2 | 2.5 | 2 | 2 | 1 |
| 01870(37K) | 00930(37K) | 2 | | 2 | | 1 | 2 | 2.5 | 2.6 | 2 | 2 | 1 |
| 02330(45K) | 01160(45K) | 1.5 | 2 | 1.5 | 2 | 1 | 2 | 2 | 2.4 | 2 | 2 | 1 |
| 03160(55K) | 01800(55K) | 1.5 | 2 | 1.5 | 2 | 0.7 | 2 | 2 | 0.7 | 2 | 2 | 1 |
| 03800 (75K) or higher | 02160 (75K) or higher | 1 | | 1 | | 1 | 1 | 1 | 1 | 1 | 1 | 1 |

- *1 **Pr.71** = "0, 2 to 6, 20, 23, 24, 40, 43, or 44" (standard motor)
- *2 **Pr.71** = "1, 13 to 16, 50, 53, or 54" (constant-torque motor)
- *3 **Pr.71** = "70, 73, or 74" (SF-PR)



- · When the Pr.0 and Pr.12 settings are changed from their initial values, the automatic change is not performed.
- When the SF-PR motor is selected (Pr.71 = "70, 73, or 74"), the output current may become large due to a small load by setting Pr.81 Number of motor poles according to the number of the SF-PR motor poles.
- · When the SF-PR motor is used, the output current tends to increase compared with the case where the SF-JR or SF-HR motor is used. Depending on the load conditions, the output current may increase even though the torque boost value has been automatically changed. When the protective function such as the electronic thermal O/L relay (E.THT, E.THM) or stall prevention (OL, E.OLT) is activated, adjust the Pr.0 Torque boost according to the load.

Make sure to set this parameter correctly according to the motor used. Incorrect setting may cause the motor and the inverter to overheat and burn.

Parameters referred to

Pr.0 Torque boost page 706

Pr.12 DC injection brake operation voltage page 715

Pr.14 Load pattern selection page 708
Pr.96 Auto tuning setting/status page 532
Pr.100 to Pr.109 (Adjustable 5 points V/F) page 713

Pr.178 to Pr.189 (Input terminal function selection) page 521

Pr.684 Tuning data unit switchover page 532

Pr.800 Control method selection page 221

Offline auto tuning for an induction motor 5.13.2

Magnetic flux Sensorless Vector

The offline auto tuning enables the optimal operation of a motor.

· Under Advanced magnetic flux vector control, Real sensorless vector control, or Vector control, automatic measurement of motor constants (offline auto tuning) enables optimal operation of motors even when motor constants vary, when a motor of another company is used, or when the wiring distance is long.

For the offline auto tuning for a PM motor, refer to page 551.

| Pr. | Name | Initial value | Setting range | Description | |
|-------------|--|--------------------|---|---|--|
| 684 | Tuning data unit | 0 | 0 | Internal data converted value | |
| C000 | switchover | U | 1 | The value is indicated in A, Ω , mH, or %. | |
| 71 C100 | Applied motor | 0 | 0 to 6, 13 to 16, 20, 23, 24, 30, 33, 34, 40, 43, 44, 50, 53, 54, 70, 73, 74, 330, 333, 334, 8090, 8093, 8094, 9090, 9093, 9094 | By selecting a motor, the thermal characteristic and motor constant of each motor are set. | |
| 80 C101 | Motor capacity | 9999 | 0.4 to 55 kW ^{*2} 0 to 3600 kW ^{*3} | Set the applied motor capacity. | |
| | | | 9999 | V/F control | |
| 81 C102 | Number of motor poles | 9999 | 2, 4, 6, 8, 10, 12 9999 | Set the number of motor poles. V/F control | |
| _ | - | Inverter | 0 to 500 A ^{*2} | | |
| 9 C103 | Electronic thermal O/L relay | rated current*1 | 0 to 3600 A*3 | Set the rated motor current. | |
| 83 C104 | Rated motor voltage | 200/400 V*4 | 0 to 1000 V | Set the rated motor voltage (V). | |
| 84 | Rated motor | 0000 | 10 to 400 Hz | Set the rated motor frequency (Hz). | |
| C105 | frequency | 9999 | 9999 | The setting value of Pr.3 Base frequency is used. | |
| 707 C107 | Motor inertia (integer) | 9999 | 10 to 999, 9999 | Set the motor inertia. 9999: The constant value of Mitsubishi Electric motor (SF-PR, | |
| 724 C108 | Motor inertia (exponent) | 9999 | 0 to 7, 9999 | SF-JR, SF-HR, SF-JRCA, SF-HRCA, SF-V5RU (1500 r/min series) and so on) is used. | |
| | | | 0 | No offline auto tuning | |
| 96 | Auto tuning | 0 | 1 | Offline auto tuning is performed without the motor rotating. | |
| C110 | C110 setting/status | | 11 | Offline auto tuning is performed without rotating the motor (V/F control, IPM motor MM-CF). (Refer to page 638.) | |
| | | | 101 | Offline auto tuning is performed with the motor rotating. | |
| 90 | Motor constant | 9999 | 0 to 50 Ω, 9999*2*5 | | |
| C120 | (R1) | 0000 | 0 to 400 mΩ, 9999*3*5 | | |
| 91 | Motor constant | or constant | 0 to 50 Ω, 9999*2*5 | | |
| C121 | (R2) | 9999 | 0 to 400 mΩ, 9999*3*5 | | |
| 92 | Motor constant | | 0 to 6000 mH, 9999*2*5 | | |
| C122 | (L1)/d-axis | 9999 | 0 to 400 mH, 9999*3*5 | Tuning data (The value measured by offline auto tuning is | |
| | inductance (Ld) | | | automatically set.) | |
| 93 C123 | Motor constant (L2)/q-axis inductance (Lq) | 9999 | 0 to 6000 mH, 9999*2*5 0 to 400 mH, 9999*3*5 | 9999: The constant value of Mitsubishi Electric motor (SF-PR, SF-JR, SF-HR, SF-JRCA, SF-HRCA, SF-V5RU (1500 r/min | |
| 94 C124 | Motor constant (X) | 9999 | 0 to 100%, 9999*5 | series) and so on) is used. | |
| 82 | Motor excitation | | 0 to 500 A, 9999*2*5 | | |
| C125 | current | 9999 | 0 to 3600 A, 9999*3*5 | | |
| 0.50 | Torque current/ | | 0 to 500 A, 9999*2*5 | | |
| 859 C126 | Rated PM motor current | 9999 | 0 to 3600 A, 9999*3*5 | | |
| 298 | Frequency search | 2000 | 0 to 32767 | The offline auto tuning automatically sets the gain required for the frequency search. | |
| A711 | gain | 9999 | 9999 | The constant value of Mitsubishi Electric motor (SF-PR, SF-JR, SF-HR, SF-JRCA, SF-HRCA and so on) is used. | |
| 450 C200 | Second applied motor | 9999 | 0, 1, 3 to 6, 13 to 16, 20, 23, 24, 30, 33, 34, 40, 43, 44, 50, 53, 54, 70, 73, 74, 330, 333, 334, 8090, 8093, 8094, 9090, 9093, 9094 | Set this parameter when using the second motor (the same specifications as Pr 71) | |
| | | | 9999 | The function is disabled. | |
| 453 | Second motor | | 0.4 to 55 kW ^{*2} | Set the capacity of the second motor. | |
| C201 | capacity | 9999 | 0 to 3600 kW ^{*3} | 23. 2.3 Supusity of the second motor. | |
| oapaony | | | 9999 | V/F control | |

| Pr. | Name | Initial value | Setting range | Description |
|------------------|---|------------------|-----------------------------------|---|
| 454 | Number of | | 2, 4, 6, 8, 10, 12 | Set the number of poles of the second motor. |
| C202 | second motor poles | 9999 | 9999 | V/F control |
| 51 | Second electronic | | 0 to 500 A ^{*2} | This function is enabled when the RT signal is ON. |
| C203 | Second electronic thermal O/L relay | 9999 | 0 to 3600 A ^{*3} | Set the rated motor current. |
| | , | | 9999 | Second electronic thermal O/L relay disabled. |
| 456 C204 | Rated second motor voltage | 200/400 V*4 | 0 to 1000 V | Set the rated voltage (V) of the second motor. |
| 457 | Rated second | 9999 | 10 to 400 Hz | Set the rated frequency (Hz) of the second motor. |
| C205 | motor frequency | 0000 | 9999 | The Pr.84 Rated motor frequency setting is used. |
| 744 C207 | Second motor inertia (integer) | 9999 | 10 to 999, 9999 | Set the inertia of the second motor. 9999: The constant value of Mitsubishi Electric motor (SF-PR, |
| 745 C208 | Second motor inertia (exponent) | 9999 | 0 to 7, 9999 | SF-JR, SF-HR, SF-JRCA, SF-HRCA and so on) is used. |
| | | | 0 | No auto tuning for the second motor. |
| 463 | Second motor auto tuning | 0 | 1 | Offline auto tuning is performed without the second motor rotating. |
| C210 | setting/status | | 11 | Offline auto tuning is performed without rotating the motor (V/F control, IPM motor MM-CF). (Refer to page 638.) |
| | | | 101 | Offline auto tuning is performed with the second motor rotating. |
| 458 | Second motor | 9999 | 0 to 50 Ω, 9999 ^{*2*5} | |
| C220 | constant (R1) | 0000 | 0 to 400 mΩ, 9999 ^{*3*5} | |
| 459 | Second motor | 9999 | 0 to 50 Ω, 9999*2*5 | |
| C221 | constant (R2) | stant (R2) | 0 to 400 mΩ, 9999*3*5 | |
| 460 | Second motor constant (L1) / d- | | 0 to 6000 mH, 9999*2*5 | |
| C222 | axis inductance (Ld) | 9999 | 0 to 400 mH, 9999 ^{*3*5} | Tuning data of the second motor. |
| | Second motor | | 0 to 6000 mH, 9999*2*5 | (The value measured by offline auto tuning is automatically |
| 461 C223 | constant (L2) / q- axis inductance (Lq) | 9999 | 0 to 400 mH, 9999*3*5 | set.) 9999: The constant value of Mitsubishi Electric motor (SF-PR, SF-JR, SF-HR, SF-JRCA, SF-HRCA and so on) is used. |
| 462 C224 | Second motor constant (X) | 9999 | 0 to 100%, 9999*5 | |
| 455 | Second motor | 9999 | 0 to 500 A, 9999*2*5 | |
| C225 | excitation current | 9999 | 0 to 3600 A, 9999*3*5 | |
| | Second motor | | 0 to 500 A, 9999*2*5 | |
| 860 C226 | • | | 0 to 3600 A, 9999*3*5 | |
| 560 | Second | | 0 to 32767 | The offline auto tuning automatically sets the gain required for the frequency search of the second motor. |
| 560 Δ712 free | frequency search gain | 9999 | 9999 | The constant value of Mitsubishi Electric motor (SF-PR, SF-JR, SF-HR, SF-JRCA, SF-HRCA and so on) is used for the second motor. |

^{*1} For the FR-A820-00077(0.75K) or lower and FR-A840-00038(0.75K) or lower, it is set to 85% of the inverter rated current.

^{*2} For the FR-A820-03160(55K) or lower, and FR-A840-01800(55K) or lower.

^{*3} For the FR-A820-03800(75K) or higher, and FR-A840-02160(75K) or higher.

The initial value differs according to the voltage class (200 V / 400 V).

^{*5} The setting range and unit change according to the **Pr.71 (Pr.450)** setting.



- The function is enabled under Advanced magnetic flux vector control, Real sensorless vector control, and Vector control.
- By using the offline auto tuning function, the optimum operation characteristics are obtained for a motor other than Mitsubishi
 Electric standard motors (SF-JR 0.4 kW or higher), high-efficiency motors (SF-HR 0.4 kW or higher), Mitsubishi Electric
 constant-torque motors (SF-JRCA 4P, SF-HRCA 0.4 kW to 55 kW), Mitsubishi Electric high-performance energy-serving
 motor (SF-PR), or Vector control dedicated motors (SF-V5RU (1500 r/min series)), such as an induction motor of other
 manufacturers, SF-JRC, or SF-TH, or with a long wiring length (30 m or longer).
- · Tuning is enabled even when a load is connected to the motor.
- During offline auto tuning, the motor rotation can be locked (**Pr.96** = "1") or unlocked (**Pr.96** = "101"). The tuning is more accurate when the motor rotates.
- Reading/writing of the motor constants tuned by offline auto tuning are enabled. The offline auto tuning data (motor constants) can be copied to another inverter using the operation panel.
- The offline auto tuning status can be monitored on the operation panel or the parameter unit.

♦ Before performing offline auto tuning

Check the following points before performing offline auto tuning:

- Check that a value other than "9999" is set in **Pr.80** and **Pr.81**, and Advanced magnetic flux vector control, Real sensorless vector control, or Vector control is selected (with Pr.800).
- · Check that a motor is connected. (Check that the motor is not rotated by an external force during tuning.)
- Select a motor with the rated current equal to or less than the inverter rated current. (The motor capacity must be 0.4 kW or higher.) If a motor with substantially low rated current compared with the inverter rated current, however, is used, speed and torque accuracies may deteriorate due to torque ripples, etc. Set the rated motor current to about 40% or higher of the inverter rated current.
- Tuning is not available for a high-slip motor, high-speed motor, or special motor.
- The maximum frequency is 400 Hz.
- The motor may rotate slightly even if offline auto tuning is performed without the motor rotating (**Pr.96 Auto tuning setting/status** = "1"). (The slight motor rotation does not affect the tuning performance.)
 - Fix the motor securely with a mechanical brake, or before tuning, make sure that it is safe even if the motor rotates. (Caution is required especially in vertical lift applications.)
- Check the following points for the offline auto tuning with motor rotation (**Pr.96 Auto tuning setting/status** = "101"). The torque is not sufficient during tuning.
 - Check that the motor can be rotated up to the speed close to the rated speed.
 - Check that the mechanical brake is released.
- Offline auto tuning is not performed correctly when the surge voltage suppression filter (FR-ASF-H/FR-BMF-H) is inserted between the inverter and motor. Be sure to remove it before performing tuning.
- Make sure to connect the encoder to the motor without coaxial misalignment for Vector control. Set the speed ratio to 1:1.

Settings

• To perform tuning, set the following parameters about the motor.

| First motor Pr. | Second motor Pr. | Name | Initial value | Description |
|-----------------------|------------------------|--------------------------------|---|--|
| 80 | 453 | Motor capacity | 9999 (V/F control) | Set the motor capacity (kW). |
| 81 | 454 | Number of motor poles | 9999 (V/F control) | Set the number of motor poles (2 to 12). |
| 800 | 451 | Control method selection | 20 | Set this parameter under Vector control or Real sensorless vector control. |
| 9 | 51 | Electronic thermal O/L relay | Inverter rated current Set the rated motor current (A). | |
| 83 | 456 | Rated motor voltage | 200 V / 400 V ^{*1} Set the rated motor voltage (V) printed on the motor's rating | |
| 84 | 457 | Rated motor frequency | 9999 | Set the rated motor frequency (Hz).*2When the setting is "9999", the Pr.3 Base frequency setting is used. |
| 71 | 450 | Applied motor | 0 (standard motor) | Set this parameter according to the motor.*3 Three types of motor constant setting ranges, units and tuning data can be stored according to settings. |
| 96 | 463 | Auto tuning setting/ status | 0 | Set "1" or "101". 1: Tuning is performed without the motor rotating. (Excitation noise occurs at this point.) 101: Tuning is performed with the motor rotating. The motor can rotate up to the speed near the rated motor frequency. |

- *1 The initial value differs according to the voltage class (200 V / 400 V).
- *2 For the settings for the SF-V5RU, refer to page 94.
- *3 Set Pr.71 Applied motor according to the motor to be used and the motor constant setting range. According to the Pr.71 setting, the range of the motor constant parameter setting values and units can be changed. (For other setting values of Pr.71, refer to page 528.)

| | | Pr.71 setting | | | | | |
|--|--|--|--|---|--|--|--|
| | Motor | Motor constant parameter mH, %, and A unit setting | Motor constant parameter internal data setting | Motor constant parameter Ω , m Ω , and A unit setting | | | |
| Mitsubishi Electric | SF-JR, SF-TH | 0 (initial value) | 3 (4) | _ | | | |
| standard motor | SF-JR 4P 1.5 kW or lower | 20 | 23 (24) | _ | | | |
| Mitsubishi Electric | SF-HR | 40 | 43 (44) | _ | | | |
| high-efficiency motor | Others | 0 (initial value) | 3 (4) | _ | | | |
| Mitsubishi Electric | SF-JRCA 4P, SF-TH (constant-torque) | 1 | 13 (14) | _ | | | |
| constant-torque motor | SF-HRCA | 50 | 53 (54) | _ | | | |
| | Others (SF-JRC, etc.) | 1 | 13 (14) | _ | | | |
| Mitsubishi Electric high-performance energy-saving motor | SF-PR | 70 | 73 (74) | _ | | | |
| Vector control | SF-V5RU (1500 r/min series) SF-THY | 30 | 33 (34) | _ | | | |
| dedicated motor | SF-V5RU (other than the 1500 r/min series) | 1 | 13 (14) | _ | | | |
| Other manufacturer's standard motor | _ | 0 (initial value) | 3 (4) | 5 (wye connection motor) 6 (delta connection motor) | | | |
| Other manufacturer's constant-torque motor | _ | 1 | 13 (14) | 15 (wye connection motor) 16 (delta connection motor) | | | |



- When the SF-V5RU (other than the 1500 r/min series) is used, be sure to perform auto tuning after setting "1, 13, or 14" in Pr.71 and setting Pr.83 and Pr.84.
- When Pr.11 DC injection brake operation time = "0" or Pr.12 DC injection brake operation voltage = "0", offline auto tuning is performed at the initial setting of **Pr.11** or Pr.12.
- When position control is selected (Pr.800 = "3 or 5" (when the MC signal is OFF)), offline auto tuning is not performed.
- If "wye connection" or "delta connection" is incorrectly selected in Pr.71, Advanced magnetic flux vector control, Real sensorless vector control, and Vector control are not performed properly.

· For tuning accuracy improvement, set the following parameters when the motor constants are known in advance.

| First motor Pr. | Second motor Pr. | Name | Mitsubishi Electric motor (SF-JR, SF-HR, SF-JRCA, SF-HRCA, SF-V5RU) | Other motors |
|--------------------|---------------------|--------------------------|---|---|
| 707 | 744 | Motor inertia (integer) | 0000 (initial value) | Motor inertia*4 |
| 724 | 745 | Motor inertia (exponent) | 9999 (initial value) | Jm = Pr.707 × 10^(-Pr.724) (kg·m ²) |

^{*4} The setting is valid only when a value other than "9999" is set in both Pr.707 (Pr.744) and Pr.724 (Pr.745).

◆ Performing tuning



- Before performing tuning, check the monitor display of the operation panel or parameter unit if the inverter is in the state ready for tuning. The motor starts by turning ON the start command while tuning is unavailable.
- In the PU operation mode, press FWD / REV on the operation panel.
 For External operation, turn ON the start command (STF signal or STR signal). Tuning starts.



- · Satisfy the required inverter start conditions to start offline auto tuning. For example, stop the input of the MRS signal.
- To force tuning to end, use the MRS or RES signal or STOP on the operation panel.

(Turning OFF the start signal (STF signal or STR signal) also ends tuning.)

- During offline auto tuning, only the following I/O signals are valid (initial value).
 Input terminals <valid signals>: STP (STOP), OH, MRS, RT, RES, STF, STR, S1, and S2
 Output terminals: RUN, OL, IPF, FM/CA, AM, A1B1C1, and So (SO)
- When the rotation speed and the output frequency are selected for terminals FM/CA and AM, the progress status of offline auto tuning is output in 15 steps from FM/CA and AM.
- Do not perform ON/OFF switching of the Second function selection (RT) signal during offline auto tuning. Auto tuning will not be performed properly.
- Setting offline auto tuning (Pr.96 Auto tuning setting/status = "1 or 101") will make pre-excitation invalid.
- When the offline auto tuning with motor rotation is selected (**Pr.96 Auto tuning setting/status** = "101"), take caution and ensure safety against the rotation of the motor.
- Since the Inverter running (RUN) signal turns ON when tuning is started, pay close attention especially when a sequence which releases a mechanical brake by the RUN signal has been designed.
- When executing offline auto tuning, input the operation command after switching ON the main circuit power (R/L1, S/L2, T/L3) of the inverter.
- While **Pr.79 Operation mode selection** = "7", turn ON the PU operation external interlock (X12) signal for tuning in the PU operation mode.
- · During tuning, the monitor is displayed on the operation panel as follows.

| Tuning status | Operation panel (| FR-DU08) display | LCD operation pane | el (FR-LU08) display |
|-----------------------|--|---|---|--|
| Tuning status | Pr.96 = "1" | Pr.96 = "101" | Pr.96 = "1" | Pr.96 = "101" |
| (1) Setting | PU -MON -M | -PU -MON -IN -IN -IN -IN -IN -IN -IN -IN -IN -I | AutoTune 12:34 TUNE 1 STOP PU PREV NEXT | AutoTune 12:34 TUNE 101 STOP PU PREV NEXT |
| (2) During tuning | | PU -MON -IM -BU -POM -PM -BU -PMON -PM | AutoTune 12:34 TUNE | AutoTune 12:34 TUNE 102 STF FWD PU PREV NEXT |
| (3) Normal completion | PU - MON - MIN - M | PRU PHU PHU PHU PHU PHU PHU PHU PHU PHU PH | AutoTune 12:34 TUNE Completed 3 STF STOP PU PREV NEXT | AutoTune 12:34 TUNE |

Note: Offline auto tuning time (with the initial setting)

| Offline auto tuning setting | Time |
|--|--|
| No motor rotation (Pr.96 = "1") | About 25 to 120 s. (The time depends on the inverter capacity and motor type.) |
| 1 With motor rotation (Dr UK = "1111") | About 40 s. (The following offline auto tuning time is set according to the acceleration/deceleration time setting. Offline auto tuning time = acceleration time + deceleration time + about 30 s) |

• When offline auto tuning ends, press on the operation panel during PU operation. For External operation, turn OFF the start signal (STF signal or STR signal).

This operation resets the offline auto tuning, and the PU's monitor display returns to the normal indication. (Without this operation, next operation cannot be started.)

• NOTE

- The motor constants measured once during offline auto tuning are stored as parameters and their data are held until offline auto tuning is performed again. However, the tuning data is cleared when performing All parameter clear.
- Changing **Pr.71** (**Pr.450**) after tuning completion will change the motor constant. For example, if "3" is set in **Pr.71** after tuning is performed with **Pr.71** = "0", the tuning data becomes invalid. To use the tuned data, set "0" again in **Pr.71**.
- If offline auto tuning has ended in error (see the following table), motor constants are not set. Perform an inverter reset and restart tuning.

| Error display | Error cause | Countermeasures |
|---------------|--|--|
| 8 | Forced end | Set Pr.96 = "1 or 101" and try again. |
| 9 | Inverter protective function operation | Make the setting again. |
| 91 | The current limit (stall prevention) function is activated. | Set the acceleration/deceleration time longer. Set Pr.156 Voltage reduction selection during stall prevention operation = "1". |
| 92 | The converter output voltage fell to 75% of the rated voltage. | Check for the power supply voltage fluctuation. Check the Pr.83 Rated motor voltage setting. |
| 93 | Calculation error. The motor is not connected. | Check the Pr.83 and Pr.84 settings. Check the motor wiring and make the setting again. |
| 94 | Rotation tuning frequency setting error. (The frequency command for the tuning was given to exceed the maximum frequency setting, or to be in the frequency jump range.) | Check the Pr.1 Maximum frequency and Pr.31 to Pr.36 Frequency jump settings. |

- When tuning is ended forcibly by pressing or turning OFF the start signal (STF or STR) during tuning, offline auto tuning does not end properly. (The motor constants have not been set.)

 Perform an inverter reset and perform tuning again.
- When the rated power supply of the motor is 200/220 V (400/440 V) 60 Hz, set the rated motor current multiplied by 1.1 in **Pr.9 Electronic thermal O/L relay** after tuning is complete.
- For a motor with a PTC thermistor, thermal protector, or other thermal detector, set "0" (motor overheat protection by inverter invalid) in **Pr.9** to protect the motor from overheating.

NOTE

- An instantaneous power failure occurring during tuning will result in a tuning error. After power is restored, the inverter starts normal operation. Therefore, when the STF (STR) signal is ON, the motor starts forward (reverse) rotation.
- Any fault occurring during tuning is handled as in the normal operation. However, if the retry function is set, no retry is performed.
- The set frequency monitor displayed during the offline auto tuning is 0 Hz.

∴ CAUTION

- · Note that the motor may start running suddenly.
- For performing offline auto tuning with the motor rotating in vertical lift applications, etc., caution is required to avoid falling due to insufficient torque.

Changing the motor constants

- The motor constants can be set directly when the motor constants are known in advance, or by using the data measured during offline auto tuning.
- According to the **Pr.71 (Pr.450)** setting, the range of the motor constant parameter setting values and units can be changed. The changed settings are stored in the EEPROM as the motor constant parameters.

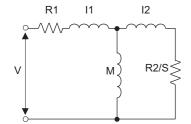
Changing the motor constants (when setting the Pr.92 and Pr.93 motor constants in units of mH)

· Set Pr.71 as follows.

| N | Pr.71 setting | |
|--|--|-------------------|
| Maria de la compansión de | SF-JR | 0 (initial value) |
| Mitsubishi Electric standard motor Mitsubishi Electric high-efficiency motor | SF-JR 4P 1.5 kW or lower | 20 |
| Witsubishi Electric high-emolericy motor | SF-HR | 40 |
| Mitsubishi Electric constant-torque motor | SF-JRCA 4P | 1 |
| Willsubistii Electric Constant-torque motor | SF-HRCA | 50 |
| Mitsubishi Electric high-performance energy-saving motor | SF-PR | 70 |
| Vector control dedicated motor | SF-V5RU (1500 r/min series) | 30 |
| | SF-V5RU (other than the 1500 r/min series) | 1 |

• Use the following formula to find the Pr.94 setting value and set a desired value as the motor constant parameter.

The setting value of **Pr.94** =
$$(1 - \frac{M^2}{L1 \times L2}) \times 100(\%)$$



R1: Primary resistance

R2: Secondary resistance

I1: Primary leakage inductance

12: Secondary leakage inductance

M: Excitation inductance

S: Slip

L1= I1+ M: Primary inductance

L2= I2+ M: Secondary inductance

Equivalent circuit diagram of the motor

| First motor Pr. | Second motor Pr. | Name | Setting range | Setting increments | Initial value |
|-----------------|---------------------|-------------------------------------|---------------------------------|-----------------------------|---------------|
| 82 | 455 | Motor excitation current (no load | 0 to 500 A, 9999 ^{*1} | 0.01 A ^{*1} | |
| 02 | 455 | current) | 0 to 3600 A, 9999*2 | 0.1 A ^{*2} | |
| 90 | 458 | Motor constant (R1) | 0 to 50 Ω, 9999*1 | 0.001 Ω ^{*1} | |
| 90 | 430 | Wotor constant (IVI) | 0 to 400 mΩ, 9999 ^{*2} | 0.01 mΩ ^{*2} | |
| 91 | 459 | Motor constant (R2) | 0 to 50 Ω, 9999*1 | 0.001 Ω ^{*1} | |
| 91 | 439 | Wotor Constant (N2) | 0 to 400 mΩ, 9999 ^{*2} | $0.01 \text{ m}\Omega^{*2}$ | |
| 92 | 460 | Motor constant (L1)/d-axis | 0 to 6000 mH, 9999*1 | 0.1 mH ^{*1} | |
| 92 | 400 | inductance (Ld) 0 to 400 mH, 9999*2 | 0 to 400 mH, 9999 ^{*2} | 0.01 mH ^{*2} | 9999 |
| 93 | 461 | Motor constant (L2)/q-axis | 0 to 6000 mH, 9999*1 | 0.1 mH ^{*1} | |
| 93 | 401 | inductance (Lq) | 0 to 400 mH, 9999*2 | 0.01 mH ^{*2} | |
| 94 | 462 | Motor constant (X) | 0 to 100%, 9999 | 0.1% ^{*1} | |
| 94 | 402 | Motor constant (A) | 0 to 100%, 9999 | 0.01% ^{*2} | |
| 859 | 860 | Torque current/Rated PM motor | 0 to 500 A, 9999*1 | 0.01 A ^{*1} | |
| 009 | 000 | current | 0 to 3600 A, 9999*2 | 0.1 A ^{*2} | |
| 298 | 560 | Frequency search gain | 0 to 32767, 9999 | 1 | |

^{*1} For the FR-A820-03160(55K) or lower, and FR-A840-01800(55K) or lower.

^{*2} For the FR-A820-03800(75K) or higher, and FR-A840-02160(75K) or higher.



• If "9999" is set, tuning data will be invalid and the constant values for Mitsubishi Electric motors (SF-PR, SF-JR, SF-HR, SF-JRCA, SF-HRCA and SF-V5RU (1500 r/min series) and so on) are used.

◆ Changing the motor constants (when setting motor constants in the internal data of the inverter)

• Set Pr.71 as follows.

| M | otor | Pr.71 setting |
|--|--|---------------|
| | SF-JR, SF-TH | 3 (4) |
| Mitsubishi Electric standard motor | SF-JR 4P 1.5 kW or lower | 23 (24) |
| Mitsubishi Electric high-efficiency motor | SF-HR | 43 (44) |
| | Others | 3 (4) |
| | SF-JRCA 4P, SF-TH (constant-torque) | 13 (14) |
| Mitsubishi Electric constant-torque motor | SF-HRCA | 53 (54) |
| | Others (SF-JRC, etc.) | 13 (14) |
| Mitsubishi Electric high-performance energy-saving motor | SF-PR | 73 (74) |
| Vector control dedicated motor | SF-V5RU (1500 r/min series), SF-THY | 33 (34) |
| vector control dedicated motor | SF-V5RU (other than the 1500 r/min series) | 13 (14) |
| Other manufacturer's standard motor | _ | 3 (4) |
| Other manufacturer's constant-torque motor | _ | 13 (14) |

• Set desired values as the motor constant parameters. The display units of the read motor constants can be changed with **Pr.684 Tuning data unit switchover**. Setting **Pr.684** = "1" disables parameter setting changes.

| Eirot motor | Casand | | Pr.684 = 0 (in | itial value) | Pr.684 = | 1 | Initial |
|--------------------|---------------------|--|----------------------|--------------------|---------------------------------|-----------------------|-----------------------|
| First motor Pr. | Second motor Pr. | Name | Setting range | Setting increments | Range indication | Unit indication | Initial value |
| 82 | 455 | Motor excitation current | | | 0 to 500 A, 9999*1 | 0.01 A ^{*1} | |
| 02 | 455 | Motor excitation current | | | 0 to 3600 A, 9999*2 | 0.1 A ^{*2} | |
| 90 | 458 | Motor constant (R1) | | | 0 to 50 Ω, 9999 ^{*1} | 0.001 Ω ^{*1} | |
| 90 | 450 | Motor Constant (ICT) | | | 0 to 400 mΩ, 9999 ^{*2} | 0.01 mΩ ^{*2} | |
| 91 | 459 | Motor constant (R2) Motor constant (L1)/d- axis inductance (Ld) | | | 0 to 50 Ω, 9999 ^{*1} | 0.001 Ω ^{*1} | |
| 91 | 458 | | | | 0 to 400 mΩ, 9999 ^{*2} | 0.01 mΩ ^{*2} | |
| 92 | 460 | | 0 to ***, 9999 | 1 | 0 to 6000 mH, 9999*1 | 0.1 mH ^{*1} | |
| 92 | 400 | | axis inductance (Ld) | 0 10 , 9999 | | 0 to 400 mH, 9999*2 | 0.01 mH ^{*2} |
| 93 | 461 | Motor constant (L2)/q- | | | 0 to 6000 mH, 9999*1 | 0.1 mH ^{*1} | |
| 93 | 401 | axis inductance (Lq) | | | 0 to 400 mH, 9999*2 | 0.01 mH ^{*2} | |
| 94 | 462 | Motor constant (X) | 1 | | 0 to 100%, 9999 | 0.1% ^{*1} | |
| 34 | 402 | MOTOL CONSTANT (X) | | | 0 10 100 %, 9999 | 0.01% ^{*2} | |
| 859 | 860 | Torque current/Rated | | | 0 to 500 A, 9999*1 | 0.01 A ^{*1} | |
| 009 | 000 | PM motor current | | | 0 to 3600 A, 9999*2 | 0.1 A ^{*2} | |
| 298 | 560 | Frequency search gain | 0 to 32767, 9999 | 1 | 0 to 32767, 9999 | 1 | |

^{*1} For the FR-A820-03160(55K) or lower, and FR-A840-01800(55K) or lower.

^{*2} For the FR-A820-03800(75K) or higher, and FR-A840-02160(75K) or higher.



• As the motor constants measured in the offline auto tuning have been converted into internal data (****), refer to the following setting example when making setting. (The value displayed has been converted into a value for internal use. Therefore, simple addition of a value to the displayed value does not bring the desired effect.)

Setting example: To slightly increase the **Pr.90** value (5%) When "2516" is displayed for **Pr.90**, set 2642 (2516 \times 1.05 = 2641.8) in **Pr.90**.

• If "9999" is set, tuning data will be invalid and the constant values for Mitsubishi Electric motors (SF-PR, SF-JR, SF-HR, SF-JRCA, SF-HRCA and SF-V5RU (1500 r/min series) and so on) are used.

Changing the motor constants (when setting the Pr.92, Pr.93, and Pr.94 motor constants in units of Ω)

• Set **Pr.71** as follows.

| Applied motor | Pr.71 setting | | |
|-----------------------|----------------------|------------------------|--|
| Applied motor | Wye connection motor | Delta connection motor | |
| Standard motor | 5 | 6 | |
| Constant-torque motor | 15 | 16 | |

· Set desired values as the motor constant parameters.

Iq = torque current, I100 = rated current, I0 = no load current

$$Iq = \sqrt{1100^2 - 10^2}$$

| First motor Pr. | Second motor Pr. | Name | Setting range | Setting increments | Initial value |
|-----------------|---------------------|-------------------------------|----------------------------------|-----------------------|---------------|
| 82 | 455 | Motor excitation current (no | 0 to 500 A, 9999 ^{*1} | 0.01 A ^{*1} | |
| 02 | 455 | load current) | 0 to 3600 A, 9999*2 | 0.1 A ^{*2} | |
| 90 | 458 | Motor constant (r1) | 0 to 50 Ω, 9999*1 | 0.001 Ω ^{*1} | |
| 90 | 430 | Motor constant (11) | 0 to 400 mΩ, 9999*2 | 0.01 mΩ ^{*2} | |
| 91 | 459 | Mater constant (r2) | 0 to 50 Ω, 9999*1 | 0.001 Ω ^{*1} | |
| 91 | 459 | Motor constant (r2) | 0 to 400 mΩ, 9999*2 | 0.01 mΩ ^{*2} | |
| 92 | 460 | Mater constant (v1) | 0 to 50 Ω, 9999*1 | 0.001 Ω ^{*1} | 9999 |
| 92 | 400 | Motor constant (x1) | 0 to 3600 mΩ, 9999 ^{*2} | 0.1 mΩ ^{*2} | |
| 93 | 461 | Mater constant (v2) | 0 to 50 Ω, 9999*1 | 0.001 Ω ^{*1} | |
| 93 | 401 | Motor constant (x2) | 0 to 3600 mΩ, 9999*2 | 0.1 mΩ ^{*2} | |
| 94 | 400 | Matan and ant (von) | 0 to 500 Ω, 9999*1 | 2212 | |
| 94 | 462 | Motor constant (xm) | 0 to 100 Ω, 9999*2 | 0.01 Ω | |
| 050 | 960 | Torque current/Rated PM motor | 0 to 500 A, 9999*1 | 0.01 A ^{*1} | |
| 859 | 860 | current | 0 to 3600 A, 9999*2 | 0.1 A ^{*2} | |
| 298 | 560 | Frequency search gain | 0 to 32767, 9999 | 1 | |

- *1 For the FR-A820-03160(55K) or lower, and FR-A840-01800(55K) or lower.
- *2 For the FR-A820-03800(75K) or higher, and FR-A840-02160(75K) or higher.

■ NOTE

- If "wye connection" or "delta connection" is incorrectly selected in **Pr.71**, Advanced magnetic flux vector control, Real sensorless vector control, and Vector control are not performed properly.
- If "9999" is set, tuning data will be invalid and the constant values for Mitsubishi Electric motors (SF-PR, SF-JR, SF-HR, SF-JRCA, SF-HRCA and SF-V5RU (1500 r/min series) and so on) are used.

♦ Tuning the second motor

- When one inverter switches the operation between two different motors, set the second motor in Pr.450 Second applied motor. (Refer to page 528.) In the initial setting, no second motor is applied.
- Turning ON the RT signal enables the parameter settings for the second motor as follows.

| Function | RT signal ON (second motor) | RT signal OFF (first motor) |
|--|-----------------------------|-----------------------------|
| Motor capacity | Pr.453 | Pr.80 |
| Number of motor poles | Pr.454 | Pr.81 |
| Motor excitation current | Pr.455 | Pr.82 |
| Rated motor voltage | Pr.456 | Pr.83 |
| Rated motor frequency | Pr.457 | Pr.84 |
| Motor constant (R1) | Pr.458 | Pr.90 |
| Motor constant (R2) | Pr.459 | Pr.91 |
| Motor constant (L1)/d-axis inductance (Ld) | Pr.460 | Pr.92 |
| Motor constant (L2)/q-axis inductance (Lq) | Pr.461 | Pr.93 |
| Motor constant (X) | Pr.462 | Pr.94 |
| Auto tuning setting/status | Pr.463 | Pr.96 |
| Frequency search gain | Pr.560 | Pr.298 |



- The RT signal is assigned to terminal RT in the initial status. Set "3" in one of Pr.178 to Pr.189 (Input terminal function selection) to assign the RT signal to another terminal.
- · Changing the terminal assignment using Pr.178 to Pr.189 (Input terminal function selection) may affect the other functions. Set parameters after confirming the function of each terminal.

Parameters referred to Pr.1 Maximum frequency page 428 Pr.9 Electronic thermal O/L relay page 415 Pr.31 to Pr.36 Frequency jump page 429 Pr.71 Applied motor □ page 528 Pr.156 Stall prevention operation selection page 431 Pr.178 to Pr.189 (Input terminal function selection) page 521 Pr.190 to Pr.196 (Output terminal function selection) page 473 Pr.800 Control method selection page 221

5.13.3 Offline auto tuning for a PM motor (under Vector control)

Vector

The offline auto tuning enables the optimal operation of a PM motor (under Vector control).

· Automatic measurement of motor constants (offline auto tuning) enables optimal operation of motors for Vector control even when motor constants vary or when the wiring distance is long.

For the offline auto tuning under Vector control (for induction motor), refer to page 532.

| Pr. | Name | Initial value | Setting range | Description |
|-------------|--------------------------|----------------------------|---|---|
| 684 | Tuning data unit | 0 | 0 | Internal data converted value |
| C000 | switchover | U | 1 | The value is indicated in A, Ω , mH, or mV. |
| 71 C100 | Applied motor | 0 | 0 to 6, 13 to 16, 20, 23, 24, 30, 33, 34, 40, 43, 44, 50, 53, 54, 70, 73, 74, 330, 333, 334, 8090, 8093, 8094, 9090, 9093, 9094 | By selecting a motor, the thermal characteristic and motor constant of each motor are set. |
| 00 | | | 0.4 to 55 kW ^{*2} | Cat the applied mater conscitu |
| 80 C101 | Motor capacity | 9999 | 0 to 3600 kW*3 | Set the applied motor capacity. |
| 0.0. | | | 9999 | V/F control |
| 81 | Number of motor poles | 9999 | 2, 4, 6, 8, 10, 12 | Set the number of motor poles. |
| C102 | Number of motor poles | 9999 | 9999 | V/F control |
| 9 C103 | Electronic thermal O/L | Inverter rated | 0 to 500 A*2 | Set the rated motor current. |
| C 103 | Telay | current*1 | 0 to 3600 A ^{*3} | |
| 83 C104 | Rated motor voltage | 200/400 V ^{*4} | 0 to 1000 V | Set the rated motor voltage (V). |
| 84 | | | 10 to 400 Hz | Set the rated motor frequency (Hz). |
| C105 | Rated motor frequency | 9999 | 9999 | As the internal data of the inverter is used, set it correctly according to the motor specifications. |
| 702 | Maximum motor | 9999 | 0 to 400 Hz | Set the permissible speed (frequency) of the motor. |
| C106 | frequency | 9999 | 9999 | The Pr.84 setting is used. |
| 707 C107 | Motor inertia (integer) | 9999 | 10 to 999, 9999 | Set the motor inertia. |
| 724 C108 | Motor inertia (exponent) | 9999 | 0 to 7, 9999 | 9999: Inverter internal data |
| | | | 0 | No offline auto tuning |
| | | | 1 | Offline auto tuning is performed without the motor rotating. |
| 96 C110 | | 0 | 11 | Offline auto tuning is performed only for motor constant R1 (without motor rotation). |
| | | | | Encoder position tuning and offline auto tuning are performed (with the motor rotating slightly). |

| Pr. | Name | Initial value | Setting range | Description |
|--------------|---|------------------|---|---|
| 90 | Motor constant (R1) | 9999 | 0 to 50 Ω, 9999 ^{*2*5} | |
| C120 | motor constant (ivi) | 3333 | 0 to 400 mΩ, 9999*3*5 | |
| 92 | Motor constant (L1)/d- | 9999 | 0 to 500 mH, 9999*2*5 | |
| C122 | axis inductance (Ld) | 3333 | 0 to 50 mH, 9999*3*5 | Tuning data (The value measured by offline auto tuning is automatically set.) |
| 93 | Motor constant (L2)/q- | 9999 | 0 to 500 mH, 9999*2*5 | 9999: Inverter internal data is used. |
| C123 | axis inductance (Lq) | 0000 | 0 to 50 mH, 9999*3*5 | |
| 859 | Torque current/Rated | 9999 | 0 to 500 A, 9999*2*5 | |
| C126 | PM motor current | 0000 | 0 to 3600 A, 9999*3*5 | |
| 706 | Induced voltage | | 0 to 5000 mV (rad/s)*5 | Set this parameter according to the PM motor specifications. |
| C130 | constant (phi f) | 9999 | 9999 | The value calculated from the parameter setting for motor constant is used. |
| 1412 C135 | Motor induced voltage constant (phi f) | 9999 | 0 to 2 | Set the exponent n when the induced voltage constant phi f (Pr.706) is multiplied by 10 ⁿ . |
| | exponent | | 9999 | No exponent setting |
| 711 C131 | Motor Ld decay ratio | 9999 | 0 to 100%, 9999 | Tuning data (The value measured by offline auto tuning is automatically set.) |
| 712 C132 | Motor Lq decay ratio | 9999 | 0 to 100%, 9999 | 9999: Inverter internal data is used. |
| 725 | Motor protection | 9999 | 100 to 500% | Set the maximum current (OCT) level of the motor. |
| C133 | current level | | 9999 50 to 150% | 200% |
| 1002 C150 | Lq tuning target current adjustment coefficient | 9999 | 50 to 150% 9999 | Adjust the target current during tuning. 100% |
| 450 C200 | Second applied motor | 9999 | 0, 1, 3 to 6, 13 to 16, 20, 23, 24, 30, 33, 34, 40, 43, 44, 50, 53, 54, 70, 73, 74, 330, 333, 334, 8090, 8093, 8094, 9090, 9093, 9094 | Set this parameter when using the second motor (the same specifications as Pr.71). |
| | | | 9999 | The function is disabled. |
| 453 C201 | Second motor capacity | 9999 | 0.4 to 55 kW*2 0 to 3600 kW*3 | Set the capacity of the second motor. |
| | | | 9999 | V/F control |
| 454 C202 | Number of second motor poles | 9999 | 2, 4, 6, 8, 10, 12 9999 | Set the number of poles of the second motor. |
| 51 | Second electronic | 9999 | 0 to 500 A*2 | V/F control Set the rated current of the second motor. |
| C203 | thermal O/L relay | 9999 | 0 to 3600 A*3 9999 | The second electronic thermal O/L relay is disabled. |
| 456 C204 | Rated second motor voltage | 200 V/400 V*4 | 0 to 1000 V | Set the rated voltage (V) of the second motor. |
| | - | * | 10 to 400 Hz | Set the rated frequency (Hz) of the second motor. |
| 457 C205 | Rated second motor frequency | 9999 | 9999 | As the inverter internal data is used for the second motor, set it correctly according to the motor specifications. |
| 743 | Second motor | 9999 | 0 to 400 Hz | Set the permissible speed (frequency) of the second motor. |
| C206 | maximum frequency | 5555 | 9999 | The Pr.457 setting is used. |
| 744 C207 | Second motor inertia (integer) | 9999 | 10 to 999, 9999 | Set the motor inertia of the second motor. |
| 745 C208 | Second motor inertia (exponent) | 9999 | 0 to 7, 9999 | 9999: Inverter internal data |
| | | | 0 | No auto tuning for the second motor. |
| 463 | Second motor auto | | 1 | Offline auto tuning is performed without the motor rotating. Offline auto tuning is performed only for motor constant R1 |
| C210 | tuning setting/status | 0 | 11 | (without motor rotation) |
| | | | 101 | Encoder position tuning and offline auto tuning are performed (with the motor rotating slightly). |

| Pr. | Name | Initial value | Setting range | Description |
|---------------------------|--|------------------|------------------------|---|
| 458 | Second motor | 9999 | 0 to 50 Ω, 9999*2*5 | |
| C220 | constant (R1) | 9999 | 0 to 400 mΩ, 9999*3*5 | |
| 460 | Second motor | | 0 to 500 mH, 9999*2*5 | |
| C222 | constant (L1) / d-axis inductance (Ld) | 9999 | 0 to 50 mH, 9999*3*5 | Tuning data of the second motor. (The value measured by offline auto tuning is automatically |
| 461 | Second motor | 0000 | 0 to 500 mH, 9999*2*5 | set.) |
| C223 | constant (L2) / q-axis inductance (Lq) | 9999 | 0 to 50 mH, 9999*3*5 | 9999: Inverter internal data is used. |
| 860 | Second motor torque | 0000 | 0 to 500 A, 9999*2*5 | |
| C226 | current/Rated PM motor current | 9999 | 0 to 3600 A, 9999*3*5 | |
| 738 | Second motor induced | | 0 to 5000 mV (rad/s)*5 | Set this parameter according to the PM motor specifications. |
| C230 | voltage constant (phi f) | 9999 | 9999 | The value calculated from the parameter setting for motor constant is used. |
| 1413 C235 | Second motor induced voltage constant (phi f) | 9999 | 0 to 2 | Set the exponent n when the induced voltage constant phi f (Pr.738) is multiplied by 10 ⁿ . |
| G235 | exponent | | 9999 | No exponent setting |
| 739 C231 | Second motor Ld decay ratio | 9999 | 0 to 100%, 9999 | Tuning data of the second motor. (The value measured by offline auto tuning is automatically |
| 740 C232 | Second motor Lq decay ratio | 9999 | 0 to 100%, 9999 | set.) 9999: Inverter internal data is used. |
| 746 | Second motor | | 100 to 500% | Set the maximum current (OCT) level of the second motor. |
| C233 | protection current level | 9999 | 9999 | 200% |
| 373 | Encoder position | 0 | 0 | Encoder position tuning disabled. |
| C142 ^{*6} | tuning setting/status | Ů | 1 | Encoder position tuning enabled. |
| 871 | Control terminal option—Encoder | | 0 | Encoder position tuning disabled. |
| C243 ^{*7} | position tuning setting/ status | 0 | 1 | Encoder position tuning enabled. |
| 1105 | Encoder magnetic pole | 65535 | 0 to 16383 | Encoder position tuning data set. |
| C143 ^{*6} | position offset | บบองอ | 65535 | Encoder position tuning not performed. |
| 007 | Control terminal | | 0 to 16383 | Encoder position tuning data set. |
| 887 C143 ^{*7} | option—Encoder magnetic pole position offset | 65535 | 65535 | Encoder position tuning not performed. |

- *1 For the FR-A820-00077(0.75K) or lower and FR-A840-00038(0.75K) or lower, it is set to 85% of the inverter rated current.
- $^{\star}2$ $\,$ For the FR-A820-03160(55K) or lower, and FR-A840-01800(55K) or lower.
- *3 For the FR-A820-03800(75K) or higher, and FR-A840-02160(75K) or higher.
- $^{*}4$ The initial value differs according to the voltage class (200 V / 400 V).
- *5 The setting range and unit change according to the **Pr.71 (Pr.450)** setting.
- *6 The setting is available when the FR-A8AL/FR-A8APR/FR-A8APS/FR-A8APA is installed.
- *7 The setting is available when the FR-A8TP is installed.



- Tuning is enabled even when a load is connected to the motor.
- Reading/writing of the motor constants tuned by offline auto tuning are enabled. The offline auto tuning data (motor constants) can be copied to another inverter using the operation panel.
- · The offline auto tuning status can be monitored on the operation panel or the parameter unit.

◆ Before performing offline auto tuning

Check the following points before performing offline auto tuning:

- · The Vector control is selected.
- · Check that a motor is connected. (Check that the motor is not rotated by an external force during tuning.)
- The rated motor current should be equal to or less than the inverter rated current. (The motor capacity must be 0.4 kW or higher.)

If a motor with substantially low rated current compared with the inverter rated current, however, is used, speed and torque accuracies may deteriorate due to torque ripples, etc. Set the rated motor current to about 40% or higher of the inverter rated current.

• The maximum frequency is 400 Hz.

- The motor may rotate slightly even if the offline auto tuning without motor rotation (**Pr.96 Auto tuning setting/status** = "1") is selected. (It does not affect the tuning performance.)
 - Fix the motor securely with a mechanical brake, or before tuning, make sure that it is safe even if the motor rotates. (Caution is required especially in vertical lift applications.)
- · Tuning is not available during position control.
- · Tuning may be disabled depending on the motor characteristics.

Settings

• To perform tuning, set the following parameters about the motor.

| First motor Pr. | Second motor Pr. | Name | Setting value |
|-----------------|---------------------|------------------------------|---|
| 80 | 453 | Motor capacity | Motor capacity (kW) |
| 81 | 454 | Number of motor poles | Number of motor poles (2 to 12) |
| 9 | 51 | Electronic thermal O/L relay | Rated motor current (A) |
| 84 | 457 | Rated motor frequency | Rated motor frequency (Hz) |
| 83 | 456 | Rated motor voltage | Rated motor voltage (V) |
| 71 | 450 | Applied motor | 8090, 8093 (IPM motor), 9090, 9093 (SPM motor) ^{*1} |
| 96 | 463 | Auto tuning setting/status | 1, 101 |

*1 Set **Pr.71 Applied motor** according to the motor to be used. According to the **Pr.71** setting, the range of the motor constant parameter setting values and units can be changed. (For other setting values of **Pr.71**, refer to page 528.)

| | Pr.71 setting | | | |
|-----------|--|--|--|--|
| Motor | Motor constant parameter Ω, mH, and A unit setting | Motor constant parameter internal data setting | | |
| IPM motor | 8090 | 8093 (8094) | | |
| SPM motor | 9090 | 9093 (9094) | | |

· For tuning accuracy improvement, set the following parameters when the motor constants are known in advance.

| First motor Pr. | Second motor Pr. | Name | Setting value |
|-----------------|---------------------|--------------------------------|---|
| 702 | 743 | Maximum motor frequency | Maximum motor frequency (Hz) |
| 707 | 744 | Motor inertia (integer) | Motor inertia ^{*1} |
| 724 | 745 | Motor inertia (exponent) | Jm = Pr.707 × 10 ^(-Pr.724) (kg·m ²) |
| 725 | 746 | Motor protection current level | Maximum current level of the motor (%) |

^{*1} The setting is valid only when a value other than "9999" is set in both Pr.707 (Pr.744) and Pr.724 (Pr.745).

Performing tuning



- Before performing tuning, check the monitor display of the operation panel or parameter unit if the inverter is in the state ready for tuning. The motor starts by turning ON the start command while tuning is unavailable.
- In the PU operation mode, press press on the operation panel.
 For External operation, turn ON the start command (STF signal or STR signal). Tuning starts.



- · Satisfy the required inverter start conditions to start offline auto tuning. For example, stop the input of the MRS signal.
- To force tuning to end, use the MRS or RES signal or STR signal) also ends tuning.)
- During offline auto tuning, only the following I/O signals are valid (initial value).
 Input terminals <valid signals>: STP (STOP), OH, MRS, RT, RES, STF, STR, S1, and S2
 Output terminals: RUN, OL, IPF, FM/CA, AM, A1B1C1, and So (SO)
- When the rotation speed and the output frequency are selected for terminals FM/CA and AM, the progress status of offline auto tuning is output in 15 steps from FM/CA and AM.
- Do not perform ON/OFF switching of the Second function selection (RT) signal during offline auto tuning. Auto tuning will not be performed properly.
- · A motor with 14 or more poles cannot be tuned.
- Since the Inverter running (RUN) signal turns ON when tuning is started, pay close attention especially when a sequence which releases a mechanical brake by the RUN signal has been designed.
- When executing offline auto tuning, input the operation command after switching ON the main circuit power (R/L1, S/L2, T/L3)
 of the inverter.
- While **Pr.79 Operation mode selection** = "7", turn ON the PU operation external interlock (X12) signal for tuning in the PU operation mode.
- Setting offline auto tuning (Pr.96 = "1") will make pre-excitation invalid.
- During tuning, the monitor is displayed on the operation panel as follows.

| Pr.96 (Pr.463) | 1 | 101 | 1 | 101 |
|-----------------------|---|---|---|---|
| setting | Operation panel (| FR-DU08) display | LCD operation pane | el (FR-LU08) display |
| (1) Setting | PU SMON MA SMAN SMAN SMAN SMAN SMAN SMAN SMAN | PU -MON -M -M -SM -SM -SM -SM -SM -SM -SM -SM - | AutoTune 12:34 TUNE 1 STOP PU PREV NEXT | AutoTune 12:34 TUNE 101 STOP PU PREV NEXT |
| (2) During tuning | PU SMON M SEXT SPAN SPIN SPIN | PU -MON -MI -EXT -PRM -PM -NET -PRUN -PM | AutoTune 12:34 TUNE 12:34 STF FWD PU PREV NEXT | AutoTune 12:34 TONE IIIIII 1 102 STF FWD PU PREV NEXT |
| (3) Normal completion | FU -MON -MI -PM | FU MON IN THE FEBRUARY OF SET ESC FOWD | AutoTune 12:34 TUNE Completed 3 STF STOP PU PREV NEXT | AutoTune 12:34 TUNE |

• When offline auto tuning ends, press on the operation panel during PU operation. For External operation, turn OFF the start signal (STF signal or STR signal). This operation resets the offline auto tuning, and the PU's monitor display returns to the normal indication. (Without this operation, next operation cannot be started.)



- The motor constants measured once during offline auto tuning are stored as parameters and their data are held until offline auto tuning is performed again. However, the tuning data is cleared when performing All parameter clear.
- Changing **Pr.71** after tuning completion will change the motor constant. For example, if the **Pr.71** setting is changed to "8093" after tuned with **Pr.71** = "8090", the tuning data become invalid. To use the tuned data, set "8090" again in **Pr.71**.

• If offline auto tuning has ended in error (see the following table), motor constants are not set. Perform an inverter reset and restart tuning.

| Error display | Error cause | Countermeasures | | |
|---------------|--|---|--|--|
| 8 | Forced end | Set Pr.96 (Pr.463) ="1 or 101" and try again. | | |
| 9 | Inverter protective function operation | Make the setting again. | | |
| 92 | The converter output voltage fell to 75% of the rated voltage. | Check for the power supply voltage fluctuation. Check the Pr.83 Rated motor voltage setting. | | |
| 93 | Calculation error. The motor is not connected. | Check the motor wiring and make the setting again. | | |
| 94 | Rotation tuning frequency setting error. (The frequency command for the tuning was given to exceed the maximum frequency setting, or to be in the frequency jump range.) | Check the Pr.1 Maximum frequency and Pr.31 to Pr.36 Frequency jump settings. | | |

• When tuning is ended forcibly by pressing or turning OFF the start signal (STF or STR) during tuning, offline auto tuning does not end properly. (The motor constants have not been set.)

Perform an inverter reset and perform tuning again.



- An instantaneous power failure occurring during tuning will result in a tuning error.
 After power is restored, the inverter starts normal operation. Therefore, when the STF (STR) signal is ON, the motor starts forward (reverse) rotation.
- Any fault occurring during tuning is handled as in the normal operation. However, if the retry function is set, no retry is performed even when a protective function that performs a retry is activated.
- The set frequency monitor displayed during the offline auto tuning is 0 Hz.

^CAUTION

Note that the motor may start running suddenly.

Parameters updated by tuning results after tuning

| | r. | Name | Tuning accor | ding to Pr.96 (F | Description | |
|--------------------------------------|-------------------|--|--------------|------------------|-------------|---|
| r | 1. | Name | 101 | 1 | 11 | Description |
| 90 (458) | | Motor constant (R1) | 0 | 0 | 0 | Resistance per phase |
| 92 (460) | | Motor constant (L1)/d-axis inductance (Ld) | 0 | 0 | _ | d-axis inductance |
| 93 (461) | | Motor constant (L2)/q-axis inductance (Lq) | 0 | 0 | _ | q-axis inductance |
| 711 (739 | 9) | Motor Ld decay ratio | 0 | 0 | _ | d-axis inductance decay ratio |
| 712 (740 |)) | Motor Lq decay ratio | 0 | 0 | _ | q-axis inductance decay ratio |
| 859 (860 |)) | Torque current/Rated PM motor current | 0 | 0 | _ | |
| 96 (463) | | Auto tuning setting/status | 0 | 0 | 0 | |
| 373 ^{*1} | 871 ^{*2} | Encoder position tuning setting/status | 0 | _ | _ | Encoder position tuning status |
| 1105 ^{*1} 887 ^{*2} | | Encoder magnetic pole position offset | 0 | _ | _ | Turning data of encoder position tuning |

- o: Tuned, —: Not tuned
 - $^{\star}1 \quad \text{The setting is available when the FR-A8AL/FR-A8APR/FR-A8APS/FR-A8APA is installed.}$
 - *2 The setting is available when the FR-A8TP is installed.



• If the offline auto tuning is started before the encoder position tuning is finished (**Pr.1105** (**Pr.887**) = "65535") for a PM motor, the protective function (E.MP) is activated.

♦ Tuning adjustment (Pr.1002)

 The overcurrent protective function may be activated during Lq tuning for an easily magnetically saturated motor (motor with a large Lq decay ratio). In such case, adjust the target flowing current used for tuning with Pr.1002 Lq tuning target current adjustment coefficient.

♦ Changing the motor constants

- The motor constants can be set directly when the motor constants are known in advance, or by using the data measured during offline auto tuning.
- According to the **Pr.71 (Pr.450)** setting, the range of the motor constant parameter setting values and units can be changed. The changed settings are stored in the EEPROM as the motor constant parameters.

Changing the motor constants (when setting motor constants in units of Ω, mH, or A)

· Set Pr.71 as follows.

| Motor | Pr.71 setting |
|-----------|---------------|
| IPM motor | 8090 |
| SPM motor | 9090 |

· Set desired values as the motor constant parameters.

| First motor Pr. | Second motor Pr. | Name | Setting range | Setting increments | Initial value |
|--------------------|---------------------|---|---------------------------------|------------------------|---------------|
| 90 | 458 | Motor constant (R1) | 0 to 50 Ω, 9999 ^{*1} | 0.001 Ω ^{*1} | |
| 90 | 450 | Wold Constant (KT) | 0 to 400 mΩ, 9999 ^{*2} | 0.01 mΩ ^{*2} | |
| 92 | 460 | Motor constant (L1)/d-axis inductance (Ld) | 0 to 500 mH, 9999*1 | 0.01 mH ^{*1} | |
| 92 | 400 | iviolor constant (E1)/d-axis inductance (Ed) | 0 to 50 mH, 9999*2 | 0.001 mH ^{*2} | |
| 93 | 461 | Motor constant (L2)/q-axis inductance (Lq) | 0 to 500 mH, 9999*1 | 0.01 mH ^{*1} | |
| 93 | 401 | Wolor constant (L2)/q-axis inductance (Lq) | 0 to 50 mH, 9999*2 | 0.001 mH ^{*2} | 9999 |
| 706 | 738 | Induced voltage constant (phi f) | 0 to 5000 mV (rad/s), 9999 | 0.1 mV (rad/s) | |
| 859 | 860 | Torque current/Rated PM motor current | 0 to 500 A, 9999*1 | 0.01 A ^{*1} | |
| 039 | 000 | Torque current/Nateu Fivi motor current | 0 to 3600 A, 9999*2 | 0.1 A ^{*2} | |
| 1412 | 1413 | Motor induced voltage constant (phi f) exponent | 0 to 2, 9999 | 1 | |

- *1 For the FR-A820-03160(55K) or lower, and FR-A840-01800(55K) or lower.
- $^{\star}2$ $\,$ For the FR-A820-03800(75K) or higher, and FR-A840-02160(75K) or higher.

NOTE

- If "9999" is set, tuning data will be invalid and the inverter internal constant is used.
- To change a motor induced voltage constant of PM motors, the setting in Pr.706 Induced voltage constant (phi f) or Pr.738 Second motor induced voltage constant (phi f) must be changed. If the constant after the change exceeds the setting range of Pr.706 or Pr.738 (0 to 5000 mV (rad/s)), set Pr.1412 Motor induced voltage constant (phi f) exponent or Pr.1413 Second motor induced voltage constant (phi f) exponent. Set a value in the exponent n in the formula, Pr.706 (Pr.738) × 10ⁿ [mV (rad/s)], to set the induced voltage constant (phi f).
- When **Pr.71 (Pr.450)** = "8093, 8094, 9093, or 9094", or **Pr.1412 (Pr.1413)** = "9999", the motor induced voltage constant is as set in **Pr.706 (Pr.738)**. (No exponent setting)

Changing the motor constants (when setting a motor constants in the internal data of the inverter)

· Set Pr.71 as follows.

| Motor | Pr.71 setting |
|-----------|---------------|
| IPM motor | 8093 (8094) |
| SPM motor | 9093 (9094) |

• Set desired values as the motor constant parameters. The displayed increments of the read motor constants can be changed with **Pr.684 Tuning data unit switchover**. Setting **Pr.684** = "1" disables parameter setting changes.

| First motor | Second | | Pr.684 = 0 (ini | tial value) | Pr.684 = 1 | | Initial | | | | | | |
|-------------|-----------|---|-----------------|--------------------|---------------------------------|------------------------|---------|--|--------------|--|---------------------|---------------------|--|
| Pr. | motor Pr. | Name | Setting range | Setting increments | Setting range | Setting increments | value | | | | | | |
| 90 | 458 | Motor constant (R1) | | | 0 to 50 Ω, 9999 ^{*1} | 0.001 Ω ^{*1} | | | | | | | |
| 90 | 450 | Wiotor Constant (ICT) | | | 0 to 400 mΩ, 9999 ^{*2} | 0.01 mΩ ^{*2} | | | | | | | |
| 92 | 460 | Motor constant (L1)/d- | | | 0 to 500 mH, 9999 ^{*1} | 0.01 mH ^{*1} | | | | | | | |
| 92 | 400 | axis inductance (Ld) | | | 0 to 50 mH, 9999*2 | 0.001 mH ^{*2} | | | | | | | |
| 93 | 461 | Motor constant (L2)/q- | | | 0 to 500 mH, 9999 ^{*1} | 0.01 mH ^{*1} | | | | | | | |
| 93 | 401 | axis inductance (Lq) | 0 to ***. 9999 | 1 | 0 to 50 mH, 9999*2 | 0.001 mH ^{*2} | 9999 | | | | | | |
| 706 | 738 | Induced voltage constant (phi f) | 0 10 , 0000 | ' | 0 to 5000 mV (rad/s), 9999 | 0.1 mV (rad/s) | 0000 | | | | | | |
| 859 | 860 | Torque current/Rated | | | 0 to 500 A, 9999*1 | 0.01 A ^{*1} | | | | | | | |
| 039 | 000 | PM motor current | | | | | | | otor current | | 0 to 3600 A, 9999*2 | 0.1 A ^{*2} | |
| 1412 | 1413 | Motor induced voltage constant (phi f) exponent | | | 0 to 2, 9999 | 1 | | | | | | | |

- *1 For the FR-A820-03160(55K) or lower, and FR-A840-01800(55K) or lower.
- *2 For the FR-A820-03800(75K) or higher, and FR-A840-02160(75K) or higher.

NOTE

- As the motor constants measured in the offline auto tuning have been converted into internal data (****), refer to the following setting example when making setting. (The value displayed has been converted into a value for internal use. Therefore, simple addition of a value to the displayed value does not bring the desired effect.)
 Setting example: to slightly increase the Pr.90 value (5%)
 - When "2516" is displayed for **Pr.90**, set 2642 (2516 \times 1.05 = 2641.8) in **Pr.90**.
- If "9999" is set, tuning data will be invalid. The MM-CF constant is used for the IPM motor MM-CF, and the inverter internal constant is used for a PM motor other than MM-CF.
- To change a motor induced voltage constant of PM motors, the setting in Pr.706 Induced voltage constant (phi f) or Pr.738 Second motor induced voltage constant (phi f) must be changed. If the constant after the change exceeds the setting range of Pr.706 or Pr.738 (0 to 5000 mV (rad/s)), set Pr.1412 Motor induced voltage constant (phi f) exponent or Pr.1413 Second motor induced voltage constant (phi f) exponent. Set a value in the exponent n in the formula, Pr.706 (Pr.738) × 10ⁿ [mV (rad/s)], to set the induced voltage constant (phi f).
- When **Pr.71 (Pr.450)** = "8093, 8094, 9093, or 9094", or **Pr.1412 (Pr.1413)** = "9999", the motor induced voltage constant is as set in **Pr.706 (Pr.738)**. (No exponent setting)

◆ Encoder position tuning

Encoder position tuning is required when a PM motor with an encoder is driven. The measured offset value between the motor home magnetic pole position and the encoder home position is stored. Only encoder position tuning can be performed when offline auto tuning is not required, such as when the parameters for motor constant are set manually, or when offline auto tuning is already performed.

■ Before performing encoder position tuning

- Check that an option for vector control for PM motor, a motor, and an encoder are properly connected.
- Check that a motor (single, stop status) is connected. (Check that the motor is not rotated by an external force during tuning.)
- · The mechanical brake is released.
- Check that the vector control (speed control) for the PM motor with an encoder is selected. (Refer to page 221.)



- Encoder position tuning is required when a PM motor is used. (It is disabled when an induction motor is used.)
- When auto tuning is performed while **Pr.96** = "101", offline auto tuning and encoder position tuning can be performed at the same time.

■ Setting

• To perform tuning, set Pr.373 (Pr.871) ="1".

■ Performing tuning



- Before performing tuning, check the monitor display of the operation panel or parameter unit if the inverter is in the state ready
 for tuning. The motor starts by turning ON the start command while tuning is unavailable.
- In the PU operation mode, press on the operation panel.

 In the external operation mode, turn ON the start command (STF signal or STR signal). Tuning starts.



- · The motor shaft rotates up to 2 times during tuning.
- During tuning, the monitor is displayed on the operation panel as follows.

| Status | Operation panel (FR-DU08) display | LCD operation panel (FR-LU08) display |
|-----------------------|-----------------------------------|---|
| (1) Setting | PU -MON -M -EXT -PRM -PM | AutoTune 12:34 TUNE 1 1 STOP PU PREV NEXT |
| (2) During tuning | PU MON MM -EXT PRM -PM | AutoTune 12:34 TUNE |
| (3) Normal completion | Blinking MODE SET ESC DOWN | AutoTune 12:34 TUNE Completed 3 STF STOP PU PREV NEXT |

• When encoder position tuning ends, press on the PU in the PU operation mode. For External operation, turn OFF the start signal (STF signal or STR signal). This operation resets encoder position tuning, and the PU's monitor display returns to the normal indication. (Without this operation, next operation cannot be started.)



- The encoder position tuning data is stored in **Pr.1105 (Pr.887)** until encoder position tuning is performed again. However, performing All parameter clear resets the tuning data.
- If encoder position tuning has ended in error (see the following table), motor constants are not set. Perform an inverter reset and perform tuning again.

| Pr.373 (Pr.871) setting | Error cause | Countermeasures |
|----------------------------|--|--|
| 8 | Forced end | Set "1" in Pr.373 (Pr.871) and retry. |
| 9 | Inverter protective function operation | Identify and remove the cause of the protective function activation, and make the setting again. |
| 93 | The motor or the encoder is not connected. | Check the wiring of the motor and the encoder, the brake opening, and make the setting again. |

• When tuning is ended forcibly by pressing or turning OFF the start signal (STF or STR) during tuning, the tuning does not end properly. (The tuning data have not been set.)

Perform an inverter reset and perform tuning again.

- When the protective function (E.EP) is activated during tuning, check the wiring of the motor and the encoder, **Pr.359** (**Pr.852**) setting, and then perform tuning again.
- When tuning ends properly, the counter value of the offset between the motor home magnetic pole position and the encoder home position is written in **Pr.1105** (**Pr.887**).

W Parameters referred to >>> Pr.9 Electronic thermal O/L relay □ page 415 Pr.71 Applied motor □ page 528 Pr.178 to Pr.189 (Input terminal function selection) □ page 521 Pr.800 Control method selection □ page 221

5.13.4 Offline auto tuning for a PM motor (motor constant tuning)

PM

The offline auto tuning enables the optimal operation of a PM motor.

 Automatic measurement of motor constants (offline auto tuning) enables optimal operation of motors for PM sensorless vector control even when motor constants vary or when the wiring distance is long. IPM and SPM motors other than the MM-CF IPM motor can also be used.

For the offline auto tuning under Advanced magnetic flux vector control, Real sensorless vector control, and Vector control, refer to page 532.

| Pr. | Name | Initial value | Setting range | Description |
|-------------|--------------------------------|--------------------------------|---|---|
| 684 | Tuning data unit | 0 | 0 | Internal data converted value |
| C000 | switchover | U | 1 | The value is indicated in A, Ω , mH, or mV. |
| 71 C100 | Applied motor | 0 | 0 to 6, 13 to 16, 20, 23, 24, 30, 33, 34, 40, 43, 44, 50, 53, 54, 70, 73, 74, 330, 333, 334, 8090, 8093, 8094, 9090, 9093, 9094 | By selecting a motor, the thermal characteristic and motor constant of each motor are set. |
| | | | 0.4 to 55 kW ^{*2} | Cat the amplied materials in |
| 80 C101 | Motor capacity | 9999 | 0 to 3600 kW ^{*3} | Set the applied motor capacity. |
| 0101 | | | 9999 | V/F control |
| 81 | Number of motor poles | 9999 | 2, 4, 6, 8, 10, 12 | Set the number of motor poles. |
| C102 | Number of motor poles | 9999 | 9999 | V/F control |
| 9 | Electronic thermal O/L | Inverter | 0 to 500 A*2 | |
| C103 | relay | rated current ^{*1} | 0 to 3600 A*3 | Set the rated motor current. |
| 83 C104 | Rated motor voltage | 200/400 V*4 | 0 to 1000 V | Set the rated motor voltage (V). |
| | | 9999 | 10 to 400 Hz | Set the rated motor frequency (Hz). |
| 84 C105 | Rated motor frequency | | 9999 | The MM-CF constant is used when the IPM motor MM-CF is selected, and the inverter internal data is used when a PM motor other than MM-CF is selected. Use the correct setting according to the motor specification. |
| | | | 0 to 400 Hz | Set the permissible speed (frequency) of the motor. |
| 702 C106 | Maximum motor frequency | 9999 | 9999 | The MM-CF motor maximum frequency is used when the IPM motor MM-CF is selected, and Pr.84 setting is used when a PM motor other than MM-CF is selected. |
| 707 C107 | Motor inertia (integer) | 9999 | 10 to 999, 9999 | Set the motor inertia. |
| 724 C108 | Motor inertia (exponent) | 9999 | 0 to 7, 9999 | 9999: The MM-CF inertia is used for the IPM motor MM-CF. |
| | | | 0, 101 | No offline auto tuning |
| 96 C110 | Auto tuning setting/ status | 0 | 1 | Offline auto tuning is performed without rotating the motor (motor other than IPM motor MM-CF). |
| C110 | | | 11 | Offline auto tuning is performed without rotating the motor (for IPM motor MM-CF). |

| Pr. | Name | Initial value | Setting range | Description | |
|--------------|---|------------------|---|--|--|
| 90 | Motor constant (D4) | 9999 | 0 to 50 Ω, 9999*2*5 | | |
| C120 | Motor constant (R1) | 9999 | 0 to 400 mΩ, 9999*3*5 | | |
| 92 | Motor constant (L1)/d- | 9999 | 0 to 500 mH, 9999*2*5 | Tuning data (The value measured by offline auto tuning is | |
| C122 | axis inductance (Ld) | 9999 | 0 to 50 mH, 9999*3*5 | automatically set.) | |
| 93 | Motor constant (L2)/q- | 9999 | 0 to 500 mH, 9999*2*5 | 9999: The MM-CF constant is used when the IPM motor MM- CF is selected, and the inverter internal data is used when a PM | |
| C123 | axis inductance (Lq) | 9999 | 0 to 50 mH, 9999*3*5 | motor other than MM-CF is selected. | |
| 859 | Torque current/Rated | 9999 | 0 to 500 A, 9999*2*5 | | |
| C126 | PM motor current | 9999 | 0 to 3600 A, 9999*3*5 | | |
| 706 | Induced voltage | | 0 to 5000 mV (rad/s)*5 | Set this parameter according to the PM motor specifications. | |
| C130 | constant (phi f) | 9999 | 9999 | The value calculated from the parameter setting for motor constant is used. | |
| 1412 C135 | Motor induced voltage constant (phi f) | 9999 | 0 to 2 | Set the exponent n when the induced voltage constant phi f (Pr.706) is multiplied by 10 ⁿ . | |
| | exponent | | 9999 | No exponent setting | |
| 711 C131 | Motor Ld decay ratio | 9999 | 0 to 100%, 9999 | | |
| 712 C132 | Motor Lq decay ratio | 9999 | 0 to 100%, 9999 | Tuning data (The value measured by offline auto tuning is automatically set.) | |
| 717 C182 | Starting resistance tuning compensation | 9999 | 0 to 200%, 9999 | 9999: The MM-CF constant is used when the IPM motor MM-CF is selected, and the inverter internal data is used when a PM motor other than MM-CF is selected. | |
| 721 C185 | Starting magnetic pole position detection pulse width | 9999 | 0 to 6000 μs, 10000 to 16000 μs, 9999 | motor other than Mini-CF is selected. | |
| | | | 100 to 500% | Set the maximum current (OCT) level of the motor. | |
| 725 C133 | Motor protection current level | 9999 | 9999 | The MM-CF constant is used when the IPM motor MM-CF is selected, and 200% when a PM motor other than MM-CF is selected. | |
| 1002 | Lq tuning target | | 50 to 150% | Adjust the target current during tuning. | |
| C150 | current adjustment coefficient | 9999 | 9999 | 100% | |
| 450 C200 | Second applied motor | 9999 | 0, 1, 3 to 6, 13 to 16, 20, 23, 24, 30, 33, 34, 40, 43, 44, 50, 53, 54, 70, 73, 74, 330, 333, 334, 8090, 8093, 8094, 9090, 9093, 9094 | Set this parameter when using the second motor (the same specifications as Pr.71). | |
| | | | 9999 | The function is disabled. | |
| 453 C201 | Second motor capacity | 9999 | 0.4 to 55 kW ^{*2} 0 to 3600 kW ^{*3} | Set the capacity of the second motor. | |
| C201 | | | 9999 | V/F control | |
| 454 | Number of second | 9999 | 2, 4, 6, 8, 10, 12 | Set the number of poles of the second motor. | |
| C202 | motor poles | | 9999 | V/F control | |
| 51 | Second electronic | 0000 | 0 to 500 A*2 | Set the rated current of the second motor. | |
| C203 | thermal O/L relay | 9999 | 0 to 3600 A*3 | | |
| 456 C204 | Rated second motor | 200 V/400 V*4 | 9999 0 to 1000 V | The second electronic thermal O/L relay is disabled. Set the rated voltage (V) of the second motor. | |
| 0204 | voltage | ν . | 10 to 400 Hz | Set the rated frequency (Hz) of the second motor. | |
| 457 | Detect occupied works | | 10 10 700 112 | The MM-CF constant is used when the IPM motor MM-CF is | |
| 457 C205 | Rated second motor frequency | 9999 | 9999 | selected for the second motor, and the inverter internal data used when a PM motor other than MM-CF is selected. Use the correct setting according to the motor specification. | |
| | | | 0 to 400 Hz | Set the permissible speed (frequency) of the second motor. | |
| 743 C206 | Second motor maximum frequency | 9999 | 9999 | The MM-CF motor maximum frequency is used when the MM-CF is selected, and Pr.457 setting is used when a motor other than MM-CF is selected. | |
| 744 C207 | Second motor inertia (integer) | 9999 | 10 to 999, 9999 | Set the inertia of the second motor. 9999: The MM-CF inertia is used for the IPM motor MM-CF. | |
| 745 C208 | Second motor inertia (exponent) | 9999 | 0 to 7, 9999 | | |

| Pr. | Name | Initial value | Setting range | Description |
|-------------|--|------------------|--|---|
| | | | 0, 101 | No auto tuning for the second motor. |
| 463 C210 | Second motor auto tuning setting/status | 0 | 1 | Offline auto tuning is performed without rotating the motor (motor other than IPM motor MM-CF). |
| 52.0 | , , , , , , , , , , , , , , , , , , , | | 11 | Offline auto tuning is performed without rotating the motor (for IPM motor MM-CF). |
| 458 | Second motor | 9999 | 0 to 50 Ω, 9999*2*5 | |
| C220 | constant (R1) | 3333 | 0 to 400 mΩ, 9999*3*5 | |
| 460 | Second motor | 0000 | 0 to 500 mH, 9999*2*5 | Tuning data of the second motor. |
| C222 | constant (L1) / d-axis inductance (Ld) | 9999 | 0 to 50 mH, 9999*3*5 | (The value measured by offline auto tuning is automatically set.) |
| 461 | Second motor constant (L2) / q-axis | 9999 | 0 to 500 mH, 9999*2*5 | 9999: The MM-CF constant is used when the IPM motor MM- |
| C223 | inductance (Lq) | 9999 | 0 to 50 mH, 9999*3*5 | CF is selected, and the inverter internal data is used when a PM motor other than MM-CF is selected. |
| 860 | Second motor torque | | 0 to 500 A, 9999*2*5 | |
| C226 | current/Rated PM motor current | 9999 | 0 to 3600 A, 9999*3*5 | |
| 738 | Second motor induced | 9999 | 0 to 5000 mV (rad/s)*5 | Set this parameter according to the PM motor specifications. |
| C230 | voltage constant (phi f) | | 9999 | The value calculated from the parameter setting for motor constant is used. |
| 1413 | Second motor induced | 9999 | 0 to 2 | Set the exponent n when the induced voltage constant phi f |
| C235 | voltage constant (phi f) exponent | | 9999 | (Pr.738) is multiplied by 10 ⁿ . |
| 739 | Second motor Ld | | | No exponent setting |
| C231 | decay ratio | 9999 | 0 to 100%, 9999 | |
| 740 C232 | Second motor Lq decay ratio | 9999 | 0 to 100%, 9999 | Tuning data of the second motor. (The value measured by offline auto tuning is automatically |
| 741 C282 | Second starting resistance tuning compensation | 9999 | 0 to 200%, 9999 | set.) 9999: The MM-CF constant is used when the IPM motor MM-CF is selected, and the inverter internal data is used when a PM |
| 742 C285 | Second motor magnetic pole detection pulse width | 9999 | 0 to 6000 μs, 10000 to 16000 μs, 9999 | motor other than MM-CF is selected. |
| | Second motor | | 100 to 500% | Set the maximum current (OCT) level of the second motor. |
| 746 C233 | 746 protection current | | 9999 | The MM-CF constant is used when the IPM motor MM-CF is selected, and 200% when a PM motor other than MM-CF is selected. |

- *1 For the FR-A820-00077(0.75K) or lower and FR-A840-00038(0.75K) or lower, it is set to 85% of the inverter rated current.
- *2 For the FR-A820-03160(55K) or lower, and FR-A840-01800(55K) or lower.
- *3 For the FR-A820-03800(75K) or higher, and FR-A840-02160(75K) or higher.
- $^{\star}4$ The initial value differs according to the voltage class (200 V / 400 V).
- *5 The setting range and unit change according to the Pr.71 (Pr.450) setting.

Point P

- The settings are valid under PM sensorless vector control.
- The offline auto tuning enables the operation with SPM motors and IPM motors other than MM-CF. (When a PM motor other than the IPM motor MM-CF is used, always perform offline auto tuning.)
- · Tuning is enabled even when a load is connected to the motor.
- · Reading/writing of the motor constants tuned by offline auto tuning are enabled. The offline auto tuning data (motor constants) can be copied to another inverter using the operation panel.
- The offline auto tuning status can be monitored on the operation panel or the parameter unit.

♦ Before performing offline auto tuning

Check the following points before performing offline auto tuning:

- · Check that PM sensorless vector control is selected.
- · Check that a motor is connected. (Check that the motor is not rotated by an external force during tuning.)

- The rated motor current should be equal to or less than the inverter rated current. (The motor capacity must be 0.4 kW or higher.)
 - If a motor with substantially low rated current compared with the inverter rated current, however, is used, speed and torque accuracies may deteriorate due to torque ripples, etc. Set the rated motor current to about 40% or higher of the inverter rated current.
- · The maximum frequency under PM sensorless vector control is 400 Hz.
- The motor may rotate slightly even if offline auto tuning is performed without the motor rotating (**Pr.96 Auto tuning setting/status** = "1 or 11"). (It does not affect the tuning performance.)
 - Fix the motor securely with a mechanical brake, or before tuning, make sure that it is safe even if the motor rotates. (Caution is required especially in vertical lift applications.)
- · Tuning is not available during position control under PM sensorless vector control.
- · Tuning may be disabled depending on the motor characteristics.

Settings

• To perform tuning, set the following parameters about the motor.

| First motor Pr. | Second motor Pr. | Name | | Setting for MM-CF |
|-----------------|---------------------|------------------------------|---|--|
| 80 | 453 | Motor capacity | Motor capacity (kW) | |
| 81 | 454 | Number of motor poles | Number of motor poles (2 to 12) | Set by the IPM parameter initialization. |
| 9 | 51 | Electronic thermal O/L relay | Rated motor current (A) | (Refer to page 231.) |
| 84 | 457 | Rated motor frequency | Rated motor frequency (Hz) | |
| 83 | 456 | Rated motor voltage | Rated motor voltage (V) | Initial value (200 V or 400 V) |
| 71 | 450 | Applied motor | 8090, 8093 (IPM motor), 9090, 9093 (SPM motor)*1 | 330, 333 ^{*1} |
| 96 | 463 | Auto tuning setting/status | 1 | 11 |

^{*1} Set **Pr.71 Applied motor** according to the motor to be used. According to the **Pr.71** setting, the range of the motor constant parameter setting values and units can be changed. (For other setting values of **Pr.71**, refer to page 528.)

| | | | Pr.71 setting | | |
|--------------|------------------|--|--|--|--|
| Motor | | Motor constant parameter Ω, mH, and A unit setting | Motor constant parameter internal data setting | | |
| IPM motor | MM-CF | 330 | 333 (334) | | |
| IFWI IIIOLOI | Other than MM-CF | 8090 | 8093 (8094) | | |
| SPM motor | | 9090 | 9093 (9094) | | |



- Under PM sensorless vector control, tuning cannot be performed even when **Pr.96** = "101". When the MM-CF is set to the applied motor, tuning cannot be performed even when **Pr.96** = "1 or 101".
- · For tuning accuracy improvement, set the following parameters when the motor constants are known in advance.

| First motor Pr. | Second motor Pr. | Name | Setting for a PM motor other than MM-CF | Setting for MM-CF |
|-----------------|---------------------|--------------------------------|--|----------------------|
| 702 | 743 | Maximum motor frequency | Maximum motor frequency (Hz) | 9999 (initial value) |
| 707 | 744 | Motor inertia (integer) | | |
| 724 | 745 | Motor inertia (exponent) | $Jm = Pr.707 \times 10^{(-Pr.724)} (kg \cdot m^2)$ | 9999 (initial value) |
| 725 | 746 | Motor protection current level | Maximum current level of the motor (%) | 9999 (initial value) |

^{*1} The setting is valid only when a value other than "9999" is set in both Pr.707 (Pr.744) and Pr.724 (Pr.745).

♦ Performing tuning



• Before performing tuning, check the monitor display of the operation panel or parameter unit if the inverter is in the state ready for tuning. The motor starts by turning ON the start command while tuning is unavailable.

• In the PU operation mode, press FWD / REV on the operation panel.

For External operation, turn ON the start command (STF signal or STR signal). Tuning starts.

• NOTE

- · Satisfy the required inverter start conditions to start offline auto tuning. For example, stop the input of the MRS signal.
- To force tuning to end, use the MRS or RES signal or STR signal) on the operation panel. (Turning OFF the start signal (STF signal or STR signal) also ends tuning.)
- During offline auto tuning, only the following I/O signals are valid (initial value).
 Input terminals <valid signals>: STP (STOP), OH, MRS, RT, RES, STF, STR, S1, and S2
 Output terminals: RUN, OL, IPF, FM/CA, AM, A1B1C1, and So (SO)
- When the rotation speed and the output frequency are selected for terminals FM/CA and AM, the progress status of offline auto tuning is output in 15 steps from FM/CA and AM.
- Do not perform ON/OFF switching of the Second function selection (RT) signal during offline auto tuning. Auto tuning will not be performed properly.
- A motor with 14 or more poles cannot be tuned.
- Since the Inverter running (RUN) signal turns ON when tuning is started, pay close attention especially when a sequence which releases a mechanical brake by the RUN signal has been designed.
- When executing offline auto tuning, input the operation command after switching ON the main circuit power (R/L1, S/L2, T/L3) of the inverter.
- While Pr.79 Operation mode selection = "7", turn ON the PU operation external interlock (X12) signal for tuning in the PU operation mode.
- Setting offline auto tuning (Pr.96 = "1 or 11") will make pre-excitation invalid.
- · During tuning, the monitor is displayed on the operation panel as follows.

| Pr.96 (Pr.463) | 1 | 11 | 1 | 11 |
|-----------------------|--|---|--|--|
| setting | Operation panel (| FR-DU08) display | LCD operation pane | el (FR-LU08) display |
| (1) Setting | PU -MON -MM -EXT -PRM -PM -EXT -PRM -PM | PU -MON BM -PM -PM -PM | AutoTune 12:34 TUNE 1 1 STOP PU PREV NEXT | AutoTune 12:34 TUNE 11 STOP PU PREV NEXT |
| (2) During tuning | PU - MON - MM - EXT - FPMM - FPM - SELT - FZUN - FPM | PU OMON PM OF M OF M | AutoTune 12:34 TUNE 1 2 STF FWD PU PREV NEXT | AutoTune 12:34 TONE IIIIII 1 12 STF FWD PU PREV NEXT |
| (3) Normal completion | PJ MON M EXT PRIUN PM Blinking | PU -MON IMP -EXT -PRIM -PM -NET -RIUN -PM MODE SET ESC - SOWD | AutoTune 12:34 TUNE IIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIII | AutoTune 12:34 TUNE |

• When offline auto tuning ends, press on the operation panel during PU operation. For External operation, turn OFF the start signal (STF signal or STR signal). This operation resets the offline auto tuning, and the PU's monitor display returns to the normal indication. (Without this operation, next operation cannot be started.)

NOTE

- The motor constants measured once during offline auto tuning are stored as parameters and their data are held until offline auto tuning is performed again. However, the tuning data is cleared when performing All parameter clear.
- Changing **Pr.71** after tuning completion will change the motor constant. For example, if the **Pr.71** setting is changed to "8093" after tuned with **Pr.71** = "8090", the tuning data become invalid. To use the tuned data, set "8090" again in **Pr.71**.

· If offline auto tuning has ended in error (see the following table), motor constants are not set. Perform an inverter reset and perform tuning again.

| Error display | Error cause | Countermeasures |
|---------------|--|---|
| 8 | Forced end | Set Pr.96 (Pr.463) ="1 or 11" and try again. |
| 9 | Inverter protective function operation | Make the setting again. |
| 92 | The converter output voltage fell to 75% of the rated voltage. | Check for the power supply voltage fluctuation. Check the Pr.83 Rated motor voltage setting. |
| 93 | Calculation error. The motor is not connected. | Check the motor wiring and make the setting again. |
| 94 | Rotation tuning frequency setting error. (The frequency command for the tuning was given to exceed the maximum frequency setting, or to be in the frequency jump range.) | Check the Pr.1 Maximum frequency and Pr.31 to Pr.36 Frequency jump settings. |

• When tuning is ended forcibly by pressing or turning OFF the start signal (STF or STR) during tuning, offline auto tuning does not end properly. (The motor constants have not been set.) Perform an inverter reset and perform tuning again.



- · An instantaneous power failure occurring during tuning will result in a tuning error. After power is restored, the inverter starts normal operation. Therefore, when the STF (STR) signal is ON, the motor starts forward (reverse) rotation.
- · Any fault occurring during tuning is handled as in the normal operation. However, if the retry function is set, no retry is performed even when a protective function that performs a retry is activated.
- The set frequency monitor displayed during the offline auto tuning is 0 Hz.

♠ CAUTION

· Note that the motor may start running suddenly.

Parameters updated by tuning results after tuning

| First motor Pr. | Second motor Pr. | Name | Other than MM-CF Pr.96 (Pr.463) = 1 | V/F control, MM-CF Pr.96 (Pr.463) = 11 | Description |
|-----------------|---------------------|---|--|---|---|
| 90 | 458 | Motor constant (R1) | 0 | 0 | Resistance per phase |
| 92 | 460 | Motor constant (L1)/d-axis inductance (Ld) | 0 | _ | d-axis inductance |
| 93 | 461 | Motor constant (L2)/q-axis inductance (Lq) | 0 | _ | q-axis inductance |
| 711 | 739 | Motor Ld decay ratio | 0 | _ | d-axis inductance decay ratio |
| 712 | 740 | Motor Lq decay ratio | 0 | _ | q-axis inductance decay ratio |
| 717 | 741 | Starting resistance tuning compensation | 0 | 0 | |
| 721 | 742 | Starting magnetic pole position detection pulse width | 0 | _ | When the setting value is 10000 or more: With polarity inversion for compensation, voltage pulse (Pr. setting minus 10000) µs |
| 859 | 860 | Torque current/Rated PM motor current | 0 | _ | |
| 96 | 463 | Auto tuning setting/status | 0 | 0 | |

Tuning adjustment (Pr.1002)

· The overcurrent protective function may be activated during Lq tuning for an easily magnetically saturated motor (motor with a large Lq decay ratio). In such case, adjust the target flowing current used for tuning with Pr.1002 Lq tuning target current adjustment coefficient.

Changing the motor constants

· The motor constants can be set directly when the motor constants are known in advance, or by using the data measured during offline auto tuning.

• According to the **Pr.71** (**Pr.450**) setting, the range of the motor constant parameter setting values and units can be changed. The changed settings are stored in the EEPROM as the motor constant parameters.

igoplus Changing the motor constants (when setting motor constants in units of Ω , mH, or A)

· Set Pr.71 as follows.

| Motor | | Pr.71 setting |
|------------|------------------|---------------|
| IPM motor | MM-CF | 330 |
| TENT MOTOR | Other than MM-CF | 8090 |
| SPM motor | | 9090 |

· Set desired values as the motor constant parameters.

| First motor Pr. | Second motor Pr. | Name | Setting range | Setting increments | Initial value |
|-----------------|---------------------|--|---------------------------------|------------------------|---------------|
| 90 | 458 | Motor constant (R1) | 0 to 50 Ω, 9999 ^{*1} | 0.001 Ω ^{*1} | |
| 90 | 450 | iviolor constant (ICT) | 0 to 400 mΩ, 9999*2 | 0.01 mΩ ^{*2} | |
| 92 | 460 | Motor constant (L1)/d-axis inductance (Ld) | 0 to 500 mH, 9999 ^{*1} | 0.01 mH ^{*1} | |
| 92 | 400 | iviolor constant (E1)/d-axis inductance (Ed) | 0 to 50 mH, 9999 ^{*2} | 0.001 mH ^{*2} | |
| 93 | 461 | Motor constant (L2)/q-axis inductance (Lq) 0 to 500 mH, 9999*1 | 0 to 500 mH, 9999 ^{*1} | 0.01 mH ^{*1} | |
| 95 | 401 | Wolor Constant (LZ)/q-axis inductance (Lq) | 0 to 50 mH, 9999*2 | 0.001 mH ^{*2} | 9999 |
| 706 | 738 | Induced voltage constant (phi f) | 0 to 5000 mV (rad/s), 9999 | 0.1 mV (rad/s) | |
| 859 | 860 | Torque current/Rated PM motor current | 0 to 500 A, 9999 ^{*1} | 0.01 A ^{*1} | |
| 039 | 000 | Torque current/Nateu Fivi motor current | 0 to 3600 A, 9999 ^{*2} | 0.1 A ^{*2} | |
| 1412 | 1413 | Motor induced voltage constant (phi f) exponent | 0 to 2, 9999 | 1 | |

- *1 For the FR-A820-03160(55K) or lower, and FR-A840-01800(55K) or lower.
- *2 For the FR-A820-03800(75K) or higher, and FR-A840-02160(75K) or higher.

NOTE

- If "9999" is set, tuning data will be invalid. The MM-CF constant is used for the IPM motor MM-CF, and the inverter internal constant is used for a PM motor other than MM-CF.
- To change a motor induced voltage constant of PM motors, the setting in Pr.706 Induced voltage constant (phi f) or Pr.738 Second motor induced voltage constant (phi f) must be changed. If the constant after the change exceeds the setting range of Pr.706 or Pr.738 (0 to 5000 mV (rad/s)), set Pr.1412 Motor induced voltage constant (phi f) exponent or Pr.1413 Second motor induced voltage constant (phi f) exponent. Set a value in the exponent n in the formula, Pr.706 (Pr.738) × 10ⁿ [mV (rad/s)], to set the induced voltage constant (phi f).
- When **Pr.71 (Pr.450)** = "8093, 8094, 9093, or 9094", or **Pr.1412 (Pr.1413)** = "9999", the motor induced voltage constant is as set in **Pr.706 (Pr.738)**. (No exponent setting)

Changing the motor constants (when setting a motor constants in the internal data of the inverter)

· Set Pr.71 as follows.

| Motor | | Pr.71 setting |
|-----------|------------------|---------------|
| IPM motor | MM-CF | 333 (334) |
| IPM Motor | Other than MM-CF | 8093 (8094) |
| SPM motor | | 9093 (9094) |

· Set desired values as the motor constant parameters. The displayed increments of the read motor constants can be changed with Pr.684 Tuning data unit switchover. Setting Pr.684 = "1" disables parameter setting changes.

| First motor | Second | | Pr.684 = 0 (ini | tial value) | Pr.684 = | 1 | Initial | |
|-------------|-----------|---|----------------------|--------------------|---------------------------------|------------------------|------------------------|------|
| Pr. | motor Pr. | Name | Setting range | Setting increments | Setting range | Setting increments | value | |
| 90 | 458 | Motor constant (R1) | | | 0 to 50 Ω, 9999 ^{*1} | 0.001 Ω ^{*1} | | |
| 30 | 430 | Wotor constant (IVI) | | | 0 to 400 mΩ, 9999 ^{*2} | 0.01 mΩ ^{*2} | | |
| 92 | 460 | Motor constant (L1)/d- | | | 0 to 500 mH, 9999*1 | 0.01 mH ^{*1} | | |
| 92 | 400 | axis inductance (Ld) | | | 0 to 50 mH, 9999*2 | 0.001 mH ^{*2} | | |
| 93 | 461 | Motor constant (L2)/q- | | | 0 to 500 mH, 9999*1 | 0.01 mH ^{*1} | | |
| 95 | 401 | axis inductance (Lq) | axis inductance (Lq) | 0 to ***, 9999 | 1 | 0 to 50 mH, 9999*2 | 0.001 mH ^{*2} | 9999 |
| 706 | 738 | Induced voltage constant (phi f) | 0 10 , 9999 | | 0 to 5000 mV (rad/s), 9999 | 0.1 mV (rad/s) | 0000 | |
| 859 | 860 | Torque current/Rated | | | 0 to 500 A, 9999*1 | 0.01 A ^{*1} | | |
| 039 | 000 | PM motor current | | | 0 to 3600 A, 9999 ^{*2} | 0.1 A ^{*2} | | |
| 1412 | 1413 | Motor induced voltage constant (phi f) exponent | | | 0 to 2, 9999 | 1 | | |

- *1 For the FR-A820-03160(55K) or lower, and FR-A840-01800(55K) or lower.
- *2 For the FR-A820-03800(75K) or higher, and FR-A840-02160(75K) or higher.



- · As the motor constants measured in the offline auto tuning have been converted into internal data (****), refer to the following setting example when making setting. (The value displayed has been converted into a value for internal use. Therefore, simple addition of a value to the displayed value does not bring the desired effect.) Setting example: to slightly increase the Pr.90 value (5%)
 - When "2516" is displayed for Pr.90, set 2642 (2516 × 1.05 = 2641.8) in Pr.90.
- If "9999" is set, tuning data will be invalid. The MM-CF constant is used for the IPM motor MM-CF, and the inverter internal constant is used for a PM motor other than MM-CF.
- To change a motor induced voltage constant of PM motors, the setting in Pr.706 Induced voltage constant (phi f) or Pr.738 Second motor induced voltage constant (phi f) must be changed. If the constant after the change exceeds the setting range of Pr.706 or Pr.738 (0 to 5000 mV (rad/s)), set Pr.1412 Motor induced voltage constant (phi f) exponent or Pr.1413 Second motor induced voltage constant (phi f) exponent. Set a value in the exponent n in the formula, Pr.706 (Pr.738) × 10ⁿ [mV (rad/s)], to set the induced voltage constant (phi f).
- When Pr.71 (Pr.450) = "8093, 8094, 9093, or 9094", or Pr.1412 (Pr.1413) = "9999", the motor induced voltage constant is as set in Pr.706 (Pr.738). (No exponent setting)

Parameters referred to

Pr.9 Electronic thermal O/L relay page 415 Pr.71 Applied motor Pr.178 to Pr.189 (Input terminal function selection) page 521 Pr.800 Control method selection page 221

Online auto tuning 5.13.5

Magneticiflux Sensorless Vector

If online auto tuning is selected under Advanced magnetic flux vector control, Real sensorless vector control, or Vector control, favorable torque accuracy is retained by adjusting temperature even when the resistance value varies due to increase in the motor temperature.

| Pr. | Name | Initial value | Setting range | Description |
|------------|---------------------------------|------------------------------|---------------|--|
| 0.5 | | | 0 | No online auto tuning |
| 95 C111 | Online auto tuning selection | 0 | 1 | Online auto tuning is performed at startup. |
| CIII | | | 2 | Magnetic flux observer (continuous tuning) |
| 574 | Second motor online outs tuning | I motor online auto tuning 0 | 0 to 2 | Select online auto tuning for the second motor. |
| C211 | Second motor online auto tuning | | 0 10 2 | (The settings are the same as those in Pr.95 .) |

◆ Online auto tuning at startup (Pr.95/Pr.574 = "1")

· By promptly tuning the motor status at startup, accurate operation without being affected by motor temperature is achieved. Also high torque can be provided at very low speed and stable operation is possible.

- Under Advanced magnetic flux vector control (Pr.80 Motor capacity, Pr.81 Number of motor poles) or Real sensorless vector control (Pr.80, Pr.81, Pr.800 Control method selection), select the online auto tuning at start.
- · Make sure to perform offline auto tuning before performing online auto tuning.

Operating procedure

- **1.** Perform offline auto tuning. (Refer to page 532.)
- 2. Check that Pr.96 Auto tuning setting/status = "3 or 103" (offline auto tuning completion).
- **3.** Set **Pr.95 Online auto tuning selection** = "1" (online auto tuning at start). Online auto tuning is enabled at the next start.
- **4.** Check that the following parameters are set before starting operation.

| Pr. | Description |
|-----|--|
| 9 | Rated motor current or electronic thermal O/L relay |
| 71 | Applied motor |
| 80 | Motor capacity (with the rated motor current equal to or less than the inverter rated current)*1 |
| 81 | Number of motor poles |

- *1 If a motor with substantially low rated current compared with the inverter rated current is used, speed and torque accuracies may deteriorate due to torque ripples, etc. Set the rated motor current to about 40% or higher of the inverter rated current.
- **5.** In the PU operation mode, press FWD / REV on the operation panel. For External operation, turn ON the start command (STF signal or STR signal).

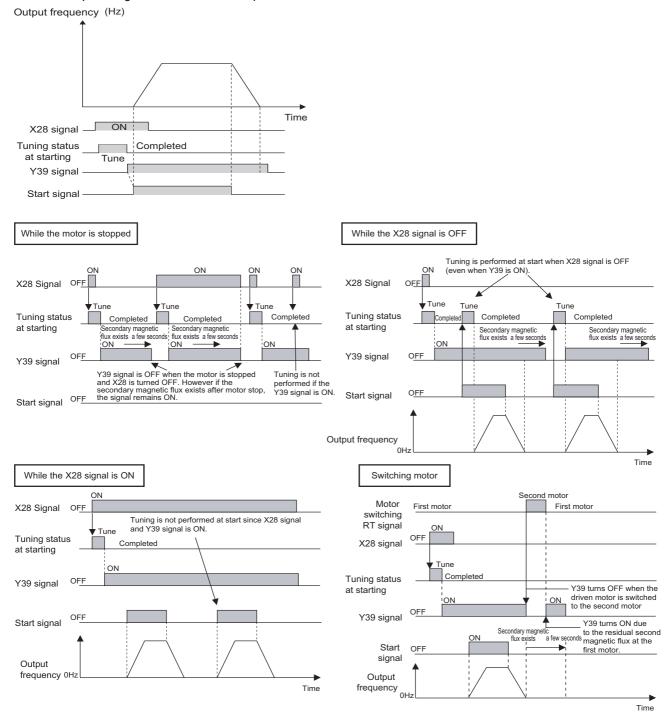
• NOTE

- When performing the online auto tuning at start for a lift, consider using a brake sequence function for the brake opening timing at a start, or tuning using the external terminal. The tuning takes about 500 ms at the most after starting. However, during this time, it is possible that not enough torque is provided and caution is required to prevent the object from dropping. Use of the Start-time tuning start external input (X28) signal is recommended to perform tuning. (Refer to page 559.)
- · Perform online auto tuning at startup when the motor is stopped.
- The online auto tuning is disabled when the MRS signal is being input, the setting speed is **Pr.13 Starting frequency** or lower (V/F control, Advanced magnetic flux vector control), an inverter fault is occurring, or the inverter's startup condition is not satisfied.
- · Online auto tuning does not operate during deceleration and restart from DC injection brake operation.
- It is disabled during JOG operation.
- If automatic restart after instantaneous power failure is selected, automatic restart is prioritized. (Online auto tuning at startup is not performed during frequency search.)
- If automatic restart after instantaneous power failure is used together, perform online auto tuning while stopping operation with the X28 signal. (Refer to page 559.)
- Zero current detection and output current detection are enabled during online auto tuning.
- The RUN signal is not output during online auto tuning. The RUN signal is turned ON at operation startup.
- If the time between the inverter stop and restart is within 4 seconds, tuning is performed at startup but its result will not be applied.

◆ Online auto tuning at startup using the external terminal (Pr.95/Pr.574 = "1", X28 signal, Y39 signal)

- Before turning ON the start signal (STF or STR), online auto tuning can be performed by turning ON the Start-time tuning start external input (X28) signal in a stopped status in order to minimize the startup delay by tuning at start.
- Perform offline auto tuning and set "1" (tuning at start) in Pr.95.
- When the Start time tuning completion (Y39) signal is OFF, tuning at start can be performed with the X28 signal.
- · The tuning takes about 500 ms at the most.
- To use the X28 signal, set "28" in any of **Pr.178 to Pr.189 (Input terminal function selection)** to assign the function to an input terminal.

• To use the Y39 signal, set "39 (positive logic) or 139 (negative logic)" in any of **Pr.190 to Pr.196 (Output terminal function selection)** to assign the function to an output terminal.





- Even if the start signal is turned ON during zero speed control or servo lock, tuning is performed at startup.
- The Y39 signal remains ON after the motor is stopped as long as the second flux remains.
- The X28 signal is disabled while the Y39 signal is ON.
- The STF and STR signals are enabled after completing tuning at start.
- The Inverter running (RUN) signal is not turned ON during online auto tuning. The RUN signal is turned ON after starting up.
- This function is disabled under V/F control or PM sensorless vector control.
- Changing the terminal assignment using Pr.178 to Pr.189 (Input terminal function selection) or Pr.190 to Pr.196 (Output terminal function selection) may affect the other functions. Set parameters after confirming the function of each terminal.

◆ Magnetic flux observer (continuous tuning) (Pr.95/Pr.574 = "2")

- Performing Vector control with a motor with encoder improves the torque accuracy. Estimate or measure the flux within
 the motor using the current running through the motor and the inverter output voltage. Since the flux of a motor can be
 accurately estimated continuously (even during operation), optimum characteristics can be obtained without being affected
 by temperature change in the second resistor.
- Under Vector control (Pr.80, Pr.81, Pr.800), select the magnetic flux observer.

• NOTE

Offline auto tuning is not necessary when magnetic flux observer is selected for SF-V5RU, SF-JR (with encoder), SF-HR (with encoder), SF-JRCA (with encoder) or SF-HRCA (with encoder). (However, when the wiring length is long (30 m or longer as a reference), perform offline auto tuning so that the resistance arises in the long wiring can be reflected to the operation.)

♦ Tuning the second motor (Pr.574)

- When one inverter switches the operation between two different motors, set the second motor in **Pr.450 Second applied motor**. (In the initial setting, no second motor is applied. (Refer to page 528.))
- Perform tuning using Pr.574 Second motor online auto tuning.
- Pr.574 is enabled when the Second function selection (RT) signal is turned ON.

| Pr. | Description |
|-----|--|
| 450 | Applied motor |
| 453 | Motor capacity (with the rated motor current equal to or less than the inverter rated current)*1 |
| 454 | Number of motor poles |

*1 If a motor with substantially low rated current compared with the inverter rated current is used, speed and torque accuracies may deteriorate due to torque ripples, etc. Set the rated motor current to about 40% or higher of the inverter rated current.



- The RT signal is the Second function selection signal. The RT signal also enables other second functions. (Refer to page 521.)
 The RT signal is assigned to terminal RT in the initial status. Set "3" in one of Pr.178 to Pr.189 (Input terminal function selection) to assign the RT signal to another terminal.
- Changing the terminal assignment using **Pr.178 to Pr.189 (Input terminal function selection)** may affect the other functions. Set parameters after confirming the function of each terminal.

Parameters referred to

Pr.9 Electronic thermal O/L relay page 415
Pr.71 Applied motor page 528
Pr.80 Motor capacity page 221, page 532, page 551
Pr.81 Number of motor poles page 221, page 532, page 551
Pr.96 Auto tuning setting/status page 532, page 551
Pr.178 to Pr.189 (Input terminal function selection) page 521
Pr.190 to Pr.196 (Output terminal function selection) page 473
Pr.800 Control method selection page 221

5.13.6 Signal loss detection of encoder signals

V/F Magnetic flux Vector

Signal loss detection (E.ECT) is turned ON to shut off the inverter output when the encoder signal is lost during encoder feedback control or orientation control operation or under Vector control.

Signal loss detection (E.ECA) is activated to shut off the inverter output when the machine end encoder signal is lost during machine end orientation control.

| P | r. | Name | Initial value | Setting range | Description |
|--------------------|--------------------|--|---------------|---------------|--------------------------------|
| 376 | 855 | Encoder signal loss | | 0 | Signal loss detection disabled |
| C148 ^{*1} | C248 ^{*2} | detection enable/ disable selection | 0 | 1 | Signal loss detection enabled |

- *1 The setting is available when a Vector control compatible plug-in option is installed.
- *2 These parameters are available when the control terminal option (FR-A8TP) is installed.

5.14 (A) Application parameters

| Purpose | | Parameter to set | | Refer to |
|--|---|---|---|----------|
| To operate by switching between the inverter and the commercial power supply operation | Electronic bypass function | P.A000 to P.A005 | Pr.135 to Pr.139, Pr.159 | 563 |
| To reduce the standby power | Self power management | P.A002, P.A006, P.A007, P.E300 | Pr.30, Pr.137, Pr.248, Pr.254 | 569 |
| To stop the motor with a mechanical brake (operation timing of mechanical brake) | Brake sequence function | P.A100 to P.A106, P.F500, P.A108, P.A109, P.A120 to P.A130 | Pr.278 to Pr.285, Pr.292, Pr.639 to Pr.651 | 572 |
| To count the number of inverter starting times | Start count monitor | P.A170, P.A171 | Pr.1410, Pr.1411 | 576 |
| To stop the motor with a mechanical brake (vibration control at stop-on-contact) | Stop-on-contact control | P.A200, P.A205, P.A206 | Pr.270, Pr.275, Pr.276 | 577 |
| To increase the speed at light load | Load torque high-speed frequency control | P.D301, P.D302, P.A200 to P.A204 | Pr.4, Pr.5, Pr.270 to Pr.274 | 580 |
| To strengthen or weaken the frequency at a constant cycle | Traverse operation | P.A300 to P.A305 | Pr.592 to Pr.597 | 582 |
| To suppress the swinging of an object moved by crane control | Anti-sway control | P.A310 to P.A317 | Pr.1072 to Pr.1079 | 584 |
| To adjust the stop position (orientation control) of the rotating shaft | Orientation control | P.A510 to P.A512, P.A520, P.A524, P.A525, P.A526 to P.A533, P.A540 to P.A545, P.C140, P.C141 | Pr.350 to Pr.366, Pr.369, Pr.393 to Pr.399 | 585 |
| To perform process control, such as for the pump flow volume and air volume | PID control | P.A601 to P.A607, P.A610 to P.A615, P.A621 to P.A625, P.A640 to P.A644, P.A650 to P.A655, P.A661 to P.A665 | Pr.127 to Pr.134, Pr.553, Pr.554, Pr.575 to Pr.577, Pr.609, Pr.610, Pr.753 to Pr.758, Pr.1015, Pr.1134, Pr.1135, Pr.1140, Pr.1141, Pr.1143 to Pr.1149 | 601 |
| | PID Pre-charge function | P.A616 to P.A620, P.A656 to P.A660 | Pr.760 to Pr.769 | 618 |
| | PID display adjustment | P.A600, P.A630 to P.A633, P.A670 to P.A673 | Pr.759, C42 to C45 (Pr.934, Pr.935), Pr.1136 to Pr.1139 | 615 |
| To control the dance roll for winding/ unwinding | Dancer control | P.A601, P.A602, P.A605, P.A606, P.A610, P.A611, P.A613 to P.A615, P.A624, P.A625, P.F020, P.F021 | Pr.44, Pr.45, Pr.128 to Pr.134, Pr.609, Pr.610, Pr.1134, Pr.1135 | 622 |
| To continue operating at analog current input loss | 4 mA input check | P.A680 to P.A682 | Pr.573, Pr.777, Pr.778 | 517 |
| | Automatic restart after instantaneous powerfailure / flying start function for induction motors | P.A700 to P.A705, P.A710 to P.F003 | Pr.57, Pr.58, Pr.162 to Pr.165, Pr.299, Pr.611 | 628 |
| To restart without stopping the motor at instantaneous power failure | Frequency search accuracy improvement (V/F control, offline auto tuning) | P.A700, P.A711, P.A712, P.C110, P.C210 | Pr.96, Pr.162, Pr.298, Pr.463, Pr.560 | 638 |
| | Automatic restart after instantaneous powerfailure / flying start function for IPM motors | P.A700, P.A702, P.F003 | Pr.57, Pr.162, Pr.611 | 635 |
| To decelerate the motor to a stop at power failure | Power failure time deceleration-to-stop function | P.A730 to P.A735, P.A785 | Pr.261 to Pr.266, Pr.294 | 642 |

| Purpose | Parameter to set | | | | |
|---|------------------|--|--|-----|--|
| To operate with sequence program | PLC function | P.A800 to P.A805, P.A811 to P.A859 | Pr.414 to Pr.417, Pr.498, Pr.675, Pr.1150 to Pr.1199 | 646 | |
| To store the inverter running status to a USB memory device | Trace function | P.A900 to P.A906, P.A910 to P.A920, P.A930 to P.A939 | Pr.1020 to Pr.1047 | 649 | |

5.14.1 Electronic bypass function

Magnetic flux Sensorless Vector

The inverter contains complicated sequence circuits for switching between the commercial power supply operation and inverter operation. Therefore, interlock operation of the magnetic contactor for switching can be easily performed by simply inputting start, stop, and automatic switching selection signals.

| Pr. | Name | Initial value | Setting range | Description |
|-------------|--|------------------|---------------|---|
| | | | 0 | Coasting time differs according to the inverter capacity.*1 |
| 57 A702 | Restart coasting time | 9999 | 0.1 to 30 s | Set the delay time for the inverter to perform a restart after restoring power due to an instantaneous power failure. |
| | | | 9999 | No restart |
| 58 A703 | Restart cushion time | 1 s | 0 to 60 s | Set the voltage cushion time for restart. |
| 135 | Electronic bypass | 0 | 0 | Electronic bypass sequence function disabled. |
| A000 | sequence selection | · · | 1 | Electronic bypass sequence function enabled. |
| 136 A001 | MC switchover interlock time | 1 s | 0 to 100 s | Set the operation interlock time for MC2 and MC3. |
| 137 A002 | Start waiting time | 0.5 s | 0 to 100 s | Set a time period that is a little longer than the time period from the ON signal input to the actual pick-up operation of MC3 (0.3 to 0.5 s). |
| | | | 0 | Inverter output stop (motor coasting) at inverter failure |
| 138 A003 | Bypass selection at a fault | 0 | 1 | Automatic switchover to commercial power supply operation at inverter failure. (Switchover is not possible when an external thermal relay (E.OHT) or CPU fault (E.CPU) is occurring.) |
| 139 | Automatic switchover | | 0 to 60 Hz | Set the frequency where the inverter operation is switched to commercial power supply operation. The inverter operation is performed from a start to Pr.139 setting, then it switches automatically to the commercial power supply operation when the output frequency is equal to or above Pr.139 . |
| A004 | frequency from inverter to bypass operation | 9999 | 8888 | When the FR-A8AVP is installed, the phase-synchronized bypass switching function is enabled. (For details, refer to the FR-A8AVP Instruction Manual.) When the FR-A8AVP is not installed, the operation is the same as the one when the setting is "9999". |
| | | | 9999 | Automatic bypass switching disabled |
| 159 A005 | 05 bypass to inverter | | 0 to 10 Hz | Set the frequency where the commercial power supply operation, which has been switched from the inverter operation with Pr.139 , switches back to inverter operation. When the frequency command becomes less than (Pr.139 - Pr.159), the motor switches automatically to inverter operation and operates at the frequency of the frequency command. Turning OFF a inverter start command (STF/STR) also switches the operation to the inverter operation. |
| | operation | | 9999 | To switch the commercial power supply operation, which has been switched from the inverter operation with Pr.139 , to the inverter operation again, the inverter start command (STF/STR) is turned OFF. The operation switches to the inverter operation, and the motor decelerates to a stop. |

^{*1} The coasting time when **Pr.57** = "0" is as shown below. (When **Pr.162 Automatic restart after instantaneous power failure selection** is set to the initial value.)

FR-A820-00105(1.5K) or lower and FR-A840-00052(1.5K) or lower: 0.5 s

FR-A820-00167(2.2K) to FR-A820-00490(7.5K), FR-A840-00083(2.2K) to FR-A840-00250(7.5K): 1 s

FR-A820-00630(11K) to FR-A820-03160(55K), FR-A840-00310(11K) to FR-A840-01800(55K): 3.0 s

FR-A820-03800(75K) or higher, FR-A840-02160(75K) or higher: 5.0 s

◆ Electronic bypass sequence function

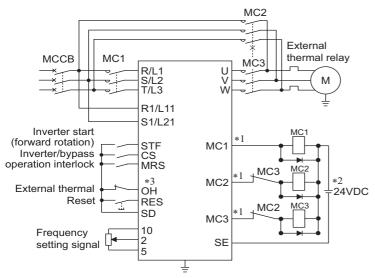
- When operating the motor at 60 Hz (or 50 Hz), the motor can be more efficiently operated with a commercial power supply. In addition, if the motor cannot be stopped for a long period of time even for an inverter maintenance and inspection, it is recommended that a commercial power supply circuit be installed.
- When switching between inverter operation and commercial power supply operation, commercial power supply may be
 accidentally applied to the output side of the inverter. To avoid such situation, provide an interlock where the magnetic
 contactor at the commercial power supply side turns ON at turn OFF of the magnetic contactor at the inverter output side.
 The inverter's electronic bypass sequence that outputs timing signals for the magnetic contactors can act as a complicated
 interlock between the commercial power supply operation and the inverter operation.



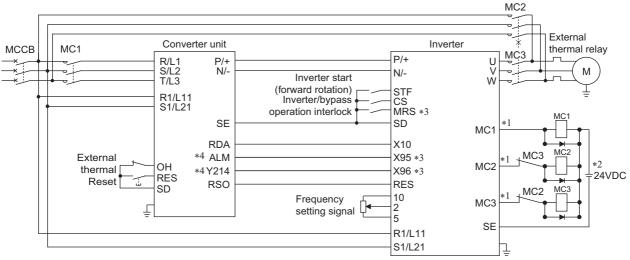
• The commercial power supply operation is not available with Mitsubishi Electric Vector control dedicated motors (SF-V5RU).

◆ Connection diagram

· A typical connection diagram of the electronic bypass sequence is shown below.



Standard models and IP55 compatible models



Separated converter type

*1 Be careful of the capacity of the sequence output terminals.

The applied terminals differ by the settings of Pr.190 to Pr.196 (Output terminal function selection).

| Output terminal capacity | Output terminal permissible load |
|--|----------------------------------|
| Open collector output of inverter (RUN, SU, IPF, OL, FU) | 24 VDC 0.1 A |
| Inverter relay output (A1-C1, B1-C1, A2-B2, B2-C2) Relay output option (FR-A8AR) | 230 VAC 0.3 A 30 VDC 0.3 A |

- *2 When connecting a DC power supply, insert a protective diode.
 - When connecting an AC power supply, use the relay output option (FR-A8AR), and use contact outputs.
- *3 The applied terminals differ by the settings of Pr.180 to Pr.189 (Input terminal function selection)
- *4 To use the signal, assign the function to the output terminal **Pr.190 to Pr.195 (Output terminal function selection)** of the converter unit. Always set the negative logic for the ALM signal.

NOTE

- To use the electronic bypass function, the wiring terminals R1/L11 and S1/L21 must be connected to a separate power source that does not go through MC1. Be sure to connect using a separate power supply.
- Be sure to provide a mechanical interlock for MC2 and MC3.
- · Operation of magnetic contactor (MC1, MC2, MC3)

| | | Operation status | | | | | |
|-----------------------|--|--|---------------------------|--|--|--|--|
| Magnetic contactor | Installation location | During commercial power supply operation | During inverter operation | During inverter fault | | | |
| MC1 | Between power supply and inverter input side | Shorted | Shorted | Open (shorted after the reset) | | | |
| MC2 | Between power supply and motor | Shorted | Open | Open (Selected by Pr.138 . Always open when the external thermal relay is operating.) | | | |
| МС3 | Between inverter output side and motor | Open | Shorted | Open | | | |

· The input signals are as shown below.

| Cinnal | Terminal | Fatia.a | On anation atatus | MC operation ^{*8} | | | |
|--|--|--|---|----------------------------|-----|-----------|--|
| Signal | rerminai | Function | Operation status | MC1*6 | MC2 | MC3 | |
| MRS | MRS ^{*1} | Electronic bypass switching function | ON: Electronic bypass switching function enabled. | 0 | _ | _ | |
| IVIING | MRS . | (enable/disable)*2 | OFF: Electronic bypass switching function disabled. | 0 | × | Unchanged | |
| | | Inverter/commercial | ON Inverter operation | 0 | × | 0 | |
| CS | CS | power supply operation switchover*3 | OFF Commercial power supply operation | 0 | 0 | × | |
| STF | · · · · · · · · · · · · · · · · · · · | | ON Forward rotation (reverse rotation) | 0 | × | 0 | |
| (STR) | (STR) | during commercial power supply operation)*4 | OFF Stop | 0 | × | 0 | |
| ОН | Selected from Pr.180 | External thermal relay | ON Motor normal | 0 | _ | _ | |
| OH | to Pr.189 to set "7". | input | OFF Motor fault | × | × | × | |
| RES | RES | Operation status reset*5 | ON Reset | Unchanged | × | Unchanged | |
| INLO | INLO | Operation status reset | OFF Normal operation | 0 | _ | _ | |
| | | | X95 signal OFF, X96 signal OFF. Converter fault (E.OHT, E.CPU). | × | × | × | |
| X95/X96 Selected from Pr.180 to Pr.189 to set "95/ | Converter unit fault / Converter unit fault | X95 signal ON, X96 signal ON. Converter normal. | 0 | _ | _ | | |
| | 96". | (E.OHT, E.CPU) | X95 signal OFF, X96 signal ON. Converter fault (other than E.OHT or E.CPU). | × | *7 | × | |

^{*1} For separated converter types, the X10 signal is assigned to the terminal MRS in the initial setting. For the MRS signal, set "24" to any of **Pr.180** to **Pr.189** (Input terminal function selection) to assign the function to another terminal.

^{*2} When the MRS signal is OFF, neither the commercial power supply operation nor the inverter operation can be performed.

^{*3} The CS signal operates only when the MRS signal is ON.

^{*4} STF (STR) operates only when the MRS and CS signals are both ON.

^{*5} Whether or not to enable reset input using the RES signal depends on the setting of **Pr.75 Reset selection/disconnected PU detection/PU stop selection**. When the RES signal and another input signal are simultaneously input, the MC operation by the RES signal has a higher priority.

^{*6} MC1 opens at an inverter fault.

- *7 MC2 opens when Pr.138 (Automatic bypass switching after inverter fault) = "0" (disabled), and MC2 closes when Pr.138 = "1" (enabled).
- *8 MC operation is as shown below.

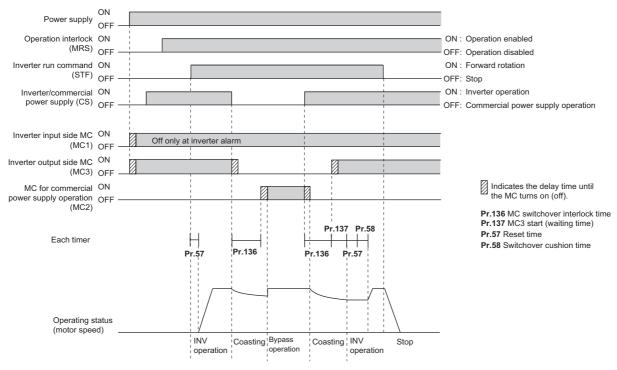
| Notation | MC operation |
|-----------|--|
| 0 | ON |
| × | OFF |
| | MC2-OFF, MC3-ON during inverter operation, |
| | MC2-ON, MC3-OFF during commercial power supply operation |
| Unchanged | The status of the MC remains the same after turning ON or OFF of the signal. |

· Output signal list

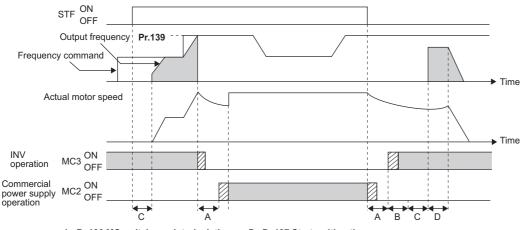
| Signal | Terminal (Pr.190 to Pr.196 setting) | Description |
|--------|--|---|
| MC1 | 17 | Output signal to control MC1 installed on the inverter input side. |
| MC2 | 18 | Output signal to control MC2 installed for commercial power supply operation. |
| MC3 | 19 | Output signal to control MC3 installed on the inverter output side. |

◆ Electronic bypass operation sequence

• Example of operation sequence without automatic bypass sequence (Pr.139 = "9999")

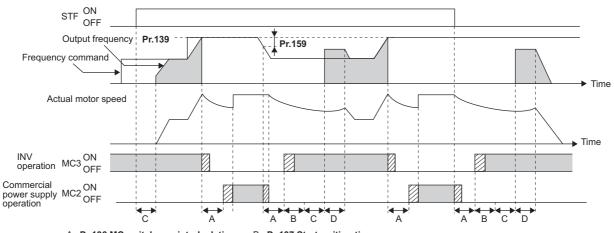


• Example of operation sequence with automatic bypass sequence (Pr.139 ≠ "9999", Pr.159 = "9999")



- A: Pr.136 MC switchover interlock time
- B: Pr.137 Start waiting time
- C : Pr.57 Restart coasting time
- D: Pr.58 Restart cushion time

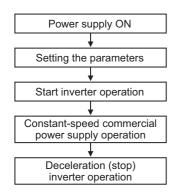
• Example of operation sequence with automatic bypass sequence (Pr.139 ≠ "9999", Pr.159 ≠ "9999")



- A: Pr.136 MC switchover interlock time
- C : Pr.57 Restart coasting time
- B : Pr.137 Start waiting time
- D: Pr.58 Restart cushion time

Operating procedure

· Operation flowchart



- Pr.135 = "1"
- Pr.136 = 2.0 s
- **Pr.137** = 1.0 s (Set the time until MC3 is actually turned ON and the inverter and motor are electrically connected. If the time is short, the restart may not function properly.)
- Pr.57 = 0.5 s
- **Pr.58** = 0.5 s (Always set this to switchover from the commercial power supply operation to the inverter operation.)

· Signal operation after setting parameters

| Status | MRS | CS | STF | MC1 | MC2 | MC3 | Remarks |
|--|--------------|--------------|--------------|--------------------|--------------|--|---|
| Power ON | OFF (OFF) | OFF (OFF) | OFF (OFF) | OFF→ON (OFF→ON) | OFF (OFF) | $\begin{array}{c} OFF \to ON \\ (OFF \to \\ ON) \end{array}$ | External operation mode (PU operation mode) |
| At start (inverter) | OFF→ON | OFF→ON | OFF→ON | ON | OFF | ON | |
| During constant-speed operation (commercial power supply) | ON | ON→OFF | ON | ON | OFF→ON | ON→OFF | MC2 turns ON after MC3 turns OFF. The delay time is 2 s (while coasting). |
| Switching to inverter operation due to deceleration (inverter) | ON | OFF→ON | ON | ON | ON→OFF | OFF→ON | MC3 turns ON after MC2 turns OFF. The delay time is 4 s (while coasting). |
| Stop | ON | ON | ON→OFF | ON | OFF | ON | |



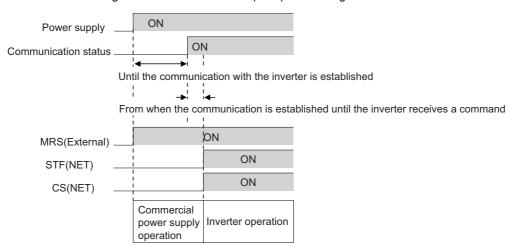
- Take power from any point between the power supply and MC1 to the terminals for control circuit power input (R1/L11 and S1/L21). If power is taken from any point between MC1 and the inverter, the electronic bypass sequence function does not work.
- The electronic bypass sequence function is enabled only when **Pr.135** = "1" and the inverter is in the External operation mode or the PU/External combined operation mode 1 (**Pr.79** = "3" (frequency command using the PU and start command using the external signals)). When **Pr.135** = "1" but the inverter is in the operation mode other than mentioned above, the MC1 and MC3 signals are ON.
- MC3 turns ON when the MRS and CS signals are ON and the STF (STR) signal is OFF. If the motor coasted to a stop from commercial power supply operation at the previous stop, the motor starts running after the time set in **Pr.137**.
- Inverter operation is only available when the MRS, STF (STR), and CS signals are ON. In all other cases (when the MRS signal is ON), commercial power supply operation is available.
- When the CS signal is OFF, the motor switches to the commercial power supply operation. However, when the STF (STR) signal is OFF, the motor decelerates to a stop during inverter operation.
- From the point where MC2 and MC3 are both turned OFF, there is a delay time set with Pr.136, till MC2 or MC3 is turned ON.
- Even when the electronic bypass sequence is enabled (**Pr.135** = "1"), the **Pr.136** and **Pr.137** settings are disabled in PU operation mode.
 - In addition, the input terminals (STF, CS, MRS, OH) return to perform their normal functions.
- When both the electronic bypass sequence function and the PU operation interlock function are enabled at the same time
 (Pr.135 = "1" and Pr.79 = "7") and the PU operation external interlock (X12) signal is not assigned to any input terminal, the
 MRS signal will have another function as the X12 signal. (In this case, the inverter operation is enabled when both the MRS
 signal and the CS signal are ON.)
- Set the acceleration time to the level that does not activate the stall prevention operation.
- If switching to the commercial power supply operation while a failure such as an output short circuit has occurred between the magnetic contactor MC3 and the motor, the damage may further spread. If a failure has occurred between the MC3 and the motor, a protection circuit such as using the OH signal input must be provided.
- Changing the terminal functions with **Pr.178 to Pr.189 and Pr.190 to Pr.196** may affect other functions. Set parameters after confirming the function of each terminal.
- Switching with the electronic bypass sequence is not available during retry. Switching occurs after the retry. When the electronic bypass is valid at a fault (**Pr.138** = "1"), switching occurs also during retry.
- When the electronic bypass sequence function and the retry function of the converter unit are used at the same time for the
 separated converter type, set 101 or more in the number of retries at fault occurrence (Pr.67) on the converter unit side. When
 a value less than 100 is set, the ALM signal does not turn ON until the retry count is exceeded. In this case, the electronic
 bypass at a fault is not performed until the retry count is exceeded.
- To use X95 and X96 signals for the separated converter type, use a converter unit manufactured in August 2014 or later.

Precautions for electronic bypass sequence function

· The response time of the inverter to the signals depends on the command source, NET or External.

After the communication with the inverter is established, the motor operation is performed according to the command via NET. The commercial power supply operation with the motor is performed when the MRS signal turns ON before the communication is established. It is recommended to turn the MRS signal ON after the communication is established.

Example: the response time of the inverter to the signals in the Network operation mode (power-ON). The command source is External for the MRS signal and NET for the STF (STR) and CS signals.



◆ Operation in combination with the self power management function for the separated converter type

· When the self power management function is used with the separated converter type, the input signal operations are as

| X95 | X95 X96 | | X94 MC operation*3 | | | |
|------------------------|---|---|--------------------|-----|-----|--|
| (Converter unit fault) | (Converter unit fault (E.OHT, E.CPU)) | (Control signal for main circuit power supply MC) | MC1 | MC2 | мсз | Converter status |
| OFF | OFF | ON | o*2 | × | × | Converter fault (E.OHT (Pr.248 = "2")) |
| OFF | OFF | OFF | × | × | × | Converter fault (E.OHT (Pr.248 = "1"), E.CPU) |
| ON | ON | ON | o*2 | _ | _ | Converter normal |
| OFF | ON | ON | o*2 | *1 | × | Converter fault (other than the circuit failure fault or E.OHT) (Pr.248 = "2") |
| | | OFF | × | *1 | × | Converter fault (other than E.OHT or E.CPU) |

- *1 When Pr.138 = "0 (electronic bypass invalid at a fault)", MC2 is OFF. When Pr.138 = "1 (electronic bypass valid at a fault)", MC2 is ON.
- *2 The self power management operation is followed.
- *3 MC operation is as shown below.

| Notation | MC operation |
|----------|---|
| 0 | ON |
| × | OFF |
| _ | MC2-OFF, MC3-ON during inverter operation, MC2-ON, MC3-OFF during commercial power supply operation |

Parameters referred to

Pr.11 DC injection brake operation time page 715
Pr.57 Restart coasting time page 628, page 635
Pr.58 Restart cushion time page 628
Pr.79 Operation mode selection page 389

Pr.178 to Pr.189 (Input terminal function selection) page 521

Pr.190 to Pr.196 (Output terminal function selection) page 473

Self power management 5.14.2

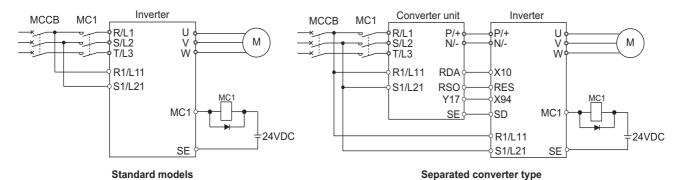


By turning ON the magnetic contactor (MC) on the input side before the motor is started and turning OFF the MC after the motor is stopped, power is not supplied to the main circuit, reducing the standby power.

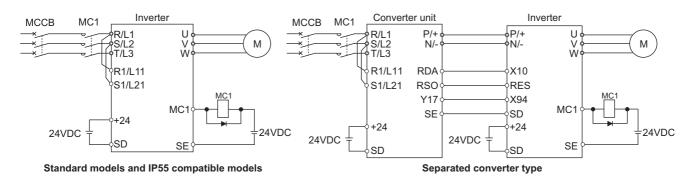
| Pr. | Name | Initial value | Setting range | Description | |
|-------------|-------------------------------------|------------------|---|---|--|
| 248 A006 | Self power management selection | 0 | 0 | Self power management function disabled | |
| | | | 1 | Self power management function enabled (main circuit OFF at protective function activation) | |
| | | | 2 | Self power management function enabled (main circuit OFF at protective function activation due to a circuit failure) | |
| 137 A002 | Start waiting time | 0.5 s | 0 to 100 s | Set a time period that is a little longer than the time period from the O signal input to the actual pick-up operation of MC1 (0.3 to 0.5 s). | |
| 254 A007 | Main circuit power OFF waiting time | 600 s | 1 to 3600 s | Set the delay time until the main circuit power supply is turned OFF after the motor is stopped. | |
| | | | 9999 | The main circuit power supply is turned OFF only when the protective function selected by Pr.248 is activated. | |
| 30 E300 | Regenerative function selection | 0 | 100, 101 | Power supply to the inverter: AC (terminals R, S, and T). When power is supplied only to the control circuit, and then switched be supplied to both the control and main circuits, inverter reset is not performed. | |
| | | | 0 to 2, 10, 11, 20, 21, 102, 110, 111, 120, 121 | For other settings, refer to page 724. | |

◆ Connection diagram

Terminal R1, S1 inputs

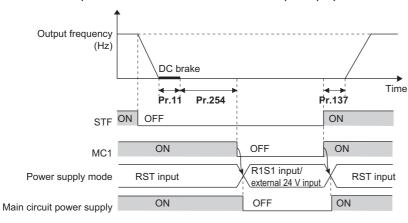


· 24 V external power supply input



Operation of the self power management function

- This function controls the magnetic contactor (MC) on the input side using the output relay to reduce the standby power during inverter stop. With the terminals R1/L11 and S1/L21 (refer to page 77) and 24 V external power supply input (refer to page 80), the main circuit power supply and control circuit power supply are separated, and the MC for main circuit power supply is controlled by the electronic bypass MC1 signal.
- Set Pr.248 Self power management selection = "1 or 2", Pr.30 Regenerative function selection ≠ "20, 21, 120, or 121" (other than DC feeding mode 2), and Pr.190 to Pr.196 (Output terminal function selection) = "17 (positive logic)" to assign the Electronic bypass MC1 (MC1) signal to an output terminal.
- After the inverter is stopped and the time set in Pr.11 DC injection brake operation time and Pr.254 Main circuit power
 OFF waiting time have passed, turning OFF the MC1 signal releases the MC on the input side (main circuit power supply
 OFF). Set Pr.254 to prevent frequent MC operation.
- Turning ON the start signal turns ON the MC1 signal and closes the MC on the input side (main circuit power supply ON). After the time set in **Pr.137 Start waiting time** has passed, the inverter starts. Set time slightly longer (about 0.3 to 0.5 s) than the time period from the MC1-ON to the actual pick-up operation of the MC is turned ON in **Pr.137**.



• When the protective function of the inverter is activated, the MC1 signal is immediately turned OFF according to the **Pr.248** setting. (The MC1 signal is turned OFF before the time set in **Pr.254** has passed.)

When Pr.248 ="1", the MC1 signal is turned OFF when the protective function is activated due to any cause.

When **Pr.248** ="2", the MC1 signal is turned OFF only when the protective function is activated due to an error resulted from a failure in the inverter circuit or a wiring error (refer to the following table). (For the fault details, refer to page 779.)

| Fault type | | | | |
|--|--|--|--|--|
| Inrush current limit circuit fault (E.IOH) | | | | |
| CPU fault (E.CPU) | | | | |
| CPU fault (E.6) | | | | |
| CPU fault (E.7) | | | | |
| Parameter storage device fault (control circuit board) (E.PE) | | | | |
| Parameter storage device fault (main circuit board) (E.PE2) | | | | |
| 24 VDC power fault (E.P24) | | | | |
| Operation panel power supply short circuit/RS-485 terminals power supply short circuit (E.CTE) | | | | |
| Output side earth (ground) fault overcurrent (E.GF) | | | | |
| Output phase loss (E.LF) | | | | |
| Brake transistor alarm detection (E.BE) | | | | |
| Internal circuit fault (E.13/E.PBT) | | | | |

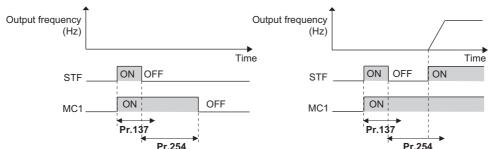
• To enable the self power management function for the separated converter type, enable the self power management function also on the converter unit side. To activate the self power management function when a converter unit fault occurs, connect the terminal to which the Y17 signal of the converter unit is assigned and the terminal to which X94 signal of the inverter is assigned.

| Y17 output signal (converter unit) | MC1 output signal (inverter) | MC1 output signal actual operation | Main circuit power supply |
|------------------------------------|------------------------------|------------------------------------|---------------------------|
| OFF | OFF | OFF | Stop |
| OFF | ON | OFF | Stop |
| ON | OFF | OFF | Stop |
| ON | ON | ON | Supplied |

• To use the X94 signal, set "94" in any of **Pr.178 to Pr.189 (Input terminal function selection)** to assign the function to an input terminal.



When the start signal is turned OFF before the time set in Pr.137 has passed after the start signal is turned ON, the inverter
does not start and the MC1 signal is turned OFF after the time set in Pr.254 has passed. If the start signal is turned ON again
before the time set in Pr.254 has passed, the inverter immediately starts outputting.



- · At inverter reset, the status of the MC1 signal is held and operation of the magnetic contactor is not performed.
- When the inverter stops the output due to, for example, the Output stop (MRS) signal, the MC1 signal is turned OFF after the time set in **Pr.254** has passed.
- During the stop, turning ON the External DC injection brake operation start signal (X13) and Pre-excitation/servo ON signal (LX) turns ON the MC1 signal.
- To avoid inverter reset when supplying power to the main circuit is started when power is supplied only to the control circuit, set 100 or more in Pr.30. (For the separated converter type, setting Pr.30 of the converter unit is also required.)
- When supplying power to the main circuit is started when power is supplied only to the control circuit, there is a slight delay before starting.
- Repeated operation of the magnetic contactor due to frequent start and stop or activation of the protective function may shorten
 the inverter life.
- Changing the terminal assignment using Pr.178 to Pr.189 (Input terminal function selection) and Pr.190 to Pr.196 (Output terminal function selection) may affect the other functions. Set parameters after confirming the function of each terminal.
- To use X94 signal for the separated converter type, use a converter unit manufactured in August 2014 or later.

Parameters referred to

Pr.11 DC injection brake operation time ☐ page 715
Pr.30 Regenerative function selection ☐ page 724

Pr.190 to Pr.196 (Output terminal function selection) page 473

5.14.3 Brake sequence function

This function outputs operation timing signals of the mechanical brake from the inverter, such as for lift applications.

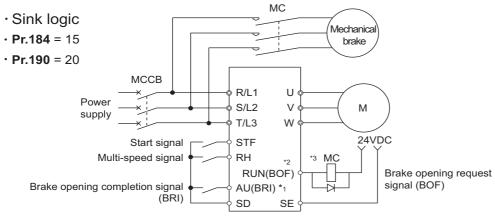
This function is useful in preventing load slippage at a start due to poor mechanical brake timing and overcurrent alarm in stop status and enable secure operation.

| Pr. | Name | Initial value | Setting range | Description |
|-------------|--------------------------------------|------------------|---------------|--|
| 278 A100 | Brake opening frequency | 3 Hz | 0 to 30 Hz | Set the rated slip frequency of the motor + approx. 1.0 Hz. This can be set only when Pr.278 ≤ Pr.282 . |
| 279 A101 | Brake opening current | 130% | 0 to 400% | Set between 50 and 90% because load slippage is more likely to occur when a start setting is too low. The inverter rated current is regarded as 100%, or the rated motor torque is regarded as 100%. (According to Pr.639 setting) |
| 280 A102 | Brake opening current detection time | 0.3 s | 0 to 2 s | Generally set between 0.1 and 0.3 s. |
| 281 A103 | Brake operation time at start | 0.3 s | 0 to 5 s | Set the mechanical delay time until braking eases. When Pr.292 = "8", set the mechanical delay time until braking eases + approx. 0.1 to 0.2 s. |
| 282 A104 | Brake operation frequency | 6 Hz | 0 to 30 Hz | Turn OFF the Brake opening request (BOF) signal and set the frequency for operating the electromagnetic brake. Generally, set the setting value of Pr.278 + 3 to 4 Hz. This can be set only when Pr.282 ≥ Pr.278 . |
| 283 A105 | Brake operation time at stop | 0.3 s | 0 to 5 s | When Pr.292 = "7", set the mechanical delay time until the brake closes + 0.1 s. When Pr.292 = "8", set the mechanical delay time until the brake closes + approx. 0.2 to 0.3 s. |

| Pr. | Name | Initial value | Setting range | | Description | |
|---------------------|---|------------------|---------------|--|---|--|
| 284 | Deceleration detection | | 0 | The deceleration dete | ection function disabled. | |
| A106 | Deceleration detection function selection | 0 | 1 | The protective function is activated when the deceleration speed of the deceleration operation is not normal. | | |
| 285 A107 | | | 0 to 30 Hz | The Brake sequence fault (E.MB1) is activated when the difference between the detection frequency and output frequency is equal to or greater than the setting value under encoder feedback control. | | |
| | | | 9999 | Overspeed detection disabled. | | |
| | Automatic acceleration/ | 0 | 0 | Normal operation | | |
| 292 A110 F500 | | | 1, 11 | Operation with the shortest acceleration/deceleration time. (Refer to page 384.) | | |
| | | | 3 | Operation with the optimum acceleration/deceleration time. (Refer to page 384.) | | |
| 1 300 | | | 5, 6 | Lift operation 1, 2. (Refer to page 387.) | | |
| | | | 7 | Brake sequence mode 1 | | |
| | | | 8 | Brake sequence mode 2 | | |
| 639 | Brake opening current | 0 | 0 | Brake opening by out | | |
| A108 | selection | Ü | 1 | Brake opening by mot | | |
| 640 | Brake operation frequency | | 0 | Brake closing operation | | |
| A109 | selection | 0 | 1 | Brake closing operation by the actual motor rotation speed (estimated value) | | |
| | Second brake sequence operation selection | 0 | 0 | Normal operation when the RT signal is ON | | |
| 641 | | | 7 | Second brake sequence 1 when the RT signal is ON | | |
| A130 | | | 8 | Second brake sequence 2 when the RT signal is ON | | |
| | | | 9999 | First brake sequence is valid when the RT signal is ON | | |
| 642 A120 | Second brake opening frequency | 3 Hz | 0 to 30 Hz | Refer to Pr.278. | | |
| 643 A121 | Second brake opening current | 130% | 0 to 400% | Refer to Pr.279. | | |
| 644 A122 | Second brake opening current detection time | 0.3 s | 0 to 2 s | Refer to Pr.280 . | | |
| 645 A123 | Second brake operation time at start | 0.3 s | 0 to 5 s | Refer to Pr.281. | Cat the accord by the carry and the carry | |
| 646 A124 | Second brake operation frequency | 6 Hz | 0 to 30 Hz | Refer to Pr.282. | Set the second brake sequence function. The second brake sequence function is enabled when the RT signal is ON. | |
| 647 A125 | Second brake operation time at stop | 0.3 s | 0 to 5 s | Refer to Pr.283. | onabled when the IXT signal is OIV. | |
| 648 A126 | Second deceleration speed detection selection | 0 | 0, 1 | Refer to Pr.284. | | |
| 650 A128 | Second brake opening current selection | 0 | 0, 1 | Refer to Pr.639 . | | |
| 651 A129 | Second brake operation frequency selection | 0 | 0, 1 | Refer to Pr.640 . | | |

^{*1} The speed deviation excess detection frequency is used when Vector control compatible option is mounted during Vector control. (Refer to page 269 for details.)

♦ Connection diagram



- *1 The input signal terminals differ by the settings of **Pr.178 to Pr.189**.
- $^{*}2$ The output signal terminals differ by the settings of **Pr.190 to Pr.196**.



- The automatic restart after instantaneous power failure function and orientation function do not operate when brake sequence is selected.
- To use this function, set the acceleration/deceleration time to 1 s or higher.
- Changing the terminal assignment using Pr.178 to Pr.189 (Input terminal function selection) and Pr.190 to Pr.196 (Output terminal function selection) may affect the other functions. Set parameters after confirming the function of each terminal.

Setting the brake sequence operation

- Set **Pr.292 Automatic acceleration/deceleration** = "7 or 8 (braking sequence operation)".

 To ensure sequence operation, it is recommended to use with **Pr.292** = "7" (with brake opening completion signal input).
- Set "15" in any of **Pr.178 to Pr.189 (Input terminal function selection)**, and assign the Brake opening completion (BRI) signal to the input terminal.
- Set "20" (positive logic) or "120" (negative logic) in any of **Pr.190 to Pr.196 (Output terminal function selection)**, and assign the brake opening request signal (BOF) to the output terminal.
- Use **Pr.639 Brake opening current selection** to select whether the output current or the motor torque is used as a reference for the brake opening operation. (Under V/F control, this operation is activated regardless of the **Pr.639** setting.)
- Under Real sensorless vector control, Vector control, or PM sensorless vector control, use Pr.640 Brake operation
 frequency selection to select whether the frequency command or the actual motor speed (estimated value) is used as a
 reference for brake closing operation. If the brake operation timing is different from the motor speed because of the load,
 set Pr.640 = "1 (brake operation with the actual motor speed (estimated value))".
- Under V/F control or Advanced magnetic flux vector control, the frequency command is used as a reference for brake operation regardless of the Pr.640 setting.

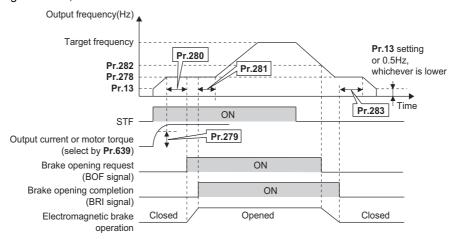


• Under torque control, position control, or PM sensorless vector control (with the low-speed range high torque characteristic disabled), the brake sequence function is disabled.

◆ Operation with brake opening completion signal input (Pr.292 = "7")

When the start signal is input to the inverter, the inverter starts running, and when the output frequency reaches the frequency set in Pr.278 Brake opening frequency and the output current or the motor torque is equal to or greater than the Pr.279 Brake opening current setting, the brake opening request signal (BOF) is output after the time set in Pr.280 Brake opening current detection time. The Brake opening completion (BRI) signal is input, and the output frequency is increased to the set speed after the set time in Pr.281 Brake operation time at start.

• When the inverter decelerates to the frequency set to Pr.282 Brake operation frequency during deceleration, the inverter turns OFF the brake opening request signal (BOF) and decelerates further to the frequency set in Pr.278. After electromagnetic brake operation completes and the inverter recognizes the turn OFF of the BRI signal, the inverter holds the frequency set in Pr.278 for the time set in Pr.283 Brake operation time at stop. And after the time set in Pr.283 passes, the inverter decelerates again. The inverter outputs is shut off when the frequency reaches Pr.13 Starting frequency setting or 0.5 Hz, whichever is lower.

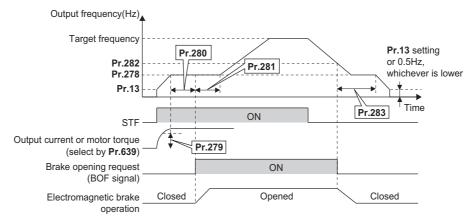


◆ Operation without Brake opening completion (Pr.292 = "8") signal input

When the start signal is input to the inverter, the inverter starts running, and when the output frequency reaches the
frequency set in Pr.278 Brake opening frequency and the output current or the motor torque is equal to or greater than
the Pr.279 Brake opening current setting, the brake opening request signal (BOF) is output after the time set in Pr.280
Brake opening current detection time.

After the BOF signal is output, the output frequency is increased to the set speed after the set time in **Pr.281 Brake** operation time at start.

• When the inverter decelerates to the frequency set to **Pr.282 Brake operation frequency** during deceleration, the inverter turns OFF the brake opening request signal (BOF) and decelerates further to the frequency set in **Pr.278**. And after the time set in **Brake operation time at stop** passes, the inverter decelerates again. **Pr.13 Starting frequency** setting or 0.5 Hz, whichever is lower





Even if the brake sequence operation has been selected, inputting the JOG signal (JOG operation) changes the operation
method to normal operation and give a priority to the JOG operation. Note that the JOG signal input by the brake sequence
function is invalid during operation.

