QUEENSLAND URBAN UTILITIES

HUDDART STREET, ALDERLEY

WATER BOOSTER PUMP STATION

WB002

ELECTRICAL SWITCHBOARD

OPERATION AND MAINTENANCE MANUAL

Developed by:

J & P RICHARDSON INDUSTRIES
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1 INTRODUCTION

These operating instructions cover the Huddart Street, Alderley Pumping Station WB002 electrical equipment supplied by J & P Richardson Industries Pty Ltd in 2011, 2012.

1.1 OPERATING INSTRUCTIONS

Normal operation of the pumping station is in the automatic mode with control by means of a Master Programmable Logic Controller (PLC), which receives level signals from the Level Measurement System in the wet well/Electronic Level Relays/Float Switches.

Manual operation control of the station is available by means of selector switches on the motor control switchboard.

2 DESCRIPTION OF OPERATION

2.1 MODE SELECTION

The station can be operated either automatically or manually with mode selection being made by means of the mode selector switches mounted on each pump section of the switchboard. These selector switches are designated with the following mode selections AUTO-OFF-MAN.

2.2 MANUAL CONTROL

Each pumping unit can be run in manual control from the motor control centre by: -

a) Selecting the "MAN" setting on the "MODE SELECTOR SWITCHES" as described in Clause 2.1
b) Starting by “START” pushbutton.
c) Stopping by “STOP” pushbutton.

N.B. DO NOT LEAVE IN MANUAL WHILE STATION UNATTENDED

2.3 AUTOMATIC CONTROL

For automatic control of the station: -

a) The "MODE SELECTOR SWITCHES" on the switchboard should be in the "AUTO" position.
b) The "DUTY SELECTOR SWITCH" should be set to provide the desired pump operation sequence. The "DUTY SELECTOR SWITCH" is marked: -

   1-2 2-1

   The pumps should be alternated at regular intervals to ensure that each pump unit has a reasonably equal running time. The total running hours of each pump unit is displayed on the hour meter located on each pump section of the switchboard.
c) The automatic Duty Selection is done via the PLC software. Refer PLC SOFTWARE Section for details. The total running hours of each pump unit is displayed on the hour meter located on each pump section of the switchboard.
d) The automatic starting and stopping of the pumps is controlled by signals from the Master PLC.

For NORMAL OPERATION, each of the pump selector switches should have "AUTO" mode selected.

In the AUTOMATIC mode the selected Duty Pump unit will start automatically as preset by the level in the wet well. In the event of the duty pump not being capable of supplying enough flow to continue draining the wet well and the well level rises to a second preset level, then the Standby Pump unit will automatically start, to provide additional pumping. The supplementary pump unit also takes over for the respective pump duty on the occurrence of one the Duty Pump unit failing.

3 PUMPS

SUPPLIER:

Grundfos
30 Blanck Street
Ormeau Qld 4208

Ph: (07) 5540 6700
Fax: (07) 5540 6710

MODEL: Hydro MPC-E 4xCRE45-2

kW RATING: 7.5

GRUNDFOS **INSTRUCTIONS**

BoosterpaQ - Hydro MPC

US **Installation and operating instructions**

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GRUNDFOS

LIMITED WARRANTY

Products manufactured by GRUNDFOS PUMPS CORPORATION (Grundfos) are warranted to the original user only to be free of defects in material and workmanship for a period of 24 months from date of installation, but not more than 30 months from date of manufacture. Grundfos' liability under this warranty shall be limited to repairing or replacing at Grundfos' option, without charge, F.O.B. Grundfos' factory or authorized service station, any product of Grundfos' manufacture. Grundfos will not be liable for any costs of removal, installation, transportation, or any other charges which may arise in connection with a warranty claim. Products which are sold but not manufactured by Grundfos are subject to the warranty provided by the manufacturer of said products and not by Grundfos' warranty. Grundfos will not be liable for damage or wear to products caused by abnormal operating conditions, accident, abuse, misuse, unauthorized alteration or repair, or if the product was not installed in accordance with Grundfos' printed installation and operating instructions.

To obtain service under this warranty, the defective product must be returned to the distributor or dealer of Grundfos' products from which it was purchased together with proof of purchase and installation date, failure date, and supporting installation data. Unless otherwise provided, the distributor or dealer will contact Grundfos or an authorized service station for instructions. Any defective product to be returned to Grundfos or a service station must be sent freight prepaid; documentation supporting the warranty claim and/or a Return Material Authorization must be included if so instructed.

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Some jurisdictions do not allow the exclusion or limitation of incidental or consequential damages and some jurisdictions do not allow limit actions on how long implied warranties may last. Therefore, the above limitations or exclusions may not apply to you. This warranty gives you specific legal rights and you may also have other rights which vary from jurisdiction to jurisdiction.

CONTENTS

Warning

Prior to installation, read these installation and operating instructions. Installation and operation must comply with local regulations and accepted codes of good practice.

1. Symbols used in this document

Warning

If these safety instructions are not observed, it may result in personal injury!

Caution ***If these safety instructions are not observed, it may result in malfunction or damage to the equipment!***

Note ***Notes or instructions that make the job easier and ensure safe operation.***

2. Scope of these instructions

These installation and operating instructions apply to Grundfos Hydro MPC booster systems.

Hydro MPC is a range of factory-assembled booster systems, ready for installation and operation.

3. Product description

As standard, Hydro MPC booster systems consist of two to six CR(E) pumps coupled in parallel and mounted on a common base frame with all the necessary fittings and a control panel.

Note ***A diaphragm tank is required in most installations.***

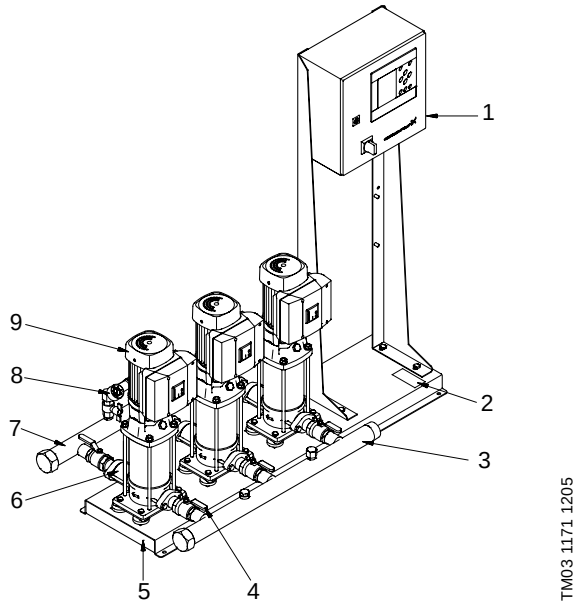


Fig. 1 Hydro MPC booster system

Pos.	Description	Quantity
1	Control panel	1
2	Nameplate	1
3	Suction manifold (stainless steel)	1
4	Isolating valve	2 per pump
5	Base frame (stainless steel)	1
6	Non-return valve	1 per pump
7	Discharge manifold (stainless steel)	1
8	Pressure transmitter/pressure gauge	2
9	Pump	2 - 6

Hydro MPC booster systems are divided into seven groups based on control variant:

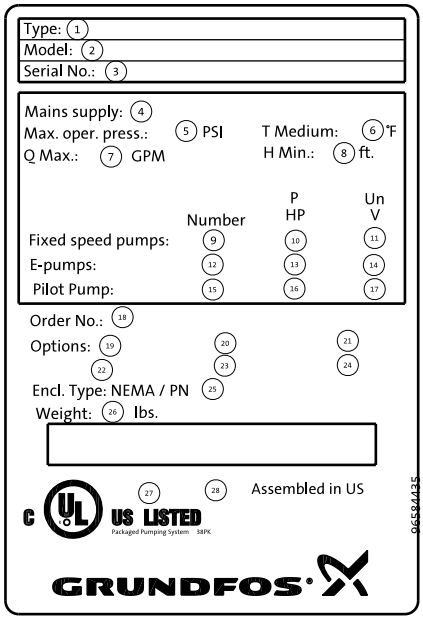
Control variant	Description
-E	Two to six CRE pumps
-ED	Two CRE pumps and up to four constant speed CR pumps
-ES	One CRE pump and up to five constant speed CR pumps
-EF	Two to six CR pumps connected to external variable frequency drives (VFD)
-EDF	Two CR pumps connected to external variable frequency drives and up to four constant speed CR pumps
-F	Up to six CR pumps connected to an external variable frequency drive. The speed-controlled operation alternates between the pumps.
-S	Two to six constant speed CR pumps

See also section *6.1 Examples of control variants*.

Hydro MPC booster systems always includes application-optimised software for setting the booster system to the application in question.

4. Nameplate

The nameplate of the booster system is fitted on the base frame. See position 2 in fig. 1.



TM03 1741 3105

Fig. 2 Nameplate

Pos.	Description
1	Type designation
2	Model
3	Serial number
4	Supply voltage
5	Maximum operating pressure in PSI
6	Liquid temperature in °F
7	Maximum flow rate in GPM
8	Minimum head in feet
9	Number of fixed speed and/or auxiliary pumps
10	Motor power in HP for fixed speed pumps
11	Nominal voltage in volts for fixed speed pumps
12	Number of E-pumps
13	Motor power in HP for E-pumps
14	Nominal voltage in volts for E-pumps
15	Number of pilot pumps
16	Motor power in HP for pilot pump
17	Nominal voltage in volts for pilot pump
18	Order number
19-24	Options
25	Enclosure type
26	Weight in lbs
27	Approval marks
28	Production location & date code

5. Software label

The software label is placed on the back of the CU 351 controller.

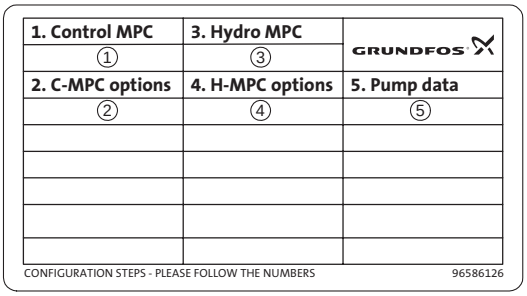


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Fig. 3 Software label

Pos.	Description
1	Control MPC - GSC file number
2	Control MPC options - GSC file numbers
3	Hydro MPC - GSC file number
4	Hydro MPC options - GSC file numbers
5	Pump data - GSC file numbers

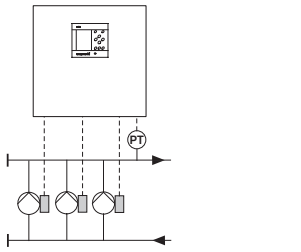
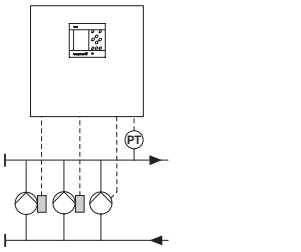
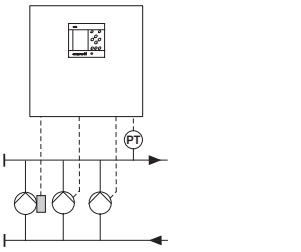
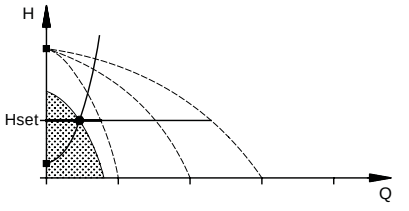
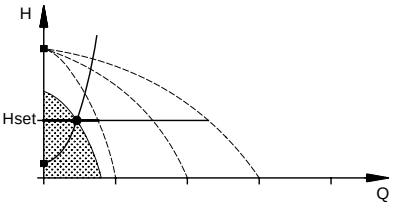
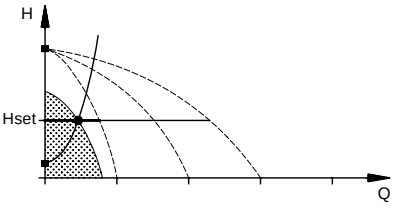
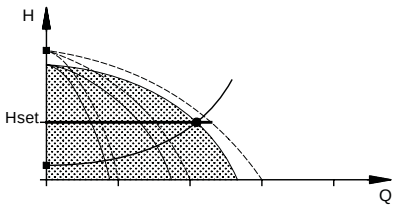
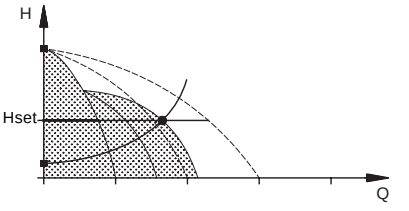
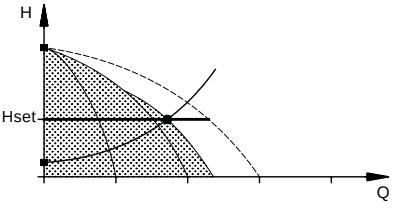
Note ***A GSC (Grundfos Standard Configuration) file is a configuration data file.***

6. Type key

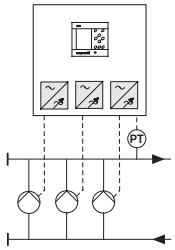
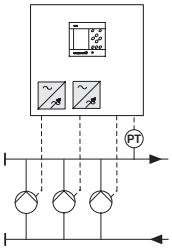
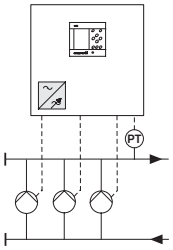
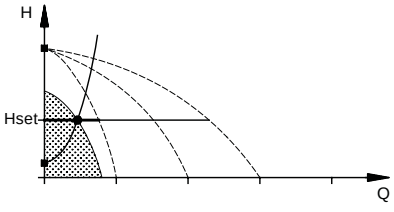
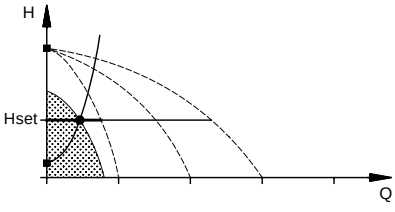
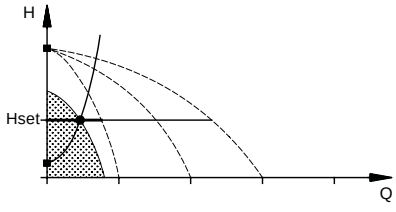
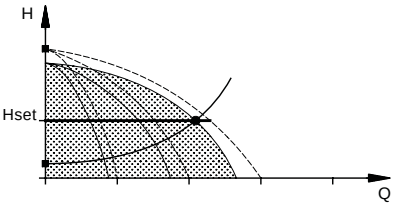
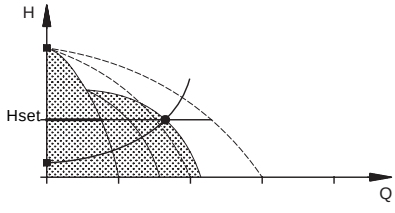
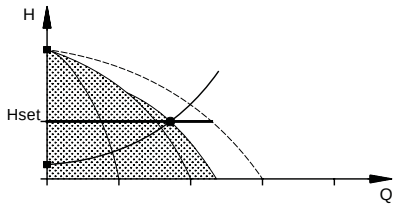
Example	Hydro MPC	-ED	2 CRE 5-10	1 CR 5-10	3x460 V, 60Hz
Type range					
Subgroups: Pumps with integrated variable frequency drive: -E, -ED, -ES Pumps with external VFD: -EF, -EDF, -F Constant speed pumps (start/stop): -S					
Number of pumps with integrated variable frequency drive and pump type					
Number of constant speed pumps and pump type					
Supply voltage, frequency					

6.1 Examples of control variants

Booster systems with motors that include an integrated variable frequency drive (CRE)

Hydro MPC-E	Hydro MPC-ED	Hydro MPC-ES
Hydro MPC booster system with three CRE pumps.	Hydro MPC booster system with two CRE pumps and one constant speed CR pump.	Hydro MPC booster system with one CRE pump and two constant speed CR pumps.
 TM03 0993 0905	 TM03 0994 0905	 TM03 0996 0905
One CRE pump in operation.	One CRE pump in operation.	One CRE pump in operation.
 TM00 7995 2296	 TM00 7995 2296	 TM00 7995 2296
Three CRE pumps in operation.	Two CRE pumps and one constant speed CR pump in operation.	One CRE pump and two constant speed CR pumps in operation.
 TM00 7996 2296	 TM03 0814 0505	 TM00 7998 2296
• The MPC-E system maintains a constant pressure through continuous adjustment of the speed of the pumps. • The system performance is adjusted to the demand through cutting in/out the required number of pumps and through parallel control of the pumps in operation. • Pump changeover is automatic and depends on load, operating hours and fault. • All pumps in operation will run at equal speed.	• The MPC-ED system maintains a constant pressure through continuous adjustment of the speed of two CRE pumps, while the CR pump is constant speed. • One CRE pump always starts first. If the pressure cannot be maintained by the pump, the second CRE pump will be cut in. If the two CRE pumps cannot maintain the pressure, the CR pump will be cut in. • Pump changeover is automatic and depends on load, operating hours and fault.	• The MPC-ES system maintains a constant pressure through continuous adjustment of the speed of the CRE pump. The other pumps are cut in/out according to demand to achieve a performance corresponding to the consumption. • The CRE pump always starts first. If the pressure cannot be maintained by the pump, one or both CR pumps will be cut in. • Changeover among the constant speed pumps is automatic and depends on load, operating hours and fault.

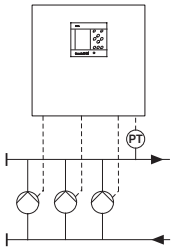
Booster systems with motors connected to external variable frequency drive (VFD)

Hydro MPC-EF	Hydro MPC-EDF	Hydro MPC-F
Hydro MPC booster system with three CR pumps connected to external variable frequency drives in the control panel.	Hydro MPC booster system with two CR pumps connected to external frequency converters in the control cabinet and one constant speed CR pump.	Hydro MPC booster system with three CR pumps connected to an external frequency converter in the control cabinet. The speed-controlled operation alternates between the pumps.
 TM03 0995 0905	 TM03 0997 0905	 TM03 1265 1505
One CR pump in operation.	One CR pump connected to an external variable frequency drive in operation.	One CR pump connected to an external variable frequency drive in operation.
 TM00 7995 2296	 TM00 7995 2296	 TM00 7995 2296
Three CR pumps in operation.	Two CR pumps connected to external variable frequency drives and one constant speed CR pump in operation.	One CR pump connected to an external variable frequency drive and two constant speed CR pumps in operation.
 TM00 7996 2296	 TM03 0814 0505	 TM00 7998 2296
• The MPC-EF system maintains a constant pressure through continuous adjustment of the speed of the pumps. • The system performance is adjusted to the demand through cutting in/out the required number of pumps and through parallel control of the pumps in operation. • Pump changeover is automatic and depends on load, operating hours and fault. • All pumps in operation will run at equal speed.	• The MPC-EDF system maintains a constant pressure through continuous adjustment of the speed of two CR pumps connected to external variable frequency drives, while the third CR pump is constant speed. • One CR pump connected to an external variable frequency drive always starts first. If the pressure cannot be maintained by the pump, the second CR pump connected to an external variable frequency drive will be cut in. If the pressure cannot be maintained by the two pumps, the constant speed CR pump will be cut in. • Pump changeover is automatic and depends on load, operating hours and fault.	• The MPC-F system maintains a constant pressure through continuous adjustment of the speed of the CR pump connected to the external variable frequency drive. The speed-controlled operation alternates between the pumps. • One CR pump connected to the external variable frequency drive always starts first. If the pressure cannot be maintained by the pump, one or two constant speed CR pumps will be cut in. • Pump changeover is automatic and depends on load, operating hours and fault.

Booster system with constant speed pumps (on/off)

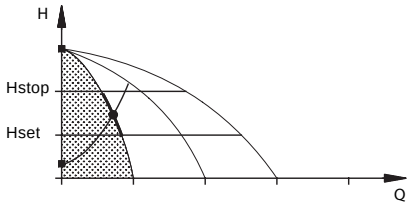
Hydro MPC-S

Hydro MPC booster system with three constant speed CR pumps.



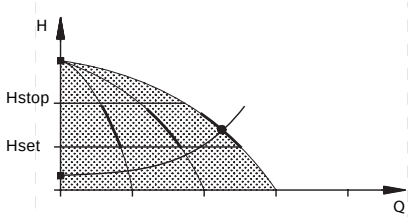
TM03 0999 0905

One constant speed CR pump in operation.



TM03 9204 3607

Three constant speed CR pumps in operation.



TM03 9203 3607

- Hydro MPC-S maintains a pressure differential through cutting in/out the required number of pumps.
- The operating range of the pumps will lie between H_{set} and H_{stop} (cut-out pressure).
- Pump changeover is automatic and depends on load, operating hours and fault.

7. Installation

Warning

Installation and operation must comply with local regulations and accepted codes of good practice.

Before installation check that

- the booster system corresponds to the one ordered.
- no visible parts have been damaged.

7.1 Mechanical installation

7.1.1 Location

The booster system must be installed in a well ventilated room to ensure sufficient cooling of the motors and control panel.

Note ***Hydro MPC is not designed for outdoor installation unless protected and must not be exposed to direct sunlight.***

The booster system must have a 3 feet clearance in front and on the two sides for inspection and dismantling.

7.1.2 Pipework

Arrows on the pump base show the direction of flow of water through the pump.

The pipework connected to the booster system must be of adequate size. The pipes are connected to the manifolds of the booster system. Either end can be used. Apply sealing compound to the unused end of the manifold and fit the screw cap. For manifolds with flanges, fit a blanking flange with gasket.

To achieve optimum operation and minimise noise and vibration, it may be necessary to consider vibration dampening of the booster system.

Noise and vibration are generated by the rotations in the motor and pump and by the flow in pipework and fittings. The effect on the environment is subjective and depends on correct installation and the state of the other parts of the system.

If booster system is to be installed where first customer on the line is close to the booster system, it is advisable to fit expansion joints on the suction and discharge pipes to prevent vibration being transmitted through the pipework.

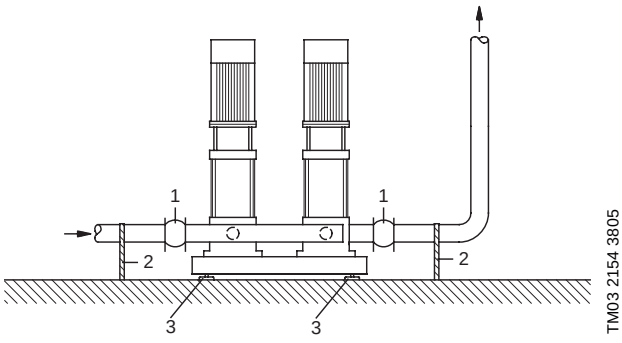


Fig. 4 Sketch showing the position of expansion joints, pipe supports and machine shoes

Pos.	Description
1	Expansion joint
2	Pipe support and good location for system isolation valve (not shown)
3	Machine shoe

Note ***Expansion joints, pipe supports and machine shoes shown in the figure above are not supplied with a standard booster system.***

All nuts should be checked and re-tightened if necessary prior to start-up.

The pipes must be fastened to parts of the building to ensure that they cannot move or be twisted.

7.1.3 Foundation

The booster system should be positioned on an even and solid surface, for instance a concrete floor or foundation. If the booster system is not fitted with machine shoes, it must be bolted to the floor or foundation.

Note ***As a rule the weight of a concrete foundation should be 1.5 x the weight of the booster system.***

7.1.4 Vibration dampers

To prevent the transmission of vibrations to buildings, it imay be necessary to isolate the booster system foundation from building parts by means of vibration dampers.

The right damper varies from installation to installation, and a wrong damper may increase the vibration level. Vibration dampers should therefore be sized by the supplier of vibration dampers. If the booster system is installed on a base frame with vibration dampers, expansion joints should always be fitted on the manifolds. This is important to prevent the booster system from "hanging" in the pipework.

7.1.5 Expansion joints

Expansion joints are installed to

- absorb expansions/contractions in the pipework caused by changing liquid temperature
- reduce mechanical strains in connection with pressure surges in the pipework
- isolate mechanical structure-borne noise in the pipework (only rubber bellows expansion joints).

Note ***Expansion joints must not be installed to compensate for inaccuracies in the pipework such as center displacement of flanges.***

Fit expansion joints at a distance of minimum 1 to 1 1/2 times the nominal flange diameter from the manifold on the suction as well as on the discharge side. This prevents the development of turbulence in the expansion joints, resulting in better suction conditions and a minimum pressure loss on the pressure side. At high water velocities (> 10 ft/sec) it is advisable to install larger expansion joints corresponding to the pipework.

Fig. 5 Examples of rubber bellows expansion joints without and with limit rods

Expansion joints with limit rods can be used to minimise the forces caused by the expansion joints. Expansion joints with limit rods are always recommended for flanges larger than 6 inches.

The pipework should be anchored so that it does not stress the expansion joints and the pump. Follow the supplier's instructions and pass them on to advisers or pipe installers.

7.2 Electrical installation

Warning

The electrical installation should be carried out by an authorized person in accordance with local regulations and the relevant wiring diagram.

- The electrical installation of the booster system must comply with enclosure class IP54.
- Make sure that the booster system is suitable for the electricity supply to which it is connected.
- Make sure that the wire cross-section corresponds to the specifications in the wiring diagram.

The connection of the electrical supply, transmitters and external monitoring equipment must be carried out by an authorized electrician in accordance with the NEC, local regulations and the BoosterpaQ wiring diagram.

Ensure that the Hydro MPC controls and the pumps are suitable for the electricity supply on which they will be used (see Technical Data). Please read the wiring diagram carefully. According to the NEC, if the motors cannot be seen from the control panel, they must be fitted with a disconnect switch.

Any BoosterpaQ that utilizes a variable frequency drive (E, ED, ES, EF, EDF, F) should be connected to an electrical supply with all phase lines electrically symmetrical with respect to ground. A "four wire wye" electrical supply with line impedance between 0.5% - 3% is recommended. If a variable frequency drive is connected to a delta transformer or if line impedance is not within the recommended 0.5% - 3%, the drive may not operate correctly and may not provide optimum performance (excessive faults, erratic behavior, or complete failure). Ask your power company or electrician to determine what type of electrical supply is present. Generator supplied power must meet public utility power quality standards.

7.3 Start-up

1. Have a qualified person check for proper power supply and plumbing connections. Make sure the main power is off.
2. Check that the air pre-charge in the diaphragm tank is 0.7 times the required discharge pressure set-point (0.9 times for MPC-S systems). System pressure must not be applied to the tank connection during the tank precharge process. If water is supplied to the tank from the system, close the tank valve and bleed off the pressure in the tank before the pressurizing process.

Prime the system as follows

3. **Suction pressure system** (pumps are flooded at least as high as the highest part of the pumps)
   – close all discharge manifold pump isolation valves and open all inlet manifold pump isolation valves
   – open the vent plug on top of each pump. It is a small hex head screw in a large vent plug. Air and water will escape from the pump through a small hole in the large vent plug. When the air is out and water is flowing steadily, tighten the small hex head screw on the vent plug to stop the flow.

Note ***If you are filling an empty piping system, do not allow the pumps to run with the discharge valves wide open as cavitation may occur.***

4. **Suction lift system** (the water source is below the pumps or does not flood the pumps to the highest point on the pumps).
   – close all discharge manifold pump isolation valves and open all inlet manifold pump isolation valves
   – for suction lift applications, a foot valve must be placed on the inlet piping at the water source (tank, etc). If there is a fill point above the highest point of the pumps, you may fill the system from this point. If there is no fill point above the highest point of the pumps, remove the large vent plug on each pump. Fill each pump until the water is up to the vent plug, then replace the vent plugs.
5. Ensure all circuit breakers are in the "on" position.
6. Make sure the discharge manifold pump isolation valves are closed. Switch on main power.

Caution ***The pumps may start at this time.***

7. At this time "Start-up wizard" may now be ran. Step 8 can be skipped upon completion of "Start-up wizard". If "Start-up wizard" could not be ran or already ran proceed to step 8.
8. Run the "Start-up wizard" again by performing the following: Move top line display to "Settings". If prompted for password enter "6814", next move down to "Functions, CU 351" and press the "OK" button. Now move down to "Run wizard again" and press the "OK" button.
9. Vent the system by opening the vent plug on each pump (as in Step 3, while the pump is running starting in step 18 of the "Start-up wizard".). Venting with the pumps running ensures all air is removed from the suction piping. Do not run the system with the discharge manifold pump isolation valves closed more than five minutes to prevent over-heating of the pump liquid.
10. As pumps stop, check pump rotation. Repeat as necessary. If the area is dark, a flashlight may be required, or remove a coupling guard on each pump for better visibility. Disconnect the main power when removing coupling guards.

Warning

Do not touch the couplings while the pumps are turning as injury may result. Replace all coupling guards after the rotation check. Disconnect main power when removing and replacing coupling guards (or open service disconnect switches if this option was supplied).

If the rotation is incorrect on any 3 phase pumps, switch any 2 of the 3 power main wires supplied to the control panel (L1, L2, L3). If that doesn't correct the rotation, call your Grundfos representative.

Note ***If you are filling an empty piping system, do not allow the pumps to run with the discharge valves wide open as cavitation may occur.***

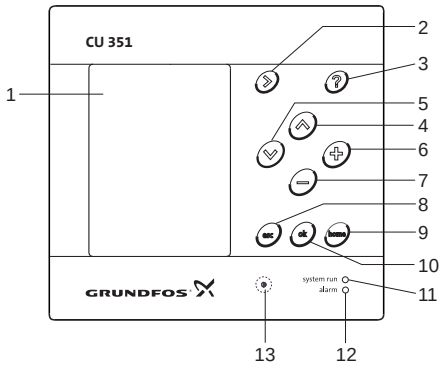
11. Upon completion of venting pumps and checking for correct rotation you are now ready to bring the BoosterpaQ into normal operation. With the discharge manifold isolation valves still closed, partially open each pump discharge isolation valve to allow water to enter into the discharge piping of the BoosterpaQ. Continue the process of filling the discharge piping until discharge piping pressure is approximately at the desired Setpoint pressure of the BoosterpaQ.
12. Open the discharge manifold isolation valves for each pump completely. System is now ready for operation.

It may be necessary to clear alarms in the fault log. Follow the steps in paragraph sections *9.6* to clear alarms.

INSTALLATION AND STARTUP NOTES

8. Control panel

The control panel in the front cover of the control cabinet features a display, a number of buttons and two indicator lights. The control panel enables manual setting and monitoring of the performance of the Hydro MPC.



TM03 1304 1705

Fig. 6 Control panel

Key

Pos.	Description
1	Display
2	Arrow to the right
3	Help
4	Up
5	Down
6	Plus
7	Minus
8	Esc
9	Home
10	Ok
11	Indicator light, operation (green)
12	Indicator light, fault (red)
13	Contrast

8.1 Display (pos. 1)

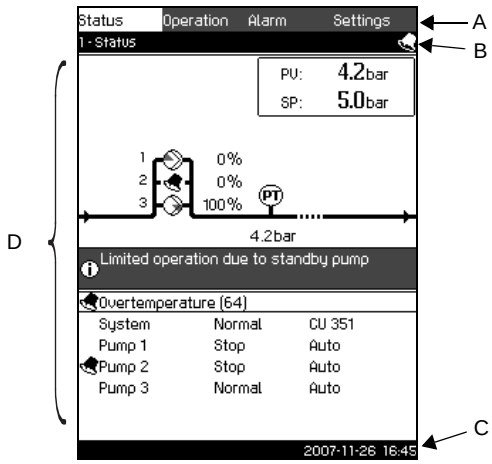


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Fig. 7 Display design

8.1.1 Menu line

The menu line (A) is illustrated in fig. 7.

The display has four main menus:

Status:	Indication of system status
Operation:	Change of operating parameters such as setpoint (password option)
Alarm:	Alarm log for fault finding
Settings:	Change of settings (password option)

8.1.2 Top line

The top line (B) is illustrated in fig. 7.

The top line shows

- the display number and title (left side)
- the selected menu (left side)
- the symbol in case of alarm (right side)
- the symbol if the service language has been selected (right side).

8.1.3 Graphical illustration

The graphical illustration (D) may show a status, an indication or other elements, depending on the position in the menu structure.

The illustration may show the entire system or part of it as well as various settings.

8.1.4 Scroll bar

If the list of illustration elements exceeds the display, the symbols and will appear in the scroll bar to the right. Use the and buttons to move up and down in the list.

8.1.5 Bottom line

The bottom line (C) shows the date and time.

8.2 Buttons and indicator lights

The buttons (pos. 2 to 10 in fig. 6) on the CU 351 are active when they are illuminated.

8.2.1 Arrow to the right (pos. 2)

Press the (›) button to move to the next menu in the menu structure. If you press (›) when the **Settings** menu is highlighted, you go to the **Status** menu.

8.2.2 Help (pos. 3)

When the (?) button is illuminated, a help text applying to the current display will appear if the button is pressed.

Close the text by pressing the (esc) button.

8.2.3 Up and down (pos. 4 and 5)

Press the (^) and (v) buttons to move up and down in lists.

A text can be selected when it is in a box.

If a text is marked and the (^) button is pressed, the text above will be marked instead. If the (v) button is pressed, the text below will be marked.

If the (v) button is pressed in the last line in the list, the first line will be marked.

If the (^) button is pressed in the first line in the list, the last line will be marked.

8.2.4 Plus and minus (pos. 6 and 7)

Use the (+) and (–) buttons to increase and reduce values.
A value is activated when the (ok) button is pressed.

8.2.5 Esc (pos. 8)

Use the (esc) button to go one display back in the menu.

If a value has been changed and the (esc) button is pressed, the new value will not be saved. For further information, see section *8.2.7 Ok (pos. 10)*.

If the (ok) button is pressed before the (esc) button, the new value will be saved. For further information, see section *8.2.7 Ok (pos. 10)*.

8.2.6 Home (pos. 9)

Press the (home) button to return to the **Status** menu.

8.2.7 Ok (pos. 10)

Use the (ok) button as an enter button.

The (ok) button is also used to start the setting of a value.

If a value has been changed and the (ok) button is pressed, the new value will be activated.

8.2.8 Indicator lights (pos. 11 and 12)

The Hydro MPC control panel incorporates a green and red indicator light.

The green indicator light is on when the Hydro MPC is in operation.It is flashing if the Hydro MPC has been set to stop.

The red indicator light is on if there is an alarm or a warning. The fault can be identified from the alarm list.

8.2.9 Contrast (pos. 13)

The contrast in the display can be changed by means of the (◑) button:

1. Press (◑).
2. Adjust the contrast with (+) and (–).

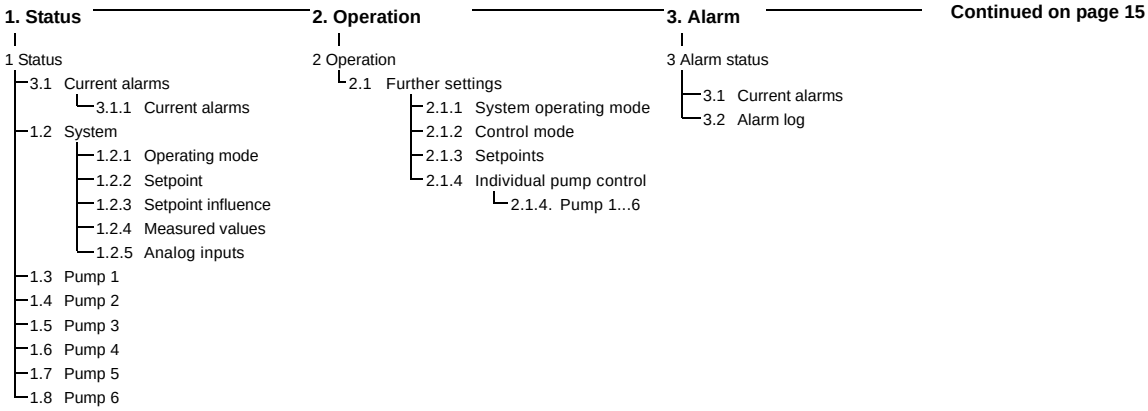
8.2.10 Back light

If no button is touched for 15 minutes, the back light of the panel will be dimmed, and the first display in the **Status** menu will appear.

Press any button to re-activate the back light.

9. Functions

9.1 Tree of functions



Continued on page 15

Key to the four main menus, Status, Operation, Alarm and Settings

Status
The **Status** menu shows alarms and the status of system and pumps. **Note:** No settings can be made in this menu.
Operation
In the **Operation** menu, the most basic parameters can be set, such as setpoint, operating mode, control mode and individual pump control.
Alarm
The **Alarm** menu gives an overview of alarms and warnings. Alarms and warnings can be reset in this menu.
Settings
In the **Settings** menu, it is possible to set various functions: • Primary controller Setting of alternative setpoints, external setpoint influence, primary sensor, clock program, proportional pressure and S-system configuration. • Pump cascade control Setting of min. time between start/stop, max. number of starts/hour, number of standby pumps, forced pump changeover, pump test run, pilot pump, pump stop attempt, pump start and stop speed, min. performance and compensation for pump start-up time. • Secondary functions Setting of stop function, soft pressure build-up, digital and analog inputs, digital outputs, emergency run, min., max. and user-defined duty, pump curve data, flow estimation, control source and fixed inlet pressure. • Monitoring functions Setting of dry-running protection, min. and max. pressure, external fault, limit 1 and 2 exceeded, pumps outside duty range and pressure relief. • Functions, CU 351 Selection of service language, main language and units. Setting of date and time, passwords, Ethernet connection, GENIbus number and software status.

Continued from page 16

4. Settings

- 4.1 Primary controller
  - 4.1.1 PI controller
  - 4.1.2 Alternative setpoints
    - 4.1.2.1 Alternative setpoints 2...7
  - 4.1.3 External setpoint influence
    - 4.1.3.1 Set the influence function
      - 4.1.3.2 Setting of influence function
  - 4.1.4 Primary sensor
  - 4.1.6 Clock program
  - 4.1.7 Proportional pressure
  - 4.1.8 S-system configuration
- 4.2 Pump cascade control
  - 4.2.1 Min. time between start/stop
    Max. number of starts/hour
  - 4.2.3 Standby pumps
  - 4.2.4 Forced pump changeover
  - 4.2.5 Pump test run
  - 4.2.6 Pilot pump
  - 4.2.7 Pump stop attempt
  - 4.2.8 Pump start and stop speed
  - 4.2.9 Min. performance
  - 4.2.10 Compensation for pump start-up time
- 4.3 Secondary functions
  - 4.3.1 Stop function
    - 4.3.1.1 Stop parameters
  - 4.3.3 Soft pressure build-up
  - 4.3.5 Emergency run
  - 4.3.7 Digital inputs
    - Function, DI1..DI3 (CU 351), [10, 12, 14]
    - Function, DI1..DI9 (IO 351-41), [10...46]
    - Function, DI1..DI9 (IO 351-42), [10...46]
  - 4.3.8 Analog inputs
    - Setting, analog input AI1..AI3 (CU 351), [51, 54, 57]
      - Function, AI1...AI3 (CU 351), [51, 54, 57]
    - Setting, AI1..AI2 (IO 351-41), [57, 60]
      - Function, AI1..AI2 (IO 351-41), [57, 60]
    - Setting, AI1..AI2 (IO 351-42), [57, 60]
      - Function, AI1..A2 (IO 351-42), [57, 60]
  - 4.3.9 Digital outputs
    - Function, DO1 and DO2 (CU 351), [71, 74]
    - Function, DO1...DO7 (IO 351-41), [77...88]
    - Function, DO1...DO7 (IO 351-42), [77...88]
  - 4.3.14 Min., max. and user-defined duty
    - 4.3.14.1 Min. duty
    - 4.3.14.2 Max. duty
    - 4.3.14.3 User-defined duty
  - 4.3.19 Pump curve data
    - 4.3.23 Flow estimation
  - 4.3.20 Control source
  - 4.3.22 Fixed inlet pressure
  - 4.3.23 Flow estimation
- 4.4 Monitoring functions
  - 4.4.1 Dry-running protection
    - 4.4.1.1 Pressure/level switch
    - 4.4.1.2 Measurement, inlet pressure
    - 4.4.1.3 Measurement, tank level
  - 4.4.2 Min. pressure
  - 4.4.3 Max. pressure
  - 4.4.4 External fault
  - 4.4.5 Limit 1 exceeded
  - 4.4.6 Limit 2 exceeded
  - 4.4.7 Pumps outside duty range
  - 4.4.8 Pressure relief

Continued from page 16

4. Settings

- 4.5 Functions, CU 351
  - Change language to service language (GB)
  - Run wizard again
  - 4.5.1 Display language
  - 4.5.2 Display units
    - 4.5.2.1 Units for pressure
    - 4.5.2.2 Units for differential pressure
    - 4.5.2.3 Units for head
    - 4.5.2.4 Units for level
    - 4.5.2.5 Units for flow rate
    - 4.5.2.6 Units for volume
    - 4.5.2.7 Units for specific energy
    - 4.5.2.8 Units for temperature
    - 4.5.2.9 Units for power
    - 4.5.2.10 Units for energy
  - 4.5.3 Date and time
  - 4.5.4 Password
  - 4.5.5 Ethernet
  - 4.5.6 GENIbus number
  - 4.5.9 Software status

9.2 Overview

9.3 Description of functions

The description of functions is based on the four main menus of the CU 351 control unit: **Status**, **Operation**, **Alarm** and **Settings**.

The functions apply to all control variants unless otherwise stated.

9.4 Status (1)

The first status display is shown below. This display is shown when the Hydro MPC is switched on, and it appears when the buttons of the control panel have not been touched for 15 minutes.

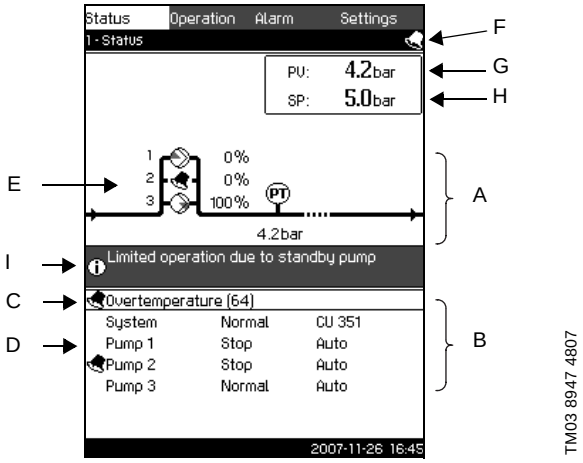


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Fig. 8 Status

Description

No settings can be made in this menu.

The current value (process value, PV) of the control parameter, usually the discharge pressure, is shown in the upper right corner (G) together with the selected setpoint (SP) (H).

The upper half of the display (A) shows a graphic illustration of the Hydro MPC booster system and part of the system. The selected measuring parameters are shown with sensor symbol and current value.

In the middle of the display, an information field (I) is shown if any incidents occur.

The lower display half (B) shows

- the latest current alarm, if any, and the fault cause together with the fault code in brackets
- system status with current operating mode and control source
- pump status with current operating mode and manual/auto.

Note

If a fault has occurred, the symbol will be shown in the alarm line (C) together with the cause and fault code, for instance Limit 2 exceeded (191).

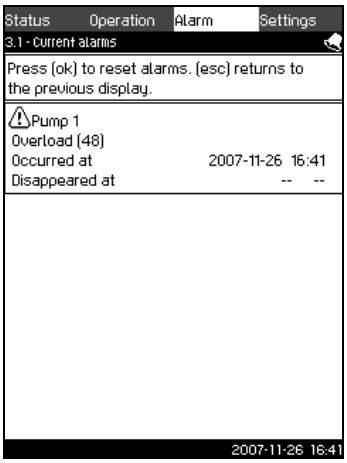
If the fault is related to one of the pumps, the symbol will also be shown in front of the status line (D) of the pump in question. At the same time, the symbol will be flashing instead of the pump symbol (E). The symbol will be shown to the right in the top line of the display (F). As long as a fault is present, this symbol will be shown in the top line of all displays.

To open a menu line, mark the line with ⌄ or ⌃, and press ok.

The display makes it possible to open status displays showing

- current alarms
- system status
- status of each pump.

9.4.1 Current alarms (3.1)



TM03 2293 4807

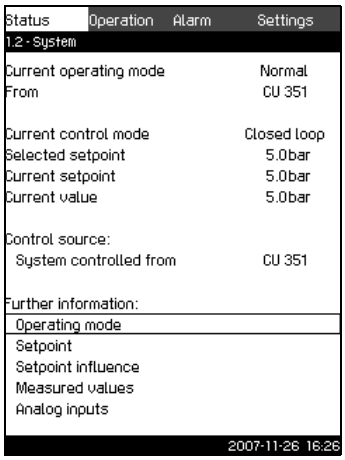
Fig. 9 Current alarms

Description

In this display, current unreset alarms and warnings are shown.

For further information, see sections *9.6.2 Current alarms (3.1)* and *9.6.3 Alarm log (3.2)*.

9.4.2 System (1.2)



TM03 8946 4807

Fig. 10 System

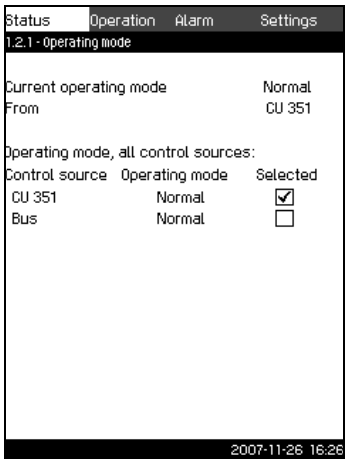
Description

This display shows the current operational state of the Hydro MPC booster system. It is possible to go to subdisplays showing details.

The display makes it possible to open specific displays about

- operating mode
- setpoint
- setpoint influence
- measured values
- analog inputs.

9.4.3 Operating mode (1.2.1)



TM03 2273 4807

Fig. 11 Operating mode

Description

Here the operating mode of the Hydro MPC booster system is shown as well as from where the Hydro MPC is controlled.

Operating modes

Hydro MPC has six operating modes:

1. *Normal*
   The booster system adapts its performance to the requirement.
2. *Max.*
   The pumps run at a constant high speed. Normally, all pumps run at maximum speed.
3. *User-defined*
   The pumps run at a constant speed set by the user. Usually it is a performance between *Max.* and *Min*.
4. *Min.*
   The pumps run at a constant low speed. Normally, one pump is running at a speed of 70 %.
5. *Stop*
   All pumps have been stopped.
6. *Emergency run*
   The pumps run according to the setting made in the display *Emergency run (4.3.5)*.

The performance required in the operating modes *Max., Min., User-defined* and *Emergency run* can be set in the **Settings** menu. See sections *9.7.33 Min., max. and user-defined duty (4.3.14)* and *9.7.25 Emergency run (4.3.5)*.

The current operating mode can be controlled from four different sources: *Fault*, *External signal*, *CU 351* and *Bus*.

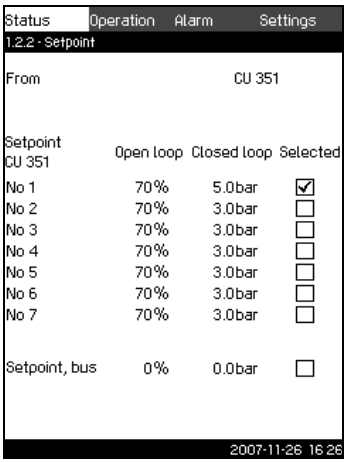
Control source

Hydro MPC can be set to remote control via an external bus (option). In this case, a setpoint and an operating mode must be set via the bus.

In the **Settings** menu, it is possible to select whether the CU 351 or the external bus is to be the control source.

The status of this setting is shown in the display **Operating mode**.

9.4.4 Setpoint (1.2.2)



TM03 2272 4807

Fig. 12 Setpoint

Description

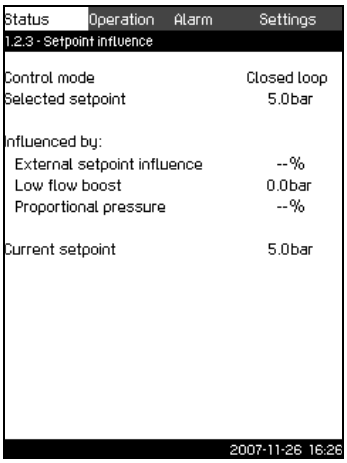
This display shows the selected setpoint and whether it comes from the CU 351 or an external bus.

The display also shows all seven possible setpoints from CU 351 (for closed- and open-loop control). At the same time, the selected setpoint is shown.

As it is a status display, no settings can be made.

Setpoints can be changed in the **Operation** menu.

9.4.5 Setpoint influence (1.2.3)



TM03 8948 4807

Fig. 13 Setpoint influence

Description

The selected setpoint can be influenced by parameters. The parameters are shown as percentage from 0 to 100 % or as a pressure measured in bar. They can only reduce the setpoint, as the influence in percentage divided with 100 is multiplied with the selected setpoint:

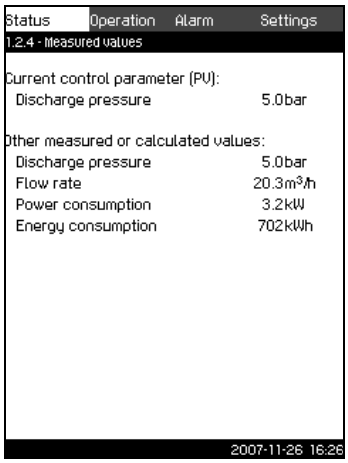
$$\text{Setpoint}_{\text{current(SP)}} = \text{Setpoint}_{\text{selected}} \times \text{Infl.}(1) \times \text{Infl.}(2) \times \ldots$$

The display shows the parameters influencing the selected setpoint and the percentage or value of influence.

Some of the possible parameters can be set in the display *External setpoint influence (4.1.3)*. The parameter low flow boost is set as an on/off band as a percentage of the setpoint set in the display *Stop function (4.3.1)*. The parameter is set as a percentage in the display *Proportional pressure (4.1.7)*.

Finally the resulting current setpoint (SP) is shown.

9.4.6 Measured values (1.2.4)



TM03 2270 4807

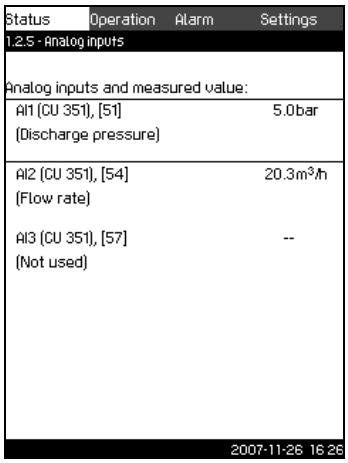
Fig. 14 Measured values

Description

This display gives a general status of all measured and calculated parameters.

Note ***The lines "Power consumption" and "Energy consumption" are only shown in Hydro MPC-E booster systems.***

9.4.7 Analog inputs (1.2.5)



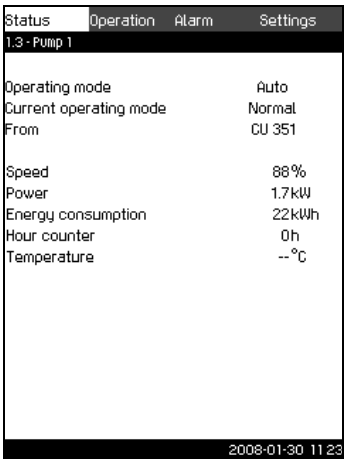
TM03 8949 4807

Fig. 15 Analog inputs

Description

The display shows an overview of the analog inputs and the current measured values of each input. See sections *9.7.28 Analog inputs (4.3.8)*, *9.7.29 Analog inputs (4.3.8.1 to 4.3.8.7)* and *9.7.30 Analog inputs and measured value (4.3.8.1.1 to 4.3.8.7.1)*.

9.4.8 Pump 1...6 (1.3 to 1.8)



TM03 2268 4807

Fig. 16 Pump 1

Description

This display shows the operational state of the individual pumps.

The pumps may have different operating modes:

- *Auto*
  Together with the other pumps in automatic operation, the pump is controlled by the PI controller which ensures that the booster system delivers the required performance (pressure).
- *Manual*
  The pump is not controlled by the PI controller. In manual operation, the pump has one of the following operating modes:
  – *Max.*
    The pump runs at a set maximum speed. (This operating mode can only be selected for variable-speed pumps.)
  – *Normal*
    The pump runs at a set speed.
  – *Min.*
    The pump runs at a set minimum speed. (This operating mode can only be selected for variable-speed pumps.)
  – *Stop*
    The pump has been forced to stop.

Besides information about the operating mode, it is possible to read various parameters in the status display, such as these:

- speed (only 0 or 100 % are shown for mains-operated pumps)
- power consumption (only CR(I)E pumps)
- energy consumption (only CR(I)E pumps)
- operating hours.

9.5 Operation (2)

In this menu, the most basic parameters can be set, such as setpoint, operating mode, control mode and forced control of pumps.

9.5.1 Operation (2)

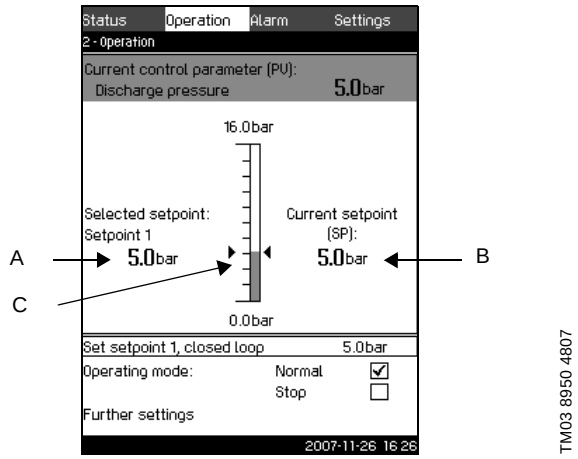


Fig. 17 Operation

Description

The column shows the setting range. In closed-loop control, it corresponds to the range of the primary sensor, here 0-16 bar. In open-loop control, the setting range is 0-100 %.

At the left hand of the column, the selected setpoint 1 (A) is shown, i.e. the value set in the display. At the right hand of the column, the current setpoint (B) is shown, i.e. the setpoint acting as reference for the PI controller. If no kind of external setpoint influence has been selected, the two values will be identical. The current measured value (discharge pressure) is shown as the grey part of the column (C). See sections *9.7.5 External setpoint influence (4.1.3)* and *9.7.6 Setting of influence function (4.1.3.2)*.

Below the display is a menu line for setting of setpoint 1 and selection of operating mode, including the operating modes *Normal* and *Stop*. It is possible to select further settings: system operating mode, control mode, setpoints for closed and open loop as well as individual pump control.

Setting range

Setpoint:

Closed-loop control:	Measuring range of the primary sensor
Open-loop control:	0-100 %

Setting via control panel

Setpoint:

1. Mark the **Operation** menu with ⊙.
2. Mark Setpoint 1 with ⊙ or ⊙. Set the value with ⊕ or ⊖.
3. Save with ok.

Operating mode:

1. Mark the **Operation** menu with ⊙.
2. Mark operating mode **Normal** or **Stop** with ⊙ or ⊙. Save with ok.

Further settings:

1. Mark the **Operation** menu with ⊙.
2. Mark **Further settings** with ⊙ or ⊙, and press ok.
3. Select one of the settings below with ⊙ or ⊙, and press ok:

- system operating mode (see section *9.5.2*)
- control mode (see section *9.5.3*)
- setpoints (see section *9.5.4*)
- individual pump control (see section *9.5.6*).

Factory setting

The setpoint is a value suitable for the Hydro MPC booster system in question. The factory setting may have been changed in the start-up menu.

9.5.2 System operating mode (2.1.1)

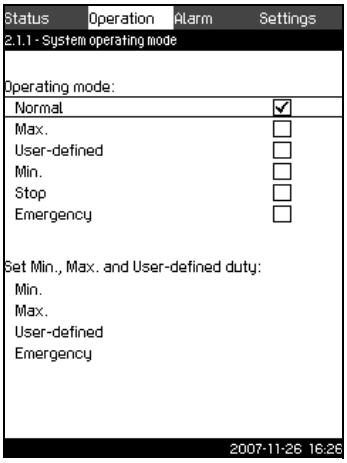


Fig. 18 System operating mode

Description

Hydro MPC can be set to six different operating modes. *Normal* is the typical setting. See section *9.4.3 Operating mode (1.2.1)*.

The performance of the operating modes *Max., Min.*, *User-defined* and *Emergency run* can be set in the **Settings** menu.

In the display shown, it is possible to go directly to the **Settings** menu in order to set the pump performance or the setpoint.

Setting range

It is possible to select the operating modes *Normal*, *Max.*, *Min.*, *User-defined, Stop* and *Emergency run*.

Setting via control panel

1. Mark the **Operation** menu with ⊙.
2. Mark **Further settings** with ⊙ or ⊙, and press ok.
3. Mark **System operating mode** with ⊙ or ⊙, and press ok.
4. Select the desired operating mode by marking one of the lines with check boxes with ⊙ or ⊙, and press ok.
5. In order to set the performance in min., max., user-defined duty or emergency run, mark the desired line at the bottom of the display, and press ok.
   See sections *9.7.33 Min., max. and user-defined duty (4.3.14)* and *9.7.25 Emergency run (4.3.5)*.

Factory setting

Normal.

9.5.3 Control mode (2.1.2)

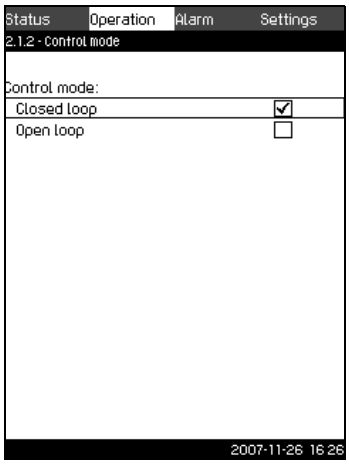


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Fig. 19 Control mode

Description

There are two control modes, namely closed and open loop.

Examples:

Closed loop

The typical control mode is closed loop where the built-in PI controller ensures that the booster system delivers the discharge pressure required (setpoint). The performance is based on the setpoint set for closed loop. See figs 20 and 21.

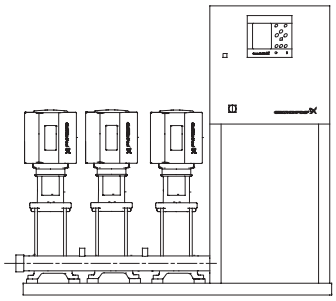

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Fig. 20 Booster system controlled by built-in PI controller (closed loop)

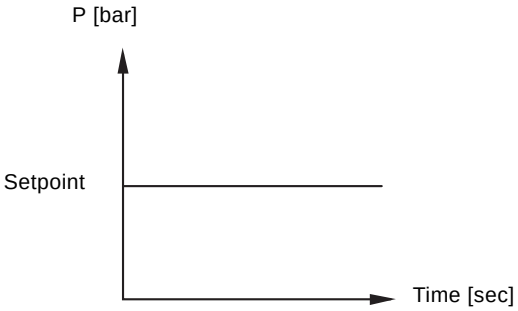

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Fig. 21 Regulation curve for closed loop

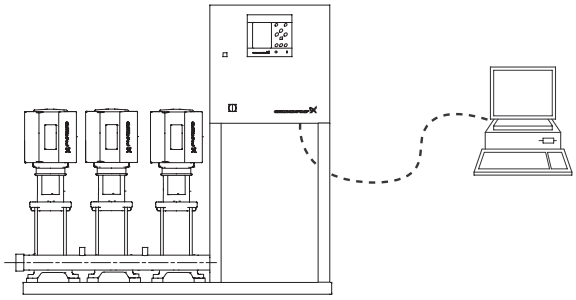
Setting via control panel

1. Mark the **Operation** menu with ⟩.
2. Mark **Further settings** with ⌄ or ⌃, and press ok.
3. Mark **Control mode** with ⌄ or ⌃, and press ok.
4. Select **Closed loop** with ⌄ or ⌃, and press ok.
5. Set the setpoint. See sections *9.5.4 Setpoints (2.1.3)* and *9.5.1 Operation (2)*.

Open loop

In open-loop control, the pumps run at a fixed speed.
The pump speed is calculated from the performance set by the user (0-100 %). The pump performance in percentage is proportional with the flow rate.

Open-loop control is usually used when the booster system is controlled by an external controller which controls the performance via an external signal. The external controller could for instance be a building management system connected to the Hydro MPC. In such cases, the Hydro MPC is like an actuator. See figs 22 and 23.



TM03 2232 3905

Fig. 22 Booster system with external controller (open loop)

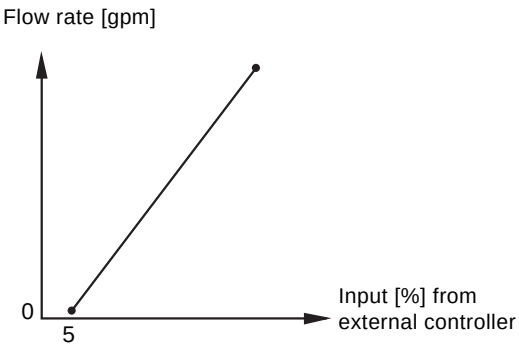


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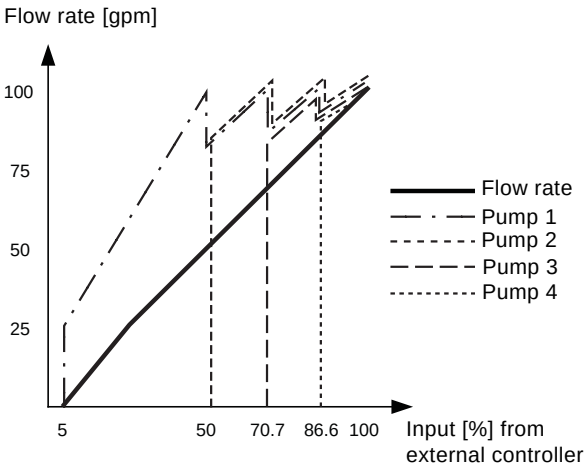
Fig. 23 Regulation curve for open loop



TM03 9977 4807

Fig. 24 Regulation curve for Hydro MPC-E in open loop

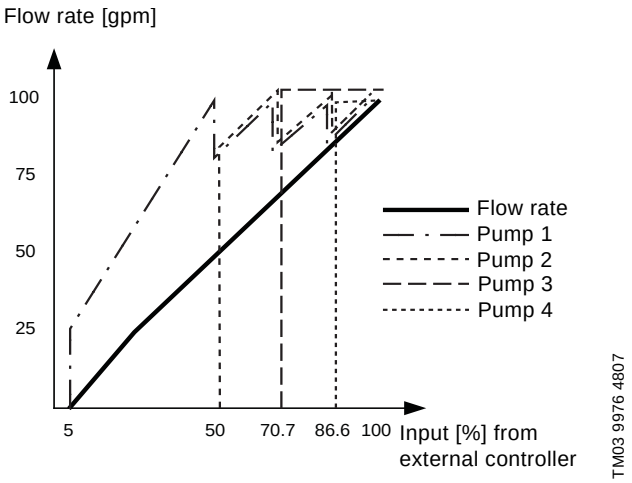


Fig. 25 Regulation curve for Hydro MPC-ED in open loop

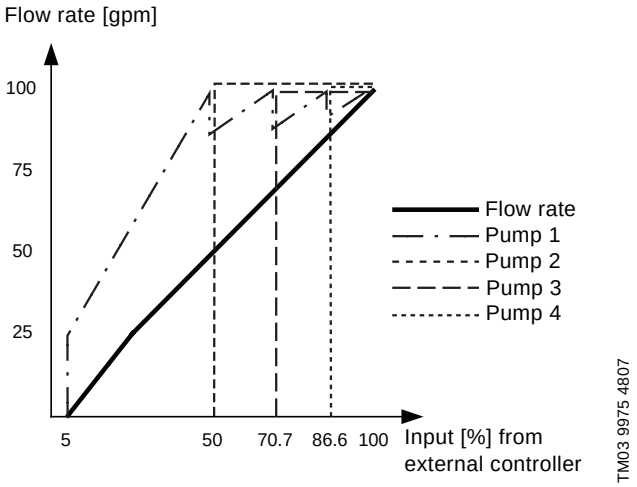


Fig. 26 Regulation curve for Hydro MPC-ES in open loop

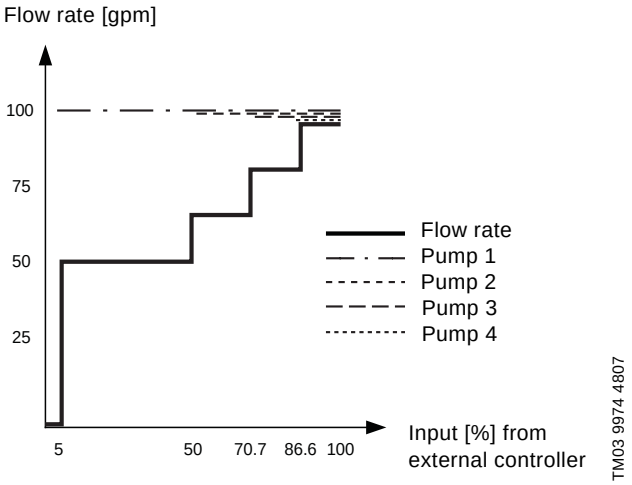


Fig. 27 Regulation curve for Hydro MPC-S in open loop

Correlating open loop input setpoint percentage with number of pumps in operation. Example: MPC system with (4) pumps

- Setpoint 0% to 5% = All pumps stopped

One pump operation from setpoint from 5% to √ (1-pump/4-pumps) = 50%

- Two pump operation from 50% to √ (2-pump/4-pumps) = 70.7%
- Three pump operation from 70.7% to √ (3-pumps/4-pumps) = 86.6%
- Four pump operation from 86.6% to 100%

For staging pumps off the cut-out is 2% less then cut-in. Example: staging from 4-pump to 3-pump operation will occur at 84.6% reference signal.

Setting range

These settings must be made in connection with open loop:

- stop of the Hydro MPC booster system
- selection of control mode *Open loop*
- setting of setpoint 1, open loop
- setting of external setpoint influence
- selection of operating mode *Normal*.

Setting via control panel

To set an external control source to control the Hydro MPC booster system, proceed as follows:

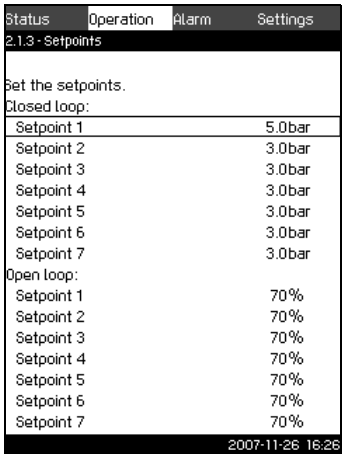
1. Mark the **Operation** menu with (>).
2. Mark the operating mode **Stop** with (v) or (^), and press (ok). The check mark in the right box shows that the operation has been stopped.
3. Mark **Further settings** with (v) or (^), and press (ok).
4. Mark **Control mode** with (v) or (^), and press (ok).
5. Select **Open loop** with (v) or (^), and press (ok).
6. Return by pressing (esc) twice.
7. Mark **Set setpoint 1, open loop** with (v) or (^).
8. Set the setpoint to 100 % with (+), and save with (ok).
9. Mark the **Settings** menu with (>).
10. Mark **Primary controller** with (v) or (^), and press (ok).
11. Mark **External setpoint influence** with (v) or (^), and press (ok).
12. Mark **Go to setting of analog input** with (v) or (^), and press (ok).
13. Select the analog input with (v) or (^), and press (ok).
14. Select the range of the analog input with (v) or (^), and press (ok). The selection is indicated by a check mark.
15. Mark **Measured input value** with (v) or (^), and press (ok). Now the display 4.3.8.1.1 appears.
16. Select **0-100 % signal** with (v) or (^), and press (ok).
17. Press (esc) to return to display 4.3.8.1.
18. Set the minimum sensor value with (+) or (−), and save with (ok).
19. Set the maximum sensor value with (+) or (−), and save with (ok).
20. Return by pressing (esc) twice.
21. Mark **Input value to be influenced by** with (v) or (^), and press (ok).
22. Mark **0-100 % signal** with (v) or (^), and press (ok).
23. Return with (esc).
24. Mark **Set the influence function** with (v) or (^), and press (ok). For details, see section *9.7.6 Setting of influence function (4.1.3.2)*.
25. Mark the menu line for number of points with (v) or (^), and press (ok).

26. Select the required number of points with ⊕ or ⊖, and save with ok.
27. Mark **External input value** (point 1) with ⌄ or ⌃.
28. Set the value of the external input value with ⊕ or ⊖, and save with ok.
29. Mark **Reduce setpoint to** (point 1) with ⌄ or ⌃.
30. Set the value as a percentage with ⊕ or ⊖, and save with ok.
31. Repeat 27 to 31 for all chosen points.
32. Return with esc.
33. Mark **Filter time** with ⌄ or ⌃, set the time in seconds with ⊕ or ⊖, and save with ok.
34. Mark **Activated** with ⌄ or ⌃, and press ok. The check mark in the right box shows that the function has been activated.
35. Return by pressing esc twice.
36. Mark the **Operation** menu with ⊳.
37. Mark the operating mode **Normal** with ⌄ or ⌃, and press ok. The check mark in the right box shows that the operation is normal. The booster system can now be controlled by an external controller.

Factory setting

Closed-loop control.

9.5.4 Setpoints (2.1.3)



TM03 8952 4807

Fig. 28 Setpoints

Description

In addition to the primary setpoint 1 (shown in the display 2 in the **Operation** menu), six alternative setpoints can be set for closed-loop control. It is furthermore possible to set seven setpoints for open-loop control.

As described in sections *9.7.3 Alternative setpoints (4.1.2)* and *9.7.4 Alternative setpoints 2 to 7 (4.1.2.1 to 4.1.2.7)*, it is possible to activate one of the alternative setpoints by means of external contacts.

Setting range

The setting range of setpoints for closed-loop control depends on the range of the primary sensor. See section *9.7.7 Primary sensor (4.1.4)*.

In open loop control, the setting range is 0 - 100 %.

Setting via control panel

1. Mark the **Operation** menu with ⊳.
2. Mark **Further settings** with ⌄ or ⌃, and press ok.
3. Mark **Setpoints** with ⌄ or ⌃, and press ok.
4. Select the setpoint with ⌄ or ⌃.
5. Set the setpoint with ⊕ or ⊖, and press ok.

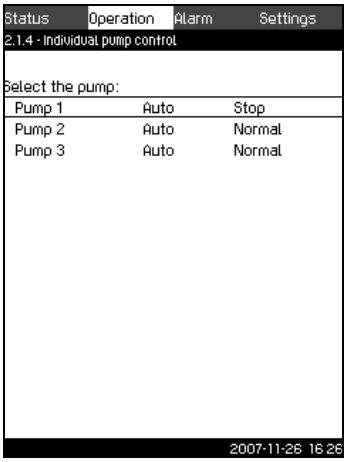
Factory setting

Setpoint 1 for closed-loop control is a value suitable for the Hydro MPC in question.

The alternative setpoints for closed-loop control are 3 bar.

All setpoints for open-loop control are 70 %.

9.5.5 Individual pump control (2.1.4)



TM03 8953 4807

Fig. 29 Individual pump control

Description

It is possible to change the operating mode from automatic operation to one of the manual operating modes.

Auto

The pumps are controlled by the PI controller, ensuring that the booster system delivers the required performance (pressure).

Manual

The pump is not controlled by the PI controller, but set to one of the following manual operating modes:

- *Max.*
  The pump runs at a set maximum speed. (This operating mode can only be selected for variable-speed pumps.)
- *Normal*
  The pump runs at a set speed.
- *Min.*
  The pump runs at a set minimum speed. (This operating mode can only be selected for variable-speed pumps.)
- *Stop*
  The pump has been forced to stop.

Pumps in manual operation are not part of the normal pump cascade and speed control. The manual pumps are a "disturbance" of the normal control of Hydro MPC.

If one or more pumps are in manual operation, Hydro MPC may not be able to deliver the set performance.

There are two displays for the function. In the first display, the pump to be set is selected, and in the next display, the operating mode is selected.

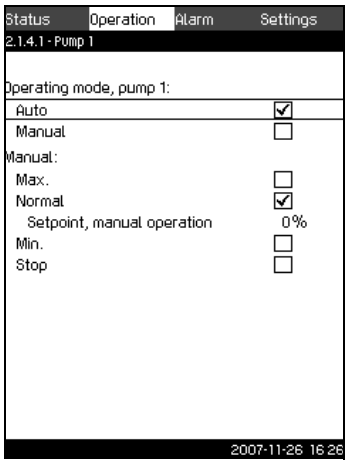
Setting range

All pumps can be selected.

Setting via control panel

1. Mark the **Operation** menu with ⊳.
2. Mark **Further settings** with ⌄ or ⌃, and press ok.
3. Mark **Individual pump control** with ⌄ or ⌃, and press ok.
4. Select the pump with ⌄ or ⌃, and press ok.

9.5.6 Setting of individual operating mode (2.1.4.1 to 2.1.4.6)



TM03 8954 4807

Fig. 30 Setting of individual operating mode

Description

This display is shown for the individual pumps and makes it possible to set an operating mode.

Setting range

It is possible to select *Auto* or *Manual* as well as the operating mode of the pump for manual operation - *Max.*, *Normal*, *Min.* or *Stop*. For mains-operated pumps only *Normal* or *Stop* can be selected.

Setting via control panel

1. Mark the **Operation** menu with ›.
2. Mark **Individual pump control** with ∨ or ∧, and press ok.
3. Select the pump with ∨ or ∧, and press ok.
4. Mark **Auto** or **Manual** with ∨ or ∧, and press ok.
5. *Manual:* Select the operating mode with ∨ or ∧, and press ok.
6. *Normal:* Mark **Setpoint** with ∨ or ∧.
   Set the speed of the variable-speed pump with + or −, and press ok.

Factory setting

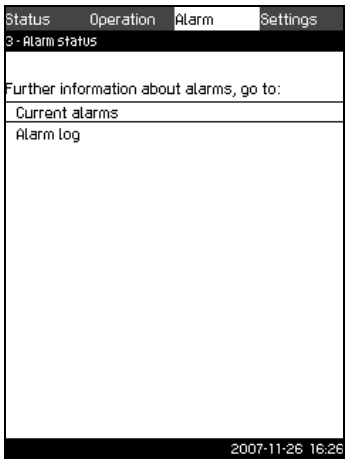
Auto.

9.6 Alarm (3)

The **Alarm** menu gives an overview of alarms and warnings.

In this menu, it is possible to reset alarms and to see the alarm log.

9.6.1 Alarm status (3)



TM03 2291 4807

Fig. 31 Alarm status

Description

A fault in the Hydro MPC booster system or one of the components monitored can cause an alarm ⊗ or a warning ⚠. Besides the fault signal via the alarm/warning signal relay and the red indicator light on the CU 351, an alarm can also cause a change of operating mode, for instance from *Normal* to *Stop*. A warning only causes a fault indication.

The table shows the possible causes of fault together with an alarm code number, and whether they result in an alarm or a warning. It also shows to what operating mode the booster system changes in case of alarm, and whether restart of the booster system and reset of the alarm is manual or automatic.

The table also shows that the reaction to some of the fault causes mentioned can be set in the **Settings** menu. See sections *9.7.24 Soft pressure build-up (4.3.3)* and *9.7.41 Monitoring functions (4.4)* to *9.7.51 Pressure relief (4.4.8)*.

Fault	Warning(⚠)/alarm(⊗)	Change of operating mode to	Reset of alarm Restart	Set in the Settings menu	Alarm code
Water shortage	⚠		Auto		206
Water shortage	⊗	Stop	Man/auto	X	214
Pressure high	⊗	Stop	Auto		210
Pressure low	⚠		Auto	X	211
	⊗	Stop	Man		
Pressure relief	⚠		Auto	X	219
Alarm, all pumps	⊗	Stop	Auto		203
External fault	⚠		Auto	X	3
	⊗	Stop	Man		
Dissimilar sensor signals	⚠		Auto		204
Fault, primary sensor	⊗	Stop	Auto		89
Fault, sensor	⚠		Auto		88
Communication fault	⚠		Auto		10
Phase failure	⚠		Auto		2
Undervoltage, pump	⚠		Auto		7, 40, 42, 73
Overvoltage, pump	⚠		Auto		32
Overload, pump	⚠		Auto		48, 50, 51, 54
Overtemperature, pump	⚠		Auto		64, 65, 67
Other fault, pump	⚠		Auto		76, 83
Internal fault, CU 351	⚠		Auto		72, 83, 157
Internal fault, IO 351	⊗	Stop	Auto		83, 157
VFD not ready	⚠		Auto		213
Fault, Ethernet	⚠		Auto		231, 232
Limit 1 exceeded	⚠ ⊗		Man/auto	X	190
Limit 2 exceeded	⚠ ⊗		Man/auto	X	191
Pressure build-up fault	⚠ ⊗		Man/auto	X	215
Pumps outside duty range	⚠		Man/auto	X	208
Pilot pump fault	⚠		Auto		216

Alarm (3) continued

MPC alarm indication "Protocol description"	Alarm code	Associated device and device no.	Description/cause	Remedy	Reset type[1]	Alarm/warning Action type[2]
1. Phase failure, pump	2	Pump 1-6	-	1. Check that all three power supply phases are within a 15 V window.	Auto	Warning
2. Undervoltage	7	Pump 1-6	HSD = hardware shut-down. There has been a fault, and the permissible number of restarts for the fault type has been exceeded. a) Fault in power supply. a) Terminal box defective.	1. Restore power supply. 2. Replace terminal box.	Auto	Warning
3. Undervoltage, pump	40	Pump 1-6	a) Power supply voltage is too low at start.	1. Bring voltage back to prescribed level.	Auto	Warning
4. Undervoltage, pump	42	Pump 1-6	a) Faulty power supply at the time of staging on a pump.	1. Restore proper power supply.	Auto	Warning
5. Undervoltage, pump	73	Pump 1-6	a) Low supply voltage. b) Power supply failure while motor is running.	1. Restore proper power supply.	Auto	Warning
6. Overvoltage, pump	32	Pump 1-6	a) Supply voltage is too high at start.	1. Bring voltage back to prescribed level.	Auto	Warning
7. Overload, associated device	48	Pump 1-6	a) Heavy overload has caused software shutdown (SSD).	1. Check and possibly reduce load.	Auto	Warning
8. Overload, associated device	50	Pump 1-6	a) MPF = motor protection function. The built-in motor protection has detected a sustained overload (MPF 60 sec. limit)>	1. Check and possibly reduce load/improve cooling.	Auto	Warning
9. Overload, associated device	51	Pump 1-6	a) Heavy overload (Imax. very high). Pump blocked at start.	1. Unblock the pump.	Auto	Warning
10. Overload, associated device	54	Pump 1-6	a) The built-in motor protection has detected a transitory overload (MPF 3 sec. limit).	1. Check and possibly reduce load/improve cooling	Auto	Warning
11. Over temperature, pump	65	Pump 1-6	a) PTC sensor in the motor has signalled over temperature.	1. Check and possibly reduce load/improve cooling.	Auto	Warning
12. Over temperature, pump	67	Pump 1-6	a) Terminal box has indicated over temperature.	1. Check and possibly reduce load/improve cooling. (Temperature during operation can be read via PC Tool E-products.)	Auto	Warning

MPC alarm indication "Protocol description"	Alarm code	Associated device and device no.	Description/cause	Remedy	Reset type[1]	Alarm/warning Action type[2]
13. Other fault, associated device	76	Pump 1-6	a) Internal communication error has occurred in the pump.	Try to reset the fault: 1. Switch off the supply power. 2. Wait until all diodes are out. 3. Switch on the supply power. If this does not remedy the fault, replace the terminal box.	Auto	Warning
14. Limit 1 exceeded	190	Measured parameter	a) The measured parameter has exceeded the limit set.	1. Remove the cause of the fault.	Auto/ manual	Alarm/warning Stop/ unchanged
15. Limit 2 exceeded	191	Measured parameter	a) The measured parameter has exceeded the limit set.	1. Remove the cause of the fault.	Auto/ manual	Alarm/warning Stop/ unchanged
16. Pressure relief	219	System	a) The monitored pressure could not be reduced sufficiently.	1. Reduce the pressure to below the limit.	Auto	Warning Unchanged
17. Pressure build-up fault	215	System	a) The pressure set cannot be reached within the configured time.	1. Check limit and pipes.	Auto/ manual	Alarm/warning Stop/ unchanged
18. Pumps outside duty range	208	System	a) The pump is running outside the defined range.	1. Check the system.	Auto/ manual	Warning Unchanged
19. Pilot pump fault	216	Pilot pump	a) Pilot pump fault	1. Check wires. 2. Check the pump.	Auto	Warning

MPC alarm indication "Protocol description"	Alarm code	Associated device and device no.	Description/cause	Remedy	Reset type[1]	Alarm/warning Action type[2]
20. Water shortage, level 1 *Water shortage, level 1	206	System	a) The pre-pressure (or the level in the feed tank) is below its programmable warning limit.	1. Check the actual and the corresponding settings. 2. Check the sensor/switch, wiring and input according to the wiring diagram. 3. Check the sensor/switch.	Auto	Warning Unchanged
21. Water shortage, level 2 *Water shortage, level 2	214		a) The pre-pressure (or the level in the feed tank) is below its programmable warning limit.		Auto/ Manual	Alarm Stop
			b) The pre-pressure switch detect water shortage.			Warning Unchanged
22. Discharge pressure high *Pressure above max. pressure	210		a) The system pressure is above the programmable high-pressure alarm limit.		Auto/ Manual	Alarm Fast stop (over rule min. seq. time)
23. Discharge pressure low *Pressure below min. pressure	211		a) The system pressure is below the programmable low-pressure alarm limit.		Auto/ Manual	Alarm/Warning Stop/ Unchanged
24. All pumps in alarm *All pumps in alarm	203		a) All pumps, set to Auto, is stopped on account of pump alarm	Troubleshoot according to the alarm message/code: 1. System 2. Pumps installed Use fault fault finding for the pump.	Auto	Alarm Stop
			b) Pumps are not indicating alarm	Check the Genibus wires eg. connection, polarisation.		
25. External fault signal *External fault signal	003		a) External fault digital input activated.	1. Check the external signal source. 2. Check the digital input according to the wiring diagram	Auto/ Manual	Alarm/Warning Stop/ Unchanged
26. Inconsistency between sensors *Inconsistency between sensors	204	Primary sensor and/or redundant sensor	a) Primary feedback sensor value (pressure) is inconsistent with redundant feedback sensor value.	1. Check the wiring and input according to the wiring diagram. 2. Check the sensor output according to the measured value.	Auto	Warning Unchanged
27. Primary sensor *Closed loop feedback sensor signal fault	089	Primary sensor	a) A fault in the sensor assigned to the feed back control is detected.	1. Check the wiring and input according to the wiring diagram. 2. Check the sensor output according to the measured value.	Auto	Alarm Stop
			b) Error in the settings of the sensor which is assigned to the regulator.	Check the primary sensor settings		
28. Sensor fault *General (measurement) sensor signal fault	088	CU 351 IO 351 as IO module	a) The signal (ex. 4-20 mA) from one of the analog sensors is outside the selected signal range.	1. Check the wiring and input according to the wiring diagram. 2. Check the sensor output according to the measured value		Warning Unchanged

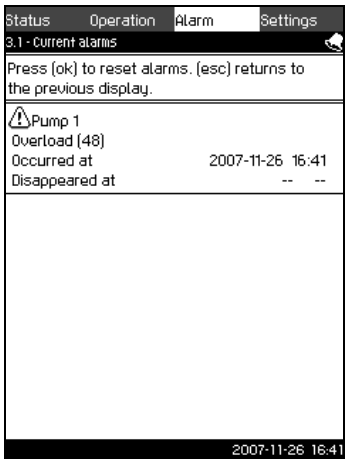
MPC alarm indication "Protocol description"	Alarm code	Associated device and device no.	Description/cause	Remedy	Reset type[1]	Alarm/warning Action type[2]
29. CU 351 internal fault *Real time clock out of order	157	CU 351	a) The real-time clock in CU 351 is out of order.	Replace the CU 351	Auto	Warning Unchanged
30. Ethernet fault *Ethernet: No address from DHCP server	231		a) No address from DHCP server	1. Communication error. 2. Please contact the system integrator.		
31. Ethernet fault *Ethernet: Auto disabled due to misuse	232		a) Auto-disabled due to misuse			
32. FLASH parameter verification error *FLASH parameter verification error	083		a) Verification error in CU 351 FLASH memory	Replace the CU 351		
33. IO 351 internal fault *Hardware fault type 2	080	IO 351	a) IO 351 pump module hardware fault b) IO 351 I/O module hardware fault	See current alarms and identify the faulty IO 351 module from the alarm message and replace the module.		
34. VFD not ready *VFD not ready	213	Pump 1-6 CU 351	a) The VFD signal relay do not release the VFD for operation	1. Check for VFD alarm 2. Check the wiring and input according to the wiring diagram.		
35. Communication fault *Pump communication fault	010	Pump 1-6 IO 351	a) No GeniBus communication with a device connected to CU 351	See actual alarms and identify the faulty device from the alarm message. 1. Check power supply 2. Check GeniBus cable connection 3. Check, with R100, that the device GeniBus no. is correct.		
36. Device alarms	From device	Pump 1-6	a) The device is in alarm	See actual alarms and identify the faulty device from the alarm message. 1. Fault find according to the service instruction for the device.		

1) Reset type is either fixed as "Auto acknowledge" (Auto) or can be programmed to be Auto or manual ackknowledge (Auto/Man)*.

2) Programmable action types:

- Go to operating mode "Stop" (no delay (<0.5 s) between pump disconnections).
- Go to operating mode "Min".
- Go to operating mode "User-defined".
- Go to operating mode "Max".
- Set pumps in source mode "Local". - No action (warning only)

9.6.2 Current alarms (3.1)



TM03 2293 4807

Fig. 32 Current alarms

Description

This submenu shows the following:

- Warnings ⚠ caused by faults that still exist.
- Warnings ⚠ caused by faults that have disappeared, but the warning requires manual reset.
- Alarms ⊗ caused by faults that still exist.
- Alarms ⊗ caused by faults that have disappeared, but the alarm requires manual reset.

All warnings and alarms with automatic reset are automatically removed from the menu when the fault has disappeared.

Alarms requiring manual reset are reset in this display by pressing (ok). An alarm cannot be reset until the fault has disappeared.

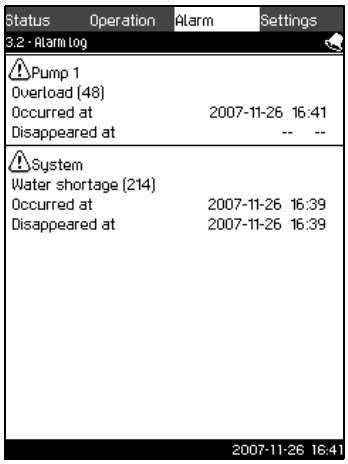
For every warning or alarm, the following is shown:

- Whether it is a warning ⚠ or an alarm ⊗.
- Where the fault occurred: System, Pump 1, Pump 2, etc.
- In case of input-related faults, the input is shown.
- What the cause of the fault is, and the alarm code in brackets: Water shortage (214), Max. pressure (210), etc.
- When the fault occurred: Date and time.
- When the fault disappeared: Date and time. If the fault still exists, date and time are shown as --...--.

The latest warning/alarm is shown at the top of the display.

9.6.3 Alarm log (3.2)

The alarm log can store up to 24 warnings and alarms.



TM03 2292 4807

Fig. 33 Alarm log

Description

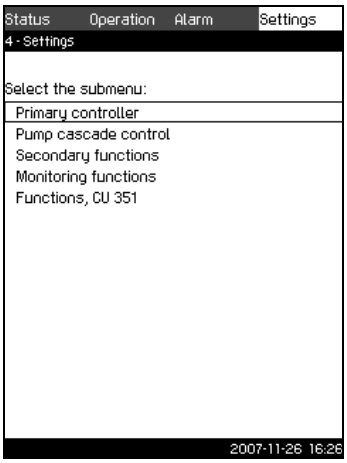
Here warnings and alarms are shown.

For every warning or alarm, the following is shown:

- Whether it is a warning ⚠ or an alarm ⊗.
- Where the fault occurred. System, Pump 1, Pump 2, etc.
- In case of input-related faults, the input is shown.
- What the cause of the fault is, and the alarm code in brackets: Water shortage (214), Max. pressure (210), etc.
- When the fault occurred: Date and time.
- When the fault disappeared: Date and time. If the fault still exists, date and time are shown as --...--.

The latest warning/alarm is shown at the top of the display.

9.7 Settings (4)



TM03 2294 4807

Fig. 34 Settings

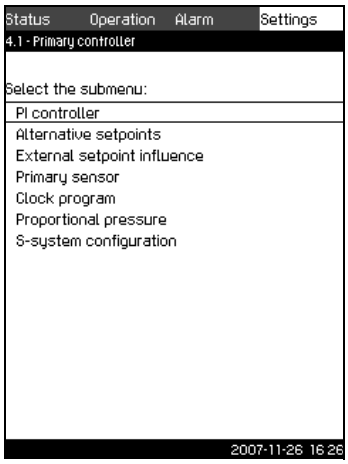
In the **Settings** menu, it is possible to set the following functions:

- Primary controller
  Setting of PI controller, alternative setpoints, external setpoint influence, primary sensor, clock program, proportional pressure and S-system configuration.
- Pump cascade control
  Setting of min. time between start/stop, max. number of starts/hour, number of standby pumps, forced pump changeover, pump test run, pilot pump, pump stop attempt, pump start and stop speed, min. performance and compensation for pump start-up time.
- Secondary functions
  Setting of stop function, soft pressure build-up, digital and analog inputs, digital outputs, emergency run, min., max. and user-defined duty, pump curve data, flow estimation, control source and fixed inlet pressure.
- Monitoring functions
  Setting of dry-running protection, min. and max. pressure, external fault, limit 1 and 2 exceeded, pumps outside duty range and pressure relief.
- Functions, CU 351
  Selection of service language, main language and units. Setting of time and date, passwords, Ethernet connection, GENIbus number and software status.

Usually, all these functions are set correctly when the Hydro MPC is switched on.

It is only necessary to make settings in this menu if the functionality is to be expanded with for instance alternative setpoints or setpoint influence, or if the settings of the CU 351 are to be adjusted.

9.7.1 Primary controller (4.1)



TM03 8955 4807

Fig. 35 Primary controller

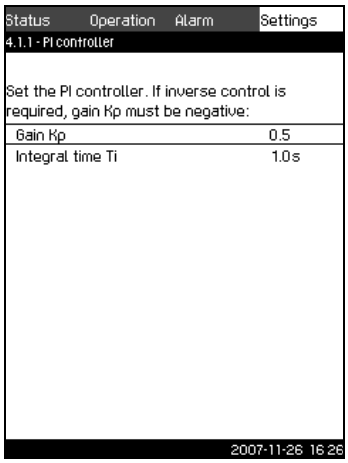
Description

In this menu section, it is possible to set the functions related to the primary controller.
It is only necessary to make settings in this menu if the functionality is to be expanded with for instance alternative setpoints, external setpoint influence, clock program or proportional pressure.

The following menus can be selected:

- PI controller
- Alternative setpoints
- External setpoint influence
- Primary sensor
- Clock program
- Proportional pressure
- S-system configuration.

9.7.2 PI controller (4.1.1)



TM03 2387 4807

Fig. 36 PI controller

Description

Hydro MPC includes a standard PI controller which ensures that the pressure is stable and corresponds to the setpoint.

It is possible to adjust the PI controller if a faster or slower reaction to changes of consumption is required.

A faster reaction is obtained if K_p is increased and T_i is reduced.

A slower reaction is obtained if K_p is reduced and T_i is increased.

Setting range

- Gain K_p: –30 to 30.
  Note: For inverse control, set K_p to a negative value.
- Integral time T_i: 0.1 to 3600 seconds.

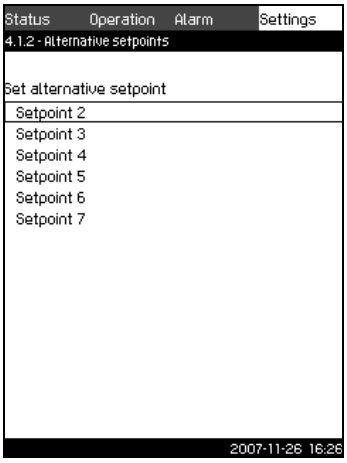
Setting via control panel

1. Mark the **Settings** menu with ⊙.
2. Mark **Primary controller** with ⊙ or ⊙, and press ⊙.
3. Mark **PI controller** with ⊙ or ⊙, and press ⊙.
4. Select the gain (K_p) with ⊙ or ⊙. Set the value with ⊙ or ⊙, and save with ⊙.
   Note: Usually it is not necessary to adjust K_p.
5. Select the integral time (T_i) with ⊙ or ⊙. Set the time with ⊙ or ⊙, and press ⊙.

Factory setting

- K_p: 0.5
- T_i: 1 second

9.7.3 Alternative setpoints (4.1.2)



TM03 2383 4807

Fig. 37 Alternative setpoints

Description

This function makes it possible to select up to six setpoints (No 2 to 7) as alternatives to the primary setpoint (No 1). The primary setpoint (No 1) is set in the **Operation** menu.
Every alternative setpoint can be addressed manually to a separate digital input (DI). When the contact of the input is closed, the alternative setpoint applies.

If more than one alternative setpoint has been selected and they are activated at the same time, the CU 351 selects the setpoint with the lowest number.

Setting range

- Six setpoints, No 2 to 7.

Factory setting

No alternative setpoints have been selected.

9.7.4 Alternative setpoints 2 to 7 (4.1.2.1 to 4.1.2.7)

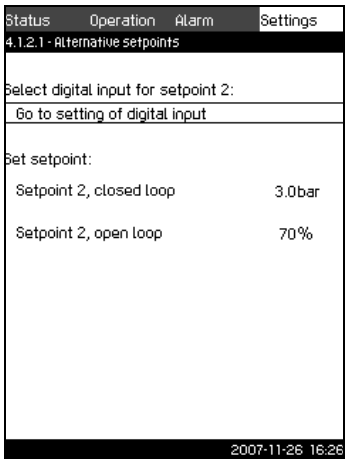


Fig. 38 Alternative setpoints 2 to 7

For each alternative setpoint, select the digital input to activate the setpoint.

It is possible to set a setpoint for closed loop and for open loop.

Setting via control panel

1. Mark the **Settings** menu with (>).
2. Mark **Primary controller** with (v) or (^), and press (ok).
3. Mark **Alternative setpoints** with (v) or (^), and press (ok).
4. Select the alternative setpoint with (v) or (^), and press (ok).
5. Mark **Go to setting of digital input** with (v) or (^), and press (ok).
   Now the display *Digital inputs (4.3.7)* appears. Set the input and return with (esc).
6. Mark the menu line of the setpoint (closed or open loop) with (v) or (^).
7. Set the required setpoint with (+) or (−), and save with (ok). Set both setpoints if Hydro MPC is to be controlled both in open and closed loop.

Factory setting

No alternative setpoints have been set.

9.7.5 External setpoint influence (4.1.3)

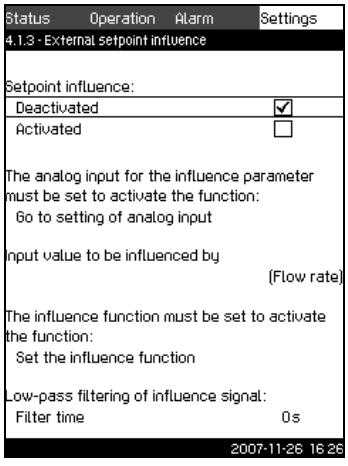


Fig. 39 External setpoint influence

Description

This function makes it possible to adapt the setpoint by letting measuring parameters influence the setpoint. Typically an analog signal from a flow or temperature transmitter, or a similar transmitter.

As an example, the setpoint can be adapted to parameters that can influence the discharge pressure or temperature of the system. The parameters which influence the performance of the booster system are shown as a percentage from 0 to 100 %. They can only reduce the setpoint, as the influence as a percentage divided with 100 is multiplied with the setpoint:

$$\text{Setpoint}_{\text{current(SP)}} = \text{Setpoint}_{\text{selected}} \times \text{Infl.(1)} \times \text{Infl.(2)} \times \ldots$$

The influence values can be set individually.

A low-pass filter ensures smoothing of the measured value which influences the setpoint. This results in stable setpoint changes.

Setting range

The following parameters can be selected.

- 0-100 % signal
- Inlet pressure
- Discharge pressure
- External pressure
- Differential pressure, pump
- Differential pressure, external
- Flow rate
- Tank level, discharge side
- Tank level, suction side
- Flow pipe temperature
- Return pipe temperature
- Ambient temperature
- Return pipe temperature, external
- Differential temperature.

Setting via control panel

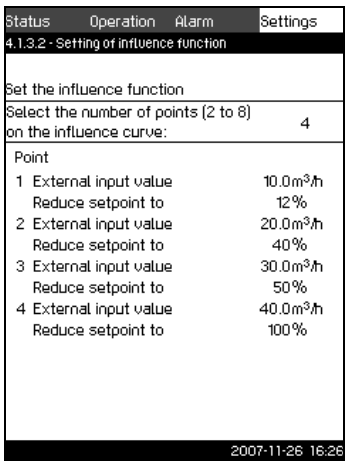
1. Mark the **Settings** menu with (>).
2. Mark **Primary controller** with (v) or (^), and press (ok).
3. Mark **External setpoint influence** with (v) or (^), and press (ok).
4. Mark **Input value to be influenced by** with (v) or (^), and press (ok).
   Now a list of available parameters appear.
5. Mark the parameter which is to influence the setpoint with (v) or (^), and press (ok).
6. Return with (esc).
7. Mark **Set the influence function** with (v) or (^), and press (ok). For details, see section *9.7.6 Setting of influence function (4.1.3.2)*.
8. Mark the menu line for number of points with (v) or (^), and press (ok).
9. Select the required number of points with (+) or (−), and save with (ok).
10. Mark **External input value** (point 1) with (v) or (^).
11. Set the value of the external input value with (+) or (−), and save with (ok).
12. Mark **Reduce setpoint to** (point 1) with (v) or (^).
13. Set the value as a percentage with (+) or (−), and save with (ok).
14. Repeat points 8 to 13 for all desired parameters.
15. Return with (esc).
16. Mark **Filter time** with (v) or (^), set the time in seconds with (+) or (−), and save with (ok).

17. Mark **Activated** with ⌄ or ⌃, and press ok. The check mark in the right box shows that the function has been activated.

Factory setting

Setpoint influence is not activated.

9.7.6 Setting of influence function (4.1.3.2)



TM03 2389 4807

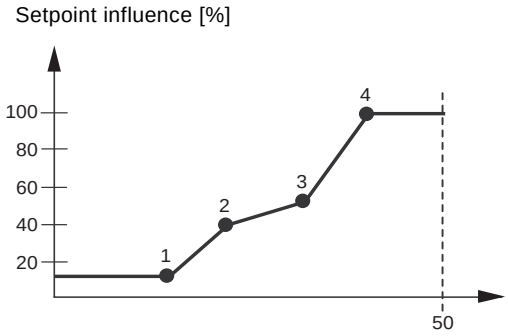
Fig. 40 Setting of influence function

Description

In this menu, you select the relation between the measuring parameter which is to influence the setpoint and the desired influence as a percentage.

The relation is set by entering values in a table with maximum eight points by means of the control panel.

Example with four points:



TM03 1691 4807

Fig. 41 Relation between setpoint influence and flow rate

The control unit of the Hydro MPC draws straight lines between the points. A horizontal line is drawn from the minimum value of the relevant sensor (0 m^3/h in the example) to the first point. This is also the case from the last point to the sensor's maximum value (example 50 m^3/h).

Setting range

Two to eight points can be selected. Each point contains the relation between the value of the parameter which is to influence the setpoint and the influence of the value.

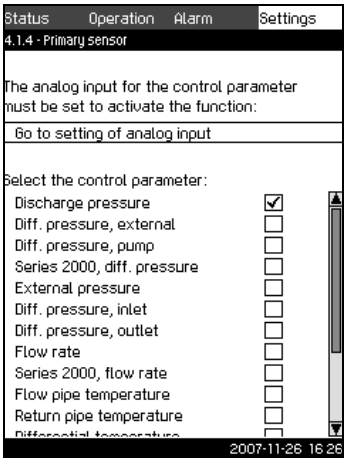
Setting via control panel

1. Mark the **Settings** menu with ⌄.
2. Mark **Primary controller** with ⌄ or ⌃, and press ok.
3. Mark **External setpoint influence** with ⌄ or ⌃, and press ok.
4. Mark **Set the influence function** with ⌄ or ⌃, and press ok.
5. Mark the menu line for number of points with ⌄ or ⌃, and press ok.
6. Select the required number of points with ⊕ or ⊖, and save with ok.
7. Mark **External input value** (point 1) with ⌄ or ⌃.
8. Set the value of the external input value with ⊕ or ⊖, and save with ok.
9. Mark **Reduce setpoint to** (point 1) with ⌄ or ⌃.
10. Set the value as a percentage with ⊕ or ⊖, and save with ok.
11. Repeat points 7 to 10 for all desired parameters.

Factory setting

External setpoint influence is not activated.

9.7.7 Primary sensor (4.1.4)



TM03 8958 4807

Fig. 42 Primary sensor

Description

In this display, select the control parameter of Hydro MPC and the sensor to measure the value.

Usually, the control parameter is the discharge pressure which is measured by a sensor fitted on the discharge manifold and connected to analog input AI1 of the CU 351.

If another control parameter is selected, the sensor must be connected to AI3 (CU 351) which is then set to one of the chosen parameters listed below.

Setting range

- Discharge pressure (factory setting)
- Differential pressure, external
- Differential pressure, pump
- Series 2000, differential pressure
- External pressure
- Differential pressure, inlet
- Differential pressure, outlet
- Flow rate
- Series 2000, flow rate
- Flow pipe temperature
- Return pipe temperature
- Differential temperature
- Ambient temperature
- Return pipe temperature, external
- 0-100 % signal
- Not used.

From factory the discharge pressure sensor is connected to AI1 (CU 351). If one of the above parameters is selected, the sensor in question must be connected to AI3 (CU 351) and set in order to function as the primary sensor.

Setting via control panel

1. Mark the **Settings** menu with ▷.
2. Mark **Primary controller** with ▽ or △, and press ok.
3. Mark **Primary sensor** with ▽ or △, and press ok.
4. Mark **Go to setting of analog input** with ▽ or △, and press ok.
   Now the display *Analog inputs (4.3.8)* appears. Select the analog input (AI) for the primary sensor, and set the parameters for this sensor. Return to display *Primary sensor (4.1.4)* with esc.
5. Select the control parameter for the primary sensor with ▽ or △, and press ok.

If the primary parameter is discharge pressure, AI1 (CU 351) must be set to this parameter.

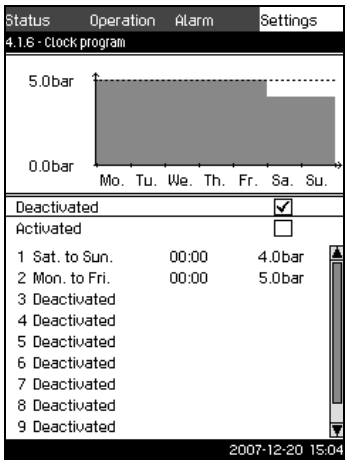
Note

If the primary parameter is external pressure or flow rate, AI3 (CU 351) must be set to this parameter.

Factory setting

The primary parameter is discharge pressure. The sensor is connected to AI1 (CU 351).

9.7.8 Clock program (4.1.6)



TM03 8990 4807

Fig. 43 Clock program

Description

With this function, it is possible to set setpoints and day and time for their activation. It is also possible to set day and time for stop of the Hydro MPC system.

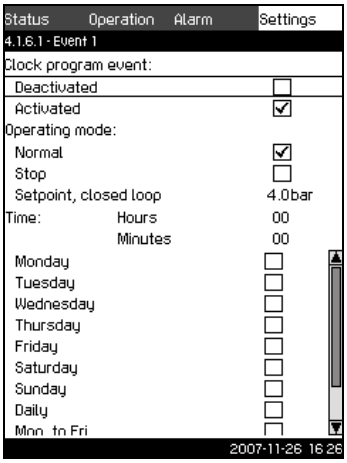
If the clock program is deactivated, the setpoint of the program will remain active.

Setting range

- Activation of the function.
- Activation and setting of event.

Setting via control panel

1. Mark the **Settings** menu with ▷.
2. Mark **Primary controller** with ▽ or △, and press ok.
3. Mark **Clock program** with ▽ or △, and press ok.
4. Mark event **1** with ▽ or △, and press ok.



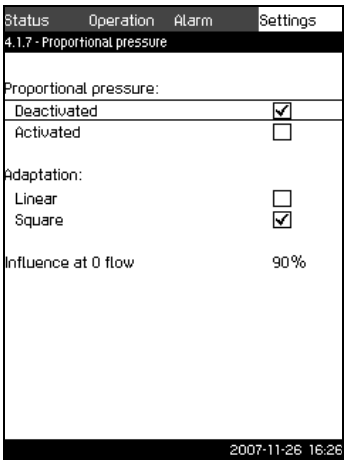
TM03 8959 4807

5. Mark operating mode **Normal** or **Stop** with ▽ or △, and press ok. (If **Stop** is selected, point 7 is skipped.)
6. Mark **Setpoint, closed loop** with ▽ or △. Set the pressure with ⊕ or ⊖, and save with ok.
7. Mark **Time (hours, minutes)** with ▽ or △.
8. Set the time with ⊕ or ⊖, and save with ok.
9. Mark day of week on which the settings are to be activated with ▽ or △, and press ok.
10. Mark **Activated** with ▽ or △, and press ok.
11. Return with esc.
12. Mark **Activated** with ▽ or △, and press ok. The check mark in the right box shows that the function has been activated.
13. Repeat points 4 to 11 if several events are to be activated.
    Note: Up to ten events can be set.

Factory setting

The function is deactivated.