◆ Set multiple brake sequence functions (Pr.641)

• When the second brake sequence function is set, it is possible to switch between and use two types of brake sequence functions. Turning ON the Second function selection (RT) signal enables the Second brake sequence function.

· Select the operation of the Second brake sequence function with Pr.641 Second brake sequence operation selection.

| Pr.641 setting | Brake sequence function when the RT signal is ON |
|-------------------|--|
| 0 (initial value) | Normal operation (The first and second brake sequence functions invalid) |
| 7 | Second brake sequence mode 1 |
| 8 | Second brake sequence mode 2 |
| 9999 | First brake sequence mode is valid |

- Set "45" in any of Pr.178 to Pr.189 (Input terminal function selection) to assign the Second brake sequence open completion signal (BRI2) to the input terminal.
- To use the Second brake opening request signal (BOF2), set "22 (positive logic)" or "122 (negative logic)" in any of Pr.190 to Pr.196 (Output terminal function selection) to assign the function to the output terminal.
- The method of setting the second brake sequence parameters is the same as that for the corresponding first brake sequence function parameters.
- · Switchover of the brake sequence function by RT signal is valid when the inverter is stopped.

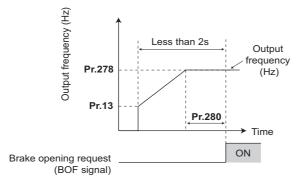
Protective function

• If one of the following faults occur while the brake sequence function is enabled, the inverter enters an fault status, shuts off output, and turns OFF the brake opening request signal (BOF).

| Fault indication | Description |
|------------------|---|
| E.MB1 | When (detection frequency) - (output frequency) ≥ Pr.285 during encoder feedback control. When Pr.285 (Overspeed detection function) = 9999, overspeed is not detected. |
| E.MB2 | When deceleration is not normal during deceleration operation from the set frequency to the frequency set in Pr.282 . (when Pr.284 = 1) (except stall prevention operation) |
| E.MB3 | When the BOF signal turned ON while the motor is at a stop. (load slippage prevention function) |
| E.MB4 | When more than 2 s have elapsed after the start command (forward or reverse rotation) is input, but the BOF signal does not turn ON. |
| E.MB5 | When more than 2 s have elapsed after the BOF signal turned ON, but the BRI signal does not turn ON. |
| E.MB6 | When the inverter had turned ON the brake opening request signal (BOF), but the BRI signal turned OFF. |
| E.MB7 | When more than 2 s have elapsed after the BOF signal turned OFF at a stop, but the BRI signal does not turn OFF. |

• NOTE

- · During PM sensorless vector control, the brake sequence function is available with the IPM motor MM-CF only.
- During deceleration, inverter output is shut OFF when the frequency reaches **Pr.13 Starting frequency** or 0.5 Hz, whichever is lower. For **Pr.278 Brake opening frequency**, set a frequency equal to or higher than the **Pr.13** setting or 0.5 Hz.
- Pr.285 Overspeed detection frequency is valid under encoder feedback control (used with the FR-A8AP (option)) even if a value other than "7 or 8" is set in Pr.292 Automatic acceleration/deceleration.
- Setting Pr.278 too high activates the stall prevention and may cause E.MB4.
- E.MB4 occurs when the acceleration time from Pr.13 to Pr.278 + Pr.280 reaches or exceeds 2 s.



Parameters referred to

Pr.3 Base frequency page 707

Pr.178 to Pr.189 (Input terminal function selection) page 521 Pr.190 to Pr.196 (Output terminal function selection) page 473

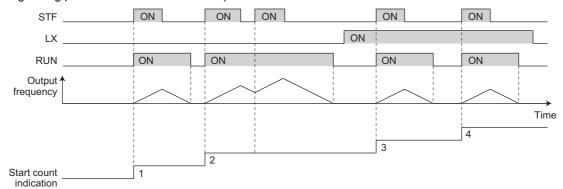
5.14.4 Start count monitor

The inverter starting times can be counted.

Confirming the starting times can be used to determine the timing of the maintenance, or can be used as a reference for system inspection or parts replacement.

| Pr. | Name | Initial value | Setting range | Description |
|--------------|-------------------------------|---------------|---------------|--|
| 1410 A170 | Starting times lower 4 digits | 0 | 0 to 9999 | Displays the lower four digits of the number of the inverter starting times. |
| 1411 A171 | Starting times upper 4 digits | 0 | 0 to 9999 | Displays the upper four digits of the number of the inverter starting times. |

• Every start signal input (the RUN signal ON) while the inverter output is stopped is counted as the inverter starting time. (Starting during pre-excitation is also counted.)



- The lower four digits of the number of starting times is displayed in **Pr.1410 Starting times lower 4 digits**, and the upper four digits of the number of starting times is displayed in **Pr.1411 Starting times upper 4 digits**.
- The maximum count is "99999999". When "99999999" is exceeded on the monitor, the monitor value is reset to 0.

| | Display data | Monitor display |
|-------|--------------------------------|---------------------|
| 10000 | Pr.1410 (Lower digits monitor) | <i>\(\alpha \)</i> |
| 10000 | Pr.1411 (Upper digits monitor) | 1 |
| 100 | Pr.1410 (Lower digits monitor) | 100 |
| 100 | Pr.1411 (Upper digits monitor) | |



- Any value can be set in **Pr.1410** or **Pr.1411**. Set "0" to clear the number on the monitor.
- · Starting during offline auto tuning is not counted.
- Under position control, the count increases when the LX signal turns ON.
- The counting is enabled even if the RUN signal is not assigned to an output terminal.
- For the RUN signal, refer to page 473.
- Starting during the test operation (Pr.800 = "9") is not counted.

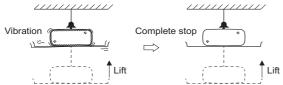
5.14.5 Stop-on-contact control

Magnetic flux Sensorless

To ensure accurate positioning at the upper limit, etc. of a lift, stop-on-contact control causes the mechanical brake to close while the motor creates a holding torque to keep the load in contact with a mechanical stopper, etc.

This function suppresses vibration that is likely to occur when the load is stopped upon contact in lift applications, thereby ensuring reliable and highly accurate positioning stop.

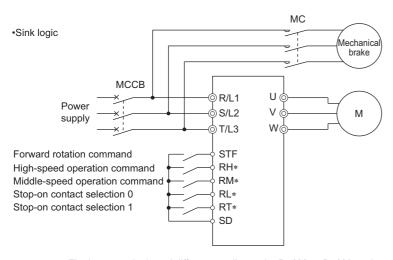
<Without stop-on-contact control> <With stop-on-contact control>



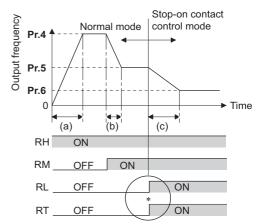
| Pr. | Name | Initial value | Setting range | Description | |
|-------------|--|---------------|----------------------|---|--|
| 6 D303 | Multi-speed setting (low speed) | 10 Hz | 0 to 590 Hz | Set the output frequency for stop-on-contact control. | |
| 22 H500 | Stall prevention operation level | 150% | 0 to 400% | Set the stall prevention operation level for stop-on-contact cont | |
| 48 H600 | Second stall prevention operation level | 150% | 0 to 400% | The smaller value set in either Pr.22 | or Pr.48 has priority. |
| | | | 0 | Normal operation | |
| | high-speed frequency control | | 1 | Stop-on-contact control | |
| | | | 2 | Load torque high-speed frequency control (Refer to page 580.) | |
| 270 A200 | | 0 | 3 | Stop-on contact + load torque high speed frequency control (Refe to page 580.) | |
| 71200 | selection | | 11 | Stop-on-contact control | |
| | | | 13 | Stop-on contact + load torque high speed frequency control (Refer to page 580.) | E.OLT is invalid under stop- on-contact control |
| 275 A205 | Stop-on contact excitation current low-speed scaling | 9999 | 0 to 300% | Set the force (holding torque) for stop-on-contact control. Normally, set the scaling factor between 130 to 180%. | |
| A205 | factor | | 9999 | Not compensated. | |
| | | | 0 to 9 ^{*1} | Set a PWM carrier frequency for stop | |
| 276 A206 | PWM carrier frequency at stop-on contact | 9999 | 0 to 4 ^{*2} | For Real sensorless vector control, the carrier frequency is always kHz when the setting value is 0 to 5 and always 6 kHz when the setting value is 6 to 9. (Valid at the output frequency of 3 Hz or les | |
| | | | 9999 | As set in Pr.72 PWM frequency sele | ection. |

- *1 The setting range of the FR-A820-03160(55K) or lower and the FR-A840-01800(55K) or lower
- *2 The setting range of the FR-A820-03800(75K) or higher and the FR-A840-02160(75K) or higher

♦ Connection and operation example



st The input terminal used differs according to the **Pr.180 to Pr.189** settings.



- Goes into stop-on-contact control mode when both RL and RT switch on.
 RL and RT may be switched on in any order with any time difference
- (a): Acceleration time(Pr.7)
- (b): Deceleration time(Pr.8)
- (c): Second deceleration time(Pr.44/Pr.45)

◆ Setting the stop-on-contact control

- Make sure that the inverter is in External or Network operation mode. (Refer to page 389.)
- · Select either Real sensorless vector control (speed control) or Advanced magnetic flux vector control.
- Set "1, 3, 11 or 13" in Pr.270 Stop-on contact/load torque high-speed frequency control selection.
- Set the output frequency for stop-on-contact control in Pr.6 Multi-speed setting (low speed).
 Set the frequency as low as possible (about 2 Hz). If a frequency higher than 30 Hz is set, it operates with 30 Hz.
- When both the RT and RL signals are switched ON, the inverter enters the stop-on-contact control, and operation is performed at the frequency set in **Pr.6** independently of the preceding speed.

• Setting **Pr.270** = "11 or 13" disables stall prevention stop (E.OLT) during stop-on-contact control (with both RL and RT signals ON).



- By increasing the **Pr.275** setting, the low-speed (stop-on-contact) torque increases, but overcurrent fault (E.OC[]) may occur or the machine may oscillate in stop-on-contact status.
- The stop-on-contact function is different from the servo-lock function, and if used to stop or hold a load for an extended period, this function can cause the motor to overheat. After a stop, immediately switch to a mechanical brake to hold the load.
- Under the following operating conditions, the stop-on-contact function is invalid:
 PU operation (Pr.79), JOG operation (JOG signal), PU + External operation (Pr.79), PID control function operation (Pr.128),
 Remote setting function operation (Pr.59), Automatic acceleration/deceleration operation (Pr.292), Start time tuning,
 Orientation control function operation
- When performing stop-on-contact control during encoder feedback control, encoder feedback control is invalid due to a transition to the stop-on-contact control mode.

◆ Function switching of stop-on-contact control selection

| Main functions | Normal operation (Either are 0 | | Stop-on-contact control (Both RL and RT are ON.) | | |
|---|--------------------------------|---------------------------------------|--|---|--|
| Main functions | Real sensorless vector control | Advanced magnetic flux vector control | Real sensorless vector control | Advanced magnetic flux vector control | |
| Output frequency | Multi-speed, 0 to 5 V, 0 to | 10 V, 4 to 20 mA, etc. | Pr.6 setting | | |
| Stall prevention operation level | _ | Pr.22 setting | _ | The smaller value set in either Pr.22 or Pr.48 *1 | |
| Torque limit level | Pr.22 setting | _ | Pr.22 setting | _ | |
| Excitation current low-speed scaling factor | _ | | The current is compensate setting from normal operat | , | |
| Carrier frequency | Pr.72 setting | | When output frequency is 3 Hz or lower, Pr.276 setting (Pr.72 when Pr.276 = "9999") | | |
| Fast-response current limit | _ | Enabled | _ | Disabled | |

^{*1} When RL and RT are ON, Pr.49 Second stall prevention operation frequency is invalid.

◆ Set frequency and validity of the stop-on-contact control (Pr.270 = "1, 3, 11, 13")

- The following table lists the frequencies set when the input terminals (RH, RM, RL, RT, JOG) are selected together.
- Stop-on-contact control is disabled when remote setting function is selected (Pr.59 = 1 to 3).

| Input signal | | | | | Set | Stop-on-contact |
|--------------|----|----|----|-----|-----------|-----------------|
| RH | RM | RL | RT | JOG | frequency | control |
| ON | | | | | Pr.4 | |
| | ON | | | | Pr.5 | |
| | | ON | | | Pr.6 | |
| | | | ON | | *1 | |
| | | | | ON | Pr.15 | |
| ON | ON | | | | Pr.26 | |
| ON | | ON | | | Pr.25 | |
| ON | | | ON | | Pr.4 | |
| ON | | | | ON | Pr.15 | |
| | ON | ON | | | Pr.24 | |
| | ON | | ON | | Pr.5 | |
| | ON | | | ON | Pr.15 | |
| | | ON | ON | | Pr.6 | Enabled |
| | | ON | | ON | Pr.15 | |
| | | | ON | ON | Pr.15 | |
| | | ON | ON | ON | Pr.15 | |

| | | • • • • • • | | 001 | Otop on contact | |
|----|----|-------------|----|-----|-----------------|---------|
| RH | RM | RL | RT | JOG | frequency | control |
| | ON | | ON | ON | Pr.15 | |
| | ON | ON | | ON | Pr.15 | |
| | ON | ON | ON | | Pr.6 | Enabled |
| ON | | | ON | ON | Pr.15 | |
| ON | | ON | | ON | Pr.15 | |
| ON | | ON | ON | | Pr.6 | Enabled |
| ON | ON | | | ON | Pr.15 | |
| ON | ON | | ON | | Pr.26 | |
| ON | ON | ON | | | Pr.27 | |
| | ON | ON | ON | ON | Pr.15 | |
| ON | | ON | ON | ON | Pr.15 | |
| ON | ON | | ON | ON | Pr.15 | |
| ON | ON | ON | | ON | Pr.15 | |
| ON | ON | ON | ON | | Pr.6 | Enabled |
| ON | ON | ON | ON | ON | Pr.15 | |
| | | | | | *1 | |
| | | | | | | |

Input signal

Stop-on-contact

^{*1} By 0 to 5 V (0 to 10 V), 4 to 20 mA input



• Changing the terminal assignment using **Pr.178 to Pr.189 (Input terminal function selection)** may affect the other functions. Set parameters after confirming the function of each terminal.

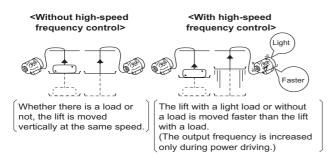
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Pr.4 to Pr.6, Pr.24 to Pr.27 (multi-speed setting) page 411
Pr.15 Jog frequency page 410
Pr.22 Stall prevention operation level, Pr.48 Second stall prevention operation level level page 431
Pr.22 Torque limit level page 245
Pr.59 Remote function selection page 377
Pr.72 PWM frequency selection page 356
Pr.79 Operation mode selection page 389
Pr.95 Online auto tuning selection page 558
Pr.128 PID action selection page 601
Pr.178 to Pr.189 (Input terminal function selection) page 521
Pr.270 Stop-on contact/load torque high-speed frequency control selection page 580
Pr.292 Automatic acceleration/deceleration page 384, page 387
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5.14.6 Load torque high-speed frequency control

Load torque high-speed frequency control is a function that automatically sets the maximum operable frequency according to the load.

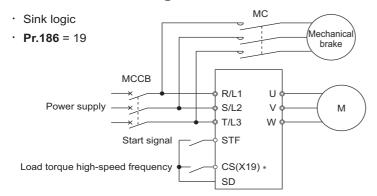
The load size during power driving is estimated by detecting average currents at set timings after a start. When the load is light, the frequency is increased from the originally-set frequency. (In regenerative driving, the frequency is not increased.)

This function is designed to increase speed automatically under light load, for example to minimize the incoming/outgoing time in a multi-story parking lot.



| Pr. | Name | Initial | value | Setting range | Descrip | tion | |
|-------------|--|---------|-------|---------------|---|----------|--|
| FI. | Name | FM | CA | Setting range | Descrip | uon | |
| 4 D301 | Multi-speed setting (high speed) | 60 Hz | 50 Hz | 0 to 590 Hz | Set the higher-speed frequency. | | |
| 5 D302 | Multi-speed setting (middle speed) | 30 Hz | | 0 to 590 Hz | Set the lower-speed frequency. | | |
| | | | | 0 | Normal | | |
| | | | | 1 | Stop-on-contact control (Refer to pa | ge 577.) | |
| | Stop-on contact/load | | | 2 | Load torque high-speed frequency of | control | |
| 270 A200 | torque high-speed frequency control | 0 | | 3 | Stop-on contact + load torque high speed frequency control (Refer to page 577.) | | |
| 7.200 | selection | | | 11 | Stop-on-contact control | | |
| | | | | 13 | Stop-on contact + load torque high speed frequency control (Refer to page 577.) | | |
| 271 A201 | High-speed setting maximum current | 50% | | 0 to 400% | Set the upper and lower limits of the current at high and middle speeds. | | |
| 272 A202 | Middle-speed setting minimum current | 100% | | 0 to 400% | | | |
| 273 | a dada | | | 0 to 590 Hz | Set the average current during acceleration from (Pr.273 × 1/2) H to (Pr.273) Hz. | | |
| A203 | | | | 9999 | Set the average current during acceleration from ($\mathbf{Pr.5} \times 1/2$) Hz to ($\mathbf{Pr.5}$) Hz. | | |
| 274 A204 | Current averaging filter time constant | 16 | | 1 to 4000 | Set the time constant of the primary delay filter relative to the output current. (The time constant [ms] is 0.5 × Pr.274 , and the initial value is 8 ms. A larger setting results in a stable operation with poorer response. | | |

◆ Connection diagram



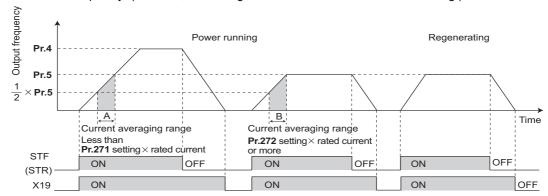
^{*1} The applied terminals differ by the settings of Pr.180 to Pr.189 (Input terminal function selection)

◆ Load torque high speed frequency control setting

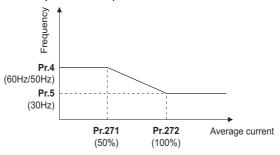
- Set "2, 3 or 13" in Pr.270 Stop-on contact/load torque high-speed frequency control selection.
- When the Load torque high-speed frequency (X19) signal ON, the inverter automatically adjusts the maximum frequency
 in the range between the Pr.4 Multi-speed setting (high speed) and Pr.5 in accordance with the average current in the
 current averaging range. The current averaging range is from the 1/2 the Pr.5 Multi-speed setting (middle speed) to the
 full Pr.5 setting (in the current averaging range).
- To use the X19 signal, set "19" in any of **Pr.178 to Pr.189 (Input terminal function selection)** to assign the function to an input terminal.
- This is valid in External operation mode and Network operation mode.
- · The control can be activated at every start.

Operation of load torque high speed frequency control

- When the average current of the current averaging range (chart A below) during operation with the X19 signal ON is the "inverter rated current **Pr.271** setting (%)" or less, the maximum frequency automatically becomes the **Pr.4 Multi-speed setting (high speed)** setting value.
- When the average current of the current averaging range (chart B below) during operation with the X19 signal ON is greater
 than the "inverter rated current × Pr.272 setting (%)", the maximum frequency automatically becomes the Pr.5 Multispeed setting (middle speed) setting value.
- · During regeneration load operation, the Pr.5 setting is the maximum frequency regardless of the average current.
- When **Pr.273** is used, the current averaging range can be set between one half of the frequency of the **Pr.273** setting value and the **Pr.273** set frequency. (However, the setting value must be smaller than **Pr.5** setting.)



• When the average current is larger than "inverter rated current × **Pr.271** setting (%)" and smaller than "inverter rated current × **Pr.272** setting (%)", linear compensation is performed as shown below.



Value in parenthesis is initial value.



- When the current averaging range includes the constant-output range, the output current may become large in the constant-output range.
- When the average current value in the current averaging range is small, deceleration time becomes longer as the output frequency increases.
- The automatic restart after instantaneous power failure function, fast-response current limit operation, fast-response current limit operation, shortest acceleration/deceleration, and optimum acceleration/deceleration are invalid.
- Changing the terminal assignment with **Pr.178 to Pr.189 (Input terminal function selection)** may affect other functions. Set parameters after confirming the function of each terminal.
- Under the following operating conditions, the load torque high-speed frequency function is invalid:
 PU operation (Pr.79), PU + External operation (Pr.79), JOG operation, PID control function operation (Pr.128), remote setting function operation (Pr.59), orientation control function operation, multi-speed setting (RH, RM, and RL signals), torque control, position control.
- When the average current during acceleration is too small, it may be judged as regeneration, and the maximum frequency may become the setting of **Pr.5**.
- The output frequency may change due to the load, so do not get unnecessarily close to the motor or machine.

Parameters referred to

Pr.4 to Pr.6, Pr.24 to Pr.27 (multi-speed setting) ☐ page 411
Pr.57 Restart coasting time ☐ page 628, page 635
Pr.59 Remote function selection ☐ page 377
Pr.79 Operation mode selection ☐ page 389
Pr.128 PID action selection ☐ page 601
Pr.178 to Pr.189 (Input terminal function selection) ☐ page 521

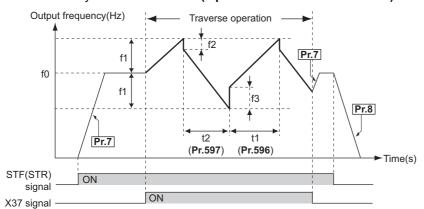
5.14.7 Traverse function

The traverse operation, which oscillates the frequency at a constant cycle, is available.

| Pr. | Name | Initial value | Setting range | Description |
|-------------|---|---------------|---------------|--|
| | | | 0 | Traverse function invalid |
| 592 A300 | Traverse function selection | 0 | 1 | Traverse function valid only in External operation mode |
| ASSO | selection | | 2 | Traverse function valid regardless of the operation mode |
| 593 A301 | Maximum amplitude amount | 10% | 0 to 25% | Level of amplitude during traverse operation |
| 594 A302 | Amplitude compensation amount during deceleration | 10% | 0 to 50% | Compensation amount during amplitude inversion (from acceleration to deceleration) |
| 595 A303 | Amplitude compensation amount during acceleration | 10% | 0 to 50% | Compensation amount during amplitude inversion (from deceleration to acceleration) |
| 596 A304 | Amplitude acceleration time | 5 s | 0.1 to 3600 s | Time period of acceleration during traverse operation |
| 597 A305 | Amplitude deceleration time | 5 s | 0.1 to 3600 s | Time period of deceleration during traverse operation |

• Setting Pr.592 Traverse function selection = "1 or 2" enables the traverse function.

• Assigning the Traverse function selection (X37) signal to the input terminal enables the traverse function only when the X37 signal is ON. (When the X37 signal is not assigned, the traverse function is always available.) To input the X37 signal, set "37" in any of **Pr.178 to Pr.189 (Input terminal function selection)** to assign the function to a terminal.



- f0: set frequency
- f1: amplitude amount from the set frequency (f0 × **Pr.593**/100)
- f2: compensation amount at transition from acceleration to deceleration (f1 × **Pr.594**/100)
- f3: compensation amount at transition from deceleration to acceleration (f1 × **Pr.595**/100)
- t1: time from acceleration during traverse operation (Time from (f0 f1) to (f0 + f1)) (**Pr.596**)
- t2: time from deceleration during traverse operation (Time from (f0 + f1) to (f0 f1)) (Pr.597)
- The motor accelerates to the set frequency f0 according to the normal **Pr.7 Acceleration time** at turn ON of the start command (STF or STR).
- When the output frequency reaches f0 and the X37 signal turns ON, the inverter begins traverse operation and accelerates to f0 + f1. The acceleration time at this time is according to the **Pr.596** setting. (If the X37 signal turns ON before the output frequency reaches f0, traverse operation begins after the output frequency reaches f0.)
- After the inverter accelerates the motor to f0 + f1, this is compensated with f2 (f1 × **Pr.594**), and the motor decelerates to f0 f1. The deceleration time at this time is according to the **Pr.597** setting.
- After the inverter decelerates the motor to f0 f1, this is compensated with f3 (f1 × **Pr.595**), and the motor accelerates again to f0 + f1.
- When the X37 signal turns OFF during traverse operation, the inverter accelerates/decelerates the motor to f0 according to the normal acceleration/deceleration time (**Pr.7**, **Pr.8**). If the start command (STF or STR) is turned OFF during traverse operation, the inverter decelerates the motor to a stop according to the normal deceleration time (**Pr.8**).

NOTE

- If the set frequency (f0) and traverse operation parameters (**Pr.593 to Pr.597**) are changed during traverse operation, this is applied in operations after the output frequency reaches f0 before the change was made.
- If the output frequency exceeds **Pr.1 Maximum frequency** or **Pr.2 Minimum frequency** during traverse operation, the output frequency is clamped at the maximum/minimum frequency when the set pattern exceeds the maximum/minimum frequency.
- When the traverse function and S-pattern acceleration/deceleration (**Pr.29** ≠ "0") are selected, S-pattern acceleration/deceleration deceleration operation occurs only in the range operated at the normal acceleration/deceleration time (**Pr.7**, **Pr.8**). Acceleration/deceleration during traverse operation is performed linearly.
- If stall prevention activates during traverse operation, traverse operation stops and normal operation begins. When stall prevention operation is completed, the inverter accelerates/decelerates to f0 at the normal acceleration/deceleration time (Pr.7, Pr.8). After the output frequency reaches f0, the traverse operation begins again.
- If the value of the amplitude inversion compensation amount (**Pr.594**, **Pr.595**) is too large, an overvoltage trip or stall prevention occurs, and pattern operation cannot be performed as set.
- Changing the terminal assignment using **Pr.178 to Pr.189 (Input terminal function selection)** may affect the other functions. Set parameters after confirming the function of each terminal.

Parameters referred to

Pr.3 Base frequency page 707

Pr.178 to Pr.189 (Input terminal function selection) page 521 Pr.190 to Pr.196 (Output terminal function selection) page 473

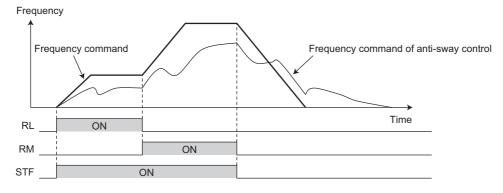
5.14.8 Anti-sway control

When an object is moved by a gantry crane, swinging is suppressed on the crane's traveling axis.

| Pr. | Name | Initial value | Setting range | Description |
|--------------|--|------------------|------------------|---|
| 1072 A310 | DC brake judgment time for anti-sway control operation | 3 s | 0 to 10 s | Set the time from when the output frequency becomes the Pr.10 DC injection brake operation frequency or less to when the DC injection brake (zero speed control or the servo lock) operation starts. |
| 1073 A311 | Anti-sway control operation selection | 0 | 0 | Anti-sway control disabled Anti-sway control enabled |
| 1074 | Anti avvov control | | 0.05 to 3 Hz | Set a swinging frequency of the object. |
| A312 | 1 11 | | 9999 | Anti-sway control is performed using a swinging frequency estimated by the inverter according to the settings of Pr.1077 to Pr.1079 . |
| 1075 A313 | Anti-sway control depth | 0 | 0 to 3 | 0 (Deep) → 3 (Shallow) |
| 1076 A314 | Anti-sway control width | 0 | 0 to 3 | 0 (Narrow) → 3 (Wide) |
| 1077 A315 | Rope length | 1 m | 0.1 to 50 m | Set the rope length of the crane. |
| 1078 A316 | Trolley weight | 1 kg | 1 to 50000 kg | Set the weight of the trolley. |
| 1079 A317 | Load weight | 1 kg | 1 to 50000 kg | Set the weight of the object. |

Anti-sway control operation (Pr.1073)

- · Setting Pr.1073 Anti-sway control operation selection = "1" enables anti-sway control. (Anti-sway control is not available under zero speed or servo lock control.)
- · During operation under anti-sway control, the travel distance becomes longer. Input a stop command earlier to avoid a collision with an obstacle.
- · A deceleration to stop without anti-sway control is applied for stopping as a result of PU stop, an emergency stop command input from a communication option, Pr.875 Fault definition, or an emergency stop input (X92 signal).



- · Under torque control or position control, the anti-sway control is disabled.
- · During operation of the power failure time deceleration-to-stop function, or when the automatic restart after instantaneous power failure is enabled (Pr.57 ≠ "9999"), the anti-sway control is disabled.

Swinging frequency setting (Pr.1074 to Pr.1079)

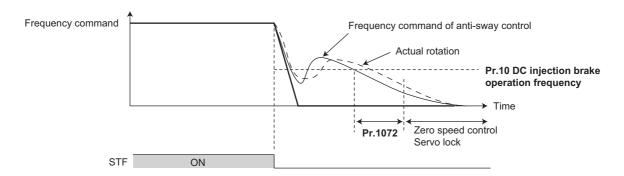
- · Set a swinging frequency in Pr.1074 Anti-sway control frequency. The swinging frequency is used as a notch filter frequency. Lower the response level of speed control in the frequency band with the width set in the Pr.1076 Anti-sway control width by the gain set in the Pr.1075 Anti-sway control depth.
- · A deeper notch depth has a greater effect in reducing mechanical resonance, but because the phase delay is larger, swinging may increase. Adjust by starting from the shallowest value.

| Setting | 3 | 2 | 1 | 0 |
|--------------|-----------------|-------|--------|-----------|
| Gain (depth) | -4 dB (shallow) | -8 dB | -14 dB | -∞ (deep) |

- · If the Pr.1076 setting is too large (the width is too wide), the response level of speed control drops, and the system may become unstable.
- After setting Pr.1074 = "9999", set the crane rope length in the Pr.1077 Rope length, the trolley weight in the Pr.1078 Trolley weight, and the weight of an object in the Pr.1079 Load weight. Then, anti-sway control is performed using a swinging frequency estimated by the inverter.

◆ Delay time for brake operation of anti-sway control (Pr.1072)

Set the time from when the output frequency becomes the Pr.10 DC injection brake operation frequency or less to when the zero speed control or the servo lock operation starts in the Pr.1072 DC brake judgment time for anti-sway control operation.





- · During anti-sway control operation, even if the motor rotation is restricted to one direction in the Pr.78 Reverse rotation prevention selection, the motor may rotate in a direction opposite to the setting.
- · A protective function (E.OSD) may be activated during vibration control. When using anti-sway control, set Pr.690 Deceleration check time = "9999 (initial value)" to disable the deceleration check function.
- · When anti-sway control is enabled, regeneration avoidance, shortest acceleration/deceleration, and the traverse function are disabled.
- · Do not set anti-sway control and droop control together.

Parameters referred to

Pr.10 DC injection brake operation frequency page 715 Pr.78 Reverse rotation prevention selection page 406 Pr.286 Droop gain page 738 Pr.292 Automatic acceleration/deceleration page 384 Pr.592 Traverse function selection page 582 Pr.690 Deceleration check time page 269
Pr.875 Fault definition page 422
Pr.882 Regeneration avoidance operation selection page 732

Orientation control 5.14.9

V/F Magnetic flux Vector

The inverter can adjust the stop position (Orientation control) using a position detector (encoder) attached to a place such as the main shaft of the machine.

A Vector control compatible option is required.

Because Pr.350 Stop position command selection is initially set to "9999", the orientation control function is invalid.

| Pr. | Name | Initial value | Setting range | Description | | | | |
|---------------------------|---------------------------------|------------------|---------------|--|--|--|--|--|
| 350 | Otan maaiki an | | 0 | Internal stop position command (Pr.356) | | | | |
| A510 ^{*1} | Stop position command selection | 9999 | 1 | External stop position command (FR-A8AX 16-bit data) | | | | |
| A510 | 99 | | 9999 | Orientation control disabled | | | | |
| 351 A526 ^{*1} | Orientation speed | 2 Hz | 0 to 30 Hz | Turning ON the X22 signal decelerates the motor speed to the set value. | | | | |
| 352 A527 ^{*1} | Creep speed | 0.5 Hz | 0 to 10 Hz | After the speed reaches the orientation speed, the speed decreases to the creep speed set in Pr.352 as soon as the current position pulse reaches the | | | | |
| 353 A528 ^{*1} | Creep switchover position | 511 | 0 to 16383 | creep switchover position set in Pr.353 . | | | | |

| Р | r. | Name | Initial value | Setting range | Description | | | | | | | | | |
|--------------------------|----------------------------------|-------------------------------------|---|---|--|--|--|--|--|--|--|--|--|--|
| 354 A529 [*] | 1 | Position loop switchover position | 96 | 0 to 8191 | | As soon as the current position pulses reach the set position loop switchover position, control is changed to the position loop. | | | | | | | | |
| 355 A530 [*] | 1 | DC injection brake start position | 5 | 0 to 255 | After the motor moves into the position loop, the motor stops by the DC injection brake when the current position pulses reach the specified start position of the DC injection brake. | | | | | | | | | |
| 356 A531 [*] | 1 | Internal stop position command | 0 | 0 to 16383 | When "0" is set in Pr.350 , the internal position command is activated and the setting value of Pr.356 becomes the stop position. | | | | | | | | | |
| 357 A532 [*] | 1 | Orientation in- position zone | 5 | 0 to 255 | Set the in-position width at a stop of the | ne orientation. | | | | | | | | |
| 358 A533 [*] | 1 | Servo torque selection | 1 | 0 to 13 | Operation at orientation completion ca | n be selected. | | | | | | | | |
| | | | | 0 | Set when using a motor for which forward rotation (encoder) is clockwise (CW) viewed from the shaft | Set for the operation at 120 Hz or less. | | | | | | | | |
| 359 | 852 | Fin and an instable in | | 100 | cw | Set for the operation at a frequency higher than 120 Hz. | | | | | | | | |
| C141 *2 | C241 *3 | Encoder rotation direction | 1 | 1 | Set when using a motor for which forward rotation (encoder) is counterclockwise (CCW) viewed from the shaft. | Set for the operation at 120 Hz or less. | | | | | | | | |
| | | | | 101 | ccw | Set for the operation at a frequency higher than 120 Hz. | | | | | | | | |
| | | | | 0 | Speed command | When Pr.350 = "1" is set and the FR- | | | | | | | | |
| 360 | | 16-bit data selection | 0 | 1 | 16-bit data is used as the external position command as is. | A8AX is installed together, set the stop position using 16-bit data. The stop position command is input | | | | | | | | |
| A511 [*] | 11 ' | | 2 to 127 | Set the stop position by dividing up to 128 stop positions. The stop position command as binary regardless of the I setting. | | | | | | | | | | |
| 361 A512 [*] | 1 | Position shift | 0 | 0 to 16383 | Shift the home position using a compensation value without changing home position of the encoder. The stop position is a position obtained adding the setting of Pr.361 to the position command. | | | | | | | | | |
| 362 A520 [*] | 1 | Orientation position loop gain | 1 | 0.1 to 100 | When the servo torque function is selected using Pr.358 , the output frequency for generating servo torque gradually increases to the Pr.352 according to the slope set in Pr.362 . Although the operation becomes fas when the value is increased, hunting may occur in the machine. | | | | | | | | | |
| 363 A521 [*] | 1 | Completion signal output delay time | 0.5 s | 0 to 5 s | The Orientation complete (ORA) signal turns ON after going into the in- position width and waiting for the set time. Also, the signal turns OFF after going out of the in-position width and waiting for the set time. | | | | | | | | | |
| 364 A522 [*] | 1 | Encoder stop check time | 0.5 s | 0 to 5 s | If the Orientation complete (ORA) signal has never been output and the encoder stays stopped for the set time without completing orientation, th Orientation fault (ORM) signal is output. If the ORA signal has been output before but the orientation cannot be completed within the set time, the OR signal is also output. | | | | | | | | | |
| 365 A523 [*] | Orientation limit 9999 0 to 60 s | | The time elapses after passing the creep switchover position is measured. If orientation cannot be completed within the set time, the Orientation fault (ORM) signal is output. | | | | | | | | | | | |
| | | | | 9999 | Set to 120 s. | | | | | | | | | |
| 366 A524 [*] | 1 | Recheck time | 9999 | 0 to 5 s | When the start signal is turned OFF wit after stopping the motor by orientation checked again after the set time elaps (ORA) signal or Orientation fault (ORA) | control, the present position is es, and the Orientation complete | | | | | | | | |
| | | | | 9999 | Not checked. | | | | | | | | | |
| 369 C140 *4 | 851 C240 *3 | Number of encoder pulses | 1024 | 0 to 4096 | Set the number of encoder pulses. Set the number of pulses before it is n | nultiplied by 4. | | | | | | | | |

| Pr. | Name | Initial value | Setting range | Description | | | | | | |
|---------------------------|--------------------------------------|------------------|---------------|---|-----------------------------------|--|--|--|--|--|
| | | | 0 | Orientation is executed from the current rotation direction. | | | | | | |
| | | | 1 | Orientation from the forward rotation direction | Motor end orientation | | | | | |
| 393 | Orientation selection | 0 | 2 | Orientation from the reverse rotation direction | | | | | | |
| A525 ^{*1} | Onemation selection | | 10 | Orientation from the current rotation direction | | | | | | |
| | | | 11 | Orientation from the forward rotation direction Machine end orientation*6 | | | | | | |
| | | | 12 | Orientation from the reverse rotation direction | | | | | | |
| 394 A540 ^{*5} | Number of machine side gear teeth | - 1 | 0 to 32767 | Sat the encoder orientation goar ratio | | | | | | |
| 395 A841 ^{*5} | Number of motor side gear teeth | ' | 0 10 32707 | Set the encoder orientation gear ratio. | | | | | | |
| 396 A542 ^{*1} | Orientation speed gain (P term) | 60 | 0 to 1000 | Response level during position control loop (servo rigidity) can be adjusted | | | | | | |
| 397 A543 ^{*1} | Orientation speed integral time | 0.333 | 0 to 20 s | at orientation stop. | | | | | | |
| 398 A544 ^{*1} | Orientation speed gain (D term) | 1 | 0 to 100 | Lag/advance compensation gain can l | pe adjusted. | | | | | |
| 399 A545 ^{*1} | Orientation deceleration ratio | 20 | 0 to 1000 | Make adjustment when the motor runs orientation time is long. | s back at orientation stop or the | | | | | |
| 829 A546 ^{*7} | Number of machine end encoder pulses | 9999 | 0 to 4096 | Set the number of pulses output from the encoder connected to the end of the machine. Set the number of pulses before it is multiplied by 4. | | | | | | |
| | | | 9999 | Machine end orientation invalid. | | | | | | |
| | | | 0 | First motor: plug-in option that supports the Vector control Second motor: control terminal option | Machine end orientation invalid | | | | | |
| | | | | that supports the Vector control*8 | | | | | | |
| 862 C242 ^{*1} | Encoder option selection | 0 | | First motor: control terminal option that supports the Vector control Second motor: plug-in option that (when Pr.393 = "0, 1, or 2") | | | | | | |
| | | | 1 | supports the Vector control*8 | | | | | | |
| | | | 1 | Motor end: control terminal option that supports the Vector control Machine end: plug-in option that supports the Vector control Machine end orientation valid (v | | | | | | |

^{*1} The setting is available when a Vector control compatible option is installed.

^{*2} These parameters are available when a plug-in option (FR-A8AP/FR-A8APR/FR-A8APS) is installed.

^{*3} These parameters are available when the option (FR-A8TP) is installed.

 $^{^{*}4}$ The setting is available when the FR-A8AP/FR-A8AL is installed.

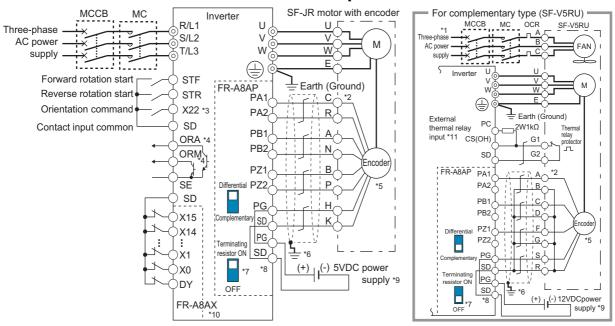
The setting is available when the FR-A8AP/FR-A8AL/FR-A8APR/FR-A8TP is installed.

^{*6} To perform machine end orientation, the plug-in option (FR-A8AP/FR-A8APR/FR-A8APS) and control terminal option (FR-A8TP) are required.

 $^{^{*}7}$ The setting is available when the FR-A8AL is installed.

^{*8} When the second motor is selected, the orientation control is disabled.

♦ Motor end orientation connection example



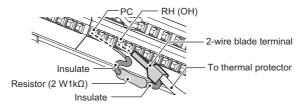
- *1 Single-phase power supply (200 V/50 Hz, 200 to 230 V/60 Hz) is used for the fan for a 7.5 kW or lower dedicated motor.
- *2 The pin number differs according to the encoder used.
- *3 Use Pr.178 to Pr.189 (Input terminal function selection) to assign the function to a terminal. (Refer to page 521.)
- *4 Use Pr.190 to Pr.196 (Output terminal function selection) to assign the function to a terminal. (Refer to page 473.)
- *5 Connect the encoder so that there is no looseness between the motor and motor shaft. Speed ratio must be 1:1.
- *6 Connect the shield of the encoder cable to the enclosure using a tool such as a P-clip. (Refer to page 93.)
- *7 For the differential line driver, set the terminating resistor selection switch to the ON position (initial status) to use. (Refer to page 88.)

 Note that the terminating resistor switch should be set to the OFF position when sharing the same encoder with another unit (NC, etc.) or when the terminating resistor is connected to another unit. For the complementary, set the switch to the OFF position.
- *8 For terminal compatibility of the FR-JCBL, the FR-V5CBL, and the FR-A8AP, refer to page 88.
- *9 A separate external power supply is necessary according to the encoder power specification. Make the voltage of the external power supply the same as the encoder output voltage, and connect the external power supply between terminals PG and SD. When performing encoder feedback control and Vector control together, an encoder and power supply can be shared.
- *10 When a stop position command is input from outside, a plug-in option FR-A8AX is required. Refer to page 589 for the external stop position command.
- *11 Connect the recommended 2W1kΩ resistor between terminals PC and OH. (Recommended product: MOS2C102J 2W1kΩ by KOA Corporation) Insert the input line and the resistor to a 2-wire blade terminal, and connect the blade terminal to terminal OH. (For the recommended 2-wire blade terminals, refer to page 74.)

Insulate the lead wire of the resistor, for example by applying a contraction tube, and shape the wires so that the resistor and its lead wire do not touch other cables. Caulk the lead wire securely together with the thermal protector input line using a 2-wire blade terminal. (Do not subject the lead wire's bottom area to an excessive pressure.)

To use a terminal as terminal OH, assign the External thermal relay input (OH) signal to an input terminal. (Set "7" in any of **Pr.178 to Pr.189**.)

When OH signal is assigned to terminal RH (**Pr.182** = "7")



Setting

• When the Orientation command (X22) signal is turned ON during operation after the parameters are set, the motor is decelerated to the orientation switchover speed. Then, the inverter calculates the orientation stop distance, further decelerates the motor and the motor enters the orientation state (servo lock). The Orientation complete (ORA) signal is output when the motor is within the orientation complete width.

◆ Setting I/O signals

| Signal | Signal name | Description |
|--------|----------------------|--|
| X22 | Orientation | Turn ON the X22 signal to start the orientation operation. |
| 7,22 | command | For the X22 signal input, set "22" in any of Pr.178 to Pr.189 to assign the function. |
| ORA | Orientation complete | The output is in LOW state when the orientation stop can be made within the orientation complete width while the start signal and X22 signal are input (ON). For the ORA signal output, set "27 (positive logic)" or "127 (negative logic)" in Pr.190 to Pr.196 . |
| ORM | Orientation fault | The output is in LOW state when the orientation stop cannot be made within the orientation complete width while the start signal and X22 signal are input (ON). For the ORM signal output, set "28 (positive logic)" or "128 (negative logic)" in Pr.190 to Pr.196 . |

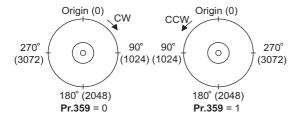
Selecting stop position command (Pr.350 Stop position command selection)

• Select either to use the internal stop position command (**Pr.356 Internal stop position command**) or the external stop position command (16-bit data using the FR-A8AX).

| Pr.350 setting | Stop position command source |
|----------------------|--|
| 0 | Internal stop position command (Pr.356 : 0 to 16383) |
| 1 | External stop position command (FR-A8AX) 16-bit data |
| 9999 (initial value) | Orientation control disabled |

- When the internal stop position command (Pr.350 = "0") is selected, the Pr.356 setting is used as the stop position.
- When the number of encoder pulses is 1024 pulses/r, one revolution (360°) of the encoder is divided by 4096 pulses (quadruplicated) so that the degree per pulse can be calculated as 360° / 4096 pulses = 0.0879°/pulse.

Refer to the following figure. Stop position (address) is shown within parentheses.



- When the external stop position command (**Pr.350** = "1") is selected while the FR-A8AX option is installed, 16-bit data (binary input) is used to give the stop position.
- The value set in Pr.360 16-bit data selection should be the divided value minus 1.

| Pr.360 setting | Description | | | | | | |
|----------------|--|--|--|--|--|--|--|
| 0 | External position command is invalid (speed command or torque command via the FR-A8AX) | | | | | | |
| 1 | Position command direct input. The 16-bit digital signal via the FR-A8AX is the direct stop position command. <example> When the Pr.369 Number of encoder pulses setting is "1024", the stop position command "0 to 4095" can be input using the FR-A8AX, and the digital signal of "2048 (H800)" is input to stop the motor at a 180° position. A command greater than 4096 is considered as 4095.</example> | | | | | | |
| 2 to 127 | Set the stop position command by dividing up to 128 stop positions. If the external stop command input is greater than the setting, the stop positions are the same as those in the maximum external stop command value. <example> When the number of stop positions is 90 (divided at intervals of 4°), 90 - 1 = 89. Hence, set "89".</example> | | | | | | |

| [Example 1] When Pr.369 = "1024" | [Example 2] With 8 stop positions | [Example 3] With 120 stop positions |
|---|--|---|
| Pr.360 = "1" | Pr.360 = "7" | Pr.360 = "119" |
| Origin (0) CW 90° (3072(HC00)) 180° (2048(H800)) | (7 or more) Origin(0) (1) 315° 45° CW (6)270° (2) (5)225° 180° (3) (4) | Origin (0) 270° At intervals (90) of 3° (30) 180° (60) |



- Values in parentheses indicate binary data input from the terminals. Even if the position pulse monitor (Pr.52 Operation panel main monitor selection = "19") is selected, the data monitored is not the number of stop positions. It is the number of pulses from 0 to 65535.
- FR-A8AX parameters (Pr.300 to Pr.305) are invalid. (Valid when Pr.360 = "0")
- · Terminal DY (data read timing input signal) becomes invalid during Vector control. (The position data is downloaded at the start of orientation.)
- Internal stop position command is given when no option is installed or Pr.360 = "0" even if "1" (external stop position command) is set in Pr.350.
- · Relationship between stop position command and 16-bit data

| Pr.350 Stop position | | Operation | | | | | | | |
|----------------------|-------------------------------|--|---------------------------|--------------------------|--|--|--|--|--|
| command selection | Pr.360 16-bit data selection | Stop position command | 16-bit data (FR- A8AX) | Speed command | | | | | |
| | 0: speed command | Internal (Pr.356) | Speed command | 16-bit data | | | | | |
| 0: internal | 1, 2 to 127: position command | Internal (Pr.356) | Disabled | External command (or PU) | | | | | |
| | 0: speed command | Internal (Pr.356) | Speed command | 16-bit data | | | | | |
| 1: EXT | 1, 2 to 127: position command | External (Internal when the FR-A8AX is not installed (Pr.356)) | Position command | External command (or PU) | | | | | |

Pr.361 Position shift (initial value "0")

- The stop position is a position obtained by adding the setting of Pr.361 to the position command.
- Position shift function Shift the home position using a compensation value without changing the home position of the position detector (encoder).



When orientation control is valid using Pr.350 Stop position command selection with the Vector control compatible option installed, the rotation direction of the encoder is displayed on the rotation direction display of the PU (operation panel/ parameter unit).

Make settings so that "FWD" is displayed at turn ON of the STF signal and "REV" is displayed at turn ON of the STR signal.

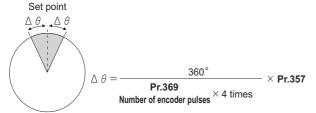
Monitor display change

| Monitor | Remarks |
|------------------------|---|
| Position pulse monitor | When "19" is set in Pr.52 Operation panel main monitor selection , the position pulse monitor is displayed instead of the output voltage monitor of the PU. (Displayed only when the Vector control compatible option is mounted.) |
| Orientation status*1 | When "22" is set in Pr.52 , the orientation status is displayed instead of the output voltage monitor of the PU. (Displayed only when the Vector control compatible option is mounted.) 0: Other than orientation operation or orientation speed is not reached 1: Orientation speed is reached 2: Creep speed is reached 3: Position loop is reached 4: Orientation complete 5: Orientation fault (pulse stop) 6: Orientation fault (orientation limit) 7: Orientation fault (recheck) 8: Continuous multi-point orientation |

^{*1} Invalid during Vector control. ("0" is always displayed.)

Pr.357 Orientation in-position zone (initial value "5")

· The in-position width for orientation stop can be set. The initial value of **Pr.357** is "5". To change the $\Delta\theta$ value, make fine adjustments by changing in increments of \pm 10. • If the position detection value from the encoder enters $\pm\Delta\theta$ during orientation stop, the Orientation complete (ORA) signal is output.



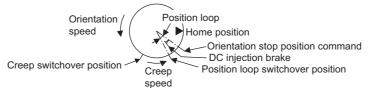
Orientation at the running status (under V/F control, Advanced magnetic flux vector control)

- 1. When the orientation command (X22) turns on, the motor speed decreases to the Pr.351 Orientation speed. (Pr.351 is initially set to: 2 Hz)
- 2. After the speed reaches the orientation speed, the speed further decreases to the Pr.352 Creep speed as soon as the current position pulse reaches the Pr.353 Creep switchover position.

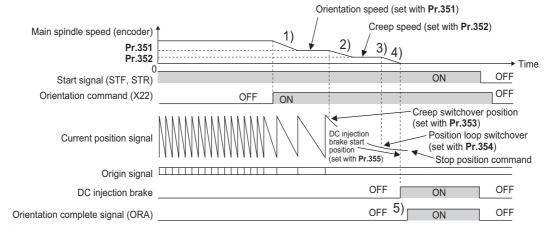
 (Pr.352 is initially set to 0.5 Hz, Pr.353 is initially set to "511".)
- **3.** Moreover, as soon as the current position pulse reaches the **Pr.354 Position loop switchover position**, control is changed to the position loop. (**Pr.354** is initially set to "96".)
- **4.** After the motor moves into the position loop, the motor decelerates and stops by the DC injection brake as soon as the current position pulse reaches the **Pr.355 DC injection brake start position**. (**Pr.355** is initially set to "5".)
- When the motor stops in **Pr.357 Orientation in-position zone**, the orientation complete (ORA) signal is output after **Pr.363 Completion signal output delay time**. If the motor does not stop within the in-position width because of external force, etc., the ORA signal turns OFF after the time set in **Pr.363**. (**Pr.357** is initially set to "5", **Pr.363** is initially set to 0.5 s.)
- **6.** If the orientation is not completed continuously in **Pr.365 Orientation limit** after passing the creep switchover position, the orientation fault signal (ORM) is output.
- **7.** After the orientation starts, if the motor is stopped by external force, etc. before reaching the in-position width and the ORA signal is not output, the ORM signal is output after the **Pr.364 Encoder stop check time**. If the motor is moved out of the in-position width by external force, etc. after the ORA signal has been output once, the ORA signal turns OFF after the set time in **Pr.363**. If the orientation is not completed within the time set in **Pr.364**, the ORM signal is output.
- **8.** If the ORA and ORM signals have been output once, but the start signal (STF or STR) is turned OFF while the X22 signal is ON, the ORA or ORM signal is output again after **Pr.366 Recheck time**.
- **9.** The ORA and ORM signals cannot be output while the X22 signal is OFF.



· When the orientation command turns OFF while the start signal is ON, the speed accelerates to the command speed.

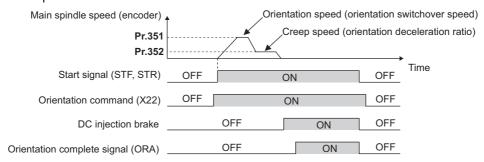


• If hunting of the motor shaft occurs during orientation stop, set a larger value in Pr.354 or a smaller value in Pr.352 to prevent it.



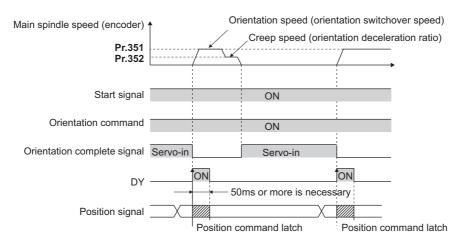
Orientation from the stop status (under V/F control, Advanced magnetic flux vector control)

- Turning ON the start signal after turning ON the Orientation command (X22) signal increases the motor speed to the Pr.351
 Orientation speed, and then the same orientation operation is performed as the operation shown in "Orientation at the running status".
- Note that the DC injection brake operates without increasing to the orientation speed if the position signal is within the DC injection brake start position.



Continuous multi-point orientation (V/F control, Advanced magnetic flux vector control)

· Orientation during orientation operation or start signal is ON



- The position data is read at the rising edge of DY. (For the details, refer to the Instruction Manual of FR-A8AX).
- When the position signal is within the creep switchover position, the speed starts up to the creep speed not to the orientation speed.
- · When the position signal is outside the creep switchover position, the speed starts up to the orientation speed.
- · The DC injection brake operates if the position signal is within the DC injection brake start position.
- 16-bit data with the FR-A8AX is valid only when the DY signal is ON.

NOTE

- Couple the encoder with the motor shaft or with the shaft that stops the main shaft at the specified position. Couple it with the speed ratio of 1:1 and without any mechanical looseness.
- The DC injection brake operates at orientation stop. Release the DC injection brake as soon as possible (within several seconds), as continuous operation of the DC injection brake will cause the motor to overheat, leading to burnout.
- Because the servo lock function is not available after orientation stop, provide a holding mechanism, such as a mechanical brake or knock pin, when secure holding of the main shaft is required.
- To ensure correct positioning, the encoder must be set in the proper rotation direction, and the A and B phases must be connected correctly.
- If the pulse signal from the encoder stops due to encoder signal loss, etc. during orientation, the Orientation fault (ORM) signal may be output.
- When performing orientation control, enable the DC injection brake (refer to page 715). When the DC injection brake is disabled, orientation operation cannot be completed.
- When orientation control is performed, the DC injection brake operates regardless of the External DC injection brake operation start (X13) signal even when **Pr.11 DC injection brake operation time** = "8888" (DC injection brake external selection).
- To terminate orientation, the start signal (STF or STR) must be first switched OFF, and then the Orientation command (X22) signal must be switched OFF. As soon as this X22 signal is switched OFF, orientation control ends. (Depending on the Pr.358 Servo torque selection setting, the orientation status continues if the X22 signal remains ON even if the DC injection brake is released by turning OFF the start signal. Because of this, the orientation status on the monitor does not show "0".)
- When the retry function of Pr.358 Servo torque selection is selected, the retry operation is performed three times including
 the first orientation.
- When performing orientation control, properly set Pr.350 Stop position command selection and Pr.360 16-bit data selection (external position command selection). If the values set are incorrect, proper orientation control will not be performed.
- When orientation control is performed, PID control is disabled.

◆ Servo torque selection (Pr.358) (V/F control, Advanced magnetic flux vector control)

| Function and description | | | | Op | erati | on f | or ea | ch P | r.35 | 8 set | ting | | | | Remarks |
|--|---|---|---|----|-------|------|-------|------|------|-------|------|----|----|----|--|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | Remarks |
| a. Servo torque function until output of the Orientation complete (ORA) signal | × | 0 | 0 | 0 | 0 | × | 0 | × | 0 | × | 0 | × | × | 0 | o: With servo torque function. ×: Without servo torque function. |
| b. Retry function | × | × | × | × | × | × | × | 0 | × | × | × | 0 | × | × | : With retry function.: Without retry function. |
| c. Output frequency compensation when the motor stops outside the in-position zone | × | × | 0 | 0 | × | 0 | 0 | × | × | × | × | × | 0 | 0 | o: With frequency compensation. x: Without frequency compensation. |
| d. DC injection brake and servo torque when the motor exits the in-position zone after output of the Orientation complete (ORA) signal | 0 | × | × | × | × | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | o: DC injection brake enabled. x: Servo torque enabled. |
| e. Turning OFF the Orientation complete (ORA) signal when the orientation operation is ended. | 0 | 0 | 0 | × | × | 0 | 0 | 0 | 0 | × | × | × | × | × | : When the start signal (STF, STR) or orientation command is turned OFF. : When the orientation command is turned OFF. |
| f. Complete signal when the motor exits the in-position zone after output of the Orientation complete (ORA) signal | 0 | 0 | 0 | 0 | 0 | × | × | × | × | × | × | × | × | × | o: Turns OFF the complete signal when the motor exits the in-position zone. x: Complete signal remains ON even if the motor exits the in-position zone (the Orientation fault (ORM) signal is not output). |



- · When the orientation command turns OFF while the start signal is ON, the motor accelerates to the command speed.
- When the motor shaft stops outside of the set setting range of the stop position, the motor shaft is returned to the stop position by the servo torque function (if enough torque is generated).
- a. Servo torque function until output of the Orientation complete signal Select whether or not servo torque is available using **Pr.358 Servo torque selection**. Servo torque is not generated if the current position pulse is in between the orientation stop position and DC injection brake start position. The shaft is fixed using the DC injection brake, and when the motor exits the width by external force, etc., the servo torque is generated to move the motor back within the width. Once the Orientation complete (ORA) signal is output, the operation is performed as described in d.
- b. Retry function Select retry function using Pr.358. Note that the retry function cannot be used together with the servo torque function. If the motor shaft does not stop within the in-position zone when the motor stop is checked, orientation operation is performed again by the retry function. This retry function is performed three times including the first orientation. The maximum retry number is three. (The Orientation fault (ORM) signal is not output during retry operation.)
- c. Frequency compensation when the motor stops outside the orientation complete width When the motor stops before entering the in-position width due to external force, etc., the output frequency is increased to move the shaft to the orientation stop position. The output frequency is gradually increased to the **Pr.352 Creep speed**. This function cannot be used with the retry function.
- d. DC injection brake and servo torque selection when the position pulse exits the in-position zone after output of the ORA signal
 If the motor exits the in-position width, select the setting either to fix the shaft with the DC injection brake or by returning

the motor to the orientation stop position with the servo torque.

- e. Turning OFF the Orientation complete (ORA) signal when the orientation operation is ended.

 When ending the orientation operation, first turn OFF the start (STF or STR) signal, and then turn OFF the Orientation command X22 signal. At this time, select when to turn OFF the ORA signal from either the time the start signal is turned OFF or the time the orientation command signal is turned OFF.
- f. Complete signal when the motor exits the in-position zone after output of the Orientation complete (ORA) signal Select to turn OFF the ORA signal or to keep the ORA signal ON (the ORM signal is not output) when the motor exits the in-position width.

◆ Position loop gain (Pr.362) (V/F control, Advanced magnetic flux vector control)

- When the servo torque function is selected using **Pr.358 Servo torque selection**, the output frequency for generating servo torque gradually increases to the **Pr.352 Creep speed** according to the slope set in **Pr.362 Orientation position loop gain**.
- · Although the operation becomes faster when the value is increased, hunting may occur in the machine.

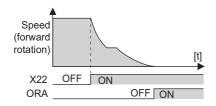
◆ Description of orientation operation (Vector control)

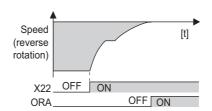
· Setting the rotation direction (Pr.393 Orientation selection)

| Pr.393 setting | Rotation direction | Remarks | | |
|-------------------|------------------------------|--|-------------------------|--|
| 0 (initial value) | Pre-orientation | Orientation is executed to the current rotation direction. | | |
| 1 | Forward rotation orientation | Orientation is executed to the forward rotation direction. (If the motor is running in reverse, orientation is executed to the forward rotation direction after deceleration.) | Motor end orientation | |
| 2 | Reverse rotation orientation | Orientation is executed to the reverse rotation direction. (If the motor is running forward, orientation is executed to the reverse rotation direction after deceleration.) | | |
| 10 | Pre-orientation | Orientation is executed to the current rotation direction. | | |
| 11 | Forward rotation orientation | Orientation is executed to the forward rotation direction. (If the motor is running in reverse, orientation is executed to the forward rotation direction after deceleration.) | Machine end orientation | |
| 12 | Reverse rotation orientation | Orientation is executed to the reverse rotation direction. (If the motor is running forward, orientation is executed to the reverse rotation direction after deceleration.) | | |

Orientation to the current rotation direction (Pr.393 = "0 (initial value), 10") (Vector control)

When the Orientation command (X22) signal is input, the motor speed decelerates from the running speed to Pr.351
 Orientation speed. At the same time, the orientation stop position command is read in. (The stop position command is determined by the setting of Pr.350 Stop position command selection, Pr.360 16-bit data selection.)





- When the orientation switchover speed is reached, the encoder Z phase pulse is confirmed, and the control changes from speed control to position control (**Pr.362 Orientation position loop gain**).
- The distance to the orientation stop position is calculated at switching of the control, and the motor decelerates to a stop with a set deceleration pattern (**Pr.399 Orientation deceleration ratio**) and enters the orientation (servo lock) state.
- · Once in the Pr.357 Orientation in-position zone, the Orientation complete (ORA) signal is output.
- The home position can be moved using Pr.361 Position shift.

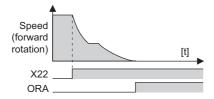
CAUTION

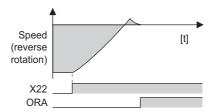
• If the X22 is turned OFF while the start signal is input, the motor accelerates toward the speed of the current speed command. Therefore, to stop, turn the Forward rotation (Reverse rotation) signal OFF.

Orientation to the forward rotation direction (Pr.393 = "1, 11") (Vector control)

- · This method is used to improve the stopping precision and maintain the mechanical precision when the backlash is large.
- If the motor is running in the forward rotation direction, it makes an orientation stop with the same method as "orientation to the current rotation direction".

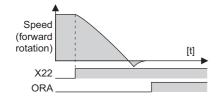
• If the motor is running in reverse, it decelerates, change to the forward rotation direction, and then orientation stop is executed.

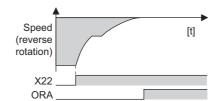




◆ Orientation to the reverse rotation direction (Pr.393 = "2, 12") (Vector control)

- If the motor is running in the reverse rotation direction, it executes an orientation stop with the same method as "orientation to the current rotation direction".
- If the motor is running in forward, it decelerates, change to the reverse rotation direction, and then orientation stop is executed.







- Couple the encoder with the motor shaft that stops the shaft at the specified position. Couple it with the speed ratio of 1:1 and without any mechanical looseness.
- To ensure correct positioning, the encoder must be set in the proper rotation direction, and the A and B phases must be connected correctly.
- If the pulse signal from the encoder stops due to encoder signal loss, etc. during orientation, orientation may not be completed.
- To terminate orientation, the start (STF or STR) signal must be first switched OFF, and then the Orientation (X22) signal must be switched OFF. As soon as this X22 signal is switched OFF, orientation control ends.
- When performing orientation control, properly set Pr.350 Stop position command selection and Pr.360 16-bit data selection.

If the values set are incorrect, proper orientation control will not be performed.

- · When orientation control is performed, PID control is disabled.
- If Signal loss detection (E.ECT) is displayed when the X22 signal is ON, causing the inverter to trip, check for a break in the cable of the Z phase of the encoder.

◆ Servo rigidity adjustment (Pr.362, Pr.396 to Pr.398) (Vector control)

- To increase the servo rigidity^{*1} during orientation stop using Pr.396 Orientation speed gain (P term) or Pr.397
 Orientation speed integral time, make adjustments with the following procedures.
 - 1. Increase the **Pr.362 Orientation position loop gain** value to the extent that rocking*2 does not occur during orientation stop.
 - 2. Increase Pr.396 and Pr.397 at the same rate.

Normally, adjust Pr.396 in the range from 10 to 100, and Pr.397 from 0.1 to 1.0 s.

(Note that these do not need to be set to the same rate.)

<Example>

When the Pr.396 value is multiplied by 1.2, divide the Pr.397 value by 1.2.

If vibration occurs during orientation stop, the scale cannot be raised any higher.

3. Pr.398 Orientation speed gain (D term) is the lag/advance compensation gain.

The limit cycle^{*3} can be prevented by increasing the value, and operation can be stopped stably. However, the torque decreases in relation to the position deviation, and the motor stops with deviation.

- *1 Servo rigidity: The response when a position control loop is configured.
 - When the servo rigidity is raised, the holding force increases and operation becomes stabilized, but vibration occurs more easily. When the servo rigidity is lowered, the holding force decreases, and the settling time increases.
- *2 Rocking: Movement in which return occurs when the stopping position is exceeded.
- *3 Limit cycle: This is a phenomenon that generates ± continuous vibration centering on the target position.



· Application of lag/advance control and PI control

PI control can be applied by setting **Pr.398** to 0. Normally, use the lag/advance control. PI control should be used when using a machine with a high spindle static friction torque and requires a stop position accuracy.

◆ Pr.399 Orientation deceleration ratio (initial value: 20) (Vector control)

Make adjustments, as shown below, according to the orientation status. (Make adjustments in the order of a, b, and c.)
 Normally, adjust Pr.362 Orientation position loop gain in the range from 5 to 20, and Pr.399 Orientation deceleration ratio from 5 to 50.

| Condition | Adjustment procedure |
|------------------------------------|---|
| Rocking occurs during stopping | a. Decrease the Pr.399 setting. b. Decrease the Pr.362 setting. c. Increase the Pr.396 and Pr.397 settings. |
| The orientation time is long. | a. Increase the Pr.399 setting. b. Increase the Pr.362 setting. |
| Hunting occurs during stopping | a. Decrease the Pr.362 setting.b. Decrease the Pr.396 setting and increase the Pr.397 setting. |
| Low servo rigidity during stopping | a. Increase the Pr.396 setting and decrease the Pr.397 setting.b. Increase the Pr.362 setting. |

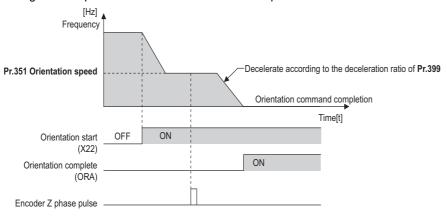


 Orientation stop operation fails, causing an excessive position error, or if the motor performs forward/reverse reciprocation operation, review the settings of Pr.393 Orientation selection (on page 587) and Pr.359 Encoder rotation direction (on page 586).

◆ Pr.351 Orientation speed (initial value: 2 Hz) (Vector control)

• Set the speed when switching between the speed control mode and the position control mode is performed under orientation operation.

Decreasing the set speed enables stable orientation stop. Note that the orientation time increases.

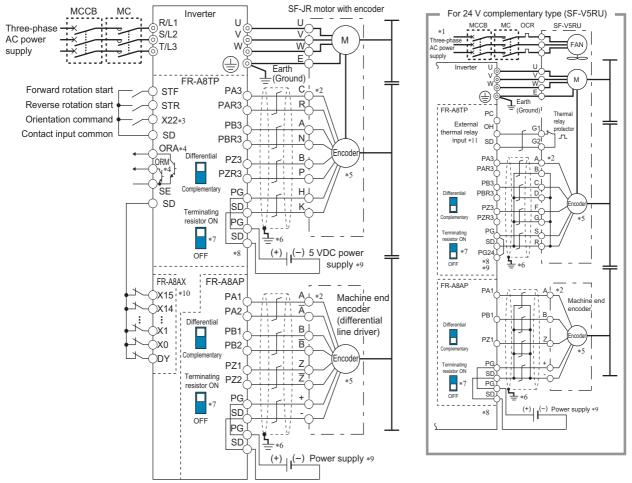




• When "19" is set in **Pr.52 Operation panel main monitor selection**, the position pulse monitor is displayed instead of the output voltage monitor on the PU.

◆ Machine end orientation connection diagram (Vector control)

- · To perform machine end orientation control, the following settings are required.
 - Install a plug-in option (FR-A8AP/FR-A8AL or FR-A8APR) and a control terminal option (FR-A8TP) to the inverter, a motor end encoder to the control terminal option, and a machine end encoder to the plug-in option.
 - Set "1" in Pr.862 Encoder option selection.
 - Set Pr.393 Orientation selection = "10 to 12". (Refer to page 596.)
 - Set the gear ratio by setting **Pr.394 Number of machine side gear teeth** and **Pr.395 Number of motor side gear teeth**. (Refer to page 599.)



- *1 Single-phase power supply (200 V/50 Hz, 200 to 230 V/60 Hz) is used for the fan for a 7.5 kW or lower dedicated motor.
- *2 The pin number differs according to the encoder used.
- *3 Use Pr.178 to Pr.182, Pr.185, or Pr.189 (Input terminal function selection) to assign the function to a terminal. (Refer to page 521.)
- *4 Use Pr.190 to Pr.192, or Pr.195 (Output terminal function selection) to assign the function to a terminal. (Refer to page 473.)
- *5 Connect the encoder so that there is no looseness between the motor and motor shaft. Speed ratio must be 1:1.
- *6 Earth (ground) the shield of the encoder cable to the enclosure using a tool such as a P-clip. (Refer to page 88.)
- *7 For the differential line driver, set the terminating resistor selection switch to the ON position. (Refer to page 93.)

 Note that the terminating resistor switch should be set to the OFF position (initial status) when sharing the same encoder with another unit (NC, etc.) having a terminating resistor under the differential line driver setting.

 For the complementary, set the switch to the OFF position.
- *8 For terminal compatibility between the FR-A8TP and the FR-JCBL/FR-V7CBL, refer to the Instruction Manual of the FR-A8TP.
- *9 A separate external power supply is necessary according to the encoder power specification. When the encoder output is the differential line driver type, only 5 V can be input. Make the voltage of the external power supply the same as the encoder output voltage, and connect the external power supply between terminals PG and SD. If using the 24V power supply of the FR-A8TP, 24V power can be supplied from terminal PG24. When performing encoder feedback control and Vector control together, an encoder and power supply can be shared.
- *10 When a stop position command is input from outside, a plug-in option FR-A8AX is required. Refer to page 589 for the external stop position command
- *11 To enable terminal OH, set Pr.876 Thermal protector input = "1 (initial value)". (Refer to page 420.)

◆ Encoder orientation gear ratio setting (Pr.394, Pr.395) (Vector control)

· Set the encoder orientation gear ratio for machine end orientation control.

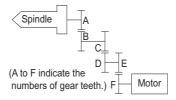
 Set the encoder orientation gear ratio in Pr.394 Number of machine side gear teeth, Pr.395 Number of motor side gear teeth An accurate gear ratio (or pulley ratio) from the motor shaft to the spindle is necessary.

Set the correct numbers of gear teeth in Pr.394 and Pr.395.

 $Pr.394 = A \times C \times E$

 $Pr.395 = B \times D \times F$

Exercise care so that the A × C × E and B × D × F settings do not exceed 32767. If either or both of them exceed that value, make approximations.





· Pulley ratio: Ratio of vector-driven motor side pulley diameter to spindle side pulley diameter



Spindle side Motor side

· Setting example (When the numbers of gear teeth are as follows)

A: 15, C: 43, E: 60, B: 10, D: 28, F: 55

 $Pr.394 = 15 \times 43 \times 60 = 38700$

 $Pr.395 = 10 \times 28 \times 55 = 15400$

Since Pr.394 setting exceeds 32767 at this time, make approximations as follows.

Pr.394/Pr.395 = 38700/15400=3870/1540

Machine end simple orientation control

- Machine end simple orientation control is available when the FR-A8AL option is installed on the inverter and connected to a machine end encoder. Both machine end orientation control and encoder feedback control/ Vector control is also enabled at the same time.
- Set the orientation speed at the motor end encoder in Pr.351 Orientation speed.
- · Set the rotation direction of the encoder in Pr.359 Encoder rotation direction. If the rotation directions of the motor end encoder and the machine end encoder differ, set the rotation direction of the motor end encoder.
- To perform encoder feedback control or Vector control using the machine end encoder, set Pr.369 Number of encoder pulses with the number of motor end encoder pulses converted from the number of machine end encoder pulses.
- To enable encoder feedback control or Vector control and machine end orientation control at the same time using the machine end encoder, set the number of machine end encoder pulses in Pr.829 Number of machine end encoder pulses and "0" in Pr.862 Encoder option selection.

| Pr.829 setting | Pr.862 setting | Description |
|---|----------------|--|
| 9999 | _ | Machine end simple orientation control invalid |
| Other than 9999 (The number of machine end 0 | 0 | Encoder feedback control / Vector control and machine end orientation control at the same time using the machine end encoder is enabled. |
| encoder pulses (before multiplied by four) is set.) | 1 | Machine end simple orientation control invalid |

 When the number of machine end encoder pulses is 4000 and the gear ratio between motor end and machine end is 4:1 (4 rotations of motor equals one rotation of machine), set the value as Pr.369 = "1000", Pr.829 = "4000" (the number of machine end encoder pulses) according to the following formula,

The equivalent of number of motor end encoder pulses = $4000 \times 1/4 = 1000$



· For other settings, refer to descriptions of motor end orientation control in this manual.

5.14.10 PID control

Process control such as flow rate, air volume or pressure are possible on the inverter.

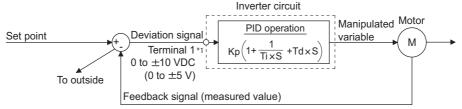
A feedback system can be configured and PID control can be performed using the terminal 2 input signal or parameter setting value as the set point and the terminal 4 input signal as the feedback value.

| Pr. | Name | Initial value | Setting range | Description |
|-------------|-------------------------------------|---------------|---|--|
| 127 | PID control automatic | | 0 to 590 Hz | Set the value at which control is automatically switched to PID |
| A612 | switchover frequency | 9999 | | control. |
| 128 A610 | PID action selection | 0 | 9999 0, 10, 11, 20, 21, 50, 51, 60, 61, 70, 71, 80, 81, 90, 91, 100, 101, 1000, 1001, 1010, 1011, 2000, 2001, 2010, 2011 | No PID control automatic switchover function Select how to input the deviation value, measured value and set point, and forward and reverse action. |
| | | | 40 to 43 | Refer to page 622. |
| 129 A613 | PID proportional band | 100% | 0.1 to 1000% | If a narrow proportional band is set (small parameter setting value), the manipulated amount changes considerably by slight changes in the measured value. As a result, response improves as the proportional band becomes narrower, though stability worsens as shown by the occurrence of hunting. Gain Kp=1/proportional band |
| | | | 9999 | No proportional control |
| 130 A614 | PID integral time | 1 s | 0.1 to 3600 s | With deviation step input, this is the time (Ti) used for obtaining the same manipulated amount as proportional band (P) by only integral (I) action. Arrival to the set point becomes quicker the shorter an integral time is set, though hunting is more likely to occur. |
| | | | 9999 | No integral control |
| 131 A601 | PID upper limit | 9999 | 0 to 100% | Set the upper limit. The FUP signal is output when the feedback value exceeds this setting. The maximum input (20 mA/5 V/10 V) of the measured value is equivalent to 100%. |
| | | | 9999 | No function |
| 132 A602 | PID lower limit | 9999 | 0 to 100% | Set the lower limit. The FDN signal is output when the measured value falls below the setting range. The maximum input (20 mA/5 V/ 10 V) of the measured value is equivalent to 100%. |
| | | | 9999 | No function |
| 133 | PID action set point | 9999 | 0 to 100% | Set the set point during PID control. |
| A611 | 1 12 dollors out point | 0000 | 9999 | Set point set by Pr.128 . |
| 134 A615 | PID differential time | 9999 | 0.01 to 10 s | With deviation ramp input, this is the time (Td) used for obtaining the manipulated amount only by proportional action (P). Response to changes in deviation increase greatly as the differential time increases. |
| | | | 9999 | No differential control |
| 553 A603 | PID deviation limit | 9999 | 0 to 100% | The Y48 signal is output when the absolute value of the deviation exceeds the deviation limit value. |
| | | | 9999 | No function |
| 554 A604 | PID signal operation selection | 0 | 0 to 3, 10 to 13 | The action when the upper or lower limit for a measured value input is detected or when a limit for the deviation is detected can be selected. The operation for PID output suspension function can be selected. |
| 575 A621 | Output interruption detection time | 1 s | 0 to 3600 s | When the output frequency after PID calculation stays less than the Pr.576 setting for the time set in Pr.575 or more, the inverter operation is suspended. |
| | | | 9999 | No output interruption function |
| 576 A622 | Output interruption detection level | 0 Hz | 0 to 590 Hz | Set the frequency at which output interruption is performed. |
| 577 A623 | Output interruption cancel level | 1000% | 900 to 1100% | Level at which the PID output suspension function is released. Set "Pr.577 - 1000%". |
| | | | 1 | The set point or deviation value is input through terminal 1. |
| 609 | PID set point/deviation | | 2 | The set point or deviation value is input through terminal 2. |
| A624 | input selection | 2 | 3 | The set point or deviation value is input through terminal 4. |
| | - | | 4 | The set point or deviation value is input via communication. |
| | | | 5 | The set point or deviation value is input by the PLC function. |

| Pr. | Name | Initial value | Setting range | | Description | |
|--------------|---|---------------|---|---|--|--|
| - | | | 1 | The measured value is ir | • | |
| | | | 2 | The measured value is ir | | |
| 610 | PID measured value | 3 | 3 | The measured value is ir | | |
| A625 | input selection | | 4 | The measured value is ir | | |
| | | | 5 | The measured value is input by the PLC function. | | |
| | | | 0 | Integral stopped at the lir cleared during output inte | nit, manipulation range of ±100%, integral erruption | |
| | | | 1 | Integral continued at the limit, manipulation range of ±100%, integral cleared during output interruption | | |
| 1015 | Integral stop selection at | 0 | 2 | integral cleared during or | · · · · · · · · · · · · · · · · · · · | |
| A607 | limited frequency | | 10 | stopped during output int | | |
| | | | 11 | integral stopped during o | | |
| | | | 12 | Integral stopped at the lir integral stopped during o | mit, manipulation range of 0 to 100%, output interruption | |
| 753 A650 | Second PID action selection | 0 | 0, 10, 11, 20, 21, 50, 51, 60, 61, 70, 71, 80, 81, 90, 91, 100, 101, 1010, 1011, 2000, 2001, 2010, 2011 | Refer to Pr.128 . | | |
| 754 A652 | Second PID control automatic switchover frequency | 9999 | 0 to 590 Hz, 9999 | Refer to Pr.127 . | | |
| 755 A651 | Second PID action set point | 9999 | 0 to 100%, 9999 | Refer to Pr.133 . | | |
| 756 A653 | Second PID proportional band | 100 | 0.1 to 1000%, 9999 | Refer to Pr.129 . | | |
| 757 A654 | Second PID integral time | 1 s | 0.1 to 3600 s, 9999 | Refer to Pr.130 . | | |
| 758 A655 | Second PID differential time | 9999 | 0.01 to 10 s, 9999 | Refer to Pr.134 . | | |
| 1140 A664 | Second PID set point/ deviation input selection | 2 | 1 to 5 | Refer to Pr.609 . | Set the second PID control. For how to enable the second PID | |
| 1141 A665 | Second PID measured value input selection | 3 | 1 to 5 | Refer to Pr.610 . | control, refer to page 613. | |
| 1143 A641 | Second PID upper limit | 9999 | 0 to 100%, 9999 | Refer to Pr.131 . | | |
| 1144 A642 | Second PID lower limit | 9999 | 0 to 100%, 9999 | Refer to Pr.132. | | |
| 1145 A643 | Second PID deviation limit | 9999 | 0 to 100%, 9999 | Refer to Pr.553 . (The Y205 signal is output.) | | |
| 1146 A644 | Second PID signal operation selection | 0 | 0 to 3, 10 to 13 | Refer to Pr.554 . | | |
| 1147 A661 | Second output interruption detection time | 1 s | 0 to 3600 s, 9999 | Refer to Pr.575 . | | |
| 1148 A662 | Second output interruption detection level | 0 Hz | 0 to 590 Hz | Refer to Pr.576 . | | |
| 1149 A663 | Second output interruption cancel level | 1000% | 900 to 1100% | Refer to Pr.577 . | | |

♦ Basic configuration of PID control

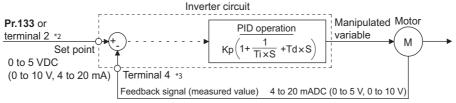
■ Pr.128 ="10, 11" (deviation value signal input)



Kp: Proportionality constant Ti: Integral time S: Operator Td: Differential time

*1 Set "0" to Pr.868 Terminal 1 function assignment. When Pr.868 ≠ "0", PID control is invalid.

■ Pr.128 = "20, 21" (measured value input)



Kp: Proportionality constant Ti: Integral time S: Operator Td: Differential time

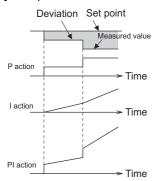
- *2 Note that the input of terminal 1 is added to the set point of terminal 2 as a set point.
- *3 Set "0" to Pr.858 Terminal 4 function assignment. When Pr.858 ≠ "0", PID control is invalid.

◆ PID action outline

■ PI action

PI action is a combination of proportional action (P) and integral action (I), and applies a manipulated amount according to the size of the deviation and transition or changes over time.

[Example of action when the measured value changes in a stepped manner]

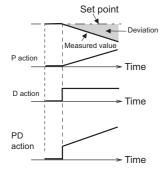


(Note) PI action is the result of P and I actions being added together.

■ PD action

PD action is a combination of proportional action (P) and differential action (D), and applies a manipulated amount according to the speed of the deviation to improve excessive characteristics.

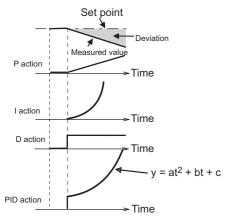
[Example of action when the measured value changes proportionately]



(Note) PD action is the result of P and D actions being added together.

■ PID action

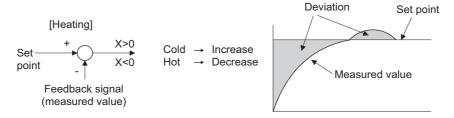
PID action is a combination of PI and PD action, which enables control that incorporates the respective strengths of these actions.



(Note) PID action is the result of all P, I and D actions being added together.

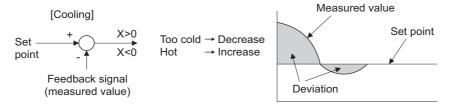
■ Reverse action

When deviation X = (set point - measured value) is a plus value, the manipulated amount (output frequency) is increased, and when the deviation is a minus value, the manipulated amount is decreased.



■ Forward action

When deviation X = (set point - measured value) is a minus value, the manipulated amount (output frequency) is increased, and when the deviation is a plus value, the manipulated amount is decreased.

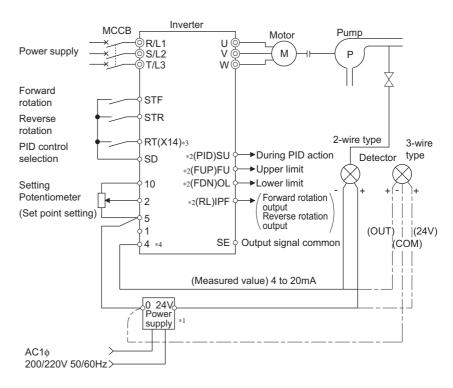


Relationship between deviation and manipulated amount (output frequency)

| PID action setting | Deviation | | | |
|--------------------|-----------|-------|--|--|
| FID action setting | Plus | Minus | | |
| Reverse action | 71 | א | | |
| Forward action | ע | 7 | | |

◆ Connection diagram

- Sink logic
- **Pr.128** = 20
- **Pr.183** = 14
- Pr.191 = 47
- **Pr.192** = 16
- **Pr.193** = 14
- Pr.194 = 15



- *1 Prepare a power supply matched to the power supply specifications of the detector.
- *2 The applied output terminals differ by the settings of Pr.190 to Pr.196 (Output terminal function selection).
- The applied input terminals differ by the settings of Pr.178 to Pr.189 (Input terminal function selection)
- *4 The AU signal need not be input.

◆ Selection of deviation value, measured value and set point input method, and PID action method (Pr.128, Pr.609, Pr.610)

• Using **Pr.128**, select the input method for the PID set point, measured value detected by the meter, and externally calculated deviation. Also, select forward or reverse action.

• Switch the power voltage/current specifications of terminals 2 and 4 by Pr.73 Analog input selection or Pr.267 Terminal 4 input selection to match the specification of the input device. After changing the Pr.73 or Pr.267 settings, check the voltage/current input selection switch. Incorrect setting may cause a fault, failure, or malfunction. (Refer to page 496 for the setting.)

| Pr.128 setting | Pr.609 Pr.610 | PID action | Set point input | Measured value input | Deviation input |
|-------------------|------------------|--|--------------------------------|---|----------------------------------|
| 0 | | PID invalid | _ | _ | _ |
| 10 | | Reverse action | | | Terminal 1 |
| 11 | Invalid | Forward action | | _ | reminar i |
| 20 | | Reverse action | T : 10 B 400*1 | Terminal 4 | |
| 21 | | Forward action | Terminal 2 or Pr.133 *1 | Terminal 4 | _ |
| 40 to 43 | Enabled | Dancer control | For details on dancer control | l, refer to page 622. | |
| 50 | | Reverse action | | | 0*2 |
| 51 | | Forward action | _ | _ | Communication*2 |
| 60 | | Reverse action | 2*2 | Communication*2 | |
| 61 | | Forward action | Communication*2 | Communication 2 | _ |
| 70 | | Reverse action | | _ | PLC function (applied |
| 71 | | Forward action | _ | | to the frequency)*3 |
| 80 | Invalid | Reverse action | PLC function (applied to the | PLC function (applied to | |
| 81 | iiivalia | Forward action | frequency)*3 | the frequency)*3 | _ |
| 90 | | Reverse action | | PLC function (not applied to the frequency)*3 | PLC function (not applied to the |
| 91 | | Forward action | _ | | frequency)*3 |
| 100 | | Reverse action | PLC function (not applied to | | |
| 101 | | Forward action | the frequency)*3 | | _ |
| 1000 | | Reverse action | According to Pr.609 *1 | According to Pr.610 | |
| 1001 | | Forward action | According to Pr.609 | According to F1.010 | |
| 1010 | | Reverse action | | _ | According to Pr.609 |
| 1011 | | Forward action | | | According to F1.003 |
| 2000 | Enabled | Reverse action (without frequency reflected) | *4 | | |
| 2001 | Lilabled | Forward action (without frequency reflected) | According to Pr.609 *1 | According to Pr.610 | _ |
| 2010 | | Reverse action (without frequency reflected) | | | According to Pr 609 |
| 2011 | | Forward action (without frequency reflected) | | _ | According to Pr.609 |

^{*1} When **Pr.133** ≠ "9999", the **Pr.133** setting is valid.

• The set point/deviation input method can also be flexibly selected by Pr.609 PID set point/deviation input selection and the measured value input method can be selected by Pr.610 PID measured value input selection. Selection by Pr.609 and Pr.610 is valid when Pr.128 = "1000 to 2011".

| Pr.609 to Pr.610 settings | Input method |
|---------------------------|-----------------------------|
| 1 | Terminal 1 ^{*4} |
| 2 | Terminal 2 ^{*4} |
| 3 | Terminal 4 ^{*4} |
| 4 | Communication ^{*5} |
| 5 | PLC function |

^{*4} When the same input method has been selected for the set point and measured value at Pr.609 and Pr.610, set point input is invalid. (Inverter runs at set point 0%)

^{*2} CC-Link, CC-Link IE Field Network, or LONWORKS communication is available. For details on communication, refer to the Instruction Manual of each option.

^{*3} For details on the PLC function, refer to the PLC Function Programming Manual.

^{*5} CC-Link, CC-Link IE Field Network, or LONWORKS communication is available. For details on communication, refer to the Instruction Manual of each option.



- When terminals 2 and 4 are selected for deviation input, perform bias calibration using **C3** and **C6** to prevent a minus voltage from being entered as the deviation input signal. Input of a minus voltage might damage devices and the inverter.
- The following shows the relationship between the input values of the analog input terminals and set point, measured value and deviation. (Calibration parameter initial values)

| Input terminal | Input | Re | Calibration parameter | | | |
|----------------|-----------------|----------------------------------|----------------------------------|--|---|--|
| input terminai | specification*6 | Set point | Result | Deviation | Campration parameter | |
| | 0 to 5 V | 0 V = 0% 5 V = 100% | 0 V = 0% 5 V = 100% | 0 V = 0% 5 V = 100% | | |
| Terminal 2 | 0 to 10 V | 0 V = 0% 10 V = 100% | 0 V = 0% 10 V = 100% | 0 V = 0% 10 V = 100% | Pr.125, C2 to C4 | |
| | 0 to 20 mA | 0 mA = 0% 20 mA = 100% | | | | |
| | 0 to ±5 V | -5 to 0 V = 0% +5 V = +100% | -5 to 0 V = 0% +5 V = +100% | -5 V = -100% 0 V = 0% +5 V = +100% | When Pr.128 = "10", Pr.125 setting, C2 to C4. | |
| Terminal 1 | 0 to ±10 V | -10 to 0 V = 0% +10 V = +100% | -10 to 0 V = 0% +10 V = +100% | -10 V = -100% 0 V = 0% +10 V = +100% | When Pr.128 ≥ "1000": C12 to C15 . | |
| | 0 to 5 V | 0 to 1 V = 0% 5 V = 100% | 0 to 1 V = 0% 5 V = 100% | 0 V = -20% 1 V = 0% 5 V = 100% | | |
| Terminal 4 | 0 to 10 V | 0 to 2 V = 0% 10 V = 100% | 0 to 2 V = 0% 10 V = 100% | 0 V = -20% 2 V = 0% 10 V = 100% | Pr.126, C5 to C7 | |
| | 0 to 20 mA | 0 to 4 mA = 0% 20 mA = 100% | 0 to 4 mA = 0% 20 mA = 100% | 0 mA = -20% 4 mA = 0% 20 mA = 100% | | |

^{*6} Can be changed by Pr.73 Analog input selection, Pr.267 Terminal 4 input selection and the voltage/current input switch. (Refer to page 496.)



• Always calibrate the input after changing the voltage/current input specification with **Pr.73 and Pr.267**, and the voltage/current input selection switch.

◆ Input/output signals

- Assigning the PID control valid signal (X14) to the input terminal by Pr.178 to Pr.189 (Input terminal function selection) enables PID control to be performed only when the X14 signal is turned ON. When the X14 signal is OFF, regular inverter running is performed without PID action. (When the X14 signal is not assigned, PID control is enabled only by setting Pr.128 ≠ "0".)
- Input signal

| Signal | Function | Pr.178 to Pr.189 setting | Description |
|--------|---|--------------------------------|---|
| X14 | PID control valid | 14 | When this signal is assigned to the input terminal, PID control is enabled when this |
| X80 | Second PID control valid | 80 | signal is ON. |
| X64 | PID forward/reverse action switchover | 64 | DID control is quitched between famuerd and reverse action without changing |
| X79 | Second PID forward/ reverse action switchover | 79 | PID control is switched between forward and reverse action without changing parameters by turning ON this signal. |
| X72 | PID P control switchover | 72 | |
| X73 | Second PID P control switchover | 73 | Integral and differential values can be reset by turning ON this signal. |

· Output signal

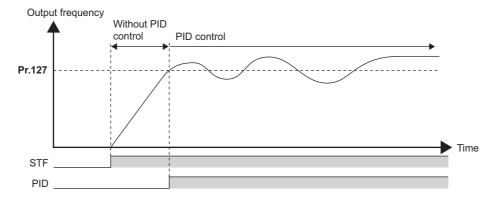
| Signal | Function | | o Pr.196 ting | Description |
|---------|--|-------------------|-------------------|---|
| Sigilal | runction | Positive logic | Negative logic | Description |
| FUP | PID upper limit | 15 | 115 | Output when the measured value signal exceeds Pr.131 PID upper limit |
| FUP2 | Second PID upper limit | 201 | 301 | (Pr.1143 Second PID upper limit). |
| FDN | PID lower limit | 14 | 114 | Output when the measured value signal falls below Pr.132 PID lower limit |
| FDN2 | Second PID lower limit | 200 | 300 | (Pr.1144 Second PID lower limit). |
| RL | PID forward/reverse rotation output | 16 | 116 | "Hi" is output when the output display of the parameter unit is forward rotation |
| RL2 | Second PID forward/ reverse rotation output | 202 | 302 | (FWD) and "Low" is output when the display is reverse rotation (REV) and stop (STOP). |
| PID | During PID control activated | 47 | 147 | Turns ON during PID control. When the PID calculation result is reflected to the output frequency (Pr.128 < |
| PID2 | During second PID control activated | 203 | 303 | "2000"), the PID signal turns OFF at turn OFF of the start signal. When the PID calculation result is not reflected to the output frequency (Pr.128 ≥ "2000"), the PID signal turns ON during PID calculation regardless of the start signal status. |
| Y48 | PID deviation limit | 48 | 148 | Output when the absolute deviation value exceeds the limit value set in |
| Y205 | Second PID deviation limit | 205 | 305 | Output when the absolute deviation value exceeds the limit value set in Pr.553 PID deviation limit (Pr.1145 Second PID deviation limit). |
| SLEEP | PID output interruption | 70 | 170 | Set Pr.575 Output interruption detection time (Pr.1147 Second output |
| SLEEP2 | During second PID output shutoff | 204 | 304 | interruption detection time) ≠ "9999". This signal turns ON when the PID output suspension function is activated. |

NOTE

• Changing the terminal functions with **Pr.178 to Pr.189 and Pr.190 to Pr.196** may affect other functions. Set parameters after confirming the function of each terminal.

PID automatic switchover control (Pr.127)

- The system can be started up more quickly by starting up without PID control activated.
- When **Pr.127 PID control automatic switchover frequency** is set, the startup is made without PID control until the output frequency reaches the **Pr.127** setting. Once the PID control starts, the PID control is continued even if the output frequency drops to **Pr.127** setting or lower.



Operation selection and sleep function stop selection when a value error is detected (FUP signal, FDN signal, Y48 signal, Pr.554)

- Using **Pr.554 PID signal operation selection**, set the action when the measured value input exceeds the upper limit (**Pr.131 PID upper limit**) or lower limit (**Pr.132 PID lower limit**), or when the deviation input exceeds the permissible value (**Pr.553 PID deviation limit**).
- Choose whether to output the signals (FUP, FDN, Y48) only or to activate the protective function to output the inverter shutoff.

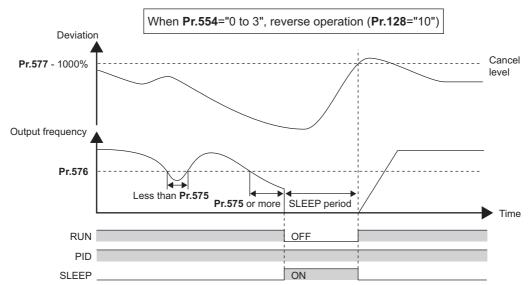
• The stop action when the inverter output is shut off by the sleep function can be selected.

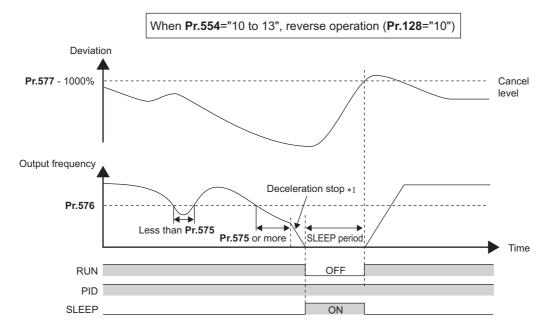
| Pr.554 setting | Inverter operation | | | | | |
|-------------------|--|--|--------------------------|--|--|--|
| P1.554 Setting | At FUP/FDN signal output*1 | At Y48 signal output ^{*1} | At sleep operation start | | | |
| 0 (initial value) | Signal output only | Signal output only | | | | |
| 1 | Signal output + output shutoff (E.PID) | Signal output only | Canada da adam | | | |
| 2 | Signal output only | Signal output + output shutoff (E.DID) | Coasts to stop | | | |
| 3 | Signal output + output shutoff (E.PID) | Signal output + output shutoff (E.PID) | | | | |
| 10 | Signal output only | Signal output only | | | | |
| 11 | Signal output + output shutoff (E.PID) | Signal output only | Deceleration stop | | | |
| 12 | Signal output only | Signal output + output shutoff (E.DID) | Deceleration stop | | | |
| 13 | Signal output + output shutoff (E.PID) | Signal output + output shutoff (E.PID) | | | | |

^{*1} When each of **Pr.131**, **Pr.132** and **Pr.553** settings corresponding to each of the FUP, FDN and Y48 signals is "9999" (no function), signal output and protective function are not available.

◆ PID output suspension function (sleep function) (SLEEP signal, Pr.575 to Pr.577)

- When a status where the output frequency after PID calculation is less than **Pr.576 Output interruption detection level** has continued for the time set in **Pr.575 Output interruption detection time** or longer, inverter running is suspended. This allows the amount of energy consumed in the inefficient low-speed range to be reduced.
- When the deviation (set point measured value) reaches the PID output shutoff release level (Pr.577 setting value -1000%)
 while the PID output suspension function is activated, the PID output suspension function is released, and PID control
 operation is automatically restarted.
- Whether to allow motor to coast to a stop or perform a deceleration stop when sleep operation is started can be selected using **Pr.554**.
- While the PID output suspension function is activated, the PID output interruption (SLEEP) signal is output. During this time, the Inverter running (RUN) signal turns OFF and the During PID control activated (PID) signal turns ON.
- For the terminal used for the SLEEP signal, set "70 (positive logic)" or "170 (negative logic)" in any of **Pr.190 to Pr.196** (Output terminal function selection).





11 When the PID output shutoff release level is reached during a deceleration stop, output shutoff is released, operation is re-accelerated and PID control is continued. During deceleration, **Pr.576 Output interruption detection level** is invalid.

♦ Integral stop selection when the frequency is limited (Pr.1015)

- The operation for the integral term can be selected when the frequency or the manipulated amount is limited during PID control. The operation during output suspension can be selected for the integral term using the PID output suspension (sleep) function.
- · The manipulation range can be selected.

| Pr.1015 setting | Operation at limited frequency | Range of manipulation | Operation during output interruption | |
|-------------------|--------------------------------|-----------------------|--------------------------------------|--|
| 0 (initial value) | Integral stop | -100% to +100% | | |
| 1 | Integral continuation | -100% to +100% | Integral clear | |
| 2 | Integral stop | 0 to 100% | | |
| 10 | Integral stop | -100% to +100% | | |
| 11 | Integral continuation | -100% 10 +100% | Integral stop | |
| 12 | Integral stop | 0 to 100% | | |



· While the integral stop is selected, the integral stop is enabled when any of the following conditions is met.

Integral stop conditions

- The frequency reaches the upper or lower limit.
- The manipulated amount reaches plus or minus 100% (Pr.1015 = "0 or 10").
- The manipulated amount reaches 0% or 100% (Pr.1015 = "2 or 12").

PID monitor function

- This function displays the PID control set point, measured value and deviation on the operation panel, and can output these from the terminals FM/CA and AM.
- An integral value indicating a negative % can be displayed on the deviation monitor. 0% is displayed as 1000. (These values cannot be output on the deviation monitor from terminals FM and CA.)

Set the following values to Pr.52 Operation panel main monitor selection, Pr.774 to Pr.776 (Operation panel monitor selection), Pr.992 Operation panel setting dial push monitor selection, Pr.54 FM/CA terminal function selection and Pr.158 AM terminal function selection for each monitor.

| Parameter | Monitor | Minimum | M | onitor rang | е | | |
|-----------|--|---------|-------------------------|-------------------------|--------------------------------------|--|--|
| Setting | tting description increment Terminal FM/ Term | | Terminal AM | Operation panel | Remarks | | |
| 52 | PID set point | | | | | | |
| 92 | Second PID set point/deviation input selection | 0.1% | 0 to 100% ^{*1} | | | "0" is displayed at all times when PID control | |
| 53 | PID measured value | 0.1% | 0 to 1009/*1 | | | is based in deviation input. | |
| 93 | Second PID measured value | 0.170 | 0 to 100% ^{*1} | | | | |
| 67 | PID measured value 2 | | ., | | | Displays PID measured value even if the PID control operating conditions are not satisfied | |
| 95 | Second PID measured value 2 | 0.1% | 0 to 100% ⁻¹ | 0 to 100% ^{*1} | | while the PID control is enabled. "0" is displayed at all times when PID control is based in deviation input. | |
| 54 | PID deviation | | | | 900% to | | |
| 94 | Second PID deviation | 0.1% | Setting not available | -100% to 100%*1*2 | or -100% to 100% ^{*1} | Using Pr.290 Monitor negative output selection , negative values can be output to the terminal AM and displayed with a minus sign on the operation panel (FR-DU08). | |
| 91 | PID manipulated amount | | 900% to 9100% to 1100% | | 1100% indicated value | | When signed indication is invalid, the indicated values are from "900%" to "1100%" |
| 96 | Second PID manipulated amount | 0.1% | available | Or Or | | on the operation panel. (0% is offset and displayed as "1000%".) | |

^{*1} When C42 (Pr.934) and C44 (Pr.935) are set, the minimum increment changes from unit % to no unit, and the monitor range can be changed. (Refer to page 615.)

◆ Adjustment procedure

1. Enable PID control

When **Pr.128** ≠ "0", PID control is enabled.

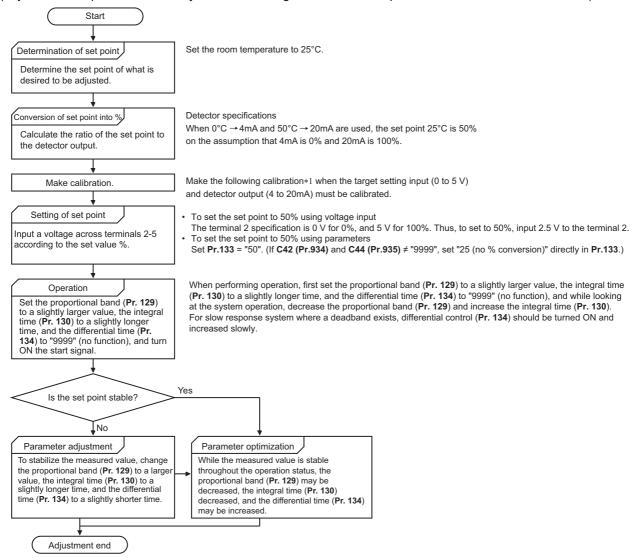
Set the set point, measured value and deviation input methods at Pr.128, Pr.609 and Pr.610.

- **2.** Setting the parameter
 - Adjust the PID control parameters of Pr.127, Pr.129 to Pr.134, Pr.553, Pr.554, Pr.575 to Pr.577.
- **3.** Terminal setting
 - Set the I/O terminals for PID control. (Pr.178 to Pr.189 (Input terminal function selection), Pr.190 to Pr.196 (Output terminal function selection))
- **4.** Turn the X14 signal ON
 - When the X14 signal is assigned to the input terminal, PID control is enabled by the X14 signal turning ON.
- **5.** Operation

^{*2} When the minus value display is set disabled using **Pr.290**, the terminal AM output becomes "0".

◆ Calibration example

(Adjust room temperature to 25°C by PID control using a detector that outputs 4 mA at 0°C and 20 mA at 50°C.)



*1 When calibration is required

Calibrate detector output and set point input by Pr.125, C2 (Pr.902) to C4 (Pr.903) (terminal 2) or Pr.126, C5 (Pr.904) to C7 (Pr.905) (terminal 4). (Refer to page 505.)

When both C42 (Pr.934) and C44 (Pr.935) are other than "9999", calibrate the detector output and set point input by Pr.934 and Pr.935 (terminal 4). (Refer to page 615.)

Make calibration in the PU operation mode during an inverter stop.

Calibrating set point input

(Example: To enter the set point on terminal 2)

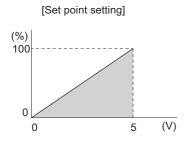
- 1. Apply the input (for example, 0 V) of set point setting 0% across terminals 2 and 5.
- **2.** Using **C2** (**Pr.902**), enter the frequency (for example, 0 Hz) to be output by the inverter when the deviation is 0%.
- **3.** Using C3 (Pr.902), set the voltage value at 0%.
- **4.** Apply the input (for example, 5 V) of set point setting 100% across terminals 2 and 5.
- **5.** Using **Pr.125**, enter the frequency (for example, 60 Hz) to be output by the inverter when the deviation is 100%.
- **6.** Using **C4** (**Pr.903**), set the voltage value at 100%.

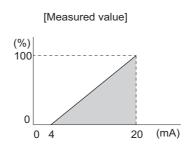


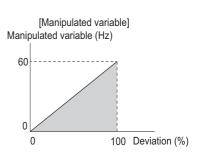
- When the set point is set at **Pr.133**, the setting frequency of **C2** (**Pr.902**) is equivalent to 0% and the setting frequency of **Pr.125** (**Pr.903**) is equivalent to 100%.
- · Measured value input calibration
 - **1.** Apply the input (for example, 4 mA) of measured value 0% across terminals 4 and 5.
 - 2. Perform calibration by C6 (Pr.904).
 - **3.** Apply the input (for example, 20 mA) of measured value 100% across terminals 4 and 5.
 - **4.** Perform calibration by **C7** (**Pr.905**).



- Set the frequencies set at C5 (Pr.904) and Pr.126 to each of the same values set at C2 (Pr.902) and Pr.125.
- The display unit for analog input can be changed from "%" to "V" or "mA". (Refer to page 507.)
- The following figure shows the results of having performed the calibration above.







♦ Setting multiple PID functions

• When the second PID function is set, two sets of PID functions can be switched for use. The PID setting is selected as shown in the following table.

| Pr.128 setting (first PID setting) | Pr.753 setting (second PID setting) | Pr.155 setting*1 | RT signal | PID setting applied to the output frequency |
|-------------------------------------|-------------------------------------|------------------|-----------|---|
| "0" or not applied to the frequency | "0" or not applied to the frequency | _ | _ | Control other than PID control |
| "0" or not applied to the frequency | Applied to the frequency | _ | _ | Second PID setting |
| Applied to the frequency | "0" or not applied to the frequency | _ | _ | First PID setting |
| | | 0 | OFF | First PID setting |
| Applied to the frequency | Applied to the frequency | U | ON | Second PID setting |
| | | 10 | _ | First PID setting |
| Dancer control | Not applied to the frequency*2 | _ | _ | Dancer control |

^{*1} While **Pr.155** = "0", the second function is enabled immediately after the RT signal turns ON. While **Pr.155** = "10", the second function is enabled only during constant speed operation when the RT signal turns ON. (For the details, refer to page 525.)

^{*2} When dancer control is selected, the setting is not applied to the frequency.

• The parameters and signals for the second PID function are in the same way as the following parameters and signals of the first PID function. Refer to the first PID function when setting the second PID functions.

| Classification | First F | PID function parameters | Seco | ond PID function parameters |
|----------------|---------|--|------|---|
| Classification | Pr. | Name | Pr. | Name |
| | 127 | PID control automatic switchover frequency | 754 | Second PID control automatic switchover frequency |
| | 128 | PID action selection | 753 | Second PID action selection |
| | 129 | PID proportional band | 756 | Second PID proportional band |
| | 130 | PID integral time | 757 | Second PID integral time |
| | 131 | PID upper limit | 1143 | Second PID upper limit |
| | 132 | PID lower limit | 1144 | Second PID lower limit |
| | 133 | PID action set point | 755 | Second PID action set point |
| | 134 | PID differential time | 758 | Second PID differential time |
| Parameter | 553 | PID deviation limit | 1145 | Second PID deviation limit |
| | 554 | PID signal operation selection | 1146 | Second PID signal operation selection |
| | 575 | Output interruption detection time | 1147 | Second output interruption detection time |
| | 576 | Output interruption detection level | 1148 | Second output interruption detection level |
| | 577 | Output interruption cancel level | 1149 | Second output interruption cancel level |
| | 609 | PID set point/deviation input selection | 1140 | Second PID set point/deviation input selection |
| | 610 | PID measured value input selection | 1141 | Second PID measured value input selection |

| Classification | First F | PID function parameters | Second PID function parameters | | |
|----------------|---------|---------------------------------------|--------------------------------|--|--|
| Classification | Signal | Name | Signal | Name | |
| | X14 | PID control valid | X80 | Second PID control valid | |
| Input signal | X64 | PID forward/reverse action switchover | X79 | Second PID forward/reverse action switchover | |
| | X72 | PID P control switchover | X73 | Second PID P control switchover | |
| | FUP | PID upper limit | FUP2 | Second PID upper limit | |
| | FDN | PID lower limit | FDN2 | Second PID lower limit | |
| Output signal | RL | PID forward/reverse rotation output | RL2 | Second PID forward/reverse rotation output | |
| | PID | During PID control activated | PID2 | During second PID control activated | |
| | SLEEP | PID output interruption | SLEEP2 | During second PID output shutoff | |
| | Y48 | PID deviation limit | Y205 | Second PID deviation limit | |



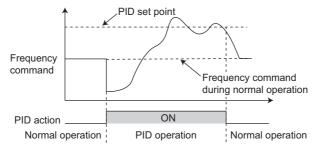
- Even if the X14 signal is ON, PID control is stopped and multi-speed or JOG operation is performed when the multi-speed operation (RH, RM, RL, or REX) signal or JOG signal (JOG operation) is input.
- · PID control is invalid under the following settings.

Pr.79 Operation mode selection = "6" (Switchover mode)

- Note that input to the terminal 1 is added to the terminals 2 and 4 inputs. For example when **Pr.128** = "20 or 21", the terminal 1 input is considered as a set point and added to the set point of the terminal 2.
- To use terminal 4 and 1 inputs in PID control, set "0" (initial value) to Pr.858 Terminal 4 function assignment and Pr.868
 Terminal 1 function assignment. When a value other than "0", PID control is invalid.
- Changing the terminal functions with **Pr.178 to Pr.189 and Pr.190 to Pr.196** may affect other functions. Set parameters after confirming the function of each terminal.
- When PID control is selected, the minimum frequency becomes the frequency of Pr.902 and the maximum frequency becomes
 the frequency of Pr.903.

(The Pr.1 Maximum frequency and Pr.2 Minimum frequency settings also are valid.)

- · During PID operation, the remote operation function is invalid.
- When control is switched to PID control during normal operation, the frequency during that operation is not carried over, and the value resulting from PID calculation referenced to 0 Hz becomes the command frequency.



Operation when control is switched to PID control during normal operation

Parameters referred to

Pr.59 Remote function selection ☞ page 377
Pr.73 Analog input selection ☞ page 496
Pr.79 Operation mode selection ☞ page 389

Pr.178 to Pr.189 (Input terminal function selection) □ page 521 Pr.190 to Pr.196 (Output terminal function selection) □ page 473

Pr.290 Monitor negative output selection page 457

C2 (Pr.902) to C7 (Pr.905) Frequency setting voltage (current) bias/gain 🖙 page 505

5.14.11 Changing the display increment of numerical values used in PID control

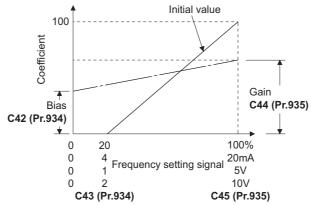
When the LCD operation panel (FR-LU08) or the parameter unit (FR-PU07) is used, the display unit of parameters and monitor items related to PID control can be changed to various units.

| Pr. | Name | Initial value | Setting range | Description | | | |
|---------------------------------|--------------------------------------|-----------------|------------------|---|-----------------------------|--|--|
| 759 A600 | PID unit selection | nit selection 0 | | Change the unit of the PID control-related values that is displayed on the LCD operation panel (FR-LU08) or the parameter unit (FR-PU07). | | | |
| | | | 9999 | Without display unit switching | | | |
| C42 (934) A630 ^{*1} | PID display bias coefficient | 9999 | 0 to 500 | Set the coefficient of the bias side input. | (minimum) of measured value | | |
| A630 | | | 9999 | Displayed in %. | | | |
| C43 (934) A631 ^{*1} | PID display bias analog value | 20% | 0 to 300% | Set the converted % of the bias side (minimum) current/voltage of measured value input. | | | |
| C44 (935) A632 ^{*1} | PID display gain coefficient | 9999 | 0 to 500 | Set the coefficient of the gain side (maximum) of measured va input. | | | |
| A032 | | | 9999 | Displayed in %. | | | |
| C45 (935) A633 ^{*1} | PID display gain analog value | 100% | 0 to 300% | Set the converted % of the gain side (maximum) current/voltage of measured value input. | | | |
| 1136 | Second PID display bias | 9999 | 0 to 500 | Refer to C42 (934) . | | | |
| A670 | coefficient | 9999 | 9999 | Refer to C42 (934) . | | | |
| 1137 A671 | Second PID display bias analog value | 20% | 0 to 300% | Refer to C43 (934) . | | | |
| 1138 | Second PID display gain | 9999 | 0 to 500 | Refer to C44 (935) . | Second PID control | | |
| A672 | coefficient | 9999 | 9999 | Refer to C44 (933) . | | | |
| 1139 A673 | Second PID display gain analog value | 100% | 0 to 300% | Refer to C45 (935) . | | | |
| 1142 A640 | Second PID unit selection | 9999 | 0 to 43, 9999 | Refer to Pr.759 . | | | |

The parameter number in parentheses is the one for use with the LCD operation panel and the parameter unit.

Calibration of PID display bias and gain (C42 (Pr.934) to C45 (Pr.935))

- When both C42 (Pr.934) and C44 (Pr.935) ≠ "9999", the bias and gain values for the set point, measured value and deviation in PID control can be calibrated.
- "Bias"/"gain" function can adjust the relation between PID displayed coefficient and measured value input signal that is externally input. Examples of these measured value input signals are 0 to 5 VDC, 0 to 10 VDC, or 4 to 20 mADC. (The terminals used for measured value input can be selected at Pr.128, Pr.609, Pr.610.)
- Set the value that is displayed when the PID measured value (control amount) is 0% to C42 (Pr.934) and the value that is displayed when the PID measured value (control amount) is 100% to C44 (Pr.935).
- When both of C42 (Pr.934) and C44 (Pr.935) ≠"9999" and Pr.133 is set as the set point, the setting of C42 (Pr.934) is treated as 0%, and C44 (Pr.935) as 100%



· There are three methods to adjust the PID display bias/gain. Method to adjust any point by application of a current (voltage) to the measured value input terminal Method to adjust any point without application of a current (voltage) to the measured value input terminal Method to adjust only the display coefficient without adjustment of current (voltage)

(Refer to page 505 for details, and make the necessary adjustments by considering C7 (Pr.905) as C45 (Pr.935) and Pr.126 as C44 (Pr.935).)



- Always calibrate the input after changing the voltage/current input specification with Pr.73 and Pr.267, and the voltage/current
 input selection switch.
- Take caution when the following condition is satisfied because the inverter recognizes the deviation value as a negative (positive) value even though a positive (negative) deviation is given: Pr.934 (PID bias coefficient) > Pr.935 (PID gain coefficient).

To perform a reverse action, set **Pr.128 PID action selection** to forward action. Alternatively, to perform a forward action, set **Pr.128** to reverse action. In this case, the PID output shutoff release level is (1000 - **Pr.577**).

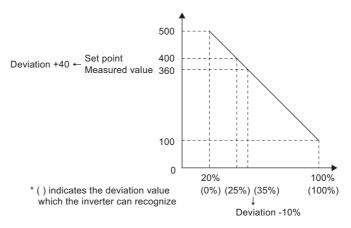
| Pr.934 < Pr.935 (normal setting) | | Pr.934 ≥ Pr.935 | | |
|----------------------------------|----------------------------------|----------------------------------|----------------------------------|--|
| Reverse action | Reverse action setting to Pr.128 | Reverse action | Forward action setting to Pr.128 | |
| Forward action | Forward action setting to Pr.128 | Forward action | Reverse action setting to Pr.128 | |
| PID output shutoff release level | Pr.577 - 1000 | PID output shutoff release level | 1000 - Pr.577 | |

(Example) Set the following: Pr.934 = "500" or 20% (4 mA is applied), Pr.935 = "100" or 100% (20 mA is applied).

When the set point = 400 and the measured value = 360, the deviation is +40 (>0), but the inverter recognizes the deviation as -10% (<0). Because of this, operation amount does not increase in the reverse operation setting.

The operation amount increases when the forward operation is set.

To perform PID output shutoff release at deviation of +40 or higher, set **Pr.577** = "960".



The display of the following parameters is changed according to the C42 (Pr.934), C44 (Pr.935), Pr.1136, and Pr.1138 settings.

| Pr. | Name | | | |
|-----|----------------------------------|--|--|--|
| 131 | PID upper limit | | | |
| 132 | PID lower limit | | | |
| 133 | PID action set point | | | |
| 553 | PID deviation limit | | | |
| 577 | Output interruption cancel level | | | |
| 761 | Pre-charge ending level | | | |
| 763 | Pre-charge upper detection level | | | |

| Pr. | Name | | | |
|------|---|--|--|--|
| 1143 | Second PID upper limit | | | |
| 1144 | Second PID lower limit | | | |
| 755 | Second PID action set point | | | |
| 1145 | Second PID deviation limit | | | |
| 1149 | Second output interruption cancel level | | | |
| 766 | Second pre-charge ending level | | | |
| 768 | Second pre-charge upper detection level | | | |

◆ Changing the PID display coefficient of the LCD operation panel (FR-LU08) or the parameter unit (FR-PU07) (Pr.759)

• Use **Pr.759 PID unit selection** to change the unit of the displayed value on the FR-LU08 or the FR-PU07. For the coefficient set in **C42 (Pr.934) to C44 (Pr.935)**, the units can be changed as follows.

| Pr.759 setting | Unit indication | Unit name | |
|----------------|-----------------|-----------------------------|--|
| 9999 | % | % | |
| 0 | _ | (No indication) | |
| 1 | K | Kelvin | |
| 2 | С | Degree Celsius | |
| 3 | F | Degree Fahrenheit | |
| 4 | PSI | Pound-force per Square Inch | |
| 5 | MPa | Mega Pascal | |
| 6 | kPa | Kilo Pascal | |
| 7 | Pa | Pascal | |
| 8 | bar | Bar | |
| 9 | mbr | Millibar | |
| 10 | GPH | Gallon per Hour | |
| 11 | GPM | Gallon per Minute | |
| 12 | GPS | Gallon per Second | |
| 13 | L/H | Liter per Hour | |
| 14 | L/M | Liter per Minute | |
| 15 | L/S | Liter per Second | |
| 16 | CFH | Cubic Feet per Hour | |
| 17 | CFM | Cubic Feet per Minute | |
| 18 | CFS | Cubic Feet per Second | |
| 19 | СМН | Cubic Meter per Hour | |
| 20 | СММ | Cubic Meter per Minute | |

| Pr.759 setting | Unit indication | Unit name | |
|----------------|-----------------|------------------------|--|
| 21 | CMS | Cubic Meter per Second | |
| 22 | ftM | Feet per Minute | |
| 23 | ftS | Feet per Second | |
| 24 | m/M | Meter per Minute | |
| 25 | m/S | Meter per Second | |
| 26 | lbH | Pound per Hour | |
| 27 | lbM | Pound per Minute | |
| 28 | lbS | Pound per Second | |
| 29 | iWC | Inch Water Column | |
| 30 | iWG | Inch Water Gauge | |
| 31 | fWG | Feet of Water Gauge | |
| 32 | mWG | Meter of Water Gauge | |
| 33 | iHg | Inches of Mercury | |
| 34 | mHg | Millimeters of Mercury | |
| 35 | kgH | Kilogram per Hour | |
| 36 | kgM | Kilogram per Minute | |
| 37 | kgS | Kilogram per Second | |
| 38 | ppm | Pulse per Minute | |
| 39 | pps | Pulse per Second | |
| 40 | kW | Kilowatt | |
| 41 | hp | Horse Power | |
| 42 | Hz | Hertz | |
| 43 | rpm | Revolution per Minute | |

5.14.12 PID Pre-charge function

This function drives the motor at a certain speed before starting PID control. This function is useful for a pump with a long hose, since PID control would start before the pump is filled with water, and proper control would not be performed without this function,

| Pr. | Name | Initial value | Setting range | Description | | |
|-------------|---|------------------|----------------------|--|---|--|
| 760 A616 | Pre-charge fault selection | 0 | 0 | Fault indication with output shutoff immediately after pre-charge fault occurs. | | |
| 71010 | | | 1 | Fault indication with deceleratio | n stop after pre-charge fault occurs. | |
| 761 | Pre-charge ending level | 9999 | 0 to 100% | Set the measured amount to en | d the pre-charge operation. | |
| A617 | Fre-charge ending level | 3333 | 9999 | Without pre-charge ending leve | l | |
| 762 | Dre charge anding time | 9999 | 0 to 3600 s | Set the time to end the pre-char | ge operation. | |
| A618 | Pre-charge ending time | 9999 | 9999 | Without pre-charge ending time | | |
| 763 A619 | Pre-charge upper detection level | 9999 | 0 to 100% | Set the upper limit for the pre-charged amount. A pre-charge fault occurs when the measured value exceeds the setting during pre-charging. | | |
| | | | 9999 | Without Pre-charge upper detection level | | |
| 764 A620 | Pre-charge time limit | 9999 | 0 to 3600 s | Set the time limit for the pre-charged amount. A pre-charge fault occur when the pre-charge time exceeds the setting. | | |
| A620 | _ | | 9999 | Without Pre-charge time limit | | |
| 765 A656 | Second pre-charge fault selection | 0 | 0, 1 | Refer to Pr.760 . | | |
| 766 A657 | Second pre-charge ending level | 9999 | 0 to 100%, 9999 | Refer to Pr.761 . | Cat the account was also and five ation | |
| 767 A658 | Second pre-charge ending time | 9999 | 0 to 3600 s, 9999 | Refer to Pr.762 . | Set the second pre-charge function. The second pre-charge function is valid when the RT signal is ON. | |
| 768 A659 | Second pre-charge upper detection level | 9999 | 0 to 100%, 9999 | Refer to Pr.763 . | | |
| 769 A660 | Second pre-charge time limit | 9999 | 0 to 3600 s, 9999 | Refer to Pr.764 . | | |

Operation selection for the pre-charge function

- To enable the pre-charge function when PID control is enabled, set the pre-charge end conditions at **Pr.761 Pre-charge** ending level and at **Pr.762 Pre-charge ending time**, or set "77" to **Pr.178 to Pr.189 (Input terminal function selection)**. When operation is started, the inverter runs at the frequency set to **Pr.127 PID control automatic switchover frequency** to enter the pre-charge state.
- · Pre-charge ends and PID control starts after a pre-charge ending condition is satisfied.
- The pre-charge function is also activated at a start after release of a PID output suspension (sleep) state or MRS (output shutoff). The PID output suspension (sleep) function is not activated until the started pre-charge operation ends.
- During pre-charge operation, the During pre-charge operation (Y49) signal is output. For the terminal used for the Y49 signal output, set "49 (positive logic)" or "149 (negative logic)" in any of **Pr.190 to Pr.196 (Output terminal function selection)** to assign the function.
- The pre-charge function valid/invalid settings and pre-charge ending conditions are as follows:

| Pr.127 setting | Pre-charge ending condition setting | | | Pre-charge | Valid pre-charge ending condition*1 | | | | | | |
|----------------|-------------------------------------|-----------------|--------------|------------|-------------------------------------|------|----------|--|---|---|-----|
| F1.127 Setting | Pr.761 setting | Pr.762 setting | X77 signal | function | Valid pre-charge ending condition | | | | | | |
| 9999 | _ | _ | _ | Disabled | | | | | | | |
| | | Not assigned | | Disabled | sabled — | | | | | | |
| | 0000 | 0000 | 0000 | 9999 | 0000 | 9999 | Assigned | | _ | _ | X77 |
| | 9999 | Other than 9999 | Not assigned | | _ | Time | _ | | | | |
| Other than | | | Assigned | Enabled | _ | Time | X77 | | | | |
| 9999 | | 9999 | Not assigned | | Result | _ | _ | | | | |
| | Other than 9999 | | Assigned | | Result | _ | X77 | | | | |
| | | Other than 9999 | Not assigned | | Result | Time | _ | | | | |
| | | | Assigned | | Result | Time | X77 | | | | |

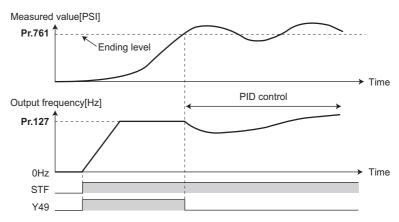
^{*1} When two or more ends conditions are satisfied, the pre-charge operation ends by the first-satisfied condition.

NOTE

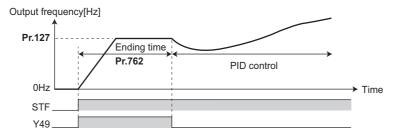
- During the pre-charge operation, it is regarded as integrated value = estimated value. The motor speed may drop shortly from the automatic switchover frequency depending on the parameter settings.
- Parameter changes and switchover to the second PID control are applied immediately. If PID control has not started when the
 settings were changed, PID control starts with changed settings. (If PID control has already started, these settings do not
 apply. If the changed settings already satisfies a condition to start PID control, the PID control starts as soon as these are
 changed.)
- The pre-charge also ends when PID control is set to invalid, the start command has been turned OFF, and output has been shut off.

♦ Example of the pre-charge operation

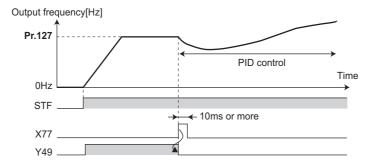
When the measured amount reaches the pre-charge ending level (Pr.761 Pre-charge ending level ≠ "9999")
 The pre-charge operation ends when the measured value reaches the Pr.761 setting or higher, then the PID control is performed.



When the elapsed time reaches the pre-charge ending time (Pr.762 Pre-charge ending time ≠ "9999")
 The pre-charge operation ends when the pre-charge time reaches the Pr.762 setting or higher, then the PID control is performed.



When the signal is input to end the pre-charge operation
 When the X77 signal turns ON, the pre-charge operation ends, and the PID control starts. (If a start command is given while the X77 signal is ON, the pre-charge operation is not performed, and PID control starts.)





- When the PID output suspension (sleep) function is in use, and the X77 signal is set to valid after this function is released, set the X77 signal to OFF after checking that the during the During pre-charge operation (Y49) signal is OFF.
- When the PID output suspension (sleep) function is in use, and PID control is to be performed immediately after this function is released, leave the X77 signal ON until PID control ends.
- When the pre-charge operation is valid, the pre-charge operation is performed at the output shutoff cancellation (MRS signal, etc.). (The pre-charge operation is also performed in the case of instantaneous power failure when the automatic restart after instantaneous power failure is valid.)
- When the control method is changed to PID control from a control with higher priority in frequency command (multi-speed setting, JOG operation, etc.), the motor is accelerated/decelerated until its speed reaches the automatic switchover frequency (Pr.127), and the pre-charge is performed.

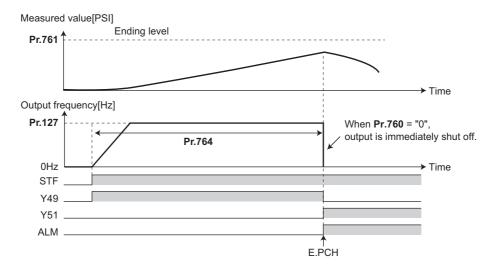
Operation setting at pre-charge fault

- The protective function can be activated when limit values are exceeded if the time limit is set at **Pr.764 Pre-charge time** limit and the measured value limit level is set at **Pr.763 Pre-charge upper detection level**.
- Whether to shut off output immediately after the protective function is activated or after a deceleration stop can be selected
 by Pr.760 Pre-charge fault selection. (Pre-charge protective function is effective regardless of the setting of pre-charge
 ending conditions.)
- When the time limit is exceeded, the Pre-charge time over (Y51) signal is output. When the measured value limit level is exceeded, the Pre-charge level over (Y53) signal is output. For the Y51 signal, set "51 (positive logic)" or "151 (negative logic)" to Pr.190 to Pr.196 (Output terminal function selection), and for the Y53 signal, set "53 (positive logic)" or "153 (negative logic)" in Pr.190 to Pr.196 (Output terminal function selection) to assign the functions to terminals.

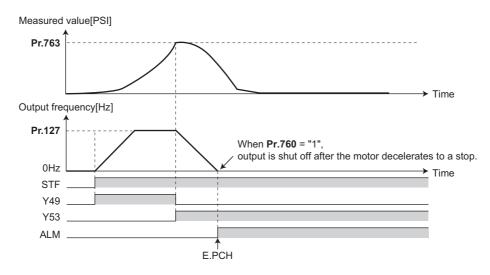


- For Pr.764 Pre-charge time limit, set a value greater than Pr.762 Pre-charge ending time.
- For Pr.763 Pre-charge upper detection level, set a value greater than Pr.761 Pre-charge ending level.

• Example of protective function by time limit (Pr.760 = "0")



• Example of protective function measured value limit (Pr.760 = "1")



Setting multiple PID pre-charge functions

- When the second pre-charge function is set, two sets of pre-charge functions can be switched for use. The second pre-charge function is enabled by the turning ON RT signal.
- The second pre-charge function parameters and signals function in the same way as the following parameters and signals of the first pre-charge function. Refer to the first pre-charge function when setting the second pre-charge functions.

| Classification First | | t pre-charge function parameters | Second pre-charge function parameters | | |
|----------------------|-----|----------------------------------|---------------------------------------|---|--|
| Ciassification | Pr. | Name | Pr. | Name | |
| | 760 | Pre-charge fault selection | 765 | Second pre-charge fault selection | |
| | 761 | Pre-charge ending level | 766 | Second pre-charge ending level | |
| Parameter | 762 | Pre-charge ending time | 767 | Second pre-charge ending time | |
| | 763 | Pre-charge upper detection level | 768 | Second pre-charge upper detection level | |
| | 764 | Pre-charge time limit | 769 | Second pre-charge time limit | |

| Classification | Firs | t pre-charge function parameters | Second pre-charge function parameters | | |
|----------------|------|----------------------------------|---------------------------------------|------------------------------------|--|
| Signal | | Name | Signal | Name | |
| Input signal | X77 | Pre-charge end command | X78 | Second pre-charge end command | |
| | Y49 | During pre-charge operation | Y50 | During second pre-charge operation | |
| Output signal | Y51 | Pre-charge time over | Y52 | Second pre-charge time over | |
| | Y53 | Pre-charge level over | Y54 | Second pre-charge level over | |



- The second PID pre-charge function is valid also when the first pre-charge function is set to invalid and the second pre-charge
- When "10" (second function enabled only during constant-speed operation) is set to Pr.155, the second PID function is not selected even if the RT signal turns ON.

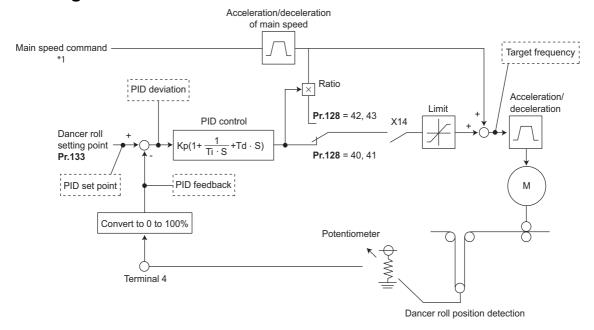
5.14.13 Dancer control

PID control is performed using detected dancer roll position as feedback data. The dancer roll is controlled to be at a designated position.

| Pr. | Name | Initial value | Setting range | ge Description | | | |
|-------------|-------------------------|---------------|---------------|--|---|--------------------------|--|
| | | | | Set the acceleration/o | deceleration time during dance | r control. | |
| 44 | Second acceleration/ | 5 s | 0 to 3600 s | In dancer control, this parameter becomes the acceleration/deceleration | | | |
| F020 | deceleration time | 0.5 | 0 10 0000 5 | time of the main spee | | <i>e</i> | |
| | | | | _ | operate as the second accelera | tion/deceleration time. | |
| | | | | | time during dancer control. s parameter becomes the dece | laration time of the | |
| 45 | Second deceleration | 9999 | 0 to 3600 s | main speed. | s parameter becomes the dece | leration time of the | |
| F021 | time | 3333 | | • | operate as the second deceler | ration time. | |
| | | | 9999 | Pr.44 is the decelerat | • | | |
| | | | 0 | No PID action | | | |
| | | | 40 | PID reverse action | Additive method: Fixed | | |
| 128 | DID action colortion | 0 | 41 | PID forward action | Additive method: Fixed | | |
| A610 | PID action selection | 0 | 42 | PID reverse action | Additive method: Ratio | For dancer control | |
| | | | 43 | PID forward action | Additive method: Ratio | | |
| | | | Others | Refer to page 601. | | | |
| | | | | | nal band is set (small paramete | | |
| | | | | | changes considerably by slight | t changes in the | |
| 129 | DID | 4000/ | 0.1 to 1000% | measured value. | improves as the proportional b | and bacomes | |
| A613 | PID proportional band | 100% | | As a result, response improves as the proportional band becomes narrower, though stability worsens as shown by the occurrence of hunting | | | |
| | | | | Gain Kp=1/proportional band | | | |
| | | | 9999 | No proportional contr | ol | | |
| | | | | With deviation step input, this is the time (Ti) used for obtaining the same | | | |
| 130 | PID integral time | | 0.1 to 3600 s | manipulated amount as proportional band (P) by only integral (I) action. | | | |
| A614 | | 1 s | 0.110 0000 0 | Arrival to the set point becomes quicker the shorter an integral time is set, | | | |
| | | | 9999 | though hunting is more likely to occur. | | | |
| | | | 9999 | No integral control | | | |
| | | | | Set the upper limit. The FUP signal is output when the feedback value exceeds this setting. | | | |
| 131 | PID upper limit | 9999 | 0 to 100% | The maximum input (20 mA/5 V/10 V) of the measured value (terminal 4) | | | |
| A601 | | | | is equivalent to 100%. | | | |
| | | | 9999 | No function | | | |
| | | | | Set the lower limit. | | | |
| 400 | | | 0 to 1000/ | The FDN signal is output when the measured value (terminal 4) falls below | | | |
| 132 A602 | PID lower limit | 9999 | 0 to 100% | the setting range. The maximum input (20 mA/5 V/10 V) of the measured value is equivalent | | | |
| A002 | | | | to 100%. | | | |
| | | | 9999 | No function | | | |
| 133 | DID action act water | 0000 | 0 to 100% | Set the set point durir | ng PID control. | | |
| A611 | PID action set point | 9999 | 9999 | | erminal selected by Pr.609 | | |
| | | | | | nput, this is the time (Td) used | | |
| 134 | | | 0.01 to 10 s | manipulated amount only by proportional action (P). | | | |
| A615 | PID differential time | 9999 | 2.01.0100 | | s in deviation increase greatly a | as the differential time | |
| - | | | 0000 | increases. | | | |
| | | | 9999 | No differential control | | | |
| | | | 1 | The set point is input | | | |
| 609 | PID set point/deviation | 2 | 2 | The set point is input through terminal 2. | | | |
| A624 | input selection | 2 | 3 | The set point is input through terminal 4. | | | |
| | | | 4 | The set point is input via communication | | | |
| | | | 5 | The set point is input by the PLC function. | | | |

| Pr. | Name | Initial value | Setting range | Description |
|--------------|------------------------------------|---------------|---------------|--|
| | | | 1 | The measured value is input through terminal 1. |
| 640 | DID management value | | 2 | The measured value is input through terminal 2. |
| 610 4625 | PID measured value input selection | 3 | 3 | The measured value is input through terminal 4. |
| A023 | | | 4 | The measured value is input via communication. |
| | | | 5 | The measured value is input by the PLC function. |
| 1134 A605 | PID upper limit manipulated value | 100% | 0 to 100% | Set the upper limit of PID action. |
| 1135 A606 | PID lower limit manipulated value | 100% | 0 to 100% | Set the lower limit of PID action. |

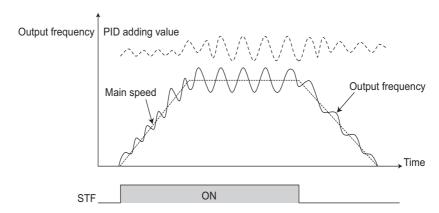
♦ Block diagram of dancer control



1 The main speed can be selected in all operation modes, External (analog voltage input, multi-speed), PU (digital frequency setting) and Communication (RS-485).

Outline of dancer control

Dancer control is performed by setting "40 to 43" in Pr.128 PID action selection. The main speed command is the speed command for each operation mode (External, PU, and communication). PID control is performed by the dancer roll position detection signal, and the control result is added to the main speed command. For the main speed acceleration/deceleration time, set the acceleration time to Pr.44 Second acceleration/deceleration time and the deceleration time to Pr.45 Second deceleration time.

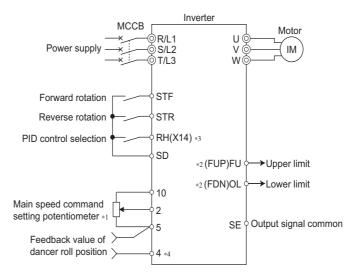




- Normally, set Pr.7 Acceleration time and Pr.8 Deceleration time to 0 s. When the Pr.7 and Pr.8 settings are large, dancer
 control response becomes slow during acceleration/deceleration.
- The **Pr.127 PID control automatic switchover frequency** setting is enabled. The larger setting value between **Pr.7** and **Pr.44** is used as the acceleration time during normal operation. For the deceleration time, the larger setting value between **Pr.8** and **Pr.45** is used. (For details on **Pr.127**, refer to page 601.)
- If an automatic restart after instantaneous power failure is activated during dancer control, E.OC[] or E.OV[] is likely to occur. In such case, disable the automatic restart after instantaneous power failure function (**Pr.57** = "9999").

Connection diagram

- · Sink logic
- Pr.128 = 41
- Pr.182 = 14
- Pr.193 = 14
- Pr.194 = 15
- Pr.133 = Set point



- *1 The main speed command differs according to each operation mode (External, PU, communication).
- *2 The applied output terminals differ by the settings of Pr.190 to Pr.196 (Output terminal function selection).
- *3 The applied input terminals differ by the settings of Pr.178 to Pr.189 (Input terminal function selection).
- *4 The AU signal need not be input.

◆ Dancer control operation selection (Pr.128)

| Pr.128 setting | PID action | Additive method | Set point input | Measured value input | |
|----------------|--------------------|-----------------|---------------------------------------|-------------------------------|--|
| 0 | PID disabled | _ | _ | _ | |
| 40 | Reverse action | Fixed | | | |
| 41 | Forward action | rixed | Set by Pr.133 or input by | Input by terminal selected by | |
| 42 | Reverse action | Ratio | terminal selected by Pr.609 *1 | Pr.610 | |
| 43 | Forward action | Ratio | | | |
| Others | Refer to page 601. | | | | |

- *1 When $Pr.133 \neq "9999"$, the Pr.133 setting is valid.
- To enable dancer control, set "40 to 43" in Pr.128 PID action selection.
- Dancer control is enabled only when the PID control valid (X14) signal turns ON when "14" is set in one of **Pr.178 to Pr.182** (Input terminal function selection) and X14 signal is assigned. When the X14 signal is not assigned, dancer control is enabled only by the **Pr.128** setting.
- Input the main speed command (External, PU, Communication). Dancer control is also supported by the main speed command in all operation modes.
- Input the set point between the terminals 2 and 5 (the setting can be selected using **Pr.133** or **Pr.609**) and input the measured value signal (dancer roll position detection signal) between the inverter terminals 4 and 5 (the setting can be selected using **Pr.610**).
- The action of **Pr.129 PID proportional band, Pr.130 PID integral time, Pr.131 PID upper limit, Pr.132 PID lower limit and Pr.134 PID differential time** is the same as PID control action. In the relationship between the control amount (%) and frequency in PID control, 0% and 100% are equivalent to the frequencies set to **Pr.902** and **Pr.903**, respectively.



- When Pr.128 is set to "0" or the X14 signal is OFF, regular inverter running not dancer control is performed.
- Dancer control is enabled by turning ON/OFF the bits of terminals assigned the X14 signal by RS-485 communication or over the network.
- When dancer control is selected, set the PID output suspension function (Pr.575 Output interruption detection time = "9999").
- When **Pr.561 PTC thermistor protection level** ≠ "9999", terminal 2 cannot be used for the main speed command. Terminal 2 becomes the PTC thermistor input terminal.

◆ Selection of set point/measured value input method (Pr.609, Pr.610)

- Select the set point input method by Pr.609 PID set point/deviation input selection and the measured value input method by Pr.610 PID measured value input selection. Switch the power voltage/current specifications of terminals 2 and 4 by Pr.73 Analog input selection or Pr.267 Terminal 4 input selection to match the specification of the input device.
- When Pr.133 PID action set point ≠ "9999", Pr.133 is the set point. When the set point is set at Pr.133, the setting frequency of Pr.902 is equivalent to 0% and the setting frequency of Pr.903 is equivalent to 100%.

| Pr.609, Pr.610 settings | Input method | | | |
|-------------------------|--------------------------|--|--|--|
| 1 | Terminal 1 ^{*1} | | | |
| 2 | Terminal 2 ^{*1} | | | |
| 3 | Terminal 4 ^{*1} | | | |
| 4 | Communication*2 | | | |
| 5 | PLC function | | | |

- *1 When the same input method has been selected for the set point and measured value at **Pr.609** and **Pr.610**, set point input is invalid. (Inverter runs at set point 0%)
- *2 CC-Link, CC-Link IE Field Network, or LONWORKS communication is available. For details on communication, refer to the Instruction Manual of each option.



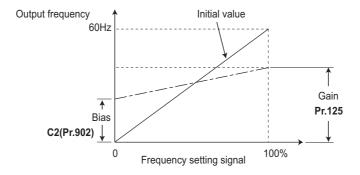
- After changing the **Pr.73 or Pr.267** settings, check the voltage/current input selection switch. Incorrect setting may cause a fault, failure or malfunction. (Refer to page 496 for the setting.)
- When terminals 2 and 4 are selected for deviation input, perform bias calibration using **C3** and **C6** to prevent a minus voltage from being entered as the deviation input signal. Input of a minus voltage might damage devices and the inverter.
- The following shows the relationship between the input values of the analog input terminals, and the set point and measured value.

| Input terminal | Input | Relationship w | vith analog input | Calibration parameter |
|----------------|-----------------|----------------------------------|----------------------------------|--|
| input terminai | specification*3 | Set point | Result | Calibration parameter |
| | 0 to 5 V | 0 V = 0% 5 V = 100% | 0 V = 0% 5 V = 100% | |
| Terminal 2 | 0 to 10 V | 0 V = 0% 10 V = 100% | 0 V = 0% 10 V = 100% | Pr.125, C2 to C4 |
| | 0 to 20 mA | 0 mA = 0% 20 mA = 100% | 0 mA = 0% 20 mA = 100% | |
| Terminal 1 | 0 to ±5 V | -5 to 0 V = 0% +5 V = +100% | -5 to 0 V = 0% +5 V = +100% | When Pr.128 = "10", Pr.125 setting, C2 to C4. |
| Terrilliai i | 0 to 10 V | -10 to 0 V = 0% +10 V = +100% | -10 to 0 V = 0% +10 V = +100% | When Pr.128 ≥ "1000", C12 setting, C2 to C15 . |
| | 0 to 5 V | 0 to 1 V = 0% 5 V = 100% | 0 to 1 V = 0% 5 V = 100% | |
| Terminal 4 | 0 to 10 V | 0 to 2 V = 0% 10 V = 100% | 0 to 2 V = 0% 10 V = 100% | Pr.126, C5 to C7 |
| | 0 to 20 mA | 0 to 4 mA = 0% 20 mA = 100% | 0 to 4 mA = 0% 20 mA = 100% | |

^{*3} Can be changed by Pr.73 and Pr.267 and the voltage/current input switch. (Refer to page 496.)

◆ Selection of additive method for PID calculation result

When ratio is selected as the additive method (Pr.128 = "42, 43"), PID calculation result × (ratio of main speed) is added to the main speed. The ratio is determined by the Pr.125 Terminal 2 frequency setting gain frequency and C2 (Pr.902) Terminal 2 frequency setting bias frequency settings. In the initial status, 0 to 60 Hz is set for 0 to 100%. Thus, 60 Hz main speed is regarded as 100%, and the 30 Hz main speed is regarded as 50%.



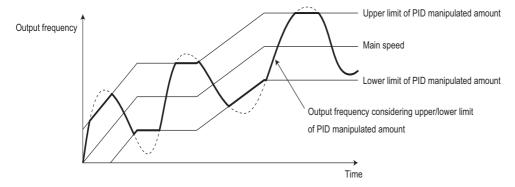


- Even if C4 (Pr.903) is set to other than 100%, the frequency setting signal is treated as 100%.
- Even if C3 (Pr.902) is set to other than 0%, the frequency setting signal is treated as 0%.
- If C2 (Pr.902) is set to other than 0 Hz, the frequency setting signal is 0% at the C2 (Pr.902) frequency setting or below.

Setting the upper and lower limits of the PID manipulated amount (Pr.1134, Pr.1135)

- · Set the upper and lower limits of the PID manipulated amount.
- The upper limit of the manipulated amount is the frequency obtained by adding the value resulting from frequency conversion of **Pr.1134** to the main speed.

The lower limit of the manipulated amount is the frequency obtained by subtracting the value resulting from frequency conversion of **Pr.1135** from the main speed.



◆ Input/output signals

- The following signals can be used by assigning functions to Pr.178 to Pr.189 (Input terminal function selection) and Pr.190 to Pr.196 (Output terminal function selection).
- · Input signal

| Signal | Function | Pr.178 to Pr.189 setting | Description |
|--------|--|--------------------------------|---|
| X14 | PID control valid | 14 | When this signal is assigned to the input terminal, PID control is enabled when this signal is ON. |
| X64 | PID forward/ reverse action switchover | 64 | PID control is switched between forward and reverse action without changing parameters by turning ON this signal. |
| X72 | PID P control switchover | 72 | Integral and differential values can be reset by turning ON this signal. |

· Output signal

| Signal | Function | Pr.190 to Pr.196 setting | | Description |
|--------|-------------------------------------|-----------------------------|-------------------|--|
| Signal | runction | Positive logic | Negative logic | Description |
| FUP | PID upper limit | 15 | 115 | Output when the measured value signal exceeds Pr.131 PID upper limit (Pr.1143 Second PID upper limit). |
| FDN | Lower limit output | 14 | 114 | Output when the measured value signal falls below Pr.132 PID lower limit (Pr.1144 Second PID lower limit). |
| RL | PID forward/reverse rotation output | 16 | 116 | "Hi" is output when the output display of the parameter unit is forward rotation (FWD) and "Low" is output when the display is reverse rotation (REV) and stop (STOP). |
| PID | During PID control activated | 47 | 147 | Turns ON during PID control. |



• Changing the terminal functions with **Pr.178 to Pr.189 and Pr.190 to Pr.196** may affect other functions. Set parameters after confirming the function of each terminal.

PID monitor function

- This function displays the PID control set point and measured value on the operation panel, and can output these from the terminals FM, AM, and CA.
- Set the following values to Pr.52 Operation panel main monitor selection, Pr.774 to Pr.776 (Operation panel monitor selection), Pr.992 Operation panel setting dial push monitor selection, Pr.54 FM/CA terminal function selection and Pr.158 AM terminal function selection for each monitor.

| Parameter | Monitor | Minimum | Monitor range | | | | |
|-----------|-----------------------|-----------|-------------------|----------------|--|---------|--|
| Setting | description | increment | Terminal FM/CA | Terminal AM | Operation panel | Remarks | |
| 97 | Dancer main set speed | 0.01 Hz. | 0 to 590 Hz | | When outputting through terminals FM, 0 90 Hz AM, the full scale value can be adjusted Frequency monitoring reference. | | |



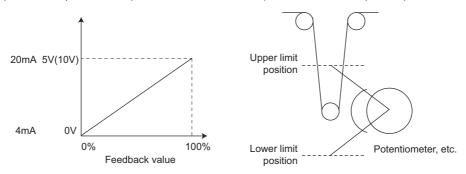
• Refer to page 610 for details on other PID control monitors.

◆ Priority of main speed commands

- The priority of main speed command sources when the speed command source is External is as follows:
 JOG signal > multi-speed setting signal (RL/RM/RH/REX) > pulse train input > 16-bit digital input (option FR-A8AX) > analog input (terminals 2, 4, 1)
- The priority of main speed command sources when "3" is set to **Pr.79 Operation mode selection** is as follows: Multi-speed setting signal (RL/RM/RH/REX) > frequency setting (digital setting by PU or operation panel)
- Even if the remote operation function is selected by **Pr.59 Remote function selection** ≠ "0", compensation of the remote setting frequency against the main speed is ignored. (The value is "0".)
- If terminal 1 is selected for the first and second PID, terminal 1 added compensation of the main speed is invalid.
- If terminal 2 is selected for the first and second PID, the terminal 2 override function of the main speed is invalid.
- If the same terminal as an external input terminal having a speed command source (external terminal where a main speed is input) is specified as the measured value input or set point input, the main speed is treated as "0".
- · Polarity reversible operation of the main speed is not possible.
- Setting "10 to 17" in Pr.73 Analog input selection enables the polarity reversible operation of the main speed command to which PID manipulated amount added. (Polarity reversible operation of the main speed command without addition is not possible.)
- When the polarity reversible operation is enabled, the integral term cannot be limited by the maximum and minimum frequency when **Pr.1015 Integral stop selection at limited frequency** = "0 or 10".