9.7.9 Proportional pressure (4.1.7)

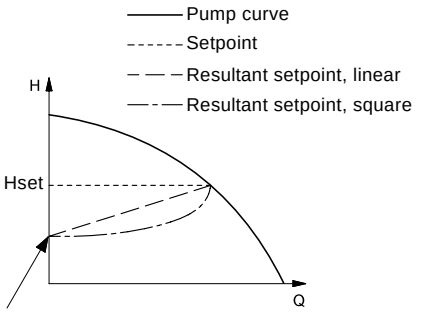


TM03 8960 4807

Fig. 44 Proportional pressure

Description

The function can only be activated in pressure-controlled systems and automatically adapts the setpoint set to the current flow rate. The adaptation can be linear or square. See fig. 45.



Starting point of proportional pressure control
(Influence at 0 flow = x % of H_{set})

TM03 8524 1807

Fig. 45 Proportional pressure

The function has these purposes:

- to compensate for pressure losses
- to reduce the energy consumption
- to increase the comfort for the user.

Setting range

- Activation of the function.
- Selection of control mode.
- Setting of setpoint influence.

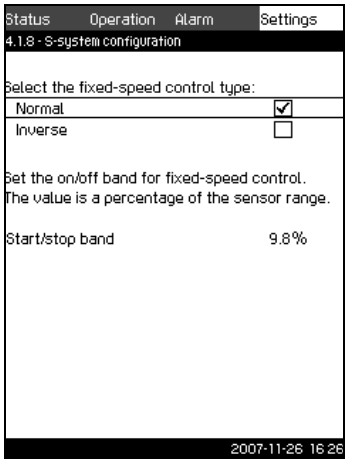
Setting via control panel

1. Mark the **Settings** menu with ⊙.
2. Mark **Primary controller** with ⊙ or ⊙, and press ⊙.
3. Mark **Proportional pressure** with ⊙ or ⊙, and press ⊙.
4. Mark **Activated** with ⊙ or ⊙, and press ⊙. The check mark in the right box shows that the function has been activated.
5. Mark **Adaptation, linear** or **square** with ⊙ or ⊙, and press ⊙.
6. Mark **Influence at 0 flow** with ⊙ or ⊙. Set the value with ⊙ or ⊙, and save with ⊙.

Factory setting

The function is deactivated.

9.7.10 S-system configuration (4.1.8)



TM03 8961 4807

Fig. 46 S-system configuration

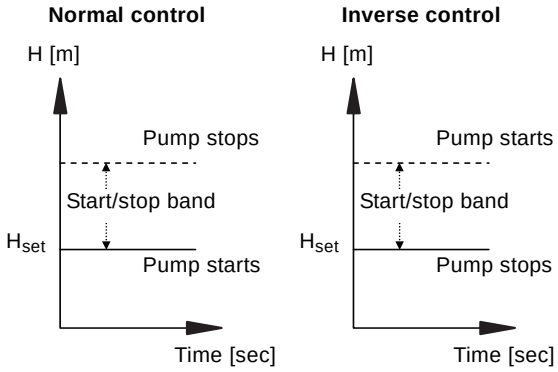
Description

The function makes it possible to invert the control of mains-operated pumps (Hydro MPC-S). That is to set whether pumps are to be started or stopped depending on the current value.

A start/stop band must be set in order to use this function. See fig. 47.

Normal control: A pump is stopped when the current value becomes higher than H_{set} + start/stop band. And a pump is started when the current value becomes lower than H_{set}. See fig. 47.

Inverse control: A pump is started when the current value becomes higher than H_{set} + start/stop band. And a pump is stopped when the current value becomes lower than H_{set}. See fig. 47.



TM03 9205 3607 - TM03 9205 3607

Fig. 47 Normal and inverse control

Setting range

- Selection of configuration (normal or inverse control).
- Setting of start/stop band.

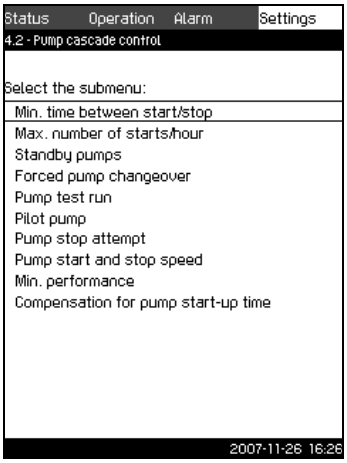
Setting via control panel

1. Mark the **Settings** menu with ⊙.
2. Mark **Primary controller** with ⊙ or ⊙, and press ⊙.
3. Mark **S-system configuration** with ⊙ or ⊙, and press ⊙.
4. Mark **Inverse** with ⊙ or ⊙, and press ⊙.
5. Mark **Start/stop band** with ⊙ or ⊙. Set the value ⊙ with or ⊙, and save with ⊙.

Factory setting

Normal.

9.7.11 Pump cascade control (4.2)



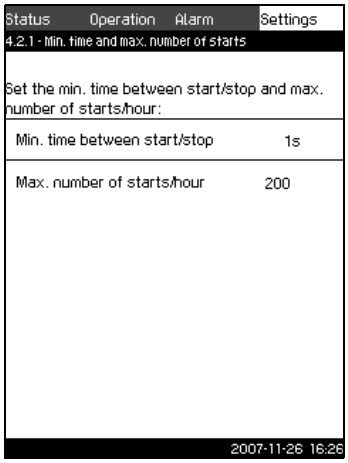
TM03 8962 4807

Fig. 48 Pump cascade control

In this menu section, it is possible to set the functions connected to pump cascade control. The following menus can be selected:

- Min. time between start/stop
- Max. number of starts/hour
- Standby pumps
- Forced pump changeover
- Pump test run
- Pilot pump
- Pump stop attempt
- Pump start and stop speed
- Min. performance
- Compensation for pump start-up time.

9.7.12 Min. time between start/stop (4.2.1)



TM03 2367 4807

Fig. 49 Min. time between start/stop

Description

This function ensures a delay between the starting/stopping of one pump and the starting/stopping of another pump.

The purpose is to prevent hunting when pumps start and stop continuously.

Setting range

From 1 to 3600 seconds.

Setting via control panel

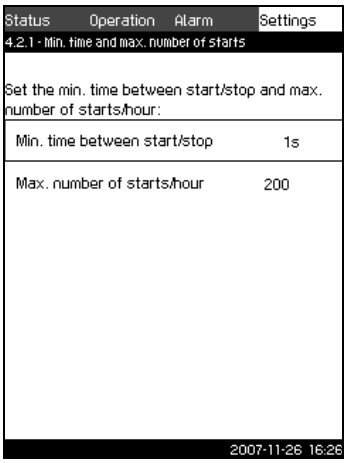
1. Mark the **Settings** menu with ⊙.
2. Mark **Pump cascade control** with ⊙ or ⊙, and press ⊙.
3. Mark **Min. time between start/stop** with ⊙ or ⊙, and press ⊙.
4. Mark **Min. time between start/stop** with ⊙ or ⊙, and press ⊙.
5. Set the required minimum time with ⊙ or ⊙, and save with ⊙.

Factory setting

Minimum time between start/stop of pumps:

Hydro MPC-E and -EF:	1 second
Other variants:	5 seconds

9.7.13 Max. number of starts/hour (4.2.1)



TM03 2367 4807

Fig. 50 Max. number of starts/hour

Description

This function limits the number of pump starts and stops per hour for the complete system. It reduces noise emission and improves the comfort of booster systems with mains-operated pumps.

Each time a pump starts or stops, the CU 351 calculates when the next pump is allowed to start/stop in order not to exceed the permissible number of starts per hour.

The function always allows pumps to be started to meet the requirement, but pump stops will be delayed, if needed, in order not to exceed the permissible number of starts per hour.

The time between pump starts must be between the minimum time between start/stop, see section *9.7.12*, and 3600/n, n being the set number of starts per hour.

Setting range

1 to 1000 starts per hour.

Setting via control panel

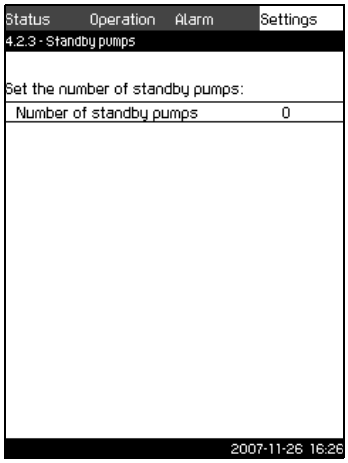
1. Mark the **Settings** menu with ⊙.
2. Mark **Pump cascade control** with ⊙ or ⊙, and press ⊙.
3. Mark **Max. number of starts/hour** with ⊙ or ⊙, and press ⊙.
4. Mark **Max. number of starts/hour** with ⊙ or ⊙, and press ⊙.
5. Set the permissible number of starts per hour with ⊙ or ⊙, and save with ⊙.

Factory setting

Hydro MPC-E and -EF:	200 starts per hour
Other variants:	100 starts per hour

Note **This function has no influence on *Stop function (4.3.1)*.**

9.7.14 Standby pumps (4.2.3)



TM03 2366 4807

Fig. 51 Standby pumps

Description

This function makes it possible to limit the maximum performance of the Hydro MPC, by selecting one or more pumps as standby pumps.

If a three-pump system has one standby pump, maximum two pumps are allowed to be in operation at a time.

If one of the two pumps in operation has a fault and is stopped, the standby pump will be started. The performance of the booster system is thus not reduced.

The status as standby pump alternates between all pumps.

Setting range

The number of possible standby pumps in a Hydro MPC booster system is equal to the total number of pumps in the system minus 1.

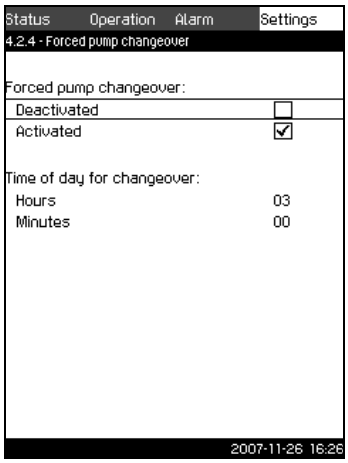
Setting via control panel

1. Mark the **Settings** menu with ⊙.
2. Mark **Pump cascade control** with ⊙ or ⊙, and press ⊙.
3. Mark **Standby pumps** with ⊙ or ⊙, and press ⊙.
4. Select the number of standby pumps with ⊙ or ⊙, and save with ⊙.

Factory setting

The number of standby pumps is set to 0, i.e. function is deactivated.

9.7.15 Forced pump changeover (4.2.4)



TM03 2365 4807

Fig. 52 Forced pump changeover

Description

This function ensures that the pumps run for the same number of operating hours.

In certain applications, the requirement remains constant for long periods and does not require all pumps to run. In such situations, pump changeover does not take place naturally, and forced pump changeover may thus be required.

Once every 24 hours, the CU 351 checks if any pump running has a larger number of operating hours than pumps that are stopped. If this is the case, the pump will be stopped and replaced by a pump with a lower number of operating hours.

Setting range

The function can be activated/deactivated. The hour of the day at which the changeover is to take place can be set.

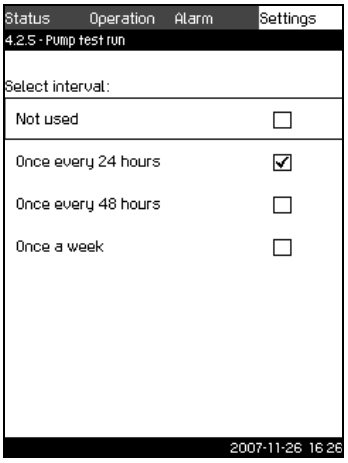
Setting via control panel

1. Mark the **Settings** menu with ⊙.
2. Mark **Pump cascade control** with ⊙ or ⊙, and press ⊙.
3. Mark **Forced pump changeover** with ⊙ or ⊙, and press ⊙.
4. Mark **Activated** with ⊙ or ⊙, and press ⊙. The check mark in the right box shows that the function has been activated.
5. Mark **Time for changeover** with ⊙, and press ⊙.
6. Set the time with ⊙ or ⊙, and save with ⊙.

Factory setting

The function is activated. The time is set to 03:00.

9.7.16 Pump test run (4.2.5)



TM03 2364 4807

Fig. 53 Pump test run

Description

This function is primarily used in situations where the forced pump changeover is deactivated, and/or if the Hydro MPC is set to operating mode *Stop*, for instance in a period when the system is not needed.
In such situations, it is important to test the pumps regularly.

The function ensures that

- pumps do not seize up during a long standstill due to deposits from the pumped liquid.
- the pumped liquid does not decay in the pump.
- trapped air is removed from the pump.

The pumps start automatically one by one and run for five seconds.

Note ***Pumps in the operating mode Manual are not included in the test run. If there is an alarm, the test run will not be carried out.***

Setting range

- Not used.
- Once every 24 hours.
- Once every 48 hours.
- Once a week.

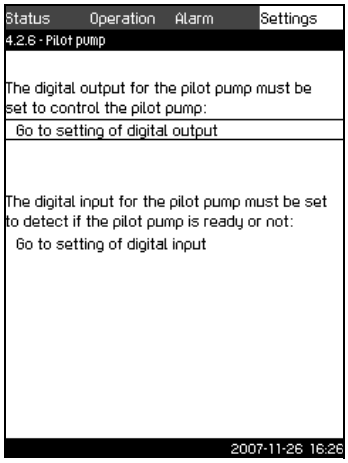
Setting via control panel

1. Mark the **Settings** menu with ▷.
2. Mark **Pump cascade control** with ▽ or △, and press ok.
3. Mark **Pump test run** with ▽ or △, and press ok.
4. Select the interval with ▽ or △.
5. Activate the function with ok.

Factory setting

Test runs are set to once every 24 hours.

9.7.17 Pilot pump (4.2.6)



TM03 8963 4807

Fig. 54 Pilot pump

Description

The function controls a pilot pump via a digital output. The pilot pump takes over the operation from the main pumps in periods when the consumption is so small that the stop function of the main pumps is activated. See section *9.7.23 Stop function (4.3.1)*.

Via a digital input, the operational state of the pilot pump is monitored, i.e. whether it is operational or in a fault condition.

The purpose is to

- save energy
- reduce the number of operating hours of the main pumps.

If the pilot pump cannot keep the pressure by itself, one or more main pumps are started. If only one main pump is started and runs on/off operation, the pilot pump remains cut in. If one or more main pumps run continuously, the pilot pump is cut out.

Note ***If the setpoint of the main pumps is changed, the setpoint of the pilot pump must be changed too.***

Setting range

- See section *9.7.31 Digital outputs (4.3.9)*.
- See section *9.7.26 Digital inputs (4.3.7)*.

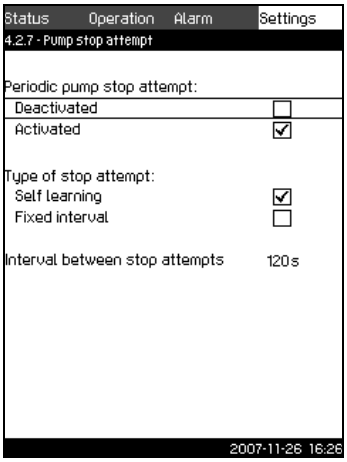
Setting via control panel

1. Mark the **Settings** menu with ▷.
2. Mark **Pump cascade control** with ▽ or △, and press ok.
3. Mark **Pilot pump** with ▽ or △, and press ok.
4. Mark **Go to setting of digital output** with ▽ or △, and press ok.
5. Select a digital output with ▽ or △, and press ok.
6. Mark **Pilot pump control** with ▽ or △, and save with ok.
7. Return by pressing esc twice.
8. Mark **Go to setting of digital input** with ▽ or △, and press ok.
9. Select a digital input ▽ or △, and press ok.
10. Mark **Pilot pump fault** with ▽ or △, and save with ok.

Factory setting

The function is deactivated.

9.7.18 Pump stop attempt (4.2.7)



TM03 8964 4807

Fig. 55 Pump stop attempt

Description

The function makes it possible to set automatic stop attempts of a pump when several pumps are running. It ensures that the optimum number of pumps is always running, in terms of energy consumption. At the same time, the purpose is to avoid disturbances in connection with automatic stop of pumps.

Stop attempts can either take place with a fixed interval set under **Interval between stop attempts** or by self learning. If self learning is selected, the interval between stop attempts will be increased if repeated attempts to stop the pump fail.

Setting via control panel

1. Mark the **Settings** menu with ▷.
2. Mark **Pump cascade control** with ▽ or △, and press ok.
3. Mark **Pump stop attempt** with ▽ or △, and press ok.
4. Mark **Self learning** or **Fixed interval** with ▽ or △, and press ok.
5. If **Fixed interval** is selected:
6. Mark **Interval between stop attempts** with ▽ or △.
7. Set the interval with ⊕ or ⊖, and save with ok.
8. Mark **Activated** with ▽ or △, and press ok. The check mark in the right box shows that the function has been activated.

Factory setting

The function is activated.

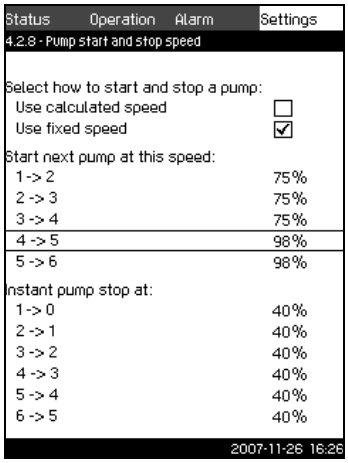
9.7.19 Pump start and stop speed (4.2.8)

Description

The function controls the starting and stopping of pumps. There are two options:

1. Use calculated speed
   This function ensures that the optimum number of pumps is always running at a desired duty point, in terms of energy consumption. The CU 351 calculates the required number of pumps and their speed. This requires that the differential pressure of the pump is measured by a differential pressure sensor or separate pressure sensors on the inlet and discharge side.
   When calculated speed has been selected, the CU 351 ignores the percentages set.
2. Use fixed speed
   The pumps are started and stopped at speeds set by the user.

1. Use calculated speed



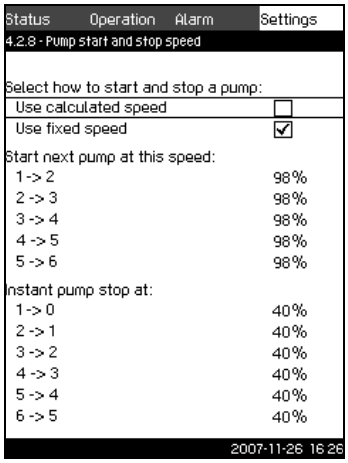
TM03 8966 4807

Fig. 56 Calculated pump start and stop speed

Setting via control panel

1. Mark the **Settings** menu with ⊙.
2. Mark **Pump cascade control** with ⊙ or ⊙, and press ⊙.
3. Mark **Pump start and stop speed** with ⊙ or ⊙, and press ⊙.
4. Mark **Use calculated speed** with ⊙ or ⊙, and press ⊙.

2. Use fixed speed



TM03 8965 4807

Fig. 57 Fixed pump start and stop speed

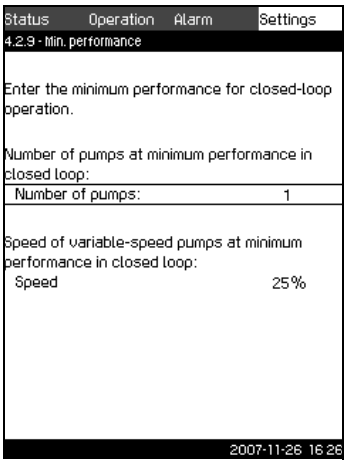
Setting via control panel

1. Mark the **Settings** menu with ⊙.
2. Mark **Pump cascade control** with ⊙ or ⊙, and press ⊙.
3. Mark **Pump start and stop speed** with ⊙ or ⊙, and press ⊙.
4. Mark **Use fixed speed** with ⊙ or ⊙, and press ⊙.
5. Mark **Start of next pump at: 1->2** with ⊙ or ⊙, and press ⊙.
6. Set the speed as percentage with ⊕ or ⊖, and save with ⊙. Set the other pumps in the same way.
7. Mark **Instant pump stop at: 1->0** with ⊙ or ⊙, and press ⊙.
8. Set the speed as percentage with ⊕ or ⊖, and save with ⊙. Set the other pumps in the same way.

Factory setting

The function is set to calculated speed.

9.7.20 Min. performance (4.2.9)



TM03 8967 4807

Fig. 58 Min. performance

Description

This function ensures circulation in a system. Note that the stop function, if activated, can influence this function. See section *9.7.23 Stop function (4.3.1)*. Examples:

- If 0 or 1 pump has been selected as a minimum, the stop function can stop the pump if there is no or a very small consumption.
- If two or more pumps have been selected as a minimum, the stop function is not active.

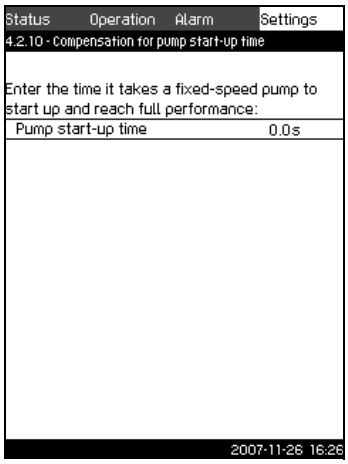
Setting via control panel

1. Mark the **Settings** menu with ⊙.
2. Mark **Pump cascade control** with ⊙ or ⊙, and press ⊙.
3. Mark **Min. performance** with ⊙ or ⊙, and press ⊙.
4. Set **Number of pumps** with ⊕ or ⊖, and save with ⊙.
5. Mark **Speed** with ⊙ or ⊙. Set the speed with ⊕ or ⊖, and save with ⊙.

Factory setting

The number of pumps is set to 1. The speed in closed loop is set to 25 %.

9.7.21 Compensation for pump start-up time (4.2.10)



TM03 8968 4807

Fig. 59 Compensation for pump start-up time

Description

The function is used for the system types -ES, -ED, -F and -EDF.

The purpose is to avoid disturbances when a mains-operated pump with fixed speed is started. The function compensates for the time it takes a mains-operated pump to reach its full performance after start. The start-up time of the mains-operated pump must be known.

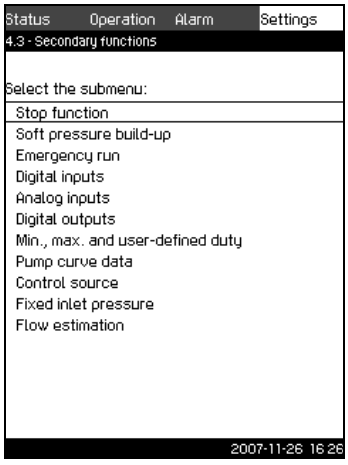
Setting via control panel

1. Mark the **Settings** menu with ⊙.
2. Mark **Pump cascade control** with ⊙ or ⊙, and press ⊙.
3. Mark **Compensation for pump start-up time** with ⊙ or ⊙, and press ⊙.
4. Set the start-up time with ⊙ or ⊙, and save with ⊙.

Factory setting

The start-up time is set to 0 seconds.

9.7.22 Secondary functions (4.3)



TM03 8969 4807

Fig. 60 Secondary functions

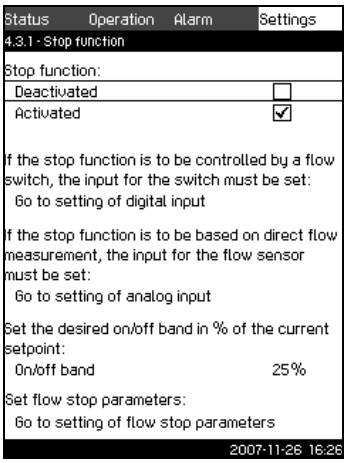
Description

Functions that are secondary in relation to the normal operation of the Hydro MPC booster system can be set in this display. Secondary functions are functions that offer additional functionality.

The display makes it possible to open specific displays regarding:

- *Stop function (4.3.1)*
- *Soft pressure build-up (4.3.3)*
- *Digital inputs (4.3.7)*
- *Analog inputs (4.3.8)*
- *Digital outputs (4.3.9)*
- *Emergency run (4.3.5)*
- *Min., max. and user-defined duty (4.3.14)*
- *Pump curve data (4.3.19)*
- *Flow estimation (4.3.23)*
- *Control source (4.3.20)*
- *Fixed inlet pressure (4.3.22)*.

9.7.23 Stop function (4.3.1)



TM03 2355 4807

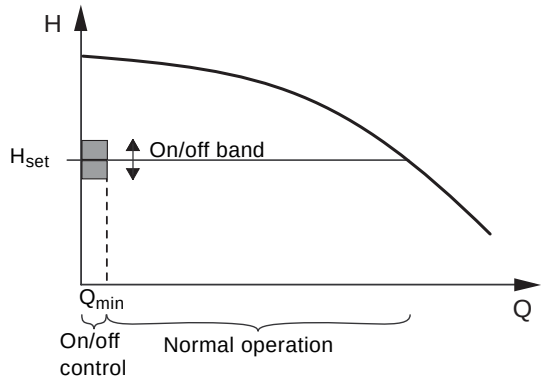
Fig. 61 Stop function

Description

This function makes it possible to stop the last pump if there is no or a very small consumption. The purpose is to

- save energy
- prevent heating of shaft seal faces due to increased mechanical friction as a result of reduced cooling by the pumped liquid
- prevent heating of the pumped liquid.

The description of the stop function applies to all Hydro MPC booster systems with variable-speed pumps. Hydro MPC-S will have on/off control of all pumps as described in section *6.1 Examples of control variants*.



TM03 1692 2705

Fig. 62 On/off band

When the stop function is activated, the operation of Hydro MPC is continuously monitored to detect a low flow rate.
When the CU 351 detects no or a low flow rate ($Q < Q_{min}$), it changes from constant-pressure operation to on/off control of the last pump in operation.

Before stopping, the pump increases the pressure to a value corresponding to H_{set} + 0.5 x on/off band. The pump is restarted when the pressure is H_{set} – 0.5 x on/off band. See fig. 63.

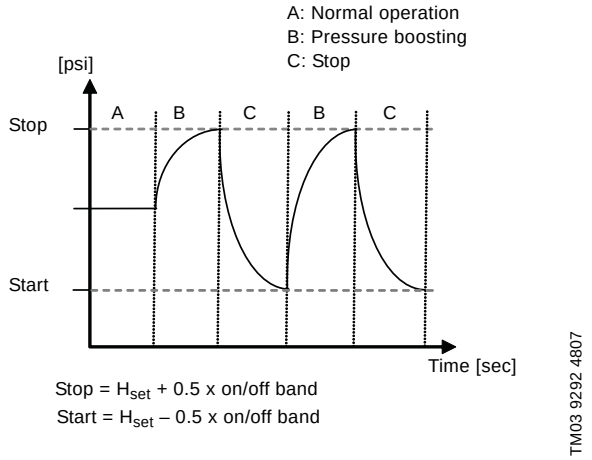


Fig. 63 On/off operation

The flow rate is estimated by the CU 351 when the pump is in the stop period. As long as the flow rate is lower than Q_{min}, the pump will run on/off. If the flow rate is increased to above Q_{min}, the pump returns to normal operation, H_{set}. H_{set} is equal to the current setpoint. See section *9.4.4 Setpoint (1.2.2)*.

Detection of low flow rate

Low flow rate can be detected by means of

- direct flow measurement with a flowmeter or flow switch
- estimation of flow rate by measurement of current pressure and speed.

If the booster system is not connected to a flowmeter or flow switch, the stop function will use the estimating function.

If the detection of low flow rate is based on flow estimation, a diaphragm tank of a certain size and with a certain precharge pressure is required.

Diaphragm tank size

Pump type	Recommended diaphragm tank size [gallons]						
	-E	-ED	-ES	-EF	-EDF	-F	-S
CR(E) 3	4.4	4.4	4.4	4.4	4.4	4.4	20
CR(E) 5	4.4	4.4	4.4	4.4	4.4	4.4	34
CR(E) 10	10.2	10.2	10.2	10.2	10.2	10.2	62
CR(E) 15	34	34	34	34	34	34	211
CR(E) 20	34	34	34	34	34	34	211
CR(E) 32	44	44	44	44	44	44	317
CR(E) 45	86	86	86	86	86	86	528
CR(E) 64	132	132	132	132	132	132	1056
CR 90	-	-	-	132	132	132	1056

Precharge pressure

Hydro MPC-E, -ED, -ES, -EF, -EDF and -F: 0.7 x setpoint.

Hydro MPC-S: 0.9 x setpoint.

During each flow estimation (every 2 minutes), the estimating function will disturb the discharge pressure by ±10 % of the setpoint. If this disturbance is not acceptable, the stop function must be based on direct flow measurement with a flowmeter or flow switch.

The minimum flow rate can be set, i.e. the flow rate at which the booster system changes to on/off control of the last pump in operation.

If both a flowmeter and a flow switch are connected, the changeover to on/off control is determined by the unit first indicating low flow rate.

Setting range

On/off band:	5 to 30 %
Min. flow rate:	2 to 50 % of the nominal flow rate (Q_{nom}) of one of the pumps. (Can only be set if direct flow measurement by means of flowmeter has been selected.)

Setting via control panel

System without flow switch or flowmeter

1. Mark the **Settings** menu with ›.
2. Mark **Secondary functions** with ⌄ or ⌃, and press ok.
3. Mark **Stop function** with ⌄ or ⌃, and press ok.
4. Mark **Activated** with ⌄ or ⌃, and press ok.
   The activation is indicated by a check mark in the box.
5. Mark **On/off band** with ⌄ or ⌃.
6. Set the on/off band with + or −, and save with ok.
7. Mark **Go to setting of flow stop parameters** with ⌄ or ⌃, and press ok.
   Now the display below is shown.

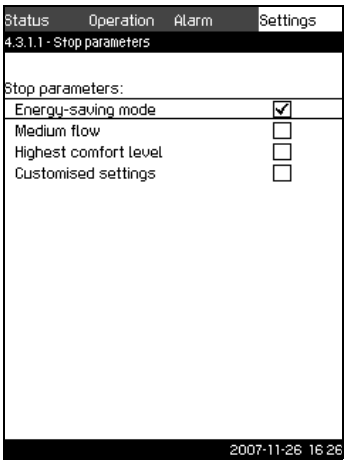


Fig. 64 Stop parameters

8. Select one of the stop parameters with ⌄ or ⌃, and save with ok. If **Customised settings** are selected, the parameters shown in fig. 65 must be set. See examples below.

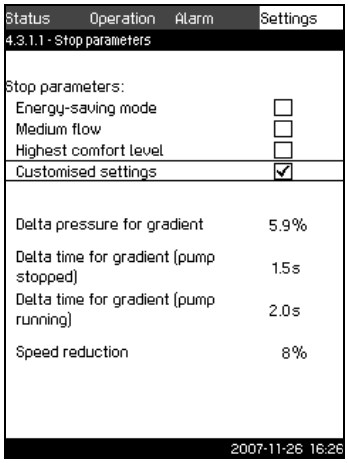


Fig. 65 Customised settings

Note ***Rule of thumb: Speed reduction = 2 x delta pressure for gradient.***

Example 1: Increasing the stop limit, Q_{min} (high flow limit)

- Increase the delta pressure for gradient.
- Reduce the delta time for gradient (pump stopped).
- Reduce the delta time for gradient (pump running).
- Increase the speed reduction.

Example of increased stop limit	
Parameter	**Value**
Delta pressure for gradient	6 %
Delta time for gradient (pump stopped)	1.5 sec
Delta time for gradient (pump running)	2.0 sec
Speed reduction	10 %

Example 2: Reducing the stop limit, Q_{min} (low flow limit)

- Reduce the delta pressure for gradient.
- Increase the delta time for gradient (pump stopped).
- Increase the delta time for gradient (pump running).
- Reduce the speed reduction.

Example of reduced flow limit	
Parameter	**Value**
Delta pressure for gradient	3 %
Delta time for gradient (pump stopped)	15.0 sec
Delta time for gradient (pump running)	25.0 sec
Speed reduction	6 %

Note ***The stop limit depends on the tank size.***

System with flow switch

Make the following additional settings:

1. Mark **Go to setting of digital input** with ⌄ or ⌃, and press ok. Now the display *Digital inputs (4.3.7)* appears.
2. Select the digital input where the flow switch is connected with ⌄ or ⌃, and press ok.
3. Mark **Flow switch** with ⌄ or ⌃, press ok and return with esc.

Note ***An open contact indicates low flow.***

System with flowmeter

Make the following additional settings:

1. Mark **Go to setting of analog input** with ⌄ or ⌃, and press ok. Now the display *Analog inputs (4.3.8)* appears.
2. Select the analog input where the flowmeter is connected, and set up the input for the flowmeter by selecting **Flow rate**.
3. Return to **Stop function** by pressing esc twice.
4. Mark **Stop limit** with ⌄ or ⌃.
5. Set the value with ⊕ or ⊖, and save with ok.

Factory setting

The function is activated.

On/off band: 25 %

Min. flow rate: 30 % of the nominal flow rate of one pump

9.7.24 Soft pressure build-up (4.3.3)

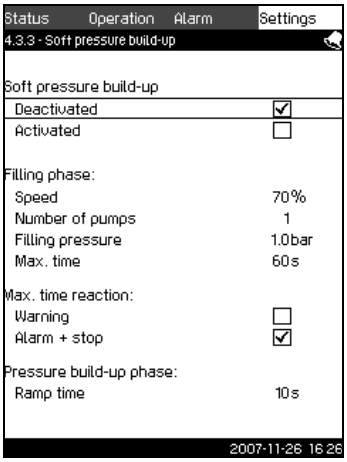


Fig. 66 Soft pressure build-up

Description

The function ensures a smooth start-up of systems with for instance empty pipes.

Start-up takes place in two phases. See fig. 67.

1. Filling phase.
   The pipework is slowly filled with water. When the pressure sensor of the system detects that the pipework has been filled, phase two begins.
2. Pressure build-up phase.
   The system pressure is increased until the setpoint is reached. The pressure build-up takes place over a ramp time. If the setpoint is not reached within a given time, a warning or an alarm can be given, and the pumps can be stopped at the same time.

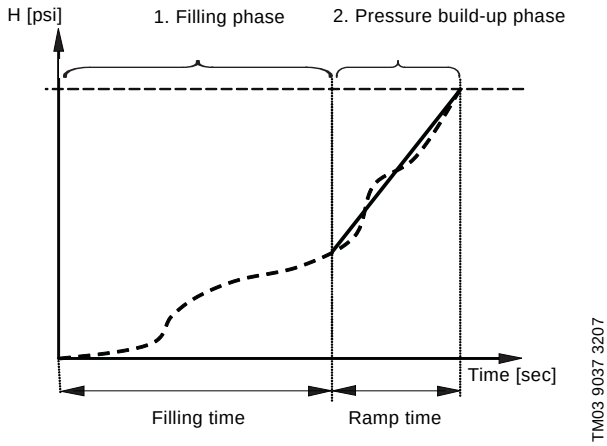


Fig. 67 Filling and pressure build-up phases

Setting range

- Activation of the function.
- Setting of pump speed.
- Setting of number of pumps.
- Setting of filling pressure.
- Setting of maximum filling time.
- Setting of warning or alarm + stop.
- Setting of ramp time for the pressure build-up phase.

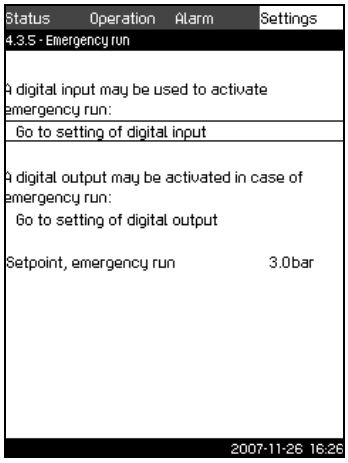
Setting via control panel

1. Mark the **Settings** menu with ▷
2. Mark **Secondary functions** with ▽ or △, and press OK.
3. Mark **Soft pressure build-up** with ▽ or △, and press OK.
4. Mark **Speed** with ▽ or △.
5. Set the value with + or −, and save with OK.
6. Mark **Number of pumps** with ▽ or △.
7. Set the value with + or −, and save with OK.
8. Mark **Filling pressure** with ▽ or △.
9. Set the value with + or −, and save with OK.
10. Mark **Max. time** with ▽ or △.
11. Set the value with + or −, and save with OK.
12. Mark **Warning** or **Alarm + stop** with ▽ or △, and press OK.
13. Mark **Ramp time** with ▽ or △.
14. Set the value with + or −, and save with OK.
15. Mark **Activated**, and press OK.

Factory setting

The function is deactivated.

9.7.25 Emergency run (4.3.5)



TM03 8971 4807

Fig. 68 Emergency run

Description

When this function has been activated, the pumps will keep running regardless of warnings or alarms. The pumps will run according to a setpoint set specifically for this function.

Caution ***In case of sensor fault, both main and standby pumps will run at 100 % speed!***

Setting range

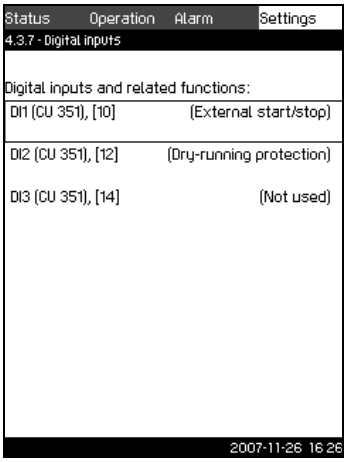
- Setting of digital input (*9.7.26 Digital inputs (4.3.7)*).
- Setting of digital output (*9.7.31 Digital outputs (4.3.9)*).
- Setting of setpoint for emergency run.

Setting via control panel

1. Mark the **Settings** menu with ▷
2. Mark **Secondary functions** with ▽ or △, and press OK.
3. Mark **Emergency run** with ▽ or △, and press OK.
4. Mark **Go to setting of digital input** with ▽ or △, and press OK.
5. Select a digital input with ▽ or △, and press OK.
6. Mark **Emergency run** with ▽ or △, and save with OK.
7. Return by pressing ESC twice.
8. Mark **Go to setting of digital output** with ▽ or △, and press OK.
9. Select a digital output with ▽ or △, and press OK.
10. Mark **Emergency run** with ▽ or △, and save with OK.
11. Return by pressing ESC twice.
12. Mark **Setpoint, emergency run** with ▽ or △.
13. Set the value with + or −, and save with OK.

Note ***When this function has been set as described above, it can also be activated via the display System operating mode (2.1.1).***

9.7.26 Digital inputs (4.3.7)



TM03 2359 4807

Fig. 69 Digital inputs

Description

In this menu, the digital inputs of the CU 351 can be set. Each input, except DI1, can be activated and related to a certain function.

As standard, the Hydro MPC has three digital inputs. If the Hydro MPC incorporates an IO 351B module (option), the number of digital inputs is 12.

In the display, all digital inputs are shown so that their physical position in the Hydro MPC can be identified.

Example

DI1 (IO 351-41), [10]:

DI1:	Digital input No 1
(IO 351-41):	IO 351, GENIbus number 41
[10]:	Terminal No 10

For further information on the connection of various digital inputs, see the wiring diagram supplied with the control cabinet.

Setting range

The digital input to be set is selected in the display *Digital inputs (4.3.7)*.

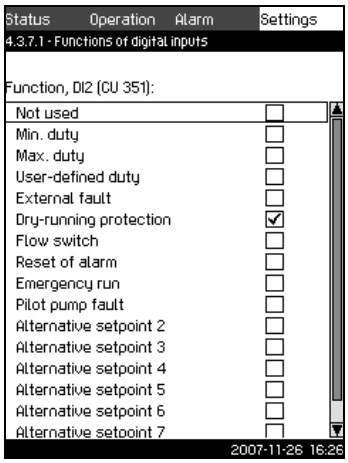
Note ***DI1 (CU 351) cannot be selected.***

Setting via control panel

1. Mark the **Settings** menu with ▷.

2. Mark **Secondary functions** with ⊙ or ⊙, and press ⊙.
3. Mark **Digital inputs** ⊙ or ⊙, and press ⊙.
4. Select the digital input with ⊙ or ⊙, and press ⊙.

9.7.27 Functions of digital inputs (4.3.7.1)



TM03 8972 4807

Fig. 70 Functions of digital inputs

Description

In the displays 4.3.7.1, a function can be related to the digital inputs.

Setting range

It is possible to select one function in each display:

Function	Contact activated	
Not used		
Min. duty		= Operating mode *Min.*
Max. duty		= Operating mode *Max.*
User-defined duty		= Operating mode *User-defined*
External fault		= External fault
Dry-running protection		= Water shortage
Flow switch		= Flow rate > Set switch value
Reset of alarm		= Reset alarms
Emergency run		= Operating mode *Emergency run*
Pilot pump fault		= Pilot pump fault
Alternative setpoint 2		= Setpoint 2 selected
Alternative setpoint 3		= Setpoint 3 selected
Alternative setpoint 4		= Setpoint 4 selected
Alternative setpoint 5		= Setpoint 5 selected
Alternative setpoint 6		= Setpoint 6 selected
Alternative setpoint 7		= Setpoint 7 selected

See the relevant sections for further information about the functions.

Generally, a closed contact activates the function selected.

Setting via control panel

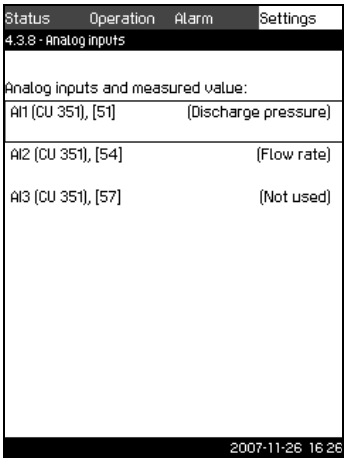
1. Mark the **Settings** menu with ⊙.
2. Mark **Secondary functions** with ⊙ or ⊙, and press ⊙.
3. Mark **Digital inputs** with ⊙ or ⊙, and press ⊙.
4. Select the digital input with ⊙ or ⊙, and press ⊙.
5. Select the desired function with ⊙ or ⊙, and activate it with ⊙.
   The activation is indicated by a check mark in the box.

Factory setting

Digital input	Function
DI1 (CU 351) [10]	External start/stop. Open contact = stop. **Note:** Input No 1 cannot be changed.
DI2 (CU 351) [12]	Monitoring of water shortage (dry-running protection). Open contact = water shortage (if the Hydro MPC is supplied with this option).

Note ***Monitoring of water shortage requires a pressure switch connected to the Hydro MPC.***

9.7.28 Analog inputs (4.3.8)



TM03 2356 4807

Fig. 71 Analog inputs

Description

In this display, the analog inputs of the Hydro MPC can be set.

Each input can be activated and related to a certain function.

As standard, the Hydro MPC has three analog inputs. If the Hydro MPC incorporates an IO 351B module (option), the number of analog inputs is 5.

In the display, all analog inputs are shown so that their physical position in the Hydro MPC can be identified. A redundant primary sensor can be fitted as back-up for the primary sensor in order to increase reliability and prevent stop of operation.

Note ***If two sensors are to be redundant, each must have a separate analog input.***

Example

AI1 (CU 351) [51]:

AI1:	Analog input No 1
(CU 351):	CU 351
[51]:	Terminal No 51

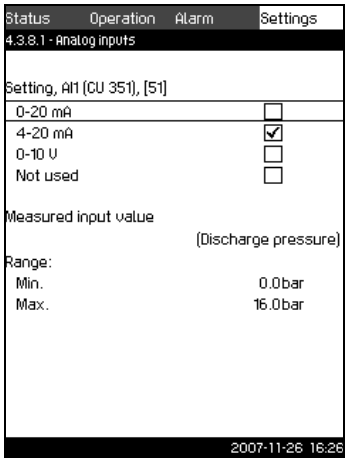
Setting range

In the display *Analog inputs (4.3.8)*, the analog input to be set is selected.

Setting via control panel

1. Mark the **Settings** menu with ⊙.
2. Mark **Secondary functions** with ⊙ or ⊙, and press ⊙.
3. Mark **Analog inputs** with ⊙ or ⊙, and press ⊙.
4. Select the analog input with ⊙ or ⊙, and press ⊙.

9.7.29 Analog inputs (4.3.8.1 to 4.3.8.7)



TM03 2357 4807

Fig. 72 Analog inputs

Description

In the displays 4.3.8.1 to 4.3.8.7, analog inputs can be set. Each display is divided into three parts:

- Setting of input signal, for instance 4-20 mA
- Measured input value, for instance discharge pressure
- Measuring range of the sensor/signal transmitter, for instance 0-16 bar.

Setting range

It is possible to set the following parameters in each display:

- Not used
- Range of input signal, 0-20 mA, 4-20 mA, 0-10 V
- Measured input value
- Sensor range.

Setting via control panel

1. Mark the **Settings** menu with ⊙.
2. Mark **Secondary functions** with ⊙ or ⊙, and press ⊙.
3. Mark **Analog inputs** with ⊙ or ⊙, and press ⊙.
4. Select the analog input with ⊙ or ⊙, and press ⊙.
5. Mark the setting of the analog input with ⊙ or ⊙, and activate it with ⊙.
   The activation is indicated by a check mark in the box.

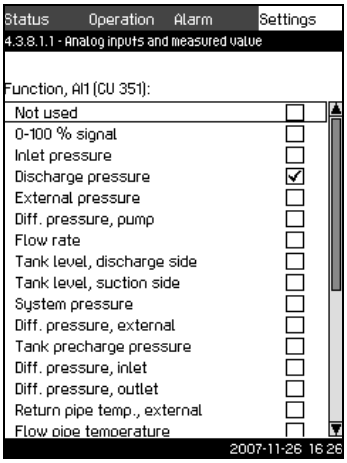
Note

If an analog input is deactivated, the display will only show the top part, i.e. the setting of the analog input.
If the input is activated, the middle part, "Measured input value", is shown. This makes it possible to relate a function to the analog input in another display. When the analog input has been related to a function, CU 351 will return to the display for setting of analog inputs.

Factory setting

Analog input	Function
AI1 (CU 351) [51]	Discharge pressure
AI2 (CU 351) [54]	Tank precharge pressure (if Hydro MPC is supplied with measurement of tank precharge pressure)
AI3 (CU 351) [57]	Redundant primary sensor (if Hydro MPC is supplied with this option)

9.7.30 Analog inputs and measured value (4.3.8.1.1 to 4.3.8.7.1)



TM03 8973 4807

Fig. 73 Analog inputs and measured value

Description

In the display *Analog inputs and measured value (4.3.8.1.1 to 4.3.8.7.1)*, a function can be related to the individual analog inputs.

Setting range

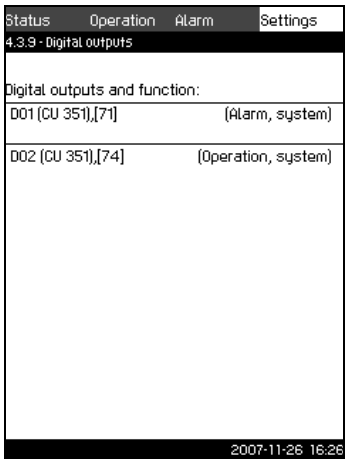
It is possible to select one function per analog input.

- Not used
- 0-100 % signal
- Inlet pressure
- Discharge pressure
- External pressure
- Differential pressure, pump
- Flow rate
- Tank level, discharge side
- Tank level, suction side
- System pressure
- Differential pressure, external
- Tank precharge pressure
- Differential pressure, inlet
- Differential pressure, outlet
- Return pipe temperature, external
- Flow pipe temperature
- Return pipe temperature
- Differential temperature
- Ambient temperature
- Power, pump 1 to 6
- Power, VFD.

Setting via control panel

1. Mark the **Settings** menu with ▷.
2. Mark **Secondary functions** with ▽ or △, and press OK.
3. Mark **Analog inputs** with ▽ or △, and press OK.
4. Select the analog input with ▽ or △, and press OK.
5. Set the range of the analog input with ▽ or △, and press OK.
   The activation is indicated by a check mark.
6. Mark **Measured input value** with ▽ or △, and press OK.
   Now the display 4.3.8.1.1 appears.
7. Select the input with ▽ or △, and press OK.
8. Press ESC to return to display 4.3.8.1.
9. Set the minimum sensor value with ⊕ or ⊖, and save with OK.
10. Set the maximum sensor value with ⊕ or ⊖, and save with OK.

9.7.31 Digital outputs (4.3.9)



TM03 2333 4807

Fig. 74 Digital outputs

Description

In this display, the digital relay outputs of the Hydro MPC can be set. Each output can be activated and related to a certain function.

As standard, the Hydro MPC has two digital outputs.

If the Hydro MPC incorporates an IO 351B module (option), the number of digital outputs is 9.

In the display, all digital outputs are shown so that their physical position in the Hydro MPC can be identified.

Example

DO1 (IO 351-41) [71]:

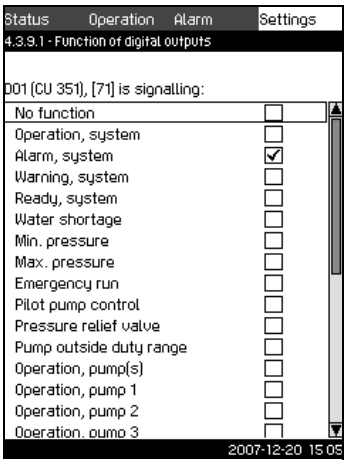
DO1	Digital output No 1
(IO 351-41)	IO 351B, GENIbus number 41
[71]	Terminal No 71

For further information on the connection of various digital outputs, see the wiring diagram supplied with the CU 351.

Setting range

In the display *Digital outputs (4.3.9)*, the digital output to be used is selected.

9.7.32 Functions of digital outputs (4.3.9.1 to 4.3.9.16)



TM03 8974 4807

Fig. 75 Functions of digital outputs

Description

In the displays *Functions of digital outputs (4.3.9.1 to 4.3.9.16)*, a function can be related to the individual outputs.

Setting range

It is possible to select one function in each display:

- No function
- Operation, system
- Alarm, system
- Warning, system
- Ready, system
- Water shortage
- Min. pressure
- Max. pressure
- Emergency run
- Pilot pump control
- Pressure relief valve
- Operation, pump 1 to 6
- Alarm, pump 1 to 6
- Alarm, limit 1 exceeded
- Warning, limit 1 exceeded
- Alarm, limit 2 exceeded
- Warning, limit 2 exceeded.

Setting via control panel

1. Mark the **Settings** menu with ▷.
2. Mark **Secondary functions** ▽ with or △, and press OK.
3. Mark **Digital outputs** with ▽ or △, and press OK.
4. Select the digital output with ▽ or △, and press OK.
5. Mark the desired function with ▽ or △, and activate it with OK.
   The activation is indicated by a check mark in the box.

Factory setting

Digital output	Function
DO1 (CU 351) [71]	Alarm, system
DO2 (CU 351) [74]	Operation, system

9.7.33 Min., max. and user-defined duty (4.3.14)

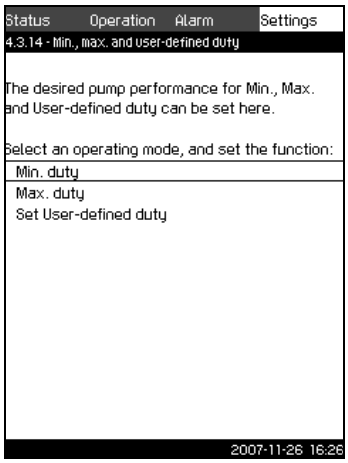


Fig. 76 Min., max. and user-defined duty

Description

Hydro MPC is usually controlled in a closed loop to maintain a discharge pressure. In certain periods, it may be necessary to let the booster system run in open loop at a set pump performance.

Setting range

The CU 351 makes it possible to change between three operating modes:

1. *Min. duty (4.3.14.1)*.
2. *Max. duty (4.3.14.2)*.
3. *User-defined duty (4.3.14.3)*.

Note ***For each of these modes, the number of operating pumps and the pump performance (speed) can be set.***

9.7.34 Min. duty (4.3.14.1)

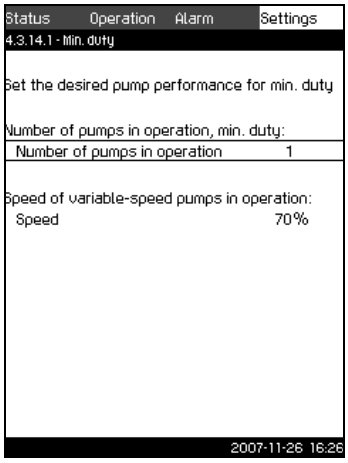


Fig. 77 Min. duty

Description

In all booster systems apart from Hydro MPC-S, minimum duty is only possible for variable-speed pumps. In Hydro MPC-S systems, only the number of pumps running at 100 % speed can be set.

Setting range

- Number of pumps in operation.
- Speed as percentage (25 to 100 %) for variable-speed pumps.

Setting via control panel

1. Mark the **Settings** menu with ⊙.
2. Mark **Secondary functions** with ⊙ or ⊙, and press ⊙.
3. Mark **Min., max. and user-defined duty** with ⊙ or ⊙, and press ⊙.
4. Mark **Min. duty** with ⊙ or ⊙, and press ⊙.
5. Mark **Number of pumps in operation, min. duty** with ⊙ or ⊙.
6. Set the number with ⊙ or ⊙, and save with ⊙.
7. Mark **Speed** with ⊙ or ⊙.
8. Set the value with ⊙ or ⊙, and save with ⊙.

Factory setting

Number of pumps in operation during min. duty:	1
Speed as percentage for variable-speed pumps:	70

9.7.35 Max. duty (4.3.14.2)

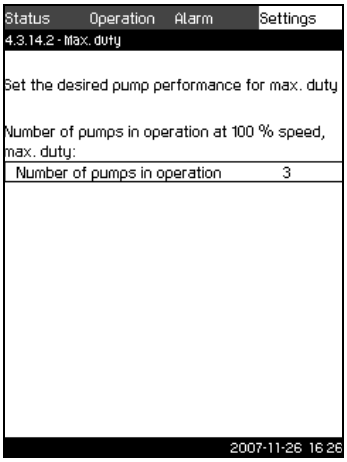


Fig. 78 Max. duty

Description

The function makes it possible for a set number of pumps to run at maximum performance when the function is activated.

Setting range

In this display, the number of pumps to run in the operating mode *Max.* can be set. All pumps run at 100 % speed.

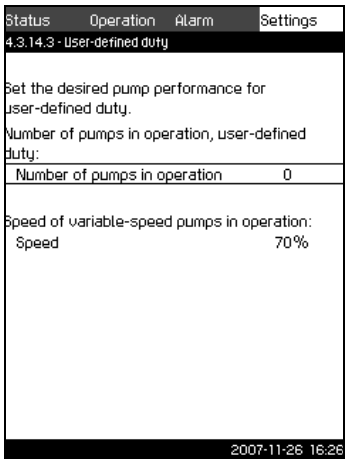
Setting via control panel

1. Mark the **Settings** menu with ⊙.
2. Mark **Secondary functions** with ⊙ or ⊙, and press ⊙.
3. Mark **Min., max. and user-defined duty** with ⊙ or ⊙, and press ⊙.
4. Mark **Max. duty** with ⊙ or ⊙, and press ⊙.
5. Mark **Number of pumps in operation at 100 % speed, max. duty** with ⊙ or ⊙.
6. Set the number with ⊙ or ⊙, and save with ⊙.

Factory setting

Number of pumps in operation during max. duty:	All pumps (except standby pumps)

9.7.36 User-defined duty (4.3.14.3)



TM03 2352 4807

Fig. 79 User-defined duty

Description

In this display, it is possible to set a user-defined performance, typically a performance between min. and max. duty.

The function makes it possible to set a pump performance by selecting the number of pumps to run and the speed of variable-speed pumps.

This function primarily selects the variable-speed pumps. If the number of selected pumps exceeds the number of variable-speed pumps, mains-operated pumps are started too.

Setting range

- Number of pumps in operation.
- Speed as percentage for variable-speed pumps.
  Note: In Hydro MPC booster systems with only variable-speed pumps, the speed can be set between 25 and 100 %; in booster systems with both variable-speed pumps and mains-operated pumps the speed can be set between 70 and 100 %.

Setting via control panel

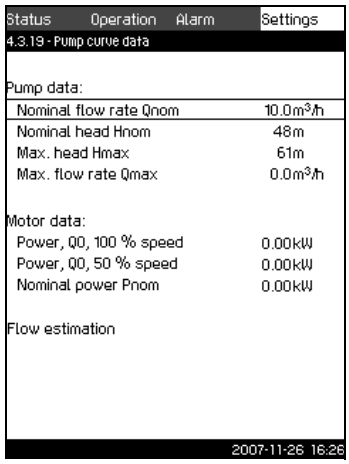
1. Mark the **Settings** menu with ⊙.
2. Mark **Secondary functions** with ⊙ or ⊙, and press ⊙.
3. Mark **Min., max. and user-defined duty** with ⊙ or ⊙, and press ⊙.
4. Mark **User-defined duty** with ⊙ or ⊙, and press ⊙.
5. Mark **Number of pumps in operation, user-defined duty** with ⊙ or ⊙.
6. Set the number with ⊙ or ⊙, and save with ⊙.
7. Mark **Speed** with ⊙ or ⊙.
8. Set the value with ⊙ or ⊙, and save with ⊙.

Factory setting

The function is not activated, as the following has been set:

Number of pumps in operation during user-defined duty:	0

9.7.37 Pump curve data (4.3.19)



TM03 8975 4807

Fig. 80 Pump curve data

Description

The CU 351 has a number of functions using these pump data:

- Nominal flow rate, Q_{nom}, in m^3/h
- Nominal head, H_{nom}, in metres
- Max. head, H_{max}, in metres
- Max. flow rate, Q_{max}, in m^3/h
- Power, Q_0, 100 % speed, in kW
- Power, Q_0, 50 % speed, in kW
- Nominal power, P_{nom}, in kW.

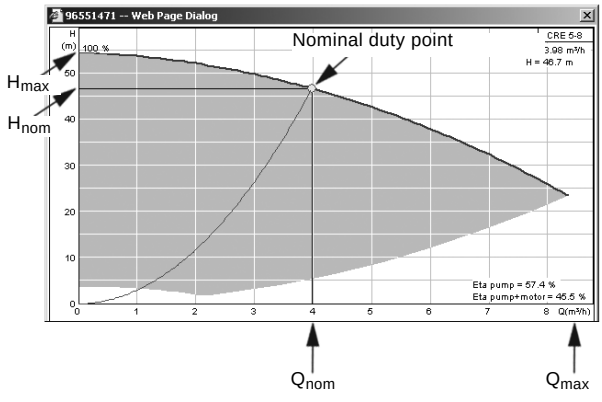
Note ***Grundfos can supply hydraulic data for CR, CRI, CRE and CRIE pumps where GSC files can be downloaded directly to the CU 351.***

Note ***The electrical data, "Power, Q0, 100 % speed" and "Power, Q0, 50 % speed" must be entered manually.***

For Grundfos E-pumps, the data of input power (P1) must be entered.

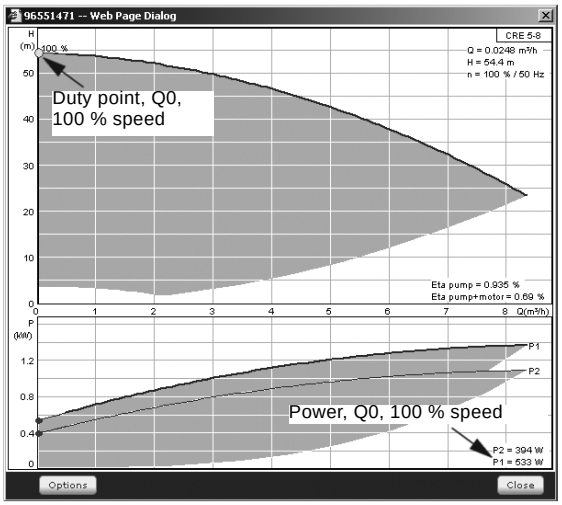
The data are read by means of the pump performance curves which can be found in WebCAPS on Grundfos' homepage, www.grundfos.com. See examples in figs 81 to 84.

If WebCAPS is not accessible, try to bring a pump into the three duty points: Power, Q0, 100 % speed, Power, Q0, 50 % speed and Nominal power, Pnom. Read the power values in displays 1.3 to 1.8, depending on the pump. See section *9.4.8 Pump 1...6 (1.3 to 1.8)*.



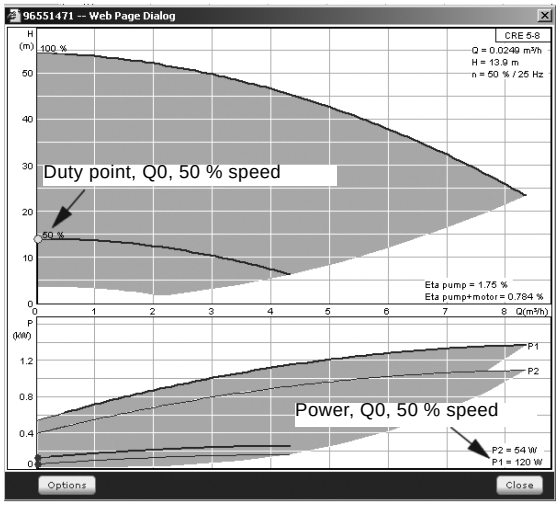
TM03 9993 4807

Fig. 81 Reading of Q_{nom}, H_{nom}, H_{max} and Q_{max} (WebCAPS)



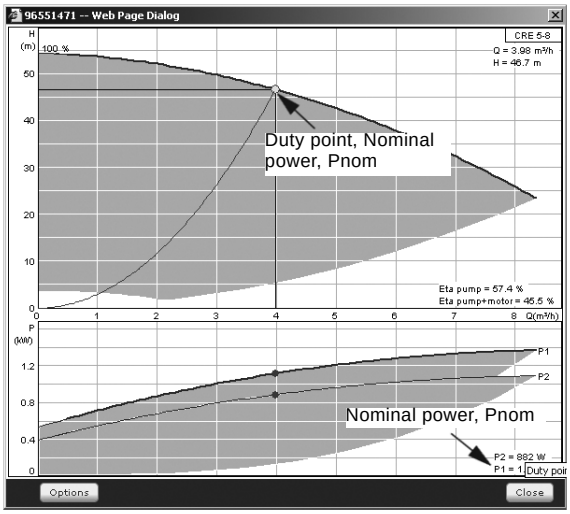
TM03 9994 4807

Fig. 82 Reading of Power, Q0, 100 % speed (WebCAPS)



TM03 9995 4807

Fig. 83 Reading of Power, Q0, 50 % speed (WebCAPS)



TM03 9996 4807

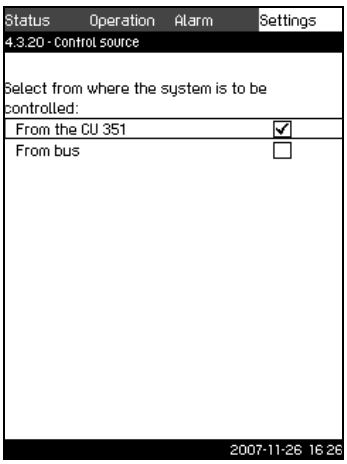
Fig. 84 Reading of Nominal power, Pnom (WebCAPS)

Note ***Q_{nom} and H_{nom} are the rated duty point of the pumps and usually the duty point with the highest efficiency.***

Setting via control panel

1. Mark the **Settings** menu with ⊙.
2. Mark **Secondary functions** with ⊙ or ⊙, and press ⊙.
3. Mark **Pump curve data** with ⊙ or ⊙, and press ⊙.
4. Mark **Nominal flow rate Q_{nom}** with ⊙ or ⊙.
5. Set the value with ⊙ or ⊙, and save with ⊙.
6. Mark **Nominal head H_{nom}** with ⊙ or ⊙.
7. Set the value with ⊙ or ⊙, and save with ⊙.
8. Mark **Max. head H_{max}** with ⊙ or ⊙.
9. Set the value with ⊙ or ⊙, and save with ⊙.
10. Mark **Max. flow rate Q_{max}** with ⊙ or ⊙.
11. Set the value with ⊙ or ⊙, and save with ⊙.
12. Mark **Power, Q_0, 100 % speed** with ⊙ or ⊙.
13. Set the value with ⊙ or ⊙, and save with ⊙.
14. Mark **Power, Q_0, 50 % speed** with ⊙ or ⊙.
15. Set the value with ⊙ or ⊙, and save with ⊙.
16. Mark **Nominal power P_{nom}** with ⊙ or ⊙.
17. Set the value with ⊙ or ⊙, and save with ⊙.

9.7.38 Control source (4.3.20)



TM03 2342 4807

Fig. 85 Control source

Description

Hydro MPC can be remote-controlled via an external bus connection (option). See section *9.8.2 GENIbus*. Control of the Hydro MPC can also take place via the bus connection. For further information, see section *9.8 Data communication*.

In this display, the control source, CU 351 or the external bus connection, is selected.

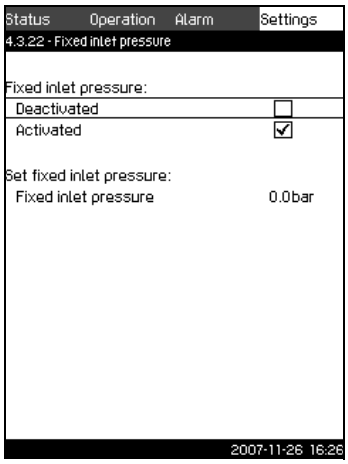
Setting via control panel

1. Mark the **Settings** menu with ⊙.
2. Mark **Secondary functions** with ⊙ or ⊙, and press ⊙.
3. Mark **Control source** with ⊙ or ⊙, and press ⊙.
4. Select the desired control source with ⊙ or ⊙, and save with ⊙.

Factory setting

The control source is CU 351.

9.7.39 Fixed inlet pressure (4.3.22)



TM03 8975 4807

Fig. 86 Fixed inlet pressure

Description

If the Hydro MPC has a fixed inlet pressure, it can be entered in this display so that the CU 351 can optimise the performance and control of the booster system.

Setting range

A fixed inlet pressure can be set, and the function can be activated/deactivated.

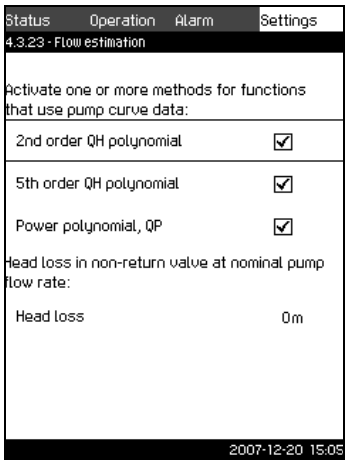
Setting via control panel

1. Mark the **Settings** menu with ▷.
2. Mark **Secondary functions** with ▽ or △, and press OK.
3. Mark **Fixed inlet pressure** with ▽ or △, and press OK.
4. Set the inlet pressure with ⊕ or ⊖, and save with OK.
5. Mark **Activated** with ▽ or △, and press OK. The activation is indicated by a check mark in the box.

Factory setting

The function is deactivated.

9.7.40 Flow estimation (4.3.23)



TM03 8977 4807

Fig. 87 Flow estimation

Description

As described in section *9.7.37 Pump curve data (4.3.19)*, the CU 351 can optimise operation according to performance curves and motor data. In this display, curve types are selected which the CU 351 will use for the optimisation if they are available.

At large flow rates, there may be a considerable head loss between the pump discharge flange and the pressure sensor. The loss is caused by non-return valves and pipe bends. To improve the flow estimation of the system, it is necessary to compensate for the difference between the measured and the actual differential pressure across the pump. This is done by entering the head loss in non-return valves and pipe bends at the rated flow rate of one pump.

Setting range

- 2nd order QH polynomial
- 5th order QH polynomial
- Power polynomial, QP
- Head loss.

Note ***It is possible to select several curve types, as the CU 351 makes a priority based on the data available.***

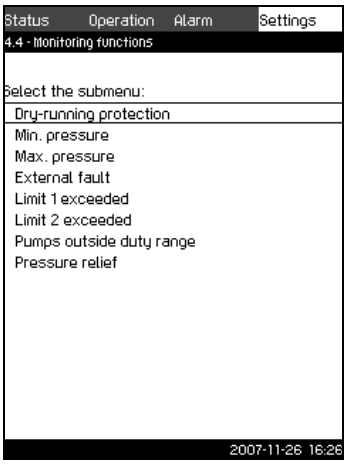
Setting via control panel

1. Mark the **Settings** menu with ▷.
2. Mark **Secondary functions** with ▽ or △, and press OK.
3. Mark **Flow estimation** with ▽ or △, and press OK.
4. Select the curve type by marking one of the lines at the selection box with ▽ or △, and press OK.

Factory setting

All polynomials are selected.

9.7.41 Monitoring functions (4.4)



TM03 8978 4807

Fig. 88 Monitoring functions

Description

Hydro MPC has a series of functions that constantly monitor the operation of the booster system.

The primary purpose of the monitoring functions is to ensure that faults do not damage pumps or the system.

Setting range

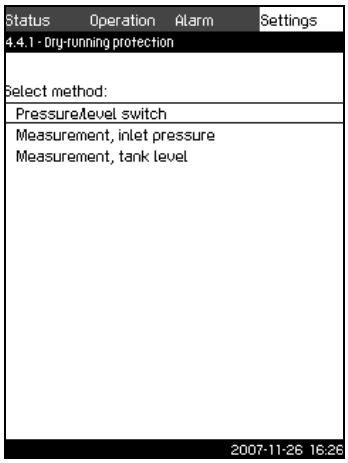
The following functions can be selected:

- *Dry-running protection (4.4.1)*
- *Min. pressure (4.4.2)*
- *Max. pressure (4.4.3)*
- *External fault (4.4.4)*
- *Limit 1 and 2 exceeded (4.4.5 and 4.4.6)*
- *Pumps outside duty range (4.4.7)*
- *Pressure relief (4.4.8)*.

Setting via control panel

1. Mark the **Settings** menu with ▷.
2. Mark **Monitoring functions** with ▽ or △, and press OK.
3. Select the function with ▽ or △, and press OK.

9.7.42 Dry-running protection (4.4.1)



TM03 2320 4807

Fig. 89 Dry-running protection

Description

Dry-running protection is one of the most important monitoring functions, as bearings and shaft seal may be damaged if the pumps run dry. Grundfos thus always recommends dry-running protection in connection with Hydro MPC booster systems.

The function is based on monitoring of the inlet pressure or the level in a possible tank or pit on the suction side.

Level switches, pressure switches or analog sensors signalling water shortage at a set level can be used.

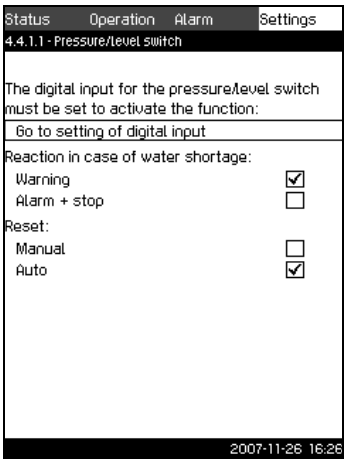
There are three different methods for detection of water shortage:

- Pressure switch on suction manifold or float switch/electrode relay in the supply tank. See section *9.7.43 Dry-running protection with pressure/level switch (4.4.1.1)*.
- Measurement of inlet pressure in the suction manifold by means of an analog pressure transmitter. See section *9.7.44 Dry-running protection with pressure transmitter (4.4.1.2)*.
- Measurement of level in the supply tank by means of an analog level transmitter. See section *9.7.45 Dry-running protection with level transmitter (4.4.1.3)*.

Setting via control panel

1. Mark the **Settings** menu with ›.
2. Mark **Monitoring functions** with ⌄ or ⌃, and press ok.
3. Mark **Dry-running protection** with ⌄ or ⌃, and press ok.
4. Select the method with ⌄ or ⌃, and press ok.

9.7.43 Dry-running protection with pressure/level switch (4.4.1.1)



TM03 2329 4807

Fig. 90 Dry-running protection with pressure/level switch

Description

Dry-running protection can take place by means of a pressure switch on the suction manifold or a level switch in a tank on the suction side.

When the contact is **open**, the CU 351 will register water shortage after a time delay of approx. 5 sec. It is possible to set whether the indication is to be just a warning or an alarm stopping the pumps.

In the display, it is possible to set whether restart and reset of the alarm is to be automatic or manual.

Setting range

- Selection of digital input for the function.
- Reaction in case of water shortage: Warning or alarm + stop.
- Restart: Manual or automatic.

Setting via control panel

1. Mark the **Settings** menu with ›.
2. Mark **Monitoring functions** with ⌄ or ⌃, and press ok.
3. Mark **Dry-running protection** with ⌄ or ⌃, and press ok.
4. Mark **Pressure/level switch** with ⌄ or ⌃, and press ok.
5. Mark **Go to setting of digital input**, and press ok. Now the display *Digital inputs (4.3.7)* appears. Set the input to dry-running protection. Return with esc.
6. Mark **Warning** or **Alarm + stop** with ⌄ or ⌃, and save with ok.
7. Mark **Manual** or **Auto** with ⌄ or ⌃, and save with ok.

Factory setting

If the booster system is equipped with a pressure switch for dry-running protection, it is set to alarm + stop in case of water shortage.

Restart: Manual.

9.7.44 Dry-running protection with pressure transmitter (4.4.1.2)

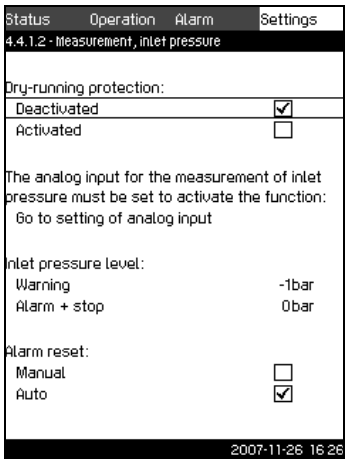


Fig. 91 Dry-running protection with pressure transmitter

Description

Dry-running protection can take place by means of a pressure transmitter measuring the inlet pressure.

It is possible to set two levels of inlet pressure: Warning and alarm + stop.

In the display, it is possible to set whether restart and reset of the alarm is to be automatic or manual.

Setting range

- Selection of analog input for the function.
- Activation of the function.
- Inlet pressure level for warning.
- Inlet pressure level for alarm + stop.
- Restart: Manual or automatic.

Setting via control panel

1. Mark the **Settings** menu with (>).
2. Mark **Monitoring functions** with (v) or (^), and press (ok).
3. Mark **Dry-running protection** with (v) or (^), and press (ok).
4. Mark **Measurement, inlet pressure** with (v) or (^), and press (ok).
5. Mark **Go to setting of analog input**, and press (ok). Now the display *Analog inputs (4.3.8)* appears. Set the input to **Inlet pressure, and save** with (ok). Return with (esc).
6. Mark **Activated** with (v) or (^), and press (ok).
7. Mark **Warning** with (v) or (^). Set the level with (+) or (−), and save with (ok).
8. Mark **Alarm + stop** with (v) or (^). Set the level with (+) or (−), and save with (ok).
9. Mark **Manual** or **Auto** with (v) or (^), and save with (ok).

Note ***If one of the levels is not required, the level value must be the minimum value of the inlet pressure transmitter. This deactivates the function.***

Factory setting

If the booster system is supplied with a pressure transmitter on the suction side, the transmitter has been set.

The warning level is 0.5 bar and the alarm level 0.2 bar. The function is activated.

Restart: Manual.

9.7.45 Dry-running protection with level transmitter (4.4.1.3)

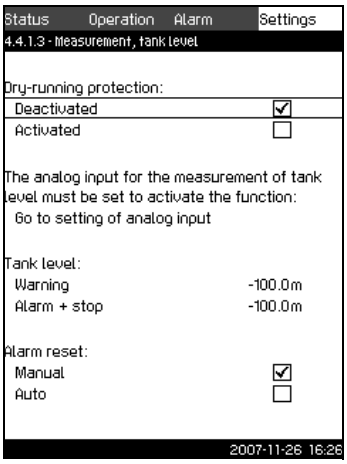


Fig. 92 Dry-running protection with level transmitter

Description

Dry-running protection can take place by means of a level transmitter measuring the level in a tank on the suction side.

It is possible to set two levels: Warning and alarm + stop.

In the display, it is possible to set whether restart and reset of alarms is to be automatic or manual.

Setting range

- Selection of analog input for the function.
- Activation of the function.
- Tank level for warning.
- Tank level for alarm + stop.
- Restart: Manual or automatic.

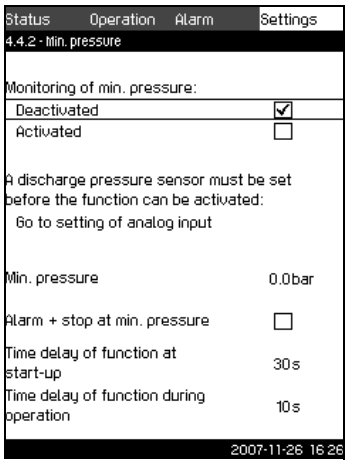
Setting via control panel

1. Mark the **Settings** menu with (>).
2. Mark **Monitoring functions** with (v) or (^), and press (ok).
3. Mark **Dry-running protection** with (v) or (^), and press (ok).
4. Mark **Measurement, tank level** with (v) or (^), and press (ok).
5. Mark **Go to setting of analog input**, and press (ok). Now the display *Analog inputs (4.3.8)* appears. Set the input to **Tank level, suction side**. Return with (esc).
6. Mark **Activated** with (v) or (^), and press (ok).
7. Mark **Warning** with (v) or (^). Set the level with (+) or (−), and save with (ok).
8. Mark **Alarm + stop** with (v) or (^). Set the level with (+) or (−), and save with (ok).
9. Mark **Manual** or **Auto** with (v) or (^), and save with (ok).

Factory setting

The function is deactivated.

9.7.46 Min. pressure (4.4.2)



TM03 8981 4807

Fig. 93 Min. pressure

Description

The discharge pressure can be monitored so that the CU 351 can react if the pressure becomes lower than a set minimum level for an adjustable time.

The minimum pressure can be monitored if a fault indication is required in situations where the discharge pressure becomes lower than the set minimum pressure.

It is possible to set whether the indication is to be just a warning or an alarm stopping the pumps. This may be desirable if Hydro MPC is used for an irrigation system where a very low discharge pressure may be due to pipe fracture and thus an extraordinarily high consumption and a very low counter-pressure. In such situations, it is desirable that the booster system stops and indicates alarm. This situation will require a manual reset of alarms.

It is possible to set a start-up delay ensuring that the Hydro MPC can build up pressure before the function is activated. It is also possible to set a time delay, i.e. for how long time the discharge pressure may be lower than the set minimum pressure before the alarm is activated.

Setting range

- Activation of the function.
- Minimum pressure level within the range of the primary sensor.
- Activation of stop when the pressure falls below the minimum pressure.
- Time delay at start-up.
- Time delay during operation.

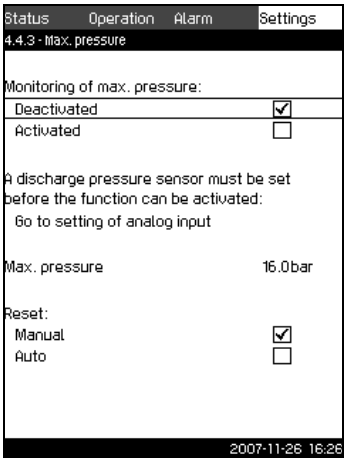
Setting via control panel

1. Mark the **Settings** menu with ▷.
2. Mark **Monitoring functions** with ▽ or △, and press OK.
3. Mark **Min. pressure** with ▽ or △, and press OK.
4. Mark **Activated** with ▽ or △, and press OK to activate/ deactivate the function.
5. Mark **Min. pressure** with ▽ or △. Set the pressure with + or −, and save with OK.
6. Mark **Stop at min. pressure** with ▽ or △, and press OK to activate/deactivate the function.
7. Mark **Time delay of function at start-up** with ▽ or △. Set the time with + or −, and save with OK.
8. Mark **Time delay of function during operation** with ▽ or △. Set the time with + or −, and save with OK.

Factory setting

The function is deactivated.

9.7.47 Max. pressure (4.4.3)



TM03 8982 4807

Fig. 94 Max. pressure

Description

The discharge pressure can be monitored so that the CU 351 can react if the pressure becomes higher than a set maximum level.

In certain installations, a too high discharge pressure may cause damage. It may therefore be necessary to stop all pumps for a short period if the pressure is too high.

It is possible to set whether the Hydro MPC is to restart automatically after the pressure has dropped below the maximum level, or if the system must be reset manually. Restart will be delayed by an adjustable time. See section *9.7.12 Min. time between start/stop (4.2.1)*.

Setting range

- Activation of the function.
- Maximum pressure level within the range of the primary sensor.
- Manual or automatic restart after fault.

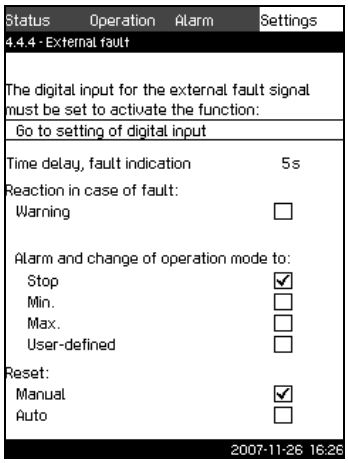
Setting via control panel

1. Mark the **Settings** menu with ▷.
2. Mark **Monitoring functions** with ▽ or △, and press OK.
3. Mark **Max. pressure** with ▽ or △, and press OK.
4. Mark **Activated** with ▽ or △, and press OK to activate/ deactivate the function.
5. Mark **Max. pressure** with ▽ or △. Set the pressure with + or −, and save with OK.
6. Mark **Manual** or **Auto** with ▽ or △. Activate the function with OK.

Factory setting

The function is deactivated.

9.7.48 External fault (4.4.4)



TM03 2313 4807

Fig. 95 External fault

Description

The function is used when the CU 351 is to be able to receive a fault signal from an external contact. In case of external fault, the CU 351 indicates warning or alarm. In case of alarm, the booster system changes to another manual operating mode, for instance *Stop*.

Setting range

- Selection of digital input for the function.
- Setting of time delay from closing of the contact until the CU 351 reacts.
- Reaction in case of external fault: Warning or alarm and change of operating mode.
- Restart after alarm: Manual or automatic.

Setting via control panel

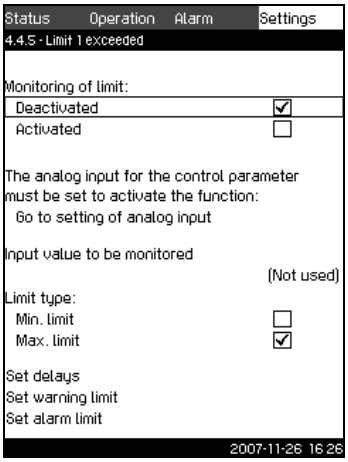
1. Mark the **Settings** menu with ▷.
2. Mark **Monitoring functions** with ▽ or △, and press OK.
3. Mark **External fault** with ▽ or △, and press OK.
4. Mark **Go to setting of digital input** with ▽ or △, and press OK. Now the display *Digital inputs (4.3.7)* appears. Set the input to **External fault**. Return with ESC.
5. Mark **Time delay, fault indication** with ▽ or △. Set the time with + or −, and save with OK.
6. Mark **Warning** with ▽ or △ if only a warning is required in case of external fault. Activate the function with OK.
7. Select operating mode with ▽ or △ if the booster system is to give alarm and change operating mode in case of external fault. Activate the function with OK.
8. Mark **Manual** or **Auto** with ▽ or △. Activate the function with OK.

Factory setting

The function is deactivated. If the function is activated, the following values have been set from factory:

- Time delay: 5 seconds.
- Operating mode in case of alarm: Stop.
- Restart: Manual.

9.7.49 Limit 1 and 2 exceeded (4.4.5 and 4.4.6)



TM03 8983 4807

Fig. 96 Limit 1 exceeded

Description

With this function, the CU 351 can monitor set limits of analog values. It will react if the values exceed the limits. Each limit can be set as a maximum or minimum value. For each of the monitored values, a warning limit and an alarm limit must be defined.

The function makes it possible to monitor two different locations in a pump system at the same time. For instance the pressure at a consumer and the pump discharge pressure. This ensures that the discharge pressure does not reach a critical value.

If the value exceeds the warning limit, a warning is given. If the value exceeds the alarm limit, the pumps are stopped.

A delay can be set between the detection of an exceeded limit and the activation of a warning or an alarm. A delay can also be set for resetting a warning or an alarm.

A warning can be reset automatically or manually.

It is possible to set whether the system is to restart automatically after an alarm, or if the alarm must be reset manually. Restart can be delayed by an adjustable time. It is also possible to set a start-up delay ensuring that the system reaches a steady state before the function becomes active.

Setting range

- Activation of an analog input for the function.
- Selection of the measured value to be monitored.
- Setting of limit type (min./max.).
- Setting of warning limit.
- Setting of alarm limit.

Setting via control panel

Note ***Analog inputs must be correctly set before the function is activated. See section 9.7.28 Analog inputs (4.3.8).***

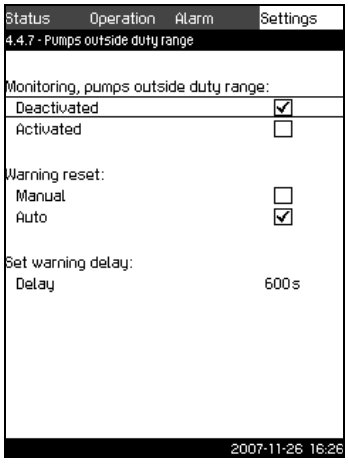
1. Mark the **Settings** menu with ▷
2. Mark **Monitoring functions** with ▽ or △, and press OK
3. Mark **Limit 1 exceeded** or **Limit 2 exceeded** with ▽ or △, and press OK.
4. Mark **Go to setting of analog input** with ▽ or △, and press OK.
5. Select the analog input with ▽ or △, and press OK.
6. Mark the setting of the analog input with ▽ or △, and activate it with OK.
   The activation is indicated by a check mark in the box.

7. Mark **Measured value** with ⌄ or ⌃, and press ok. Now the display 4.3.8.1.1 appears.
8. Select the input with ⌄ or ⌃, and press ok.
9. Press esc to return to display 4.3.8.1.
10. Set the minimum sensor value with + or −, and save with ok.
11. Set the maximum sensor value with + or −, and save with ok.
12. Return by pressing esc twice.
13. Mark **Measured value to be monitored** with ⌄ or ⌃., and press ok. Select the input with ⌄ or ⌃, and press ok.
14. Return with esc.
15. Mark **Min. limit** or **Max. limit** with ⌄ or ⌃., and press ok.
16. Mark **Set delays** with ⌄ or ⌃, and press ok
17. Mark **Time delay of function at start-up** with ⌄ or ⌃. Set the time with + or −, and save with ok.
18. Mark **Time delay of function during operation** with ⌄ or ⌃. Set the time with + or −, and save with ok.
19. Mark **Time delay of function at reset** with ⌄ or ⌃. Set the time with + or −, and save with ok.
20. Return with esc.
21. Mark **Set warning limit** with ⌄ or ⌃, and press ok.
22. Mark **Activated** with ⌄ or ⌃, and press ok.
23. Mark **Warning limit** with ⌄ or ⌃. Set the value with + or −, and save with ok.
24. Mark **Manual** or **Auto** with ⌄ or ⌃. Activate the function with ok.
25. Return with esc.
26. Mark **Set alarm limit** with ⌄ or ⌃, and press ok.
27. Mark **Activated** with ⌄ or ⌃, and press ok.
28. Mark **Alarm limit** with ⌄ or ⌃. Set the value with + or −, and save with ok.
29. Mark **Manual** or **Auto** with ⌄ or ⌃. Activate the function with ok.
30. Return with esc.
31. Mark **Activated** with ⌄ or ⌃, and press ok to activate the function.

Factory setting

The function is deactivated.

9.7.50 Pumps outside duty range (4.4.7)



TM03 8984 4807

Fig. 97 Pumps outside duty range

Description

The function gives a warning if the duty point of the pumps moves outside the defined range. For instance, if the inlet pressure becomes lower than a minimum permissible value, thus causing a risk of cavitation for some pump types.

The warning is given with a set time delay. It is possible to set whether the warning is to be reset automatically or manually when the duty point comes within the defined duty range. It is also possible to set a relay output to be activated when the warning is given, and to be deactivated when the warning is reset.

This function requires that the discharge pressure and the inlet pressure (either measured or configured) or the differential pressure of the pumps is monitored, and that CU 351 contains valid pump data from either a GSC file or from manual input. See section *9.7.37 Pump curve data (4.3.19)*.

Setting range

- Activation of the function.
- Setting of manual or automatic reset.
- Setting of warning delay.

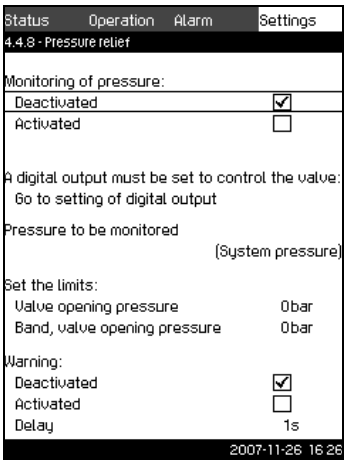
Setting via control panel

1. Mark the **Settings** menu with ›
2. Mark **Monitoring functions** with ⌄ or ⌃, and press ok.
3. Mark **Pumps outside duty range** with ⌄ or ⌃, and press ok.
4. Mark **Manual** or **Auto** with ⌄ or ⌃, and activate the function with ok.
5. Mark **Warning delay** with ⌄ or ⌃. Set the time with ⌄ or −, and save with ok.
6. Mark **Activated** with ⌄ or ⌃, and press ok to activate the function.

Factory setting

The function is deactivated.

9.7.51 Pressure relief (4.4.8)



TM03 8986 4807

Fig. 98 Pressure relief

Description

The purpose of the function is to reduce the pressure in the pipework by opening a solenoid valve if it exceeds a set limit. If the pressure is not reduced within a given time, the solenoid valve will be closed, and a warning can be given.

1: Solenoid valve opens.
2: Solenoid valve closes.
3: Solenoid valve opens.
4: Warning is activated.
5: Solenoid valve closes, and warning is reset.

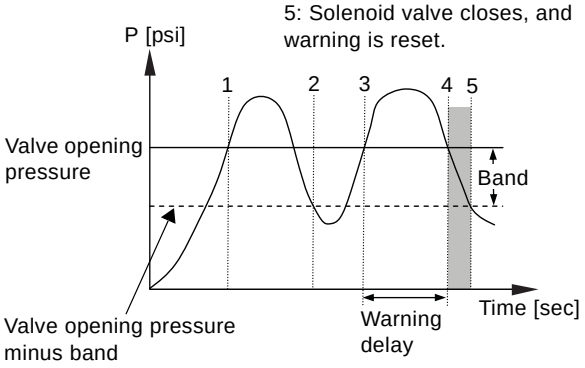


Fig. 99 Pressure relief

Setting range

- Setting of digital output.
- Setting of pressure to be monitored.
- Setting of valve opening pressure.
- Setting of band for valve opening pressure.
- Setting of warning or alarm.
- Activation of the function.

Setting via control panel

1. Mark the **Settings** menu with ⊙
2. Mark **Monitoring functions** with ⊙ or ⊙, and press ⊙.
3. Mark **Pressure relief** with ⊙ or ⊙, and press ⊙.
4. Mark **Go to setting of digital output** with ⊙ or ⊙, and press ⊙.
5. Select a digital output with ⊙ or ⊙, and press ⊙.
6. Mark **Pressure relief** with ⊙ or ⊙, and save with ⊙.
7. Return by pressing ⊙ twice.
8. Mark **Pressure to be monitored** with ⊙ or ⊙, and press ⊙.
9. Mark **Discharge pressure**, **System pressure** or **External pressure** with ⊙ or ⊙, and save with ⊙.
10. Return with ⊙.
11. Mark **Valve opening pressure** with ⊙ or ⊙. Set the pressure with ⊙ or ⊙, and save with ⊙.
12. Mark **Band, valve opening pressure** with ⊙ or ⊙. Set the pressure with ⊙ or ⊙, and save with ⊙.
13. Mark **Warning**, **Deactivated** or **Activated** with ⊙ or ⊙, and press ⊙.
14. Mark **Delay** with ⊙ or ⊙. Set the time with ⊙ or ⊙, and save with ⊙. (Only to be set if warning has been activated.)
15. Mark **Activated** with ⊙ or ⊙, and press ⊙ activate the function.

Factory setting

The function is deactivated.

9.7.52 Functions, CU 351 (4.5)

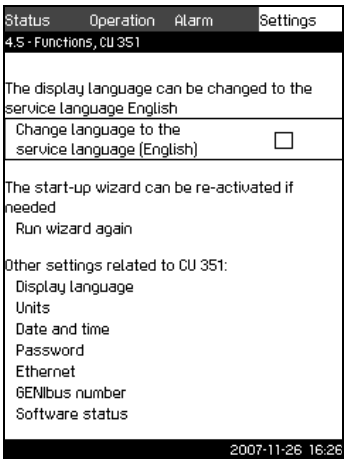


Fig. 100 Functions, CU 351

Description

In this submenu, it is possible to make the basic settings of the CU 351.

CU 351 comes with most of these settings, or they are made at start-up and normally not to be changed.

The service language, English, can be activated for service purposes. If no buttons are touched for 15 minutes, the display will return to the language selected at start-up or to the language set in section *9.7.53 Display language (4.5.1)*.

Note ***If the service language is selected, the symbol will be shown to the right of the top line of all displays.***

Setting range

- Activation of service language, British English.
- Re-activation of start-up wizard.
  (After start-up, the wizard is inactive.)
- Selection of display language.
- Selection of display units.
- Setting date and time.
- Selection of password for the menus **Operation** and **Settings**.
- Setting of Ethernet communication.
- Setting of GENIbus number.
- Reading of software status.

9.7.53 Display language (4.5.1)

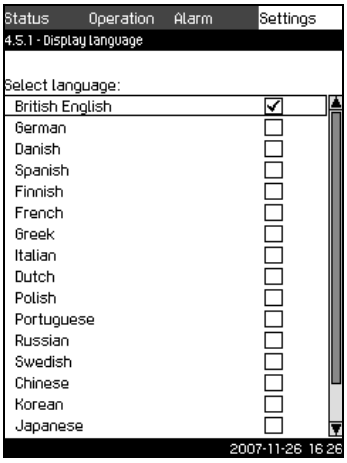


Fig. 101 Display language

Description

Here the language for the CU 351 display is selected.

Setting range

- British English
- German
- Danish
- Spanish
- Finnish
- French
- Greek
- Italian
- Dutch
- Polish
- Portuguese
- Russian
- Swedish
- Chinese
- Korean
- Japanese
- Czech
- Turkish.

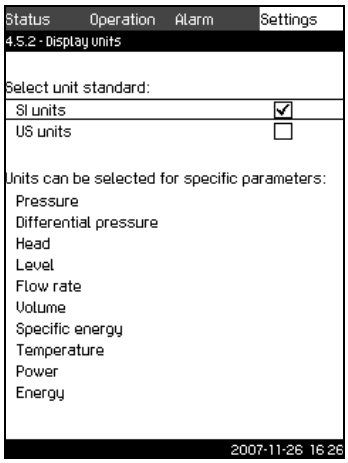
Setting via control panel

1. Mark the **Settings** menu with ⊙.
2. Mark **Functions, CU 351** with ⊙ or ⊙, and press ⊙.
3. Mark **Display language** with ⊙ or ⊙, and press ⊙.
4. Select language with ⊙ or ⊙, and save with ⊙.

Factory setting

The display language is English. It can be changed at start-up.

9.7.54 Display units (4.5.2)



TM03 8988 4807

Fig. 102 Display units

Description

In this display, it is possible to select units for the various parameters.

As basic setting, it is possible to select between SI and US units. It is also possible to select other units for the individual parameters.

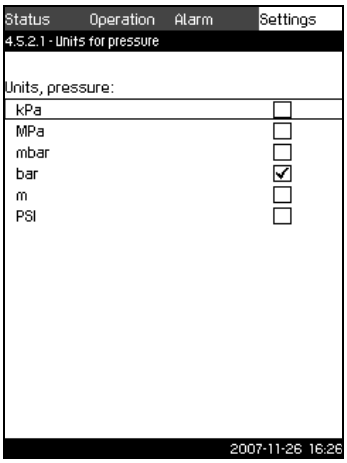
Setting range

Parameter	Basic setting		Possible units
	SI	US	
Pressure	bar	psi	kPa, MPa, mbar, bar, m, psi
Differential pressure	m	psi	kPa, MPa, mbar, bar, m, psi
Head	m	ft	m, cm, ft, in
Level	m	ft	m, cm, ft, in
Flow rate	m^3/h	gpm	m^3/s, m^3/h, l/s, gpm, yd^3/s, yd^3/min, yd^3/h
Volume	m^3	gal	l, m^3, gal, yd^3
Specific energy	kWh/m^3	Wh/gal	kWh/m^3, Wh/gal, Wh/kgal, BTU/gal, HPh/gal
Temperature	°C	°F	K, °C, °F
Differential temperature	K	K	K
Power	kW	HP	W, kW, MW, HP
Energy	kWh	kWh	kWh, MWh, BTU, HPh

Note ***If units are changed from SI to US or vice versa, all individually set parameters will be changed to the basic setting in question.***

Setting via control panel

1. Mark the **Settings** menu with ⊙.
2. Mark **Functions, CU 351** with ⊙ or ⊙, and press ⊙.
3. Mark **Units** with ⊙ or ⊙, and press ⊙.
4. Select the unit with ⊙ or ⊙, and save with ⊙.
   A check mark shows that the unit has been selected.
5. Select the measuring parameter with ⊙ or ⊙, and press ⊙ to open the display for the measuring parameter.
   See the example.



TM03 2310 4807

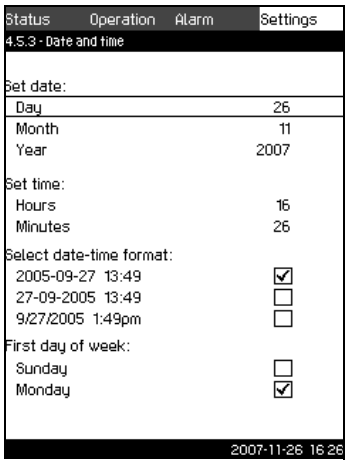
Fig. 103 Example of selection of display units

6. Select the unit with ⊙ or ⊙, and save with ⊙.
   A check mark shows that the unit has been selected.

Factory setting

CU 351 has been set to US units from factory.

9.7.55 Date and time (4.5.3)



TM03 8989 4807

Fig. 104 Date and time

Description

In this display, date and time are set as well as how they are to be shown in the display.

The clock has a built-in rechargeable voltage supply which can supply the clock for up to 20 days if the voltage supply to the Hydro MPC is interrupted.

If the clock is without voltage for more than 20 days, it must be set again.

Setting range

The date can be set as day, month and year. The time can be set as a 24-hour clock showing hours and minutes.

There are three formats.

Examples of format
2005-09-27 13:49
27-09-2005 13:49
9/27/2005 1:49pm

It is also possible to select if Sunday or Monday is to be the first day of week.

Setting via control panel

1. Mark the **Settings** menu with ▶.
2. Mark **Functions, CU 351** with ▼ or ▲, and press OK.
3. Mark **Date and time** with ▼ or ▲, and press OK.
4. Mark **Day**, **Month** and **Year** with ▼ or ▲, and set the date with + or −. Save with OK.
5. Mark **Hours** and **Minutes** with ▼ or ▲, and set the time with + or −. Save with OK.
6. Select the format with ▼ or ▲, and save with OK.
7. Mark **First day of week**, **Sunday** or **Monday** with ▼ or ▲, and save with OK.

Factory setting

Local time.

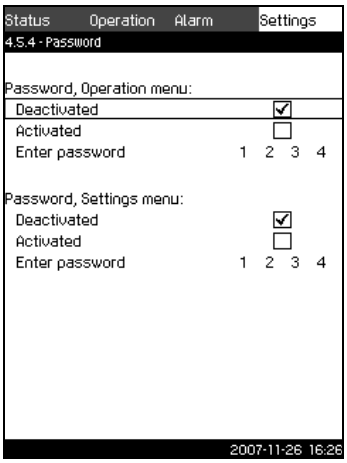
Note

If the booster has been without voltage for more than 20 days since it left the factory, the clock may have returned to the original setting: 01-01-2005 0:00.

Date and time may have been changed during the setting of Hydro MPC.

There is no automatic changeover to/from daylight-saving time.

9.7.56 Passwords (4.5.4)



TM03 2899 4807

Fig. 105 Passwords

Description

In this display it is possible to limit the access to the **Operation** and **Settings** menus by means of a password. If the access is limited, it is not possible to view or set any parameters in the menus.

The password must consist of four digits and may be used for both menus.

Note

If you have forgotten the password(s), contact Grundfos.

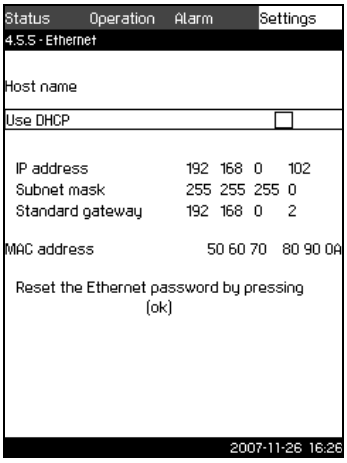
Setting via control panel

1. Mark the **Settings** menu with ▶.
2. Mark **Functions, CU 351** with ▼ or ▲, and press OK.
3. Mark **Password** with ▼ or ▲, and press OK.
4. Mark the password to be activated, and press OK.
5. Mark **Enter password**, and press OK.
   Now the first digit of the password is flashing.
6. Select the digit with + or −, and save with OK.
   Now the second digit of the password is flashing.
7. Repeat points 4 to 6 if it is necessary to activate the other password.

Factory setting

Both passwords are deactivated. If a password is activated, the factory setting will be "6814".

9.7.57 Ethernet (4.5.5)



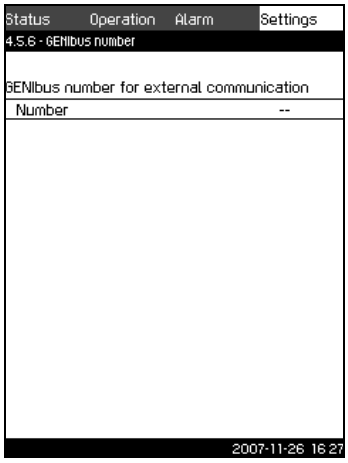
TM03 2298 4807

Fig. 106 Ethernet

Description

The CU 351 is equipped with an Ethernet connection for communication with a computer, either directly or via Internet. For further information, see section *9.8.1 Ethernet*.

9.7.58 GENIbus number (4.5.6)



TM03 2297 4807

Fig. 107 GENIbus number

Description

CU 351 can communicate with external units via an RS-485 interface (option). For further information, see fig. 109 and section *9.8.2 GENIbus*.

Communication is carried out according to the Grundfos bus protocol, GENIbus, and enables connection to a building management system or another external control system.

Operating parameters, such as setpoint and operating mode, can be set via the bus signal. Furthermore, status about important parameters, such as current value and input power, and fault indications can be read from the CU 351.

Contact Grundfos for further information.

Setting range

The number can be set between 1 and 64.

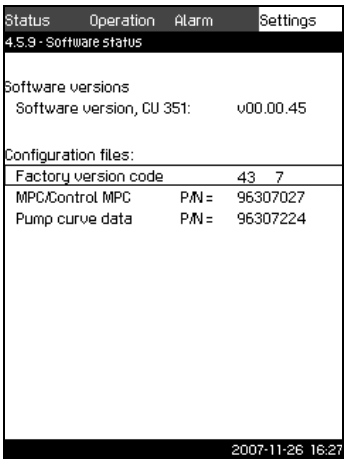
Setting via control panel

1. Mark the **Settings** menu with ⊙.
2. Mark **Functions, CU 351** with ⊙ or ⊙, and press ⊙.
3. Mark **GENIbus number** with ⊙ or ⊙, and press ⊙.
4. Select the number with ⊙ or ⊙, and save with ⊙.

Factory setting

No number is set ("–").

9.7.59 Software status (4.5.9)



TM03 2296 4807

Fig. 108 Software status

Description

This display shows the status of the software installed in the CU 351. Furthermore, the version code and the product numbers of configuration files (GSC) read into the unit are shown.

As it is a status display, no settings can be made.

9.8 Data communication

CU 351 is equipped with a hardware enabling communication with external units, such as a computer, via an external GENIbus or Ethernet connection.

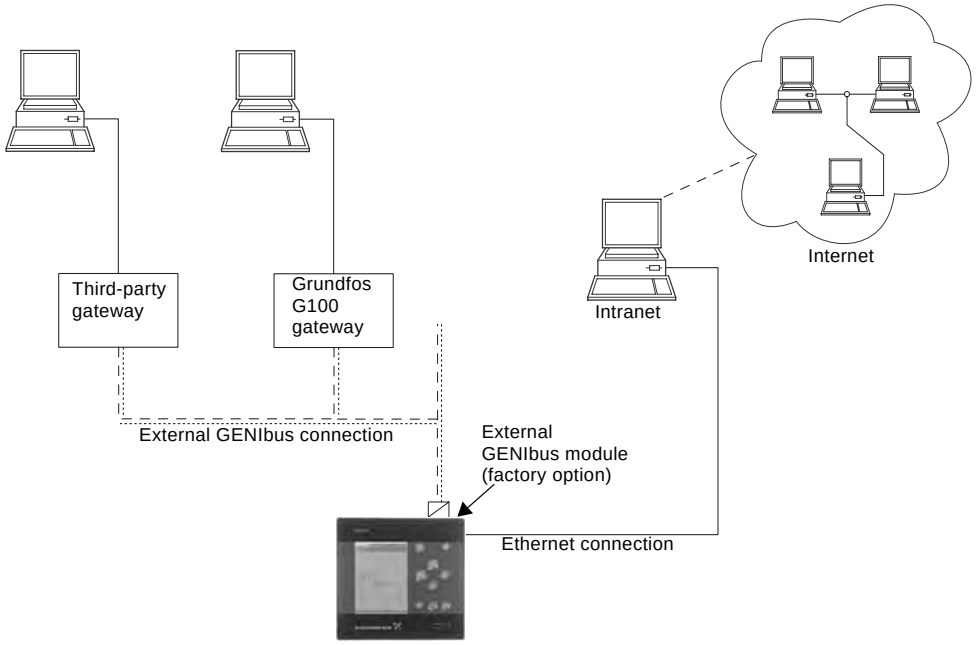


Fig. 109 Data communication via external GENIbus and Ethernet connection

9.8.1 Ethernet

Ethernet is the most widely used standard for local networks (LAN). The standardisation of this technology has created some of the easiest and cheapest ways of creating communication between electrical units, for instance between computers or between computers and control units.