◆ Adjustment procedure for dancer roll position detection signal

• When the input of terminal 4 is voltage input, 0 V and 5 V (10 V) are the lower limit position and upper limit position, respectively (initial value). When it is current input, 4 mA and 20 mA are the lower limit position and upper limit position, respectively (initial value). When the potentiometer has an output of 0 to 7 V, C7 (Pr.905) must be calibrated at 7 V.



(Example) To execute control at the dancer center position using a 0 to 7 V potentiometer

- **1.** Switch the current/voltage input selection switch to "OFF", set "2" to **Pr.267** and set terminal 4 input to voltage input.
- 2. Input 0 V across terminals 4 and 5, and calibrate C6 (Pr.904). (The % display that is indicated at analog calibration is not related to the % of the feedback value.)
- **3.** Input 7 V across terminals 4 and 5, and calibrate **C6 (Pr.905)**. (The % display that is indicated at analog calibration is not related to the % of the feedback value.)
- **4.** Set **Pr.133** to "50%".



- After changing the Pr.267 setting, check the voltage/current selection switch. Incorrect setting may cause a fault, failure or malfunction. (Refer to page 496 for the setting.)
- If the Multi-speed operation (RH, RM, RL, or REX) signal, or JOG signal is input during regular PID control, PID control is interrupted. However, at dancer control, these signals are treated as main speed commands, so PID control is continued.
- During dancer control, **Pr.44 and Pr.45** (Second acceleration/deceleration time) is the parameter for setting the acceleration/deceleration time for the main speed command. This function does not work as a second function.
- When the switchover mode is set by setting "6" to Pr.79, dancer control (PID control) is invalid.
- The acceleration/deceleration action of the main speed command is the same as that when the frequency is increased or decrease by analog input. The SU signal sometimes stays ON even if operation is turned ON/OFF by the start signal. The set frequency monitor is the value "main speed command + PID control" which is constantly changing.
- With the main speed setting frequency setting, acceleration/deceleration is performed for the acceleration/deceleration time set in Pr.45, and with the output frequency setting, acceleration/deceleration is performed for the acceleration/deceleration time set in Pr.7 and Pr.8. For this reason, with the output frequency, when the time set in Pr.7 and Pr.8 is longer than the time set in Pr.44 and Pr.45, acceleration/deceleration is performed for the acceleration/deceleration time set in Pr.7 and Pr.8
- The limit of the integral term is the smaller of 100% and the value after conversion of the straight line after interpolation of Pr.1
 Maximum frequency by Pr.902 and Pr.903 to the PID manipulated amount.

However, note that the lower limit frequency limits the output frequency, but does not restrict the action of the integral item.

Parameters referred to

Pr.57 Restart coasting time □ page 628
Pr.59 Remote function selection □ page 377
Pr.73 Analog input selection □ page 496
Pr.79 Operation mode selection □ page 389
Pr.178 to Pr.189 (Input terminal function selection) □ page 521
Pr.190 to Pr.196 (Output terminal function selection) □ page 473
Pr.561 PTC thermistor protection level □ page 415
C2 (Pr.902) to C7 (Pr.905) Frequency setting voltage (current) bias/gain □ page 505

5.14.14 Automatic restart after instantaneous power failure/flying start with an induction motor



The inverter can be restarted without stopping the motor operation in the following situations:

- · When switching from commercial power supply operation over to inverter running
- · When an instantaneous power failure occurs during inverter running
- · When the motor is coasting at start

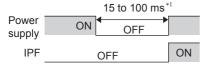
| Pr. | Name | Initial value | Setting range | Description |
|-------------|--|------------------|---------------|--|
| | | | 0, 1000 | Frequency search only performed at the first start |
| | | | 1, 1001 | Reduced voltage start only at the first start (no frequency search) |
| | | | 2, 1002 | Encoder detection frequency search |
| 162 | Automatic restart after instantaneous power | 0 | 3, 1003 | Frequency search only performed at the first start (reduced impact restart) |
| A700 | failure selection | U | 10, 1010 | Frequency search at every start |
| | | | 11, 1011 | Reduced voltage start at every start (no frequency search) |
| | | | 12, 1012 | Encoder detection frequency search at every start |
| | | | 13, 1013 | Frequency search at every start (reduced impact restart) |
| | | | 0 | Rotation direction detection disabled |
| | Rotation direction | | 1 | Rotation direction detection enabled |
| 299 A701 | detection selection at | | 9999 | When Pr.78 Reverse rotation prevention selection = "0", with rotation direction detection When Pr.78 Reverse rotation prevention selection= "1 or 2", without rotation direction detection |
| | | | 0 | Coasting time differs according to the inverter capacity.*1 |
| 57 A702 | Restart coasting time | 9999 | 0.1 to 30 s | Set the time delay for the inverter to perform a restart after restoring power due to an instantaneous power failure. |
| | | | 9999 | No restart |
| 58 A703 | Restart cushion time | 1 s | 0 to 60 s | Set the voltage cushion time for restart. |
| 163 A704 | First cushion time for restart | 0 s | 0 to 20 s | Set the voltage cushion time for restart. |
| 164 A705 | First cushion voltage for restart | 0% | 0 to 100% | Consider this matched to the size of the load amount (moment of inertia/ torque). |
| 165 A710 | Stall prevention operation level for restart | 150% | 0 to 400% | Set the stall prevention level at restart operation on the assumption that the inverter rated current is 100%. |
| 611 | Acceleration time at a | 0000 | 0 to 3600 s | Set the acceleration time to reach Pr.20 Acceleration/deceleration reference frequency at restart. |
| F003 | restart | 9999 | 9999 | Standard acceleration time (for example, Pr.7) is applied as the acceleration time at restart. |

*1 The coasting time when **Pr.57** = "0" is as shown below. (When **Pr.162** and Pr.570 are set to the initial value.) FR-A820-00105(1.5K) or lower and FR-A840-00052(1.5K) or lower: 0.5 s FR-A820-00167(2.2K) to FR-A820-00490(7.5K) and FR-A840-00083(2.2K) to FR-A840-00250(7.5K): 1 s FR-A820-00630(11K) to FR-A820-03160(55K), FR-A840-00310(11K) to FR-A840-01800(55K): 3.0 s FR-A820-03800(75K) or higher and FR-A840-02160(75K) or higher: 5.0 s

Point P

- To operate the inverter with the automatic restart after instantaneous power failure function enabled, check the following points.
- Set Pr.57 Restart coasting time = "0".
- When the Selection of automatic restart after instantaneous power failure / flying start (CS) signal is assigned to the input terminal, restart operation is enabled at turn-ON of the CS signal.

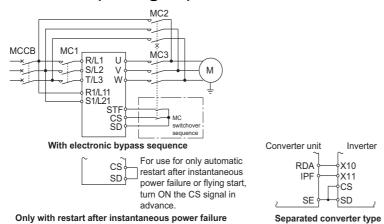
◆ Automatic restart after instantaneous power failure function



- *1 10 to 100 ms for IP55 compatible models
- The inverter output is shut off at the activation of the Instantaneous power failure (E.IPF) or Undervoltage (E.UVT). (Refer to page 788 for E.IPF or E.UVT.)
- When E.IPF or E.UVT is activated, the Instantaneous power failure/undervoltage (IPF) signal is output.
- The IPF signal is assigned to terminal IPF in the initial status. By setting "2 (positive logic) or 102 (negative logic)" in any of **Pr.190 to Pr.196 (Output terminal function selection)**, the IPF signal can be assigned to another terminal.

• When the automatic restart after instantaneous power failure function is selected, motor driving is resumed at the power restoration after an instantaneous power failure or undervoltage. (E.IPF and E.UVT are not activated.)

◆ Connection (CS signal)



- Restart is enabled at turn-ON of the Selection of automatic restart after instantaneous power failure / flying start (CS) signal.
- The inverter operation is disabled at turn-OFF of the CS signal while Pr.57 Restart coasting time ≠ "9999" (with restart).
- Separated converter types detect the instantaneous power failure on the converter unit side. Perform wiring so that the IPF signal transmitted from the converter unit is input to the terminal to which the X11 signal is assigned.
 On the converter unit side, enable the restart operation. (For setting the converter unit, refer to the Instruction Manual of the converter unit.)
- For the terminal used for the X10 or X11 signal, set "10" (X10) or "11" (X11) in **Pr.178 to Pr.189** and assign the function. (For separated converter types, the X10 signal is assigned to the terminal MRS in the initial setting.)
- For the X10 signal of separated converter types, NC contact input specification is selected in the initial setting. Set **Pr.599** = "0" to change the input specification to NO contact.



- The CS signal is assigned to terminal CS in the initial setting. By setting "6" to any of **Pr.178 to Pr.189** (Input terminal function selection), the CS signal can be assigned to other terminals. Changing the terminal assignment may affect other functions. Set parameters after confirming the function of each terminal.
- If the CS signal is not assigned to any input terminal, solely setting Pr.57 enables the restart operation at all times.

◆ Setting for the automatic restart after instantaneous power failure operation (Pr.162)

• The **Pr.162** settings and the instantaneous power failure automatic restart operation under each operation mode are as shown in the following table.

| | | Automati | c restart operation | selection after insta | selection after instantaneous power failure | | | |
|-------------------|-------------------|--|---|----------------------------------|---|-------------------------------------|---|--|
| Pr.162 setting | Restart timing | V/F control, Advanced magnetic flux vector control | | Real sensorless vector control | Vector control | PM sensorless vector control | CS signal command source selection | |
| | | Without encoder | With encoder | | | | | |
| 0 (initial value) | | Frequency search | Frequency search | | | | | |
| 1 | | Reduced voltage start | Reduced voltage start | | | | | |
| 2 | At first start | Frequency search | Encoder detection frequency search | | | | | |
| 3 | | Frequency search (reduced impact restart) | Frequency search (reduced impact restart) | | | | Always External | |
| 10 | | Frequency search | Frequency search | | | | | |
| 11 | | Reduced voltage start | Reduced voltage start | | | | | |
| 12 | At every start | Frequency search | Encoder detection frequency search | | Encoder detection | Frequency search for PM motor | | |
| 13 | | Frequency search (reduced impact restart) | Frequency search (reduced impact restart) | Frequency search (reduced impact | | | | |
| 1000 | | Frequency search | Frequency search | restart) | frequency search | (Refer to page | | |
| 1001 | | Reduced voltage start | Reduced voltage start | | 000.011 | 635.) | | |
| 1002 | At first start | Frequency search | Encoder detection frequency search | | | | | |
| 1003 | | Frequency search (reduced impact restart) | Frequency search (reduced impact restart) | | | | Determined by the Pr.338 | |
| 1010 | | Frequency search | Frequency search | | | | setting | |
| 1011 | | Reduced voltage start | Reduced voltage start | | | | | |
| 1012 | At every start | Frequency search | Encoder detection frequency search | | | | | |
| 1013 | | Frequency search (reduced impact restart) | Frequency search (reduced impact restart) | | | | | |

◆ Restart operation with frequency search (Pr.162 = "0, 3, 10, 13, 1000, 1003, 1010, or 1013", Pr.299)

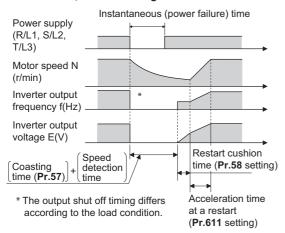
- When **Pr.162** = "0 (initial value), 3, 10, 13, 1000, 1003, 1010, or 1013", the motor speed is detected at a power restoration so that the motor can re-start smoothly.
- The encoder also detects the rotation direction so that the inverter can re-start smoothly even during the reverse rotation.
- Whether or not to detect the rotation direction can be selected by **Pr.299 Rotation direction detection selection at restarting**. If the motor capacity is different from the inverter capacity, set **Pr.299** = "0" (no rotation direction detection).
- When the rotation direction is detected, the following operation is performed according to **Pr.78 Reverse rotation** prevention selection setting.

| Dr 200 potting | Pr.78 setting | | | | | | |
|-------------------|---------------|---|---|--|--|--|--|
| Pr.299 setting | 0 | 1 | 2 | | | | |
| 9999 | 0 | × | × | | | | |
| 0 (initial value) | × | × | × | | | | |
| 1 | 0 | 0 | 0 | | | | |

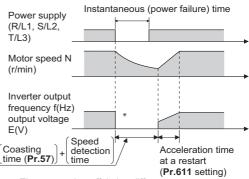
o: With rotation direction detection x: Without rotation direction detection

• By setting "3, 13, 1003, or 1013" in **Pr.162**, the restart can be made smoother with even less impact than when "0, 10, 1000, or 1010" is set in **Pr.162**. When the inverter is restarted with "3, 13, 1003, or 1013" set in **Pr.162**, offline auto tuning is required. (For details on offline auto tuning of Advanced magnetic flux vector control and Real sensorless vector control, refer to page 532, and for details on offline auto tuning of V/F control, refer to page 638.)

V/F control, Advanced magnetic flux vector control



Real sensorless vector control



* The output shut off timing differs according to the load condition.

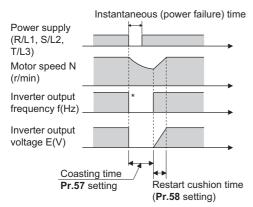


- The rotation speed detection time (frequency search) changes according to the rotation speed of the motor. (maximum 1 s)
- When the inverter capacity is two ranks or greater than the motor capacity, the overcurrent protective function (E.OC[]) is sometimes activated and prevents the inverter from restarting.
- If two or more motors are connected to one inverter, this function operates abnormally. (The inverter does not restart successfully.)
- Because a DC injection brake is applied instantaneously at speed detection during a restart, the speed might drop if the moment of inertia (J) of the load is small.
- If reverse operation is detected when "1" (reverse rotation disabled) is set to **Pr.78**, operation decelerates by reverse rotation and then changes to forward rotation when the start command is forward rotation. The inverter does not restart when the start command is reverse rotation.
- When "3, 13, 1003, or 1013" is set to Pr.162, limit the wiring length to within 100 m.

◆ Restart operation without frequency search (Pr.162 ="1, 11, 1001, or 1011")

• When **Pr.162** = "1 11, 1001, or 1011", reduced voltage start is used for the restart operation. In this method, the voltage is raised gradually while keeping the output frequency level at the level before an instantaneous power failure, regardless of the motor's coasting speed.

V/F control, Advanced magnetic flux vector control



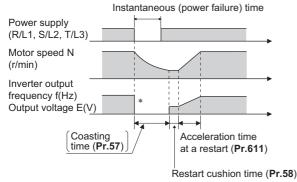
* The output shut off timing differs according to the load condition.



- This restart method uses the output frequency that was active before the instantaneous power failure stored in memory. If the instantaneous power failure time is 0.2 s or more, the output frequency can no longer be stored and held in memory, so the restart is performed from **Pr.13 Starting frequency** (initial value: 0.5 Hz).
- During Real sensorless vector control, Pr.162 is set to "3, 13, 1003, or 1013" (reduced impact restart).

◆ Restart operation with encoder detection frequency search (Pr.162 = "2, 12, 1002, or 1012")

- When "2, 12, 1002, or 1012" is set in **Pr.162** by encoder feedback control, the inverter is restarted by the motor speed and direction of rotation that were detected by the encoder at the power restoration.
- By encoder detection frequency search, the Pr.299 Rotation direction detection selection at restarting setting are invalid.



* The output shut off timing differs according to the load condition.

NOTE

- When "2, 12, 1002, or 1012" are set in **Pr.162** when encoder feedback control is invalid, the automatic restart is with a frequency search (**Pr.162** = "0, 10, 1000, or 1010").
- In Vector control, encoder detection frequency search is used regardless of the Pr.162 setting. The Pr.58 and Pr.299 settings
 are invalid at this time.
- For the encoder feedback control, refer to page 736.

◆ Restart at every start (Pr.162 ="10 to 13, or 1010 to 1013")

When "10 to 13, or 1010 to 1013" is set in Pr.162, a restart operation is performed at each start and automatic restart after instantaneous power failure (after the time period set in Pr.57 elapsed). When "0 (initial value) to 3, or 1000 to 1003" is set in Pr.162, a restart operation is performed at the first start after a power-ON, and from the second power-ON onwards, a start from the starting frequency is performed.

◆ Automatic restart operation of the MRS (X10) signal

• The restart operation after restoration from output shutoff by the MRS (X10) signal is as shown in the following table according to the **Pr.30** setting.

| Pr.30 setting | Operation after restoration from output shutoff by the MRS (X10) signal |
|--------------------------|---|
| 2, 10, 11, 102, 110, 111 | Restart operation (starting from the coasting speed) |
| Other than the above | Starting from Pr.13 Starting frequency. |



• When output is shut off using safety stop function (terminals S1 and S2), the inverter restarts in the same way as when output is shut off by the MRS (X10) signal.

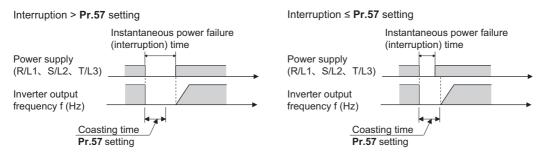
◆ Adjustment of restart coasting time (Pr.57)

• Restart coasting time is the time period from the occurrence of instantaneous power failure until the operation is restarted after power is restored.

With frequency search, the motor speed is detected and operation is restarted after the coasting time.

• To enable restart operation, set "0" to Pr.57 Restart coasting time. If "0" is set to Pr.57, the coasting time is automatically set to the following number of seconds. Generally, this setting does not interfere with inverter operation.

| | | 200 V class FR-A820-[] | | | | | | | | | | | | | | | | |
|---------|---------------------------------------|------------------------|------------------|-----------------|-----|-----------------|-----------------|--------|----------------|----------------|-------------------------------|----------------|----------------|----------------|----------------|----------------|----------------|-----------------------------|
| Pr.570 | Pr.162 | 00046 (0.4K) | 00077 (0.75K) | | | 00250 (3.7K) | | (7.5K) | (11K) | (15K) | 00930 (18.5K) R-A840-[] | 01250 (22K) | | 01870 (37K) | 02330 (45K) | 03160 (55K) | 03800 (75K) | 04750 (90K) |
| setting | setting | 00023 (0.4K) | 00038 (0.75K) | 00052 (1.5K) | | | 00170 (5.5K) | | 00310 (11K) | 00380 (15K) | 00470 (18.5K) | 00620 (22K) | 00770 (30K) | 00930 (37K) | 01160 (45K) | 01800 (55K) | 02160 (75K) | 02600 (90K) or higher |
| | Other than 3, 13, 1003, 1013 | 0.5 | 0.5 | 1 | 1 | 1 | 1 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 5 | 5 | 5 |
| i (LD) | 3, 13, 1003, 1013 | 1 | 1 | 2 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 5 | 5 | 5 |
| | Other than 3, 13, 1003, 1013 | 0.5 | 0.5 | 0.5 | 1 | 1 | 1 | 1 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 5 | 5 |
| | 3, 13, 1003, 1013 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 5 | 5 |
| | Other than 3, 13, 1003, 1013 | 0.5 | 0.5 | 0.5 | 0.5 | 1 | 1 | 1 | 1 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 5 |
| | 3, 13, 1003, 1013 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 5 |



- · Inverter operation is sometimes hindered by the size of the moment of inertia (J) of the load, output frequency, or the residual magnetic flux in the motor. Adjust this coasting time within the range 0.1 to 30 seconds to match the load specification.
- Set 3 seconds or more time delay when the sine wave filter is used (Pr.72 PWM frequency selection = "25").



• Note that the coasting time setting is different from that of the FR-A700 series inverter. (Refer to page 856.)

Restart cushion time (Pr.58)

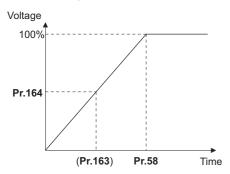
- · The cushion time is the time taken to raise the voltage to the level required for the specified speed after the motor speed detection (output frequency before the instantaneous power failure when Pr.162 = "1, 11, 1001, or 1011").
- · Normally, the motor runs at the initial value as it is. However, adjust to suit the moment of inertia (J) of the load or the size of the torque.



• Pr.58 is invalid under Real sensorless vector control or Vector control.

◆ Adjustment of restart operation (Pr.163 to Pr.165, Pr.611)

• The voltage cushion time at a restart can be adjusted by Pr.163 and Pr.164 as shown in the figure on the left.



- The stall prevention operation level at a restart operation can be set in Pr.165.
- Using **Pr.611**, the acceleration time to reach **Pr.20 Acceleration/deceleration reference frequency** after a restart operation can be set. This can be set individually from the normal acceleration time.

→ NOTE

- Pr.163 to Pr.165 are invalid under Real sensorless vector control and Vector control.
- Changing the Pr.21 setting does not affect the Pr.611 setting increment.
- Changing the terminal assignment using **Pr.178 to Pr.189 (Input terminal function selection)** may affect the other functions. Set parameters after confirming the function of each terminal.
- When the restart operation is selected, Undervoltage (E.UVT) and Instantaneous power failure (E.IPF) of the fault output signals become invalid.
- The SU and FU signals are not output during the restart. These signals are output after the restart cushion time passes.
- · Restart operation is also performed after the inverter reset is released or after the retry by the retry function occurs.
- The automatic restart after instantaneous power failure function is invalid when the load torque high-speed frequency control (**Pr.270** = "2, 3, or 13") is set.

Operation command source selection for the CS signal during communication operation (Pr.162 = "1000 to 1003, 1010 to 1013")

• When "1000 to 1003, or 1010 to 1013" is set in **Pr.162**, the CS signal input via communication is enabled depending on the setting in **Pr.338 Communication operation command source**. (When **Pr.162** = "0 to 3, or 10 to 13", the CS signal can be input via an external terminal only.)

^CAUTION

- Provide a mechanical interlock for MC1 and MC2. The inverter will be damaged if power supply is input to the inverter output section.
- When the automatic restart after instantaneous power failure function is selected, the motor suddenly starts (after reset time passes) when an instantaneous power failure occurs. Stay away from the motor and machinery.
 Apply the supplied CAUTION stickers to easily visible places when automatic restart after instantaneous power failure has been selected.

Parameters referred to

Pr.7 Acceleration time, Pr.21 Acceleration/deceleration time increments □ page 367 Pr.13 Starting frequency □ page 381, page 382 Pr.65, Pr.67 to Pr.69 Retry function □ page 426 Pr.78 Reverse rotation prevention selection □ page 406 Pr.178 to Pr.189 (Input terminal function selection) □ page 521

5.14.15 Automatic restart after instantaneous power failure/flying start with a PM motor

PM

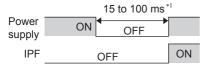
When using the IPM motor MM-CF, the inverter operation can be restarted without stopping the motor operation.

When the automatic restart after instantaneous power failure function is selected, the motor driving is resumed in the following situations:

- · When power comes back ON during inverter driving after an instantaneous power failure
- · When the motor is coasting at start

| Pr. | Name | Initial value | Setting range | Description | | |
|------------|--|---------------|---------------------------|---|--|--|
| | | | 0 | No delay | | |
| 57 A702 | Restart coasting time | 9999 | 0.1 to 30 s | Set the delay time for the inverter to perform a restart after restoring power due to an instantaneous power failure. | | |
| | | | 9999 | No restart | | |
| 162 | Automatic restart after | 0 | 0 to 3, 1000 to 1003 | Frequency search only performed at the first start | | |
| A700 | A700 instantaneous power failure selection | | 10 to 13, 1010 to 1013 | Frequency search at every start | | |
| 611 | Acceleration time at a | 9999 | 0 to 3600 s | Set the acceleration time to reach Pr.20 Acceleration/deceleration reference frequency at restart. | | |
| F003 | restart | ਬਬਬਬ | 9999 | Standard acceleration time (for example, Pr.7) is applied as the acceleration time at restart. | | |

Automatic restart after instantaneous power failure function



*1 10 to 100 ms for IP55 compatible models

- The inverter output is shut off at the activation of the Instantaneous power failure (E.IPF) or Undervoltage (E.UVT). (Refer
 to page 779 for E.IPF or E.UVT.)
- When E.IPF or E.UVT is activated, the Instantaneous power failure/undervoltage (IPF) signal is output.
- The IPF signal is assigned to terminal IPF in the initial status. By setting "2 (positive logic) or 102 (negative logic)" in any of **Pr.190 to Pr.196 (Output terminal function selection)**, the IPF signal can be assigned to another terminal.
- When the automatic restart after instantaneous power failure function is selected, motor driving is resumed at the power restoration after an instantaneous power failure or undervoltage. (E.IPF and E.UVT are not activated.)

◆ Connection (CS signal)

- When the Selection of automatic restart after instantaneous power failure / flying start (CS) signal is assigned to an input terminal (initial setting), a restart operation is enabled at turn-ON of the CS signal.
- The inverter operation is disabled at turn-OFF of the CS signal while Pr.57 Restart coasting time ≠ "9999" (with restart).

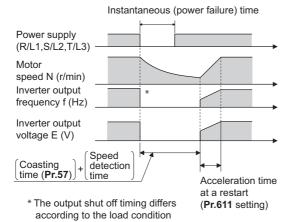


- The CS signal is assigned to terminal CS in the initial setting. By setting "6" to any of **Pr.178 to Pr.189** (Input terminal function selection), the CS signal can be assigned to other terminals. Changing the terminal assignment may affect other functions. Set parameters after confirming the function of each terminal.
- If the CS signal is not assigned to any input terminal, solely setting Pr.57 enables the restart operation at all times.
- If the restart operation is selected, instantaneous power failure (E.IPF) is disabled while the fault output signal is output at an instantaneous power failure.
- The SU and FU signals are not output during the restart. These signals are output after the restart cushion time passes.
- · Restart operation is also performed after the inverter reset is released or after the retry by the retry function occurs.
- The automatic restart after instantaneous power failure function is invalid when the load torque high-speed frequency control (**Pr.270** = "2, 3, 13") is set.

◆ Selection of restart operation (Pr.162)

- At a power restoration, the encoder detects the motor speed by a frequency search so that the inverter can re-start smoothly.
- The encoder also detects the rotation direction so that the inverter can re-start smoothly even during the reverse rotation.

When "10 to 13, or 1010 to 1013" is set in Pr.162, a restart operation is performed at each start and automatic restart after instantaneous power failure. When "0 to 2, or 1000 to 1002" is set in Pr.162, a restart operation is performed at the first start after a power-ON, and from the second power-ON onwards, a start from the starting frequency is performed.





- Because a DC injection brake is applied instantaneously at speed detection during a restart, the speed might drop if the moment of inertia (J) of the load is small.
- · Restart operation with reduced voltage is not available for PM sensorless vector control.

◆ Restart coasting time (Pr.57)

- · Coasting time is the time from the motor speed detection to the restart operation start.
- To enable restart operation, set "0" (no coasting time) in **Pr.57 Restart coasting time**. Generally, this setting does not interfere with inverter operation.
- Inverter operation is sometimes hindered by the size of the moment of inertia (J) of the load or the output frequency. Adjust this coasting time within the range 0.1 to 30 seconds to match the load specification.

◆ Adjustment of restart operation (Pr.611)

• Using **Pr.611**, the acceleration time to reach **Pr.20 Acceleration/deceleration reference frequency** after a restart operation can be set. This can be set individually from the normal acceleration time.



- Changing the Pr.21 Acceleration/deceleration time increments setting does not affect the Pr.611 setting increment.
- An IPM motor is a motor with interior permanent magnets. Regression voltage is generated when the motor coasts at an instantaneous power failure or at a flying start. The inverter's DC bus voltage rises if the motor coasts fast or makes a flying start in this condition.

When using the automatic restart after instantaneous power failure function (**Pr.57** ≠ "9999"), it is recommended to also use the regenerative avoidance function (**Pr.882 Regeneration avoidance operation selection** = "1") to make startups stable. If the overvoltage protective function (E.OV[]) still occurs with the regeneration avoidance function, also use the retry function (**Pr.67**).

• During PM sensorless vector control, the automatic restart after instantaneous power failure function operates only when an IPM MM-CF motor is connected.

When a built-in brake or a regeneration unit is used, the frequency search may not be available at 2200 r/min or higher. The restart operation cannot be performed until the motor speed drops to a frequency where the frequency search is available.

♠ CAUTION

- An IPM motor is a motor with interior permanent magnets. High voltage is generated at motor terminals while the motor is running.
 - Do not touch motor terminals and other parts until the motor stops to prevent an electric shock.
- When the automatic restart after instantaneous power failure function is selected, the motor suddenly starts (after reset time passes) when an instantaneous power failure occurs.
 - Stay away from the motor and machinery.

Apply the supplied CAUTION stickers to easily visible places when automatic restart after instantaneous power failure has been selected.

Parameters referred to

Pr.13 Starting frequency page 381, page 382
Pr.65, Pr.67 to Pr.69 Retry function page 426
Pr.78 Reverse rotation prevention selection page 406
Pr.178 to Pr.189 (Input terminal function selection) page 521
Pr.882 Regeneration avoidance operation selection page 732

5.14.16 Offline auto tuning for a frequency search



Under V/F control or when driving the IPM motor MM-CF, the accuracy of the "frequency search", which is used to detect the motor speed for the automatic restart after instantaneous power failure and flying start, can be improved.

| Pr. | Name | Initial value | Setting range | Description | | |
|--------------------|---|------------------|--|--|--|--|
| | | | 0, 1000 | Frequency search only performed at the first start | | |
| | | | 1, 1001 | Reduced voltage start only at the first start (no frequency search) | | |
| | | | 2, 1002 | Encoder detection frequency search | | |
| 162 A700 | Automatic restart after instantaneous power | 0 | 3, 1003 | Frequency search only performed at the first start (reduced impact restart) | | |
| A700 | failure selection | | 10, 1010 | Frequency search at every start | | |
| | ianure selection | | 11, 1011 | Reduced voltage start at every start (no frequency search) | | |
| | | | 12, 1012 | Encoder detection frequency search at every start | | |
| | | | 13, 1013 | Frequency search at every start (reduced impact restart) | | |
| 298 | Frequency search gain | 0000 | 0 to 32767 | The offline auto tuning automatically sets the gain required for the frequency search. | | |
| A711 ^{*1} | Frequency Search gain | 9999 | 9999 | The constant value of Mitsubishi Electric motor (SF-PR, SF-JR, SF-HR, SF-JRCA, SF-HRCA, or MM-CF) is used. | | |
| 560 | Second frequency | 9999 | 0 to 32767 | The offline auto tuning automatically sets the gain required for the frequency search of the second motor. | | |
| A712 ^{*1} | search gain | 9999 | 9999 | The constant value of Mitsubishi Electric motor (SF-PR, SF-JR, SF-HR, SF-JRCA, SF-HRCA, or MM-CF) is used for the second motor. | | |
| | | | 0 | No offline auto tuning | | |
| 96 C110 | Auto tuning setting/ status | 0 | 1, 101 | Offline auto tuning is performed under Advanced magnetic flux vector control, Real sensorless vector control, or Vector control. (Refer to page 532 and page 542.) | | |
| | | | 11 | Offline auto tuning is performed without rotating the motor (for IPM motor MM-CF). | | |
| | | | 0 to 50 Ω, 9999*2 | Tuning data (The value measured by offline auto tuning is | | |
| 90 C120 | Motor constant (R1) | 9999 | 0 to 400 mΩ, 9999 ^{*3} | automatically set.) 9999: The constant value of Mitsubishi Electric motor (SF-PR, SF-JR, SF-HR, SF-JRCA, SF-HRCA and so on) is used. | | |
| | | | 0 | No auto tuning for the second motor. | | |
| 463 | Second motor auto | 0 | 1, 101 | Offline auto tuning is performed for the second motor. (Refer to page 532 and page 542.) | | |
| C210 | tuning setting/status | | 11 | Offline auto tuning is performed without rotating the second motor (under V/F control or PM sensorless vector control (IPM motor MM-CF)). | | |
| 458 C220 | Second motor constant (R1) | 9999 | 0 to 50 Ω, 9999*2 0 to 400 mΩ, 9999*3 | Tuning data of the second motor (same as Pr.90) | | |
| | onotant (iti) | | 0 10 100 11122, 00000 | | | |

^{*1} Tuning is not available under PM sensorless vector control.

^{*2} For the FR-A820-03160(55K) or lower, and FR-A840-01800(55K) or lower.

*3 For the FR-A820-03800(75K) or higher, and FR-A840-02160(75K) or higher.

◆ Offline auto tuning for a frequency search (reduced impact restart)

- When an induction motor is used and the frequency search (reduced impact restart) is selected by setting **Pr.162 Automatic restart after instantaneous power failure selection** = "3, 13, 1003, or 1013", perform offline auto tuning.
- When the MM-CF motor is used and the automatic restart after instantaneous power failure is selected, it is recommended that offline auto tuning is performed.

Before performing offline auto tuning

Check the following points before performing offline auto tuning:

- Check that V/F control or PM sensorless vector control (IPM motor MM-CF) is selected.
- · Check that a motor is connected. (Check that the motor is not rotated by an external force during tuning.)
- Select a motor with the rated current equal to or less than the inverter rated current. (The motor capacity must be 0.4 kW or higher.)
 - If a motor with substantially low rated current compared with the inverter rated current is used, speed and torque accuracies may deteriorate due to torque ripples, etc. Set the rated motor current to about 40% or higher of the inverter rated current.
- The target motor is other than a high-slip motor, a high-speed motor, or a special motor.
- The motor may rotate slightly even if the offline auto tuning without motor rotation (**Pr.96 Auto tuning setting/status** = "11") is selected. Fix the motor securely with a mechanical brake, or before tuning, make sure that it is safe even if the motor rotates. (Caution is required especially in vertical lift applications.) Note that even if the motor runs slightly, tuning performance is unaffected.
- Offline auto tuning is not performed correctly when the surge voltage suppression filter (FR-ASF-H/FR-BMF-H) and sine wave filter (MT-BSL/BSC) are inserted between the inverter and motor. Be sure to remove them before performing tuning.

Setting

- 1. Set "11" in Pr.96 Auto tuning setting/status.
- 2. Set the rated motor current (initial value is inverted rated current) in **Pr.9 Electronic thermal O/L relay**. (Refer to page 415.)
- 3. Set Pr.71 Applied motor according to the motor to be used.

| Mo | Pr.71 setting | |
|--|--|-------------|
| | SF-JR, SF-TH | 0 (3, 4) |
| Mitsubishi Electric standard motor | SF-JR 4P 1.5 kW or lower | 20 (23, 24) |
| Mitsubishi Electric high-efficiency motor | SF-HR | 40 (43, 44) |
| | Others | 0 (3, 4) |
| No. 1. 1. El . 1. | SF-JRCA 4P, SF-TH (constant-torque) | 1 (13, 14) |
| Mitsubishi Electric constant-torque motor | SF-HRCA | 50 (53, 54) |
| | Others (SF-JRC, etc.) | 1 (13, 14) |
| Mitsubishi Electric high-performance energy- saving motor | SF-PR | 70 (73, 74) |
| Other manufacturer's standard motor | _ | 0 (3, 4) |
| Other manufacturer's constant-torque motor | _ | 1 (13, 14) |

Performing tuning



- Before performing tuning, check the monitor display of the operation panel or parameter unit if the inverter is in the state ready
 for tuning. The motor starts by turning ON the start command while tuning is unavailable.
- In the PU operation mode, press FWD / REV on the operation panel.

 For External operation, turn ON the start command (STF signal or STR signal). Tuning starts. (At this time, excitation noise occurs.)



- It takes about 10 s for tuning to complete. (The time depends on the inverter capacity and motor type.)
- · Satisfy the required inverter start conditions to start offline auto tuning. For example, stop the input of the MRS signal.
- To force tuning to end, use the MRS or RES signal or RESET on the operation panel.

 (Turning OFF the start signal (STF signal or STR signal) also ends tuning.)
- During offline auto tuning, only the following I/O signals are valid (initial value).
 Input terminals <valid signals>: STP (STOP), OH, MRS, RT, RES, STF, STR, S1, and S2
 Output terminals: RUN, OL, IPF, FM/CA, AM, A1B1C1, and So (SO)
- When the rotation speed and the output frequency are selected for terminals FM/CA and AM, the progress status of offline auto tuning is output in 15 steps from FM/CA and AM.
- Do not perform ON/OFF switching of the Second function selection (RT) signal during offline auto tuning. Auto tuning will not be performed properly.
- Since the RUN signal turns ON when tuning is started, pay close attention especially when a sequence which releases a mechanical brake by the RUN signal has been designed.
- When executing offline auto tuning, input the operation command after switching ON the main circuit power (R/L1, S/L2, T/L3) of the inverter.
- While **Pr.79 Operation mode selection** = "7", turn the PU operation external interlock (X12) signal ON to tune in the PU operation mode.
- · During tuning, the monitor is displayed on the operation panel as follows.

| Status | Operation panel (FR-DU08) display | LCD operation panel (FR-LU08) display |
|--------------------|--|--|
| Setting | PU -MON -MM -BY -PMN -PM -ST -PMN -PM | AutoTune |
| Tuning in progress | PU -MON -M -M - BM -PM -PM -PM | AutoTune 12:34 TUNE |
| Normal end | PU -MON -M -EXT -PRM -M -NET | AutoTune 12:34 TUNE Completed 13 STF STOP PU PRBV NEXT |

- When offline auto tuning ends, press on the operation panel during PU operation. For External operation, turn OFF the start signal (STF signal or STR signal). This operation resets the offline auto tuning, and the PU's monitor display returns to the normal indication. (Without this operation, next operation cannot be started.)
- At tuning completion, the tuning results are set in the following parameters:

| Parameter | Name |
|-----------|----------------------------|
| 90 | Motor constant (R1) |
| 298 | Frequency search gain |
| 96 | Auto tuning setting/status |



- The motor constants measured once during offline auto tuning are stored as parameters and their data are held until offline auto tuning is performed again. However, the tuning data is cleared when performing All parameter clear.
- If offline auto tuning has ended in error, motor constants are not set.

Perform an inverter reset and perform tuning again.

| Error display | Error cause | Countermeasures |
|---------------|--|--|
| 8 | Forced end | Set "11" in Pr.96 and retry. |
| 9 | Inverter protective function operation | Make the setting again. |
| 91 | The current limit (stall prevention) function is activated. | Set the acceleration/deceleration time longer. Set Pr.156 Stall prevention operation selection = "1". |
| 92 | The converter output voltage fell to 75% of the rated voltage. | Check for the power supply voltage fluctuation. |
| 93 | Calculation error. The motor is not connected. | Check the motor wiring and make the setting again. |
| 94 | Rotation tuning frequency setting error. (The frequency command for the tuning was given to exceed the maximum frequency setting, or to be in the frequency jump range.) | Check the Pr.1 Maximum frequency and Pr.31 to Pr.36 Frequency jump settings. |

- When tuning is ended forcibly by pressing or turning OFF the start signal (STF or STR) during tuning, offline auto tuning does not end properly. (The motor constants have not been set.)

 Perform an inverter reset and perform tuning again.
- When the rated power supply of the motor is 200/220 V (400/440 V) 60 Hz, set the rated motor current multiplied by 1.1 in **Pr.9 Electronic thermal O/L relay** after tuning is complete.
- For a motor with a PTC thermistor, thermal protector or other thermal detection, set "0" (motor overheat protection by inverter invalid) in **Pr.9** to protect the motor from overheating.

NOTE

- An instantaneous power failure occurring during tuning will result in a tuning error. After power is restored, the inverter starts normal operation. Therefore, when the STF (STR) signal is ON, the motor starts forward (reverse) rotation.
- Any fault occurring during tuning is handled as in the normal operation. However, if the retry function is set, no retry is performed.
- The set frequency monitor displayed during the offline auto tuning is 0 Hz.

◆ Tuning the second motor (Pr.463)

- When one inverter switches the operation between two different motors, set the second motor in Pr.450 Second applied
 motor, set Pr.463 Second motor auto tuning setting/status = "11", and perform tuning of the second motor.
- Turning ON the RT signal enables the parameter settings for the second motor as shown in the following table.

| Function | RT signal ON (second motor) | RT signal OFF (first motor) |
|----------------------------|-----------------------------|-----------------------------|
| Motor constant (R1) | Pr.458 | Pr.90 |
| Frequency search gain | Pr.560 | Pr.298 |
| Auto tuning setting/status | Pr.463 | Pr.96 |

NOTE

- The RT signal is assigned to terminal RT in the initial status. Set "3" in one of **Pr.178 to Pr.189 (Input terminal function selection)** to assign the RT signal to another terminal.
- Changing the terminal assignment using **Pr.178 to Pr.189 (Input terminal function selection)** may affect the other functions. Set parameters after confirming the function of each terminal.

∴CAUTION

- · Note that the motor may start running suddenly.
- For the offline auto tuning in vertical lift applications, etc., caution is required to avoid falling due to insufficient torque.

Parameters referred to

Pr.9 Electronic thermal O/L relay ☐ page 415 Pr.65, Pr.67 to Pr.69 Retry function ☐ page 426

Pr.71 Applied motor, Pr.450 Second applied motor □ page 528

Pr.79 Operation mode selection page 389

Pr.156 Stall prevention operation selection ☐ page 431

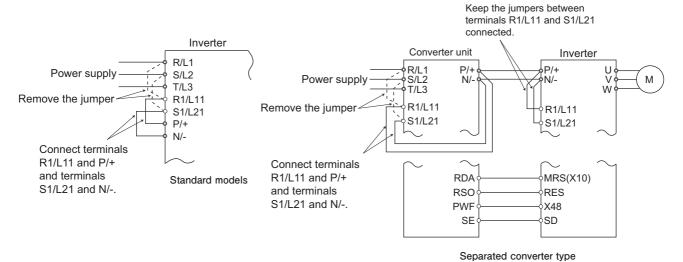
Pr.178 to Pr.189 (Input terminal function selection) page 521

5.14.17 Power failure time deceleration-to-stop function

This is a function to decelerate the motor to a stop when an instantaneous power failure or undervoltage occurs.

| Pr. | Name | Initial | value | Setting | Description |
|-------------|--|-------------|-------|-------------------------|---|
| PI. | Name | FM | CA | range | Description |
| 261 | Power failure stop | | | 0 | Power failure time deceleration-to-stop function disabled |
| A730 | selection | 0 | | 1, 2, 11, 12, 21, 22 | Power failure time deceleration-to-stop function enabled. Select action at an undervoltage or when a power failure occurs. |
| 262 A731 | Subtracted frequency at deceleration start | 3 Hz | | 0 to 20 Hz | Normally, the motor runs at the initial value as it is. However, adjust to suit the size of the load specification (moment of inertia, torque). |
| 263 A732 | Subtraction starting frequency | 60 Hz 50 Hz | | 0 to 590 Hz | When the output frequency ≥ the frequency set in Pr.263: The motor decelerates if the output frequency decreases by the frequency set in Pr.262. When the output frequency < the frequency set in Pr.263: The motor decelerates at frequencies of the output frequency. |
| | | | | 9999 | The motor decelerates from the output frequency - Pr.262 . |
| 264 A733 | Power-failure deceleration time 1 | 5 s | | 0 to 3600 s | Set the slope applicable from the deceleration start to the Pr.266 set frequency. |
| 265 A734 | Power-failure deceleration time 2 | 9999 | | 0 to 3600 s | Set the slope applicable for the frequency range starting at Pr.266 and downward. |
| A/34 | deceleration time 2 | | | 9999 | Same as Pr.264. |
| 266 A735 | Power failure deceleration time switchover frequency | 60 Hz | 50 Hz | 0 to 590 Hz | Set the frequency at which the slope during deceleration switches from the Pr.264 setting to the Pr.265 setting. |
| 294 A785 | UV avoidance voltage gain | 100% | | 0 to 200% | Adjust the response at undervoltage avoidance operation. Setting a large value improves the response to changes in the bus voltage. |
| 668 A786 | Power failure stop frequency gain | 100% | | 0 to 200% | Adjust the response level for the operation where the deceleration time is automatically adjusted. |
| 606 | Power failure stop | | | 0 | Normally open input (NO contact input specification) |
| T722 | external signal input selection | 1 | | 1 | Normally closed input (NC contact input specification) |

◆ Connection and parameter setting



- For the standard model, remove the jumpers between terminals R/L1 and R1/L11 and terminals S/L2 and S1/L21, and connect terminals R1/L11 and P/+ and terminals S1/L21 and N/-.
- If an undervoltage, power failure or input phase loss occurs when Pr.261 Power failure stop selection ≠ "0", the motor decelerates to a stop.

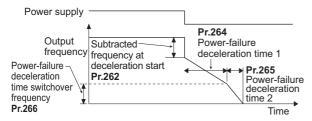
• The power failure time deceleration-to-stop function operates as follows at an input phase loss.

| Pr.261 | Pr.872 | Operation when an input phase loss occurs |
|--------|--------|---|
| 0 | 0 | Operation continues |
| U | 1 | Input phase loss (E.ILF) |
| 1. 2 | 0 | Operation continues |
| 1, 2 | 1 | Deceleration stop |
| 21, 22 | _ | Deceleration stop |

- For the separated converter type, remove the jumpers between terminals R/L1 and R1/L11 and terminals S/L2 and S1/L21 of the converter unit, and connect terminals R1/L11 and P/+ and terminals S1/L21 and N/-. Do not remove the jumpers of terminal R1/L11 and terminal S1/L21 of the inverter. (In the initial status of the separated converter type, terminals P/+ and R1/L11 and terminals N/- and S1/L21 are connected.)
- For the separated converter type, connect the terminal to which the PWF signal of the converter unit is assigned and the terminal to which the X48 signal of the inverter is assigned. Also, set **Pr.261** of the converter unit in accordance with the inverter setting. (Refer to the Instruction Manual of the converter unit.)

◆ Outline of operation of deceleration stop at a power failure

- If an undervoltage or power failure occurs, the output frequency is turned OFF only for the frequency set to **Pr.262**Subtracted frequency at deceleration start.
- The motor decelerates for the time set to **Pr.264 Power-failure deceleration time 1**. (The deceleration time setting is the time it takes for the motor to stop from **Pr.20 Acceleration/deceleration reference frequency**.)
- Change the deceleration time (slope) to stop using **Pr.265 Power-failure deceleration time 2** when the frequency is too low to obtain the regenerative energy or in other instances.



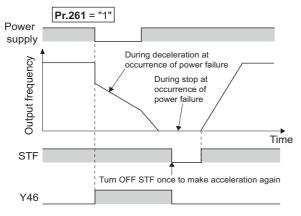
◆ Action setting at undervoltage and power failure

· Set Pr.261 to select the action at an undervoltage and power failure.

| Pr.261 setting | Action at undervoltage and power failure | Power restoration during deceleration at occurrence of power failure | Deceleration stop time | Undervoltage avoidance function |
|-------------------|--|--|-------------------------------|---------------------------------|
| 0 | Coasts to stop | Coasts to stop | _ | _ |
| 1 | | Deceleration stop | | Not available |
| 2 | Deceleration stop | Re-acceleration | According to Pr.262 to Pr.266 | Not available |
| 11 | | Deceleration stop | setting | Available |
| 12 | | Re-acceleration | | Available |
| 21 | | Deceleration stop | Automatic adjustment of | Not available |
| 22 | | Re-acceleration | deceleration time | Not available |

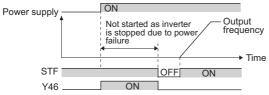
◆ Power failure stop function (Pr.261 = "1, 11, or 21")

• Even if power is restored during deceleration triggered by a power failure, deceleration stop is continued after which the inverter stays stopped. To restart operation, turn the start signal OFF then ON again.



NOTE

- If the automatic restart after instantaneous power failure is selected (Pr.57 Restart coasting time ≠ "9999") while the power failure time deceleration-to-stop function is set enabled (Pr.261 = "1, 11, or 21"), the power failure time deceleration stop function is disabled.
- When the power failure time deceleration-to-stop function is enabled (**Pr.261** = "1, 11 or 21"), the inverter does not start even if the power is turned ON or inverter reset is performed with the start signal (STF/STR) ON. Turn OFF the start signal once and then ON again to make a start.

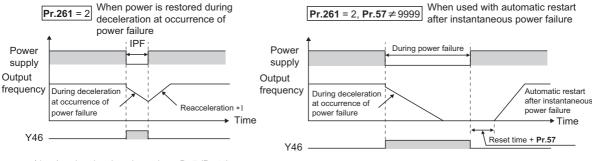


• During cyclic transmission or the like (in which start commands are periodically transmitted), operation is restarted if the power is restored during the deceleration even when the power failure time deceleration-to-stop function is enabled.

Continuous operation function at instantaneous power failure (Pr.261 = "2, 12, or 22")

- The motor re-accelerates to the set frequency when the power restores during the deceleration triggered by a power failure.
- Combining with the automatic restart after instantaneous power failure function enables a deceleration triggered by a
 power failure and re-acceleration at a power restoration.

If the power is restored after stoppage by a power failure, a restart operation is performed when automatic restart after instantaneous power failure ($Pr.57 \neq "9999"$) is selected.



*1 Acceleration time depends on Pr.7 (Pr.44)

◆ Undervoltage avoidance function (Pr.261 = "11 or 12", Pr.294)

• When "11 or 12" is set to **Pr.261**, the deceleration time is adjusted (shortened) to prevent an undervoltage from occurring during deceleration at occurrence of power failure.

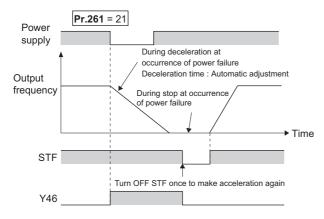
Adjust the downward frequency slope and the response level using Pr.294 UV avoidance voltage gain. Setting a large
value improves the response to the bus voltage.



• The undervoltage avoidance function is invalid under torque control by Real sensorless vector control. When **Pr.261** = "11 (12)", the operation is performed in the same manner as if **Pr.261** = "1 (2)".

◆ Automatic adjustment of deceleration time (Pr.261 = "21 or 22", Pr.294, Pr.668)

- When "21 or 22" is set to **Pr.261**, the deceleration time is automatically adjusted to keep (DC bus) voltage constant in the converter when the motor decelerates to a stop at a power failure. Setting of **Pr.262 to Pr.266** is not required.
- If a phenomenon such as motor vibration occurs during operation of the deceleration time automatic adjustment function, adjust the response level by setting the Pr.668 Power failure stop frequency gain. Increasing the setting improves the response to change in the bus voltage. However, the output frequency may become unstable.
- If setting Pr.294 UV avoidance voltage gain lower also does not suppress the vibration, set Pr.668 lower.



◆ Deceleration stop by the Power failure stop external (X48) signal

- By turning OFF X48 signal, the power failure time deceleration-to-stop function is activated. This function is used, for example, when an external power failure detection circuit is installed.
- To use the power failure time deceleration-to-stop function for the separated converter type, use X48 signal. Connect the terminal to which the PWF signal of the converter unit is assigned and the terminal to which the X48 signal of the inverter is assigned.
- In the initial setting, the X48 signal is used with the normally closed (NC contact) input specification. Use **Pr.606 Power failure stop external signal input selection** to change the specification to the normally open (NO contact) input.
- To use the X48 signal, set "48" in any of **Pr.178 to Pr.189 (Input terminal function selection)** to assign the function to an input terminal.

◆ During deceleration at occurrence of power failure (Y46) signal

- After deceleration by a power failure, the inverter is not restarted even though the start command is input. Check the During deceleration at occurrence of power failure (Y46) signal at a power failure. (For example, when input phase loss protection (E.ILF) occurs.)
- The Y46 signal is turned ON during deceleration at occurrence of power failure and in a stop status after deceleration at occurrence of power failure.
- For the Y46 signal, set "46 (positive logic)" or "146 (negative logic)" in any of **Pr.190 to Pr.196 (Output terminal function selection)** to assign the function.

◆ Power failed (Y67) signal

- Y67 signal turns ON when the output is shut off due to detection of power failure (power supply fault) or undervoltage, or the power failure time deceleration-to-stop function is activated.
- To use the Y67 signal, assign the function by setting "67 (positive logic)" or "167 (negative logic)" in any of **Pr.190 to Pr.196** (Output terminal function selection).



- When Pr.30 Regenerative function selection = "2" and the FR-HC2, FR-XC (in common bus regeneration mode), or FR-CV
 is used, the deceleration stop function is invalid at power failure.
- If the "output frequency **Pr.262**" at undervoltage or at power failure is a negative value, it is regarded as 0 Hz. (DC injection brake operation is performed without deceleration.)
- The power failure time deceleration stop function is disabled during a stop or when the breaker is tripped.
- The Y46 signal turns ON if an undervoltage occurs even if a deceleration at a power failure has not occurred. For this reason, the Y46 signal is sometimes output instantaneously when the power supply is turned OFF, but this is not a fault.
- When the power failure time deceleration-to-stop function is selected, undervoltage protection (E.UVT), instantaneous power failure protection (E.IPF) and input phase loss protection (E.ILF) are invalid.
- · When the load is high during PM sensorless vector control, an undervoltage sometimes causes the coasting stop.
- To use the power failure time deceleration-to-stop function for the separated converter type, use a converter unit manufactured in August 2014 or later.
- Changing the terminal assignment using Pr.178 to Pr.189 (Input terminal function selection) and Pr.190 to Pr.196 (Output terminal function selection) may affect the other functions. Set parameters after confirming the function of each terminal.

A CAUTION

Even if the power failure time deceleration-to-stop function is set, some loads might cause the inverter to trip and the
motor to coast.

The motor coasts if sufficient regenerative power is not obtained from the motor.

Parameters referred to

Pr.12 DC injection brake operation voltage page 715
Pr.20 Acceleration/deceleration reference frequency, Pr.21 Acceleration/deceleration time increments page 367
Pr.30 Regenerative function selection page 724
Pr.57 Restart coasting time page 628, page 635
Pr.190 to Pr.196 (Output terminal function selection) page 473
Pr.872 Input phase loss protection selection page 426

5.14.18 PLC function

The inverter can be run in accordance with a sequence program.

In accordance with the machine specifications, a user can set various operation patterns: inverter movements at signal inputs, signal outputs at particular inverter status, and monitor outputs, etc.

| Pr. | Name | Initial value | Setting range | Description | | |
|------------------------------------|--|------------------|------------------------|--|--|-----------------|
| | PLC function operation selection | 0 | 0 | PLC function disabled | | |
| 414 A800 | | | 1, 11 | PLC function enabled | The SQ signal is enabled by input from a command source (external input terminal/communication). | |
| | | | 2, 12 | The SQ signal is enabled by in external input terminal. | | • |
| 415 | Inverter operation lock mode setting | 0 | 0 | The inverter start command is enabled regardless of the operating status of the sequence program. $ \\$ | | |
| A801 | | | 1 | The inverter start command is enabled only while the sequence program is running. | | ence program is |
| 416 A802 | Pre-scale function selection | 0 | 0 to 5 | Unit scale factor 0: No function 1: ×1 2: ×0.1 3: ×0.01 4: ×0.001 5: ×0.0001 | When the pulse train is input from terminal JOG, the number of sampling pulses can be converted. The result of conversion is stored to SD1236. Number of sampled pulses = Input pulse value per count cycle × Pre-scale setting value (Pr.417) × Unit scale factor (Pr.416) | |
| 417 A803 | Pre-scale setting value | 1 | 0 to 32767 | Pre-scale setting value | | |
| 498 A804 | PLC function flash memory clear | 0 | 0, 9696 (0 to 9999) | 0: Clears the flash memory fault display (no operation after writing while the flash memory is in normal operation). 9696: Clears the flash memory (no operation after writing while the flash memory is at a fault). Other than 0 and 9696: Outside the setting range | | Write |
| | | | | 0: Normal display | | Read |
| | | | | 1: The flash memory is not cleared because the PLC function is enabled. | | |
| | | | | 9696: During flash memory clearing operation or flash memory fault | | |
| 675 | User parameter auto storage function selection | 9999 | 1 | Auto storage function enabled | | |
| A805 | | | 9999 | Auto storage function disabled | | |
| 1150 to 1199 A810 to A859 | User parameters 1 to User parameters 50 | 0 | 0 to 65535 | Desired values can be set. Because devices D206 to D255 used by the PLC function can be mutually accessed, the values set to Pr.1150 to Pr.1199 can be used by the sequence program. The result of performing calculation by a sequence program can also be monitored by Pr.1150 to Pr.1199 . | | |

◆ Outline of PLC function

- To enable the PLC function, set a value other than "0" in **Pr.414 PLC function operation selection**. When "2 or 12" is set in **Pr.414**, the Sequence startup (SQ) signal from the external input terminal is valid regardless of the setting of the **Pr.338**Communication operation command source. (The **Pr.414** setting change becomes valid after inverter reset.)
- Switch the execution key (RUN/STOP) of the sequence program by turning the SQ signal ON/OFF. The sequence program can be executed by turning the SQ signal ON. To input the SQ signal, set "50" in any of **Pr.178 to Pr.189 (Input terminal function selection)** to assign the function to a terminal.
- When "1" is set in **Pr.415 Inverter operation lock mode setting**, the inverter can be operated only when the sequence program is running. By changing the PLC program status from RUN to STOP during inverter operation, the motor decelerates to stop. To stop the inverter operation at the STOP status of the PLC program while performing auto operation using SD1148 (or SM1200 to 1211) of the PLC program, set **Pr.415** = "1".
- For reading or writing sequence programs, use FR Configurator2 on the personal computer connected to the inverter via RS-485 communication or USB. (When **Pr.414** ≠ "0", sequence programs can be read from or written to FR Configurator2.)
- The following shows the required conditions to enable the SQ signal.

| | | SQ signal | | |
|----------------|----------------|---|--|--|
| Pr.414 setting | Pr.338 setting | Input via an external (physical) terminal | Input via a communication virtual terminal | |
| 1, 11 | 0 | ON | ON | |
| 1, 11 | 1 | ON | _ | |
| 2, 12 | _ | ON | _ | |

◆ User parameter (data register (D)) auto storage function selection

- Setting Pr.675 = "1" enables the auto storage function for user parameters.
- The user parameter auto storage function is used to store the setting of **Pr.1195 PLC function user parameters 46** (D251) to **Pr.1199 PLC function user parameters 50** (D255) automatically in EEPROM at power OFF or inverter reset.
- The auto storage function is disabled while the inverter performs any of the following.
 Measurement of the main circuit capacitor's life, offline auto tuning, or measurement of load characteristics



• The auto storage function may fail if the EEPROM is accessed by other functions at the same time at power OFF. To ensure the auto storage, provide a power source for the control circuit separately from that of the main circuit.

User parameter reading from EEPROM

• User parameters (**Pr.1150 to Pr.1199**) are read from RAM or EEPROM according to the settings in **Pr.342 Communication EEPROM write selection** and **Pr.414 PLC function operation selection**. When **Pr.414** = "11 or 12", RAM data is read regardless of the **Pr.342** setting.

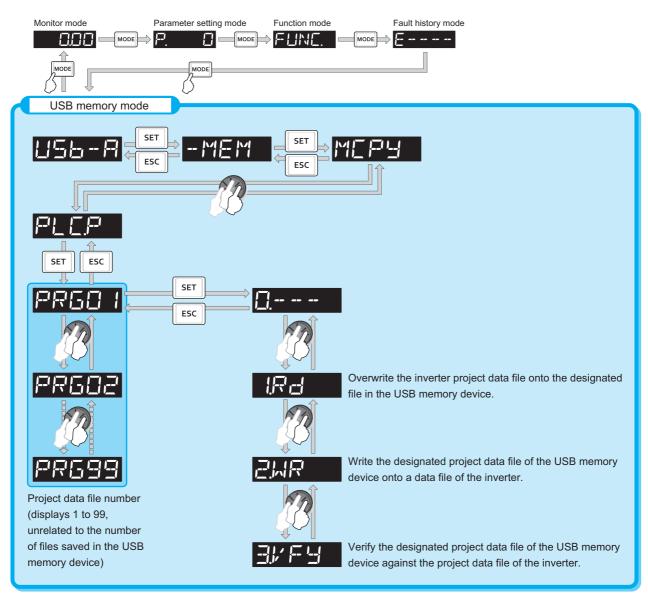
| Device | Pr.342 | Pr.414 | Read from | Written to | |
|-----------------------------------|--------|---------|---|-------------|--|
| | 0 | 0, 1, 2 | EEPROM | EEPROM | |
| Inverter (via communication), | | 11, 12 | RAM | TELI INOIVI | |
| FR Configurator2 | 1 | 0, 1, 2 | RAM | RAM | |
| | ' | 11, 12 | RAM | KAW | |
| | 0 | 0, 1, 2 | (Differs according to the option type.) | EEPROM | |
| | | 11, 12 | RAM | EEPROW | |
| Communication option | 1 | 0, 1, 2 | RAM | RAM | |
| | | 11, 12 | RAM | TVAIVI | |
| | 0 | 0, 1, 2 | EEPROM | EEPROM | |
| Parameter unit Operation panel | | 11, 12 | RAM | ELFROW | |
| | 1 | 0, 1, 2 | EEPROM | RAM | |
| | 1 | 11, 12 | RAM | KAIVI | |



• For details on the PLC function, refer to the PLC Function Programming Manual and the Instruction Manual of FR Configurator2.

◆ Copying the PLC function project data to USB memory

- This function copies the PLC function project data to a USB memory device. The PLC function project data copied in the
 USB memory device can be copied to other inverters. This function is useful in backing up the parameter setting and for
 allowing multiple inverters to operate by the same sequence programs.
- Refer to page 85 for an outline of the USB communication function.



• The following data can be copied by copying the project data via USB memory device.

| Extension | File type | Copy from inverter to USB memory device | Copy from USB memory device to inverter |
|-----------|-----------------------------------|---|---|
| .QPA | Parameter file | Supported | Supported |
| .QPG | Program file | Supported | Supported |
| .C32 | Function block source information | Supported | Supported |
| .QCD | Global text comment information | Supported | Supported |
| .DAT | Project management information | Supported | Not available |
| .TXT | Copy information | Supported | Not available |

• NOTE

• If the project data of the PLC function is locked with a password using FR Configurator2, copying to the USB memory device and verification are disabled. Also if set to write-disabled, writing to the inverter is disabled. (For details on the PLC function, refer to the PLC Function Programming Manual and the Instruction Manual of FR Configurator2.)

Parameters referred to

Pr.338 Communication operation command source □ page 400

5.14.19 Trace function

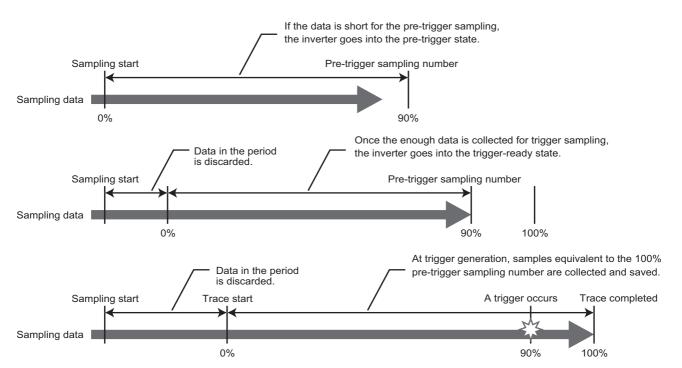
- The operating status of the inverter can be traced and stored on a USB memory device.
- Stored data can be monitored by FR Configurator2, and the status of the inverter can be analyzed.

| Pr. | Name | Initial value | Setting range | Description |
|--------------|--------------------------------------|---------------|--------------------------------|--|
| | | | 0 | Without trace operation (The read value is always "0".) |
| 1020 | | | 1 | Sampling start |
| A900 | Trace operation selection | 0 | 2 | Forced trigger |
| AUUU | | | 3 | Sampling stop |
| | | | 4 | Transfer of data to USB memory device |
| 1021 | | | 0 | Memory mode |
| A901 | Trace mode selection | 0 | 1 | Memory mode (automatic transfer) |
| | | | 2 | Recorder mode |
| 1022 A902 | Sampling cycle | 2 | 0 to 9 | Set the sampling cycle. 0: approx. 0.125 ms, 1: approx. 0.25 ms, 2: 1 ms, 3: 2 ms, 4: 5 ms, 5: 10 ms, 6: 50 ms, 7: 100 ms, 8: 500 ms, 9: 1 s (For the setting values "0" and "1", the cycle varies according to the control mode.) |
| 1023 A903 | Number of analog channels | 4 | 1 to 8 | Select the number of analog channels for sampling. |
| 1024 | | | 0 | Manual sampling start |
| A904 | Sampling auto start | 0 | 1 | Sampling starts automatically when the power supply is turned ON or at a reset |
| | | | 0 | Fault trigger |
| 1025 | | 0 | 1 | Analog trigger |
| A905 | Trigger mode selection | | 2 | Digital trigger |
| 71000 | | | 3 | Analog or digital trigger (OR logic) |
| | | | 4 | Both analog and digital triggers (AND logic) |
| 1026 A906 | Number of sampling before trigger | 90% | 0 to 100% | Set the percentage of the pre-trigger sampling time with respect to the overall sampling time. |
| 1027 A910 | Analog source selection (1ch) | 201 | | |
| 1028 A911 | Analog source selection (2ch) | 202 | 1 to 3, 5 to 14, 17 to 20, | |
| 1029 A912 | Analog source selection (3ch) | 203 | 22 to 24, 32 to 36, 39 to | |
| 1030 A913 | Analog source selection (4ch) | 204 | 42, 46, 52 to 54, 61, 62, | Select the analog data (monitor item) for sampling on each channel. |
| 1031 A914 | Analog source selection (5ch) | 205 | 64, 67, 71 to 75, 87 to 98, | Select the analog data (monitor item) for sampling on each channel. |
| 1032 A915 | Analog source selection (6ch) | 206 | 201 to 213, 222 to 227, | |
| 1033 A916 | Analog source selection (7ch) | 207 | 230 to 232, 235 to 238 | |
| 1034 A917 | Analog source selection (8ch) | 208 | | |
| 1035 A918 | Analog trigger channel | 1 | 1 to 8 | Select the analog channel to be the trigger. |
| 1036 | Analog trigger operation | 0 | 0 | Sampling starts when the value of the analog monitor exceeds the value set at the trigger level (Pr.1037) |
| A919 | selection | J | 1 | Sampling starts when the value of the analog monitor falls below the value set at the trigger level (Pr.1037) |
| 1037 A920 | Analog trigger level | 1000 | 600 to 1400 | Set the level at which the analog trigger turns ON. The trigger level is the value obtained by subtracting 1000 from the set value. |

| Pr. | Name | Initial value | Setting range | Description |
|--------------|--------------------------------|---------------|--|---|
| 1038 A930 | Digital source selection (1ch) | 1 | | |
| 1039 A931 | Digital source selection (2ch) | 2 | | |
| 1040 A932 | Digital source selection (3ch) | 3 | 1 to 255 Select the digital data (I/O signal) for sampling on each | |
| 1041 A933 | Digital source selection (4ch) | 4 | | Soloct the digital data (I/O signal) for sampling an each channel |
| 1042 A934 | Digital source selection (5ch) | 5 | | Select the digital data (I/O signal) for sampling on each chainle |
| 1043 A935 | Digital source selection (6ch) | 6 | | |
| 1044 A936 | Digital source selection (7ch) | 7 | | |
| 1045 A937 | Digital source selection (8ch) | 8 | | |
| 1046 A938 | Digital trigger channel | 1 | 1 to 8 | Select the digital channel to be the trigger. |
| 1047 | Digital trigger operation | 0 | 0 | Tracing starts when the signal turns ON |
| A939 | selection | U | 1 | Tracing starts when the signal turns OFF |

♦ Operation outline

- This function is used to sample the status data (analog monitor and digital monitor) of the inverter, trace the sampling data when a trigger (trace start condition) occurs, and stores the resulting trace data.
- · When the trace function is set enabled, samplings are collected and the inverter goes into the pre-trigger status.
- In the pre-trigger status, samples are collected, and the trigger standby status is entered when sufficient samples for the number of pre-trigger samples have been collected.
- · When a trigger occurs in the trigger standby status, tracing is started and the trace data is stored.



◆ Tracing procedure

1. Preparing a USB memory device

Select a USB memory device with ample capacity to store the necessary amount of trace data. When the trace function is used in the recorder mode, use a USB memory device with at least 1 GB of free space.

2. Prior setting for tracing

Set Pr.1021 to select a trace mode.

Set Pr.1022 Sampling cycle and Pr.1023 Number of analog channels according to the necessary sampling time. Use Pr.1027 to Pr.1034 to set analog sources, and Pr.1038 to Pr.1045 to set digital sources.

Set a trigger type in Pr.1025.

3. Tracing

Set Pr.1020 or Pr.1024 to start sampling or store trace data in the USB memory device.

The trace status can be monitored. (Refer to page 658.)

4. Waveform check

By using FR Configurator2, trace data stored in a USB memory device can be displayed on a computer screen. For details, refer to the Instruction Manual of FR Configurator2.

Selection of trace mode (Pr.1021)

- Select how to store the trace data which results from sampling the inverter status.
- There are two methods to store trace data, memory mode and recorder mode.

| Pr.1021 setting | Mode | Description | Storing trace data |
|--------------------|--|---|--|
| 0 | Memory mode | Trace data is stored sequentially to the internal RAM in the inverter. | To store trace data on a USB memory device, set Pr.1020 Trace operation selection = "4" after the sampling and tracing is completed.*1 |
| 1 | Memory mode (automatic transfer) | Trace data is stored sequentially to the internal RAM in the inverter, and automatically transferred to the USB memory device. | Trace data is automatically stored on the USB memory device after tracing is completed. |
| 2 | Recorder mode | Trace data is stored directly on the USB memory device. Sampling data is fixed at 8 analog channels and 8 digital channels. The sampling cycle in this mode is longer than in the memory mode. (1 ms or longer) | To stop sampling and complete storing trace data after the sampling is started, set "2" (forced trigger) or "3" (sampling stop) in Pr.1020 Trace operation selection.*1 |

^{*1} For details on **Pr.1020**, refer to page 657.

NOTE

- · When the trace function is used in the recorder mode, use USB memory device having at least 1 GB of free space.
- Data transferred to the USB memory device is stored in the "TRC" folder under the "FR INV" folder.
- Up to 99 sets of trace data can be stored in the USB memory device in the memory mode. When a data set is transferred to the USB memory that contains 99 sets of data, its "MEM001.tr1" file will be overwritten. REC001.tr1 is the only data file stored in the recorder mode.
- · The data sampled in the recorder mode will be corrupted by resetting or turning OFF the inverter during sampling.
- By using FR Configurator2, the trace data of the internal RAM can be directly transmitted to the personal computer via the USB cable. For details, refer to the Instruction Manual of FR Configurator2.

◆ Selection of sampling time (Pr.1022, Pr.1023)

• The sampling time is determined by the sampling cycle and the number of data acquisition points. The number of data acquisition points differs between the memory mode and the recorder mode.

Memory mode

The sampling time varies depending on the setting in Pr.1022 Sampling cycle and Pr.1023 Number of analog channels.

| Pr.1023 | Memory mode | Memory mode sampling time | | | |
|---------------------------|-------------------------|---------------------------|-----------------------------------|--|--|
| Number of analog channels | Minimum (Pr.1022 = "0") | Maximum (Pr.1022 = "9") | Number of data acquisition points | | |
| 1 | 213 ms | 1704 s | 1704 | | |
| 2 | 160 ms | 1280 s | 1280 | | |
| 3 | 128 ms | 1024 s | 1024 | | |
| 4 | 106.5 ms | 852 s | 852 | | |
| 5 | 91 ms | 728 s | 728 | | |
| 6 | 80 ms | 640 s | 640 | | |
| 7 | 71 ms | 568 s | 568 | | |
| 8 | 64 ms | 512 s | 512 | | |

Recorder mode

The sampling time varies depending on the setting in Pr.1023 Number of analog channels.

| Analog channel number | Recorder mode Minimum (Pr.1022 = "2")*1 | Number of data acquisition points | |
|---|---|---|----------|
| Fixed to 8ch (analog source selection) | | Maximum (Pr.1022 = "9") Approx. 621 days | 53687091 |

^{*1} Sampling is performed at a sampling cycle of 1 ms even if "0 or 1" is set to **Pr.1022 Sampling cycle**.

◆ Analog source (monitor item) selection

• Select the analog sources (monitor items) to be set to **Pr.1027 to Pr.1034** from the following table.

| Setting value | Monitor item*1 | Minus (-) display*2 | Trigger level criterion*3 | Setting | Monitor item*1 | Minus (-) display*2 | Trigger level criterion*3 |
|---------------|---|------------------------|---------------------------------|---------|---|------------------------|---------------------------------|
| 1 | Output frequency/speed | | *4 | 74 | Cumulative pulse overflow times (control terminal option) | 0 | *4 |
| 2 | Output current | | *4 | 75 | Multi-revolution counter | | 65535 |
| 3 | Output voltage | | *4 | 87 | Remote output value 1 | 0 | *4 |
| | Frequency setting value/motor speed setting | | *4 | 88 | Remote output value 2 | 0 | *4 |
| 6 | Running speed | | *4 | 89 | Remote output value 3 | 0 | *4 |
| 7 | Motor torque | | *4 | 90 | Remote output value 4 | 0 | *4 |
| 8 | Converter output voltage | | *4 | 91 | PID manipulated amount | 0 | *4 |
| 9*5 | Regenerative brake duty | | *4 | 92 | Second PID set point/deviation input selection | | *4 |
| 10 | Electronic thermal O/L relay load factor | | *4 | 93 | Second PID measured value | | *4 |
| 11 | Output current peak value | | *4 | 94 | Second PID deviation | 0 | *4 |
| 12 | Converter output voltage peak value | | *4 | 95 | Second PID measured value 2 | | *4 |
| 13 | Input power | | *4 | 96 | Second PID manipulated amount | 0 | *4 |
| 14 | Output power | | *4 | 97 | Dancer main set speed | | *4 |
| 17 | Load meter | | *4 | 98 | Control circuit temperature | 0 | *4 |
| 18 | Motor excitation current | | *4 | 201 | *Output frequency | | Pr.84 |
| 19 | Position pulse | | 65535 | 202 | *U-phase output current | 0 | ND rated current |
| 20 | Cumulative energization time | | 65535 | 203 | *V-phase output current | 0 | ND rated current |
| 22 | Orientation status | | 65535 | 204 | *W-phase output current | 0 | ND rated current |
| 23 | Actual operation time | | 65535 | 205 | Converter output voltage | | 400 V/800 V |
| 24 | Motor load factor | | *4 | 206 | *Output current (all three phases) | | ND rated current |
| 32 | Torque command | | *4 | 207 | *Excitation current (A) | | ND rated current |
| 33 | Torque current command | | *4 | 208 | *Torque current (A) | | ND rated current |
| | Motor output | | *4 | 209 | Terminal 2 | | 100% |
| | Feedback pulse | | 65535 | 210 | Terminal 4 | | 100% |
| 36 | Torque monitor (power driving/ regenerative driving polarity switching) | 0 | *4 | 211 | Terminal 1 | 0 | 100% |
| | SSCNET III communication status*7 | | 65535 | 212 | *Excitation current (%) | 0 | 100% |
| 40 | PLC function user monitor 1 | 0 | *4 | 213 | *Torque current (%) | 0 | 100% |
| 41 | PLC function user monitor 2 | 0 | *4 | 222 | Position command | | 65535 |
| 42 | PLC function user monitor 3 | 0 | *4 | 223 | Position command (upper digits) | 0 | 65535 |
| 46 | Motor temperature | 0 | *4 | 224 | Current position | | 65535 |
| 52 | PID set point | | *4 | 225 | Current position (upper digits) | 0 | 65535 |
| 53 | PID measured value | | *4 | 226 | Droop pulse | | 65535 |
| 54 | PID deviation | 0 | *4 | 227 | Droop pulse (upper digits) | 0 | 65535 |
| 61 | Motor thermal load factor | | *4 | 230 | *Output frequency (signed) | 0 | Pr.84 |
| 62 | Inverter thermal load factor | | *4 | 231 | *Motor speed (with sign) | 0 | *6 |
| 64 | PTC thermistor resistance | | Pr.561 | 232 | *Speed command (with sign) | 0 | *6 |
| 67 | PID measured value 2 | | *4 | 235 | *Torque command | 0 | 100% |
| 71 | Cumulative pulse | 0 | *4 | 236 | *Motor torque | 0 | 100% |

| Setting value | Monitor item*1 | Minus (-) display*2 | Trigger level criterion*3 | Setting | Monitor item*1 | Minus (-) display*2 | Trigger level criterion ^{*3} |
|---------------|--|------------------------|---------------------------------|---------|-----------------------------|------------------------|---|
| 72 | Cumulative pulse overflow times | 0 | *4 | 237 | *Excitation current command | 0 | 100% |
| 73 | Cumulative pulse (control terminal option) | 0 | *4 | 238 | *Torque current command | 0 | 100% |

- *1 "*" shows a monitor item with a high-speed sampling cycle.
- *2 The monitor items with a circle (o) represents that its monitor value can be indicated with minus sign.
- $^{*}3$ Indicates a criterion at 100% when the analog trigger is set.
- *4 Refer to the full-scale value of terminal FM/CA, or AM (page 458).
- *5 Monitoring is available only for standard models.
- *6 Rated motor frequency × 120 / number of motor poles
- *7 Inverter output voltage is displayed when the FR-A8NS is not installed.

◆ Digital source (monitor item) selection

• Select the digital sources (input/output signals) to be set to Pr.1038 to Pr.1045 from the following table. When a value other than the ones in the following table is set, "0" (OFF) is applied for indication.

| Setting value | Signal name | Remarks |
|---------------|-------------|--|
| 0 | _ | |
| 1 | STF | |
| 2 | STR | |
| 3 | AU | |
| 4 | RT | |
| 5 | RL | For details on the signals, refer to |
| 6 | RM | For details on the signals, refer to page 521. |
| 7 | RH | |
| 8 | JOG | |
| 9 | MRS | |
| 10 | STP (STOP) | |
| 11 | RES | |
| 12 | cs | |
| 21 | X0 | |
| 22 | X1 | |
| 23 | X2 | |
| 24 | X3 | |
| 25 | X4 | |
| 26 | X5 | |
| 27 | X6 | |
| 28 | X7 | For details on the signals, refer to |
| 29 | X8 | the Instruction Manual of the FR- |
| 30 | X9 | A8AX (option). |
| 31 | X10 | |
| 32 | X11 | |
| 33 | X12 | |
| 34 | X13 | |
| 35 | X14 | |
| 36 | X15 | |
| 37 | DY | |

| Setting value | Signal name | Remarks |
|---------------|-------------|--|
| 101 | RUN | |
| 102 | SU | |
| 103 | IPF | |
| 104 | OL | For details on the signals, refer to page 473. |
| 105 | FU | page 475. |
| 106 | ABC1 | |
| 107 | ABC2 | |
| 121 | DO0 | |
| 122 | DO1 | |
| 123 | DO2 | For details on the signals, refer to |
| 124 | DO3 | the Instruction Manual of the FR- |
| 125 | DO4 | A8AY (option). |
| 126 | DO5 | |
| 127 | DO6 | |
| 128 | RA1 | For details on the signals, refer to |
| 129 | RA2 | the Instruction Manual of the FR- |
| 130 | RA3 | A8AR (option). |

◆ Trigger setting (Pr.1025, Pr.1035 to Pr.1037, Pr.1046, Pr.1047)

• Set the trigger generating conditions and the trigger target channels.

| Pr.1025 setting | Trigger generating conditions | Selection of trigger target channel |
|--------------------|---|-------------------------------------|
| 0 | Tracing starts when inverter enters an fault status (protective function activated) | _ |
| 1 | Tracing starts when analog monitor satisfies trigger conditions | Pr.1035 |
| 2 | Tracing starts when digital monitor satisfies trigger conditions | Pr.1046 |
| 3 | Tracing starts when either of analog or digital monitor satisfies trigger conditions (OR) | Pr.1035, Pr.1046 |
| 4 | Tracing starts when both of analog or digital monitor satisfies trigger conditions (AND) | Pr.1035, Pr.1046 |

• Set the trigger generation conditions for the analog monitor.

| Pr.1036 setting | Trigger generation conditions | Trigger level setting |
|--------------------|--|---|
| 0 | Sampling starts when the analog data targeted for the trigger exceeds the value specified at the trigger level | Set the trigger level from 600 to |
| 1 | Sampling starts when the analog data targeted for the trigger falls below the value specified at the trigger level | 1400 (-400 to 400%*1) in Pr.1037 . |

^{*1} In **Pr.1037**, set the number obtained by adding 1,000 to the trigger level.

· Set the trigger generation conditions for the digital monitor.

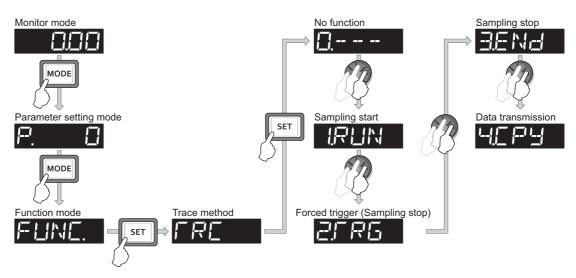
| Pr.1047 setting | Trigger generation conditions | | |
|--------------------|---|--|--|
| 0 | racing starts when the digital data targeted for the trigger turns ON | | |
| 1 | Tracing starts when the digital data targeted for the trigger turns OFF | | |

◆ Start of sampling and copying of data (Pr.1020, Pr.1024)

- Set the trace operation. The trace operation is set by one of two ways, by setting **Pr.1020 Trace operation selection** and by setting in the trace mode on the operation panel.
- When "1" is set in Pr.1020, sampling starts.
- When "2" is set in **Pr.1020**, it is regarded that a trigger occurs (forced trigger), and the sampling stops and the tracing starts.
- When "3" is set in Pr.1020, sampling stops.
- When "4" is set in **Pr.1020**, the trace data in internal RAM is transferred to USB memory device. (Trace data cannot be transferred during sampling.)
- To start sampling automatically when the power supply at power-ON or at a recovery after an inverter reset, set "1" in **Pr.1024 Sampling auto start**.

| Pr.1020 setting | Trace mode | Operation |
|-----------------|------------|--------------------------------|
| 0 | <u> </u> | Sampling standby |
| 1 | IRLIN | Sampling start |
| 2 | 2FRG | Forced trigger (sampling stop) |
| 3 | BENd | Sampling stop |
| 4 | HERY | Data transmission |

- The read value of Pr.1020 is always "0".
- Trace operation can also be set in the trace mode on the operation panel.



◆ Selection of trace operation by input terminal (TRG signal, TRC signal)

- · Trace operation can be selected by signal inputs.
- A forced trigger can be applied when the Trace trigger input (TRG) signal is ON.
- Sampling is started and stopped by the Trace sampling start/end (TRC) signal turning ON and OFF, respectively.
- To input the TRG signal, set "46" in any of **Pr.178 to Pr.189 (Input terminal function selection)**, and to input the TRC signal, set "47" to assign the function to a terminal.

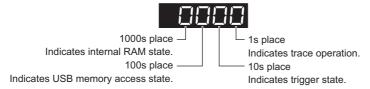
NOTE

• Changing the terminal assignment using **Pr.178 to Pr.189 (Input terminal function selection)** may affect the other functions. Set parameters after confirming the function of each terminal.

Monitoring the trace status

• The trace status can be monitored on the operation panel by setting "38" in Pr.52 Operation panel main monitor selection, Pr.774 to Pr.776 (Operation panel monitor selection), or Pr.992 Operation panel setting dial push monitor selection.

The content depends on the digits on the operation panel.



| Monitor value | Trace status | | | | |
|-------------------|-------------------------------|---------------------------|----------------------|-----------------|--|
| Worldor value | Fourth digit | Third digit | Second digit | First digit | |
| 0 or no display*1 | No trace data in internal RAM | USB memory not accessed | Trigger not detected | Tracing stopped | |
| 1 | Trace data in internal RAM | USB memory being accessed | Trigger detected | Trace operation | |
| 2 | _ | USB memory transfer error | _ | _ | |
| 3 | _ | USB buffer overrun | _ | _ | |

^{*1} The value(s) "0" to the left of the leftmost non-zero value is(are) not shown in the monitor display. For example, if no trace data is in internal RAM, the USB memory is not accessed, no trigger is detected, and the trace operation is performed, "1" appears. (not "0001")

 When copying the traced data to a USB memory device, the operating status of the USB host can be checked with the inverter LED.

Refer to page 85 for an outline of the USB communication function.

| LED display status | Operating status | |
|--------------------|--|--|
| OFF | No USB connection. | |
| ON | The communication is established between the inverter and the USB device. | |
| Blinking rapidly | Traced data is being transmitted. (In the memory mode, transmission command is being issued. In the recorder mode, sampling is being performed.) | |
| Blinking slowly | Error in the USB connection. | |

During trace operation, the Trace status (Y40) signal can be output.
 To use the Y40 signal, set "40 (positive logic) or 140 (negative logic)" in one of Pr.190 to Pr.196 (Output terminal function selection) to assign function to an output terminal.



 Changing the terminal assignment using Pr.190 to Pr.196 (Output terminal function selection) may affect the other functions. Set parameters after confirming the function of each terminal.

Parameters referred to

Pr.52 Operation panel main monitor selection page 446
Pr.178 to Pr.189 (Input terminal function selection) page 521
Pr.190 to Pr.196 (Output terminal function selection) page 473

5.15 (N) Communication operation parameters

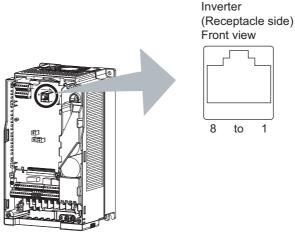
| Purpose | Parameter to set | | | Refer to page |
|---|---|--|--|---------------------|
| To start operation via communication | Initial setting of operation via communication | P.N000, P.N001, P.N010 to P.N014 | Pr.549, Pr.342, Pr.349, Pr.500 to Pr.502, Pr.779 | 663 |
| To communicate via PU connector | Initial setting of computer link communication (PU connector) | P.N020 to P.N028 | Pr.117 to Pr.124 | 670 |
| To communicate via RS-485 | Initial setting of computer link communication (RS-485 terminals) | P.N030 to P.N038 | Pr.331 to Pr.337, Pr.341 | 670 |
| terminals | MODBUS RTU communication specification | P.N002, P.N030, P.N031, P.N034, P.N080 | Pr.539, Pr.331, Pr.332, Pr.334, Pr.343 | 686 |
| To communicate via the CC-Link IE Field Network (FR-A800-GF) | CC-Link IE Field Network | P.N100 to P.N110, P.N111 | Pr.434 to Pr.435, Pr.541 | 699 |
| To Communicate using USB (FR Configurator2) | USB communication | P.N040, P.N041 | Pr.547, Pr.548 | 701 |
| To connect a GOT | GOT automatic recognition | P.N020, P.N030 | Pr.117, Pr.331 | 701 |
| To back up the data of parameter settings and PLC function to the GOT | Backup/restore | P.N110, P.N111 | Pr.434, Pr.435 | 702 |

5.15.1 Wiring and configuration of PU connector

Using the PU connector as a computer network port enables communication operation from a personal computer, etc.

When the PU connector is connected with a personal, FA, or other computer by a communication cable, a user program can run and monitor the inverter or read and write to parameters.

♦ PU connector pin-outs



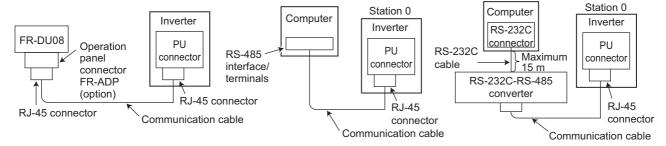
| Pin number | Name | Description |
|------------|------|--|
| 1 | SG | Earth (ground) (connected to terminal 5) |
| 2 | _ | Operation panel power supply |
| 3 | RDA | Inverter receive+ |
| 4 | SDB | Inverter send- |
| 5 | SDA | Inverter send+ |
| 6 | RDB | Inverter receive- |
| 7 | SG | Earth (ground) (connected to terminal 5) |
| 8 | _ | Operation panel power supply |



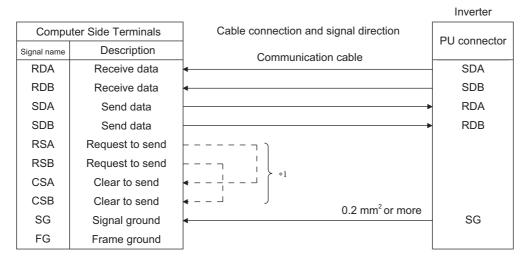
- Pins No. 2 and 8 provide power to the operation panel or parameter unit. Do not use these pins for RS-485 communication.
- Do not connect the PU connector to the computer's LAN board, FAX modem socket, or telephone modular connector. The
 product could be damaged due to differences in electrical specifications.

◆ Wiring and configuration of PU connector communication system

· System configuration



· Wiring between a computer and an inverter for RS-485 communication



*1 Make connection in accordance with the Instruction Manual of the computer to be used with. Fully check the terminal numbers of the computer since they vary with the model.



- · When performing RS-485 communication with multiple inverters, use the RS-485 terminals. (Refer to page 662.)
- · Computer-inverter connection cable

Refer to the following for the connection cable (RS-232C to RS-485 converter) between the computer with an RS-232C interface and an inverter. Commercially available products (as of October 2020)

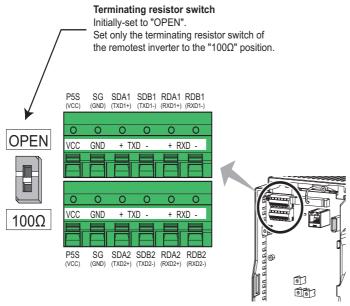
| Model | Manufacturer |
|---|----------------|
| Interface embedded cable | |
| DAFXIH-CAB (D-SUB25P for personal computer) DAFXIH-CABV (D-SUB9P for personal computer) | |
| + | Diatrend Corp. |
| Connector conversion cable DINV-485CAB (for inverter)*2 | · |
| Interface embedded cable dedicated for inverter | |
| DINV-CABV*2 | |

- *2 The conversion cable cannot connect multiple inverters. (The computer and inverter are connected in a 1:1 pair.) This is an RS232C-to-RS485 converter-embedded conversion cable. No additional cable or connector is required. For the product details, contact the manufacturer.
- Use Ethernet cables compliant with the following standards when fabricating the cable.

| Ethernet cable | Connector | Туре |
|--|-----------|---|
| Category 5e or higher straight cable (double shielded / STP)*3 | | The following conditioning cables: • IEEE 802.3 (1000BASE-T) • ANSI/TIA/EIA-568-B (Category 5e) |

5.15.2 Wiring and configuration of RS-485 terminals

♦ RS-485 terminal layout



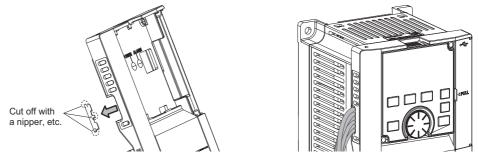
| | 5 | | |
|--------------|---|--|--|
| Name | Description | | |
| RDA1 (RXD1+) | Inverter receive+ | | |
| RDB1 (RXD1-) | Inverter receive- | | |
| RDA2 (RXD2+) | Inverter receive + (for branch) | | |
| RDB2 (RXD2-) | Inverter receive - (for branch) | | |
| SDA1 (TXD1+) | Inverter send+ | | |
| SDB1 (TXD1-) | Inverter send- | | |
| SDA2 (TXD2+) | Inverter send + (for branch) | | |
| SDB2 (TXD2-) | Inverter send - (for branch) | | |
| P5S (VCC) | 5 V (permissible load current 100 mA) | | |
| SG (GND) | Earthing (grounding) (connected to terminal SD) | | |

◆ Connection of RS-485 terminals and wires

• The size of RS-485 terminal block is the same as that of the control circuit terminal block. Refer to page 74 for the wiring method.



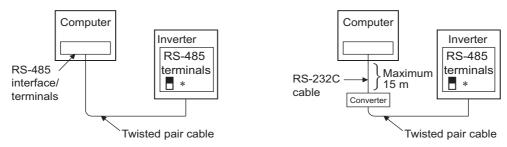
- · To avoid malfunction, keep the RS-485 terminal wires away from the control circuit board.
- When the FR-A820-01250(22K) or lower, or the FR-A840-00620(22K) or lower is used with a plug-in option, lead the wires through the hole on the side face of the front cover for wiring of the RS-485 terminals.



• When the FR-A820-01540(30K) of higher, or the FR-A840-00770(30K) or higher is used with a plug-in option, lead the wires on the left side of the plug-in option for wiring of the RS-485 terminals.

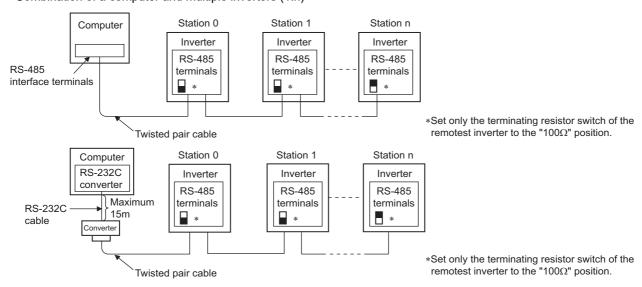
◆ System configuration of RS-485 terminals

· Computer and inverter connection (1:1)



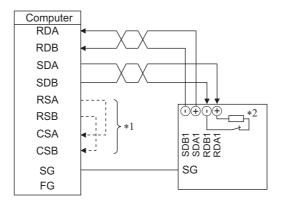
*Set the terminating resistor switch to the "100 Ω " position.

• Combination of a computer and multiple inverters (1:n)

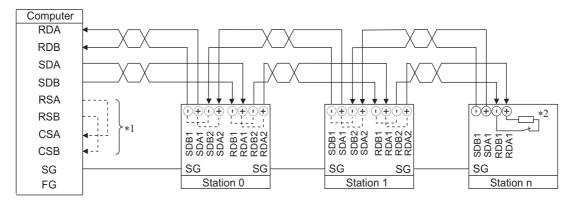


♦ RS-485 terminal wiring method

• Wiring between a computer and an inverter for RS-485 communications



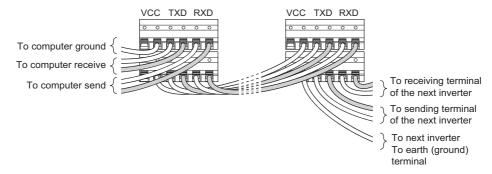
· Wiring between a computer and multiple inverters for RS-485 communication



- *1 Make connection in accordance with the Instruction Manual of the computer to be used with. Fully check the terminal numbers of the computer since they vary with the model.
- *2 On the inverter most remotely connected with the computer, set the terminating resistor switch in the ON (100 Ω) position.



· To connect the terminals in series, refer to the following.

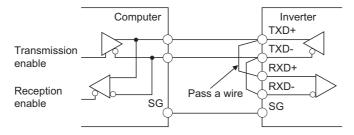


• To connect multiple inverters using RS-485 distributors, refer to the following. Commercially available products (as of October 2020)

| Product name | Model | Manufacturer |
|--------------|--|----------------------------|
| RS-485 | BMJ-8-28N (Pins No. 2 and No. 8 are not connected internally.) (A plug with a terminating resistor is not used.) | HACHIKO ELECTRIC CO., LTD. |
| distributor | DMDH-3PN (Pins No. 2 and No. 8 are not connected internally.) DMDH-10PN (Pins No. 2 and No. 8 are not connected internally.) | Diatrend Corp. |

♦ Two-wire type connection

• If the computer is 2-wire type, a connection from the inverter can be changed to 2-wire type by passing wires across reception terminals and transmission terminals of the RS-485 terminals.





A program should be created so that transmission is disabled (receiving state) when the computer is not sending and reception
is disabled (sending state) during sending to prevent the computer from receiving its own data.

5.15.3 Initial setting of operation via communication

Set the action when the inverter is performing operation via communication.

- Set the RS-485 communication protocol. (Mitsubishi inverter protocol / MODBUS RTU protocol)
- · Set the action at fault occurrence or at writing of parameters.

| Pr. | Name | Initial value | Setting range | Description |
|---------------------------|--|---------------|---|---|
| 549 | Protocol selection | 0 | 0 | Mitsubishi inverter protocol (computer link) |
| N000 | Protocoi Selection | U | 1 | MODBUS RTU protocol |
| 342 N001 | Communication EEPROM write | 0 | 0 | Parameter values written by communication are written to the EEPROM and RAM. |
| 14001 | selection | | 1 | Parameter values written by communication are written to the RAM. |
| | | | 0 | Enables the error reset function in any operation mode. |
| | | | 1 | Enables the error reset function only in the Network operation mode. |
| | | | 100, 101 | For details, refer to page 895 and page 897. |
| 349 ^{*1} | Communication reset selection/Ready bit status selection | 0 | 1000, 1001, 1100, 1101, 10000, 10001, 10100, 10101, 11000, 11001, 11100, 11101 | For details, refer to page 893. |
| N040*1 | N010*1 Communication reset selection | 0 | 0 | Enables the error reset function in any operation mode. |
| NUTU | | | 1 | Enables the error reset function only in the Network operation mode. |
| N240 ^{*1} | Ready bit status selection | 0 | 1 | The status of Ready bit in communication data can be changed when an HMS network option is installed. |
| 500 N011 ^{*1} | Communication error execution waiting time | 0 | 0 to 999.8 s | Set the time from when the communication line error occurs until the inverter starts the operation for the communication error (when a communication option is used). |
| 501 N012 ^{*1} | Communication error occurrence count display | 0 | 0 | Displays the communication error occurrence count (when a communication option is used). |
| 502 N013 | Stop mode selection at communication error | 0 | 0 to 4, 11, 12 | Select the operation at a communication error occurrence. |
| 779 | Operation frequency | 9999 | 0 to 590 Hz | Set the frequency for the operation when a communication error occurs. |
| N014 | during communication error | | 9999 | Operation continues at the same frequency before the communication error. |

^{*1} The setting is available only when a communication option is installed.

Setting the communication protocol (Pr.549)

- · Select the RS-485 communication protocol.
- The MODBUS RTU protocol can be used by communication from the RS-485 terminals.

| Pr.549 setting | Communication protocol | | | | | | |
|-------------------|--|--|--|--|--|--|--|
| 0 (initial value) | Mitsubishi inverter protocol (computer link) | | | | | | |
| 1 | MODBUS RTU protocol | | | | | | |

◆ Communication EEPROM write selection (Pr.342)

- When parameter write is performed via the inverter PU connector, RS-485 terminal, USB communication, or a communication option, the parameters storage device can be changed to "RAM only" from "EEPROM and RAM". Use this function if parameter settings are changed frequently.
- When changing the parameter values frequently, set "1" in **Pr.342 Communication EEPROM write selection** to write them to the RAM only. The life of the EEPROM will be shorter if parameter write is performed frequently with the setting unchanged from "0 (initial value)" (EEPROM write).



- Turning OFF the inverter's power supply clears the modified parameter settings when **Pr.342** = "1 (write only to RAM)". Therefore, the parameter values at next power-ON are the values last stored in EEPROM.
- The parameter setting written in RAM cannot be checked on the operation panel. (The values displayed on the operation panel are the ones stored in EEPROM.)

◆ Operation selection at a communication error (Pr.502, Pr.779)

• For communication using RS-485 terminals or a communication option, operation at a communication error can be selected. The operation is active under the Network operation mode.

^{*2} If in communication by the communication option, "E.OP1" is displayed.

• Select the stop operation at the retry count excess (**Pr.335**, enabled only when the Mitsubishi inverter protocol is selected) or at a signal loss detection (**Pr.336**, **Pr.539**).

| | Pr.502 | | At fault occurren | ce | At fault removal | | | | |
|-------------------------------|-------------------|---|-------------------------------------|-----------------------|---|--------------|-----------------------|--|--|
| Fault type | setting | Operation | Indication | Fault (ALM) signal | Operation | Indication | Fault (ALM) signal | | |
| | 0 (initial value) | Output shutoff | E. SER*1 | ON | Output stop status | E. SER*1 | ON | | |
| | 1, 11 | Output to | "E.SER" | ON after stop | continues. | | | | |
| Communication line | 2, 12 | decelerate and stop the motor. | indication after stop ^{*1} | OFF | Restart*3 | Normal | OFF | | |
| | 3 | Operation | Normal | | | | | | |
| | 4 | continues at the frequency | "CF" warning | OFF | Normal | Normal | OFF | | |
| | | set in Pr.779 .*2 | | | | | | | |
| | 0, 3 | Output shutoff | "E. 1" | ON | Output stop | | | | |
| Communication option (when a | 1, 2, 11, 12 | Output to decelerate and stop the motor. | "E. 1" after stop | ON after stop | status continues. | "E. 1" | ON | | |
| communication option is used) | 4 | Operation continues at the frequency set in Pr.779 .*2 | "CF" warning | OFF | Operation continues at the frequency set in Pr.779 . | "CF" warning | OFF | | |

^{*1} If in communication by the communication option, "E.OP1" is displayed.

• The motor is decelerated to a stop according to the setting of **Pr.111 Third deceleration time** when an error occurs while **Pr.502** = "11 or 12".

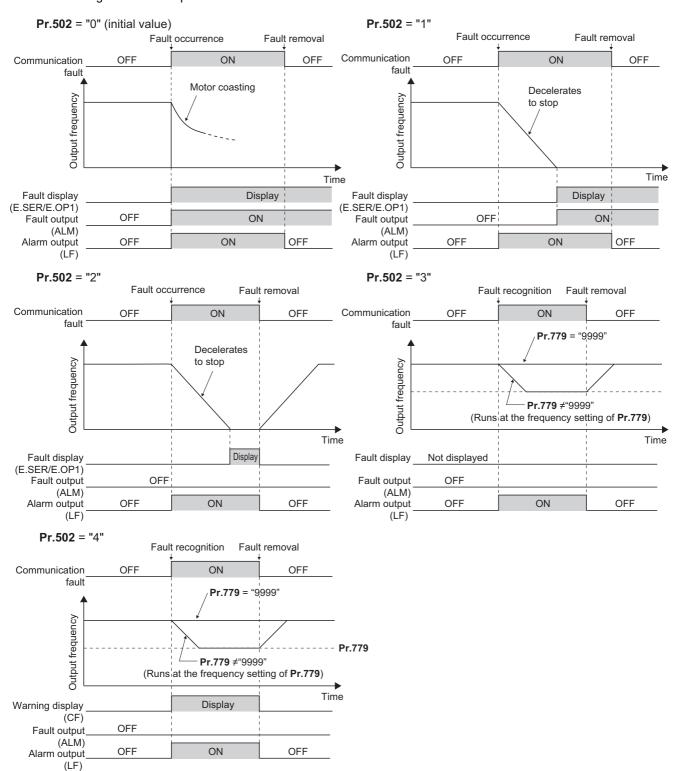
| Pr.502 setting | Operation to a stop at a communication error occurrence |
|----------------|--|
| 0 | Output shutoff |
| 1 to 4 | Deceleration stop according to the selected deceleration time (selectable using the RT or X9 signal) |
| 11, 12 | Deceleration stop according to the setting of Pr.111 |

• When a communication error is detected while communication with the RS-485 terminals is performed, the Alarm (LF) signal is output to an output terminal of the inverter. To use the LF signal, set "98 (positive logic) or 198 (negative logic)" in any of Pr.190 to Pr.196 (Output terminal function selection) to assign the function to the output terminal. (To output the LF signal even if communication through RS-485 terminals is not performed for the time set in Pr.336 or longer, or during communication using a communication option, set "3 or 4" in Pr.502.)

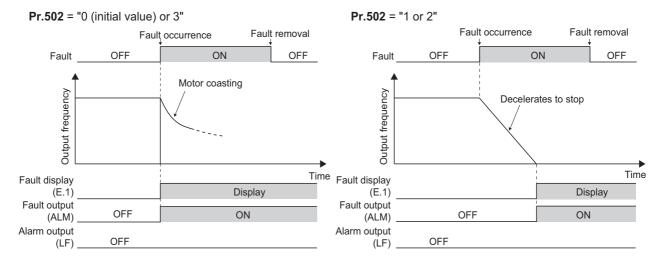
^{*2} Under position control, the operation is continued to the target position.

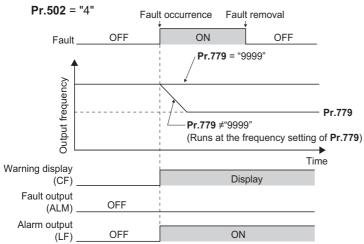
^{*3} When the communication error is removed during deceleration, the motor re-accelerates. Under position control, the motor does not re-accelerate even when the communication error is removed during deceleration.

· The following charts show operations when a communication line error occurs.



• The following charts show operations when a communication option fault occurs.







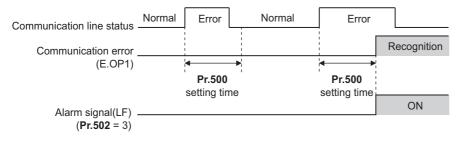
- When a communication option is used, the protective function [E.OP1 (fault data: HA1)] is activated at error occurrences on the communication line. The protective function [E.1 (fault data: HF1)] is activated at error occurrences in the communication circuit inside the option.
- · Fault output indicates the Fault (ALM) signal and an alarm bit output.
- When the fault output is set enabled, fault records are stored in the fault history. (A fault record is written to the fault history at a fault output.)
- · When the fault output is not enabled, a fault record is overwritten to the fault history temporarily but not stored.
- After the fault is removed, the fault indication goes back to normal indication on the monitor, and the fault history goes back to the previous status.
- When Pr.502 ≠ "0", the normal deceleration time setting (settings like Pr.8, Pr.44, and Pr.45) is applied as the deceleration time. Normal acceleration time setting (settings like Pr.7 and Pr.44) is applied as the acceleration time for restart.
- When **Pr.502** = "2, 3, or 4", the inverter operates with the start command and the speed command, which were used before the fault
- If a communication line error occurs, then the error is removed during deceleration while Pr.502 = "2", the motor re-accelerates
 from that point. (When a communication option is used, acceleration does not restart at a communication option error.)
- The Pr.502 and Pr.779 settings are valid when communication is performed via the RS-485 terminals or a communication option.
- These parameters are valid under the Network operation mode. When performing communication through RS-485 terminals, set Pr.551 PU mode operation command source selection ≠ "1".
- **Pr.502** is valid for the device that has the command source under the Network operation mode. If a communication option is installed while **Pr.550** = "9999 (initial setting)", a communication error in RS-485 terminals occurs and **Pr.502** becomes invalid.
- If the communication error setting is disabled with **Pr.335** = "9999" or **Pr.539** = "9999" while **Pr.502** = "3 or 4", the inverter does not operate with the frequency set in **Pr.779** when a communication error occurs.
- If a communication error occurs while continuous operation at Pr.779 is selected with Pr.502 = "3 or 4", the inverter operates at the frequency set in Pr.779 even though the speed command source is at the external terminals.
 Example) If a communication error occurs while Pr.339 = "2" and the RL signal is input through an external terminal, the operation is continued at the frequency set in Pr.779.
- During position control, an error occurs even if "2" is set in Pr.502.

^CAUTION

When Pr.502 = "3" and a communication line error occurs, or Pr.502 = "4" and a communication line error or a communication option fault occurs, the operation continues. When setting "3 or 4" in Pr.502, provide a safety stop countermeasure other than via communication. For example, input a signal through an external terminal (RES, MRS, or X92) or press the PU stop on the operation panel.

◆ Waiting time setting from the communication line error occurrence to the communication error activation (Pr.500)

- When a communication option is used, use **Pr.500 Communication error execution waiting time** to set the time from when the communication line error occurs until the inverter starts the operation for the communication error.
- When a communication line error occurs and lasts longer than the time set in Pr.500, it is recognized as a communication
 error. If the communication returns to normal within the time, it is not recognized as a communication error, and the
 operation continues.



• Operation from the error occurrence until the Pr.500 setting time elapses

| Fault type | Pr.502 setting | Operation | Indication | Fault output |
|----------------------|-------------------|--|----------------------|-------------------|
| | 0 | | | |
| | 1 | Operation | | |
| Communication line | 2 | continues.*1 | Normal ^{*1} | Not provided.*1 |
| | 3 | Continues. | | |
| | 4 | | | |
| | 0, 3 | Output shutoff | "E. 1" | Output |
| Communication option | 1, 2 | Output to decelerate and stop the motor. | "E. 1" after stop | Output after stop |
| | 4 | Operation continues. | "CF" warning | Not output |

^{*1} When the communication returns to normal within the time period set in Pr.500, the protective function (E.OP1) is not activated.

♦ Displaying and clearing the communication error count (Pr.501)

- When a communication option is used, the cumulative count of communication error occurrences can be displayed. Write "0" to clear this cumulative count.
- When a communication line error occurs, the setting of **Pr.501 Communication error occurrence count display** increases by one.
- The cumulative count of communication error occurrences is counted from 0 to 65535. When the count exceeds 65535, the displayed value is cleared and the counting starts over from 0 again.





 Communication error count is temporarily stored in the RAM memory. The error count is stored in EEPROM only once per hour. If power reset or inverter reset is performed, Pr.501 setting will be the one that is last stored to EEPROM depending on the reset timing.

◆ Error reset operation selection at inverter fault (Pr.349)

An error reset command from a communication option can be invalidated in the External operation mode or the PU
operation mode.

| Pr.349 setting | Description |
|--|---|
| 0 (initial value) | Error reset is enabled independently of operation mode. |
| 1 | Error reset is enabled in the Network operation mode. |
| 100, 101 | For details, refer to page 895 and page 897. |
| 1000, 1001, 1100, 1101, 10000, 10001, 10100, 10101, 11000, 11101 | For details, refer to page 895. |

Operation mode switching and communication startup mode (Pr.79, Pr.340)

· Check the following before switching the operation mode.

The inverter is at a stop.

Both the STF and STR signals are off.

The **Pr.79 Operation mode selection** setting is correct. (Check the setting on the operation panel of the inverter.) (Refer to page 389.)

- The operation mode at power ON and at restoration from instantaneous power failure can be selected. Set a value other than "0" in **Pr.340 Communication startup mode selection** to select the Network operation mode. (Refer to page 398.)
- · After the inverter starts up in the Network operation mode, parameter write can be commanded via the network.



- · The changed value in Pr.340 is applied after the next power-ON or inverter reset.
- The Pr.340 setting can be changed on the operation panel in any operation mode.
- When setting a value other than "0" in Pr.340, make sure that the communication settings of the inverter are correct.

Parameters referred to

Pr.7 Acceleration time, Pr.8 Deceleration time, Pr.111 Third deceleration time page 367 Pr.79 Operation mode selection page 389 Pr.340 Communication startup mode selection page 398 Pr.348 Communication retry count page 670 Pr.336 RS-485 communication check time interval page 670 Pr.539 MODBUS RTU communication check time interval page 686 Pr.550 NET mode operation command source selection page 400 Pr.551 PU mode operation command source selection page 400

5.15.4 Initial settings and specifications of RS-485 communication

Use the following parameters to perform required settings for RS-485 communication between the inverter and a personal computer.

- Use the PU connector on the inverter or RS-485 terminals as communication interface.
- Parameter setting, monitoring, etc. can be performed using Mitsubishi inverter protocol or MODBUS RTU communication protocol.
- To make communication between the personal computer and inverter, setting of the communication specifications must be made to the inverter in advance. Data communication cannot be made if the initial settings are not made or if there is any setting error.

♦ Parameters related to PU connector communication

| Pr. | Name | Initial value | Setting range | Desci | ription | | | | |
|-------------|---|--|--|--|--|--|--|--|--|
| 117 N020 | PU communication station number | 0 | 0 to 31 | Use this parameter to specify the i Enter the inverter station numbers connected to one personal computer | when two or more inverters are | | | | |
| 118 N021 | PU communication speed | 192 | 48, 96, 192, 384, 576, 768, 1152 | Select the communication speed. The setting value × 100 equals the For example, enter 192 to set the communication speed. | communication speed. communication speed of 19200 bps. | | | | |
| N022 | PU communication data length | 0 | 0 | Data length 8 bits Data length 7 bits | | | | | |
| N023 | PU communication stop bit length | 1 | 0 | Stop bit length 1 bit Stop bit length 2 bits | | | | | |
| 119 | PU communication stop bit length / data | 1 | 0 1 10 | Stop bit length 1 bit Stop bit length 2 bits Stop bit length 1 bit | Data length 8 bits | | | | |
| | length | | 11 | Stop bit length 2 bits | Data length 7 bits | | | | |
| 120 N024 | PU communication parity check | 2 | 1 | Parity check disabled. Parity check (odd parity) enabled. | | | | | |
| 121 | PU communication | 2 Parity check (even parity) enabled. Set the permissible number of retries for unsucc If the number of consecutive errors exceeds the inverter output will be stopped. | | | | | | | |
| N025 | retry count | | 9999 | The inverter output will not be shut error occurs. | off even when a communication | | | | |
| 122 N026 | PU communication check time interval | 9999 | 0.1 to 999.8 s | PU connector communication is disabled. Set the interval of the communication check (Signal loss detection) time. If a no-communication state persists for longer than the permissible time, the inverter output will be shut off. | | | | | |
| | | | 9999 | No communication check (Signal le | oss detection) ansmission to the converter and the | | | | |
| 123 N027 | PU communication | 9999 | 0 to 150 ms | response. | | | | | |
| NU21 | waiting time setting | | 9999 | The time delay is not set in this parameter but in communication Delay time: Number set in the data × 10 ms | | | | | |
| 124 | PU communication CR/ | | 0 | Without CR/LF | | | | | |
| N028 | LF selection | 1 | 2 | With CR With CR/LF | | | | | |

Parameters related to RS-485 terminal communication

| Pr. | Name | Initial value | Setting range | Description | |
|---------------------------|--|------------------|---|--|--|
| 331 N030 | RS-485 communication station number | 0 | 0 to 31 (0 to 247)*1*2 | Enter the station number of the inverter. (Same specifications as Pr.117) | |
| 332 N031 | RS-485 communication speed | 96 | 3, 6, 12, 24, 48, 96, 192, 384, 576, 768, 1152 | Select the communication speed. (Same specifications as Pr.118) | |
| N032 | RS-485 communication data length | 0 | 0, 1 | Select the data length. (Same specifications as P.N022)*3 | |
| N033 | RS-485 communication stop bit length | 1 | 0, 1 | Select the stop bit length. (Same specifications as P.N023)*4 | |
| 333 | RS-485 communication stop bit length / data length | 1 | 0, 1, 10, 11 | Select the stop bit length and data bit length. (Same specifications as Pr.119)*3*4 | |
| 334 N034 | RS-485 communication parity check selection | 2 | 0, 1, 2 | Select the parity check specifications. (Same specifications as Pr.120) | |
| 335 N035 ^{*5} | RS-485 communication retry count | 1 | 0 to 10, 9999 | Set the permissible number of retries for unsuccessful data reception. (Same specifications as Pr.121) | |
| 336 | D0 405 | | 0 | RS-485 communication is available, but the inverter trips in the NET operation mode. | |
| N036 ^{*5} | RS-485 communication check time interval | 0 s | 0.1 to 999.8 s | Set the interval of the communication check (Signal loss detection) time. (Same specifications as Pr.122) | |
| | | | 9999 | No communication check (Signal loss detection) | |
| 337 N037 ^{*5} | RS-485 communication waiting time setting | 9999 | 0 to 150 ms, 9999 | Set the waiting time between data transmission to the inverter and the response. (Same specifications as Pr.123) | |
| 341 N038 ^{*5} | RS-485 communication CR/LF selection | | | | |

- *1 When "1" (MODBUS RTU protocol) is set in **Pr.549**, the setting range within parentheses is applied.
- *2 When a value outside the setting range is set, the inverter operates at the initial value.
- *3 In the MODBUS RTU protocol, the data length is fixed at 8 bits.
- *4 In the MODBUS RTU protocol, Pr.334 setting is applied as the stop bit length. (Refer to page 686.)
- *5 In the MODBUS RTU protocol, this is invalid.

NOTE

- The monitor items and parameter settings can be read during communication with the Pr.336 RS-485 communication check time interval = "0 (initial value)" setting, but such operation will become faulty once the operation mode is changed to the NET operation mode. When the NET operation mode is selected as the start-up operation mode, communication is performed once, then a Communication fault (inverter) (E.SER) occurs. To perform operation or parameter writing via communication, set "9999" or a large setting value in Pr.336. (The setting value is determined by the computer program.) (Refer to page 678.)
- · Always reset the inverter after making the initial settings of the parameters. After changing the communication-related parameters, communication cannot be made until the inverter is reset.

Mitsubishi inverter protocol (computer link 5.15.5 communication)

Parameter setting and monitoring, etc. are possible by using the Mitsubishi inverter protocol (computer link communication) via inverter PU connector and the RS-485 terminals.

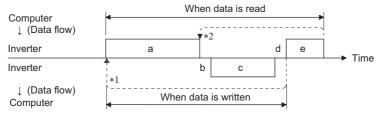
♦ Communication specifications

• The communication specifications are shown in the following table.

| It | tem | Description | Related parameter | | | | | |
|-------------------|------------------|--|-------------------|--|--|--|--|--|
| Communication | protocol | Mitsubishi inverter protocol (computer link communication) | Pr.551 | | | | | |
| Conforming stan | dard | EIA-485 (RS-485) | _ | | | | | |
| Number of conne | ectable units | 1: N (maximum 32 units), the setting range of station number is 0 to 31. | Pr.117 Pr.331 | | | | | |
| Communication | PU connector | Selected among 4800/9600/19200/38400/57600/76800/115200 bps. | Pr.118 | | | | | |
| speed | RS-485 terminals | Selected among 300/600/1200/2400/4800/9600/19200/38400/57600/76800/115200 bps. | Pr.332 | | | | | |
| Control procedu | re | Asynchronous method | _ | | | | | |
| Communication | method | Half-duplex system | _ | | | | | |
| | Character system | ASCII (7 bits or 8 bits can be selected.) | Pr.119 Pr.333 | | | | | |
| | Start bit | 1 bit | _ | | | | | |
| Communication | Stop bit length | 1 bit or 2 bits can be selected. | Pr.119 Pr.333 | | | | | |
| specifications | Parity check | Check (at even or odd numbers) or no check can be selected. | Pr.120 Pr.334 | | | | | |
| | Error check | Sum code check | | | | | | |
| | Terminator | | | | | | | |
| Time delay settir | ng | Availability of the setting is selectable. | Pr.123 Pr.337 | | | | | |

Communication procedure

- Data communication between the computer and inverter is made in the following procedure.
- (a) Request data is sent from the computer to the inverter. (The inverter will not send data unless requested.)
- (b) Communication waiting time
- (c) The inverter sends reply data to the computer in response to the computer request.
- (d) Inverter data processing time
- (e) An answer from the computer in response to reply data (c) of the inverter is transmitted. (Even if (e) is not sent, subsequent communication is made properly.)



- *1 If a data error is detected and a retry must be made, perform retry operation with the user program. The inverter output is shut off if the number of consecutive retries exceeds the parameter setting.
- *2 On receipt of a data error occurrence, the inverter returns reply data (c) to the computer again. The inverter output is shut off if the number of consecutive data errors reaches or exceeds the parameter setting.

Communication operation presence/absence and data format types

· Data communication between the computer and inverter is made in ASCII code (hexadecimal code).

• Communication operation presence/absence and data format types are as follows.

| Symbol | Operation | | Operation command | Operation frequency | Multi command | Parameter write | Inverter reset | Monitor | Parameter read | |
|--------|--|---|-------------------|---------------------|------------------|-----------------|----------------|------------------|----------------|--|
| а | Communication request is inverter in accordance wit program in the computer. | A, A1 | А | A2 | А | А | В | В | | |
| b | Inverter data processing t | ime | With | With | With | With | Without | With | With | |
| С | Reply data from the inverter (Data (a) is checked for an error.) | No error*1 (Request accepted) | С | С | C1 ^{*3} | С | C*2 | E, E1, E2, E3 | Е | |
| | | With error (Request rejected) | D | D | D | D | D*2 | D | D | |
| d | Computer processing dela | ay time | 10 ms or more | | | | | | | |
| | Reply from computer in response to reply data c | No error*1 (No inverter processing) | Without | Without | Without (C) | Without | Without | Without (C) | Without (C) | |
| е | (Data c is checked for error.) | With error (Inverter outputs c again.) | Without | Without | F | Without | Without | F | F | |

- *1 In the communication request data from the computer to the inverter, the time of 10 ms or more is also required after an acknowledgment (ACK) signal showing "No data error detected" is sent. (Refer to page 677.)
- *2 Reply from the inverter to the inverter reset request can be selected. (Refer to page 681.)
- *3 At mode error, and data range error, C1 data contains an error code. (Refer to page 686.) Except for those errors, the error is returned with data format D.
- · Data writing format
 - a. Communication request data from the computer to the inverter

| Format | Number of characters | | | | | | | | | | | | | | | | | | |
|--------|----------------------|--------------------------|---|----------------|-------|----|----------------------|-------------------------|--------|--------------|--------|----|----|----|-------|------|----|----|----|
| Format | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 |
| A | ENQ *1 | Invert statio numb | n | Instru code | ction | *3 | Data | | | Sum check | | *4 | | | | | | | |
| A1 | ENQ *1 | Invert statio numb | n | Instru code | ction | *3 | Data | | Sum | Sum check *4 | | | | | | | | | |
| A2 | ENQ *1 | Invert statio numb | n | Instru code | ction | *3 | Send data type | Receive data type | Data 1 | | Data : | 2 | | | Sum c | heck | *4 | | |

c. Reply data from the inverter to the computer (No data error detected)

| Format | | Number of characters | | | | | | | | | | | | | | | | | |
|--------|------------------|---------------------------|---------|----------------------|-------------------------|-----------------|-----------------|------|---|----|----|------|----|----|----|------------------|--------------|----|----|
| Format | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 |
| С | ACK *1 | Invert station numb | n *2 | *4 | | | | | | | | | | | | | | | |
| C1 | STX [*] | Invert station numb | n | Send data type | Receive data type | Error code 1 | Error code 2 | Data | 1 | | | Data | 2 | | | ETX [*] | Sum check | (| *4 |

c. Reply data from the inverter to the computer (Data error detected)

| Format | Number of characters | | | | | | | | | |
|--------|----------------------|------------------|-------------|------------|----|--|--|--|--|--|
| Format | 1 | 2 | 2 3 | | 5 | | | | | |
| D | NAK ^{*1} | Inverter station | n number *2 | Error code | *4 | | | | | |

- *1 A control code.
- *2 The inverter station number is specified in hexadecimal in the range of H00 to H1F (stations No. 0 to 31).
- *3 Set the delay time. When **Pr.123 PU communication waiting time setting** or **Pr.337 RS-485 communication waiting time setting** is set to other than "9999", create the communication request data without "delay time" in the data format. (The number of characters decreases by 1.)
- *4 CR+LF code: When a computer transmits data to the inverter, some computers automatically provide either one or both of the codes CR (carriage return) and LF (line feed) at the end of a data group. In this case, the same setting is required for data sent from the inverter to the computer. Use Pr.124 or Pr.341 for the CR+LF code setting.
- Data reading format

a. Communication request data from the computer to the inverter

| Format | | Number of characters | | | | | | | | | | |
|--------|-------|----------------------|---------------|------------|--------|----|---------|----|----|--|--|--|
| Format | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | | | |
| В | ENQ*1 | Inverter s | station *2 | Instructio | n code | *3 | Sum che | ck | *4 | | | |

c. Reply data from the inverter to the computer (No data error detected)

| Format | Number of characters | | | | | | | | | | | | |
|--------|----------------------|------------|--------------------------------------|-----------|-----------|---|------------|-----|--------|-------------------|---------|-----|----|
| Format | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
| E | STX*1 | | Inverter station number *2 Read data | | ta | | ETX *1 Sum | | Sum ch | eck | *4 | | |
| E1 | STX*1 | Inverter s | | Read da | Read data | | Sum che | eck | *4 | | | • | |
| E2 | STX*1 | Inverter s | | Read data | | | | | | ETX ^{*1} | Sum che | eck | *4 |

| Format | | Number of characters | | | | | | | | |
|--------|-------|----------------------|---|--|-------|---------|-----|----|--|--|
| Format | 1 | 2 | 3 | 4 to 23 | 24 | 25 | 26 | 27 | | |
| E3 | STX*1 | Inverter s | 2 | Read data (Inverter model information) | ETX*1 | Sum che | eck | *4 | | |

c. Reply data from the inverter to the computer (Data error detected)

| Format | Number of characters | | | | | | | |
|--------|----------------------|------------|---|---------------|----|--|--|--|
| Format | 1 | 2 | 3 | 4 | 5 | | | |
| D | NAK*1 | Inverter s | | Error code | *4 | | | |

e. Transmission data from the computer to the inverter when reading data

| Format | N | Number of characters | | | | | |
|----------------------------|-------|----------------------|--|----|--|--|--|
| Format | 1 | 2 3 | | 4 | | | |
| C (No data error detected) | ACK*1 | Inverter s | | *4 | | | |
| F (Data error detected) | NAK*1 | Inverter s | | *4 | | | |

- *1 A control code.
- *2 The inverter station number is specified in hexadecimal in the range of H00 to H1F (stations No. 0 to 31).
- *3 Set the delay time. When **Pr.123 PU communication waiting time setting** or **Pr.337 RS-485 communication waiting time setting** is set to other than "9999", create the communication request data without "delay time" in the data format. (The number of characters decreases by 1.)
- *4 CR+LF code: When a computer transmits data to the inverter, some computers automatically provide either one or both of the codes CR (carriage return) and LF (line feed) at the end of a data group. In this case, the same setting is required for data sent from the inverter to the computer. Use Pr.124 or Pr.341 for the CR+LF code setting.

Data definitions

· Control code

| Signal name | ASCII code | Description |
|-------------|------------|--|
| STX | H02 | Start Of Text (Start of data) |
| ETX | H03 | End Of Text (End of data) |
| ENQ | H05 | Enquiry (Communication request) |
| ACK | H06 | Acknowledge (No data error detected) |
| LF | H0A | Line Feed |
| CR | H0D | Carriage Return |
| NAK | H15 | Negative Acknowledge (Data error detected) |

· Inverter station number

Specify the station number of the inverter which communicates with the computer.

· Instruction code

Specify the processing request, for example, operation or monitoring, given by the computer to the inverter. Therefore, the operation or monitoring an item is enabled by specifying the corresponding instruction code. (Refer to page 681.)

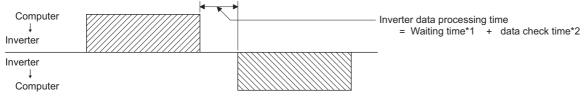
Data

Read/write data such as parameters transmitted from/to the inverter. The definitions and ranges of set data are determined in accordance with the instruction codes. (Refer to page 681.)

· Time delay

Specify the delay time (time period between the time when the inverter receives data from the computer and the time when the inverter starts transmission of reply data). Set the delay time in accordance with the response time of the computer in the range of 0 to 150 ms in 10 ms increments. (For example, "1" for 10 ms or "2" for 20 ms.)

When Pr.123 PU communication waiting time setting or Pr.337 RS-485 communication waiting time setting is set to other than "9999", create the communication request data without "delay time" in the data format. (The number of characters decreases by 1.)

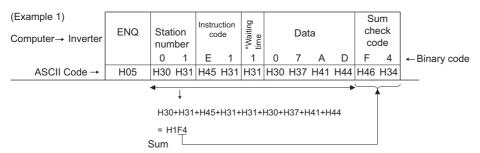


- *1 Number set in data × 10 (ms) when Pr.123 = "9999". Pr.123 setting (ms) when Pr.123 ≠ "9999".
- *2 About 10 to 30 ms. It varies depending on the instruction code.

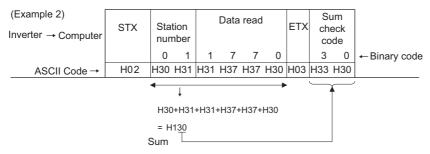


- The data check time varies depending on the instruction code. (Refer to page 677.)
- · Sum check code

The sum check code is a 2-digit ASCII (hexadecimal) representing the lower 1 byte (8 bits) of the sum derived from the checked ASCII data.



*When the **Pr.123 or Pr.337 (Waiting time setting)** #9999", create the communication request data without "waiting time" in the data format. (The number of characters decreases by 1.)

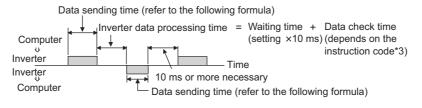


· Error code

If any error is found in the data received by the inverter, its error definition is sent back to the computer together with the NAK code.

| Error code | Error item | Error description | Inverter operation | |
|------------|------------------------|--|---|--|
| Н0 | Computer NAK error | The number of errors consecutively detected in communication request data from the computer is greater than the permissible number of retries. | | |
| H1 | Parity error | The parity check result does not match the specified parity. | | |
| H2 | Sum check error | The sum check code in the computer does not match that of the data received by the inverter. | The inverter output is shut off (E.PUE/E.SER) if error occurs | |
| Н3 | Protocol error | The data received by the inverter has a grammatical mistake. Or, data receive is not completed within the predetermined time. The CR or LF code specification is not the same as the setting of the parameter. | continuously more than the permissible number of retries. The LF signal is output. | |
| H4 | Framing error | The stop bit length differs from the initial setting. | | |
| H5 | Overrun error | New data has been sent by the computer before the inverter completes receiving the preceding data. | | |
| H6 | _ | _ | _ | |
| H7 | Character error | The character received is invalid (other than 0 to 9, A to F, control code). | The inverter does not accept the received data. However, the inverter output is not shut off. | |
| H8 | _ | _ | _ | |
| H9 | _ | _ | _ | |
| НА | Mode error | Parameter write was attempted when the inverter does not perform computer link communication, when the operation commands are not given through communication, or during inverter operation. | The inverter does not accept the received data. However, the | |
| НВ | Instruction code error | The specified instruction code does not exist. | inverter output is not shut off. | |
| НС | Data range error | Invalid data has been specified for parameter writing, frequency setting, etc. | | |
| HD | _ | _ | _ | |
| HE | _ | _ | _ | |
| HF | Normal (no error) | _ | _ | |

◆ Response time



[Formula for data transmission time]

- *1 Refer to page 673.
- *2 Communication specifications

| Name | Name | | | |
|-----------------|-----------------|------------------|--|--|
| Stop bit length | 1 bit 2 bits | | | |
| Data length | | 7 bits 8 bits | | |
| Parity check | With | 1 bit | | |
| Failty Check | Without | 0 | | |

In addition to the above, 1 start bit is necessary.

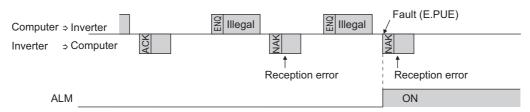
Minimum number of total bits: 9 bits
Maximum number of total bits: 12 bits

| Item | Check time |
|--|-----------------|
| Monitoring, operation command, frequency setting (RAM) | Less than 12 ms |
| Parameter read/write, frequency setting (EEPROM) | Less than 30 ms |
| Parameter clear / All parameter clear | Less than 5 s |
| Reset command | No reply |

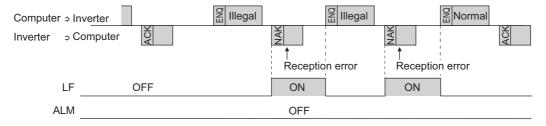
◆ Retry count setting (Pr.121, Pr.335)

- Set the permissible number of retries at data receive error occurrence. (Refer to page 676 for data receive error for retry.)
- When the data receive errors occur consecutively and the number of retries exceeds the permissible number setting, a
 communication fault (PU connector communication: E.PUE, RS-485 terminal communication: E.SER) occurs and the
 inverter output is shut off.
- When a data transmission error occurs while "9999" is set, the inverter does not shut off its output but outputs the Alarm
 (LF) signal. To use the LF signal, set "98 (positive logic) or 198 (negative logic)" in any of Pr.190 to Pr.196 (Output
 terminal function selection) to assign the function to an output terminal.

Example: PU connector communication, Pr. 121 = "1" (initial value)



Example: PU connector communication, Pr. 121 = "9999"





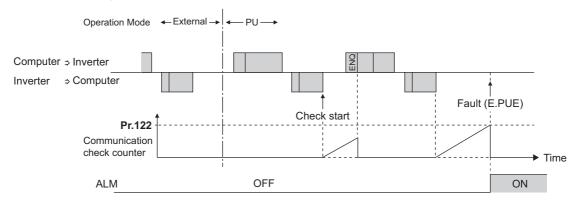
 For the RS-485 terminal communication, the operation at a communication error occurrence depends on the Pr.502 Stop mode selection at communication error setting. (Refer to page 663.)

◆ Signal loss detection (Pr.122, Pr.336 RS-485 communication check time interval)

- If signal loss is detected between the inverter and computer, communication error "E.PUE" (PU connector communication) or "E.SER" (RS-485 terminal communication) will occur and the inverter output is shut off.
- The LF signal is not output when a signal loss is detected. However, when a signal loss is detected via communication through the RS-485 terminals while **Pr.502** = "3 or 4", the LF signal is output.
- When the setting is "9999", communication check (signal loss detection) is not made.
- When the setting is "0", communication through the PU connector is not possible. The monitor items and parameter settings can be read during communication via RS-485 terminals, but a communication error (E.SER) occurs instantly when the operation mode is switched to the Network operation.
- Setting any value from 0.1 second to 999.8 seconds will enable signal loss detection. To detect signal loss, data must be sent from the computer within the communication check time interval (for further information on control codes, refer to page 675). (The inverter makes a communication check (clearing of communication check counter) regardless of the station number setting of the data sent from the master).

Communication check is started at the first communication in the operation mode having the operation source (PU operation mode for PU connector communication in the initial setting or Network operation mode for RS-485 terminal communication).

Example: PU connector communication, Pr. 122 = "0.1 to 999.8s"

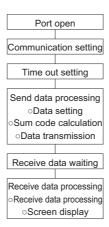


♦ Programming instructions

- When data from the computer has any error, the inverter does not accept that data. Hence, in the user program, always insert a retry program for data error.
- All data communication, for example, run command or monitoring, are started when the computer gives a communication
 request. The inverter does not return any data without the computer's request. Hence, design the program so that the
 computer gives a data read request for monitoring, etc. as required.
- · Program example: To switch to the Network operation mode

Microsoft® Visual C++® (Ver.6.0) programming example

```
#include <stdio.h>
#include <windows.h>
void main(void){
     HANDLE
                      hCom;
                                        // Communication handle
                      hDcb;
                                        // Structure for setting communication settings
     COMMTIMEOUTS
                               hTim;
                                       // Structure for setting timeouts
     char
                      szTx[0x10];
                                                 // Send buffer
     char
                      szRx[0x10];
                                                // Receive buffer
                      szCommand[0x10];// Command
     char
                      nTx,nRx;
                                                // For storing buffer size
     int
                                                // For calculating sum code
     int
                      nSum:
     BOOL
                      bRet;
                      nRet;
     int
     int
     // **** Open COM1 port ****
     hCom = CreateFile("COM1", (GENERIC_READ | GENERIC_WRITE), 0, NULL, OPEN_EXISTING, FILE_ATTRIBUTE_NORMAL, NULL);
     if(hCom != NULL) {
              //**** Set COM1 port communication ****
              GetCommState(hCom,&hDcb);
                                                                                    // Get current communication information
              hDcb.DCBlength = sizeof(DCB);
                                                                                    // Structure size setting
              hDcb.BaudRate = 19200;
                                                                                    // Communication speed = 19200 bps
              hDcb.ByteSize = 8;
                                                                                    // Data length = 8 bits
              hDcb.Parity = 2:
                                                                                    // Parity check at even numbers
              hDch StopBits = 2
                                                                                    // Stop bit = 2 bits
              bRet = SetCommState(hCom,&hDcb);
                                                                                    // Setting of changed communication information
              if(bRet == TRUE) {
                      // **** Set COM1 port timeout ****
                       GetCommTimeouts(hCom,&hTim);
                                                                                    // Get current timeout values
                      hTim.WriteTotalTimeoutConstant = 1000;
                                                                                    // Write timeout 1 second
                       hTim.ReadTotalTimeoutConstant = 1000;
                                                                                    // Read timeout 1 second
                      hTim.ReadTotalTimeoutConstantSetCommTimeouts(hCom,&hTim);// Setting of changed timeout values
                       // **** Setting of command for switching the station number 1 inverter to the Network operation mode ****
                       sprintf(szCommand,"01FB10000");
                                                                                    // Send data (NET operation write)
                       nTx = strlen(szCommand);
                                                                                    // Send data size
                      // **** Generate sum code ****
                                                                                    // Initialize sum data
                       nSum = 0:
                       for(i = 0; i < nTx; i++) {
                               nSum += szCommand[i];
                                                                                    // Calculate sum code
                               nSum &= (0xff);
                                                                                    // Mask data
                      // **** Generate send data ****
                                                                                    // Initialize send buffer
                      memset(szTx, 0, size of(szTx));\\
                       memset(szRx,0,sizeof(szRx));
                                                                                    // Initialize receive buffer
                       sprintf(szTx,"\5%s%02X",szCommand,nSum);// ENQ code + send data + sum code
                      nTx = 1 + nTx + 2:
                                                                                    // ENQ code + number of send data + number of sum codes
                       nRet = WriteFile(hCom,szTx,nTx,&nTx,NULL);
                       // **** Send ***
                       if(nRet != 0) {
                               nRet = ReadFile(hCom,szRx,sizeof(szRx),&nRx,NULL);
                       // **** Receive ****
                               if(nRet != 0) {
                                        // **** Display receive data ****
                                        for(i = 0; i < nRx; i++) {
                                                 printf("%02X ",(BYTE)szRx[i]);// Output received data to console
                                                 // Display ASCII code in Hexadecimal' In case of 0', "30" is displayed.
                                        printf("\n\r");
              CloseHandle(hCom);
                                                                                    // Close communication port
     }
```



- · Always set the communication check time interval before starting operation to prevent hazardous conditions.
- Data communication is not started automatically but is made only once when the computer provides a communication request. If communication is disabled during operation due to signal cable breakage etc., the inverter cannot be stopped.
 When the communication check time interval has elapsed, the inverter output will be shut off (E.PUE, E.SER).
 Turn the RES signal of the inverter ON or shut off the power supply to coast the motor to a stop.
- If communication is broken due to signal cable breakage, computer fault etc., the inverter does not detect such a fault. This should be fully noted.

Setting items and set data

• After completion of parameter settings, set the instruction codes and data, then start communication from the computer to allow various types of operation control and monitoring.

| Item | Read/ write | Instruction code | Data description | Number of data digits (format)*1 |
|----------------|----------------|------------------|--|--|
| | Read | Н7В | H0000: Network operation H0001: External operation, External operation (JOG operation) H0002: PU operation, External/PU combined operation, PUJOG operation | 4 digits (B and E/D) |
| Operation mode | Write | HFB | H0000: Network operation (Setting is available via communication through the RS-485 terminals.) H0001: External operation H0002: PU operation (Setting is available via communication through the PU connector.) | 4 digits (A and C/D) |

| | Item | Read/ write | Instruction code | Data description | Number of data digits (format)*1 |
|---------|---|----------------|----------------------|---|--|
| | Output frequency / speed | Read | H6F | H0000 to HFFFF: Output frequency in 0.01 Hz increments. (The display can be changed to the rotations per minute using Pr.37 , Pr.144 and Pr.811 . (Refer to page 446.)) | 4 digits (B and E/D) |
| | Output current | Read | H70 | H0000 to HFFFF: Output current (hexadecimal) Increment 0.01 A (FR-A820-03160(55K) or lower, FR-A840-01800(55K) or lower) Increment 0.1 A (FR-A820-03800(75K) or higher, FR-A840-02160(75K) or higher) | 4 digits (B and E/D) |
| | Output voltage | Read | H71 | H0000 to HFFFF: Output voltage (hexadecimal) in 0.1 V increments | 4 digits (B and E/D) |
| | Special monitor | Read | H72 | H0000 to HFFFF: Data of the monitor item selected with the instruction code HF3. | 4 digits (B and E/D) |
| | Special monitor | Read | H73 | | 2 digits (B and E1/D) |
| | selection No. | Write | HF3 | Monitor selection data (Refer to page 446 for details on selection No.) | 2 digits (A1 and C/D) |
| Monitor | Fault record | Read | H74 to H77 | b15 b8 b7 b0 H74 Second latest fault Latest fault H75 Fourth latest fault Third latest fault H76 Sixth latest fault Fifth latest fault H77 Eighth latest fault Seventh latest fault Fault record display example (instruction code H74) With the read data H30A0 (Second fault: THT) (Latest fault: OPT) b15 b8 b7 b0 0 0 1 1 0 0 0 0 1 0 1 0 0 0 0 0 Second fault Latest fault (H30) (Refer to page 776 for details on fault record read data.) | 4 digits (B and E/D) |
| • | eration command tended) | Write | HF9 | Control input commands such as the Forward rotation command (STF) signal and the Reverse rotation command (STR) signal can be set. (For the details, | 4 digits (A and C/D) |
| | eration command | Write | HFA | refer to page 685.) | 2 digits (A1 and C/D) |
| mo | erter status nitor (extended) | Read | H79 | The states of the output signals such as the Forward rotation output, Reverse rotation output, and Inverter running (RUN) signals can be monitored. (For | 4 digits (B and E/D) |
| mo | erter status nitor | Read | Н7А | the details, refer to page 685.) | 2 digits (B and E1/D) |
| (RA | t frequency AM) | Read | H6D | Read the set frequency/speed from the RAM or EEPROM. H0000 to HFFFF: Set frequency in 0.01 Hz increments. | 4 digits (B and |
| (EE | t frequency EPROM) | | H6E | (The display can be changed to the rotations per minute using Pr.37 , Pr.144 and Pr.811 . (Refer to page 446.)) | E/D) |
| (RA | Write the set frequency/speed into the RAM or EEPROM. H0000 to HE678 (0 to 590.00 Hz): frequency in 0.01 Hz increments. (The display can be changed to the rotations per minute using Pr.37 , Pr.14 : and Pr.811 . (Refer to page 446.)) To change the set frequency consecutively, write data to the inverter RAM. | | 4 digits (A and C/D) | | |
| Inv | (Instruction code: HED) H9696: Inverter reset As the inverter is reset at the start of communication by the computer, the inverter cannot send reply data back to the computer. HFD HFD HFD HFD HFD HFD HFD HF | | | | 4 digits (A and C/D) 4 digits (A and D) |

| | Item Read/ Instruction write code | | | Data description | Number of data digits (format)*1 |
|-----------------|---------------------------------------|---|------------|---|----------------------------------|
| Fa | ult history clear | Write | HF4 | H9696: Fault history is cleared. | 4 digits (A,C/D) |
| | rameter clear / All rameter clear | Clear Write HFC H55AA: Parameters other than communication parameters are cleared. Ye For details on whether or not to clear parameters, refer to page 864. When a clear is performed with H9696 or H9966, communication related parameter settings also return to the initial values. When resuming the operation, set the parameters again. Performing a clear will clear the instruction code HEC, HF3, and HFF settings. Only H9966 and H55AA (All parameter clear) are valid when a password is registered (refer to page 348). | | 4 digits (A and C/D) | |
| Pai | rameter | Read | H00 to H6B | Refer to the instruction code (page 864) and write and/or read parameter values as required. When setting Pr.100 and later, the link parameter | 4 digits (B and E/D) |
| l u | amotor | Write | H80 to HEB | extended setting must be set. | 4 digits (A and C/D) |
| Lin | k parameter | arameter Read H7F | | Parameter settings are changed according to the instruction code settings. For details on the settings, refer to the extended code in the instruction code | 2 digits (B and E1/D) |
| ext | ended setting | Write | HFF | list (on page 864). | 2 digits (A1 and C/D) |
| | cond parameter | Read | H6C | When setting the calibration parameters ^{*3} H00: Frequency ^{*4} | 2 digits (B and E1/D) |
| | anging (instruction de HFF = 1, 9) | Write | HEC | H01: Parameter-set analog value H02: Analog value input from terminal | 2 digits (A1 and C/D) |
| Mu | lti command | Read/ write | HF0 | Available for writing 2 commands, and monitoring 2 items for reading data. (Refer to page 686 for details.) | 10 digits (A2 and C1/D) |
| profile | Model | Read | H7C | The inverter model can be read in ASCII code. "H20" (blank code) is set for blank area. Example) FR-A840-1 (FM type): H46,H52,H2D,H41,H38,H34,H30,H2D,H31,H20,H20H20 | 20 digits (B and E3/D) |
| Product profile | Capacity | Read | H7D | The capacity in the inverter model can be read in ASCII code. Data is read in increments of 0.1 kW, and rounds down to 0.01 kW increments. "H20" (blank code) is set for blank area. Example) 0.75K: " 7" (H20, H20, H20, H20, H20, H37) | 6 digits (B and E2/D) |

- *1 Refer to page 673 for data formats (A, A1, A2, B, C, C1, D, E, E1, E2, E3, F).
- *2 Turning OFF the power supply while clearing parameters with H5A5A or H55AA returns the communication parameter settings to the initial
- *3 Refer to the following calibration parameter list for details on the calibration parameters.
- *4 The gain frequency can be also written using Pr.125 (instruction code: H99) or Pr.126 (instruction code: H9A).

MOTE `

- Set 65520 (HFFF0) as a parameter value "8888" and 65535 (HFFFF) as "9999".
- · For the instruction codes HFF, HEC, and HF3, their values once written are held, but cleared to zero when an inverter reset or all clear is performed.
- When a 32-bit parameter setting or monitor item is read and the value to be read exceeds HFFFF, HFFFF is returned.

Example) When reading the C3 (Pr.902) and C6 (Pr.904) settings from the inverter of station No. 0.

| | Computer send data | Inverter send data | Description |
|---|--------------------|--------------------|--|
| а | ENQ 00 FF 0 01 7D | ACK 00 | "H01" is set in the extended link parameter. |
| b | ENQ 00 EC 0 01 79 | ACK 00 | "H01" is set in the second parameter changing. |
| С | ENQ 00 5E 0 0A | STX 00 0000 ETX 20 | C3 (Pr.902) is read. 0% is read. |
| d | ENQ 00 60 0 F6 | STX 00 0000 ETX 20 | C6 (Pr.904) is read. 0% is read. |

To read/write C3 (Pr.902) or C6 (Pr.904) after inverter reset or parameter clear, execute from (a) again.

♦ List of calibration parameters

| _ | | lı | nstruction c | ode |
|--------------|--|------|--------------|----------|
| Pr. | Name | Read | Write | Extended |
| C2 (902) | Terminal 2 frequency setting bias frequency | 5E | DE | 1 |
| C3 (902) | Terminal 2 frequency setting bias | 5E | DE | 1 |
| 125 (903) | Terminal 2 frequency setting gain frequency | 5F | DF | 1 |
| C4 (903) | Terminal 2 frequency setting gain | 5F | DF | 1 |
| C5 (904) | Terminal 4 frequency setting bias frequency | 60 | E0 | 1 |
| C6 (904) | Terminal 4 frequency setting bias | 60 | E0 | 1 |
| 126 (905) | Terminal 4 frequency setting gain frequency | 61 | E1 | 1 |
| C7 (905) | Terminal 4 frequency setting gain | 61 | E1 | 1 |
| C12 (917) | Terminal 1 bias frequency (speed) | 11 | 91 | 9 |
| C13 (917) | Terminal 1 bias (speed) | 11 | 91 | 9 |
| C14 (918) | Terminal 1 gain frequency (speed) | 12 | 92 | 9 |
| C15 (918) | Terminal 1 gain (speed) | 12 | 92 | 9 |
| C16 (919) | Terminal 1 bias command (torque/magnetic flux) | 13 | 93 | 9 |
| C17 (919) | Terminal 1 bias (torque/magnetic flux) | 13 | 93 | 9 |
| C18 (920) | Terminal 1 gain command (torque/magnetic flux) | 14 | 94 | 9 |
| C19 (920) | Terminal 1 gain (torque/magnetic flux) | 14 | 94 | 9 |
| C8 (930) | Current output bias signal | 1E | 9E | 9 |
| C9 (930) | Current output bias current | 1E | 9E | 9 |
| C10 (931) | Current output gain signal | 1F | 9F | 9 |
| C11 (931) | Current output gain current | 1F | 9F | 9 |
| C38 (932) | Terminal 4 bias command (torque/magnetic flux) | 20 | A0 | 9 |
| C39 (932) | Terminal 4 bias (torque/magnetic flux) | 20 | A0 | 9 |
| C40 (933) | Terminal 4 gain command (torque/magnetic flux) | 21 | A1 | 9 |
| C41 (933) | Terminal 4 gain (torque/magnetic flux) | 21 | A1 | 9 |
| C42 (934) | PID display bias coefficient | 22 | A2 | 9 |
| C43 (934) | PID display bias analog value | 22 | A2 | 9 |
| C44 (935) | PID display gain coefficient | 23 | A3 | 9 |
| C45 (935) | PID display gain analog value | 23 | A3 | 9 |

Operation command

| Item | Instruction code | Bit length | Description*1*4 | Example |
|------------------------------|------------------|------------|---|---|
| Operation command | HFA | 8 bits | b0: AU (Terminal 4 input selection) b1: Forward rotation command b2: Reverse rotation command b3: RL (Low-speed operation command) b4: RM (Middle-speed operation command) b5: RH (High-speed operation command) b6: RT (Second function selection) b7: MRS (Output stop)*2 | [Example 1] H02 Forward rotation b7 |
| Operation command (extended) | HF9 | 16 bits | b0: AU (Terminal 4 input selection) b1: Forward rotation command b2: Reverse rotation command b3: RL (Low-speed operation command) b4: RM (Middle-speed operation command) b5: RH (High-speed operation command) b6: RT (Second function selection) b7: MRS (Output stop)*2 b8: JOG (Jog operation selection)*3 b9: CS (Selection of automatic restart after instantaneous power failure / flying start)*3 b10: STP (STOP) (Start self-holding selection)*3 b11: RES (Inverter reset)*3 b12 to b15: – | [Example 1] H0002 Forward rotation b15 b0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 |

^{*1} The signal within parentheses () is the initial status. The description changes depending on the setting of Pr.180 to Pr.189 (Input terminal function selection) (page 521).

Inverter status monitor

| Item | Instruction code | Bit length | Description*1 | Example |
|---|------------------|---------------|---|---|
| Inverter status monitor | Н7А | 8 bits | b0: RUN (Inverter running) b1: Forward rotation output b2: Reverse rotation output b3: SU (Up to frequency) b4: OL (Overload warning) b5: IPF (Instantaneous power failure/ undervoltage)*2 b6: FU (Output frequency detection) b7: ABC1 (Fault) | [Example 1] H03 ··· During forward b7 rotation b0 0 0 0 0 0 0 1 1 [Example 2] H80 ··· Stop at fault occurrence b7 b0 1 0 0 0 0 0 0 0 0 |
| Inverter status monitor (extended) | H79 | 16 bits | b0: RUN (Inverter running) b1: Forward rotation output b2: Reverse rotation output b3: SU (Up to frequency) b4: OL (Overload warning) b5: IPF (Instantaneous power failure/ undervoltage)*2 b6: FU (Output frequency detection) b7: ABC1 (Fault) b8: ABC2 (-) b9: Safety monitor output b10 to b14: - b15: Fault occurrence | [Example 1] H0003···During forward rotation b15 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 1 [Example 2] H8080···Stop at fault occurrence b15 1 0 0 0 0 0 0 0 0 1 0 0 0 0 0 0 |

^{*2} The Inverter run enable signal is in the initial status for the separated converter type.

^{*3} JOG operation/automatic restart after instantaneous power failure/start self-holding selection/reset cannot be controlled over a network, so in the initial status bit 8 to bit 11 are invalid. To use bit 8 to bit 11, change the signal by Pr.185, Pr.186, Pr.188, or Pr.189 (Input terminal function selection) (page 521) (A reset can be executed by the instruction code HFD.)

^{*4} During RS-485 communication through the PU connector, only the Forward rotation command and Reverse rotation command signals can be

- The signal within parentheses () is the initial status. The description changes depending on the setting of Pr.190 to Pr.196 (Output terminal function selection).
- No function is assigned in the initial status for the separated converter type.

▶ Multi command (HF0)

· Sending data format from computer to inverter

| Format | | Number of characters | | | | | | | | | | | | | | | | | |
|--------|-----|--------------------------|---|----------------|---|---------------|------------------------------------|---------------------------------------|------|-----------------|----|----|------|-----------------|----|----|-----|-------|-----------|
| Format | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 |
| A2 | ENQ | Invert statio numb | n | Instru code | | Time delay | Send data type ^{*1} | Receive data type ^{*2} | Data | 1 ^{*3} | | | Data | 2 ^{*3} | | | Sum | check | CR/ LF |

· Reply data format from inverter to computer (No data error detected)

| Format | | Number of characters | | | | | | | | | | | | | | | | | |
|--------|-----|------------------------------|---|------------------------------------|---------------------------------------|------|----------------------------------|------|-----|----|----|------|-----------------|----|----|-----|-----|-------|-----------|
| Format | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 |
| C1 | STX | Inverte station number | ı | Send data type ^{*1} | Receive data type ^{*2} | code | Error code 2 ^{*5} | Data | 1*4 | | | Data | 2 ^{*4} | | | ETX | Sum | check | CR/ LF |

- *1 Specify the data type of sending data (from computer to inverter).
- *2 Specify the data type of reply data (from inverter to computer).
- *3 Combination of data 1 and data 2 for sending

| Data type | Data 1 | Data 2 | Remarks |
|-----------|------------------------------|-----------------------------|--|
| 0 | Operation command (extended) | Set frequency (RAM) | Run command (extended) is same as instruction code HF9. (Refer |
| 1 | Operation command (extended) | Set frequency (RAM, EEPROM) | to page 685.) |

*4 Combination of data 1 and data 2 for reply

| Data type | Data 1 | Data 2 | Remarks |
|-----------|------------------------------------|--------------------------|--|
| 0 | Inverter status monitor (extended) | Output frequency (speed) | Inverter status monitor (extended) is same as instruction code H79. (Refer to page 685.) |
| 1 | Inverter status monitor (extended) | Special monitor | Replies the monitor item specified in instruction code HF3 for special monitor. (Refer to page 446.) |

^{*5} The error code for sending data 1 is set in error code 1, and the error code for sending data 2 is set in error code 2. Mode error (HA), instruction code error (HB), data range error (HC) or no error (HF) is replied. (Refer to page 776 for details on the error codes.)

MODBUS RTU communication specification 5.15.6

Operation by MODBUS RTU communication or parameter setting is possible by using the MODBUS RTU communication protocol through the RS-485 terminals of the inverter.

| Pr. | Name | Initial value | Setting range | Descr | ription | | | |
|-------------|---|------------------|---|---|--------------------------------------|--|--|--|
| | | | 0 | Broadcast communication | | | | |
| 331 N030 | RS-485 communication station number | 0 | 1 to 247 | Specify the inverter station numbers Enter the inverter station numbers connected to one personal comput | when two or more inverters are | | | |
| 332 N031 | RS-485 communication speed | 96 | 3, 6, 12, 24, 48, 96, 192, 384, 576, 768, 1152 | Select the communication speed. The setting value × 100 equals the communication speed. For example, enter 96 to set the communication speed of 9600 bps. | | | | |
| N033 | RS-485 communication stop | 1 | 0 | Stop bit length 1 bit | Valid when Pr.N034 (Pr.334) = | | | |
| 14033 | bit length | ' | 1 | Stop bit length 2 bits | "0" | | | |
| | RS-485 communication stop bit length / data length | | 0 | Stop bit length 1 bit | | | | |
| 333 | | 1 | 1 | Stop bit length 2 bits | Valid when Pr.334 = "0" | | | |
| | | ' | 10 | Stop bit length 1 bit | Valid Wilen F1.554 | | | |
| | | | 11 | Stop bit length 2 bits | | | | |
| | | | 0 | Without parity check Stop bit length 1 bit / 2 bits (dependent) | ds on the setting of Pr.333) | | | |
| 334 N034 | RS-485 communication parity check selection | 2 | 1 | With parity check at odd numbers. Stop bit length: 1 bit. | | | | |
| | | | 2 | With parity check at even numbers Stop bit length: 1 bit. | i. | | | |
| 343 N080 | Communication error count | 0 | _ | Displays the communication error communication. Read-only. | count during MODBUS RTU | | | |
| 500 | MODBUS RTU | | 0 | MODBUS RTU communication is a shut off in the NET operation mode | • | | | |
| 539 N002 | communication check time interval | 9999 | 0.1 to 999.8 s | Set the interval of the communication check (signal loss detection) time (same specifications as Pr.122). | | | | |
| | | | 9999 | No communication check (signal loss detection) | | | | |
| 549 | Protocol selection | 0 | 0 | Mitsubishi inverter protocol (computer link) | | | | |
| N000 | FIOLOCOI SEIECLIOII | U | 1 | MODBUS RTU protocol | | | | |

. ■ NOTE

- To use the MODBUS RTU protocol, set "1" in Pr.549 Protocol selection.
- If MODBUS RTU communication is performed from the master to the address 0 (station number 0), the data is broadcasted, and the inverter does not send any reply to the master. To obtain replies from the inverter, set Pr.331 RS-485 communication station number ≠ "0 (initial value)".
- Some functions are disabled in broadcast communication. (Refer to page 689.)
- If a communication option is installed with Pr.550 NET mode operation command source selection = "9999 (initial value)", commands (operation commands) transmitted via RS-485 terminals become invalid. (Refer to page 400.)

◆ Communication specifications

• The communication specifications are shown in the following table.

| Ite | em | Description | Related parameter |
|-------------------|------------------|--|-------------------|
| Communication | protocol | MODBUS RTU protocol | Pr.549 |
| Conforming stan | dard | EIA-485 (RS-485) | _ |
| Number of conne | ectable units | 1: N (maximum 32 units), setting is 0 to 247 stations | Pr.331 |
| Communication | speed | Selected among 300/600/1200/2400/4800/9600/19200/38400/57600/76800/ 115200 bps. | Pr.332 |
| Control procedur | re | Asynchronous method | _ |
| Communication | method | Half-duplex system | _ |
| | Character system | Binary (fixed at 8 bits) | _ |
| | Start bit | 1 bit | _ |
| Communication | Stop bit length | Select from the following three types: | |
| specifications | Parity check | No parity check, stop bit length 1 bit / 2 bits (depends on the setting of Pr.333). Odd parity check, stop bit length 1 bit. Even parity check, stop bit length 1 bit. | Pr.333 Pr.334 |
| | Error check | CRC code check | _ |
| | Terminator | Not available | _ |
| Time delay settin | g | Not available | _ |

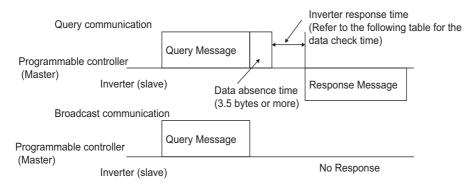
Outline

- The MODBUS communication protocol was developed by Modicon for programmable controllers.
- The MODBUS protocol uses exclusive message frames to perform serial communication between a master and slaves.
 These exclusive message frames are provided with a feature called "functions" that allows data to be read or written. These
 functions can be used to read or write parameters from the inverter, write input commands to the inverter or check the
 inverter's operating status, for example. This product classifies the data of each inverter into holding register area (register
 address 40001 to 49999). The master can communicate with inverters (slaves) by accessing pre-assigned holding register
 addresses.



There are two serial transmission modes, the ASCII (American Standard Code for Information Interchange) mode and the RTU
(Remote Terminal Unit) mode. However, this product supports only the RTU mode, which transfers 1 byte data (8 bits) as it
is. Also, only communication protocol is defined by the MODBUS protocol. Physical layers are not stipulated.

♦ Message format



Data check time

| Item | Check time |
|--|-----------------|
| Monitoring, operation command, frequency setting (RAM) | Less than 12 ms |
| Parameter read/write, frequency setting (EEPROM) | Less than 30 ms |
| Parameter clear / All parameter clear | < 5 s |
| Reset command | No reply |

Query

A message is sent to the slave (the inverter) having the address specified by the master.

· Normal response

After the query from the master is received, the slave executes the request function, and returns the corresponding normal response to the master.

Error Response

When an invalid function code, address or data is received by the slave, the error response is returned to the master.

This response is appended with an error code that indicates the reason why the request from the master could not be executed.

This response cannot be returned for errors, detected by the hardware, frame error and CRC check error.

Broadcast

The master can broadcast messages to all slaves by specifying address 0. All slaves that receive a message from the master execute the requested function. With this type of communication, slaves do not return a response to the master.



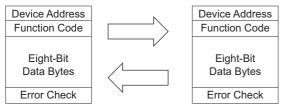
During broadcast communication, functions are executed regarded of the set inverter station number (Pr.331).

♦ Message frame (protocol)

· Communication method

Basically, the master sends a query message (inquiry), and slaves return a response message (response). At normal communication, the device address and function code are copied as they are, and at erroneous communication (illegal function code or data code), bit 7 (= H80) of the function code is turned ON, and the error code is set at data bytes.

Query message from Master



Response message from slave

Message frames comprise the four message fields shown in the figures above.

A slave recognizes message data as one message when a 3.5 character long no-data time (T1: start/end) is added before and after the data.

Details of protocol

The following table explains the four message fields.

| | Start | Address | Function | Data | CRC check | | End |
|---|-------|---------|----------|------------|-------------|-------------|-----|
| - | T1 | 8 bits | 8 bits | n × 8 bits | L 8 bits | H 8 bits | T1 |

| Message field | Description |
|-----------------|--|
| Address field | "0 to 247" can be set in the single-byte (8-bit) length field. Set "0" when sending broadcast messages (instructions to all addresses), and "1 to 247" to send messages to individual slaves. The response from the slave also contains the address set by the master. The value set in Pr.331 RS-485 communication station number is the slave address. |
| Function field | "1 to 255" can be set as the function code in the single-byte (8-bit) length filed. The master sets the function to be sent to the slave as the request, and the slave performs the requested operation. Refer to the function code list for details on the supported function codes. An error response is generated when a function code other than those in the function code list is set. The normal response from the slave contains the function code set by the master. The error response contains H80 and the function code. |
| Data field | The format changes according the function code. (Refer to page 690.) The data, for example, includes the byte count, number of bytes, and accessing content of holding registers. |
| CRC check field | Errors in the received message frame are detected. Errors are detected in the CRC check, and the 2 bytes length data is appended to the message. When the CRC is appended to the message, the lower bytes of the CRC are appended first, followed by the upper bytes. The CRC value is calculated by the sender that appends the CRC to the message. The receiver recalculates the CRC while the message is being received, and compares the calculation result against the actual value that was received in the error check field. If the two values do not match, the result is treated as an error. |

♦ Function code list

| Function name | Read/ write | Code | Outline | Broadcast communication | Message format reference page |
|----------------------------------|----------------|------|--|-------------------------|--|
| Read holding register | Read | H03 | The data of the holding registers is read. The various data of the inverter can be read from MODBUS registers. System environmental variable (Refer to page 695.) Real time monitor (Refer to page 447.) Fault history (Refer to page 697.) Product profile (Refer to page 698.) Inverter parameters (Refer to page 696.) | Not available | page 690 |
| Preset single register | Write | H06 | Data is written to a holding register. Data can be written to MODBUS registers to output instructions to the inverter or set parameters. System environmental variable (Refer to page 695.) Inverter parameters (Refer to page 696.) | Available | page 691 |
| Diagnostics | Read | H08 | Functions are diagnosed. (communication check only) A communication check can be made since the query message is sent and the query message is returned as it is as the return message (subfunction code H00 function). Subfunction code H00 (Return query data). | Not available | page 691 |
| Preset multiple registers | Write | H10 | Data is written to multiple consecutive holding registers. Data can be written to consecutive multiple MODBUS registers to output instructions to the inverter or set parameters. System environmental variable (Refer to page 695.) Inverter parameters (Refer to page 696.) | Available | page 692 |
| Read holding register access log | Read | H46 | The number of registers that were successfully accessed by the previous communication is read. Queries by function codes H03 and H10 are supported. The number and start address of holding registers successfully accessed by the previous communication are returned. "0" is returned for both the number and start address for queries other than function code H03 and H10. | Not available | page 693 |

◆ Read holding register (reading data of holding registers) (H03 or 03)

· Query message

| a. Slave address | b. Function | c. Starting address | | d. No. of points | | CRC check | |
|------------------|-------------|---------------------|----------|------------------|----------|-----------|----------|
| (O F:t-) | H03 | Н | L | Н | L | L | Н |
| (8 bits) | (8 bits) | (8 bits) | (8 bits) | (8 bits) | (8 bits) | (8 bits) | (8 bits) |

• Normal response (Response message)

| a. Slave address | b. Function | e. Byte count | f. Data | | | CRC check | |
|------------------|-------------|---------------|----------|----------|---------------|-----------|----------|
| (8 bits) | H03 | (8 bits) | Н | L | | L | Н |
| (o bits) | (8 bits) | (o bits) | (8 bits) | (8 bits) | (n × 16 bits) | (8 bits) | (8 bits) |

· Query message setting

| | Message | Description |
|---|------------------|---|
| а | Slave address | Set the address to send messages to. Broadcast communication is not possible. (Invalid when "0" is set.) |
| b | Function | Set H03. |
| С | Starting address | Set the holding register address from which to start reading the data. Starting address = start register address (decimal) - 40001 For example, when starting register address 0001 is set, the data of holding register address 40002 is read. |
| d | No. of points | Set the number of holding registers for reading data. Data can be read from up to 125 registers. |

· Content of normal response

| | Message | Description |
|---|------------|---|
| е | Byte count | The setting range is H02 to HFA (2 to 250). Twice the number of reads specified by (d) is set. |
| f | Data | The amount of data specified by (d) is set. Read data is output Hi bytes first followed by Lo bytes, and is arranged as follows: data of start address, data of start address+1, data of start address+2, and so forth. |

■ Example) Read the register values of 41004 (Pr.4) to 41006 (Pr.6) from slave address 17 (H11).

Query message

| Slave address | Function | Starting address | | No. of points | | CRC check | |
|---------------|----------|------------------|----------|---------------|----------|-----------|----------|
| H11 | H03 | H03 | HEB | H00 | H03 | H77 | H2B |
| (8 bits) | (8 bits) | (8 bits) | (8 bits) | (8 bits) | (8 bits) | (8 bits) | (8 bits) |

Normal response (Response message)

| Slave address | Function | Byte count | Data | | | | CRC check | | | |
|---------------|----------|------------|-------------------------|----------|----------|----------|-----------|----------|----------|----------|
| H11 | H03 | H06 | H17 H70 H0B HB8 H03 HE8 | | | | H2C | HE6 | | |
| (8 bits) | (8 bits) | (8 bits) | (8 bits) | (8 bits) | (8 bits) | (8 bits) | (8 bits) | (8 bits) | (8 bits) | (8 bits) |

Read value

Register 41004 **(Pr.4)**: H1770 (60.00 Hz) Register 41005 **(Pr.5)**: H0BB8 (30.00 Hz) Register 41006 **(Pr.6)**: H03E8 (10.00 Hz)

Preset single register (writing data to holding registers) (H06 or 06)

- The content of the system environmental variables and inverter parameters (refer to page 694) assigned to the holding register area can be written.
- · Query message

| a. Slave address | b. Function | c. Register address | | d. Preset data | | CRC check | |
|------------------|-------------|---------------------|----------|----------------|----------|-----------|----------|
| (0 h:t-) | H06 | Н | L | Н | L | L | Н |
| (8 bits) | (8 bits) | (8 bits) | (8 bits) | (8 bits) | (8 bits) | (8 bits) | (8 bits) |

· Normal response (Response message)

| a. Slave address | b. Function | c. Register address | | d. Preset data | | CRC check | |
|------------------|-------------|---------------------|----------|----------------|----------|-----------|----------|
| (O hito) | H06 | Н | L | Н | L | L | Н |
| (8 bits) | (8 bits) | (8 bits) | (8 bits) | (8 bits) | (8 bits) | (8 bits) | (8 bits) |

· Query message setting

| | Message | Description |
|------------|-----------|---|
| a Slave ad | ddress | Set the address to send messages to. Setting "0" enables broadcast communication. |
| b Function | ١ | Set H06. |
| c Register | r address | Set the holding register address to write data to. Register address = holding register address (decimal) - 40001 For example, when register address 0001 is set, data is written to holding register address 40002. |
| d Preset D | Data | Set the data to write to the holding register. Write data is fixed at 2 bytes. |

· Content of normal response

The contents in the normal response (**a to d**, including the CRC check) are the same as those in the query messages. In the case of broadcast communication, no response is returned.

■ Example) Write 60 Hz (H1770) to 40014 (set frequency RAM) of slave address 5 (H05).

Query message

| Slave address | Function | Register address | | Preset data | | CRC check | |
|---------------|----------|------------------|----------|-------------|----------|-----------|----------|
| H05 | H06 | H00 | H0D | H17 | H70 | H17 | H99 |
| (8 bits) | (8 bits) | (8 bits) | (8 bits) | (8 bits) | (8 bits) | (8 bits) | (8 bits) |

Normal response (Response message)

The same data as those in the query message



• With broadcast communication, no response is generated even if a query is executed, so when the next query is made, it must be made after waiting for the inverter data processing time after the previous query is executed.

◆ Diagnostics (diagnosis of functions) (H08 or 08)

• A communication check can be made since the query message is sent and the query message is returned as it is as the return message (subfunction code H00 function). Subfunction code H00 (Return query data)

· Query message

| a. Slave address | b. Function | c. Subfunction | | d. Data | | CRC check | |
|------------------|-------------|----------------|----------|----------|----------|-----------|----------|
| (O hita) | H08 | H00 | H00 | Н | L | L | Н |
| (8 bits) | (8 bits) | (8 bits) | (8 bits) | (8 bits) | (8 bits) | (8 bits) | (8 bits) |

· Normal response (Response message)

| a. Slave address | b. Function | c. Subfunction | | d. Data | | CRC check | |
|------------------|-------------|----------------|----------|----------|----------|-----------|----------|
| (9 hita) | H08 | H00 | H00 | Н | L | L | Н |
| (8 bits) | (8 bits) | (8 bits) | (8 bits) | (8 bits) | (8 bits) | (8 bits) | (8 bits) |

· Query message setting

| | Message | Description |
|---|---------------|--|
| а | Slave address | Set the address to send messages to. Broadcast communication is not possible. (Invalid when "0" is set.) |
| b | Function | Set H08. |
| С | Subfunction | Set H0000. |
| d | Data | Any 2-byte long data can be set. The setting range is H0000 to HFFFF. |

· Content of normal response

The contents in the normal response (a to d, including the CRC check) are the same as those in the query messages.



• With broadcast communication, no response is generated even if a query is executed, so when the next query is made, it must be made after waiting for the inverter data processing time after the previous query is executed.

◆ Preset multiple registers (writing data to multiple holding registers) (H10 or 16)

- Data can be written to multiple holding registers.
- · Query message

| a. Slave address | b. Function | | arting ress | | o. of sters | e. Byte count | | f. Data | l | CRC | check |
|------------------|-----------------|---------------|----------------|---------------|----------------|---------------|---------------|---------------|-------------------------|---------------|---------------|
| (8 bits) | H10 (8 bits) | H (8 bits) | L (8 bits) | H (8 bits) | L (8 bits) | (8 bits) | H (8 bits) | L (8 bits) | (n × 2 × 8 bits) | L (8 bits) | H (8 bits) |

· Normal response (Response message)

| a. Slave address | b. Function c. Starting address | | d. No. of registers | | CRC check | | |
|------------------|---------------------------------|----------|---------------------|----------|-----------|----------|----------|
| (O hita) | H10 | Н | L | Н | L | L | Н |
| (8 bits) | (8 bits) | (8 bits) | (8 bits) | (8 bits) | (8 bits) | (8 bits) | (8 bits) |

· Query message setting

| | Message | Description |
|---|------------------|---|
| а | Slave address | Set the address to send messages to. Setting "0" enables broadcast communication. |
| b | Function | Set H10. |
| С | Starting address | Set the holding register address from which to start writing the data. Starting address = start register address (decimal) - 40001 For example, when starting address 0001 is set, data is written to holding register 40002. |
| d | No. of registers | Set the number of holding registers for writing data. Data can be written to up to 125 registers. |
| е | Byte count | The setting range is H02 to HFA (2 to 250). Set twice the value specified by d . |
| f | Data | Set the amount of data specified by d . Write data is output Hi bytes first followed by Lo bytes, and is arranged as follows: data of start address, data of start address+1, data of start address+2, and so forth. |

· Content of normal response

The contents in the normal response (a to d, including the CRC check) are the same as those in the query messages.

■ Example) Write 0.5 s (H05) to 41007 (Pr.7) and 1 s (H0A) to 41008 (Pr.8) of slave address 25 (H19).

Query message

| Slave address | Function | Starting | address | No. of r | egisters | Byte count | | Da | ıta | | CRC | check |
|---------------|----------|----------|----------|----------|----------|------------|----------|----------|----------|----------|----------|----------|
| H19 | H10 | H03 | HEE | H00 | H02 | H04 | H00 | H05 | H00 | H0A | H86 | H3D |
| (8 bits) | (8 bits) | (8 bits) | (8 bits) | (8 bits) | (8 bits) | (8 bits) | (8 bits) | (8 bits) | (8 bits) | (8 bits) | (8 bits) | (8 bits) |

Normal response (Response message)

| Slave address | Function | Starting | address | No. of r | egisters | CRC | check |
|---------------|----------|----------|----------|----------|----------|----------|----------|
| H19 | H10 | H03 | HEE | H00 | H02 | H22 | H61 |
| (8 bits) | (8 bits) | (8 bits) | (8 bits) | (8 bits) | (8 bits) | (8 bits) | (8 bits) |

◆ Read holding register access log (H46 or 70)

- Queries by function codes H03 and H10 are supported. The number and start address of holding registers successfully accessed by the previous communication are returned. "0" is returned for both the number and start address for queries other than the function codes above.
- · Query message

| a. Slave address | b. Function | CRC check | | |
|------------------|-------------|-----------|----------|--|
| (8 bits) | H46 | L | Н | |
| (o bits) | (8 bits) | (8 bits) | (8 bits) | |

· Normal response (Response message)

| a. Slave address b. Function | | c. Starting | c. Starting address | | d. No. of points | | check |
|------------------------------|----------|-------------|---------------------|----------|------------------|----------|----------|
| (8 bits) | H46 | Н | L | Н | L | L | Н |
| (o bits) | (8 bits) | (8 bits) | (8 bits) | (8 bits) | (8 bits) | (8 bits) | (8 bits) |

· Query message setting

| | Message | Description |
|---|---------------|--|
| а | Slave address | Set the address to send messages to. Broadcast communication is not possible. (Invalid when "0" is set.) |
| b | Function | Set H46. |

· Content of normal response

| | Message | Description |
|---|------------------|--|
| С | Starting address | The start address of the holding register that was successfully accessed is returned. Starting address = start register address (decimal) - 40001 For example, when starting address 0001 is returned, the holding register address that was successfully accessed is 40002. |
| d | No. of points | The number of holding registers that were successfully accessed is returned. |

■ Example) Read the successful register start address and number of successful accesses from slave address 25 (H19).

Query message

| Slave address | Function | CRC | check |
|-------------------|----------|----------|----------|
| H19 | H46 | H8B | HD2 |
| (8 bits) (8 bits) | | (8 bits) | (8 bits) |

Normal response (Response message)

| Slave address | Function | Starting | address | No. of | points | CRC (| check |
|---------------|----------|----------|----------|----------|----------|----------|----------|
| H19 | H10 | H03 | HEE | H00 | H02 | H22 | H61 |
| (8 bits) | (8 bits) | (8 bits) | (8 bits) | (8 bits) | (8 bits) | (8 bits) | (8 bits) |

The number of holding registers that were successfully accessed was returned as two with the start address 41007 (Pr.7).

♦ Error response

• An error response is returned if the query message received from the master contains an illegal function, address or data. No response is returned for parity, CRC, overrun, framing, and busy errors.



- · No response is also returned in the case of broadcast communication.
- · Error response (Response message)

| a. Slave address b. Function | | c. Exception code | CRC check | |
|------------------------------|-------------------------|-------------------|---------------|---------------|
| (8 bits) | H80 + Function (8 bits) | (8 bits) | L (8 bits) | H (8 bits) |

| | Message | Description |
|---|----------------|---|
| а | Slave address | Set the address received from the master. |
| b | Function | The function code requested by the master and H80 is set. |
| С | Exception code | The codes in the following table are set. |

· Error code list

| Code | Error item | Error description | | |
|------|--|---|--|--|
| 01 | ILLEGAL FUNCTION The query message from the master has a function code that cannot be handled by the sla | | | |
| 02 | ILLEGAL DATA ADDRESS*1 | The query message from the master has a register address that cannot be handled by the slave. (No parameter, parameter cannot be read, parameter cannot be written) | | |
| 03 | ILLEGAL DATA VALUE | The query message from the master has data that cannot be handled by the slave. (Out of parameter write range, a mode is specified, or other error) | | |

- *1 An error response is not returned in the following cases:
 - (a) Function code H03 (reading data of holding registers)

When the number of registers is specified as one or more and there are one or more holding registers from which data can be read

(b) Function code H10 (writing data to multiple holding registers)

When the number of registers is specified as one or more and there are one or more holding registers to which data can be written.

In other words, when function code H03 or H10 is used and multiple holding registers are accessed, an error response is not returned even if a nonexistent holding register or holding register that cannot be read or written from/to is accessed.



- An error response is returned if none of the accessed holding registers exist. When an accessed holding register does not exist, the read value is 0 and the written data is invalid.
- Error detection of message data

The following errors are detected in message data from the master. The inverter output is not shut off even if an error is detected.

Error check items

| Error item | Error description | Inverter operation |
|--|---|--|
| Parity error | The data received by the inverter is different from the specified parity (Pr.334 setting). | |
| Framing error | The data received by the inverter is different from the stop bit length (Pr.333/Pr.334) setting. | M/Law this away accurs By 242 is |
| Overrun error | The next data has been sent by the master before the inverter completes receiving the preceding data. | When this error occurs, Pr.343 is incremented by one. When this error occurs, the LF signal is |
| The data length of the message frame is checked, and an error is generated if the received data length is less than 4 bytes. | | output. |
| CRC check error | An error is generated if the data in the message frame does not match the calculation result. | |



The LF signal can be assigned to an output terminal by setting Pr.190 to Pr.196 (Output terminal function selection).
 Changing the terminal assignment may affect other functions. Set parameters after confirming the function of each terminal.

♦ MODBUS register

• The following shows the MODBUS registers for system environment variables (read/write), real time monitor items (read), parameters (read/write), fault history data (read/write), and model information monitor items (read).

· System environment variables

| Register | Definition | Read/write | Remarks |
|----------|---|------------|--|
| 40002 | Inverter reset | Write | Any value |
| 40003 | Parameter clear | Write | Set H965A. |
| 40004 | All parameter clear | Write | Set H99AA. |
| 40006 | Parameter clear ^{*1} | Write | Set H5A96. |
| 40007 | All parameter clear ^{*1} | Write | Set HAA99. |
| 40009 | Inverter status / control input command*2 | Read/write | Refer to the following. |
| 40010 | Operation mode / inverter setting*3 | Read/write | Refer to the following. |
| 40014 | Set frequency (RAM value) | Read/write | The display can be changed to the rotations |
| 40015 | Set frequency (EEPROM value) | Write | per minute using Pr.37 , Pr.144 and Pr.811 . (Refer to page 446.) |

- *1 Settings in the communication parameters are not cleared.
- *2 The data is written as a control input command for writing. The data is read as the inverter status for reading.
- *3 The data is written as an operation mode setting for writing. The data is read as the operation mode status for reading.
- · Inverter status / control input command

| Bit | Definition | | | | |
|-----|---|--------------------------------------|--|--|--|
| Dit | Control input command | Inverter status | | | |
| 0 | Stop command | RUN (Inverter running) ^{*6} | | | |
| 1 | Forward rotation command | Forward running | | | |
| 2 | Reverse rotation command | Reverse running | | | |
| 3 | RH (High-speed operation command)*4 | SU (Up to frequency)*6 | | | |
| 4 | RM (Middle-speed operation command)*4 | OL (Overload warning)*6 | | | |
| 5 | RL (Low-speed operation command)*4 | IPF (Instantaneous power failure/ | | | |
| | , , , | undervoltage) ^{*6*7} | | | |
| 6 | JOG (Jog operation selection)*4 | FU (Output frequency detection)*6 | | | |
| 7 | RT (Second function selection)*4 | ABC1 (Fault)*6 | | | |
| 8 | AU (Terminal 4 input selection)*4 | ABC2 (-)*6 | | | |
| 9 | CS (Selection of automatic restart after | Safaty monitor output | | | |
| 9 | instantaneous power failure / flying start)*4 | Safety monitor output | | | |
| 10 | MRS (Output stop)*4*5 | 0 | | | |
| 11 | STP (STOP) (Start self-holding selection)*4 | 0 | | | |
| 12 | RES (Inverter reset)*4 | 0 | | | |
| 13 | _ | 0 | | | |
| 14 | _ | 0 | | | |
| 15 | _ | Fault occurrence | | | |

- *4 The signal within parentheses () is the initial status. The description changes depending on the setting of Pr.180 to Pr.189 (Input terminal function selection) (page 521).
 - The signals assigned to the input terminals may be valid or invalid in the NET operation mode. (Refer to page 404.)
- *5 The Inverter run enable signal is in the initial status for the separated converter type.
- *6 The signal within parentheses () is the initial status. The description changes depending on the setting of Pr.190 to Pr.196 (Output terminal function selection) (page 473).
- *7 No function is assigned in the initial status for the separated converter type.
- · Operation mode / inverter setting

| Mode | Read value | Write value |
|------------|------------|---------------------|
| EXT | H0000 | H0010 ^{*8} |
| PU | H0001 | H0011 ^{*8} |
| EXT JOG | H0002 | _ |
| PU JOG | H0003 | _ |
| NET | H0004 | H0014 |
| PU + EXT | H0005 | _ |

*8 Writing is available depending on the **Pr.79** and Pr.340 settings. (For details, refer to page 398.) Restrictions in each operation mode conform with the computer link specification.

- · Real time monitor Refer to page 446 for the register numbers and monitor items of the real time monitor.
- Parameters

| Pr. | Register | Name | Read/write | Remarks |
|-----------|-------------------|--|------------|--|
| 0 to 999 | 41000 to 41999 | For details on parameter names, refer to the parameter list (page 166). | Read/write | The parameter number + +41000 is the register number. |
| C2 (902) | 41902 | Terminal 2 frequency setting bias (frequency) | Read/write | |
| C2 (002) | 42092 | Terminal 2 frequency setting bias (analog value) | Read/write | Analog value (%) set to C3 (902) |
| C3 (902) | 43902 | Terminal 2 frequency setting bias (terminal analog value) | Read | Analog value (%) of the voltage (current) applied to terminal 2 |
| 125 (903) | 41903 | Terminal 2 frequency setting gain (frequency) | Read/write | |
| C4 (903) | 42093 | Terminal 2 frequency setting gain (analog value) | Read/write | Analog value (%) set in C4 (903) |
| C4 (903) | 43903 | Terminal 2 frequency setting gain (terminal analog value) | Read | Analog value (%) of the voltage (current) applied to terminal 2 |
| C5 (904) | 41904 | Terminal 4 frequency setting bias (frequency) | Read/write | |
| C6 (904) | 42094 | Terminal 4 frequency setting bias (analog value) | Read/write | Analog value (%) set in C6 (904) |
| C6 (904) | 43904 | Terminal 4 frequency setting bias (terminal analog value) | Read | Analog value (%) of the current (voltage) applied to terminal 4 |
| 126 (905) | 41905 | Terminal 4 frequency setting gain (frequency) | Read/write | |
| C7 (005) | 42095 | Terminal 4 frequency setting gain (analog value) | Read/write | Analog value (%) set in C7 (905) |
| C7 (905) | 43905 | Terminal 4 frequency setting gain (terminal analog value) | Read | Analog value (%) of the current (voltage) applied to terminal 4 |
| C12 (917) | 41917 | Terminal 1 bias frequency (speed) | Read/write | |
| | 42107 | Terminal 1 bias (speed) | Read/write | Analog value (%) set in C13 (917) |
| C13 (917) | 43917 | Terminal 1 bias (speed) (terminal analog value) | Read | Analog value (%) of voltage applied to terminal 1 |
| C14 (918) | 41918 | Terminal 1 gain frequency (speed) | Read/write | |
| | 42108 | Terminal 1 gain (speed) | Read/write | Analog value (%) set in C15 (918) |
| C15 (918) | 43918 | Terminal 1 gain (speed) (terminal analog value) | Read | Analog value (%) of voltage applied to terminal 1 |
| C16 (919) | 41919 | Terminal 1 bias command (torque/magnetic flux) | Read/write | |
| C17 (919) | 42109 | Terminal 1 bias (torque/magnetic flux) | Read/write | Analog value (%) set to C17 (919) |
| 017 (010) | 43919 | Terminal 1 bias (torque/magnetic flux) (terminal analog value) | Read | Analog value (%) of voltage applied to terminal 1 |
| C18 (920) | 41920 | Terminal 1 gain command (torque/magnetic flux) | Read/write | |
| C19 (920) | 42110 | Terminal 1 gain (torque/magnetic flux) | Read/write | Analog value (%) set to C19 (920) |
| 310 (020) | 43920 | Terminal 1 gain (torque/magnetic flux) (terminal analog value) | Read | Analog value (%) of voltage applied to terminal 1 |
| | 42115 | Motor temperature detection calibration (analog input) | Read/write | |
| C29 (925) | 43925 | Motor temperature detection calibration (analog input) (terminal analog value) | Read | Analog value (%) between terminals TH1 and TH2 of the FR-A8AZ |
| C30 (926) | 41926 | Terminal 6 bias frequency (speed) | Read/write | |
| | 42116 | Terminal 6 bias (speed) | Read/write | Analog value (%) set in C31 (926) |
| C31 (926) | 43926 | Terminal 6 bias (speed) (terminal analog value) | Read | Analog value (%) of the voltage applied to terminal 6 of the FR-A8AZ |
| C32 (927) | 41927 | Terminal 6 gain frequency (speed) | Read/write | |

| Pr. | Register | Name | Read/write | Remarks |
|-----------------|-------------------|---|------------|--|
| C33 | 42117 | Terminal 6 gain (speed) | Read/write | Analog value (%) set in C33 (927) |
| (927) | 43927 | Terminal 6 gain (speed) (terminal analog value) | Read | Analog value (%) of the voltage applied to terminal 6 of the FR-A8AZ |
| C34 (928) | 41928 | Terminal 6 bias command (torque) | Read/write | |
| C35 | 42118 | Terminal 6 bias (torque) | Read/write | Analog value (%) set in C35 (928) |
| (928) | 43928 | Terminal 6 bias (torque) (terminal analog value) | Read | Analog value (%) of the voltage applied to terminal 6 of the FR-A8AZ |
| C36 (929) | 41929 | Terminal 6 gain command (torque) | Read/write | |
| C37 | 42119 | Terminal 6 gain (torque) | Read/write | Analog value (%) set in C37 (929) |
| (929) | 43929 | Terminal 6 gain (torque) (terminal analog value) | Read | Analog value (%) of the voltage applied to terminal 6 of the FR-A8AZ |
| C8 (930) | 41930 | Current output bias signal | Read/write | |
| C9 (930) | 42120 | Current output bias current | Read/write | Analog value (%) set in C9 (930) |
| C10 (931) | 41931 | Current output gain signal | Read/write | |
| C11 (931) | 42121 | Current output gain current | Read/write | Analog value (%) set in C11 (931) |
| C38 (932) | 41932 | Terminal 4 bias command (torque/magnetic flux) | Read/write | |
| C39 (932) | 42122 | Terminal 4 bias (torque/magnetic flux) | Read/write | Analog value (%) set in C39 (932) |
| 039 (932) | 43932 | Terminal 4 bias (torque/magnetic flux) (terminal analog value) | Read | Analog value (%) of the current (voltage) applied to terminal 4 |
| C40 (933) | 41933 | Terminal 4 gain command (torque/magnetic flux) | Read/write | |
| C41 (933) | 42123 | Terminal 4 gain (torque/magnetic flux) | Read/write | Analog value (%) set in C41 (933) |
| 041 (933) | 43933 | Terminal 4 gain (torque/magnetic flux) (terminal analog value) | Read | Analog value (%) of the current (voltage) applied to terminal 4 |
| C42 (934) | 41934 | PID display bias coefficient | Read/write | |
| | 42124 | PID display bias analog value | Read/write | Analog value (%) set in C43 (934) |
| C43 (934) | 43934 | PID display bias analog value (terminal analog value) | Read | Analog value (%) of the current (voltage) applied to terminal 4 |
| C44 (935) | 41935 | PID display gain coefficient | Read/write | |
| | 42125 | PID display gain analog value | Read/write | Analog value (%) set in C45 (935) |
| C45 (935) | 43935 | PID display gain analog value (terminal analog value) | Read | Analog value (%) of the current (voltage) applied to terminal 4 |
| 1000 to 1999 | 45000 to 45359 | For details on parameter names, refer to the parameter list (page 166). | Read/write | The parameter number + 44000 is the register number. |

Fault history

| Register | Definition | Read/write | Remarks |
|----------|----------------|------------|---|
| 40501 | Fault record 1 | Read/write | |
| 40502 | Fault record 2 | Read | |
| 40503 | Fault record 3 | Read | Being 2 bytes in length, the data is stored as H00oo. |
| 40504 | Fault record 4 | Read | Refer to the lowest 1 byte for the error code. (For details or |
| 40505 | Fault record 5 | Read | error codes, refer to page 776.) The fault history is cleared by writing to register 40501. |
| 40506 | Fault record 6 | Read | Set any value as data. |
| 40507 | Fault record 7 | Read | <u> </u> |
| 40508 | Fault record 8 | Read | |

· Product profile

| Register | Definition | Read/write | Remarks |
|----------|-----------------------------------|------------|--|
| 44001 | Model (1st and 2nd characters) | Read | |
| 44002 | Model (3rd and 4th characters) | Read | |
| 44003 | Model (5th and 6th characters) | Read | |
| 44004 | Model (7th and 8th characters) | Read | The inverter model can be read in ASCII code. |
| 44005 | Model (9th and 10th characters) | Read | "H20" (blank code) is set for blank area. |
| 44006 | Model (11th and 12th characters) | Read | Example) FR-A840-1 (FM type): |
| 44007 | Model (13th and 14th characters) | Read | H46, H52, H2D, H41, H38, H34, H30, H2D, H31, H20H20 |
| 44008 | Model (15th and 16th characters) | Read | |
| 44009 | Model (17th and 18th characters) | Read | |
| 44010 | Model (19th and 20th characters) | Read | |
| 44011 | Capacity (1st and 2nd characters) | Read | The capacity in the inverter model can be read in ASCII code. |
| 44012 | Capacity (3rd and 4th characters) | Read | Data is read in increments of 0.1 kW, and rounds down to 0.01 |
| 44013 | Capacity (5th and 6th characters) | Read | kW increments. "H20" (blank code) is set for blank area. Example) 0.75K: " 7" (H20, H20, H20, H20, H20, H37) |



• When a 32-bit parameter setting or monitor item is read and the value to be read exceeds HFFFF, HFFFF is returned.

◆ Pr.343 Communication error count

The communication error occurrence count can be checked.

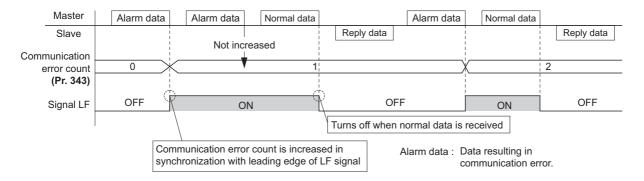
| Parameter | Setting range | Minimum setting range | Initial value |
|-----------|---------------|-----------------------|---------------|
| 343 | (Read-only) | 1 | 0 |



• The communication error count is temporarily stored in the RAM memory. The value is not stored in EEPROM, and so is cleared to 0 when power is reset and the inverter is reset.

Alarm (LF) signal output (communication error warning)

• During a communication error, the Alarm (LF) signal is output by open collector output. Assign the terminal to be used using any of **Pr.190 to Pr.196 (Output terminal function selection)**.





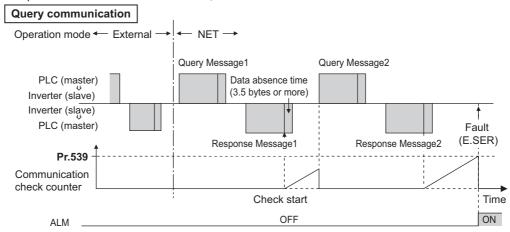
• The LF signal can be assigned to an output terminal by setting **Pr.190 to Pr.196**. Changing the terminal assignment may affect other functions. Set parameters after confirming the function of each terminal.

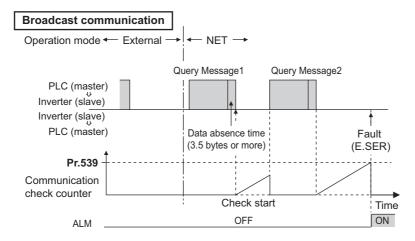
◆ Signal loss detection (Pr.539 RS-485 communication check time interval)

- If a signal loss (communication) is detected between the inverter and the master as a result of a signal loss detection, the Communication fault (inverter) (E.SER) occurs and the inverter output is shut off.
- When the setting is "9999", communication check (signal loss detection) is not made.
- When the setting is "0", reading, etc. of monitors and parameters is possible, though E.SER occurs instantly when the operation mode is switched to the Network operation.

- A signal loss detection is made when the setting is any of "0.1 s to 999.8 s". In order to enable the signal loss detection,
 data must be sent by the master at an interval equal to or less than the time set for the communication check. (The inverter
 makes a communication check (clearing of communication check counter) regardless of the station number setting of the
 data sent from the master).
- The communication check is made from the first communication in the Network operation mode (can be changed by Pr.551
 PU mode operation command source selection).
- The communication check time by query communication includes a no-data time (3.5 bytes).
 This no-data time differs according to the communication speed, so take this no-data time into consideration when setting the communication check time.

Example: RS-485 terminal communication, Pr. 539 = "0.1 to 999.8 s"







• For the RS-485 terminal communication, the operation at a communication error occurrence depends on the **Pr.502 Stop** mode selection at communication error setting. (Refer to page 663.)

5.15.7 CC-Link IE Field Network function setting (FR-A800-GF)

Use the following parameters to perform required settings for CC-Link IE Field Network communication between the inverter and other stations.

- For details on the CC-Link IE Field Network, refer to page 752.
- For the inverter operation at communication error, refer to page 663.
- · Set the parameters other than Pr.434, Pr.435, and Pr.541 in the same way as when a communication option is used.

| Pr. | Name | Initial value | Setting range | Description |
|-------------|---------------------------------|------------------|---------------|---|
| 434 N110 | Network number (CC- Link IE) | 0 | 0 to 255 | Enter the network number of the inverter. |
| 435 N111 | Station number (CC-Link IE) | 0 | 0 to 255 | Enter the station number of the inverter. |
| 541 | Frequency command | 0 | 0 | Signed frequency command value |
| N100 | sign selection | Ü | 1 | Unsigned frequency command value |

◆ Network number and station number setting (Pr.434, Pr.435)

- Enter the inverter network number in Pr.434 Network number (CC-Link IE).
- The setting range of **Pr.434** is "0 to 255", but its active range is "1 to 239". The values out of the active range are invalid because such values cannot be transmitted to the master station.
- Use Pr.435 Station number (CC-Link IE) to enter the station number of the inverter.
- The setting range of **Pr.435** is "0 to 255", but its active range is "1 to 120". The values out of the active range are invalid because such values cannot be transmitted to the master station.



- Use different station numbers for different devices. (If different devices have the same station number, the communication cannot be performed properly. If an error occurs due to a duplicated number, re-assign the station numbers, then reset the master station and the inverter power.)
- · Station numbers do not have to be consecutive numbers.
- The Pr.434 and Pr.435 settings are applied after an inverter reset or next power-ON.

◆ Frequency command with sign (Pr.541)

- By adding a sign to the frequency command value, the start command (forward/reverse rotation) can be inverted to start operation
- The Pr.541 Frequency command sign selection setting is applied to the frequency command from RWw0.

| Rotations per minute (machine speed) setting using Pr.37 and Pr.144 | Pr.541 setting | Sign | Setting range | Actual frequency command |
|---|----------------|---------|------------------------------------|---|
| Without | 0 | Without | 0 to 59000 | 0 to 590.00 Hz |
| Without | 1 | With | -32768 to 32767 (two's complement) | -327.68 to 327.67 Hz |
| With | 0 | Without | 0 to 65535 | It depends on Pr.37, Pr.144, and Pr.811 |
| vvitri | 1 | With | -32768 to 32767 (two's complement) | settings (in 1 or 0.1 increments). |

• Relationship between the start command and sign (Pr.541 = "1")

| Start command | Sign of the frequency command | Actual operation command |
|------------------|-------------------------------|--------------------------|
| Forward rotation | + | Forward rotation |
| | - | Reverse rotation |
| Reverse rotation | + | Forward rotation |
| | - | Reverse rotation |



- When Pr.541 = "1" (with sign)
 - When EEPROM write is specified by turning ON of RY22, write mode error (error code H01) will occur.
 - When both RY21 and RY22 are turned ON, RY21 has precedence.
 - When power is turned ON (inverter reset), the initial setting status of the sign bit is "positive" and the set frequency is 0 Hz. (The motor does not operate at the frequency set before turning OFF the power (inverter reset).)
 - When set frequency is written with the instruction code of HED or HEE, the sign of the frequency command is not changed.

Parameters referred to

Pr.37 Speed display, Pr.144 Speed setting switchover, Pr.811 Set resolution switchover page 444

5.15.8 USB device communication

A personal computer and an inverter can be connected with a USB cable. Setup of the inverter can be easily performed with FR Configurator2.

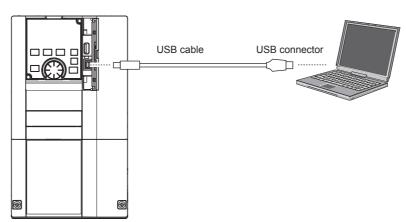
The inverter can be connected easily to a personal computer by a USB cable.

| Pr. | Name | Initial value | Setting range | Description |
|---------------------------|----------------------------------|------------------|--|---|
| 547 ^{*1} N040 | USB communication station number | 0 | 0 to 31 | Specify the inverter station number. |
| | | 0 | USB communication is possible, however the inverter output is shut off (E.USB) when the mode changes to the PU operation mode. | |
| 548 ^{*1} N041 | | 9999 | 0.1 to 999.8 s | Set the communication check time interval. If a no-communication state persists for longer than the permissible time, the inverter output is shut off (E.USB). |
| | | | 9999 | No communication check |

^{*1} The changed value is applied after the next power-ON or inverter reset.

♦ USB communication specifications

| Interface | Conforms to USB 1.1 (USB 2.0 full speed) |
|-----------------------|--|
| Transmission speed | 12 Mbps |
| Wiring length | Maximum 5 m |
| Connector | USB mini B connector (receptacle) |
| Power supply | Self-powered |
| Recommended USB cable | MR-J3USBCBL3M (cable length 3 m) |



- At the initial setting (**Pr.551 PU mode operation command source selection** = "9999"), communication with FR Configurator2 can be made in the PU operation mode simply by connecting a USB cable. To fix the command source to the USB connector in the PU operation mode, set "3" in **Pr.551**.
- Parameter setting and monitoring can be performed by using FR Configurator2. For details, refer to the Instruction Manual
 of FR Configurator2.

Parameters referred to

Pr.551 PU mode operation command source selection $\[\]$ page 400

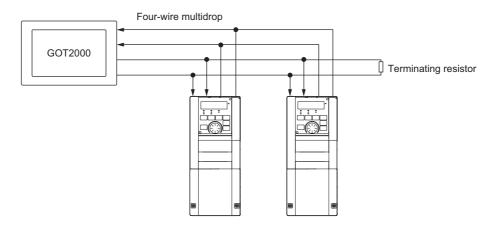
5.15.9 Automatic connection with GOT

When the automatic connection is enabled in the GOT2000 series, the inverter can communicate with the GOT2000 series with only setting the station number and connecting the GOT. This eliminates the need for the communication parameter setting.

| Pr. | Name | Initial value | Setting range | Description |
|-------------|-------------------------------------|---------------|------------------------|---|
| 117 N020 | PU communication station number | 0 | 0 to 31 | Use this parameter to specify the inverter station number. The inverter station number setting is required when multiple inverters are connected to one GOT (PU connector communication). |
| 331 N030 | RS-485 communication station number | 0 | 0 to 31 (0 to 247)*1*2 | Specify the inverter station number. The inverter station number setting is required when multiple inverters are connected to one GOT (RS-485 terminal communication). |

^{*1} When Pr.549 Protocol selection = "1" (MODBUS RTU protocol), the setting range is as shown in the parentheses.

♦ Automatic connection system configuration



◆ GOT2000 series automatic recognition

- When the GOT2000 series is connected, the parameters required for the GOT connection are automatically changed by setting the automatic recognition on the GOT2000 series side.
- · Set the station number (Pr.117 or Pr.331) of the inverter before the automatic recognition is performed.
- Connect all the stations of inverters with GOT before the automatic recognition is performed. The inverter newly added after automatic recognition will not be recognized automatically. (When an inverter is added, perform the initial setting in **Pr.999 Automatic parameter setting** or set the automatic recognition on the GOT side again.)

| Automatic change item | Automatic cha | ange parameter | Setting value after change | |
|-----------------------------------|--|----------------------------|---|--|
| Automatic change item | PU connector connection | RS-485 terminal connection | Setting value after change | |
| Communication speed | Pr.118 | Pr.332 | | |
| Data length / stop bit | Pr.119 | Pr.333 | Donor dia non disconsidera | |
| Parity | Pr.120 | Pr.334 | Depending on the setting of the connected device on the GOT side. | |
| Time delay setting | Pr.123 | Pr.337 | | |
| CR/LF selection | Pr.124 | Pr.341 | | |
| Number of communication retries | Pr.121 | Pr.335 | 9999 (fixed) | |
| Communication check time interval | Pr.122 | Pr.336 | 9999 (fixed) | |
| Protocol selection | (Pr.549 holds the value before the automatic recognition.) | Pr.549 | 0 (fixed to Mitsubishi inverter protocol) | |



- If the automatic recognition cannot be performed, initial setting in Pr.999 is required.
- For connection to a device other than the GOT2000 series, initial setting in Pr.999 is required.
- For details, refer to the GOT2000 Series Connection Manual (Mitsubishi Product).

≪ Parameters referred to ≫ Pr.999 Automatic parameter setting □ page 350

5.15.10 Backup/restore

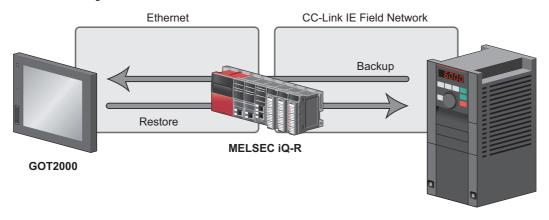
The GOT can be used for backing up inverter parameters and the data used in the PLC function of inverter.

^{*2} When a value outside the setting range is set, the inverter operates at the initial value.

The backup data stored in the GOT can be used to restore the data in the inverter.

| Pr. | Name | Initial value | Setting range | Description |
|---------------------------|-----------------------------|------------------|---------------|---|
| 434 N110 ^{*1} | Network number (CC-Link IE) | 0 | 0 to 255 | Enter the network number of the inverter. |
| 435 N111 ^{*1} | Station number (CC-Link IE) | 0 | 0 to 255 | Enter the station number of the inverter. |

^{*1} The setting is available in the inverter on which the FR-A8NCE is installed or when the FR-A800-GF inverter is used.



FR-A800 (with the FR-A8NCE installed) FR-A800-GF

◆ Connected devices

• To enable backup/restore, connect either the general-purpose inverter with the FR-A8NCE or the FR-A800-GF inverter to a programmable controller (master station) via the CC-Link IE Field Network.



- The backup/restore function is enabled only when the inverter is connected to a master station programmable controller.
- For details on the connected devices, refer to the GOT2000 Series User's Manual (Monitor).

Data to be backed up and restored

• The following data can be backed up and restored. The data other than those listed in the following table cannot be backed up or restored.

| Item |
|--|
| Inverter parameters |
| Parameters used for activating the PLC function |
| Programs (including SFCs) used in the PLC function |
| Global device comment information used in the PLC function |
| Function block source information |

◆ Backup/restore operation

- · The GOT backs up all applicable data in all the inverters that can be identified with the network numbers and station numbers in the controller list file.
- · The GOT restores all relevant data of the inverters selected based on the network numbers and station numbers using the backup data.
- The backup/restore cannot be performed in the following cases.

| Operation | Inverter status |
|-----------|---|
| Backup | During an inverter reset A password is registered or password protection is enabled (Pr.297 ≠ "9999"). During parameter copy using an operation panel or USB memory device (during writing to the inverter) During restore While password protection is enabled for files used in the PLC function (read protection) While PLC function project data is written to, read from, or verified against a USB memory device |
| Restore | During an inverter reset During running During auto tuning A password is registered or password protection is enabled (Pr.297 ≠ "9999"). While parameter write is disabled (Pr.77 = "1") During parameter copy using an operation panel or USB memory device (during writing to / reading from / verification against the inverter) During backup operation During the RUN status of the PLC function While password protection is enabled for files used in the PLC function (write protection) While PLC function project data is written to, read from, or verified against a USB memory device |

• On the operation panel, "RD" is displayed during backup, and "WR" is displayed during restore.



- To enable the restore operation, Pr.434 Network number (CC-Link IE) and Pr.435 Station number (CC-Link IE) must be
- Backup is performed for parameters for which parameter copy can be performed.
- For details on backup/restore function, refer to the GOT2000 Series User's Manual (Monitor).

5.16 (G) Control parameters

| P.G000 to P.G010, Pr.0 to Pr.46, Pr.112 706 frequency P.G001, P.G002, Pr.3, Pr.19, Pr.47, P.G011, P.G021 Pr.113 707 P.G003 Pr.14 708 -speed P.G003, P.G080, P.G201, P.G201, P.G202, Pr.86, Pr.565, Pr.86, Pr.566, Pr.566, Pr.566, Pr.566, Pr.566, Pr.566, Pr.566, Pr.566, Pr.560 Pr.60 712 p.G049 Pr.71, Pr.100 to Pr.713 | , |
|--|--|
| P.G011, P.G021 Pr.113 707 P.G003 Pr.14 708 P.G003, P.G080, Pr.14, Pr.85, Pr.86, Pr.565, Pr.86, Pr.566, Pr.56 | 1 |
| P.G003, P.G080, Pr.14, Pr.85, P.G201, P.G202, Pr.86, Pr.565, P.G301, P.G302 Pr.566, Pr.617 P.G030 Pr.60 712 P.C100, P.G040 to Pr.71, Pr.100 to 713 | |
| P.G201, P.G202, Pr.86, Pr.565, P.G301, P.G302 Pr.566, Pr.617 on P.G030 Pr.60 712 P.C100, P.G040 to Pr.71, Pr.100 to 713 | |
| P.C100, P.G040 to Pr.71, Pr.100 to 713 | |
| F 1 1/13 | |
| | |
| ustment P.G060, P.G061 Pr.673, Pr.674 714 | |
| P.G100 to P.G103, Pr.10 to Pr.12, Pr.802, Pr.850, Pr.1299 | ı |
| P.G105 Pr.522 720 | |
| p method P.G106 Pr.250 722 | |
| P.E300 to P.G107, Pr.30, Pr.70, P.T721 Pr.599 | |
| P.E300 Pr.30 724 | |
| Pr.882 to Pr.886, Pr.665 | |
| P.G130 to P.G132 Pr.660 to Pr.662 735 | |
| ion P.G200, P.G300 Pr.800, Pr.451 221 | |
| P.G203 to P.G205 Pr.245 to Pr.247 736 | |
| torque p.G210 Pr.803 245, | , 283 |
| P.G211, P.G212, Pr.820, Pr.821, Pr.6311, P.G312 Pr.830, Pr.831 | |
| P.G213, P.G214, Pr.824, P.825, P.G313, P.G314 Pr.834, P.835 | |
| torque P.G215, P.G216, Pr.823, Pr.827, P.G315, P.G316 Pr.833, Pr.837 | |
| P.G217 Pr.854 332 | |
| ntrol, control P.G224, P.G220 to Pr.828, Pr.877 to P.G222, P.G223 Pr.879, Pr.881 | |
| P.G230 to P.G238 Pr.840 to Pr.848 265 | |
| P.M002, P.A107, Pr.144, Pr.285, P.C140, P.C141, Pr.359, Pr.367 to Pr.369 | |
| P.G250, P.G350 Pr.788, Pr.747 233 | |
| rtion P.G264 Pr.1349 367 | |
| P.G400 to P.G404, P.G420 to P.G424 Pr.679 to Pr.683, Pr.994, Pr.995 | |
| trol P.G410, P.G411 Pr.653, Pr.654 741 | |
| P.G601 to P.G603 Pr.1003 to Pr.1005 271 | |
| P.G932, P.G942 Pr.89, Pr.569 228 | |
| 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 | o speed gnetic flux P.G100 to P.G103, Pr.10 to Pr.12, Pr.802, Pr.850, Pr.1299 P.G105 Pr.522 720 method P.G106 Pr.250 722 lection P.E300 to P.G107, Pr.599 724 P.E300 Pr.30 724 P.E300 Pr.882 to Pr.886, Pr.665 Citation P.G120 to P.G125 Pr.882 to Pr.886, Pr.665 Citation P.G130 to P.G320 Pr.800, Pr.451 221 P.G203 to P.G205 Pr.245 to Pr.247 736 torque P.G210 Pr.803 245 P.G211, P.G212, P.G311, P.G312 Pr.820, Pr.821, Pr.830, Pr.831 P.G213, P.G214, P.G312 Pr.824, P.835 Pr.834, P.835 P.G215, P.G216, Pr.823, Pr.827, Pr.831, Pr. |

5.16.1 Manual torque boost

V/F

Voltage drop in the low-frequency range can be compensated, improving reduction of the motor torque in the low-speed range.

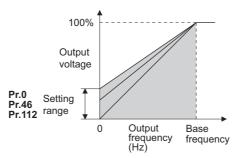
- · Motor torque in the low-frequency range can be adjusted according to the load, increasing the motor torque at the start up.
- By using the RT signal or X9 signal, it is possible to switch between 3 types of torque boost.

| Pr. | Name | Initial value | Setting range | Description | |
|-----------|---------------------|------------------|---------------|---|--|
| | | 6% ^{*1} | | | |
| | | 4% ^{*2} | | | |
| 0 G000 | Torque boost | 3% ^{*3} | 0 to 30% | Set the output voltage at 0 Hz in %. | |
| | | 2% ^{*4} | | | |
| | | 1% ^{*5} | | | |
| 46 | Second torque boost | 9999 | 0 to 30% | Set the torque boost value at when the RT signal is ON. | |
| G010 | Second torque boost | 9999 | 9999 | Without the second torque boost | |
| 112 | Third torque boost | 9999 | 0 to 30% | Set the torque boost value at when the X9 signal is ON. | |
| G020 | Tilliu torque boost | 3333 | 9999 | Without the third torque boost | |

- *1 The initial value for the FR-A820-00077(0.75K) or lower and FR-A840-00038(0.75K) or lower.
- *2 The initial value for the FR-A820-00105(1.5K) to FR-A820-00250(3.7K), FR-A840-00052(1.5K) to FR-A840-00126(3.7K).
- *3 The initial values for the FR-A820-00340(5.5K), FR-A820-00490(7.5K), FR-A840-00170(5.5K), FR-A840-00250(7.5K).
- *4 The initial value for the FR-A820-00630(11K) to FR-A820-03160(55K), FR-A840-00310(11K) to FR-A840-01800(55K).
- *5 The initial value for the FR-A820-03800(75K) or higher and FR-A840-02160(75K) and higher.

◆ Starting torque adjustment

- Assuming Pr.19 Base frequency voltage is 100%, set the output voltage at 0 Hz to Pr.0 (Pr.46, Pr.112) in percentage.
- Perform the adjustment of the parameter little by little (approximately 0.5%), and confirm the status of the motor each time. The motor may overheat when the value is set too high. Do not use more than 10% as a guideline.



◆ Setting multiple torque boosts (RT signal, X9 signal, Pr.46, Pr.112)

- When changing the torque boost depending on the application or when using single inverter switching between multiple
 motors, use the second (third) torque boost.
- Pr.46 Second torque boost is enabled when the RT signal is ON.
- Pr.112 Third torque boost is enabled when the X9 signal is ON. Set "9" in Pr.178 to Pr.189 (Input terminal function selection) to assign the X9 signal function to a terminal.

NOTE

- The RT (X9) signal acts as the second (third) function selection signal and makes the other second (third) functions valid. (Refer to page 525.)
- The RT signal is assigned to the terminal RT in the initial status. Set "3" in one of **Pr.178 to Pr.189 (Input terminal function selection)** to assign the RT signal to another terminal.
- Set a larger value when the distance between the inverter and the motor is long or when there is not enough motor torque in the low-speed range. It may cause overcurrent trip when it is set too large.
- Setting for Pr.0, Pr.46, and Pr.112 becomes enabled only when the V/F control is selected.
- When the initial value is set in **Pr.0**, the **Pr.0** setting is automatically changed by changing the **Pr.71 Applied motor** or **Pr.81 Number of motor poles** setting. (Refer to page 528.)
- Changing the terminal assignment using Pr.178 to Pr.189 (Input terminal function selection) may affect the other functions.
 Set parameters after confirming the function of each terminal.

Parameters referred to

Pr.3 Base frequency, Pr.19 Base frequency voltage page 707

Pr.71 Applied motor page 528

Pr.178 to Pr.189 (Input terminal function selection) F page 521

5.16.2 Base frequency voltage

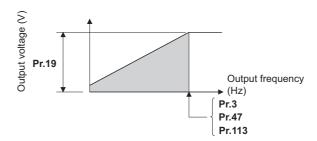
V/F

Use this function to adjust the inverter outputs (voltage, frequency) to match with the motor rating.

| Pr. | Name | Initial value | | Setting range | Description | |
|------------|------------------------|----------------------|------|---------------|---|--|
| FI. | Ivallie | FM | CA | Setting range | Description | |
| 3 G001 | Base frequency | 60 Hz 50 Hz 0 to 590 | | 0 to 590 Hz | Set the frequency at the rated motor torque. (50/60 Hz) | |
| 40 | | | | 0 to 1000 V | Set the base voltage. | |
| 19 G002 | Base frequency voltage | 9999 | 8888 | 8888 | 95% of the power supply voltage | |
| 3002 | | | | 9999 | Same as the power supply voltage | |
| 47 | Second V/F (base | 9999 | | 0 to 590 Hz | Set the base frequency when the RL signal is ON. | |
| G011 | frequency) | 9999 | | 9999 | Second V/F disabled | |
| 113 | Third V/F (base | base 9999 | | 0 to 590 Hz | Set the base frequency when the X9 signal is ON. | |
| G021 | frequency) | שששש | | 9999 | Third V/F disabled | |

♦ Base frequency setting (Pr.3)

- When operating a standard motor, generally set the rated frequency of the motor in **Pr.3 Base frequency**. When the motor operation require switching to the commercial power supply, set the power supply frequency in **Pr.3**.
- When the frequency described on the motor rating plate is "50 Hz" only, make sure to set to 50 Hz. When it is set to 60 Hz, the voltage will drop too much, causing insufficient torque. As a result, the inverter output may be shut off due to overload. A caution is required especially in case of **Pr.14 Load pattern selection** = "1" (variable torque load).
- When using the Mitsubishi Electric constant torque motor, set Pr.3 to 60 Hz.



◆ Setting multiple base frequencies (Pr.47, Pr.113)

- To change the base frequency when using a single inverter switching between multiple motors, use Pr.47 Second V/F
 (base frequency) and Pr.113 Third V/F (base frequency).
- **Pr.47** is enabled when the RT signal is ON and **Pr.113** is enabled when the X9 signal is ON. To input the X9 signal, set "9" in any of **Pr.178 to Pr.189** (**Input terminal function selection**) to assign the function to a terminal.

NOTE

- The RT (X9) signal acts as the second (third) function selection signal and makes the other second (third) functions valid. (Refer to page 525.)
- The RT signal is assigned to the terminal RT in the initial status. Set "3" in one of **Pr.178 to Pr.189 (Input terminal function selection)** to assign the RT signal to another terminal.

◆ Setting of base frequency voltage (Pr.19)

- Use Pr.19 Base frequency voltage to set the base voltage (for example, rated motor voltage).
- · When it is set lower than the power supply voltage, maximum output voltage of the inverter will be the voltage set in Pr.19.

- Pr.19 can be used in following cases.
 - (a) When regenerative driving (continuous regeneration, etc.) is performed frequently
 Output voltage will get higher than the specification during the regenerative driving, which may cause overcurrent trip
 (E.OC[]) by the increase in motor current.
 - (b) When the fluctuation of power supply voltage is high When the power supply voltage exceeds the rated voltage of the motor, fluctuation of rotation speed or overheating of motor may occur due to excessive torque or increase in motor current.
- When operating a Vector control dedicated motor (SF-V5RU, SF-V5RU1, SF-V5RU3, SF-V5RU4, SF-VR) with V/F control, perform following settings.

| Motor model | Pr.19 setting | Pr.3 setting | | |
|--|---------------|--------------|--|--|
| SF-V5RU, 3.7 kW or lower | 170 V | | | |
| SF-V5RU, 5.5 kW or higher | 160 V | 50 Hz | | |
| SF-V5RUH, 3.7 kW or lower | 340 V | 30 HZ | | |
| SF-V5RUH, 5.5 kW or higher | 320 V | | | |
| SF-V5RU1, 30 kW or lower | 160 V | | | |
| SF-V5RU1, 37 kW | 170 V | 33.33 Hz | | |
| SF-V5RU3, 22 kW or lower | 160 V | 33.33 ⊓Z | | |
| SF-V5RU3, 30 kW | 170 V | | | |
| SF-V5RU4, 3.7 kW and 7.5 kW | 150 V | 16.67 Hz | | |
| SF-V5RU4 and motors other than described above | 160 V | 10.07 HZ | | |
| SF-VR | 160 V | 50.11- | | |
| SF-VRH | 320 V | - 50 Hz | | |



- When the operation becomes not possible due to failure in encoder, etc., under Vector control, set Pr.80 Motor capacity or Pr.81 Number of motor poles = "9999" to perform V/F control.
- When the Advanced magnetic flux vector control, Real sensorless vector control, Vector control, or PM sensorless vector control is selected, Pr.3, Pr.47, Pr.113, and Pr.19 will become disabled, and Pr.83 and Pr.84 will become enabled.
 However, S-pattern curve with Pr.29 Acceleration/deceleration pattern selection = "1" (S-pattern acceleration/deceleration A) will make Pr.3 or Pr.47 and Pr.113 enabled. (S-pattern curve under PM sensorless vector control is the rated frequency of the motor.)
- When **Pr.71 Applied motor** = "2" (adjustable 5 points V/F), setting for **Pr.47** and **Pr.113** will become disabled. Also, **Pr.19** cannot be set to "8888" or "9999".
- Changing the terminal assignment using **Pr.178 to Pr.189 (Input terminal function selection)** may affect the other functions. Set parameters after confirming the function of each terminal.

Parameters referred to

Pr.14 Load pattern selection page 708

Pr.29 Acceleration/deceleration pattern selection □ page 372

Pr.71 Applied motor page 528

Pr.83 Rated motor voltage, Pr.84 Rated motor frequency page 532

Pr.178 to Pr.189 (Input terminal function selection) page 521

5.16.3 Load pattern selection

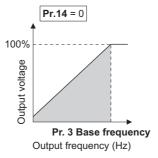


Optimal output characteristics (V/F characteristics) for application or load characteristics can be selected.

| Pr. | Name | Initial value | Setting range | Description |
|------|------------------------|---------------|---------------|--|
| | | | 0 | For constant-torque load |
| | | | 1 | For variable-torque load |
| | | | 2 | For constant-torque lift (boost at reverse rotation: 0%) |
| 14 | | 0 | 3 | For constant-torque lift (boost at forward rotation: 0%) |
| G003 | Load pattern selection | | 4 | RT signal ON for constant-torque load, RT signal OFF for constant-torque lift, boost at reverse rotation 0% |
| | | | 5 | RT signal ON for constant-torque load, RT signal OFF for constant-torque lift, boost at forward rotation 0% |
| | | | 12 to 15 | Excitation current low-speed scaling factor (Refer to page 711.) |

◆ Application for constant-torque load (Pr.14 ="0", initial value)

- · The output voltage will change linearly against the output frequency at the base frequency or lower.
- Set this parameter when driving a load that has constant load torque even when the rotation speed is changed, such as conveyor, dolly, or roll drive.



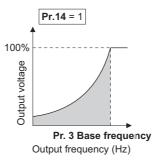


Select for constant-torque load (setting value "0") even for fan and pump in following cases.

- When accelerating a blower with large moment of inertia (J) in a short period of time.
- · When it is a constant-torque load such as rotary pump or gear pump.
- · When the load torque increases in low speed such as screw pump.

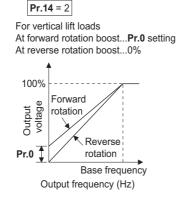
◆ Application for variable-torque load (Pr.14 ="1")

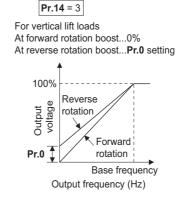
- The output voltage will change in square curve against the output frequency at the base frequency or lower. (1.75th-power curve for the FR-A820-01870(37K) or higher, and the FR-A840-00930(37K) or higher)
- Set this parameter when driving a load with load torque change proportionally against the square of the rotation speed, such as a fan or pump.



◆ Vertical lift load applications (Pr.14 = "2, 3")

- Set "2" when a vertical lift load is fixed as power driving load at forward rotation and regenerative load at reverse rotation.
- **Pr.0 Torque boost** is valid during forward rotation, and torque boost is automatically changed to "0%" during reverse rotation.
- Set "3" for an elevated load that is in the driving mode during reverse rotation and in the regenerative load mode during forward rotation according to the load weight, e.g. counterweight system.







 When torque is continuously regenerated as vertical lift load, it is effective to set the rated voltage in Pr.19 Base frequency voltage to prevent trip due to current at regeneration.

◆ Switching load pattern using signal (Pr.14 = "4, 5")

- · The output characteristics can be switched between for constant-torque load and for lift with the RT signal or X17 signal.
- To input the X17 signal, set "17" in any of Pr.178 to Pr.189 (Input terminal function selection) to assign the function.
- Switching with the RT signal will become disabled when the X17 signal is assigned.

| Pr.14 setting | RT (X17) signal | Output characteristics | | |
|---------------|-----------------|--|--|--|
| 4 | ON | For constant-torque load (same as setting value "0") | | |
| 4 | OFF | For lift, boost at reverse rotation 0% (same as setting value "2") | | |
| 5 | ON | For constant-torque load (same as setting value "0") | | |
| 3 | OFF | For lift, boost at forward rotation 0% (same as setting value "3") | | |



- The RT signal is assigned to the terminal RT in the initial status. Set "3" in one of **Pr.178 to Pr.189 (Input terminal function selection)** to assign the RT signal to another terminal.
- Changing the terminal assignment using **Pr.178 to 189** may affect other functions. Set parameters after confirming the function of each terminal.
- Pr.14 will become enabled under V/F control.
- · Other second functions will become enabled when the RT signal is ON.

Pr.0 Torque boost page 706
Pr.3 Base frequency page 707

Pr.178 to Pr.189 (Input terminal function selection) page 521

5.16.4 Excitation current low-speed scaling factor

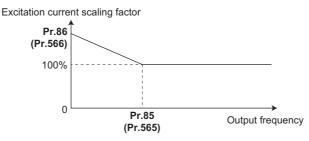
Magnetic flux Sensorless

Under Advanced magnetic flux vector control or Real sensorless vector control, the excitation current scaling factor in the low-speed range can be adjusted.

| Pr. | Name | Initial value | Setting range | Description |
|-------------|---|---------------|------------------|--|
| | | | 0 to 5 | Excitation current low-speed scaling factor: Pr.86 Refer to page 708 for details on the operation under V/F control. |
| | | | 12 ^{*1} | Forward rotation excitation current low-speed scaling factor: Pr.86 Reverse rotation excitation current low-speed scaling factor: Pr.617 |
| 14 | Load pattern selection | 0 | 13 ^{*1} | Forward rotation excitation current low-speed scaling factor: Pr.617 Reverse rotation excitation current low-speed scaling factor: Pr.86 |
| G003 | Zoda pattorii obiootiori | | 14 ^{*1} | Forward rotation excitation current low-speed scaling factor: Pr.86 Reverse rotation excitation current low-speed scaling factor: Pr.617 (X17-OFF), Pr.86 (X17 signal-ON) |
| | | | 15 ^{*1} | Forward rotation excitation current low-speed scaling factor: Pr.617 (X17-OFF), Pr.86 (X17 signal-ON) Reverse rotation excitation current low-speed scaling factor: Pr.86 |
| | | | 0 to 400 Hz | Set the frequency at which increased excitation is started. |
| 85 G201 | Excitation current break point | 9999 | 9999 | SF-PR/SF-HR/SF-HRCA motor: The predetermined frequency is applied. Motor other than the above: 10 Hz is applied. |
| | | 9999 | 0 to 300% | Set an excitation current scaling factor at 0 Hz. |
| 86 G202 | Excitation current low- speed scaling factor | | 9999 | SF-PR/SF-HR/SF-HRCA motor: The predetermined scaling factor is applied. |
| 047 | Reverse rotation excitation | | 0 to 300% | Motor other than the above: 130% is applied. Set an excitation current scaling factor when different excitation current scaling factors are used for forward and reverse rotation. |
| 617 G080 | current low-speed scaling factor | 9999 | 9999 | SF-PR/SF-HR/SF-HRCA motor: The predetermined scaling factor is applied. Motor other than the above: 130% is applied. |
| | | | 0 to 400 Hz | Set an excitation current break point when the RT signal is ON. |
| 565 G301 | Second motor excitation current break point | 9999 | 9999 | SF-PR/SF-HR/SF-HRCA motor: The predetermined frequency is applied. Motor other than the above: 10 Hz is applied. |
| 566 | Second motor excitation | 1 | 0 to 300% | Set an excitation current low-speed scaling factor when the RT signal is ON. |
| G302 | current low-speed scaling | 9999 | 9999 | SF-PR/SF-HR/SF-HRCA motor: The predetermined scaling factor is applied. Motor other than the above: 130% is applied. |

^{*1} The setting is valid only under Advanced magnetic flux vector control or Real sensorless vector control. When **Pr.14** = "12 to 15" and V/F control is selected, the operation is the same as the one for constant-torque load (**Pr.14** = "0"). (Refer to page 708.)

- Under Advanced magnetic flux vector control or Real sensorless vector control, excitation current in the low-speed range can be increased to improve torque. When **Pr.14** = "12 to 15", the excitation current scaling factor can be switched for the forward/reverse rotation.
- Increased excitation is applied when the output frequency is equal to or lower than the setting in Pr.85 Excitation current break point. The excitation current scaling factor at 0 Hz is set in Pr.86 Excitation current low-speed scaling factor.
 Use Pr.565 Second motor excitation current break point and Pr.566 Second motor excitation current low-speed scaling factor for the setting for using the second motor (RT signal-ON).



• When **Pr.14** = "14 or 15" and the X17 signal is turned ON, the excitation current scaling factor is switched from the value set in **Pr.617** to the value set in **Pr.86**.

• An excitation current low-speed scaling factor set in the parameter shown in the table is used according to the Pr.14 setting and other conditions.

| Pr.14 setting | X17 signal | During forw | ard rotation | During reverse rotation | | |
|---------------|------------|---------------|--------------|-------------------------|--------------|--|
| P1.14 Setting | ATT Signal | RT signal OFF | RT signal ON | RT signal OFF | RT signal ON | |
| 0 to 5 | _ | Pr.86 | Pr.566 | Pr.86 | Pr.566 | |
| 12 | _ | Pr.86 | Pr.566 | Pr.617 | Pr.617 | |
| 13 | _ | Pr.617 | Pr.617 | Pr.86 | Pr.566 | |
| 14 | OFF | Pr.86 | Pr.566 | Pr.617 | Pr.617 | |
| 14 | ON | Pr.86 | Pr.566 | Pr.86 | Pr.566 | |
| 15 | OFF | Pr.617 | Pr.617 | Pr.86 | Pr.566 | |
| 15 | ON | Pr.86 | Pr.566 | Pr.86 | Pr.566 | |

• When the SF-PR/SF-HR/SF-HRCA motor is used (Pr.71 = "40, 43, 44, 50, 53, 54, 70, 73, or 74") and "9999" is set in Pr.85/ Pr.86, the predetermined setting in the following table is applied.

| Motor | SF-PR | | | | | | SF-HR/SF-HRCA | | | | | |
|----------|-------|-------|-------|-------|-------|-------|---------------|-------|-------|-------|-------|-------|
| capacity | Pr.81 | = "2" | Pr.81 | = "4" | Pr.81 | = "6" | Pr.81 | = "2" | Pr.81 | = "4" | Pr.81 | = "6" |
| (kW) | Pr.85 | Pr.86 | Pr.85 | Pr.86 | Pr.85 | Pr.86 | Pr.85 | Pr.86 | Pr.85 | Pr.86 | Pr.85 | Pr.86 |
| 0.4 | _ | _ | _ | _ | _ | _ | 10 Hz | 130% | 10 Hz | 130% | 10 Hz | 130% |
| 0.75 | 20 Hz | 130% | 20 Hz | 130% | 10 Hz | 130% | 10 Hz | 130% | 10 Hz | 130% | 10 Hz | 130% |
| 1.5 | 30 Hz | 140% | 10 Hz | 130% | 10 Hz | 130% | 10 Hz | 130% | 10 Hz | 130% | 10 Hz | 130% |
| 2.2 | 10 Hz | 150% | 10 Hz | 130% | 20 Hz | 130% | 20 Hz | 150% | 10 Hz | 130% | 10 Hz | 130% |
| 3.7 | 30 Hz | 150% | 25 Hz | 133% | 20 Hz | 130% | 30 Hz | 160% | 30 Hz | 140% | 10 Hz | 130% |
| 5.5 | 10 Hz | 150% | 10 Hz | 130% | 30 Hz | 130% | 30 Hz | 140% | 30 Hz | 140% | 20 Hz | 140% |
| 7.5 | 10 Hz | 150% | 30 Hz | 118% | 30 Hz | 130% | 30 Hz | 140% | 30 Hz | 140% | 30 Hz | 150% |
| 11 | 10 Hz | 150% | 20 Hz | 140% | 10 Hz | 130% | 30 Hz | 140% | 10 Hz | 130% | 30 Hz | 130% |
| 15 | 10 Hz | 150% | 30 Hz | 130% | 30 Hz | 130% | 20 Hz | 140% | 10 Hz | 130% | 30 Hz | 130% |
| 18.5 | 10 Hz | 150% | 30 Hz | 130% | 20 Hz | 130% | 30 Hz | 150% | 30 Hz | 140% | 30 Hz | 140% |
| 22 | 30 Hz | 130% | 10 Hz | 130% | 10 Hz | 130% | 30 Hz | 150% | 30 Hz | 140% | 20 Hz | 140% |
| 30 | 10 Hz | 150% | 20 Hz | 130% | 10 Hz | 130% | 30 Hz | 150% | 20 Hz | 150% | 10 Hz | 130% |
| 37 | 20 Hz | 140% | 10 Hz | 140% | 20 Hz | 130% | 20 Hz | 160% | 20 Hz | 150% | 10 Hz | 130% |
| 45 | 10 Hz | 140% | 20 Hz | 130% | 10 Hz | 130% | 10 Hz | 130% | 20 Hz | 140% | 10 Hz | 140% |
| 55 | 20 Hz | 140% | 30 Hz | 130% | _ | — | 10 Hz | 140% | 20 Hz | 150% | _ | _ |

5.16.5 **Energy saving control**



The inverter will automatically perform energy saving operation without setting detailed parameters.

This control method is suitable for applications such as fans and pumps.

| Pr. | Name | Initial value | Setting range | Description |
|------------------------|---------------------------------|---------------|----------------------------|-------------------------|
| 60 | Energy saving control selection | 0 | 0 | Normal operation |
| 60 G030 | | | 4 | Energy saving operation |
| G030 Control Selection | | 9 | Optimum excitation control | |

◆ Energy saving operation (Pr.60 = "4")

- Setting **Pr.60** = "4" will select the energy saving operation.
- · With the energy saving operation, the inverter will automatically control the output voltage so the inverter output power during the constant-speed operation will become minimal.
- Energy saving operation will be enabled under V/F control.

Optimum excitation control (Pr.60 = "9")

- Setting Pr.60 = "9" will select the Optimum excitation control.
- The Optimum excitation control is a control method to decide the output voltage by controlling the excitation current so the efficiency of the motor is maximized.
- · Optimum excitation control will be enabled under V/F control and Advanced magnetic flux vector control.



- In the energy saving operation mode, an energy saving effect is not expected for applications with high load torque or with the equipment with frequent acceleration and deceleration.
- In the Optimum excitation control mode, an energy saving effect is not expected when the motor capacity is extremely small compared with the inverter capacity or when multiple motors are connected to a single inverter.
- When the energy saving operation mode or Optimum excitation control mode is selected, the deceleration time may become longer than the setting value. Also, it may cause overvoltage more often compared to constant-torque load characteristics, so set the deceleration time longer.
- When the motor becomes unstable during the acceleration, set the acceleration time longer.
- Output current may increase slightly with the energy saving operation mode or the Optimum excitation control mode since the output voltage is controlled.

5.16.6 Adjustable 5 points V/F



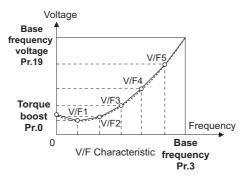
By setting a desired V/F characteristic from the start up to the base frequency or base voltage with the V/F control (frequency voltage/frequency), a dedicated V/F pattern can be generated.

The optimal V/F pattern matching the torque characteristics of the facility can be set.

| Pr. | Name | Initial value | Setting range | Description |
|-------------|---------------------------------|---------------|-------------------|---|
| 71 C100 | Applied motor | 0 | 2 | Standard motor (such as SF-JR) Adjustable 5 points V/F |
| C 100 | | | Others | Refer to page 528. |
| 100 G040 | V/F1 (first frequency) | 9999 | 0 to 590 Hz, 9999 | |
| 101 G041 | V/F1 (first frequency voltage) | 0 V | 0 to 1000 V | |
| 102 G042 | V/F2 (second frequency) | 9999 | 0 to 590 Hz, 9999 | |
| 103 G043 | V/F2 (second frequency voltage) | 0 V | 0 to 1000 V | |
| 104 G044 | V/F3 (third frequency) | 9999 | 0 to 590 Hz, 9999 | Set each point of the V/F pattern (frequency, voltage). |
| 105 G045 | V/F3 (third frequency voltage) | 0 V | 0 to 1000 V | 9999: Do not set V/F. |
| 106 G046 | V/F4 (fourth frequency) | 9999 | 0 to 590 Hz, 9999 | |
| 107 G047 | V/F4 (fourth frequency voltage) | 0 V | 0 to 1000 V | |
| 108 G048 | V/F5 (fifth frequency) | 9999 | 0 to 590 Hz, 9999 | |
| 109 G049 | V/F5 (fifth frequency voltage) | 0 V | 0 to 1000 V | |

- By setting the V/F1 (first frequency voltage/first frequency) to V/F5 parameters in advance, a desired V/F characteristic
 can be obtained.
- For an example, with the equipment with large static friction factor and small dynamic friction factor, large torque is required only at the start up, so a V/F pattern that will raise the voltage only at the low-speed range is set.
- · Setting procedure
 - **1.** Set the rated motor voltage in **Pr.19 Base frequency voltage**. (No function at the setting of "9999" or "8888".)
 - 2. Set Pr.71 Applied motor = "2" (adjustable 5 points V/F).

3. Set frequency and voltage to be set in Pr.100 to Pr.109.



↑ CAUTION

Make sure to set the parameters correctly according to the motor used. Incorrect setting may cause the motor to overheat
and burn.



- The adjustable 5 points V/F is enabled under V/F control.
- When **Pr.19 Base frequency voltage** = "8888 or 9999", setting of **Pr.71** = "2" is not available. To set "2" in **Pr.71**, set the rated motor voltage in **Pr.19**.
- A write disable error " " is generated when the same frequency value is used for multiple points.
- Set frequency or voltage for each point in Pr.100 to Pr.109 within the range of Pr.3 Base frequency or Pr.19 Base frequency voltage.
- When Pr.71 = "2", Pr.47 Second V/F (base frequency) and Pr.113 Third V/F (base frequency) are not available.
- When Pr.71 = "2", the inverter calculates the characteristic of the electronic thermal relay for a standard motor.
- By simultaneously using Pr.60 Energy saving control selection and the adjustable 5 points V/F, further energy saving effect
 is expected.
- The Pr.0 Torque boost and Pr.12 DC injection brake operation voltage settings are automatically changed according to the Pr.71 setting. (Refer to page 531.)

Parameters referred to

Pr.0 Torque boost page 706
Pr.3 Base frequency, Pr.19 Base frequency voltage page 707
Pr.12 DC injection brake operation voltage page 715
Pr.47 Second V/F (base frequency), Pr.113 Third V/F (base frequency) page 713
Pr.60 Energy saving control selection page 712
Pr.71 Applied motor, Pr.450 Second applied motor page 528

5.16.7 SF-PR slip amount adjustment mode

V/F

- As compared to our conventional SF-JR motor, the slip amount is small for the high-performance energy-saving SF-PR motor. When replacing the SF-JR to the SF-PR, the slip amount is reduced and the rotations per minute increases. Therefore, when the SF-PR is used with the same frequency setting as that of the SF-JR, power consumption may increase as compared to the SF-JR.
- By setting the slip amount adjustment mode, the frequency command can be adjusted to keep the rotations per minute of the SF-PR equivalent to those of the SF-JR for power consumption reduction.

| Pr. | Name | Initial value | Setting range | Description | |
|-------------|-----------------------------------|---------------|---------------|--|--|
| 673 | SF-PR slip amount adjustment | 9999 | 2, 4, 6 | Set the number of SF-PR motor poles. | |
| G060 | operation selection | 9999 | 9999 | The slip amount adjustment is disabled. | |
| 674 G061 | SF-PR slip amount adjustment gain | | 0 to 500% | Setting is available for fine adjustment of the slip amount. | |

- By setting the number of SF-PR motor poles in Pr.673 SF-PR slip amount adjustment operation selection, the SF-PR slip amount adjustment mode is activated.
- The SF-PR slip amount adjustment mode is available only under V/F control.

Use Pr.674 SF-PR slip amount adjustment gain to fine-tune the rotations per minute. To reduce the rotations per minute
(to increase the compensation frequency), set a larger value in Pr.674. To increase the rotations per minute (to reduce the
compensation frequency), set a smaller value in Pr.674. (Lower rotations per minute reduce the power consumption, and
higher rotations per minute increase the power consumption.)

№ NOTE

- The slip amount adjustment is not available in the following conditions.
 During acceleration/deceleration, during DC injection brake operation, during PID control, during orientation control, during encoder feedback control, during stall prevention operation, during regeneration avoidance operation, during traverse
- The slip amount adjustment is not available when the applicable motor capacity of the inverter is not compatible with the SF-PR. (For details on applicable motor capacity, refer to page 826.)

5.16.8 DC injection brake, zero speed control, and servo lock

· Adjust the braking torque and timing to stop the motor using the DC injection brake.

operation, and while the slip compensation is valid (Pr.245).

- Zero speed control is also available under Real sensorless vector control, and zero speed control and servo lock are selectable under Vector control or PM sensorless vector control.
- When the DC injection brake operation is used, DC voltage is applied to the motor to prevent rotation of the motor shaft, and when the zero speed control is used, Vector control is performed to keep 0 r/min. Either way, when a motor shaft is rotated by external force, it does not go back to the original position.
- When the servo lock control is used, the position of the motor shaft is held. When a motor shaft is rotated by external force, it goes back to the original position.
- Select the magnetic flux decay output shutoff function to decay the magnetic flux before shutting off the output at a stop.

| Pr. | Name | Initial value | Setting range | Description | | | |
|-------------|--|------------------|---------------|--|-------------------------------------|--|--|
| 10 G100 | DC injection brake operation frequency | 3 Hz | 0 to 120 Hz | Set the operation frequency for the DC injection brake (zero speed control / servo lock). | | | |
| G100 | operation frequency | | 9999 | The operation starts at the | frequency set in Pr.13 or lower. | | |
| | | | 0 | Without DC injection brake | (zero speed control / servo lock) | | |
| 11 G101 | DC injection brake operation time | 0.5 s | 0.1 to 10 s | Set the operation time for the DC injection brake (zero speed control / servo lock). | | | |
| | | | 8888 | The operation continues w | hile the X13 signal is ON. | | |
| 40 | DC injection business | 4% ^{*1} | | Out the DO in its first head to sell the sell to sell the DO | | | |
| 12 G110 | DC injection brake operation voltage | 2% ^{*2} | 0 to 30% | Set the DC injection brake voltage (torque). When set to "0", the DC injection brake is not applied. | | | |
| | | 1% ^{*3} | | , | | | |
| 802 | Pre-excitation | 0 | 0 | Zero speed control | | | |
| G102 | selection | U | 1 | Servo lock | rvo lock | | |
| 1299 | Second pre- | 0 | 0 | Zero speed control | The pre-excitation operation of the | | |
| G108 | excitation selection | 0 | 1 | Servo lock | second motor can be selected. | | |
| 050 | Duelse en eneties | | 0 | DC injection brake operation | on | | |
| 850 G103 | Brake operation selection | 0 | 1 | Zero speed control (Real s | ensorless vector control) | | |
| 5103 | 3616611011 | | 2 | Magnetic flux decay output shutoff (Real sensorless vector control) | | | |

- $^{\star}1\quad \text{ The initial value for the FR-A820-00490(7.5K) or lower and FR-A840-00250(7.5K) or lower.}$
- *2 The initial value for the FR-A820-00630(11K) to FR-A820-03160(55K), FR-A840-00310(11K) to FR-A840-01800(55K).
- *3 The initial value for the FR-A820-03800(75K) or higher and FR-A840-02160(75K) and higher.

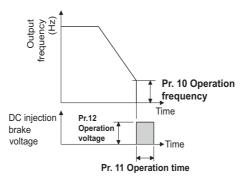
Setting of operating frequency (Pr.10)

- By setting the frequency to operate the DC injection brake (zero speed control / servo lock) to Pr.10 DC injection brake
 operation frequency, the DC injection brake (zero speed control / servo lock) will operate when it reaches this frequency
 at the time of deceleration.
- When **Pr.10** = "9999", DC injection brake (zero speed control / servo lock) will start when the frequency reaches **Pr.13**Starting frequency.

• The DC injection brake operation frequency depends on the stopping method.

| Stopping method | Parameter setting | DC injection brake operation frequency | |
|--|--|--|--|
| Press the STOP key on the operation panel. Turn OFF the STF/STR signal. | 0.5 Hz or higher in Pr.10 | Pr.10 setting | |
| | Lower than 0.5 Hz in Pr.10 , and 0.5 Hz or higher in Pr.13 | 0.5 Hz | |
| | Lower than 0.5 Hz in both Pr.10 and Pr.13 | Pr.10 or Pr.13 setting, whichever larger | |
| Set frequency to 0 Hz | _ | Pr.13 setting or 0.5 Hz, whichever smaller | |

 The DC injection brake operation frequency will be fixed to 0 Hz under PM sensorless vector control (low-speed range high-torque mode disabled).

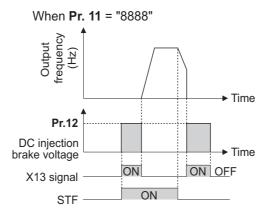


№ NOTE

- When executing pre-excitation (zero speed control) under Real sensorless vector control, set **Pr.10 DC injection brake** operation frequency to 0.5 Hz or lower since it may cause motor vibration, etc., at the time of deceleration stop.
- The initial value of Pr.10 will automatically switch to 0.5 Hz under Vector control.

◆ Setting of operation time (X13 signal, Pr.11)

- Set the operation time for the DC injection brake (zero speed control / servo lock) to Pr.11 DC injection brake operation time.
- · When the motor does not stop due to large load moment (J), increase the setting to ensure the effect.
- When **Pr.11** = "0 s", DC injection brake (zero speed control / servo lock) will not operate. (The motor will coast to stop.)
- When **Pr.11** = "8888", DC injection brake (zero speed control / servo lock) will operate when the X13 signal is turned ON. DC injection brake will operate when the X13 signal is turned ON even while operating.
- For the X13 signal input, set "13" in any of Pr.178 to Pr.189 to assign the function.



• NOTE

- Under Real sensorless vector control, when the X13 signal turns ON while **Pr.11** = "8888", the zero speed control is activated regardless of the **Pr.850 Brake operation selection** setting.
- Under Vector control or PM sensorless vector control, zero speed control or servo lock will operate depending of the setting of Pr.802.
- The X13 signal is disabled during PM sensorless vector control.

◆ Setting of operation voltage (torque) (Pr.12)

- Set the percentage against the power supply voltage in **Pr.12 DC injection brake operation voltage**. (The setting is not used for zero speed control or servo lock.)
- The DC injection brake operation is not available when the setting of Pr.12 is 0%. (The motor will coast to stop.)



 When the setting of Pr.12 is the initial value, the setting corresponding to the motor is set according to the Pr.71 Applied motor setting. (Refer to page 531.) However, when an energy saving motor (SF-HR or SF-HRCA) is used, change the Pr.12 setting as shown below.

| Inverter | Pr.12 setting |
|---|---------------|
| FR-A820-00250(3.7K) or lower FR-A840-00126(3.7K) or lower | 4% |
| FR-A820-00340(5.5K), FR-A820-00490(7.5K) FR-A840-00170(5.5K), FR-A840-00250(7.5K) | 3% |
| FR-A820-00630(11K) to FR-A820-01250(22K), FR-A820-01870(37K) or higher FR-A840-00310(11K) to FR-A840-00620(22K), FR-A840-00930(37K) or higher | 2% |
| FR-A820-01540(30K) FR-A840-00770(30K) | 1.5% |

• Even if the setting value of **Pr.12** is made larger, braking torque will be limited so the output current will be within the rated current of the inverter.

◆ Braking operation selection under Real sensorless vector control (Pr.850 = "0 or 1")

• The braking operation under Real sensorless vector control can be selected between the DC injection brake operation (initial setting) and zero speed control.

By setting **Pr.850 Brake operation selection** = "1", zero speed control will be performed at the frequency set in **Pr.10 DC** injection brake operation frequency or lower.

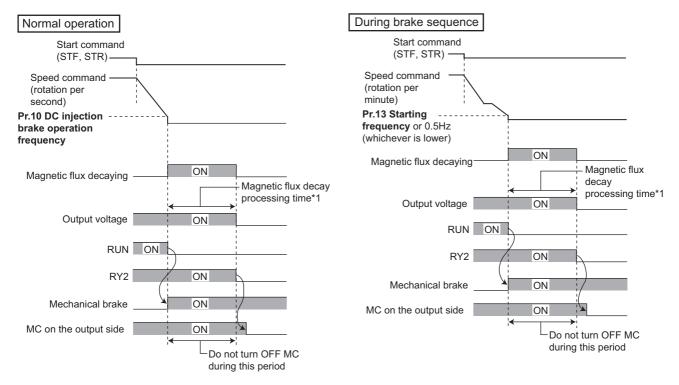


- Under Real sensorless vector control, when the X13 signal turns ON while **Pr.11** = "8888", zero speed control is activated regardless of the **Pr.850** setting.
- When restarting the operation after a brake operation under Real sensorless vector control, set **Pr.850** = "1" (zero speed control). Setting "0" (DC injection brake) may cause a delay of about 2 seconds from the time the start up command is input until it actually is output.

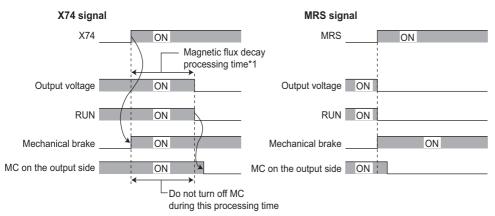
◆ Magnetic flux decay output shutoff and the Magnetic flux decay output shutoff signal (X74 signal, Pr.850 = "2")

- Frequent starts/stops (inching) under Real sensorless vector control may cause an inverter failure or create a difference in operation with the motor. The reason is that some magnetic flux is left in the motor at shutoff of the inverter output. If this is the case, set **Pr.850** = "2" (magnetic flux decay output shutoff) or turn ON the Magnetic flux decay output shutoff (X74) signal to decay the magnetic flux at a stop, and then shut off the output.
- While **Pr.850** = "2", deceleration starts at turning OFF of the start command, and the magnetic flux decay output shutoff is activated when the estimated speed becomes lower than **Pr.10 DC injection brake operation frequency**.
- While the brake sequence function is active, the magnetic flux decay output shutoff is activated when the running frequency drops to 0.5 Hz or **Pr.13 Starting frequency**, whichever is smaller.

• Inverter output voltage shutoff timing when Pr.850 = "2"



- *1 Maximum processing time of the magnetic flux decay
- Tuning ON the Magnetic flux decay output shutoff (X74) signal starts the magnetic flux decay output shutoff regardless of the Pr.850 setting. For the X74 signal, set "74" in any of Pr.178 to 189 (Input terminal function selection) to assign the function.
- · Inverter output shutoff timing with X74 signal



- *1 Maximum processing time of the magnetic flux decay
- Since the torque will decrease at the time of magnetic flux decay output shutoff, set up so the mechanical brake will operate.
- The magnetic flux decay output shutoff will be canceled at the time of restart and when the Pre-excitation/servo ON (LX) signal or External DC injection brake operation start (X13) signal is turned ON.
- If an MC is installed at the inverter's output side, set to open the MC after the operation time of the magnetic flux decay output shutoff elapses. (See below.)

| Motor capacity (Pr.80 setting) | 2.2 kW or lower | 3.7 kW to 11 kW | 15 kW to 30 kW | 37 kW to 55 kW | 75 kW or higher |
|----------------------------------|-----------------|-----------------|----------------|----------------|-----------------|
| Magnetic flux decay process time | 250 ms | 500 ms | 800 ms | 900 ms | 1100 ms |



- When operating under controls other than Real sensorless vector control, the inverter will immediately shutoff the output when the X74 signal is turned ON.
- Even under Real sensorless vector control, the inverter will immediately shutoff the output when the X74 signal is turned ON during the automatic restart after instantaneous power failure and online auto tuning during the start up.
- If another output-shutoff trigger (inverter fault, turn-ON of the MRS signal, etc.) occurs during the magnetic flux decay operation, the magnetic flux decay operation is terminated, and the output is shut off immediately.
- Unlike the MRS signal, voltage is output during the magnetic flux decay output shutoff operation, so take caution on electric shocks
- When the release timing of the mechanical brake is too fast, the motor shaft may be rotated by dropping or external force.
 When the release timing is too late, the overcurrent prevention operation, stall prevention operation, or electronic thermal O/L relay function may be activated. Perform release of the mechanical brake matching the equipment using the Output frequency detection (FU) signal or Output current detection (Y12) signal.
- Changing the terminal assignment using **Pr.178 to Pr.189 (Input terminal function selection)** may affect the other functions. Set parameters after confirming the function of each terminal.

◆ Braking operation selection under Vector control or PM sensorless vector control (Pr.802, Pr.1299)

- **Pr.802** Pre-excitation selection to select the braking operation when the pre-excitation is performed from either zero speed control or servo lock.
- Turning ON the RT signal enables the second pre-excitation selection (when Pr.450 ≠ "9999").

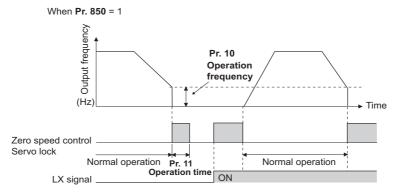
| Pr.802 (Pr.1299) setting | Pre- excitation | Description | |
|--------------------------------|--------------------|---|--|
| 0 (initial value) | Zero speed control | Even under a load, the inverter does not rotate the motor and holds 0 r/min. However, it will not return to its original position when the shaft moves due to external force. This setting is invalid during position control. The inverter operates according to this setting only during speed control. | |
| 1 | Servo lock | Even under a load, the inverter holds the position of the motor shaft. When the shaft moves due to external force, it will return to its original position after the external force is removed. To perform the position control, this loop gain can be adjusted using Pr.422 Position control gain (Pr.1298 Second position control gain). | |

• The relation between the DC injection brake operation and pre-excitation operation is as follows.

| Control method | Control mode | Pr.802 (Pr.1299) | Pr.850 | Deceleration stop | LX-ON | X13-ON (Pr.11 = "8888") | |
|---|--------------|---------------------|--------|------------------------------------|------------|----------------------------|--|
| V/F control | _ | _ | _ | DC injection brake | _ | DC injection brake | |
| Advanced magnetic flux vector control | _ | _ | _ | DC injection brake | _ | DC injection brake | |
| Real sensorless vector control | Speed | _ | 0 | DC injection braking | Zoro opend | Zero speed | |
| | | _ | 1 | Zero speed | Zero speed | | |
| | | _ | 2 | Magnetic flux decay output shutoff | Zero speed | Zero speed | |
| | Torque | _ | 0 | DC injection braking | Zoro opend | Zero speed | |
| | | _ | 1 | Zero speed | Zero speed | | |
| | | _ | 2 | Magnetic flux decay output shutoff | Zero speed | Zero speed | |
| Vector control | Speed | 0 | _ | Zero speed | Zero speed | Zero speed | |
| | | 1 | _ | Servo lock | Servo lock | Servo lock | |
| | Torque | _ | _ | Zero speed | Zero speed | Zero speed | |
| | Position | _ | _ | _ | Servo lock | _ | |
| PM sensorless vector control, low-speed range high-torque mode disabled | Speed | _ | _ | DC injection brake | _ | _ | |
| PM sensorless vector control, low-speed range high-torque mode enabled | Spood | 0 | | Zero speed | Zero speed | | |
| | Speed | 1 | 1 | Servo lock | Servo lock | | |
| | Position | _ | _ | _ | Servo lock | _ | |

◆ Pre-excitation signal (LX signal)

- When the Pre-excitation/servo ON (LX) signal is turned ON while the motor stops under Real sensorless vector control, Vector control, or PM sensorless vector control, pre-excitation (zero speed control / servo lock) starts.
- To input the LX signal, set "23" in any of **Pr.178 to Pr.189 (Input terminal function selection)** to assign the function.





- Changing the terminal assignment using **Pr.178 to Pr.189 (Input terminal function selection)** may affect the other functions. Set parameters after confirming the function of each terminal.
- Performing pre-excitation (by using the LX or X13 signal) during torque control (under Real sensorless vector control) may
 rotate a motor at a low speed even though a start command (STF or STR) is not input. The inverter at a start command ON
 may also rotate the motor at a low speed even though a speed limit value is set to zero. It must be confirmed that the motor
 running will not cause any safety problem before performing pre-excitation.
- Note that during the pre-excitation operation, a voltage is applied to the motor even with the FWD/REV indicator OFF on the operation panel.
- When offline auto tuning (**Pr.96 Auto tuning setting/status** = "1, 11, or 101") is performed during pre-excitation operation, pre-excitation is disabled.

∴ CAUTION

- During the orientation operation, do not set "0 or 8888" in **Pr.11** and do not set "0" in **Pr.12**. The motor may not stop properly.
- Install a mechanical brake to make an emergency stop or to stay stopped for a long time.
 Wait until the machine stops completely, and fix the motor with a mechanical brake, then turn the LX signal (pre-excitation) OFF.

Parameters referred to

Pr.13 Starting frequency page 381, page 382

Pr.71 Applied motor □ page 528
Pr.80 Motor capacity □ page 532

Pr.178 to Pr.189 (Input terminal function selection) page 521

Pr.422 Position control gain, Pr.1298 Second position control gain ☐ page 328

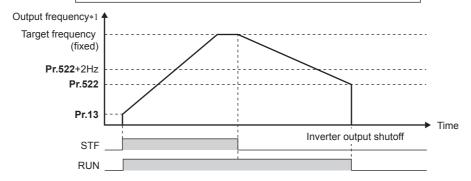
5.16.9 Output stop function

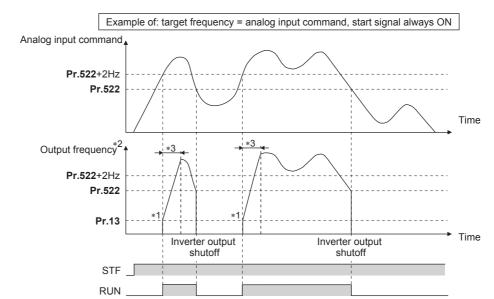
The motor coasts to a stop (inverter output is shutoff) when the inverter output frequency falls to Pr.522 setting or lower.

| Pr. | Name | Initial value | Setting range | Description |
|------|-----------------------|---------------|---------------|---|
| 522 | Output aton fraguancy | 9999 | 0 to 590 Hz | Set the frequency to start coasting to a stop (output shutoff). |
| G105 | Output stop frequency | | 9999 | No function |

- When both of the frequency setting signal and output frequency fall to the frequency set in **Pr.522** or lower, the inverter stops the output and the motor coasts to a stop.
- The motor re-starts when the frequency setting signal exceeds Pr.522 + 2 Hz and is accelerated at the Pr.13 Starting frequency (0.01 Hz under PM sensorless vector control).

Example of when target frequency>Pr.522+2Hz, and start signal is ON/OFF





- *1 The output frequency to be compared with the **Pr.522** setting is the output frequency before slip compensation (V/F control or Advanced magnetic flux vector control), or the speed command value converted into the frequency (Real sensorless vector control, Vector control, or PM sensorless vector control).
- *2 The motor is accelerated at the **Pr.13 Starting frequency** (0.01 Hz under PM sensorless vector control).
- *3 The steepness of the slope depends on the acceleration/deceleration time settings such as Pr.7.

• NOTE

- When the output stop function is enabled (**Pr.522** ≠ "9999"), the DC injunction brake (zero speed control / servo lock) operation is disabled and the motor coasts to stop when the output frequency drops to the **Pr.522** setting or lower.
- The motor starts acceleration again at Pr.13 Starting frequency (0.01 Hz under PM sensorless vector control) when the
 command value exceeds Pr.522 + 2 Hz again if the start signal remains ON while the motor is coasting after the frequency
 drops to the Pr.522 setting or lower. Re-acceleration during coasting may cause an output shutoff of the inverter depending
 on the parameter setting. (Activation of the restart function is recommended especially for a PM motor.)
- The output stop frequency function is disabled during PID control, JOG operation, power failure stop, traverse function operation, offline auto tuning, orientation control, position control, torque control, or stop-on contact control.
- The output stop function does not operate during reverse rotation deceleration. However, when the frequency setting signal and output frequency fall to **Pr.522** or lower, the inverter output is shut off.
- During the output stop due to the output stop function (when forward/reverse command is given, but frequency command is not given), the FWD/REV LED indicator on the operation panel blinks fast. (When the frequency command is not given even if the forward/reverse command is given.)

∴ CAUTION

• A PM motor is a motor with interior permanent magnets. High voltage is generated at motor terminals while the motor is running.

Do not touch motor terminals and other parts until the motor stops to prevent an electric shock.

Pr.10 DC injection brake operation frequency, Pr.11 DC injection brake operation time, Pr.12 DC injection brake operation voltage page 715 Pr.13 Starting frequency page 381, page 382

5.16.10 Start signal operation selection / stop selection

Select the stopping method (deceleration stop or coasting) at turn-OFF of the start signal.

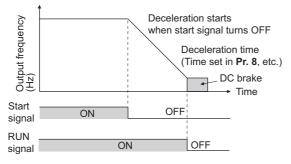
Coasting can be selected for the cases such that the motor is stopped with a mechanical brake at turn-OFF of the start signal. The operation of the start signal (STF/STR) can be selected.

| Pr. | Name | Initial value | Setting range | Description | | |
|-------------|-------------------|---------------|----------------|--|--|--|
| FI. | FI. Name | | Setting range | Start signal (STF/STR) | Stop operation | |
| | | 9999 | 0 to 100 s | STF signal: Forward rotation start STR signal: Reverse rotation start | The motor coasts to a stop after a lapse of the setting time when the start signal is turned OFF. | |
| 250 G106 | Stop selection | | 1000 to 1100 s | STF signal: Start signal STR signal: Forward/reverse rotation signal | The motor coasts to a stop after a lapse of the (Pr.250 - 1000) seconds when the start signal is turned OFF. | |
| | | | 9999 | STF signal: Forward rotation start STR signal: Reverse rotation start | The motor is decelerated to a stop | |
| | | | 8888 | STF signal: Start signal STR signal: Forward/reverse rotation signal | when the start signal is turned OFF. | |

♦ Stop selection

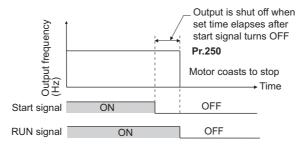
■ To decelerate the motor to a stop

- Set Pr.250 = "9999 (initial value) or 8888".
- The motor is decelerated to a stop when the start signal (STF/STR) is turned OFF.



■ To coast the motor to a stop

- Set the time required to shut off the output after the start signal is turned OFF in **Pr.250**. When "1000 to 1100" is set, output is shut off after a lapse of the (**Pr.250** 1000) seconds.
- The output is shut off after a lapse of the setting time of Pr.250 when the start signal is turned OFF. Motor coasts to a stop.
- · The RUN signal is turned OFF when the output is shut off.





· The stop selection setting is disabled when following functions are operating.

Position control

Power failure stop function (Pr.261)

PU stop (Pr.75)

Deceleration stop due to fault definition (Pr.875)

Deceleration stop due to communication error (Pr.502)

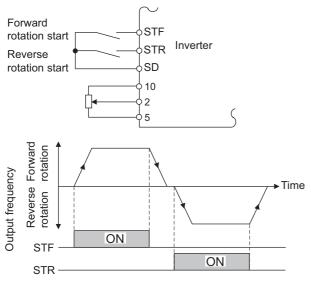
Offline auto tuning (with motor rotation)

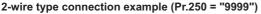
- When Pr.250 ≠ "9999 or 8888", acceleration/deceleration is performed in accordance to the frequency command until the
 output is shut off by turning OFF the start signal.
- · When the restart signal is turned ON during the motor coasting, the operation is resumed from Pr.13 Starting frequency.
- Even with the setting of coasting to a stop, when the LX signal is turned ON, the motor does not coast but zero speed control or servo lock is applied.

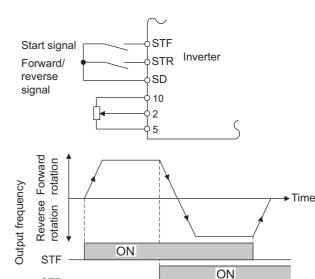
◆ Start signal operation selection

■ 2-wire type (STF signal, STR signal)

- · The following figure shows the 2-wire type connection.
- As an initial setting, the forward/reverse rotation signals (STF/STR) acts as both start and stop signals. Either one turned
 ON will be enabled, and the operation will follow that signal. The motor will decelerate to a stop when both are turned OFF
 (or both are turned ON) during the operation.
- The frequency can be set by inputting 0 to 10 VDC between the speed setting input terminals 2 and 5, or with **Pr.4 to Pr.6**Multi-speed setting (high speed, middle speed, and low speed). (For the multi-speed operation, refer to page 411.)
- By setting **Pr.250** = "1000 to 1100, 8888", the STF signal input becomes the start command and the STR signal input becomes the forward/reverse command.







2-wire type connection example (Pr.250 = "8888")



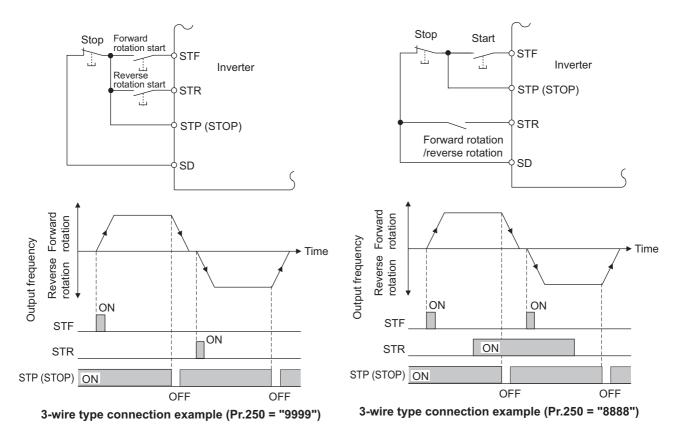
- By setting **Pr.250** = "0 to 100, 1000 to 1100", the motor will coast to a stop when the start command is turned OFF.
- The STF and STR signals are assigned to terminals STF and STR in the initial status. The STF signal can be assigned to terminal STF only using Pr.178 STF terminal function selection, and the STR signal can be assigned to terminal STR only using Pr.179 STR terminal function selection.

STR

■ 3-wire type (STF signal, STR signal, STP (STOP) signal)

- The following figure shows the 3-wire type connection.
- The self-holding function is enabled when the STP (STOP) signal is turned ON. In such case, the forward/reverse signal is simply used as a start signal.

- · Even if a start signal (STF or STR) is turned ON and then OFF, the start command remains valid and the motor operation continues. To change the rotation direction, turn the STR (STF) signal ON once and then OFF.
- In order to decelerate the motor to a stop, turn OFF the STP (STOP) signal once.





- The STP (STOP) signal is assigned to terminal STP (STOP) in the initial status. Set "25" in any of Pr.178 to Pr.189 to assign the STP (STOP) signal to another terminal.
- When the JOG operation is enabled by turning ON the JOG signal, the STP (STOP) signal will be disabled.
- Even when the output is stopped by turning ON the MRS signal, the self-holding function is not canceled.

■ Start signal selection

| STF | STR | Pr.250 setting and inverter status | | |
|-----|-----|------------------------------------|----------------------|--|
| | | 0 to 100 s, 9999 | 1000 to 1100 s, 8888 | |
| OFF | OFF | Stop | Stop | |
| OFF | ON | Reverse rotation | | |
| ON | OFF | Forward rotation | Forward rotation | |
| ON | ON | Stop | Reverse rotation | |

Parameters referred to

Pr.7 Acceleration time, Pr.8 Deceleration time page 367

Pr.4 to Pr.6 (Multi-speed setting) □ page 411 Pr.13 Starting frequency □ page 381, page 382

Pr.75 Reset selection/disconnected PU detection/PU stop selection page 336

Pr.178 to Pr.189 (Input terminal function selection) page 521

Pr.261 Power failure stop selection page 642

Pr.419 Position command source selection page 298

Pr.502 Stop mode selection at communication error □ page 663

Pr.875 Fault definition page 422

5.16.11 Regenerative brake selection and DC feeding mode

· When performing frequent start and stop operation, usage rate of the regenerative brake can be increased by using the optional high-duty brake resistor (FR-ABR) or the brake unit (FR-BU2, BU, or FR-BU).

- The multifunction regeneration converter (FR-XC in power regeneration mode 1 or 2), power regeneration common
 converter (FR-CV), and power regeneration converter (MT-RC) are used for continuous operation during regenerative
 driving. The high power factor converter (FR-HC2) and multifunction regeneration converter (FR-XC in common bus
 regeneration mode) can also be used to reduce harmonics, improve power factor, and operate continuously during
 regenerative driving.
- It is possible to choose between the DC feeding mode 1, which will operate with DC power supply (terminals P and N), and DC feeding mode 2, which will normally operate in AC power supply (terminals R, S, and T) and operate in DC power supply (terminal P and N), such as batteries, at the time of power failure.
- While the power is supplied only to the control circuit, the reset operation when the power is supplied to the main circuit can be selected.

| Pr. | Name | Initial value | Setting range | Description | |
|--------------------------|---------------------------------|------------------|--|---|--|
| 30 | Regenerative function | | 0 to 2, 10, 11, 20, 21, 100 to 102, 110, 111, 120, 121 ^{*1} 2, 10, 11, 102, | Set the applied regeneration unit, the terminal used for power supply, and | |
| E300 | 300 selection | 10 ^{*2} | 110, 111, 102, | whether to reset the inverter when the power is supplied to the main circle | |
| | | | 0, 2, 10, 20, 100, 102, 110, 120 ^{*3} | | |
| 70 G107 ^{*4} | Special regenerative brake duty | 0% | 0 to 100% | Set the %ED of the built-in brake transistor operation. | |
| 599 | X10 terminal input | 0*1*3, | 0 | Normally open input | |
| T721 | selection 1 ^{*2} | | 1 | Normally closed input (NC contact input specification) | |

- *1 The initial value or setting range for the standard model.
- *2 The initial value or setting range for the separated converter type.
- *3 The initial value or setting range for the IP55 compatible model.
- *4 The setting is available for the standard model.

◆ Details of the setting value

• FR-A820-03160(55K) or lower, FR-A840-01800(55K) or lower

| Regeneration unit | Power supply terminals of inverter | Pr.30 setting ^{*4} | Pr.70 setting | Remarks | |
|--|------------------------------------|--------------------------------|-----------------------|--|--|
| Built-in brake ^{*3} , | R, S, T | 0 (initial value), 100 | | The regenerative brake duty will be as follows. • FR-A820-00046(0.4K) to 00250(3.7K): 3% | |
| brake unit | P, N | 10, 110 | _ | • FR-A820-00340(5.5K), 00490(7.5K): 2% | |
| (FR-BU2 (GZG/GRZG/FR-BR), FR-BU, BU) | R, S, T/P, N | 20, 120 | | FR-A840-00023(0.4K) to 00250(7.5K): 2% Other than above: 0% (without the built-in brake resistor) | |
| I limb alutu basha nasistan | R, S, T | 1, 101 | 10% ^{*1} | The ED ADD are he was doubt ED A000 04050(00K) | |
| High-duty brake resistor (FR-ABR) | P, N | 11, 111 | 6% ^{*2} | The FR-ABR can be used with FR-A820-01250(22K) or lower and the FR-A840-00620(22K) or lower. | |
| (ITC-ABIV) | R, S, T/P, N | 21, 121 | 6% = | lower and the Fix-Ao-to-50020(22IX) or lower. | |
| Multifunction regeneration converter (FR-XC) (power regeneration mode 1 or 2) | R, S, T | 0 (initial value) | _ | _ | |
| High power factor converter (FR-HC2), multifunction regeneration converter (FR-XC) (common bus regeneration mode), power regeneration common converter (FR-CV) | P, N | 2, 102 | 0% (initial value) | _ | |

FR-A820-03800(75K) or higher, FR-A840-02160(75K) or higher

| Regeneration unit | Regeneration unit Power supply terminals of inverter | | Pr.70 Setting | |
|---|--|------------------------|--------------------|--|
| | R, S, T | 0 (initial value), 100 | | |
| Without regenerative function | P, N | 10, 110 | _ | |
| | R, S, T/P, N | 20, 120 | | |
| | R, S, T | 1, 101 | | |
| Brake unit (FR-BU2 (MT-BR5)) | P, N | 11, 111 | 0% (initial value) | |
| | R, S, T/P, N | 21, 121 | | |
| Power regeneration converter (MT-RC) | R, S, T | 1, 101 | 0% (initial value) | |
| High power factor converter (FR-HC2) | P, N | 2, 102 | _ | |
| Multifunction regeneration converter (FR-XC) (power regeneration mode 1 or 2) | R, S, T | 0 (initial value) | _ | |

• FR-A842-07700(315K) or higher

| Regeneration unit | Pr.30 setting ^{*4} |
|--|-----------------------------|
| Without regenerative function (FR-CC2) | 10 (initial value), 110 |
| Brake unit (FR-CC2+FR-BU2 (MT-BR5)) | 11, 111 |
| High power factor converter (FR-HC2) | 2, 102 |

- *1 For the FR-A820-00490(7.5K) or lower and FR-A840-00250(7.5K) or lower.
- For the FR-A820-00630(11K) or higher, and FR-A840-00310(11K) or higher.
- *3 The built-in brake is installed on FR-A820-00490(7.5K) or lower and FR-A840-00250(7.5K) or lower.
- *4 While the power is supplied only to the control circuit with Pr.30 = "100 or higher", the inverter reset is not performed when the power is supplied to the main circuit.



• For the use of a brake resistor other than the FR-ABR, contact your sales representative.

♦ When using the built-in brake resistor or brake unit (FR-BU2, BU, FR-BU) (FR-A820-03160(55K) or lower, FR-A840-01800(55K) or lower)

• When using the built-in brake, using the FR-BU2 in combination with the GZG/GRZG/FR-BR, or using the BU or FR-BU, set Pr.30 = "0 (initial value), 10, 20, 100, 110, or 120". The Pr.70 setting is invalid. At this time, the regenerative brake duty is as follows.

| Inverter | Regenerative brake duty |
|--|--|
| FR-A820-00250(3.7K) or lower | 3% |
| FR-A820-00340(5.5K), FR-A820-00490(7.5K) | 2% |
| FR-A840-00250(7.5K) or lower | 2% |
| Other than the above | 0% (without the built-in brake resistor) |



The built-in brake resistor is equipped for the FR-A820-00490(7.5K) or lower, and the FR-A840-00250(7.5K) or lower.

♦ When using the high-duty brake resistor (FR-ABR) (FR-A820-01250(22K) or lower, FR-A840-00620(22K) or lower)

- Set "1, 11, or 21" in Pr.30.
- · Set Pr.70 as follows.

| Inverter | Pr.70 setting |
|--|---------------|
| FR-A820-00490(7.5K) or lower, FR-A840-00250(7.5K) or lower | 10% |
| FR-A820-00630(11K) or higher, FR-A840-00310(11K) or higher | 6% |

♦ When using the brake unit (FR-BU2) (FR-A820-03800(75K) or higher, FR-A840-02160(75K) or higher)

- To use the FR-BU2 in combination with the MT-BR5, set as follows.
- Set "1, 11, or 21" in Pr.30.

- Set **Pr.70** = 0% (initial value).
- Set the brake unit FR-BU2, Pr.0 Brake mode selection = "2".



• The stall prevention (overvoltage), oL, does not occur while **Pr.30** = "1, 11, or 21".

◆ When using the power regeneration converter (MT-RC)

- Set "1 or 101" in Pr.30.
- Set **Pr.70** = 0% (initial value).

When using the high power factor converter (FR-HC2), multifunction regeneration converter (FR-XC), power regeneration common converter (FR-CV), or converter unit (FR-CC2)

- To use the FR-HC2 or FR-CV, set Pr.30 = "2 or 102". The Pr.70 setting is invalid.
- To use the FR-XC in common bus regeneration mode, set **Pr.30** = "2 or 102".
- To use the FR-XC in power regeneration mode, set Pr.30 = "0 or 100".
- When using the FR-CC2, set Pr.30 = "10" (initial value of the separated converter type).
- Use any of **Pr.178 to Pr.189 (Input terminal function assignment)** to assign the following signals to the contact input terminals.
 - (a) Inverter run enable (X10) signal: FR-HC2 connection, FR-XC connection, FR-CV connection, FR-CC2 connection

 To ensure coordinated protection of the FR-HC2, FR-XC (common bus regeneration mode), FR-CV, or FR-CC2, use
 the X10 signal to shut off the inverter output.
 - Input the RDY signal of the FR-HC2 (the RYB signal of the FR-XC, the RDYB signal of FR-CV, or the RDA signal of FR-CC2).
 - (b) FR-HC2/FR-CC2 connection, instantaneous power failure detection (X11) signal: FR-HC2 connection, FR-CC2 connection
 - During the operation using RS-485 communication, with the remote output and analog remote output functions enabled, the X11 signal is used to store the status when the inverter is set to store the status before an instantaneous power failure.
 - Input the FR-HC2/FR-CC2 connection, instantaneous power failure detection signal.
- For the terminal used for the X10 or X11 signal, set "10" (X10) or "11" (X11) in any of **Pr.178 to Pr.189** and assign the function. (For the separated converter type, the X10 signal is assigned to terminal MRS in the initial setting.)

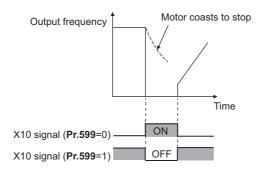
NOTE

- For details of the high-duty brake resistor (FR-ABR), brake unit, high power factor converter (FR-HC2), multifunction regeneration converter (FR-XC), or power regeneration common converter (FR-CV) connections, refer to page 97. Also, for details on each option, refer to the Instruction Manual of each option.
- Setting Pr.30 = "2" will reset the inverter, and "Err" is displayed on the operation panel during the reset.

♦ Logic reversing of the Inverter run enable signal (X10 signal, Pr.599)

- Use Pr.599 X10 terminal input selection to select the X10 signal input specification between normally open (NO contact) and normally closed (NC contact). With the normally closed (NC contact) input specification, the inverter output is shut off by turning OFF (opening) the X10 signal.
- Changing the inverter logic (NO/NC contact) with the **Pr.599** setting is required according to the logic of the Inverter run enable signal sent from the option unit.

The response time of the X10 signal is within 2 ms.



Relationship between Pr.599 and the Inverter run enable signal of each option unit

| Dr. 500 potting | Correspond | ing signals o | Operation according to the X10 | | |
|---|--|---------------|--------------------------------|--------|---|
| Pr.599 setting | FR-HC2 | FR-XC | FR-CV | FR-CC2 | signal status |
| 0 (initial value of standard structure models and IP55 compatible models) | RDY (negative logic) (initial setting) | RYB | RDYB | RDB | X10-ON: Inverter output shutoff (NO contact) |
| 1 (initial value of separated converter types) | RDY (positive logic) | RYA | RDYA | RDA | X10-OFF: Inverter output shutoff (NC contact) |

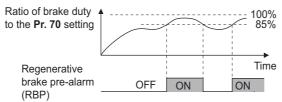


- If the X10 signal is unassigned while Pr.30 = "2" (FR-HC2/FR-XC/FR-CV connection) or "10 or 11" (DC feeding mode 1), the MRS signal can be used as the X10 signal. At this time, logic setting for the signal will follow Pr.17 MRS input selection.
- · The MRS signal is valid from either of communication or external, but when the MRS signal is to be used as the Inverter run enable (X10) signal, it must be input from external.
- When the FR-HC or MT-HC is connected, set Pr.599 = "0 (initial value)".
- · When the terminal assignment is changed with Pr.178 to Pr.189 (Input terminal function selection), wiring may be mistaken due to different terminal name and signal contents, or may affect other functions. Set parameters after confirming the function of each terminal.

◆ Regenerative brake duty warning output and the warning signal (RBP signal) (standard models)

- When the regenerative brake duty reaches 85% of the Pr.70 setting, "RB" is indicated on the operation panel and the Regenerative brake prealarm signal (RBP) signal is output. When it reaches 100% of the Pr.70 setting, it will become regenerative overvoltage (E.OV[]).
- The inverter output is not shut off with the warning signal.
- For the terminal to be used for the RBP signal output, set "7 (positive logic) or 107 (negative logic)" to one of Pr.190 to Pr.196 (Output terminal function selection), and assign the function.

100%: Regeneration overvoltage protection operation value



NOTE

- When Pr.30 = "0 (initial value), 10, or 20" for the FR-A820-00630(11K) or higher and the FR-A840-00310(11K) or higher, "RB" is not indicated
- · Changing the terminal assignment using Pr.190 to Pr.196 (Output terminal function selection) may affect the other functions. Set parameters after confirming the function of each terminal.

◆ Selection between resetting or not resetting during power supply to main circuit (Pr.30 = "100, 101, 102, 110, 111, 120, or 121")

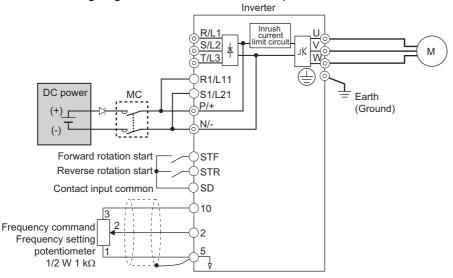
- Inverter reset is not performed if **Pr.30** = "100" or more, and supplying power to the main circuit (input through terminals R/L1, S/L2, and T/L3) is started when power is supplied only to the control circuit (input through terminals R1/L11 and S1/L12, or 24 V external power supply input).
- · When a communication option, etc. is used, communication interruption due to the inverter reset can be avoided.



When supplying power to the main circuit is started while the protective function of the inverter is activated, inverter reset is
performed even when "not resetting after power-ON" is selected.

◆ DC feeding mode 1 (Pr.30 = "10 or 11") (standard models and IP55 compatible models)

- For standard models and IP55 compatible models, setting Pr.30 = "10 or 11" allows operation with a DC power supply.
- Keep the AC power supply connection terminals R/L1, S/L2, and T/L3 open, and connect the DC power supply between terminals P/+ and N/-. Also, for the standard model, remove the jumpers between terminals R/L1 and R1/L11 and between terminals S/L2 and S1/L21, and connect the terminals R1/L11 and S1/L21 to the terminals P/+ and N/- respectively.
- · The following diagram shows a connection example.



<u>∕N</u>CAUTION

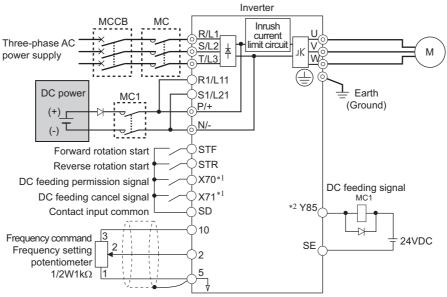
· Do not connect a separated converter type inverter to a DC power supply. Doing so may damage the inverter.

◆ DC feeding mode 2 (Pr.30 = "20 or 21") (standard models and IP55 compatible models)

- When **Pr.30** = "20 or 21", it will normally operate with AC power supply and operate with DC power supply such as batteries at the time of power failure.
- Connect the AC power supply to the AC power supply connecting terminals R/L1, S/L2, and T/L3, and connect the DC power supply to the terminals P/+ and N/-. Also, for the standard model, remove the jumpers between terminals R/L1 and R1/L11 and between terminals S/L2 and S1/L21, and connect the terminals R1/L11 and S1/L21 to the terminals P/+ and N/- respectively.
- Operation with DC current is possible by turning ON the DC feeding operation permission (X70) signal. For details on the I/O signals, refer to following table.

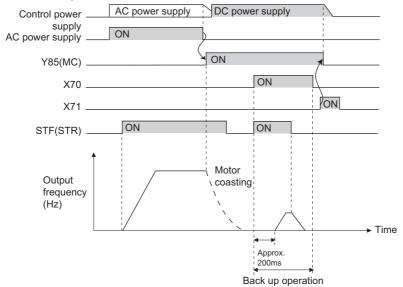
| Signa | I name | Name | Description | Parameter setting |
|--------|--------|---------------------------------|---|---|
| Input | X70 | DC feeding operation permission | To operate with DC feeding, turn ON the X70 signal. When the inverter output is shutoff due to power failure, it will be possible to start up 200 ms after turning ON the X70 signal. (Automatic restart after instantaneous power failure can start after the time set in Pr.57 has elapsed.) When the X70 signal is turned OFF while operating the inverter, output shutoff (Pr.261 = "0") or deceleration stop (Pr.261 ≠ "0") will occur. | Set "70" in any of Pr.178 to Pr.189 . |
| mput | X71 | DC feeding cancel | Turn ON when stopping the DC feeding. When the X71 signal is turned ON during the operation of the inverter and X70 signal is ON, output shutoff (Pr.261 = "0") or deceleration stop (Pr.261 ≠ "0") will occur, and Y85 signal will turn OFF after stopping. After turning ON the X71 signal, operation is not possible even if the X70 signal is turned ON. | Set "71" in any of Pr.178 to Pr.189 . |
| Output | Y85 | DC current feeding | This signal will turn ON during power failure or undervoltage of the AC power supply. It will turn OFF when the X71 signal turns ON or power restoration. The Y85 signal will not turn OFF even with the power restoration while the inverter is running, but turns OFF after stopping the inverter. When the Y85 signal is turned ON due to undervoltage, the Y85 signal will not turn OFF even when the undervoltage is resolved. The ON/OFF status is maintained when the inverter is reset. | Set "85 (positive logic) or 185 (negative logic)" in any of Pr.190 to Pr.196 . |

• Following is the connection diagram of switching to DC power supply using the power failure detection of the inverter.

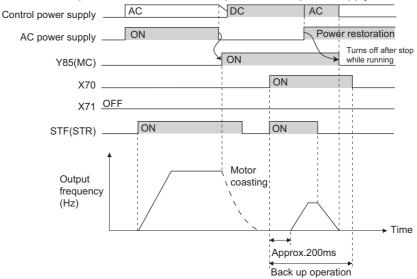


- *1 Assign the function using Pr.178 to Pr.182 (Input terminal function selection).
- *2 Assign the function using Pr.190 to Pr.196 (Output terminal function selection).

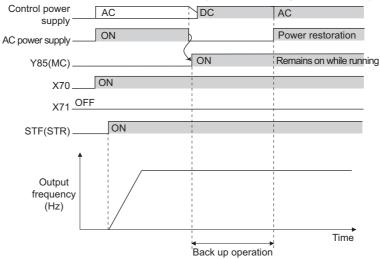
• Operation example at the time of power failure occurrence 1



· Operation example at the time of power failure occurrence 2 (when the AC power supply is restored)



· Operation example at the time of power failure occurrence 3 (when continuing the operation)



◆ Power supply specification for DC feeding (standard models and IP55 compatible models)

| 200 V class | Rated input DC voltage | 283 to 339 VDC |
|-------------|-------------------------|--------------------|
| 200 V Class | Permissible fluctuation | 240 to 373 VDC |
| 400 V class | Rated input DC voltage | 537 VDC to 707 VDC |
| 400 V Class | Permissible fluctuation | 457 VDC to 777 VDC |

NOTE

- The voltage between terminals P and N briefly increases to 415 V (830 V) or higher during the regenerative driving, so take caution on the selection of the DC power supply.
- When an AC power supply is connected to terminals R/L1, S/L2, and T/L3 during DC feeding with **Pr.30** = "2, 10, or 11" (DC feeding), an option fault (E.OPT) will occur.
- When the input voltage is insufficient during inverter operation with **Pr.30** = "2, 10, 11, 20, or 21" (DC feeding), the inverter output will be shut off. (The undervoltage protection function (E.UVT) is not activated.)
- When the inverter is operated with **Pr.30** = "2, 10, 11, 20, or 21" (DC feeding), detection of Instantaneous power failure (E.IPF) is not performed.
- When the DC power is switched ON, an inrush current higher than that for the AC power flows in the inverter. Minimize the number of power-ON events.
- Changing the terminal assignment using **Pr.178 to Pr.189 (Input terminal function selection)** or **Pr.190 to Pr.196 (Output terminal function selection)** may affect the other functions. Set parameters after confirming the function of each terminal.

^ WARNING

The value set in Pr.70 must not exceed the setting of the brake resistor used.
 It may cause overheating.

Parameters referred to

Pr.17 MRS input selection page 524
Pr.57 Restart coasting time page 628, page 635
Pr.178 to Pr.189 (Input terminal function selection) page 521
Pr.190 to Pr.196 (Output terminal function selection) page 473
Pr.261 Power failure stop selection page 642

5.16.12 Regeneration avoidance function

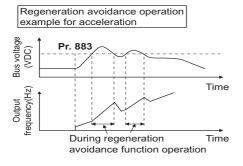
The regenerative status can be detected and avoided by raising the frequency.

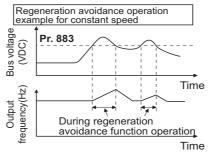
• The operation frequency is automatically increased to prevent the regenerative operations. This function is useful when a load is forcibly rotated by another fan in the duct.

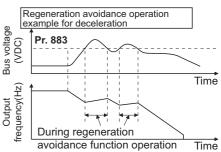
| Pr. | Name | Initial value | | Setting range | Description |
|-------------|--|----------------|---------|---------------|---|
| | Dononoustion | 0 | | 0 | The regeneration avoidance function is disabled. |
| 882 | Regeneration avoidance operation | | | 1 | The regeneration avoidance function is always enabled. |
| G120 | selection | | | 2 | The regeneration avoidance function is enabled only during constant-speed operation. |
| | | 200 V class | 380 VDC | | Set the bus voltage level to operate the regeneration avoidance operation. When the bus voltage level is set low, it will be harder |
| 883 G121 | Regeneration avoidance operation level | 400 V | 760 VDC | 300 to 1200 V | to generate overvoltage error, but actual deceleration time will be longer. Set the setting value higher than the (power supply voltage × |
| | | Class | | | $\sqrt{2}$) value. |
| 884 | Regeneration avoidance at | 0 | | 0 | The regeneration avoidance is disabled due to bus voltage change rate. |
| G122 | deceleration detection sensitivity | | | 1 to 5 | Set the sensitivity to detect the bus voltage change rate. Setting value 1 (detection sensitivity: low) to 5 (detection sensitivity: high) |
| 885 | Regeneration avoidance | 6 Hz | | 0 to 590 Hz | Set the limit value for frequency to rise when the regeneration avoidance function is activated. |
| G123 | compensation frequency limit value | | | 9999 | The frequency limit is disabled. |
| 886 G124 | Regeneration avoidance voltage gain | 100% | | 0 to 200% | Adjust the response during the regeneration avoidance operation. Increasing the setting improves the response to |
| 665 G125 | Regeneration avoidance frequency gain | | | 0 to 200% | change in the bus voltage. However, the output frequency may become unstable. If setting a smaller value in Pr.886 does not suppress the vibration, set a smaller value in Pr.665 . |

◆ Regeneration avoidance operation (Pr.882, Pr.883)

- When the regenerative voltage increases, the DC bus voltage will rise, which may cause an overvoltage fault (E.OV[]). The regenerative status can be avoided by detecting this rise of bus voltage, and raising the frequency when the bus voltage level exceeds **Pr.883 Regeneration avoidance operation level**.
- · The regeneration avoidance operation can be selected to operate constantly or operate only during constant speed.
- The regeneration avoidance function is enabled by setting "1 or 2" in **Pr.882 Regeneration avoidance operation** selection.







NOTE

- The slope of frequency rising or lowering by the regeneration avoidance operation will change depending on the regenerative status.
- The DC bus voltage of the inverter will be approximately √2 times of the normal input voltage.
 The bus voltage is about 311 VDC (622 VDC) when the input voltage is 220 VAC (440 VAC). However, it may vary depending on the input power supply waveform.
- Make sure that the setting value of **Pr.883** will not get under DC bus voltage level. The frequency will rise with operation of the regeneration avoidance function even during operation other than the regenerative operation.
- The stall prevention (overvoltage) (oL) will only operate during deceleration, stopping the lowering of output frequency, but on the other hand, the regeneration avoidance function will constantly operate (**Pr.882** = "1") or operate only at constant speed (**Pr.882** = "2"), and raise the frequency depending on the amount of regeneration.
- When the motor becomes unstable due to operation of the stall prevention (overcurrent) (OL) during the regeneration avoidance operation, increase the deceleration time or lower the setting of **Pr.883**.
- During position control, the regeneration avoidance function is not activated.

◆ Detecting the regenerative status faster during deceleration (Pr.884)

Since a rapid change in bus voltage cannot be handled by bus voltage level detection during the regeneration avoidance operation, deceleration is stopped by detecting the change in bus voltage and if it is equal to or lower than Pr.883 Regeneration avoidance operation level. Set the detectable bus voltage change rate as the detection sensitivity in Pr.884 Regeneration avoidance at deceleration detection sensitivity. A larger set value increases the detection sensitivity.



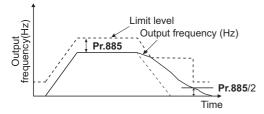
When the setting value is too small (detection sensitivity is not good), detection will not be possible, and regeneration
avoidance will operate even with the bus voltage change caused by a change in the input power.

◆ Limiting the regeneration avoidance operation frequency (Pr.885)

- It is possible to assign a limit to the output frequency corrected (rise) by the regeneration avoidance operation.
- Limit of the frequency is output frequency (frequency before regeneration avoidance operation) + Pr.885 Regeneration
 avoidance compensation frequency limit value for during acceleration and constant speed. During deceleration, when
 the frequency increases due to the regeneration avoidance operation and exceeds the limit value, the limit value will be
 retained until the output frequency is reduced to be the half the Pr.885 setting.
- When the frequency that have increased by the regeneration avoidance operation exceeds **Pr.1 Maximum frequency**, it will be limited to the maximum frequency.
- When Pr.885 = "9999", the regeneration avoidance compensation frequency limit is disabled.
- Set the frequency around the motor rated slip frequency. Increase the setting value if the overvoltage protection function (E.OV[]) is activated at the start of deceleration.

Rated motor slip frequency = Synchronized speed at the time of base frequency – rated rotation speed

Synchronized speed at the time of base frequency × Rated motor frequency



♦ Adjusting the regeneration avoidance operation (Pr.665, Pr.886)

- If the frequency becomes unstable during regeneration avoidance operation, decrease the setting of Pr.886 Regeneration
 avoidance voltage gain. On the other hand, if an overvoltage fault occurs due to a sudden regeneration, increase the
 setting.
- If setting a smaller value in Pr.886 does not suppress the vibration, set a smaller value in Pr.665 Regeneration avoidance frequency gain.



- During the regeneration avoidance operation, the stall prevention (overvoltage) "oL" is displayed and the Overload warning
 (OL) signal is output. Set the operation pattern at an OL signal output using Pr.156 Stall prevention operation selection.
 Use Pr.157 OL signal output timer to set the OL signal output timing.
- · The stall prevention is enabled even during regeneration avoidance operation.
- The regeneration avoidance function cannot decrease the actual deceleration time for the motor to stop. Since the actual deceleration time is determined by the regenerative power consumption performance, consider using a regeneration unit (FR-BU2, BU, FR-BU, FR-CV, FR-HC2, or FR-XC) or a brake resistor (such as the FR-ABR) to decrease the deceleration time.
- When using a regeneration unit (FR-BU2, BU, FR-BU, FR-CV, FR-HC2, or FR-XC) or a brake resistor (such as the FR-ABR) to consume the regenerative power at constant speed, set Pr.882 = "0 (initial value)" (the regeneration avoidance function is disabled). When consuming the regenerative power at the time of deceleration with the regeneration unit, etc., set Pr.882 = "2" (enables regeneration avoidance function only at the constant speed).
- When using the regeneration avoidance function under Vector control, noise may be generated from the motor during deceleration. In such case, adjust the gain by performing easy gain tuning, etc. (Refer to page 254.)

W Parameters referred to >>> Pr.1 Maximum frequency □ page 428 Pr.8 Deceleration time □ page 367 Pr.22 Stall prevention operation level □ page 431

5.16.13 Increased magnetic excitation deceleration

Magnetic flux Sensorless Vector

Increase the loss in the motor by increasing the magnetic flux during deceleration. The deceleration time can be reduced by suppressing the stall prevention (overvoltage) (oL).

The deceleration time can further be shortened without a brake resistor. (When a brake resistor is used, the duty can be reduced.)

| Pr. | Name | Initial value | Setting range | Description |
|----------------------|---|---------------|---------------|--|
| 660 | Increased magnetic | | 0 | Without the increased magnetic excitation deceleration function |
| G130 | excitation deceleration | | 1 | With the increased magnetic excitation deceleration function |
| | Magnetic excitation | 9999 | 0 to 40% | Set the increase of excitation. |
| 661 G131 | | | 9999 | The magnetic excitation increase rate is 10% under V/F control and Advanced magnetic flux vector control. |
| G131 IIICI ease I au | increase rate | | | The magnetic excitation increase rate is 0% under Real sensorless vector control and Vector control. |
| 662 G132 | Increased magnetic excitation current level | 100% | 0 to 300% | The increased magnetic excitation rate is automatically lowered when the output current exceeds the setting value during increased magnetic excitation deceleration. |

◆ Setting of increased magnetic excitation rate (Pr.660, Pr.661)

- To enable the increased magnetic excitation deceleration, set **Pr.660 Increased magnetic excitation deceleration** operation selection = "1".
- Set the amount of excitation increase in **Pr.661 Magnetic excitation increase rate**. Increased magnetic excitation deceleration will be disabled when **Pr.661** = "0".
- When the DC bus voltage exceeds the increased magnetic excitation deceleration operation level during the deceleration, excitation is increased in accordance with the setting value in **Pr.661**.
- The increased magnetic excitation deceleration will continue even if the DC bus voltage goes under the increased magnetic excitation deceleration operation level during increased magnetic excitation deceleration.

| Inverter | Increased magnetic excitation deceleration operation level |
|------------------|--|
| 200 V class | 340 V |
| 400 V class | 680 V |
| With 500 V input | 740 V |

- When the stall prevention (overvoltage) occurs during the increased magnetic excitation deceleration operation, increase the deceleration time or raise the setting value of **Pr.661**. When the stall prevention (overcurrent) occurs, increase the deceleration time or lower the setting value of **Pr.661**.
- Increased magnetic excitation deceleration is enabled under V/F control, Advanced magnetic flux vector control, Real sensorless vector control (speed control), and Vector control (speed control).



Increased magnetic excitation deceleration will be disabled in the following conditions:
 During PM sensorless vector control, power failure stop, orientation control, operation with the FR-HC2, FR-XC (in common bus regeneration mode), or FR-CV, energy saving operation, Optimum excitation control, and stop-on-contact control.

Overcurrent prevention function (Pr.662)

- The overcurrent prevention function is enabled under V/F control and Advanced magnetic flux vector control.
- The increased magnetic excitation rate is lowered automatically when the output current exceeds the level set in **Pr.662** during increased magnetic excitation deceleration.

- When the inverter protective function (E.OC[], E.THT) is activated due to increased magnetic excitation deceleration, adjust the level set in **Pr.662**.
- The overcurrent preventive function is disabled when Pr.662 = "0".



When the level set in Pr.662 is more than the one set in Pr.22 Stall prevention operation level, the overcurrent preventive
function is activated at the level set in Pr.22. (The level set in Pr.662 is applied when Pr.22 = "0".)

```
Pr.22 Stall prevention operation level page 431
Pr.30 Regenerative function selection page 724
Pr.60 Energy saving control selection page 712
Pr.162 Automatic restart after instantaneous power failure selection page 628, page 635
Pr.270 Stop-on contact/load torque high-speed frequency control selection page 577
Pr.261 Power failure stop selection page 642
Pr.350 Stop position command selection page 585
```

5.16.14 Slip compensation



Under V/F control, the slip of the motor is estimated from the inverter output current to maintain the rotation of the motor constant.

| Pr. | Name | Initial value | Setting range | Description |
|--------------------------------|---------------------------------|---------------|---------------|---|
| 245 | Pated alia | 9999 | 0.01 to 50% | Set the rated motor slip. |
| G203 Rated slip | | 9999 | 0, 9999 | No slip compensation |
| 246 G204 | Slip compensation time constant | 0.5 s | 0.01 to 10 s | Set the response time of the slip compensation. Reducing the value improves the response, but the regenerative overvoltage (E.OV[]) error is more likely to occur with a larger load inertia. |
| 247 Constant output range slip | | 9999 | 0 | No slip compensation in the constant power range (frequency range higher than the frequency set in Pr.3). |
| G205 | compensation selection | | 9999 | Slip compensation is performed in the constant power range. |

Calculate the rated motor slip and set the value in Pr.245 to enable slip compensation.