The web server of the CU 351 makes it possible to connect a computer to the CU 351 via an Ethernet connection. The user interface can thus be exported from the CU 351 to a computer so that the CU 351 and consequently the Hydro MPC booster system can be monitored and controlled externally.

Note ***Grundfos recommends that you protect the connection to the CU 351 according to your safety requirements in consultation with the system administrator.***

In order to use the web server, you must know the IP address of the CU 351. All network units must have a unique IP address in order to communicate with each other. The IP address of the CU 351 from factory is 192.168.0.102.

Alternatively to the factory-set IP address, it is possible to use a dynamic assignment of IP address. This is possible by activating a DHCP (Dynamic Host Configuration Protocol) either directly in the CU 351 or via the web server. See the example in fig. 110.

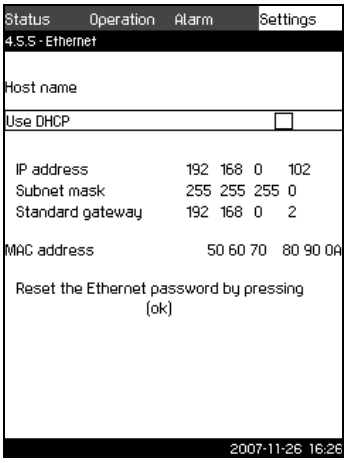


Fig. 110 Example of setting of Ethernet

Dynamic assignment of an IP address for the CU 351 requires a DHCP server in the network. The DHCP server assigns a number of IP addresses to the electrical units and makes sure that two units do not receive the same IP address.

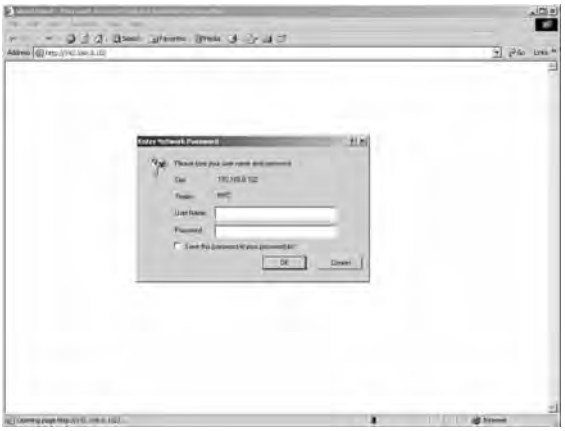
A traditional Internet browser is used for connection to the web server of the CU 351.

If you want to use the factory-set IP address, no changes are required in the display. Open the Internet browser and enter the IP address of the CU 351.

In order to use dynamic assignment, the function must be activated. Click (ok) **Use DHCP** in the menu line. A check mark next to the menu line shows that activation has been made. After activation in the display, open the Internet and enter the host name of the CU 351 instead of the IP address. The Internet browser will now try to connect to the CU 351. The host name can be read in the display, but can only be changed by either a GSC-file (configuration file) or via a web server. See *Change of network setting* on page 63.

Note ***To use DHCP, a host name is required.***

This is the first display shown when connecting to the CU 351.



TM03 2048 3505

Fig. 111 Connection to CU 351

Factory setting

User name: admin
Password: admin

When user name and password have been entered, a Java Runtime Environment application starts up in the CU 351, provided that it has been installed on the computer in question. If this is not the case, but the computer is connected to Internet, then use the link on the screen to download and install the Java Runtime Environment application.

TM03 2049 3505

Fig. 112 Display with link to the JavaScript® program

The Java Runtime Environment application will then export the CU 351 user interface (including display and operating panel) to the computer screen. It is now possible to monitor and control the CU 351 from the computer.

TM03 2047 3505

Fig. 113 Network setting

Change of network setting

When connection to the web server of the CU 351 has been established, it is possible to change the network setting.

TM03 2050 3505

Fig. 114 Change of network setting

1. Press the icon >**Network admin**.
2. Enter the changes.
3. Press **Submit** to activate the changes.

Change of password

TM03 2051 3505

Fig. 115 Change of password

1. Press the icon >**Change password**.
2. Enter the new password.
3. Press **Submit** to activate the new password.

9.8.2 GENIbus

By installing a GENIbus module it is possible to connect a CU 351 to an external network. The connection can take place via a GENIbus-based network or a network based on another protocol via a gateway. See fig. 109. For further information, contact Grundfos.

The gateway may be a Grundfos G100 gateway or a third party gateway. For further information on the G100 gateway, see the G100 data booklet (publication number V7139522).

10. External variable frequency drive

External variable frequency drives used in Hydro MPC booster system variants -F, -EF and -EDF come with the manufacturer's factory settings. See tables below.

At start-up, the factory settings must be changed to the Grundfos settings in the tables below.

In order not to affect the functions of the CU 351 at optimum operation, only the parameters shown should be adjusted. Other parameters should be as set from factory.

10.1 VLT 2800

Press [QUICK MENU] + [+] to access all parameters.

Parameter	Factory setting		Grundfos setting	
	Function	Value or number in the display of VLT	Function	Value or number in the display of VLT
2	Local/remote operation		Local/remote operation	0
3	Local reference		Local reference	Default
101	Torque characteristics		Torque characteristics	2
102	Motor power		Motor power	Motor nameplate in kW
103	Motor voltage		Motor voltage	Motor nameplate
104	Motor frequency		Motor frequency	Motor nameplate, Hz
105	Motor current		Motor current	Motor nameplate, SFA
106	Rated motor speed		Rated motor speed	Motor nameplate RPM
107	Automatic motor adaptation		Automatic motor adaptation	2
128	Thermal motor protection		Thermal motor protection	4
204	Minimum reference		Minimum reference	20 Hz
205	Maximum reference		Maximum reference	60 Hz
206	Ramp type		Ramp type	2
207	Ramp up time		Ramp up time	1.5 sec
208	Ramp down time		Ramp down time	3 sec
214	Reference function		Reference function	2
215	Preset reference		Preset reference	100
302	Digital input		Digital input	7
304	Digital input		Digital input	0
305	Digital input6		Digital input6	24
323	Relay output		Relay output	1
406	Automatic restart time		Automatic restart time	10 sec
411	Switching frequency		Switching frequency	4500

* Thermistor function used for thermal protection of LC filter.

** For information about languages available, see relevant documentation.

*** Use data from the Hydro MPC booster set.

Factory setting of VLT 2800

To recall the factory settings of all parameters, follow one of the procedures below:

1. Set the parameter 620 to (3).
2. Disconnect the power supply.
3. Re-connect the power supply.
4. All parameters are now factory-set except from the fault log.

or

1. Disconnect the power supply.
2. Press and hold [QUICK MENU] + [+] + [CHANGE DATA] and re-connect the power supply.

All parameters are now factory-set, including the fault log.

10.2 Danfoss VLT 8000 factory settings

Press [EXTEND MENU] to access all parameters.

Parameter	Function	Grundfos setting	
		Value	
001	Language	English	0
002	Motor power	Motor nameplate	
003	Motor voltage	Motor nameplate	
004	Motor frequency	Motor nameplate	
005	Motor current	Motor nameplate (SFA)	
006	Motor speed	Motor nameplate (RPM)	
201	Minimum frequency	20 Hz	
202	Maximum frequency	60 Hz	
207	Ramp up time	1.5 sec	
208	Ramp down time	3 sec	
323	Relay 1 function	Ready signal	1
326	Relay 2 function	Running	3

10.3 Danfoss VLT 8000 extended menu programming

Parameter	Function	Grundfos setting	
		Value	
007	Large readout	Frequency [Hz]	3
008	Small display readout	Motor voltage [V]	16
009	Small display readout	Motor current	5
010	Small display readout	Power [Hp]	6
101	Torque characteristics	VT low	2
113	Motor Preheater DC Current	0%	
117	Motor Thermal Protection	ETR Trip 1	4
208	Automatic ramp-down	Disable	0
210	Reference type	External/preset	2
302	Pin 18	Start	1
303	Pin 19	Reverse and start	2
304	Pin 27	Safety interlock	3
308	Pin 53	Reference	1
309	Term. 53, min. scaling	0.0 V	
310	Term. 53, max. scaling	10 V	
325	Relay 01, off delay	1 sec.	
400	Reset function	Automatic reset x 10	6
401	Automatic restart time	5 sec.	
407	Switching frequency	4500	
408	Interference reduction method	Fixed switching freq.	0
016	Lock for data change	Locked	1

10.4 Danfoss VLT 8000 factory settings

Press [EXTEND MENU] to access all parameters.

Parameter	Function	Grundfos setting	
		Value	
001	Language	English	0
002	Motor power	Motor nameplate	
003	Motor voltage	Motor nameplate	
004	Motor frequency	Motor nameplate	
005	Motor current	Motor nameplate (SFA)	
006	Motor speed	Motor nameplate (RPM)	
201	Minimum frequency	20 Hz	
202	Maximum frequency	60 Hz	
207	Ramp up time	1.5 sec	
208	Ramp down time	3 sec	
323	Relay 1 function	Ready signal	1
326	Relay 2 function	Running	3

10.5 Danfoss VLT 8000 extended menu programming

Parameter	Function	Grundfos setting	
		Value	
007	Large readout	Frequency [Hz]	3
008	Small display readout	Motor voltage [V]	16
009	Small display readout	Motor current	5
010	Small display readout	Power [Hp]	6
101	Torque characteristics	VT low	2
113	Motor Preheater DC Current	0%	
117	Motor Thermal Protection	ETR Trip 1	4
208	Automatic ramp-down	Disable	0
210	Reference type	External/preset	2
302	Pin 18	Start	1
303	Pin 19	Reverse and start	2
304	Pin 27	Safety interlock	3
308	Pin 53	Reference	1
309	Term. 53, min. scaling	0.0 V	
310	Term. 53, max. scaling	10 V	
325	Relay 01, off delay	1 sec.	
400	Reset function	Automatic reset x 10	6
401	Automatic restart time	5 sec.	
407	Switching frequency	4500	
408	Interference reduction method	Fixed switching freq.	0
016	Lock for data change	Locked	1

10.6 Baldor Smart motor settings

Section	Parameter	Grundfos setting	
		Value	
Level 2 blocks			
Output limts	Min. output frequency	12 Hz	
Output limts	Max. output	60 Hz	
Output limts	PK current limit	Max. of drive	
Output limts	PWM frequency	6 kHz	
Miscellaneous	Restart aut/man	Auto	
Motor data	Motor voltage	230 V	
Motor data	Motor rated amps	SFA on nameplate	
Level 1 blocks			
Preset speed	Preset speed #1	60 Hz	
Accel	Accel #1	CR 3 - CR 10	1.5 sec.
		CR 15 - CR 90	2.0 sec.
Decel rate	Decel #1	CR 3 - CR 10	3.0 sec.
		CR 15 - CR 90	4.0 sec.
Output	Opto output #1	Ready	
Input	Operating mode	#1 2 wire / 7 spd	
Input	ANA CMD select	Pot. / 0-10 V	
V/Hz and Boost	V/Hz profile	67% sqr. law	

10.7 VLT FC 202

Press [EXTEND MENU] to access all parameters.

Parameter	Function	Grundfos setting	
		Value	
001	Language	English	0
002	Motor Speed Unit	Hz	1
003	Regional Settings	North America	1
020	Display Line 1.1	Small Power [hp]	1611
021	Display Line 1.2	Small Motor Voltage	1612
022	Display Line 1.3	Small Motor Current	1614
023	Display Line 2 Large	Frequency	1615
024	Display Line 3 Large	Speed [RMP]	1617
100	Configuration Mode	Open Loop	0
103	Torque Characteristics	Variable Torque	1
121	Motor Power [HP]	Nameplate	
122	Motor Voltage	Nameplate	
123	Motor Frequency	Nameplate	
124	Motor Current	Nameplate	
125	Motor Nominal Speed	Nameplate	
190	Motor Thermal Protection	ETR trip 1	4
302	Minimum Reference	0.000 Hz	
303	Maximum Reference	60.000 Hz	
304	Reference Function	Sum	0
310	Preset Reference	100.00%	
313	Reference Site	Remote	1
341	Ramp 1 Ramp up Time	1.50 s	
342	Ramp 1 Ramp down Time	3.00 s	
412	Motor Speed Low Limit [Hz]	0.0 Hz	
414	Motor Speed High Limit [Hz]	60.0 Hz	
419	Max Output Frequency	65.0 Hz	
511	Terminal 19 Digital Input	Start reversing	11
513	Terminal 29 Digital Input	Preset reference on	15
540.0	Function Relay	Drive ready	2
542.0	Off Delay, Relay	2.00 s	
610	Terminal 53 Low Voltage	0.00 V	
611	Terminal 53 High Voltage	10.00 V	
614	Terminal 53 Low Ref. / Feedb.	20.000 Hz	
615	Terminal 53 High Ref. / Feedb.	60.000 Hz	
1400	Switching Pattern	60 AVM	0
1401	Switching Frequency	5.0 kHz	7

Factory setting of VLT FC 100

To recall the factory settings of all parameters, follow one of the procedures below:

1. Select parameter 14-22.
2. Press [OK].
3. Select “Initialisation” (for NLCP select “2”).
4. Press [OK].
5. Disconnect the power supply.
6. Reconnect the power supply.
7. All parameters are now factory-set, except RFI 1, protocol, address, baud rate, minimum response delay, maximum response delay, maximum inter-char delay, operating data, historic log and fault log.

or

1. Disconnect the power supply.
2. Press and hold [STATUS] + [MAIN MENU] + [OK] and reconnect the power supply.
3. All parameters are now factory-set, except operating hours, the number of power-ups and overtemp’s and overvolt’s.

11. Fault finding chart

Warning

Before making any connections in pumps, terminal boxes or breaker cabinet, make sure that the electricity supply has been switched off for at least 5 minutes and that it cannot be accidentally switched on.

Fault	Possible cause	Remedy
Pumps do not run when started.	Current pressure is higher than or equal to the setpoint.	Wait until the pressure has dropped, or lower the pressure on the discharge side of the Hydro MPC, and check that the pumps start.
	Electricity supply disconnected.	Connect the electricity supply.
	Main switch cut out.	Cut in the main switch.
	Main switch is defective.	Replace the main switch.
	Motor protection is activated.	Contact Grundfos.
	Motor is defective.	Repair or replace the motor.
	Pressure transmitter fault - Pressure transmitter is defective.	Replace the pressure transmitter. Transmitters with 0-20 mA or 4-20 mA output signals are monitored by the Hydro MPC.
	- Cable is broken or short-circuited.	Repair or replace the cable.
The pumps start, but stop immediately. The operating pressure is not reached.	Dry running or no inlet pressure.	Re-establish the supply of water to the Hydro MPC. When the inlet pressure has been re-established, the pumps will restart after 15 seconds.
The Hydro MPC is stopped and cannot restart.	Pressure transmitter fault - Pressure transmitter is defective.	Replace the pressure transmitter. Transmitters with 0-20 mA or 4-20 mA output signals are monitored by the Hydro MPC.
	- Cable is broken or short-circuited.	Repair or replace the cable.
	CU 351 fault - Electricity supply disconnected.	Connect the electricity supply.
	- CU 351 defective.	Contact Grundfos.
Unstable water delivery from Hydro MPC (applies to unstable water supply).	Inlet pressure is too low.	Check the suction pipe and possible suction strainer.
	Suction pipe or pumps partly blocked by impurities.	Clean the suction pipes, strainer or pumps.
	Pumps suck air.	Check the suction pipe for leakages.
	Pressure transmitter defective.	Replace the transmitter.
Pumps are running, but deliver no water.	The valves are closed.	Open the valves.
	Suction pipe or pumps blocked by impurities.	Clean the suction pipe or pumps.
	Non-return valve blocked in closed position.	Clean the non-return valve. The non-return valve must move freely.
	Suction pipe leaky.	Check the suction pipe for leakages.
	Air in suction pipe or pumps.	Vent and prime the pumps. Check the suction pipe for leakages.
The Hydro MPC is unable to reach the setpoint.	Too high consumption.	- Reduce consumption (if possible). - Install a bigger Hydro MPC booster system.
	Too many standby pumps selected.	Reduce the number of standby pumps.
	Pipe fracture or leakage in the system.	Check the system, and repair damages, if necessary.
Leakage from the shaft seal.	Shaft seal is defective.	Replace the shaft seal.
	Height adjustment of pump shaft inaccurate.	Readjust the shaft height.
Noise.	The pumps are cavitating.	Clean the suction pipe/pumps and possibly the suction strainer.
	The pumps do not rotate freely (friction resistance) due to inaccurate height adjustment of the pump shaft.	Readjust the shaft height.
Very frequent starts and stops.	Wrong diaphragm tank precharge pressure.	Set correct precharge pressure.

12. Maintenance

Warning

Before starting work on the pumps, make sure that the electricity supply has been switched off. Lock the main switch with a padlock to ensure that it cannot be accidentally switched on.

12.1 Pumps

Pump bearings and shaft seal are maintenance-free.

12.2 Motor bearings

Motors without grease nipples are maintenance-free.

Motors with grease nipples should be lubricated with a high-temperature lithium-based grease. See the instructions on the fan cover of Grundfos motors.

In the case of seasonal operation (motor is idle for more than 6 months of the year), it is recommended to grease the motor when the pump is taken out of operation.

12.3 CU 351

The CU 351 is maintenance-free. It must be kept clean and dry. Protect it against direct sunlight. Furthermore, the CU 351 must not be outside the ambient temperature range. See section *15. Technical data*.

13. Frost protection

Pumps which are not being used during periods of frost should be drained to avoid damage.

Drain the pump by loosening the vent screw in the pump head and by removing the drain plug from the base.

Warning

Care must be taken to ensure that the escaping water does not cause injury to persons or damage to the motor or other components. In hot water installations, special attention should be paid to the risk of injury caused by scalding hot water.

Do not tighten the vent screw and replace the drain plug until the pump is to be used again.

14. Taking out of operation

Switch off the main switch to take the booster system out of operation.

Warning

The conductors in front of the main switch are still energised. Lock the main switch with a padlock to ensure that it cannot be accidentally switched on.

Individual pumps are taken out of operation by switching off the corresponding motor-protective circuit breaker, automatic circuit breaker or fuse.

15. Technical data

15.1 Pressure

Inlet pressure

Hydro MPC booster sets can operate with a positive inlet pressure (precharged pressure system) or with a negative inlet pressure (i.e vacuum at the inlet manifold).

Calculation of the inlet pressure is recommended when

- water is drawn through long pipes,
- water is drawn from depths,
- inlet conditions are poor.

Note ***In this installation and operating instruction the term 'inlet pressure' is defined as the pressure/ vacuum which can be measured immediately before the booster set.***

To avoid cavitation, make sure that there is a minimum inlet pressure on the suction side of the booster set. The minimum inlet pressure in bar can be calculated as follows:

$$H = P_b - NPSH - H_f - H_v - H_S$$

P_b = Barometric pressure in feet (33.9 feet at sea level). In closed systems, P_b indicates system pressure in feet.

H_f = Friction loss in suction piping in feet. (At the highest flow the pump will be delivering).

H_v = Vapor pressure in feet.

NPSH = **N**et **P**ositive **S**uction **H**ead in feet.
NPSH can be read from the NPSH curve at the maximum capacity at which the pump will run.
(See installation and operating instructions for CR, CRI, CRN).

H_S = Safety margin = minimum 2 feet.

If "H" is calculated as positive, the pump can operate at a suction of maximum "H" feet. If "H" is calculated as negative, an inlet pressure (psia) of minimum "H" feet is required.

Maximum inlet pressure

Pump	Maximum inlet pressure [psi]
60 Hz	
CR(E) 5-7	145
CR(E) 10-3	116
CR(E) 15-3	145
CR(E) 20-3	145
CR(E) 32-2	58
CR(E) 45-2-1	145
CR(E) 64-2-1	145
CR 90-2-1	218

Note ***The maximum inlet pressure is determined by the construction of the pump, such as bearing pressure.***
For information about other CR pump sizes, see WebCAPS on www.grundfos.com.

Operating pressure

As standard the maximum operating pressure is 230 psi [16 bar].

On request, Grundfos offers Hydro MPC booster systems with a maximum operating pressure higher than 230 psi [16 bar].

15.2 Temperature

Liquid temperature: 32 °F to +158 °F

Ambient temperature: 32 °F to +104 °F

15.3 Relative humidity

Max. relative humidity: 95 %

15.4 Sound pressure

For sound pressure level, see the installation and operating instructions for the CR pumps.

The sound pressure level for a number of pumps can be calculated as follows:

$L_{max} = L_{pump} + (n - 1) \times 3$

L_{max} = Maximum sound pressure level.

L_{pump} = Sound pressure level for one pump.

n = Number of pumps.

16. Electrical data

Supply voltage

See nameplate of the Hydro MPC.

Backup fuse

See the wiring diagram supplied with the Hydro MPC.

Digital inputs

Open circuit voltage:	24 VDC
Closed circuit current:	5 mA, DC
Frequency range:	0-4 Hz

Note ***All digital inputs are supplied with PELV voltage (Protective Extra-Low Voltage).***

Analog inputs

Input current and voltage:	0-20 mA 4-20 mA 0-10 V
Tolerance:	±3.3 % of full scale
Repetitive accuracy:	±1% of full scale
Input resistance, current:	< 250 Ω
Input resistance, voltage, CU 351:	10 kΩ ±10 %
Input resistance, voltage, IO 351:	> 50 kΩ ± 10 %
Supply to sensor:	24 V, maximum 50 mA, short-circuit protected

Note ***All analog inputs are supplied with PELV voltage (Protective Extra-Low Voltage).***

Digital outputs (relay outputs)

Maximum contact load:	240 VAC, 2 A
Minimum contact load:	5 VDC, 10 mA

All digital outputs are potential-free relay contacts.

Note ***Some outputs have a common C terminal. For further information, see the wiring diagram supplied with the Hydro MPC.***

Inputs for PTC sensor/thermal switch

For PTC sensors to DIN 44082. Thermal switches can also be connected.

Open circuit voltage:	12 VDC ±15 %
Closed circuit current:	2.6 mA, DC

Note ***Inputs for PTC sensors are electrically separated from the other inputs and outputs of the Hydro MPC.***

17. Related documents

Further product information about Hydro MPC booster systems can be found in the following documents.

All documents are available in WebCAPS on Grundfos' homepage, www.grundfos.com.

Title	Frequency	Publication number
Product Guide		
Grundfos Hydro MPC	60 Hz	L-BPQ-PG-01
Grundfos CR,CRI,CRN	60 Hz	L-CR-PG-001
Installation and operating instructions		
CR, CRI, CRN	60 Hz	L-CP-TL-003
CRE, CRIE, CRNE, CRKE, SPKE, MTRE, CHIE *	60 Hz	L-MLE-TL-02
Service documentation		
Service instructions	50/60 Hz	96646712
Service kit catalog	50/60 Hz	96488862
Other documentation		
Wiring diagram**	-	-

* Only relevant for Hydro MPC-E, -ED and -ES booster systems.

** A wiring diagram is supplied with the booster system.

18. Disposal

This product or parts of it must be disposed of in an environmentally sound way:

1. Use the public or private waste collection service.
2. If this is not possible, contact the nearest Grundfos company or service workshop.

Subject to alterations.

4 ELECTRICAL EQUIPMENT TECHNICAL INFORMATION

4.1 CIRCUIT BREAKERS & ISOLATORS

Terasaki – **DINTMS1003** – 100A Metering Isolator

Terasaki – **E125NJ100** – 3P 100A Moulded Case Circuit Breaker

Terasaki – **DTCB15332C + DTLDC** – 3P 32A Circuit Breaker + Captive Lock Dog

Terasaki – **DTCB10306C** – 3P 6A Circuit Breaker

Terasaki – **DTCB10106C** – 1P 6A Circuit Breaker

Terasaki – **DTCB10104C** – 1P 4A Circuit Breaker

Terasaki – **DSRCBH-16-30A** – 1P 16A Residual Circuit Breaker Overload

Terasaki – **DSRCBH-06-30A** – 1P 6A Residual Circuit Breaker Overload

TERASAKI
Innovators in Protection Technology

Miniature circuit breakers

Din-TMS main switches 63 – 100 amps

- AS/NZS 60947-3
- Double break contacts
- Dual function terminals – busbar and cable
- Padlockable handle
- Handle sealable: On and Off position
- Terminal protection degree IP 20
- Used as main switch (isolator) in loadcentres and distribution boards
- Suits NC or CD type chassis

Main switch range 63 & 80 amp, side mounts direct to CD Din-T chassis. 63 - 100 A to NC Din-T chassis. All accept side mount auxiliary switch

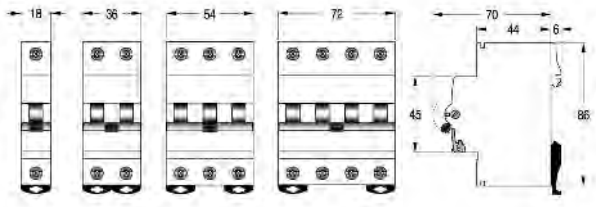
DINTMS 3 pole

Rating In (A)	No. of Poles	No. of Modules	Contacts	Cat. No. [1])
63	1	1		DINTMS631
	2	2		DINTMS632
	3	3		DINTMS633
80	1	1		DINTMS801
	2	2		DINTMS802
	3	3		DINTMS803
100	1	1		DINTMS1001
	2	2		DINTMS1002
	3	3		DINTMS1003

DINTMS 1 pole

Technical data

Nominal rated current	63-80-100 A
Usable as mains disconnect switch	yes
Nominal breaking capacity at 415 V, cos ø = 0.95	3 x I_n
Nominal breaking capacity at 415 V, cos ø = 0.65	3 x I_n
Nominal voltage single pole devices	240 / 415 V
Nominal voltage multipole devices	240 / 415 V
Maximum allowed current during less than 1 s.	2 kA
Mechanical service life (complete on-off-cycle)	>20000
Electrical service life, cos ø = 0.95, U_n and I_n	>1500
Short-circuit resistance with upfront fuses	16 kA (nominal)
Short-circuit resistance without upfront fuses	7 kA (peak)
Protection degree	IP 20
Screws	Pozidrive 2
Terminal capacity: min.	1 x 6 mm²
max.	1 x 50 mm²
Making capacity 1.05 x 4, cos ø0.65	3 x Ie



Accessories	Page
Auxiliary contacts	1 - 32 to 35
Padlock attachment	1 - 45

Notes: [1]) DINTMS Main switches will accept side mounting auxiliary switches only. Front mounting and terminal devices can also be fitted.

TERASAKI Innovators in Protection Technology

TemBreak MCCB's

NHP

Thermal magnetic type

E125NJ

25kA

Current rating: **12.5 – 125A**

Approvals and Tests:
Standards AS/NZS 3947-2, and IEC60947-2

Interrupting capacity:

	Voltage	Icu	Ics
AC use	380/415	25	19
DC use	250V	25	19

Trip unit:
Adjustable thermal (0.63 *Ir* to 100% *Ir*) and adjustable magnetic (6 *Im* to 12 *Im*)

Dimensions (mm)

Poles	3
H	155
W	90
D (less toggle)	68
Toggle cut-out	Standard DIN

Ampere Rating NRC	**Adj. *Ir*** 1) Min - Max.	**Adj. *Im*** 1) Min - Max.	**Cat. No.**
20	12.5 - 20	120 - 240	**E125 NJ 3 20**
32	20 - 32	192 - 384	**E125 NJ 3 32**
50	32 - 50	300 - 600	**E125 NJ 3 50**
63	40 - 63	378 - 756	**E125 NJ 3 63**
100	63 - 100	600 - 1200	**E125 NJ 3 100**
125	80 - 125	750 - 1500	**E125 NJ 3 125**

1) NRC: Nominal rated current
Adj. *Ir*: Adjustable thermal setting
Adj. *Im*: Adjustable magnetic setting

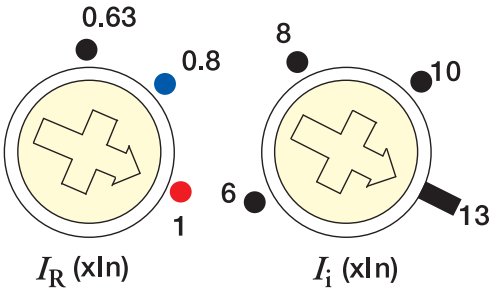
Replaces: XS125CJ, Note: check exact ratings or dimenions to suit your application requirement

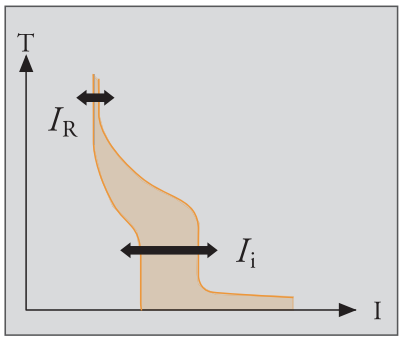
Price Schedule T2

OPERATING CHARACTERISTICS

THERMAL MAGNETIC PROTECTION

Adjustment Dials





1. I_R is the thermal element adjustment dial and is used to set the rated current to match the conductor rating.

   I_R can be set between 0.63 and 1.0 times I_n.

2. I_i is the magnetic element adjustment dial and is used to set the short circuit tripping threshold to suit the application.

   I_i can be set between 6 and 12 times I_n on 125A and 400A frame models.

   I_i can be set between 6 and 13 times I_n on 250A frame models with ratings of 160A, 200A and 250A.

   I_i can be set between 6 and 12 times I_n on 250A frame models with ratings of 125A and less.

Models, Types and Rated Currents of Thermal Elements

Model	Type	Current Rating In (A)
S125	-NF	16, 20, 25, 32, 40, 50, 63, 80, 100, 125
E125	-NJ	20, 32, 50, 63, 100, 125
S125	-NJ	20, 32, 50, 63, 100, 125
S125	-GJ	20, 32, 50, 63, 100, 125
H125	-NJ	20, 32, 50, 63, 100, 125
L125	-NJ	20, 32, 50, 63, 100, 125
S160	-NF	16, 20, 25, 32, 40, 50, 63, 80, 100, 125, 160
S160	-NJ	20, 32, 50, 63, 100, 125, 160
S160	-GJ	50, 63, 100, 125, 160
H160	-NJ	160
L160	-NJ	160
E250	-NJ	20, 32, 50, 63, 100, 125, 160, 200, 250
S250	-NJ	160, 200, 250
S250	-GJ	160, 200, 250
H250	-NJ	160, 250
L250	-NJ	160, 250
E400	-NJ	250, 400
S400	-CJ	250, 400
S400	-NJ	250, 400
S400	-GJ	250, 400
H400	-NJ	250, 400
L400	-NJ	250, 400

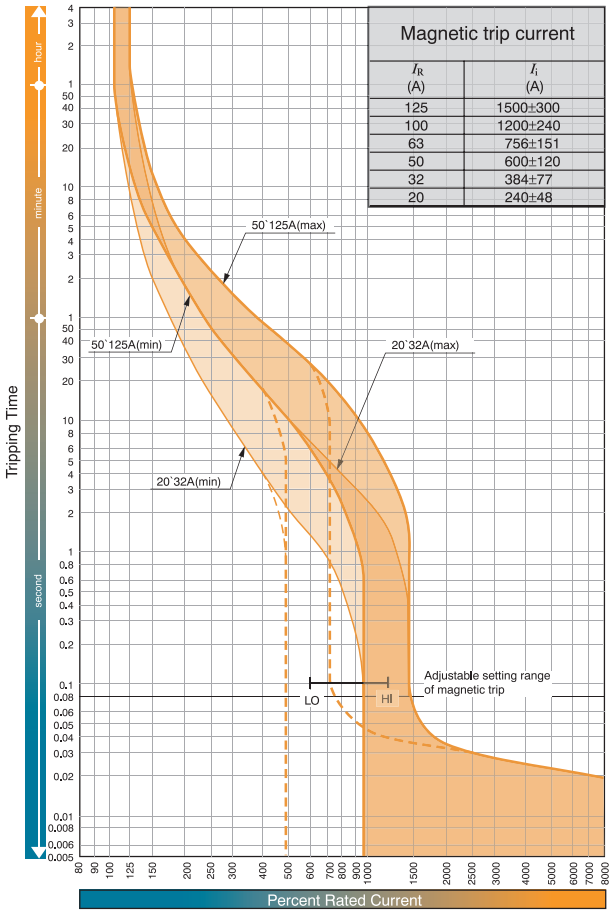
OPERATING CHARACTERISTICS

THERMAL MAGNETIC CHARACTERISTICS

125A Frame MCCBs

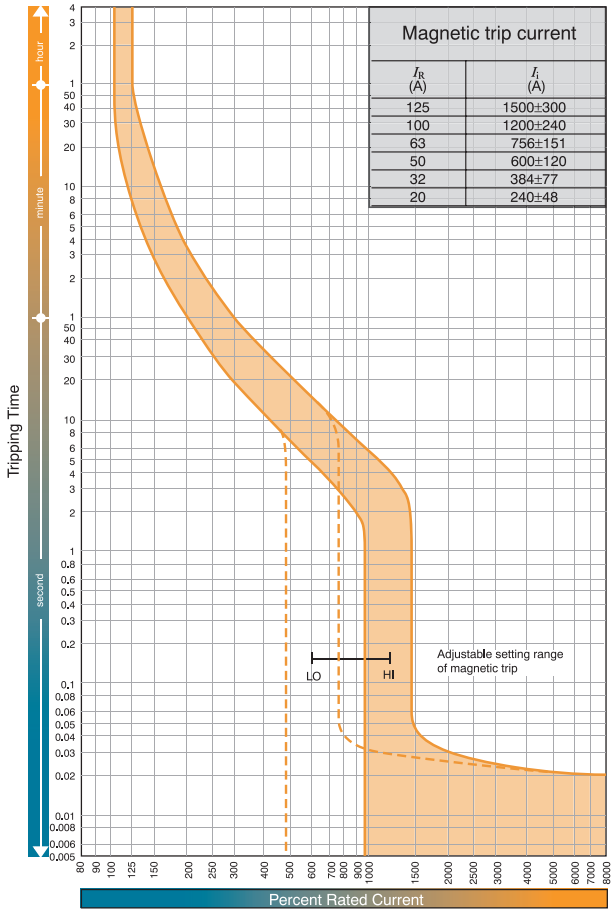
Time/current characteristic curves

E125-NJ, S125-NJ, S125-GJ



Time/current characteristic curves

H125-NJ, L125-NJ



SECTION 3

APPLICATION DATA

SELECTIVITY (DISCRIMINATION) AND CASCADE

Selectivity

The principle of Selectivity (Discrimination) is based upon an analysis of several circuit breaker characteristics. These include time-current (tripping) curves, peak-let-through current (I_{peak}) and energy let-through (I^2t).

The figures stated give the maximum selectivity level with the two nominated breakers in series under short-circuit conditions. For an indication on selectivity under overloads refer to the circuit breaker tripping/characteristic curves, or use the NHP TemCurve selectivity analysis software package.

Selectivity can be enhanced beyond the breaking capacity of the downstream breaker provided it is backed up by an appropriately selected upstream breaker, which should not trip (unlatch) under the stated short circuit current.

Cascade

Cascading is achieved by using an upstream device to assist (back-up) a downstream device in clearing a fault current. This principal is necessary should the downstream device be required to clear a prospective short circuit current greater than the devices' breaking capacity.

In most cascading applications it is generally necessary for the upstream breaker to trip (unlatch), as well as the downstream breaker to give adequate back-up protection. As such, cascade is commonly used in feeding and protecting non-essential loads, such as basic lighting.

For more information on selectivity and cascading please refer to the latest NHP Part C catalogue.

APPLICATION DATA

SELECTIVITY TABLES

Selectivity & Cascade Tables @ 400 / 415 V

Upstream MCCBs kA (RMS) / Downstream MCCBs	S250PE 70	H250NE 125	S400NE 50	S400GE 70	H400NE 125	L400NE 200	E630NE 36	S630CE 50
E125NJ	25/25	25/65	25/36	25/50	25/65	25/85	25/36	25/25
S125NJ	36/36	36/85	36/50	36/65	36/85	36/125	36/36	36/36
S125GJ	65/65	65/125	50/50	65/70	65/125	65/150	36/36	50/50
H125NJ	70/70	125/125	50/50	70/70	125/125	125/200	36/36	50/50
S160NJ			36/50	36/65	36/85	36/125	36/36	36/50
S160GJ			50/50	65/70	65/125	65/150	36/36	50/50
H160NJ					125/125	125/200	36/36	50/50
E250NJ					25/65	25/85	25/36	25/25
S250NJ					36/85	36/125	36/36	36/36
S250GJ					65/125	65/150	36/36	50/50
S250PE					40/125	70/150	36/36	50/50
H250NJ					125/125	125/200	36/36	50/50
H250PE					125/125	125/200	36/36	50/50
E400NJ							10/25	10/25
S400CJ							10/36	10/36
S400NE							10/36	10/50
S400NJ							10/36	10/36
S400GJ							10/36	10/50
H400NJ							10/36	10/50
H400NE							10/36	10/50
E630NE								
E630CE								
S630GE								
XS630CJ								
XS630NJ								
XS630PJ								
XS630SE								
XH630SE								
XH630PE								
XS800NJ								
XS800SE								
XJ800PJ								
XH800SE								
XH800PE								
XS1250SE								
XS1600SE								

XX / YY Selectivity/ Cascade

Downstream MCCBs	S630GE 70	TL630NE 125	XS800SE 50	XH800SE 65	TL800NE 125	XS1250SE 85	TL1250NE 125	XS1600SE 100	XS2000NE 85	XS2500NE 85
E125NJ	25/50	25/25	25/36	25/36	25/65	25/25	25/25	25/25	25/25	25/25
S125NJ	36/65	36/36	36/50	36/36	36/36	36/36	36/36	36/36	36/36	36/36
S125GJ	65/70	65/65	50/50	65/65	65/65	65/65	65/65	65/65	65/65	65/65
H125NJ	70/70	70/70	50/50	65/65	65/65	85/50	85/50	100/100	85/85	85/85
S160NJ	36/50	36/36	36/36	36/65	36/65	36/36	36/36	36/36	36/36	36/36
S160GJ	65/70	65/65	50/50	50/65	50/65	65/65	65/65	65/65	65/65	65/65
H160NJ	70/70	70/70	50/50	50/65	50/65	85/65	85/65	100/100	85/85	85/85
E250NJ	25/50	25/25	25/25	25/50	25/50	25/25	25/25	25/25	25/25	25/25
S250NJ	36/65	36/36	36/36	36/36	36/36	36/36	36/36	36/36	36/36	36/36
S250GJ	65/70	65/65	50/50	50/65	50/65	65/65	65/65	65/65	65/65	65/65
S250PE	70/70	70/70	50/50	50/65	50/65	70/70	70/70	70/70	70/70	70/70
H250NJ	70/70	70/70	50/50	50/65	50/65	85/85	85/85	100/100	85/85	85/85
H250PE	70/70	70/70	50/50	50/65	50/65	85/85	85/85	100/100	85/85	85/85
E400NJ	10/50	10/36	25/25	25/25	25/36	25/25	25/25	25/36	25/25	25/25
S400CJ	10/65	10/50	25/36	25/36	25/50	36/36	36/36	36/50	36/36	36/36
S400NE	10/50	10/50	25/50	25/50	25/50	50/50	50/50	50/50	50/50	50/50
S400NJ	10/70	10/65	25/50	25/50	25/65	50/50	50/50	50/65	50/50	50/50
S400GJ	10/70	10/70	25/50	25/50	25/65	70/36	70/36	70/85	70/70	70/70
H400NJ	10/70	10/70	25/50	25/65	25/65	125/85	125/85	125/100	125/85	125/85
H400NE	10/70	10/70	25/50	25/65	25/65	125/85	125/85	125/100	125/85	125/85
E630NE			25/36	25/36	25/36	36/36	36/36	36/36	36/36	36/36
E630CE			25/50	25/50	25/50	50/50	50/50	50/50	50/50	50/50
S630GE						70/36	70/70	70/70	70/70	70/70
XS630CJ						30/45	30/45	30/45	35/45	35/45
XS630NJ						30/65	30/65	30/65	35/65	35/65
XS630PJ						30/85	30/85	30/85	35/85	35/85
XS630SE						30/65	30/65	30/85	30/85	30/85
XH630SE						30/65	30/65	30/85	30/85	30/85
XH630PE						30/65	30/65	30/85	30/85	30/85
XS800NJ						15/65	15/65	20/65	35/65	35/65
XS800SE						15/50	15/50	20/50	35/50	35/50
XJ800PJ						15/85	15/85	20/85	35/85	35/85
XH800SE						15/65	15/65	20/65	35/65	35/65
XH800PE						15/65	15/65	20/65	35/65	35/65
XS1250SE								20/65	35/65	35/65
XS1600SE									35/85	35/85

APPLICATION DATA

CASCADE TABLES

CASCADE @ 380 – 415 V AC [1]		E125NJ	S125NJ	S125GJ	H125NJ	L125NJ	S160NJ	S160GJ	H160NJ	L160NJ	E250NJ	S250NJ	S250GJ	S250PE	H250NJ	H250NE	L250NJ
Downstream MCCBs	kA (RMS)	25	36	65	125	200	36	65	125	200	25	36	65	70	125	125	200
E125NJ	25	–	36	36	65	85	36	36	65	85	–	36	36	–	65	65	85
S125NJ	36	–	–	50	85	125	–	50	85	125	–	–	–	–	85	85	125
S125GJ	65	–	–	–	125	150	–	–	125	150	–	–	65	–	125	125	150
H125NJ	125	–	–	–	–	200	–	–	-	200	–	–	65	–	–	–	200
S160NJ	36	–	–	65	–	–	–	65	85	125	–	–	65	65	85	85	125
S160GJ	65	–	–	–	–	–	–	–	125	150	–	–	–	70	125	125	150
H160NJ	125	–	–	–	–	–	–	–	–	200	–	–	–	-	–	–	200
S250NJ	36	–	–	–	–	–	–	65	–	–	–	–	–	65	85	85	125
S250GJ	65	–	–	–	–	–	–	–	–	–	–	–	–	70	125	125	150
S250PE	70	–	–	–	–	–	–	–	–	–	–	–	–	–	125	125	150
H250NJ	125	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	200
E400NJ	25	–	–	–	–	–	–	–	–	–	–	–	–	36	65	65	–
S400CJ	36	–	–	–	–	–	–	–	–	–	–	–	–	50	70	70	–
S400NJ	50	–	–	–	–	–	–	–	–	–	–	–	50	65	85	85	–
S400GJ	70	–	–	–	–	–	–	–	–	–	–	–	50	–	125	125	–
H400NJ	125	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–

Note: [1] Ratings have not been verified where a dash "–" is shown.

All pick-up and time delay settings are to be set at a maximum for upstream MCCB's

Upstream MCCBs

CASCADE @ 380 – 415 V AC [1]		S400CJ	S400NE S400NJ	S400GE S400GJ	H400NJ H400NE	L400NJ	L400NE	E630NE	S630CE	S630GE	TL630NE	XS800SE	XS800NJ	XH800SE	TL800NE	XS1250SE	XS1600SE
Downstream MCCBs	kA (RMS)	36	50	70	125	200	200	36	50	70	125	65	65	65	200	65	85
E125NJ	25	36	36	50	65	85	85	36	-	50	–	36	36	36	–	–	–
S125NJ	36	–	50	65	85	125	125	–	-	65	–	50	50	–	–	–	–
S125GJ	65	–	–	70	125	150	150	–	50	70	–	–	–	65	–	–	–
H125NJ	125	–	–	–	–	200	200	–		-	–	–	–	65	–	50	–
S160NJ	36	–	50	65	85	125	125	–	50	50	–	–	65	65	–	–	–
S160GJ	65	–	–	70	125	150	150	–	–	70	–	–	–	–	–	–	–
H160NJ	125	–	–	–	–	200	200	–	–	–	–	–	–	65	–	65	–
E250NJ	25	36	36	50	65	85	85	36	–	50	–	–	36	50	–	–	–
S250NJ	36	–	50	65	85	125	125	–	–	65	–	–	65	–	–	–	–
S250GJ	65	–	–	70	125	150	150	–	–	70	–	–	–	–	–	–	–
S250PE	70	–	–	–	125	150	150	–	–	–	–	–	–	–	–	–	–
H250NJ	125	–	–	–	–	200	200	–	–-	–	–	–	–	–	–	–	–
E400NJ	25	36	36	50	65	85	85	36	–	50	36	–	–	–	36	–	36
S400CJ	36	–	50	65	70	100	100	–	–	65	50	–	–	–	50	–	50
S400NJ	50	–	–	70	85	125	125	–	36	70	65	–	–	50	65	–	65
S400GJ	70	–	–	–	125	150	150	–	36	–	–	–	–	50	–	36	85
H400NJ	125	–	–	–	–	200	200	–	–	–	–	–	–	–	–	–	–

Note: [1] Ratings have not been verified where a dash "–" is shown.

All pick-up and time delay settings are to be set at a maximum for upstream MCCBs

APPLICATION DATA

SELECTIVITY AND CASCADE TEMBREAK 2 MCCBs AND DIN-T / SAFE-T MCBs

SELECTIVITY / CASCADE @ 415 V AC			Upstream MCCB							
			E125NJ	S125NJ	H125NJ S125GJ	S250NJ	S250GJ	S400CJ	S400GE S400GJ	H400NJ
Downstream MCB	Amp rating	kA (RMS)	25	36	65	36	65	36	70	125
DTCB6	2 – 20	6	18/18	25/25	35/35	35/35	35/35	–	–	–
	25 – 63	6	18/18	20/25	20/25	30/30	30/30	–	–	–
DTCB10	0.5 – 32	10	18/18	30/30	30/50	35/35	40/50	35/35	40/50	40/50
	40 – 63	10	18/18	20/25	25/25	30/30	30/30	30/30	30/30	30/30
DSRCBH /	0.5 – 32	10	18/18	30/30	30/50	35/35	40/50	35/35	40/50	40/50
DSRCD	40	10	18/18	20/25	25/25	30/30	30/30	30/30	30/30	30/30
Din-T10H	80 – 125	10	4/18	4/25	4/25	15/15	15/15	10/10	10/10	–
DTCH15	0.5 – 32	15	18/18	30	30/50	35/35	40/50	35/35	40/50	40/50
	40 – 63	15	18/18	20	25/25	30/30	30/30	30/30	30/30	30/30
Safe-T	16 – 20	6	3/10	3/10	3/10	–	–	–	–	–
SRCB	16 – 20	6	3/10	3/10	3/10	–	–	–	–	–

Guide

XX / YY

Selectivity Cascade

Notes: All figures stated are at 400/415 V AC.

SECTION 4

APPLICATION DATA

MOTOR STARTING TYPE 1 CO-ORDINATION TABLES

Short-Circuit Co-Ordination Motor Starting Table

Type '1'
Terasaki MCCB's & Sprecher + Schuh KT7's
DOL starting 50/65 kA @ 400/415 V to AS/NZS 60947.4.1

TYPE 1 50/65 kA

		Terasaki Combinations	
Motor Size (kW)	Approx. amps @ 400/415 V (A)	MCCB	Contactor
0.37	1.1	XM30PB/1.4	CA7-9
0.55	1.5	XM30PB/2	CA7-9
0.75	1.8	XM30PB/2.6	CA7-9
1.1	2.6	XM30PB/4.0	CA7-9
1.5	3.4	XM30PB/5	CA7-9
2.2	4.8	XM30PB/8	CA7-9
3	6.5	XM30PB/10	CA7-9
4	8.2	XM30PB/12	CA7-9
5.5	11	S125GJ/20	CA7-12
7.5	14	S125GJ/20	CA7-16
11	21	S125GJ/32	CA7-23
15	28	S125GJ/50	CA7-30
18.5	34	S125GJ/50	CA7-37
22	40	S125GJ/63	CA7-43
30	55	S125GJ/100	CA7-60
37	66	S125GJ/100	CA7-72
45	80	S125GJ/125	CA7-85
55	100	S125GJ/125	CA6-110
5	130	S250PE/250	CA6-140
0	155	S250PE/250	CA6-180
10	200	S250PE/250	CA6-210
32	225	S400GE/400	CA6-210
60	270	S400GE/400	CA6-300
00	361	S400GE/400	CA6-420

Terasaki Combinations		Sprecher + Schuh Combinations	
Overload Relay	Thermal Setting (A)	KT7 Circuit Breaker	Contactor
CT 7-24	1.0 - 1.6	KTA7-25S-1.0A	CA7-9
CT 7-24	1.0 - 1.6	KTA7-25S-1.6A	CA7-9
CT 7-24	1.6 - 2.4	KTA7-25S-2.5A	CA7-9
CT 7-24	2.4 - 4.0	KTA7-25S-2.5A	CA7-9
CT 7-24	2.4 - 4.0	KTA7-25S-4.0A	CA7-9
CT 7-24	4.0 - 6.0	KTA7-25S-6.3A	CA7-9
CT 7-24	6.0 - 10	KTA7-25S-6.3A	CA7-9
CT 7-24	6.0 - 10	KTA7-25S-10A	CA7-9
CT 7-24	10 - 16	KTA7-25H-16A	CA7-12
CT 7-24	10 - 16	KTA7-25H-16A	CA7-16
CT 7-24	16 - 24	KTA7-45H-20A	CA7-23
CT 7-45	18 - 30	KTA7-45H-32A	CA7-30
CT 7-45	30 - 45	KTA7-45H-45A	CA7-37
CT 7-45	30 - 45	KTA7-45H-45A	CA7-43
CT 7-75	45 - 60	KTA3-100-63A	CA7-60
CT 7-75	60 - 75	KTA3-100-90A	CA7-72
CT 7-100	70 - 90	KTA3-100-90A	CA7-85
CEF 1-11/12	20 - 180	KTA3-160S-100A	CA6-110
CEF 1-11/12	20 - 180	KTA3-160S-160A	CA6-140
CEF 1-11/12	20 - 180	KTA3-160S-160A	CA6-180
CEF 1-41/42	160 - 400	KTA3-250S-200A	CA6-210
CEF 1-41/42	160 - 400	KTA3-250S-250A	CA6-250
CEF 1-41/42	160 - 400	KTA3-400S-320A	CA6-300
CEF 1-41/42	160 - 400	KTA3-400S-400A	CA6-420

Notes:
- Thermal or electronic overload relays may be used.
- XM30PB MCCB's can be replaced with S125GJ/20 if required.
- Combinations based on the thermal overload relay tripping before the circuit. breaker at overload currents up to the motor locked rotor current.

APPLICATION DATA

MOTOR STARTING TYPE 2 CO-ORDINATION TABLES

Short-Circuit Co-Ordination DOL Motor Starting Table

Type '2'
Terasaki MCCB's & Sprecher + Schuh KT7's
DOL starting 50/65 kA @ 400/415 V to AS/NZS 60947.4.1

TYPE 2 50/65 kA

		Terasaki Combinations	
Motor Size (kW)	Approx. amps @ 400/415 V (A)	MCCB	Contactor
0.37	1.1	XM30PB/1.4	CA7-9
0.55	1.5	XM30PB/2	CA7-9
0.75	1.8	XM30PB/2.6	CA7-9
1.1	2.6	XM30PB/4.0	CA7-16
1.5	3.4	XM30PB/5	CA7-16
2.2	4.8	XM30PB/8	CA7-16
3	6.5	XM30PB/10	CA7-30
4	8.2	XM30PB/12	CA7-30
5.5	11	S125GJ/20	CA7-30
7.5	14	S125GJ/20	CA7-30
11	21	S125GJ/32	CA7-30
15	28	S125GJ/50	CA7-43
18.5	34	S125GJ/50	CA7-43
22	40	S125GJ/63	CA7-43
30	55	S125GJ/100	CA7-72
37	66	S125GJ/100	CA7-72
45	80	S125GJ/125	CA6-105
55	100	S250PE/160	CA6-105
75	130	S250PE/250	CA6-140
90	155	S250PE/250	CA6-170
110	200	S250PE/250	CA6-210
132	225	S400PE/400	CA6-210
160	270	S400PE/400	CA6-300
200	361	S400PE/400	CA6-420

Terasaki Combinations		Sprecher + Schuh Combinations	
Overload Relay	Thermal Setting (A)	KT7 Circuit Breaker	Contactor
CT 7-24	1.0 - 1.6	KTA7-25S-1A	CA7-9
CT 7-24	1.0 - 1.6	KTA7-25S-1.6A	CA7-9
CT 7-24	1.6 - 2.4	KTA7-25S-2.5A	CA7-9
CT 7-24	2.4 - 4.0	KTA7-25S-2.5A	CA7-9
CT 7-24	2.4 - 4.0	KTA7-25S-4A	CA7-9
CT 7-24	4.0 - 6.0	KTA7-25S-6.3A	CA7-9
CT 7-24	6.0 - 10	KTA7-25S-6.3A	CA7-9
CT 7-24	6.0 - 10	KTA7-25S-10A	CA7-9
CT 7-24	10 - 16	KTA7-25H-16A	CA7-12
CT 7-24	10 - 16	KTA7-25H-16A	CA7-16
CT 7-24	16 - 24	KTA7-45H-20A	CA7-23
CT 7-45	18 - 30	KTA7-45H-32A	CA7-30
CT 7-45	30 - 45	KTA7-45H-45A	CA7-37
CT 7-45	30 - 45	KTA7-45H-45A	CA7-43
CT 7-75	45 - 60	KTA3-100-63A	CA7-60
CT 7-75	60 - 75	KTA3-100-90A	CA7-72
CT 7-100	70 - 90	KTA3-100-90A	CA7-85
CEF 1-11/12	20 - 180	KTA3-160S-100A	CA6-110
CEF 1-11/12	20 - 180	KTA3-160S-160A	CA6-140
CEF 1-11/12	20 - 180	KTA3-160S-160A	CA6-180
CEF 1-41/42	160 - 400	KTA3-250S-200A	CA6-210
CEF 1-41/42	160 - 400	KTA3-250S-250A	CA6-250
CEF 1-41/42	160 - 400	KTA3-400S-320A	CA6-300
CEF 1-41/42	160 - 400	KTA3-400S-400A	CA6-420

Notes:
- Thermal or electronic overload relays may be used.
- XM30PB combinations can be replaced with S125GJ/20 and CA7-30 if required.
- Combinations based on the thermal overload relay tripping before the circuit breaker at overload currents up to the motor locked rotor current.