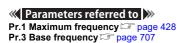
Slip compensation is not performed when Pr.245 = "0 or 9999".

```
Rated slip = \frac{\text{Synchronized speed at the time of base frequency - rated rotation speed}}{\text{Synchronized speed at the time of base frequency}} \times 100 [\%]
```



- When the slip compensation is performed, the output frequency may become larger than the set frequency. Set **Pr.1 Maximum frequency** higher than the set frequency.
- Slip compensation will be disabled in the following conditions:

 Stall prevention (oL, OL) operation, regeneration avoidance operation, auto tuning, encoder feedback control operation



5.16.15 Encoder feedback control



This controls the inverter output frequency so that the motor speed is constant to the load variation by detecting the motor speed with the speed detector (encoder) to feed back to the inverter.

A Vector control compatible option is required.

| Р | r. | Name | Initial value | Setting range | Descriptio | n |
|-----------------------------|---------------------------|---------------------------------|------------------|---|--|--|
| 144 M002 | | Speed setting switchover | 4 | 0, 2, 4, 6, 8, 10, 12, 102, 104, 106, 108, 110, 112 | Set the number of motor poles feedback control under V/F con | |
| 285 H416 | | Overspeed detection frequency*1 | 9999 | 0 to 30 Hz | When the difference between the detected frequency and the output frequency exceeds the set value during encoder feedback control, an inverter fault (E.MB1) is generated. | |
| | | | | 9999 | Overspeed detection is disabled | d. |
| | | | | 0 | Set when using a motor for which forward rotation | Set for the operation at 120 Hz or less. |
| 359*2*3 | 852 ^{*4} C241 | Encoder rotation direction | 1 | 100 | (encoder) is clockwise (CW) viewed from the shaft | Set for the operation at a frequency higher than 120 Hz. |
| C141 | | | | 1 | Set when using a motor for which forward rotation (encoder) is counterclockwise (CCW) viewed from the shaft. | Set for the operation at 120 Hz or less. |
| | | | | 101 | | Set for the operation at a frequency higher than 120 Hz. |
| 367 ^{*2} G240 | | Speed feedback range | 9999 | 0 to 590 Hz | Set the range of speed feedback control. | |
| | | Speed leedback ralige | שששש | 9999 | The encoder feedback control is disabled. | |
| 368 ^{*2} G24 | 1 | Feedback gain | 1 | 0 to 100 | Set when the rotation is unstable | e or response is slow. |
| 369 ^{*2*3} C140 | 851 ^{*4} C240 | Number of encoder pulses | 1024 | 0 to 4096 | Set the number of encoder puls Set the number of pulses before | |

^{*1} The speed deviation excess detection frequency is used when Vector control compatible option is mounted during Vector control. (Refer to page 269 for details.)

◆ Setting before operation (Pr.144, Pr.359, Pr.369)

- For the operation during encoder feedback control under V/F control, set the number of motor poles in **Pr.144 Speed setting switchover** in accordance with the applied motor. Since the **Pr.81 Number of motor poles** setting is used during Advanced magnetic flux vector, the **Pr.144** setting does not need to be changed.
- Use **Pr.359 Encoder rotation direction** and Pr.369 Number of encoder pulses to set the rotation direction and the number of pulses for the encoder.

NOTE

- Operating the inverter with **Pr.144** = "0, 10, 12, 110, or 112" causes E.1 to E.3.
- When "102, 104, 106, or 108" is set in **Pr.144**, the value obtained by subtracting 100 from the set value will be set as the number of poles.
- The **Pr.144** setting changes automatically when setting the motor poles in **Pr.81**, but even if **Pr.144** is changed, **Pr.81** will not automatically change.
- · Control with correct speed is not possible if the number of poles for the applied motor is incorrect. Check first before operation.
- Encoder feedback control is not possible when the rotation direction setting of the encoder is incorrect. (Operation of the inverter is possible.)
 - Check the indicator on the parameter unit to confirm the direction.

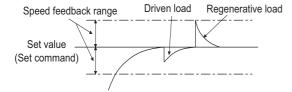
^{*2} The setting is available when a Vector control compatible option is installed.

^{*3} The parameter number is the one for use a Vector control compatible option. (Pr.369 is applicable for the FR-A8AP and FR-A8AL.)

^{*4} The parameter number is the one for use with the control terminal option (FR-A8TP).

Selection of encoder feedback control (Pr.367)

• When a value other than "9999" is set in Pr.367 Speed feedback range, encoder feedback control is enabled. Set a target value (frequency at which stable speed operation is performed) and specify the range around the value. Normally, use the frequency converted from the slip amount (r/min) at the rated motor speed (rated load). If the setting is too large, response becomes slow.



• Example: when the rated speed of a motor (4 poles) is 1740 r/min at 60 Hz

```
Slip Nsp = Synchronous speed - Rated speed
         = 1800 - 1740
         = 60 (r/min)
Frequency equivalent to slip (fsp) = Nsp × Number of poles/120
                                  = 60 \times 4/120
                                  = 2 (Hz)
```

♦ Feedback gain (Pr.368)

- · Set Pr.368 Feedback gain when the rotation is unstable or response is slow.
- · Response of the feedback will become slow when the acceleration/deceleration time is long. In such case, increase the setting value of Pr.368.

| Pr.368 setting | Description | | |
|---|--|--|--|
| Pr.368 > 1 Response will become faster but it may cause overcurrent or unstable operation. | | | |
| 1 > Pr.368 | Response will become slower but the operation will become more stable. | | |

Overspeed detection (Pr.285)

- · To prevent malfunction when the correct pulse signal cannot be detected from the encoder, when [detection frequency] - [output frequency] ≥ Pr.285 during encoder feedback control, a protective function (E.MB1) will be activated to shut off the inverter output.
- Overspeed detection is not performed when Pr.285 = "9999".



- · Couple the encoder on the same axis as the motor axis without any mechanical clatter, with speed ratio of 1:1.
- Encoder feedback control is not performed during the acceleration and deceleration to prevent unstable operation such as hunting
- Encoder feedback control is performed after the output frequency has reached [set frequency] ± [speed feedback range] once.
- · When following status occurs during encoder feedback control operation, the inverter output is not shut off, the output frequency becomes the value obtained by [set frequency] ± [speed feedback range], and tracking of the motor speed is not performed.

When the pulse signal from the encoder is lost due to a break, etc.

When correct pulse signal cannot be detected due to induction noise, etc.

When the motor is forcefully accelerated (regenerative rotation) or decelerated (motor lock) due to large external force

- · Use the Inverter running (RUN) signal when releasing the brake from the motor with a brake. (The brake may not be released when the Output frequency detection (FU) signal is used.)
- Do not turn OFF the external power supply for the encoder during encoder feedback control. Normal encoder feedback control will not be possible.



5.16.16 Droop control

Magnetic flux Sensorless Vector PM

This is a function to give droop characteristics to the speed by balancing the load in proportion with the load torque during the Advanced magnetic flux vector control, Real sensorless vector control, Vector control, and PM sensorless vector control.

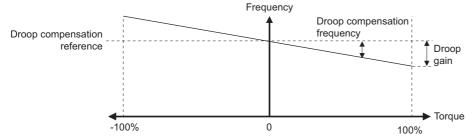
This is effective in balancing the load when multiple inverters are connected.

| Pr. | Name | Initial value | Setting range | Descr | ription |
|-------------|--|---------------|-----------------------------|---|--|
| | | | 0 | Normal operation | |
| 286 G400 | Droop gain | 0% | 0.1 to 100% | Droop control enabled. Set the droop amount at the tim the rated motor frequency. | ne of rated torque as % value of |
| 287 G401 | Droop filter time constant | 0.3 s | 0 to 1 s | Set the time constant of the filte | er relative to the torque current. |
| | | | 0 | No droop control during acceleration/deceleration (with 0 limit) | |
| | | | 1 | Continuous droop control during operation (with 0 limit) | The Pr.84 setting is the droop compensation reference. |
| | | | 2 | Continuous droop control during operation (without 0 limit) | |
| 288 G402 | Droop function activation selection | 0 | 10 | No droop control during acceleration/deceleration (with 0 limit) | The motor speed is the droop compensation reference. |
| G402 | Selection | | 11 | Continuous droop control during operation (with 0 limit) | compensation reference. |
| | | | 20 | No droop control during acceleration/deceleration (with 0 limit) | The Pr.1121 setting is the droop compensation reference. |
| | | | 21 | Continuous droop control during operation (with 0 limit) | |
| | | | 22 | Continuous droop control during operation (without 0 limit) | |
| 994 G403 | Droop break point gain | 9999 | 0.1 to 100% | Set the droop amount to be changed as % value of the rated motor frequency. | |
| G403 | | | 9999 | No function | |
| 995 G404 | Droop break point torque | 100% | 0.1 to 100% | Set the torque to change the d | roop amount. |
| 679 | | | 0 to 100% | Refer to Pr.286 . | |
| G420 | Second droop gain | 9999 | 9999 | The first droop control setting is applied. | |
| 680 | Second droop filter time | | 0 to 1 s | Refer to Pr.287. | |
| G421 | constant | 9999 | 9999 | The first droop control setting is applied. | |
| 681 | Second droop function activation selection | | 0 to 2, 10, 11, 20 to 22 | Refer to Pr.288 . | Set the second droop control. The second droop control is enabled when the RT signal is ON. |
| G422 | | | 9999 | The first droop control setting is applied. | |
| 682 | Second droop break point | | 0.1 to 100% | Refer to Pr.994 . | |
| G423 | gain | 9999 | 9999 | The first droop control setting is applied. | |
| 683 | Second droop break point | | 0.1 to 100% | Refer to Pr.995 . | |
| G424 | torque | 9999 | 9999 | The first droop control setting is applied. | |

♦ Droop control

- · Droop control is enabled under Advanced magnetic flux vector control, Real sensorless vector control, Vector control, and PM sensorless vector control.
- In the droop control, the speed command changes depending on the amount of the current for torque. Set the droop amount at the rated torque in Droop gain as % value of the rated motor frequency (or motor speed when **Pr.288** = "10 or 11").
- The upper limit of the droop compensation frequency is 400 Hz or **Pr.1 Maximum frequency**, whichever smaller.

• During PM sensorless vector control, the upper limit of the droop compensation frequency is 400 Hz, the frequency set in **Pr.1**, or the maximum motor frequency, whichever the smallest.



· The droop compensation frequency is calculated as follows.

Droop compensation frequency =
$$\frac{\text{Current for torque after filtering}}{\text{Rated torque current}} \times \text{K} \times \frac{\text{Droop compensation reference} \times \text{Droop gain}}{100}$$

When the output frequency is equal to or lower than the rated frequency set in Pr.84: K=1

When the output frequency is higher than the rated frequency set in Pr.84: K = $\frac{\text{Rated frequency (Pr.84)}}{\text{Output frequency}}$



• Set the droop gain equivalent to the rated slip of the motor.

Rated slip =
$$\frac{\text{Synchronized speed at the time of base frequency - rated rotation speed}}{\text{Synchronized speed at the time of base frequency}} \times 100[\%]$$

• The speed loop integration can be disabled at the emergency stop using **Pr.1349 Emergency stop operation selection**. (Refer to page 367.)

◆ Limiting the frequency after the droop compensation (0 limit)

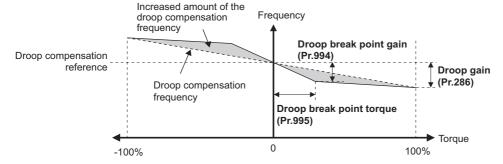
• Under Real sensorless vector control, Vector control, or PM sensorless vector control, the lower limit can be set for the frequency command value by setting **Pr.288** when the value falls below zero after droop compensation.

| Pr.288 setting | Operation | When the output frequency after droop compensation is negative | Droop compensation reference |
|-------------------|---|--|--|
| 0 (initial value) | | | Rated motor frequency (Pr.84 setting) |
| 10 ^{*1} | No droop control during | | Motor speed |
| 20*1 | acceleration/deceleration | Limited at 0 Hz (limited at 0.5 Hz under Advanced | Per-unit speed control reference frequency (Pr.1121 setting) |
| 1*1 | Continuous droop control during operation | magnetic flux vector control) | Rated motor frequency (Pr.84 setting) |
| 11 ^{*1} | | | Motor speed |
| 21*1 | | | Per-unit speed control reference frequency (Pr.1121 setting) |
| 2*1 | Continuous droop control during | Not limited (but reversed) under Vector control or PM | Rated motor frequency (Pr.84 setting) |
| 22*1 | operation | sensorless vector control • Limited at 0 Hz under Real sensorless vector control | Per-unit speed control reference frequency (Pr.1121 setting) |

^{*1} Under Advanced magnetic flux vector control, the operation is the same as the one when the setting is "0".

Setting the break point for droop control (Pr.994, Pr.995)

· Set Pr.994 and Pr.995 to have a break point on a droop compensation frequency line. Setting a break point allows the inverter to raise the droop compensation frequency for light-load (no load) operation without raising it for heavy-load operation.





The droop break point function is disabled when any of the following conditions is met. (Linear compensation by Pr.286 is performed.)

Pr.995 = 100% (initial value)

Pr.286 < Pr.994

 $Pr.994 \le Pr.995 \times Pr.286 / 100\%$

◆ Setting multiple droop control types (Pr.679 to Pr.683)

· When the second droop control is set, two sets of droop controls can be switched for use. Turning ON the Second function selection (RT) signal enables the second droop control.



- The RT signal is the Second function selection signal which also enables other second functions.
- The RT signal is assigned to terminal RT in the initial status. Set "3" in one of Pr.178 to Pr.189 (Input terminal function selection) to assign the RT signal to another terminal.
- · Changing the terminal assignment using Pr.178 to Pr.189 (Input terminal function selection) may affect the other functions. Set parameters after confirming the function of each terminal.

Parameters referred to

Pr.1 Maximum frequency page 428
Pr.178 to Pr.189 Input terminal function selection page 521

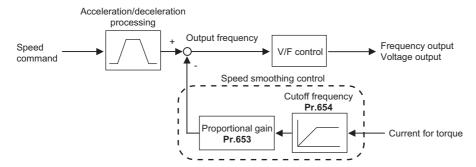
5.16.17 Speed smoothing control



The output current (torque) of the inverter sometimes becomes unstable due to vibration caused by mechanical resonance. Such vibration can be suppressed by reducing fluctuation of the output current (torque) by changing the output frequency.

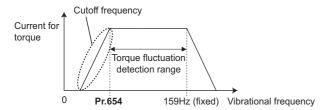
| Pr. | Name | Initial value | Setting range | Description |
|-------------|----------------------------------|---------------|---------------|---|
| 653 G410 | Speed smoothing control | 0% | 0 to 200% | Check the effect by increasing and decreasing the value at around 100%. |
| 654 G411 | Speed smoothing cutoff frequency | 20 Hz | 0 to 120 Hz | Set the minimum frequency for the torque variation cycle. |

◆ Control block diagram



Setting method

- When vibration caused by mechanical resonance occurs, set 100% in **Pr.653 Speed smoothing control**, perform operation at the frequency with the largest vibration, and check if the vibration is suppressed after few seconds.
- If the setting is not effective, gradually increase the value set in **Pr.653** and repeat the operation to check the effect to determine the most effective value (**Pr.653**).
- · If the vibration increases by increasing the value in Pr.653, decrease the value in Pr.653 from 100% to check the effect.
- When the vibrational frequency at which mechanical resonance occurs (during fluctuation of torque, speed, or converter
 output voltage) is measured using an instrument such as a tester, set 1/2 to 1 times of the vibrational frequency in Pr.654
 Speed smoothing cutoff frequency. (Setting the resonance frequency range mitigates vibration more effectively.)





• Depending on the equipment, the vibration may not be suppressed sufficiently or the setting is not effective.

5.17 Parameter clear / All parameter clear

Point P

- Set "1" to Pr.CLR Parameter clear or ALL.CL All parameter clear to initialize all parameters. (Parameters cannot be cleared
 when Pr.77 Parameter write selection = "1".)
- Pr.CLR does not clear calibration parameters or the terminal function selection parameters.
- Refer to the parameter list on page 864 for parameters cleared with this operation.

Operating procedure

- **1.** Turning ON the power of the inverter The operation panel is in the monitor mode.
- 2. Changing the operation mode

Press PU to choose the PU operation mode. The [PU] indicator turns ON.

3. Selecting the parameter setting mode

Press Mode to choose the parameter setting mode. (The parameter number read previously appears.)

4. Selecting the parameter

5. Parameter clear

Turn to change the set value to " \[\]". Press \[\] to set. " \[\] " and " \[\]

- Turn to read another parameter.
- Press SET to show the setting again.
- Press SET twice to show the next parameter.

| Setting | Description | | | | |
|---------|--|---|--|--|--|
| Setting | Pr.CL Parameter clear | ALL.CL All parameter clear | | | |
| 0 | Initial display (Parameters are not cleared.) | | | | |
| 1 | The settings of parameters except for calibration parameters and terminal function selection parameters are initialized. | The settings of all the parameters, including calibration parameters and terminal function selection parameters, are initialized. | | | |

MOTE

- " | " and " | are displayed alternately when the operation mode is other than the PU operation mode.
 - 1) Press PU EXT

- 2) Press SET to clear the parameter.
- · Stop the inverter first. Writing error occurs if parameter clear is attempted while the inverter is running.
- To clear parameters, the inverter must be in the PU operation mode even if "2" is set to Pr.77.
- For availability of the Parameter clear or All parameter clear operation for each parameter, refer to the parameter list on page 864.

5.18 Copying and verifying parameters on the operation panel

| Pr.CPY setting value | Description |
|----------------------|---|
| 0 | Initial display |
| 1.RD | Copy the parameters from the source inverter to the operation panel. |
| 2.WR | Write the parameters stored in the operation panel to the target inverter. |
| 3.VFY | Verify parameters in the inverter and operation panel. (Refer to page 746.) |

→ NOTE

- Refer to the parameter list on page 864 for the availability of parameter copy.
- When the power is turned OFF or an operation panel is disconnected, etc. during parameter copy writing, write again or check the setting values by parameter verification.
- When parameters are copied from a different-capacity inverter, there are parameters with different initial values depending on
 the inverter capacity, so the setting values of some parameters will be automatically changed. After performing a parameter
 copy from a different-capacity inverter, check all the parameter settings. (Refer to the parameter list (page 166) for details on
 parameters with different initial values depending on individual inverter capacity.)
- · While password protection is enabled, parameter copy and parameter verification cannot be performed. (Refer to page 348.)
- If parameters are copied from an older inverter to a newer inverter that has additional parameters, out-of-range setting values may be written in some parameters. In that case, those parameters operate as if they were set to initial values.

5.18.1 Parameter copy

· Inverter parameter settings can be copied to another inverter.

◆ Reading the parameter settings in the inverter and storing them in the operation panel

Operating procedure

- **1.** Connect the operation panel to the source inverter.
- 2. Selecting the parameter setting mode

Press Mode to choose the parameter setting mode. (The parameter number read previously appears.)

3. Selecting the parameter

4. Reading to and storing in the operation panel

Turn to change the set value to " Tress start reading the parameter settings by the operation panel. (It takes about 30 seconds to read and store all the settings. During reading, " Tress blinks.)

- **5.** End of reading and storing
 - " | | | and | | and | | are displayed alternately after the reading and storing are completed.



Copying parameter settings stored in the operation panel to the inverter

Operating procedure

- **1.** Connect the operation panel to the destination inverter.
- **2.** Selecting the parameter setting mode

Press MODE to choose the parameter setting mode. (The parameter number read previously appears.)

3. Selecting the parameter

4. Selecting parameter copy

5. Copying to the inverter

- Perform this step while the inverter is stopped. (Parameter settings cannot be copied during operation.)
- **6.** End of copying

7. When parameters are written to the destination inverter, reset the inverter before operation by, for example, turning the power supply OFF.

• NOTE

- "

 " appears when a parameter write error occurred. Perform the operation from step 3 again.
- " and " are displayed alternately when parameter copy is performed between the FR-A820-03160(55K) or lower or FR-A840-01800(55K) or lower inverters and the FR-A820-03800(75K) or higher or FR-A840-02160(75K) or higher inverters. When CP and 0.00 are displayed alternately, set **Pr.989 Parameter copy alarm release** as shown in the following table (initial value).

| Pr.989 setting | Operation |
|----------------|---|
| 10 | Cancels the warning of FR-A820-03160(55K) or lower and FR-A840-01800(55K) or lower. |
| 100 | Cancels the warning of FR-A820-03800(75K) or higher and FR-A840-02160(75K) or higher. |

After setting Pr.989, perform setting of Pr.9, Pr.30, Pr.51, Pr.56, Pr.57, Pr.61, Pr.70, Pr.72, Pr.80, Pr.82, Pr.90 to Pr.94, Pr.453, Pr.455, Pr.458 to Pr.462, Pr.557, Pr.859, Pr.860, and Pr.893 again.

5.18.2 Parameter verification

· Whether the parameter settings of inverters are the same or not can be checked.

Operating procedure

- **1.** Copy the parameter settings of the verification source inverter to the operation panel according to the procedure on page 744.
- **2.** Detach the operation panel from the source inverter and attach it to the verification target inverter.
- **3.** Turning ON the power of the inverter The operation panel is in the monitor mode.
- **4.** Selecting the parameter setting mode

Press MODE to choose the parameter setting mode. (The parameter number read previously appears.)

5. Selecting the parameter

6. Parameter verification

Press SET. Verification of the parameter settings copied to the operation panel and the parameter settings of the verification destination inverter is started. (It takes about 60 seconds to verify all the settings. During verification,

- If there are different parameters, the different parameter number and ",-- 🔁 📑 " are displayed alternately.
- To continue verification, press SET .

• NOTE

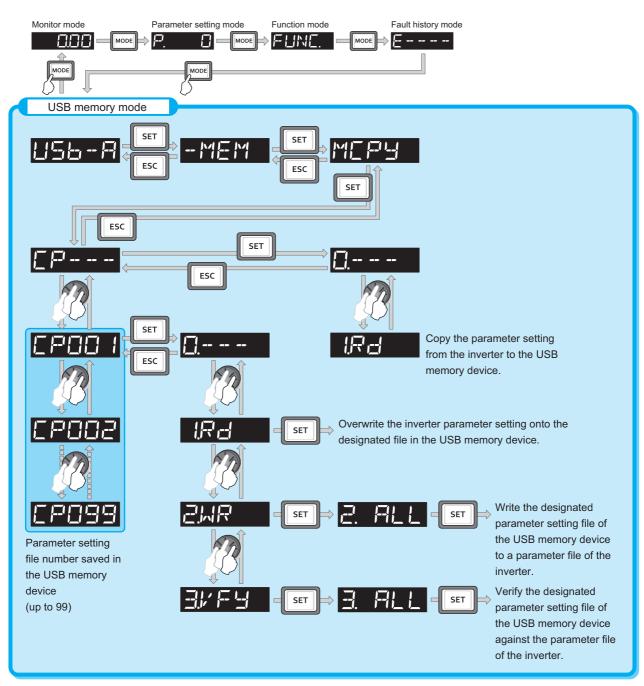
• When "-- | J" blinks, the set frequency may be incorrect. To continue verification, press

5.19 Copying and verifying parameters using a USB memory

- · Inverter parameter settings can be copied to a USB memory device.
- Parameter setting data stored in a USB memory device can be copied to another inverter or verified to see if they differ from the parameter settings of another inverter.
- Parameter settings can also be imported to a personal computer and edited in FR Configurator2.

◆ Changes in the USB memory copy operation states

• Insert the USB memory device into the inverter. The USB memory mode is displayed and the USB memory operations are enabled.





- When parameter settings are copied to the USB memory without specifying a parameter setting file number in the USB memory, numbers are automatically assigned.
- · Up to 99 files can be saved in the USB memory. When the USB memory already has 99 files, attempting copying of another file to the USB memory causes the file quantity error (rE7).
- · Refer to the Instruction Manual of FR Configurator2 for the details on importing files to FR Configurator2.
- · While password protection is enabled, parameter copy and parameter verification cannot be performed. (Refer to page 348.)

Procedure for copying parameters to the USB memory

Operating procedure

- 1. Insert the USB memory device into the copy source inverter.
- 2. USB memory mode

Press MODE to change to the USB memory mode.

3. Displaying the file selection screen

> Press SET three times to display " - - - - " (file selection screen) and press SET. (To overwrite files on the USB memory, display the file selection screen, turn to select the file number, and press SET ()

4. Copying to the USB memory

> Turn to change to " Press set to copy the parameter settings at the copy source to the USB

" | | and the file number are displayed alternately after copying ends.

Procedure for copying parameters from the USB memory to the inverter

Operating procedure

- 1. Insert the USB memory device into the destination inverter.
- 2. USB memory mode

Press MODE to change to the USB memory mode.

3. Displaying the file selection screen

Press SET three times to display " - - - - " (file selection screen).

4. Selecting the file number

Turn to select the file number to copy to the inverter, and press

Turn to display " and press SET . " appears.

Writing to the inverter

Press | SET | to start writing the parameter settings stored in the USB memory to the destination inverter. (It takes

" and the file number are displayed alternately after copying ends.

• Perform this step while the inverter is stopped.

- When parameters are written to the destination inverter, reset the inverter before operation by, for example, turning the power supply OFF.



- "I" or "I" appears when a USB memory device error occurred. Check the connection of the USB memory device and try the operation again.
- " and " are displayed alternately when parameter copy is performed between the FR-A820-03160(55K) or lower or FR-A840-01800(55K) or lower inverters and the FR-A820-03800(75K) or higher or FR-A840-02160(75K) or higher inverters. When CP and 0.00 are displayed alternately, set **Pr.989 Parameter copy alarm release** as shown below (initial value).

| Pr.989 setting | Operation |
|----------------|---|
| 10 | Cancels the warning of FR-A820-03160(55K) or lower and FR-A840-01800(55K) or lower. |
| 100 | Cancels the warning of FR-A820-03800(75K) or higher and FR-A840-02160(75K) or higher. |

- After setting Pr.989, perform setting of Pr.9, Pr.30, Pr.51, Pr.56, Pr.57, Pr.61, Pr.70, Pr.72, Pr.80, Pr.82, Pr.90 to Pr.94, Pr.453, Pr.455, Pr.458 to Pr.462, Pr.557, Pr.859, Pr.860, and Pr.893 again.
- Refer to the parameter list on page 864 for the availability of parameter copy.
- When the power is turned OFF or an operation panel is disconnected, etc. during parameter copy writing, write again or check the setting values by parameter verification.
- When parameters are copied from a different-capacity inverter, there are parameters with different initial values depending on
 the inverter capacity, so the setting values of some parameters will be automatically changed. After performing a parameter
 copy from a different-capacity inverter, check all the parameter settings. (Refer to the parameter list (page 166) for details on
 parameters with different initial values depending on individual inverter capacity.)

◆ Procedure for verifying parameters in the USB memory

Operating procedure

- **1.** Copy the parameter settings of the verification source inverter to the USB memory according to the procedure on page 748.
- **2.** Move the USB memory device to the inverter to be verified.
- **3.** Turning ON the power of the inverter The operation panel is in the monitor mode.
- **4.** USB memory mode

Press MODE to change to the USB memory mode.

5. Displaying the file selection screen

Press SET three times to display " - - - - " (file selection screen).

6. Selecting the file number

Turn to select the file number to be verified, and press set

7. Parameter verification

Turn to display the setting " Turn (Parameter copy verification mode), and press " Turn uppears.

Press start verification of the parameter settings copied to the USB memory and the parameter settings of the verification destination inverter. (It takes about 15 seconds to verify all the settings. During verification,

- To continue verification, press SET



• When " | Blinks, the set frequency may be incorrect. To continue verification, press | SET |

5.20 Checking parameters changed from their initial values (initial value change list)

Parameters changed from their initial values can be displayed.

Operating procedure

- **1.** Turning ON the power of the inverter The operation panel is in the monitor mode.
- 2. Selecting the parameter setting mode

Press Mode to choose the parameter setting mode. (The parameter number read previously appears.)

3. Selecting a parameter

4. Checking the Initial value change list

Turn ②. The parameter numbers that have been changed from their initial value appear in order.

• When set is pressed with a changed parameter displayed, the parameter settings can be changed as they are. (Parameter numbers are no longer displayed in the list when they are returned to their initial values.)

Other changed parameters appear by turning ②.

• The indication returns to " -- -- " when the last changed parameter is displayed.

• NOTE

- The calibration parameters (C0 (Pr.900) to C7 (Pr.905), C42 (Pr.934) to C45 (Pr.935)) are not displayed even when these are changed from the initial settings.
- Only the simple mode parameters are displayed when the simple mode is set (Pr.160 = "9999").
- Only user groups are displayed when user groups are set (**Pr.160** = "1").
- Pr.160 is displayed independently of whether the setting value is changed or not.
- · Parameter setting using the Initial value change list is also possible.

5.21 CC-Link IE Field Network (FR-A800-GF)

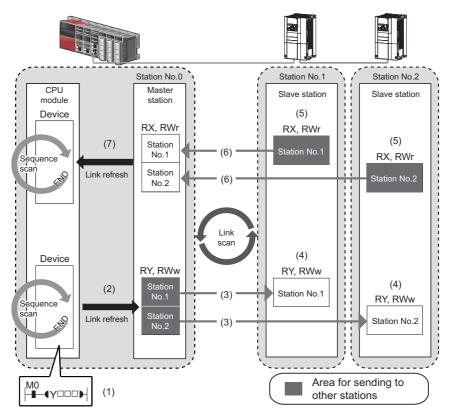
5.21.1 Cyclic transmission

Data communication is available periodically among stations on the same network. Link devices (RX, RY, RWr, and RWw) are used.

◆ Data flow and link device assignment (master and slave stations (except for local stations))

One-to-one communication is possible between the master and slave stations.

The status information of the link devices (RY and RWw) of the master station is output to the external device of the slave station, and the input status information from the external device of the slave station is stored in the link devices (RX and RWr) of the master station.



| Status | No. | Description | | | | |
|------------------------------|-----|---|--|--|--|--|
| | (1) | The device of the CPU module turns ON. | | | | |
| Output from the master | (2) | The device status data of the CPU module are stored in the link devices (RY and RWw) of the master station by link refresh. | | | | |
| station | (3) | The status data of the link devices (RY and RWw) of the master station are stored in the link devices (and RWw) of each slave station by link scan. | | | | |
| | (4) | The inverter starts according to the link device (RY and RWw) conditions (input signals such as STF STR) of the slave station. | | | | |
| | (5) | Inverter conditions (output signals such as RUN and SU, monitoring) are stored in the link devices (RX and RWr) of the slave station. | | | | |
| Input from the slave station | (6) | The status data of the link devices (RX and RWr) of the slave station are stored in the link devices (RX and RWr) of the master station by link scan. | | | | |
| | (7) | The status data of the link devices (RX and RWr) of the master station are stored in the devices of the CPU module by link refresh. | | | | |



• Refer to the MELSEC iQ-R, MELSEC-Q, or MELSEC-L CC-Link IE Field Network Master/Local Module User's Manual for the detailed assignment methods for the link devices and link refresh.

5.21.2 I/O signal list

◆ Remote I/O (64 points (fixed))

| Device No.*5 | Signal | Refer to page | Device No.*5 | |
|-------------------------|---|------------------|-------------------------------------|---------------|
| RYn0 | Forward rotation command*2 | 756 | RXn0 | Forv |
| RYn1 | Reverse rotation command*2 | 756 | RXn1 | Rev |
| RYn2 | High-speed operation command (terminal RH function)*1 | 756 | RXn2 | Run |
| RYn3 | Middle-speed operation command (terminal RM function)*1 | 756 | RXn3 | Up t |
| RYn4 | Low-speed operation command (terminal RL function)*1 | 756 | RXn4 | Ove |
| RYn5 | Jog operation selection (terminal JOG function)*1 | 756 | RXn5 | Insta func |
| RYn6 | Second function selection (terminal RT function)*1 | 756 | RXn6 | Fred fund |
| RYn7 | Current input selection (terminal AU function)*1 | 756 | RXn7 | Erro |
| RYn8 | Selection of automatic restart after instantaneous power failure (terminal CS function)*1 | 756 | RXn8 | <u> </u> |
| RYn9 | Output stop (terminal MRS function)*1 | 756 | | |
| RYnA | Start self-holding selection (terminal STOP function)*1 | | | Res |
| RYnB | Reset (terminal RES function)*1 | 756 | RXnF | 1769 |
| RYnC to RYnF | | | | |
| D) // | Reserved | _ | RX(n+1)0 | Pr.3 |
| RY(n+1)0 to RY(n+1)2 | | | RX(n+1)1 | Pr.3 |
| 111(1111)2 | | | RX(n+1)2 | Pr.3 |
| RY(n+1)3 to RY(n+1)F | Reserved | _ | RX(n+1)3 to RX(n+1)F | Res |
| RY(n+2)0 | Monitor command | 756 | RX(n+2)0 | Mor |
| RY(n+2)1 | Frequency setting command (RAM) | 756 | RX(n+2)1 | Fred |
| RY(n+2)2 | Frequency setting command (RAM, EEPROM) | 756 | RX(n+2)2 | Fred EEF |
| RY(n+2)3 | Torque command / torque limit (RAM) | 757 | RX(n+2)3 | Tord com |
| RY(n+2)4 | Torque command / torque limit (RAM, EEPROM) | 757 | RX(n+2)4 | Com |
| RY(n+2)5 | Instruction code execution request | 757 | RX(n+2)5 | Insti |
| RY(n+2)6 to RY(n+3)9 | Reserved | _ | RX(n+2)6 to RX(n+3)9 | Res |
| RY(n+3)A | Error reset request flag | 757 | RX(n+3)A | Erro |
| RY(n+3)B to RY(n+3)F | Reserved | _ | RX(n+3)B RX(n+3)C to RX(n+3)F | Ren |

| Device No.*5 | Signal | Refer to page |
|-------------------------|--|---------------|
| RXn0 | Forward running | 758 |
| RXn1 | Reverse running | 758 |
| RXn2 | Running (terminal RUN function)*3 | 758 |
| RXn3 | Up to frequency (terminal SU function)*3 | 758 |
| RXn4 | Overload alarm (terminal OL function)*3 | 758 |
| RXn5 | Instantaneous power failure (terminal IPF function)*3 | 758 |
| RXn6 | Frequency detection (terminal FU function)*3 | 758 |
| RXn7 | Error (terminal ABC1 function)*3 | 758 |
| RXn8 | — (terminal ABC2 function)*3 | 758 |
| RXn9 to RXnF | Reserved | _ |
| RX(n+1)0 | Pr.313 assignment function (DO0)*4 | 758 |
| RX(n+1)1 | Pr.314 assignment function (DO1)*4 | 758 |
| RX(n+1)2 | Pr.315 assignment function (DO2)*4 | 758 |
| RX(n+1)3 to RX(n+1)F | Reserved | _ |
| RX(n+2)0 | Monitoring | 758 |
| RX(n+2)1 | Frequency setting completion (RAM) | 758 |
| RX(n+2)2 | Frequency setting completion (RAM, EEPROM) | 758 |
| RX(n+2)3 | Torque command / torque limit setting completion (RAM) | 758 |
| RX(n+2)4 | Torque command / torque limit setting completion (RAM, EEPROM) | 758 |
| RX(n+2)5 | Instruction code execution completed | 758 |
| RX(n+2)6 to RX(n+3)9 | Reserved | _ |
| RX(n+3)A | Error status flag | 758 |
| RX(n+3)B | Remote station ready | 758 |
| RX(n+3)C to RX(n+3)F | Reserved | _ |

^{*1} These signals are set in the initial setting. Using **Pr.180 to Pr.189**, input signals assigned to the device numbers can be changed. (Refer to page 521.)

^{*2} The signals are fixed. They cannot be changed using parameters.

^{*3} These signals are set in the initial setting. Using **Pr.190** to **Pr.196**, output signals assigned to the device numbers can be changed. (Refer to page 473.)

^{*4} Output signal can be assigned using **Pr.313 to Pr.315**. (Refer to page 473.)

^{*5 &}quot;n" indicates a value determined by the station number setting.

◆ Remote register (128 words (fixed))

| Address*3 | | ription | Refer |
|--------------------------|---------------------------------|--------------------------------|---------|
| | Upper 8 bits | Lower 8 bits | to page |
| RWwn | Set frequency (0.01 F | Iz increments) | 759 |
| RWwn+1 | Reserved | _ | |
| RWwn+2 | Torque command / to | 759 | |
| RWwn+3 | Reserved | _ | |
| RWwn+4 | PID set point (0.01% | 759 | |
| RWwn+5 | PID measured value | 759 | |
| RWwn+6 | PID deviation (0.01% | 759 | |
| RWwn+7 to RWwn+F | Reserved | , | _ |
| RWwn+10 | Link parameter extended setting | Instruction code ^{*2} | 759 |
| RWwn+11 | Write data | | 759 |
| RWwn+12 | Link parameter extended setting | Instruction code*2 | 759 |
| RWwn+13 | Write data | | 759 |
| D)\\(\frac{1}{2}\) | Link parameter | | 750 |
| RWwn+14 | extended setting | Instruction code ^{*2} | 759 |
| RWwn+15 | Write data | | 759 |
| RWwn+16 | Link parameter extended setting | Instruction code*2 | 759 |
| RWwn+17 | Write data | • | 759 |
| RWwn+18 | Link parameter extended setting | Instruction code*2 | 759 |
| RWwn+19 | Write data | <u> </u> | 759 |
| RWwn+1A | Link parameter extended setting | Instruction code*2 | 759 |
| RWwn+1B | Write data | 759 | |
| RWwn+1C to RWwn+1F | Reserved | | _ |
| RWwn+20 | Reserved | _ | |
| RWwn+21 | Fault history No. | 759 | |
| RWwn+22 to RWwn+25 | Reserved | | _ |
| RWwn+26 | Monitor code 1 | | 759 |
| RWwn+27 | Monitor code 2 | | 759 |
| RWwn+28 | Monitor code 3 | | 759 |
| RWwn+29 | Monitor code 4 | | 759 |
| RWwn+2A | Monitor code 5 | | 759 |
| RWwn+2B | Monitor code 6 | | 759 |
| RWwn+2C | Monitor code 7 | | 759 |
| RWwn+2D | Monitor code 8 | | 759 |
| RWwn+2E | Monitor code 9 | 759 | |
| RWwn+2F | Monitor code 10 | | 759 |
| RWwn+30 to RWwn+39 | Reserved | | _ |

| A al alua = = *3 | Descr | ription | Refer |
|-----------------------|----------------------------------|---------------------------|---------|
| Address*3 | Upper 8 bits | Lower 8 bits | to page |
| RWrn | Reply code | | 760 |
| RWrn+1 | Reserved | | _ |
| RWrn+2 | Reply code | 760 | |
| RWrn+3 | Reserved | | |
| RWrn+4 | Reply code | | 760 |
| RWrn+5 | Reply code | 760 | |
| RWrn+6 | Reply code | | 760 |
| RWrn+7 to RWrn+F | Reserved | | _ |
| RWrn+10 | Reply code | | 760 |
| RWrn+11 | Read data ^{*2} | | 760 |
| RWrn+12 | Reply code | | 760 |
| RWrn+13 | Read data ^{*2} | | 760 |
| RWrn+14 | Reply code | | 760 |
| RWrn+15 | Read data ^{*2} | | 760 |
| RWrn+16 | Reply code | | 760 |
| RWrn+17 | Read data*2 | | 760 |
| RWrn+18 | Reply code | | 760 |
| RWrn+19 | Read data ^{*2} | | 760 |
| RWrn+1A | Reply code | | 760 |
| RWrn+1B | Read data ^{*2} | | 760 |
| RWrn+1C to RWrn+1F | Reserved | | _ |
| RWrn+20 | Error status | | 760 |
| RWrn+21 | Fault history No. | Fault record (fault data) | 760 |
| RWrn+22 | Fault record (output fi | requency) | 760 |
| RWrn+23 | Fault record (output current) | | 760 |
| RWrn+24 | Fault record (output voltage) | | 760 |
| RWrn+25 | Fault record (energization time) | | 760 |
| RWrn+26 | First monitor value | | 760 |
| RWrn+27 | Second monitor value |) | 760 |
| RWrn+28 | Third monitor value | | 760 |
| RWrn+29 | Fourth monitor value | | 760 |
| RWrn+2A | Fifth monitor value | | 760 |
| RWrn+2B | Sixth monitor value | | 760 |
| RWrn+2C | Seventh monitor valu | e | 760 |
| RWrn+2D | Eighth monitor value | | 760 |
| RWrn+2E | Ninth monitor value | | 760 |
| RWrn+2F | Tenth monitor value | | 760 |
| RWrn+30 | Output frequency | 760 | |
| RWrn+31 | Reserved | 700 | |
| RWrn+32 | Output current | | 760 |
| RWrn+33 | Output voltage | | 760 |
| RWrn+34 | Reserved | luo. | 760 |
| RWrn+35 | Frequency setting val | ue | 760 |
| RWrn+36 | Motor speed | | 760 |
| RWrn+37 | Motor torque | 200 | 760 |
| RWrn+38 | Converter output volta | | 760 |
| RWrn+39 | Regenerative brake d | 760 | |

| | Doscr | ription | Refer | | Description | Refer |
|-----------|--------------|--------------|-----------------------|-----------------------------------|---|---------|
| Address*3 | Upper 8 bits | Lower 8 bits | to page | Address*3 | Upper 8 bits Lower 8 bits | to page |
| | | | | RWrn+3A | Electric thermal relay function load factor | 760 |
| | | | | RWrn+3B | Output current peak value | 760 |
| | | | | RWrn+3C | Converter output voltage peak value | 760 |
| | | | | RWrn+3D | Input power | 760 |
| | | | | RWrn+3E | Output power | 760 |
| | | | | RWrn+3F | Input terminal status | 760 |
| | | | | RWrn+40 | Output terminal status | 760 |
| | | | | RWrn+41 | Load meter | 760 |
| | | | | RWrn+42 | Motor excitation current | 760 |
| | | | | RWrn+43 | Position pulse | 760 |
| | | | | RWrn+44 | Cumulative energization time | 760 |
| | | | | RWrn+45 | Reserved | _ |
| | | | | RWrn+46 | Orientation status | 760 |
| | | | | RWrn+47 | Actual operation time | 760 |
| | | | | RWrn+48 | Motor load factor | 760 |
| | | | | RWrn+49 | Cumulative power | 760 |
| | | | | RWrn+4A | Position command (lower) | 760 |
| | | | | RWrn+4B | Position command (upper) | 760 |
| | | | | RWrn+4C | Current position (lower) | 760 |
| | | | | RWm+4C RWm+4D | , , , | 760 |
| | | | | RWm+4E | Current position (upper) | 760 |
| | | | | | Droop pulse (lower) | |
| | | | | RWrn+4F | Droop pulse (upper) | 760 |
| | | | | RWrn+50 | Torque command | 760 |
| | | | RWrn+51 | Torque current command | 760 | |
| | | | | RWrn+52 | Motor output | 760 |
| | | | | RWrn+53 | Feedback pulse monitor | 760 |
| RWwn+3A | Reserved | RWrn+54 | | Torque monitor | 760 | |
| to | | RWrn+55 | | Reserved | _ | |
| RWwn+73 | | | | RWrn+56 | Trace status | 760 |
| | | RWrn+57 | | Reserved | _ | |
| | | RWrn+58 | | PLC function user monitor 1 | 760 | |
| | | RWrn+59 | | PLC function user monitor 2 | 760 | |
| | | RWrn+5A | | PLC function user monitor 3 | 760 | |
| | | RWrn+5B | | Station number (RS-485 terminals) | 760 | |
| | | RWrn+5C | | Station number (PU) | 760 | |
| | | | | RWrn+5D | Station number (CC-Link) | 760 |
| | | | | RWrn+5E | Motor temperature | 760 |
| | | | | RWrn+5F to RWrn+61 | Reserved | _ |
| | | | | RWrn+62 | Power saving effect | 760 |
| | | | | RWrn+63 | Cumulative energy saving | 760 |
| | | | | RWrn+64 | PID set point | 760 |
| | | | | RWrn+65 | PID measured value | 760 |
| | | | | RWrn+66 | PID deviation | 760 |
| | | | RWrn+67 to RWrn+69 | Reserved | _ | |
| | | | RWrn+6A | Option input terminal status 1 | 760 | |
| | | | RWrn+6B | Option input terminal status 2 | 760 | |
| | | | RWrn+6C | Option output terminal status | 760 | |
| | | | RWrn+6D | Motor thermal load factor | 760 | |
| | | | | RWrn+6E | Inverter thermal load factor | 760 |
| | | | | RWrn+6F | Reserved | _ |
| | | | | RWrn+70 | PTC thermistor value | 760 |
| | | | | RWrn+71 | | . 50 |
| | | | | RWrn+72 | Reserved | _ |
| | | | | | PID measured value 2 | 760 |
| | | | <u> </u> | RWrn+73 | I ID INCASAICA VAIAC Z | 700 |

| Address*3 | Descr | Refer | |
|--------------------------|--------------|--------------|---------|
| Address | Upper 8 bits | Lower 8 bits | to page |
| RWwn+74 to RWwn+7F | Reserved | | _ |

| Address*3 | Descr | Refer | |
|-----------------------|---|--------------|---------|
| Address | Upper 8 bits | Lower 8 bits | to page |
| RWrn+74 to RWrn+76 | Reserved | _ | |
| RWrn+77 | Cumulative pulse | 760 | |
| RWrn+78 | Cumulative pulse ove | 760 | |
| RWrn+79 | Cumulative pulse (cor | 760 | |
| RWrn+7A | Cumulative pulse overflow times (control terminal option) | | 760 |
| RWrn+7B to RWrn+7F | Reserved | _ | |

^{*1} When **Pr.128** = "50, 51, 60, or 61", the register is valid.

Details of the remote input and output signals 5.21.3

The following device numbers are for the station number 1.

For the station number 2 and later, the device numbers are different. (Refer to the manual for the CC-Link master module for the correspondence between device numbers and station numbers.)

◆ Output signals (from the master module to the inverter)

Output signals from the master module are as follows. (Input signals to the inverter)

| Device No. | Signal | Description | |
|------------|---|--|--|
| RY0 | Forward rotation command | 0: Stop command 1: Forward rotation start • When "1" is set, a start command is input to the inverter. When "1" is set in RY0 and RY1, a stop | |
| RY1 | Reverse rotation command | 0: Stop command 1: Reverse rotation start command is input. • The signals are fixed. They cannot be changed usir parameters. | |
| RY2 | High-speed operation command (terminal RH function) | | |
| RY3 | Middle-speed operation command (terminal RM function) | | |
| RY4 | Low-speed operation command (terminal RL function) | | |
| RY5 | Jog operation selection (terminal JOG function) | • Functions assigned to terminals RH, RM, RL, JOG, RT, AU, CS, MRS, STOP | |
| RY6 | Second function selection (terminal RT function) | and RES are activated. These signals are set in the initial setting. Using Pr.180 to Pr.189, input signals assigned to the device numbers can be changed. Some signals are not | |
| RY7 | Current input selection (terminal AU function) | controllable via network depending on the settings of Pr.338 and Pr.339 . F example, RYB reset (terminal RES function) cannot be controlled via network | |
| RY8 | Selection of automatic restart after instantaneous power failure (terminal CS function) | | |
| RY9 | Output stop (terminal MRS function) | | |
| RYA | Start self-holding selection (terminal STOP function) | | |
| RYB | Reset (terminal RES function) | | |
| RY20 | Monitor command | When "1" is set in the monitor command (R20), the monitored value is set in the remote register RWr26 to RWr2F, and "1" is set in the monitoring (RX20). While "1" is set in the monitor command (RY20), the monitored data is always updated | |
| RY21 | Frequency setting command (RAM) | When "1" is set in the frequency setting command (RY21), the set frequency (RWw0) is written to RAM of the inverter. While "1" is set, the set frequency (RWw0) is always applied. After the writing completes, "1" is set in the frequency setting completion (RX21) | |
| RY22 | Frequency setting command (RAM, EEPROM) | When "1" is set in the frequency setting command (RY22), the set frequency (RWw0) is written to RAM and EEPROM of the inverter. After the writing completes, "1" is set in the frequency setting completion (RX22) To change the frequency consecutively, be sure to write data to the inverter RAM | |

^{*2} Instructions will be processed in the order they are received. Thus, the read value of an instruction may differ at different timings if other writing requests are being made.

^{*3 &}quot;n" indicates a value determined by the station number setting.

| Device No. | Signal | Description |
|------------|---|--|
| RY23 | Torque command / torque limit (RAM) | When "1" is set in the torque command / torque limit (RY23), the set torque command / torque limit (RWw2) is written to RAM of the inverter. After the writing completes, "1" is set in the torque command / torque limit setting completion (RX23). The following value is written to RAM. During torque control*1: Torque command value During speed control / position control: Torque limit value |
| RY24 | Torque command / torque limit (RAM, EEPROM) | When "1" is set in the torque command / torque limit (RY24), the set torque command / torque limit (RWw2) is written to RAM and EEPROM of the inverter. After the writing completes, "1" is set in the torque command / torque limit setting completion (RX24). The following value is written to RAM and EEPROM. During torque control 1: Torque command value During speed control / position control: Torque limit value To change the torque command or the torque limit consecutively, be sure to write data to the inverter RAM. |
| RY25 | Instruction code execution request | When "1" is set in the instruction code execution request (RY25), processes corresponding to the instruction codes set to RWw10, 12, 14, 16, 18 and 1A are executed. "1" is set in the instruction code execution completed (RX25) after completion of instruction codes. When an instruction code execution error occurs, a value other than "0" is set in the reply code (RWr10, 12, 14, 16, 18, and 1A). |
| RY3A | Error reset request flag | When "1" is set in the error reset request flag (RY3A) at an inverter fault, the inverter is reset, then "0" is set in the error status flag (RX3A). Refer to page 669 for operation conditions of inverter reset. |

^{*1} Torque control cannot be performed with a PM motor.

◆ Input signals (from the inverter to the master module)

Input signals to the master module are as follows. (Output signals from the inverter)

| Device No. | Signal | Description |
|------------|--|---|
| RX0 | Forward running | Other than forward running (during stop or reverse rotation) Forward running |
| RX1 | Reverse running | Other than reverse running (during stop or forward rotation) Reverse running |
| RX2 | Running (terminal RUN function) | |
| RX3 | Up to frequency (terminal SU function) | |
| RX4 | Overload alarm (terminal OL function) | Formations and investoral and a PUIN OUL OIL IDE SILL ADOLAR ADOLAR |
| RX5 | Instantaneous power failure (terminal IPF function) | Functions assigned to terminals RUN, SU, OL, IPF, FU, ABC1 and ABC2 are activated. These signals are set in the initial setting. Using Pr.190 to Pr.196, output |
| RX6 | Frequency detection (terminal FU function) | signals assigned to the device numbers can be changed. |
| RX7 | Error (terminal ABC1 function) | |
| RX8 | — (terminal ABC2 function) | |
| RX10 | — (DO0 function) | Functions assigned to Pr.313 to Pr.315 are activated. |
| RX11 | — (DO1 function) | No signal is assigned in the initial setting. Use Pr.313 to Pr.315 to assign |
| RX12 | — (DO2 function) | signals. |
| RX20 | Monitoring | After "1" is set in the monitor command (RY20), and the monitored value is set in the remote register RWr26 to RWr2F, "1" is set in this signal. When "0" is set in the monitor command (RY20), "0" is set in this signal. |
| RX21 | Frequency setting completion (RAM) | After "1" is set in the frequency setting command (RY21) and the set frequency is written to the inverter RAM, "1" is set in this signal. When "0" is set in the frequency setting command (RY21), "0" is set in this signal. |
| RX22 | Frequency setting completion (RAM, EEPROM) | After "1" is set in the frequency setting command (RY22) and the set frequency is written to the inverter RAM and EEPROM, "1" is set in this signal. When "0" is set in the frequency setting command (RY22), "0" is set in this signal. |
| RX23 | Torque command / torque limit setting completion (RAM) | After "1" is set in the torque command / torque limit (RY23) and the torque command / torque limit value is written to the inverter RAM, "1" is set in this signal. When "0" is set in the torque command / torque limit (RY23), "0" is set in this signal. |
| RX24 | Torque command / torque limit setting completion (RAM, EEPROM) | After "1" is set in the torque command / torque limit (RY24) and the torque command / torque limit value is written to the inverter RAM and EEPROM, "1" is set in this signal. When "0" is set in the torque command / torque limit (RY24), "0" is set in this signal. |
| RX25 | Instruction code execution completed | After "1" is set in the instruction code execution request (RY25) and the processes corresponding to the instruction codes (RWw10, 12, 14, 16, 18 and 1A) are executed, "1" is set in this signal. When "0" is set in the instruction code execution request (RY25), "0" is set in this signal. |
| RX3A | Error status flag | When an inverter error occurs (protective function is activated), "1" is set in this signal. |
| RX3B | Remote station ready | When the inverter goes into the ready status upon completion of initial setting after power-on or hardware reset, "1" is set in this signal. When an inverter error occurs (protective function is activated), "0" is set in this signal. The signal is used as an interlock during the write to/read from the master module. |

Details of the remote register 5.21.4

The following device numbers are for the station number 1.

For the station number 2 and later, the device numbers are different. (Refer to the manual for the CC-Link master module for the correspondence between device numbers and station numbers.)

◆ Remote register (from the master module to the inverter)

| Device No. | Signal | | Description | |
|---|--|--|--|--|
| RWw0 | Set frequency*1*2 | to write to RAM or EEPROM is de the set frequency in this register, writing of frequency is completed, command. | ons per minute (machine speed). At this time, whether ecided with the RY21 and RY22 settings. After setting set "1" in RY21 or RY22 to write the frequency. After, "1" is set in RX21 or RX22 in response to the input Hz (0.01 Hz increments). Write "59000" when setting | |
| | Torque command value | | / torque limit value. Set Pr.804 Torque command | |
| RWw2 ^{*5} | Torque limit value | source selection = "1, 3, 5, or 6" to activate this signal under Real sensorless vector control, Vector control, and PM sensorless vector control. The value is written to the inverter either by RY23 or RY24. Pr.805 Torque command value (RAM) and Pr.806 Torque command value (RAM, EEPROM) are updated as well. The setting range and the setting increment depend on the Pr.804 setting. (Refer to page 762.) | | |
| RWw4 | PID set point ^{*3} | Set the PID action set point. Setting range: 0 to 100.00% | Input a value 100 times greater than the value to be | |
| RWw5 | PID measured value*3 | Set the PID measured value. Setting range: 0 to 100.00% | set. For example, enter "10000" when setting 100.00%. | |
| RWw6 | PID deviation ^{*3} | Set the PID deviation. Setting range: -100.00 to 100.00% | | |
| RWw10, RWw12, RWw14, RWw16, RWw18, RWw1A | Link parameter extended setting / instruction code | Set an instruction code (refer to page 760) for an operation such as operation mode switching, parameter read/write, error reference, and error clear in the lower eight bits. The instructions are executed in the following order by setting "1" in RY25 after completing the register setting: RWw10, 12, 14, 16, 18, then 1A. After completing the execution up to RWw1A, "1" is set in RX25. Set HFFFF to disable an instruction by RWw10 to 1A. Set the link parameter extended setting in the upper 8 bits. Example) When reading Pr.160 , instruction code is H0200. | | |
| RWw11, RWw13, RWw15, RWw17, RWw19, RWw1B | Write data | Set the data specified by the instruction code of RWw10, 12, 14, 16, 18 and 1A (when required). RWw10 and 11, 12 and 13, 14 and 15, 16 and 17, 18 and 19, and 1A and 1B correspondence of their set "1" in RY25 after setting the instruction codes (RWw10, 12, 14, 16, 18 and 1A) and the corresponding register. Set "0" when the write data is not required. | | |
| RWw21 | Fault history No.*4 | Set the individual fault number of th be read back to the eighth latest fault Last two digits: H00 (latest fault) to Set H08 to HFF to make the fault h | H07 (eighth latest fault) | |
| RWw26 | Monitor code 1 ^{*4} | | | |
| RWw27 | Monitor code 2*4 | | | |
| RWw28 | Monitor code 3*4 | Set the monitor code to be monitor monitor data is stored in RWr26 to | ed. By setting "1" in RY20 after setting, the specified RWr2F. | |
| RWw29 | Monitor code 4 ^{*4} | If a monitor code out of the setting r | range is set, no item is monitored (the monitor value is | |
| RWw2A | Monitor code 5 ^{*4} | fixed to 0). The monitor codes are the same as | s those of the RS-485 communication dedicated | |
| RWw2B | Monitor code 6 ^{*4} | monitor. (Refer to page 446.) | | |
| RWw2C | Monitor code 7 ^{*4} | | to 2F are used for monitoring, H01 (output frequency) icate the frequency regardless of the settings of Pr.37 , | |
| RWw2D | Monitor code 8 ^{*4} | Pr.144, and Pr.811. | neate the frequency regardless of the settings of Pr.37, | |
| RWw2E | Monitor code 9*4 | | | |
| RWw2F | Monitor code 10*4 | | | |

^{*1} The rotation speed command or the machine speed command is selected according to the combination of Pr.37, Pr.144, and Pr.811. (Refer to page 444.)

^{*2} When Pr.541 Frequency command sign selection = "1", the set frequency is a signed value. When the setting value is negative, the command is the inverse from the start command. Setting range: -327.68 Hz to 327.67 Hz (-327.68 to 327.67), 0.01 Hz increments. (Refer to page 699.)

^{*3} When Pr.128 = "50, 51, 60, or 61", the register is valid. If the data outside the range is set, the previous setting is retained. (Refer to page 601.)

^{*4} Write data is in hexadecimal, and only two digits are valid. (The upper two digits are ignored.)

^{*5} The value in RWw2 is used as the torque limit value during speed control or position control, and as the torque command value during torque control. (Torque control cannot be performed with a PM motor.) To use the value as the torque limit value, set Pr.810 = "2".

◆ Remote register (from the inverter to the master module)

| Device No. | Signal | Description |
|---|------------------------------------|---|
| RWr0 | Reply code | When "1" is set in RY21 or RY22, the following reply codes are set for the frequency setting command. The setting value "0" is set normally, and a value other than "0" is set at an error. H0000: Normal H0001: Write mode fault H0003: Setting range fault |
| RWr2 | Reply code | When "1" is set in RY23 or RY24, the following reply codes are set for the torque command / torque limit. The setting value "0" is set normally, and a value other than "0" is set at an error. H0000: Normal H0003: Setting range fault |
| RWr4, RWr5, RWr6 | Reply code | When the PID command (RWw4 to RWw6) is set, the following reply code is set for the PID command. The setting value "0" is set normally, and a value other than "0" is set at an error. H0000: Normal H0003: Setting range fault |
| RWr10, RWr12, RWr14, RWr16, RWr18, | Reply code | When "1" is set in RY25, the following reply codes corresponding to the instruction code RWw10, 12, 14, 16, 18, and 1A are set. The setting value "0" is set normally, and a value other than "0" is set at an error. H0000: Normal H0001: Write mode fault H0002: Parameter selection fault H0003: Setting range fault |
| RWr11, RWr13, RWr15, RWr17, RWr19, RWr1B | Read data | In a normal reply, a replay code for the instruction code is set. |
| RWr20 | Error status | The setting value "0" is set during normal inverter operation, and the data code of the corresponding error is set at an error. (For the data codes or details of fault records, refer to page 776.) |
| RWr21 | Fault record (fault data) | The data code of fault history No. specified by RWw21 is stored in the lower 8 bits. Lower 8 bits of RWw21 will be reverted back to the upper 8 bits. |
| RWr22 | Fault record (output frequency) | The output frequency of the fault history No. specified in RWw21 is stored. |
| RWr23 | Fault record (output current) | The output current of the fault history No. specified in RWw21 is always stored. |
| RWr24 | Fault record (output voltage) | The output voltage of the fault history No. specified in RWw21 is always stored. |
| RWr25 | Fault record (energization time) | The energization time of the fault history No. specified in RWw21 is always stored. |
| RWr26 | First monitor value | |
| RWr27 | Second monitor value | |
| RWr28 | Third monitor value | |
| RWr29 | Fourth monitor value | When "1" is set in RY20, the monitor value specified to the corresponding monitor code (RWw26 |
| RWr2A | Fifth monitor value | to RWw2F) is stored. |
| RWr2B | Sixth monitor value | The output frequency, output current, and output voltage monitors are held at an inverter failure. |
| RWr2C | Seventh monitor value | |
| RWr2D | Eighth monitor value | |
| RWr2E | Ninth monitor value | |
| RWr2F RWr30 to RWr7F | Tenth monitor value Monitor value | Fixed monitored data are saved regardless of the RY20 setting. The output frequency, output current, and output voltage monitors are held at an inverter failure. |

♦ Instruction code

Set instruction codes using the remote register (RWw). (Refer to page 759.)

The definition read by the instruction code is stored in the remote register (RWr). (Refer to page 760.)

| | Item | Read/ write | Instruction code | Data description | |
|--|------------------------------------|----------------|-------------------|--|--|
| Operation mode | | Read | Н7В | H0000: Network operation mode H0001: External operation mode, External JOG operation mode H0002: PU operation mode, External/PU combined operation 1 and 2, PUJOG operation | |
| · | | | HFB | H0000: Network operation mode H0001: External operation mode H0002: PU operation mode (Pr.79 = "6", Pr.340 = "10, 12") | |
| | Output frequency*1*2 | Read | H6F | H0000 to HFFFF: Output frequency in 0.01 Hz increments (The display can be changed to the rotations per minute using Pr.37 , Pr.144 and Pr.811 . (Refer to page 444.)) | |
| | Output current | Read | H70 | H0000 to HFFFF: Output current (hexadecimal) Increment 0.01 A (FR-A820-03160(55K) or lower, FR-A840-01800(55K) or lower) Increment 0.1 A (FR-A820-03800(75K) or higher, FR-A840-02160(75K) or higher) | |
| | Output voltage | Read | H71 | H0000 to HFFFF: Output voltage (hexadecimal) Increments 0.1 V | |
| | Special monitor | Read | H72 | H0000 to HFFFF: Monitor data selected in the instruction code HF3 | |
| | | Read | H73 | H01 to HFF: Selection of the monitor item (monitor code) | |
| | Special monitor selection No. | Write | HF3 ^{*3} | If a monitor code out of the setting range is set, a range error occurs. The monitor codes (monitor items) are the same as those of the RS-485 communication dedicated monitor. (Refer to page 446.) | |
| Monitor | Fault record | Read | H74 to H77 | H0000 to HFFFF: Two fault records per code. b15 b8 b7 b0 H74 Second latest fault Latest fault H75 Fourth latest fault Fifth latest fault H76 Sixth latest fault Seventh latest fault H77 Eighth latest fault Seventh latest fault Fault record display example (instruction code H74) With the read data H30A0 (Second fault : THT) (Latest fault : OPT) b15 b8 b7 b0 0 0 1 1 0 0 0 1 0 1 0 0 0 0 0 Second fault Latest fault (H30) (HA0) (Refer to page 776 for details on fault record read data.) | |
| Set frequ | uency (RAM) | | H6D | Read the set frequency/speed from the RAM or EEPROM. | |
| Set frequ | uency (EEPROM) | Read | H6E | H0000 to HFFFF: Set frequency in 0.01 Hz increments (The display can be changed to the rotations per minute using Pr.37 , Pr.144 , and Pr.811 . (Refer to page 444.)) | |
| Set frequ | uency (RAM) ^{*4} | Write | HED | Write the set frequency/speed into the RAM or EEPROM. | |
| Set frequ | uency (RAM and M) ^{*4} | Write | HEE | H0000 to HE678 (0 to 590.00 Hz): frequency in 0.01 Hz increments (The display can be changed to the rotations per minute using Pr.37 , Pr.144 , and Pr.811 . (Refer to page 444.)) • To change the set frequency consecutively, write data to the inverter RAM. (Instruction code: HED) | |
| Paramet | Parameter | | H00 to H6B | Refer to the instruction code (page 864) and write and/or read parameter values as required. Write to Pr.77 and Pr.79 is disabled. When setting Pr.100 and later, set the link parameter extended setting. Set 65520 (HEEED) as a parameter value "9999" and 65525 (HEEED) as "9999". | |
| | | Write | H80 to HEB | the RAM. (Refer to page 663.) | |
| Fault history clear Write HF4 H9696: Fault history is cleared. | | | | | |

| Item | Read/ write | Instruction code | Data description |
|--|----------------|------------------|--|
| Parameter clear All parameter clear | Write | HFC | All parameters return to initial values. Whether to clear communication parameters or not can be selected according to the data. • Parameter clear H9696: Communication parameters are cleared. H5A5A*5: Communication parameters are not cleared. • All parameter clear H9966: Communication parameters are cleared. H55AA*5: Communication parameters are cleared. For details on whether or not to clear parameters, refer to page 864. When clear is performed with H9696 or H9966, communication related parameter settings also return to the initial values. When resuming the operation, set the parameters again. Performing a clear will clear the instruction code HEC, HF3, and HFF settings. |
| Inverter reset | Write | HFD | H9696: Resets the inverter. |
| Second parameter changing*6 | | H6C | Read or write of bias and gain parameters (instruction codes H5E to H61 and HDE to HE1 with the link parameter extended setting = "1", H11 to H23 and H91 to HA3 with the link parameter extended setting = "9"). |
| | Write HEC | | H00: Frequency ^{*7} H01: Parameter-set analog value H02: Analog value input from terminal |

- *1 When "100" is set in Pr.52 Operation panel main monitor selection, set frequency is monitored during a stop and output frequency is monitored during running.
- *2 When position control is selected, the number of pulses is monitored when **Pr.430** ≠ "9999".
- *3 Write data is in hexadecimal, and only two digits are valid. (The upper two digits are ignored.)
- *4 Setting from the remote register (RWw0) is also available.
- *5 Turning OFF the power supply while clearing parameters with H5A5A or H55AA returns the communication parameter settings to the initial
- *6 Reading or writing is available when the link parameter extended setting = "1 or 9".
- *7 The gain frequency can be also written using Pr.125 (instruction code: H99) or Pr.126 (instruction code: H9A).



· When a 32-bit parameter setting or monitored value is read and the read value exceeds HFFFF, the reply data will be HFFFF.

◆ Torque command / torque limit through CC-Link IE Field Network communication

- · Torque commands can be given or the torque can be limited via CC-Link IE Field Network under Real sensorless vector control, Vector control, or PM sensorless vector control. The value is used to limit the torque during speed control or position control, and to give a torque command during torque control. To limit the torque, set Pr.810 = "2". The torque command / torque limit setting method can be selected using Pr.804 Torque command source selection. (Torque control cannot be performed with a PM motor.)
- For setting the torque limit parameters, refer to page 245, and for setting the torque command parameters, refer to page 283.
- Set the torque command value or the torque limit value in RWw2. The RWw2 function is switched according to the Pr.804 and Pr.810 settings and the control mode.

| Dr 904 sotting | Pr.810 setting | RWw2 function | | | |
|----------------|----------------|----------------------------------|----------------|--|--|
| F1.004 Setting | F1.010 Setting | Speed control / position control | Torque control | | |
| 1, 3, 5, 6 | 2 | Torque limit | Torque command | | |
| 1, 3, 5, 6 | 0, 1 | RWw2 disabled | Torque command | | |
| 0, 4 | _ | RWw2 disabled | RWw2 disabled | | |

• Relationship between the Pr.804 setting, the setting range, and the actual torque command / torque limit (when setting is made from CC-Link IE Field Network communication)

| Pr.804 setting | Setting range | Actual torque command | Actual torque limit |
|----------------|--------------------------------------|-----------------------|---------------------|
| 1, 3 | 600 to 1400 (1% increments)*1 | -400 to 400% | 0 to 400% |
| 5, 6 | -32768 to 32767 (two's complement)*1 | -327.68 to 327.67% | 0 to 327.67% |

^{*1} The torque limit setting is defined as an absolute value.

· Torque command / torque limit setting method

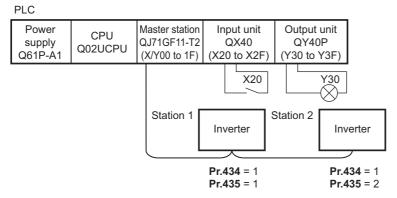
| Setting method | Setting procedure | | | |
|---|--|--|--|--|
| Writing in RWw2 | Set the torque command / torque limit value in RWw2. Set "1" in RY23 (or RY24). | | | |
| Writing in Pr.805 or Pr.806 | Set link parameter extended setting = H08 for RWw10 (12, 14, 16, 18, 1A). Set H85 or H86 as the instruction code. Set the torque command / torque limit value in RWw11 (13, 15, 17, 19, 1B). Set "1" in RY25. | | | |

5.21.5 Programming examples

The following explains the programming examples for controlling the inverter with sequence programs.

| Item | Program example | Refer to page |
|---------------------------------------|--|---------------|
| Reading the inverter status | Reading the inverter status from the buffer memory of the master station | 765 |
| Setting the operation mode | Selecting the Network operation mode | 765 |
| Setting the operation commands | Commanding the forward rotation and middle speed signals | 766 |
| Setting the monitoring function | Monitoring the output frequency | 766 |
| Reading a parameter value | Reading the value of Pr.7 Acceleration time | 767 |
| Writing a parameter value | Setting "3.0 s" in Pr.7 Acceleration time | 767 |
| Setting the set frequency (set speed) | Setting to 50.00 Hz | 768 |
| Reading the fault records | Reading the inverter faults | 769 |
| Inverter reset | Resetting the inverter when an inverter error occurs | 769 |

· System configuration for programming example



• In the programming example, network parameters of the master station are set as follows. (Network parameters (module 1))

| Item | Setting condition |
|----------------------------------|-----------------------------------|
| Network type | CC-Link IE Field (master station) |
| Start I/O | 0000 |
| Network No. | 1 |
| Total number of (slave) stations | 2 |
| Mode | Online (standard mode) |
| Network configuration | Refer to the following. |
| Refresh parameter | Refer to the following. |

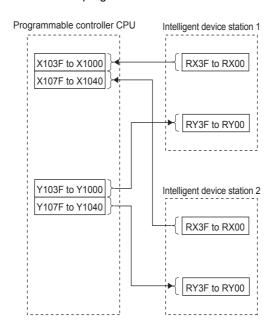
· Network configuration (assignment method: start/end)

| Item | | Setting condition | |
|--|-------|----------------------------|----------------------------|
| | | Module 1 | Module 2 |
| Station number | | 1 | 2 |
| Station type | | Intelligent device station | Intelligent device station |
| RX/RY setting | Start | 0000 | 0040 |
| | End | 003F | 007F |
| RWw/RWr setting | Start | 0000 | 0080 |
| RVVW/RVVI Setting | End | 007F | 00FF |
| Reserved station / error invalid station | | No setting | No setting |

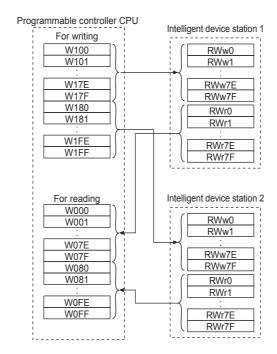
· Refresh parameters (assignment method: start/end)

| Link side | | | Master side | | |
|-------------|-------|------|-------------|--------|--------|
| Device name | Start | End | Device name | Start | End |
| SB | 0000 | 01FF | SB | 0000 | 01FF |
| SW | 0000 | 01FF | SW | 0000 | 01FF |
| RX | 0000 | 007F | Х | 1000 | 107F |
| RY | 0000 | 007F | Υ | 1000 | 107F |
| RWr | 0000 | 00FF | W | 000000 | 0000FF |
| RWw | 0000 | 00FF | W | 000100 | 0001FF |

• Remote I/O (RX and RY) transmitted between the programmable controller CPU and intelligent device stations

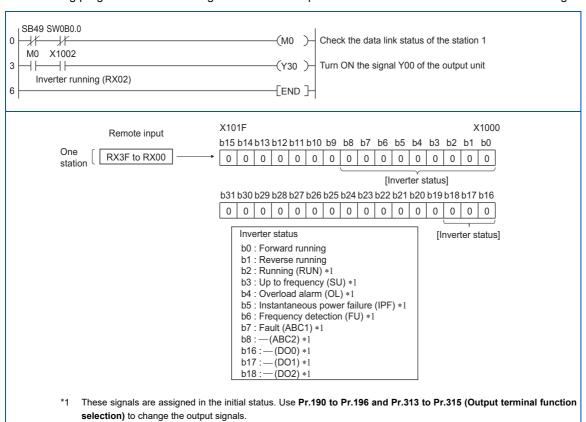


 Remote registers (RWw and RWr) transmitted between the programmable controller CPU and the intelligent device stations



◆ Programming example for reading the inverter status

The following program turns ON the signal Y00 of the output unit when the station 1 inverter starts running.



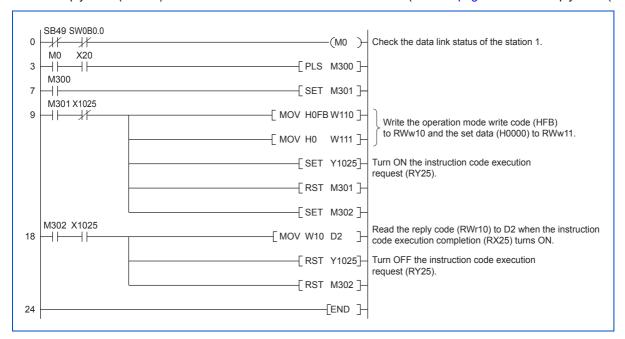
◆ Programming example for setting the operation mode

The following explains a program to write various data to the inverter.

The following program changes the operation mode of the station 1 inverter to network operation.

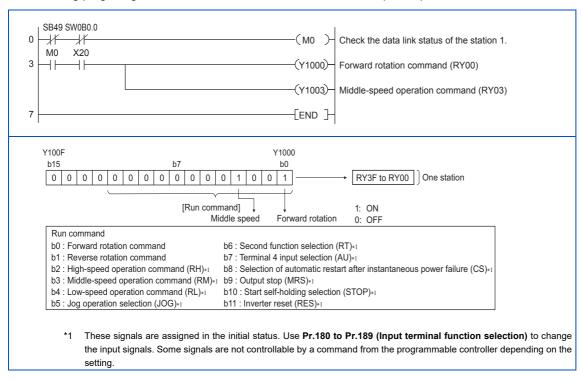
- · Operation mode write code: HFB (hexadecimal)
- Network operation set data: H0000 (hexadecimal) (Refer to page 760.)

• The reply code (RWr10) to the instruction code execution is set in D2. (Refer to page 760 for the reply code (RWr10).)



♦ Programming example for setting the operation commands

The following program gives a forward rotation command and middle-speed operation command to the station 1 inverter.



◆ Programming example for monitoring the output frequency

The following explains a program to read monitor functions of the inverter.

The following program reads the output frequency of the station 1 inverter to output to D1.

Output frequency read code: H0001 (hexadecimal)

For the monitor codes, refer to page 446.

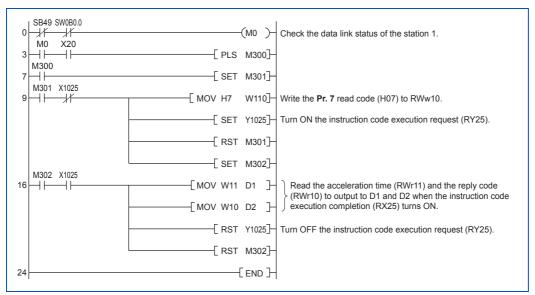
Example) The output frequency of 60 Hz is indicated as "H1770 (6000)".

```
SB49 SW0B0 0
    #
          #
                                                                   ( MO )
                                                                             Check the data link status of the station 1.
    M0
          X20
                                                                             Set the monitor code (H01) of output frequency
                                                       -√MOV H1
                                                                    W126
                                                                             in RWw26.
                                                                             Turn ON the monitor command (RY20).
                                                                   (Y1020)
                             X1020
                                                                             Read the output frequency (RWr26) to output to D1
                               \dashv\vdash
                                                       -[ MOV W26 D1 ]
                                                                             when the monitoring (RX20) turns ON.
                                                                   END }
11
```

Programming example for the parameter reading

The following program reads **Pr.7 Acceleration time** of the station 1 inverter to output to D1.

- Pr.7 Acceleration time reading instruction code: H07 (hexadecimal)
- Refer to page 864 for details on the parameter instruction code.
- The reply code (RWr10) to the instruction code execution is set in D2. (Refer to page 760 for the reply code (RWr10).)





• For the parameter assigned the number of 100 or higher, change the link parameter extended setting (set it to the one other than H00). Refer to page 864 for the settings.

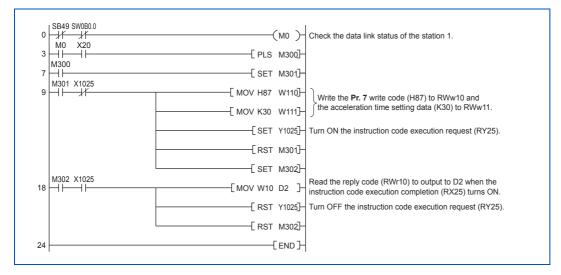
◆ Programming example for the parameter writing

The following program changes the setting value in Pr.7 Acceleration time of the station 1 inverter to 3.0 seconds.

- · Acceleration time writing instruction code: H87 (hexadecimal)
- Acceleration time setting data: K30 (decimal)

For details on instruction codes of each parameter, refer to the list of parameters (function codes) and instruction codes under different control modes (on page 864).

The reply code (RWr10) to the instruction code execution is set in D2. (Refer to page 760 for the reply code (RWr10).)



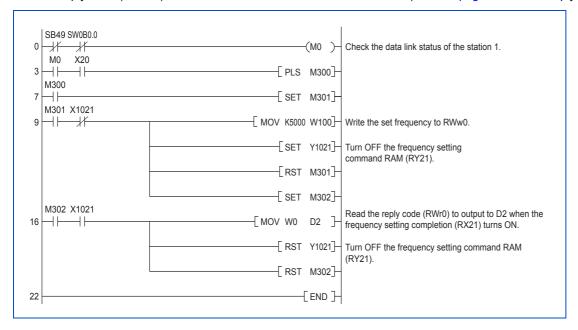


- For the parameter assigned the number of 100 or higher, change the link parameter extended setting (set it to the one other than H00). Refer to page 864 for the settings.
- For other functions, refer to the instruction codes (refer to page 760).

◆ Programming example for setting the running frequency

The following program changes the running frequency of the station 1 inverter to 50.00 Hz.

- Set frequency: K5000 (decimal)
- The reply code (RWr10) to the instruction code execution is set in D2. (Refer to page 760 for the reply code (RWr0).)





- To change the set frequency continuously from a programmable controller, check that the frequency setting complete (for example, X1021) turns ON, and the reply code from the intelligent register is H0000. Then change the setting data (for example, W100) continuously.
- To write the set frequency to the EEPROM, change the following points in the program shown above.
 - Frequency setting command (from Y1021 to Y1022)
 - Frequency setting completion (from X1021 to X1022)

<Timing chart for writing to the RAM>

Y1021
W100
W100
Inverter set frequency
Inverter set frequency
W100
W100
W100
W100

Apply to the inverter when the command Y1022 turns ON.

- *1 To the EEPROM, a writing is performed only once after the command Y1022 turns ON
- *2 If the set data is changed at the command Y1022 ON, the change is not applied to the inverter.

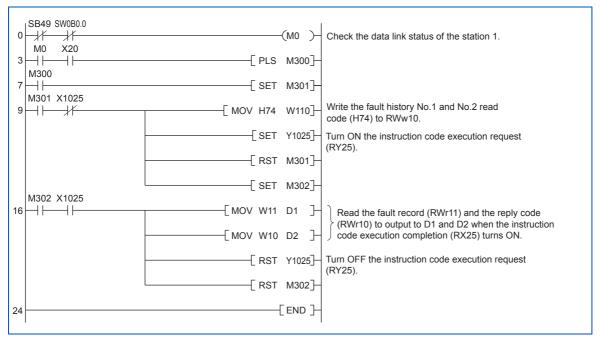
Programming example for the fault record reading

The following program reads the fault records of the station 1 inverter to output to D1.

• Fault history No. 1 and 2 reading instruction code: H74 (hexadecimal)

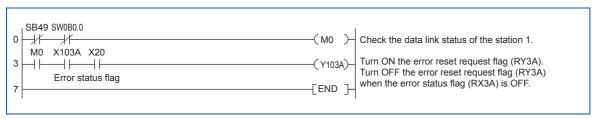
For the error code, refer to page 776.

The reply code (RWr10) to the instruction code execution is set in D2. (Refer to page 760 for the reply code (RWr10).)



◆ Programming example for resetting the inverter at an inverter fault

The following program resets the station 1 inverter at an inverter fault.



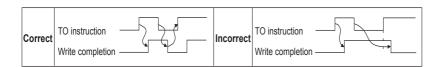
NOTE

- The inverter reset with the flag RY3A shown above is enabled at an inverter fault only.
- When **Pr.349 Communication reset selection/Ready bit status selection** = "0 or 100", inverter reset is available independently of the operation mode.
- When using the instruction code execution request (RY25) with the instruction code (HFD) and data (H9696) to reset the inverter, set a value other than "0" in **Pr.340 Communication startup mode selection** or change the operation mode to the Network operation mode. (For the program example, refer to page 765.)

5.21.6 Instructions

Programming instructions

- · Since the buffer memory data of the master station is kept transferred (refreshed) to/from the inverters, the TO instruction need not be executed every scan in response to data write or read requests. (The execution of the TO instruction every scan does not pose any problem.)
- If the FROM/TO instruction is executed frequently, data may not be written reliably. When transferring data between the inverter and sequence program via the buffer memory, perform the handshake to confirm that data has been written without error.



Operating and handling instructions

- The commands only from the programmable controller can be accepted during CC-Link IE Field Network communication. The run command from external and parameter unit is ignored.
- · If multiple inverters have the same station number, the communication cannot be performed properly.
- The inverter protective function (E.OP1) is activated if data communication stops for more than the time set in Pr.500 Communication error execution waiting time due to a programmable controller fault, an open Ethernet cable etc. during CC-Link IE Field Network operation.
- · If the programmable controller (master station) is reset during CC-Link IE Field Network operation or if the programmable controller is powered off, data communication stops and the inverter protective function (E.OP1) is activated. To reset the programmable controller (master station), switch the operation mode to the External operation once, then reset the programmable controller.
- When **Pr.340** = "0 (initial value)", any inverter whose main power is restored is reset to return to the External operation mode. To resume the Network operation, therefore, set the operation mode to the Network operation using the sequence program. Set a value other than "0" in Pr.340 to start in the Network operation mode after inverter reset.

5.21.7 Troubleshooting

| Description | Point to be checked |
|---|---|
| | Check for looseness of the connector between the CC-Link IE Field Network communication circuit board and the inverter's control circuit board. Check that the Ethernet cable is installed correctly. (Check for contact fault, break in the cable, etc.) |
| Operation mode does not switch to the Network operation mode. | Check that Pr.434 Network number (CC-Link IE) and Pr.435 Station number (CC-Link IE) are correctly set. (Check that their settings match with the program, that the network number is set within the range, that no overlapping stations exist, and that the station number is set within the range.) |
| | Check that the inverter is in the External operation mode. |
| | Check that the operation mode switching program is running. |
| | Check that the operation mode switching program has been written correctly. |
| | Check that the inverter starting program is running. |
| Inverter does not start in the Network operation mode. | Check that the inverter starting program has been written correctly. |
| rectivorit operation mode. | Check that Pr.338 Communication operation command source is not set to External. |

CHAPTER 6 PROTECTIVE FUNCTIONS

| 6.1 | Inverter fault and alarm indications | 772 |
|-----|---|-----|
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6 PROTECTIVE FUNCTIONS

This chapter explains the "PROTECTIVE FUNCTIONS" that operate in this product. Always read the instructions before use.

6.1 Inverter fault and alarm indications

- When the inverter detects a fault, depending on the nature of the fault, the operation panel displays an error message or warning, or a protective function is activated to shut off the inverter output.
- When any fault occurs, take an appropriate corrective action, then reset the inverter, and resume the operation. Restarting the operation without a reset may break or damage the inverter.
- · When a protective function is activated, note the following points.

| Item | Description |
|---------------------------|---|
| Fault output signal | Opening the magnetic contactor (MC) provided on the input side of the inverter at a fault occurrence shuts off the control power to the inverter, therefore, the fault output will not be retained. |
| Fault or alarm indication | When a protective function is activated, the operation panel displays a fault indication. |
| Operation restart method | While a protective function is activated, the inverter output is kept shutoff. Reset the inverter to restart the operation. |

· Inverter fault or alarm indications are categorized as follows.

| Displayed item | Description |
|----------------|---|
| Error message | A message regarding operational fault and setting fault by the operation panel and the parameter unit. The inverter output is not shut off. |
| Warning | The inverter output is not shut off even when a warning is displayed. However, failure to take appropriate measures will lead to a fault. |
| Alarm | The inverter output is not shut off. An Alarm (LF) signal can also be output with a parameter setting. |
| Fault | When a protective function is activated, the inverter output is shut off and a Fault (ALM) signal is output. |



• The last eight faults can be displayed on the operation panel. (Fault history) (For the operation, refer to page 774.)

6.2 Reset method for the protective functions

Reset the inverter by performing any of the following operations. Note that the accumulated heat value of the electronic thermal relay function and the number of retries are cleared (erased) by resetting the inverter.

The inverter recovers about 1 second after the reset is released.

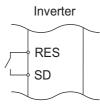
• On the operation panel, press to reset the inverter. (This operation is valid only when a protective function for a fault is activated. (Refer to page 785 of the Instruction Manual for faults.))



• Switch the power OFF once, then switch it ON again.



• Turn ON the Reset (RES) signal for 0.1 second or more. (If the RES signal is kept ON, "Err" appears (blinks) to indicate that the inverter is in a reset status.)



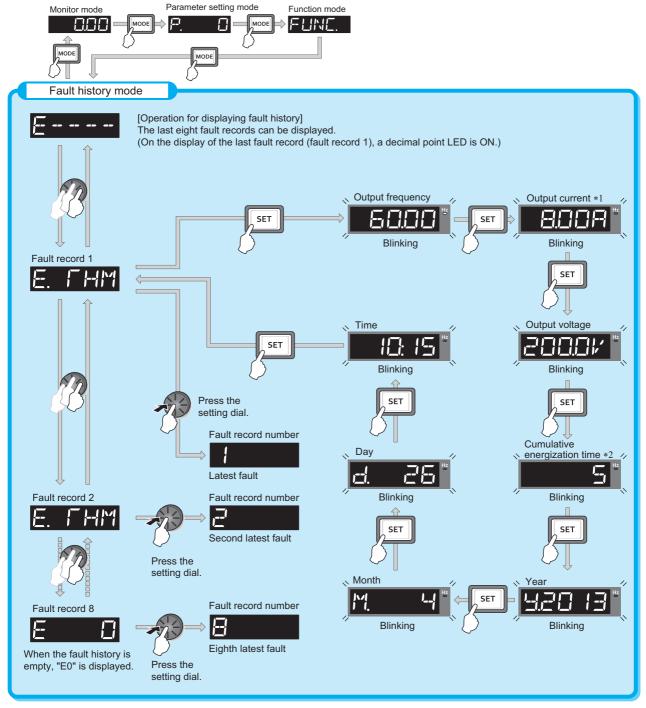


• OFF status of the start signal must be confirmed before resetting the inverter fault. Resetting an inverter fault with the start signal ON restarts the motor suddenly.

6.3 Check and clear of the fault history

The operation panel stores the fault indications which appear when a protective function is activated to display the fault record for the past 8 faults (fault history).

◆ Check for the fault history



^{*1} When an overcurrent trip occurs by an instantaneous overcurrent, the monitored current value saved in the fault history may be lower than the actual current that has flowed.

^{*2} The cumulative energization time and actual operation time are accumulated from 0 to 65535 hours, then cleared, and accumulated again from 0.

♦ Fault history clearing procedure



• Set Err.CL Fault history clear = "1" to clear the fault history.

Operating procedure

- **1.** Turning ON the power of the inverter The operation panel is in the monitor mode.
- **2.** Selecting the parameter setting mode

Press Mode to choose the parameter setting mode. (The parameter number read previously appears.)

3. Selecting the parameter number

Turn until " (Fault history clear) appears. Press set value. " (initial value) appears.

4. Fault history clear

Turn to change the set value to " \". Press SET to start clearing.

" | f" and " f= -- f- [] " are displayed alternately after parameters are cleared.

- Turn (3) to read another parameter.
- Press | SET | to show the setting again.
- Press SET twice to show the next parameter.

6.4 List of fault displays

If the displayed message does not correspond to any of the following or if you have any other problem, contact your sales representative.

♦ Error message

 A message regarding operational fault and setting fault by the operation panel and the parameter unit is displayed. The inverter output is not shut off.

| Operation panel indication | Name | Refer to page |
|----------------------------|-----------------------|------------------|
| HOLd | Operation panel lock | 779 |
| LOCA | Password locked | 779 |
| Er 1 to Er 4 Er 8 | Parameter write error | 779, 780 |
| | Copy operation fault | 780, 781 |
| Err. | Error | 781 |

♦ Warning

 The inverter output is not shut off even when a warning is displayed. However, failure to take appropriate measures will lead to a fault.

| Operation panel indication | Name | Refer to page |
|----------------------------|--|------------------|
| | Stall prevention (overcurrent) | 782 |
| aL | Stall prevention (overvoltage) | 782 |
| Rb | Regenerative brake pre-alarm | 782 |
| | Electronic thermal relay function pre-alarm | 783 |
| PS | PU stop | 783 |
| 5 <u>L</u> | Speed limit indication | 783 |
| EP | Parameter copy | 783 |
| 5A | Safety stop | 783 |
| MF 1 to | Maintenance signal output | 784 |
| | USB host error | 784 |
| HP 1 | Home position return setting error | 784 |
| HPZ | Home position return uncompleted | 784 |
| HP3 | Home position return parameter setting error | 784 |

| Operation panel indication | Name | Refer to page |
|----------------------------|---|------------------|
| <u> </u> | Continuous operation during communication fault | 784 |
| LdF | Load fault warning | 784 |

♦ Alarm

• The inverter output is not shut off. An Alarm (LF) signal can also be output with a parameter setting.

| Operation panel indication | Name | Refer to page |
|----------------------------|--------------------|------------------|
| FN | Fan alarm | 785 |
| FNE | Internal fan alarm | 785 |

♦ Fault

- When a protective function is activated, the inverter output is shut off and a Fault (ALM) signal is output.
- The data code is used for checking the fault detail via communication or with Pr.997 Fault initiation.

■ Data code 16 to 199

| Operation panel indication | | Name | Data code | Refer to page |
|----------------------------|--|--|-------------|------------------|
| E. 0 | | Overcurrent trip during acceleration | 16 (H10) | 785 |
| E. 0 | | Overcurrent trip during constant speed | 17 (H11) | 786 |
| E. [] | | Overcurrent trip during deceleration or stop | 18 (H12) | 786 |
| E. 0 | 11 | Regenerative overvoltage trip during acceleration | 32 (H20) | 787 |
| E. 0 | V E | Regenerative overvoltage trip during constant speed | 33 (H21) | 787 |
| E. 0 | ! ′∃ | Regenerative overvoltage trip during deceleration or | 34 (H22) | 787 |
| E. F | | Inverter overload trip (electronic thermal relay | 48 (H30) | 787 |
| E. F | 1-11-1 | Motor overload trip (electronic thermal relay | 49 (H31) | 788 |
| E. F | 1 14 | Heat sink overheat | 64 (H40) | 788 |
| E. I | FF | Instantaneous power failure | 80 (H50) | 788 |
| E. LI | 1, 1 | Undervoltage | 81 (H51) | 789 |
| E. I | LF | Input phase loss | 82 (H52) | 789 |
| E. 0 | <u> </u> | Stall prevention stop | 96 (H60) | 789 |
| E. 5 | | Loss of synchronism detection | 97 (H61) | 790 |
| E. L | | Upper limit fault detection | 98 (H62) | 790 |
| E. L | | Lower limit fault detection | 99 (H63) | 790 |

| | ation panel | Name | Data | Refer |
|----------------|-------------|--|--------------|---------|
| | dication | | code | to page |
| E. | 6 E | Brake transistor alarm detection | 112 (H70) | 790 |
| E. E. | GF | Output side earth (ground) fault overcurrent | 128 (H80) | 790 |
| E. | LF | Output phase loss | 129 (H81) | 791 |
| E. | []}-{ | External thermal relay operation | 144 (H90) | 791 |
| E. | PII | PTC thermistor operation | 145 (H91) | 791 |
| E. | OPT | Option fault | 160 (HA0) | 791 |
| E. | OP I | | 161 (HA1) | |
| E. | | Communication option fault | 162 (HA2) | 792 |
| E. | | | 163 (HA3) | |
| | 15 | | 164 (HA4) | |
| E. | 17 | | 165 (HA5) | |
| E. | 18 | User definition error by the PLC function | 166 (HA6) | 792 |
| E. E. E. | 19 | | 167 (HA7) | |
| E. | 20 | | 168 (HA8) | |
| E. | PE | Parameter storage device fault (control circuit board) | 176 (HB0) | 792 |
| E. | PUE | PU disconnection | 177 (HB1) | 792 |
| E. | REF | Retry count excess | 178 (HB2) | 793 |
| E. | PE2 | Parameter storage device fault (main circuit board) | 179 (HB3) | 793 |
| E. | CPU | CPU fault | 192 (HC0) | 793 |
| E. | EFE | Operation panel power supply short circuit/RS-485 | 193 (HC1) | 793 |
| E. | PZH | 24 VDC power fault | 194 (HC2) | 793 |
| E. | | Abnormal output current detection | 196 (HC4) | 794 |
| E. | 1 [] | Inrush current limit circuit fault | 197 (HC5) | 794 |
| E. | SER | Communication fault (inverter) | 198 (HC6) | 794 |
| E. | AI E | Analog input fault | 199 (HC7) | 794 |

■ Data code 200 or more

| Operation panel indication | | Name | Data code | Refer to page |
|----------------------------|-----|-------------------------|--------------|------------------|
| E. | USB | USB communication fault | 200 (HC8) | 794 |
| E. | SAF | Safety circuit fault | 201 (HC9) | 795 |
| E. | PEL | Internal circuit fault | 202 (HCA) | 795 |
| E. | 13 | internal offcult fault | 253 (HFD) | 195 |

| | ration panel | Name | Data | Refer |
|----------------------|---|--|--------------|---------|
| in | dication | | code | to page |
| E. | | Overspeed occurrence | 208 (HD0) | 795 |
| E. | 058 | Speed deviation excess detection | 209 (HD1) | 795 |
| E. | EEF | Signal loss detection | 210 (HD2) | 796 |
| E. | | Excessive position fault | 211 (HD3) | 796 |
| E. | ECA | Orientation encoder no- signal | 212 (HD4) | 796 |
| E. | 1415 | | 213 (HD5) | |
| E. | MEZ | | 214 (HD6) | |
| E. | 11153 | | 215 (HD7) | |
| E. | <u> </u> | Brake sequence fault | 216 (HD8) | 797 |
| E. | 1115 | | 217 (HD9) | |
| E. | MEE | | 218 (HDA) | |
| E. | 141-7 | | 219 (HDB) | |
| E. | EP | Encoder phase fault | 220 (HDC) | 797 |
| E. | MF | Magnetic pole position unknown | 222 (HDE) | 797 |
| <u>E.</u> E. | EF | External fault during output operation | 224 (HE0) | 797 |
| E. | 1 1714 | Abnormal internal temperature | 225 (HE1) | 797 |
| E. | | 4 mA input fault | 228 (HE4) | 797 |
| E. | PEH | Pre-charge fault | 229 (HE5) | 798 |
| E. | Pl d | PID signal fault | 230 (HE6) | 798 |
| E. | } | | 241 (HF1) | |
| E. | 2 | Option fault | 242 (HF2) | 798 |
| E. | \exists | | 243 (HF3) | |
| E. E. E. E. | 5 | | 245 (HF5) | |
| E. | 5 | CPU fault | 246 (HF6) | 793 |
| E. | 7 | | 247 (HF7) | |
| E. | 11 | Opposite rotation deceleration fault | 251 (HFB) | 799 |

♦ Others

• The fault history and the operation status of the inverter are displayed. It is not a fault indication.

| Operation panel indication | Name | Refer to page |
|----------------------------|------------------|------------------|
| E | Fault history | 774 |
| E. [] | No fault history | 799 |

| Operation panel indication | Name | Refer to page |
|----------------------------|--------------------------------------|------------------|
| El | 24 V external power supply operation | 799 |
| Rd | Backup in progress | 799 |
| KIR! | Restoration in progress | 799 |

If faults other than the above appear, contact your sales representative.

6.5 **Causes and corrective actions**

♦ Error message

A message regarding operational troubles is displayed. Output is not shut off.

| Operation panel indication | HOLD | HOLH |
|----------------------------|--|-----------------------------|
| Name | Operation panel lock | |
| Description | Operation lock is set. Operation other than TITOP is invalid. (Refer to page 341.) | |
| Check point | | |
| Corrective action | Press MODE for 2 s | econds to release the lock. |

| Operation panel indication | LOCD | LOCa |
|----------------------------|---|------|
| Name | Password locked | |
| Description | Password function is active. Display and setting of parameters are restricted. | |
| Check point | | |
| Corrective action | Enter the password in Pr.297 Password lock/unlock to unlock the password function before operating. (Refer to page 348.) | |

| Operation panel indication | Er1 | Er l |
|----------------------------|--|------|
| Name | Write disable error | |
| Description | Parameter setting was attempted while Pr.77 Parameter write selection is set to disable parameter write. Overlapping range has been set for the frequency jump. Overlapping range has been set for the adjustable 5 points V/F. The PU and inverter cannot make normal communication. IPM parameter initialization was attempted while Pr.72 PWM frequency selection = "25". | |
| Check point | Check the Pr.77 setting. (Refer to page 345.) Check the settings of Pr.31 to Pr.36 (frequency jump). (Refer to page 429.) Check the settings of Pr.100 to Pr.109 (adjustable 5 points V/F). (Refer to page 713.) Check the connection of PU and the inverter. Check the Pr.72 setting. A sine wave filter cannot be used under PM sensorless vector control. | |

| Operation panel indication | Er2 | Era | |
|----------------------------|---|--|--|
| Name | Write error during op | Write error during operation | |
| Description | Parameter write was attempted while Pr.77 Parameter write selection = "0". | | |
| Check point | Check that the inve | Check that the inverter is stopped. | |
| Corrective action | | After stopping the operation, make parameter setting. When setting Pr.77 = "2", parameter write is enabled during operation. (Refer to page 345.) | |

| Operation panel indication | Er3 | Er3 | |
|----------------------------|-----------------------|--|--|
| Name | Calibration error | | |
| Description | Analog input bias an | Analog input bias and gain calibration values have been set too close. Check the settings of the calibration parameters C3, C4, C6, and C7 (calibration functions). (Refer to page 505.) | |
| Check point | Check the settings of | | |

| Operation panel indication | Er4 | E ' |
|----------------------------|---|-----|
| Name | Mode designation er | ror |
| Description | Parameter setting was attempted in the External or NET operation mode while Pr.77 Parameter write selection = "1". Parameter write was attempted when the command source is not at the operation panel (FR-DU08). | |
| Check point | Check that the operation mode is the PU operation mode. Check that the Pr.551 PU mode operation command source selection setting is correct. After setting the operation mode to the "PU operation mode", make parameter setting. (Refer to page 389.) When Pr.77 = "2", parameter write is enabled regardless of the operation mode. (Refer to page 345.) Set Pr.551 = "2". (Refer to page 400.) | |
| Corrective action | | |

| Operation panel indication | Er8 | E-8 | |
|----------------------------|--|---|--|
| Name | USB memory device | operation error | |
| Description | An operation command was given during the USB memory device operation. A copy operation (writing) was performed while the PLC function was in the RUN state. A copy operation was attempted for a password locked project. | | |
| Check point | Check if the USB memory device is operating. Check if the PLC function is in the RUN state. Check if the project data is locked with a password. | | |
| Corrective action | Stop the PLC functUnlock the passwo | e operation after the USB memory device operation is completed. .C function. (Refer to page 646 and the PLC function programming manual.) password of the project data using FR Configurator2. (Refer to the Instruction Manuals of FR or2 and GX Works2.) | |

| Operation panel indication | rE1 | rE I | |
|----------------------------|---|------|--|
| Name | Parameter read erro | r | |
| Description | A failure has occurred at the operation panel side EEPROM while reading the copied parameters. A failure has occurred in the USB memory device while copying the parameters or reading the PLC function project data. | | |
| Check point | • | | |
| Corrective action | Perform parameter copy again. (Refer to page 744 and page 747.) Perform PLC function project data copy again. (Refer to page 646.) The USB memory device may be faulty. Replace the USB memory device. The operation panel (FR-DU08) may be faulty. Contact your sales representative. | | |

| Operation panel indication | rE2 | r-E-2 | |
|----------------------------|--|---|--|
| Name | Parameter write erro | r | |
| Description | A failure has occur | om the operation panel to the inverter was attempted during operation. red at the operation panel side EEPROM while writing the copied parameters. red in the USB memory device while writing the copied parameters or PLC function project | |
| Check point | Check that the inverter is stopped. | | |
| Corrective action | After stopping the operation, perform parameter copy again. (Refer to page 744.) The operation panel (FR-DU08) may be faulty. Contact your sales representative. Perform parameter copy or PLC project data copy again. (Refer to page 646 and page 747.) The USB memory device may be faulty. Replace the USB memory device. | | |

| Operation panel indication | rE3 | r E 3 | | |
|----------------------------|--|---|--|--|
| Name | Parameter verification | n error | | |
| Description | The data in the inverter are different from the data in the operation panel. A failure has occurred at the operation panel side EEPROM during parameter verification. A failure has occurred in the USB memory device during parameter verification. The data in the inverter are different from the data in the USB memory device or the personal computer (FR Configurator2). | | | |
| Check point | Check the parameter setting of the source inverter against the setting of the destination inverter. | | | |
| Corrective action | Perform parameterThe operation paneThe USB memory | the verification by pressing SET. parameter verification again. (Refer to page 746.) ation panel (FR-DU08) may be faulty. Contact your sales representative. memory device may be faulty. Replace the USB memory device. PLC function project data again. (Refer to page 646.) | | |

| Operation panel indication | rE4 | r- E '-{ | |
|----------------------------|---|----------|--|
| Name | Model error | | |
| Description | The series of the source inverter used to copy or verify parameters is not the same as the target inverter. The operation panel data was incorrect when attempting to verify parameters or copy parameters from the operation panel to the inverter. | | |
| Check point | Check that the source inverter being used to verify or copy parameters is the same series as the target inverter. Check that the copying of parameters was not interrupted due to a loss of power to the inverter or the operation panel being disconnected. | | |
| Corrective action | Use a source inverter that is the same series (FR-A800 series) as the target inverter. Try to copy the parameters to the operation panel from the inverter again. | | |

| Operation panel indication | rE5 | r-E5 | |
|----------------------------|---|------|--|
| Name | File error | | |
| Description | The data in the USB memory device may be damaged. | | |
| Check point | • | | |
| Corrective action | Delete the copy file in the USB memory device and perform parameter copy again. | | |

| Operation panel indication | rE6 | rE5 | |
|----------------------------|--|-----|--|
| Name | File error | | |
| Description | The parameter copy file in the USB memory device cannot be recognized. An error has occurred in the file system during transfer of the PLC function data or writing to RAM. | | |
| Check point | • | | |
| Corrective action | Perform parameter copy again. (Refer to page 747.) Copy the PLC function project data again. (Refer to page 646.) | | |

| Operation panel indication | rE7 | r-E7 | |
|----------------------------|---|------|--|
| Name | File quantity error | | |
| Description | A parameter copy was attempted to the USB memory device in which the copy files from 001 to 099 had already been saved. | | |
| Check point | Check if the number of copy files in the USB memory device has reached 99. | | |
| Corrective action | Delete the copy file in the USB memory device and perform parameter copy again. (Refer to page 747.) | | |

| Operation panel indication | rE8 | r-E8 | | |
|----------------------------|--|------------------------------|--|--|
| Name | No PLC function pro | No PLC function project file | | |
| Description | The specified PLC function project file does not exist in the USB memory device. | | | |
| Check point | Check that the file exists in the USB memory device. Check that the folder name and the file name in the USB memory device is correct. | | | |
| Corrective action | The data in the USB memory device may be damaged. | | | |

| Operation panel indication | Err. | Err. | |
|----------------------------|---|------|--|
| Description | The RES signal is turned ON. The operation panel and inverter cannot make normal communication (contact faults of the connector). This error may occur when the voltage at the input side of the inverter drops. When using a separate power source for the control circuit power (R1/L11, S1/L21) from the main circuit power (R/L1, S/L2, T/L3), this error may appear at turning ON of the main circuit. It is not a fault. | | |
| Corrective action | Turn OFF the RES signal.Check the connection between the operation panel and the inverter.Check the voltage on the input side of the inverter. | | |

♦ Warning

Output is not shut off when a protective function is activated.

| Operation panel indication | OL | | FR-LU08 indication | OL | | |
|----------------------------|--|---|--|---|--|--|
| Name | Stall prevention (overcurrent) | | | | | |
| | When the output current of the inverter increases, the stall prevention (overcurrent) function is activated. The following section explains about the stall prevention (overcurrent) function. | | | | | |
| | During acceleration | control) of the inverter ex operation level, etc.), th current decreases to pre | ceeds the stall prevention is function stops the incovent the inverter from re | eal sensorless vector control or Vector on level (Pr.22 Stall prevention rease in frequency until the overload sulting in overcurrent trip. When the properation level, this function increases | | |
| Description | During constant- speed operation | When the output current (output torque under Real sensorless vector control or Vector control) of the inverter exceeds the stall prevention level (Pr.22 Stall prevention operation level , etc.), this function reduces frequency until the overload current decreases to prevent the inverter from resulting in overcurrent trip. When the overload current is reduced below stall prevention operation level, this function increases the frequency up to the set value. | | | | |
| | During deceleration When the output current (output torque under Real sensorless vector control or Vector control) of the inverter exceeds the stall prevention level (Pr.22 Stall prevention operation level , etc.), this function stops the decrease in frequency until the overload current decreases to prevent the inverter from resulting in overcurrent trip. When the overload current is reduced below stall prevention operation level, this function decreases the frequency again. | | | | | |
| Check point | Check that the Pr.0 Torque boost setting is not too large. The Pr.7 Acceleration time and Pr.8 Deceleration time settings may be too short. Check that the load is not too heavy. Check for any failures in peripheral devices. Check that the Pr.13 Starting frequency is not too large. Check that Pr.22 Stall prevention operation level is appropriate. | | | | | |
| Corrective action | Gradually increase or decrease the Pr.0 setting by 1% at a time and check the motor status. (Refer to page 706.) Set a larger value in Pr.7 and Pr.8. (Refer to page 367.) Reduce the load. Try Advanced magnetic flux vector control, Real sensorless vector control, or Vector control. Change the Pr.14 Load pattern selection setting. The stall prevention operation current can be set in Pr.22 Stall prevention operation level. (Initial value is 150%.) The acceleration/deceleration time may change. Increase the stall prevention operation level with Pr.22 Stall prevention operation level, or disable stall prevention with Pr.156 Stall prevention operation selection. (Use Pr.156 to set either operation continued or not at OL operation.) | | | | | |

| Operation panel indication | oL | ٦L | FR-LU08 indication | oL |
|----------------------------|---|--|--------------------|----|
| Name | Stall prevention (overv | /oltage) | | |
| Description | The regeneration average 732.) | output voltage of the inverter increases, the stall prevention (overvoltage) function is activated. eration avoidance function is activated due to excessive regenerative power of the motor. (Refer to any section explains the stall prevention (overvoltage) function. If the regenerative power of the motor becomes excessive to exceed the regenerative | | |
| Check point | Check for sudden speed reduction. Check if the regeneration avoidance function (Pr.882 to Pr.886) is being used. (Refer to page 732.) | | | |
| Corrective action | The deceleration time may change. Increase the deceleration time using Pr.8 Deceleration time . | | | |

| Operation panel indication | RB | RE | FR-LU08 indication | RB | |
|----------------------------|--|---|--------------------|----|--|
| Name | Regenerative brake p | re-alarm (Standard models | only) | | |
| Description | Appears if the regenerative brake duty reaches or exceeds 85% of the Pr.70 Special regenerative brake duty value. If the regenerative brake duty reaches 100%, a regenerative overvoltage (E. OV[]) occurs. | | | | |
| Check point | Check if the brake resistor duty is not too high. Check that the Pr.30 Regenerative function selection and Pr.70 settings are correct. | | | | |
| Corrective action | Set the deceleration Check the Pr.30 and | time longer. I Pr.70 settings. (Refer to p | age 724.) | | |

| Operation panel indication | тн | ; }{ | FR-LU08 indication | тн | |
|----------------------------|--|----------------------|--------------------|----|--|
| Name | Electronic thermal rela | y function pre-alarm | | | |
| Description | Appears if the cumulative value of the electronic thermal O/L relay reaches or exceeds 85% of the preset level of Pr.9 Electronic thermal O/L relay . If the specified value is reached, the protection circuit is activated to shut off the inverter output. | | | | |
| Check point | Check for large load or sudden acceleration. Check that the Pr.9 setting is appropriate. (Refer to page 415.) | | | | |
| Corrective action | Reduce the load and frequency of operation. Set an appropriate value in Pr.9. (Refer to page 415.) | | | | |

| Operation panel indication | PS | P5 | FR-LU08 indication | PS | | |
|----------------------------|--|--|--------------------|----|--|--|
| Name | PU stop | | | | | |
| Description | under the mode other PU stop selection. | The motor is stopped using under the mode other than the PU operation mode. (To enable under the mode other than the PU operation mode, set Pr.75 Reset selection/disconnected PU detection/PU stop selection. Refer to page 336 for details.) The motor is stopped by the emergency stop function. | | | | |
| Check point | Check for a stop made by pressing STOP of the operation panel. Check for whether the X92 signal is OFF. | | | | | |
| Corrective action | _ | OFF and release with EX | <u> </u> | | | |

| Operation panel indication | SL | SL | FR-LU08 indication | SL | |
|----------------------------|---|----|--------------------|----|--|
| Name | Speed limit indication (output during speed limit) | | | | |
| Description | Output if the speed limit level is exceeded during torque control. | | | | |
| Check point | Check that the torque command is not larger than required. Check if the speed limit level is set too low. | | | | |
| Corrective action | Decrease the torque command value. Increase the speed limit level. | | | | |

| Operation panel indication | СР | | FR-LU08 indication | СР | |
|----------------------------|---|--|--------------------|----|--|
| Name | Parameter copy | | | | |
| Description | Appears when parameter copy is performed between the FR-A820-03160(55K) or lower / FR-A840-01800(55K) or lower inverters and the FR-A820-03800(75K) or higher / FR-A840-02160(75K) or higher inverters. | | | | |
| Check point | Resetting of Pr.9, Pr.30, Pr.51, Pr.56, Pr.57, Pr.61, Pr.70, Pr.72, Pr.80, Pr.82, Pr.90 to Pr.94, Pr.453, Pr.455, Pr.458 to Pr.462, Pr.557, Pr.859, Pr.860, and Pr.893 is necessary. | | | | |
| Corrective action | Set the initial value in Pr.989 Parameter copy alarm release. | | | | |

| Operation panel indication | SA | 58 | FR-LU08 indication | _ | | |
|----------------------------|--|-------------------------------|----------------------------|--------------------|--|--|
| Name | Safety stop | | | | | |
| Description | Appears when safety | stop function is activated (c | luring output shutoff). (F | Refer to page 82.) | | |
| Check point | Check if an emergency stop device is activated. Check if the shorting wire between S1 and PC or between S2 and PC is disconnected when not using the safety stop function. | | | | | |
| Corrective action | An emergency stop device is active when using the safety stop function. Identify the cause of emergency stop, ensure the safety and restart the system. When not using the safety stop function, short across terminals S1 and PC and across S2 and PC with shorting wire for the inverter to run. If " | | | | | |

| Operation panel indication | MT1 to MT3 | MF 1 to | FR-LU08 indication | MT1 to MT3 | | |
|----------------------------|---|--|--------------------|------------|--|--|
| Name | Maintenance signal or | utput | | | | |
| Description | Appears when the inverter's cumulative energization time reaches or exceeds the parameter set value. Set the time until the MT is displayed using Pr.504 Maintenance timer 1 warning output set time (MT1), Pr.687 Maintenance timer 2 warning output set time (MT2), and Pr.689 Maintenance timer 3 warning output set time (MT3). MT does not appear when the settings of Pr.504, Pr.687, and Pr.689 are initial values (9999). | | | | | |
| Check point | The set time of maintenance timer has been exceeded. (Refer to page 363.) | | | | | |
| Corrective action | | Take appropriate countermeasures according to the purpose of the maintenance timer setting. Setting "0" in Pr.503 Maintenance timer 1, Pr.686 Maintenance timer 2, and Pr.688 Maintenance timer 3 | | | | |

| Operation panel indication | UF | LIF | FR-LU08 indication | UF | | | |
|----------------------------|--|---|--------------------|----|--|--|--|
| Name | USB host error | USB host error | | | | | |
| Description | Appears when an exc | Appears when an excessive current flows into the USB A connector. | | | | | |
| Check point | Check if a USB device | Check if a USB device other than a USB memory device is connected to the USB A connector. | | | | | |
| Corrective action | If a device other than a USB memory device is connected to the USB A connector, remove the device. Setting Pr.1049 USB host reset = "1" or inverter reset clears the UF indication. | | | | | | |

| Operation panel indication | HP1 to HP3 | HP HP3 | to | FR-LU08 indication | HP1 to HP3 |
|----------------------------|--|-------------|----|--------------------|------------|
| Name | Home position return | error | | | |
| Description | Appears when an error occurs during the home position return operation under position control. For the details, refer to page 313. | | | | |
| Check point | Identify the cause of the error occurrence. | | | | |
| Corrective action | Check the parameter setting, and check that the input signal is correct. | | | | |

| Operation panel indication | CF | <u></u> F | FR-LU08 indication | CF | |
|----------------------------|--|---------------------------|--------------------|----|--|
| Name | Continuous operation | during communication faul | t | | |
| Description | Appears when the operation continues while an error is occurring in the communication line or communication option (when Pr.502 = "4"). | | | | |
| Check point | Check for a break in the communication cable. Check for communication option faults. | | | | |
| Corrective action | Check the connection of communication cable. Replace the communication option. | | | | |

| Operation panel indication | LDF | LdF | FR-LU08 indication | LDF | |
|----------------------------|---|-----|--------------------|-----|--|
| Name | Load fault warning | | | | |
| Description | Appears when the load is deviated from the detection width set in Pr.1488 Upper limit warning detection width or Pr.1489 Lower limit warning detection width. | | | | |
| Check point | Check if too much load is applied to the equipment, or if the load is too light. Check that the load characteristics settings are correct. | | | | |
| Corrective action | Inspect the equipment. Set the load characteristics (Pr.1481 to Pr.1487) correctly. | | | | |

♦ Alarm

Output is not shut off when a protective function is activated. The Alarm (LF) signal can be output depending on the parameter setting. (Set "98" in **Pr.190 to Pr.196 (Output terminal function selection)**. Refer to page 473.)

| Operation panel indication | FN | FN | FR-LU08 indication | FN | | |
|----------------------------|---|-----------|--------------------|----|--|--|
| Name | Fan alarm | Fan alarm | | | | |
| Description | For the inverter that contains a cooling fan, FN appears on the operation panel when the cooling fan stops due to a fault, low rotation speed, or different operation from the setting of Pr.244 Cooling fan operation selection . | | | | | |
| Check point | When the cooling fan is replaced, check that the fan is not installed upside down. Check the cooling fan for a failure. | | | | | |
| Corrective action | Install the fan correctly. (Refer to page 815.) If the fan alarm still occurs after the fan is installed correctly, the fan may be faulty. Contact your sales representative. | | | | | |

| Operation panel indication | FN2 | FNE | FR-LU08 indication | FN2 | | | | | | |
|----------------------------|---|---|----------------------------|--|--|--|--|--|--|--|
| Name | Internal fan alarm (IP5 | Internal fan alarm (IP55 compatible models only) | | | | | | | | |
| Description | FN2 appears on the op | eration panel when the inte | rnal air circulation fan s | tops due to a fault or low rotation speed. | | | | | | |
| Check point | Check the internal air | Check the internal air circulation fan for a failure. | | | | | | | | |
| Corrective action | The fan may be faulty. Contact your sales representative. | | | | | | | | | |

♦ Fault

When a protective function is activated, the inverter output is shut off and a Fault signal is output.

| Operation panel indication | E.OC1 | E. | | 1 | FR-LU08 indication | OC During Acc | | | |
|----------------------------|---|----|--|---|--------------------|---------------|--|--|--|
| Name | Overcurrent trip during acceleration | | | | | | | | |
| Description | When the inverter output current reaches or exceeds approximately 235%*1 of the rated current during acceleration, the protection circuit is activated and the inverter output is shut off. | | | | | | | | |
| Check point | Check for sudden speed acceleration. Check if the downward acceleration time is too long in a lift application. Check for output short-circuit. Check that the Pr.3 Base frequency setting is not 60 Hz when the motor rated frequency is 50 Hz. Check if the stall prevention operation level is set too high. Check if the fast-response current limit operation is disabled. Check that the regenerative driving is not performed frequently. (Check if the output voltage becomes larger than the V/F reference voltage at regenerative driving and overcurrent occurs due to increase in the motor current.) Check that the power supply for RS-485 terminal is not shorted (under Vector control). Check that the encoder wiring and the specifications (encoder power supply, resolution, differential/complementary) are correct. Check also that the motor wiring (U, V, W) is correct (under Vector control). Check that the rotation direction is not switched from forward to reverse rotation (or from reverse to forward) during torque control under Real sensorless vector control. Check that the inverter capacity matches with the motor capacity. (PM sensorless vector control) Check if a start command is given to the inverter while the motor is coasting. (PM sensorless vector control) | | | | | | | | |
| Corrective action | Check if a start command is given to the inverter while the motor is coasting. (PM sensorless vector control) Set the acceleration time longer. (Shorten the downward acceleration time of the lift.) If "E.OC1" always appears at start, disconnect the motor once and restart the inverter. If "E.OC1" still appears, contact your sales representative. Check the wiring to make sure that output short circuit does not occur. Set 50 Hz in Pr.3 Base frequency. (Refer to page 707.) Lower the stall prevention operation level. Activate the fast-response current limit operation. (Refer to page 431.) Set the base voltage (rated voltage of the motor, etc.) in Pr.19 Base frequency voltage. (Refer to page 707.) Check RS-485 terminal connection (under Vector control). Check the wiring and specifications of the encoder and the motor. Perform the setting according to the specifications of the encoder and the motor (under vector control). (Refer to page 87.) Prevent the motor from switching the rotation direction from forward to reverse (or from reverse to forward) during torque control under Real sensorless vector control. Choose inverter and motor capacities that match. (PM sensorless vector control) Input a start command after the motor stops. Alternatively, use the automatic restart after instantaneous power failure/flying start function. (Refer to page 635.) (PM sensorless vector control) | | | | | | | | |

^{*1} Differs according to ratings. The rating can be changed using **Pr.570 Multiple rating setting**. (Refer to page 343.) 148% for SLD rating, 170% for LD rating, 235% for ND rating (initial setting), and 280% for HD rating

| Operation panel indication | E.OC2 | E. | 002 | FR-LU08 indication | OC During Cnst Spd | | | | |
|----------------------------|---|---|---|--|---|--|--|--|--|
| Name | Overcurrent trip during constant speed | | | | | | | | |
| Description | When the inverter output current reaches or exceeds approximately 235%*2 of the rated current during constant- speed operation, the protection circuit is activated and the inverter output is shut off. | | | | | | | | |
| Check point | Check for sudden load change. Check for a short-circuit in the output circuit. Check if the stall prevention operation level is set too high. Check if the fast-response current limit operation is disabled. Check that the power supply for RS-485 terminal is not shorted (under Vector control). Check that the rotation direction is not switched from forward to reverse rotation (or from reverse to forward) during torque control under Real sensorless vector control. Check that the inverter capacity matches with the motor capacity. (PM sensorless vector control) Check if a start command is given to the inverter while the motor is coasting. (PM sensorless vector control) | | | | | | | | |
| Corrective action | Lower the stall preversal.) Check RS-485 termi Prevent the motor from the during torque controls. Choose inverter and Input a start comman. | nake sure ention ope nal conne om switch under Ro motor ca id after the | eration level. Active ection (under Vecting the rotation deal sensorless ve pacities that matce e motor stops. Alt | or control). irection from forward to ctor control. ch. (PM sensorless vectors.) | reverse (or from reverse to forward) for control) matic restart after instantaneous power | | | | |

 $^{^{\}star}2$ Differs according to ratings. The rating can be changed using **Pr.570 Multiple rating setting**. (Refer to page 343.) 148% for SLD rating, 170% for LD rating, 235% for ND rating (initial setting), and 280% for HD rating

| Operation panel indication | E.OC3 | E. [| 353 | FR-LU08 indication | OC During Dec | | | | |
|----------------------------|---|------|-----|--------------------|---------------|--|--|--|--|
| Name | Overcurrent trip during deceleration or stop | | | | | | | | |
| Description | When the inverter output current reaches or exceeds approximately 235%*3 of the rated current during deceleration (other than acceleration or constant speed), the protection circuit is activated and the inverter output is shut off. | | | | | | | | |
| Check point | Check for sudden speed reduction. Check for a short-circuit in the output circuit. Check for too fast operation of the motor's mechanical brake. Check if the stall prevention operation level is set too high. Check if the fast-response current limit operation is disabled. Check that the power supply for RS-485 terminal is not shorted (under Vector control). Check that the rotation direction is not switched from forward to reverse rotation (or from reverse to forward) during torque control under Real sensorless vector control. Check that the inverter capacity matches with the motor capacity. (PM sensorless vector control) Check if a start command is given to the inverter while the motor is coasting. (PM sensorless vector control) | | | | | | | | |
| Corrective action | Check it a start command is given to the inverter while the motor is coasting. (PM sensoriess vector control) Set the deceleration time longer. Check the wiring to make sure that output short circuit does not occur. Check the mechanical brake operation. Lower the stall prevention operation level. Activate the fast-response current limit operation. (Refer to page 431.) Check RS-485 terminal connection (under Vector control). Prevent the motor from switching the rotation direction from forward to reverse (or from reverse to forward) during torque control under Real sensorless vector control. Choose inverter and motor capacities that match. (PM sensorless vector control) Input a start command after the motor stops. Alternatively, use the automatic restart after instantaneous power failure/flying start function. (Refer to page 635.) (PM sensorless vector control) | | | | | | | | |

 $^{^{\}star}3$ Differs according to ratings. The rating can be changed using **Pr.570 Multiple rating setting**. (Refer to page 343.) 148% for SLD rating, 170% for LD rating, 235% for ND rating (initial setting), and 280% for HD rating

| Operation panel indication | E.OV1 | E. | | 1 | FR-LU08 indication | OV During Acc | | | |
|----------------------------|---|---|--|---|--------------------|---------------|--|--|--|
| Name | Regenerative overvolt | Regenerative overvoltage trip during acceleration | | | | | | | |
| Description | If regenerative power causes the inverter's internal main circuit DC voltage to reach or exceed the specified value, the protection circuit is activated to stop the inverter output. The circuit may also be activated by a surge voltage produced in the power supply system. | | | | | | | | |
| Check point | Check for too slow acceleration. (e.g. during downward acceleration in vertical lift load) Check that the Pr.22 Stall prevention operation level is not set to the no load current or lower. Check if the stall prevention operation is frequently activated in an application with a large load inertia. | | | | | | | | |
| Corrective action | Set the acceleration time shorter. Use the regeneration avoidance function (Pr.882 to Pr.886). (Refer to page 732.) Set a value larger than the no load current in Pr.22. Set Pr.154 Voltage reduction selection during stall prevention operation = "10 or 11". (Refer to page 431.) | | | | | | | | |

| Operation panel indication | E.OV2 | E. | | FR-LU08 indication | OV During Cnst Spd | | | |
|----------------------------|---|--|--|---|--|--|--|--|
| Name | Regenerative overvolt | age trip d | uring constant sp | eed | | | | |
| Description | If regenerative power causes the inverter's internal main circuit DC voltage to reach or exceed the specified value, the protection circuit is activated to stop the inverter output. The circuit may also be activated by a surge voltage produced in the power supply system. | | | | | | | |
| Check point | Check for sudden load change. Check that the Pr.22 Stall prevention operation level is not set to the no load current or lower. Check if the stall prevention operation is frequently activated in an application with a large load inertia. Check that acceleration/deceleration time is not too short. | | | | | | | |
| Corrective action | Use the brake unit, r (FR-CV) as required Set a value larger th Set Pr.154 Voltage if Set the acceleration/ | n avoidand nultifunction an the no reduction deceleration be increa | on regeneration of load current in Progression selection during ion time longer. (Uased, However, su | 22. g stall prevention oper Inder Vector control or A | page 732.) ower regeneration common converter ration = "10 or 11". (Refer to page 431.) Advanced magnetic flux vector control, cause an overshoot in speed, resulting | | | |

| Operation panel indication | E.OV3 | E. | | 3 | FR-LU08 indication | OV During Dec | | |
|----------------------------|---|--------------------------------------|-------------|-----------------------------|--|---|--|--|
| Name | Regenerative overvolt | age trip o | luring dece | leration | or stop | | | |
| Description | If regenerative power causes the inverter's internal main circuit DC voltage to reach or exceed the specified value, the protection circuit is activated to stop the inverter output. The circuit may also be activated by a surge voltage produced in the power supply system. | | | | | | | |
| Check point | Check for sudden speed reduction. Check if the stall prevention operation is frequently activated in an application with a large load inertia. | | | | | | | |
| Corrective action | Make the brake cyclUse the regenerationUse the brake unit, r (FR-CV) as required | e longer. n avoidan nultifunct | ce functior | n (Pr.88 ration c | 22 to Pr.886). (Refer to onverter (FR-XC), or po | page 732.) ower regeneration common converter ration = "10 or 11". (Refer to page 431.) | | |

| Operation panel indication | E.THT | E. | 1 | 1-11 | F | R-LU08 indicat | ion | Inv. overload trip | |
|-------------------------------|---|--|-----------------------------------|--|---------------------------|---|------------|---|--|
| Name | Inverter overload trip (| Electroni | ic the | rmal O/L re | elay) [*] | * 4 | | | |
| Description | • | If the temperature of the output transistor elements exceeds the protection level with a rated output current or higher flowing without the overcurrent trip (E.OC[]), the inverter output is stopped. (Overload capacity 150% 60 s) | | | | | | | |
| Check point | Check the motor for Check that the enco | oost setti ern selec the use u der wiring | ng is tion s under g and | not too larg setting is ap overload. the specif | ge (sr oprop icatio | mall). oriate for the load ons (encoder pov | · /er s | ttern of the using machine. supply, resolution, differential/ /) is correct (under Vector control). | |
| Corrective action | complementary) are correct. Check also that the motor wiring (U, V, W) is correct (under Vector control). Set the acceleration/deceleration time longer. Adjust the torque boost setting. Set the load pattern selection setting according to the load pattern of the using machine. Reduce the load. Check the wiring and specifications of the encoder and the motor. Perform the setting according to the specifications of the encoder and the motor (under vector control). (Refer to page 87.) | | | | | | | | |

*4 Resetting the inverter initializes the internal cumulative heat value of the electronic thermal O/L relay function.

| Operation panel indication | E.THM | E. | | 1-11-1 | F | R-LU08 indication | Motor Ovrload | |
|----------------------------|--|--|--------|-------------|-------|-------------------|---------------|--|
| Name | Motor overload trip (e | ectronic 1 | therma | al relay fu | nctio | n) ^{*5} | | |
| Description | The electronic thermal O/L relay function in the inverter detects motor overheat, which is caused by overload or reduced cooling capability during low-speed operation. When the cumulative heat value reaches 85% of the Pr.9 Electronic thermal O/L relay setting, pre-alarm (TH) is output. When the accumulated value reaches the specified value, the protection circuit is activated to stop the inverter output. When the inverter is used to drive a dedicated motor, such as a multiple-pole motor, or several motors, the motor cannot be protected by the electronic thermal O/L relay. Install an external thermal relay on the inverter output side. | | | | | | | |
| Check point | Check that the settir | Check the motor for the use under overload. Check that the setting of Pr.71 Applied motor for motor selection is correct. (Refer to page 528.) Check that the stall prevention operation setting is correct. | | | | | | |
| Corrective action | Reduce the load.For a constant-torquSet the stall prevent | | | | | • | 1.) | |

^{*5} Resetting the inverter <u>initializes the internal cumulative heat value of the electronic thermal relay function</u>.

| Operation panel indication | E.FIN | E. | FI | N | FR-LU08 indication | Heatsink overheat | |
|----------------------------|--|----|----|---|--------------------|-------------------|--|
| Name | Heat sink overheat | | | | | | |
| Description | When the heat sink overheats, the temperature sensor is activated, and the inverter output is stopped. The FIN signal can be output when the temperature becomes approximately 85% of the heat sink overheat protection operation temperature. For the terminal used for the FIN signal output, assign the function by setting "26 (positive logic) or 126 (negative logic)" from Pr.190 to Pr.196 (Output terminal function selection) . (Refer to page 473.) | | | | | | |
| Check point | Check for too high surrounding air temperature. Check for heat sink clogging. Check that the cooling fan is not stopped. (Check that FN is not displayed on the operation panel.) | | | | | | |
| Corrective action | Set the surrounding air temperature to within the specifications. Clean the heat sink. Replace the cooling fan. | | | | | | |

| Operation panel indication | E.IPF | E. | 1 85 | | FR-LU08 indication | Instant Pwr failure | |
|----------------------------|---|------------------------|--------------|--------|----------------------|---------------------|--|
| Name | Instantaneous power | ailure (Star | ndard mode | els an | d IP55 compatible mo | dels only) | |
| Description | If a power failure occurs (or when power input to the inverter is shut off) for longer than 15 ms ^{*6} , the instantaneous power failure protective function is activated to shut off the inverter output in order to prevent the control circuit from malfunctioning. If a power failure persists for 100 ms or longer, the fault warning output is not provided, and the inverter restarts if the start signal is ON upon power restoration. (The inverter continues operating if an instantaneous power failure is within 15 ms ^{*6} .) In some operating status (load magnitude, acceleration/deceleration time setting, etc.), overcurrent or other protection may be activated upon power restoration. When instantaneous power failure protection is activated, the IPF signal is output. (Refer to page 628 and page 635.) | | | | | | |
| Check point | Find the cause of insta | ıntaneous _l | power failuı | e occ | currence. | | |
| Corrective action | Remedy the instantaneous power failure. Prepare a backup power supply for instantaneous power failure. Set the function of automatic restart after instantaneous power failure (Pr.57). (Refer to page 628 and page 635.) | | | | | | |

^{*6 10} ms for IP55 compatible models

| Operation panel indication | E.UVT | E. | <u> </u> | FR-LU08 indication | Under Voltage | | | | | |
|----------------------------|---|----|---|--------------------|---------------|--|--|--|--|--|
| Name | Undervoltage (Standard models and IP55 compatible models only) | | | | | | | | | |
| Description | If the power supply voltage of the inverter decreases, the control circuit will not perform normal functions. In addition, the motor torque will be insufficient and/or heat generation will increase. To prevent this, if the power supply voltage decreases to about 150 VAC (300 VAC for the 400 V class) or below, this function shuts off the inverter output. When a jumper is not connected across P/+ and P1, the undervoltage protective function is activated. When undervoltage protection is activated, the IPF signal is output. (Refer to page 628 and page 635.) | | | | | | | | | |
| Check point | Check if a high-capaCheck if the jumper | , | | als P/+ and P1. | | | | | | |
| Corrective action | Check if the jumper is connected across terminals P/+ and P1. Check the devices on the power supply line such as the power supply itself. If this function is activated due to unstable voltage in the power supply, change the undervoltage level (DC bus voltage value). (Refer to page 425.) Do not remove the jumper across terminals P/+ and P1 except when connecting a DC reactor. If the problem still persists after taking the above measure, contact your sales representative. | | | | | | | | | |

| Operation panel indication | E.ILF | E. | 1 | L | F | FR-LU08 indication | Input phase loss |
|----------------------------|--|----|---|---|---|--------------------|------------------|
| Name | Input phase loss (Standard models and IP55 compatible models only) | | | | | | |
| Description | When Pr.872 Input phase loss protection selection is enabled ("1") and one of the three-phase power input is lost, the inverter output is shut off. This protective function is not available when Pr.872 is set to the initial value (Pr.872 = "0"). (Refer to page 426.) | | | | | | |
| Check point | Check for a break in the cable for the three-phase power supply input. | | | | | | |
| Corrective action | Wire the cables properly. Repair a break portion in the cable. | | | | | | |

| Operation panel indication | E.OLT FR-LU08 indication Stall prevention STP | | | | | | | |
|----------------------------|---|--|--|--|--|--|--|--|
| Name | Stall prevention stop | | | | | | | |
| | Magneticiflux | | | | | | | |
| | If the output frequency has fallen to 0.5 Hz by stall prevention operation and remains for 3 seconds, a fault (E.OLT) appears and the inverter is shut off. OL appears while stall prevention is being activated. | | | | | | | |
| Description | Sensorless Vector PM | | | | | | | |
| | When speed control is performed, a fault (E.OLT) appears and the inverter output is shut off if frequency drops to the Pr.865 Low speed detection (initial value is 1.5 Hz) setting by torque limit operation and the output torque exceeds the Pr.874 OLT level setting (initial value is 150%) setting and remains 3 seconds. | | | | | | | |
| Check point | Check the motor for the use under overload. Check that the Pr.865 and Pr.874 values are correct. (Check the Pr.22 Stall prevention operation level setting under V/F control and Advanced magnetic flux vector control.) Check if a motor is connected under PM sensorless vector control. | | | | | | | |
| Corrective action | Reduce the load. Change the Pr.22, Pr.865, and Pr.874 values. (Check the Pr.22 setting under V/F control and Advanced magnetic flux vector control.) For the test operation without connecting a motor, select the PM sensorless vector control test operation. (Refer to page 224.) Also check that the stall prevention (overcurrent) warning (OL) or the stall prevention (overvoltage) warning (oL) countermeasure is taken. | | | | | | | |

| Operation panel indication | E.SOT | E. | 500 | FR-LU08 indication | Motor Step Out | | | | | | |
|----------------------------|---|-------------------------------|-----|--------------------|----------------|--|--|--|--|--|--|
| Name | Loss of synchronism of | Loss of synchronism detection | | | | | | | | | |
| Description | The inverter output is shut off when the motor operation is not synchronized. (This function is only available under PM sensorless vector control.) | | | | | | | | | | |
| Check point | Check that the PM motor is not driven overloaded. Check if a start command is given to the inverter while the PM motor is coasting. Check if a motor is connected under PM sensorless vector control. Check if a PM motor other than the MM-CF series is driven. | | | | | | | | | | |
| Corrective action | Set the acceleration time longer. Reduce the load. If the inverter restarts during coasting, set Pr.57 Restart coasting time ≠ "9999", and select the automatic restart after instantaneous power failure. Check the connection of the IPM motor. For the test operation without connecting a motor, select the PM sensorless vector control test operation. (Refer to page 224.) Drive an IPM motor (MM-CF series). When driving an IPM motor other than MM-CF series, offline auto tuning must be performed. (Refer to page 551.) | | | | | | | | | | |

| Operation panel indication | E.LUP | E. | LUP | FR-LU08 indication | Upper limit fault | | | |
|----------------------------|---|----|-----|--------------------|-------------------|--|--|--|
| Name | Upper limit fault detection | | | | | | | |
| Description | The inverter output is shut off when the load exceeds the upper limit fault detection range. This protective function is not available in the initial setting of Pr.1490 (Pr.1490 = "9999"). | | | | | | | |
| Check point | Check if too much load is applied to the equipment. Check that the load characteristics settings are correct. | | | | | | | |
| Corrective action | Inspect the equipment. Set the load characteristics (Pr.1481 to Pr.1487) correctly. | | | | | | | |

| Operation panel indication | E.LDN | E. | | FR-LU08 indication | Lower limit fault | | | |
|----------------------------|---|----|--|--------------------|-------------------|--|--|--|
| Name | Lower limit fault detection | | | | | | | |
| Description | The inverter output is shut off when the load falls below the lower limit fault detection range. This protective function is not available in the initial setting of Pr.1491 (Pr.1491 = "9999"). | | | | | | | |
| Check point | Check if the equipment load is too light. Check that the load characteristics settings are correct. | | | | | | | |
| Corrective action | Inspect the equipment. Set the load characteristics (Pr.1481 to Pr.1487) correctly. | | | | | | | |

| Operation panel indication | E.BE | E. | ЬE | FR-LU08 indication | Brake transistor err | | | |
|----------------------------|---|----|----|--------------------|----------------------|--|--|--|
| Name | Brake transistor alarm detection | | | | | | | |
| Description | The inverter output is shut off if a fault due to damage of the brake transistor and such occurs in the brake circuit. In such a case, the power supply to the inverter must be shut off immediately. Appears when an internal circuit fault occurred for separated converter types and IP55 compatible models. | | | | | | | |
| Check point | Reduce the load inertia. Check that the brake duty is proper. | | | | | | | |
| Corrective action | Replace the inverter. | | | | | | | |

| Operation panel indication | E.GF | E. | GF | FR-LU08 indication | Ground Fault | | |
|----------------------------|--|----|----|--------------------|--------------|--|--|
| Name | Output side earth (ground) fault overcurrent | | | | | | |
| Description | The inverter output is shut off if an earth (ground) fault overcurrent flows due to an earth (ground) fault that occurred on the inverter's output side (load side). | | | | | | |
| Check point | Check for a ground fault in the motor and connection cable. | | | | | | |
| Corrective action | Remedy the earth (ground) fault portion. | | | | | | |

| Operation panel indication | E.LF | E. | LF | | FR-LU08 indication | Output phase loss | | |
|----------------------------|---|----|----|--|--------------------|-------------------|--|--|
| Name | Output phase loss | | | | | | | |
| Description | The inverter output is shut off if one of the three phases (U, V, W) on the inverter's output side (load side) is lost. | | | | | | | |
| Check point | Check the wiring. (Check that the motor is normally operating.) Check that the capacity of the motor used is not smaller than that of the inverter. Check if a start command is given to the inverter while the motor is coasting. (PM sensorless vector control) | | | | | | | |
| Corrective action | Wire the cables properly. Input a start command after the motor stops. Alternatively, use the automatic restart after instantaneous power failure/flying start function (page 635). (PM sensorless vector control) | | | | | | | |

| Operation panel indication | E.OHT | E. | | FR-LU08 indication | Ext TH relay oper | | | |
|----------------------------|---|---|---|--------------------|-------------------|--|--|--|
| Name | External thermal relay | operatio | n | | | | | |
| Description | mounted thermal relay signal) is set in any of | The inverter output is shut off if the external thermal relay provided for motor overheat protection or the internally mounted thermal relay in the motor, etc. switches ON (contacts open). This function is available when "7" (OH signal) is set in any of Pr.178 to Pr.189 (Input terminal function selection) . This protective function is not available in the initial status. (OH signal is not assigned.) | | | | | | |
| Check point | Check for motor overheating. Check that the value "7" (OH signal) is set correctly to any of Pr.178 to Pr.189 (Input terminal function selection). | | | | | | | |
| Corrective action | Reduce the load and operation duty. Even if the relay contacts are reset automatically, the inverter will not restart unless it is reset. | | | | | | | |

| Operation panel indication | E.PTC | Ε. | PFE | FR-LU08 indication | PTC thermistor oper | | | |
|----------------------------|--|----|-----|--------------------|---------------------|--|--|--|
| Name | PTC thermistor operation | | | | | | | |
| Description | The inverter output is shut off if resistance of the PTC thermistor connected between terminal 2 and terminal 10 is equal to or higher than the Pr.561 PTC thermistor protection level setting for a continuous time equal to or longer than the setting value in Pr.1016 PTC thermistor protection detection time . When the initial value (Pr.561 = "9999") is set, this protective function is not available. | | | | | | | |
| Check point | Check the connection with the PTC thermistor. Check the Pr.561 and Pr.1016 settings. Check the motor for operation under overload. | | | | | | | |
| Corrective action | Reduce the load. | | | | | | | |

| Operation panel indication | E.OPT | E. | | FR-LU08 indication | Option Fault | | | | | |
|----------------------------|---|----|--|--------------------|--------------|--|--|--|--|--|
| Name | Option fault | | | | | | | | | |
| Description | Appears if the AC power supply is accidentally connected to terminal R/L1, S/L2, or T/L3 when a high power factor converter (FR-HC2), multifunction regeneration converter (FR-XC in common bus regeneration mode), or power regeneration common converter (FR-CV) is connected to the inverter while Pr.30 Regenerative function selection = "2". Appears when torque command by the plug-in option is selected using Pr.804 Torque command source selection and no plug-in option is mounted. This function is available under torque control. Appears when either one of a Vector control compatible plug-in option or a control terminal option (FR-A8TP) is not installed during machine end orientation control. Appears when the switch for manufacturer setting of the plug-in option is changed. Appears when a communication option is connected while Pr.296 Password lock level = "0 or 100". | | | | | | | | | |
| Check point | Check that the AC power supply is not connected to terminal R/L1, S/L2, or T/L3 when the FR-HC2, FR-XC (in common bus regeneration mode), or FR-CV is connected to the inverter while Pr.30 = "2". Check that the plug-in option for torque command setting is connected. Check that the Vector control plug-in option and the control terminal option (FR-A8TP) are installed correctly. Check that the Pr.393 Orientation selection and Pr.862 Encoder option selection settings are correct. Check for the preservery lock with a setting of Pr.396 = "0.100". | | | | | | | | | |
| Corrective action | Check for the password lock with a setting of Pr.296 = "0, 100". Check the Pr.30 setting and wiring with the FR-HC2, FR-XC, or FR-CV. The inverter may be damaged if the AC power supply is connected to terminal R/L1, S/L2, or T/L3 when a high power factor converter is connected. Contact your sales representative. Check for connection of the plug-in option. Check the Pr.804 setting. Install the Vector control plug-in option and the control terminal option (FR-A8TP) correctly. Set Pr.393 and Pr.862 correctly. (Refer to page 585.) Set the switch on the plug-in option, which is for manufacturer setting, back to the initial setting. (Refer to the Instruction Manual of each option.) To apply the password lock when installing a communication option, set Pr.296 ≠ "0, 100". (Refer to page 348.) | | | | | | | | | |

| Operation panel indication | E.OP1 to E.OP3 | E. | OP | to | FR-LU08 indication | Option1 Fault to Option3 Fault | | |
|----------------------------|--|-------|----|----|--------------------|--------------------------------|--|--|
| Name | Communication option | fault | | | | | | |
| Description | The inverter output is shut off if a communication line error occurs in the communication option. This function stops the inverter output when a communication line error occurs on the CC-Link IE Field network communication circuit board of the FR-A800-GF. When the FR-A8APR is installed to the inverter and a motor with a resolver is used, the inverter output is shut off if the FR-A8APR fails or the wiring of the resolver is not properly connected. | | | | | | | |
| Check point | Check for an incorrect option function setting and operation. Check that the plug-in option is plugged into the connector securely. For the FR-A800-GF, check that the CC-Link IE Field Network communication circuit board is securely installed to the connector of the inverter control circuit board. Check for a break in the communication cable. Check that the terminating resistor is fitted properly. | | | | | | | |
| Corrective action | Check that the wiring of the resolver is correct. (When the FR-A8APR is used.) Check the option function setting, etc. Connect the plug-in option securely. Connect the CC-Link IE Field Network communication circuit board of the FR-A800-GF securely. Check the connection of communication cable. Check the wiring of the resolver (when the FR-A8APR is used). If the fault occurs again when the inverter is reset, contact your sales representative. | | | | | | | |

| Operation panel indication | E.16 to E.20 | E. E. | 15 to | FR-LU08 indication | Fault 16 to Fault 20 | | | | |
|----------------------------|--|---|------------------------------------|---------------------|--|--|--|--|--|
| Name | User definition error b | y the PLC for | unction | | | | | | |
| Description | inverter output is shut The protective functio the initial setting (Pr.4 | off when th n is activate 14 = "0"). | e protective fun d when the PLC | ction is activated. | ister SD1214 for the PLC function. The is protective function is not available in ence programs. | | | | |
| Check point | Check if "16 to 20" is | Check if "16 to 20" is set in the special register SD1214. | | | | | | | |
| Corrective action | Set a value other that | • Set a value other than "16 to 20" in the special register SD1214. | | | | | | | |

| Operation panel indication | E.PE | E. | FE | FR-LU08 indication | Corrupt Memory | | | | |
|----------------------------|------------------------|---|--------------|--------------------|---|--|--|--|--|
| Name | Parameter storage de | Parameter storage device fault (control circuit board) | | | | | | | |
| Description | The inverter output is | The inverter output is shut off if a fault occurs in the parameter stored. (EEPROM failure) | | | | | | | |
| Check point | Check for too many no | Check for too many number of parameter write times. | | | | | | | |
| Corrective action | | municatio | n EEPROM wri | | RAM) for the operation which requires RAM goes back to the initial status at | | | | |

| Operation panel indication | E.PUE | E. | PLE | FR-LU08 indication | PU disconnection | | | |
|----------------------------|--|---|--|--|---|--|--|--|
| Name | PU disconnection | | | | | | | |
| Description | panel or parameter under the Reset selection/disection of the inverter output is number of retries where the PU connectors. The inverter output is | unit is disc connecte s shut off en Pr.12 ^r r. s shut off | connected, when ed PU detection/ if communication 1 PU communication | the disconnected PU di PU stop selection. errors occurred consection retry count ≠ "99" is broken within the pe | nd PU is suspended, e.g. the operation sconnection function is valid in Pr.75 cutively for more than permissible 99" during the RS-485 communication riod of time set in Pr.122 PU on via the PU connector. | | | |
| Check point | Check that the operation panel or the parameter unit is connected properly. Check the Pr.75 setting. | | | | | | | |
| Corrective action | Fit the operation pane | or the pa | arameter unit sec | urely. | | | | |

| Operation panel indication | E.RET | E. | REF | FR-LU08 indication | Retry count excess | | | |
|----------------------------|---|-----------|--------------------|--------------------|--|--|--|--|
| Name | Retry count excess | | | | | | | |
| Description | | fault occ | urrence. This fun | | within the number of retries set in Pr.67 Pr.67 is set. This protective function is | | | |
| Check point | Find the cause of the fault occurrence. | | | | | | | |
| Corrective action | Eliminate the cause of | the fault | preceding this fau | ılt indication. | | | | |

| Operation panel indication | E.PE2 | E. | PEZ | FR-LU08 indication | PR storage alarm | | | | |
|----------------------------|------------------------|---|-------------------|--------------------------|------------------|--|--|--|--|
| Name | Parameter storage de | Parameter storage device fault (main circuit board) | | | | | | | |
| Description | The inverter output is | shut off if | a fault occurs in | the parameter stored. (E | EPROM failure) | | | | |
| Check point | | | | | | | | | |
| Corrective action | Contact your sales rep | resentati | ve. | | | | | | |

| | E.CPU | E. (| | FR-LU08 indication | CPU Fault | | | |
|-------------------|------------------------|---|---------------|-----------------------------|------------|--|--|--|
| Operation panel | E. 5 | E. | 5 | | Fault 5 | | | |
| indication | E. 6 FR-LU08 indicat | FR-LOVO IIIuication | Fault 6 | | | | | |
| | E. 7 | E. | 7 | | Fault 7 | | | |
| Name | CPU fault | • | | | | | | |
| Description | The inverter output is | shut off if the | communication | on fault of the built-in Cl | PU occurs. | | | |
| Check point | Check for devices pro | Check for devices producing excess electrical noises around the inverter. | | | | | | |
| Corrective action | | Take measures against noises if there are devices producing excess electrical noises around the inverter. Contact your sales representative. | | | | | | |

| Operation panel indication | E.CTE | E. | | E | FR-LU08 indication | Circuit fault | | | | |
|----------------------------|---|----|-----------|-----------|--------------------|---------------|--|--|--|--|
| Name | Operation panel power supply short circuit/RS-485 terminals power supply short circuit | | | | | | | | | |
| Description | When the power supply for the operation panel (PU connector) is shorted, the power output is shutoff and the inverter output is shut off. The use of the operation panel (parameter unit) and the RS-485 communication via the PU connector are disabled. To reset, enter the RES signal from the terminal, reset through communication via the RS-485 terminals, or switch power OFF then ON again. When the power supply for the RS-485 terminals are short circuited, this function shuts off the power output. At this time, communication from the RS-485 terminals cannot be made. To reset, use on the operation panel, enter the RES signal, or switch power OFF then ON again. | | | | | | | | | |
| Check point | Check that the PU connector cable is not shorted. Check that the RS-485 terminals are connected correctly. | | | | | | | | | |
| Corrective action | Check PU and the c Check the connection | | RS-485 t€ | erminals. | | | | | | |

| Operation panel indication | E.P24 | E. | PEH | FR-LU08 indication | 24 VDC power fault | | | | |
|----------------------------|--|-------------|-------------------|--------------------|--|--|--|--|--|
| Name | 24 VDC power fault | | | | | | | | |
| Description | When the 24 VDC power output from the PC terminal is shorted, this function shuts off the power output. At this time, all external contact inputs switch OFF. The inverter cannot be reset by entering the RES signal. To reset it, use the operation panel, or switch power OFF, then ON again. | | | | | | | | |
| Check point | Check for a short cirCheck that the 24 V | | | | | | | | |
| Corrective action | | 24 V. (If t | he power with ins | 0 | olied to the 24 V input circuit for a long age the inverter, supply power at the | | | | |

| Operation panel indication | E.CDO | E. | | FR-LU08 indication | OC detect level | | | | | |
|----------------------------|---|-----------------------------------|-----------------------------|------------------------|---|--|--|--|--|--|
| Name | Abnormal output curre | Abnormal output current detection | | | | | | | | |
| Description | | able when | "1" is set in Pr.1 0 | 67 Output current dete | utput current detection level setting. ection operation selection. When the | | | | | |
| Check point | Check the settings of detection signal rete | | • | | delay time, Pr.166 Output current | | | | | |

| Operation panel indication | E.IOH | E. | 1 | []}-{ | FR-LU08 indication | Inrush overheat | |
|----------------------------|---|--------------|------|-------------|---|-----------------------|--|
| Name | Inrush current limit cire | cuit fault (| Stan | dard models | and IP55 compatible n | nodels only) | |
| Description | The inverter output is shut off when the resistor of the inrush current limit circuit is overheated. The inrush current limit circuit is faulty. | | | | | | |
| Check point | Check that frequent power ON/OFF is not repeated. Check if the input side fuse (5A) in the power supply circuit of the inrush current limit circuit contactor (FR-A840-03250(110K) or higher) is blown. Check that the power supply circuit of inrush current limit circuit contactor is not damaged. | | | | | | |
| Corrective action | Configure a circuit who | | | | F is not repeated. measure, contact your | sales representative. | |

| Operation panel indication | E.SER | E. | SER | FR-LU08 indication | VFD Comm error | | |
|----------------------------|---|-----------|-------------------|--------------------|----------------|--|--|
| Name | Communication fault (| nverter) | | | | | |
| Description | The inverter output is shut off when communication error occurs consecutively for the permissible number of retries or more when Pr.335 RS-485 communication retry count ≠ "9999" during RS-485 communication through the RS-485 terminals. The inverter output is also shut off if communication is broken for the period of time set in Pr.336 RS-485 communication check time interval . | | | | | | |
| Check point | Check the RS-485 terminal wiring. | | | | | | |
| Corrective action | Perform wiring of the F | RS-485 te | erminals properly | | | | |

| Operation panel indication | E.AIE | E. | FII | E | FR-LU08 indication | Analog input fault | | |
|----------------------------|---|--|-----------|----------|----------------------------|---------------------|--|--|
| Name | Analog input fault | | | | | | | |
| Description | while the current input | The inverter output is shut off when a 30 mA or higher current or a 7.5 V or higher voltage is input to terminal 2 while the current input is selected by Pr.73 Analog input selection , or to terminal 4 while the current input is selected by Pr.267 Terminal 4 input selection . | | | | | | |
| Check point | Check the Pr.73, Pr.2 | 67 , and th | ne voltag | e/curren | t input switch settings. (| Refer to page 496.) | | |
| Corrective action | Either give a current less than 30 mA, or set Pr.73 , Pr.267 , and the voltage/current input switch to the voltage input and input a voltage. | | | | | | | |

| Operation panel indication | E.USB | E. | USb | FR-LU08 indication | USB comm error | | | | |
|----------------------------|--|--|--------------------|--------------------|----------------|--|--|--|--|
| Name | USB communication f | ault | | | | | | | |
| Description | The inverter output is scheck time interval. | The inverter output is shut off when the communication is cut off for the time set in Pr.548 USB communication check time interval. | | | | | | | |
| Check point | Check that the USB | communi | cation cable is co | nnected securely. | | | | | |
| Corrective action | • Check the Pr.548 se • Connect the USB co • Increase the Pr.548 | mmunica | | | | | | | |

| Operation panel indication | E.SAF | E. | SAF | FR-LU08 indication | Safety circuit fault | | | |
|----------------------------|--|--|---|--|---|--|--|--|
| Name | Safety circuit fault | | | | | | | |
| Description | The inverter output is shut off when a safety circuit fault occurs. The inverter output is shut off if the either of the wire between S1 and SIC or S2 and SIC becomes non-conductive while using the safety stop function. When the safety stop function is not used, the inverter output is shut off when the shorting wire between terminals S1 and PC or across S2 and PC is disconnected. Settings of the switches (SW3 and SW4) for manufacturer setting may have been changed from the initial settings. | | | | | | | |
| Check point | · · | wire betw | een S1 and PC or | between S2 and PC is | n using the safety stop function. disconnected when not using the safety | | | |
| Corrective action | input signal source s Instruction Manual fo • When the safety stop shorting wires. (Refe | uch as a sor causes of function or to page | safety relay modu and countermeas is not used, shor 82.) | lle is operating properly sures. (Contact your sal t across terminals S1 a | 2 and SIC is correct and the safety stop 7. Refer to the Safety Stop Function les representative for the manual.) 1. Refer to the Safety Stop Function 1. Refer to page 19 for the positions of the | | | |

| Operation panel | E.PBT | E. | PEF | FR-LU08 indication | PBT fault | | | | |
|-------------------|------------------------|--|-----|--------------------|------------------------|--|--|--|--|
| indication | E.13 | E. | | 1 K-LOGO marcation | Internal circuit fault | | | | |
| Name | Internal circuit fault | | | | | | | | |
| Description | The inverter output is | The inverter output is shut off when an internal circuit fault occurs. | | | | | | | |
| Corrective action | Contact your sales rep | oresentativ | /e. | | | | | | |

| Operation panel indication | E.OS | E. | 8 | FR-LU08 indication | Overspeed occurrence | | | | |
|----------------------------|--|---|--|--|--|--|--|--|--|
| Name | Overspeed occurrence | 9 | | | | | | | |
| Description | The inverter output is shut off when the motor speed exceeds the Pr.374 Overspeed detection level under encoder feedback control, Real sensorless vector control, Vector control, and PM sensorless vector control. This protective function is not available in the initial status. | | | | | | | | |
| Check point | of encoder pulses. (I | g of Pr.369 Jnder enco temperatu | (Pr.851) Num l der feedback corrections | ontrol or vector control) sed under Real sensorle | does not differ from the actual number | | | | |
| Corrective action | Set Pr.374 correctly. Set Pr.369 (Pr.851) correctly. (Under encoder feedback control or vector control) When the motor temperature increases, enable the online auto tuning at startup (set Pr.95 (Pr.574) = "1") (under Real sensorless vector control). To perform the online auto tuning at startup for a lift, use of the Start-time tuning start external input (X28) signal is recommended. (Refer to page 558.) | | | | | | | | |

| Operation panel indication | E.OSD Vector | E. | 058 | FR-LU08 indication | Spd deviation fault | | | | | | |
|----------------------------|---|---|-----|--------------------|---------------------|--|--|--|--|--|--|
| Name | Speed deviation exces | Speed deviation excess detection | | | | | | | | | |
| Description | The inverter output is shut off if the motor speed is increased or decreased under the influence of the load etc. during Vector control with Pr.285 Overspeed detection frequency set and cannot be controlled in accordance with the speed command value. If the motor is accelerated against the stop command accidentally, the deceleration check function (Pr.690) is activated to stop the inverter output. | | | | | | | | | | |
| Check point | Check for sudden loa | Check that the settings of Pr.285 and Pr.853 Speed deviation time are correct. Check for sudden load change. Check that the setting of Pr.369 (Pr.851) Number of encoder pulses does not differ from the actual number of encoder pulses. | | | | | | | | | |
| Corrective action | Set Pr.285 and Pr.853 correctly. Keep the load stable. Set Pr.369 (Pr.851) correctly. | | | | | | | | | | |

| Operation panel indication | E.ECT | E. | EEF | FR-LU08 indication | Encoder signal loss | | | | |
|----------------------------|---|--|--|--|--|--|--|--|--|
| Name | Signal loss detection | | | | | | | | |
| Description | The inverter output is shut off when the encoder signal is shut off under orientation control, encoder feedback control or vector control. This protective function is not available in the initial status. | | | | | | | | |
| Check point | Check for the encoder signal loss. Check that the encoder specifications are correct. Check for a loose connector. Check that the switch setting of a Vector control compatible option is correct. Check that the power is supplied to the encoder. Alternatively, check that the power is not supplied to the encoder later than the inverter. Check that the voltage of the power supplied to the encoder is the same as the encoder output voltage. | | | | | | | | |
| Corrective action | Supply the power to supplied to the inver If the power is suppli and set "0 (initial valu loss detection. | meets the curely. g of a Ve the encoder. ed to the ne)" in Pr. | ctor control composition of the control composition of the control con | t to the inverter, check that loss detection ena | Refer to page 88.) at the same time when the power is that the encoder signal is properly sent ble/disable selection to disable signal e encoder output voltage. | | | | |

| Operation panel indication | E.OD Vector | E. | | FR-LU08 indication | Position fault | | | | |
|----------------------------|---|---|--|--------------------|----------------|--|--|--|--|
| Name | Excessive position fau | lt | | | | | | | |
| Description | The inverter output is shut off when the difference between the position command and position feedback exceeds the setting of Pr.427 Excessive level error during position control. This protective function is not available in the initial status. | | | | | | | | |
| Check point | Check that the load | Check that the position detecting encoder mounting orientation matches the parameter. Check that the load is not large. Check that the settings of Pr.427 and Pr.369 (Pr.851) Number of encoder pulses are correct. | | | | | | | |
| Corrective action | Check the parameters. Reduce the load. Set Pr.427 and Pr.369 (Pr.851) correctly. | | | | | | | | |

| Operation panel indication | E.ECA Vector | E. | EEA | FR-LU08 indication | ENC direction fault | | | | |
|----------------------------|---|---|---|--|--|--|--|--|--|
| Name | Encoder signal loss fo | r orientati | ion | | | | | | |
| Description | · · | The inverter output is shut off when the machine end encoder signal is shut off during machine end orientation control under Vector control. This protective function is not available in the initial status. | | | | | | | |
| Check point | Check for the encoder signal loss. Check that the encoder specifications are correct. Check for a loose connector. Check that the switch setting of a Vector control compatible option is correct. Check that the power is supplied to the encoder. Alternatively, check that the power is not supplied to the encoder later than the inverter. Check that the voltage of the power supplied to the encoder is the same as the encoder output voltage. | | | | | | | | |
| Corrective action | Supply the power to supplied to the inver If the power is suppli and set "0 (initial values detection. | meets the curely. g of a Veo the encoder. ed to the e)" in Pr. | ctor control composite. der. Or supply the encoder after sen | t to the inverter, check that loss detection enaited | Refer to page 88.) at the same time when the power is that the encoder signal is properly sent ble/disable selection to disable signal e encoder output voltage. | | | | |

| Operation panel indication | E.MB1 to 7 | E. E. | 14 <u>1-</u> 141- | • | FR-LU08 indication | E.MB1 Fault to E.MB7 Fault | | |
|----------------------------|---|------------|----------------------|-----------|--------------------|--|--|--|
| Name | Brake sequence fault | | | | | | | |
| Description | • | ctive func | ction is not | availab | · · | of the brake sequence function (Pr.278 he brake sequence function is invalid.) | | |
| Check point | Find the cause of the fault occurrence. | | | | | | | |
| Corrective action | Check the set parame | ters and | perform w | iring pro | perly. | | | |

| Operation panel indication | E.EP Vector | E. | EP | FR-LU08 indication | Encoder phase fault |
|----------------------------|--|----|----|----------------------------|---|
| Name | Encoder phase fault | | | | |
| Description | - | | | | r differs from the actual motor rotation tive function is not available in the initial |
| Check point | Check for mis-wiring Check if the Pr.359 (| | | n direction setting is inc | orrect. |
| Corrective action | Perform connection a Change the Pr.359 (I | 0 | , | | |

| Operation panel indication | E.MP Vector | E. | MF | FR-LU08 indication | MagnetPole Pos Fault | | | |
|----------------------------|--|---------|----|--|--|--|--|--|
| Name | Magnetic pole position | unknown | | | | | | |
| Description | When the offset value between the PM motor home magnetic pole position and the home position of the encoder (position detector) is unknown, the protective circuit is activated to stop the inverter output. | | | | | | | |
| Check point | Check that the encoder position tuning was performed. Check that the encoder position tuning ended properly. When Pr.1105 (Pr.887) Encoder magnetic pole position offset = "9999", the encoder position tuning does not end properly. | | | | | | | |
| Corrective action | 542.) | _ | • | .871) Encoder position orm tuning again. (Refe | tuning setting/status. (Refer to page er to page 542.) | | | |

| Operation panel indication | E.EF | E. | EF | FR-LU08 indication | E.EF | |
|----------------------------|--|--------------|------------------|---------------------------------|---|--|
| Name | External fault during output operation | | | | | |
| Description | shut off. This function | is available | when "32" is s | et in any of Pr.178 to P | ult or other factor, the inverter output is r.189 (Input terminal function (32 signal is not assigned). | |
| Check point | Check that the X32 s | ignal is OF | F. | | | |
| Corrective action | Make sure that there | is no proble | em in starting o | peration, and turn ON t | he X32 signal. | |

| Operation panel indication | E.IAH | E. | 1 | F11-1 | FR-LU08 indication | Abnormal Intnl Temp | |
|----------------------------|---|---|---|-------|--------------------------|-----------------------------------|--|
| Name | Abnormal internal tem | bnormal internal temperature (IP55 compatible models only) | | | | | |
| Description | The inverter output is | The inverter output is shut off when the inverter internal temperature reaches the specified value or higher. | | | | | |
| Check point | Check for too high sCheck if the internal | | | | oling fan stops due to a | ı fault. | |
| Corrective action | Install an inverter suReplace the internal | | | | • | e Instruction Manual (Hardware).) | |

| Operation panel indication | E.LCI | E. | | FR-LU08 indication | 4 mA input fault | | |
|----------------------------|---|---|--|--------------------|------------------|--|--|
| Name | 4 mA input fault | | | | | | |
| Description | check filter. This fund | The inverter output is shut off when the analog input current is 2 mA or less for the time set in Pr.778 4 mA input check filter. This function is available when Pr.573 4 mA input check selection = "2 or 3". (Refer to page 517.) This protective function is not available in the initial status. | | | | | |
| Check point | | Check for a break in the wiring for the analog current input. Check that the Pr.778 setting is not too short. | | | | | |
| Corrective action | Check the wiring forSet the Pr.778 setting | | | t. | | | |

| Operation panel indication | E.PCH | E. | PEH | FR-LU08 indication | Pre-charge fault | | | |
|----------------------------|--|--|-----|--------------------|------------------|--|--|--|
| Name | Pre-charge fault | | | | | | | |
| Description | The inverter output is shut off when the pre-charge time exceeds Pr.764 Pre-charge time limit . The inverter output is shut off when the measured value exceeds Pr.763 Pre-charge upper detection level during pre-charging. This function is available when Pr.764 and Pr.763 are set (refer to page 618). This protective function is not available in the initial status. | | | | | | | |
| Check point | Check that the Pr.76Check that the Pr.12 | Check that the Pr.764 setting is not too short. Check that the Pr.763 setting is not too small. Check that the Pr.127 PID control automatic switchover frequency setting is not too low. Check for a break in the connection to the pump. | | | | | | |
| Corrective action | Set the Pr.764 settir Set the Pr.763 settir Set the Pr.127 settir Check the connection | g larger. g higher. | | | | | | |

| Operation panel indication | E.PID | E. | FI | | FR-LU08 indication | PID signal fault | |
|----------------------------|--|---|------------|--------|--------------------|------------------|--|
| Name | PID signal fault | | | | | | |
| Description | setting, or the absolute function in Pr.131 PID | The inverter output is shut off if the measured value exceeds the PID upper limit or PID lower limit parameter setting, or the absolute deviation value exceeds the PID deviation parameter setting during PID control. Set this function in Pr.131 PID upper limit , Pr.132 PID lower limit , Pr.553 PID deviation limit , and Pr.554 PID signal operation selection. (Refer to page 601.) This protective function is not available in the initial status. | | | | | |
| Check point | • | Check the meter for a failure or break. Check that the parameter settings are correct. | | | | | |
| Corrective action | Check that the mete Set the parameters of | | failure or | break. | | | |

| Operation panel indication | E. 1 to E. 3 | E. 1 ^{to} | FR-LU08 indication | Fault 1 to Fault 3 | | | |
|----------------------------|--|---|--|--------------------|--|--|--|
| Name | Option fault | | | | | | |
| Description | The inverter output is shut off when a contact fault is found between the inverter and the plug-in option, or when the communication option is not connected to the connector 1. For the FR-A800-GF, the inverter output is shut off when a connector contact fault or the like occurs between the CC-Link IE Field network communication circuit board and the inverter control circuit board. The inverter output is shut off when encoder feedback control is performed while 10 poles or more is set in Pr.144 Speed setting switchover. Appears when the switch for manufacturer setting of the plug-in option is changed. | | | | | | |
| Check point | connection of option For the FR-A800-GF to the connector of t Check for excessive Check if the communications | is.) | E Field Network communicoard ed to the connector 2 or | | | | |
| Corrective action | Take precautions ag If the problem still pe Connect the commu For encoder feedbace | k IE Field Network commingations to noise if there are determined the about the control operation, use the plug-in option, which is | vices producing excessing excessing measure, contact you nector 1. | · | | | |

| Operation panel indication | E.11 Sensorless | Ε. | 1 | 1 | FR-LU08 indication | Opst rot dtct fault | | |
|----------------------------|--|---|----------|---|--------------------|--------------------------------------|--|--|
| Name | Opposite rotation dec | eleration fault | | | | | | |
| Description | the estimated speed of during torque control u due to the un-switched | The speed may not decelerate during low speed operation if the rotation direction of the speed command and the estimated speed differ when the rotation is changing from forward to reverse or from reverse to forward during torque control under Real sensorless vector control. The inverter output is shut off when overload occurs due to the un-switched rotation direction. This protective function is not available in the initial status (V/F control). (This function is only available under Real sensorless vector control.) | | | | | | |
| Check point | | • Check that the rotation direction is not switched from forward to reverse rotation (or from reverse to forward) during torque control under Real sensorless vector control. | | | | | | |
| Corrective action | Prevent the motor from during torque contro Contact your sales reconstruction. | under Real s | sensorle | | | reverse (or from reverse to forward) | | |

♦ Others

Indicate the status of the inverter. It is not a fault.

| Operation panel indication | E.0 | E. | | FR-LU08 indication | No faults |
|----------------------------|--|----------------|--------------|--------------------------|--|
| Name | No fault history | | | | |
| Description | Appears when no fault has been activated.) | records are st | ored. (Appea | rs when the fault histor | y is cleared after the protective function |

| Operation panel indication | EV | Eľ | FR-LU08 indication | _ | | | |
|----------------------------|--|---|-------------------------|--|--|--|--|
| Name | 24 V external power s | 24 V external power supply operation | | | | | |
| Description | Blinks when the main | Blinks when the main circuit power supply is off and the 24 V external power supply is being input. | | | | | |
| Check point | Power is supplied from | Power is supplied from a 24 V external power supply. | | | | | |
| Corrective action | If the indication is sti | er supply (main circuit) of t Il displayed after turning Ol be low, or the jumper betwo | N of the power supply (| main circuit) of the inverter, the power | | | |

| Operation panel indication | RD | Rd | FR-LU08 indication | Rd | | | | |
|----------------------------|----------------------------------|----------------------------|-------------------------|---|--|--|--|--|
| Name | Backup in progress | Backup in progress | | | | | | |
| Description | The GOT is used for b page 702.) | acking up inverter paramet | ers and the data used i | the PLC function of inverter. (Refer to | | | | |

| Operation panel indication | WR | MR | FR-LU08 indication | WR |
|----------------------------|------------------------|------------------------------|---------------------------|-----------------------------|
| Name | Restoration in progres | s | | |
| Description | The backup data store | ed in the GOT is used to res | store the data in the inv | erter. (Refer to page 702.) |

• NOTE

- If protective functions with indication of "Fault" on the FR-LU08 or FR-PU07 are activated, "ERR" appears in the fault history of the FR-LU08 or FR-PU07.
- If faults other than the above appear, contact your sales representative.