SECTION 4

APPLICATION DATA

MOTOR STARTING TYPE 2 CO-ORDINATION

Short-Circuit Co-Ordination DOL Motor Starting Table

Type '2'
Terasaki MCCB's & Sprecher + Schuh KT7's
DOL starting 85 kA @ 400/415 V to AS/NZS 60947.4.1

TYPE 2
85 kA

		Terasaki Combinations	
Motor Size (kW)	Approx. amps @ 400/415 V (A)	MCCB	Contactor
0.37	1.1	XM30PB/1.4	CA 7-9
0.55	1.5	XM30PB/2	CA 7-9
0.75	1.8	XM30PB/2.6	CA 7-9
1.1	2.6	XM30PB/4.0	CA 7-16
1.5	3.4	XM30PB/5	CA 7-16
2.2	4.8	XM30PB/8	CA 7-30
3	6.5	XM30PB/10	CA 7-30
4	8.2	XM30PB/12	CA 7-30
5.5	11	H125NJ/20	CA 7-30
7.5	14	H125NJ/20	CA 7-30
11	21	H125NJ/32	CA 7-30
15	28	H125NJ/50	CA 7-43
18.5	34	H125NJ/50	CA 7-43
22	40	H125NJ/63	CA 7-43
30	55	H125NJ/100	CA 7-72
37	66	H125NJ/100	CA 7-72
45	80	H125NJ/160	CA 6-105
55	100	H160NJ/160	CA 6-105
75	130	H250PE/250	CA 6-210
90	155	H250PE/250	CA 6-210
110	200	H250PE/250	CA 6-210
132	225	H400NE/400	CA 6-210
160	270	H400NE/400	CA 6-300
200	361	H400NE/400	CA 6-420

Terasaki Combinations		Sprecher + Schuh Combinations	
Overload Relay	Thermal Setting (A)	KT7 Circuit Breaker	Contactor
CT 7-24	1.0 - 1.6	KTA7-25S-1A	CA 7-9
CT 7-24	1.0 - 1.6	KTA7-25S-1.6A	CA 7-9
CT 7-24	1.6 - 2.4	KTA7-25S-2.5A	CA 7-9
CT 7-24	2.4 - 4.0	KTA7-25H-2.5A	CA 7-9
CT 7-24	2.4 - 4.0	KTA7-25H-4A	CA 7-9
CT 7-24	4.0 - 6.0	KTA7-25H-6.3A	CA 7-9
CT 7-24	6.0 - 10	KTA7-25H-6.3A	CA 7-9
CT 7-24	6.0 - 10	KTA7-25H-10A	CA 7-9
CT 7-24	10 - 16	KTA7-45H-16A	CA 7-12
CT 7-24	10 - 16	KTA7-45H-16A	CA 7-16
CT 7-24	16 - 24	KTA7-45H-20A	CA 7-23
CT 7-45	18 - 30	KTA7-45H-32A	CA 7-30
CT 7-45	30 - 45	KTA7-45H-45A	CA 7-37
CT 7-45	30 - 45	KTA7-45H-45A	CA 7-43
CT 7-75	45 - 60	KTA3-100-63A	CA7-60
CT 7-75	60 - 75	KTA3-100-90A	CA7-72
CT 7-100	70 - 90	KTA3-100-90A	CA7-85
CEF 1-11/12	20 - 180	-	-
CEF 1-11/12	20 - 180	-	-
CEF 1-11/12	20 - 180	-	-
CEF 1-41/42	160 - 400	-	-
CEF 1-41/42	160 - 400	-	-
CEF 1-41/42	160 - 400	-	-
CEF 1-41/42	160 - 400	-	-

Notes:
- Thermal or electronic overload relays may be used.
- XM30PB combinations can be replaced with H125GJ/20 and CA7-30 if required.
- Combinations based on the thermal overload relay tripping before the circuit breaker at overload currents up to the motor locked rotor current.

APPLICATION DATA

MOTOR STARTING TYPE 2 CO-ORDINATION

Short-Circuit Co-Ordination DOL Motor Starting Table

Type '2'
Terasaki MCCB's & Sprecher + Schuh KT7's
DOL starting 100 kA @ 400/415 V to AS/NZS 60947.4.1

TYPE 2
100 kA

		Terasaki Combinations	
Motor Size (kW)	Approx. amps @ 400/415 V (A)	MCCB	Contactor
0.37	1.1	H125NJ/20	CA 7-30
0.55	1.5	H125NJ/20	CA 7-30
0.75	1.8	H125NJ/20	CA 7-30
1.1	2.6	H125NJ/20	CA 7-30
1.5	3.4	H125NJ/20	CA 7-30
2.2	4.8	H125NJ/20	CA 7-30
3	6.5	H125NJ/20	CA 7-30
4	8.2	H125NJ/20	CA 7-30
5.5	11	H125NJ/20	CA 7-30
7.5	14	H125NJ/20	CA 7-30
11	21	H125NJ/32	CA 7-30
15	28	H125NJ/50	CA 7-43
18.5	34	H125NJ/50	CA 7-43
22	40	H125NJ/63	CA 7-43
30	55	H125-NJ/100	CA 7-60
37	66	H125-NJ/100	CA 7-72
45	80	H125-NJ/125	CA 7-85
55	100	H250-NE/160	CA 6-95
75	130	H250-NE/250	CA 6-140
90	155	H250-NE/250	CA 6-140
110	200	H250-NE/250	CA 6-180
132	225	H400-NE/400	CA 6-420
160	270	H400-NE/400	CA 6-420
200	361	H400-NE/400	CA 6-420

Terasaki Combinations		Sprecher + Schuh Combinations	
Overload Relay	Thermal Setting (A)	KT7 Circuit Breaker	Contactor
CT 7-24	1.0 - 1.6	KTA7-25S-1A	CA 7-9
CT 7-24	1.0 - 1.6	KTA7-25S-1.6A	CA 7-9
CT 7-24	1.6 - 2.4	KTA7-25S-2.5A	CA 7-9
CT 7-24	2.4 - 4.0	KTA7-25H-2.5A	CA 7-9
CT 7-24	2.4 - 4.0	KTA7-25H-4A	CA 7-9
CT 7-24	4.0 - 6.0	KTA7-25H-6.3A	CA 7-9
CT 7-24	6.0 - 10	KTA7-25H-6.3A	CA 7-9
CT 7-24	6.0 - 10	KTA7-25H-10A	CA 7-9
CT 7-24	10 - 16	KTA7-45H-16A	CA 7-12
CT 7-24	10 - 16	KTA7-45H-16A	CA 7-16
CT 7-24	16 - 24	KTA7-45H-20A	CA 7-23
CT 7-45	18 - 30	KTA7-45H-32A	CA 7-30
CT 7-45	30 - 45	KTA7-45H-45A	CA 7-37
CT 7-45	30 - 45	KTA7-45H-45A	CA 7-43
CT 7-75	45 - 60	-	-
CT 7-75	60 - 75	-	-
CT 7-100	70 - 90	-	-
CEF 1-11/12	20 - 180	-	-
CEF 1-11/12	20 - 180	-	-
CEF 1-11/12	20 - 180	-	-
CEF 1-41/42	160 - 400	-	-
CEF 1-41/42	160 - 400	-	-
CEF 1-41/42	160 - 400	-	-
CEF 1-41/42	160 - 400	-	-

Notes:
- Thermal or electronic overload relays may be used.
- Combinations based on the thermal overload relay tripping before the circuit breaker at overload currents up to the motor locked rotor current.

SECTION 4

INSTALLATION

INSULATION DISTANCE IN mm (AT 440V AC MAXIMUM)

Model	Type	A	B1	B2	C	D	E
E125	NJ	50	10	10	0	25	*(1)
S125	NF	50	10	10	0	25	*(1)
S125	NJ	50	10	10	0	25	*(1)
S125	GJ	75	45	25	0	25	*(1)
H125	NJ	100	80	60	0	50	*(1)
L125	NJ	100	80	60	0	50	*(1)
S160	NF	50	40	30	0	25	*(1)
S160	NJ	50	40	30	0	25	*(1)
S160	GJ	100	80	60	0	50	*(1)
H160	NJ	100	80	60	0	50	*(1)
L160	NJ	100	80	60	0	50	*(1)
E250	NJ	50	40	30	0	25	*(1)
S250	NJ	50	40	30	0	25	*(1)
S250	GJ	100	80	30	0	25	*(1)
S250	PE	100	80	60	0	50	*(1)
H250	NJ	100	80	60	0	50	*(1)
H250	NE	100	80	60	0	50	*(1)
L250	NJ	100	80	60	0	50	*(1)
E400	NJ	100	80	40	0	30	*(1)
S400	CJ	100	80	40	0	30	*(1)
S400	NJ	100	80	40	0	30	*(1)
S400	GJ	100	80	40	0	30	*(1)
S400	GE	100	80	40	0	30	*(1)
H400	NJ	120	120	80	0	80	*(1)
H400	NE	120	120	80	0	80	*(1)
L400	NJ	120	120	80	0	80	*(1)
L400	NE	120	120	80	0	80	*(1)
E630	NE	120	100	80	0	80	*(1)
S630	CE	120	100	80	0	80	*(1)
S630	GE	120	100	80	0	80	*(1)

***Note:** (1) Insulate the exposed conductor until it overlaps the moulded case at the terminal, or the terminal cover.

INSTALLATION

TEMPERATURE RATINGS & DERATINGS

Calibration Temperature: 45°C

MCCB Type	Connection Type	Rating at calibration temperature (50°C)	Rated Current (A)			
			50°C	55°C	60°C	65°C
E125-NJ S125-NJ S125-GJ	Front Rear Plug-in	20A	19	18.5	18	17.5
		32A	31	30.5	30	29
		50A	48	45	43	41
		63A	60	57	55	52
		100A	97	94	90	87
		125A	121	117	113	109
H125-NJ L125-NJ	Front Rear Plug-in	20A	19	18.5	18	17.5
		32A	31	30	29	28
		50A	48	47	45	44
		63A	61	59	57	55
		100A	97	95	92	89
		125A	121	118	114	111
S160-NJ S160-GJ	Front Rear Plug-in	20A	19	18.5	18	17.5
		32A	31	30	29	28
		50A	48	46	44	42
		63A	61	59	57	55
		100A	97	94	91	88
		125A	121	117	113	109
		160A	156	151	146	141
H160-NJ L160-NJ	Front Rear Plug-in	160A	156	151	147	143
E250-NJ	Front Rear Plug-in	20A	19	18.5	18	17.5
		32A	31	30	29	28
		50A	48	46	44	42
		63A	61	59	57	55
		100A	97	94	91	88
		125A	121	117	113	109
E250-NJ S250-NJ S250-GJ	Front Rear Plug-in	160A	156	151	146	141
		250A	243	235	227	219
H250-NJ L250-NJ	Front Rear Plug-in	160A	156	151	147	143
	Front Rear	250A	244	237	230	223
E400-NJ S400-CJ S400-NJ S400-GJ	Front Rear Plug-in	250A	244	237	230	223
		400A	390	380	369	358
H400-NJ L400-NJ	Front Rear	250A	243	237	230	223
		400A	390	381	371	361
	Plug-in	250A	243	237	231	224
		400A	392	384	376	368

Calibration Temperature: 30°C

MCCB Type	Connection Type	Rating at calibration temperature (30°C)	Rated Current (A)						
			35°C	40°C	45°C	50°C	55°C	60°C	65°C
H250-NJ L250-NJ	Plug-in Conn.	250A	244	236	225	219	209	200	190

MCCB Type	Connection Type	Rating	Rated Current (A)							
			30°C	35°C	40°C	45°C	50°C	55°C	60°C	65°C
S250-PE H250-NE	Front Rear	250A	250	250	250	250	237.5	225	200	200
	Plug-in	250A	250	237.5	225	225	200	200	157.5	157.5
S400-NE S400-GE	Front Rear Plug-in	250A	250	250	250	250	250	250	225	200
		400A	400	400	400	400	400	380	360	320
H400-NE L400-NE	Front Rear	250A	250	250	250	250	250	250	225	200
		400A	400	400	400	400	400	380	360	320
	Plug-in	250A	250	250	250	250	250	250	225	200
		400A	400	400	400	400	400	380	360	320
E630-NE S630-CE S630-GE	Front Rear*	630A	630	630	630	630	598.5	598.5	567	504

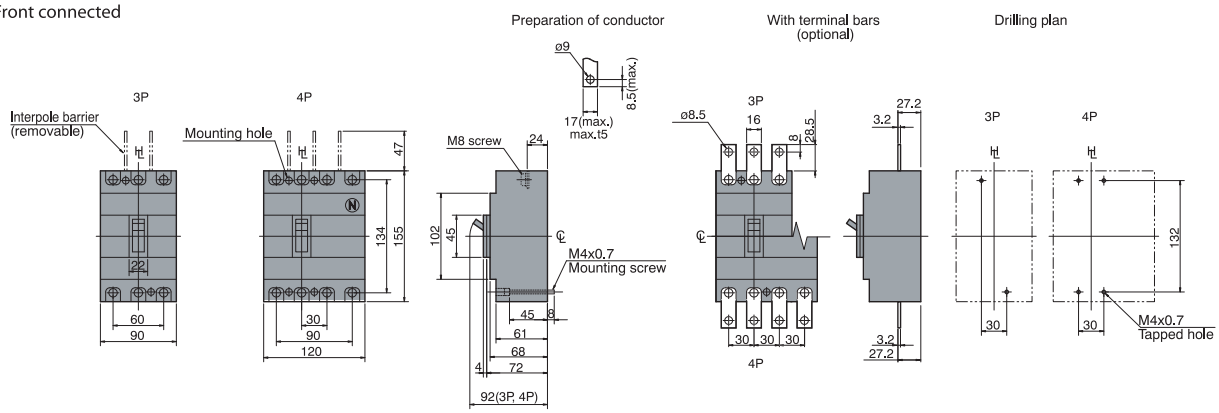
SECTION 6

DIMENSIONS

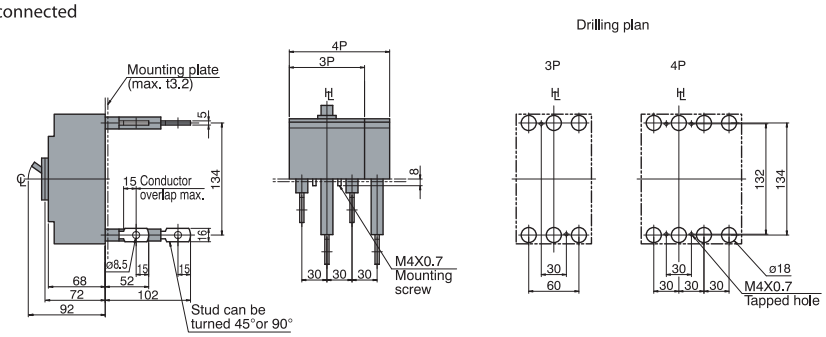
E125-NJ, S125-NJ, S125-GJ

ASL: Arrangement Standard Line
HL : Handle Frame Centre Line

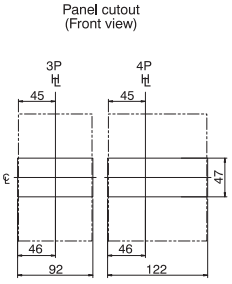
Front connected



Rear connected

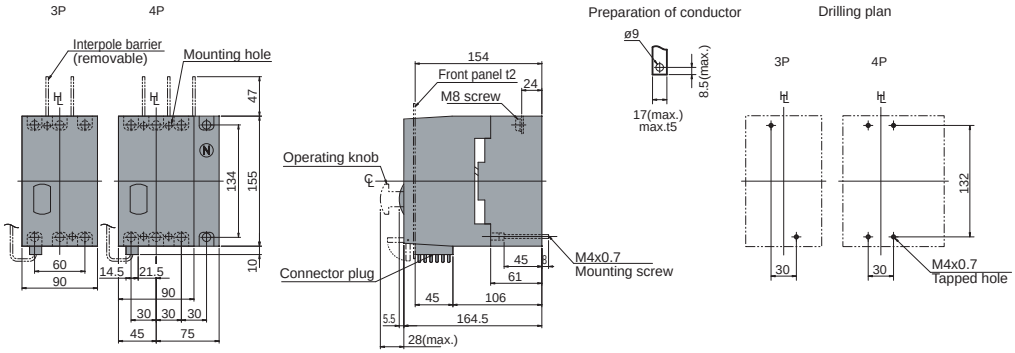


Panel cutout (Front view)

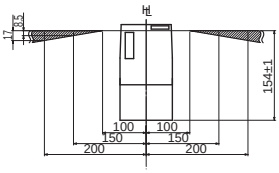


Panel cutout dimensions shown give an allowance of 1.0mm around the handle escutcheon.

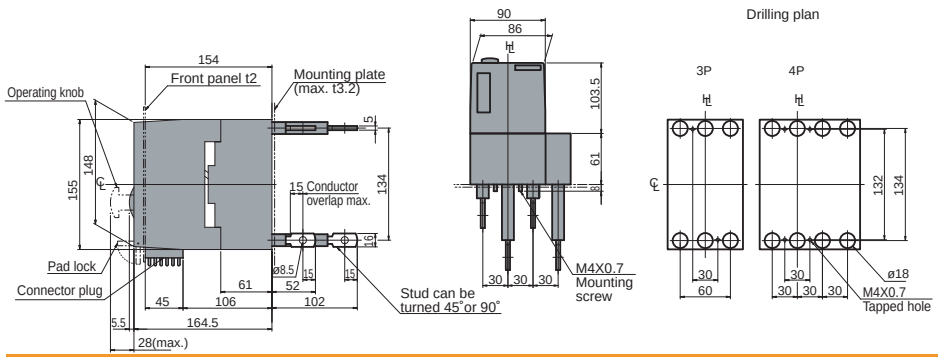
Front connected with Motor Operator



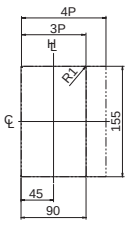
Panel hinge position (hatching area) bottom view



Rear connected with Motor Operator



Panel cutout (Front view)



Panel cutout dimensions shown give an allowance of 1.5mm around the handle escutcheon.

SECTION 7

Miniature circuit breakers

Din-T15 series 15 kA, 20 kA, 25 kA MCBs

- Standards AS/NZS 60947-2
- Current range 6-63 Amp 1, 2, 3 and 4 pole
- Sealable and lockable handle
- Modular design
- Mounts on NC or CD chassis
- Industrial applications

DTCB15
1 pole

1 pole 1 module [1])

In (A)	Icu (kA)	C - Curve 5 - 10 In
6	25	DTCB15106C
10	25	DTCB15110C
13	25	[i] DTCB15113C
16	25	DTCB15116C
20	25	DTCB15120C
25	25	DTCB15125C
32	20	DTCB15132C
40	20	DTCB15140C
50	15	DTCB15150C
63	15	DTCB15163C

2 pole 2 modules [1])

In (A)	Icu (kA)	C - Curve 5 - 10 In
6	25	[i] DTCB15206C
10	25	DTCB15210C
13	25	[i] DTCB15213C
16	25	DTCB15216C
20	25	DTCB15220C
25	25	[i] DTCB15225C
32	20	[i] DTCB15232C
40	20	[i] DTCB15240C
50	15	[i] DTCB15250C
63	15	[i] DTCB15263C

3 pole 3 modules [1])

6	25	DTCB15306C
10	25	DTCB15310C
13	25	[i] DTCB15313C
16	25	DTCB15316C
20	25	DTCB15320C
25	25	DTCB15325C
32	20	DTCB15332C
40	20	DTCB15340C
50	15	DTCB15350C
63	15	DTCB15363C

4 pole 4 modules [1]) [2])

6	25	[i] DTCB15406C
10	25	[i] DTCB15410C
13	25	[i] DTCB15413C
16	25	[i] DTCB15416C
20	25	[i] DTCB15420C
25	25	[i] DTCB15425C
32	20	[i] DTCB15432C
40	20	[i] DTCB15440C
50	15	[i] DTCB15450C
63	15	[i] DTCB15463C

In (A)	6 - 63
1 P	240 V AC
2 P	240/415 V AC
3 P	240/415 V AC
4 P	240/415 V AC

Shock resistance (in x, y, z direction)

20 g with shock duration of 10 ms (minimum 18 shocks)
40 g with shock duration of 5 ms (minimum 18 shocks)

Vibration resistance (in x, y, z direction)

3 g in frequency range 10 to 55 Hz (operating time at least 30 mins) according to IEC 60068-2-6

Storage temperature

from -55 °C to +55 °C according to VDE 0664 parts 1 and 2

Operating temperature

from -25 °C to +55 °C according to VDE 0664 Parts 1 and 2.

Use at 400 Hz

At 400 Hz the magnetic tripping current is approximately 50 % higher than at AC 50/60 Hz

Notes: [1]) Refer Section 3 for kA ratings at 240/415 V. The above ratings are at 415 V AC.
[2]) All poles include overcurrent and short circuit protection.
[i] Available on indent only.

The LINE-side is the OFF or bottom of the MCB and connects to CD chassis tee-offs.

Accessories	Page
Add-on RCD	1 - 28 to 1 - 29
Shunt trip	1 - 36 to 1 - 38
UVT	1 - 39 to 1 - 40
Auxiliary/alarm	1 - 32 to 1 - 35
Padlock bracket	1 - 45
Link bars and terminals	1 - 44 to 1 - 45
Enclosures	Section 2
Busbar chassis	2 - 52

Technical data	Page
Technical data	Section 3
Tripping characteristics	3 - 6, 3 - 8
Dimensions	3 - 24

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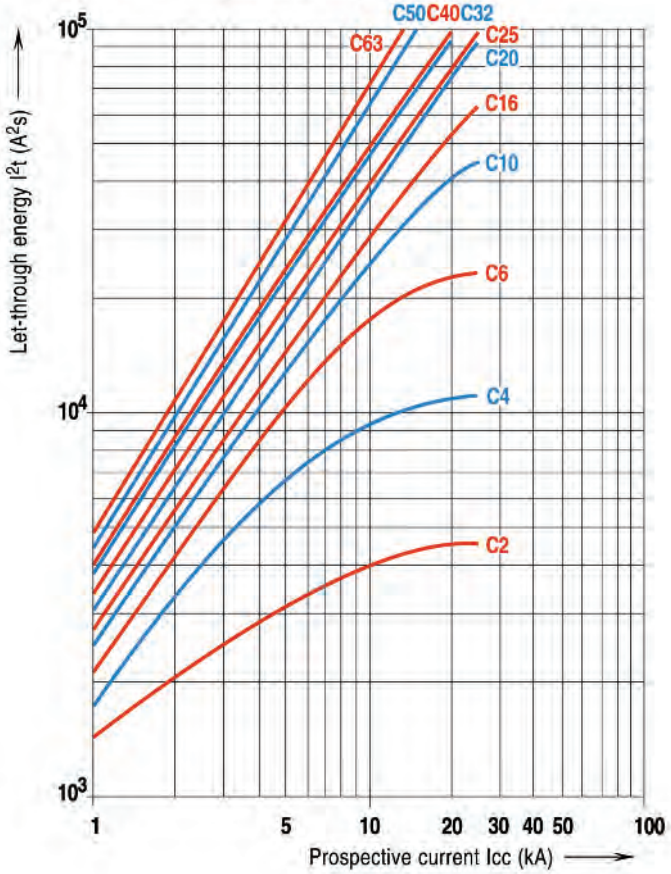
Din-T MCBs + RCDs Technical data

Din-T 15

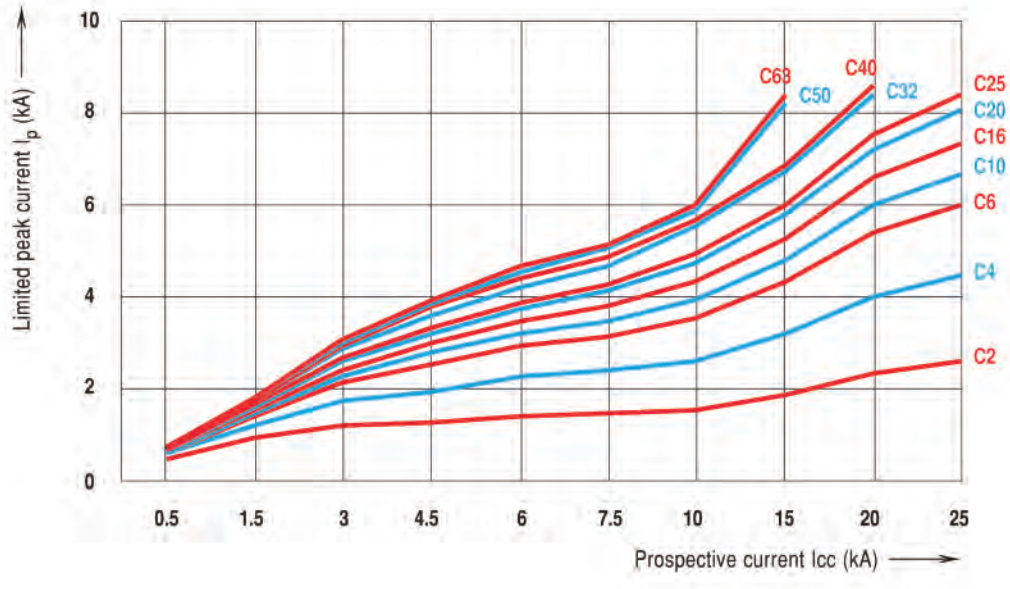
15 kA

C curve

I^2t Let-through energy at 240 V



Ip Limited peak current at 230/400 V



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Din-T MCBs + RCDs Technical data
Text for specifiers

MCB Series Din-T 6 and 10

- According to AS/NZS 60898 standard
- For DIN rail mounting (top hat rail 35 mm)
- Grid distance 35 mm
- Working ambient temperature from -25 °C up to +50 °C
- Approved by CEBEC, VDE, KEMA, IMQ
- Lloyd listed
- 1 pole is a module of 18 mm wide
- Nominal rated currents are: 0.5/1/2/3/4/6/10/13/16/20/25/32/40/50/63 A
- Tripping characteristics: B,C,D (B curve Din-T 10 only)
- Number of poles: 1 P, 2 P, 3 P, 4 P
- The short-circuit breaking capacity is: 6/10 kA, energy limiting class 3
- Terminal capacity from 1 up to 35 mm^2 rigid wire or 1.5 up to 25 mm^2 flexible wire
- Screw head suitable for flat or Pozidrive screwdriver
- Can be connected by means of both pin or fork busbars
- The toggle can be sealed in the ON or OFF position
- Captive locking option
- Rapid closing
- Both incoming and outgoing terminals have a protection degree of IP 20 and they are sealable
- Isolator function thanks to Red/Green printing on the toggle
- Maximum voltage between two phases; 440 V~
- Maximum voltage for utilisation in DC current: 48 V 1 P and 110 V 2 P
- Two position rail clip
- Mechanical shock resistance 40 g (direction x, y, z) minimum 18 shocks 5 ms half-sinusoidal acc. to IEC 60068-2-27
- Vibration resistance: 3 g (direction x, y, z) minimum 30 min. according to IEC 60068-2-6
- Extensions can be added on both left or right hand side
  - Auxiliary contact
  - Shunt trip
  - Undervoltage release
  - Motor operator
  - Panelboard switch
- Add-on RCD can be coupled

MCB Series Din-T 15

- According to AS/NZS 60947.2 standard
- For DIN rail mounting (top hat rail 35 mm)
- Working ambient temperature from -25 °C up to +50 °C
- 1 pole is a module of 18 mm wide
- Nominal rated currents are: 6/10/13/16/20/25/32/40/50/63 A
- Tripping characteristic: C
- Number of poles: 1 P, 2 P, 3 P, 4 P
- Short-circuit capacity is: 15 kA
- Terminal capacity from 1 up to 35 mm^2 rigid wire or 1.5 up to 25 mm^2 flexible wire
- Screw head suitable for flat or Pozidrive screwdriver
- Can be connected by means of both pin or fork busbars
- The toggle can be sealed in the ON or OFF position
- Captive locking option
- Rapid closing
- Both incoming and outgoing terminals have a protection degree of IP 20 and they are sealable
- Isolator function thanks to Red/Green printing on the toggle
- Maximum voltage between two phases; 440 V~
- Maximum voltage for utilisation in DC current: 48 V 1 P and 110 V 2 P
- Two position rail clip
- Mechanical shock resistance 40 g (direction x, y, z) minimum 18 shocks 5 ms half-sinusoidal acc. to IEC 60068-2-27
- Vibration resistance: 3 g (direction x, y, z) minimum 30 min. according to IEC 60068-2-6
- Extensions can be added on both left or right hand side
  - Auxiliary contact
  - Shunt trip
  - Undervoltage release
  - Motor operator
  - Panelboard switch
- Add-on RCD can be coupled

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Din-T MCBs + RCDs Technical data

Series					Din-T10 AS/NZS 60898	Din-T10H AS/NZS 60947-2	Din-T15 AS/NZS 60947-2
Standards (Aust / NZ / International)					IEC 60898	IEC 60947-2	IEC 60947-2
Tripping characteristics					B, C, D	C, D	C
Nominal current				A	B6 -63 , C/D 0.5 - 63	80 up to 125	0.5-63
Calibration temperature				°C	30	40	40
Number of poles (# mod)					1/2/3/4	1/2/3/4	1/2/3/4
Neutral pole protected					yes	Yes	Yes
Nominal voltage Un	AC	1 P		V	240/415	240/415	240/415
		3 P/4 P		V	415	415	415
	DC	1 P		V DC	48	48	48
		2 P		V DC	110 [1])	110 [1])	110 [1])
Frequency				Hz	50/60	50/60	50/60
				Hz	DC: mag.trip +40 %	DC: mag.trip +40 %	DC: mag.trip +40 %
				Hz	400: mag.trip +50 %	400: mag.trip +50 %	400: mag.trip +50 %
Maximum service voltage Ubmax between two wires				V	250/440; 53/120	250/440; 53/120	250/440; 53/120
Minimum service voltage Ubmin				V	12; 12	12; 12	12; 12
Selectivity class (IEC 60898)					3	-	-
Isolator application	IEC 60947-2				yes	yes	yes
Rated insulation voltage	Pollution degree 2			V	500	500	500
	Pollution degree 3			V	440	440	440
Impulse withstand test voltage				kV	6	6	6
Insulation resistance				mOhm	10,000	10,000	10,000
Dielectric rigidity				kV	2.5	2.5	2.5
Vibration resistance (in x, y, z direction) (IEC 77/16.3)					3 g	3 g	3 g
Endurance	Electrical at Un, In				10,000	4000	4000
	mechanical				20,000	20,000	20,000
Utilisation category (IEC 60947-2)					A	A	A
Protection degree (outside / inside, in enclosure with door)					IP 20/IP 40	IP 20/IP 40	IP 20/IP 40
Self-extinguish degree (according to UL94)					V2	V2	V2
Tropicalisation (according to IEC 60068-2 / DIN 40046)				°C/RH	+55 °C/95 % RH	+55 °C/95 % RH	+55 °C/95 % RH
Operating temperature				°C	-25/+55	-25/+55	-25/+55
Storage temperature				°C	-55/+55	-55/+55	-55/+55
Terminal capacity Rigid cable min/max (top)				mm²	1/35	70	1/35
	Flexible cable min*/max (top)			mm²	0.75/25	-	0.75/25
	Rigid cable min/max (bottom)			mm²	1/35	70	1/35
	Flexible cable min*/max (bottom) (* Flexible cable 0.75/1/1.5 mm² with cable lug)			mm²	0.75/25	-	0.75/25
	Torque			Nm	4.5	5	4.5
Add-on devices (side add-on)	Auxiliary contacts				yes	yes	yes
	UVT				yes	-	yes
	Shunt trip				yes	yes	yes
	Motor operator				yes	-	yes
	Panelboard switch				yes	-	yes
Busbar systems	Pin (top/bottom)				yes/yes	-	yes/yes
	Fork (top/bottom)				-/yes	-	-/yes
Accessories					yes	-	yes
Dimensions, weights, packaging							
	(HxDxW) 86x68xW			mm/mod.	18	27	18
	Weight/mod.			g	120	210	120
	Package			mod.	12	8	12
Short-circuit capacity AC			**(kA)**		**AS/NZS 60898**	**AS/NZS 60947-2**	**AS/NZS 60947-2**
IEC 60898	Icn	1 P	230/400 V		10	-	-
		2 P	230/400 V		10	-	-
		3 P/4 P	230/400 V		10	-	-
	Ics (service)				75 % Icn	-	-
IEC 60947-2	Icu (ultimate)	1 P	127 V		30	-	50
			240 V		15	C 10; D 7.5	50/25/20/15 [2])
			415 V		4	4.5	-
		2 P	127 V		40	-	-
			240 V		30	C 15	50/50/40/30 [2])
			415 V		15	C 10; D 7.5	50/25/20/15 [2])
		3 P, 4 P	240 V		30	B/C 15	50/50/40/30 [2])
			415 V		15	C 10; D 7.5	50/25/20/15 [2])
			440 V		10	-	50/20/15/10 [2])
	Ics (service)				50 % Icu	100 % Icu	75 % Icu
	NEMA AB1 (120/240V)				30	-	-
Short-circuit capacity DC		**(kA)**					
IEC 60947-2	Icu (ultimate)	1 P	≤60 V		25	10	25
			≤220 V		-	-	-
		2 P	≤125 V		30	15	30
			≤440 V		-	-	-
	Ics (service)				100 % Icu	100 % Icu	100 % Icu

Notes: Refer page 3 - 25 for information on Safe-T MCBs.

[1]) Poles in series
[2]) 0.5-4 A/6-25 A/32-40 A/50-63 A
[3]) 10 (125 V DC)

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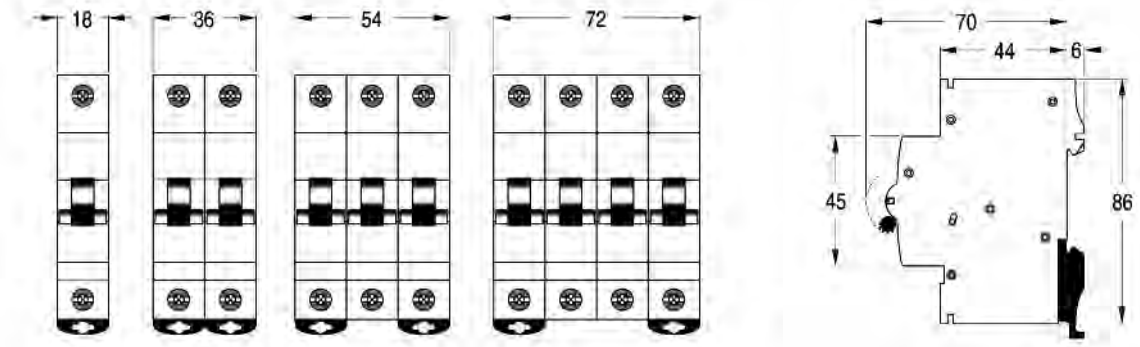
Din-T MCBs + RCDs Technical data

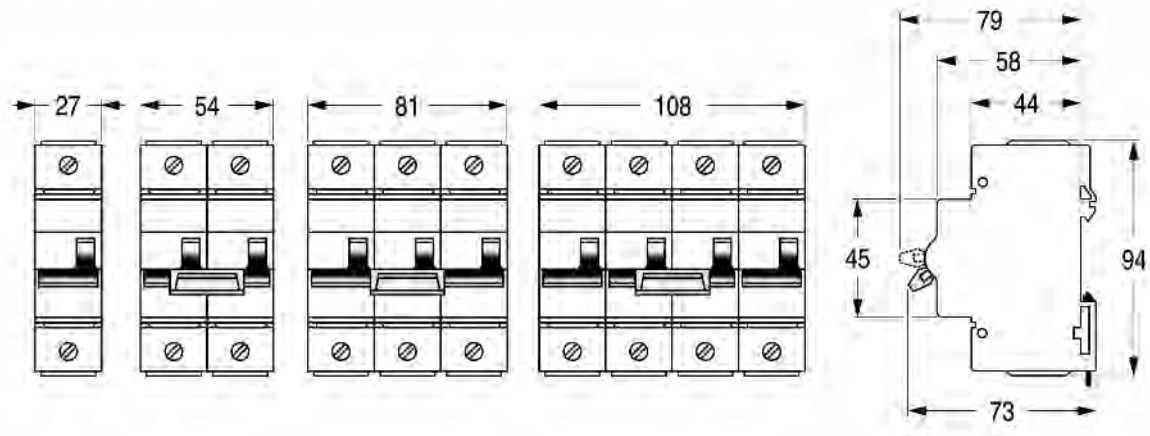
Miniature circuit breakers - Din-T 6, 10, 15 / Easy-fit

3

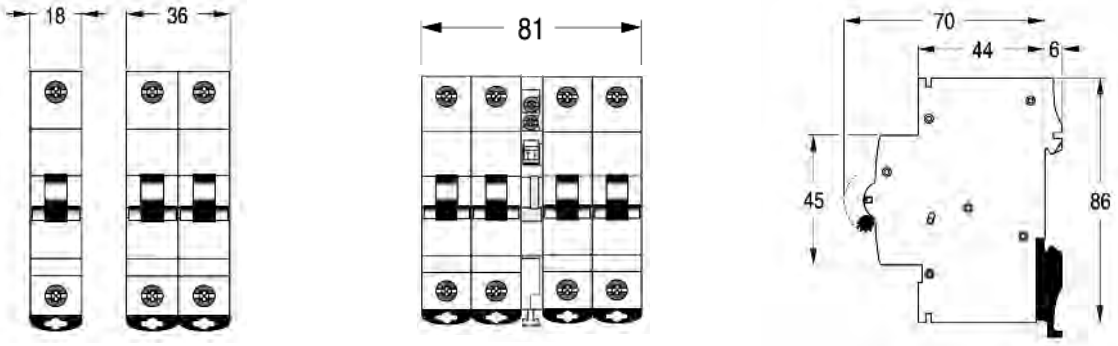
Dimensions in mm.



Miniature circuit breakers - Din-T 10H



Miniature circuit breakers - Din-T DC



Miniature circuit breakers

Din-T10 series 10 kA MCB

- Standard AS/NZS 4898 [1])
- Approval No. N17481
- Short circuit breaking capacity - 10000 Amps
- Current range 0.5 - 63 Amps 1, 2, 3 and 4 pole
- Sealable and lockable handle
- Modular design
- Available in curve type B, C and D
- Mounts on CD chassis (250 A and 355 A)

DTCB10
1 pole

1 pole 1 module

In (A)	C – Curve 5-10 I_n
0.5	DTCB10105C
1	DTCB10101C
2	DTCB10102C
3	DTCB10103C
4	DTCB10104C
6	DTCB10106C
10	DTCB10110C
13	DTCB10113C
16	DTCB10116C
20	DTCB10120C
25	DTCB10125C
32	DTCB10132C
40	DTCB10140C
50	DTCB10150C
63	DTCB10163C

Short circuit capacity 10 kA

In (A)	0.5 - 63
1 P	240 V AC
2 P	240/415 V AC
3 P	240/415 V AC
4 P	240/415 V AC

Use at DC

	1 P	2 P [2])
Short circuit	25 kA	30 kA
Max voltage	48 V DC	110 V DC

2 pole 2 modules

0.5	DTCB10205C
1	DTCB10201C
2	DTCB10202C
4	DTCB10204C
6	DTCB10206C
10	DTCB10210C
13	DTCB10213C
16	DTCB10216C
20	DTCB10220C
25	DTCB10225C
32	DTCB10232C
40	DTCB10240C
50	DTCB10250C
63	DTCB10263C

Notes: [1]) A range of UL standard MCBs is available on indent. (ref DTCBUL10___C).
[2]) 2 pole MCB connected in series.
The line side is the "OFF" (bottom) side of the MCB, and connects to CD chassis tee-offs.
i Available on indent only.

Miniature circuit breakers

Din-T10 series 10 kA MCB (cont.)

3 pole 3 modules

In (A)	C – Curve 5-10 In
0.5	[i] DTCB10305C
1	[i] DTCB10301C
2	DTCB10302C
4	DTCB10304C
6	DTCB10306C
10	DTCB10310C
13	[i] DTCB10313C
16	DTCB10316C
20	DTCB10320C
25	DTCB10325C
32	DTCB10332C
40	DTCB10340C
50	DTCB10350C
63	DTCB10363C

DTCB10
1 - 4 pole types

4 pole 4 modules [1])

6	DTCB10406C
10	DTCB10410C
13	[i] DTCB10413C
16	DTCB10416C
20	DTCB10420C
25	DTCB10425C
32	DTCB10432C
40	DTCB10440C
50	DTCB10450C
63	DTCB10463C

Notes: [1]) All poles include overcurrent and short circuit protection.
[i] Available on indent only.

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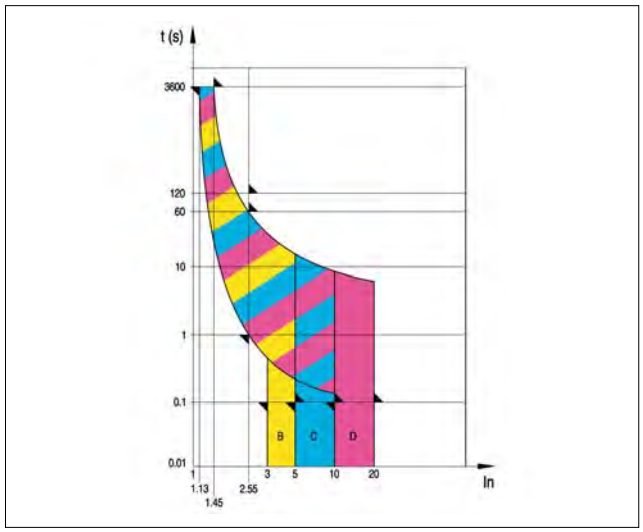
Din-T MCBs Technical data

Characteristics according to BS EN 60898

3

Miniature Circuit Breakers are intended for the protection of wiring installations against both overloads and short-circuits in **domestic** or **commercial** wiring installations where operation is possible by **uninstructed** people

Tripping characteristic curves



Magnetic release

An electromagnet with plunger ensures instantaneous tripping in the event of short-circuit. The NHP Din-T range has 3 different types, following the current for instantaneous release: types B, C and D curve.

Icn (A)	Test current	Tripping time	Applications
B	3 x In 5 x In	0.1<t<45 s (In≤32 A) 0.1<t<90 s (In>32 A) t<0.1 s	Only for resistive loads eg: • electrical heating • water heater • stoves.
C	5 x In 10 x In	0.1<t<15 s (In≤32 A) 0.1<t<30 s (In>32 A) t<0.1 s	Usual loads such as: • lighting • socket outlets • small motors
D	10 x In 20 x In	0.1<t<4 s(**) (In≤32 A) 0.1<t<8 s (In>32 A) t<0.1 s	Control and protection of circuits having important transient inrush currents (large motors)

Thermal release

The release is initiated by a bimetal strip in the event of overload. The standard defines the range of releases for specific overload values. Reference ambient temperature is 30 °C.

Test current	Tripping time
1.13 x In	t ≥ 1 h (In ≤ 63 A) t ≥ 2 h (In > 63 A)
1.45 x In	t < 1 h (In ≤ 63 A) t < 2 h (In > 63 A)
2.55 x In	1 s < t < 60 s (In ≤ 32 A) 1 s < t < 120 s (In >32 A)

Rated short-circuit breaking capacity (Icn)

Is the value of the short-circuit that the MCB is capable of withstanding in the following test of sequence of operations: O-t-CO.

After the test the MCB is capable, without maintenance, to withstand a dielectric strength test at a test voltage of 900 V. Moreover, the MCB shall be capable of tripping when loaded with 2.8 In within the time corresponding to 2.55 In but greater than 0.1s.

Service short-circuit breaking capacity (Ics)

Is the value of the short-circuit that the MCB is capable of withstanding in the following test of sequence of operations: O-t-CO-t-CO.

After the test the MCB is capable, without maintenance, to withstand a dielectric strength test at a test voltage of 1500 V. Moreover, the MCB shall not trip at a current of 0.96 In. The MCB shall trip within 1h when current is 1.6 In.

O - Represents an opening operation

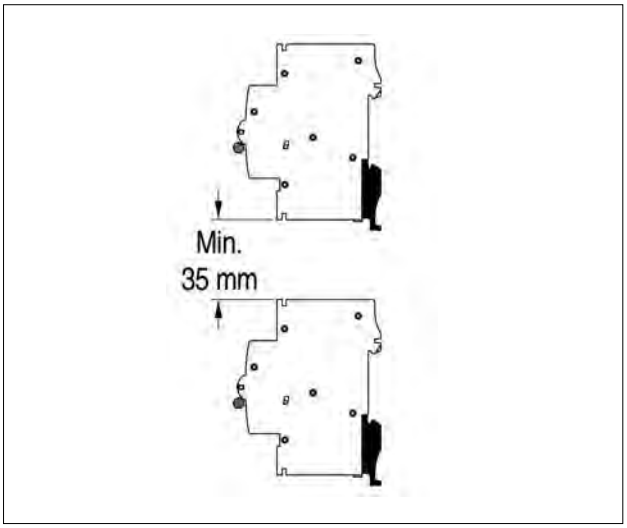
C - Represents a closing operation followed by an automatic opening.

t - Represents the time interval between two successive short-circuit operations: 3 minutes.

The relation between the rated short-circuit capacity (Icn) and the rated service short-circuit breaking capacity (Ics) shall be as follows:

Icn (A)	Ics (A)
≤ 6000	6000
> 6000 ≤ 10000	0.75 Icn min. 6000
> 10000	0.75 Icn min. 7500

In both sequences all MCBs are tested for emission of ionized gases during short-circuit (grid distance), in a safety distance between two MCBs of 35 mm when devices are installed in two different rows in the enclosure. This performance allows the use of any NHP/Terasaki enclosure.



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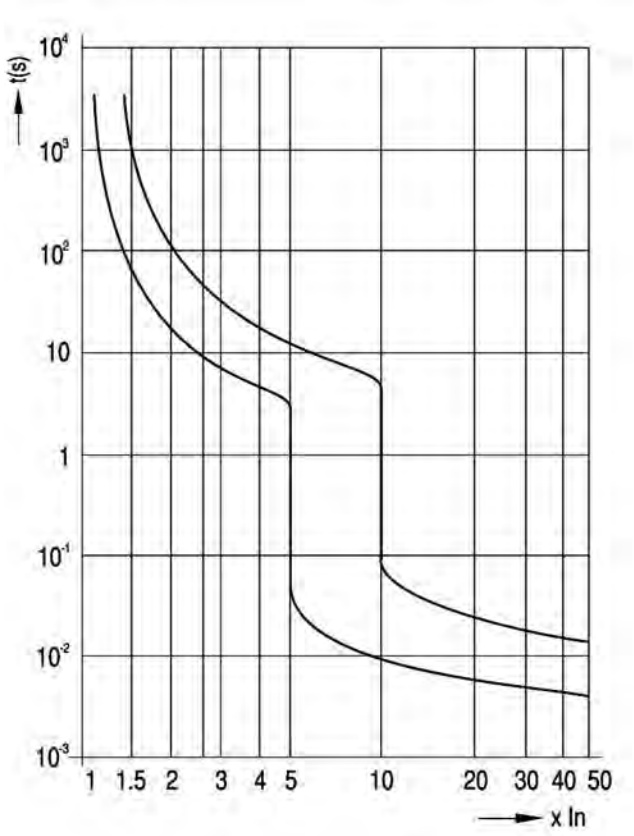
Din-T MCBs Technical data

Tripping curves according to EN 60898

The following tables show the average tripping curves of the Terasaki Din-T MCBs based on the thermal and magnetic characteristics.

3

Curve C



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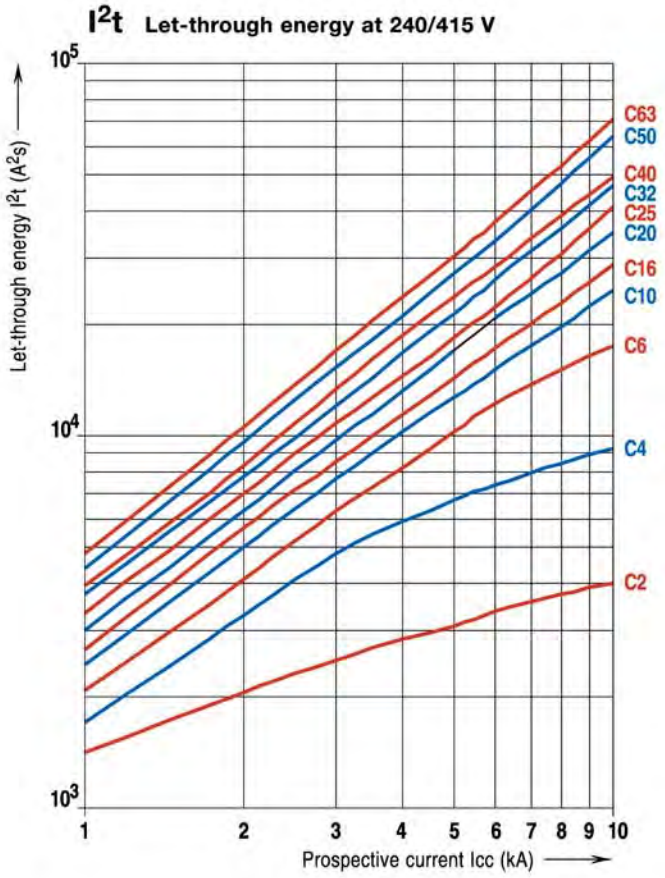
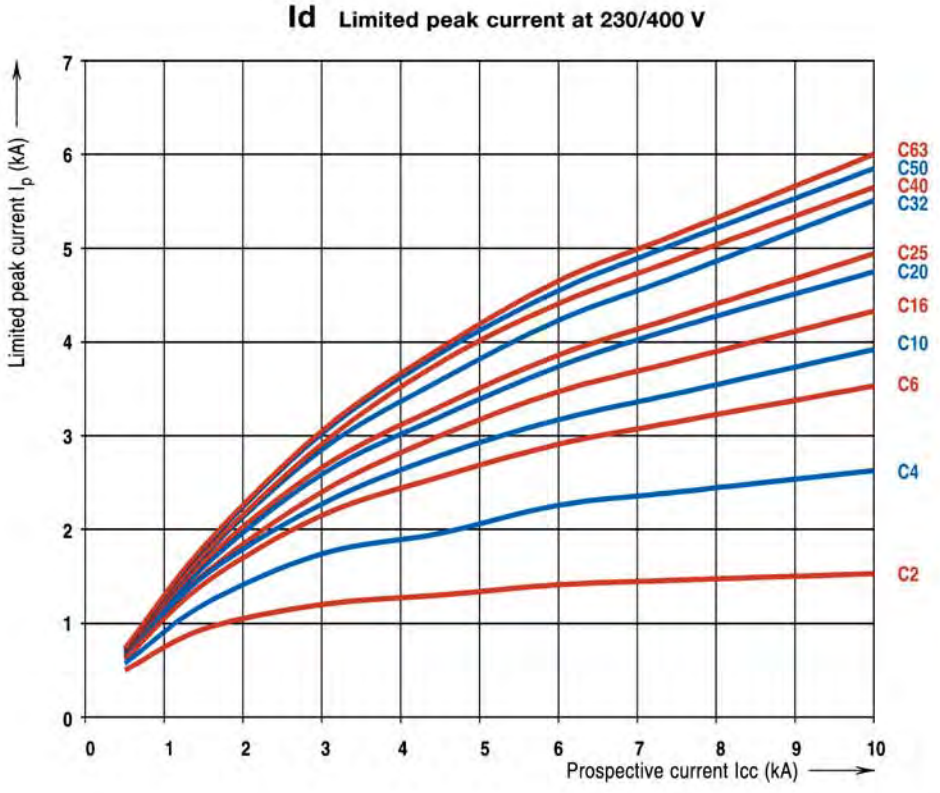
Din-T MCBs Technical data

Din-T 10

10 kA

C curve





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3

Din-T MCBs Technical data

Influence of ambient air temperature on the rated current

The maximum value of the current which can flow through an MCB depends on the nominal current of the MCB, the conductor cross-section and the ambient air temperature.