6.6 Check first when you have a trouble

For Real sensorless vector control and Vector control, also refer to the troubleshooting on page 261 (speed control), page 295 (torque control), and page 329 (position control).



• If the cause is still unknown after every check, it is recommended to initialize the parameters, set the required parameter values and check again.

6.6.1 Motor does not start

| Check point | Possible cause | Countermeasure | Refer to page |
|-----------------|--|--|---------------|
| | An appropriate power supply voltage is not | Power on a molded case circuit breaker (MCCB), an earth leakage circuit breaker (ELB), or a magnetic contactor (MC). | _ |
| | applied. (The operation panel display is not | Check for the decreased input voltage, input phase loss, and wiring. | — |
| | (The operation panel display is not operating.) | If only the control power is ON when using a separate power source for the control circuit, turn ON the main circuit power. | 77 |
| Main circuit | The motor is not connected properly. | Check the wiring between the inverter and the motor. If the electronic bypass function is active, check the wiring of the magnetic contactor (MC) between the inverter and the motor. | 55 |
| | The jumper across P/+ to P1 is disconnected. A DC reactor (FR-HEL) is not connected. | Securely fit a jumper across P/+ and P1. When using a DC reactor (FR-HEL), remove the jumper across P/+ to P1, and then connect the DC reactor. Connect the DC reactor securely when required according to the capacity. | 55, 109 |

| Check point | Possible cause | Countermeasure | Refer to page |
|-----------------|--|--|--|
| | A start signal is not input. | Check the start command source, and input a start signal. PU operation mode: FWD / REV External operation mode: STF/STR signal | 393 |
| | Both the forward and reverse rotation start signals (STF, STR) are input simultaneously. | Turn ON only one of the forward and reverse rotation start signals (STF or STR). When the STF and STR signals are turned ON simultaneously in the initial setting, a stop command is given. | 68 |
| | Frequency command is zero. (The [FWD] or [REV] LED indicator on the operation panel is blinking.) | Check the frequency command source and input a frequency command. | 393 |
| | The AU signal is not ON when terminal 4 is used for frequency setting. (The [FWD] or [REV] LED indicator on the operation panel is blinking.) | Turn ON the AU signal. Turning ON the AU signal activates terminal 4 input. | 496 |
| | The Output stop (MRS) signal or Inverter reset (RES) signal is ON. (The [FWD] or [REV] LED indicator on the operation panel is blinking.) | Turn the MRS or RES signal OFF. The inverter starts the operation with a given start command and a frequency command after turning OFF the MRS or RES signal. Before turning OFF, ensure the safety. | 68 |
| Input signal | The CS signal is OFF while the automatic restart after instantaneous power failure function is selected (Pr.57 Restart coasting time ≠ 9999). (The [FWD] or [REV] LED indicator on the operation panel is blinking.) | Turn ON the Selection of automatic restart after instantaneous power failure / flying start (CS) signal. When the CS signal is assigned to an input terminal, automatic restart operation is enabled when the CS signal is turned ON. | 628 |
| | The jumper connector for selecting sink logic or source logic is incorrectly installed. (The [FWD] or [REV] LED indicator on the operation panel is blinking.) | Check that the control logic switchover jumper connector is correctly installed. If it is not installed correctly, the input signal is not recognized. | 72 |
| | The wiring of the encoder is incorrect. (Under encoder feedback control or vector control) | Check the wiring of the encoder. | 91 |
| | The voltage/current input switch is not correctly set for the analog input signal (0 to 5 V, 0 to 10 V, or 4 to 20 mA). (The [FWD] or [REV] LED indicator on the operation panel is blinking.) | Set Pr.73 Analog input selection, Pr.267 Terminal 4 input selection, and a voltage/current input switch correctly, then input an analog signal in accordance with the setting. | 496 |
| | The STOP RESET key was pressed. (The operation panel indication is " PS).) | During the External operation mode, check the method of restarting from a stop input stop from PU. | 338, 783 |
| | For the separated converter type, terminals RDA and SE of the converter unit are not connected to terminals MRS (X10 signal) and SD (PC for source logic) of the inverter respectively. | Check for secure wiring connections. | Refer to the Instruction Manual (Hardware) of the FR- A802. |

| Check point | Possible cause | Countermeasure | Refer to page |
|----------------------|---|---|-----------------------|
| | Two-wire or three-wire type connection is incorrect. | Check the connection. Use the Start self-holding selection (STP (STOP)) signal when the three-wire type is used. | 722 |
| | Under V/F control, Pr.0 Torque boost setting is not appropriate. | Increase the Pr.0 setting by 0.5% increments while observing the rotation of a motor. If that makes no difference, decrease the setting. | 706 |
| | Pr.78 Reverse rotation prevention selection is set. | Check the Pr.78 setting. Set Pr.78 when you want to limit the motor rotation to only one direction. | 406 |
| | The Pr.79 Operation mode selection setting is incorrect. | Select the operation mode suitable for the input methods of the start command and frequency command. | 389 |
| | The bias and gain (the calibration parameter C2 to C7) settings are not appropriate. | Check the bias and gain (the calibration parameter C2 to C7) settings. | 505 |
| | The Pr.13 Starting frequency setting is greater than the set frequency. | Set the frequency higher than the one set in Pr.13 . The inverter does not start if the frequency setting signal has a value lower than that of Pr.13 . | 381, 367 |
| | Zero is set in frequency settings (such as for multi-speed operation). Especially, Pr.1 Maximum frequency is zero. | Set the frequency command according to the application. Set Pr.1 higher than the actual frequency used. | 411, 428 |
| | Pr.15 Jog frequency is lower than Pr.13 Starting frequency for JOG operation. | The Pr.15 setting should be equal to or higher than the Pr.13 setting. | 381, 382, 410 |
| | The Pr.359 (Pr.852) Encoder rotation direction setting is incorrect under encoder feedback control or under vector control. | If the REV indicator on the operation panel is ON even though the forward-rotation command is given, set Pr.359 (Pr.852) = "1". | 94, 736 |
| | When a Vector control option is used, the option to be used and parameter settings do not match. | Correctly set Pr.862 Encoder option selection according to the option to be used. | 226 |
| Parameter setting | Operation mode and a writing device do not correspond. | Check Pr.79 Operation mode selection, Pr.338 Communication operation command source, Pr.339 Communication speed command source, Pr.550 NET mode operation command source selection and Pr.551 PU mode operation command source selection, and select an operation mode suitable for the purpose. | 389, 400 |
| | The start signal operation selection is set by Pr.250 Stop selection | Check the Pr.250 setting and the connection of the STF and STR signals. | 722 |
| | The motor has decelerated to a stop when the power failure time deceleration-to-stop function is selected. | When power is restored, ensure the safety, and turn OFF the start signal once, then turn ON again to restart. When Pr.261 Power failure stop selection = "2 or 12", the motor automatically restarts after the power is restored. | 642 |
| | Auto tuning is being performed. | When offline auto tuning ends, press the pressure operation panel for the PU operation. For the External operation, turn OFF the start signal (STF or STR). This operation resets the offline auto tuning, and the PU's monitor display returns to the normal indication. (Without this operation, next operation cannot be started.) | 532, 542, 551, 638 |
| | The automatic restart after instantaneous power failure function or power failure stop function has been activated. (Performing overload operation during input phase loss may cause voltage insufficiency, and that may result in detection of power failure.) | Set Pr.872 Input phase loss protection selection = "1" (input phase failure protection active). Disable the automatic restart after instantaneous power failure function and power failure stop function. Reduce the load. Increase the acceleration time if the function was activated during acceleration. | 426, 628, 635, 642 |
| | The motor test operation is selected under Vector control or PM sensorless vector control. | Check the Pr.800 Control method selection setting. | 221 |
| | When the FR-HC2, FR-XC, FR-CV, or FR-CC2 is used, the input logic setting of the X10 signal is incorrect. | Set Pr.599 = "0" (initial value for standard models and IP55 compatible models) to use the X10 signal with the NO contact input specification, and Pr.599 = "1" (initial value for separated converter types) to use the X10 signal with the NC contact input specification. | 724 |
| Lood | Load is too heavy. | Reduce the load. | _ |
| Load | The shaft is locked. | Inspect the machine (motor). | _ |

6.6.2 Motor or machine is making abnormal acoustic noise

| Check point | Possible cause | Countermeasure | Refer to page |
|-------------------|--|---|---------------|
| Input signal | Disturbance due to EMI when the frequency | Take countermeasures against EMI. | 116 |
| Parameter setting | or torque command is given through analog input terminal 1, 2, or 4. | Increase the Pr.74 Input filter time constant setting if steady operation cannot be performed due to EMI. | 503 |
| | No carrier frequency noises (metallic noises) are generated. | In the initial setting, Pr.240 Soft-PWM operation selection is enabled to change motor noise to an unoffending complex tone. Therefore, no carrier frequency noises (metallic noises) are generated. Set Pr.240 = "0" to disable this function. | 356 |
| | The motor noise increases due to activation of the carrier frequency automatic reduction function when the motor is driven overloaded. | Reduce the load. Disable the automatic reduction function by setting Pr.260 PWM frequency automatic switchover = "0". (As the load remains excessive, overload may cause a protective function E.THT.) | 356 |
| | Resonance occurs. (Output frequency) | Set Pr.31 to Pr.36 , and Pr.552 (frequency jump). When it is desired to avoid resonance attributable to the natural frequency of a mechanical system, these parameters allow resonant frequencies to be jumped. | 429 |
| Parameter setting | Resonance occurs. (Carrier frequency) | Change the Pr.72 PWM frequency selection setting. Changing the PWM carrier frequency produces an effect on avoiding the resonance frequency of a mechanical system or a motor. | 356 |
| , , , | | Set a notch filter. | 271 |
| | Auto tuning is not performed under Advanced magnetic flux vector control, Real sensorless vector control, or Vector control. | Perform offline auto tuning. | 532 |
| Others | Gain adjustment during PID control is insufficient. | To stabilize the measured value, change the proportional band (Pr.129) to a larger value, the integral time (Pr.130) to a slightly longer time, and the differential time (Pr.134) to a slightly shorter time. Check the calibration of set point and measured value. | 601 |
| | The gain is too high under Real sensorless vector control, Vector control, or PM | During speed control, check the setting of Pr.820 Speed control P gain 2. | 254 |
| | sensorless vector control. | During torque control, check the setting of Pr.824 Torque control P gain 2 (current loop proportional gain) . | 294 |
| | Mechanical looseness | Adjust machine/equipment so that there is no mechanical looseness. | _ |
| | Contact the motor manufacturer. | | |
| Motor | Operating with output phase loss | Check the motor wiring. | _ |

6.6.3 Inverter generates abnormal noise

| Check point | Possible cause | Countermeasure | Refer to page |
|-------------|--|----------------------------------|---------------|
| ⊦an | The fan cover was not correctly installed when a cooling fan was replaced. | Install the fan cover correctly. | 816 |

Motor generates heat abnormally 6.6.4

| Check point | Possible cause | Countermeasure | Refer to page |
|-------------------|---|--|---------------|
| Motor | The motor fan is not working. (Dust is accumulated.) | Clean the motor fan. Improve the environment. | _ |
| WIOLOI | Phase to phase insulation of the motor is insufficient. | Check the insulation of the motor. | _ |
| Main circuit | The inverter output voltage (U, V, W) are unbalanced. | Check the output voltage of the inverter. Check the insulation of the motor. | 821 |
| Parameter setting | The Pr.71 Applied motor setting is incorrect. | Check the Pr.71 Applied motor setting. | 528 |
| _ | Motor current is too large | Refer to "6.6.11 Motor current is too large". | 807 |

Motor rotates in the opposite direction 6.6.5

| Check point | Possible cause | Countermeasure | Refer to page |
|--|---|--|---------------|
| Main circuit | The phase sequence of output terminals U, V and W is incorrect. | Connect the output side terminals (terminals U, V, and W) correctly. | 55 |
| | The start signals (STF and STR signals) are connected improperly. | Check the connection. (STF: forward rotation, STR: reverse rotation) | 68, 722 |
| Input signal | The polarity of the frequency command is negative during the polarity reversible operation set by Pr.73 Analog input selection . | Check the polarity of the frequency command. | 496 |
| Input signal, parameter setting | The torque command is negative during torque control under Vector control. | Check the torque command value. | 283 |

6.6.6 Speed greatly differs from the setting

| Check point | Possible cause | Countermeasure | Refer to page |
|-------------------|---|--|---------------|
| Input | The frequency setting signal is incorrect. | Measure the input signal level. | _ |
| signal | The input signal lines are affected by external EMI. | Take countermeasures against EMI, such as using shielded wires for input signal lines. | 118 |
| | Pr.1 Maximum frequency, Pr.2 Minimum | Check the settings of Pr.1 , Pr.2 , and Pr.18 . | 428 |
| Parameter setting | frequency, Pr.18 High speed maximum frequency, and the calibration parameter C2 to C7 settings are not appropriate. | Check the calibration parameter C2 to C7 settings. | 505 |
| | Pr.31 to Pr.36 , and Pr.552 (frequency jump) settings are not appropriate. | Narrow down the range of frequency jump. | 429 |
| Load | | Reduce the load weight. | _ |
| Parameter setting | The stall prevention (torque limit) function is activated due to a heavy load. | Set Pr.22 Stall prevention operation level (Torque limit level) higher according to the load. (If Pr.22 is set too high, an overcurrent trip (E.OC[]) is likely to occur.) | 245, 431 |
| Motor | | Check the capacities of the inverter and the motor. | _ |

6.6.7 Acceleration/deceleration is not smooth

| Check point | Possible cause | Countermeasure | Refer to page |
|-------------------|--|--|---------------|
| | The acceleration/deceleration time is too short. | Increase the acceleration/deceleration time. | 367 |
| Dovemeter | The torque boost (Pr.0 , Pr.46 , Pr.112) setting is not appropriate under V/F control, so the stall prevention function is activated. | Increase/decrease the Pr.0 Torque boost setting value by 0.5% increments so that stall prevention does not occur. | 706 |
| Parameter setting | The base frequency does not match the motor characteristics. | Under V/F control, set Pr.3 Base frequency , Pr.47 Second V/F (base frequency), and Pr.113 Third V/F (base frequency). | 707 |
| | | Under Vector control, set Pr.84 Rated motor frequency. | 221 |
| | Regeneration avoidance operation is performed. | If the frequency becomes unstable during regeneration avoidance operation, decrease the setting of Pr.886 Regeneration avoidance voltage gain. | 732 |
| Load | | Reduce the load. | _ |
| Parameter setting | The stall prevention (torque limit) function is activated due to a heavy load. | Set Pr.22 Stall prevention operation level (Torque limit level) higher according to the load. (If Pr.22 is set too high, an overcurrent trip (E.OC[]) is likely to occur.) | 245, 431 |
| Motor | | Check the capacities of the inverter and the motor. | _ |

Speed varies during operation 6.6.8

Under Advanced magnetic flux vector control, Real sensorless vector control, Vector control, and encoder feedback control, the output frequency varies between 0 and 2 Hz as the load fluctuates. This is a normal operation and not a fault.

| Check point | Possible cause | Countermeasure | Refer to page |
|-----------------|--|---|---------------|
| Load | The load varies during an operation. | Select Advanced magnetic flux vector control, Real sensorless vector control, Vector control, or encoder feedback control. | 221, 736 |
| | The frequency setting signal is varying. | Check the frequency setting signal. | _ |
| | The frequency setting signal is affected by | Set filter to the analog input terminal using Pr.74 Input filter time constant , Pr.822 Speed setting filter 1. | 503 |
| | EMI. | Take countermeasures against EMI, such as using shielded wires for input signal lines. | 118 |
| Input signal | A malfunction is occurring due to the undesirable current generated when the transistor output unit is connected. | Use terminal PC (terminal SD when source logic) as a common terminal to prevent a malfunction caused by undesirable current. | 74 |
| | A multi-speed command signal is chattering. | Take countermeasures to suppress chattering. | _ |
| | The feedback signal from the encoder is affected by EMI. | Run the encoder cable away from any EMI source such as the main circuit and power supply voltage. Earth (ground) the shield of the encoder cable to the enclosure using a metal P-clip or U-clip. | 91 |
| | Fluctuation of power supply voltage is too large. | Under V/F control, change the Pr.19 Base frequency voltage setting (approximately by 3%). | 707 |
| | The Pr.80 Motor capacity and Pr.81 Number of motor poles settings are not appropriate for the motor capacity under Advanced magnetic flux vector control, Real sensorless vector control, Vector control, or PM sensorless vector control. | Check the settings of Pr.80 and Pr.81 . | 221 |
| Parameter | The wiring length exceeds 30 m when Advanced magnetic flux vector control, Real sensorless vector control, Vector control, or PM sensorless vector control is selected. | Perform offline auto tuning. | 532 |
| setting | Under V/F control, wiring is too long and a | In the low-speed range, adjust the Pr.0 Torque boost setting by 0.5% increments. | 706 |
| | voltage drop occurs. | Change the control method to Advanced magnetic flux vector control or Real sensorless vector control. | 221 |
| | Hunting occurs by the generated vibration, for example, when structural rigidity of the load is insufficient. | Disable automatic control functions, such as the energy saving operation, fast-response current limit operation, torque limit, regeneration avoidance function, Advanced magnetic flux vector control, Real sensorless vector control, Vector control, encoder feedback control, droop control, stall prevention, online auto tuning, notch filter, and orientation control. For PID control, set smaller values to Pr.129 PID proportional band and Pr.130 PID integral time . Lower the control gain to increase the stability. | _ |
| | | Change the Pr.72 PWM frequency selection setting. | 356 |

Operation mode is not changed properly 6.6.9

| Check point | Possible cause | Countermeasure | Refer to page |
|-----------------|---|--|---------------|
| Input signal | The start signal (STF or STR) is ON. | Check that the STF and STR signals are OFF. When either is ON, the operation mode cannot be changed. | 68, 722 |
| Parameter | The Pr.79 Operation mode selection setting is not appropriate. | When the Pr.79 is set to "0 (initial value)", the operation mode is the External operation mode at power ON. To switch to the PU operation mode, press the PU key on the operation panel (press the PU key on the parameter unit (FR-PU07)). At other settings (1 to 4, 6, 7), the operation mode is limited accordingly. | 389 |
| setting | Operation mode and a writing device do not correspond. | Check Pr.79 Operation mode selection, Pr.338 Communication operation command source, Pr.339 Communication speed command source, Pr.550 NET mode operation command source selection and Pr.551 PU mode operation command source selection, and select an operation mode suitable for the purpose. | 389, 400 |

6.6.10 Operation panel (FR-DU08) display is not operating

| Check point | Possible cause | Countermeasure | Refer to page |
|--|--|--|---------------|
| Main circuit, control circuit | The power is not input. | Input the power. | 46 |
| Front cover | The operation panel is not properly connected to the inverter. | Check if the inverter front cover is installed securely. | 33 |

6.6.11 The motor current is too large

| Check point | Possible cause | Countermeasure | Refer to page |
|-------------|--|---|---------------|
| | The torque boost (Pr.0 , Pr.46 , Pr.112) setting is not appropriate under V/F control, so the stall prevention function is activated. | Increase/decrease the Pr.0 Torque boost setting value by 0.5% increments so that stall prevention does not occur. | 706 |
| | The V/F pattern is not appropriate when V/F control is performed. (Pr.3, Pr.14, Pr.19) | Set the rated frequency of the motor to Pr.3 Base frequency . Use Pr.19 Base frequency voltage to set the base voltage (for example, rated motor voltage). | 707 |
| | | Change the Pr.14 Load pattern selection setting according to the load characteristic. | 708 |
| Parameter | | Reduce the load weight. | _ |
| setting | | Set Pr.22 Stall prevention operation level (Torque limit level)higher according to the load. (If Pr.22 is set too high, an overcurrent trip (E.OC[]) is likely to occur.) | 245, 431 |
| | | Check the capacities of the inverter and the motor. | _ |
| | | Perform offline auto tuning. | 532 |
| | When PM sensorless vector control is selected for an IPM motor other than MM-CF, offline auto tuning is not performed. | Perform offline auto tuning for the IPM motor. | 551 |

6.6.12 Speed does not accelerate

| Check point | Possible cause | Countermeasure | Refer to page |
|-------------------|--|--|---------------|
| | The start command or frequency command is chattering. | Check if the start command and the frequency command are correct. | _ |
| Input signal | The wiring length is too long for the analog frequency command, causing a voltage (current) drop. | Perform the bias and gain calibration for the analog input. | 505 |
| | The input signal lines are affected by external EMI. | Take countermeasures against EMI, such as using shielded wires for input signal lines. | 118 |
| | Pr.1 Maximum frequency, Pr.2 Minimum frequency, Pr.18 High speed | Check the settings of Pr.1 and Pr.2 . To operate at 120 Hz or higher, set Pr.18 High speed maximum frequency . | 428 |
| | maximum frequency, and the calibration parameter C2 to C7 settings are not appropriate. | Check the calibration parameter C2 to C7 settings. | 505 |
| | The maximum voltage (current) input value is not set during the External operation. (Pr.125, Pr.126, Pr.18) | Check the settings of Pr.125 Terminal 2 frequency setting gain frequency and Pr.126 Terminal 4 frequency setting gain frequency. To operate at 120 Hz or higher, set Pr.18. | 428, 505 |
| | The torque boost (Pr.0 , Pr.46 , Pr.112) setting is not appropriate under V/F control, so the stall prevention function is activated. | Increase/decrease the Pr.0 Torque boost setting value by 0.5% increments so that stall prevention does not occur. | 706 |
| | The V/F pattern is not appropriate when V/F control is performed. (Pr.3, Pr.14, Pr.19) | Set the rated frequency of the motor to Pr.3 Base frequency . Use Pr.19 Base frequency voltage to set the base voltage (for example, rated motor voltage). | 707 |
| Parameter setting | 1 control is perioritied. (11.0, 11.14, 11.10) | Change the Pr.14 Load pattern selection setting according to the load characteristic. | 708 |
| | | Reduce the load weight. | _ |
| | The stall prevention (torque limit) function is activated due to a heavy load. | Set Pr.22 Stall prevention operation level (Torque limit level) higher according to the load. (If Pr.22 is set too high, an overcurrent trip (E.OC[]) is likely to occur.) | 245, 431 |
| | | Check the capacities of the inverter and the motor. | _ |
| | Auto tuning is not performed under Advanced magnetic flux vector control, Real sensorless vector control, or Vector control. | Perform offline auto tuning. | 532 |
| | The setting of pulse train input is not appropriate. | Check the specification of the pulse generator (open collector output or complementary output) and check the adjustment of the pulse train and frequency (Pr.385 Frequency for zero input pulse and Pr.386 Frequency for maximum input pulse). | 406 |
| | During PID control, the output frequency is point. | automatically controlled so that the measured value equals the set | 601 |
| Main circuit | A brake resistor is connected across terminals P/+ and P1 or across P1 and PR by mistake. | Connect an optional brake resistor (FR-ABR) across terminals P/+ and PR. | 97 |

6.6.13 Unable to write parameter setting

| Check point | Possible cause | Countermeasure | Refer to page |
|-----------------|---|---|---------------|
| Input signal | Operation is being performed (the STF or STR signal is ON). | Stop the operation. When Pr.77 Parameter write selection = "0 (initial value)", writing is enabled only during a stop. | 345 |
| | Parameter setting was attempted in the External operation mode. | Choose the PU operation mode. Or, set Pr.77 Parameter write selection = "2" to enable parameter writing regardless of the operation mode. | 345, 389 |
| | Parameter write is disabled by the Pr.77 Parameter write selection setting. | Check the Pr.77 setting. | 345 |
| Parameter | The key lock mode is enabled by the Pr.161 Frequency setting/key lock operation selection setting. | Check the Pr.161 setting. | 341 |
| setting | Operation mode and a writing device do not correspond. | Check Pr.79 , Pr.338 , Pr.339 , Pr.550 and Pr.551 , and select an operation mode suitable for the purpose. | 389, 400 |
| | Under PM sensorless vector control, setting "25" in Pr.72 PWM frequency selection was attempted. Or, setting PM sensorless vector control was attempted while Pr.72 = "25". | Under PM sensorless vector control, "25" cannot be set in Pr.72 . (A sine wave filter (MT-BSL/BSC) cannot be used under PM sensorless vector control.) | 356 |

6.6.14 Power lamp is not lit

| Check point | Possible cause | Countermeasure | Refer to page |
|-----------------------------|---|--|---------------|
| Main circuit, control | The wiring or installation is inadequate. | Check for secure wiring and installation. The power lamp is lit when power is supplied to the control circuit (R1/ | 54 |
| circuit | | L11, S1/L21). | |

MEMO

CHAPTER 7 PRECAUTIONS FOR **MAINTENANCE AND INSPECTION**

| 7.1 | Inspection item | .812 |
|-----|--|------|
| 7.2 | Measurement of main circuit voltages, currents, and powers | .821 |

7 PRECAUTIONS FOR MAINTENANCE AND INSPECTION

This chapter explains the precautions for maintenance and inspection of this product.

Always read the instructions before use.

For the precautions for maintenance and inspection of the separated converter type inverter, refer to the FR-A802 (Separated Converter Type) Instruction Manual (Hardware).

For the precautions for maintenance and inspection of the IP55 compatible model inverter, refer to the FR-A806 (IP55/UL Type 12 specification) Instruction Manual (Hardware).

7.1 Inspection item

The inverter is a static unit mainly consisting of semiconductor devices. Daily inspection must be performed to prevent any fault from occurring due to the adverse effects of the operating environment, such as temperature, humidity, dust, dirt and vibration, changes in the parts with time, service life, and other factors.

◆ Precautions for maintenance and inspection

When accessing the inverter for inspection, wait for at least 10 minutes after the power supply has been switched OFF. Then, make sure that the voltage across the main circuit terminals P/+ and N/- on the inverter is not more than 30 VDC using a digital multimeter, etc.

7.1.1 Daily inspection

Basically, check for the following faults during operation.

- · Motor operation fault
- · Improper installation environment
- · Cooling system fault
- · Abnormal vibration, abnormal noise
- · Abnormal overheat, discoloration

7.1.2 Periodic inspection

Check the areas inaccessible during operation and requiring periodic inspection. Consult us for periodic inspection.

Check and clean the cooling system: Clean the air filter, etc.

Check the tightening and retighten: The screws and bolts may become loose due to vibration, temperature

changes, etc. Check and tighten them. Tighten them according to the specified

tightening torque. (Refer to page 57.)

Check the conductors and insulating materials for corrosion and damage.

Measure the insulation resistance.

Check and change the cooling fan and relay.



 When using the safety stop function, periodic inspection is required to confirm that safety function of the safety system operates correctly. For more details, refer to the Safety Stop Function Instruction Manual.

7.1.3 Daily and periodic inspection

| Area of | lı | nspection | Description | | pection nterval | Corrective action at fault | Check by | | | |
|-----------------------------|---------------------------------------|-------------------------|---|-------|--------------------|--|----------|---|--|--|
| inspection | | item | | Daily | Periodic*3 | occurrence | user | | | |
| | | rounding | Check the surrounding air temperature, humidity, dirt, corrosive gas, oil mist, etc. | 0 | | Improve the environment. | | | | |
| General | | vironment erall unit | Check for unusual vibration and noise. | 0 | | Check fault location and retighten. | | | | |
| | | | Check for dirt, oil, and other foreign material.*1 | 0 | | Clean. | | | | |
| | | wer supply tage | Check that the main circuit voltage and control circuit voltage are normal.*2 | 0 | | Inspect the power supply. | | | | |
| | | | Check with megger (between main circuit terminals and earth (ground) terminal). | | 0 | Contact the manufacturer. | | | | |
| | Ge | neral | Check for loose screws and bolts. Check for overheat traces on the parts. | | 0 | Retighten. Contact the | | | | |
| | | | Check for stains. | | 0 | manufacturer. Clean. | | | | |
| | Coi | nductors and | Check conductors for distortion. | | 0 | Contact the manufacturer. | | | | |
| | cab | oles | Check cable sheaths for breakage and deterioration (crack, discoloration, etc.). | | 0 | Contact the manufacturer. | | | | |
| | | nsformer/ ctor | Check for unusual odor and abnormal increase of whining sound. | 0 | | Stop the equipment and contact the manufacturer. | | | | |
| Main circuit | Ter | minal block | Check for a damage. | | 0 | Stop the equipment and contact the manufacturer. | | | | |
| | Sm | oothing | Check for liquid leakage. | | 0 | Contact the manufacturer. | | | | |
| | aluminum electrolytic capacitor | | Check for safety valve projection and bulge. | | 0 | Contact the manufacturer. | | | | |
| | | | Visual check and judge by the life check of the main circuit capacitor. (Refer to page 815.) | | 0 | | | | | |
| | Rel | ay/contactor | Check that the operation is normal and no chattering sound is heard. | | 0 | Contact the manufacturer. | | | | |
| | Res | sistor | Check for cracks in the resistor insulator. | | 0 | Contact the manufacturer. | | | | |
| | | | Check for a break in the cable. | | 0 | Contact the manufacturer. | | | | |
| | | eration | Check for an output voltage imbalance between phases while operating the inverter alone. | | 0 | Contact the manufacturer. | | | | |
| | che | СК | Check that no fault is found in protective and display circuits in a sequence protective operation test. | | 0 | Contact the manufacturer. | | | | |
| Control circuit, protection | heck | heck | check | heck | Overall | Check for unusual odor and discoloration. | | 0 | Stop the equipment and contact the manufacturer. | |
| circuit | nents | | Check for serious rust development. | | 0 | Contact the manufacturer. | | | | |
| | Components | Aluminum electrolytic | Check for liquid leakage in a capacitor and deformation trace. | | 0 | Contact the manufacturer. | | | | |
| | | capacitor | Visual check and judge by the life check of the control circuit capacitor. (Refer to page 815.) | | 0 | | | | | |
| | Ca | oling for | Check for unusual vibration and noise. Check for loose sersive and helts. | 0 | | Replace the fan. Fix with the fan | | | | |
| Cooling system | U00 | oling fan | Check for loose screws and bolts. Check for stains. | | 0 | cover fixing screws. Clean. | | | | |
| | | | Check for stains. Check for clogging. | | 0 | Clean. | | | | |
| | Hea | at sink | Check for stains. | | 0 | Clean. | | | | |

| Area of inspection | Inspection item | Description | | pection iterval | Corrective action at fault | Check by user |
|--------------------|--------------------|---|-------|--------------------|--|---------------|
| inspection | iteiii | | Daily | Periodic*3 | occurrence | usei |
| | Indication | Check that indications are correct. | 0 | | Contact the manufacturer. | |
| | | Check for stains. | | 0 | Clean. | |
| Display | Meter/counter | Check that readouts are correct. | 0 | | Stop the equipment and contact the manufacturer. | |
| Load motor | Operation check | Check for vibration and abnormal increase in operation noise. | 0 | | Stop the equipment and contact the manufacturer. | |

^{*1} Oil component of the heat dissipation grease used inside the inverter may leak out. The oil component, however, is not flammable, corrosive, nor conductive and is not harmful to humans. Wipe off such oil component.

^{*3} One to two years of periodic inspection cycle is recommended. However, it differs according to the installation environment. Consult us for periodic inspection.



• Continuous use of a leaked, deformed, or degraded smoothing aluminum electrolytic capacitor (as shown in the table above) may lead to a burst, breakage, or fire. Replace such capacitor without delay.

7.1.4 Checking the inverter and converter modules

Preparation

- Disconnect the external power supply cables (R/L1, S/L2, T/L3) and motor cables (U, V, W).
- Prepare a continuity tester. (For the resistance measurement, use the 100 Ω range.)

Checking method

Change the polarity of the tester alternately at the inverter terminals R/L1, S/L2, T/L3, U, V, W, P/+, and N/- and check the electric continuity.



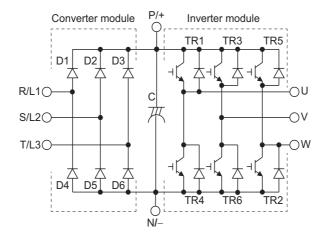
- · Before measurement, check that the smoothing capacitor is discharged.
- At the time of electric discontinuity, the measured value is almost ∞. When there is an instantaneous electric continuity, due
 to the smoothing capacitor, the tester may not indicate ∞. At the time of electric continuity, the measured value is several Ω to
 several tens of Ω. When all measured values are almost the same (although values may not be constant depending on the
 tester type), it shows that there are no electrical paths with problems.

◆ Module device numbers and terminals to be checked

| | | Tester | polarity | Continuity | | Tester | polarity | Continuity | |
|------------------|------|--------|----------|------------|-------|----------|----------|------------|--|
| | D1 | | θ | Continuity | | \oplus | θ | Continuity | |
| | D1 | R/L1 | P/+ | No | D4 | R/L1 | N/- | Yes | |
| | וט | P/+ | R/L1 | Yes | D4 | N/- | R/L1 | No | |
| Converter module | D2 | S/L2 | P/+ | No | D5 | S/L2 | N/- | Yes | |
| Converter module | DZ | P/+ | S/L2 | Yes | D3 | N/- | S/L2 | No | |
| | D3 | T/L3 | P/+ | No | D6 | T/L3 | N/- | Yes | |
| | | P/+ | T/L3 | Yes | DO | N/- | T/L3 | No | |
| | TR1 | U | P/+ | No | TR4 | U | N/- | Yes | |
| | IIXI | P/+ | U | Yes | 11114 | N/- | U | No | |
| Inverter module | TR3 | V | P/+ | No | TR6 | V | N/- | Yes | |
| inverter module | 1173 | P/+ | V | Yes | 110 | N/- | V | No | |
| | TR5 | W | P/+ | No | TR2 | W | N/- | Yes | |
| | IKS | P/+ | W | Yes | 1172 | N/- | W | No | |

(Assuming that an analog meter is used.)

^{*2} It is recommended to install a voltage monitoring device for checking the voltage of the power supplied to the inverter.



7.1.5 Cleaning

Always run the inverter in a clean status.

When cleaning the inverter, gently wipe dirty areas with a soft cloth immersed in neutral detergent or ethanol.



- Do not use solvent, such as acetone, benzene, toluene and alcohol, as these will cause the inverter surface paint to peel off.
- The display, etc. of the operation panel (FR-DU08) and parameter unit (FR-PU07) are vulnerable to detergent and alcohol. Therefore, avoid using them for cleaning.

7.1.6 Replacement of parts

The inverter consists of many electronic parts such as semiconductor devices.

The following parts may deteriorate with age because of their structures or physical characteristics, leading to reduced performance or fault of the inverter. For preventive maintenance, the parts must be replaced periodically. Use the life check function as a guidance of parts replacement.

| Part name | Estimated lifespan*1 | Description | | | | | |
|---|------------------------|----------------------------------|--|--|--|--|--|
| Cooling fan | 10 years | Replace (as required) | | | | | |
| Main circuit smoothing capacitor | 10 years ^{*2} | Replace (as required) | | | | | |
| On-board smoothing capacitor | 10 years ^{*2} | Replace the board (as required). | | | | | |
| Relays | _ | As required | | | | | |
| Main circuit fuse inside the inverter (FR-A840-04320(160K) or higher) | 10 years | Replace (as required) | | | | | |

- *1 Estimated lifespan for when the yearly average surrounding air temperature is 40°C. (without corrosive gas, flammable gas, oil mist, dust and dirt etc.)
- *2 Output current: 80% of the inverter rating



• For parts replacement, contact the nearest Mitsubishi FA center.

◆ Inverter parts life display

The inverter diagnoses the main circuit capacitor, control circuit capacitor, cooling fan, and inrush current limit circuit by itself and estimates their lives.

The self-diagnostic warning is output when the life span of each part is near its end. It gives an indication of replacement time. **Guideline for life judgment using the life warning output**

| Part | Judgment level |
|------------------------------|---|
| Main circuit capacitor | 85% of the initial capacity |
| Control circuit capacitor | Estimated remaining life 10% |
| Inrush current limit circuit | Estimated remaining life 10% (Power ON: 100,000 times left) |
| Cooling fan | Less than the specified speed |



• Refer to page 359 to perform the life check of the inverter parts.

Replacement procedure of the cooling fan

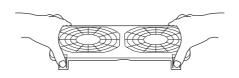
The replacement interval of the cooling fan used for cooling the parts generating heat such as the main circuit semiconductor is greatly affected by the surrounding air temperature. When unusual noise and/or vibration are noticed during inspection, the cooling fan must be replaced immediately.

■ Removal (FR-A820-00105(1.5K) to 04750(90K), FR-A840-00083(2.2K) to 03610(132K))

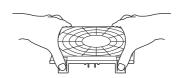
1. Push the hooks from above and remove the fan cover.



FR-A820-00105(1.5K) to 00250(3.7K) FR-A840-00083(2.2K), 00126(3.7K)

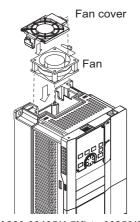


FR-A820-00340(5.5K) to 01540(30K) FR-A840-00170(5.5K) to 00770(30K)

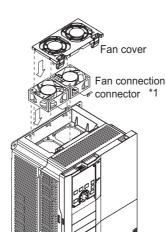


FR-A820-01870(37K) or higher FR-A840-00930(37K) to 03610(132K)

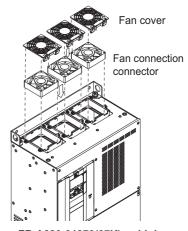
- **2.** Disconnect the fan connectors.
- **3.** Remove the fan.



FR-A820-00105(1.5K) to 00250(3.7K) FR-A840-00083(2.2K), 00126(3.7K)



FR-A820-00340(5.5K) to 01540(30K) FR-A840-00170(5.5K) to 00770(30K)

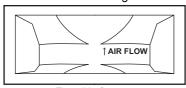


FR-A820-01870(37K) or higher FR-A840-00930(37K) to 03610(132K)

*1 The number of cooling fans differs according to the inverter capacity.

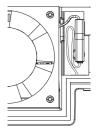
■ Installation (FR-A820-00105(1.5K) to 04750(90K), FR-A840-00083(2.2K) to 03610(132K))

1. After confirming the orientation of the fan, install the fan so that the "AIR FLOW" arrow faces up.

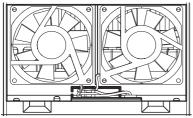


<Fan side face>

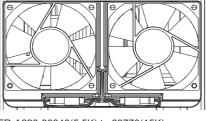
2. Connect the fan connectors.



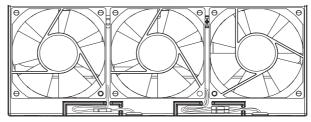
FR-A820-00105(1.5K) to 00250(3.7K) FR-A840-00083(2.2K), 00126(3.7K)



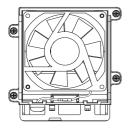
FR-A820-00930(18.5K), 01250(22K) FR-A840-00470(18.5K), 00620(22K)



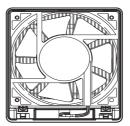
FR-A820-00340(5.5K) to 00770(15K) FR-A840-00170(5.5K) to 00380(15K)



FR-A820-01540(30K) FR-A840-00770(30K)

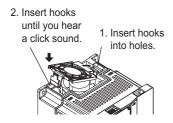


FR-A820-01870(37K), 02330(45K) FR-A840-00930(37K) to 01800(55K)

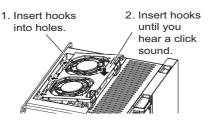


FR-A820-03160(55K) or higher FR-A840-02160(75K) to 03610(132K)

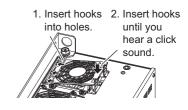
3. Install the fan cover.



FR-A820-00105(1.5K) to 00250(3.7K) FR-A840-00083(2.2K), 00126(3.7K)



FR-A820-00340(5.5K) to 01540(30K) FR-A840-00170(5.5K) to 00770(30K)



FR-A820-01870(37K) or higher FR-A840-00930(37K) to 03610(132K)

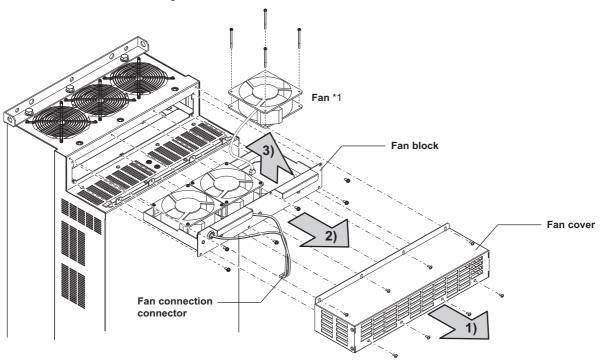
NOTE

- Installing the fan in the opposite direction of air flow may shorten the inverter life.
- Ensure that the cables are not caught when the fan is installed.
- Switch OFF the power before starting the fan replacement work. To prevent an electric shock accident, keep the inverter with its covers on during fans replacement since the inverter circuits are charged with voltage even after power OFF.

■ Removal (FR-A840-04320(160K) or higher)

- **1.** Remove the fan cover fixing screws, and remove the fan cover.
- **2.** Disconnect the fan connector and remove the fan block.

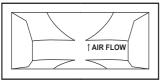
3. Remove the fan fixing screws, and remove the fan.



*1 The number of cooling fans differs according to the inverter capacity

■ Installation (FR-A840-04320(160K) or higher)

After confirming the orientation of the fan, install the fan so that the "AIR FLOW" arrow faces up.



<Fan side face>

2. Install fans referring to the above figure.

The tightening torque of the fan fixing screws is 0.73 N·m.



- Installing the fan in the opposite direction of air flow may shorten the inverter life.
- Ensure that the cables are not caught when the fan is installed.
- · Switch OFF the power before starting the fan replacement work. To prevent an electric shock accident, keep the inverter with its covers on during fans replacement since the inverter circuits are charged with voltage even after power OFF.

Smoothing capacitors

A large-capacity aluminum electrolytic capacitor is used for smoothing in the DC section of the main circuit, and an aluminum electrolytic capacitor is used for stabilizing the control power in the control circuit. Adverse effects from ripple currents deteriorate capacitors. Replacement intervals of capacitors vary greatly with surrounding temperatures and operating conditions. Replace them roughly every 10 years when used in normal air-conditioned environments. Inspecting the product visually:

- · Case: Check that the sides and bottom of the capacitor have not ruptured.
- · Rubber seal: Check for any noticeable bulging or severe cracks.
- · Check for external cracks, discoloration, leakage, etc. It is assumed that the capacitor has reached the end of its life when its capacity has dropped below 80% of its rated capacity.



The inverter diagnoses the main circuit capacitor and control circuit capacitor by itself and estimates its remaining life. (Refer to page 359.)

Relay output terminals

- The contacts of relays deteriorate over time. To prevent faults from occurring, relays must be replaced when they have reached the maximum of switching operations (switching life).
- The control terminal block must be replaced (refer to page 819) in case of failure of either relay between the relay output terminals C1 and B1 or A1, or terminals C2 and B2 or A2. After replacing the control terminal block, connect the jumper connector to the correct position in accordance with the control logic of input signals. (Refer to page 72.)

◆ Main circuit fuse inside the inverter (FR-A840-04320(160K) or higher)

Fuses are used in some inverters. Replacement intervals of fuses vary greatly with surrounding temperatures and operating conditions. Replace them roughly every 10 years when used in normal air-conditioned environments.

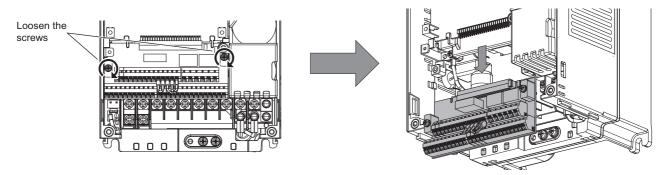
7.1.7 Removal and reinstallation of the control circuit terminal block

This product has a removable control circuit terminal block, which can be replaced with a new one or a control terminal option.

◆ Removal and reinstallation

1. Loosen the two installation screws at the both side of the control circuit terminal block. (These screws cannot be removed.)

Slide down the control circuit terminal block to remove it.



2. Be careful not to bend the pins of the inverter's control circuit connector, reinstall the control circuit terminal block and fix it with the mounting screws.



• Before starting the replacement, power OFF the inverter, wait for at least 10 minutes, and then check that the charge lamp is OFF to ensure safety.

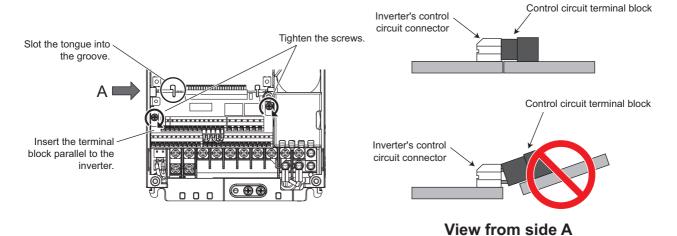
◆ Removal and reinstallation precautions

The following are the precautions to remove or reinstall the control circuit terminal block. Observe the following precautions and handle the inverter properly to avoid malfunctions or failures.

- · To remove or reinstall the control circuit terminal block, keep it upright so that it is parallel with the inverter.
- To install the control circuit terminal block, slide it upward so that the tongues on the inverter slot into the grooves on the terminal block.

• Check that the terminal block is parallel to the inverter and the pins on the inverter control circuit connector are not bent.

After checking proper connection, fix the terminal block in place with two screws.





- Do not tilt the terminal block while tightening the screws or removing it from the inverter. (Otherwise, a stress applied to the control circuit terminal block or the control circuit connector may cause damage to them.)
- After replacing the control terminal block, connect the jumper connector to the correct position in accordance with the control logic of input signals. (Refer to page 72.)

7.2 Measurement of main circuit voltages, currents, and powers

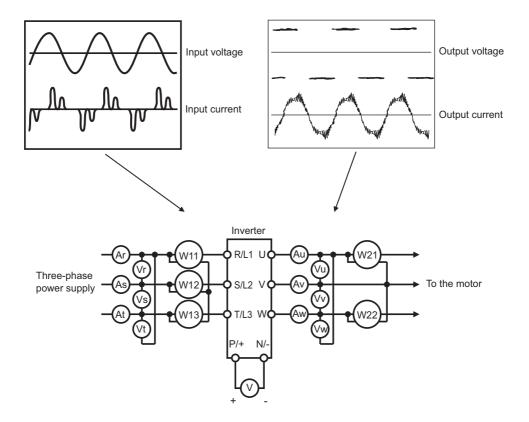
Since the voltages and currents on the inverter power supply and output sides include harmonics, measurement data depends on the instruments used and circuits measured. When instruments for commercial frequency are used for measurement, measure the following circuits with the instruments given on the next page.



• When installing meters etc. on the inverter output side

When the inverter-to-motor wiring length is long, especially in the 400 V class, small-capacity models, the meters and CTs may generate heat due to line-to-line leakage current. Therefore, choose the equipment which has enough allowance for the current rating.

To measure and display the output voltage and output current of the inverter, it is recommended to use the terminal AM and FM/CA output functions of the inverter.



♦ Measuring points and instruments

| Item | Measuring point | Measuring instrument | Remarks (reference measure | d value) | | | | |
|---|---|--|--|--|--|--|--|--|
| Input voltage V1 | Between R/L1 and S/L2, S/L2 and T/L3, and T/L3 and R/L1 | | Commercial power Within permissible AC voltage fluctua page 826.) | tion. (Refer to | | | | |
| Input current | Line current at R/L1, S/L2, and T/L3 | Digital power meter (designed for inverter) | | | | | | |
| Input power P1 | At R/L1, S/L2, and T/L3, and between R/L1 and S/ L2, S/L2 and T/L3, and T/ L3 and R/L1 | involter) | P1 = W11 + W12 + W13 (3-wattmete | er method) | | | | |
| | Calculate after measuring i | nput voltage, input current and inp | ut power. | | | | | |
| Input power factor Pf1 | $Pf_1 = \frac{P_1}{\sqrt{3}V_{1 \times I_1}}$ | x 100% | | | | | | |
| Output voltage V2 | Between U and V, V and W, and W and U | Digital power meter (designed for inverter)*1 | Difference between the phases must of the maximum output voltage. | be within 1% | | | | |
| Output current I2 | Line current at U, V, and W | Digital power meter (designed for | Difference between the phases must 10%. | be within | | | | |
| Output power P2 | At U, V, and W, and between U and V, and V and W | inverter) | P2 = W21 + W22 2-wattmeter method (or 3-wattmeter | method) | | | | |
| Output power factor Pf2 | Calculate in similar manner $Pf_2 = \frac{P_2}{\sqrt{3}V_2 \times I_2}$ | • • | | | | | | |
| Converter output | Between P/+ and N/- | Digital multimeter or other tester | Inverter LED indication 1.35 × V1 | | | | | |
| Frequency setting | 2, and between 4(+) and 5 | | 0 to 10 VDC, 4 to 20 mA | | | | | |
| signal | Between 1(+) and 5 | | 0 to ±5 VDC and 0 to ±10 VDC | | | | | |
| Power supply for a | Between 10(+) and 5 | | 5.2 VDC | | | | | |
| frequency setting potentiometer | Between 10E(+) and 5 | | 10 VDC | Terminal 5 is a common terminal. | | | | |
| | Between AM(+) and 5 | | Approximately 10 VDC at maximum frequency (without frequency meter) | | | | | |
| | Between CA(+) and 5 | | Approximately 20 mADC at maximum frequency | | | | | |
| Frequency meter signal | Between FM(+) and SD | Digital multimeter or other tester, or moving-coil type instrument (internal resistance 50 k Ω or more) | Approximately 5 VDC at maximum frequency (without frequency meter) T1 8 VDC Pulse width T1: Adjust with C0 (Pr.900). Pulse cycle T2: Set with Pr.55 (for frequency monitor only). Voltage when terminal is open: 20 to 30 VDC. Voltage when signal is ON: 1 V or less. | | | | | |
| Start signal, selection signal, reset signal, output stop signal | Between STF, STR, RH, RM, RL, JOG, RT, AU, STP (STOP), CS, RES, or MRS(+) and SD (for sink logic) | | | | | | | |
| Fault signal | Between A1 and C1 Between B1 and C1 | Digital multimeter or other tester | Continuity check*2 Normal: discontinuity across A1 and across B1 and C1) Fault: continuity across A1 and C1 (cacross B1 and C1) | , | | | | |

^{*1} Use an FFT to measure the output voltage accurately. A digital multimeter or general measuring instrument cannot measure accurately.

^{*2} When the setting of Pr.195 ABC1 terminal function selection is the positive logic.

7.2.1 Measurement of powers

Use digital power meters (for inverter) both on the inverter's input and output sides.

7.2.2 Measurement of voltages

◆ Inverter input side

Use a digital power meter (for inverter) on the inverter's input side.

◆ Inverter output side

When using a measuring instrument, use a digital power meter for inverters as the inverter outputs PWM-controlled square wave voltage. The value monitored on the operation panel is the inverter-controlled voltage itself. Monitoring values via the operation panel or by outputting the analog signal is recommended as these values are accurate.

7.2.3 Measurement of currents

Use a digital power meter (for inverter) both on the inverter's input and output sides.

Since the inverter input current tends to be unbalanced, measurement of three phases is recommended. The correct value cannot be obtained by measuring only one or two phases. On the other hand, the unbalanced ratio of each phase of the output current should be within 10%.

The inverter output current can be monitored on the operation panel. The value displayed on the operation panel is accurate even if the output frequency varies. Hence, it is recommended to monitor values on the operation panel.

7.2.4 Measurement of inverter input power factor

Calculate the factor from the effective power and the apparent power. A power-factor meter cannot indicate an exact value.

Total power factor of the inverter =

Effective power
Apparent power

Three-phase input power found by the 3-wattmeter method

 $\sqrt{3}$ ×V (power supply voltage) × I (input current effective value)

7.2.5 Measurement of converter output voltage (between terminals P and N)

The output voltage of the converter can be measured with a voltmeter (such as a digital multimeter) between terminals P and N. The voltage varies according to the power supply voltage. Approximately 270 to 300 VDC (540 to 600 VDC for the 400 V class) is output when no load is connected. The voltage decreases when a load is applied.

When energy is regenerated from the motor during deceleration, for example, the converter output voltage rises to nearly 400 to 450 VDC (800 to 900 VDC for the 400 V class) maximum.

7.2.6 Measurement of inverter output frequency

In the initial setting of the FM type inverter, a pulse train proportional to the output frequency is output across the pulse train output terminals FM and SD on the inverter. This pulse train output can be counted by a frequency counter, or a digital multimeter can be used to read the mean value of the pulse train output voltage. When a digital multimeter is used to measure the output frequency, approximately 5 VDC is indicated at the maximum frequency.

For detailed specifications of the pulse train output terminal FM, refer to page 463.

In the initial setting of the CA type inverter, a pulse train proportional to the output frequency is output across the analog current output terminals CA and 5 on the inverter. Measure the current using a digital multimeter.

For detailed specifications of the analog current output terminal CA, refer to page 465.

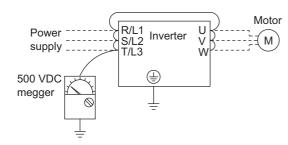
7.2.7 Insulation resistance test using megger

• For the inverter, conduct the insulation resistance test on the main circuit only as follows and do not perform the test on the control circuit.

(Use a 500 VDC megger.)



- Before performing the insulation resistance test on the external circuit, disconnect the cables from all terminals of the inverter so that the test voltage is not applied to the inverter.
- · For the continuity test of the control circuit, use a tester for high resistance range and do not use the megger or buzzer.



7.2.8 Withstand voltage test

Do not conduct a withstand voltage test. Deterioration may occur.

CHAPTER 8 SPECIFICATIONS

| 8.1 | Inverter rating | .826 |
|-----|----------------------------|------|
| 8.2 | Motor rating | .829 |
| 8.3 | Common specifications | .835 |
| 8.4 | Outline dimension drawings | .837 |

SPECIFICATIONS

This chapter explains the specifications of this product.

Always read the instructions before use.

For the separated converter type inverter, refer to "SPECIFICATIONS" in the FR-A802 (Separated Converter Type) Instruction Manual (Hardware).

For the IP55 compatible model inverter, refer to "SPECIFICATIONS" in the FR-A806 (IP55/UL Type12 specification) Instruction Manual (Hardware).

8.1 **Inverter rating**

◆ 200 V class

| | Mod | lel FR-A820- | п | 00046 | 00077 | 00105 | 00167 | 00250 | 00340 | 00490 | 00630 | 00770 | 00930 | 01250 | 01540 | 01870 | 02330 | 03160 | 03800 | 04750 |
|--------------|---|------------------------|-------------------------------|--|--|-------------|--------------|------------|--------------|------------|------------|------------|------------|-------------|------------|------------|------------|------------|------------|----------|
| | IVIOU | IEI FK-A02U | ·n | 0.4K | 0.75K | 1.5K | 2.2K | 3.7K | 5.5K | 7.5K | 11K | 15K | 18.5K | 22K | 30K | 37K | 45K | 55K | 75K | 90K |
| | | SLD | | 0.75 | 1.5 | 2.2 | 3.7 | 5.5 | 7.5 | 11 | 15 | 18.5 | 22 | 30 | 37 | 45 | 55 | 75 | 90/ 110 | 132 |
| | licable motor | LD | | 0.75 | 1.5 | 2.2 | 3.7 | 5.5 | 7.5 | 11 | 15 | 18.5 | 22 | 30 | 37 | 45 | 55 | 75 | 90 | 110 |
| cap | acity (kW)*1 | ND (initial se | etting) | 0.4 | 0.75 | 1.5 | 2.2 | 3.7 | 5.5 | 7.5 | 11 | 15 | 18.5 | 22 | 30 | 37 | 45 | 55 | 75 | 90 |
| | | HD | | 0.2*2 | 0.4 | 0.75 | 1.5 | 2.2 | 3.7 | 5.5 | 7.5 | 11 | 15 | 18.5 | 22 | 30 | 37 | 45 | 55 | 75 |
| | | SLD | | 1.8 | 2.9 | 4 | 6.4 | 10 | 13 | 19 | 24 | 29 | 35 | 48 | 59 | 71 | 89 | 120 | 145 | 181 |
| | Rated | LD | | 1.6 | 2.7 | 3.7 | 5.8 | 8.8 | 12 | 17 | 22 | 27 | 32 | 43 | 53 | 65 | 81 | 110 | 132 | 165 |
| | (KVA) | ND (initial se | etting) | 1.1 | 1.9 | 3 | 4.2 | 6.7 | 9.1 | 13 | 18 | 23 | 29 | 34 | 44 | 55 | 67 | 82 | 110 | 132 |
| | | HD | | 0.6 | 1.1 | 1.9 | 3 | 4.2 | 6.7 | 9.1 | 13 | 18 | 23 | 29 | 34 | 44 | 55 | 67 | 82 | 110 |
| | | SLD | | 4.6 | 7.7 | 10.5 | 16.7 | 25 | 34 | 49 | 63 | 77 | 93 | 125 | 154 | 187 | 233 | 316 | 380 | 475 |
| | Rated | LD | | 4.2 | 7 | 9.6 | 15.2 | 23 | 31 | 45 | 58 | 70.5 | 85 | 114 | 140 | 170 | 212 | 288 | 346 | 432 |
| | current (A) | ND (initial se | etting) | 3 | 5 | 8 | 11 | 17.5 | 24 | 33 | 46 | 61 | 76 | 90 | 115 | 145 | 175 | 215 | 288 | 346 |
| | | HD | | 1.5 | 3 | 5 | 8 | 11 | 17.5 | 24 | 33 | 46 | 61 | 76 | 90 | 115 | 145 | 175 | 215 | 288 |
| Output | Overlead | SLD | | 110% | 60 s, 1 | 20% 3 | s (inve | rse-tim | e char | acterist | ics) at | surrour | nding a | ir temp | erature | e of 40° | ,C | | | |
| <u>o</u> | current | LD | | | 60 s, 1 | | • | | | | | | | | | | | | | |
| | rating*4 | ND (initial se | etting) | | 60 s, 2 | | • | | | | | | | | | | | | | |
| | ·g | HD | | 200% | 60 s, 2 | 50% 3 | s (inve | rse-tim | e char | acterist | ics) at | surrour | nding a | ir temp | erature | e of 50° | ,C | | | |
| | Rated voltage | *5 | | Three | -phase | 200 to | 240 V | | | | | | | | | | | | | |
| | | Brake transi | stor | Built-ir | า | | | | | | | | | | FR-BU | J2 (opti | on) | | | |
| | Regenerative | Maximum brake torque*7 | | | torque, | 3% | | torque, | | | 20% ta | oralie (| continu | OUE | | | | | 10% to | |
| | braking | | | ED*6 | 3% ED*6 2% ED*6 20% torque, continuous | | | | | | ous | | continuous | | | | | | | |
| | Ü | | | | 50% torque, 100% torque, 10% ED | | | | | | | | | _ | _ | _ | | | | |
| | ABR is used | | | | 10 % ED | | | | | | | | | | | | | | | |
| | Rated input AC voltage/frequency | | | Three-phase 200 to 240 V, 50/60 Hz 170 to 264 V, 50/60 Hz | | | | | | | | | | | | | | | | |
| | Permissible AC voltage fluctuation | | 170 to 264 V, 50/60 Hz ±5% | | | | | | | | | | | | | | | | | |
| | Permissible frequency fluctuation | | 5.3 | 8.9 | 13.2 | 19.7 | 31.3 | 45.1 | 62.8 | 80.6 | 96.7 | 115 | 151 | 185 | 221 | 269 | | | | |
| | | Without DC reactor | LD | 5.5 | 8.3 | 12.2 | 18.3 | 28.5 | 45.1 41.6 | 58.2 | 74.8 | 90.9 | 106 | 139 | 178 | 207 | 255 | | | |
| | | | ND (initial | | 0.0 | | | | | | 74.0 | | 100 | | | | | | | |
| | | | setting) | 3.9 | 6.3 | 10.6 | | 22.6 | 33.4 | 44.2 | 60.9 | 80 | 96.3 | 113 | 150 | 181 | 216 | 266 | _ | |
| | Rated input current (A)*8 | | SLD | 2.3 4.6 | 3.9 7.7 | 6.3 10.5 | 10.6 16.7 | 14.1 25 | 22.6 34 | 33.4 49 | 44.2 63 | 60.9 77 | 80 93 | 96.3 125 | 113 154 | 150 187 | 181 233 | 216 316 | — 380 | — 475 |
| | current (A) | | LD | 4.0 | 7.1 | 9.6 | 15.2 | 23 | 31 | 49 45 | 58 | 70.5 | 95 85 | 114 | 140 | 170 | 212 | 288 | 346 | 432 |
| p I | | With DC | ND (initial | | , | | | | | | | | | | | | | | | |
| Power supply | | reactor | setting) | 3 | | 8 | 11 | 17.5 | 24 | 33 | 46 | 61 | 76 | 90 | 115 | 145 | 175 | 215 | 288 | 346 |
| Š | | | HD SLD | 1.5 2 | 3 3.4 | 5 5 | 8 | 11 12 | 17.5 | 24 24 | 33 31 | 46 37 | 61 44 | 76 58 | 90 70 | 115 84 | 145 103 | 175 | 215 | 288 |
| ۳ | | | | 1.9 | - | 5 4.7 | 7.5 7 | 11 | 17 16 | 24 22 | 29 | 3 <i>1</i> | | 58 53 | 68 | 84 79 | | _ | _ | |
| | | Without DC | LD ND (initial | 1.9 | 3.2 | 4.7 | 1 | 11 | 10 | 22 | 29 | აⴢ | 41 | ეა | 00 | 19 | 97 | _ | | |
| | Powersupply | reactor | setting) | 1.5 | 2.4 | 4 | 5.4 | 8.6 | 13 | 17 | 23 | 30 | 37 | 43 | 57 | 69 | 82 | 101 | _ | _ |
| | capacity | | HD | 0.9 | 1.5 | 2.4 | 4 | 5.4 | 8.6 | 13 | 17 | 23 | 30 | 37 | 43 | 57 | 69 | 82 | | _ |
| | (kVA) ^{*9} | | SLD | 1.8 | 2.9 | 4 | 6.4 | 10 | 13 | 19 | 24 | 29 | 35 | 48 | 59 | 71 | 89 | 120 | 145 | 181 |
| | | With DC | LD (initial | 1.6 | 2.7 | 3.7 | 5.8 | 8.8 | 12 | 17 | 22 | 27 | 32 | 43 | 53 | 65 | 81 | 110 | 132 | 165 |
| | | reactor | ND (initial setting) | 1.1 | 1.9 | 3 | 4.2 | 6.7 | 9.1 | 13 | 18 | 23 | 29 | 34 | 44 | 55 | 67 | 82 | 110 | 132 |
| | | | | 0.6 | 1.1 | 1.9 | 3 | 4.2 | 6.7 | 9.1 | 13 | 18 | 23 | 29 | 34 | 44 | 55 | 67 | 82 | 110 |
| | | | HD | _ | | | | | | | | | | | _ | | | | | |
| Prof | tection rating | of structure (| | _ | sed type | е | | | | | | | | | Open | type (II | P00) | | | |
| Coc | tection rating of bling system brox. mass (kg | , | | Enclos Natura | sed type | Force | | 3.4 | 6.7 | 6.7 | 8.3 | 15.5 | 15.5 | 15.5 | Open 22 | type (IF | P00) | 54 | 74 | 74 |

^{*1} The applicable motor capacity indicated is the maximum capacity applicable for use of the Mitsubishi Electric standard 4-pole motor.

- *2 A 0.2 kW motor can be operated under V/F control only.
- *3 The rated output capacity is the value with respect to 220 V output voltage.
- *4 The percentage of the overload current rating is the ratio of the overload current to the inverter's rated output current. For repeated duty, allow time for the inverter and motor to return to or below the temperatures under 100% load.
- *5 The maximum output voltage does not exceed the power supply voltage. The maximum output voltage can be changed within the setting range.
 - However, the maximum point of the voltage waveform at the inverter output side is the power supply voltage multiplied by about $\sqrt{2}$.
- *6 The built-in brake resistor is used.
- *7 Value for the ND rating
- *8 The rated input current is the value at a rated output voltage. The input power impedances (including those of the input reactor and cables) affect
- *9 The power supply capacity is the value at the rated output current. The input power impedances (including those of the input reactor and cables) affect the value.

 $|\hspace{.06cm} 00023 \hspace{.05cm} |\hspace{.06cm} 00038 \hspace{.05cm} |\hspace{.06cm} 00052 \hspace{.05cm} |\hspace{.06cm} 00083 \hspace{.05cm} |\hspace{.06cm} 00126 \hspace{.05cm} |\hspace{.06cm} 00170 \hspace{.05cm} |\hspace{.06cm} 00250 \hspace{.05cm} |\hspace{.06cm} 00310 \hspace{.05cm} |\hspace{.06cm} 00380 \hspace{.05cm} |\hspace{.06cm} 00470 \hspace{.05cm} |\hspace{.06cm} 00620 \hspace{.05cm} |\hspace{.06cm} 00770 \hspace{.05cm} |\hspace{.06cm} 00930 \hspace{.05cm} |\hspace{.06cm} 01160 \hspace{.05cm} |\hspace{.06cm} 01800 \hspace{.05cm} |\hspace{.06cm} 00038 \hspace{.05cm} |\hspace{.06cm} 00470 \hspace{.05cm} |\hspace{.06cm} 00620 \hspace{.05cm} |\hspace{.06cm} 00770 \hspace{.05cm} |\hspace{.06cm} 00930 \hspace{.05cm} |\hspace{.06cm} 01160 \hspace{.05cm} |\hspace{.06cm} 01800 \hspace{.05cm} |\hspace{.06cm} 00620 \hspace{.05cm} |\hspace{.06cm} 00770 \hspace{.05cm} |\hspace{.06cm} 00930 \hspace{.05cm} |\hspace{.06cm} 01160 \hspace{.05cm} |\hspace{.06cm} 01800 \hspace{.05cm} |\hspace{.06cm} 00620 \hspace{.05cm} |\hspace{.06cm} 00770 \hspace{.05cm} |\hspace{.06cm} 00930 \hspace{.05cm} |\hspace{.06cm} 01800 \hspace{.05cm} |\hspace{.06cm} 01800 \hspace{.05cm} |\hspace{.06cm} 00620 \hspace{.05cm} |\hspace{.06cm} 00770 \hspace{.05cm} |\hspace{.06cm} 00930 \hspace{.05cm} |\hspace{.06cm} 01160 \hspace{.05cm} |\hspace{.06cm} 01800 \hspace{.05cm} |\hspace{.06cm} 00820 \hspace{.05cm} |\hspace{.06cm} 00620 \hspace{.05cm} |\hspace{.06cm} 00620 \hspace{.05cm} |\hspace{.06cm} 00770 \hspace{.05cm} |\hspace{.06cm} 00930 \hspace{.05cm} |\hspace{.06cm} 01160 \hspace{.05cm} |\hspace{.06cm} 01800 \hspace{.05cm} |\hspace{.06cm} 00620 \hspace{.05cm} |\hspace{.06cm} 00620 \hspace{.05cm} |\hspace{.06cm} 00620 \hspace{.05cm} |\hspace{.06cm} 00770 \hspace{.05cm} |\hspace{.06cm} 00930 \hspace{.05cm} |\hspace{.06cm} 00160 \hspace{.05cm} |\hspace{.06cm} 00820 \hspace{.05cm} |\hspace{.06cm} 00620 \hspace{.05cm} |\hspace{.06cm} 00620 \hspace{.05cm} |\hspace{.06cm} 00770 \hspace{.05cm} |\hspace{.06cm} 00930 \hspace{.05cm} |\hspace{.06cm} 00160 \hspace{.05cm} |\hspace{.06cm} 00820 \hspace{$

*10 FR-DU08: IP40 (except for the PU connector)

◆ 400 V class

■ 00023 to 01800

| Model FR-A840-[] | | | 00023 | 00038 | 00052 | | | | | | 00380 | 00470 | 00620 | 00770 | 00930 | 01160 | | |
|----------------------------------|------------------------------------|------------------------------------|--|---|----------|----------|----------|----------|----------|-----------|----------|----------|---------|----------|--------|-------|-----|-------|
| | WIOC | Jei i it-A040- | J | 0.4K | 0.75K | 1.5K | 2.2K | 3.7K | 5.5K | 7.5K | 11K | 15K | 18.5K | 22K | 30K | 37K | 45K | 55K |
| | | SLD | | 0.75 | 1.5 | 2.2 | 3.7 | 5.5 | 7.5 | 11 | 15 | 18.5 | 22 | 30 | 37 | 45 | 55 | 75/90 |
| Аp | plicable motor | LD | | 0.75 | 1.5 | 2.2 | 3.7 | 5.5 | 7.5 | 11 | 15 | 18.5 | 22 | 30 | 37 | 45 | 55 | 75 |
| capacity (kW)*1 | | ND (initial setting) | | 0.4 | 0.75 | 1.5 | 2.2 | 3.7 | 5.5 | 7.5 | 11 | 15 | 18.5 | 22 | 30 | 37 | 45 | 55 |
| ' | | HD | | 0.2 ^{*2} | 0.4 | 0.75 | 1.5 | 2.2 | 3.7 | 5.5 | 7.5 | 11 | 15 | 18.5 | 22 | 30 | 37 | 45 |
| | | SLD | | 1.8 | 2.9 | 4 | 6.3 | 10 | 13 | 19 | 24 | 29 | 36 | 47 | 59 | 71 | 88 | 137 |
| Output | Rated | LD | | 1.6 | 2.7 | 3.7 | 5.8 | 8.8 | 12 | 18 | 22 | 27 | 33 | 43 | 53 | 65 | 81 | 110 |
| | (KVA) | ND (initial setting) | | 1.1 | 1.9 | 3 | 4.6 | 6.9 | 9.1 | 13 | 18 | 24 | 29 | 34 | 43 | 54 | 66 | 84 |
| | | HD S, | | 0.6 | 1.1 | 1.9 | 3 | 4.6 | 6.9 | 9.1 | 13 | 18 | 24 | 29 | 34 | 43 | 54 | 66 |
| | Rated current (A) | SLD | | 2.3 | 3.8 | 5.2 | 8.3 | 12.6 | 17 | 25 | 31 | 38 | 47 | 62 | 77 | 93 | 116 | 180 |
| | | LD | | 2.1 | 3.5 | 4.8 | 7.6 | 11.5 | 16 | 23 | 29 | 35 | 43 | 57 | 70 | 85 | 106 | 144 |
| | | ND (initial setting) | | 1.5 | 2.5 | 4 | 6 | 9 | 12 | 17 | 23 | 31 | 38 | 44 | 57 | 71 | 86 | 110 |
| | | HD | | 0.8 | 1.5 | 2.5 | 4 | 6 | 9 | 12 | 17 | 23 | 31 | 38 | 44 | 57 | 71 | 86 |
| | | SLD | | 110% 6 | 0 s, 120 |)% 3 s (| (inverse | -time ch | aracter | istics) a | t surrou | nding ai | r tempe | rature c | f 40°C | | | |
| | current rating*4 | LD | | 110% 60 s, 120% 3 s (inverse-time characteristics) at surrounding air temperature of 40°C 120% 60 s, 150% 3 s (inverse-time characteristics) at surrounding air temperature of 50°C | | | | | | | | | | | | | | |
| | | ND (initial setting) | | 150% 60 s, 200% 3 s (inverse-time characteristics) at surrounding air temperature of 50°C | | | | | | | | | | | | | | |
| | | HD | | 200% 6 | 0 s, 250 |)%3s(| (inverse | -time ch | naracter | istics) a | t surrou | nding ai | r tempe | rature o | f 50°C | | | |
| | Rated voltage*5 | | | Three-p | hase 3 | 80 to 50 | 00 V | | | | | | | | | | | |
| | | Brake transistor | | Built-in | | | | | | | | | | | | | | |
| | | Maximum brake torque ^{*7} | | 100% to | orque, 2 | % FD*6 | 6 | | | | 20% to | rque, co | ntinuou | IS | | | | |
| | | when the option FR-ABR is used | | | | | | | | | | | | | | | | |
| | Ů | | | 100% torque, 10% ED 100% torque, 6% ED*12 | | | | | | | | | | | | | | |
| | Rated input AC voltage/frequency | | | Three-p | hase 3 | 80 to 50 | 00 V, 50 | /60 Hz* | 11 | | | | | | | | | |
| | Permissible AC voltage fluctuation | | | | 550 V, 5 | | | | | | | | | | | | | |
| | Permissible frequency fluctuation | | | ±5% | | | | | | | | | | | | | | |
| Power supply | Rated input current (A)*8 | SLD | | 3.2 | 5.4 | 7.8 | 10.9 | 16.4 | 22.5 | 31.7 | 40.3 | 48.2 | 58.4 | 76.8 | 97.6 | 115 | 141 | _ |
| | | Without DC reactor | LD | 3 | 4.9 | 7.3 | 10.1 | 15.1 | 22.3 | 31 | 38.2 | 44.9 | 53.9 | 75.1 | 89.7 | 106 | 130 | _ |
| | | | ND (initial setting) | 2.3 | 3.7 | 6.2 | 8.3 | 12.3 | 17.4 | 22.5 | 31 | 40.3 | 48.2 | 56.5 | 75.1 | 91 | 108 | 134 |
| | | | HD | 1.4 | 2.3 | 3.7 | 6.2 | 8.3 | 12.3 | 17.4 | 22.5 | 31 | 40.3 | 48.2 | 56.5 | 75.1 | 91 | 108 |
| | | With DC reactor | SLD | 2.3 | 3.8 | 5.2 | 8.3 | 12.6 | 17 | 25 | 31 | 38 | 47 | 62 | 77 | 93 | 116 | 180 |
| | | | LD | 2.1 | 3.5 | 4.8 | 7.6 | 11.5 | 16 | 23 | 29 | 35 | 43 | 57 | 70 | 85 | 106 | 144 |
| | | | ND (initial setting) | 1.5 | 2.5 | 4 | 6 | 9 | 12 | 17 | 23 | 31 | 38 | 44 | 57 | 71 | 86 | 110 |
| | | | HD 37 | 0.8 | 1.5 | 2.5 | 4 | 6 | 9 | 12 | 17 | 23 | 31 | 38 | 44 | 57 | 71 | 86 |
| | Power supply capacity (kVA)*9 | Without DC reactor | SLD | 2.5 | 4.1 | 5.9 | 8.3 | 12 | 17 | 24 | 31 | 37 | 44 | 59 | | 88 | 107 | |
| | | | LD | 2.3 | 3.7 | 5.5 | 7.7 | 12 | 17 | 24 | 29 | 34 | 41 | 57 | 68 | 81 | 99 | |
| | | | ND (initial setting) | 1.7 | 2.8 | 4.7 | 6.3 | 9.4 | 13 | 17 | 24 | 31 | 37 | 43 | 57 | 69 | 83 | 102 |
| | | | HD | 1.1 | 1.7 | 2.8 | 4.7 | 6.3 | 9.4 | 13 | 17 | 24 | 31 | 37 | 43 | 57 | 69 | 83 |
| | | With DC reactor | SLD | 1.8 | 2.9 | 4 | 6.3 | 10 | 13 | 19 | 24 | 29 | 36 | 47 | 59 | 71 | 88 | 137 |
| | | | LD | 1.6 | 2.7 | 3.7 | 5.8 | 8.8 | 12 | 18 | 22 | 27 | 33 | 43 | 53 | 65 | 81 | 110 |
| | | | ND (initial setting) | 1.1 | 1.9 | 3 | 4.6 | 6.9 | 9.1 | 13 | 18 | 24 | 29 | 34 | 43 | 54 | 66 | 84 |
| | | | HD | 0.6 | 1.1 | 1.9 | 3 | 4.6 | 6.9 | 9.1 | 13 | 18 | 24 | 29 | 34 | 43 | 54 | 66 |
| Dro | taatian vati: | of atmostores /IF | <u> </u> | | | | | | | | | | | | | | | |
| | otection rating o | oi structure (IE | Enclosed type Open type (IP00) Natural Forced air | | | | | | | | | | | | | | | |
| Cooling system Approx. mass (kg) | | | | | 3.0 | 3.0 | 3.4 | 3.4 | 6.7 | 6.7 | 8.3 | 8.3 | 15 | 15 | 23 | 41 | 41 | 43 |
| Αþ | prox. mass (kg |) | 3.0 | 5.0 | 5.0 | 5.4 | 5.4 | 0.1 | 0.1 | 0.3 | 0.3 | 10 | 10 | ۷3 | + I | + I | 43 | |

- *1 The applicable motor capacity indicated is the maximum capacity applicable for use of the Mitsubishi Electric standard 4-pole motor.
- *2 A 0.2 kW motor can be operated under V/F control only.
- *3 The rated output capacity is the value with respect to 440 V output voltage.
- *4 The percentage of the overload current rating is the ratio of the overload current to the inverter's rated output current. For repeated duty, allow time for the inverter and motor to return to or below the temperatures under 100% load.

- *5 The maximum output voltage does not exceed the power supply voltage. The maximum output voltage can be changed within the setting range. However, the maximum point of the voltage waveform at the inverter output side is the power supply voltage multiplied by about $\sqrt{2}$.
- *6 The built-in brake resistor is used.
- *7 Value for the ND rating
- *8 The rated input current is the value at a rated output voltage. The input power impedances (including those of the input reactor and cables) affect the value.
- *9 The power supply capacity is the value at the rated output current. The input power impedances (including those of the input reactor and cables) affect the value.
- *10 FR-DU08: IP40 (except for the PU connector)
- *11 For the power voltage exceeding 480 V, set Pr.977 Input voltage mode selection. (For details, refer to page 345.)
- *12 The braking capability of the inverter can be improved with a commercial brake resistor. (For details, refer to page 97.)

■ 02160 to 06830

| | Mo | del FR-A840- | n | 02160 | 05470 | 06100 | 06830 | | | | | | | | | | | |
|--------------|---|------------------|--------------------------|---|-------------------------|-------|-------|------|------|------|------|-------------|--|--|--|--|--|--|
| | IVIO | uei FK-A040 | ·u | 75K | 90K | 110K | 132K | 160K | 185K | 220K | 250K | 280K | | | | | | |
| | | SLD | | 110 | 132 | 160 | 185 | 220 | 250 | 280 | 315 | 355 | | | | | | |
| Аp | plicable motor | LD | | 90 | 110 | 132 | 160 | 185 | 220 | 250 | 280 | 315 | | | | | | |
| ca | pacity (kW) ^{*1} | ND (initial set | ting) | 75 | 90 | 110 | 132 | 160 | 185 | 220 | 250 | 280 | | | | | | |
| | | HD | | 55 | 75 | 90 | 110 | 132 | 160 | 185 | 220 | 250 | | | | | | |
| | Rated | SLD | | 165 | 198 | 248 | 275 | 329 | 367 | 417 | 465 | 521 | | | | | | |
| | capacity | LD | | 137 | 165 | 198 | 248 | 275 | 329 | 367 | 417 | 465 | | | | | | |
| | (kVA)*2 | ND (initial set | ting) | 110 | 137 | 165 | 198 | 248 | 275 | 329 | 367 | 417 | | | | | | |
| | (, | HD | | 84 | 110 | 137 | 165 | 198 | 248 | 275 | 329 | 367 | | | | | | |
| | | SLD | | 216 | 260 | 325 | 361 | 432 | 481 | 547 | 610 | 683 | | | | | | |
| | Rated | LD | | 180 | 216 | 260 | 325 | 361 | 432 | 481 | 547 | 610 547 | | | | | | |
| | current (A) | ND (initial set | ting) | 144 180 216 260 325 361 432 481 | | | | | | | | | | | | | | |
| = | | HD | | 110 144 180 216 260 325 361 432 481 | | | | | | | | | | | | | | |
| Output | Overload | SLD | | 110% 60 s, 120% 3 s (inverse-time characteristics) at surrounding air temperature of 40°C | | | | | | | | | | | | | | |
| Ō | current | | | 120% 60 s, 150% 3 s (inverse-time characteristics) at surrounding air temperature of 50°C | | | | | | | | | | | | | | |
| | | ND (initial set | ting) | 150% 60 s, 200% 3 s (inverse-time characteristics) at surrounding air temperature of 50°C | | | | | | | | | | | | | | |
| | | HD | | 200% 60 s, 250% 3 s (inverse-time characteristics) at surrounding air temperature of 50°C | | | | | | | | | | | | | | |
| | Rated LD Current (A) ND (initial setting) HD Overload current rating *3 HD Rated voltage *4 Regenerative braking When the option FR-Afis used Rated input AC voltage fluctuation Permissible Frequency Fluctuation Rated input With DC SLD LD ND (initial setting) HD Rated voltage *4 Brake transistor When the option FR-Afis used Rated input AC voltage fluctuation SLD LD LD Rated input With DC | | | Three-phas | hree-phase 380 to 500 V | | | | | | | | | | | | | |
| | | | | FR-BU2 (option) | | | | | | | | | | | | | | |
| | Overload current rating*3 NH Rated voltage*4 NF Regenerative MF BIR Regenerative MF BIR Rated input AC Permissible AC Permissible free | Maximum bra | ike torque ^{*5} | 10% torque, continuous | | | | | | | | | | | | | | |
| | braking | when the c | | | | | | | | | | | | | | | | |
| | | is used | | | | | | | | | | | | | | | | |
| | | | | Three-phase 380 to 500 V, 50/60 Hz*9 | | | | | | | | | | | | | | |
| | Permissible A | C voltage fluc | tuation | 323 to 550 V, 50/60 Hz | | | | | | | | | | | | | | |
| | Permissible fr | equency fluct | uation | ±5% | | | | | | | | | | | | | | |
| | | | | 216 | 260 | 325 | 361 | 432 | 481 | 547 | 610 | 683 | | | | | | |
| 습 | Rated input | With DC | LD | 180 | 216 | 260 | 325 | 361 | 432 | 481 | 547 | 610 | | | | | | |
| Power supply | current (A)*6 | reactor | ND (initial setting) | 144 | 180 | 216 | 260 | 325 | 361 | 432 | 481 | 547 | | | | | | |
| Š | | | HD | 110 | 144 | 180 | 216 | 260 | 325 | 361 | 432 | 481 | | | | | | |
| ď | | | SLD | 165 | 198 | 248 | 275 | 329 | 367 | 417 | 465 | 521 | | | | | | |
| | Powersupply | With DC | LD | 137 | 165 | 198 | 248 | 275 | 329 | 367 | 417 | 465 | | | | | | |
| | capacity (kVA) ^{*7} | reactor | ND (initial setting) | 110 | 137 | 165 | 198 | 248 | 275 | 329 | 367 | 417 | | | | | | |
| L | <u> </u> | | HD | 84 | 110 | 137 | 165 | 198 | 248 | 275 | 329 | 367 | | | | | | |
| Pro | otection rating | of structure (II | EC 60529)*8 | Open type (| IP00) | | | | | | | | | | | | | |
| | ooling system | | | Forced air | | | | | | | | | | | | | | |
| | prox. mass (kg | 1) | | 52 | 55 | 71 | 78 | 117 | 117 | 166 | 166 | 166 | | | | | | |
| <u> </u> | | | | | | + | - | | - | | | | | | | | | |

- *1 The applicable motor capacity indicated is the maximum capacity applicable for use of the Mitsubishi Electric standard 4-pole motor.
- *2 The rated output capacity is the value with respect to 440 V output voltage.
- *3 The percentage of the overload current rating is the ratio of the overload current to the inverter's rated output current. For repeated duty, allow time for the inverter and motor to return to or below the temperatures under 100% load.
- *4 The maximum output voltage does not exceed the power supply voltage. The maximum output voltage can be changed within the setting range. However, the maximum point of the voltage waveform at the inverter output side is the power supply voltage multiplied by about $\sqrt{2}$.
- *5 Value for the ND rating
- *6 The rated input current is the value at a rated output voltage. The input power impedances (including those of the input reactor and cables) affect the value.
- *7 The power supply capacity is the value at the rated output current. The input power impedances (including those of the input reactor and cables) affect the value.
- *8 FR-DU08: IP40 (except for the PU connector)
- *9 For the power voltage exceeding 480 V, set Pr.977 Input voltage mode selection. (For details, refer to page 345.)

8.2 **Motor rating**

Vector control dedicated motor SF-V5RU (1500 r/ 8.2.1 min series)

♦ Motor specifications

■200 V class

| Single-phase 200 to 230 to 60 Hz Single-phase 200 to 230 to 60 Hz | | | | | | | | | | | | | | | | | | | | | |
|--|------------------------|--------------------------------|-------|-----------|---------|-----------|---------------|-----------|-----------------|-----------|----------|------------------|---------------------|------------------|---------------------------|--|--|--|--|--|--|
| R-A820-[K (ND rating) 2.2 3.7 5.5 7.5 11 15 18.5 22 30 37 45 55 7.5 | Motor model: | SF-V5RU[]K | 1 | 2 | 3 | 5 | 7 | 11 | 15 | 18 | 22 | 30 | 37 | 45 | 55 | | | | | | |
| State Stat | | | 2.2 | 3.7 | 5.5 | 7.5 | 11 | 15 | 18.5 | 22 | 30 | 37 | 45 | 55 | 75 | | | | | | |
| Single-phase 200 V 50 Hz / Single-phase 200 V | Rated output | oower (kW) | 1.5 | 2.2 | 3.7 | 5.5 | 7.5 | 11 | 15 | 18.5 | 22 | 30 ^{*1} | 37 ^{*1} | 45 ^{*1} | 55 | | | | | | |
| Single-phase 200 V 50 Hz Single-phase 200 to 230 V 60 Hz Single-phas | Rated current | (A) | 8.5 | 11.5 | 17.6 | 28.5 | 37.5 | 54 | 72.8 | 88 | 102 | 126 | 168 | 198 | 264 | | | | | | |
| N-m 14.3 21.1 35.4 52.4 71.6 105 143 176 211 287 353 429 525 | Rated torque | N·m) | 9.55 | 14.1 | 23.6 | 35.0 | 47.7 | 70.0 | 95.5 | 118 | 140 | 191 | 235 | 286 | 350 | | | | | | |
| Askimum speed (r/min) 3000°2 2400 | Maximum toro (N·m) | ue at 150% 60 s | 14.3 | 21.1 | 35.4 | 52.4 | 71.6 | 105 | 143 | 176 | 211 | 287 | 353 | 429 | 525 | | | | | | |
| Single-phase 200 V 50 Hz Single-phase 200 V | Rated speed (| r/min) | 1500 | | | | | | | | | | | | | | | | | | |
| Cooling fan with hermal rotector) Three-phase 200 V 50 Hz / Single-phase 200 to 230 V 60 Hz | Maximum spe | ed (r/min) | | | | | | 300 | 0° ² | | | | | | 2400 | | | | | | |
| Notice Single-phase 200 \ V 50 \ Hz / Three-phase 200 \ V 50 \ Hz / Three-phase 200 \ V 50 \ Hz / Single-phase 200 \ V 50 \ Hz / Single-phase 200 \ V 50 \ Hz / Three-phase 200 \ V 50 \ Hz / Single-phase 200 \ V 50 \ Hz / Three-phase 200 \ V 50 \ Hz / Single-phase 200 \ V 50 \ Hz / Three-phase 200 \ V 50 \ Hz / Single-phase 200 \ V 50 \ Hz / Single-phase 200 \ V 50 \ Hz / Three-phase 200 \ V 50 \ Hz / Single-phase 200 \ V 50 \ Hz / Three-phase 200 \ V 50 \ Hz / Single-phase 200 \ V 50 \ Hz / Single-phase 200 \ V 50 \ Hz / Three-phase 200 \ V 50 \ Hz / Single-phase 200 \ V 50 \ Hz / Three-phase 200 \ V 50 \ Hz / Single-phase 200 \ V 50 \ Hz / Single-phase 200 \ V 50 \ Hz / Three-phase 200 \ V 50 \ Hz / Three-phase 200 \ V 50 \ Hz / Single-phase 200 \ V 50 \ Hz / Single-phase 200 \ V 50 \ Hz / Three-phase 200 \ V 50 \ Hz / Single-phase 200 \ V 50 \ Hz / Three-phase 200 \ V 50 \ Hz / Single-phase 200 \ V 50 \ Hz / Three-phase 200 \ V 50 \ Hz / Single-phase 200 \ V 50 \ Hz / Sin | Frame No. | | 90L | 100L | 112M | 132S | 132M | 160M | 160L | 180M | 180M | 200L | 200L 200L 200L 225S | | | | | | | | |
| Voltage | Inertia momer | ıt J (×10 ⁻⁴ kg⋅m²) | 67.5 | 105 | 175 | 275 | 400 | 750 | 875 | 1725 | 1875 | 3250 | 3625 | 3625 | 6850 | | | | | | |
| Single-phase 200 to 230 V 60 Hz Three-phase 200 to 230 V 60 Hz | Noise*5 | | | | | 75 | dB or le | ss | | | | 80 | dB or le | ss | 85 dB or less | | | | | | |
| Input 3 36/55 W (0.26/0.32 A) 22/28 W (0.11/ 0.13 A) 55/71 W (0.37/0.39 A) 100/156 W (0.47/0.53 A) 85/130 W (0.46/0.52 A) | Cooling fan | Voltage | | | | | | | | | | | | | | | | | | | |
| Recommended thermal setting 0.36 A 0.18 A 0.51 A 0.69 A 0.68 A surrounding air temperature and umidity Totally enclosed forced ventilated (Motor: IP44, Cooling fan: IP23S)*4 Petector Encoder 2048P/R, A phase, B phase, Z phase, +12 V/24 VDC power supply*6 Encoder, thermal protector, fan Encoder, thermal protector, fan F Vioration rank V10 | thermal | Input ^{*3} | 36/55 | W (0.26/0 | 0.32 A) | | | 55 | 5/71 W (0 | .37/0.39 | A) | 100/156 | 6 W (0.47 | /0.53 A) | 85/130 W (0.46/0.52 A) | | | | | | |
| Totally enclosed forced ventilated (Motor: IP44, Cooling fan: IP23S)*4 Petector Encoder 2048P/R, A phase, B phase, Z phase, +12 V/24 VDC power supply*6 Equipment Encoder, thermal protector, fan sulation class F Vibration rank V10 | 8 | | | 0.36 A | | 0.1 | 0.18 A 0.51 A | | | | | | 0.69 A | | 0.68 A | | | | | | |
| Encoder 2048P/R, A phase, B phase, Z phase, +12 V/24 VDC power supply 6 Equipment Encoder, thermal protector, fan F Vibration rank V10 | Surrounding a humidity | ir temperature and | | | | -10 to | +40°C (| non-freez | ing), 90% | % RH or I | ess (non | -condens | sing) | | | | | | | | |
| Equipment Encoder, thermal protector, fan Insulation class F Vibration rank V10 | Structure (Pro | tection rating) | | | | Totally e | nclosed f | orced ve | ntilated (l | Motor: IP | 44, Cool | ing fan: II | P23S) ^{*4} | | | | | | | | |
| Equipment Encoder, thermal protector, fan Insulation class F Vibration rank V10 | Detector | | | | Enco | oder 204 | 3P/R, A p | hase, B | phase, Z | phase, + | -12 V/24 | VDC pov | wer suppl | y*6 | | | | | | | |
| ibration rank V10 | Equipment | | | | | | | | | | | | | | | | | | | | |
| | Insulation class | ss | | | | | | | F | | | | | | | | | | | | |
| Approx. mass (kg) 24 33 41 52 62 99 113 138 160 238 255 255 320 | Vibration rank | | | | | | | | V1 | 0 | | | | | | | | | | | |
| | Approx. mass | (kg) | 24 | 33 | 41 | 52 | 62 | 99 | 113 | 138 | 160 | 238 | 255 | 255 | 320 | | | | | | |

■ 400 V class

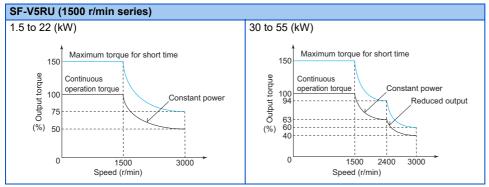
| Motor model: | SF-V5RUH[]K | 1 | 2 | 3 | 5 | 7 | 11 | 15 | 18 | 22 | 30 | 37 | 45 | 55 | | |
|----------------------------------|---|--|-----------|---------|-----------|------------------|-----------|------------------|-----------|-----------|------------------|------------------|------------------|---------------------------|--|--|
| Applicable inv FR-A840-[]K (I | | 2.2 | 2.2 | 3.7 | 7.5 | 11 | 15 | 18.5 | 22 | 30 | 37 | 45 | 55 | 75 | | |
| Rated output | power (kW) | 1.5 | 2.2 | 3.7 | 5.5 | 7.5 | 11 | 15 | 18.5 | 22 | 30 ^{*1} | 37 ^{*1} | 45 ^{*1} | 55 | | |
| Rated current | (A) | 4.2 | 5.8 | 8.8 | 14.5 | 18.5 | 27.5 | 35.5 | 44 | 51 | 67 | 84 | 99 | 132 | | |
| Rated torque | (N·m) | 9.55 | 14.1 | 23.6 | 35.0 | 47.7 | 70.0 | 95.5 | 118 | 140 | 191 | 235 | 286 | 350 | | |
| Maximum toro | que at 150% 60 s | 14.3 | 21.1 | 35.4 | 52.4 | 71.6 | 105 | 143 | 176 | 211 | 287 | 353 | 429 | 525 | | |
| Rated speed (| r/min) | | | | | | | 150 | 00 | | | | | | | |
| Maximum spe | ed (r/min) | | | | | | 300 | 00 ^{*2} | | | | | | 2400 | | |
| Frame No. | | 90L | 100L | 112M | 132S | 132M | 160M | 160L | 180M | 180M | 200L | 200L | 225S | | | |
| Inertia momer | nt J (×10 ⁻⁴ kg·m ²) | 67.5 | 105 | 175 | 275 | 400 | 750 | 875 | 1725 | 1875 | 3250 | 3625 | 3625 | 6850 | | |
| Noise*5 | | | | | 75 | dB or le | ss | | | | 80 | dB or le | ss | 85 dB or less | | |
| Cooling fan | Voltage | Single-phase 200 V 50 Hz / Three-phase 380 to 400 V 50 Hz / Single-phase 200 to 230 V 60 Hz Three-phase 400 to 460 V 60 Hz | | | | | | | | | | | | | | |
| thermal protector)*7* | Input*3 | 36/55 | W (0.26/0 | 0.32 A) | | V (0.11/ 3 A) | 55 | i/71 W (0 | .19/0.19 | A) | 100/156 | 6 W (0.27 | /0.30 A) | 85/130 W (0.23/0.26 A) | | |
| 8 | Recommended thermal setting | | 0.36 A | | 0.1 | 8 A | | 0.2 | 5 A | | | 0.39 A | | 0.34 A | | |
| Surrounding a humidity | air temperature and | | | | -10 to | +40°C (| non-freez | ing), 90% | 6 RH or I | ess (non | -condens | sing) | | | | |
| Structure (Pro | tection rating) | | | | Totally e | nclosed f | orced ve | ntilated (I | Motor: IP | 44, Cooli | ing fan: I | P23S)*4 | | | | |
| Detector | | Encoder 2048P/R, A phase, B phase, Z phase, +12 V/24 VDC power supply*6 | | | | | | | | | | | | | | |
| Equipment | | | | | | | Encode | r, therma | l protect | or, fan | | | | | | |
| Insulation class | SS | | | | | | | F | | | | | | | | |
| Vibration rank | (| | | | | | | V1 | 0 | | | | | | | |
| | (kg) | 24 33 41 52 62 99 113 138 160 238 255 255 320 | | | | | | | | | | | | | | |

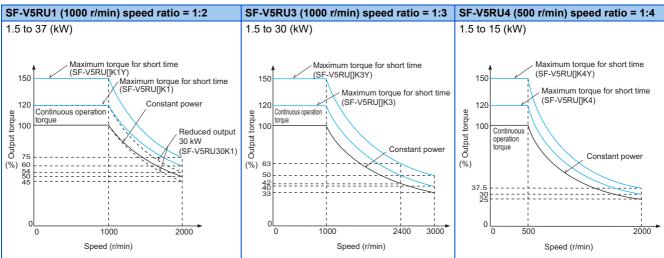
- *1 80% output in the high-speed range. (The output is reduced when the speed is 2400 r/min or faster.) (Contact us separately for details.)
- *2 The maximum speed of a 3.7 kW motor or less is 3600 r/min. Consult our sales office for use of these motor.
- *3 Power (current) at 50/60 Hz.
- *4 Since a brake motor has a window for gap check, the protection rating of both the cooling fan section and brake section of the motor is IP20. The letter S in IP23S is an additional code indicating that a cooling fan was checked for water protection while it is stationary.
- *5 The value shown is applicable to the motor at high carrier frequency (**Pr.72** = 6 and **Pr.240** = 0).
- *6 A separate power supply of 12/24 V is required for the encoder. (When the FR-A8TP is installed on the inverter, the 24 V power supply from the FR-A8TP is available.)
- *7 The cooling fan is equipped with a thermal protector. The cooling fan stops when the coil temperature exceeds the specified value in order to protect the fan motor. A restrained cooling fan or degraded fan motor insulation could be causes for the rise in coil temperature. The cooling fan re-starts when the coil temperature drops to normal.
- *8 The cooling fan voltage and input values are the basic specifications of the cooling fan alone and free air values. The input value becomes slightly larger when it is rotated by this motor due to an increased workload, but the cooling fan can be used as it is. When preparing a thermal relay at the user side, use the recommended thermal setting.

◆ Motor torque

The torque characteristics of the SF-V5RU series driven by the inverter are shown in graph form as follows.

These are the case of the motor driven by the inverter at ND or HD rating. As the overload capacity decreases in the case of LD or SLD rating, observe the specified range of the inverter.





- The maximum speed of the SF-V5RU55K and SF-V5RU30K3 is 2400 r/min.
- The maximum speed of a 3.7 kW motor or less is 3600 r/min. Consult our sales office for use of these motor.
- The maximum speed of a brake motor is 1800 r/min.
- The maximum short-time torque of the SF-V5RU[]K1, SF-V5RU[]K3, and SF-V5RU[]K4 is 120% of the rated torque. The maximum short-time torque of the SF-V5RU[]K1Y, SF-V5RU[]K3Y, and SF-V5RU[]K4Y is 150% of the rated torque.

Vector control dedicated motor SF-THY 8.2.2

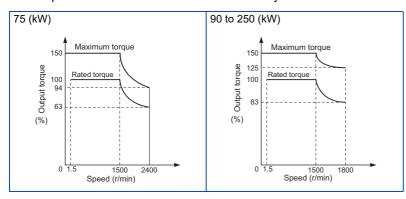
♦ Motor specifications

| Motor model | | | | SF-THY | | | | | | | | | | | | |
|------------------------------------|---------------------|-----------------|---------|--|--|------------------------------------|------------|-------------------|---------------------------|--------------|------|--|--|--|--|--|
| Annliaghla inva | utou model (A | ID ratios) | | FR-A820-[]K | | | FF | R-A840-[]I | K | | | | | | | |
| Applicable inve | rter moder (r | id rating) | | 90 | 90 | 110 | 132 | 160 | 185 | 220 | 280 | | | | | |
| Rated output po | ower (kW) | | | 75 | 75 | 90 | 110 | 132 | 160 | 200 | 250 | | | | | |
| Rated torque (N | l·m) | | | 477 | 477 | 572 | 700 | 840 | 1018 | 1273 | 1591 | | | | | |
| Maximum torqu | ie at 150% 60 | s (N·m) | | 715 | 715 | 858 | 1050 | 1260 | 1527 | 1909 | 2386 | | | | | |
| Rated speed (r/ | min) | | | 1500 | 1500 1500 | | | | | | | | | | | |
| Maximum spee | d (r/min) | | | 2400 | 2400 | 2400 1800 | | | | | | | | | | |
| Frame No. | | | | 250MD | 250MD | 250MD 250MD 280MD 280MD 280MD 280L | | | | | | | | | | |
| Inertia moment | J (kg⋅m²) | | | 1.1 | 1.1 1.7 2.3 2.3 4.0 3.8 5.0 | | | | | | | | | | | |
| Noise | | | | 90 dB | | 90 dB | | | 95 (| dB | | | | | | |
| | | Voltage | | Three-phase 200 V 50 Hz / 200 V 60 Hz / 220 V 60 Hz | | | | | | | | | | | | |
| Cooling fan | | ronago | | | (400 V class cooling fan is available upon order.) | | | | | | | | | | | |
| Cooling fan Input (W) 50 Hz 60 Hz | | | | 750 | 400 | 400 | 400 | 400 | 400 | 750 | 750 | | | | | |
| Input (W) 60 Hz | | | | | 750 | 750 | 750 | 750 | 750 | 1500 | 1500 | | | | | |
| Approx. mass (| <u> </u> | | | 610 | 610 | 660 | 870 | 890 | 920 | 1170 | 1630 | | | | | |
| | Surroundin humidity | g air temperatu | re and | -10 to +40°C (non-freezing), 90% RH or less (non-condensing) | | | | | | | | | | | | |
| | Structure | | | | | Totally en | closed for | ced ventila | ated | | | | | | | |
| | Equipment | | | | | Encoder, | thermal pr | otector*2, | fan | | | | | | | |
| | Insulation of | lass | | | | | F | | | | | | | | | |
| 0 | Vibration ra | ınk | | | | | V10 | | | | | | | | | |
| Common specifications | | Resolution | | | | 2 | 2048 pulse | e/rev | | | | | | | | |
| Specifications | | Power supply | voltage | | | 12 | /24 VDC± | 10% ^{*1} | | | | | | | | |
| | Dedicated | Current consu | mption | | | | 90 mA | | | | | | | | | |
| | encoder | Output signal t | form | Phase A | and Phas | se B: 90 de | egrees out | t of phase | , Phase Z: | 1 pulse/re | ev | | | | | |
| | | Output circuit | | Comple | ementary (| constant v | oltage ou | tput match | ned by emi | itter follow |) | | | | | |
| | | Output voltage | | | | • | | _ | e (IOH: -20 s (IOL: 20 | , | | | | | | |

^{*1} The 12/24 V power supply is required for the encoder.

Motor torque

The torque characteristics of the SF-THY driven by the inverter are shown in graph form as follows.



^{*2} A motor with a thermal protector is available. Contact your sales representative.

IPM motor MM-CF (2000 r/min series)

◆ Motor specifications

| Motor model: MM | -CF[] | | 52(C)(B) | 102(C)(B) | 152(C)(B) | 202(C)(B) | 352(C)(B) | 502(C) | 702(C) | | | | | | | | |
|--|------------------------|----------------------|--|-------------------|-----------------------|--------------------------------|----------------------------|------------------------|------------------|--|--|--|--|--|--|--|--|
| | | SLD | 0.4 | 0.4 | 0.75 | 1.5 | 2.2 | 3.7 | 5.5 | | | | | | | | |
| Applicable inverte | er model: | LD | 0.4 | 0.4 | 0.75 | 1.5 | 2.2 | 3.7 | 5.5 | | | | | | | | |
| FR-A820[]K | | ND (initial setting) | 0.4 | 0.75 | 1.5 | 2.2 | 3.7 | 5.5 | 7.5 | | | | | | | | |
| | | HD | 0.75 ^{*6} | 1.5 ^{*6} | 2.2 ^{*6} | 3.7 ^{*6} | 5.5 ^{*6} | 7.5 ^{*6} | 11 ^{*6} | | | | | | | | |
| Continuous | Rated outpu | t power (kW) | 0.5 | 1.0 | 1.0 1.5 2.0 3.5 5.0 | | | | | | | | | | | | |
| characteristics*1 | Rated torque | e (N·m) | 2.39 | 4.78 | 7.16 | 9.55 | 16.70 | 23.86 | 33.41 | | | | | | | | |
| Rated speed*1(r/n | nin) | | 2000 | | | | | | | | | | | | | | |
| Maximum speed (| (r/min) | | 3000 | | | | | | | | | | | | | | |
| Instantaneous pe | rmissible spe | ed (r/min) | | | | 3450 ^{*7} | | | | | | | | | | | |
| Maximum torque | (N·m) | | 4.78 9.56 14.32 19.09 33.41 47.73 66.8 | | | | | | | | | | | | | | |
| Inertia moment J* | 5 | | 20.0 | 45.5 | 45.5 85.6 120.0 160.0 | | | | | | | | | | | | |
| (×10 ⁻⁴ kg m ²) | | | (7.0) | (14.9) | (21.2) | (48.9) | (89.0) | 120.0 | 100.0 | | | | | | | | |
| Recommended ra | | ertia moment to | 100 times max. 50 times max. | | | | | | | | | | | | | | |
| motor shaft inerti | a moment ^{*2} | | Too times max. | | | | | | | | | | | | | | |
| Rated current (A) | | | 1.81 | 3.70 | 5.22 | 7.70 | 12.5 | 20.5 | 27.0 | | | | | | | | |
| Insulation class | | | | | | F | | | | | | | | | | | |
| Structure (Protect | tion rating) | | | Totally e | nclosed, nat | urally air-cod | oled (IP44 ^{*3} / | IP65 ^{*3*4}) | | | | | | | | | |
| Surrounding air to | emperature a | nd humidity | - | 10 to +40°C | (non-freezin | ıg), 90% RH | or less (non | -condensing |) | | | | | | | | |
| Storage temperat | ure and humi | dity | | 20 to +70°C | <u> </u> | - | | | | | | | | | | | |
| Ambience | | | Indoors (no | direct sun liç | | from corrosi and dirt, etc. | - | mable gas, o | il mist, dust | | | | | | | | |
| Altitude | | | | | Ма | ximum 1000 |) m | | | | | | | | | | |
| Vibration | | | | | X: 9.8 | m/s ² , Y: 24. | 5 m/s ² | | | | | | | | | | |
| Approx. mass*5 (F | (g) | | 5.1/7.8 | 7.2/11 | 9.3/13 | 13/20 | 19/28 | 27 | 36 | | | | | | | | |

^{*1} The rated output power or speed is not guaranteed at low supply voltages.

^{*2} It is the case that the load torque is 20% of the motor rating. The permissible load inertia moment ratio is smaller when the load torque is larger. Consult us if the load inertia moment ratio exceeds the above value.

^{*3} This does not apply to the shaft through portion.

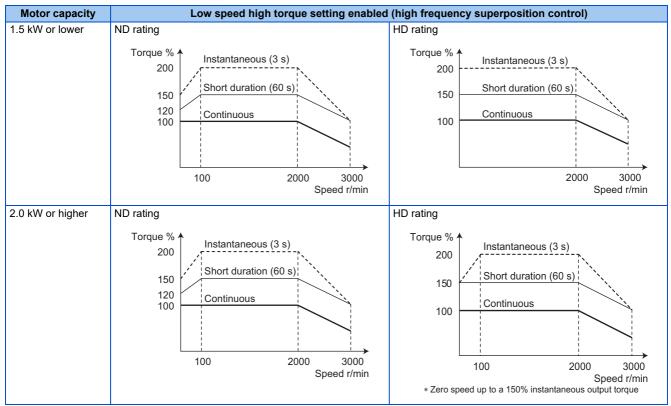
^{*4} The value after the slash is for MM-CF[]2C.

^{*5} The value for MM-CF[]2B is indicated in parentheses.

^{*6} The one-rank higher inverter is designated for high torque in low-speed range.

Set 3150 r/min (210 Hz) or less in Pr.374 Overspeed detection level. The inverter may be damaged by the motor induction voltage if the motor speed exceeds 3150 r/min (210 Hz).

◆ Motor torque



| Motor capacity | Low speed high torque setting disabled (current synchronization operation) |
|----------------|--|
| All capacities | Torque % Instantaneous (3 s) 200 150 Continuous 200 200 3000 Speed r/min |

8.3 **Common specifications**

| | | | Soft-PWM control, high carrier frequency PWM control (selectable among V/F control, Advanced |
|-----------|----------------------------------|---------------------------------|--|
| | Control met | nod | magnetic flux vector control, Real sensorless vector control), Optimum excitation control, Vector |
| | | | control ^{*1} , and PM sensorless vector control |
| | Output frequ | ency range | 0.2 to 590 Hz (The upper-limit frequency is 400 Hz under Advanced magnetic flux vector control, Real sensorless vector control, Vector control ^{*1} , and PM sensorless vector control.) |
| | | | 0.015 Hz/60 Hz at 0 to 10 V/12 bits (terminals 2 and 4). |
| | Frequency | | 0.03 Hz/60 Hz at 0 to 5 V/11 bits or 0 to 20 mA/approx. 11 bits (terminals 2 and 4), at 0 to ±10 V/12 |
| | setting and | Analog input | bits (terminal 1). |
| | resolution | | 0.06 Hz/60 Hz at 0 to ±5 V/11 bits (terminal 1). |
| | | Digital input | 0.01 Hz |
| | Frequency | Analog input | Within ±0.2% of the maximum output frequency (25 ± 10°C) |
| | accuracy | Digital input | 0.01% or less of the set output frequency |
| ō | Voltage/freq characterist | | Base frequency can be set from 0 to 590 Hz. Constant-torque/variable-torque pattern or adjustable 5 points V/F can be selected. |
| Control | | *0 | SLD rating: 120% 0.3 Hz, LD rating: 150% 0.3 Hz, ND rating: 200% ^{*3} 0.3 Hz, HD rating: 250% ^{*3} 0.3 Hz (under Real sensorless vector control) |
| | Starting tord | lue ^{°2} | SLD rating: 120% 0 Hz, LD rating: 150% 0 Hz, ND rating: 200%*3 0 Hz, HD rating: 250%*3 0 Hz (under |
| | | | Vector control ^{*1}) |
| | Torque boos | st | Manual torque boost |
| | | /deceleration | 0 to 3600 s (acceleration and deceleration can be set individually), linear or S-pattern acceleration/ |
| | time setting | brake (induction | deceleration mode, backlash countermeasures acceleration/deceleration can be selected. |
| | motor) | Diane (induction | Operation frequency (0 to 120 Hz), operation time (0 to 10 s), operation voltage (0 to 30%) variable |
| | Stall preven | tion operation | Activation range of stall prevention operation (SLD rating: 0 to 120%, LD rating: 0 to 150%, ND rating: 0 to 220%, HD rating: 0 to 280%). Whether to use the stall prevention or not can be selected (V/F |
| | 10401 | | control, Advanced magnetic flux vector control) |
| | Torque limit | level | Torque limit value can be set (0 to 400% variable). |
| | | | (Real sensorless vector control, Vector control ^{*1} , PM sensorless vector control) Terminals 2 and 4: 0 to 10 V / 0 to 5 V / 4 to 20 mA (0 to 20 mA). |
| | Frequency | Analog input | Terminal 1: -10 to +10 V / -5 to +5 V. |
| | setting signal | Digital input | Input using the setting dial of the operation panel or parameter unit. Input of four-digit BCD (Binary-coded decimal) or 16-bit binary when the option FR-A8AX is installed. |
| | Start signal | | Forward and reverse rotation or start signal automatic self-holding input (3-wire input) can be selected. |
| | Input signal | (12) | Low-speed operation command, Middle-speed operation command, High-speed operation command, Second function selection, Terminal 4 input selection, Jog operation selection, Selection of automatic restart after instantaneous power failure / flying start, Output stop, Start self-holding selection, Forward rotation command, Reverse rotation command, Inverter reset The signal to be input can be changed using Pr.178 to Pr.189 (Input terminal function selection) . |
| | Pulse tra | ain input | 100k pulses/s |
| | Pulse tra | in input | Maximum frequency, Minimum frequency, multi-speed operation, acceleration/deceleration pattern, thermal protection, DC injection brake, Starting frequency, JOG operation, Output stop (MRS), stall |
| Operation | Operational | function | prevention, regeneration avoidance, increased magnetic excitation deceleration, DC feeding*4, frequency jump, rotation indication, automatic restart after instantaneous power failure, electronic bypass sequence, remote setting, Automatic acceleration/deceleration, retry function, carrier frequency selection, fast-response current limit, forward/reverse rotation prevention, Operation mode selection, slip compensation, droop control, load torque high-speed frequency control, Speed smoothing control, traverse, auto tuning, applied motor selection, gain tuning, RS-485 |
| | | | communication, PID control, PID pre-charge function, dancer control, Cooling fan operation selection, Stop selection (deceleration stop/coasting), power-failure deceleration stop function, stop-on-contact control, PLC function, life diagnosis, maintenance timer, current average monitoring, multiple rating, orientation control *1, speed control, torque control, position control, pre-excitation, torque limit, test operation, 24 V power supply input for control circuit, safety stop function, anti-sway control, CC-Link IE Field Network communication *11 |
| | Open co Relay ou Pulse tra | llector output (5) itput (2) | Inverter running, Up to frequency, Instantaneous power failure/undervoltage*4, Overload warning, Output frequency detection, Fault The signal to be output can be changed using Pr.190 to Pr.196 (Output terminal function selection) . Fault codes (4 bits) of the inverter can be output from the open collector. |
| | | in output | 50k pulses/s |
| | (FM type | inverter) | |

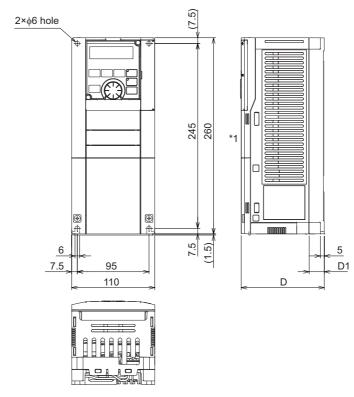
| | For | Pulse train output (FM type inverter) | Max. 2.4 kHz via one terminal (for the indication of inverter output frequency). The item for monitoring can be changed using Pr.54 FM/CA terminal function selection . |
|-------------|-------------------------------------|---|---|
| ion | indication on external meters | Current output (CA type inverter) | Max. 20 mADC via one terminal (for the indication of inverter output frequency). The item for monitoring can be changed using Pr.54 FM/CA terminal function selection . |
| Indication | | Voltage output | Max. 10 VDC via one terminal (for the indication of inverter output frequency). The item for monitoring can be changed using Pr.158 AM terminal function selection . |
| _ | Operation | Status monitoring | Output frequency, output current, output voltage, and frequency setting value are monitored. The item for monitoring can be changed using Pr.52 Operation panel main monitor selection . |
| | panel (FR- DU08) | Fault monitoring | When a protective function is activated, a fault indication is displayed and the output voltage, output current, output frequency, cumulative energization time, date (year, month, day) and time at the occurrence of the fault are stored. Each fault is recorded and the last 8 records can be displayed. |
| | | | Overcurrent trip during acceleration, Overcurrent trip during constant speed, Overcurrent trip during deceleration or stop, Regenerative overvoltage trip during acceleration, Regenerative overvoltage trip during constant speed, Regenerative overvoltage trip during deceleration or stop, Inverter overload trip (electronic thermal relay function), Motor overload trip (electronic thermal relay function), Heat sink overheat, Instantaneous power failure*4, Undervoltage*4, Input phase loss*4*5, Stall prevention stop, Loss of synchronism detection*5, Brake transistor alarm detection*6, Upper limit fault detection, Lower limit fault detection, Output side earth (ground) fault overcurrent, Output short circuit, Output |
| | Fault | | phase loss, External thermal relay operation*5, PTC thermistor operation*5, Option fault, Communication option fault, Parameter storage device fault (control circuit board), PU disconnection, Retry count excess*5, CPU fault, Operation panel power supply short circuit/RS-485 terminals power |
| | ective tion | | supply short circuit, 24 VDC power fault, Abnormal output current detection*5, Inrush current limit circuit fault*4, Communication fault (inverter), Analog input fault, USB communication fault, Safety circuit fault, Overspeed occurrence*5, Speed deviation excess detection*1*5, Signal loss detection*1*5, Excessive position fault*1*5, Brake sequence fault*5, Encoder phase fault*1*5, 4 mA input fault*5, Precharge fault*5, PID signal fault*5, Option fault, Opposite rotation deceleration fault*5, Internal circuit fault, Abnormal internal temperature*7, Magnetic pole position unknown*1, External fault during output operation*5 |
| | Alarm, warning, erroi message | | Fan alarm, Stall prevention (overcurrent), Stall prevention (overvoltage), Regenerative brake pre- alarm*5*6, Electronic thermal relay function pre-alarm, PU stop, Speed limit indication*5, Parameter copy, Safety stop, Maintenance signal output*5, USB host error, Home position return setting error*5, Home position return uncompleted*5, Home position return parameter setting error*5, Operation panel lock*5, Password locked*5, Parameter write error, Copy operation error, 24 V external power supply operation, Internal fan alarm*7, Continuous operation during communication fault*5, Load fault warning |
| | Surrounding air temperature | | -10 to +50°C (0 to +50°C for the FR-A800-GF) (non-freezing) (LD, ND, HD ratings)10 to +40°C (0 to +40°C for the FR-A800-GF) (non-freezing) (SLD rating, IP55 compatible models). |
| Environment | Surrounding | air humidity | 95% RH or less (non-condensing) (With circuit board coating (conforming to IEC 60721-3-3 3C2/3S2), IP55 compatible models). 90% RH or less (non-condensing) (Without circuit board coating). |
| invi | Storage temp | erature ^{*8} | -20 to +65°C |
| ш | Ambience | | Indoors (free from corrosive gas, flammable gas, oil mist, dust and dirt) |
| | Altitude/vibra | tion | Maximum 2500 m *9, 5.9 m/s ² or less*10 at 10 to 55 Hz (directions of X, Y, Z axes) |

- *1 Available when a Vector control compatible option is installed.
- *2 For PM sensorless vector control, refer to page 863.
- *3 For the FR-A820-00340(5.5K) or higher and the FR-A840-00170(5.5K) or higher, the starting torque is initially limited to a level of 150% due to the torque limitation.
- *4 The function is available for standard structure models and IP55 compatible models.
- *5 Not activated in the inverter in the initial state.
- *6 Available only for the standard model.
- *7 Available only for the IP55 compatible model.
- *8 Applicable to conditions for a short time, for example, in transit.
- *9 For the installation at an altitude above 1000 m, consider a 3% reduction in the rated current per 500 m increase in altitude.
- *10 2.9 m/s^2 or less for the FR-A840-04320(160K) or higher.
- *11 Available only for the FR-A800-GF series.

8.4 Outline dimension drawings

8.4.1 Inverter outline dimension drawings

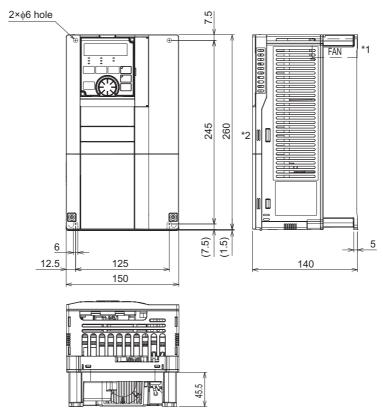
FR-A820-00046(0.4K), FR-A820-00077(0.75K)(-GF)



| Inverter model | D | D1 |
|----------------------|-----|----|
| FR-A820-00046(0.4K) | 110 | 20 |
| FR-A820-00077(0.75K) | 125 | 35 |

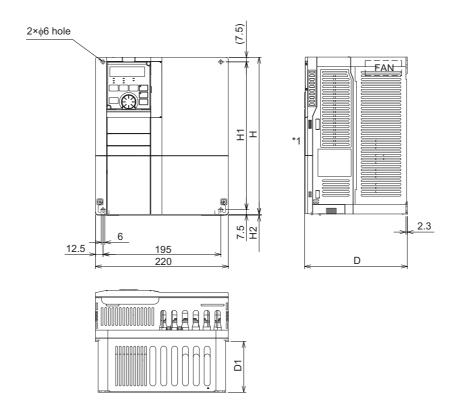
 $^{^{\}star}1$ The LED display cover attached to the FR-A800-GF in this position has an additional 2.1 mm depth.

FR-A820-00105(1.5K), 00167(2.2K), 00250(3.7K)(-GF) FR-A840-00023(0.4K), 00038(0.75K), 00052(1.5K), 00083(2.2K), 00126(3.7K)(-GF)



- *1 FR-A840-00023(0.4K) to 00052(1.5K) are not provided with a cooling fan.
- *2 The LED display cover attached to the FR-A800-GF in this position has an additional 2.1 mm depth.

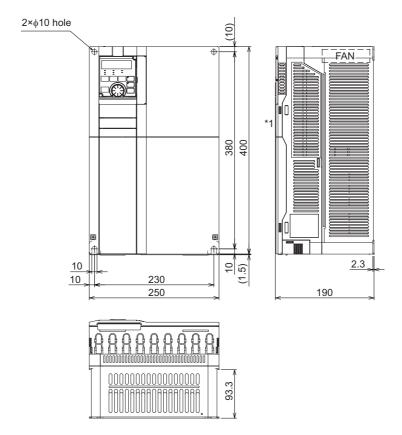
FR-A820-00340(5.5K), 00490(7.5K), 00630(11K)(-GF) FR-A840-00170(5.5K), 00250(7.5K), 00310(11K), 00380(15K)(-GF)



| Inverter model | Н | H1 | H2 | D | D1 |
|--|-----|-----|-----|-----|-------|
| FR-A820-00340(5.5K), 00490(7.5K) FR-A840-00170(5.5K), 00250(7.5K) | 260 | 245 | 1.5 | 170 | 84 |
| FR-A820-00630(11K) FR-A840-00310(11K), 00380(15K) | 300 | 285 | 3 | 190 | 101.5 |

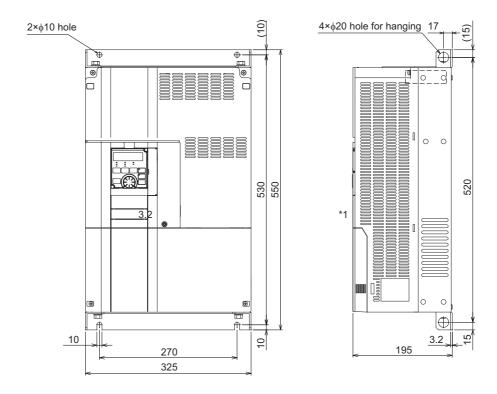
 $^{^{\}star}1$ The LED display cover attached to the FR-A800-GF in this position has an additional 2.1 mm depth.

FR-A820-00770(15K), 00930(18.5K), 01250(22K)(-GF) FR-A840-00470(18.5K), 00620(22K)(-GF)



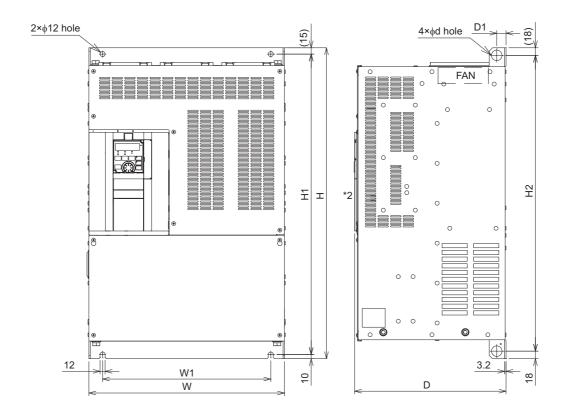
*1 The LED display cover attached to the FR-A800-GF in this position has an additional 2.1 mm depth.

FR-A820-01540(30K)(-GF) FR-A840-00770(30K)(-GF)



*1 The LED display cover attached to the FR-A800-GF in this position has an additional 2.1 mm depth.

FR-A820-01870(37K), 02330(45K), 03160(55K), 03800(75K), 04750(90K)(-GF) FR-A840-00930(37K), 01160(45K), 01800(55K), 02160(75K), 02600(90K), 03250(110K), 03610(132K)(-GF)

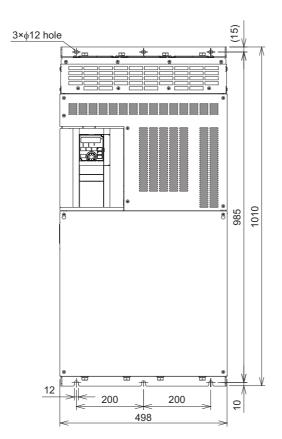


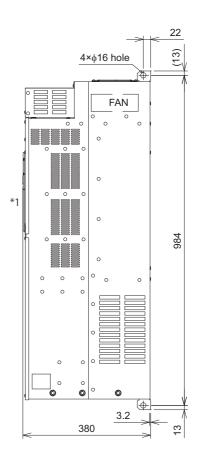
| Inverter model | W | W1 | Н | H1 | H2 | d | D | D1 |
|--|-----|-----|-----|-----|-----|----|-----|----|
| FR-A820-01870(37K), 02330(45K) | 435 | 380 | 550 | 525 | 514 | 25 | 250 | 24 |
| FR-A840-00930(37K), 01160(45K), 01800(55K)*1 | 433 | 360 | 550 | 323 | 514 | 20 | 250 | 24 |
| FR-A820-03160(55K) ^{*1} | 465 | 410 | 700 | 675 | 664 | 25 | 250 | 22 |
| FR-A820-03800(75K)*1, 04750(90K)*1 | 465 | 400 | 740 | 715 | 704 | 24 | 360 | 22 |
| FR-A840-02160(75K)*1, 02600(90K)*1 | 465 | 400 | 620 | 595 | 584 | 24 | 300 | 22 |
| FR-A840-03250(110K)*1, 03610(132K)*1 | 465 | 400 | 740 | 715 | 704 | 25 | 360 | 22 |

^{*1} For the FR-A820-03800(75K) or higher, the FR-A840-02160(75K) or higher, or whenever a 75 kW or higher motor is used, always connect a DC reactor (FR-HEL), which is available as an option.

 $^{^{*}2}$ The LED display cover attached to the FR-A800-GF in this position has an additional 2.1 mm depth.

FR-A840-04320(160K), 04810(185K)(-GF)

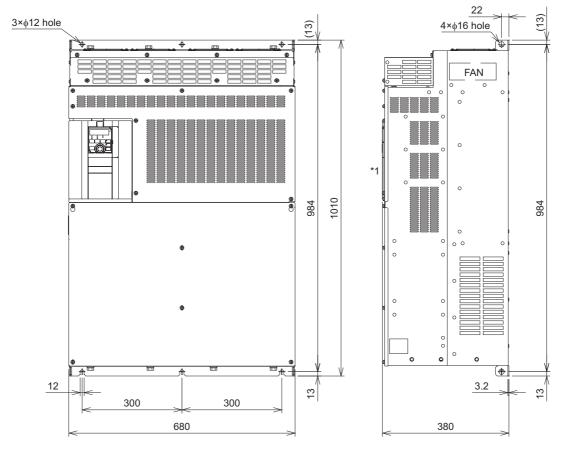




Always connect a DC reactor (FR-HEL), which is available as an option.

*1 The LED display cover attached to the FR-A800-GF in this position has an additional 2.1 mm depth. (Unit: mm)

FR-A840-05470(220K), 06100(250K), 06830(280K)(-GF)

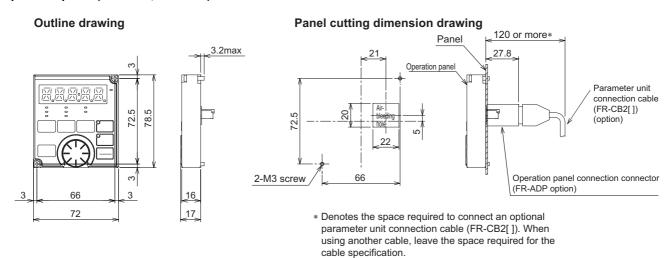


Always connect a DC reactor (FR-HEL), which is available as an option.

*1 The LED display cover attached to the FR-A800-GF in this position has an additional 2.1 mm depth.

(Unit: mm)

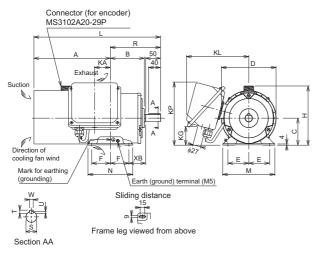
Operation panel (FR-DU08, FR-LU08)

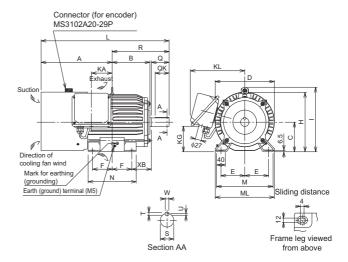


8.4.2 Dedicated motor outline dimension drawings

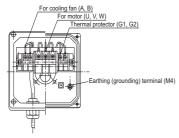
◆ Dedicated motor (SF-V5RU(H)) outline dimension drawings (standard horizontal type)

Frame number: 90L





Frame number: 100L, 112M, 132S, 132M

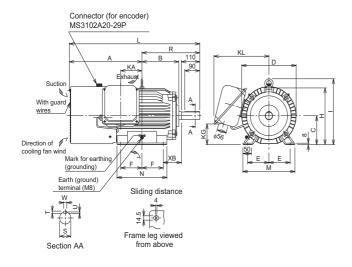


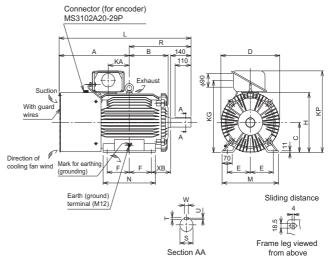
Make sure to earth the earth terminal of the flange section as well as the earth terminal in the terminal box.

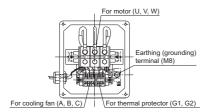
| SF- | SF- | SF- | SF- | Frame | Mana | | Motor | | | | | | | | | | | | | | Terminal screw size | | | | | | | | | | |
|-------------|--------------|--------------|--------------|-------|------|-------|-------|-----|-------|-----|------|-------|-----|----|-----|--------------|-----|-----|-----|-----|---------------------|----|----|-------|------|---|---|----|------------|--------------|-----------|
| V5RU []K | V5RU []K1 | V5RU []K3 | V5RU []K4 | No. | (kg) | Α | В | С | D | Е | F | н | ı | KA | KG | KL (KP) | L | М | ML | N | ХВ | Q | QK | R | s | т | U | w | U, V, W | A, B, (C) | G1, G2 |
| 1 | - | _ | _ | 90L | 24 | 256.5 | 114 | 90 | 183.6 | 70 | 62.5 | 198 | _ | 53 | 65 | 220 (210) | 425 | 175 | _ | 150 | 56 | - | _ | 168.5 | 24j6 | 7 | 4 | 8 | М6 | M4 | M4 |
| 2 | 1 | _ | - | 100L | 33 | 284 | 128 | 100 | 207 | 80 | 70 | 203.5 | 230 | 65 | 78 | 231 | 477 | 200 | 212 | 180 | 63 | 60 | 45 | 193 | 28j6 | 7 | 4 | 8 | M6 | M4 | M4 |
| 3 | 2 | 1 | - | 112M | 41 | 278 | 135 | 112 | 228 | 95 | 70 | 226 | 253 | 69 | 93 | 242 | 478 | 230 | 242 | 180 | 70 | 60 | 45 | 200 | 28j6 | 7 | 4 | 8 | M6 | M4 | M4 |
| 5 | 3 | 2 | - | 132S | 52 | 303 | 152 | 132 | 266 | 108 | 70 | 265 | 288 | 75 | 117 | 256 | 542 | 256 | 268 | 180 | 89 | 80 | 63 | 239 | 38k6 | 8 | 5 | 10 | M6 | M4 | M4 |
| 7 | 5 | 3 | 1 | 132M | 62 | 322 | 171 | 132 | 266 | 108 | 89 | 265 | 288 | 94 | 117 | 256 | 580 | 256 | 268 | 218 | 89 | 80 | 63 | 258 | 38k6 | 8 | 5 | 10 | M6 | M4 | M4 |

Frame Number: 160M, 160L, 180M, 180L

Frame number: 200L, 225S







Make sure to earth the earth terminal of the flange section as well as the earth terminal in the terminal box.