The values shown in the table below are for devices in free air. For devices installed with other modular devices in the same switchboard, a correction factor (K) shall be applied relative to the mounting situation of the MCB, the ambient temperature and the number of main circuits in the installation.

No of devices	K [1])
2 or 3	0.9
4 or 5	0.8
6 or 9	0.7
> 10	0.6

Calculation example

Within a distribution board consisting of eight 2 Pole, 16 A, 'C' curve type MCBs, with an operating ambient temperature of 45 °C, which is the highest temperature the MCB can operate at without unwanted tripping?

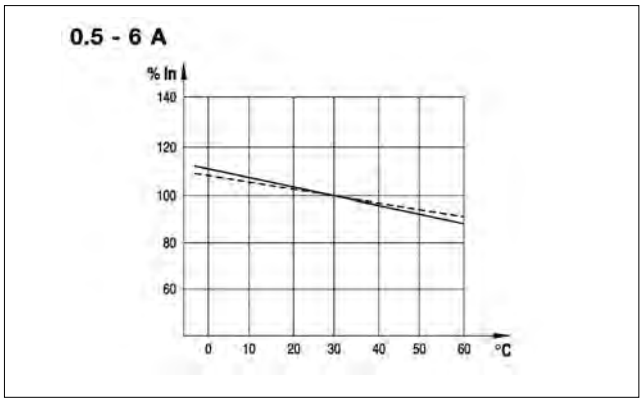
Calculation

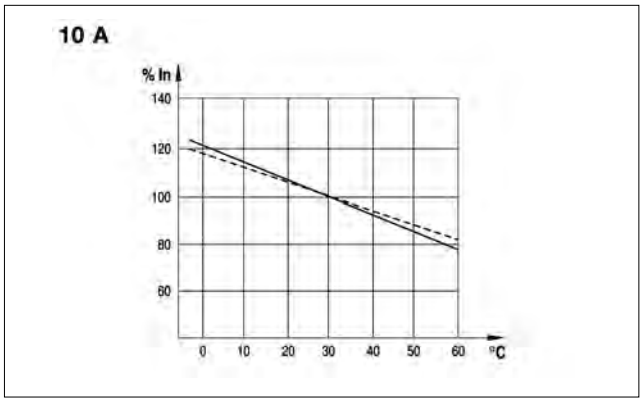
The correction factor K = 0.7, for use in an eight circuit installation: 16 A x 0.7 = 11.2 A

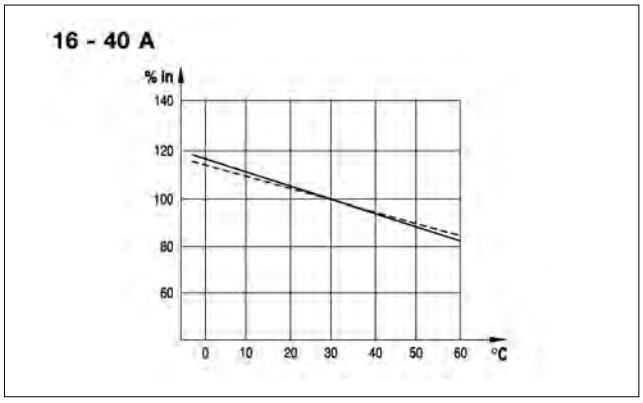
As the MCB is working at 45 °C it shall be given another factor (90 % = 0.9):
In at 45 °C = In at 30 °C x 0.9 = 11.2 A x 0.9 = 10.1 A.

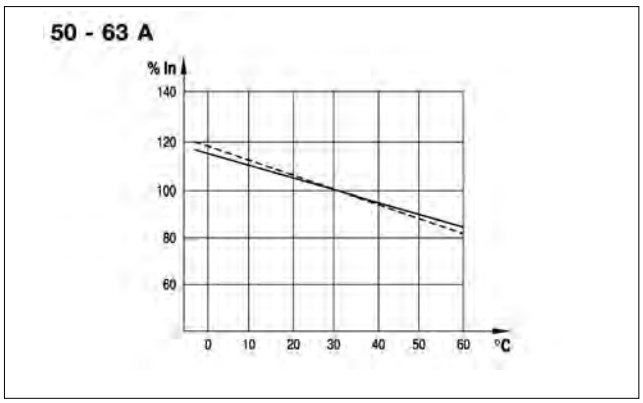
Note: [1]) Applicable for MCBs working at maximum rated currents.

The thermal calibration of the MCBs was carried out at an ambient temperature of 30 °C. Ambient temperatures different from 30 °C influence the bimetal and this results in earlier or later thermal tripping.









——— : 1P (single pole)

- - - - - - - - : mP (multi-pole)

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Din-T MCBs Technical data

Effects of frequency on the tripping characteristic

All the MCBs are designed to work at frequencies of 50-60 Hz, therefore to work at different values, consideration must be given to the variation of the tripping characteristics. The thermal tripping does not change with variation of the frequency but the magnetic tripping values can be up to 50 % higher than the ones at 50-60 Hz.

Tripping current variation

60 Hz	100 Hz	200 Hz	300 Hz	400 Hz
1	1.1	1.2	1.4	1.5

Power losses

The power losses are calculated by measuring the voltage drop between the incoming and the outgoing terminals of the device at rated current.

Power loss per pole

In (A)	Voltage drop (V)	Energy loss (W)	Resistance (mOhm)
0.5	2.230	1.115	4458.00
1	1.270	1.272	1272.00
2	0.620	1.240	310.00
3	0.520	1.557	173.00
4	0.370	1.488	93.00
6	0.260	1.570	43.60
8	0.160	1.242	19.40
10	0.160	1.560	15.60
13	0.155	2.011	11.90
16	0.162	2.586	10.10
20	0.138	2.760	6.90
25	0.128	3.188	5.10
32	0.096	3.072	3.00
40	0.100	4.000	2.50
50	0.090	4.500	1.80
63	0.082	5.160	1.30
80	0.075	6.000	0.90
100	0.075	7.500	0.75
125	0.076	9.500	0.60

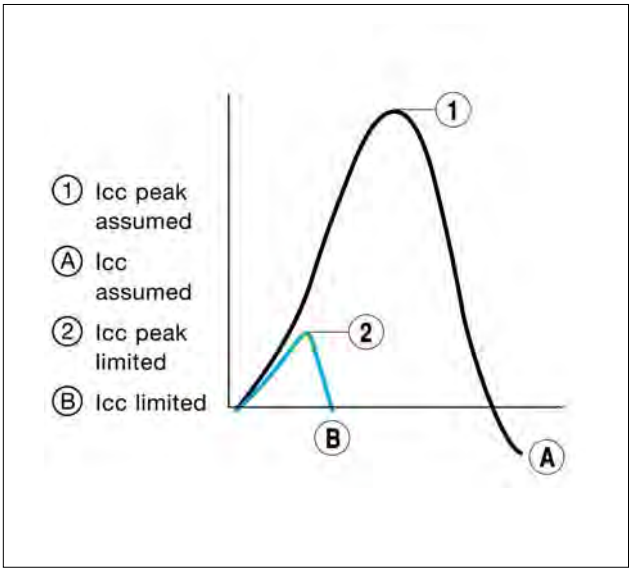
Limitation curves

Let-through energy I^2t

The limitation capacity of an MCB in short-circuit conditions, is its capacity to reduce the value of the let-through energy that the short-circuit would be generating.

Peak current Ip

Is the value of the maximum peak of the short-circuit current limited by the MCB.



See following pages

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Din-T MCBs Technical data

Use of standard MCB for DC use

For MCBs designed to be used in alternating current but used in installations in direct current, the following should be taken into consideration:

- For protection against overloads it is necessary to connect the two poles to the MCB. In these conditions the tripping characteristic of the MCB in direct current is similar to alternating current.
- For protection against short-circuits it is necessary to connect the two poles to the MCB. In these conditions the tripping characteristic of the MCB in direct current is 40% higher than the one in alternating current.

Use of special MCB Din-T DC for DC use.

(UC = Universal current)

For MCBs designed to work in both alternating and direct current, it is necessary to respect the polarity of the terminals since the device is equipped with a permanent magnet.

Use in DC selection table

Series	Rated current (A)	48 V 1 pole Icu (kA)	110 V 2 poles in series Icu (kA)	250 V 1 pole Icu (kA)	440 V 2 poles in series Icu (kA)
Din-T 10	0.5....63 A	25	30	-	-

Installation of Din-T DC MCBs in direct current

Din-T MCBs Technical data

Text for specifiers

MCB Series Din-T 10

- According to EN 60898 standard
- For DIN rail mounting according to DIN EN 50022; EN 50022; future EN 60715; IEC 60715 (top hat rail 35 mm)
- Grid distance 35 mm
- Working ambient temperature from -25 °C up to +50 °C
- Approved by CEBEC, VDE, KEMA, IMQ.
- 1 pole is a module of 18 mm wide
- Nominal rated currents are: 0.5/1/2/3/4/6/10/13/16/20/25/32/40/50/63 A
- Tripping characteristics: B,C,D (B curve Din-T 10 only).
- Number of poles: 1 P, 1 P+N, 2 P, 3 P, 3 P+N, 4 P
- The short-circuit breaking capacity is: 6/10k A, energy limiting class 3
- Terminal capacity from 1 up to 35 mm^2 rigid wire or 1.5 up to 25 mm^2 flexible wire.
- Screw head suitable for flat or Pozidrive screwdriver
- Can be connected by means of both pin or fork busbars
- The toggle can be sealed in the ON or OFF position
- Rapid closing
- Both incoming and outgoing terminals have a protection degree of IP 20 and they are sealable
- Isolator function thanks to Red/Green printing on the toggle.
- Maximum voltage between two phases; 440 V~
- Maximum voltage for utilisation in DC current: 48 V 1 P and 110 V 2 P
- Two position rail clip
- Mechanical shock resistance 40 g (direction x, y, z) minimum 18 shocks 5 ms half-sinusoidal acc. to IEC 60068-2-27
- Vibration resistance: 3 g (direction x, y, z) minimum 30 min. according to IEC 60068-2-6
- Extensions can be added on both left or right hand side
  - Auxiliary contact
  - Shunt trip
  - Undervoltage release
  - Motor operator
  - Panelboard switch
- Add-on RCD can be coupled.

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Din-T MCBs Technical data

Series					Din-T10 AS/NZS 4898
Standards (Aust / NZ / International)					IEC 60898
Tripping characteristics					B, C, D
Nominal current				A	B(6-63), C/D(0.5-63)
Calibration temperature				°C	30
Number of poles (# mod)					1/2/3/4
Neutral pole protected					yes
Nominal voltage Un	AC	1 P		V	240/415
		3 P/4 P		V	415
	DC	1 P [1]		V DC	48
		2 P (in series) [1]		V DC	110
Frequency				Hz	50/60
				Hz	DC: magn.trip +40%
				Hz	400: magn.trip +50%
Maximum service voltage Ubmax between two wires				V	250/440; 53/120
Minimum service voltage Ubmin				V	12; 12
Selectivity class (IEC 60898)					3
Isolator application	IEC 60947-2				yes
Rated insulation voltage	Pollution degree 2			V	500
	Pollution degree 3			V	440
Impulse withstand test voltage				kV	6
Insulation resistance				mOhm	10,000
Dielectric rigidity				kV	2.5
Vibration resistance (in x, y, z direction) (IEC 77/16.3)					3 g
Endurance	Electrical at Un, In				10,000
	mechanical				20,000
Utilisation category (IEC 60947-2)					A
Protection degree (outside / inside, in enclosure with door)					IP 20/IP 40
Self-extinguish degree (according to UL94)					V2
Tropicalisation (according to IEC 60068-2 / DIN 40046)				°C/RH	+55 °C/95 % RH
Operating temperature				°C	-25/+55
Storage temperature				°C	-55/+55
Terminal capacity Rigid cable min/max (top)				mm²	1/35
	Flexible cable min*/max (top)			mm²	0.75/25
	Rigid cable min/max (bottom)			mm²	1/35
	Flexible cable min*/max (bottom) (* Flexible cable 0.75/1/1.5 mm² with cable lug)			mm²	0.75/25
	Torque			Nm	4.5
Add-on devices (side add-on)	Auxiliary contacts				yes
	UVT				yes
	Shunt trip				yes
	Motor operator				yes
	Panelboard switch				yes
Busbar systems	Pin (top/bottom)				yes/yes
	Fork (top/bottom)				-/yes
Accessories					yes
Dimensions, weights, packaging					
	(HxDxW) 86x68xW			mm/mod.	18
	Weight/mod.			g	120
	Package			mod.	12
Short-circuit capacity AC			**(kA)**		**AS/NZS 4898**
IEC 60898	Icn	1 P	230/400 V		10
		2 P	230/400 V		10
		3 P/4 P	230/400 V		10
	Ics (service)				75 % Icn
IEC 60947-2	Icu (ultimate)	1 P	127 V		30
			240 V		15
			415 V		4
		2 P	127 V		40
			240 V		30
			415 V		15
		3 P, 4 P	240 V		30
			415 V		15
			440 V		10
	Ics (service)				50 % Icu
	NEMA AB1 (120/240V)				30
Short-circuit capacity DC		**(kA)**			
IEC 60947-2	Icu (ultimate)	1 P	≤60 V		25
			≤220 V		-
		2 P	≤125 V		30
			≤440 V		-
	Ics (service)				100 % Icu

Notes Refer pages 3 - 23, 24 for information on SAFE-T MCBs.

[1]) Preferred values of rated control supply voltage (IEC 60947 - 2): 24 V, 48 V, 110 V, 125 V, 250 V

[2]) 0.5-4 A/6-25 A/32-40 A/50-63 A

[3]) 10 (125 V DC)

[4]) 10 (250 V DC)

[5]) On request.

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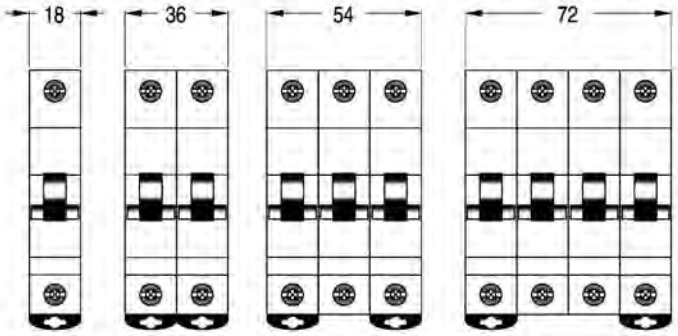
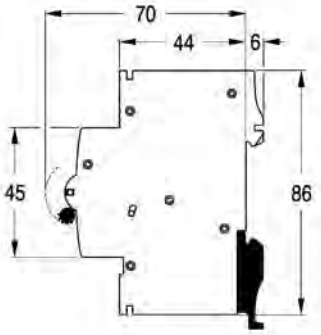
Din-T MCBs + RCDs Technical data

Miniature circuit breakers - Din-T 10

Dimensions in mm.

3





Miniature circuit breakers

Din-Safe single pole width residual current circuit breaker (RCBO) 10 kA

- Standards AS/NZS 61009
- Approval N17482
- One module wide (18 mm)
- Short circuit, overcurrent and earth leakage protection
- Short circuit protection, 10 kA
- Sensitivity 30 mA, 10 mA
- DIN rail mount
- Suits NC or CD chassis
- Type 'A' residual current device
- 240 V AC

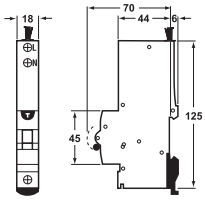
Trip sensitivity	Amp rating (A)	Cat. No [1][2]
10 mA	6	i DSRCBH0610A
	10	DSRCBH1010A
	16	DSRCBH1610A
	20	DSRCBH2010A
	25	i DSRCBH2510A
	32	i DSRCBH3210A
	40	i DSRCBH4010A
30 mA	6	DSRCBH0630A
	10	DSRCBH1030A
	16	DSRCBH1630A
	20	DSRCBH2030A
	25	DSRCBH2530A
	32	DSRCBH3230A
	40	DSRCBH4030A

Operation

This unit combines the overload and short circuit protection of an MCB with earth leakage protection of an RCD. The unit occupies one, sub- circuit (one pole) of the distribution board and provides single phase protection against overload, short circuit and earth leakage current.

- The MCB element provides thermal and magnetic tripping protection which is rated to 6 kA prospective fault current.
- The RCD element of the device provides core-balance detection of the difference between the active and neutral currents and amplification to provide high sensitivity. The rated residual operating current (IΔn) is 30 mA.
- The white earth reference cable, in case of loss of supply neutral, ensures the device will continue to provide earth leakage protection and will operate normally upon detection of an earth leakage current.

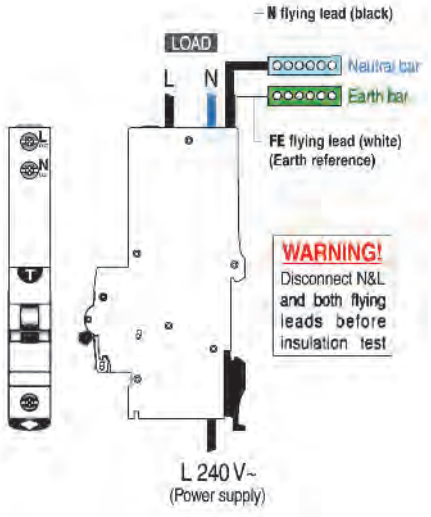
Dimensions (mm)



Application

The Din-Safe single pole width residual current circuit breaker will fit the standard Din-T chassis for use in NHP panelboards. The design makes it possible to provide an MCB complete with earth leakage protection in an 18 mm wide module, which allows a greater number of devices to be fitted into a distribution board.

Connection diagram



Accessories	Page
Padlock bracket	1 - 45
Link bars and terminals	1 - 44 to 1 - 45
Enclosures	Section 2

Technical data	Page
Tripping characteristics	Section 3
Technical data / wiring	Section 3

Notes: [1] Neutral not switched.
[2] Will not accept Din-T side mounting accessories.
30 mA tripping characteristics: 0.5 x IΔn = no tripping, 1 x IΔn = T ≤300 mS
2 x IΔn = T ≤150 mS, 5 x IΔn = T ≤40 mS
Nuisance tripping may be experienced in VFD and motor starting applications refer NHP.
i Available on indent only.

4.2 SURGE PROTECTION & FUSES

Critec – **TDS-180-4S-277** – Surge Diverter

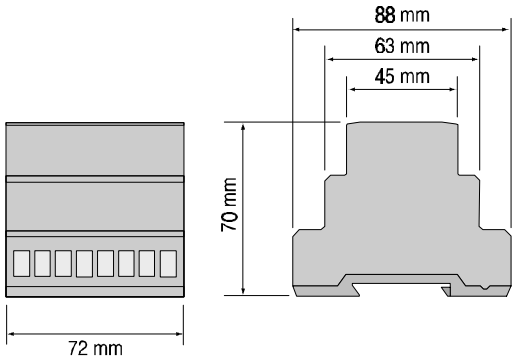
Critec – **TDF-10A-240V** – Surge Reduction Filter

Polyphaser Corp – **IS-50NX-C2** – Surge Protection Unit

NHP – 63A Fuse + 100A Fuse Holder

FACILITY ELECTRICAL PROTECTION

CRITEC™



Detailed Specifications for ERICO's TDS-DINLINE SURGE DIVERTER TDS180-4S

Applications

Lightning transients and surges are a major cause of expensive electronic equipment failure and business disruption. Damage may result in loss of computers, data and communications, loss of revenue, and loss of profits. The new TDS-DINLINE family of surge diverters and filters offer economical and reliable protection from power transients in even the most strenuous applications.

Transient Discriminating Technology (TDS) introduces the first quantum leap in transient suppression technology for mains powered equipment. It offers a new level of safety and reliability, yet retains optimum protection levels critical for electronic equipment. TDS is an active frequency based device that discriminates between the slower mains voltages and the higher speed transients. When transient frequencies are detected the patented TDS "Quick-Switch" technology "switches in" robust protection devices to limit the transient to safe levels. The frequency discrimination circuit controlling the TDS "Quick-Switch" ensures that the device is virtually immune to the effects of the 50/60Hz sustained over-voltages, allowing fault voltages of up to 480Vrms without degradation, and providing over-voltage robustness in excess of the demanding new and emerging standards.

TDS technology is essential for any site where abnormal over-voltages can occur or where the possible catastrophic failure of traditional technologies due to over-voltage events can not be tolerated.

The TDS180-4S unit provides this technology in a single mode shunt-only, 72mm width module. Its unique design allows it to be configured for Ph-N or Ph-E or N-E applications.

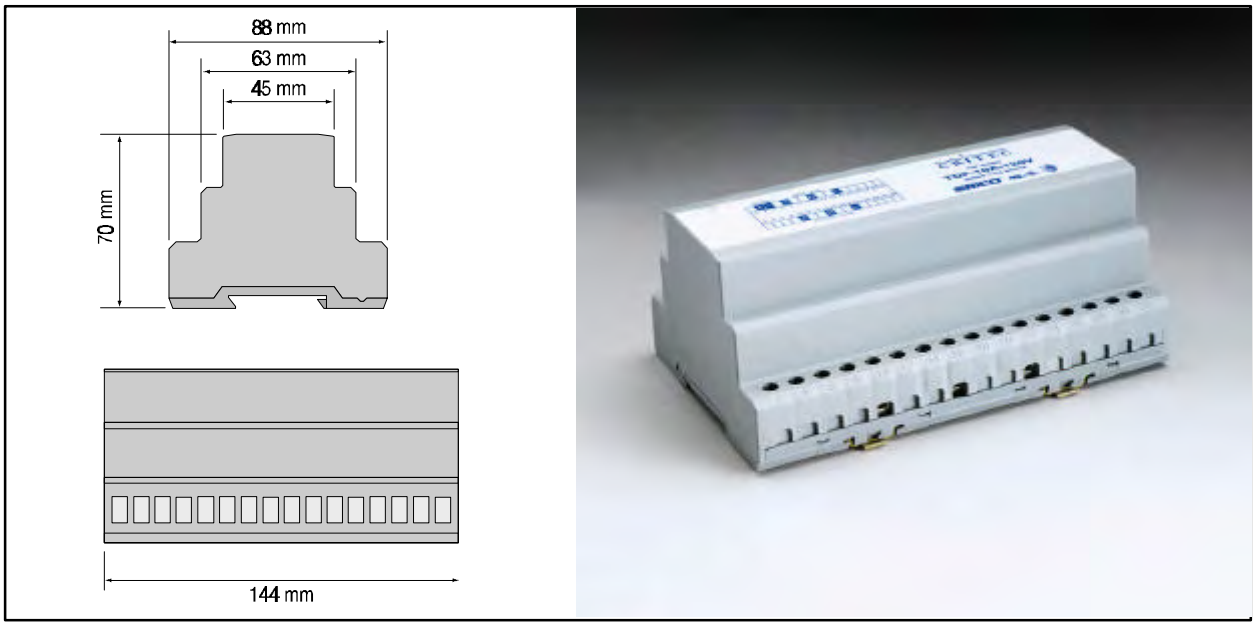
Rated to a surge capacity of 80kA (8/20µs), internally 160kA of surge material is provided for additional robustness and to provide long service life. The unit is designed for sites with a medium risk of transients or for secondary protection applications. For the protection of high exposure sites or critical equipment higher surge rated TDS DINLINE units, or TDS MOVTEC™ should be installed.

Features

- Robust against abnormal over-voltage
- UL1449 Edition 2 compliant
- Single phase primary protection for medium exposure sites or secondary protection applications
- Single mode protection, configurable to Ph-N, Ph-E or N-E protection
- 35mm DIN rail mount, DIN 43 880 profile matches common MCBs
- 72mm width compact design fits into most switch and distribution boards
- Electronic status indicator ideal for poorly illuminated locations
- Long Service life
- Optional retrofittable TDS Alarm Relay for remote alarms

FACILITY ELECTRICAL PROTECTION

CRITEC™



Detailed specifications for ERICO's

TRANSIENT DISCRIMINATING FILTER, TDF-10A SERIES

Applications

Lightning transients and surges are a major cause of expensive electronic equipment failure and business disruption. Damage may result in loss of computers, data commmunications, loss of revenue, and loss of profits. The new Transient Discriminating Filter™ family of TVSS devices offer economical and reliable protection from power transients with the convenience of easy installation on 35mm DIN rail mountings.

The TDF series has been specifically designed for process control applications to protect the switched mode power supply units on devices such as PLC controllers, SCADA systems and motor controllers. Units are available for 3A, 10A and 20A loads and in a range of clamping voltages including 30V, 150V, 275V. The range is intended for use in conjunction with ERICO's Universal Transient Barrier UTB's to provide a coordinated approach to protection of both the power and data control circuits.

The TDF is a series connected **single phase surge filter** providing an aggregate surge capacity of 50kA (8/20µs) - 20kA L-N & L-G and 10kA N-G. The space efficient low pass filter, provides some 65dB of attenuation to voltage transients. Not only does this reduce the residual let through voltage, but it helps further reduce the steep rates of rise of voltage and current providing superior protection for sensitive electronic equipment.

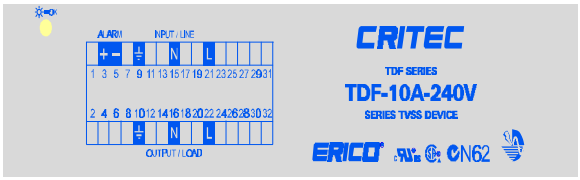
Features

- Compact design fits into most distribution boards and motor control centres
- High efficiency filtering - ideal for the protection of switched mode power supplies from large dv/dt and di/dt transients
- Three modes of protection L-N, L-G, N-G
- 35mm DIN rail mount - DIN 43 880 profile matches common MCB's
- LED indication and opto-isolated output for remote status monitoring
- Transient Discriminating Technology ensures safe operation during abnormal over-voltage events
- UL1449 Edition 2 recognized
- Large 50kA surge capacity provides a high level of protection and long operational life
- 5 year limited warranty

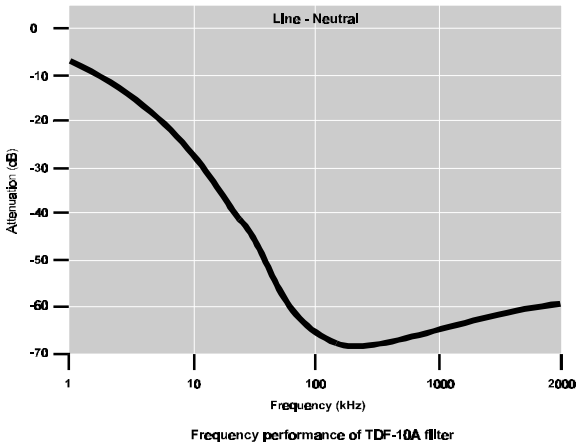
CADWELD® WELDED ELECTRICAL CONNECTIONS CRITEC® SURGE PROTECTION DEVICES ERITECH® LIGHTNING PROTECTION/GROUNDING ERICO®

PROCESS CONTROL TVSS PROTECTION

SPECIFICATIONS



Operation:		
Models available	TDF-10A-120V	TDF-10A-240V
Nominal line voltage	120VAC/125VDC	240VAC
Max Continuous Operating Voltage MCOV	170Vrms	340Vrms
Max Load Current	10A	
Input frequency	50/60Hz	
Earth leakage current	<0.2mA	
Protection:		
Max aggregate surge rating	50kA 8/20µs	
Protection modes	L-N, L-G and N-G	
Max surge current/mode L-N	20kA 8/20µs	
L-G	20kA 8/20µs	
N-G	10kA 8/20µs	
SPD circuit description	Series low pass LC filter Transient Discriminating Technology Thermal fusing	
Filter:		
Inductor	Ferrite cored	
Capacitor type	X & Y grade interference suppression polypropylene film	
Attenuation @100kHz L-N	65dB	
Performance:		
UL1449 SVR L-N	500V	700V
ANSI/IEEE C62.41 Cat B3 - 500A ringwave	22V	28V
Cat C1 - 3kA, 8/20µs	262V	481V
Alarms and Indicators:		
Protection status indication	Red LED, On = OK. Opto-isolated output	
Physical Data:		
Dimensions(W x D x H)	144mm x 88mm x x70mm	
Weight	750g (approx)	
Enclosure material	Flame Retardant UL94V-O	
Connection means	Screw terminals	
Wire size	1.0mm² - 6.0mm²	
Mounting method	DIN T35 Rail	
Enclosure style	DIN 43880	
Environmental rating	IP20	
Opearting temperature	-30°C to +55°C	
Humidity	0-90%	
Surface finish	Spark eroded finish	
Warranty	5 years	
Test standards:		
Approvals	UL1449 Ed 2, UL1283 recognised, CSA22.2 C-Tick AS3260	
Surge rated to meet	ANSI/IEEE C62.41 Cat A, Cat B, Cat C AS/NZS 1768-1991 Cat A, B, C	



Frequency performance of TDF-10A filter

Due to a policy of continual product development, specifications are subject to change without notice.

Part Number	Description
TDF-10A-120V	120V 1 phase, 50kA 8/20µs, 10A series TVSS protector
TDF-10A-240V	240V 1 phase, 50kA 8/20µs, 10A series TVSS protector

Hobart	ph:+61 3 6237-3200	fax:+61 3 6273-0399	Adelaide	ph:+61 8 8366-6555	fax:+61 8 8366-6556
Sydney	ph:+61 2 9479-8500	fax:+61 2 9980-5092	Perth	ph:+61 8 9358-1233	fax:+61 8 9358-1404
Melbourne	ph:+61 3 9894-2677	fax:+61 3 9894-3216	Singapore	ph:+ 65-763-2477	fax:+ 65 763-2397
Canberra	ph:+61 2 6257-3055	fax:+61 2 6257-3127	Thailand	ph:+ 662 627-9037-8	fax:+662 627-9168

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tdf10a.pm5

Technical Support

Explanatory Notes

Lightning Protection

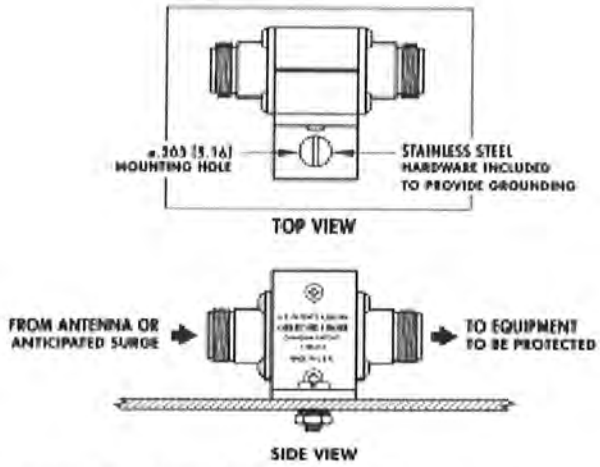
Lightning damages equipment at radio communications sites every day. Although lightning is a DC pulse, the time from zero current to peak current can be very fast. When lightning energy travels through a coaxial cable, there is a slight propagation delay that occurs due to the unbalanced inductances of the shield and centre conductor, and the centre conductor's capacitive relationship through the dielectric to the shield. The higher-frequency shield energy will arrive at the equipment first, followed by the centre conductor energy. Since the pulse energy arrives at different times, a differential voltage occurs. A properly designed coaxial protector equalises this potential difference, which prevents current flow and therefore damage to the site's equipment.

However, the choice of a standard gas tube type coaxial protector without DC blocking may not offer the user complete protection. The fast rise-time lightning pulse can produce over 1000 Volts across the gas tube before the gas can ionise and become conductive. Since there is no DC blocking mechanism, this high voltage is applied directly to the equipment input before the gas tube turns on.

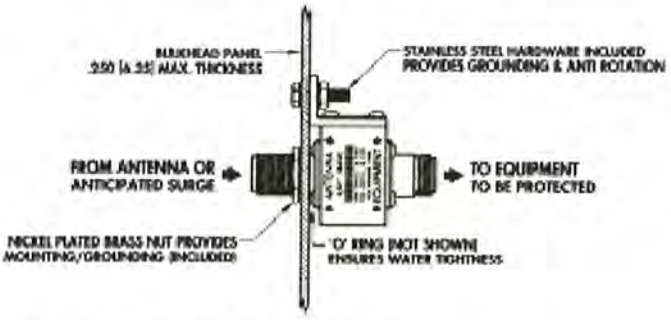
A quarter wave stub coaxial protector creates a band-pass filter, at a frequency determined by the length of the quarter wave coaxial section from the horizontal centre conductor to the grounded base. However, if the equipment input is DC-shorted, the quarter wave stub can allow significant divided DC and low frequency energy to flow towards the equipment input.

A "DC blocking mechanism" inside the protector (no DC continuity through the protector) will prevent harmful levels of throughput energy from reaching the equipment. RFI stocks and distributes the patented PolyPhaser DC-blocked coaxial protector line, which has the lowest throughput specifications in the industry. There is also a series of PolyPhaser coaxial protectors that block DC in the RF path to the equipment, and either inject, pass through, or pick off a specified DC voltage on the feeder's coaxial cable centre conductor. This series of protectors is particularly suited to applications requiring DC to be passed up the coaxial feeder cable to power tower-top amplifier electronics.

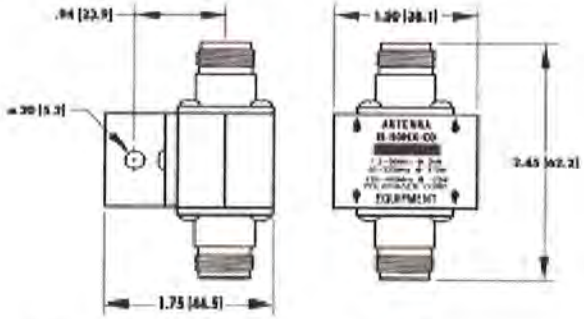
Remember that no matter how good your lightning protector is, it's not a fuse. It still needs to be correctly installed and connected to a suitable grounding system. RFI offers a complete range of products to protect your system, including the coaxial protector, grounding rods, copper strapping and grounding kits for the feeder cables.



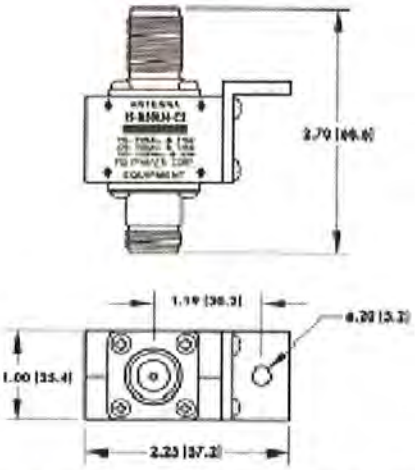
Mounting Configuration, flange mount models



Mounting Configuration, bulkhead mount models



Product Dimensions, IS-50NX-CO, flange mount



Product Dimensions, IS-B50NX-C2, bulkhead mount

IS-B5OHN-CO
Throughput Energy: ≤20mJ* (N Connector/ Bulkhead)
Frequency Range: 1.5 MHz to 400 MHz
Max Power: HF 3kW, VHF 500W, UHF 250W

IS-B5OLN-C1
Throughput Energy: ≤600µJ* (N Connector/ Bulkhead)
Frequency Range: 50MHz to 700MHz
Max Power: VHF 375W, UHF 125W

IS-B5OHN-C1
Throughput Energy: ≤1mJ* (N Connector/ Bulkhead)
Frequency Range: 50 MHz to 700 MHz
Max. Power: VHF 500W, UHF 250W

IS-B50LN-C2
Throughput Energy ≤220µJ* (N Connector/ Bulkhead)
Frequency Range: 125MHz to 1000MHz
Max. Power VHF 375W, UHF (low) 125W
900MHz to 1GHz 50W

IS-B50HN-C2
Throughput Energy: ≤800µJ* (N Connector/ Bulkhead)
Frequency Range: 125MHz to 1000MHz
Max. Power: VHF 500W, UHF (low) 250W
800MHz to 1GHz 125W

IS-B50UX-CO
Throughput Energy: ≤10mJ* (UHF Connector/ Surface)
Frequency Range: 1.5MHz to 400MHz
Max. Power: HF 2kW, VHF 375W, UHF 125W

IS-50UX-C1
Throughput Energy: ≤600µJ* (UHF Connector/ Surface)
Frequency Range: 50 MHz to 700 MHz
Max Power: VHF 375W, UHF 125W

IS-50NX-CO
Throughput Energy: ≤10mJ* (N Connector/ Surface)
Frequency Range: 1.5MHz to 400MHz
Max Power: HF 2kW, VHF 375W, UHF 125W

IS-B50NX-C1
Throughput Energy: ≤600µJ* (N Connector/ Surface)
Frequency Range: 50 MHz to 700 MHz
Max. Power: VHF 375W, UHF 125W

IS-B5ONX-C2
Throughput Energy ≤220µJ* (N Connector/ Surface)
Frequency Range: 125MHz to 1000MHz
Max. Power VHF 375W, UHF (low) 125W
800MHz to 1GHz 50W

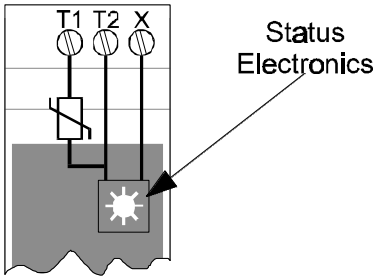
IS-75F-C1
Throughput Energy: ≤1mJ* (F Connector/ Surface)
Frequency Range: 4MHz to 900MHz VSWR ≤1.2:1
Max. Power: HF 100W, VHF 100W, UHF 25W

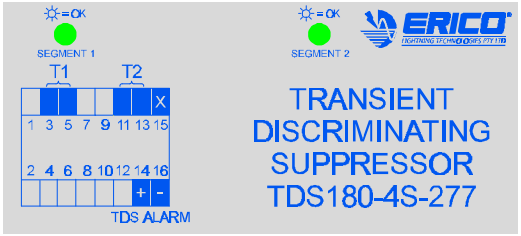
Add suffix - MA for male antenna port connector
Add suffix - ME for female antenna port connector

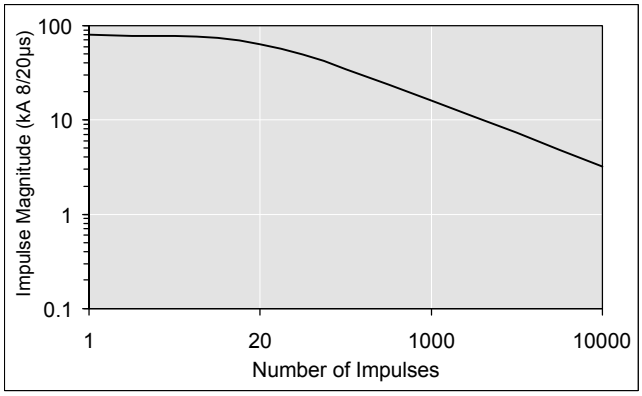
DOC REF:PB36328-1

TDS-DINLINE SURGE DIVERTER TDS180-4S

SPECIFICATIONS







Operation:	
Nominal input voltage	220 -277 Vrms
Input frequency	50/60 Hz
Max. permissible abnormal over-voltage	480 Vrms
Power systems	TN-C, TN-S, TN-C-S (MEN), TT
Earth leakage current	<2mA
Protection:	
Modes	Ph-N, Ph-E or N-E
Let through voltage @ 3kA 8/20µs	<720V
Let through voltage @ 20kA 8/20µs	<910V
Surge rating 8/20µs	80kA
Surge rating 10/350µs	16kA
Energy rating	3840J
Multipulse™ capability	Yes
Aggregate surge material	160kA 8/20µs
Alarms and Indicators:	
Protection status indication	Two, electronic. On = OK
Alarm contacts	User configurable, with optional TDS-AR
Physicals:	
Environmental rating	IP20
Operating conditions	-35 to +55°C, 0-90% humidity
Enclosure style	DIN 43880
Dimensions (W x D x H)	72 x 88 x 70mm
Weight	350g (approx.)
Encapsulation	Shockguard
Enclosure material	Flame Retardent UL94V-0
Surface finish	Spark eroded finish
Wiring terminals	Accepts up to 6mm²
Warranty	5 years
Test standards:	
Approvals	UL1449 Edition 2 AS 3260, IEC 950 Certificate of suitability, Electricity Regulator
Surge rated to meet	ANSI/IEEE C62.41-1991 Cat A, Cat B, Cat C. ANSI/IEEE C62.45-1987 Life cycle testing. AS/NZS 1768-1991 Cat A, Cat.B, Cat C. BS 6651:1992 Cat A, Cat B. IEC801-5 Installation Class 5. IEC 61643-1

Note: Other operating voltages and frequencies are available on application.
For specifications on other DINLINE products, refer to relevant Specifications Sheet.
Exceeding nominal operating voltage while transient events occur may affect product life.

Due to a policy of continual product development, specifications are subject to change without notice.

Model Number	Description
TDS180-4S-277	TDS 277V 80KA SURGE SUPPRESSOR

Hobart	ph:+61 3 6237-3200	fax:+61 3 6273-0399	Adelaide	ph:+61 8 8366-6555	fax:+61 8 8366-6556
Sydney	ph:+61 2 9479-8500	fax:+61 2 9980-5092	Perth	ph:+61 8 9358-1233	fax:+61 8 9358-1404
Melbourne	ph:+61 3 9894-2677	fax:+61 3 9894-3216	Singapore	ph:+ 65-763-2477	fax:+ 65 763-2397
Canberra	ph:+61 2 6257-3055	fax:+61 2 6257-3127	Thailand	ph:+ 662 627-9037-8	fax:+662 627-9168

ERICO's coordinated approach to facility protection - CADWELD, CRITEC, ERITECH www.erico.com

TDS180.PM5 ISSUE 2.0

4.3 CONTROL DEVICES

Critec – **DAR-275V** – Surge Diverter Relay

Crompton Instruments – **252-PSGW** – Phase Failure Relay

Finder - **38.51 24VDC** – Pump Run Relay

Sprecher & Schuh – **CS7C-40E24V** – Pump Relay
c/w – **CS7-PV-22** – Pump Relay Auxiliary

Sprecher & Schuh – **CS7C-22E24V** – Pump Relay

Multitrode – **MTR** – Level Relay

Multitrode – **0.2/1-'x'** – Level Probe

CRITEC TDS/TDS50/DAR/TDS SC

Transient Discriminating Suppressor and DINLINE Alarm Relay & Surge Counter

Asia/Australia
Europe
Latin America
North America

TDS/TDS50 series offers compact TVSS with TD Technology in DIN enclosures

The DINLINE Alarm Relay (DAR) is used with the above where alarm contacts are required for remote signaling

The TDS-SC Surge Counter provides a non-resettable record of the number of surges diverted

The TDS units are compact 35mm DIN mounting TVSS devices, ideal for installation into electrical panels or equipment. The TDS unit protects a single mode while the TDS50 protects L-N, L-G and N-G simultaneously.

The DAR (DINLINE Alarm Relay) can be connected to the TDS or TDF units to provide potential free change-over alarm contacts.

See page 56 for schematic diagrams.

Model	TDS140 2S 277	TDS180 4S 277	TDS50 240	DAR275V	TDC SC
Item Number for Europe	700300	700710	700305	700900	702150
Nominal Voltage U_n	240V	240V	240V (1Ph 2W+G)	110V and 240V	–
Max. Cont. Operating Voltage U_c	340V	340V	340V	275V	–
Stand-off Voltage	480V	480V	480V	275V	–
Frequency	50/60Hz	50/60Hz	50/60Hz	50/60Hz	–
Operating Current @ U_n	2mA	4mA	2mA	20mA	–
Max. Discharge Current I_{max}	40kA 8/20µs	80kA 8/20µs	20kA 8/20µs L-G 20kA 8/20µs L-N 10kA 8/20µs N-G	–	–
Impulse Current I_{imp}	8kA 10/350µs	16kA 10/350µs		–	–
Aggregate Surge Rating	80kA 8/20µs	160kA 8/20µs		–	–
Protection Modes	Single	Single	L-N, L-G & N-G	–	–
Technology	TD Technology			–	–
Voltage Protection Level U_p @ 500A 8/20µs (UL SVR) @ Cat B3, 3kA 8/20µs @ 20kA 8/20µs	 800V <750V <960V	 800V <720V <910V	L-N 600V <700V	–	–
Status	Green LED. On=OK. Isolated opto-coupler output(1)			Red/Green LEDs. Change-over contact(2)	Maximum count 9999 Non-resettable
Dimensions	2M. 90mm x 68mm x 36mm (3.5" x 2.6" x 1.4")	4M. 90mm x 68mm x 72mm (3.5" x 2.6" x 2.8")	2M. 90mm x 68mm x 36mm (3.5" x 2.6" x 1.4") (excluding CT)		
Weight	0.2kg (0.44lb)	0.35kg (0.77lb)	0.2kg (0.44lb)		
Enclosure	DIN 43 880, UL94V-0 thermoplastic, IP 20 (NEMA-1)				
Connection	1mm² to 6mm² (#18AWG to #10)				
Mounting	35mm top hat DIN rail				
Back-up Overcurrent Protection	16-32A. Refer to installation instructions				–
Temperature	-35°C to +55°C (-31°F to +131°F)				
Humidity	0% to 90%				
Warranty	5 years				
Approvals	UL 1449, C-Tick AS 3260, IEC 950		UL 1449, CSA22.2 CE, C-Tick, NOM	CSA22.2 C-Tick, AS 3260, CE	
Surge Rated to Meet	ANSI/IEEE C62.41-1991 Cat A, Cat B, Cat C		ANSI/IEEE C62.41-1991		

(1) Opto-coupler output can be connected to DAR275V to provide Form C dry contacts
(2) Form C = Change-over contact (Form C dry contact), 400V~/3A 1mm² to 6mm² (#18AWG to #10AWG) connecting wire

Refer catalogue F1

Relay interface module

DIN rail mount

- Interface module with 34 series relay
- Ultra-slim profile, only 6.2 mm wide
- Integral LED and diode
- Simple removal of relay for replacement
- DIN rail mounting

Cat. No.	Cat. No.
38.51...V DC **38.51...V AC/DC**	**38.61...V DC** **38.61...V AC/DC**

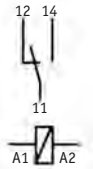
Contact specifications

Contact configuration	1 C/O
Rated current	6 A
Rated voltage	250 V AC
Rated load in AC 1	1,500 VA
Rated load in AC 15 (230 V AC)	300 VA
Breaking capacity in DC 1 : 30/110/220 V	6/0.2/0.15 A
Maximum peak current	10 A
Maximum switching voltage	400 V AC
Minimum switching load	500 mW

Coil specifications

Nominal voltage (U_N)	(50/60 Hz) AC/DC	24, 110, 240
	DC	6 [i], 12, 48 [i], 60 [i]
Rated power AC/DC	(50/60 Hz) AC/DC	(0.2...0.9)W
	DC	0.3W
Operation range	(50/60 Hz) AC/DC	(0.83...1.1) U_N
	DC	(0.83...1.2) U_N
Holding voltage AC/DC		0.6 U_N/0.6 U_N
Must drop-out voltage AC/DC		0.1 U_N/0.1 U_N

Technical data

Mechanical life AC/DC	-/10.10^6
Electrical life @ rated load AC 1	60.10^3
Insulation between coil and contacts	6 kV
Ambient temperature range	-40 °C...+55 °C
Protection rating	IP 20
Connection diagram	
Accessories	**93.01** Isolating plate **93.20** Jumperlink 20 way **93.64** Identification labels

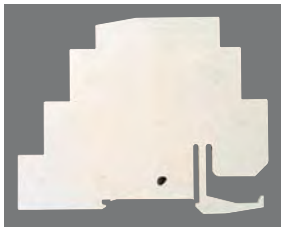
Notes: **The equipment on this page is rated 230/400 V and is suitable for use on 240/415 V systems as per AS 60038:2000.**
[i] Available on indent only.

9

Refer catalogue F1

Relay interface module

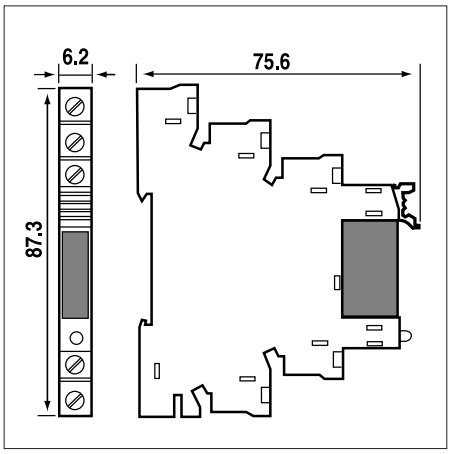
Accessories

	 ■ Isolates varying voltages mounted in the same row. One isolating plate every four relays is recommended	 ■ Reduced wiring and installation costs	 ■ Easy identification for maintenance
Cat. No.	**93.01**	**93.20**	**93.64**
Description	Isolating plate	Jumperlink 20 way 36 A, 250 V rating	Identification labels (64 tags in a pack)
Relay to suit	38.51, 38.61	38.51, 38.61	38.51, 38.61

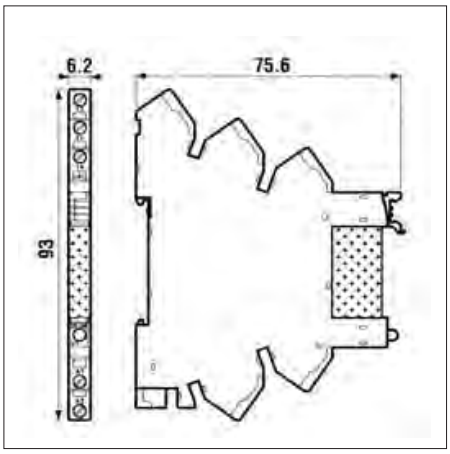
Relay dimensions (mm)

38 Series

Cat. No. 38.51



Cat. No. 38.61



9

Low Power Consumption Low Profile Design Electronic DC Coil Relay

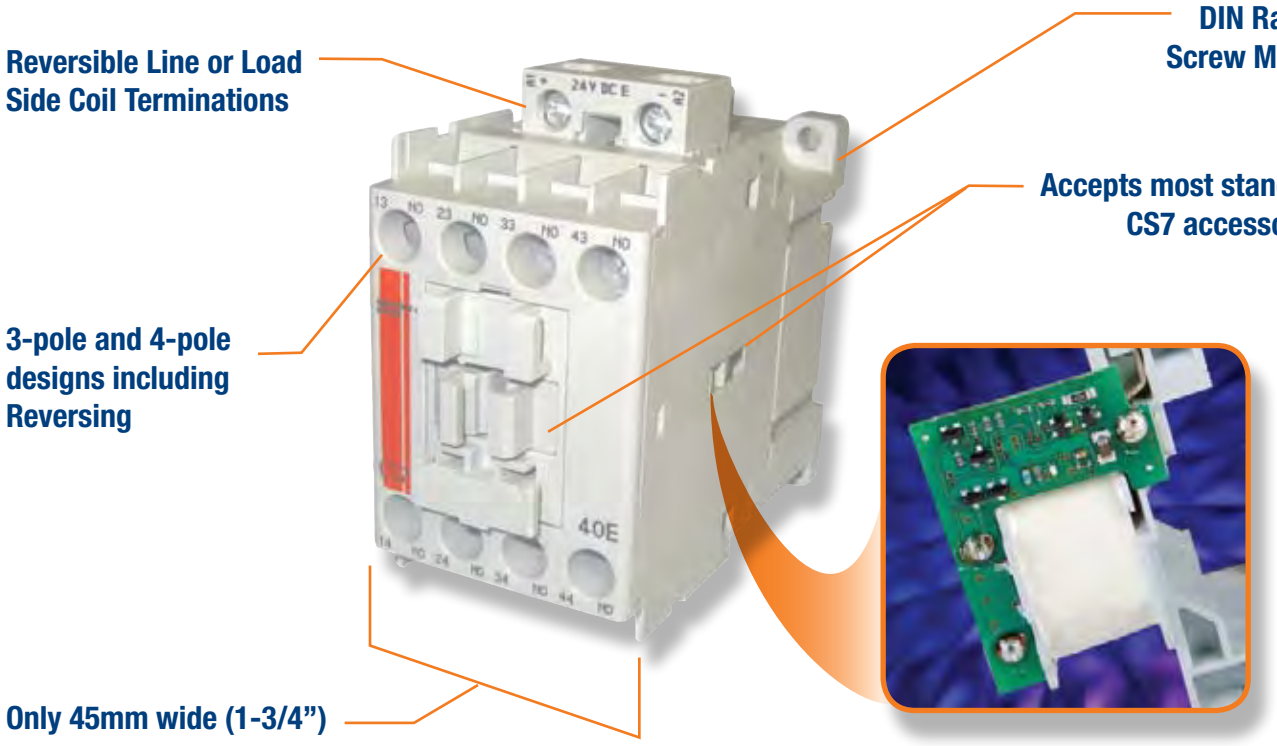
CS7E Industrial Control Relays with 24V DC Electronic Coil

Same size as AC coil relays

Draws less than 1.5W/60mA

More energy efficient

Standard, Master & Bifurcated models



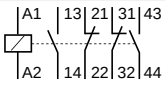
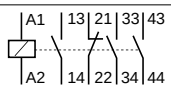
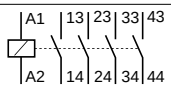
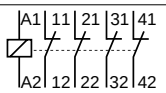
Low Consumption DC Coils

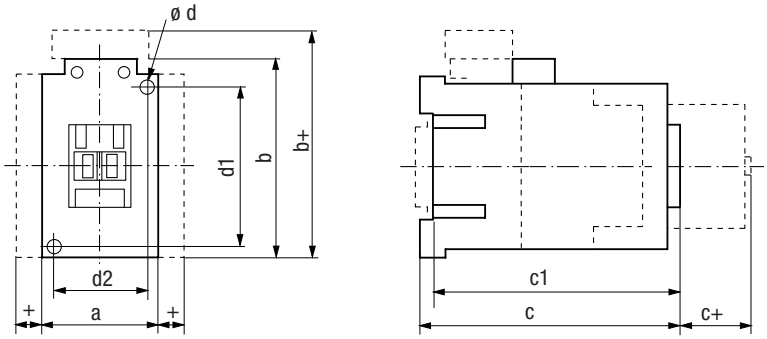
Sprecher+Schuh has expanded its line of CS7 industrial Control Relays with a new low consumption electronic coil. The 24V DC coil with low power consumption is integrated in a small relay body and draws less than 1.5 W/60mA holding power. The new design results in a shorter and more energy efficient relay, eases wiring and promotes a uniform panel appearance.