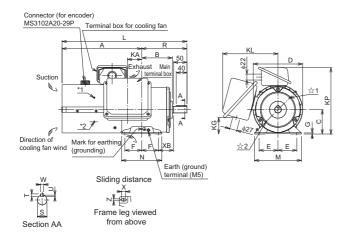
| SF- | SF- | SF- | SF- | | | | | | | | | | | | | | /lotor | | | | | | | | | | | | Termi | nal scre | w size |
|--------|--------------|--------|--------------|--------------|--------------|-------|-------|-----|-----|-------|-------|-----|-----|-----|-----|------------|--------|-----|----|-----|-----|---|----|-------|--------|----|-----|----|------------|--------------|-----------|
| V5RU | V5RU []K1 | | V5RU []K4 | Frame No. | Mass (kg) | Α | В | С | D | Е | F | н | ı | KA | KG | KL (KP) | L | М | ML | N | ХВ | Q | QK | R | s | т | U | w | U, V, W | A, B, (C) | G1, G2 |
| 11 | 7 | 5 | 2 | 160M | 99 | 412 | 198 | 160 | 318 | 127 | 105 | 316 | 367 | 105 | 115 | 330 | 735 | 310 | _ | 254 | 108 | _ | - | 323 | 42k6 | 8 | 5 | 12 | M8 | M4 | M4 |
| 15 | 11 | 7 | 3 | 160L | 113 | 434 | 220 | 160 | 318 | 127 | 127 | 316 | 367 | 127 | 115 | 330 | 779 | 310 | _ | 298 | 108 | _ | - | 345 | 42k6 | 8 | 5 | 12 | M8 | M4 | M4 |
| 18 | - | _ | _ | 180M | 138 | 138 5 | 225.5 | 180 | 363 | 139.5 | 120.5 | 359 | 410 | 127 | 139 | 352 | 790 | 335 | | 285 | 121 | | | 351.5 | 1816 | 9 | 5.5 | 14 | М8 | M4 | M4 |
| 22 | 15 | 11 | - | TOOW | 160 | 430.3 | 220.0 | 100 | 303 | 133.3 | 120.5 | 333 | 410 | 121 | 100 | 332 | 150 | 333 | _ | 200 | 121 | | _ | 331.3 | 4000 | 3 | 5.5 | 14 | IVIO | IVI-+ | 171-4 |
| _ | 18 | 15 | 5 | 180L | 200 | 457.5 | 242.5 | 180 | 363 | 139.5 | 139.5 | 359 | 410 | 146 | 139 | 352 | 828 | 335 | _ | 323 | 121 | _ | _ | 370.5 | 55m6 | 10 | 6 | 16 | M8 | M4 | M4 |
| 30 | _ | _ | 7 | 200L | 238 | 402 E | 267.5 | 200 | 406 | 159 | 152.5 | 401 | _ | 145 | 487 | (546) | 909 | 390 | _ | 361 | 133 | _ | | 425.5 | 60m6 | 11 | 7 | 18 | M10 | M4 | M4 |
| 37, 45 | 22, 30 | 18, 22 | - | 200L | 255 | 403.5 | 207.5 | 200 | 400 | 109 | 132.3 | 401 | _ | 145 | 407 | (340) | 909 | 390 | _ | 301 | 133 | _ | _ | 423.3 | 001110 | | ′ | 10 | IVITO | 1014 | 10124 |
| 55 | 37 | 30 | 11, 15 | 225S | 320 | 500 | 277 | 225 | 446 | 178 | 143 | 446 | _ | 145 | 533 | (592) | 932 | 428 | _ | 342 | 149 | _ | _ | 432 | 65m6 | 11 | 7 | 18 | M10 | M4 | M4 |

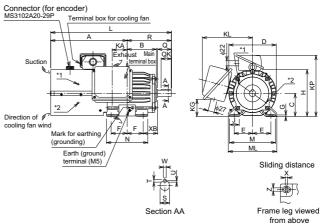


- Install the motor with a frame number 180 or larger on the floor and use it with the shaft horizontal.
- Leave an enough clearance between the fan suction port and wall to ensure adequate cooling. Check that a fan blows air from the opposite load side to the load side.
- The vertical tolerance for the shaft center height is $^{0}_{-0.5}$.
- The 400 V class motor has "-H" at the end of its model name.

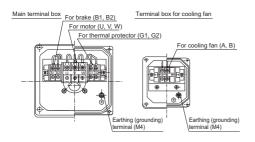
◆ Dedicated motor (SF-V5RU(H)) outline dimension drawings (standard horizontal type with brake)

Frame number: 90L





Frame number: 100L, 112M, 132S, 132M

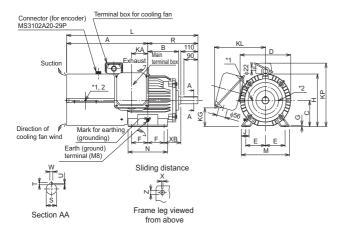


* indicates an inserting position of a bolt with hex head holes for manual opening.

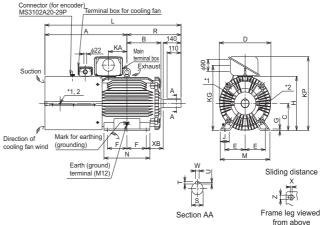
Make sure to earth the earth terminal of the flange section as well as the earth terminal in the terminal box.

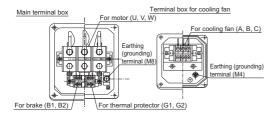
| SF- | SF- | SF- | SF- | Frame | Maga | | | | | | | | | | | M | otor | | | | | | | | | | | | | Sha | aft end | ı | | | Terr | ninal s | crew | size |
|-----|-----|---------------|------|-------|------|-------|-----|-----|-------|-----|------|-----|---|---|----|----|------|-----|-----|-----|-------|-----|-----|-----|----|----|----|----|----|-------|---------|---|---|----|------------|--------------|-----------|-----------|
| | | V5RU []K3B | VSRU | No | (kg) | Α | В | С | D | Е | F | G | Н | 1 | J | KA | KD | KG | KL | KP | L | M | ML | N | х | ХВ | Z | Q | QK | R | S | т | U | w | U, V, W | A, B, (C) | G1, G2 | B1, B2 |
| 1 | _ | - | _ | 90L | 29 | 296.5 | 114 | 90 | 183.6 | 70 | 62.5 | 4 | - | - | - | 53 | 27 | 65 | 220 | 245 | 465 | 175 | _ | 150 | 15 | 56 | 9 | 50 | 40 | 168.5 | 24j6 | 7 | 4 | 8 | M6 | M4 | M4 | M4 |
| 2 | 1 | - | - | 100L | 46 | 333.5 | 128 | 100 | 207 | 80 | 70 | 6.5 | - | - | 40 | 65 | 27 | 78 | 231 | 265 | 526.5 | 200 | 212 | 180 | 4 | 63 | 12 | 60 | 45 | 193 | 28j6 | 7 | 4 | 8 | M6 | M4 | M4 | M4 |
| 3 | 2 | 1 | - | 112M | 53 | 355 | 135 | 112 | 228 | 95 | 70 | 6.5 | - | - | 40 | 69 | 27 | 93 | 242 | 290 | 555 | 230 | 242 | 180 | 4 | 70 | 12 | 60 | 45 | 200 | 28j6 | 7 | 4 | 8 | M6 | M4 | M4 | M4 |
| 5 | 3 | 2 | _ | 132S | 70 | 416 | 152 | 132 | 266 | 108 | 70 | 6.5 | - | - | 40 | 75 | 27 | 117 | 256 | 329 | 655 | 256 | 268 | 180 | 4 | 89 | 12 | 80 | 63 | 239 | 38k6 | 8 | 5 | 10 | M6 | M4 | M4 | M4 |
| 7 | 5 | 3 | 1 | 132M | 80 | 435 | 171 | 132 | 266 | 108 | 89 | 6.5 | _ | _ | 40 | 94 | 27 | 117 | 256 | 329 | 693 | 256 | 268 | 218 | 4 | 89 | 12 | 80 | 63 | 258 | 38k6 | 8 | 5 | 10 | М6 | M4 | M4 | M4 |

Frame Number: 160M, 160L, 180M, 180L



Frame number: 200L, 225S





* indicates an inserting position of a bolt with hex head holes for manual opening.

Make sure to earth the earth terminal of the flange section as well as the earth terminal in the terminal box.

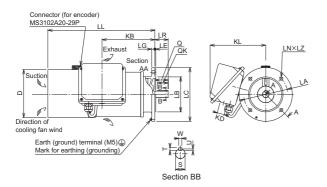
| SF- | SF- | SF- | SF- | Frame | Maga | | | | | | | | | | | M | otor | | | | | | | | | | | | | Sh | aft en | | | | | ninal s | | size |
|-------|----------|---------------|--------|--------|------|-------|-------|-----|-----|-------|-------|----|---|---|-----|-----|------|-----|-----|-----|-------|-----|----|-----|---|-----|------|-----|-----|-------|--------|----|----------|----|------------|--------------|-----------|-----------|
| | | V5RU []K3B | VSKU | No | (kg) | Α | В | С | D | Е | F | G | н | 1 | J | KA | KD | KG | KL | KP | L | M | ML | N | х | хв | z | Q | QK | R | s | т | U | w | U, V, W | A, B, (C) | G1, G2 | B1, B2 |
| 11 | 7 | 5 | 2 | 160M | 140 | 522.5 | 198 | 160 | 318 | 127 | 105 | 8 | - | - | 50 | 105 | 56 | 115 | 330 | 391 | 845.5 | 310 | _ | 254 | 4 | 108 | 14.5 | 110 | 90 | 323 | 42k6 | 8 | 5 | 12 | M8 | M4 | M4 | M4 |
| 15 | 11 | 7 | 3 | 160L | 155 | 544.5 | 220 | 160 | 318 | 127 | 127 | 8 | - | - | 50 | 127 | 56 | 115 | 330 | 391 | 889.5 | 310 | _ | 298 | 4 | 108 | 14.5 | 110 | 90 | 345 | 42k6 | 8 | 5 | 12 | M8 | M4 | M4 | M4 |
| 18 | — | - | | 180M | 185 | 568.5 | 225 5 | 100 | 262 | 120 5 | 120 E | 8 | | | E0. | 127 | E6 | 120 | 252 | 420 | 920 | 225 | | 285 | 4 | 121 | 115 | 110 | 00 | 251 5 | 48k6 | ٥ | | 14 | М8 | M4 | M4 | M4 |
| 22 | 15 | 11 | | TOUIVI | 215 | 300.3 | 220.0 | 100 | 303 | 138.3 | 120.5 | 0 | _ | | 50 | 121 | 50 | 139 | 332 | 420 | 920 | 333 | _ | 200 | + | 121 | 14.5 | 110 | 90 | 331.3 | 4000 | 9 | 5.5 | 14 | IVIO | IVI4 | IVI4 | IVI4 |
| _ | 18 | 15 | 5 | 180L | 255 | 587.5 | 242.5 | 180 | 363 | 139.5 | 139.5 | 8 | - | - | 50 | 146 | 56 | 139 | 352 | 428 | 958 | 335 | _ | 323 | 4 | 121 | 14.5 | 110 | 90 | 370.5 | 55m6 | 10 | 6 | 16 | M8 | M4 | M4 | M4 |
| 30 | — | - | 7 | 200L | 305 | 644.5 | 267 5 | 200 | 406 | 150 | 152.5 | 11 | | | 70 | 115 | 00 | 487 | | E46 | 1070 | 200 | | 361 | 4 | 122 | 10 E | 140 | 110 | 40E E | 60m6 | 11 | 7 | 10 | M10 | M4 | M4 | M4 |
| 37, 4 | 22, 30 | 18, 22 | | 200L | 330 | 044.0 | 207.0 | 200 | 400 | 139 | 132.3 | '' | - | | , 0 | 140 | 50 | 407 | _ | 540 | 10/0 | 530 | _ | 301 | + | 133 | 10.0 | 140 | 110 | 420.0 | 001110 | '' | ' | 10 | IVI IU | 1714 | 1714 | 1914 |
| 55 | 37 | 30 | 11, 15 | 225S | 395 | 659 | 277 | 225 | 446 | 178 | 143 | 11 | — | - | 70 | 145 | 90 | 533 | _ | 592 | 1091 | 428 | _ | 342 | 4 | 149 | 18.5 | 140 | 110 | 432 | 65m6 | 11 | 7 | 18 | M10 | M4 | M4 | M4 |

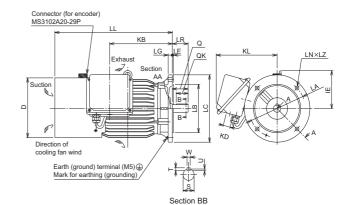


- Install the motor on the floor and use it with the shaft horizontal.
- Leave an enough clearance between the fan suction port and wall to ensure adequate cooling. Check that a fan blows air from the opposite load side to the load side.
- The vertical tolerance for the shaft center height is $^{0}_{-0.5}$.
- The 400 V class motor has "-H" at the end of its model name.
- Since a brake power device is a stand-alone, install it inside the enclosure. (This device should be arranged by the customer. Refer to the FR-A800 catalog.)

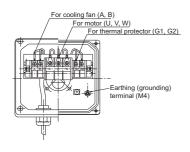
◆ Dedicated motor (SF-V5RU(H)) outline dimension drawings (flange type)

Frame number: 90L





Frame number: 100L, 112M, 132S, 132M



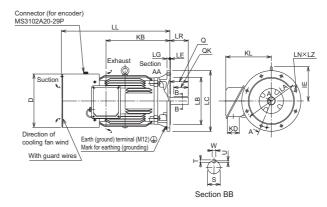
Make sure to earth the earth terminal of the flange section as well as the earth terminal in the terminal box.

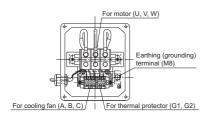
| SF- | SF- | SF- | SF- | Flange | Eramo | Mace | | | | | | | Motor | | | | | | | | | Sh | aft end | | | | Termir | nal scre | w size |
|--------------|---------------|---------------|---------------|--------|-------|------|-------|-----|-------|----|-----|-----|-------|-----|-----|----|-----|----|------|----|----|----|---------|---|---|----|------------|--------------|-----------|
| V5RUF []K | V5RUF []K1 | V5RUF []K3 | V5RUF []K4 | No. | No. | (kg) | D | ΙE | КВ | KD | KL | LA | LB | LC | LE | LG | LL | LN | LZ | LR | Q | QK | S | т | U | w | U, V, W | A, B, (C) | G1, G2 |
| 1 | _ | _ | _ | FF165 | 90L | 26.5 | 183.6 | _ | 198.5 | 27 | 220 | 165 | 130j6 | 200 | 3.5 | 12 | 402 | 4 | 12 | 50 | 50 | 40 | 24j6 | 7 | 4 | 8 | M6 | M4 | M4 |
| 2 | 1 | _ | _ | FF215 | 100L | 37 | 207 | 130 | 213 | 27 | 231 | 215 | 180j6 | 250 | 4 | 16 | 432 | 4 | 14.5 | 60 | 60 | 45 | 28j6 | 7 | 4 | 8 | M6 | M4 | M4 |
| 3 | 2 | 1 | - | FF215 | 112M | 46 | 228 | 141 | 239 | 27 | 242 | 215 | 180j6 | 250 | 4 | 16 | 448 | 4 | 14.5 | 60 | 60 | 45 | 28j6 | 7 | 4 | 8 | M6 | M4 | M4 |
| 5 | 3 | 2 | - | FF265 | 132S | 65 | 266 | 156 | 256 | 27 | 256 | 265 | 230j6 | 300 | 4 | 20 | 484 | 4 | 14.5 | 80 | 80 | 63 | 38k6 | 8 | 5 | 10 | M6 | M4 | M4 |
| 7 | 5 | 3 | 1 | FF265 | 132M | 70 | 266 | 156 | 294 | 27 | 256 | 265 | 230j6 | 300 | 4 | 20 | 522 | 4 | 14.5 | 80 | 80 | 63 | 38k6 | 8 | 5 | 10 | M6 | M4 | M4 |

Frame Number: 160M, 160L, 180M, 180L

Connector (for encoder) MS3102A20-29P LE KB LG KL LN×LZ Suction Direction of cooling fan wind With guard wires Mark for earthing (grounding) With guard wires

Frame number: 200L





Make sure to earth the earth terminal of the flange section as well as the earth terminal in the terminal box.

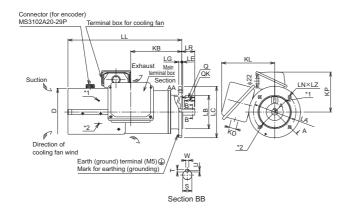
| SF- | SF- | SF- | SF- | Flange | Eramo | Mace | | | | | | | Motor | | | | | | | | | Sh | aft end | | | | Termir | al scre | ew size |
|--------------|---------------|---------------|---------------|--------|--------|------|-----|-----|-------|----|-----|-----|-------|-----|----|----|-------|----|------|-----|-----|-----|---------|------|-----|----|------------|--------------|-----------|
| V5RUF []K | V5RUF []K1 | V5RUF []K3 | V5RUF []K4 | No. | No. | (kg) | D | ΙE | КВ | KD | KL | LA | LB | LC | LE | LG | LL | LN | LZ | LR | Q | QK | s | т | U | w | U, V, W | A, B, (C) | G1, G2 |
| 11 | 7 | 5 | 2 | FF300 | 160M | 110 | 318 | 207 | 318 | 56 | 330 | 300 | 250j6 | 350 | 5 | 20 | 625 | 4 | 18.5 | 110 | 110 | 90 | 42k6 | 8 | 5 | 12 | M8 | M4 | M4 |
| 15 | 11 | 7 | 3 | FF300 | 160L | 125 | 318 | 207 | 362 | 56 | 330 | 300 | 250j6 | 350 | 5 | 20 | 669 | 4 | 18.5 | 110 | 110 | 90 | 42k6 | 8 | 5 | 12 | M8 | M4 | M4 |
| 18 | _ | _ | - | FF350 | 180M | 160 | 363 | 230 | 378.5 | 56 | 352 | 350 | 300j6 | 400 | _ | 20 | 690 | 4 | 18.5 | 110 | 110 | 90 | 48k6 | 9 | 5.5 | 14 | M8 | M4 | M4 |
| 22 | 15 | 11 | - | FF350 | TOUIVI | 185 | 303 | 230 | 376.3 | 30 | 332 | 330 | 300]0 | 400 | 3 | 20 | 090 | 4 | 10.5 | 110 | 110 | 90 | 4000 | 9 | 5.5 | 14 | IVIO | IVI4 | 1014 |
| _ | 18 | 15 | 5 | FF350 | 180L | 225 | 363 | 230 | 416.5 | 56 | 352 | 350 | 300j6 | 400 | 5 | 20 | 728 | 4 | 18.5 | 110 | 110 | 90 | 55m6 | 10 | 6 | 16 | M8 | M4 | M4 |
| 30 | - | _ | 7 | FF400 | 200L | 270 | 406 | 255 | 485 | 90 | 346 | 400 | 350j6 | 450 | _ | 22 | 823.5 | 8 | 18.5 | 140 | 140 | 110 | 60m6 | 11 | 7 | 10 | M10 | M4 | M4 |
| 37, 45 | 22, 30 | 18, 22 | _ | FF400 | 200L | 290 | 400 | 200 | 400 | 90 | 340 | 400 | 330Jb | 450 | ິນ | 22 | 023.5 | О | 10.5 | 140 | 140 | 110 | OUTTO | - 11 | ′ | 10 | IVI IU | IVI4 | ivi4 |

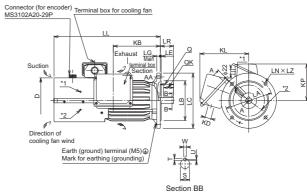


- The motor with a frame number 180 or larger cannot be installed on the ceiling (with the shaft facing up). For use with the shaft facing down, the protection rating of the cooling fan is IP20.
- Leave an enough clearance between the fan suction port and wall to ensure adequate cooling. Check that a fan blows air from the opposite load side to the load side.
- The 400 V class motor has "-H" at the end of its model name.

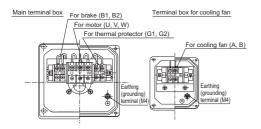
◆ Dedicated motor (SF-V5RU(H)) outline dimension drawings (flange type with brake)

Frame number: 90L





Frame number: 100L, 112M, 132S, 132M

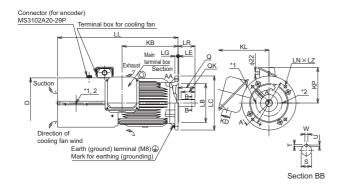


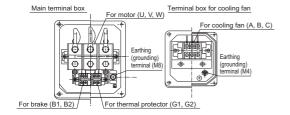
* indicates an inserting position of a bolt with hex head holes for manual opening.

Make sure to earth the earth terminal of the flange section as well as the earth terminal in the terminal box.

| SF- | SF- | SF- | SF- | Flange | Frame | Mana | | | | | | | Motor | | | | | | | | | S | haft en | d | | | Ter | minal s | screw | size |
|---------------|-----|-----|-----|--------|-------|------|-------|-------|----|-----|-----|-----|-------|-----|-----|----|-------|----|------|----|----|----|---------|---|---|----|------------|--------------|-----------|-----------|
| V5RUF []KB | | | | No. | No. | (kg) | D | КВ | KD | KL | KP | LA | LB | LC | LE | LG | LL | LN | LZ | LR | Q | QK | s | т | U | w | U, V, W | A, B, (C) | B1, B2 | G1, G2 |
| 1 | _ | _ | _ | FF165 | 90L | 31.5 | 183.6 | 198.5 | 27 | 220 | 155 | 165 | 130j6 | 200 | 3.5 | 12 | 442 | 4 | 12 | 50 | 50 | 40 | 24j6 | 7 | 4 | 8 | M6 | M4 | M4 | M4 |
| 2 | 1 | _ | _ | FF215 | 100L | 50 | 207 | 213 | 27 | 231 | 165 | 215 | 180j6 | 250 | 4 | 16 | 481.5 | 4 | 14.5 | 60 | 60 | 45 | 28j6 | 7 | 4 | 8 | M6 | M4 | M4 | M4 |
| 3 | 2 | 1 | _ | FF215 | 112M | 58 | 228 | 239 | 27 | 242 | 178 | 215 | 180j6 | 250 | 4 | 16 | 525 | 4 | 14.5 | 60 | 60 | 45 | 28j6 | 7 | 4 | 8 | M6 | M4 | M4 | M4 |
| 5 | 3 | 2 | - | FF265 | 132S | 83 | 266 | 256 | 27 | 256 | 197 | 265 | 230j6 | 300 | 4 | 20 | 597 | 4 | 14.5 | 80 | 80 | 63 | 38k6 | 8 | 5 | 10 | M6 | M4 | M4 | M4 |
| 7 | 5 | 3 | 1 | FF265 | 132M | 88 | 266 | 294 | 27 | 256 | 197 | 265 | 230j6 | 300 | 4 | 20 | 635 | 4 | 14.5 | 80 | 80 | 63 | 38k6 | 8 | 5 | 10 | M6 | M4 | M4 | M4 |

Frame number: 160M, 160L





* indicates an inserting position of a bolt with hex head holes for manual opening.

Make sure to earth the earth terminal of the flange section as well as the earth terminal in the terminal box.

| SF- | SF- | SF- | SF- | Flange | Eramo | Mass | | | | | | | Motor | | | | | | | | | S | haft en | d | | | Ter | minal s | crew s | size |
|---------------|----------------|----------------|----------------|--------|-------|------|-----|-----|----|-----|-----|-----|-------|-----|----|----|-------|----|------|-----|-----|----|---------|---|---|----|------------|--------------|-----------|-----------|
| V5RUF []KB | V5RUF []K1B | V5RUF []K3B | V5RUF []K4B | No. | No. | (kg) | D | КВ | KD | KL | KP | LA | LB | LC | LE | LG | LL | LN | LZ | LR | Q | QK | s | т | U | w | U, V, W | A, B, (C) | B1, B2 | G1, G2 |
| 11 | 7 | 5 | 2 | FF300 | 160M | 151 | 318 | 318 | 56 | 330 | 231 | 300 | 250j6 | 350 | 5 | 20 | 735.5 | 4 | 18.5 | 110 | 110 | 90 | 42k6 | 8 | 5 | 12 | M8 | M4 | M4 | M4 |
| 15 | 11 | 7 | 3 | FF300 | 160L | 167 | 318 | 362 | 56 | 330 | 231 | 300 | 250j6 | 350 | 5 | 20 | 779.5 | 4 | 18.5 | 110 | 110 | 90 | 42k6 | 8 | 5 | 12 | M8 | M4 | M4 | M4 |

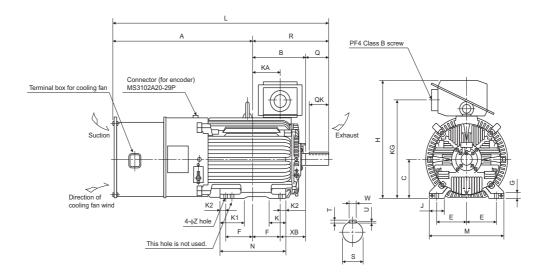


- Install the motor on the wall and use it with the shaft horizontal.
- Leave an enough clearance between the fan suction port and wall to ensure adequate cooling. Check that a fan blows air from the opposite load side to the load side.
- The 400 V class motor has "-H" at the end of its model name.
- Since a brake power device is a stand-alone, install it inside the enclosure. (This device should be arranged by the customer. Refer to the FR-A800 catalog.)

◆ Dedicated motor (SF-THY) outline dimension drawings (1500 r/min series)

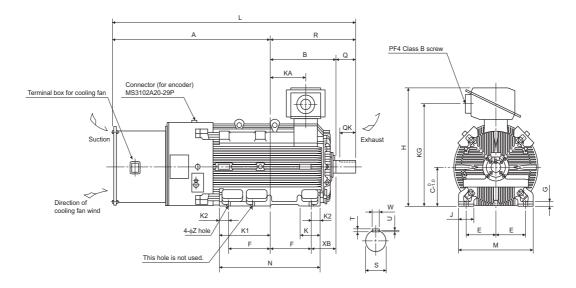
Frame number: 250MD, 280MD

75 to 160 kW



Frame number: 280L, 315H

200 kW, 250 kW



Dimensions table (Unit: mm)

| Output | Frame | Mass | | | | | | | | | | Mo | tor | | | | | | | | | | | | Shaft en | d size | | |
|--------|-------|------|--------|-------|-----|-----|-------|-------|----|-----|-----|-----|-----|----|------|-----|-----|-------|----|-----|-------|-----|-----|-----|----------|--------|----|-----|
| Output | No. | (kg) | Α | В | С | D | Е | F | G | Н | J | K | K1 | K2 | L | M | N | R | Z | XB | KA | KG | Q | QK | S | W | T | U |
| 75 | 250MD | 610 | 988.5 | 340.5 | 250 | 557 | 203 | 174.5 | 30 | 775 | 100 | 130 | 168 | 50 | 1471 | 486 | 449 | 482.5 | 24 | 168 | 157.5 | 635 | 140 | 110 | φ75m6 | 20 | 12 | 7.5 |
| 90 | 250MD | 660 | 988.5 | 340.5 | 250 | 557 | 203 | 174.5 | 30 | 775 | 100 | 130 | 168 | 50 | 1471 | 486 | 449 | 482.5 | 24 | 168 | 157.5 | 635 | 140 | 110 | φ75m6 | 20 | 12 | 7.5 |
| 110 | 280MD | 870 | 1049.5 | 397.5 | 280 | 607 | 228.5 | 209.5 | 30 | 845 | 110 | 130 | 181 | 40 | 1619 | 560 | 449 | 569.5 | 24 | 190 | 210.5 | 705 | 170 | 140 | φ85m6 | 22 | 14 | 9 |
| 132 | 280MD | 890 | 1049.5 | 397.5 | 280 | 607 | 228.5 | 209.5 | 30 | 845 | 110 | 130 | 181 | 40 | 1619 | 560 | 449 | 569.5 | 24 | 190 | 210.5 | 705 | 170 | 140 | φ85m6 | 22 | 14 | 9 |
| 160 | 280MD | 920 | 1049.5 | 397.5 | 280 | 607 | 228.5 | 209.5 | 30 | 845 | 110 | 130 | 181 | 40 | 1619 | 560 | 499 | 569.5 | 24 | 190 | 210.5 | 705 | 170 | 140 | φ85m6 | 22 | 14 | 9 |
| 200 | 280L | 1170 | 1210.5 | 416.5 | 280 | 652 | 228.5 | 228.5 | 30 | 885 | 110 | 160 | 160 | 75 | 1799 | 560 | 607 | 588.5 | 24 | 190 | 214.5 | 745 | 170 | 140 | φ85m6 | 22 | 14 | 9 |
| 250 | 315H | 1630 | 1343 | 565 | 315 | 717 | 254 | 355 | 35 | 965 | 130 | 175 | 428 | 80 | 2084 | 636 | 870 | 741 | 28 | 216 | 306 | 825 | 170 | 140 | φ95m6 | 25 | 14 | 9 |

NOTE

• The vertical tolerance for the shaft center height C is $^{\,0}_{-0.5}$ for the frame number 250, and $^{\,0}_{-1.0}$ for the frame number 280 or larger.

MEMO

CHAPTER 9 APPENDIX

| 9.1 | For customers replacing the conventional model with this inverter | 856 |
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APPENDIX

APPENDIX provides the reference information for use of this product. Refer to APPENDIX as required.

9.1 For customers replacing the conventional model with this inverter

Replacement of the FR-A700 series 9.1.1

♦ Differences and compatibility with the FR-A700 series

| | Item | FR-A700 | FR-A800 |
|--------------------------|--|--|--|
| | Control method | V/F control Advanced magnetic flux vector control Real sensorless vector control Vector control (with plug-in option) PM sensorless vector control (IPM motor) | V/F control Advanced magnetic flux vector control Real sensorless vector control Vector control (with plug-in option / control terminal option) PM sensorless vector control (IPM motor / SPM motor) |
| | Added functions | _ | USB host function, safety stop function, etc. |
| В | Brake transistor (brake resistor usable) | Built in for the FR-A720-0.4K to 22K. Built in for the FR-A740-0.4K to 22K. | Built in for the FR-A820-00046(0.4K) to 01250(22K). Built in for the FR-A840-00023(0.4K) to 01800(55K). |
| ठ | V/F control | 400 Hz | 590 Hz |
| uenbe | Advanced magnetic flux vector control | 120 Hz | 400 Hz |
| put fre | Real sensorless vector control | 120 Hz | 400 Hz |
| out | Vector control | 120 Hz | 400 Hz |
| Maximum output frequency | PM sensorless vector control | 300 Hz | 400 Hz |
| | PID control | Turn the X14 signal ON to enable PID control. | When the X14 signal is not assigned, just set a value in Pr.128 to enable PID control. When the X14 signal is assigned, turn the X14 signal ON while Pr.128 ≠ "0" to enable PID control. The PID pre-charge function and dancer control are added. |
| | Automatic restart after antaneous power failure | Turn the CS signal ON to enable restart. | Restart is enabled by turning ON the CS signal, or solely setting Pr.57 if the CS signal is not assigned to any input terminal. |
| | tart coasting time after antaneous power failure | Time period from restoration of power until the operation is restarted | Time period from occurrence of instantaneous power failure until the operation is restarted |
| | lumber of motor poles V/F control switching | The V/F switchover (X18) signal is valid when Pr.81 = "12 to 20" (2 to 10 poles). | Pr.81 = "12" (12 poles) The X18 signal is valid regardless of the Pr.81 setting. (The Pr.81 settings "14 to 20" are not available.) |
| | PTC thermistor input | Input through terminal AU (The function of terminal AU is switched by a switch.) | Input through terminal 2 (The function of terminal 2 is switched by the Pr.561 setting.) |
| | USB connector | B connector | Mini B connector |
| С | Control circuit terminal block | Removable terminal block (screw type) | Removable terminal block (spring clamp type) |
| To | erminal response level | Inverter output terminal filter and Pr.699 In | sponse level than the FR-A700's terminals. By setting Pr.289 nput terminal filter, the terminal response level can be compatible 5 to 8 ms and adjust the setting according to the system. |
| | PU | FR-DU07 (4-digit LED) FR-PU07 | FR-DU08 (5-digit LED) FR-LU08 (LCD operation panel) FR-PU07 (Some functions such as Parameter copy are unavailable.) The FR-DU07 is not supported. |
| | Plug-in option | Dedicated plug-in options (not interchangea | able) |

| Item | FR-A700 | FR-A800 |
|------------------------------|---|--|
| Communication option | Connected to the connector 3 | Connected to the connector 1 |
| Installation size | same capacities does not require new mou | size is compatible for all capacities. (Replacement between the nting holes.) size is not compatible. (New mounting holes are required.) |
| Converter | Built-in for all capacities | An optional converter unit (FR-CC2) is required for separated converter types. |
| DC reactor | The 75K or higher comes with a DC reactor (FR-HEL). | For the FR-A820-03800(75K) or higher, the FR-A840-02160(75K) or higher, and when a 75 kW or higher motor is used, select a DC reactor suitable for the applicable motor capacity. (A DC reactor is not included.) Separated converter types (converter unit FR-CC2) and IP55 compatible models have a built-in DC reactor. |
| Brake unit (75 kW or higher) | FR-BU2, MT-BU5 | FR-BU2 |

♦ Installation precautions

- Removal procedure of the front cover is different. (Refer to page 33.)
- · Plug-in options of the FR-A700 series are not compatible.
- · Operation panel (FR-DU07) cannot be used.

Wiring instructions

· The spring clamp type terminal block has changed to the screw type. Use of blade terminals is recommended.

◆ Instructions for continuous use of the PU07 (parameter unit) manufactured in September 2015 or earlier

- For the FR-A800 series, many functions (parameters) have been added. When setting these parameters, the parameter names and setting ranges are not displayed.
- Only the parameter with the numbers up to "999" can be read and set. The parameters with the numbers after "999" cannot be read or set.
- Many protective functions have been added for the FR-A800 series. These functions are available, but all faults are
 displayed as "Fault". When the fault history is checked, "ERR" appears. Added faults will not appear on the parameter unit.
 (However, MT1 to MT3 are displayed as MT.)
- · Parameter copy/verification function are not available.

Copying parameter settings

• The FR-A700 series' parameter settings can be easily copied to the FR-A800 series by using the setup software (FR Configurator2). (Not supported by the setup software FR-SW3-SETUP or older.)

9.1.2 Replacement of the FR-A500(L) series

◆ Installation precautions

- Installation size is compatible for replacing the FR-A520(L)-0.4K to 90K, FR-A540(L)-0.4K to 7.5K, 18.5K to 55K, 110K, 160K, or 220K. New mounting holes are required for replacing models with other capacities.
- To use the same mounting holes of the FR-A540-11K or 15K for the A800 series, the optional installation interchange attachment (FR-AAT) is necessary.
- The external heat sink attachment is not interchangeable.
 The enclosure cut dimensions of the FR-A520-3.7K or lower, FR-A520-30K, FR-A520-55K or higher, FR-A540-3.7K or lower, FR-A540-11K and 15K, and FR-A540-75K or higher are not compatible.



 For the installation size and the outline dimensions of the separated converter type, refer to the FR-A802 (Separated Converter Type) Instruction Manual (Hardware).

9.2 International standards

• For information on compliance with EU Directives or standards including UL or cUL standards, refer to both the Startup and Hardware versions of the Instruction Manual.

9.3 Acquisition of type certification for ship classification standards (400 V class)

9.3.1 Applicable models

| Structure/functionality | Applicable inverter |
|--------------------------|--|
| Standard model | FR-A840-00023(0.4K) to 06830(280K) |
| Separated converter type | FR-A842-07700(315K) to 12120(500K) FR-CC2-H315 to H500K |
| IP55 compatible model | FR-A846-00023(0.4K) to 03610(132K)-C2*1 |

^{*1} FR-A846-00023(0.4K) to 03610(132K)-C3 inverters are not applicable.

9.3.2 Details of type certification for standard model / Separated converter type

The inverters can be used in ships, except on the bridge and open deck areas.

◆ Details of certification

| Certification body | Certificate number | Compatible from (Manufacture year and month) |
|---|---|--|
| NK (Nippon Kaiji Kyokai) | 14A020 | September 2014 |
| ABS (American Bureau of Shipping) | 19-YO1938937-PDA 19-YO1938937-PDAPDP | September 2014 |
| BV (Bureau Veritas) | 37962/B0 | October 2014 |
| DNV GL (DNV GL AS)*1 | TAE00000H2 | November 2015 |
| LR (Lloyd's Register of British and Foreign Shipping) | LR2002550TA-CERT LR2002550TA-DAD LR2002550TA-Appendix | November 2014 |
| CCS (China Classification Society) | DB15T00005 DB19PTB00014 | April 2015 |
| KR (Korean Register of Shipping) | TKY21652-AC002 | April 2015 |

^{*1} From November 2014 to October 2015, the certification body was DNV. (Certificate No.: E-14104)

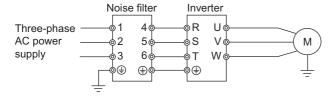
Precautions

The following are precautions for the system as a whole to be compliant with ship classification standards.

- To use the FR-A840-01800(55K) or lower, set AC voltage/frequency to three-phase 380 to 480 V, 50/60 Hz.
- The applicable inverters have been approved as products for use in enclosure. Install the inverters in enclosures.
- Use the inverters in an environment without corrosive gas or the like. (Inverters with circuit board coating are available for improved environmental resistance. Consult our sales office for more details.)
- For electromagnetic compatibility (EMC), install the recommended EMC filter shown in the following page (manufactured by Soshin Electric Co., Ltd.) or an equivalent at the input side of the inverter.
- Set the built-in EMC filter in the inverter to "enabled" (ON).
- Ensure that the finalized system which includes an inverter complies with the ship classification standards.

♦ Noise filter wiring

Install a recommended noise filter (manufactured by Soshin Electric Co., Ltd.) at the input side of the inverter as shown in the following diagram.



♦ Recommended EMC filter (manufactured by Soshin Electric Co., Ltd.)

The following section shows the specifications of recommended EMC filters to be used in combination with inverters.

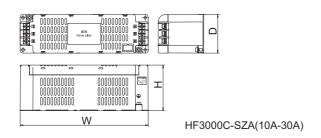
■ Standard model

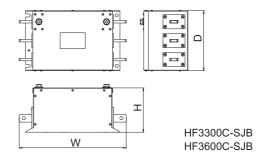
| Inverter model | Noise filter model | | | | |
|----------------|--------------------|-------------|-------------|----|--|
| FR-A840-[] | SLD | LD | ND | HD | |
| 00023(0.4K) | | · | | · | |
| 00038(0.75K) | HF3010C-SZA | | | | |
| 00052(1.5K) | | | | | |
| 00083(2.2K) | HF3020C-SZA | | | | |
| 00126(3.7K) | HF3020C-SZA | | | | |
| 00170(5.5K) | HF3030C-SZA | | HF3020C-SZA | | |
| 00250(7.5K) | HF3030C-SZA | | | | |
| 00310(11K) | HF3040C-SZA | | | | |
| 00380(15K) | HF3050C-SZA | | HF3040C-SZA | | |
| 00470(18.5K) | HF3060C-SZA | | | | |
| 00620(22K) | HF3080C-SZA | | | | |
| 00770(30K) | HF3100C-SZA | | | | |
| 00930(37K) | HF3150C-SZA | HF3100C-SZA | | | |
| 01160(45K) | HF3150C-SZA | | | | |
| 01800(55K) | HF3200C-SZA | | | | |
| 02160(75K) | | | | | |
| 02600(90K) | HF3230C-3ZA | HF3250C-SZA | | | |
| 03250(110K) | HF3600C-SJB | HF3300C-SJB | | | |
| 03610(132K) | HF3600C-SJB | | HF3300C-SJB | | |
| 04320(160K) | | | | | |
| 04810(185K) | HF3600C-SJB | | | | |
| 05470(220K) | | | | | |
| 06100(250K) | | | | | |
| 06830(280K) | HF31000C-SJB | | | | |

■ Separated converter type

| Inverter model | Noise filter model | | | |
|----------------|--------------------|----|----|----|
| FR-A842-[] | SLD | LD | ND | HD |
| 07700(315K) | | | | |
| 08660(355K) | HF31000C-SJB | | | |
| 09620(400K) | | | | |
| 10940(450K) | HF31200C-SJB | | | |
| 12120(500K) | HF31600C-SJB | | | |

■ Appearance examples and outline dimensions





| Noise filter model | W | D | Н | |
|--------------------|-----|-----|-----|--|
| HF3010C-SZA | | 66 | 78 | |
| HF3020C-SZA | 220 | | | |
| HF3030C-SZA | | | | |
| HF3040C-SZA | | | | |
| HF3050C-SZA | 270 | 80 | 84 | |
| HF3060C-SZA | | | | |
| HF3080C-SZA | 310 | 100 | 210 | |
| HF3100C-SZA | 310 | 100 | | |
| HF3150C-SZA | 395 | 110 | 230 | |
| HF3200C-SZA | 400 | 120 | 260 | |
| HF3250C-SZA | 400 | 120 | | |
| HF3300C-SJB | 340 | 190 | 140 | |
| HF3600C-SJB | 340 | | | |
| HF31000C-SJB | 390 | 190 | 160 | |
| HF31200C-SJB | 480 | 200 | 190 | |
| HF31600C-SJB | 400 | 200 | | |

(Unit: mm)

For details on this filter, contact Soshin Electric Co., Ltd.

9.3.3 Details of type certification for IP55 compatible model

The inverters can be used in ships, except on the bridge and open deck areas.

Details of certification

| Certification body | Certificate number | Compatible from (Manufacture year and month) |
|---|---|--|
| NK (Nippon Kaiji Kyokai) | 14A020 | October 2015 |
| ABS (American Bureau of Shipping) | 19-YO1938937-PDA 19-YO1938937-PDAPDP | October 2015 |
| BV (Bureau Veritas) | 37962/B0 | October 2015 |
| LR (Lloyd's Register of British and Foreign Shipping) | LR2002550TA-CERT LR2002550TA-DAD LR2002550TA-Appendix | October 2015 |
| DNV GL (DNV GL AS) | TAE00000H2 | November 2015 |
| CCS (China Classification Society) | DB16T00003 DB19PTB00014 | April 2016 |
| KR (Korean Register of Shipping) | TKY21652-AC002 | April 2016 |

♦ Precautions

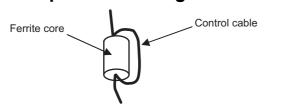
The following are precautions for the system as a whole to be compliant with ship classification standards.

- To use the FR-A846-01800(55K)-C2 or lower, set AC voltage/frequency to three-phase 380 to 480 V, 50/60 Hz.
- Set the built-in EMC filter in the inverter to "enabled" (ON).
- Ensure that the finalized system which includes an inverter complies with the ship classification standards.
- For electromagnetic compatibility (EMC), install the recommended ferrite core (shown in the following page) or an equivalent by two turns (passing the cable twice through the core) for wiring of control circuit terminals.

• When the inverter is used in an environment with the surrounding air temperature exceeding 40°C, the rated output current must not exceed the value shown in the following table.

| | Rated output current | | | |
|----------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|
| Inverter model | ND rating | | LD rating | |
| FR-A846-[]-C2 | Surrounding air temperature: 45°C | Surrounding air temperature: 50°C | Surrounding air temperature: 45°C | Surrounding air temperature: 50°C |
| 00023(0.4K) | 1.4 A | 1.4 A | 2.0 A | 1.9 A |
| 00038(0.75K) | 2.4 A | 2.3 A | 3.3 A | 3.2 A |
| 00052(1.5K) | 3.8 A | 3.6 A | 4.6 A | 4.3 A |
| 00083(2.2K) | 5.7 A | 5.4 A | 7.2 A | 6.8 A |
| 00126(3.7K) | 8.6 A | 8.1 A | 10.9 A | 9.2 A |
| 00170(5.5K) | 11.4 A | 9.6 A | 13.6 A | 11.2 A |
| 00250(7.5K) | 16 A | 15 A | 22 A | 21 A |
| 00310(11K) | 22 A | 21 A | 28 A | 26 A |
| 00380(15K) | 29 A | 28 A | 33 A | 28 A |
| 00470(18.5K) | 36 A | 30 A | 37 A | 30.1 A |
| 00620(22K) | 42 A | 40 A | 54 A | 51 A |
| 00770(30K) | 54 A | 51 A | 67 A | 63 A |
| 00930(37K) | 67 A | 64 A | 81 A | 77 A |
| 01160(45K) | 82 A | 77 A | 101 A | 95 A |
| 01800(55K) | 105 A | 99 A | 137 A | 130 A |
| 02160(75K) | 137 A | 130 A | 171 A | 162 A |
| 02600(90K) | 171 A | 162 A | 205 A | 178 A |
| 03250(110K) | 205 A | 194 A | 247 A | 234 A |
| 03610(132K) | 247 A | 234 A | 284 A | 244 A |

◆ Example of installing ferrite cores





For using one ferrite core

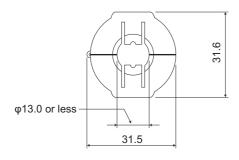
For using two ferrite cores

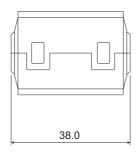
- · The wiring must be contained in the casing.
- When there is more than one bundle of control signal lines, install ferrite cores to each bundle.

♦ Recommended ferrite core

Manufacturer: TOKIN Corporation

Model: ESD-SR-250



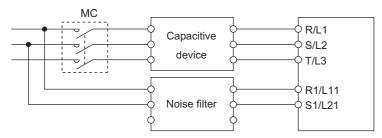


(Unit: mm)

For details on this ferrite core, contact TOKIN Corporation.

9.3.4 Wiring for compliance with EMC standards

 When a power supply is provided for the control circuit separately from the main circuit and a capacitive device (such as an EMC filter or a radio noise filter) is connected, connect a noise filter (example: RTMN5006 manufactured by TDK-Lambda Corporation) to the control circuit power supply.



Connect two of the three phases.

- Connect the inverter, noise filter, and motor to the enclosure earth (ground). (It is assumed that the enclosure earth (ground) is connected to the ship hull earth (ground).)
- When the wiring is different from the recommended one, the noise suppression effect may be insufficient (inadequate earthing (grounding)).

9.4 Specification comparison between PM sensorless vector control and induction motor control

| Item | PM sensoriess vec | Induction motor control | | |
|---|---|--|---|--|
| Applicable motor | IPM motor MM-CF series (0.5 to 7 | Induction motor*1 | | |
| - фр. | IPM motors other than MM-CF (tu | | | |
| | High frequency superposition | 200% (when used with MM-CF, 200% for the 1.5 kW or lower, and | 200% (FR-A820-00250(3.7K) or lower and FR-A840-00126(3.7K) | |
| | control | 150% for the 2.0 kW or higher) | or lower). | |
| Starting torque | Current synchronization | 50% | 150% (FR-A820-00340(5.5K) or higher and FR-A840-00126(3.7K) | |
| | operation | | or higher) under Real sensorless vector control and Vector control. | |
| Zoro opood | High frequency superposition control | Available (Select the HD rating for zero speed 200%.) | - | |
| Zero speed | Current synchronization operation | Not available | vector control and Vector control | |
| | | 6 kHz (Pr.72 = "0 to 9"), 10 kHz (Pr.72 = "10 to 13"), | Any value in the range of 0.75 kHz to 14.5 kHz | |
| | High frequency superposition control | 14 kHz (Pr.72 = "14 or 15") (6 kHz in a low-speed range of 10 | (FR-A820-03160(55K) or lower | |
| | control | kHz or higher. 2 kHz is not selectable.) | and FR-A840-01800(55K) or lower) | |
| Carrier frequency | 2 kHz (Pr.72 = "0 to 5"), | | | |
| | Current synchronization | 6 kHz (Pr.72 = "6 to 9"), 10 kHz (Pr.72 = "10 to 13"), | 0.75 kHz to 6 kHz (FR-A820-03800(75K) or higher, | |
| | operation | 14 kHz (Pr.72 = "14 or 15") (6 kHz in a low-speed range of 10 | FR-A840-02160(75K) or higher) | |
| | | kHz or higher.) | | |
| Automatic restart after instantaneous power failure | No startup delay time. Using the regeneration avoidance is recommended. | Startup waiting time exists. | | |
| Startup delay | Startup delay of about 0.1 second detection. | No startup delay (when online auto tuning is not performed at startup). | | |
| Driving by the commercial power supply | Cannot be driven by the commerce | Can be driven by the commercial power supply. (Other than vector control dedicated motor.) | | |
| Operation during coasting | While the motor is coasting, poten terminals. | While the motor is coasting, potential is not generated across motor terminals. | | |
| Torque control | Not available | Available under Real sensorless vector control and Vector control | | |
| Position control | High frequency superposition control | Available (sensorless) Available under Vector control | | |
| | Current synchronization operation Not available | | | |

^{*1} For the motor capacity, the rated motor current should be equal to or less than the rated inverter current. (It must be 0.4 kW or higher.) If a motor with substantially low rated current compared with the inverter rated current is used, speed and torque accuracies may deteriorate due to torque ripples, etc. Set the rated motor current to about 40% or higher of the inverter rated current.

NOTE

- Before wiring, make sure that the motor is stopped. Otherwise you may get an electric shock.
- · Never connect an IPM motor to the commercial power supply.
- · No slippage occurs with an IPM motor because of its characteristic. If an IPM motor, which took over an induction motor, is driven at the same speed as for the general-purpose motor, the running speed of the IPM motor becomes faster by the amount of the general-purpose motor's slippage. Adjust the speed command to run the IPM motor at the same speed as the induction motor, as required.

9.5 Parameters (functions) and instruction codes under different control methods

- *1 Instruction codes are used to read and write parameters in accordance with the Mitsubishi inverter protocol of RS-485 communication. (For RS-485 communication, refer to page 670.)
- *2 Function availability under each control method is shown as follows:
 - o: Available
 - ×: Not available
 - Δ: Available with some restrictions
- *3 If function availability differs between using induction motors with an encoder and using PM motors with an encoder, the function availability using PM motors with an encoder is described in parentheses. Also, a PM motor with an encoder is not available in the torque control mode.
- *4 For Parameter copy, Parameter clear, and All parameter clear, indicates the function is available, and × indicates the function is not available.
- *5 Communication parameters that are not cleared by parameter clear or all clear (H5A5A or H55AA) via communication. (For RS-485 communication, refer to page 670.)
- *6 When a communication option is installed, parameter clear (lock release) during password lock (Pr.297 Password lock/unlock ≠ "9999") can be performed only from the communication option.
- *7 Available when the IPM motor MM-CF series is used and the low-speed range high-torque characteristic is enabled (Pr.788 Low speed range torque characteristic selection = "9999 (initial value)").
- *8 Reading and writing via the PU connector are available.

Symbols in the table indicate parameters that operate when the options are connected.

APFR-A8AP, ALFR-A8AL, TPFR-A8TP, APRFR-A8APR, APSFR-A8APS, APAFR-A8APA, ARFR-A8AX, AYFR-A8AX, AYFR-AXX, AYFR-AXX, AYFR-AXX, AYFR-AXX, AYFR-AXX, AYFR-AXX, A8AY, AZFR-A8AZ, AVPFR-A8AVP, NCFR-A8NC, NCEFR-A8NCE, NCGFR-A8NCG, NDFR-A8ND, NPFR-A8NP, NFFR-A8NF, NS FR-A8NS

| | | | truct ode | | | | | Contr | ol meth | nod ^{*2} | | | | Pa | rame | ter |
|-----|---|------|--------------|----------|------------|---------------|---------------|----------------|------------------|-------------------|----------------|---------------|--------------------|--------|---------|-------------|
| | | | | | | | V | ecto | *3 | Sens | orless | P | M | | | |
| Pr. | Name | Read | Write | Extended | 4// | Magnetic flux | Speed control | Torque control | Position control | Speed control | Torque control | Speed control | Position control*7 | Copy*4 | Clear*4 | All clear*4 |
| 0 | Torque boost | 00 | 80 | 0 | 0 | × | × | × | × | × | × | × | × | 0 | 0 | 0 |
| 1 | Maximum frequency | 01 | 81 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2 | Minimum frequency | 02 | 82 | 0 | 0 | 0 | 0 | 0 | × | 0 | 0 | 0 | × | 0 | 0 | 0 |
| 3 | Base frequency | 03 | 83 | 0 | 0 | × | × | × | × | × | × | × | × | 0 | 0 | 0 |
| 4 | Multi-speed setting (high speed) | 04 | 84 | 0 | 0 | 0 | 0 | 0 | Δ | 0 | 0 | 0 | Δ | 0 | 0 | 0 |
| 5 | Multi-speed setting (middle speed) | 05 | 85 | 0 | 0 | 0 | 0 | 0 | Δ | 0 | 0 | 0 | Δ | 0 | 0 | 0 |
| 6 | Multi-speed setting (low speed) | 06 | 86 | 0 | 0 | 0 | 0 | 0 | Δ | 0 | 0 | 0 | Δ | 0 | 0 | 0 |
| 7 | Acceleration time | 07 | 87 | 0 | 0 | 0 | 0 | 0 | Δ | 0 | 0 | 0 | Δ | 0 | 0 | 0 |
| 8 | Deceleration time | 08 | 88 | 0 | 0 | 0 | 0 | 0 | Δ | 0 | 0 | 0 | Δ | 0 | 0 | 0 |
| 9 | Electronic thermal O/L relay | 09 | 89 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 10 | DC injection brake operation frequency | 0A | 8A | 0 | 0 | 0 | 0 | 0 | × | 0 | 0 | 0 | × | 0 | 0 | 0 |
| 11 | DC injection brake operation time | 0В | 8B | 0 | 0 | 0 | 0 | 0 | × | 0 | 0 | 0 | × | 0 | 0 | 0 |
| 12 | DC injection brake operation voltage | 0C | 8C | 0 | 0 | 0 | × | × | × | × | × | × | × | 0 | 0 | 0 |
| 13 | Starting frequency | 0D | 8D | 0 | 0 | 0 | 0 | 0 | × | 0 | 0 | 0 | × | 0 | 0 | 0 |
| 14 | Load pattern selection | 0E | 8E | 0 | 0 | × | × | × | × | × | × | × | × | 0 | 0 | 0 |
| 15 | Jog frequency | 0F | 8F | 0 | 0 | 0 | 0 | 0 | × | 0 | 0 | 0 | × | 0 | 0 | 0 |
| 16 | Jog acceleration/deceleration time | 10 | 90 | 0 | 0 | 0 | 0 | 0 | × | 0 | 0 | 0 | × | 0 | 0 | 0 |
| 17 | MRS input selection | 11 | 91 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 18 | High speed maximum frequency | 12 | 92 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 19 | Base frequency voltage | 13 | 93 | 0 | 0 | × | × | × | × | × | × | × | × | 0 | 0 | 0 |
| 20 | Acceleration/deceleration reference frequency | 14 | 94 | 0 | 0 | 0 | 0 | 0 | Δ | 0 | 0 | 0 | Δ | 0 | 0 | 0 |

| | | | truct | | | | | Conti | rol meth | nod ^{*2} | | | | Pa | rame | ter |
|-----|--|------|-------|----------|-----|---------------|---------------|----------------|------------------|-------------------|----------------|---------------|--------------------|--------|---------|-------------|
| | | | | | | | V | ecto | *3 | Senso | orless | P | M | | | |
| Pr. | Name | Read | Write | Extended | N/E | Magnetic flux | Speed control | Torque control | Position control | Speed control | Torque control | Speed control | Position control*7 | Copy*4 | Clear*4 | All clear*4 |
| 21 | Acceleration/deceleration time increments | 15 | 95 | 0 | 0 | 0 | 0 | 0 | Δ | 0 | 0 | 0 | Δ | 0 | 0 | 0 |
| 22 | Stall prevention operation level (Torque limit level) | 16 | 96 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 23 | Stall prevention operation level compensation factor at double speed | 17 | 97 | 0 | 0 | 0 | × | × | × | × | × | × | × | 0 | 0 | 0 |
| 24 | Multi-speed setting (speed 4) | 18 | 98 | 0 | 0 | 0 | 0 | 0 | Δ | 0 | 0 | 0 | Δ | 0 | 0 | 0 |
| 25 | Multi-speed setting (speed 5) | 19 | 99 | 0 | 0 | 0 | 0 | 0 | Δ | 0 | 0 | 0 | Δ | 0 | 0 | 0 |
| 26 | Multi-speed setting (speed 6) | 1A | 9A | 0 | 0 | 0 | 0 | 0 | Δ | 0 | 0 | 0 | Δ | 0 | 0 | 0 |
| 27 | Multi-speed setting (speed 7) | 1B | 9B | 0 | 0 | 0 | 0 | 0 | Δ | 0 | 0 | 0 | Δ | 0 | 0 | 0 |
| 28 | Multi-speed input compensation selection | 1C | 9C | 0 | 0 | 0 | 0 | 0 | × | 0 | 0 | 0 | × | 0 | 0 | 0 |
| 29 | Acceleration/deceleration pattern selection | 1D | 9D | 0 | 0 | 0 | 0 | 0 | × | 0 | 0 | 0 | × | 0 | 0 | 0 |
| 30 | Regenerative function selection | 1E | 9E | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 31 | Frequency jump 1A | 1F | 9F | 0 | 0 | 0 | 0 | 0 | × | 0 | 0 | 0 | × | 0 | 0 | 0 |
| 32 | Frequency jump 1B | 20 | A0 | 0 | 0 | 0 | 0 | 0 | × | 0 | 0 | 0 | × | 0 | 0 | 0 |
| 33 | Frequency jump 2A | 21 | A1 | 0 | 0 | 0 | 0 | 0 | × | 0 | 0 | 0 | × | 0 | 0 | 0 |
| 34 | Frequency jump 2B | 22 | A2 | 0 | 0 | 0 | 0 | 0 | × | 0 | 0 | 0 | × | 0 | 0 | 0 |
| 35 | Frequency jump 3A | 23 | А3 | 0 | 0 | 0 | 0 | 0 | × | 0 | 0 | 0 | × | 0 | 0 | 0 |
| 36 | Frequency jump 3B | 24 | A4 | 0 | 0 | 0 | 0 | 0 | × | 0 | 0 | 0 | × | 0 | 0 | 0 |
| 37 | Speed display | 25 | A5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 41 | Up-to-frequency sensitivity | 29 | A9 | 0 | 0 | 0 | 0 | × | × | 0 | × | 0 | × | 0 | 0 | 0 |
| 42 | Output frequency detection | 2A | AA | 0 | 0 | 0 | 0 | Δ | Δ | 0 | Δ | 0 | Δ | 0 | 0 | 0 |
| 43 | Output frequency detection for reverse rotation | 2B | AB | 0 | 0 | 0 | 0 | Δ | Δ | 0 | Δ | 0 | Δ | 0 | 0 | 0 |
| 44 | Second acceleration/ deceleration time | 2C | AC | 0 | 0 | 0 | 0 | 0 | Δ | 0 | 0 | 0 | Δ | 0 | 0 | 0 |
| 45 | Second deceleration time | 2D | AD | 0 | 0 | 0 | 0 | 0 | Δ | 0 | 0 | 0 | Δ | 0 | 0 | 0 |
| 46 | Second torque boost | 2E | ΑE | 0 | 0 | × | × | × | × | × | × | × | × | 0 | 0 | 0 |
| 47 | Second V/F (base frequency) | 2F | AF | 0 | 0 | × | × | × | × | × | × | × | × | 0 | 0 | 0 |
| 48 | Second stall prevention operation level | 30 | В0 | 0 | 0 | 0 | × | × | × | × | × | × | × | 0 | 0 | 0 |
| 49 | Second stall prevention operation frequency | 31 | В1 | 0 | 0 | 0 | × | × | × | × | × | × | × | 0 | 0 | 0 |
| 50 | Second output frequency detection | 32 | B2 | 0 | 0 | 0 | 0 | Δ | Δ | 0 | Δ | 0 | Δ | 0 | 0 | 0 |
| 51 | Second electronic thermal O/L relay | 33 | В3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 52 | Operation panel main monitor selection | 34 | B4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 54 | FM/CA terminal function selection | 36 | B6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 55 | Frequency monitoring reference | 37 | B7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 56 | Current monitoring reference | 38 | B8 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 57 | Restart coasting time | 39 | B9 | 0 | 0 | 0 | 0 | 0 | × | 0 | 0 | 0 | × | 0 | 0 | 0 |
| 58 | Restart cushion time | 3A | BA | 0 | 0 | 0 | × | × | × | × | × | × | × | 0 | 0 | 0 |
| 59 | Remote function selection | 3B | BB | 0 | 0 | 0 | 0 | 0 | × | 0 | 0 | 0 | × | 0 | 0 | 0 |
| 60 | Energy saving control selection | 3C | ВС | 0 | 0 | 0 | × | × | × | × | × | × | × | 0 | 0 | 0 |
| 61 | Reference current | 3D | BD | 0 | 0 | 0 | o (×) | × | × | 0 | × | × | × | 0 | 0 | 0 |
| 62 | Reference value at acceleration | 3E | BE | 0 | 0 | 0 | ° (×) | × | × | 0 | × | × | × | 0 | 0 | 0 |

| | | | truct | | | | | Conti | rol meth | nod ^{*2} | | | | Pa | rame | ter |
|------------------|---|------|-------|----------|------|---------------|---------------|----------------|------------------|-------------------|----------------|---------------|--------------------|--------|---------|-------------|
| | | | | | | | V | ecto | *3 | Sens | orless | P | M | | | |
| Pr. | Name | Read | Write | Extended | A/VF | Magneticiflux | Speed control | Torque control | Position control | Speed control | Torque control | Speed control | Position control*7 | Copy*4 | Clear*4 | All clear*4 |
| 63 | Reference value at deceleration | 3F | BF | 0 | 0 | 0 | o (×) | × | × | 0 | × | × | × | 0 | 0 | 0 |
| 64 | Starting frequency for elevator mode | 40 | C0 | 0 | 0 | × | × | × | × | × | × | × | × | 0 | 0 | 0 |
| 65 | Retry selection | 41 | C1 | 0 | 0 | 0 | 0 | 0 | × | 0 | 0 | 0 | × | 0 | 0 | 0 |
| 66 | Stall prevention operation reduction starting frequency | 42 | C2 | 0 | 0 | 0 | × | × | × | × | × | × | × | 0 | 0 | 0 |
| 67 | Number of retries at fault occurrence | 43 | С3 | 0 | 0 | 0 | 0 | 0 | × | 0 | 0 | 0 | × | 0 | 0 | 0 |
| 68 | Retry waiting time | 44 | C4 | 0 | 0 | 0 | 0 | 0 | × | 0 | 0 | 0 | × | 0 | 0 | 0 |
| 69 | Retry count display erase | 45 | C5 | 0 | 0 | 0 | 0 | 0 | × | 0 | 0 | 0 | × | 0 | 0 | 0 |
| 70 | Special regenerative brake duty | 46 | C6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 71 | Applied motor | 47 | C7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 72 | PWM frequency selection | 48 | C8 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 73 | Analog input selection | 49 | C9 | 0 | 0 | 0 | 0 | 0 | × | 0 | 0 | 0 | × | 0 | × | 0 |
| 74 | Input filter time constant | 4A | CA | 0 | 0 | 0 | 0 | 0 | × | 0 | 0 | 0 | × | 0 | 0 | 0 |
| 75 | Reset selection/disconnected PU detection/PU stop selection | 4B | СВ | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | × | × |
| 76 | Fault code output selection | 4C | CC | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 77 ^{*8} | Parameter write selection | 4D | CD | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 78 | Reverse rotation prevention selection | 4E | CE | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 79 ^{*8} | Operation mode selection | 4F | CF | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 80 | Motor capacity | 50 | D0 | 0 | × | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 81 | Number of motor poles | 51 | D1 | 0 | × | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 82 | Motor excitation current | 52 | D2 | 0 | × | 0 | o (×) | 0 | o (×) | 0 | 0 | × | × | 0 | × | 0 |
| 83 | Rated motor voltage | 53 | D3 | 0 | × | 0 | 0 | 0 | o (×) | 0 | 0 | 0 | × | 0 | 0 | 0 |
| 84 | Rated motor frequency | 54 | D4 | 0 | × | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 85 | Excitation current break point | 55 | D5 | 0 | × | 0 | × | × | × | 0 | 0 | × | × | 0 | × | 0 |
| 86 | Excitation current low-speed scaling factor | 56 | D6 | 0 | × | 0 | × | × | × | 0 | 0 | × | × | 0 | × | 0 |
| 89 | Speed control gain (Advanced magnetic flux vector) | 59 | D9 | 0 | × | 0 | × | × | × | × | × | × | × | 0 | × | 0 |
| 90 | Motor constant (R1) | 5A | DA | 0 | × | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | × | 0 |
| 91 | Motor constant (R2) | 5B | DB | 0 | × | 0 | o (×) | 0 | o (×) | 0 | 0 | × | × | 0 | × | 0 |
| 92 | Motor constant (L1)/d-axis inductance (Ld) | 5C | DC | 0 | × | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | × | 0 |
| 93 | Motor constant (L2)/q-axis inductance (Lq) | 5D | DD | 0 | × | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | × | 0 |
| 94 | Motor constant (X) | 5E | DE | 0 | × | 0 | o (×) | 0 | o (×) | 0 | 0 | × | × | 0 | × | 0 |
| 95 | Online auto tuning selection | 5F | DF | 0 | × | 0 | o (×) | 0 | o (×) | 0 | 0 | × | × | 0 | 0 | 0 |
| 96 | Auto tuning setting/status | 60 | E0 | 0 | × | 0 | 0 | 0 | o (×) | 0 | 0 | 0 | × | 0 | × | 0 |
| 100 | V/F1 (first frequency) | 00 | 80 | 1 | 0 | × | × | × | × | × | × | × | × | 0 | 0 | 0 |
| 101 | V/F1 (first frequency voltage) | 01 | 81 | 1 | 0 | × | × | × | × | × | × | × | × | 0 | 0 | 0 |
| 102 | V/F2 (second frequency) | 02 | 82 | 1 | 0 | × | × | × | × | × | × | × | × | 0 | 0 | 0 |
| 103 | V/F2 (second frequency voltage) | 03 | 83 | 1 | 0 | × | × | × | × | × | × | × | × | 0 | 0 | 0 |
| 104 | V/F3 (third frequency) | 04 | 84 | 1 | 0 | × | × | × | × | × | × | × | × | 0 | 0 | 0 |
| 105 | V/F3 (third frequency voltage) | 05 | 85 | 1 | 0 | × | × | × | × | × | × | × | × | 0 | 0 | 0 |

| | | | truct | | | | | Conti | rol metl | hod ^{*2} | | | | Pa | ramet | ter |
|-----|--|------|-------|----------|---|--------------|---------------|----------------|------------------|-------------------|----------------|---------------|--------------------|--------|---------|-------------|
| | | | | | | | V | ecto | *3 | Sens | orless | P | M | | | |
| Pr. | Name | Read | Write | Extended | | Magneticflux | Speed control | Torque control | Position control | Speed control | Torque control | Speed control | Position control*7 | Copy*4 | Clear*4 | All clear*4 |
| 106 | V/F4 (fourth frequency) | 06 | 86 | 1 | 0 | × | × | × | × | × | × | × | × | 0 | 0 | 0 |
| 107 | V/F4 (fourth frequency voltage) | 07 | 87 | 1 | 0 | × | × | × | × | × | × | × | × | 0 | 0 | 0 |
| 108 | V/F5 (fifth frequency) | 80 | 88 | 1 | 0 | × | × | × | × | × | × | × | × | 0 | 0 | 0 |
| 109 | V/F5 (fifth frequency voltage) | 09 | 89 | 1 | 0 | × | × | × | × | × | × | × | × | 0 | 0 | 0 |
| 110 | Third acceleration/deceleration time | 0A | 8A | 1 | 0 | 0 | 0 | 0 | Δ | 0 | 0 | 0 | Δ | 0 | 0 | 0 |
| 111 | Third deceleration time | 0B | 8B | 1 | 0 | 0 | 0 | 0 | Δ | 0 | 0 | 0 | Δ | 0 | 0 | 0 |
| 112 | Third torque boost | 0C | 8C | 1 | 0 | × | × | × | × | × | × | × | × | 0 | 0 | 0 |
| 113 | Third V/F (base frequency) | 0D | 8D | 1 | 0 | × | × | Δ | Δ | × | Δ | × | Δ | 0 | 0 | 0 |
| 114 | Third stall prevention operation level | 0E | 8E | 1 | 0 | 0 | × | × | × | × | × | × | × | 0 | 0 | 0 |
| 115 | Third stall prevention operation frequency | 0F | 8F | 1 | 0 | 0 | × | × | × | × | × | × | × | 0 | 0 | 0 |
| 116 | Third output frequency detection | 10 | 90 | 1 | 0 | 0 | 0 | Δ | Δ | 0 | Δ | 0 | Δ | 0 | 0 | 0 |
| 117 | PU communication station number | 11 | 91 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | o*5 | o*5 |
| 118 | PU communication speed | 12 | 92 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | o*5 | o*5 |
| 119 | PU communication stop bit length / data length | 13 | 93 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | o*5 | o*5 |
| 120 | PU communication parity check | 14 | 94 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | o*5 | o*5 |
| | | | - | | | | | | | | | | | | | |
| 121 | PU communication retry count | 15 | 95 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | o*5 | o*5 |
| 122 | PU communication check time interval | 16 | 96 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | o*5 | o*5 |
| 123 | PU communication waiting time setting | 17 | 97 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | o*5 | o*5 |
| 124 | PU communication CR/LF selection | 18 | 98 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | o*5 | o*5 |
| 125 | Terminal 2 frequency setting gain frequency | 19 | 99 | 1 | 0 | 0 | 0 | 0 | × | 0 | 0 | 0 | × | 0 | × | 0 |
| 126 | Terminal 4 frequency setting gain frequency | 1A | 9A | 1 | 0 | 0 | 0 | 0 | × | 0 | 0 | 0 | × | 0 | × | 0 |
| 127 | PID control automatic switchover frequency | 1B | 9B | 1 | 0 | 0 | 0 | × | × | 0 | × | 0 | × | 0 | 0 | 0 |
| 128 | PID action selection | 1C | 9C | 1 | 0 | 0 | 0 | × | × | 0 | × | 0 | × | 0 | 0 | 0 |
| 129 | PID proportional band | 1D | 9D | 1 | 0 | 0 | 0 | × | × | 0 | × | 0 | × | 0 | 0 | 0 |
| 130 | PID integral time | 1E | 9E | 1 | 0 | 0 | 0 | × | × | 0 | × | 0 | × | 0 | 0 | 0 |
| 131 | PID upper limit | 1F | 9F | 1 | 0 | 0 | 0 | × | × | 0 | × | 0 | × | 0 | 0 | 0 |
| 132 | PID lower limit | 20 | A0 | 1 | 0 | 0 | 0 | × | × | 0 | × | 0 | × | 0 | 0 | 0 |
| 133 | PID action set point | 21 | A1 | 1 | 0 | 0 | 0 | × | × | 0 | × | 0 | × | 0 | 0 | 0 |
| 134 | PID differential time | 22 | A2 | 1 | 0 | 0 | 0 | × | × | 0 | × | 0 | × | 0 | 0 | 0 |
| 135 | Electronic bypass sequence selection | 23 | А3 | 1 | 0 | 0 | o (×) | × | × | 0 | × | × | × | 0 | 0 | 0 |
| 136 | MC switchover interlock time | 24 | A4 | 1 | 0 | 0 | o (×) | × | × | 0 | × | × | × | 0 | 0 | 0 |
| 137 | Start waiting time | 25 | A5 | 1 | 0 | 0 | o (×) | × | × | 0 | × | × | × | 0 | 0 | 0 |
| 138 | Bypass selection at a fault | 26 | A6 | 1 | 0 | 0 | o (×) | × | × | 0 | × | × | × | 0 | 0 | 0 |
| 139 | Automatic switchover frequency from inverter to bypass operation | 27 | A7 | 1 | 0 | 0 | o (×) | × | × | 0 | × | × | × | 0 | 0 | 0 |
| 140 | Backlash acceleration stopping frequency | 28 | A8 | 1 | 0 | 0 | 0 | 0 | × | 0 | 0 | 0 | × | 0 | 0 | 0 |
| 141 | Backlash acceleration stopping time | 29 | A9 | 1 | 0 | 0 | 0 | 0 | × | 0 | 0 | 0 | × | 0 | 0 | 0 |

| | | _ | truct | | | | | Conti | rol meti | hod ^{*2} | | | | Pa | rame | ter |
|------------|--|--------|-------|----------|------|--------------|---------------|----------------|------------------|-------------------|----------------|---------------|--------------------|--------|---------|-------------|
| | | | | | | | V | ecto | r*3 | Sens | orless | P | M | | | |
| Pr. | Name | Read | Write | Extended | N/NE | Magneticflux | Speed control | Torque control | Position control | Speed control | Torque control | Speed control | Position control*7 | Copy*4 | Clear*4 | All clear*4 |
| 142 | Backlash deceleration stopping frequency | 2A | AA | 1 | 0 | 0 | 0 | 0 | × | 0 | 0 | 0 | × | 0 | 0 | 0 |
| 143 | Backlash deceleration stopping time | 2B | AB | 1 | 0 | 0 | 0 | 0 | × | 0 | 0 | 0 | × | 0 | 0 | 0 |
| 144 | Speed setting switchover | 2C | AC | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 145 | PU display language selection | 2D | AD | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | × | × |
| 147 | Acceleration/deceleration time switching frequency | 2F | AF | 1 | 0 | 0 | 0 | 0 | Δ | 0 | 0 | 0 | Δ | 0 | 0 | 0 |
| 148 | Stall prevention level at 0 V input | 30 | B0 | 1 | 0 | 0 | × | × | × | × | × | × | × | 0 | 0 | 0 |
| 149 | Stall prevention level at 10 V input | 31 | В1 | 1 | 0 | 0 | × | × | × | × | × | × | × | 0 | 0 | 0 |
| 150 | Output current detection level | 32 | B2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 151 | Output current detection signal delay time | 33 | В3 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 152 | Zero current detection level | 34 | B4 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 153 | Zero current detection time | 35 | B5 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 154 | Voltage reduction selection during stall prevention operation | 36 | В6 | 1 | 0 | 0 | × | × | × | × | × | × | × | 0 | 0 | 0 |
| 155 | RT signal function validity condition selection | 37 | В7 | 1 | 0 | 0 | 0 | × | × | 0 | × | 0 | × | 0 | 0 | 0 |
| 156 | Stall prevention operation selection | 38 | В8 | 1 | 0 | 0 | 0 | × | × | 0 | × | 0 | × | 0 | 0 | 0 |
| 157 | OL signal output timer | 39 | В9 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 158 | AM terminal function selection | 3A | ВА | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 159 | Automatic switchover frequency range from bypass to inverter operation | 3В | ВВ | 1 | 0 | 0 | o (×) | × | × | 0 | × | × | × | 0 | 0 | 0 |
| 160 | User group read selection | 00 | 80 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 161 | Frequency setting/key lock operation selection | 01 | 81 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | × | 0 |
| 162 | Automatic restart after instantaneous power failure selection | 02 | 82 | 2 | 0 | 0 | 0 | 0 | × | 0 | 0 | 0 | × | 0 | 0 | 0 |
| 163 | First cushion time for restart | 03 | 83 | 2 | 0 | 0 | × | × | × | × | × | × | × | 0 | 0 | 0 |
| 164 | First cushion voltage for restart | 04 | 84 | 2 | 0 | 0 | × | × | × | × | × | × | × | 0 | 0 | 0 |
| 165 | Stall prevention operation level for restart | 05 | 85 | 2 | 0 | 0 | × | × | × | × | × | × | × | 0 | 0 | 0 |
| 166 | Output current detection signal retention time | 06 | 86 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 167 | Output current detection operation selection | 07 | 87 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 168 169 | Parameter for manufacturer settir | ng. Do | o not | set. | | | | | | | | | | | | |
| 170 | Watt-hour meter clear | 0A | 8A | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | × | 0 |
| 171 | Operation hour meter clear | 0B | 8B | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | × | × | × |
| 172 | User group registered display/ batch clear | 0C | 8C | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | × | × | × |
| 173 | User group registration | 0D | 8D | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | × | × | × |
| 174 | User group clear | 0E | 8E | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | × | × | × |
| 178 | STF terminal function selection | 12 | 92 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | × | 0 |
| 179 | STR terminal function selection | 13 | 93 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | × | 0 |
| 180 | RL terminal function selection | 14 | 94 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | × | 0 |
| 181 | RM terminal function selection | 15 | 95 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | × | 0 |
| 182 | RH terminal function selection | 16 | 96 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | × | 0 |

| | | | truct | | | | | Conti | rol metl | hod ^{*2} | | | | Pa | rame | ter |
|------------|---|----------|----------|----------|-----|--------------|---------------|----------------|------------------|-------------------|----------------|---------------|--------------------|--------|---------|-------------|
| | | | | | | | V | ecto | *3 | Sens | orless | P | M | | | |
| Pr. | Name | Read | Write | Extended | N/N | Magneticflux | Speed control | Torque control | Position control | Speed control | Torque control | Speed control | Position control*7 | Copy*4 | Clear*4 | All clear*4 |
| 183 | RT terminal function selection | 17 | 97 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | × | 0 |
| 184 | AU terminal function selection | 18 | 98 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | × | 0 |
| 185 | JOG terminal function selection | 19 | 99 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | × | 0 |
| 186 | CS terminal function selection | 1A | 9A | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | × | 0 |
| 187 | MRS terminal function selection | 1B | 9B | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | × | 0 |
| 188 | STOP terminal function selection | 1C | 9C | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | × | 0 |
| 189 | RES terminal function selection | 1D | 9D | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | × | 0 |
| 190 | RUN terminal function selection | 1E | 9E | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | × | 0 |
| 191 | SU terminal function selection | 1F | 9F | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | × | 0 |
| 192 | IPF terminal function selection | 20 | A0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | × | 0 |
| 193 | OL terminal function selection | 21 | A1 A2 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | × | 0 |
| 194 | FU terminal function selection | 22 | | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | × | 0 |
| 195 | ABC1 terminal function selection | 23 | A3 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | × | 0 |
| 196 232 | ABC2 terminal function selection | 24 28 | A4 A8 | 2 | 0 | 0 | 0 | 0 | Ο Λ | 0 | 0 | 0 | 0 | 0 | | 0 |
| 232 | Multi-speed setting (speed 8) Multi-speed setting (speed 9) | 29 | A9 | 2 | 0 | 0 | 0 | 0 | Δ | 0 | 0 | 0 | Δ | 0 | 0 | 0 |
| 233 | Multi-speed setting (speed 9) Multi-speed setting (speed 10) | 29 2A | AA | 2 | 0 | 0 | 0 | 0 | Δ | 0 | 0 | 0 | Δ | 0 | 0 | 0 |
| 235 | Multi-speed setting (speed 10) | 2B | AB | 2 | 0 | 0 | 0 | 0 | Δ | 0 | 0 | 0 | Δ | 0 | 0 | 0 |
| 236 | Multi-speed setting (speed 11) | 2C | AC | 2 | 0 | 0 | 0 | 0 | Δ | 0 | 0 | 0 | Δ | 0 | 0 | 0 |
| 237 | Multi-speed setting (speed 12) | 2D | AD | 2 | 0 | 0 | 0 | 0 | Δ | 0 | 0 | 0 | Δ | 0 | 0 | 0 |
| 238 | Multi-speed setting (speed 14) | 2E | AE | 2 | 0 | 0 | 0 | 0 | Δ | 0 | 0 | 0 | Δ | 0 | 0 | 0 |
| 239 | Multi-speed setting (speed 14) | 2F | AF | 2 | 0 | 0 | 0 | 0 | Δ | 0 | 0 | 0 | Δ | 0 | 0 | 0 |
| 240 | Soft-PWM operation selection | 30 | B0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 241 | Analog input display unit switchover | 31 | B1 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 242 | Terminal 1 added compensation amount (terminal 2) | 32 | B2 | 2 | 0 | 0 | 0 | 0 | × | 0 | 0 | 0 | × | 0 | 0 | 0 |
| 243 | Terminal 1 added compensation amount (terminal 4) | 33 | В3 | 2 | 0 | 0 | 0 | 0 | × | 0 | 0 | 0 | × | 0 | 0 | 0 |
| 244 | Cooling fan operation selection | 34 | B4 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 245 | Rated slip | 35 | B5 | 2 | 0 | × | × | × | × | × | × | × | × | 0 | 0 | 0 |
| 246 | Slip compensation time constant | 36 | В6 | 2 | 0 | × | × | × | × | × | × | × | × | 0 | 0 | 0 |
| 247 | Constant output range slip compensation selection | 37 | В7 | 2 | 0 | × | × | × | × | × | × | × | × | 0 | 0 | 0 |
| 248 | Self power management selection | 38 | В8 | 2 | 0 | 0 | × (○) | × | × | × | × | 0 | × | 0 | 0 | 0 |
| 249 | Earth (ground) fault detection at start | 39 | B9 | 2 | 0 | 0 | × | × | × | × | × | × | × | 0 | 0 | 0 |
| 250 | Stop selection | 3A | ВА | 2 | 0 | 0 | 0 | 0 | × | 0 | 0 | 0 | × | 0 | 0 | 0 |
| 251 | Output phase loss protection selection | 3B | ВВ | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 252 | Override bias | 3C | ВС | 2 | 0 | 0 | 0 | 0 | × | 0 | 0 | 0 | × | 0 | 0 | 0 |
| 253 | Override gain | 3D | BD | 2 | 0 | 0 | 0 | 0 | × | 0 | 0 | 0 | × | 0 | 0 | 0 |
| 254 | Main circuit power OFF waiting time | 3E | BE | 2 | 0 | 0 | × (∘) | × | × | × | × | 0 | × | 0 | 0 | 0 |
| 255 | Life alarm status display | 3F | BF | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | × | × | × |
| 256 | Inrush current limit circuit life display | 40 | C0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | × | × | × |
| 257 | Control circuit capacitor life display | 41 | C1 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | × | × | × |
| 258 | Main circuit capacitor life display | 42 | C2 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | × | × | × |
| 259 | Main circuit capacitor life measuring | 43 | С3 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

| | | | truct | | | | | Conti | rol meti | hod ^{*2} | | | | Pa | rame | ter |
|-----|--|----------|----------|----------|-----|--------------|---------------|----------------|------------------|-------------------|----------------|---------------|--------------------|--------|---------|-------------|
| | | | | | | | V | ecto | *3 | Sens | orless | P | M | | | |
| Pr. | Name | Read | Write | Extended | N/N | Magneticflux | Speed control | Torque control | Position control | Speed control | Torque control | Speed control | Position control*7 | Copy*4 | Clear*4 | All clear*4 |
| 260 | PWM frequency automatic switchover | 44 | C4 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 261 | Power failure stop selection | 45 | C5 | 2 | 0 | 0 | 0 | 0 | × | 0 | 0 | 0 | × | 0 | 0 | 0 |
| 262 | Subtracted frequency at deceleration start | 46 | C6 | 2 | 0 | 0 | 0 | 0 | × | 0 | 0 | 0 | × | 0 | 0 | 0 |
| 263 | Subtraction starting frequency | 47 | C7 | 2 | 0 | 0 | 0 | 0 | × | 0 | 0 | 0 | × | 0 | 0 | 0 |
| 264 | Power-failure deceleration time 1 | 48 | C8 | 2 | 0 | 0 | 0 | 0 | × | 0 | 0 | 0 | × | 0 | 0 | 0 |
| 265 | Power-failure deceleration time 2 | 49 | C9 | 2 | 0 | 0 | 0 | 0 | × | 0 | 0 | 0 | × | 0 | 0 | 0 |
| 266 | Power failure deceleration time switchover frequency | 4A | CA | 2 | 0 | 0 | 0 | 0 | × | 0 | 0 | 0 | × | 0 | 0 | 0 |
| 267 | Terminal 4 input selection | 4B | СВ | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | × | 0 |
| 268 | Monitor decimal digits selection | 4C | CC | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 269 | Parameter for manufacturer setting | ıg. Do | o not | set. | | | | | | | | | | | | |
| 270 | Stop-on contact/load torque high-speed frequency control selection | 4E | CE | 2 | 0 | 0 | 0 | × | × | 0 | × | × | × | 0 | 0 | 0 |
| 271 | High-speed setting maximum current | 4F | CF | 2 | 0 | 0 | 0 | × | × | 0 | × | × | × | 0 | 0 | 0 |
| 272 | Middle-speed setting minimum current | 50 | D0 | 2 | 0 | 0 | 0 | × | × | 0 | × | × | × | 0 | 0 | 0 |
| 273 | Current averaging range | 51 | D1 | 2 | 0 | 0 | 0 | × | × | 0 | × | × | × | 0 | 0 | 0 |
| 274 | Current averaging filter time constant | 52 | D2 | 2 | 0 | 0 | 0 | × | × | 0 | × | × | × | 0 | 0 | 0 |
| 275 | Stop-on contact excitation current low-speed scaling factor | 53 | D3 | 2 | × | 0 | × | × | × | 0 | × | × | × | 0 | 0 | 0 |
| 276 | PWM carrier frequency at stop- on contact | 54 | D4 | 2 | × | 0 | × | × | × | 0 | × | × | × | 0 | 0 | 0 |
| 278 | Brake opening frequency | 56 | D6 | 2 | 0 | 0 | 0 | × | × | 0 | × | 0 | × | 0 | 0 | 0 |
| 279 | Brake opening current | 57 | D7 | 2 | 0 | 0 | 0 | × | × | 0 | × | 0 | × | 0 | 0 | 0 |
| 280 | Brake opening current detection time | 58 | D8 | 2 | 0 | 0 | 0 | × | × | 0 | × | 0 | × | 0 | 0 | 0 |
| 281 | Brake operation time at start | 59 | D9 | 2 | 0 | 0 | 0 | × | × | 0 | × | 0 | × | 0 | 0 | 0 |
| 282 | Brake operation frequency | 5A | DA | 2 | 0 | 0 | 0 | × | × | 0 | × | 0 | × | 0 | 0 | 0 |
| 283 | Brake operation time at stop Deceleration detection function | 5B | DB | 2 | 0 | Δ | 0 | × | × | × | × | 0 | × | 0 | 0 | 0 |
| 284 | Selection Overspeed detection frequency (Speed deviation excess | 5C 5D | DC DD | 2 | × | Δ | 0 | × | × | × | × | × | × | 0 | 0 | 0 |
| 286 | detection frequency) Droop gain | 5E | DE | 2 | × | 0 | 0 | × | × | 0 | × | 0 | × | 0 | 0 | 0 |
| 287 | Droop filter time constant | 5F | DF | 2 | × | × | 0 | × | × | 0 | × | 0 | × | 0 | 0 | 0 |
| 288 | Droop function activation selection | 60 | E0 | 2 | × | 0 | 0 | × | × | 0 | × | 0 | × | 0 | 0 | 0 |
| 289 | Inverter output terminal filter | 61 | E1 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | × | 0 |
| 290 | Monitor negative output selection | 62 | E2 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 291 | Pulse train I/O selection | 63 | E3 | 2 | 0 | 0 | 0 | 0 | × | 0 | 0 | 0 | × | 0 | × | 0 |
| 292 | Automatic acceleration/ deceleration | 64 | E4 | 2 | Δ | Δ | Δ (×) | × | × | Δ | × | × | × | 0 | 0 | 0 |
| 293 | Acceleration/deceleration separate selection | 65 | E5 | 2 | 0 | 0 | o (×) | × | × | 0 | × | × | × | 0 | 0 | 0 |
| 294 | UV avoidance voltage gain | 66 | E6 | 2 | 0 | 0 | 0 | 0 | × | 0 | 0 | 0 | × | 0 | 0 | 0 |
| 295 | Frequency change increment amount setting | 67 | E7 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

| | | | truct | | | | | Conti | rol metl | hod ^{*2} | | | | Pa | ramet | ter |
|------------|---|----------|----------|----------|------|--------------|---------------|----------------|------------------|-------------------|----------------|---------------|--------------------|--------|---------|-------------|
| | | | | | | | V | ecto | *3 | Sens | orless | P | M | | | |
| Pr. | Name | Read | Write | Extended | A//P | Magneticflux | Speed control | Torque control | Position control | Speed control | Torque control | Speed control | Position control*7 | Copy*4 | Clear*4 | All clear*4 |
| 296 | Password lock level | 68 | E8 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | × | 0 |
| 297 | Password lock/unlock | 69 | E9 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | o*6 | 0 |
| 298 | Frequency search gain | 6A | EA | 2 | 0 | 0 | × | × | × | 0 | 0 | × | × | 0 | × | 0 |
| 299 | Rotation direction detection selection at restarting | 6B | EB | 2 | 0 | 0 | × | × | × | 0 | × | × | × | 0 | 0 | 0 |
| 300 | BCD input bias AX | 00 | 80 | 3 | 0 | 0 | 0 | 0 | × | 0 | 0 | 0 | × | 0 | 0 | 0 |
| 301 | BCD input gain AX | 01 | 81 | 3 | 0 | 0 | 0 | 0 | × | 0 | 0 | 0 | × | 0 | 0 | 0 |
| 302 | BIN input bias AX | 02 | 82 | 3 | 0 | 0 | 0 | 0 | × | 0 | 0 | 0 | × | 0 | 0 | 0 |
| 303 | BIN input gain AX | 03 | 83 | 3 | 0 | 0 | 0 | 0 | × | 0 | 0 | 0 | × | 0 | 0 | 0 |
| 304 | Digital/analog input compensation enable/disable selection AX | 04 | 84 | 3 | 0 | 0 | 0 | 0 | × | 0 | 0 | 0 | × | 0 | 0 | 0 |
| 305 | Read timing operation selection AX | 05 | 85 | 3 | 0 | 0 | 0 | 0 | × | 0 | 0 | 0 | × | 0 | 0 | 0 |
| 306 | Analog output signal selection AY | 06 | 86 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 307 | Setting for zero analog output AY | 07 | 87 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 308 | Setting for maximum analog output AY | 08 | 88 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 309 | Analog output voltage/current signal switchover AY | 09 | 89 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 310 | Analog meter voltage output selection AY | 0A | 8A | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 311 | Setting for zero analog meter voltage output AY | 0B | 8B | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 312 | Setting for maximum analog meter voltage output AY | 0C | 8C | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 313 | DO0 output selection AY NC NCE NCG | 0D | 8D | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | × | 0 |
| 314 | DO1 output selection AY NC NCE NCG | 0E | 8E | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | × | 0 |
| 315 | DO2 output selection AY NC NCE NCG | 0F | 8F | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | × | 0 |
| 316 | DO3 output selection AY | 10 | 90 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | × | 0 |
| 317 | DO4 output selection AY | 11 | 91 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | × | 0 |
| 318 | DO5 output selection AY | 12 | 92 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | × | 0 |
| 319 | DO6 output selection AY | 13 | 93 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | × | 0 |
| 320 | RA1 output selection AR | 14 | 94 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | × | 0 |
| 321 322 | RA2 output selection AR | 15 | 95 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | × | 0 |
| 322 | RA3 output selection AR AM0 0 V adjustment AY | 16 17 | 96 97 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | × | 0 |
| 324 | AM1 0 mA adjustment AY | 18 | 98 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | ^ × | 0 |
| 326 | Motor temperature feedback reference | 1A | 9A | 3 | × | × | o (×) | 0 | o (×) | × | × | × | × | 0 | × | 0 |
| 328 | Inverter/converter switching AVP | 1C | 9C | 3 | × | × | (··) | × | (··) | × | × | × | × | × | × | × |
| 329 | Digital input unit selection AX | 1D | 9D | 3 | 0 | 0 | 0 | 0 | × | 0 | 0 | 0 | × | 0 | × | 0 |
| 331 | RS-485 communication station number | 1F | 9F | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | o*5 | o*5 |
| 332 | RS-485 communication speed | 20 | A0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | o*5 | o*5 |
| 333 | RS-485 communication stop bit length / data length | 21 | A1 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | o*5 | o*5 |

| | | _ | truct | | | | | Conti | rol meti | hod ^{*2} | | | | Pa | ramet | ter |
|-----|---|------|-------|----------|------|--------------|---------------|----------------|------------------|-------------------|----------------|---------------|--------------------|--------|---------|-------------|
| | | | | | | | V | ecto | *3 | Sens | orless | P | M | | | |
| Pr. | Name | Read | Write | Extended | N/NE | Magneticflux | Speed control | Torque control | Position control | Speed control | Torque control | Speed control | Position control*7 | Copy*4 | Clear*4 | All clear*4 |
| 334 | RS-485 communication parity check selection | 22 | A2 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | o*5 | o*5 |
| 335 | RS-485 communication retry count | 23 | А3 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | o*5 | o*5 |
| 336 | RS-485 communication check time interval | 24 | A4 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | o*5 | o*5 |
| 337 | RS-485 communication waiting time setting | 25 | A5 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | o*5 | o*5 |
| 338 | Communication operation command source | 26 | A6 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | o*5 | o*5 |
| 339 | Communication speed command source | 27 | A7 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | o*5 | o*5 |
| 340 | Communication startup mode selection | 28 | A8 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | o*5 | o*5 |
| 341 | RS-485 communication CR/LF selection | 29 | A9 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | o*5 | o*5 |
| 342 | Communication EEPROM write selection | 2A | AA | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 343 | Communication error count | 2B | AB | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | × | × | × |
| 345 | DeviceNet address ND | 2D | AD | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | o*5 | o*5 |
| 346 | DeviceNet baud rate ND | 2E | ΑE | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | o*5 | o*5 |
| 349 | Communication reset selection/ Ready bit status selection NC NCE NCG ND NP NF | 31 | В1 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | o*5 | o*5 |
| 350 | Stop position command selection AP AL TP APR APS APA | 32 | B2 | 3 | 0 | 0 | 0 | × | × | × | × | × | × | 0 | 0 | 0 |
| 351 | Orientation speed[AP][AL][TP][APR][APS][APA] | 33 | В3 | 3 | 0 | 0 | 0 | × | × | × | × | × | × | 0 | 0 | 0 |
| 352 | Creep speed AP AL TP APR APS APA | 34 | B4 | 3 | 0 | 0 | 0 | × | × | × | × | × | × | 0 | 0 | 0 |
| 353 | Creep switchover position AP AL TP APR APS APA | 35 | B5 | 3 | 0 | 0 | 0 | × | × | × | × | × | × | 0 | 0 | 0 |
| 354 | Position loop switchover position AP AL TP APR APS APA | 36 | В6 | 3 | 0 | 0 | 0 | × | × | × | × | × | × | 0 | 0 | 0 |
| 355 | DC injection brake start position AP AL TP APR APS APA | 37 | В7 | 3 | 0 | 0 | 0 | × | × | × | × | × | × | 0 | 0 | 0 |
| 356 | Internal stop position command AP AL TP APR APS APA | 38 | В8 | 3 | 0 | 0 | 0 | × | × | × | × | × | × | 0 | 0 | 0 |
| 357 | Orientation in-position zone AP AL TP APR APS APA | 39 | В9 | 3 | 0 | 0 | 0 | × | × | × | × | × | × | 0 | 0 | 0 |
| 358 | Servo torque selection AP AL TP APR APS APA | ЗА | ВА | 3 | 0 | 0 | 0 | × | × | × | × | × | × | 0 | 0 | 0 |
| 359 | Encoder rotation direction AP AL APRIAPS APA | 3В | ВВ | 3 | 0 | 0 | ο (Δ) | 0 | ο (Δ) | × | × | × | × | 0 | 0 | 0 |
| 360 | 16-bit data selection_AP_AL_TP_APR_APS_APA | зС | вс | 3 | 0 | 0 | 0 | × | × | × | × | × | × | 0 | 0 | 0 |
| 361 | Position shift[ap] al [tp]apr[aps]apa | 3D | BD | 3 | 0 | 0 | 0 | × | × | × | × | × | × | 0 | 0 | 0 |
| 362 | Orientation position loop gain AP AL TP APR APS APA | 3E | BE | 3 | 0 | 0 | 0 | × | × | × | × | × | × | 0 | 0 | 0 |
| 363 | Completion signal output delay time AP AL TP APR APS APA | 3F | BF | 3 | 0 | 0 | 0 | × | × | × | × | × | × | 0 | 0 | 0 |
| 364 | Encoder stop check time[AP][AL][TP][APR][APS][APA] | 40 | C0 | 3 | 0 | 0 | 0 | × | × | × | × | × | × | 0 | 0 | 0 |

| | | | truct | | | | | Conti | rol meth | nod ^{*2} | | | | Pa | aramet | ter |
|-----|--|------|-------|----------|-----|---------------|---------------|----------------|------------------|-------------------|----------------|---------------|--------------------|--------|---------|-------------|
| | | | | | | | V | ecto | *3 | Senso | orless | P | M | | | |
| Pr. | Name | Read | Write | Extended | N/E | Magnetic flux | Speed control | Torque control | Position control | Speed control | Torque control | Speed control | Position control*7 | Copy*4 | Clear*4 | All clear*4 |
| 365 | Orientation limit_AP AL TP APR APS APA | 41 | C1 | 3 | 0 | 0 | 0 | × | × | × | × | × | × | 0 | 0 | 0 |
| 366 | Recheck time[AP][AL][TP][APR][APS][APA] | 42 | C2 | 3 | 0 | 0 | 0 | × | × | × | × | × | × | 0 | 0 | 0 |
| 367 | Speed feedback range AP AL TP APR APS APA | 43 | С3 | 3 | 0 | 0 | × | × | × | × | × | × | × | 0 | 0 | 0 |
| 368 | Feedback gain_AP_AL_TP_APR_APS_APA | 44 | C4 | 3 | 0 | 0 | × | × | × | × | × | × | × | 0 | 0 | 0 |
| 369 | Number of encoder pulses AP AL APA | 45 | C5 | 3 | 0 | 0 | o (×) | 0 | o (×) | × | × | × | × | 0 | 0 | 0 |
| 373 | Encoder position tuning setting/ status AL APR APS APA | 49 | C9 | 3 | × | × | × (∘) | × | × | × | × | × | × | 0 | × | 0 |
| 374 | Overspeed detection level | 4A | CA | 3 | × | × | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 376 | Encoder signal loss detection enable/disable selection AP AL APR APS APA | 4C | СС | 3 | × | × | 0 | 0 | 0 | × | × | × | 0 | 0 | 0 | 0 |
| 379 | SSCNET III rotation direction selection NS | 4F | CF | 3 | × | × | 0 | 0 | 0 | × | × | × | × | 0 | o*5 | o*5 |
| 380 | Acceleration S-pattern 1 | 50 | D0 | 3 | 0 | 0 | 0 | 0 | × | 0 | 0 | 0 | × | 0 | 0 | 0 |
| 381 | Deceleration S-pattern 1 | 51 | D1 | 3 | 0 | 0 | 0 | 0 | × | 0 | 0 | 0 | × | 0 | 0 | 0 |
| 382 | Acceleration S-pattern 2 | 52 | D2 | 3 | 0 | 0 | 0 | 0 | × | 0 | 0 | 0 | × | 0 | 0 | 0 |
| 383 | Deceleration S-pattern 2 | 53 | D3 | 3 | 0 | 0 | 0 | 0 | × | 0 | 0 | 0 | × | 0 | 0 | 0 |
| 384 | Input pulse division scaling factor | 54 | D4 | 3 | 0 | 0 | 0 | 0 | × | 0 | 0 | 0 | × | 0 | 0 | 0 |
| 385 | Frequency for zero input pulse | 55 | D5 | 3 | 0 | 0 | 0 | 0 | × | 0 | 0 | 0 | × | 0 | 0 | 0 |
| 386 | Frequency for maximum input pulse | 56 | D6 | 3 | 0 | 0 | 0 | 0 | × | 0 | 0 | 0 | × | 0 | 0 | 0 |
| 393 | Orientation selection AP AL TP APR APS APA | 5D | DD | 3 | × | × | 0 | × | × | × | × | × | × | 0 | 0 | 0 |
| 394 | Number of machine side gear teeth AP AL TP APR APA | 5E | DE | 3 | × | × | 0 | × | × | × | × | × | × | 0 | 0 | 0 |
| 395 | Number of motor side gear teeth AP AL TP APR APA | 5F | DF | 3 | × | × | 0 | × | × | × | × | × | × | 0 | 0 | 0 |
| 396 | Orientation speed gain (P term) AP AL TP APR APS APA | 60 | E0 | 3 | × | × | 0 | × | × | × | × | × | × | 0 | 0 | 0 |
| 397 | Orientation speed integral time_AP_AL_TP_APR_APS_APA | 61 | E1 | 3 | × | × | 0 | × | × | × | × | × | × | 0 | 0 | 0 |
| 398 | Orientation speed gain (D term) AP AL TP APRIAPS APA | 62 | E2 | 3 | × | × | 0 | × | × | × | × | × | × | 0 | 0 | 0 |
| 399 | Orientation deceleration ratio AP AL TP APR APS APA | 63 | E3 | 3 | × | × | 0 | × | × | × | × | × | × | 0 | 0 | 0 |
| 406 | High resolution analog input selection AZ | 06 | 86 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | × | 0 |
| 407 | Motor temperature detection filter AZ | 07 | 87 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 408 | Motor thermistor selection AZ | 80 | 88 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 413 | Encoder pulse division ratio | 0D | 8D | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 414 | PLC function operation selection | 0E | 8E | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | × | × |
| 415 | Inverter operation lock mode setting | 0F | 8F | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 416 | Pre-scale function selection | 10 | 90 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 417 | Pre-scale setting value | 11 | 91 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 418 | Extension output terminal filter AY AR | 12 | 92 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | × | 0 |

| | | | truct | | | | | Conti | rol metl | nod ^{*2} | | | | Pa | rame | ter |
|------------|--|----------|----------|----------|---|--------------|---------------|----------------|------------------|-------------------|----------------|---------------|--------------------|--------|---------|-------------|
| | | | | | | | V | ecto | *3 | Sens | orless | P | M | | | |
| Pr. | Name | Read | Write | Extended | | Magneticflux | Speed control | Torque control | Position control | Speed control | Torque control | Speed control | Position control*7 | Copy*4 | Clear*4 | All clear*4 |
| 419 | Position command source selection | 13 | 93 | 4 | × | × | × | × | 0 | × | × | × | 0 | 0 | 0 | 0 |
| 420 | Command pulse scaling factor numerator (electronic gear numerator) | 14 | 94 | 4 | × | × | × | × | 0 | × | × | × | 0 | 0 | 0 | 0 |
| 421 | Command pulse multiplication denominator (electronic gear denominator) | 15 | 95 | 4 | × | × | × | × | 0 | × | × | × | 0 | 0 | 0 | 0 |
| 422 | Position control gain | 16 | 96 | 4 | × | × | × | × | 0 | × | × | × | 0 | 0 | 0 | 0 |
| 423 | Position feed forward gain | 17 | 97 | 4 | × | × | × | × | 0 | × | × | × | 0 | 0 | 0 | 0 |
| 424 | Position command acceleration/ deceleration time constant | 18 | 98 | 4 | × | × | × | × | 0 | × | × | × | 0 | 0 | 0 | 0 |
| 425 | Position feed forward command filter | 19 | 99 | 4 | × | × | × | × | 0 | × | × | × | 0 | 0 | 0 | 0 |
| 426 | In-position width | 1 A | 9A | 4 | × | × | × | × | 0 | × | × | × | 0 | 0 | 0 | 0 |
| 427 | Excessive level error | 1B | 9B | 4 | × | × | × | × | 0 | × | × | × | 0 | 0 | 0 | 0 |
| 428 | Command pulse selection | 1C | 9C | 4 | × | × | × | × | 0 | × | × | × | 0 | 0 | 0 | 0 |
| 429 | Clear signal selection | 1D | 9D | 4 | × | × | × | × | 0 | × | × | × | 0 | 0 | 0 | 0 |
| 430 | Pulse monitor selection | 1E | 9E | 4 | × | × | × | × | 0 | × | × | × | 0 | 0 | 0 | 0 |
| 432 | Pulse train torque command bias AL | 20 | A0 | 4 | × | × | × | 0 | × | × | 0 | × | × | 0 | 0 | 0 |
| 433 | Pulse train torque command gain AL | 21 | A1 | 4 | × | × | × | 0 | × | × | 0 | × | × | 0 | 0 | 0 |
| 434 | Network number (CC-Link IE)NCE IP Address 1NCG | 22 | A2 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | o*5 | o*5 |
| 435 | Station number (CC-Link IE)NCE IP Address 2NCG | 23 | А3 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | o*5 | o*5 |
| 436 | IP address 3NCG | 24 | A4 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | o*5 | o*5 |
| 437 | IP address 4 _{NCG} | 25 | A5 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | o*5 | o*5 |
| 438 | Subnet mask 1 NCG | 26 | A6 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | o*5 | o*5 |
| 439 | Subnet mask 2 NCG | 27 | A7 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | o*5 | o*5 |
| 440 | | 28 | A8 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | o*5 | o*5 |
| 441 | Subnet mask 3 NCG Subnet mask 4 NCG | 29 | A9 | 4 | | | | | | | | | | 0 | o*5 | o*5 |
| | | | | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | | |
| 446 447 | Model position control gain Digital torque command bias AX | 2E 2F | AE AF | 4 | × | × | × | × | ° × | × | × | × | o × | 0 | 0 | 0 |
| 447 | Digital torque command bias AX Digital torque command gain AX | 30 | B0 | 4 | × | × | × | 0 | × | × | 0 | × | × | 0 | 0 | 0 |
| | | | | | | | | | | | | | | | o*5 | o*5 |
| 449 | SSCNET III input filter setting NS Second applied motor | 31 | B1 | 4 | × | × | 0 | 0 | 0 | × | × | × | 0 | 0 | | |
| 450 451 | Second motor control method | 32 | B2 B3 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 453 | selection Second motor capacity | 35 | B5 | 4 | × | _ | _ | _ | 0 | _ | _ | _ | _ | 0 | 0 | |
| 453 | Number of second motor poles | 36 | В5 В6 | 4 | × | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 454 | Second motor excitation current | 37 | В7 | 4 | × | 0 | o (×) | 0 | o (×) | 0 | 0 | × | × | 0 | × | 0 |
| 456 | Rated second motor voltage | 38 | В8 | 4 | × | 0 | (^) o | 0 | (×) | 0 | 0 | 0 | × | 0 | 0 | 0 |
| 457 | Rated second motor frequency | 39 | В9 | 4 | × | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 458 | Second motor constant (R1) | 3A | BA | 4 | × | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | × | 0 |
| 459 | Second motor constant (R2) | 3B | ВВ | 4 | × | 0 | o (×) | 0 | o (×) | 0 | 0 | × | × | 0 | × | 0 |

| | | | truct | | | | | Conti | rol meth | nod ^{*2} | | | | Pa | ramet | ter |
|-----|--|------|-------|----------|------------|---------------|---------------|----------------|------------------|-------------------|----------------|---------------|--------------------|--------|---------|-------------|
| | | | | | | | V | ecto | *3 | Sens | orless | P | M | | | |
| Pr. | Name | Read | Write | Extended | 4// | Magnetic flux | Speed control | Torque control | Position control | Speed control | Torque control | Speed control | Position control*7 | Copy*4 | Clear*4 | All clear*4 |
| 460 | Second motor constant (L1) / d-axis inductance (Ld) | 3C | вс | 4 | × | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | × | 0 |
| 461 | Second motor constant (L2) / q-axis inductance (Lq) | 3D | BD | 4 | × | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | × | 0 |
| 462 | Second motor constant (X) | 3E | BE | 4 | × | 0 | o (×) | 0 | o (×) | 0 | 0 | × | × | 0 | × | 0 |
| 463 | Second motor auto tuning setting/status | 3F | BF | 4 | × | 0 | 0 | 0 | o (×) | 0 | 0 | 0 | × | 0 | × | 0 |
| 464 | Digital position control sudden stop deceleration time | 40 | C0 | 4 | × | × | × | × | 0 | × | × | × | 0 | 0 | 0 | 0 |
| 465 | First target position lower 4 digits | 41 | C1 | 4 | × | × | × | × | 0 | × | × | × | 0 | 0 | 0 | 0 |
| 466 | First target position upper 4 digits | 42 | C2 | 4 | × | × | × | × | 0 | × | × | × | 0 | 0 | 0 | 0 |
| 467 | Second target position lower 4 digits | 43 | С3 | 4 | × | × | × | × | 0 | × | × | × | 0 | 0 | 0 | 0 |
| 468 | Second target position upper 4 digits | 44 | C4 | 4 | × | × | × | × | 0 | × | × | × | 0 | 0 | 0 | 0 |
| 469 | Third target position lower 4 digits | 45 | C5 | 4 | × | × | × | × | 0 | × | × | × | 0 | 0 | 0 | 0 |
| 470 | Third target position upper 4 digits | 46 | C6 | 4 | × | × | × | × | 0 | × | × | × | 0 | 0 | 0 | 0 |
| 471 | Fourth target position lower 4 digits | 47 | C7 | 4 | × | × | × | × | 0 | × | × | × | 0 | 0 | 0 | 0 |
| 472 | Fourth target position upper 4 digits | 48 | C8 | 4 | × | × | × | × | 0 | × | × | × | 0 | 0 | 0 | 0 |
| 473 | Fifth target position lower 4 digits | 49 | C9 | 4 | × | × | × | × | 0 | × | × | × | 0 | 0 | 0 | 0 |
| 474 | Fifth target position upper 4 digits | 4A | CA | 4 | × | × | × | × | 0 | × | × | × | 0 | 0 | 0 | 0 |
| 475 | Sixth target position lower 4 digits | 4B | СВ | 4 | × | × | × | × | 0 | × | × | × | 0 | 0 | 0 | 0 |
| 476 | Sixth target position upper 4 digits | 4C | СС | 4 | × | × | × | × | 0 | × | × | × | 0 | 0 | 0 | 0 |
| 477 | Seventh target position lower 4 digits | 4D | CD | 4 | × | × | × | × | 0 | × | × | × | 0 | 0 | 0 | 0 |
| 478 | Seventh target position upper 4 digits | 4E | CE | 4 | × | × | × | × | 0 | × | × | × | 0 | 0 | 0 | 0 |
| 479 | Eighth target position lower 4 digits | 4F | CF | 4 | × | × | × | × | 0 | × | × | × | 0 | 0 | 0 | 0 |
| 480 | Eighth target position upper 4 digits | 50 | D0 | 4 | × | × | × | × | 0 | × | × | × | 0 | 0 | 0 | 0 |
| 481 | Ninth target position lower 4 digits | 51 | D1 | 4 | × | × | × | × | 0 | × | × | × | 0 | 0 | 0 | 0 |
| 482 | Ninth target position upper 4 digits | 52 | D2 | 4 | × | × | × | × | 0 | × | × | × | 0 | 0 | 0 | 0 |
| 483 | Tenth target position lower 4 digits | 53 | D3 | 4 | × | × | × | × | 0 | × | × | × | 0 | 0 | 0 | 0 |
| 484 | Tenth target position upper 4 digits | 54 | D4 | 4 | × | × | × | × | 0 | × | × | × | 0 | 0 | 0 | 0 |
| 485 | Eleventh target position lower 4 digits | 55 | D5 | 4 | × | × | × | × | 0 | × | × | × | 0 | 0 | 0 | 0 |
| 486 | Eleventh target position upper 4 digits | 56 | D6 | 4 | × | × | × | × | 0 | × | × | × | 0 | 0 | 0 | 0 |
| 487 | Twelfth target position lower 4 digits | 57 | D7 | 4 | × | × | × | × | 0 | × | × | × | 0 | 0 | 0 | 0 |
| 488 | Twelfth target position upper 4 digits | 58 | D8 | 4 | × | × | × | × | 0 | × | × | × | 0 | 0 | 0 | 0 |
| 489 | Thirteenth target position lower 4 digits | 59 | D9 | 4 | × | × | × | × | 0 | × | × | × | 0 | 0 | 0 | 0 |

| | | | truct | | | | | Contr | rol metl | nod ^{*2} | | | | Pa | rame | ter |
|-----|--|------|-------|----------|---|--------------|---------------|----------------|------------------|-------------------|----------------|---------------|--------------------|--------|---------|-------------------------|
| | | | | | | | V | ecto | *3 | Sens | orless | P | M | | | |
| Pr. | Name | Read | Write | Extended | | Magneticflux | Speed control | Torque control | Position control | Speed control | Torque control | Speed control | Position control*7 | Copy*4 | Clear*4 | All clear ^{*4} |
| 490 | Thirteenth target position upper 4 digits | 5A | DA | 4 | × | × | × | × | 0 | × | × | × | 0 | 0 | 0 | 0 |
| 491 | Fourteenth target position lower 4 digits | 5B | DB | 4 | × | × | × | × | 0 | × | × | × | 0 | 0 | 0 | 0 |
| 492 | Fourteenth target position upper 4 digits | 5C | DC | 4 | × | × | × | × | 0 | × | × | × | 0 | 0 | 0 | 0 |
| 493 | Fifteenth target position lower 4 digits | 5D | DD | 4 | × | × | × | × | 0 | × | × | × | 0 | 0 | 0 | 0 |
| 494 | Fifteenth target position upper 4 digits | 5E | DE | 4 | × | × | × | × | 0 | × | × | × | 0 | 0 | 0 | 0 |
| 495 | Remote output selection | 5F | DF | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 496 | Remote output data 1 | 60 | E0 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | × | × | × |
| 497 | Remote output data 2 | 61 | E1 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | × | × | × |
| 498 | PLC function flash memory clear | 62 | E2 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | × | × | × |
| 499 | SSCNET III operation selection NS | 63 | E3 | 4 | × | × | 0 | 0 | 0 | × | × | × | 0 | 0 | o*5 | o*5 |
| 500 | Communication error execution waiting time NC NCE NCG ND NP NF | 00 | 80 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 501 | Communication error occurrence count display NC NCE NCG ND NP NF | 01 | 81 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | × | 0 | 0 |
| 502 | Stop mode selection at communication error | 02 | 82 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 503 | Maintenance timer 1 | 03 | 83 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | × | × | × |
| 504 | Maintenance timer 1 warning output set time | 04 | 84 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | × | 0 |
| 505 | Speed setting reference | 05 | 85 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 506 | Display estimated main circuit capacitor residual life | 06 | 86 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | × | × | × |
| 507 | Display/reset ABC1 relay contact life | 07 | 87 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | × | × | × |
| 508 | Display/reset ABC2 relay contact life | 08 | 88 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | × | × | × |
| 516 | S-pattern time at a start of acceleration | 10 | 90 | 5 | 0 | 0 | 0 | 0 | × | 0 | 0 | 0 | × | 0 | 0 | 0 |
| 517 | S-pattern time at a completion of acceleration | 11 | 91 | 5 | 0 | 0 | 0 | 0 | × | 0 | 0 | 0 | × | 0 | 0 | 0 |
| 518 | S-pattern time at a start of deceleration | 12 | 92 | 5 | 0 | 0 | 0 | 0 | × | 0 | 0 | 0 | × | 0 | 0 | 0 |
| 519 | S-pattern time at a completion of deceleration | 13 | 93 | 5 | 0 | 0 | 0 | 0 | × | 0 | 0 | 0 | × | 0 | 0 | 0 |
| 522 | Output stop frequency | 16 | 96 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 539 | MODBUS RTU communication check time interval | 27 | A7 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | o*5 | o*5 |
| 541 | Frequency command sign selection NC NCE NCG NP | 29 | A9 | 5 | 0 | 0 | 0 | × | × | 0 | × | 0 | × | 0 | o*5 | o*5 |
| 542 | Communication station number (CC-Link) NC | 2A | AA | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | o*5 | o*5 |
| 543 | Baud rate selection (CC-Link) NC | 2B | АВ | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | o*5 | o*5 |
| 544 | CC-Link extended setting NC | 2C | AC | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | o*5 | o*5 |
| 547 | USB communication station number | 2F | AF | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | o*5 | o*5 |

| | | _ | truct | | | | | Conti | rol meth | hod ^{*2} | | | | Pa | aramet | ter |
|------------|--|----------|----------|----------|-----|--------------|---------------|----------------|------------------|-------------------|----------------|---------------|--------------------|--------|---------|-------------|
| | | | | | | | V | ecto | *3 | Sens | orless | P | M | | | |
| Pr. | Name | Read | Write | Extended | | Magneticflux | Speed control | Torque control | Position control | Speed control | Torque control | Speed control | Position control*7 | Copy*4 | Clear*4 | All clear*4 |
| 548 | USB communication check time interval | 30 | В0 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | o*5 | o*5 |
| 549 | Protocol selection | 31 | B1 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | o*5 | o*5 |
| 550 | NET mode operation command source selection | 32 | B2 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | o*5 | o*5 |
| 551 | PU mode operation command source selection | 33 | В3 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | o*5 | o*5 |
| 552 | Frequency jump range | 34 | B4 | 5 | 0 | 0 | 0 | 0 | × | 0 | 0 | 0 | × | 0 | 0 | 0 |
| 553 | PID deviation limit | 35 | B5 | 5 | 0 | 0 | 0 | × | × | 0 | × | 0 | × | 0 | 0 | 0 |
| 554 | PID signal operation selection | 36 | B6 | 5 | 0 | 0 | 0 | × | × | 0 | × | 0 | × | 0 | 0 | 0 |
| 555 556 | Current average time Data output mask time | 37 38 | B7 B8 | 5 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Current average value monitor | | | | | U | O | | U | 0 | 0 | 0 | U | | U | 0 |
| 557 560 | signal output reference current Second frequency search gain | 39 3C | B9 BC | 5 5 | 0 | 0 | ° × | ° × | ° × | 0 | 0 | ° × | ° × | 0 | × | 0 |
| 561 | PTC thermistor protection level | 3D | BD | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | × | 0 |
| 563 | Energization time carrying-over times | 3F | BF | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | × | × | × |
| 564 | Operating time carrying-over times | 40 | C0 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | × | × | × |
| 565 | Second motor excitation current break point | 41 | C1 | 5 | × | 0 | × | × | × | 0 | 0 | × | × | 0 | × | 0 |
| 566 | Second motor excitation current low-speed scaling factor | 42 | C2 | 5 | × | 0 | × | × | × | 0 | 0 | × | × | 0 | × | 0 |
| 569 | Second motor speed control gain | 45 | C5 | 5 | × | 0 | × | × | × | × | × | × | × | 0 | × | 0 |
| 570 | Multiple rating setting | 46 | C6 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | × | × |
| 571 | Holding time at a start | 47 | C7 | 5 | 0 | 0 | 0 | 0 | × | 0 | 0 | 0 | × | 0 | 0 | 0 |
| 573 574 | 4 mA input check selection Second motor online auto tuning | 49 4A | C9 CA | 5 5 | ° × | 0 | 。 。 (×) | 0 | o (x) | 0 | 0 | ° × | × | 0 | 0 | 0 |
| 575 | Output interruption detection time | 4B | СВ | 5 | 0 | 0 | 0 | × | × | 0 | × | 0 | × | 0 | 0 | 0 |
| 576 | Output interruption detection level | 4C | СС | 5 | 0 | 0 | 0 | × | × | 0 | × | 0 | × | 0 | 0 | 0 |
| 577 | Output interruption cancel level | 4D | CD | 5 | 0 | 0 | 0 | × | × | 0 | × | 0 | × | 0 | 0 | 0 |
| 592 | Traverse function selection | 5C | DC | 5 | 0 | 0 | 0 | × | × | 0 | × | 0 | × | 0 | 0 | 0 |
| 593 | Maximum amplitude amount | 5D | DD | 5 | 0 | 0 | 0 | × | × | 0 | × | 0 | × | 0 | 0 | 0 |
| 594 | Amplitude compensation amount during deceleration | 5E | DE | 5 | 0 | 0 | 0 | × | × | 0 | × | 0 | × | 0 | 0 | 0 |
| 595 | Amplitude compensation amount during acceleration | 5F | DF | 5 | 0 | 0 | 0 | × | × | 0 | × | 0 | × | 0 | 0 | 0 |
| 596 | Amplitude acceleration time | 60 | E0 | 5 | 0 | 0 | 0 | × | × | 0 | × | 0 | × | 0 | 0 | 0 |
| 597 | Amplitude deceleration time | 61 | E1 | 5 | 0 | 0 | 0 | × | × • | 0 | × | 0 | × | 0 | 0 | 0 |
| 598 599 | Undervoltage level X10 terminal input selection | 62 63 | E2 E3 | 5 5 | 0 | 0 | (×) | 0 | (×) | 0 | 0 | × 0 | × | 0 | 0 | 0 |
| วลล | First free thermal reduction | | ∟S | υ | U | 0 | 0 | 0 | 0 | U | U | U | U | U | 0 | 0 |
| 600 | frequency 1 First free thermal reduction ratio | 00 | 80 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 601 | 1 First free thermal reduction ratio | 01 | 81 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 602 | frequency 2 First free thermal reduction ratio | 02 | 82 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 603 | 2 | 03 | 83 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

| | | | truct | | | | | Contr | rol metl | nod ^{*2} | | | | Pa | ramet | ter |
|-----|---|------|-------|----------|------|--------------|---------------|----------------|------------------|-------------------|----------------|---------------|--------------------|--------|---------|-------------|
| | | | | | | | V | ecto | r*3 | Sens | orless | P | M | | | |
| Pr. | Name | Read | Write | Extended | A//F | Magneticflux | Speed control | Torque control | Position control | Speed control | Torque control | Speed control | Position control*7 | Copy*4 | Clear*4 | All clear*4 |
| 604 | First free thermal reduction frequency 3 | 04 | 84 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 606 | Power failure stop external signal input selection | 06 | 86 | 6 | 0 | 0 | 0 | 0 | × | 0 | 0 | 0 | × | 0 | 0 | 0 |
| 607 | Motor permissible load level | 07 | 87 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 608 | Second motor permissible load level | 08 | 88 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 609 | PID set point/deviation input selection | 09 | 89 | 6 | 0 | 0 | 0 | × | × | 0 | × | 0 | × | 0 | 0 | 0 |
| 610 | PID measured value input selection | 0A | 8A | 6 | 0 | 0 | 0 | × | × | 0 | × | 0 | × | 0 | 0 | 0 |
| 611 | Acceleration time at a restart | 0B | 8B | 6 | 0 | 0 | 0 | × | × | 0 | × | 0 | × | 0 | 0 | 0 |
| 617 | Reverse rotation excitation current low-speed scaling factor | 11 | 91 | 6 | × | 0 | × | × | × | 0 | 0 | × | × | 0 | × | 0 |
| 635 | Cumulative pulse clear signal selection AP AL TP APR APS APA | 23 | А3 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 636 | Cumulative pulse division scaling factor AP AL TP APR APS APA | 24 | A4 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 637 | Control terminal option- Cumulative pulse division scaling factor AP AL TP APR APS APA | 25 | A5 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 638 | Cumulative pulse storage AP AL TP APR APS APA | 26 | A6 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 639 | Brake opening current selection | 27 | Α7 | 6 | × | 0 | 0 | × | × | 0 | × | 0 | × | 0 | 0 | 0 |
| 640 | Brake operation frequency selection | 28 | A8 | 6 | × | × | 0 | × | × | 0 | × | 0 | × | 0 | 0 | 0 |
| 641 | Second brake sequence operation selection | 29 | A9 | 6 | 0 | 0 | 0 | × | × | 0 | × | 0 | × | 0 | 0 | 0 |
| 642 | Second brake opening frequency | 2A | AA | 6 | 0 | 0 | 0 | × | × | 0 | × | 0 | × | 0 | 0 | 0 |
| 643 | Second brake opening current | 2B | AB | 6 | 0 | 0 | 0 | × | × | 0 | × | 0 | × | 0 | 0 | 0 |
| 644 | Second brake opening current detection time | 2C | AC | 6 | 0 | 0 | 0 | × | × | 0 | × | 0 | × | 0 | 0 | 0 |
| 645 | Second brake operation time at start | 2D | AD | 6 | 0 | 0 | 0 | × | × | 0 | × | 0 | × | 0 | 0 | 0 |
| 646 | Second brake operation frequency | 2E | ΑE | 6 | 0 | 0 | 0 | × | × | 0 | × | 0 | × | 0 | 0 | 0 |
| 647 | Second brake operation time at stop | 2F | AF | 6 | 0 | 0 | 0 | × | × | 0 | × | 0 | × | 0 | 0 | 0 |
| 648 | Second deceleration detection function selection | 30 | В0 | 6 | × | Δ | 0 | × | × | 0 | × | 0 | × | 0 | 0 | 0 |
| 650 | Second brake opening current selection | 32 | B2 | 6 | × | 0 | 0 | × | × | 0 | × | 0 | × | 0 | 0 | 0 |
| 651 | Second brake operation frequency selection | 33 | В3 | 6 | × | × | 0 | × | × | 0 | × | 0 | × | 0 | 0 | 0 |
| 653 | Speed smoothing control | 35 | В5 | 6 | 0 | × | × | × | × | × | × | × | × | 0 | 0 | 0 |
| 654 | Speed smoothing cutoff frequency | 36 | В6 | 6 | 0 | × | × | × | × | × | × | × | × | 0 | 0 | 0 |
| 655 | Analog remote output selection | 37 | В7 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 656 | Analog remote output 1 | 38 | B8 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | × | × | × |
| 657 | Analog remote output 2 | 39 | В9 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | × | × | × |
| 658 | Analog remote output 3 | 3A | ВА | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | × | × | × |

| | | | truct | | | | | Conti | rol meth | nod ^{*2} | | | | Pa | ramet | ter |
|-----|--|------|-------|----------|---|--------------|---------------|----------------|------------------|-------------------|----------------|---------------|--------------------|--------|---------|-------------|
| | | | | | | | V | ecto | *3 | Sens | orless | P | M | | | |
| Pr. | Name | Read | Write | Extended | | Magneticflux | Speed control | Torque control | Position control | Speed control | Torque control | Speed control | Position control*7 | Copy*4 | Clear*4 | All clear*4 |
| 659 | Analog remote output 4 | 3B | BB | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | × | × | × |
| 660 | Increased magnetic excitation deceleration operation selection | 3C | вс | 6 | 0 | 0 | o (×) | × | × | 0 | × | × | × | 0 | 0 | 0 |
| 661 | Magnetic excitation increase rate | 3D | BD | 6 | 0 | 0 | ° (×) | × | × | 0 | × | × | × | 0 | 0 | 0 |
| 662 | Increased magnetic excitation current level | 3E | BE | 6 | 0 | 0 | × | × | × | × | × | × | × | 0 | 0 | 0 |
| 663 | Control circuit temperature signal output level | 3F | BF | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 665 | Regeneration avoidance frequency gain | 41 | C1 | 6 | 0 | 0 | 0 | × | × | 0 | × | 0 | × | 0 | 0 | 0 |
| 668 | Power failure stop frequency gain | 44 | C4 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 673 | SF-PR slip amount adjustment operation selection | 49 | C9 | 6 | 0 | × | × | × | × | × | × | × | × | 0 | 0 | 0 |
| 674 | SF-PR slip amount adjustment gain | 4A | CA | 6 | 0 | × | × | × | × | × | × | × | × | 0 | 0 | 0 |
| 675 | User parameter auto storage function selection | 4B | СВ | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 679 | Second droop gain | 4F | CF | 6 | × | 0 | 0 | × | × | 0 | × | 0 | × | 0 | 0 | 0 |
| 680 | Second droop filter time constant | 50 | D0 | 6 | × | 0 | 0 | × | × | 0 | × | 0 | × | 0 | 0 | 0 |
| 681 | Second droop function activation selection | 51 | D1 | 6 | × | 0 | 0 | × | × | 0 | × | 0 | × | 0 | 0 | 0 |
| 682 | Second droop break point gain | 52 | D2 | 6 | × | 0 | 0 | × | × | 0 | × | 0 | × | 0 | 0 | 0 |
| 683 | Second droop break point torque | 53 | D3 | 6 | × | 0 | 0 | × | × | 0 | × | 0 | × | 0 | 0 | 0 |
| 684 | Tuning data unit switchover | 54 | D4 | 6 | × | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 686 | Maintenance timer 2 | 56 | D6 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | × | × | × |
| 687 | Maintenance timer 2 warning output set time | 57 | D7 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | × | 0 |
| 688 | Maintenance timer 3 | 58 | D8 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | × | × | × |
| 689 | Maintenance timer 3 warning output set time | 59 | D9 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | × | 0 |
| 690 | Deceleration check time | 5A | DA | 6 | × | × | 0 | × | × | × | × | × | × | 0 | 0 | 0 |
| 692 | Second free thermal reduction frequency 1 | 5C | DC | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 693 | Second free thermal reduction ratio 1 | 5D | DD | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 694 | Second free thermal reduction frequency 2 | 5E | DE | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 695 | Second free thermal reduction ratio 2 | 5F | DF | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 696 | Second free thermal reduction frequency 3 | 60 | E0 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 699 | Input terminal filter | 63 | E3 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | × | 0 |
| 702 | Maximum motor frequency | 02 | 82 | 7 | × | × | × (∘) | × | × (○) | × | × | 0 | 0 | 0 | 0 | 0 |
| 706 | Induced voltage constant (phi f) | 06 | 86 | 7 | × | × | × (○) | × | × (○) | × | × | 0 | 0 | 0 | × | 0 |
| 707 | Motor inertia (integer) | 07 | 87 | 7 | × | × | 0 | × | 0 | 0 | × | 0 | 0 | 0 | 0 | 0 |
| 711 | Motor Ld decay ratio | 0B | 8B | 7 | × | × | × (○) | × | × (○) | × | × | 0 | 0 | 0 | × | 0 |
| 712 | Motor Lq decay ratio | 0C | 8C | 7 | × | × | × (○) | × | × (○) | × | × | 0 | 0 | 0 | × | 0 |
| 717 | Starting resistance tuning compensation | 11 | 91 | 7 | × | × | × | × | × | × | × | 0 | 0 | 0 | × | 0 |

| | | | truct | | | | | Contr | rol meth | nod ^{*2} | | | | Pa | rame | ter |
|------------|--|----------|----------|----------|------|---------------|---------------|----------------|------------------|-------------------|----------------|---------------|--------------------|--------|---------|-------------|
| | | | | | | | V | ecto | *3 | Sense | orless | P | M | | | |
| Pr. | Name | Read | Write | Extended | A//E | Magnetic flux | Speed control | Torque control | Position control | Speed control | Torque control | Speed control | Position control*7 | Copy*4 | Clear*4 | All clear*4 |
| 721 | Starting magnetic pole position detection pulse width | 15 | 95 | 7 | × | × | × | × | × | × | × | 0 | 0 | 0 | × | 0 |
| 724 | Motor inertia (exponent) | 18 | 98 | 7 | × | × | 0 | × | 0 | 0 | × | 0 | 0 | 0 | 0 | 0 |
| 725 | Motor protection current level | 19 | 99 | 7 | × | × | × (∘) | × | × (○) | × | × | 0 | 0 | 0 | 0 | 0 |
| 738 | Second motor induced voltage constant (phi f) | 26 | A6 | 7 | × | × | × (∘) | × | × (○) | × | × | 0 | 0 | 0 | × | 0 |
| 739 | Second motor Ld decay ratio | 27 | A7 | 7 | × | × | × (∘) | × | × (○) | × | × | 0 | 0 | 0 | × | 0 |
| 740 | Second motor Lq decay ratio | 28 | A8 | 7 | × | × | × (∘) | × | × (○) | × | × | 0 | 0 | 0 | × | 0 |
| 741 | Second starting resistance tuning compensation | 29 | A9 | 7 | × | × | × | × | × | × | × | 0 | 0 | 0 | × | 0 |
| 742 | Second motor magnetic pole detection pulse width | 2A | AA | 7 | × | × | × | × | × | × | × | 0 | 0 | 0 | × | 0 |
| 743 | Second motor maximum frequency | 2B | АВ | 7 | × | × | × (∘) | × | × (○) | × | × | 0 | 0 | 0 | 0 | 0 |
| 744 | Second motor inertia (integer) | 2C | AC | 7 | × | × | 0 | × | 0 | 0 | × | 0 | 0 | 0 | 0 | 0 |
| 745 | Second motor inertia (exponent) | 2D | AD | 7 | × | × | 0 | × | 0 | 0 | × | 0 | 0 | 0 | 0 | 0 |
| 746 | Second motor protection current level | 2E | AE | 7 | × | × | × (∘) | × | × (∘) | × | × | 0 | 0 | 0 | 0 | 0 |
| 747 | Second motor low-speed range torque characteristic selection | 2F | AF | 7 | × | × | × | × | × | × | × | 0 | 0 | 0 | 0 | 0 |
| 750 | Motor temperature detection level AZ | 32 | B2 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 751 | Reference motor temperature AZ | 33 | B3 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 753 | Second PID action selection | 35 | B5 | 7 | 0 | 0 | 0 | × | × | 0 | × | 0 | × | 0 | 0 | 0 |
| 754 | Second PID control automatic switchover frequency | 36 | B6 | 7 | 0 | 0 | 0 | × | × | 0 | × | 0 | × | 0 | 0 | 0 |
| 755 | Second PID action set point | 37 | B7 | 7 | 0 | 0 | 0 | × | × | 0 | × | 0 | × | 0 | 0 | 0 |
| 756 | Second PID proportional band | 38 | B8 | 7 | 0 | 0 | 0 | × | × | 0 | × | 0 | × | 0 | 0 | 0 |
| 757 | Second PID differential time | 39 | B9 | 7 | 0 | 0 | 0 | × | × | 0 | × | 0 | × | 0 | 0 | 0 |
| 758 759 | Second PID differential time PID unit selection | 3A | BA | 7 7 | 0 | 0 | 0 | × | × | 0 | × | 0 | × | 0 | 0 | 0 |
| 759 760 | Pre-charge fault selection | 3B 3C | BB BC | 7 | 0 | 0 | 0 | × | × | 0 | × | 0 | × | 0 | 0 | 0 |
| 761 | Pre-charge ending level | 3D | BD | 7 | 0 | 0 | 0 | × | × | 0 | × | 0 | × | 0 | 0 | 0 |
| 762 | Pre-charge ending time | 3E | BE | 7 | 0 | 0 | 0 | × | × | 0 | × | 0 | × | 0 | 0 | 0 |
| 763 | Pre-charge upper detection level | 3F | BF | 7 | 0 | 0 | 0 | × | × | 0 | × | 0 | × | 0 | 0 | 0 |
| 764 | Pre-charge time limit | 40 | C0 | 7 | 0 | 0 | 0 | × | × | 0 | × | 0 | × | 0 | 0 | 0 |
| 765 | Second pre-charge fault selection | 41 | C1 | 7 | 0 | 0 | 0 | × | × | 0 | × | 0 | × | 0 | 0 | 0 |
| 766 | Second pre-charge ending level | 42 | C2 | 7 | 0 | 0 | 0 | × | × | 0 | × | 0 | × | 0 | 0 | 0 |
| 767 | Second pre-charge ending time | 43 | C3 | 7 | 0 | 0 | 0 | × | × | 0 | × | 0 | × | 0 | 0 | 0 |
| 768 | Second pre-charge upper detection level | 44 | C4 | 7 | 0 | 0 | 0 | × | × | 0 | × | 0 | × | 0 | 0 | 0 |
| 769 | Second pre-charge time limit | 45 | C5 | 7 | 0 | 0 | 0 | × | × | 0 | × | 0 | × | 0 | 0 | 0 |
| 774 | Operation panel monitor selection 1 | 4A | CA | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 775 | Operation panel monitor selection 2 | 4B | СВ | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 776 | Operation panel monitor selection 3 | 4C | СС | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

| | | | truct | | | | | Conti | rol meth | nod ^{*2} | | | | Pa | ramet | ter |
|------------|---|----------|----------|----------|-------------|--------------|---------------|----------------|------------------|-------------------|----------------|---------------|--------------------|--------|---------|-------------|
| | | | | | | | V | ecto | *3 | Sens | orless | P | M | | | |
| Pr. | Name | Read | Write | Extended | A NA | Magneticflux | Speed control | Torque control | Position control | Speed control | Torque control | Speed control | Position control*7 | Copy*4 | Clear*4 | All clear*4 |
| 777 | 4 mA input fault operation frequency | 4D | CD | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 778 | 4 mA input check filter | 4E | CE | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 779 | Operation frequency during communication error | 4F | CF | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 788 | Low speed range torque characteristic selection | 58 | D8 | 7 | × | × | × | × | × | × | × | 0 | 0 | 0 | 0 | 0 |
| 791 | Acceleration time in low-speed range | 5B | DB | 7 | × | × | × | × | × | × | × | 0 | 0 | 0 | 0 | 0 |
| 792 | Deceleration time in low-speed range | 5C | DC | 7 | × | × | × | × | × | × | × | 0 | 0 | 0 | 0 | 0 |
| 799 | Pulse increment setting for output power | 63 | E3 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 800 | Control method selection | 00 | 80 | 8 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 802 | Pre-excitation selection | 02 | 82 | 8 | × | × | 0 | × | × | × | × | × | × | 0 | 0 | 0 |
| 803 | Constant output range torque characteristic selection | 03 | 83 | 8 | × | × | o (×) | 0 | o (×) | 0 | 0 | × | × | 0 | 0 | 0 |
| 804 | Torque command source selection | 04 | 84 | 8 | × | × | 0 | 0 | × | 0 | 0 | × | × | 0 | 0 | 0 |
| 805 | Torque command value (RAM) | 05 | 85 | 8 | × | × | × | 0 | × | × | 0 | × | × | × | 0 | 0 |
| 806 | Torque command value (RAM, EEPROM) | 06 | 86 | 8 | × | × | × | 0 | × | × | 0 | × | × | 0 | 0 | 0 |
| 807 | Speed limit selection | 07 | 87 | 8 | × | × | × | 0 | × | × | 0 | × | × | 0 | 0 | 0 |
| 808 | Forward rotation speed limit/ speed limit | 08 | 88 | 8 | × | × | × | 0 | × | × | 0 | × | × | 0 | 0 | 0 |
| 809 | Reverse rotation speed limit/ reverse-side speed limit | 09 | 89 | 8 | × | × | × | 0 | × | × | 0 | × | × | 0 | 0 | 0 |
| 810 | Torque limit input method selection | 0A | 8A | 8 | × | × | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 811 | Set resolution switchover | 0B | 8B | 8 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 812 | Torque limit level (regeneration) | 0C | 8C | 8 | × | × | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 813 | Torque limit level (3rd quadrant) | 0D | 8D | 8 | × | × | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 814 | Torque limit level (4th quadrant) | 0E | 8E | 8 | × | × | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 815 | Torque limit level 2 Torque limit level during | 0F | 8F | 8 | × | × | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 816 | acceleration | 10 | 90 | 8 | × | × | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 817 | Torque limit level during deceleration | 11 | 91 | 8 | × | × | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 818 | Easy gain tuning response level setting | 12 | 92 | 8 | × | × | 0 | × | 0 | 0 | × | 0 | 0 | 0 | 0 | 0 |
| 819 | Easy gain tuning selection | 13 | 93 | 8 | × | × | 0 | × | 0 | 0 | × | 0 | 0 | 0 | × | 0 |
| 820 | Speed control P gain 1 | 14 | 94 | 8 | × | × | 0 | × | 0 | 0 | × | 0 | 0 | 0 | 0 | 0 |
| 821 822 | Speed control integral time 1 Speed setting filter 1 | 15 16 | 95 | 8 | × | × | 0 | × | o × | 0 | × | 0 | ° × | 0 | 0 | 0 |
| | Speed setting filter 1 Speed detection filter | | 96 | 0 | ^ | ^ | 0 | 0 | ^ | 0 | 0 | 0 | * | 0 | 0 | 0 |
| 823 | 1 AP AL TP APR APS APA | 17 | 97 | 8 | × | × | 0 | 0 | 0 | × | × | × | × | 0 | 0 | 0 |
| 824 | Torque control P gain 1 (current loop proportional gain) | 18 | 98 | 8 | × | × | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 825 | Torque control integral time 1 (current loop integral time) | 19 | 99 | 8 | × | × | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 826 | Torque setting filter 1 | 1 A | 9A | 8 | × | × | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 827 828 | Torque detection filter 1 Model speed control gain | 1B 1C | 9B 9C | 8 | × | × | 0 | o × | 0 | 0 | ° × | 0 | 0 | 0 | 0 | 0 |
| 0∠ŏ | woder speed control gain | IC | 90 | 0 | ^ | ^ | U | ^ | U | Ü | ^ | U | Ú | U | U | 0 |

| | | _ | truct | | | | | Conti | rol metl | hod ^{*2} | | | | Pa | rame | ter |
|-----|--|------|----------|----------|-----|--------------|---------------|----------------|------------------|-------------------|----------------|---------------|--------------------|--------|---------|-------------|
| | | | | | | | V | ecto | r*3 | Sens | orless | P | M | | | |
| Pr. | Name | Read | Write | Extended | N/E | Magneticifux | Speed control | Torque control | Position control | Speed control | Torque control | Speed control | Position control*7 | Copy*4 | Clear*4 | All clear*4 |
| 829 | Number of machine end encoder pulses | 1D | 9D | 8 | 0 | 0 | 0 | × | × | × | × | × | × | 0 | 0 | 0 |
| 830 | Speed control P gain 2 | 1E | 9E | 8 | × | × | 0 | × | 0 | 0 | × | 0 | 0 | 0 | 0 | 0 |
| 831 | Speed control integral time 2 | 1F | 9F | 8 | × | × | 0 | × | 0 | 0 | × | 0 | 0 | 0 | 0 | 0 |
| 832 | Speed setting filter 2 | 20 | A0 | 8 | × | × | 0 | 0 | × | 0 | 0 | 0 | × | 0 | 0 | 0 |
| 833 | Speed detection filter 2 AP AL TP APR APS APA Torque control P gain 2 (current | 21 | A1 | 8 | × | × | 0 | × | 0 | × | × | × | 0 | 0 | 0 | 0 |
| 834 | loop proportional gain) Torque control integral time 2 | 22 | A2 | 8 | × | × | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 835 | (current loop integral time) Torque setting filter 2 | 23 | A3 A4 | 8 | × | × | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 837 | Torque detection filter 2 | 25 | A4 A5 | 8 | × | × | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 838 | DA1 terminal function selection AZ | 26 | A6 | 8 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 839 | DA1 output filter AZ | 27 | A7 | 8 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 840 | Torque bias selection | 28 | A8 | 8 | × | × | o (×) | × | × | 0 | × | × | × | 0 | 0 | 0 |
| 841 | Torque bias 1 | 29 | A9 | 8 | × | × | o (×) | × | × | 0 | × | × | × | 0 | 0 | 0 |
| 842 | Torque bias 2 | 2A | AA | 8 | × | × | 。 (×) | × | × | 0 | × | × | × | 0 | 0 | 0 |
| 843 | Torque bias 3 | 2B | АВ | 8 | × | × | 。 (×) | × | × | 0 | × | × | × | 0 | 0 | 0 |
| 844 | Torque bias filter | 2C | AC | 8 | × | × | ° (×) | × | × | 0 | × | × | × | 0 | 0 | 0 |
| 845 | Torque bias operation time | 2D | AD | 8 | × | × | ° (×) | × | × | 0 | × | × | × | 0 | 0 | 0 |
| 846 | Torque bias balance compensation | 2E | AE | 8 | × | × | ° (×) | × | × | 0 | × | × | × | 0 | 0 | 0 |
| 847 | Fall-time torque bias terminal 1 bias | 2F | AF | 8 | × | × | o (×) | × | × | 0 | × | × | × | 0 | 0 | 0 |
| 848 | Fall-time torque bias terminal 1 gain | 30 | B0 | 8 | × | × | ° (×) | × | × | 0 | × | × | × | 0 | 0 | 0 |
| 849 | Analog input offset adjustment | 31 | B1 | 8 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 850 | Brake operation selection Control terminal option-Number | 32 | B2 | 8 | × | × | × | × | × | 0 | 0 | × | × | 0 | 0 | 0 |
| 851 | of encoder pulses TP Control terminal option-Number of encoder pulses TP | 33 | В3 | 8 | 0 | 0 | ° (×) | 0 | ° (×) | × | × | × | × | 0 | 0 | 0 |
| 852 | rotation direction TP | 34 | B4 | 8 | 0 | 0 | ° (×) | 0 | ° (×) | × | × | × | × | 0 | 0 | 0 |
| 853 | Speed deviation time AP AL TP APR APS APA | 35 | B5 | 8 | × | × | 0 | × | × | × | × | × | × | 0 | 0 | 0 |
| 854 | Excitation ratio | 36 | В6 | 8 | × | × | ° (×) | 0 | o (×) | 0 | 0 | × | × | 0 | 0 | 0 |
| 855 | Control terminal option-Signal loss detection enable/disable selection TP | 37 | В7 | 8 | × | × | ° (×) | 0 | ° (×) | × | × | × | × | 0 | 0 | 0 |
| 857 | DA1-0V adjustment AZ | 39 | В9 | 8 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | × | 0 |
| 858 | Terminal 4 function assignment | 3A | ВА | 8 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | × | 0 |
| 859 | Torque current/Rated PM motor current | 3B | ВВ | 8 | × | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | × | 0 |
| 860 | Second motor torque current/ Rated PM motor current | 3C | вс | 8 | × | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | × | 0 |
| 862 | Encoder option selection AP AL TP APR APS APA | 3E | BE | 8 | 0 | 0 | 0 | 0 | 0 | × | × | × | × | 0 | 0 | 0 |

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|------------|---|----------|----------|----------|------|--------------|---------------|----------------|------------------|-------------------|----------------|---------------|--------------------|--------|---------|-------------|
| | | | | | | | V | ecto | r*3 | Sens | orless | P | M | | | |
| Pr. | Name | Read | Write | Extended | A//E | Magneticflux | Speed control | Torque control | Position control | Speed control | Torque control | Speed control | Position control*7 | Copy*4 | Clear*4 | All clear*4 |
| 863 | Control terminal option-Encoder pulse division ratio TP | 3F | BF | 8 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 864 | Torque detection | 40 | C0 | 8 | × | × | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 865 | Low speed detection | 41 | C1 | 8 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 866 | Torque monitoring reference | 42 | C2 | 8 | × | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 867 | AM output filter | 43 | C3 | 8 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 868 | Terminal 1 function assignment | 44 45 | C4 | 8 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | × | 0 |
| 869 870 | Current output filter Speed detection hysteresis | 45 | C5 C6 | 8 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 871 | Control terminal option— Encoder position tuning setting/ status TP | 47 | C7 | 8 | × | × | × (°) | × | × | × | × | × | × | 0 | × | 0 |
| 872 | Input phase loss protection selection | 48 | C8 | 8 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 873 | Speed limit_AP_AL_TP_APR_APS_APA | 49 | C9 | 8 | × | × | o (×) | × | × | × | × | × | × | 0 | 0 | 0 |
| 874 | OLT level setting | 4A | CA | 8 | × | × | 0 | × | 0 | 0 | × | 0 | 0 | 0 | 0 | 0 |
| 875 | Fault definition | 4B | СВ | 8 | 0 | 0 | 0 | 0 | × | 0 | 0 | 0 | × | 0 | 0 | 0 |
| 876 | Thermal protector input TP | 4C | CC | 8 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 877 | Speed feed forward control/ model adaptive speed control selection | 4D | CD | 8 | × | × | 0 | × | 0 | 0 | × | 0 | 0 | 0 | 0 | 0 |
| 878 | Speed feed forward filter | 4E | CE | 8 | × | × | 0 | × | 0 | 0 | × | 0 | 0 | 0 | 0 | 0 |
| 879 | Speed feed forward torque limit | 4F | CF | 8 | × | × | 0 | × | 0 | 0 | × | 0 | 0 | 0 | 0 | 0 |
| 880 | Load inertia ratio | 50 | D0 | 8 | × | × | 0 | × | 0 | 0 | × | 0 | 0 | 0 | × | 0 |
| 881 | Speed feed forward gain | 51 | D1 | 8 | × | × | 0 | × | 0 | 0 | × | 0 | 0 | 0 | 0 | 0 |
| 882 | Regeneration avoidance operation selection | 52 | D2 | 8 | 0 | 0 | 0 | × | × | 0 | × | 0 | × | 0 | 0 | 0 |
| 883 | Regeneration avoidance operation level | 53 | D3 | 8 | 0 | 0 | 0 | × | × | 0 | × | 0 | × | 0 | 0 | 0 |
| 884 | Regeneration avoidance at deceleration detection sensitivity | 54 | D4 | 8 | 0 | 0 | 0 | × | × | 0 | × | 0 | × | 0 | 0 | 0 |
| 885 | Regeneration avoidance compensation frequency limit value | 55 | D5 | 8 | 0 | 0 | 0 | × | × | 0 | × | 0 | × | 0 | 0 | 0 |
| 886 | Regeneration avoidance voltage gain | 56 | D6 | 8 | 0 | 0 | 0 | × | × | 0 | × | 0 | × | 0 | 0 | 0 |
| 887 | Control terminal option— Encoder magnetic pole position offset TP | 57 | D7 | 8 | × | × | × (○) | × | × (○) | × | × | × | × | 0 | × | 0 |
| 888 | Free parameter 1 | 58 | D8 | 8 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | × | × |
| 889 | Free parameter 2 | 59 | D9 | 8 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | × | × |
| 891 | Cumulative power monitor digit shifted times | 5B | DB | 8 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 892 | Load factor | 5C | DC | 8 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 893 | Energy saving monitor reference (motor capacity) | 5D | DD | 8 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 894 | Control selection during commercial power-supply operation | 5E | DE | 8 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 895 | Power saving rate reference value | 5F | DF | 8 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 896 | Power unit cost | 60 | E0 | 8 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 897 | Power saving monitor average time | 61 | E1 | 8 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

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|--------------|---|------|-------|----------|-----|---------------|---------------|----------------|------------------|-------------------|----------------|---------------|--------------------|--------|---------|-------------|
| | | | | | | | V | ecto | r*3 | Sens | orless | P | M | | | |
| Pr. | Name | Read | Write | Extended | N/E | Magnetic flux | Speed control | Torque control | Position control | Speed control | Torque control | Speed control | Position control*7 | Copy*4 | Clear*4 | All clear*4 |
| 898 | Power saving cumulative monitor clear | 62 | E2 | 8 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | × | 0 |
| 899 | Operation time rate (estimated value) | 63 | E3 | 8 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| C0 (900) | FM/CA terminal calibration | 5C | DC | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | × | 0 |
| C1 (901) | AM terminal calibration | 5D | DD | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | × | 0 |
| C2 (902) | Terminal 2 frequency setting bias frequency | 5E | DE | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | × | 0 |
| C3 (902) | Terminal 2 frequency setting bias | 5E | DE | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | × | 0 |
| 125 (903) | Terminal 2 frequency setting gain frequency | 5F | DF | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | × | 0 |
| C4 (903) | Terminal 2 frequency setting gain | 5F | DF | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | × | 0 |
| C5 (904) | Terminal 4 frequency setting bias frequency | 60 | E0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | × | 0 |
| C6 (904) | Terminal 4 frequency setting bias | 60 | E0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | × | 0 |
| 126 (905) | Terminal 4 frequency setting gain frequency | 61 | E1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | × | 0 |
| C7 (905) | Terminal 4 frequency setting gain | 61 | E1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | × | 0 |
| C12 (917) | Terminal 1 bias frequency (speed) | 11 | 91 | 9 | × | × | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | × | 0 |
| C13 (917) | Terminal 1 bias (speed) | 11 | 91 | 9 | × | × | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | × | 0 |
| C14 (918) | Terminal 1 gain frequency (speed) | 12 | 92 | 9 | × | × | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | × | 0 |
| C15 (918) | Terminal 1 gain (speed) | 12 | 92 | 9 | × | × | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | × | 0 |
| C16 (919) | Terminal 1 bias command (torque/magnetic flux) | 13 | 93 | 9 | × | × | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | × | 0 |
| C17 (919) | Terminal 1 bias (torque/magnetic flux) | 13 | 93 | 9 | × | × | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | × | 0 |
| C18 (920) | Terminal 1 gain command (torque/magnetic flux) | 14 | 94 | 9 | × | × | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | × | 0 |
| C19 (920) | Terminal 1 gain (torque/magnetic flux) | 14 | 94 | 9 | × | × | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | × | 0 |
| C29 (925) | Motor temperature detection calibration (analog input) AZ | 19 | 99 | 9 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | × | 0 |
| C30 (926) | Terminal 6 bias frequency (speed) AZ | 1A | 9A | 9 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | × | 0 |
| (926) | Terminal 6 bias (speed) | 1A | 9A | 9 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | × | 0 |
| C32 (927) | Terminal 6 gain frequency (speed) AZ | 1B | 9B | 9 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | × | 0 |
| C33 (927) | Terminal 6 gain (speed) | 1B | 9B | 9 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | × | 0 |
| C34 (928) | Terminal 6 bias command (torque)[AZ] | 1C | 9C | 9 | × | × | 0 | 0 | 0 | 0 | 0 | × | × | 0 | × | 0 |
| C35 (928) | Terminal 6 bias (torque) AZ | 1C | 9C | 9 | × | × | 0 | 0 | 0 | 0 | 0 | × | × | 0 | × | 0 |
| C36 (929) | Terminal 6 gain command (torque) AZ | 1D | 9D | 9 | × | × | 0 | 0 | 0 | 0 | 0 | × | × | 0 | × | 0 |

| | | | truct ode | | | | | Contr | rol meth | nod*2 | | | | Pa | rame | ter |
|--------------|---|------|--------------|----------|---|--------------|---------------|----------------|------------------|---------------|----------------|---------------|--------------------|--------|---------|-------------|
| | | | | | | | V | ecto | *3 | Sens | orless | P | M | | | |
| Pr. | Name | Read | Write | Extended | | Magneticflux | Speed control | Torque control | Position control | Speed control | Torque control | Speed control | Position control*7 | Copy*4 | Clear*4 | All clear*4 |
| C37 (929) | Terminal 6 gain (torque) AZ | 1D | 9D | 9 | × | × | 0 | 0 | 0 | 0 | 0 | × | × | 0 | × | 0 |
| C8 (930) | Current output bias signal | 1E | 9E | 9 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| C9 (930) | Current output bias current | 1E | 9E | 9 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| C10 (931) | Current output gain signal | 1F | 9F | 9 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| C11 (931) | Current output gain current | 1F | 9F | 9 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| C38 (932) | Terminal 4 bias command (torque/magnetic flux) | 20 | A0 | 9 | × | × | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | × | 0 |
| C39 (932) | Terminal 4 bias (torque/magnetic flux) | 20 | A0 | 9 | × | × | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | × | 0 |
| C40 | Terminal 4 gain command (torque/magnetic flux) | 21 | A1 | 9 | × | × | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | × | 0 |
| C41 (933) | Terminal 4 gain (torque/ magnetic flux) | 21 | A1 | 9 | × | × | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | × | 0 |
| C42 (934) | PID display bias coefficient | 22 | A2 | 9 | 0 | 0 | 0 | × | × | 0 | × | 0 | × | 0 | × | 0 |
| C43 (934) | PID display bias analog value | 22 | A2 | 9 | 0 | 0 | 0 | × | × | 0 | × | 0 | × | 0 | × | 0 |
| C44 (935) | PID display gain coefficient | 23 | А3 | 9 | 0 | 0 | 0 | × | × | 0 | × | 0 | × | 0 | × | 0 |
| C45 (935) | PID display gain analog value | 23 | А3 | 9 | 0 | 0 | 0 | × | × | 0 | × | 0 | × | 0 | × | 0 |
| 977 | Input voltage mode selection | 4D | CD | 9 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | × | × |
| 989 | Parameter copy alarm release | 59 | D9 | 9 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | × | 0 |
| 990 | PU buzzer control | 5A | DA | 9 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 991 | PU contrast adjustment | 5B | DB | 9 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | × | 0 |
| 992 | Operation panel setting dial push monitor selection | 5C | DC | 9 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 994 | Droop break point gain | 5E | DE | 9 | × | 0 | 0 | × | × | 0 | × | 0 | × | 0 | 0 | 0 |
| 995 | Droop break point torque | 5F | DF | 9 | × | 0 | 0 | × | × | 0 | × | 0 | × | 0 | 0 | 0 |
| 997 | Fault initiation | 61 | E1 | 9 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | × | 0 | 0 |
| 998 | PM parameter initialization | 62 | E2 | 9 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 999 | Automatic parameter setting | 63 | E3 | 9 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | × | × | 0 |
| 1000 | Direct setting selection | 00 | 80 | Α | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1002 | Lq tuning target current adjustment coefficient | 02 | 82 | Α | × | × | × (°) | × | × | × | × | 0 | × | 0 | 0 | 0 |
| | Notch filter frequency | 03 | 83 | Α | × | × | 0 | × | 0 | 0 | × | 0 | 0 | 0 | 0 | 0 |
| | Notch filter depth | 04 | 84 | Α | × | × | 0 | × | 0 | 0 | × | 0 | 0 | 0 | 0 | 0 |
| | Notch filter width | 05 | 85 | Α | × | × | 0 | × | 0 | 0 | × | 0 | 0 | 0 | 0 | 0 |
| | Clock (year) | 06 | 86 | Α | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | × | × | × |
| | Clock (month, day) | 07 | 87 | Α | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | × | × | × |
| | Clock (hour, minute) | 08 | 88 | Α | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | × | × | × |
| 1015 | Integral stop selection at limited frequency | 0F | 8F | Α | 0 | 0 | 0 | × | × | 0 | × | 0 | × | 0 | 0 | 0 |
| 1016 | PTC thermistor protection detection time | 10 | 90 | Α | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | × | 0 |
| 1018 | Monitor with sign selection | 12 | 92 | Α | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1019 | Analog meter voltage negative output selection AY | 13 | 93 | Α | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1020 | Trace operation selection | 14 | 94 | Α | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

| Name | | | | truct | | | | | Conti | rol metl | hod ^{*2} | | | | Pa | arame | ter |
|--|------|----------------------------------|------|-------|----------|-----|---------------|---------------|----------------|------------------|-------------------|----------------|---------------|--------------------|--------|---------|-------------|
| 1021 Trace mode selection 15 95 A 0 0 0 0 0 0 0 0 0 | | | | | | | | V | ecto | *3 | Sens | orless | P | M | | | |
| Sampling cycle | Pr. | Name | Read | Write | Extended | N/E | Magnetic flux | Speed control | Torque control | Position control | Speed control | Torque control | Speed control | Position control*7 | Copy*4 | Clear*4 | All clear*4 |
| 1023 Number of analog channels 17 97 A 0 0 0 0 0 0 0 0 0 | 1021 | Trace mode selection | 15 | 95 | Α | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Sampling auto start 18 98 A 0 0 0 0 0 0 0 0 0 | 1022 | Sampling cycle | 16 | 96 | Α | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1025 Trigger mode selection 19 99 | 1023 | Number of analog channels | 17 | 97 | Α | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Number of sampling before 1A 9A A 0 0 0 0 0 0 0 0 | 1024 | Sampling auto start | 18 | 98 | Α | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| trigger 1027 Analog source selection (1ch) 18 9K A 0 0 0 0 0 0 0 0 0 | 1025 | Trigger mode selection | 19 | 99 | Α | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1028 Analog source selection (3ch) 10 90 A 0 0 0 0 0 0 0 0 | 1026 | | 1A | 9A | Α | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1029 Analog source selection (3ch) 1D 9D A 0 0 0 0 0 0 0 0 0 | 1027 | Analog source selection (1ch) | 1B | 9B | Α | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1030 Analog source selection (4ch) 1E 9E A 0 0 0 0 0 0 0 0 0 | 1028 | Analog source selection (2ch) | 1C | 9C | Α | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1031 Analog source selection (Sch) 1F 9F A 0 0 0 0 0 0 0 0 0 | 1029 | Analog source selection (3ch) | 1D | 9D | Α | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1032 Analog source selection (6ch) 20 A0 A 0 0 0 0 0 0 0 | 1030 | Analog source selection (4ch) | 1E | 9E | Α | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1033 Analog source selection (7ch) 21 A1 A 0 0 0 0 0 0 0 0 0 | 1031 | Analog source selection (5ch) | 1F | 9F | Α | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1034 Analog source selection (8ch) 22 A2 A O O O O O O O O O | 1032 | Analog source selection (6ch) | 20 | A0 | Α | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1035 Analog trigger channel | 1033 | Analog source selection (7ch) | 21 | A1 | Α | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Analog trigger operation 24 A4 A O O O O O O O O O | 1034 | Analog source selection (8ch) | 22 | A2 | Α | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Analog trigger operation selection Sel | 1035 | Analog trigger channel | 23 | А3 | Α | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1038 Digital source selection (1ch) 26 A6 A 0 0 0 0 0 0 0 0 0 | 1036 | | 24 | A4 | Α | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1039 Digital source selection (2ch) 27 A7 A 0 0 0 0 0 0 0 0 0 | 1037 | Analog trigger level | 25 | A5 | Α | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1040 Digital source selection (3ch) 28 A8 A 0 0 0 0 0 0 0 0 0 | 1038 | Digital source selection (1ch) | 26 | A6 | Α | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1041 Digital source selection (4ch) 29 A9 A A A A A A A A | 1039 | Digital source selection (2ch) | 27 | Α7 | Α | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1042 Digital source selection (5ch) 2A AA A O O O O O O O | 1040 | Digital source selection (3ch) | 28 | A8 | Α | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1043 Digital source selection (6ch) 2B AB A O O O O O O O O O | 1041 | Digital source selection (4ch) | 29 | A9 | Α | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1044 Digital source selection (7ch) 2C AC A 0 0 0 0 0 0 0 0 0 | 1042 | Digital source selection (5ch) | 2A | AA | Α | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1044 Digital source selection (7ch) 2C AC A 0 0 0 0 0 0 0 0 0 | 1043 | | 2B | AB | Α | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1045 Digital source selection (8ch) 2D AD A 0 0 0 0 0 0 0 0 0 | 1044 | | | AC | Α | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1046 Digital trigger channel 2E AE A O O O O O O O O O | 1045 | | | | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1047 Digital trigger operation selection 2F AF A O O O O O O O O O | 1046 | ` ' | | | _ | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1048 Display-off waiting time 30 B0 A 0 0 0 0 0 0 0 0 | | 0 00 | | | | 0 | | | | | 0 | 0 | 0 | 0 | 0 | | 0 |
| 1049 USB host reset | | | | _ | | | | | | | | | | | | | |
| 1072 DC brake judgment time for antisway control operation 48 C8 A 0 0 0 x x 0 x 0 0 0 | | | | | | | | | | | | | | | | | |
| 1073 selection | | DC brake judgment time for anti- | | | | | | | | | | | | | | | |
| 1075 Anti-sway control depth 4B CB A 0 0 0 x x 0 x 0 0 0 | 1073 | | 49 | С9 | Α | 0 | 0 | 0 | × | × | 0 | × | 0 | × | 0 | 0 | 0 |
| 1076 Anti-sway control width 4C CC A O O X X O X O | 1074 | Anti-sway control frequency | 4A | CA | Α | 0 | 0 | 0 | × | × | 0 | × | 0 | × | 0 | 0 | 0 |
| 1077 Rope length 4D CD A 0 0 0 x x 0 x 0 0 0 | | | | | Α | 0 | 0 | 0 | × | × | 0 | × | 0 | × | 0 | 0 | 0 |
| 1078 Trolley weight 4E CE A O O X X O X O | | _ | 4C | | Α | 0 | 0 | 0 | × | × | 0 | × | 0 | × | 0 | 0 | 0 |
| 1079 Load weight | 1077 | Rope length | 4D | CD | Α | 0 | 0 | 0 | × | × | 0 | × | 0 | × | 0 | 0 | 0 |
| 1103 Deceleration time at emergency 03 83 B 0 0 0 0 0 0 0 0 0 | 1078 | Trolley weight | 4E | CE | Α | 0 | 0 | 0 | × | × | 0 | × | 0 | × | 0 | 0 | 0 |
| 1105 Encoder magnetic pole position offset AL APR APS APA | 1079 | Load weight | 4F | CF | Α | 0 | 0 | 0 | × | × | 0 | × | 0 | × | 0 | 0 | 0 |
| 1103 offset AL [APR] APS [APA] 03 63 B X X (o) X < | 1103 | stop | 03 | 83 | В | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1107 Running speed monitor filter 07 87 B O | | offset AL APR APS APA | | | | × | × | (○) | × | (○) | × | × | × | × | 0 | × | 0 |
| 1108 Excitation current monitor filter 08 88 B O | | - | | | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1109 PROFIBUS communication command source selection NP 09 89 B × ° | | | | 87 | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1109 command source selection NP 09 89 B × ° < | 1108 | | 08 | 88 | В | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 1109 | | 09 | 89 | В | × | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | |
| 1113 Speed limit method selection 0D 8D B × × × · · · × · · · · · · · · | 1110 | PROFIBUS format selection NP | 0A | 8A | В | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | o*5 | o*5 |
| | 1113 | Speed limit method selection | 0D | 8D | В | × | × | × | 0 | × | × | 0 | × | × | 0 | 0 | 0 |

| | | | truct | | | | | Conti | rol metl | nod ^{*2} | | | | Pa | rame | ter |
|------|---|------|-------|----------|--------------|--------------|---------------|----------------|------------------|-------------------|----------------|---------------|--------------------|--------|---------|-------------|
| | | | | | | | V | ecto | *3 | Sens | orless | P | M | | | |
| Pr. | Name | Read | Write | Extended | H //A | Magneticflux | Speed control | Torque control | Position control | Speed control | Torque control | Speed control | Position control*7 | Copy*4 | Clear*4 | All clear*4 |
| 1114 | Torque command reverse selection | 0E | 8E | В | × | × | × | 0 | × | × | 0 | × | × | 0 | 0 | 0 |
| 1115 | Speed control integral term clear time | 0F | 8F | В | × | × | 0 | × | 0 | 0 | × | 0 | 0 | 0 | 0 | 0 |
| 1116 | Constant output range speed control P gain compensation | 10 | 90 | В | × | × | 0 | × | 0 | 0 | × | 0 | 0 | 0 | 0 | 0 |
| 1117 | Speed control P gain 1 (per-unit system) | 11 | 91 | В | × | × | 0 | × | 0 | 0 | × | 0 | 0 | 0 | 0 | 0 |
| 1118 | Speed control P gain 2 (per-unit system) | 12 | 92 | В | × | × | 0 | × | 0 | 0 | × | 0 | 0 | 0 | 0 | 0 |
| 1119 | Model speed control gain (per- unit system) | 13 | 93 | В | × | × | 0 | × | 0 | 0 | × | 0 | 0 | 0 | 0 | 0 |
| 1121 | Per-unit speed control reference frequency | 15 | 95 | В | × | × | 0 | × | 0 | 0 | × | 0 | 0 | 0 | 0 | 0 |
| 1134 | PID upper limit manipulated value | 22 | A2 | В | 0 | 0 | 0 | × | × | 0 | × | 0 | × | 0 | 0 | 0 |
| 1135 | PID lower limit manipulated value | 23 | А3 | В | 0 | 0 | 0 | × | × | 0 | × | 0 | × | 0 | 0 | 0 |
| 1136 | Second PID display bias coefficient | 24 | A4 | В | 0 | 0 | 0 | × | × | 0 | × | 0 | × | 0 | × | 0 |
| 1137 | Second PID display bias analog value | 25 | A5 | В | 0 | 0 | 0 | × | × | 0 | × | 0 | × | 0 | × | 0 |
| 1138 | Second PID display gain coefficient | 26 | A6 | В | 0 | 0 | 0 | × | × | 0 | × | 0 | × | 0 | × | 0 |
| 1139 | Second PID display gain analog value | 27 | A7 | В | 0 | 0 | 0 | × | × | 0 | × | 0 | × | 0 | × | 0 |
| 1140 | Second PID set point/deviation input selection | 28 | A8 | В | 0 | 0 | 0 | × | × | 0 | × | 0 | × | 0 | 0 | 0 |
| 1141 | Second PID measured value input selection | 29 | A9 | В | 0 | 0 | 0 | × | × | 0 | × | 0 | × | 0 | 0 | 0 |
| 1142 | Second PID unit selection | 2A | AA | В | 0 | 0 | 0 | × | × | 0 | × | 0 | × | 0 | 0 | 0 |
| 1143 | Second PID upper limit | 2B | AB | В | 0 | 0 | 0 | × | × | 0 | × | 0 | × | 0 | 0 | 0 |
| 1144 | Second PID lower limit | 2C | AC | В | 0 | 0 | 0 | × | × | 0 | × | 0 | × | 0 | 0 | 0 |
| 1145 | Second PID deviation limit | 2D | AD | В | 0 | 0 | 0 | × | × | 0 | × | 0 | × | 0 | 0 | 0 |
| 1146 | Second PID signal operation selection | 2E | AE | В | 0 | 0 | 0 | × | × | 0 | × | 0 | × | 0 | 0 | 0 |
| 1147 | Second output interruption detection time | 2F | AF | В | 0 | 0 | 0 | × | × | 0 | × | 0 | × | 0 | 0 | 0 |
| 1148 | Second output interruption detection level | 30 | В0 | В | 0 | 0 | 0 | × | × | 0 | × | 0 | × | 0 | 0 | 0 |
| 1149 | Second output interruption cancel level | 31 | B1 | В | 0 | 0 | 0 | × | × | 0 | × | 0 | × | 0 | 0 | 0 |
| 1150 | PLC function user parameters 1 | 32 | B2 | В | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1151 | PLC function user parameters 2 | 33 | В3 | В | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1152 | PLC function user parameters 3 | 34 | B4 | В | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1153 | PLC function user parameters 4 | 35 | B5 | В | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1154 | PLC function user parameters 5 | 36 | В6 | В | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1155 | PLC function user parameters 6 | 37 | В7 | В | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1156 | PLC function user parameters 7 | 38 | В8 | В | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1157 | PLC function user parameters 8 | 39 | В9 | В | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1158 | PLC function user parameters 9 | ЗА | ВА | В | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1159 | PLC function user parameters 10 | 3B | ВВ | В | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1160 | PLC function user parameters 11 | 3C | ВС | В | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1161 | PLC function user parameters 12 | 3D | BD | В | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

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|--------------|---|----------|----------|----------|-------------|--------------|---------------|----------------|------------------|-------------------|----------------|---------------|--------------------|--------|---------|-------------|
| | | | | | | | V | ecto | *3 | Sens | orless | P | M | | | |
| Pr. | Name | Read | Write | Extended | A WA | Magneticflux | Speed control | Torque control | Position control | Speed control | Torque control | Speed control | Position control*7 | Copy*4 | Clear*4 | All clear*4 |
| 1162 | PLC function user parameters 13 | 3E | BE | В | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1163 | PLC function user parameters 14 | 3F | BF | В | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1164 | PLC function user parameters 15 | 40 | C0 | В | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1165 | PLC function user parameters 16 | 41 | C1 | В | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1166 | PLC function user parameters 17 | 42 | C2 | В | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1167 | PLC function user parameters 18 | 43 | C3 | В | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1168 | PLC function user parameters 19 | 44 | C4 | В | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1169 | PLC function user parameters 20 | 45 | C5 | В | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1170 | PLC function user parameters 21 | 46 | C6 | В | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1171 | PLC function user parameters 22 | 47 | C7 | В | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1172 | PLC function user parameters 23 | 48 | C8 | В | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1173 | PLC function user parameters 24 | 49 | C9 | В | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1174 | PLC function user parameters 25 | 4A | CA | В | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1175 | PLC function user parameters 26 | 4B | СВ | В | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1176 | PLC function user parameters 27 | 4C | CC | В | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1177 | PLC function user parameters 28 | 4D | CD | В | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1178 | PLC function user parameters 29 | 4E | CE | В | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1179 | PLC function user parameters 30 | 4F | CF | В | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1180 | PLC function user parameters 31 | 50 | D0 | В | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1181 | PLC function user parameters 32 | 51 | D1 | В | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1182 | PLC function user parameters 33 | 52 | D2 | В | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1183 | PLC function user parameters 34 | 53 | D3 | В | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1184 | PLC function user parameters 35 | 54 | D4 | В | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1185 | PLC function user parameters 36 | 55 | D5 | В | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1186 | PLC function user parameters 37 | 56 | D6 | В | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1187 | PLC function user parameters 38 | 57 | D7 | В | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1188 | PLC function user parameters 39 | 58 | D8 | В | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1189 | PLC function user parameters 40 | 59 | D9 | В | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1190 | PLC function user parameters 41 | 5A | DA | В | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1191 | PLC function user parameters 42 | 5B | DB | В | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1192 | PLC function user parameters 43 | 5C | DC | В | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1193 | PLC function user parameters 44 | 5D | DD | В | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1194 | PLC function user parameters 45 | 5E 5F | DE DF | B B | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1195 | PLC function user parameters 46 | | | В | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1196 1197 | PLC function user parameters 47 | 60 61 | E0 E1 | В | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1197 | PLC function user parameters 48 PLC function user parameters 49 | 62 | E2 | В | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1196 | PLC function user parameters 49 PLC function user parameters 50 | 63 | E3 | В | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1220 | Target position/speed selection | 14 | 94 | С | × | × | × | × | 0 | × | × | × | 0 | 0 | 0 | 0 |
| 1221 | Start command edge detection selection | 15 | 95 | С | × | × | × | × | 0 | × | × | × | 0 | 0 | 0 | 0 |
| 1222 | First positioning acceleration time | 16 | 96 | С | × | × | × | × | 0 | × | × | × | 0 | 0 | 0 | 0 |
| 1223 | First positioning deceleration time | 17 | 97 | С | × | × | × | × | 0 | × | × | × | 0 | 0 | 0 | 0 |
| 1224 | First positioning dwell time | 18 | 98 | С | × | × | × | × | 0 | × | × | × | 0 | 0 | 0 | 0 |
| 1225 | First positioning sub-function | 19 | 99 | С | × | × | × | × | 0 | × | × | × | 0 | 0 | 0 | 0 |
| 1226 | Second positioning acceleration time | 1A | 9A | С | × | × | × | × | 0 | × | × | × | 0 | 0 | 0 | 0 |
| 1227 | Second positioning deceleration time | 1B | 9B | С | × | × | × | × | 0 | × | × | × | 0 | 0 | 0 | 0 |
| 1228 | Second positioning dwell time | 1C | 9C | С | × | × | × | × | 0 | × | × | × | 0 | 0 | 0 | 0 |

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|--------------|--|----------|----------|----------|---|--------------|---------------|----------------|------------------|-------------------|----------------|---------------|--------------------|--------|---------|-------------|
| | | | | | | | V | ecto | *3 | Sens | orless | P | M | | | |
| Pr. | Name | Read | Write | Extended | | Magneticflux | Speed control | Torque control | Position control | Speed control | Torque control | Speed control | Position control*7 | Copy*4 | Clear*4 | All clear*4 |
| 1229 | Second positioning sub-function | 1D | 9D | С | × | × | × | × | 0 | × | × | × | 0 | 0 | 0 | 0 |
| 1230 | Third positioning acceleration time | 1E | 9E | С | × | × | × | × | 0 | × | × | × | 0 | 0 | 0 | 0 |
| 1231 | Third positioning deceleration time | 1F | 9F | С | × | × | × | × | 0 | × | × | × | 0 | 0 | 0 | 0 |
| 1232 | Third positioning dwell time | 20 | A0 | С | × | × | × | × | 0 | × | × | × | 0 | 0 | 0 | 0 |
| 1233 1234 | Third positioning sub-function Fourth positioning acceleration time | 21 22 | A1 A2 | C C | × | × | × | × | 0 | × | × | × | 0 | 0 | 0 | 0 |
| 1235 | Fourth positioning deceleration time | 23 | А3 | С | × | × | × | × | 0 | × | × | × | 0 | 0 | 0 | 0 |
| 1236 | Fourth positioning dwell time | 24 | A4 | С | × | × | × | × | 0 | × | × | × | 0 | 0 | 0 | 0 |
| 1237 | Fourth positioning sub-function | 25 | A5 | С | × | × | × | × | 0 | × | × | × | 0 | 0 | 0 | 0 |
| 1238 | Fifth positioning acceleration time | 26 | A6 | С | × | × | × | × | 0 | × | × | × | 0 | 0 | 0 | 0 |
| 1239 | Fifth positioning deceleration time | 27 | A7 | С | × | × | × | × | 0 | × | × | × | 0 | 0 | 0 | 0 |
| 1240 | Fifth positioning dwell time | 28 | A8 | С | × | × | × | × | 0 | × | × | × | 0 | 0 | 0 | 0 |
| 1241 | Fifth positioning sub-function | 29 | A9 | С | × | × | × | × | 0 | × | × | × | 0 | 0 | 0 | 0 |
| 1242 | Sixth positioning acceleration time | 2A | AA | С | × | × | × | × | 0 | × | × | × | 0 | 0 | 0 | 0 |
| 1243 | Sixth positioning deceleration time | 2B | AB | С | × | × | × | × | 0 | × | × | × | 0 | 0 | 0 | 0 |
| 1244 | Sixth positioning dwell time | 2C | AC | С | × | × | × | × | 0 | × | × | × | 0 | 0 | 0 | 0 |
| 1245 1246 | Sixth positioning sub-function Seventh positioning acceleration time | 2D 2E | AD AE | C C | × | × | × | × | 0 | × | × | × | 0 | 0 | 0 | 0 |
| 1247 | Seventh positioning deceleration time | 2F | AF | С | × | × | × | × | 0 | × | × | × | 0 | 0 | 0 | 0 |
| 1248 | Seventh positioning dwell time | 30 | B0 | С | × | × | × | × | 0 | × | × | × | 0 | 0 | 0 | 0 |
| 1249 | Seventh positioning sub-function | 31 | В1 | С | × | × | × | × | 0 | × | × | × | 0 | 0 | 0 | 0 |
| 1250 | Eighth positioning acceleration time | 32 | B2 | С | × | × | × | × | 0 | × | × | × | 0 | 0 | 0 | 0 |
| 1251 | Eighth positioning deceleration time | 33 | В3 | С | × | × | × | × | 0 | × | × | × | 0 | 0 | 0 | 0 |
| 1252 | Eighth positioning dwell time | 34 | B4 | С | × | × | × | × | 0 | × | × | × | 0 | 0 | 0 | 0 |
| 1253 | Eighth positioning sub-function | 35 | B5 | С | × | × | × | × | 0 | × | × | × | 0 | 0 | 0 | 0 |
| 1254 | Ninth positioning acceleration time | 36 | В6 | С | × | × | × | × | 0 | × | × | × | 0 | 0 | 0 | 0 |
| 1255 | Ninth positioning deceleration time | 37 | B7 | С | × | × | × | × | 0 | × | × | × | 0 | 0 | 0 | 0 |
| 1256 | Ninth positioning dwell time | 38 | B8 | С | × | × | × | × | 0 | × | × | × | 0 | 0 | 0 | 0 |
| 1257 | Ninth positioning sub-function | 39 | В9 | С | × | × | × | × | 0 | × | × | × | 0 | 0 | 0 | 0 |
| 1258 | Tenth positioning acceleration time | 3A | ВА | С | × | × | × | × | 0 | × | × | × | 0 | 0 | 0 | 0 |
| 1259 | Tenth positioning deceleration time | 3B | ВВ | С | × | × | × | × | 0 | × | × | × | 0 | 0 | 0 | 0 |
| 1260 | Tenth positioning dwell time | 3C | BC | С | × | × | × | × | 0 | × | × | × | 0 | 0 | 0 | 0 |
| 1261 | Tenth positioning sub-function Eleventh positioning | 3D | BD | С | × | × | × | × | 0 | × | × | × | 0 | 0 | 0 | 0 |
| 1262 | acceleration time | 3E | BE | С | × | × | × | × | 0 | × | × | × | 0 | 0 | 0 | 0 |
| 1263 | Eleventh positioning deceleration time | 3F 40 | BF C0 | C C | × | × | × | × | 0 | × | × | × | 0 | 0 | 0 | 0 |
| 1264 | Eleventh positioning dwell time | 40 | CU | C | ^ | × | × | × | 0 | × | × | ^ | 0 | 0 | 0 | 0 |

| | | | truct | | | | | Contr | rol met | hod ^{*2} | | | | Pa | arame | ter |
|------|---|------|-------|----------|----------------------|--------------|---------------|----------------|------------------|-------------------|----------------|---------------|--------------------|--------|---------|-------------|
| | | | | | | | V | ecto | *3 | Sens | orless | P | M | | | |
| Pr. | Name | Read | Write | Extended | ₽ // N | Magneticflux | Speed control | Torque control | Position control | Speed control | Torque control | Speed control | Position control*7 | Copy*4 | Clear*4 | All clear*4 |
| 1265 | Eleventh positioning sub- function | 41 | C1 | С | × | × | × | × | 0 | × | × | × | 0 | 0 | 0 | 0 |
| 1266 | Twelfth positioning acceleration time | 42 | C2 | С | × | × | × | × | 0 | × | × | × | 0 | 0 | 0 | 0 |
| 1267 | Twelfth positioning deceleration time | 43 | С3 | С | × | × | × | × | 0 | × | × | × | 0 | 0 | 0 | 0 |
| 1268 | Twelfth positioning dwell time | 44 | C4 | С | × | × | × | × | 0 | × | × | × | 0 | 0 | 0 | 0 |
| 1269 | Twelfth positioning sub-function | 45 | C5 | С | × | × | × | × | 0 | × | × | × | 0 | 0 | 0 | 0 |
| 1270 | Thirteenth positioning acceleration time | 46 | C6 | С | × | × | × | × | 0 | × | × | × | 0 | 0 | 0 | 0 |
| 1271 | Thirteenth positioning deceleration time | 47 | C7 | С | × | × | × | × | 0 | × | × | × | 0 | 0 | 0 | 0 |
| 1272 | Thirteenth positioning dwell time | 48 | C8 | С | × | × | × | × | 0 | × | × | × | 0 | 0 | 0 | 0 |
| 1273 | Thirteenth positioning sub- function | 49 | C9 | С | × | × | × | × | 0 | × | × | × | 0 | 0 | 0 | 0 |
| 1274 | Fourteenth positioning acceleration time | 4A | CA | С | × | × | × | × | 0 | × | × | × | 0 | 0 | 0 | 0 |
| 1275 | Fourteenth positioning deceleration time | 4B | СВ | С | × | × | × | × | 0 | × | × | × | 0 | 0 | 0 | 0 |
| 1276 | Fourteenth positioning dwell time | 4C | CC | С | × | × | × | × | 0 | × | × | × | 0 | 0 | 0 | 0 |
| 1277 | Fourteenth positioning sub- function | 4D | CD | С | × | × | × | × | 0 | × | × | × | 0 | 0 | 0 | 0 |
| 1278 | Fifteenth positioning acceleration time | 4E | CE | С | × | × | × | × | 0 | × | × | × | 0 | 0 | 0 | 0 |
| 1279 | Fifteenth positioning deceleration time | 4F | CF | С | × | × | × | × | 0 | × | × | × | 0 | 0 | 0 | 0 |
| 1280 | Fifteenth positioning dwell time | 50 | D0 | С | × | × | × | × | 0 | × | × | × | 0 | 0 | 0 | 0 |
| 1281 | Fifteenth positioning sub- function | 51 | D1 | С | × | × | × | × | 0 | × | × | × | 0 | 0 | 0 | 0 |
| 1282 | Home position return method selection | 52 | D2 | С | × | × | × | × | 0 | × | × | × | 0 | 0 | 0 | 0 |
| 1283 | Home position return speed | 53 | D3 | С | × | × | × | × | 0 | × | × | × | 0 | 0 | 0 | 0 |
| 1284 | Home position return shifting speed | 54 | D4 | С | × | × | × | × | 0 | × | × | × | 0 | 0 | 0 | 0 |
| 1285 | Home position shift amount lower 4 digits | 55 | D5 | С | × | × | × | × | 0 | × | × | × | 0 | 0 | 0 | 0 |
| 1286 | Home position shift amount upper 4 digits | 56 | D6 | С | × | × | × | × | 0 | × | × | × | 0 | 0 | 0 | 0 |
| 1287 | Travel distance after proximity dog ON lower 4 digits | 57 | D7 | С | × | × | × | × | 0 | × | × | × | 0 | 0 | 0 | 0 |
| 1288 | Travel distance after proximity dog ON upper 4 digits | 58 | D8 | С | × | × | × | × | 0 | × | × | × | 0 | 0 | 0 | 0 |
| 1289 | Home position return stopper torque | 59 | D9 | С | × | × | × | × | 0 | × | × | × | 0 | 0 | 0 | 0 |
| 1290 | Home position return stopper waiting time | 5A | DA | С | × | × | × | × | 0 | × | × | × | 0 | 0 | 0 | 0 |
| 1292 | Position control terminal input selection | 5C | DC | С | × | × | × | × | 0 | × | × | × | 0 | 0 | 0 | 0 |
| 1293 | Roll feeding mode selection | 5D | DD | С | × | × | × | × | 0 | × | × | × | 0 | 0 | 0 | 0 |
| 1294 | Position detection lower 4 digits | 5E | DE | С | × | × | × | × | 0 | × | × | × | 0 | 0 | 0 | 0 |
| 1295 | Position detection upper 4 digits | 5F | DF | С | × | × | × | × | 0 | × | × | × | 0 | 0 | 0 | 0 |
| 1296 | Position detection selection | 60 | E0 | С | × | × | × | × | 0 | × | × | × | 0 | 0 | 0 | 0 |
| 1297 | Position detection hysteresis width | 61 | E1 | С | × | × | × | × | 0 | × | × | × | 0 | 0 | 0 | 0 |
| 1298 | Second position control gain | 62 | E2 | С | × | × | × | × | 0 | × | × | × | 0 | 0 | 0 | 0 |

| | | | truct | | | | | Conti | rol meth | nod ^{*2} | | | | Pa | aramet | ter |
|------|--|------|-------|----------|---|---------------|---------------|----------------|------------------|-------------------|----------------|---------------|--------------------|--------|---------|-------------|
| | | | | | | | V | ecto | *3 | Sens | orless | P | M | | | |
| Pr. | Name | Read | Write | Extended | | Magnetic flux | Speed control | Torque control | Position control | Speed control | Torque control | Speed control | Position control*7 | Copy*4 | Clear*4 | All clear*4 |
| 1299 | Second pre-excitation selection | 63 | E3 | C | × | × | 0 | × | × | × | × | 0 | × | 0 | 0 | 0 |
| 1344 | R-S turns ratio compensation | 2C | AC | D | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | × | × |
| 1345 | T-S turns ratio compensation | 2D | AD | D | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | × | × |
| 1348 | P/PI control switchover frequency | 30 | В0 | D | × | × | 0 | × | (°) | 0 | × | 0 | 0 | 0 | 0 | 0 |
| 1349 | Emergency stop operation selection | 31 | B1 | D | 0 | 0 | 0 | 0 | × (∘) | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1382 | MC switchover interlock time (for phase-synchronized bypass switching function)[AVP] | 52 | D2 | D | 0 | 0 | × | × | × | × | × | × | × | 0 | 0 | 0 |
| 1383 | Phase compensation amount for synchronous bypass switching AVP | 53 | D3 | D | 0 | 0 | × | × | × | × | × | × | × | 0 | 0 | 0 |
| 1384 | PLL tuning gain AVP | 54 | D4 | D | 0 | 0 | × | × | × | × | × | × | × | 0 | 0 | 0 |
| 1410 | Starting times lower 4 digits | 0 A | 8A | Е | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | × | × | × |
| 1411 | Starting times upper 4 digits | 0B | 8B | Е | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | × | × | × |
| 1412 | Motor induced voltage constant (phi f) exponent | 0C | 8C | Е | × | × | × (∘) | × | × (∘) | × | × | 0 | 0 | 0 | × | 0 |
| 1413 | Second motor induced voltage constant (phi f) exponent | 0D | 8D | Е | × | × | × (∘) | × | × (∘) | × | × | 0 | 0 | 0 | × | 0 |
| 1442 | IP filter address 1 (Ethernet) | 2A | AA | Е | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | o*5 | o*5 |
| 1443 | IP filter address 2 (Ethernet)NCG | 2B | AB | Ε | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | o*5 | o*5 |
| 1444 | IP filter address 3 (Ethernet)NCG | 2C | AC | Е | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | o*5 | o*5 |
| 1445 | IP filter address 4 (Ethernet) | 2D | AD | Е | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | o*5 | o*5 |
| 1446 | IP filter address 2 range specification (Ethernet)NCG | 2E | ΑE | E | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | o*5 | o*5 |
| 1447 | IP filter address 3 range specification (Ethernet)NCG | 2F | AF | Е | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | o*5 | o*5 |
| 1448 | IP filter address 4 range specification (Ethernet)NCG | 30 | В0 | Е | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | o*5 | o*5 |
| 1459 | Clock source selection NCG | 3B | BB | Е | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | o*5 | o*5 |
| 1480 | Load characteristics measurement mode | 50 | D0 | Е | 0 | 0 | 0 | 0 | × | 0 | 0 | 0 | × | 0 | 0 | 0 |
| 1481 | Load characteristics load reference 1 | 51 | D1 | Е | 0 | 0 | 0 | 0 | × | 0 | 0 | 0 | × | 0 | 0 | 0 |
| 1482 | Load characteristics load reference 2 | 52 | D2 | Е | 0 | 0 | 0 | 0 | × | 0 | 0 | 0 | × | 0 | 0 | 0 |
| 1483 | Load characteristics load reference 3 | 53 | D3 | Е | 0 | 0 | 0 | 0 | × | 0 | 0 | 0 | × | 0 | 0 | 0 |
| 1484 | Load characteristics load reference 4 | 54 | D4 | Е | 0 | 0 | 0 | 0 | × | 0 | 0 | 0 | × | 0 | 0 | 0 |
| 1485 | Load characteristics load reference 5 | 55 | D5 | Е | 0 | 0 | 0 | 0 | × | 0 | 0 | 0 | × | 0 | 0 | 0 |
| 1486 | Load characteristics maximum frequency | 56 | D6 | E | 0 | 0 | 0 | 0 | × | 0 | 0 | 0 | × | 0 | 0 | 0 |
| 1487 | Load characteristics minimum frequency | 57 | D7 | Е | 0 | 0 | 0 | 0 | × | 0 | 0 | 0 | × | 0 | 0 | 0 |
| 1488 | Upper limit warning detection width | 58 | D8 | E | 0 | 0 | 0 | 0 | × | 0 | 0 | 0 | × | 0 | 0 | 0 |
| 1489 | Lower limit warning detection width | 59 | D9 | Е | 0 | 0 | 0 | 0 | × | 0 | 0 | 0 | × | 0 | 0 | 0 |
| 1490 | Upper limit fault detection width | 5A | DA | Е | 0 | 0 | 0 | 0 | × | 0 | 0 | 0 | × | 0 | 0 | 0 |
| 1491 | Lower limit fault detection width | 5B | DB | Е | 0 | 0 | 0 | 0 | × | 0 | 0 | 0 | × | 0 | 0 | 0 |

| | | | truct ode [*] | | | | | Contr | ol meth | nod ^{*2} | | | | Pa | ramet | ter |
|------|---|------|---------------------------|----------|----------------------|---------------|---------------|----------------|------------------|-------------------|----------------|---------------|--------------------|--------|---------|-------------|
| | | | | | | | V | ector | *3 | Sens | orless | P | M | | | |
| Pr. | Name | Read | Write | Extended | 4 // A | Magnetic flux | Speed control | Torque control | Position control | Speed control | Torque control | Speed control | Position control*7 | Copy*4 | Clear*4 | All clear*4 |
| 1492 | Load status detection signal delay time / load reference measurement waiting time | 5C | DC | Е | 0 | 0 | 0 | 0 | × | 0 | 0 | 0 | × | 0 | 0 | 0 |

9.6 For customers using HMS network options

♦ List of inverter monitor items / command items

The following items can be set using a communication option.

16-bit data

| No. | Description | Unit | Type | Read/ write |
|-------------------|---|-----------------|----------|-------------|
| H0000 | No data | - | - | - |
| H0001 | Output frequency | 0.01 Hz | unsigned | R |
| H0002 | Output current | 0.01 A/0.1 A | unsigned | R |
| H0003 | Output voltage | 0.1 V | unsigned | R |
| H0004 | reserved | - | - | - |
| H0005 | Frequency setting value | 0.01 Hz | unsigned | R |
| H0006 | Motor speed | 1 r/min | unsigned | R |
| H0007 | Motor torque | 0.1% | unsigned | R |
| H0008 | Converter output voltage | 0.1 V | unsigned | R |
| H0009 | Regenerative brake duty | 0.1% | unsigned | R |
| H000A | Electric thermal relay function load factor | 0.1% | unsigned | R |
| H000B | Output current peak value | 0.01 A/0.1 A | unsigned | R |
| H000C | Converter output voltage peak value | 0.1 V | unsigned | R |
| H000D | Input power | 0.01 kW/ 0.1 kW | unsigned | R |
| H000E | Output power | 0.01 kW/ 0.1 kW | unsigned | R |
| H000F | Input terminal status*1 | _ | _ | R |
| | | - | _ | |
| H0010 | Output terminal status*1 | - | - | R |
| H0011 | Load meter | 0.1% | unsigned | R |
| H0012 | Motor excitation current | 0.01 A/0.1 A | unsigned | R |
| H0013 | Position pulse | 1 | unsigned | R/W |
| H0014 | Cumulative energization time | 1 h | unsigned | R |
| H0015 | reserved | - | - | - |
| H0016 | Orientation status | 1 | unsigned | R |
| H0017 | Actual operation time | 1 h | unsigned | R |
| H0018 | Motor load factor | 0.1% | unsigned | R |
| H0019 | Cumulative power | 1 kWh | unsigned | R |
| H001A | Position command (lower 16 bits) | 1 | signed | R |
| H001B | Position command (upper 16 bits) | · | 9 | 11 |
| H001C | Current position (lower 16 bits) | 1 | signed | R |
| H001D | Current position (upper 16 bits) | · | 9 | |
| H001E | Droop pulse (lower 16 bits) | 1 | signed | R |
| H001F | Droop pulse (upper 16 bits) | | 5.g5 | |
| H0020 | Torque order | 0.1% | unsigned | R |
| H0021 | Torque current order | 0.1% | unsigned | R |
| H0022 | Motor output | 0.1 kW | unsigned | R |
| H0023 | Feedback pulse | 1 | unsigned | R |
| H0024 H0025 | reserved | - | - | - |
| H0026 | Trace status | - | unsigned | R |
| H0027 | reserved | - | - | - |
| H0028 | PLC function user monitor 1 | - | unsigned | R |
| H0029 | PLC function user monitor 2 | - | unsigned | R |
| H002A | PLC function user monitor 3 | - | unsigned | R |
| H002B to | reserved | | _ | |
| H002D | 10301 VGU | = | _ | |
| H002E | Motor temperature | | | R |
| H002F to H0031 | reserved | - | - | - |
| H0032 | Power saving effect | - | unsigned | R |

| H0033 | No. | Description | Unit | Туре | Read/ write |
|--|-------------------|--------------------------------------|------|----------|-------------|
| H0034 | | - | - | | |
| H0035 PID measured value 0.1% unsigned R/W H0036 PID deviation 0.1% unsigned R/W H0037 to reserved - H0038 Option input terminal status 1 | | ū. | 0.1% | _ | |
| H0036 | | | | - | |
| H0037 to | | | | _ | |
| H003B | | reserved | - | - | - |
| H003B | H003A | Option input terminal status 1*1 | - | - | R |
| H003D Motor thermal load factor 0.1% unsigned R H003E Transistor thermal load factor 0.1% unsigned R H003F reserved H0040 PTC thermistor resistance ohm unsigned R H0041 Gutput power (with regenerative display) R H0042 Cumulative regenerative power R H0043 PID measured value 2 H0044 Second PID set point 0.1% unsigned R/W H0045 Second PID measured value 0.1% unsigned R/W H0046 Second PID deviation 0.1% unsigned R/W H0047 Cumulative pulse 1 signed R H0048 Cumulative pulse 1 signed R H0049 Cumulative pulse (control terminal option) 1 signed R H0040 Cumulative pulse (control terminal option) 1 signed R H0040 Cumulative pulse carrying-over times 1 signed R H0040 To reserved H0050 Integrated power on time R R H0051 Running time R R H0052 Saving energy monitor R R H0053 reserved R H0054 Fault code (1) R H0055 Fault code (2) R H0056 Fault code (3) R H0057 Fault code (4) R H0058 Fault code (6) R H0059 Fault code (6) R H0050 Second PID measured value 2 0.1% signed R H0056 Current position 2 (lower 16 bits) H0066 Current position 2 (lower 16 bits) H0066 Current position 2 (lower 16 bits) H0066 Full manipulated variable 0.1% signed R | H003B | | - | - | R |
| H003E | H003C | Option output terminal status*1 | - | - | R |
| H003F reserved - - - - - - - - - | H003D | Motor thermal load factor | 0.1% | unsigned | R |
| H0040 | H003E | Transistor thermal load factor | 0.1% | unsigned | R |
| H0041 Output power (with regenerative display) R | H003F | reserved | - | - | - |
| H0042 | H0040 | PTC thermistor resistance | ohm | unsigned | R |
| H0043 | H0041 | | | | R |
| H0044 Second PID set point 0.1% unsigned R/W H0045 Second PID measured value 0.1% unsigned R/W H0046 Second PID deviation 0.1% unsigned R/W H0047 Cumulative pulse 1 signed R H0048 Cumulative pulse carrying-over times 1 signed R H0049 Cumulative pulse carrying-over times 1 signed R H0040 Cumulative pulse carrying-over times 1 signed R H0041 Cumulative pulse carrying-over times 1 signed R H0042 Cumulative pulse carrying-over times 1 signed R H0044 Cumulative pulse carrying-over times 1 signed R H0045 Multi-revolution counter 1 unsigned R H0046 Teserved H0050 Integrated power on time R R H0051 Running time R R H0052 Saving energy monitor R R H0053 Teserved R H0054 Fault code (1) R H0055 Fault code (2) R H0056 Fault code (3) R H0057 Fault code (4) R H0058 Fault code (6) R H0059 Fault code (6) R H0050 Fault code (8) R H0050 Teserved R H0051 Fault code (8) R H0055 Second PID measured value 2 0.1% signed R H0061 to H0066 PID manipulated variable 0.1% signed R H0067 to teserved - - teserved - H0066 PID manipulated variable 0.1% signed R H0067 to teserved - | H0042 | Cumulative regenerative power | | | R |
| H0045 Second PID measured value 0.1% unsigned R/W H0046 Second PID deviation 0.1% unsigned R/W H0047 Cumulative pulse 1 signed R H0048 Cumulative pulse carrying-over times 1 signed R H0049 Cumulative pulse (control terminal option) 1 signed R H0040 Cumulative pulse carrying-over times 1 signed R H0041 Cumulative pulse carrying-over times 1 signed R H0042 Cumulative pulse carrying-over times 1 signed R H0043 Runding time 1 unsigned R H0044 Teserved H0050 Integrated power on time R H0051 Running time R R H0052 Saving energy monitor R R H0053 reserved R H0054 Fault code (1) R H0055 Fault code (2) R H0056 Fault code (3) R H0057 Fault code (4) R H0058 Fault code (6) R H0059 Fault code (6) R H0059 Fault code (7) R H0050 Fault code (8) R H0050 Fault code (8) R H0051 Fault code (8) R H0052 Second PID measured value 2 0.1% unsigned R H0060 Second PID manipulated variable 0.1% signed R H0061 Current position 2 (upper 16 bits) 1 signed R H0065 Current position 2 (upper 16 bits) 1 signed R H0066 PID manipulated variable 0.1% signed R H0067 to reserved - - - H0066 PID manipulated variable 0.1% signed R H0067 to reserved - | H0043 | PID measured value 2 | | | |
| H0046 Second PID deviation Second PID deviation Second PID deviation Second PID deviation H0047 Cumulative pulse Second PID deviation Second PID deviation H0048 Cumulative pulse carrying-over times Second PID manipulated variable Second PID manipulated variable Second PID manipulated variable H0046 Reveneed Second PID manipulated variable Current position 2 (upper 16 bits) H0066 PID manipulated variable Curres preserved Current position 2 (upper 16 bits) H0065 Current position 2 (upper 16 bits) H0065 Second PID manipulated variable Current position 2 (upper 16 bits) H0066 Pice page 16 Pice page 16 | H0044 | Second PID set point | 0.1% | unsigned | R/W |
| H0047 Cumulative pulse | H0045 | Second PID measured value | 0.1% | unsigned | R/W |
| H0048 Cumulative pulse carrying-over times 1 signed R H0049 Cumulative pulse (control terminal option) 1 signed R H004A Cumulative pulse carrying-over times (control terminal option) 1 signed R H004B Multi-revolution counter 1 unsigned R H004C to | H0046 | Second PID deviation | 0.1% | unsigned | R/W |
| H0049 | H0047 | Cumulative pulse | 1 | signed | R |
| H0049 | H0048 | Cumulative pulse carrying-over times | 1 | signed | R |
| H004A | H0049 | | 1 | signed | R |
| H004C to H004F reserved - - - - - | H004A | | 1 | signed | R |
| H004F reserved - | H004B | Multi-revolution counter | 1 | unsigned | R |
| H0051 Running time R H0052 Saving energy monitor R R H0053 reserved R H0054 Fault code (1) R R H0055 Fault code (2) R R H0056 Fault code (3) R R H0057 Fault code (4) R R H0058 Fault code (5) R R H0059 Fault code (6) R R H005A Fault code (7) R R H005B Fault code (8) R R H005C to H005E Fault code (8) R H005F Second PID measured value 2 0.1% unsigned R H0060 Second PID manipulated variable 0.1% signed R H0061 to H0063 Current position 2 (lower 16 bits) 1 signed R H0066 PID manipulated variable 0.1% signed R H0067 to reserved | | reserved | - | - | - |
| H0052 Saving energy monitor R H0053 reserved - - - - - | H0050 | Integrated power on time | | | R |
| H0053 reserved - - - - | H0051 | Running time | | | R |
| H0054 | H0052 | Saving energy monitor | | | R |
| H0055 | H0053 | reserved | - | - | - |
| H0056 Fault code (3) - - R H0057 Fault code (4) - - R H0058 Fault code (5) - - R H0059 Fault code (6) - - R H005A Fault code (7) - - R H005B Fault code (8) - - R H005C to H005E reserved - - - - H005F Second PID measured value 2 0.1% unsigned R H0060 Second PID manipulated variable 0.1% signed R H0061 to H0063 reserved - - - - H0064 Current position 2 (lower 16 bits) 1 signed R H0066 PID manipulated variable 0.1% signed R H0067 to reserved - - - - H0066 PID manipulated variable 0.1% signed R H0067 to reserved - - - - - H0068 PID manipulated variable 0.1% signed R H0069 reserved - - - - - H0060 reserved - - - - - H0061 reserved - - - - - H0062 R H0063 R - - - - - H0064 R H0065 R - - - - - - H0066 PID manipulated variable 0.1% signed R | H0054 | Fault code (1) | - | - | R |
| H0057 Fault code (4) - - R | H0055 | Fault code (2) | - | - | R |
| H0058 Fault code (5) - - R | H0056 | Fault code (3) | - | - | R |
| H0059 Fault code (6) - - R H005A Fault code (7) - - R H005B Fault code (8) - - R H005C to H005E reserved - - - H005F Second PID measured value 2 0.1% unsigned R H0060 Second PID manipulated variable 0.1% signed R H0061 to H0063 reserved - - - - H0064 Current position 2 (lower 16 bits) 1 signed R H0065 Current position 2 (upper 16 bits) 0.1% signed R H0067 to reserved - - - - | H0057 | Fault code (4) | - | - | R |
| H005A Fault code (7) - - R H005B Fault code (8) - - R H005C to H005E reserved - - - - - H005F Second PID measured value 2 0.1% unsigned R R H0060 Second PID manipulated variable 0.1% signed R H0061 to H0063 reserved - - - - H0064 Current position 2 (lower 16 bits) 1 signed R H0065 Current position 2 (upper 16 bits) 0.1% signed R H0067 to reserved - - - - | H0058 | Fault code (5) | - | - | R |
| H005B Fault code (8) - - R H005C to H005E reserved - - - H005F Second PID measured value 2 0.1% unsigned R H0060 Second PID manipulated variable 0.1% signed R H0061 to H0063 reserved - - - - H0064 Current position 2 (lower 16 bits) 1 signed R H0065 Current position 2 (upper 16 bits) 1 signed R H0066 PID manipulated variable 0.1% signed R H0067 to reserved - - - - | H0059 | Fault code (6) | - | - | R |
| H005C to H005E reserved - - - - - | H005A | Fault code (7) | - | - | R |
| H005E reserved - - - - - | H005B | Fault code (8) | - | - | R |
| H0060 Second PID manipulated variable 0.1% signed R H0061 to H0063 reserved - - - H0064 Current position 2 (lower 16 bits) 1 signed R H0065 Current position 2 (upper 16 bits) 1 signed R H0066 PID manipulated variable 0.1% signed R H0067 to reserved - - - | | reserved | - | - | - |
| H0061 to | H005F | Second PID measured value 2 | 0.1% | unsigned | R |
| H0063 reserved - - - - | H0060 | Second PID manipulated variable | 0.1% | signed | R |
| H0065 Current position 2 (upper 16 bits) H0066 PID manipulated variable H0067 to reserved | | reserved | - | - | - |
| H0065 Current position 2 (upper 16 bits) H0066 PID manipulated variable 0.1% signed R H0067 to | H0064 | Current position 2 (lower 16 bits) | 1 | oignod | Ь |
| H0067 to received | H0065 | Current position 2 (upper 16 bits) |] ' | signed | K |
| H0067 to | H0066 | 1 1 1 1 | 0.1% | signed | R |
| 110010 | H0067 to H00F8 | reserved | - | | - |
| H00F9 Run command ^{*2} R/W | H00F9 | Run command ^{*2} | - | - | R/W |
| H00FA to H01FF | | | - | - | - |

^{*1} For the details, refer to page 446.

Operation command This signal is assigned in the initial status. The description changes depending on the setting of Pr.180 to Pr.180 (Input terminal function

| b15 | | | | | | | | | | | | | | | b0 |
|-----|---|---|---|-----|---------------|----|-----|-----|----|----|----|----|---|---|----|
| - | - | - | - | RES | STP (STOP) | CS | JOG | MRS | RT | RH | RM | RL | - | - | AU |

<32-bit data>

| No. | Description | Unit | Туре | Read/ write |
|-------------------|---|----------------|----------|-------------|
| H0200 | reserved | - | - | - |
| H0201 | Output frequency (0-15 bit) | 0.01 Hz | signed | R |
| H0202 | Output frequency (16-31 bit) | 0.01112 | signed | K |
| H0203 | Setting frequency (0-15 bit) | 0.01 Hz | signed | R |
| H0204 | Setting frequency (16-31 bit) | 0.01112 | signed | K |
| H0205 | Motor rotation (0-15 bit) | 1 r/min | signed | R |
| H0206 | Motor rotation (16-31 bit) | 1 1/111111 | signed | K |
| H0207 | Load meter (0-15 bit) | 0.1% | signed | R |
| H0208 | Load meter (16-31 bit) | 0.170 | signed | K |
| H0209 | Positioning pulse (0-15 bit) | 1 | signed | R/W |
| H020A | Positioning pulse (16-31 bit) | | signed | IN/VV |
| H020B | Watt-hour meter (1 kWh step) (0-15 bit) | 1 kWh | ungianod | R |
| H020C | Watt-hour meter (1 kWh step) (16-31 bit) | I KVVII | unsigned | K |
| H020D | Watt-hour meter (0.1/0.01 kWh step) (0-15 bit) | 0.1/0.01 kWh | unaignad | R |
| H020E | Watt-hour meter (0.1/0.01 kWh step) (16-31 bit) | 0.1/0.01 KVVII | unsigned | K |
| H020F | Position error (0-15 bit) | 1 | signed | R |
| H0210 | Position error (16-31 bit) | | signed | K |
| H0211 | Position command (lower 16 bits) | 1 | signed | R |
| H0212 | Position command (upper 16 bits) | | signed | K |
| H0213 | Current position (lower 16 bits) | 4 | signed | R |
| H0214 | Current position (upper 16 bits) | 1 | signed | I.V. |
| H0215 to H03FF | reserved | - | - | - |

◆ Error reset and Ready bit status selection

- · An error reset command from a communication option can be invalidated in the External operation mode or the PU operation mode.
- · The status of Ready bit is selectable.

| Pr. | Name | Initial value | Setting range | Description |
|-------|--|---------------|--|---|
| 349 | Communication reset selection/Ready bit status selection | 0 | 0, 1, 100, 101, 1000, 1001, 1100, 1101, 10000, 10001, 10100, 10101, 11000, 11001, 11100, 11101 | Use this parameter to select the error reset operation, Ready bit status, and inverter reset operation when a fault is cleared. |
| N010 | Communication reset | 0 | 0 | Enables the error reset function in any operation mode. |
| NOTO | selection | O | 1 | Enables the error reset function only in the Network operation mode. |
| N240 | Ready bit status | 0 | 0 | The status of Ready bit in communication data |
| 14240 | selection | U | 1 | can be selected. |
| | Reset selection after | | 0 | The inverter is reset when a fault is cleared. |
| N241 | inverter faults are cleared | 0 | 1 | The inverter is not reset when a fault is cleared. |
| N242 | DriveControl writing | 0 | 0 | DriveControl writing is not restricted. |
| 14242 | restriction selection | U | 1 | DriveControl writing is restricted. |

- The status of Ready bit in communication data can be changed when an HMS network option is installed. (P.N240)
- · When an HMS network option is installed and the communication option is specified for the command source in Network operation mode, it is possible to select whether the inverter is reset after the "Fault reset" command is executed. (P.N241)

When an HMS network option is installed, the command source to change the DriveControl settings can be restricted to
only the command source selected by Pr.550 NET mode operation command source selection. (P.N242)

| | Set | ting val | ue | | | | | Description | | |
|--------|------|----------|------|------|--------------------------|--|------------------------------|---|--------------------------------|---------------------|
| | | | | | | cation reset tion ^{*1} | | oit status ction ^{*2} | Reset selection after | DriveControl |
| Pr.349 | N010 | N240 | N241 | N242 | NET operation mode | Other than NET operation mode | Main circuit: power-ON | Main circuit: power- OFF ^{*3} | inverter faults are cleared | writing restriction |
| 0 | 0 | 0 | 0 | 0 | Reset enabled | Reset enabled | Ready bit: ON | Ready bit: ON | Reset | Not restricted |
| 1 | 1 | 0 | 0 | 0 | Reset enabled | Reset disabled | Ready bit: ON | Ready bit: ON | Reset | Not restricted |
| 100 | 0 | 1 | 0 | 0 | Reset enabled | Reset enabled | Ready bit: ON | Ready bit: OFF | Reset | Not restricted |
| 101 | 1 | 1 | 0 | 0 | Reset enabled | Reset disabled | Ready bit: ON | Ready bit: OFF | Reset | Not restricted |
| 1000 | 0 | 0 | 1 | 0 | Reset enabled | Reset enabled | Ready bit: ON | Ready bit: ON | Not reset*4 | Not restricted |
| 1001 | 1 | 0 | 1 | 0 | Reset enabled | Reset disabled | Ready bit: ON | Ready bit: ON | Not reset*4 | Not restricted |
| 1100 | 0 | 1 | 1 | 0 | Reset enabled | Reset enabled | Ready bit: ON | Ready bit: OFF | Not reset*4 | Not restricted |
| 1101 | 1 | 1 | 1 | 0 | Reset enabled | Reset disabled | Ready bit: ON | Ready bit: OFF | Not reset*4 | Not restricted |
| 10000 | 0 | 0 | 0 | 1 | Reset enabled | Reset enabled | Ready bit: ON | Ready bit: ON | Reset | Restricted*4 |
| 10001 | 1 | 0 | 0 | 1 | Reset enabled | Reset disabled | Ready bit: ON | Ready bit: ON | Reset | Restricted*4 |
| 10100 | 0 | 1 | 0 | 1 | Reset enabled | Reset enabled | Ready bit: ON | Ready bit: OFF | Reset | Restricted*4 |
| 10101 | 1 | 1 | 0 | 1 | Reset enabled | Reset disabled | Ready bit: ON | Ready bit: OFF | Reset | Restricted*4 |
| 11000 | 0 | 0 | 1 | 1 | Reset enabled | Reset enabled | Ready bit: ON | Ready bit: ON | Not reset*4 | Restricted*4 |
| 11001 | 1 | 0 | 1 | 1 | Reset enabled | Reset disabled | Ready bit: ON | Ready bit: ON | Not reset*4 | Restricted*4 |
| 11100 | 0 | 1 | 1 | 1 | Reset enabled | Reset enabled | Ready bit: ON | Ready bit: OFF | Not reset*4 | Restricted*4 |
| 11101 | 1 | 1 | 1 | 1 | Reset enabled | Reset disabled | Ready bit: ON | Ready bit: OFF | Not reset*4 | Restricted*4 |

^{*1} The operation mode affects the availability of communication reset.

◆ Direct command mode for position control

In the direct command mode, the target position and maximum speed can be set through communication.

| Pr. | Name | Initial value | Setting range | Description |
|--------------|---------------------------------|---------------|---------------|--|
| | | | 0 | Target position and maximum speed: Point table |
| 1220 B100 | Target position/speed selection | 0 | 1 | Target position: Direct command. Maximum speed: Point table. |
| | | | 2 | Target position and maximum speed: Direct command |

• The point table is set as follows in the direct command mode. (The setting is applied when the start signal is turned ON.)

| Pr.1220 setting | Target position | Maximum speed | Acceleration time | Deceleration time | Dwell time | Auxiliary function |
|-----------------|-----------------|----------------|-------------------|-------------------|-----------------------|--------------------|
| 1 | Direct command | Point table 1 | *1 | *1 | Invalid ^{*2} | *1 |
| 2 | Direct command | Direct command | Pr.7 | Pr.8 | Invalid ^{*2} | *1 |

^{*1} Same as the point table 1. However, even when continuous operation is set in the auxiliary function, individual operation is applied.

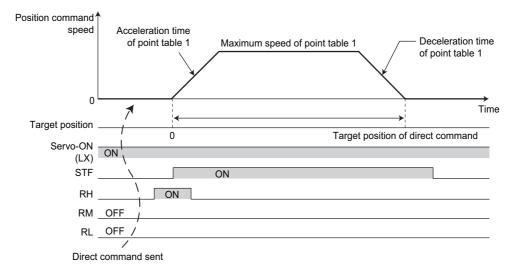
^{*2} The ON/OFF state of the power supply affects the ON/OFF state of Ready bit.

^{*3} When either the external 24 V power supply or the control circuit power supply is ON.

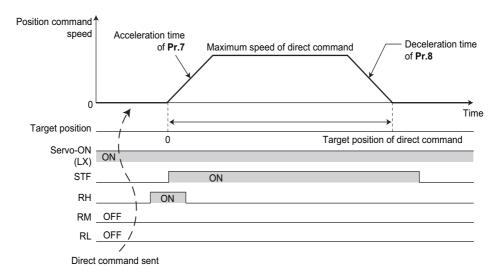
^{*4} Available when the HMS network option is installed.

^{*2} The direct command mode is available only for individual operation. The dwell time is invalid.

- To perform positioning operation in the direct command mode, specify the point table (RH recommended) and turn ON the start signal. (When no point table is specified, home position return operation is performed.)
- Example when Pr.1220 = "1"



• Example when Pr.1220 = "2"



9.7 Ready bit status selection (Pr.349, N240)

Error reset operation selection at inverter fault

- The status of Ready bit in communication data can be selected when a communication option (FR-A8ND or FR-A8NF) is installed.
- An error reset command from a communication option can be invalidated in the External operation mode or the PU
 operation mode.
- The status of Ready bit is selectable.

| Pr. | Name | Initial value | Setting range | Function |
|--------------------|--|---------------|---|---|
| | | 0 | 0, 100 | Error reset is enabled independently of operation mode. |
| | | | 1, 101 | Error reset is enabled in the Network operation mode. |
| 349*1 | Communication reset selection/Ready bit status selection | | 1001, 1000, 1100, 1101, 10000, 10001, 10100, 10101, 11000, 11001, 11100, 11101 | For details, refer to page 893. |
| N010 ^{*1} | Communication reset selection | 0 | 0 | Enables the error reset function in any operation mode. |
| | | | 1 | Enables the error reset function only in the Network operation mode. |
| N240 ^{*1} | Ready bit status selection | 0 | 0 | The status of Ready bit in communication data can be selected when a communication option is installed. |
| | Selection | I | Т | selected when a communication option is installed. |

^{*1} The setting is available only when a communication option is installed.

■ Ready bit status selection (P.N240)

The status of Ready bit in communication data can be selected.

| Setting value | | | Description | | | | | |
|---------------|------|------|--------------------|-------------------------------|----------------------------|---|--|--|
| | | N240 | Communication | reset selection | Ready bit status selection | | | |
| Pr.349 | N010 | | NET operation mode | Other than NET operation mode | Main circuit: power- ON | Main circuit: power- OFF ^{*1} | | |
| 0 | 0 | 0 | Reset enabled | Reset enabled | Ready bit: ON | Ready bit: ON | | |
| 1 | 1 | 0 | Reset enabled | Reset disabled | Ready bit: ON | Ready bit: ON | | |
| 100 | 0 | 1 | Reset enabled | Reset enabled | Ready bit: ON | Ready bit: OFF | | |
| 101 | 1 | 1 | Reset enabled | Reset disabled | Ready bit: ON | Ready bit: OFF | | |

^{*1} When either the external 24 V power supply or the control circuit power supply is ON.

• FR-A8ND

Class 0x29 Instance 1

| Attribute ID | Access | Name | Data type | Number of data bytes | Initial value | Range | Description | |
|--------------|--------|---------|--------------|----------------------------|------------------|-------|-----------------------------------|--|
| | | | | | | 0 | Other than the below | |
| 9 | Get | Ready B | BOOL | 1 | 1 | 1 | Pr.349 = "0, 1" N240 = "0" | During stop / during acceleration / during constant speed operation / during deceleration / during reverse rotation deceleration |
| | | | | | | | Pr.349 = "100, 101" N240 = "1" | During stop while the RY signal is ON / during acceleration / during constant speed operation / during deceleration / during reverse rotation deceleration |

• FR-A8NF

Inverter status monitor

| Bit | Name | Description | | |
|--------|-------|--|---|---|
| 1.1 | READY | Poset cancel | Pr.349 = "0, 1" N240 = "0" | During an inverter reset / during startup after power-ON. During normal operation |
| signal | | Pr.349 = "100, 101" N240 = "1" | 0: RY signal is OFF 1: RY signal is ON | |

REVISIONS

*The manual number is given on the bottom left of the back cover.

| Revision date | *Manual number | Revision | | | |
|---------------|---------------------|--|--|--|--|
| May 2013 | IB(NA)-0600503ENG-A | First edition | | | |
| Dec. 2013 | IB(NA)-0600503ENG-B | Added | | | |
| Mar. 2014 | IB(NA)-0600503ENG-C | Added Separated converter type | | | |
| Apr. 2014 | IB(NA)-0600503ENG-D | Added • Motor permissible load level (Pr.607, Pr.608) • FR-A846-00023(0.4K) to FR-A846-00170(5.5K) | | | |
| Sep. 2014 | IB(NA)-0600503ENG-E | Added SF-PR heavy duty setting SF-PR slip amount adjustment mode (Pr.673, Pr.674) Addition to the power failure time deceleration-to-stop function (Pr.606, X48 signal, Y67 signal, and compatibility with the separated converter type) Addition to the self power management function (X94 signal) Addition to the electronic bypass sequence function (X95 signal and X96 signal) Pr.1015 Integral stop selection at limited frequency Pr.1016 PTC thermistor protection detection time | | | |
| Mar. 2015 | IB(NA)-0600503ENG-F | Added | | | |
| Aug. 2015 | IB(NA)-0600503ENG-G | Added FR-A800-GF (CC-Link IE Field Network communication function type) | | | |
| Oct. 2016 | IB(NA)-0600503ENG-H | Added Start count monitor (Pr.1410, Pr.411) Excitation current low-speed scaling factor (Pr.14 = "12 to 15", Pr.85, Pr.86, Pr.565, Pr.566, Pr.617) Backup/restore function Input signals (CLRN, JOGF, JOGR) Output signal (SAFE) Simple position control by point table (The home position information is retained at servo-OFF.) (Pr.419 = "10") MODBUS RTU communication stop bit length selection Continuous operation at communication error (Pr.502 = "4") | | | |
| May 2017 | IB(NA)-0600503ENG-J | Added Load characteristics fault detection (Pr.1480 to Pr.1492) Droop control using the per-unit speed control reference frequency (Pr.288 (Pr.681) = "20 to 22") Torque current command limit (Pr.801, Pr.803 = "2") PID manipulated amount: 0 to 100% (Pr.1015 = "2, 12") Pr.1348 P/PI control switchover frequency Pr.1349 Emergency stop operation selection Operation selection at a communication error (Pr.502 = "11, 12") Multi-revolution counter monitoring Edited Pr.275 setting range: 0 to 300% | | | |
| Oct. 2018 | IB(NA)-0600503ENG-K | Added Reset selection / disconnected PU detection / PU stop selection (Pr.75 = "1000 to 1003, 1014 to 1017, 1100 to 1103, 1114 to 1117") External fault input signal (Pr.178 to Pr.189 = "32") Error reset operation selection at inverter fault (Pr.349 = "100, 101") PLC function (Pr.414 = "11, 12", Pr.675) Pulse monitor selection (Pr.430 = "2000 to 2005, 2012, 2013, 2100 to 2105, 2112, 2113, 3000 to 3005, 3012, 3013, 3100 to 3105, 3112, 3113") | | | |

| Revision date | *Manual number | Revision |
|---------------|---------------------|---|
| Apr. 2020 | IB(NA)-0600503ENG-L | Added Operation command source selection for the CS signal (Pr.162 = "1000 to 1003, 1010 to 1013") Main circuit capacitor life measurement at power OFF (every time) (Pr.259 = "11") Selecting clearing of the current position 2 monitor value (Pr.419 = "200, 210, 300, 310, 1310") Pr.506 Display estimated main circuit capacitor residual life Current input check terminal selection (Pr.573 = "11 to 14, 21 to 24") Ready bit status selection (for FR-A8ND and FR-A8NF) Forward stroke end (LSP) signal, Reverse stroke end (LSN) signal Low-speed forward rotation command (RLF) signal, Low-speed reverse rotation command (RLR) signal Vector control for PM motor with encoder supported (for FR-A8AL and FR-A8TP) Input terminal monitor (for terminals S1 and S2) Reset selection after inverter faults are cleared (with the HMS network option installed) |
| Mar. 2021 | IB(NA)-0600503ENG-M | Added Cooling fan operation selection during the test operation (Pr.244 = "1000, 1001, 1101 to 1105") Display/reset ABC relay contact life (Pr.507, Pr.508) DriveControl writing restriction selection (Pr.349 = "10000, 10001, 10100, 10101, 11000, 11001, 11101") |
| | | |
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FR-A800/A800 Plus Series Instruction Manual Supplement

1 Emergency drive



This function is used in case of emergency such as a fire to forcibly continue inverter operation to drive a motor without activating protective functions even if the inverter detects a fault. Using this function may cause damage of the motor or the inverter because driving the motor is given the highest priority. Use this function for emergency operation only. When the inverter is damaged by a fault, the motor operation can be continued by switching to the commercial power supply operation.

The emergency drive function is available only for standard structure models and IP55 compatible models.

| Pr. | Name | Initial value | | Setting range | Description | |
|----------------------------|---|---------------|----|--|---|--|
| FI. | Ivaille | FM | CA | Setting range | Description | |
| 523 H320*1 | Emergency drive mode selection | 9999 | | 100, 111, 112, 121, 122, 123, 124, 200, 211, 212, 221, 222, 223, 224, 300, 311, 312, 321, 322, 323, 324, 400, 411, 412, 421, 422, 423, 424 | Select the operation mode of the emergency drive. | |
| | | | | 9999 | Emergency drive disabled. | |
| 524 | | | | 0 to 590 Hz*3 | Set the running frequency in the fixed frequency mode of the emergency drive (when the fixed frequency mode is selected in Pr.523) | |
| H321 ^{*1*2} | Emergency drive running speed | 1 0000 | | 0% to 100% ^{*3} | Set the PID set point in the PID control mode of the emergency drive (when the PID control mode is selected in Pr.523) | |
| | | | | 9999 ^{*3} | Emergency drive disabled. | |
| 515 | 515 Emergency drive | | | 1 to 200 | Set the retry count during emergency drive operation. | |
| H322*1 | dedicated retry count | 1 | | 9999* ³ | Without retry count excess (no restriction on the number of retries). | |
| 1013 H323 ^{*1} | Emergency drive running speed after retry reset | 60 Hz 50 Hz | | 0 to 590 Hz | Set the frequency for operation after a retry when any of E.CPU, E.1 to E.3, and E.5 to E.7 occurs during emergency drive operation. | |
| 514 H324 ^{*1} | Emergency drive dedicated waiting | 9999 | | 0.1 to 600 s | Set the retry waiting time during emergency drive operation. | |
| П324 | time | | | 9999 | The Pr.68 setting is applied to the operation. | |
| 136 A001 | MC switchover interlock time | 1 s | | 0 to 100 s | Set the operation interlock time for MC2 and MC3. | |
| 139 A004 | Automatic switchover frequency from inverter to bypass | 9999 | | 0 to 60 Hz | Set the frequency at which the inverter-driven operation is switched over to the commercial power supply operation when the condition for the electronic bypass is established during emergency drive operation. | |
| | operation | | | 8888, 9999 | Electronic bypass during emergency drive is disabled. | |
| 57 | Restart coasting | 9 4444 | | 0 | Coasting time differs according to the inverter capacity. (Refer to the description of the automatic restart after instantaneous power failure function in the Instruction Manual (Detailed) or the Instruction Manual (Function).) | |
| A702 | time | | | 0.1 to 30 s | Set the waiting time for the inverter to perform a restart after restoring power due to an instantaneous power failure. | |
| | | | | 9999 | No restart | |

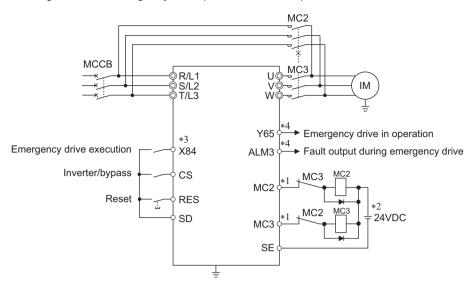
^{*1} The setting is available for the standard structure model and the IP55 compatible model.

^{*2} Set Pr.524 after setting Pr.523.

^{*3} When Pr.523 = "100, 200, 300, or 400", the emergency drive is activated regardless of the Pr.524 setting.

Connection diagram

• A connection diagram of the emergency drive (commercial mode) is as follows.



*1 Be careful of the capacity of the sequence output terminals. The applied terminals differ by the settings of Pr.190 to Pr.196 (Output terminal function selection).

| Output terminal capacity | Output terminal permissible load |
|--|----------------------------------|
| Open collector output of inverter (RUN, SU, IPF, OL, FU) | 24 VDC 0.1 A |
| Inverter relay output | |
| (A1-C1, B1-C1, A2-B2, B2-C2) | 230 VAC 0.3 A |
| Relay output option | 30 VDC 0.3 A |
| (FR-A8AR) | |

- *2 When connecting a DC power supply, insert a protective diode.

 When connecting an AC power supply, use relay output terminals of the inverter or contact output terminals of the relay output option (FR-A8AR).
- *3 The applied terminals differ by the settings of Pr.180 to Pr.189 (Input terminal function selection)
- *4 The applied terminals differ by the settings of Pr.190 to Pr.196 (Output terminal function selection).



• Be sure to provide a mechanical interlock for MC2 and MC3.

♦ Emergency drive execution sequence

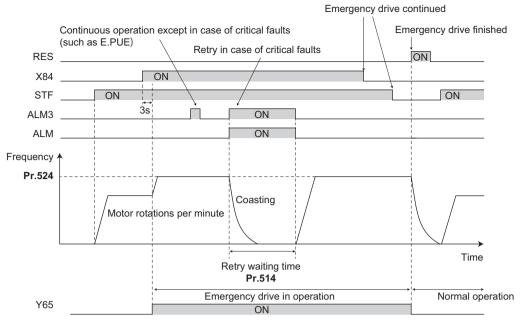


- When the X84 signal is ON for 3 seconds, the emergency drive is activated.
- The Y65 signal turns ON during emergency drive operation.
- "ED" appears on the operation panel during emergency drive operation.
- The ALM3 signal turns ON when a fault occurs during emergency drive operation.
- To activate the emergency drive, the X84 signal needs to be ON for three seconds while all the following conditions are satisfied.

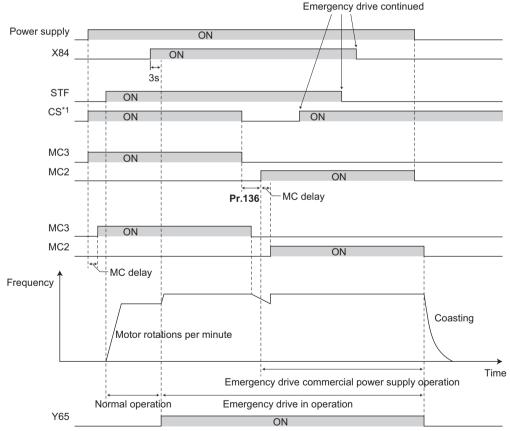
| Item | Condition | | |
|-------------------------|--|--|--|
| Emergency drive | Pr.523 ≠ "9999" | | |
| parameter settings | Pr.524 ≠ "9999" (Setting is not required when Pr.523 = "100, 200, 300, or 400".) | | |
| Control method | Either of the following control methods is selected (when Pr.800 = "9, 10, 20, 109, or 110" or Pr.451 = "10, 20, 110, or 9999") • V/F control • Advanced magnetic flux vector control • Real sensorless vector control (speed control) • PM sensorless vector control test operation | | |
| Contradictory condition | None of the following conditions are satisfied. Enabling the electronic bypass sequence function Enabling the brake sequence function Using the FR-A8NS (option) During offline auto tuning Supplying power through terminals R1 and S1 Pr.30 = "2, 102" | | |

- When the "retry" (**Pr.523** = "2[][], 3[][]") is selected, it is recommended to use the automatic restart after instantaneous power failure function at the same time.
- Parameter setting is not available during emergency drive operation.
- To return to the normal operation during emergency drive operation, do the following. (The operation will not be returned to normal only by turning OFF the X84 signal.)
 - Reset the inverter, or turn the power supply OFF.
 - Clear a fault by turning ON the X51 signal while the sequence function is enabled (when the protective function is activated).
- The operation is switched over to the commercial power supply operation in case of the following during emergency drive operation while the commercial mode or the retry / commercial mode is selected.
 - 24 V external power supply operation, power failure status or operation with the power supplied through R1/S1 (except when the DC feeding mode 1 or 2 is selected), undervoltage
- To input the X84 signal, set "84" in any of Pr.178 to Pr.189 (Input terminal function selection) to assign the function.
- For the terminal used for the Y65 signal output, assign the function by setting "65 (positive logic)" or "165 (negative logic)" in any of **Pr.190 to Pr.196 (Output terminal function selection)**. For the terminal used for the ALM3 signal output, assign the function by setting "66 (positive logic)" or "166 (negative logic)" in any of **Pr.190 to Pr.196 (Output terminal function selection)**.
- The X84 signal input is valid either through the external terminal or via network regardless of the **Pr.338** and **Pr.339** settings (Selection of control source in Network operation mode).
- During emergency drive operation, the operation is performed as **Pr.502 Stop mode selection at communication error** = "0 (initial value)" and communication errors (such as E.SER) do not occur. (A protective function is performed according to its operation during emergency drive operation.)

• The following diagram shows the operation of the emergency drive function (in the retry / output shutoff mode or in the fixed frequency mode (**Pr.523** = "211")).



The following diagram shows the operation of switching over to the commercial power supply operation during
emergency drive operation by using the CS signal (when the electronic bypass during emergency drive operation
is enabled) (in the commercial mode or in the fixed frequency mode (Pr.523 = "411")).



*1 Input the CS signal via an external terminal.



• The emergency drive function is not available for the FR-A800-CRN and FR-B, B3 series inverters.

◆ Emergency drive operation selection (Pr.523, Pr.524)

 Use Pr.523 Emergency drive mode selection to select the emergency drive operation. Set a value in the hundreds place to select the operation when a valid protective function is activated (critical fault) during emergency drive. Set values in the ones and tens places to select the operation method.

| Pr.523 setting | | Emergency drive oper | ration mode | Description | | |
|----------------|---------------------------|--|---|--|--|--|
| 200 | Output shutch | off mode | | Output shutoff at a critical fault occurrence. Retry operation at a critical fault occurrence. (Output shutoff at the occurrence of a fault for which retry is not permitted.) The output is shut off when a critical fault for which retry is not permitted occurs, or the retry count is exceeded. | | |
| 300*1 | Retry / comn | nercial mode | Selecting operation when a critical fault occurs during emergency drive operation | Retry operation at a critical fault occurrence. (Electronic bypass at the occurrence of a critical fault for which retrisinot permitted.) The operation is switched over to the commercial power supply operation when a critical fault for which retry is not permitted occurs, or the retry count is exceeded. While Pr.515 = "9999", the operation is switched over to the commercial power supply operation when the retry count reaches 200. | | |
| 4[][]*1 | Commercial mode | | | The operation is switched over to the commercial power supply operation when a critical fault occurs. | | |
| []00 | Normal operation | | | The operation is performed with the same set frequency and by the same starting command as those in the normal operation. Use this mode to avoid output shutoff due to a fault. | | |
| []11 | Fixed | Forward rotation | | The operation is forcibly performed with the frequency | | |
| []12 | frequency mode | Reverse rotation | Selecting the operation Even when the motor is stopped, the by the emergency drive operation | set in Pr.524 . Even when the motor is stopped, the operation is started by the emergency drive operation. | | |
| []21 | | Forward rotation | method during emergency drive | The operation is performed under PID control using the | | |
| []22 | | Reverse rotation | operation | Pr.524 setting as a set point. The measured values are input in the method set in Pr.128 . | | |
| []23 | PID control mode | Forward rotation (Second PID measured value input) Reverse rotation | | The operation is performed under PID control using the Pr.524 setting as a set point. The measured values are | | |
| []24 | | (Second PID measured value input) | | input in the method set in Pr.753 . | | |
| 9999 | Emergency drive disabled. | | | | | |

^{*1} Under PM sensorless vector control, the operation is not switched over to the commercial power supply operation and the output is shut off.



 The operation is automatically switched from the PU operation mode or External/PU combined operation mode to the External operation mode when the emergency drive is activated in the fixed frequency mode or in the PID control mode.

◆ Retry operation during emergency drive (Pr.515, Pr.514)

- Set the retry operation during emergency drive operation. Use Pr.515 Emergency drive dedicated retry count
 to set the retry count, and use Pr.514 Emergency drive dedicated waiting time to set the retry waiting time.
- The ALM signal output conditions depend on the **Pr.67 Number of retries at fault occurrence** setting. (Refer to the description of the retry function in the Instruction Manual (Detailed) or the Instruction Manual (Function).)
- For the protective functions (critical faults) for which a retry is performed during emergency drive operation, refer to page 7.



• During emergency drive operation, Pr.65 Retry selection is not available.

◆ Electronic bypass during emergency drive (Pr.136, Pr.139, Pr.57)

- For selecting the commercial mode (**Pr.523** = "3[][], 4[][]"), setting is required as follows.
 - Set Pr.136 MC switchover interlock time and Pr.139 Automatic switchover frequency from inverter to bypass operation and assign MC2 and MC3 signals to output terminals.
 - When the CS signal is assigned to an input terminal, set **Pr.57 Restart coasting time** ≠ "9999" and input the CS signal through the terminal. (In the initial setting, the CS signal is assigned to the terminal CS.)
 - Select V/F control, Advanced magnetic flux vector control, or Real sensorless vector control. (Under PM sensorless vector control, the operation is not switched over to the commercial power supply operation the output is shut off.)
- During emergency drive operation, the operation is switched over to the commercial power supply operation when any of the following conditions is satisfied.
 CS signal turns OFF.
 - A critical fault for which retry is not permitted occurs while **Pr.523** = "3[][]".
 - A critical fault occurs while **Pr.523** = "4[][]".
- While the motor is driven by the inverter during emergency drive operation, if a condition for electronic bypass is satisfied, the output frequency is accelerated/decelerated to the Pr.139 setting. When the frequency reaches the set frequency, the operation is switched over to the commercial power supply operation. (The operation is immediately switched over to the commercial power supply operation during output shutoff due to a critical fault occurrence.)
- If the parameter for electronic bypass is not set while the commercial mode is set (**Pr.523** = "3[][], 4[][]"), the operation is not switched over to the commercial power supply operation even when a condition for switchover is satisfied, and the output is shut off.
- To assign the MC2 and MC3 signals to output terminals, use any two of **Pr.190 to Pr.196 (Output terminal function selection)** and set "18 (positive logic)" for the MC2 signal and set "19 (positive logic)" for the MC3 signal.
- Operation of magnetic contactor (MC2, MC3)

| Magnetic | | Operation | | |
|-----------|--|--|---------------------------|--|
| contactor | Installation location | During commercial power supply operation | During inverter operation | |
| MC2 | Between power supply and motor | Shorted | Open | |
| MC3 | Between inverter output side and motor | Open | Shorted | |

· The input signals are as follows.

| Signal | Function | Operation | MC operation*4 | |
|-----------------|---------------------------|---------------------------------------|----------------|-----------|
| Signal Function | | Operation | MC2 | MC3 |
| | | ON: Inverter operation | × | 0 |
| CS*1 | Inverter/bypass | OFF: Emergency drive commercial power | | × |
| | | supply operation*2 | 0 | |
| V04 | | ON: Emergency drive operation | _ | _ |
| X84 | Emergency drive operation | OFF: Normal operation*3 | × | 0 |
| RES | Operation status reset | ON: Reset | × | No change |
| KES | | OFF: Normal operation | _ | _ |

- *1 Input the CS signal via an external terminal. (Set Pr.162 = "0 to 3, 10 to 13" or Pr.338 = "1".)
- *2 If the signal is turned ON after switchover to the emergency drive commercial power supply operation, the operation will not be returned to the inverter-driven operation.
- *3 If the signal is turned OFF during the emergency drive operation, the operation will not be returned to normal.
- *4 MC operation is as follows.

| Notation | MC operation | | | |
|-----------|---|--|--|--|
| 0 | ON | | | |
| × | OFF | | | |
| | During inverter operation: MC2-OFF, MC3-ON | | | |
| - | During commercial power supply operation: MC2-ON, MC3-OFF | | | |
| No change | The operation status before changing the signal state to ON or OFF is held. | | | |

NOTE

During electronic bypass operation while the electronic bypass sequence is enabled (Pr.135 = "1"), the emergency
drive function is not available.

◆ PID control during emergency drive operation

- During emergency drive operation in the PID control mode, the operation is performed under PID control using the **Pr.524** setting as a set point. Input the measured values in the method set in **Pr.128** or **Pr.753**.
- When the PID control mode is selected for emergency drive, the PID action during emergency drive operation is as follows depending on the PID control setting.

| | PID control action | | | | |
|--|--|--------------------------|-----------------------------|--|--|
| ltem | Set point / measured value input setting | Deviation input setting | Without PID control setting | | |
| Measured value input selection (Pr.128, Pr.753) | Held | Terminal 4 input | Terminal 4 input | | |
| Forward action / reverse action selection (Pr.128, Pr.753) | Held | Held | Reverse action | | |
| Proportional band (Pr.129, Pr.756) | Held | Held | 100% (initial value) | | |
| Integral time (Pr.130, Pr.757) | Held | Held | 1 s (initial setting) | | |
| Differential time (Pr.134, Pr.758) | Held | Held | Not used (initial setting) | | |
| Applied to the frequency / calculation only (Pr.128, Pr.753) | Applied to the frequency | Applied to the frequency | Applied to the frequency | | |
| Dancer control | Invalid | Invalid | Invalid | | |
| Other PID-related settings | Held | Held | Held | | |

 While the "retry" (Pr.523 = "22[], 32[]") is selected in the PID control mode, if a retry occurs at an occurrence of E.CPU, E.1 to E.3, or E.5 to E.7 during emergency drive operation, the operation is performed not under PID control but with the fixed frequency.

Use Pr.1013 Emergency drive running speed after retry reset to set the fixed frequency.

◆ Operation of protective functions during emergency drive

· Operation of protective functions during emergency drive is as follows.

| Protective | Operation during | Protective | Operation during | Protective | Operation during |
|------------|---------------------------|------------|---------------------------|------------|---------------------------|
| function | emergency drive | function | emergency drive | function | emergency drive |
| E.OC1 | Retry | E.OP3 | The function is disabled. | E.ECA | The function is disabled. |
| E.OC2 | Retry | E.16 | The function is disabled. | E.MB1 | The function is disabled. |
| E.OC3 | Retry | E.17 | The function is disabled. | E.MB2 | The function is disabled. |
| E.OV1 | Retry | E.18 | The function is disabled. | E.MB3 | The function is disabled. |
| E.OV2 | Retry | E.19 | The function is disabled. | E.MB4 | The function is disabled. |
| E.OV3 | Retry | E.20 | The function is disabled. | E.MB5 | The function is disabled. |
| E.THT | Retry | E.PE | Output shutoff | E.MB6 | The function is disabled. |
| E.THM | Retry | E.PUE | The function is disabled. | E.MB7 | The function is disabled. |
| E.FIN | Retry | E.RET | Output shutoff | E.EP | The function is disabled. |
| E.IPF | The function is disabled. | E.PE2 | Output shutoff | E.MP | The function is disabled. |
| E.UVT | The function is disabled. | E.CPU | Retry | E.EF | The function is disabled. |
| E.ILF | The function is disabled. | E.CTE | The function is disabled. | E.IAH | The function is disabled. |
| E.OLT | Retry | E.P24 | The function is disabled. | E.LCI | The function is disabled. |
| E.SOT | Retry | E.CDO | Retry | E.PCH | The function is disabled. |
| E.LUP | The function is disabled. | E.IOH | Output shutoff | E.PID | The function is disabled. |
| E.LDN | The function is disabled. | E.SER | The function is disabled. | E.1 | Retry*2 |
| E.BE | Retry ^{*1} | E.AIE | The function is disabled. | E.2 | Retry*2 |
| E.GF | Retry | E.USB | The function is disabled. | E.3 | Retry*2 |
| E.LF | The function is disabled. | E.SAF | Retry ^{*1} | E.5 | Retry*2 |
| E.OHT | Retry | E.PBT | Retry*1 | E.6 | Retry*1*2 |
| E.PTC | Retry | E.OS | The function is disabled. | E.7 | Retry*1*2 |
| E.OPT | The function is disabled. | E.OSD | The function is disabled. | E.11 | The function is disabled. |
| E.OP1 | The function is disabled. | E.ECT | The function is disabled. | E.13 | Output abutoff |
| E.OP2 | The function is disabled. | E.OD | The function is disabled. | E.13 | Output shutoff |

^{*1} While the switchover to the commercial power supply operation during emergency drive operation is enabled, when the same protective function is activated twice consecutively, the retry is attempted up to twice.

^{*2} In normal operation (**Pr.523** = "200 or 300"), the start signal is turned OFF at the same time the retry function resets the protective function. Input the start signal again to resume the operation.

· The fault output during emergency drive operation is as follows.

| Pr.190 to P | | .196 setting | | |
|-------------|-------------------|-------------------|---|--|
| Signal | Positive logic | Negative logic | Description | |
| ALM | 99 | 199 | Turns ON at the occurrence of a fault that causes the above-mentioned "retry" or "output shutoff" during emergency drive operation. | |
| ALM3 | 66 | 166 | Output when a fault occurs during emergency drive operation. During emergency drive operation, if a fault that does not activate any protective function occurs, the signal turns ON for 3 seconds and then turns OFF. | |

Input signal operation

- During emergency drive operation in the fixed frequency mode or in the PID control mode, input signals unrelated to the emergency drive become invalid with some exceptions.
- The following table shows functions of the signals that do not become invalid during emergency drive operation in the fixed frequency mode or in the PID control mode.

| Input signal status | Fixed frequency mode | PID control mode |
|---------------------|---|---|
| Valid | OH, X31 ^{*1} , X32, X41 ^{*1} , TRG, TRC, X51, RES, X70, X71 | OH, X31 ^{*1} , X32, X41 ^{*1} , TRG, TRC, X51, RES, X70, X71 |
| Held | RT, X9, X17, X18, MC, SQ, X84 | RT, X9, X17, X18, MC, SQ, X64, X65, X66, X67, X79, X84 |
| Always-ON | _ | X14, X77, X78, X80 |

^{*1} The signal is available only for the FR-A800-LC.

♦ Emergency drive status monitor

- Set "68" in Pr.52, Pr.774 to Pr.776, Pr.992 to monitor the status of the emergency drive on the operation panel.
- · Description of the status monitor

| Operation | | Descriptio | n | | | |
|------------------|--|--|---|--|--|--|
| panel indication | Emergency drive setting | Emergency drive operating status | | | | |
| 0 | Emergency drive function setting is not available. | _ | | | | |
| 1 | | During normal operation | | | | |
| 2 | | | Operating properly | | | |
| 3 | Electronic bypass during | | A certain alarm is occurring.*2 | | | |
| 4 | emergency drive operation is disabled. | Emergency drive in operation | A critical fault is occurring. The operation is being continued by the retry. | | | |
| 5 | | | A critical fault is occurring. The continuous operation is not allowed due to output shutoff. | | | |
| 11 | | During normal operation | | | | |
| 12 | | Emergency drive in operation | Operating properly | | | |
| 13 | | | A certain alarm is occurring.*2 | | | |
| 14 | Electronic bypass during | | A critical fault is occurring. The operation is being continued by the retry. | | | |
| 15 | emergency drive operation is enabled. | | A critical fault is occurring. The continuous operation is not allowed due to output shutoff. | | | |
| 2[]*1 | | Electronic bypass is started during emergency drive (during acceleration/ deceleration to the switchover frequency). | | | | |
| 3[]*1 | | During electronic bypass during emergency drive (waiting during the interlock time). | | | | |
| 4[]*1 | | During commercial power supply operation during emergency drive | | | | |

^{*1} The first digit remains the same as the previous numerical value (fault condition).

∴ CAUTION

When the emergency drive operation is performed, the operation is continued or the retry is repeated even when
a fault occurs, which may damage or burn the inverter and motor. Before restarting the normal operation after
using this function, make sure that the inverter and motor have no fault. Any damage of the inverter or the motor
caused by using the emergency drive function is not covered by the warranty even within the guarantee period.

^{*2 &}quot;A certain alarm" means a protective function disabled during emergency drive shown in the tables on page 7.

Forward rotation output (Y30) signal and Reverse rotation output (Y31) signal

The Forward rotation output (Y30) signal and Reverse rotation output (Y31) signal become available under encoder feedback control.

• Under Vector control or encoder feedback control, the Forward rotation output (Y30) signal or the Reverse rotation output (Y31) signal is output according to the actual rotation direction of the motor.



• For the details on the Y30 and Y31 signals, refer to the Instruction Manual (Detailed) or the Instruction Manual (Function).

FR-A800/A800 Plus Series Instruction Manual Supplement

1 Internal storage device fault (E.PE6)

The operation of the storage device in the inverter can be checked.

If a data fault occurs in the storage device in the inverter, the protective function (E.PE6) is activated.

When the read value of **Pr.890** is "7" or smaller, an inverter reset after All parameter clear can return the operation to normal. (The parameters that had been changed before All parameter clear must be set again.)

| Operation panel indication | E.PE6 | E. | PE6 | FR-LU08 indication | Fault | |
|---|---|----|-----|--------------------|--------------------------------------|--|
| Name | Internal storage device fault | | | | | |
| Description This protective function is activated by an inverter reset if writing data fails due to power-OFF of fault occurs in the storage device during parameter operations 1. | | | | | ata fails due to power-OFF or a data | |
| Check point | Check if the power was turned OFF during parameter operations. | | | | | |
| Corrective action | Check the power supply or the devices on the power system to check that the devices have no fault. When E.PE6 occurs due to power-OFF during parameter operations: Check the read value of Pr.890 . When the value is "7" or smaller, perform All parameter clear and then an inverter reset. The parameters that had been changed before All parameter clear must be set again. When E.PE6 occurs due to other reason (such as turning OFF/ON the power or an inverter reset): Contact your sales representative. | | | | | |

^{*1} For example, when parameter clear, All parameter clear, Parameter copy, or offline auto tuning is performed in the inverter, or when parameter batch write is performed in FR Configurator2.



- "E.PE6" does not activate the retry function.
- "E.PE6" outputs the Fault output 3 (Y91) signal.
- "E.PE6" turns OFF the Safety monitor output (SAFE) signal.
- "E.PE6" is not cleared by turning ON the Fault clear (X51) signal.
- "E.PE6" is not activated during emergency drive operation.
- The communication data code for "E.PE6" is 172 (HAC).

Checking faulty area in the internal storage device

When E.PE6 occurs, faulty area in the internal storage device can be checked by reading Pr.890.

| Pr. | Name | Initial value | Setting range | Description |
|-------------|---|---------------|---------------|--|
| 890 H325 | Internal storage device status indication | 0 | (0 to 9999) | A faulty area detected by self-check function can be indicated in the internal storage device. |



- Use the read value of Pr.890 to check the faulty area.
- The following table shows faulty areas indicated by the read value of Pr.890. Some read values indicate that there are multiple
 faulty areas. (For example, the read value "7" indicates that all the areas described in No. 1 to No. 3 are faulty.)

| No. | Read value | Description |
|-----|------------|---|
| 1 | 1, 3, 5, 7 | Storage area other than the area for parameter settings is faulty (such as area for the set frequency). (When All parameter clear is performed, the set frequency, remotely-set frequency, host name for Ethernet communication, position pulse, multi-revolution counter, and offline auto tuning data are cleared.) |
| 2 | 2, 3, 6, 7 | Storage area for standard parameter settings is faulty. |
| 3 | 4, 5, 6, 7 | Storage area for communication parameter settings is faulty. |
| 4 | 8 to 9999 | Area for manufacturer setting |

2 Note for terminal P3 (200/400 V class only)

Some descriptions about terminal P3 are incorrect in the Instruction Manual. The descriptions are corrected as follows.

Details on the main circuit terminals

Use terminal P3 only when a brake resistor is connected.

[Incorrect]

| Terminal symbol | Terminal name | Terminal function description |
|-----------------|---|--|
| P3, PR | Brake resistor connection for FR-A820- 00770(15K) to 01250(22K), or FR- A840-00470(18.5K) to 01800(55K) | Connect an optional brake resistor across terminals P3 and PR. Connecting a brake resistor increases the regenerative braking capability. |
| P/+, N/- | Brake unit connection | Connect the brake unit (FR-BU2, FR-BU, BU), power regeneration common converter (FR-CV), power regeneration converter (MT-RC), high power factor converter (FR-HC2), multifunction regeneration converter (FR-XC), or DC power supply (under DC feeding mode). When connecting multiple inverters, FR-A820-00770(15K) to |
| P3, N/- | Brake unit connection for FR-A820- 00770(15K) to 01250(22K), or FR- A840-00470(18.5K) to 01800(55K) | 01250(22K) or FR-A840-00470(18.5K) to 01800(55K), in parallel using the FR-CV, FR-HC2, or FR-XC, always use either terminal P/+ or P3 for the connection. (Do not use terminals P/+ and P3 together.) Do not connect the DC power supply between terminals P3 and N/ Use terminals P/+ and N/- for DC feeding. |

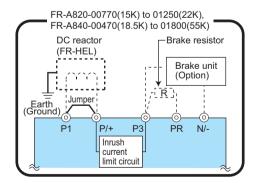
[Correct]

| Terminal symbol | Terminal name | Terminal function description | | |
|-----------------|---|--|--|--|
| P3, PR | Brake resistor connection for FR-A820- 00770(15K) to 01250(22K), or FR- A840-00470(18.5K) to 01800(55K) | Connect an optional brake resistor across terminals P3 and PR. Connecting a brake resistor increases the regenerative braking capability. | | |
| P/+, N/- | Brake unit connection | Connect the brake unit (FR-BU2, FR-BU, BU), power regeneration common converter (FR-CV), power regeneration converter (MT-RC), high power factor converter (FR-HC2), multifunction regeneration converter (FR-XC), or DC power supply (under DC feeding mode). | | |

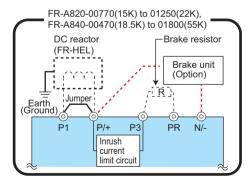
♦ Terminal connection diagrams

In the terminal connection diagrams, the wiring of the optional brake unit is corrected as follows.

[Incorrect]

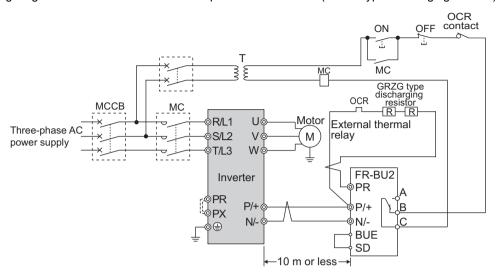


[Correct]



♦ Connection of stand-alone option units

When the brake unit (FR-BU2, FR-BU, BU), power regeneration common converter (FR-CV), power regeneration converter (MT-RC), high power factor converter (FR-HC2), multifunction regeneration converter (FR-XC), or DC power supply (under DC feeding mode) is connected, use terminal P/+ of the inverter. (Do not use terminal P3.) The following diagram shows the connection example with the FR-BU2 (GRZG type discharging resistor).



Connection example with the FR-BU2 (GRZG type discharging resistor)

3

FR-A800/A800 Plus Series Instruction Manual Supplement

1 Monitoring terminals S1 and S2 (FR Configurator2)

Graph display using FR Configurator2 is supported for terminals S1 and S2 (data from the high speed sampling and the USB trace file).

The state of terminals S1 and S2 can be displayed in graph form using FR Configurator2.

The FR Configurator2 version 1.28E or later supports graph display for terminals S1 and S2.

For details on FR Configurator2, refer to the FR Configurator2 Instruction Manual.

◆ Digital source (monitor item) selection

- Terminals S1 and S2 can be selected as digital sources for the trace function.
- Select the digital sources (input/output signals) to be set to **Pr.1038 to Pr.1045** from the following table. When a value other than the ones in the following table is set, "0" (OFF) is applied for indication.

| Setting value | Signal name |
|---------------|----------------|
| 1 | STF |
| 2 | STR |
| 3 | AU |
| 4 | RT |
| 5 | RL |
| 6 | RM |
| 7 | RH |
| 8 | JOG |
| 9 | MRS |
| 10 | STP(STOP) |
| 11 | RES |
| 12 | CS |
| 15 | S2 |
| 16 | S1 |

| Setting value | Signal name |
|---------------|-------------|
| 21 | X0 |
| 22 | X1 |
| 23 | X2 |
| 24 | X3 |
| 25 | X4 |
| 26 | X5 |
| 27 | X6 |
| 28 | X7 |
| 29 | X8 |
| 30 | X9 |
| 31 | X10 |
| 32 | X11 |
| 33 | X12 |
| 34 | X13 |
| 35 | X14 |
| 36 | X15 |
| 37 | DY |

| Setting | Signal |
|---------|--------|
| value | name |
| 101 | RUN |
| 102 | SU |
| 103 | IPF |
| 104 | OL |
| 105 | FU |
| 106 | ABC1 |
| 107 | ABC2 |
| 121 | DO0 |
| 122 | DO1 |
| 123 | DO2 |
| 124 | DO3 |
| 125 | DO4 |
| 126 | DO5 |
| 127 | DO6 |
| 128 | RA1 |
| 129 | RA2 |
| 130 | RA3 |

2 Note for use with the Type E combination motor controller

When Appendix "Instructions for UL and cUL" in the Instruction Manual (Startup) mentions the Type E combination motor controller, only the MMP-T series controllers with the UL mark affixed are applicable for certification.

FR-A800/A800 Plus Series Instruction Manual Supplement

1 Earth (ground) fault detection at start / restricting reset method for an earth (ground) fault

The reset method for the output side earth (ground) fault overcurrent (E.GF) can be restricted.

- Select whether to enable or disable the earth (ground) fault detection at start. When enabled, the earth (ground) fault detection is performed immediately after a start signal input to the inverter.
- Select whether to restrict the reset method for an earth (ground) fault.

| Pr. | Pr. Name Initial value Setting range | | Setting range | Description | |
|----------|---|----------------|---------------|-----------------------|----------------|
| Pr. Name | | Illitial value | Setting range | Earth (ground) fault | Reset method |
| 0.40 | 249 Earth (ground) fault detection H101 at start | 0 | 0 | Not detected at start | Not restricted |
| | | | 1 | Detected at start | Not restricted |
| пи | | | 2 | Detected at Staft | Restricted |

◆ Selecting whether to perform the earth (ground) fault detection at start ✓// Magneticifix

- If an earth (ground) fault is detected at start while **Pr.249** = "1 or 2", the output side earth (ground) fault overcurrent (E.GF) is detected and output is shut off.
- · Earth (ground) fault detection at start is enabled under V/F control and Advanced magnetic flux vector control.
- · When the Pr.72 PWM frequency selection setting is high, enable the earth (ground) fault detection at start.

NOTE

- Because the detection is performed at start, output is delayed for approx. 20 ms every start.
- Use Pr.249 to enable/disable the earth (ground) fault detection at start. During operation, earth (ground) faults are
 detected regardless of the Pr.249 setting.

Restricting reset method for an earth (ground) fault

- The reset method when the output is shut off due to the output side earth (ground) fault overcurrent (E.GF) can be restricted. When E.GF occurs while **Pr.249** = "2", E.GF can be reset only by turning OFF the control circuit power.
- This restriction prevents the inverter from being damaged due to repeated reset operations by the other methods such as entering the RES signal.
- When E.GF occurs while Pr.249 = "2", the output short-circuit detection (ALM4) signal can be output.
- For the terminal used to output the ALM4 signal, set "23" (positive logic) or "123" (negative logic) in any of **Pr.190** to **Pr.196 (Output terminal function selection)**.
- If Pr.249 is set to "2" while the retry function is enabled (Pr.67 is not set to "0"), no retry is performed even when E.GF occurs.
- If **Pr.249** is set to "2" while the automatic bypass switching after inverter fault is enabled (**Pr.138** is not set to "1"), the operation is not switched to the commercial power supply operation even when E.GF occurs.

NOTE

- Changing the terminal assignment using Pr.190 to Pr.196 (Output terminal function selection) may affect the
 other functions. Set parameters after confirming the function of each terminal.
- E.GF is not cleared by turning ON the Fault clear (X51) signal when Pr.249 = "2".
- If E.GF occurs during emergency drive operation when Pr.249 = "2", the output is shut off.

2 Output short-circuit fault (E.SCF)

Select the reset operation and fault indication for an output short-circuit.

| Pr. | Name | Initial | Setting range | Description | |
|------|------------------------|---------------|---------------|---------------------------|----------------|
| FI. | ri. Name value | | Setting range | Operation after detection | Reset method |
| 521 | 1 Output short-circuit | short-circuit | 0 | E.OC1 to E.OC3 | Not restricted |
| H194 | detection | U | 1 | E.SCF | Restricted |

- The fault indication for an output short-circuit (E.OC1 to E.OC3, and E.SCF) can be changed by the Pr.521 setting.
- When an output short-circuit is detected while Pr.521 = "1", E.SCF is displayed and the inverter output is shut off.
- When E.SCF occurs while **Pr.521** = "1", E.SCF can be reset only by turning OFF the control circuit power. (E.OC1 to E.OC3 can be reset by any reset method.)
- This restriction prevents the inverter from being damaged due to repeated reset operations by the other methods such as entering the RES signal.
- When E.SCF occurs, the output short-circuit detection (ALM4) signal can be output.
- For the terminal used to output the ALM4 signal, set "23" (positive logic) or "123" (negative logic) in any of **Pr.190** to **Pr.196 (Output terminal function selection)**.
- If the automatic bypass switching after inverter fault is enabled (**Pr.138** is not set to "1"), the operation is not switched to the commercial power supply operation even when E.SCF occurs.

| Operation panel indication | E.SCF | E. | SEF | FR-LU08 indication | Fault | |
|----------------------------|--|----|-----|--------------------|-------|--|
| Name | Output short-circuit fault | | | | | |
| Description | The inverter output is shut off when an output short-circuit is detected while Pr.521 = "1". When Pr.521 = "0" (initial value), E.OC1, E.OC2, or E.OC3 appears when an output short-circuit is detected. | | | | | |
| Check point | Check for output short-circuit. | | | | | |
| Corrective action | Check the wiring to make sure that any output short circuit does not occur, then turn OFF the control circuit power to reset the inverter. | | | | | |



- When short-circuit resistance is large, the current does not reach the short-circuit detection level. In such a case, an output short-circuit cannot be detected.
- Changing the terminal assignment using **Pr.190 to Pr.196 (Output terminal function selection)** may affect the other functions. Set parameters after confirming the function of each terminal.
- · E.SCF does not activate the retry function.
- E.SCF is not cleared by turning ON the Fault clear (X51) signal.
- · If E.SCF occurs during emergency drive operation, the output is shut off.
- The communication data code for E.SCF is 20 (H14).

3 Extended detection time of the output current and zero current

The setting range of the **Pr.151 Output current detection signal delay time** and **Pr.153 Zero current detection time** is extended.

| Pr. | Name | Initial value | Setting range | Description |
|-------------|--|------------------|---------------|---|
| 151 M461 | Output current detection signal delay time | 0 s | 0 to 300 s | Set the output current detection time. Enter the time from when the output current reaches the set current or higher to when the Output current detection (Y12) signal is output. |
| 153 M463 | Zero current detection time | 0.5 s | 0 to 300 s | Set the time from when the output current drops to the Pr.152 setting or lower to when the Zero current detection (Y13) signal is output. |

4 Selecting the command interface in the Network operation mode (Pr.338, Pr.339)

- The proximity dog (X76) signal can be input via communication.
- The following table shows the command interface for the function in the Network operation mode, determined by the parameter settings: an external terminal or a communication interface (RS-485 terminals or communication option).

| Pr.338 | Communication operation command source | | 0: NET | | 1: EXT | | | |
|-------------------|--|----------------------|--------|--|--------|--------|--------|--|
| Pr.33 | 9 Communication speed command source | 0: NET 1: EXT 2: EXT | | | 0: NET | 1: EXT | 2: EXT | |
| X76 Proximity dog | | Combined | | | EXT | | | |

[Explanation of Terms in Table]

EXT: External terminal only

Combined: Either external terminal or communication interface

FR-A800/A800 Plus Series Instruction Manual Supplement

1 Compatibility with SF-PR 0.4kW

The SF-PR 0.4kW is supported. Offline auto tuning is not required for operation under Advanced magnetic flux vector control, Real sensorless vector control, or Vector control. (When the wiring length exceeds 30 m, offline auto tuning must be performed.)

◆ Automatic change of Pr.0 Torque boost and Pr.12 DC injection brake operation voltage

When initial values are set in Pr.0 and Pr.12, the Pr.0 and Pr.12 settings are automatically changed to the values
in the following table by changing the Pr.71 setting.

| Inve | erter | | Pr.0 value (%) after automatic change | | | | | Pr.12 valu | ıe (%) after aı change | utomatic | | |
|-------------------------|-------------------------|-------------|---------------------------------------|------------|------------------------------------|--------------------|--------------|--------------|---------------------------|------------------|--------------------------------|---------|
| FR-A820-[] | FR-A840-[] | Stan mot | dard tor*1 | tor | stant- que tor ^{*2} | | SF-P | R*3 | | Standard motor*1 | Constant- torque motor*2 | SF-PR*3 |
| | | SLD /LD | ND /HD | SLD /LD | ND /HD | Pr.81 ≠ 2, 4, 6 | Pr.81 = 2 | Pr.81 = 4 | Pr.81 = 6 | illotor | | |
| 00046(0.4K) | 00023(0.4K) | 6 | | 6 | | 5 | 8 | 6.5 | 7.5 | 4 | 4 | 5 |
| 00077(0.75K) | 00038(0.75K) | 6 | | 6 | | 4 | 7.4 | 6 | 6.4 | 4 | 4 | 4 |
| 00105(1.5K) | 00052(1.5K) | 4 | | 4 | | 3 | 5.8 | 5 | 3.7 | 4 | 4 | 2.5 |
| 00167(2.2K) | 00083(2.2K) | 4 | | 4 | | 2.5 | 6 | 4.5 | 3.3 | 4 | 4 | 2.5 |
| 00250(3.7K) | 00126(3.7K) | 4 | | 4 | | 2.5 | 6.4 | 4.5 | 4.2 | 4 | 4 | 2.5 |
| 00340(5.5K) | 00170(5.5K) | 3 | | 2 | | 2 | 4.5 | 3.7 | 3.3 | 4 | 2 | 2 |
| 00490(7.5K) | 00250(7.5K) | 3 | | 2 | | 2 | 4.4 | 4.5 | 3.8 | 4 | 2 | 2 |
| 00630(11K) | 00310(11K) | 2 | | 2 | | 1.5 | 3.5 | 3.3 | 3.5 | 2 | 2 | 1.5 |
| 00770(15K) | 00380(15K) | 2 | | 2 | | 1.5 | 4.5 | 3 | 3.5 | 2 | 2 | 1.5 |
| 00930(18.5K) | 00470(18.5K) | 2 | | 2 | | 1.5 | 4 | 3.2 | 3 | 2 | 2 | 1.5 |
| 01250(22K) | 00620(22K) | 2 | | 2 | | 1.5 | 2.5 | 3.4 | 3 | 2 | 2 | 1 |
| 01540(30K) | 00770(30K) | 2 | | 2 | | 1 | 3 | 2 | 2.5 | 2 | 2 | 1 |
| 01870(37K) | 00930(37K) | 2 | | 2 | | 1 | 2 | 2.5 | 2.6 | 2 | 2 | 1 |
| 02330(45K) | 01160(45K) | 1.5 | 2 | 1.5 | 2 | 1 | 2 | 2 | 2.4 | 2 | 2 | 1 |
| 03160(55K) | 01800(55K) | 1.5 | 2 | 1.5 | 2 | 0.7 | 2 | 2 | 0.7 | 2 | 2 | 1 |
| 03800(75K) or higher | 02160(75K) or higher | 1 | | 1 | | 1 | 1 | 1 | 1 | 1 | 1 | 1 |

- *1 **Pr.71** = "0, 2 to 6, 20, 23, 24, 40, 43, or 44" (standard motor)
- *2 **Pr.71** = "1, 13 to 16, 50, 53, or 54" (constant-torque motor)
- *3 **Pr.71** = "70, 73, or 74" (SF-PR)

NOTE

- · When the Pr.0 and Pr.12 settings are changed from their initial values, the automatic change is not performed.
- When the SF-PR motor is selected (**Pr.71** = "70, 73, or 74"), the output current may become large due to a small load by setting **Pr.81 Number of motor poles** according to the number of the SF-PR motor poles.
- When the SF-PR motor is used, the output current tends to increase compared with the case where the SF-JR or SF-HR motor is used. Depending on the load conditions, the output current may increase even though the torque boost value has been automatically changed. When the protective function such as the electronic thermal O/L relay (E.THT, E.THM) or stall prevention (OL, E.OLT) is activated, adjust the **Pr.0 Torque boost** according to the load.

2 Compatibility with PM motor EM-A series

The PM motor EM-A series (200 V class 0.75kW to 7.5kW) is supported.

| Motor model: EM-AMF[] | | 0.75kW | 1.5kW | 2.2kW | 3.7kW | 5.5kW | 7.5kW |
|---------------------------|-----|--------|-------|-------|-------|-------|-------|
| | SLD | 0.4 | 0.75 | 1.5 | 2.2 | 3.7 | 5.5 |
| Applicable inverter model | LD | 0.4 | 0.75 | 1.5 | 2.2 | 3.7 | 5.5 |
| FR-A820-[]K | ND | 0.75 | 1.5 | 2.2 | 3.7 | 5.5 | 7.5 |
| | HD | 1.5 | 2.2 | 3.7 | 5.5 | 7.5 | 11 |

2.1 Selecting the PM sensorless vector control

Initializing the parameters required for the PM sensorless vector control (Pr.998)

- PM parameter initialization sets parameters required for driving an EM-A motor.

| Pr. | Name | Initial value | Setting range | Descri | ption | | | | | | | | |
|------|----------------|------------------|---------------|---|---|--|--|--|--|--|---|---|---|
| | | | | | | | | | | | 0 | Parameter setting (in frequencies) for an induction motor | The setting of the motor parameters is changed to the setting required to drive an induction motor. |
| | | | 3003 | Parameter setting (in rotations per minute) for an MM-CF motor | The setting of the motor parameters is changed to the setting required to drive | | | | | | | | |
| | | | 3103 | Parameter setting (in frequencies) for an MM-CF motor | an MM-CF motor. | | | | | | | | |
| | | | 3044 | Parameter setting (in rotations per minute) for an EM-A motor | The setting of the motor parameters is changed to the setting required to drive | | | | | | | | |
| 998 | B PM parameter | | 3144 | Parameter setting (in frequencies) for an EM-A motor | an EM-A motor. | | | | | | | | |
| E430 | initialization | - 10 | 8009 | Parameter setting (in rotations per minute) for an IPM motor other than EM-A/MM-CF (after tuning) | The setting of the motor parameters is changed to the setting required to drive an IPM motor. (Set Pr.71 Applied motor | | | | | | | | |
| | | | 8109 | Parameter setting (in frequencies) for an IPM motor other than EM-A/MM-CF (after tuning) | and perform offline auto tuning in advance.) | | | | | | | | |
| | | 90 | 9009 | Parameter setting (in rotations per minute) for an SPM motor (after tuning) | The setting of the motor parameters is changed to the setting required to drive an SPM motor. (Set Pr.71 Applied | | | | | | | | |
| | | | 9109 | Parameter setting (in frequencies) for an SPM motor (after tuning) | motor and perform offline auto tuning in advance.) | | | | | | | | |

- To use a motor capacity that is one rank lower than the inverter capacity, set **Pr.80 Motor capacity** before performing PM parameter initialization.
- When "3003, 3044, 8009, or 9009" is set in **Pr.998**, the motor speed which was set/monitored in frequencies is set/monitored in motor rotations per minute. To set/monitor in frequencies, set "3103, 3144, 8109, or 9109" in **Pr.998**.
- Set **Pr.998** = "0" to change the PM sensorless vector control parameter settings to the parameter settings required to drive an induction motor.
- When using an IPM motor or SPM motor other than EM-A or MM-CF, set Pr.998 = "8009, 8109, 9009, or 9109".



- Make sure to set Pr.998 before setting other parameters. If the Pr.998 setting is changed after setting other
 parameters, some of those parameters are initialized too. (Refer to the "List of the target parameters for the motor
 parameter initialization".)
- To change back to the parameter settings required to drive an induction motor, perform Parameter clear or All parameter clear.
- Whenever the setting of Pr.998 PM parameter initialization is changed from "3003, 3044, 8009, or 9009 (rotations per minute)" to "3103, 3144, 8109, or 9109 (frequency)", and vice versa, all the relevant parameters are initialized. The purpose of Pr.998 is not to change the display units. Use Pr.144 Speed setting switchover to change the display units between rotations per minute and frequency. Using Pr.144 enables switching the units between rotations per minute and frequency without initializing the settings of the motor parameters.
 Example) Changing the Pr.144 setting between "6" and "106" switches the display units between frequency and rotations per minute.
- For an inverter out of the capacity range of the EM-A motor, the settings "3044 and 3144" are disabled. For an inverter out of the capacity range of the MM-CF motor, the settings "3003 and 3103" are disabled.
- The PM parameter initialization (**Pr.998**) changes parameter settings for the first motor. When a PM motor is used as the second motor, parameters for the second motor must be set individually.

◆ List of the target parameters for the motor parameter initialization (EM-A)

- The parameter settings in the following table are changed to the settings required to perform PM sensorless vector control by selecting PM sensorless vector control with the IPM initialization on the operation panel or with Pr.998 PM parameter initialization. The changed settings differ according to the specification (capacity) of the PM motor used.
- Performing Parameter clear or All parameter clear sets back the parameter settings to the settings required to drive an induction motor.

| | | | ction | PM motor (setting in rotations per minute) | PM motor (setting in frequencies) | Setting in | ncrements |
|--------------|---|---------------------|-------------------------|--|-----------------------------------|--------------------|--------------------|
| Pr. | Name | Pr.99 | 8 = "0 value)" CA | Pr.998 = "3044" (EM-A) | Pr.998 = "3144" (EM-A) | Pr.998 = "3044" | Pr.998 = "0, 3144" |
| 1 | Maximum frequency | 120 Hz | | Maximum motor rotations per minute*2 | Maximum motor frequency*2 | 1 r/min | 0.01 Hz |
| 4 | Multi-speed setting (high speed) | 60 Hz | 50 Hz | Rated motor rotations per minute*2 | Rated motor frequency*2 | 1 r/min | 0.01 Hz |
| 9 | Electronic thermal O/L relay | Inverter rated c | | Rated motor current*2 | | 0.01 A | • |
| 10 | DC injection brake operation frequency | 3 Hz | | Rated motor rotations per minute × 3%*2 | Rated motor frequency × 3%*2 | 1 r/min | 0.01 Hz |
| 13 | Starting frequency | 0.5 Hz | | Rated motor rotations per minute × 0.5%*2 | Rated motor frequency × 0.5%*2 | 1 r/min | 0.01 Hz |
| 15 | Jog frequency | 5 Hz | | Rated motor rotations per minute × 10%*2 | Rated motor frequency × 10%*2 | 1 r/min | 0.01 Hz |
| 18 | High speed maximum frequency | 120 Hz | | Maximum motor rotations per minute*2 | Maximum motor frequency*2 | 1 r/min | 0.01 Hz |
| 20 | Acceleration/deceleration reference frequency | 60 Hz | 50 Hz | Rated motor rotations per minute*2 | Rated motor frequency*2 | 1 r/min | 0.01 Hz |
| 22 | Stall prevention operation level | 150% | | 200% | | 0.1% | |
| 37 | Speed display | 0 | | 0 | | | |
| 55 | Frequency monitoring reference | 60 Hz | 50 Hz | Rated motor rotations per minute*2 | Rated motor frequency*2 | 1 r/min | 0.01 Hz |
| 56 | Current monitoring reference | Inverter rated c | | Rated motor current*2 | | 0.01 A | |
| 71 | Applied motor | 0 | | 1140 | | 1 | |
| 80 | Motor capacity | 9999 | | Motor capacity (EM-A)*1 | | 0.01 kW | |
| 81 | Number of motor poles | 9999 | | Number of motor poles (EM-A | \)*1 | 1 | |
| 84 | Rated motor frequency | 9999 | | Rated motor rotations per minute*2 | Rated motor frequency*2 | 1 r/min | 0.01 Hz |
| 116 | Third output frequency detection | 60 Hz | 50 Hz | Rated motor rotations per minute ^{*2} | Rated motor frequency*2 | 1 r/min | 0.01 Hz |
| 125 (903) | Terminal 2 frequency setting gain frequency | 60 Hz | 50 Hz | Rated motor rotations per minute*2 | Rated motor frequency*2 | 1 r/min | 0.01 Hz |
| 126 (905) | Terminal 4 frequency setting gain frequency | 60 Hz | 50 Hz | Rated motor rotations per minute*2 | Rated motor frequency*2 | 1 r/min | 0.01 Hz |
| 144 | Speed setting switchover | 4 | | Number of motor poles (EM-A) + 100*2 | Number of motor poles (EM-A)*2 | 1 | |
| 240 | Soft-PWM operation selection | 1 | | 0 | | 1 | |

| | | | ction tor | PM motor (setting in rotations per minute) | PM motor (setting in frequencies) | Setting in | ncrements |
|--------------|---|--------------------|-------------------------|---|--|--------------------|-----------------------|
| Pr. | Name | | 8 = "0 value)" CA | Pr.998 = "3044" (EM-A) | Pr.998 = "3144" (EM-A) | Pr.998 = "3044" | Pr.998 = "0, 3144" |
| 263 | Subtraction starting frequency | 60 Hz | 50 Hz | Rated motor rotations per minute*2 | Rated motor frequency*2 | 1 r/min | 0.01 Hz |
| 266 | Power failure deceleration time switchover frequency | 60 Hz | 50 Hz | Rated motor rotations per minute*2 | Rated motor frequency*2 | 1 r/min | 0.01 Hz |
| 374 | Overspeed detection level | 9999 | | Maximum motor rotations per minute × 115% ^{*2} | Maximum motor frequency × 115% ^{*2} | 1 r/min | 0.01 Hz |
| 386 | Frequency for maximum input pulse | 60 Hz | 50 Hz | Rated motor rotations per minute*2 | Rated motor frequency*2 | 1 r/min | 0.01 Hz |
| 422 | Position control gain | 25 s ⁻¹ | | 20 s ⁻¹ | | 1 s ⁻¹ | |
| 505 | Speed setting reference | 60 Hz | 50 Hz | Rated motor frequency*2 | | 0.01 Hz | |
| 557 | Current average value monitor signal output reference current | Inverted c | | Rated motor current*2 | | 0.01 A | |
| 665 | Regeneration avoidance frequency gain | 100% | | 80% | | 0.1% | |
| 820 | Speed control P gain 1 | 60% | | 30% | | 1% | |
| 821 | Speed control integral time 1 | 0.333 s | i | 0.333 s | | 0.001 s | |
| 824 | Torque control P gain 1 (current loop proportional gain) | 100% | | 150% | | 1% | |
| 825 | Torque control integral time 1 (current loop integral time) | 5 ms | | 6.7 ms | | 0.1 ms | |
| 870 | Speed detection hysteresis | 0 Hz | | Rated motor rotations per minute × 0.5%*2 | Rated motor frequency × 0.5%*2 | 1 r/min | 0.01 Hz |
| 885 | Regeneration avoidance compensation frequency limit value | 6 Hz | | Rated motor rotations per minute × 6%*2 | Rated motor frequency × 6%*2 | 1 r/min | 0.01 Hz |
| 893 | Energy saving monitor reference (motor capacity) | Inverte capacit | | Motor capacity (Pr.80) | | 0.01 kW | |
| C14 (918) | Terminal 1 gain frequency (speed) | 60 Hz | 50 Hz | Rated motor rotations per minute*2 | Rated motor frequency*2 | 1 r/min | 0.01 Hz |
| 1121 | Per-unit speed control reference frequency | 120 Hz | | Maximum motor rotations per minute*2 | Maximum motor frequency*2 | 1 r/min | 0.01 Hz |

^{*1} When a value other than "9999" is set, the set value is not changed.

^{*2} The rated motor rotations per minute (frequency), maximum motor rotations per minute (frequency), number of motor poles, and rated motor current are as follows.

| Item | 0.75kW | 1.5kW or higher |
|--|--|--|
| Rated motor rotations per minute (frequency) | 3000 r/min (100 Hz) | 3000 r/min (150 Hz) |
| Maximum motor rotations per minute (frequency) | 4000 r/min (133.33 Hz) | 4000 r/min (200 Hz) |
| Number of motor poles | 4 | 6 |
| Rated motor current | 0.75kW: 3.3 A, 1.5kW: 6.1 A, 2.2kW: 9.3 A, 3.7 | kW: 16.5 A, 5.5kW: 22.0 A, 7.5kW: 31.0 A |

NOTE

When the motor parameter initialization is performed with the setting in units of rotations per minute (Pr.998 = "3044"), the parameters not listed in the table and the monitor items are also set and displayed in rotations per minute.

◆ List of the target parameters for the motor parameter initialization (other than EM-A)

The settings in Pr.10, Pr.422, and Pr.665 are changed to the settings shown in the following table by selecting
a motor other than EM-A with the IPM initialization on the operation panel or with Pr.998 PM parameter
initialization. For other parameters whose settings are to be changed, refer to the Instruction Manual (Detailed).

| | motor rotations p | | PM motor (setting in rotations per minute) | PM motor (setting in frequencies) | Setting ir | ncrements | |
|-----|--|--------------------|---|--|--|--------------------|-----------------------------|
| Pr. | Name | Pr.998 (initial | | Pr.998 = "3003" (MM-CF) Pr.998 = "8009, 9009" | Pr.998 = "3103" (MM-CF) Pr.998 = "8109, 9109" | Pr.998 = "3003, | Pr.998 = "0, 3103, 8109, |
| | | FM | CA | (other than EM-A/MM- CF) | (other than EM-A/MM- CF) | 8009, 9009" | 9109" |
| 10 | DC injection brake operation frequency | 3 Hz | | 3 Hz*1 | 3 Hz | 1 r/min | 0.01 Hz |
| 422 | Position control gain | 25 s ⁻¹ | | 25 s ⁻¹ | | 1 s ⁻¹ | |
| 665 | Regeneration avoidance frequency gain | 100% | | 100% | | 0.1% | |

^{*1} The setting value is converted from frequency to rotations per minute. (It differs according to the number of motor poles.)

2.2 Offline auto tuning for a PM motor (motor constant tuning)

The offline auto tuning enables the optimal operation of a PM motor.

 Automatic measurement of motor constants (offline auto tuning) enables optimal operation of motors for PM sensorless vector control even when motor constants vary or when the wiring distance is long.

◆ Before performing offline auto tuning

Check the following points before performing offline auto tuning:

- · The PM sensorless vector control is selected.
- A motor is connected. (Check that the motor is not rotated by an external force during tuning.)
- The maximum frequency under PM sensorless vector control is 400 Hz.
- The motor may rotate slightly even if the offline auto tuning without the motor rotating (Pr.96 Auto tuning setting/ status = "11") is selected. (It does not affect the tuning performance.)

Fix the motor securely with a mechanical brake, or before tuning, make sure that it is safe even if the motor rotates. (Caution is required especially in vertical lift applications.)

Tuning is not available during position control under PM sensorless vector control.

Settings

• To perform tuning, set the following parameters about the motor.

| First motor Pr. | Second motor Pr. | Name | Setting for EM-A | | |
|-----------------|------------------|------------------------------|--|--|--|
| 80 | 453 | Motor capacity | | | |
| 81 | 454 | Number of motor poles | Daniel de la final | | |
| 9 | 51 | Electronic thermal O/L relay | Parameters for the first motor are set by IPM parameter initialization. | | |
| 84 | 457 | Rated motor frequency | by it ivi parameter initialization. | | |
| 71 | 450 | Applied motor | | | |
| 83 | 456 | Rated motor voltage | Initial value (200 V) | | |
| 96 | 463 | Auto tuning setting/status | 11 | | |



- Under PM sensorless vector control, tuning cannot be performed even when Pr.96 = "101". When the EM-A is set
 to the applied motor, tuning cannot be performed even when Pr.96 = "1 or 101".
- Use the following parameters in the initial settings ("9999").

| First motor Pr. | Second motor Pr. | Name | Setting for EM-A | |
|-----------------|------------------|--------------------------------|----------------------|--|
| 702 | 743 | Maximum motor frequency | 9999 (initial value) | |
| 707 | 744 | Motor inertia (integer) | 0000 (initial value) | |
| 724 | 745 | Motor inertia (exponent) | 9999 (initial value) | |
| 725 | 746 | Motor protection current level | 9999 (initial value) | |

Performing tuning



- Before performing tuning, check the monitor display of the operation panel or parameter unit if the inverter is in the state ready for tuning. The motor starts by turning ON the start command while tuning is unavailable.
- In the PU operation mode, press on the operation panel.

In the external operation mode, turn ON the start command (STF signal or STR signal). Tuning starts. For details on the tuning procedure, refer to "5.13.4 Offline auto tuning for a PM motor (motor constants tuning)" in the Instruction Manual (Detailed).

◆ Parameters updated by tuning results after tuning

| First motor Pr. | Second motor Pr. | Name | Description |
|-----------------|------------------|---|----------------------|
| 90 | 458 | Motor constant (R1) | Resistance per phase |
| 717 | 741 | Starting resistance tuning compensation | |
| 96 | 463 | Auto tuning setting/status | |

◆ Tuning adjustment (Pr.1002)

 The overcurrent protective function may be activated during Lq tuning for an easily magnetically saturated motor (motor with a large Lq decay ratio). In such case, adjust the target flowing current used for tuning with Pr.1002 Lq tuning target current adjustment coefficient.

♦ Changing the motor constants

- The motor constants can be set directly when the motor constants are known in advance, or by using the data measured during offline auto tuning.
- According to the **Pr.71 (Pr.450)** setting, the range of the motor constant parameter setting values and units can be changed. The changed settings are stored in the EEPROM as the motor constant parameters.

Changing the motor constants (when setting motor constants in units of Ω, mH, or A)

· Set Pr.71 as follows.

| Motor | | Pr.71 setting | |
|----------|------|---------------|--|
| PM motor | EM-A | 1140 | |

· Set desired values as the motor constant parameters.

| First motor Pr. | Second motor Pr. | Name | Setting range | Setting increments | Initial value |
|--------------------|---------------------|---|----------------------------|--------------------|------------------|
| 90 | 458 | Motor constant (R1) | 0 to 50 Ω, 9999 | 0.001 Ω | |
| 92 | 460 | Motor constant (L1)/d-axis inductance (Ld) | 0 to 500 mH, 9999 | 0.01 mH | |
| 93 | 461 | Motor constant (L2)/q-axis inductance (Lq) | 0 to 500 mH, 9999 | 0.01 mH | |
| 706 | 738 | Induced voltage constant (phi f) | 0 to 5000 mV (rad/s), 9999 | 0.1 mV (rad/s) | 9999 |
| 859 | 860 | Torque current/Rated PM motor current | 0 to 500 A, 9999 | 0.01 A | |
| 1412 | 1413 | Motor induced voltage constant (phi f) exponent | 0 to 2, 9999 | 1 | |

NOTE

- If "9999" is set, tuning data will be invalid. When the EM-A motor is selected, the EM-A constant is used.
- To change a motor induced voltage constant of PM motors, the setting in Pr.706 Induced voltage constant (phi f) or Pr.738 Second motor induced voltage constant (phi f) must be changed. If the constant after the change exceeds the setting range of Pr.706 or Pr.738 (0 to 5000 mV (rad/s)), set Pr.1412 Motor induced voltage constant (phi f) exponent or Pr.1413 Second motor induced voltage constant (phi f) exponent. Set a value in the exponent n in the formula, Pr.706 (Pr.738) × 10ⁿ [mV (rad/s)], to set the induced voltage constant (phi f).
- When **Pr.1412 (Pr.1413)** = "9999", the motor induced voltage constant is as set in **Pr.706 (Pr.738)**. (No exponent setting)

2.3 Selection of the control method and the control mode

 Select a control method (and a control mode) from V/F control, Advanced magnetic flux vector control (speed control), Real sensorless vector control (speed control, torque control), Vector control (speed control, torque control, position control), and PM sensorless vector control (speed control, position control).

| Settings of Pr.80 (Pr.453) and Pr.81 (Pr.454) | Pr.71 (Pr.450) | Pr.800 setting*1 | Pr.451 setting ^{*1} | Control method | Control mode | Remarks | |
|---|---|--|--|---|---|--|--|
| | Induction motor | | settings, refer | to the Instruction Ma | , , | | |
| | | 9, 109 | — | PM sensorless vector control test operation | | | |
| | | 13, 113 | | | Position control*4 | _ | |
| | EM-A, MM-CF*2 | 14, 114 | | PM sensorless vector control | Speed control / position control switchover*4 | MC signal ON: position contro MC signal OFF: speed contro | |
| | | 20 (initial value), 110 | 20, 110 | | Speed control | _ | |
| Otherthan | | 0, 100 ^{*5} | | Vector control*7 | Speed control | _ | |
| 9999 | | 3, 103 | | | Position control | _ | |
| | PM motor (other than EM-A/MM- CF) | 4, 104 ^{*6} | | | Speed control / position control switchover | MC signal ON: position control MC signal OFF: speed control | |
| | | 9, 109 | _ | PM sensorless vector control test operation | | tion | |
| | | 20 (initial value), 110 ^{*8} | 20, 110 ^{*8} | PM sensorless vector control | Speed control | _ | |
| | PM motor — 9999 (initial value) | | The setting value of Pr.800 is used for the second motor. (PM sensorless vector control (speed control) when Pr.800 ="9 or 109") | | | | |
| 9999 ^{*3} | _ | _ | | V/F control | | | |

- *1 The setting values of 100 and above are used when the fast-response operation is selected.
- *2 For the EM-A or MM-CF motor, the setting other than "9, 13, 14, 109, 113, 114, or 9999" in **Pr.800 (Pr.451)** has the same meaning as the setting "20 or 110" in **Pr.800 (Pr.451)** (speed control under PM sensorless vector control).
- *3 V/F control is applied when **Pr.80** or **Pr.81** is "9999", regardless of the **Pr.80**0 setting. When **Pr.71** is set to the EM-A or MM-CF, PM sensorless vector control is enabled even if **Pr.80** ≠ "9999" or **Pr.81** = "9999". (When other PM motors are used, set **Pr.80** and **Pr.81** according to the motor. Otherwise, proper operation cannot be performed.)
- *4 Setting **Pr.788 (Pr.747)** = "0" (low-speed range torque characteristic disabled) selects speed control.
- *5 The operation for the setting of "0 or 100" is performed when "1, 2, 6, 101, 102, or 106" is set.
- *6 The operation for the setting of "4 or 104" is performed when "5 or 105" is set.
- *7 Speed control under PM sensorless vector control is applied if an option for vector control for PM motor is not installed.
- *8 The operation for the setting of "20 or 110" is performed when "10 to 14 or 111 to 114" is set.

2.4 Low-speed range torque characteristics selection

- When the low-speed range high-torque characteristic is enabled (Pr.788 Low speed range torque characteristic selection = "9999 (initial value)")
- The high frequency superposition control provides enough torque in the low-speed range operation.
- The low-speed range high-torque characteristic is enabled for the EM-A and MM-CF motors.
- ◆ When the low-speed range high-torque characteristic is disabled (Pr.788 Low speed range torque characteristic selection = "0")
 - The current synchronization operation reduces much motor noise compared with the high frequency superposition control.
 - Since the torque in a low-speed range is low, use this setting for an operation with light start-up load.



 Position control under PM sensorless vector control is not available when the current synchronization operation is selected. Zero speed and servo lock are also disabled during current synchronization operation.

2.5 Applied motor

By setting the applied motor type, the thermal characteristic appropriate for the motor can be selected.

When using a constant-torque or PM motor, the electronic thermal O/L relay is set according to the motor.

When the Advanced magnetic flux vector control, Real sensorless vector control, Vector control, or PM sensorless vector control is selected, the motor constant necessary for control (SF-PR, SF-JR, SF-HR, SF-JRCA, SF-HRCA, SF-V5RU (1500 r/min series), EM-A, MM-CF, etc.) is also selected at the same time.

| Pr. | Name | Initial value | Setting range | Description |
|-------------|----------------------|------------------|---|--|
| 71 C100 | Applied motor | 0 | 0 to 6, 13 to 16, 20, 23, 24, 30, 33, 34, 40, 43, 44, 50, 53, 54, 70, 73, 74, 330, 333, 334, 1140 , 8090, 8093, 8094, 9090, 9093, 9094 | By selecting a motor, the thermal characteristic and motor constant of each motor are set. |
| 450 C200 | Second applied motor | 9999 | 0, 1, 3 to 6, 13 to 16, 20, 23, 24, 30, 33, 34, 40, 43, 44, 50, 53, 54, 70, 73, 74, 330, 333, 334, 1140 , 8090, 8093, 8094, 9090, 9093, 9094 | Set this parameter when using the second motor (the same specifications as Pr.71). |
| | | | 9999 | The function is disabled. |

Setting the applied motor

· Refer to the following list and set the parameters according to the applied motor.

| Pr.71 Pr.450 | | Motor | Motor constant value range (increment) | Electronic thermal O/L relay function | | |
|--------------------|-----------------------------------|---|--|---------------------------------------|----|--------------|
| F1.71 | P1.450 Motor Motor Constant Value | wotor constant value range (increment) | Standard | Constant -torque | PM | |
| 0 ^{*1} | 0 | Standard motor (such as SF-JR) | | 0 | | |
| 1 | • | Constant-torque motor (SF- JRCA, etc.) SF-V5RU (other than the 1500 r/ min series) | Pr.82 (Pr.455), Pr.859 (Pr.860) • 0 to 500 A, 9999 (0.01 A)*3 | | 0 | |
| 2 | _ | Standard motor (such as SF-JR) Adjustable 5 points V/F | • 0 to 3600 A, 9999 (0.1 A)*4 Pr.90 (Pr.458), Pr.91 (Pr.459) | 0 | | |
| 20 | | Mitsubishi Electric standard motor (SF-JR 4P 1.5kW or lower) | • 0 to 50 Ω, 9999 (0.001 Ω)*3 | | 0 | |
| 30 | | Vector control dedicated motor SF-V5RU (1500 r/min series) SF-THY | • 0 to 400 mΩ, 9999 (0.01 mΩ)*4 Pr.92 (Pr.460), Pr.93 (Pr.461) (Induction motor) | | 0 | |
| 40 | | Mitsubishi Electric high-efficiency motor SF-HR | • 0 to 6000 mH, 9999 (0.1 mH)*3 • 0 to 400 mH, 9999 (0.01 mH)*4 | 0 | | |
| 50 | | Mitsubishi Electric constant- torque motor SF-HRCA | Pr.92 (Pr.460), Pr.93 (Pr.461) (PM motor) • 0 to 500 mH, 9999 (0.01 mH) | | 0 | |
| 70 | | Mitsubishi Electric high- performance energy-saving motor SF-PR | • 0 to 50 mH, 9999 (0.001 mH)* ⁴ Pr.94 (Pr.462) • 0 to 100%, 9999 (0.1%)* ³ | | 0 | |
| 330 ^{*2} | | IPM motor MM-CF | • 0 to 100%, 9999 (0.01%)*4 Pr.706 (Pr.738) | | | o (MM-CF) |
| 1140 ^{*2} | | PM motor EM-A | • 0 to 5000 mV (rad/s), 9999 (0.1 mV (rad/s)) | | | ○ (EM-A) |
| 8090 | | IPM motor (other than EM-A/MM-CF) | | | 0 | |
| 9090 | | SPM motor | | | 0 | |

| Pr.71 | Pr.450 | Matar | Motor constant value range (increment) | | Electronic thermal O/L relay function | | |
|----------------------|--------------------|---|--|--|---------------------------------------|------------------|--------------|
| Pr./1 | Pr.450 | Motor | | | Standard | Constant -torque | PM |
| 3 (4)*5 | | Standard motor (such as SF-JR) | | | 0 | | |
| 13 (14) [*] | 5 | Constant-torque motor (SF- JRCA, etc.) SF-V5RU (other than the 1500 r/ min series) | | | | 0 | |
| 23 (24)* | 5 | Mitsubishi Electric standard motor (SF-JR 4P 1.5kW or lower) | | Pr.82 (Pr.455), Pr.859 (Pr.860), Pr.90 (Pr.458), Pr.91 (Pr.459), Pr.92 (Pr.460), Pr.93 (Pr.461), Pr.94 (Pr.462), Pr.706 (Pr.738) • Internal data value 0 to 65534, 9999 (1) | | 0 | |
| 33 (34)* | 5 | Vector control dedicated motor SF-V5RU (1500 r/min series) SF-THY | | | | 0 | |
| 43 (44) [*] | 5 | Mitsubishi Electric high-efficiency motor SF-HR | (Pr.461), Pr | | | | |
| 53 (54) [*] | 5 | Mitsubishi Electric constant- torque motor SF-HRCA | The display increment can be changed in Pr.684. | | | 0 | |
| 73 (74) [*] | 5 | Mitsubishi Electric high- performance energy-saving motor SF-PR | | | | 0 | |
| 333 (33 | 4) ^{*2*5} | IPM motor MM-CF | | | | | ○ (MM-CF) |
| 8093 (8 | 094) ^{*5} | IPM motor (other than EM-A/MM-CF) | | | | 0 | |
| 9093 (9 | 094) ^{*5} | SPM motor | | | | 0 | |
| 5 | | Standard motor | Wye | Pr.82 (Pr.455), Pr.859 (Pr.860) • 0 to 500 A, 9999 (0.01 A)*3 • 0 to 3600 A, 9999 (0.1 A)*4 | 0 | | |
| 15 | | Constant-torque motor | connection | | | 0 | |
| 6 | | Standard motor | • 0 to 400 mΩ, 9999 (0.01 mΩ) • Pr.92 (Pr.460), Pr.93 (Pr.461) • 0 to 50 Ω, 9999 (0.001 Ω)*3 • 0 to 3600 mΩ, 9999 (0.1 mΩ)*4 | | 0 | | |
| 16 | | Constant-torque motor | connection | Pr.94 (Pr.462) • 0 to 500 Ω, 9999 (0.01 Ω)*3 • 0 to 100 Ω, 9999 (0.01 Ω)*4 | | 0 | |
| _ | 9999*1 | No second applied motor | | , () | I | I | I |

^{*1} Initial value.

^{*2} The setting is available only for the inverters with the capacity applicable for the motor.

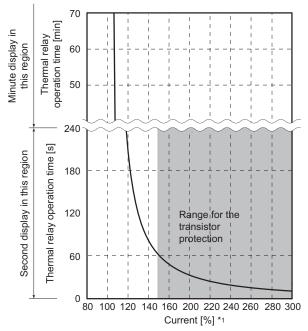
^{*3} For the FR-A820-55K(03160) or lower and FR-A840-55K(01800) or lower.

^{*4} For the FR-A820-75K(03800) or higher and FR-A840-75K(02160) or higher.

^{*5} The same operation is performed for the both settings.

2.6 Electronic thermal O/L relay (Pr.9)

- This function detects the overload (overheat) of the motor and shuts off the inverter output by stopping the operation of the transistor at the inverter output side.
- Set the rated current (A) of the motor in **Pr.9 Electronic thermal O/L relay**. Performing IPM parameter initialization automatically sets the rated current of the IPM motor.
- Set "0" in **Pr.9** to avoid activating the electronic thermal relay function; for example, when using an external thermal relay for the motor. (Note that the output transistor protection of the inverter is activated. (E.THT))
- · Operational characteristic of the electronic thermal O/L relay when the EM-A motor is used



Protective function activated area: the area right of the characteristic curve Normal operation area: the area left of the characteristic curve

*1 The % value denotes the percentage to the rated motor current.



- The internal accumulated heat value of the electronic thermal relay function is reset to the initial value by the inverter's power reset or reset signal input. Avoid unnecessary reset and power-OFF.
- The transistor protection thermal O/L relay is activated early when the Pr.72 PWM frequency selection setting is increased.

2.7 Brake sequence function

The brake sequence function is available when the EM-A motor is used.

For details on the brake sequence function, refer to "5.14.3 Brake sequence function" in the Instruction Manual (Detailed).

2.8 Automatic restart after instantaneous power failure function

The automatic restart after instantaneous power failure function is available when the EM-A motor is used.

When the EM-A motor is used, the frequency search is available at 450 r/min or higher.

For details on the automatic restart after instantaneous power failure function, refer to "5.14.15 Automatic restart after instantaneous power failure/flying start with a PM motor" in the Instruction Manual (Detailed).

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