Direct Control from PLC

The low power consumption relay designed to control motors and other loads is especially aligned to the specific requirement of electronic control circuits. The low power consumption allows direct control through PLC's without the need for interposing relays. This means smaller power supplies which reduce panel space and cost.

CS7E Relay with 24V DC Electronic Coil

Contact Arrangement and Numbering	Contacts ❶ NO	Contacts ❶ NC	Standard Relay Catalog Number	Also Available Bifurcated	Also Available Master
	2	2	CS7E-22E-24E	✔	✔
	3	1	CS7E-31E-24E	✔	✔
	4	0	CS7E-40E-24E	✔	✔
	0	4	CS7E-04E-24E	✔	✔



Three Types of Relays

- Standard relay for typical control applications
- Bifurcated relay for low voltage applications
- Master relay for high ampere control circuits

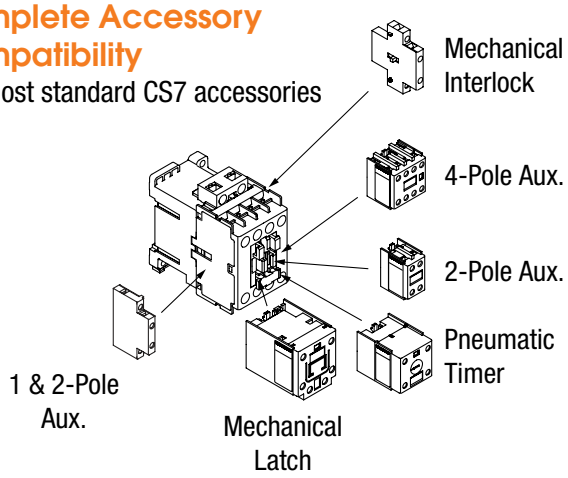
Extremely Low Inrush

Lower inrush means a smaller power supply may be used, resulting in:

- Easier wiring
- Uniform panel appearance
- Smaller panels mean less cost

Complete Accessory Compatibility

Fits most standard CS7 accessories



Dimension Comparison to True DC Relays

	a	b	c	c1	c2	ød	d1	d2
NEW! 24V DC Electronic Relay								
CS7E -...	45 (1-25/32)	81 (3-3/16)	80.5 (3-11/64	75.5 (3-3/32)	6 (1/4)	2 screws 4.5 (3/16)	60 (2-23/64)	35 (1-25/64)
True DC Relays								
CS7C-...	45 (1-25/32)	81 (3-3/16)	106.5 (4-3/16)	101.5 (4)	6 (1/4)	2 screws 4.5 (3/16)	60 (2-23/64)	35 (1-25/64)

26mm Shorter than True DC
CS7E vs. CS7C

Coil Consumption Data Comparison

		Electronic DC Coil CS7E	True DC Coil CS7C	Two Winding DC Coil CS7D
Pickup	[W]	10	6.5	120
Holdin	[W]	1.5	6.5	1.1

12x Less Inrush
CS7E vs. CS7D

4x Less Power to Maintain
CS7E vs. CS7C

Smaller space requirement + lower inrush = LESS COST!

Sprecher + Schuh US Division Headquarters
15910 International Plaza Dr., Houston, TX 77032
Tel: (281) 442-9000; Fax: (800) 739-7370
www.sprecherschuh.com

Sprecher + Schuh Canadian Division
3610 Nashua Dr., Unit 10, Mississauga, Ontario L4V 1L2
Tel: (905) 677-7514; Fax: (905) 677-7663

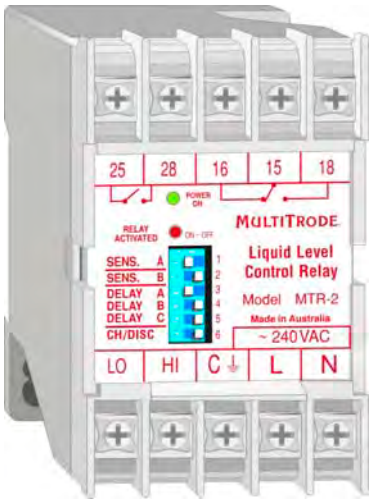
Publication No: F-CS7E_108 Jan-2008

1 Introduction

The MultiTrode level control relay is a solid-state electronic module in a hi-impact plastic case with a DIN rail attachment on the back, making a snap-on-snap-off installation. Any number of relays can be easily added to the DIN metal rail then wired together to form a complex pumping system that other wise may have to be controlled and operated by a programmed PLC.

The relay is normally matched with the MultiTrode probe which works in conjunction with the relay and uses the conductivity of the liquid to complete an electrical circuit.

2 Electrical Overview



There are 10 screw terminals on the unit. Facing the relay as shown, we look at the bottom terminals (left to right):

- Lo – (Charge mode). This is the point when the probe is dry the relay will turn on.
- Lo – (Discharge mode). This is the point when the probe in the tank is dry the relay will turn off.
- Hi – (Charge mode). This is the point when the probe in the tank is wet a relay will turn off
- Hi – (Discharge mode). This is the point when the probe in the tank is wet a relay will turn on.
- C - is common earth. All earth bonding must be terminated here for correct operation.
- " L " is "live" (240V AC)
- " N " is "neutral" (240V AC)

If the tank is plastic, or if you are conducting tests in a plastic bucket, or the vessel has no earth point inside, you must install an earth rod within the tank, vessel or bucket and make sure that it is bonded back to C on the relay unit.

3 DIP Switches

3.1 DIP Switches

(See Wiring Diagram for full program functions.)

3.1.1 DIP 1 & 2

DIP 1 and 2 control the Sensitivity, in other words the cleaner the liquid the higher the sensitivity setting must be. Concentrated acids, minerals are by their own chemical composition highly conductive, so a low level of sensitivity is required, purified water is almost an insulator against electrical current flow so a higher sensitivity inside the relay is required.

3.1.2 DIP 3, 4 & 5

DIP switches 3, 4 and 5, control delay on activation. For example, in discharge mode with DIP switches 3, 4 and 5 set to 10 seconds, when the Hi point becomes wet it will activate the motor and it will take 10 seconds of continual coverage of the probe sensor to make the relay close and start the pump. This is invaluable when the probe is in a turbulent part of a well where fluid is splashing around touching the sensors momentarily, and false activation cannot be tolerated.

3.1.3 DIP 6

DIP switch 6 controls the charge/discharge function. Set "ON" for charge, and "OFF" for discharge

3.2 Relay Contacts & their Applications

3.2.1 Contacts 15, 16 & 18

Contacts 15, 16, and 18 are used for electronic or visual notification of a change in state at the pump itself. Contacts 15, 16, and 18 are used for more advanced applications because they are a changeover relay, their state may be the same as contacts 25, 28 or the opposite. Both sets of contactors are triggered simultaneously. An example is when in discharge mode, (see Figure 1).

You have a gravity flow coming in so the fluid reaches the lower sensor PB1, contacts 15 and 18 are open (15 being common to both contact 16 and 18) contacts 25 and 28 are also normally open but contacts 15 16 in this current situation are closed, whether PB1 is wet or dry is of no concern all will stay the same. The level now rises to PB2 and both relays change state, contacts 25 and 28 close to turn on the pump, contacts 15 and 16 are open, with 15 and 18 closed.

In advanced applications this state change may be fed into a logic device to indicate the pump is running or the pump has stopped and perhaps light an LED or incandescent light source for visual confirmation that a change has occurred in the relay.

3.2.2 Contacts 25 & 28

Contacts 25 and 28 are used to control pump states. Contacts 25 and 28 are mostly used for turning on motors via a starting relay or solenoid, so, these sets of contacts react to the rising or falling levels of the fluid inside the tank, they will operate to turn on a pump in discharge mode when the top sensor is wet and in charge mode turn on the pump when the bottom sensor is dry.

4 Practical Overview

4.1 Discharge Mode – DIP switch 6 set to “OFF”

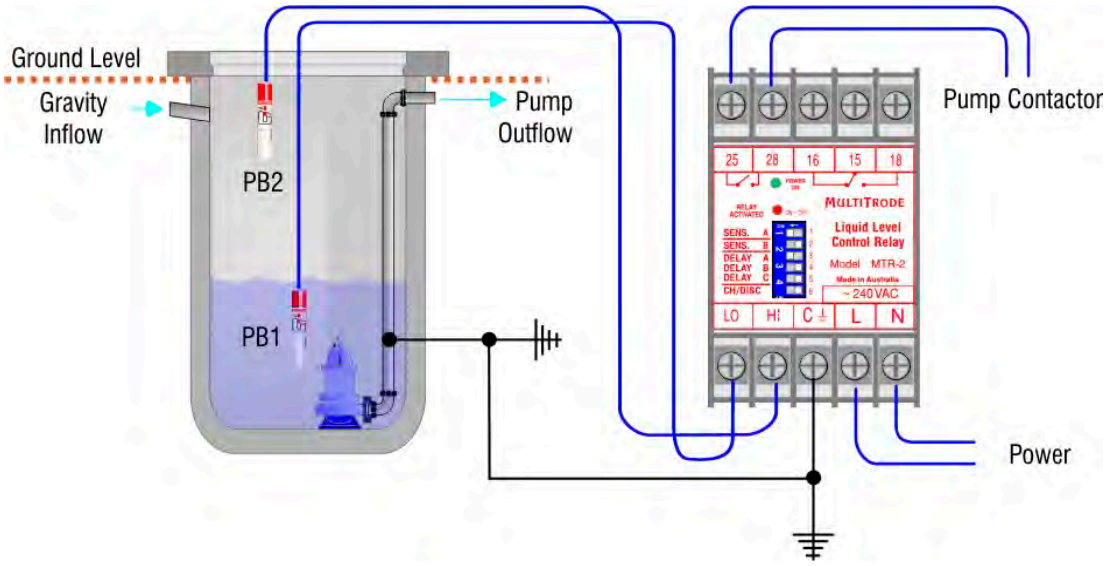
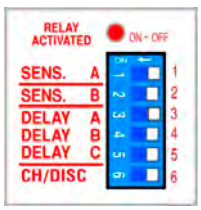


Figure 1 – Discharge Mode

Figure 1 shows two probes, (PB1 connected to Lo and PB2 connected to Hi). The pit is mostly underground and there is a gravity-fed inlet at the top left-hand side. The pit is empty with PB1 completely dry. Dipswitch 6 is set to “OFF.”



The relay operation depends on the electrical conductivity of liquid in the pit, i.e. no liquid = no current flow. The level starts to rise and covers PB1.

This is a discharge operation so we do not want the relay to close and start a pump until the well is full so as the water rises it reaches PB2, the relay closes and the pump starts. The level now drops below PB2 but the pump still continues to run, the level continues to drop below PB1 the relay opens the pump stops.

4.2 Charge Mode – DIP switch 6 set to "On"

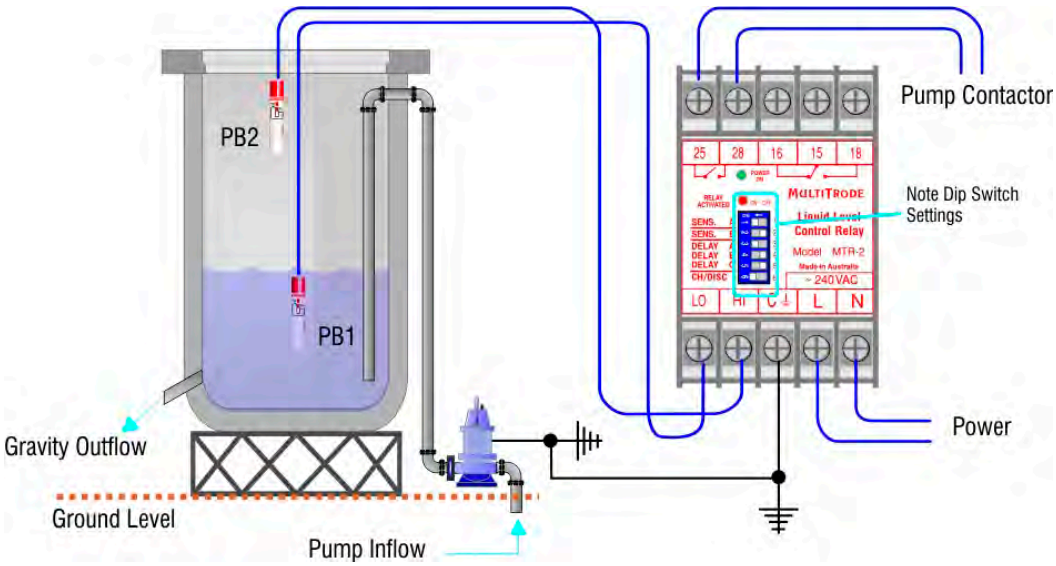


Figure 2 – Charge Mode

Note: "C" is connected to common bonded earth. The unit will not operate correctly if not earthed.

Let's look at the same relay but in a tank that is charging (DIP 6 is now on). See Figure 3, where liquid is being pumped into a tank, and discharging through a gravity feed, the tank is on steel stands "x" metres above the ground.

With the tank full, PB1 and PB2 will be wet, the relay is off, and the pump has stopped. Water is slowly fed out from the bottom, and now as PB2 (HI) becomes dry nothing happens; the water now drops to below PB1 (Lo), and the pumps restarts to fill the tank.

The pump will continue to fill the tank until PB2 (HI), becomes wet again.

4.3 MTRA Relay with Alarm (Discharge Applications Only)

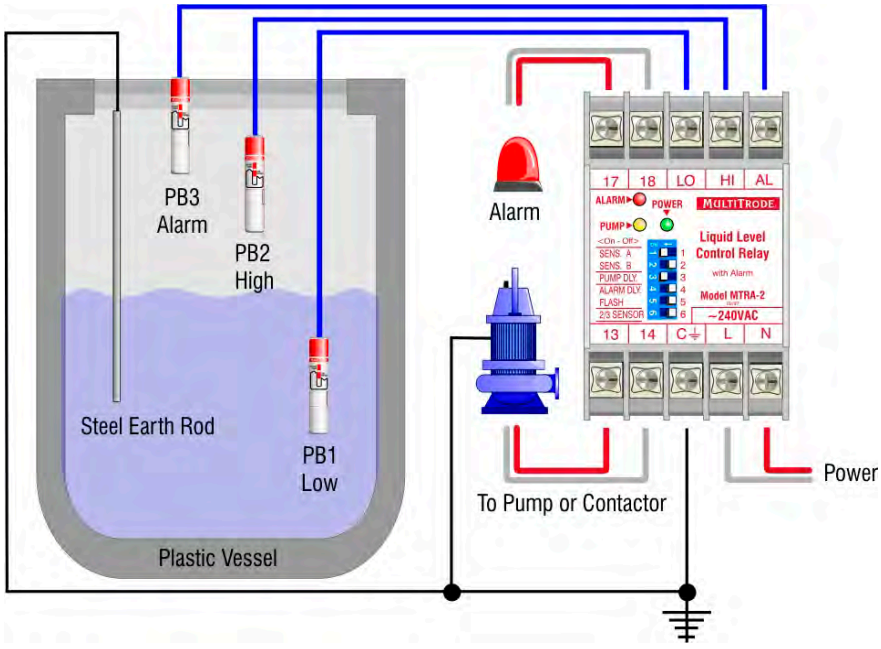


Figure 3 - MTRA Operation

The MTRA relay works in the same way as the MTR relay except the MTRA has a separate alarm output, and does not have a charge mode. The planned application is to close a contact to illuminate a warning alarm light. . Various other applications have included introducing a third probe to latch another relay.

In Figure 2 we see three probes in a pit that is plastic, note the steel rod in the tank. (In a plastic vessel a steel rod must be used to create an earth return in the liquid so probes can function.) PB1, PB2, and PB3 are dry, and the relay power LED is on. When water enters the pit and wets PB1, nothing happens, water now reaches PB2 causing contacts 13 and 14 to close, the pump LED to light, and the water to drop.

If, for example, the pump has its inlet partially blocked, the level continues to rise and wets PB3. This closes a separate relay that can activate a red flashing light, an audible fog horn or send a 5 volt pulse into another device with the common cause to warn human beings that a spill is due to occur. If the pumps become unclogged and PB3 becomes dry the alarm opens again and breaks the circuit that stops the light from flashing or the foghorn from sounding.

5 Most Common Installation Problems

The relay requires a path between the probes to earth through the liquid. If you are testing in a plastic bucket, have installed the probe in a plastic tank or have no good earthing in the vessel you will need to install a separate earth and make sure all earth bonding comes back to the C terminal. Most problems like these are traced back to a lack of or poor earthing, or open circuits in the probe wiring.

Now is the time to check the relay by using “the bridge testing line technique” remember you must simulate a fluid flow to correctly ascertain a good relay or a bad one. (All DIPswitch settings from 1 to 6 should be off.)

Cut two pieces of insulated flexible copper wire one black one red 250 mm long, strip both ends back 10 mm on both cables, and join one black end and one red end. Insert the joined ends into C on the relay box, observing all safe electrical practises. You should have one black wire and one red wire free.

Set your relay for discharge mode (DIP switch 6 is off) with no sensors connected to the unit, connect the red wire to Lo – nothing should happen (if it does return the relay for replacement or repair*). Now connect the black wire to the Hi terminal the relay activated LED should light instantly (if it does not, the relay should be returned for repair*).

6 Troubleshooting

I have checked all the DIPswitches and settings but in discharge mode as soon as the bottom sensor gets wet the pump turns on then turns off almost straight away.	• This is the most common problem encountered with relay set up and commissioning, the probe in the bottom of the tank is wired into the Hi terminal instead of the Lo terminal.
The installation went fine but now and again the pump will not turn on even though I am sure the probe is wet.	• Check the sensitivity level set on the relay, some times the level is set for foul water but due to changes in the flow the water becomes grey or clear, try changing the setting from 20KΩ to 80KΩ and monitor the results carefully.
All wiring is complete and all DIPswitches have been checked but the pump will not turn on at all.	• If you have completed the test schedule for the relay and it passed then check the wiring to the sensors – for this is now where the problem lies or in the earthing arrangements. If possible check the resistance between the sensor cable and the steel sensor on the probe to prove a solid connection.

*** Please contact your distributor or agent before returning any product for repair or warranty claim.**

MULTITRODE
Leaders in Pump Station Management Technology

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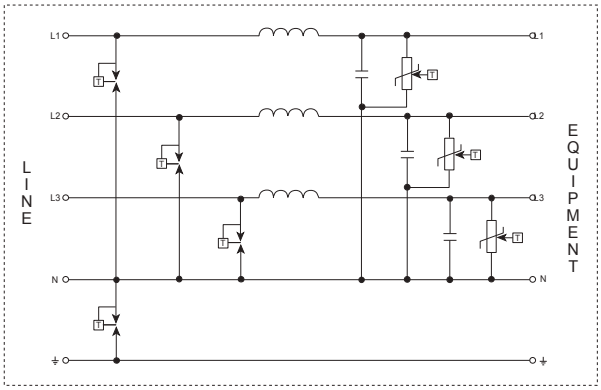
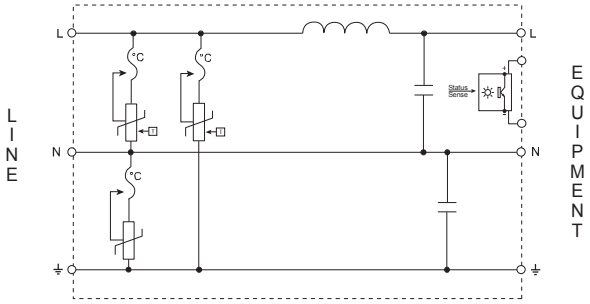
Schematic Diagrams

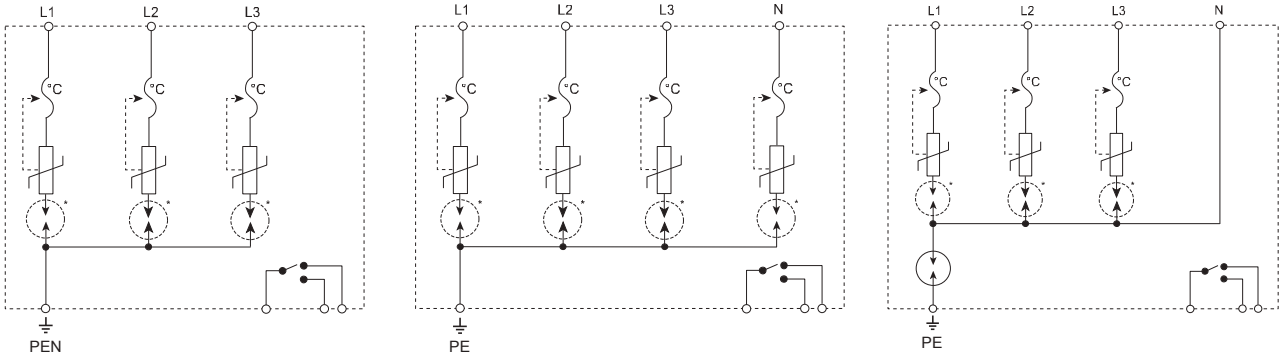
TSG-SRF



TDF



DSD340/380 *L

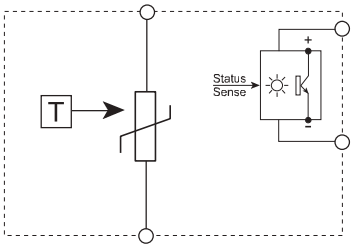


TNC Configuration
*Only present in "L" low leakage models

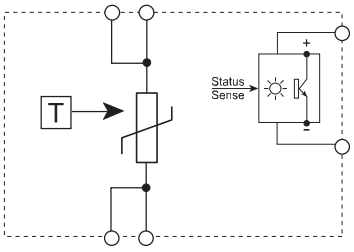
TNS Configuration
*Only present in "L" low leakage models

TT Configuration
*Only present in "L" low leakage models

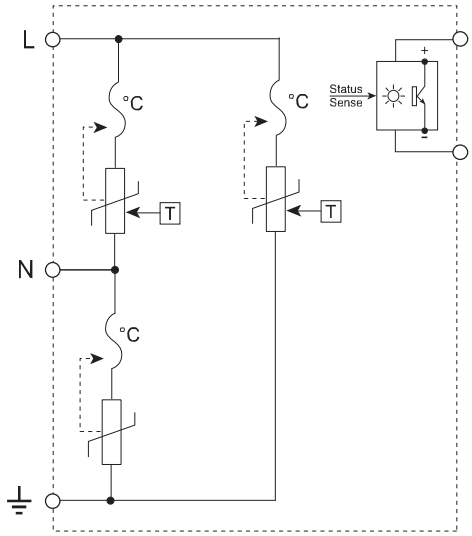
TDS 140



TDS 180



TDS 50



Crompton INSTRUMENTS

Protector Trip Relays

Phase Balance Relay

Application

The Crompton Protector Phase Balance module provides continuous surveillance of a 3 phase, 3 or 4 wire system and protects against:-

- ✔ Phase Loss
- ✔ Phase Reversal
- ✔ Sequence
- ✔ Phase Unbalance
- ✔ System Under Voltage

The protector de-energizes a relay should any one of the above faults occur. It is fitted with an adjustable time delay to eliminate premature operation on short duration supply fluctuations.

A red LED indicates that the supply is within limits and that the output relay is energized. N.B. the relay will not energize if the supply is connected in the wrong sequence.

The phase unbalance feature protects motors of any size, from full load to no-load for

- ✔ Excessive temperature rise due to unbalanced supplies (e.g. a 10% unbalanced supply can increase the temperature rise by 150%)
- ✔ The regenerated voltage generated during a single phase failure when running at low load.

Principle of operation

The Protector comprises monitoring circuits for voltage phase reversal and phase unbalance. Outputs from these circuits are fed to a comparator which changes state under fault conditions.

When the comparator switches, the output relay will de-energize after a preset time delay and the red LED will also de-energize in series.

The relay and LED will automatically energize again when all the supply parameters have returned to safe and acceptable limits

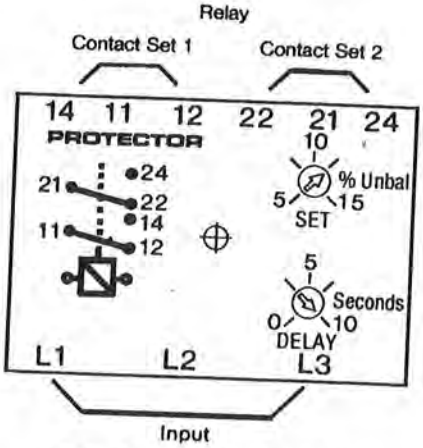
	Product Code
Phase loss and unbalanced	252-PSF
Phase loss, unbalanced and undervoltage	252-PSG

Specification

This model is U.R. and C.U.R approved.

System :	3 phase, 3 or 4 wire
Frequency:	50 or 60Hz
Nominal Voltage :	100, 110, 120, 220, 230, 240, 380, 400, 415 & 440V
Burden:	3VA
Voltage Withstand:	1.2 x continuously 1.5 x for 10 x 10 seconds
Set Points	
Unbalance:	Adjustable 5% to 15%
Time Delay:	Up to 10 seconds adjustable (not operative if voltage falls below 70% of the nominal voltage or set point on type 252-PSG)
Under Voltage: (Type 252-PSG only)	Internally preset at 15% of nominal voltage (other values between 10% and 30% available on request)
Weight:	Approximately - 0.3 kg
Output Relay	
Type:	DP changeover
Rating a.c.:	240V, 5A non-inductive
d.c.:	24V, 5A resistive
Operations:	0.2 million at the above load
Reset:	Automatic

Connection Diagram



252-PSF & 252-PSG

C 9

4.4 INSTRUMENTS

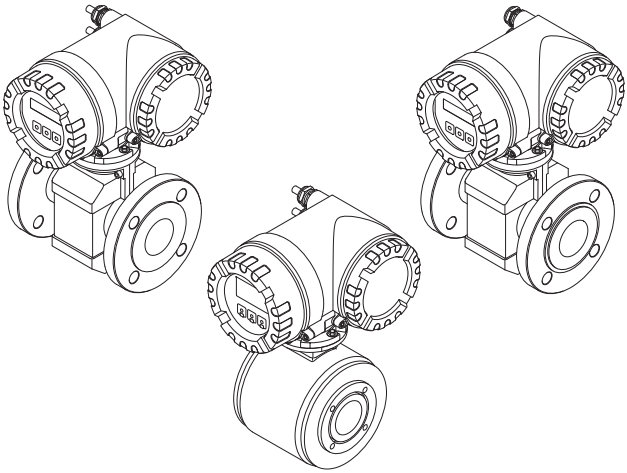
Endres & Hauser – **Promatic 50** - Flowmeter

Level | Pressure | Flow | Temperature | Liquid Analysis | Registration | Systems Components | Services | Solutions

Brief Operating Instructions

Proline Promag 50

Electromagnetic Flow Measuring System



These Brief Operating Instructions are not intended to replace the Operating Instructions provided in the scope of supply.
Detailed information is provided in the Operating Instructions and the additional documentation on the CD-ROM supplied.

The complete device documentation consists of:
- These Brief Operating Instructions
- Depending on the device version:
  - Operating Instructions and the Description of Device Functions
  - Approvals and safety certificates
  - Special safety instructions in accordance with the approvals for the device (e.g. explosion protection, pressure equipment directive etc.)
  - Additional device-specific information

KA00026D/06/EN/14.11
71154524

Endress+Hauser
People for Process Automation

Table of contents

1 Safety instructions

1.1 Designated use

- The measuring device is to be used only for measuring the flow of conductive liquids in closed pipes. A minimum conductivity of 20 µS/cm is required for measuring demineralized water. Most liquids can be measured as of a minimum conductivity of 5 µS/cm.
- Any use other than that described here compromises the safety of persons and the entire measuring system and is, therefore, not permitted.
- The manufacturer is not liable for damage caused by improper or non-designated use.

1.2 Installation, commissioning and operation

- The measuring device must only be installed, connected, commissioned and maintained by qualified and authorized specialists (e.g. electrical technicians) in full compliance with the instructions in these Brief Operating Instructions, the applicable norms, legal regulations and certificates (depending on the application).
- The specialists must have read and understood these Brief Operating Instructions and must follow the instructions they contain. If you are unclear on anything in these Brief Operating Instructions, you must read the Operating Instructions (on the CD-ROM). The Operating Instructions provide detailed information on the measuring device.
- The measuring device should only installed in a de-energized state free from outside loads or strain.
- The measuring device may only be modified if such work is expressly permitted in the Operating Instructions (on the CD-ROM).
- Repairs may only be performed if a genuine spare parts kit is available and this repair work is expressly permitted.
- If performing welding work on the piping, the welding unit may not be grounded by means of the measuring device.

1.3 Operational safety

- The measuring device is designed to meet state-of-the-art safety requirements, has been tested, and left the factory in a condition in which it is safe to operate. Relevant regulations and European standards have been observed.
- The manufacturer reserves the right to modify technical data without prior notice. Your Endress+Hauser distributor will supply you with current information and updates to these Operating Instructions.
- The information on the warning notices, nameplates and connection diagrams affixed to the device must be observed. These contain important data on the permitted operating conditions, the range of application of the device and information on the materials used.
- If the device is not used at atmospheric temperatures, compliance with the relevant marginal conditions as specified in the device documentation supplied (on CD-ROM) is mandatory.
- The device must be wired as specified in the wiring and connection diagrams. Interconnection must be permitted.

- All parts of the device must be included in the potential equalization of the system.
- Cables, certified cable glands and certified dummy plugs must be suitable to withstand the prevailing operating conditions, such as the temperature range of the process. Housing apertures that are not used must be sealed with dummy plugs.
- The device should only be used for fluids to which all the wetted parts of the device are sufficiently resistant. With regard to special fluids, including fluids used for cleaning, Endress+Hauser will be happy to assist in clarifying the corrosion-resistant properties of wetted materials.
  However, minor changes in temperature, concentration or in the degree of contamination in the process may result in variations in corrosion resistance.
  For this reason, Endress+Hauser does not accept any responsibility with regard to the corrosion resistance of wetted materials in a specific application. The user is responsible for the choice of suitable wetted materials in the process.
- When hot fluid passes through the measuring tube, the surface temperature of the housing increases. In the case of the sensor, in particular, users should expect temperatures that can be close to the fluid temperature. If the temperature of the fluid is high, implement sufficient measures to prevent burning or scalding.
- Hazardous areas
  Measuring devices for use in hazardous areas are labeled accordingly on the nameplate. Relevant national regulations must be observed when operating the device in hazardous areas. The Ex documentation on the CD-ROM is an integral part of the entire device documentation. The installation regulations, connection data and safety instructions provided in the Ex documentation must be observed. The symbol and name on the front page provides information on the approval and certification (e.g. Ex Europe, FM USA, CSA Canada). The nameplate also bears the documentation number of this Ex documentation (XA***D/../..).
- For measuring systems used in SIL 2 applications, the separate manual on functional safety (on the CD-ROM) must be observed.
- Hygienic applications
  Measuring devices for hygienic applications have their own special labeling. Relevant national regulations must be observed when using these devices.
- Pressure instruments
  Measuring devices for use in systems that need to be monitored are labeled accordingly on the nameplate. Relevant national regulations must be observed when using these devices. The documentation on the CD-ROM for pressure instruments in systems that need to be monitored is an integral part of the entire device documentation. The installation regulations, connection data and safety instructions provided in the Ex documentation must be observed.
- Endress+Hauser will be happy to assist in clarifying any questions on approvals, their application and implementation.

1.4 Safety conventions

⚠ Warning!
"Warning" indicates an action or procedure which, if not performed correctly, can result in injury or a safety hazard. Comply strictly with the instructions and proceed with care.

☝ Caution!
"Caution" indicates an action or procedure which, if not performed correctly, can result in incorrect operation or destruction of the device. Comply strictly with the instructions.

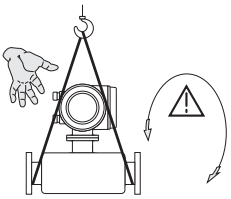
✎ Note!
"Note" indicates an action or procedure which, if not performed correctly, can have an indirect effect on operation or trigger an unexpected response on the part of the device.

2 Installation

2.1 Transporting to the measuring point

- Transport the measuring device to the measuring point in the original packaging.
- Do not remove the covers or caps until immediately before installation.

2.1.1 Transporting flanged devices DN ≤ 300 (≤ 12")



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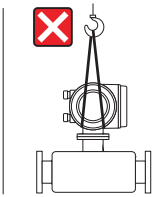
To transport the unit, use slings slung around the process connections or use lugs (if available).

⚠ Warning!
Risk of injury! The device can slip.
The center of gravity of the measuring device may be higher than the holding points of the slings.
Always ensure that the device cannot slip or turn around its axis.



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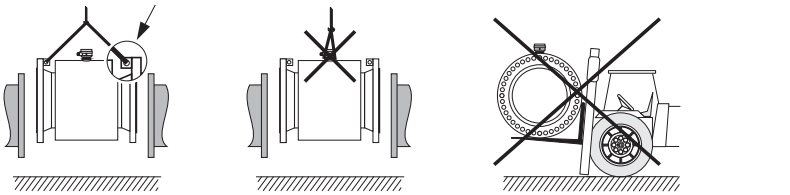
Do not lift measuring devices by the transmitter housing or the connection housing in the case of the remote version. Do not use chains as they could damage the housing.

2.1.2 Transporting flanged devices DN > 300 (> 12")

Use only the metal eyes provided on the flanges to transport, lift or position the sensor in the piping.

☝ Caution!
Do not attempt to lift the sensor with the tines of a fork-lift truck beneath the metal casing! This would buckle the casing and damage the internal magnetic coils.



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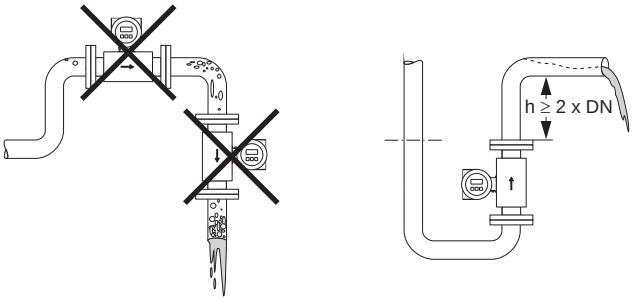
2.2 Installation conditions

2.2.1 Dimensions

For the dimensions of the measuring device, see the associated Technical Information on the CD-ROM.

2.2.2 Mounting location

The accumulation of air or formation of gas bubbles in the measuring tube can result in an increase in measuring errors.
For this reason avoid the following mounting locations in the pipe:
- At the highest point of a pipeline. Risk of air accumulating!
- Directly upstream from a free pipe outlet in a down pipe.



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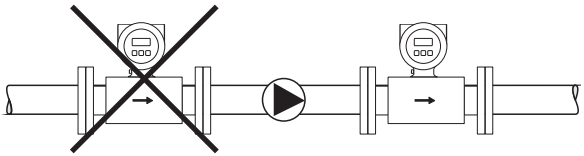
Installation of pumps

Do not install the sensor on the intake side of a pump. This precaution is to avoid low pressure and the consequent risk of damage to the lining of the measuring tube. It might be necessary to use pulse dampers in systems incorporating piston pumps, piston diaphragm pumps or peristaltic pumps.

Information on the measuring system's pressure tightness and resistance to vibration and shock can be found in the Operating Instructions of the CD-ROM.



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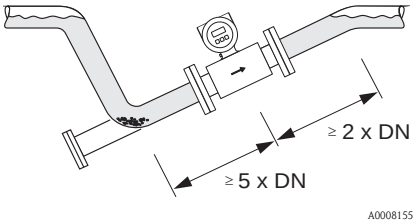
Partially filled pipes

Partially filled pipes with gradients necessitate a drain-type configuration.
The empty pipe detection (EPD) function offers additional protection by detecting empty or partially filled pipes.

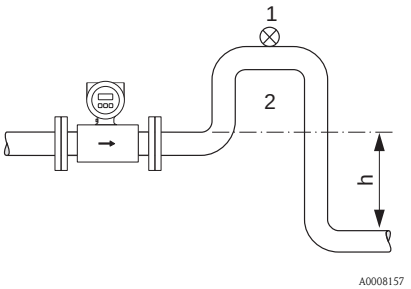
Caution!
Risk of solids accumulating! Do not install the sensor at the lowest point in the drain. It is advisable to install a cleaning valve.



Installation in a partially filled pipe

Down pipes

Install a siphon or a vent valve downstream of the sensor in down pipes longer than 5 meters (16 ft). This precaution is to avoid low pressure and the consequent risk of damage to the lining of the measuring tube. This measure also prevents the system losing prime, which could cause air pockets.
For information on the pressure tightness of the measuring tube lining, see the Operating Instructions on the CD-ROM.



Measures for installation in a down pipe (h > 5 m/16 ft)

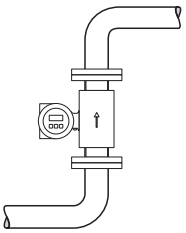
1. Vent valve
2. Siphon

2.2.3 Orientation

An optimum orientation helps avoid gas and air accumulations and buildup in the measuring tube. The measuring device, nevertheless, supplies a range of functions and tools to measure problematic fluids correctly:

- Electrode cleaning circuitry (ECC) to prevent electrically conductive deposits in the measuring tube, e.g. for fluids causing buildup
- Empty pipe detection (EPD) for detecting partially filled measuring tubes, e.g. in the case of degassing fluids or varying process pressures
- Exchangeable measuring electrodes for abrasive fluids (only Promag W)

Vertical orientation



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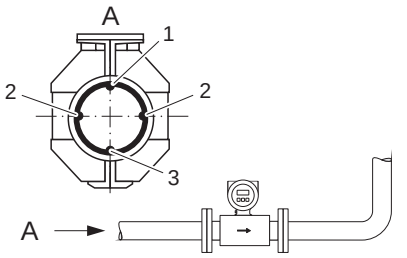
This orientation is optimum for self-emptying piping systems and when using empty pipe detection (EPD) or open electrode detection (OED).

Horizontal orientation

The measuring electrode plane should be horizontal. This prevents brief insulation of the two electrodes by entrained air bubbles.

Caution!
In the case of horizontal orientation, empty pipe detection only works correctly if the transmitter housing is facing upwards. Otherwise there is no guarantee that empty pipe detection will respond if the measuring tube is only partially filled or empty.



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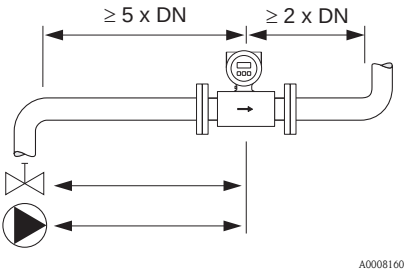
1. EPD electrode for empty pipe detection (not for Promag H, DN 2 to 15, 1/12" to ½").
2. Measuring electrodes for signal detection
3. Reference electrode for potential equalization (not for Promag H)

Inlet and outlet runs

If possible, install the sensor upstream from fittings such as valves, T-pieces, elbows, etc.



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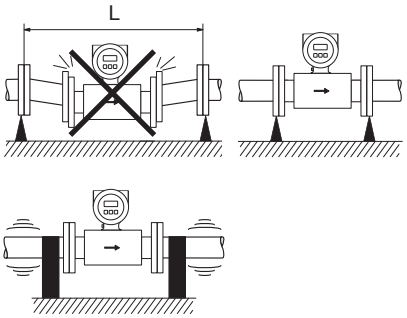
The following inlet and outlet runs must be observed in order to meet accuracy specifications:
- Inlet run: ≥ 5 × DN
- Outlet run: ≥ 2 × DN

2.2.4 Vibrations

Secure and fix both the piping and the sensor if vibrations are severe.



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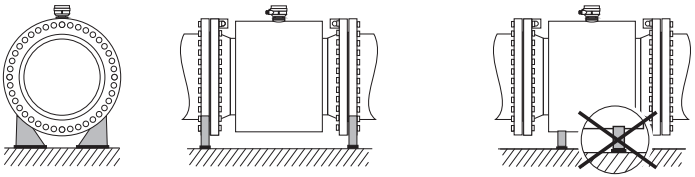
Measures to prevent device vibration
(L > 10 m/33 ft)

Caution!
It is advisable to install the sensor and transmitter separately if vibration is excessively severe. For information on the permitted shock and vibration resistance, see the Operating Instructions on the CD-ROM.

2.2.5 Foundations, supports

If the nominal diameter is DN ≥ 350 (≥ 14"), mount the sensor on a foundation of adequate load-bearing strength.

Caution!
Risk of damage! Do not support the weight of the sensor on the metal casing.
This would buckle the casing and damage the internal magnetic coils.



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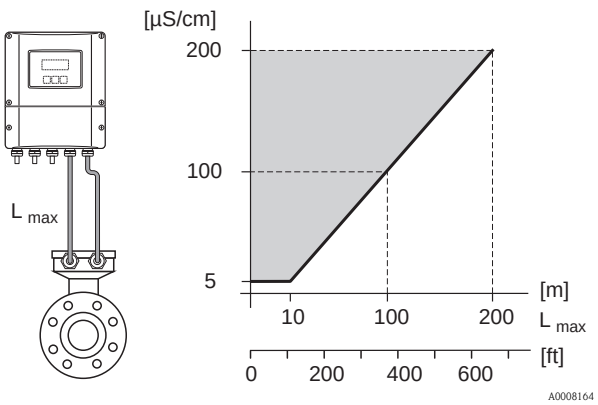
2.2.6 Length of connecting cable

Comply with the following instructions in order to ensure correct measuring results:
- Secure the cable run or route the cable in an armored conduit. Movement of the cable can falsify the measuring signal, particularly if the fluid conductivity is low.
- Route the cable well clear of electrical machines and switching elements.
- Ensure potential equalization between the sensor and transmitter, if necessary.
- The permissible cable length L_{max} depends on the fluid conductivity.



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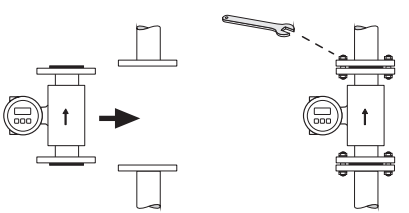
Gray shaded area = permissible range

L_{max} = length of connecting cable in [m]/[ft]

Fluid conductivity in (µS/cm]

2.3 Installing the Promag L sensor

Caution!
- The protective covers mounted on the two sensor flanges (DN 50…300) are used to hold the lap joint flanges in place and to protect the PTFE liner during transportation. Consequently, do not remove these covers until immediately before the sensor is installed in the pipe.
- The protective plates must always remain mounted while the device is in storage.
- Make sure that the lining at the flange is not damaged or removed.



Note!
Screws, nuts, seals, etc. are not included in the scope of supply and must be supplied by the customer.

The sensor is installed between the two pipe flanges:
- The requisite torques must be observed → 13
- If grounding disks are used, follow the mounting instructions which will be enclosed with the shipment.
- To comply with the device specification, a concentrical installation in the measuring section is required

2.3.1 Seals

Comply with the following instructions when installing seals:
- Hard rubber lining → additional seals are **always** required!
- Polyurethane lining → **no** seals are required.
- **No** seals are required for PFTE measuring tube lining.
- For DIN flanges, only use seals to DIN EN 1514-1.
- Make sure that the mounted seals do not protrude into the piping cross-section.

Caution!
Risk of short circuit!
Do not use electrically conductive sealing compounds such as graphite! An electrically conductive layer could form on the inside of the measuring tube and short-circuit the measuring signal.

2.3.2 Ground cable

If necessary, special ground cables can be ordered as accessories for potential equalization.

2.3.3 Screw tightening torques (Promag L)

Please note the following:
- The tightening torques listed below are for lubricated threads only.
- Always tighten the screws uniformly and in diagonally opposite sequence.
- Overtightening the screws will deform the sealing faces or damage the seals.
- The tightening torques listed below apply only to pipes not subjected to tensile stress.

Promag L tightening torques for EN (DIN)

Nominal diameter [mm]	EN (DIN) Pressure rating [bar]	Threaded fasteners	Max. tightening torque Hard rubber [Nm]	Polyurethane [Nm]	PTFE [Nm]
50	PN 10/16	4 × M 16	–	15	40
65*	PN 10/16	8 × M 16	–	10	22
80	PN 10/16	8 × M 16	–	15	30
100	PN 10/16	8 × M 16	–	20	42
125	PN 10/16	8 × M 16	–	30	55
150	PN 10/16	8 × M 20	–	50	90
200	PN 10	8 × M 20	–	65	130
250	PN 10	12 × M 20	–	50	90
300	PN 10	12 × M 20	–	55	100
350	PN 6	12 × M 20	111	120	–
350	PN 10	16 × M 20	112	118	–
400	PN 6	16 × M 20	90	98	–
400	PN 10	16 × M 24	151	167	–
450	PN 6	16 × M 20	112	126	–
450	PN 10	20 × M 24	153	133	–
500	PN 6	20 × M 20	119	123	–
500	PN 10	20 × M 24	155	171	–
600	PN 6	20 × M 24	139	147	–
600	PN 10	20 × M 27	206	219	–
700	PN 6	24 × M 24	148	139	–
700	PN 10	24 × M 27	246	246	–
800	PN 6	24 × M 27	206	182	–
800	PN 10	24 × M 30	331	316	–
900	PN 6	24 × M 27	230	637	–
900	PN 10	28 × M 30	316	307	–
1000	PN 6	28 × M 27	218	208	–
1000	PN 10	28 × M 33	402	405	–
1200	PN 6	32 × M 30	319	299	–
1200	PN 10	32 × M 36	564	568	–
1400	PN 6	36 × M 33	430	–	–

Nominal diameter [mm]	EN (DIN) Pressure rating [bar]	Threaded fasteners	Max. tightening torque Hard rubber [Nm]	Polyurethane [Nm]	PTFE [Nm]
1400	PN 10	36 × M 39	654	618	-
1400	PN 16	36 × M 45	729	762	-
1600	PN 6	40 × M 33	440	417	-
1600	PN 10	40 × M 45	946	893	-
1600	PN 16	40 × M 52	1007	1100	-
1800	PN 6	44 × M 36	547	521	-
1800	PN 10	44 × M 45	961	895	-
1800	PN 16	44 × M 52	1108	1003	-
2000	PN 6	48 × M 39	629	605	-
2000	PN 10	48 × M 45	1047	1092	-
2000	PN 16	48 × M 56	1324	1261	-
2200	PN 6	52 × M 39	698	-	-
2200	PN 10	52 × M 52	1217	-	-
2400	PN 6	56 × M 39	768	-	-
2400	PN 10	56 × M 52	1229	-	-
* Designed acc. to EN 1092-1 (not to DIN 2501)					

Promag L tightening torques for ANSI

Nominal diameter [mm]	[inch]	ANSI Pressure rating [lbs]	Threaded fasteners	Max. tightening torque Hard rubber [Nm]	[lbf · ft]	Polyurethane [Nm]	[lbf · ft]	PTFE [Nm]	[lbf · ft]
50	2"	Class 150	4 × 5/8"	-	-	15	11	40	29
80	3"	Class 150	4 × 5/8"	-	-	25	18	65	48
100	4"	Cla ss 150	8 × 5/8"	-	-	20	15	44	32
150	6"	Class 150	8 × ¾"	-	-	45	33	90	66
200	8"	Class 150	8 × ¾"	-	-	65	48	125	92
250	10"	Class 150	12 × 7/8"	-	-	55	41	100	74
300	12"	Class 150	12 × 7/8"	-	-	68	56	115	85
350	14"	Class 150	12 × 1"	135	100	158	117	-	-
400	16"	Class 150	16 × 1"	128	94	150	111	-	-
450	18"	Class 150	16 × 1 1/8"	204	150	234	173	-	-
500	20"	Class 150	20 × 1 1/8"	183	135	217	160	-	-
600	24"	Class 150	20 × 1 ¼"	268	198	307	226	-	-

Promag L tightening torques for AWWA

Nominal diameter		AWWA	Threaded fasteners	Max. tightening torque					
		Pressure rating		Hartgummi		Polyurethane		PTFE	
[mm]	[inch]			[Nm]	[lbf · ft]	[Nm]	[lbf · ft]	[Nm]	[lbf · ft]
700	28"	Class D	28 × 1 ¼"	247	182	292	215	–	–
750	30"	Class D	28 × 1 ¼"	287	212	302	223	–	–
800	32"	Class D	28 × 1 ½"	394	291	422	311	–	–
900	36"	Class D	32 × 1 ½"	419	309	430	317	–	–
1000	40"	Class D	36 × 1 ½"	420	310	477	352	–	–
1050	42"	Class D	36 × 1 ½"	528	389	518	382	–	–
1200	48"	Class D	44 × 1 ½"	552	407	531	392	–	–
1350	54"	Class D	44 × 1 ¾"	730	538	–	–	–	–
1500	60"	Class D	52 × 1 ¾"	758	559	–	–	–	–
1650	66"	Class D	52 × 1 ¾"	946	698	–	–	–	–
1800	72"	Class D	60 × 1 ¾"	975	719	–	–	–	–
2000	78"	Class D	64 × 2"	853	629	–	–	–	–
2150	84"	Class D	64 × 2"	931	687	–	–	–	–
2300	90"	Class D	68 × 2 ¼"	1048	773	–	–	–	–

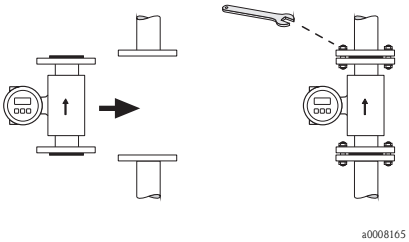
Promag L tightening torques for AS 2129

Nominal diameter	AS 2129	Threaded fasteners	Max. tightening torque		
	Pressure rating		Hard rubber	Polyurethane	PTFE
[mm]			[Nm]	[Nm]	[Nm]
350	Table E	12 × M 24	203	–	–
400	Table E	12 × M 24	226	–	–
450	Table E	16 × M 24	226	–	–
500	Table E	16 × M 24	271	–	–
600	Table E	16 × M 30	439	–	–
700	Table E	20 × M 30	355	–	–
750	Table E	20 × M 30	559	–	–
800	Table E	20 × M 30	631	–	–
900	Table E	24 × M 30	627	–	–
1000	Table E	24 × M 30	634	–	–
1200	Table E	32 × M 30	727	–	–

Promag L tightening torques for AS 4087

Nominal diameter [mm]	AS 4087 Pressure rating	Threaded fasteners	Max. tightening torque		
			Hard rubber [Nm]	Polyurethane [Nm]	PTFE [Nm]
350	PN 16	12 × M 24	203	-	-
375	PN 16	12 × M 24	137	-	-
400	PN 16	12 × M 24	226	-	-
450	PN 16	12 × M 24	301	-	-
500	PN 16	16 × M 24	271	-	-
600	PN 16	16 × M 27	393	-	-
700	PN 16	20 × M 27	330	-	-
750	PN 16	20 × M 30	529	-	-
800	PN 16	20 × M 33	631	-	-
900	PN 16	24 × M 33	627	-	-
1000	PN 16	24 × M 33	595	-	-
1200	PN 16	32 × M 33	703	-	-

2.4 Installing the W sensor



Note!
Screws, nuts, seals, etc. are not included in the scope of supply and must be supplied by the customer.

The sensor is installed between the two pipe flanges:
- The requisite torques must be observed → 18
- If grounding disks are used, follow the mounting instructions which will be enclosed with the shipment.
- To comply with the device specification, a concentrical installation in the measuring section is required

2.4.1 Seals

Comply with the following instructions when installing seals:
- Hard rubber lining → additional seals are **always** necessary.
- Polyurethane lining → **no** seals are required.
- For DIN flanges, use only seals according to EN 1514-1.
- Make sure that the seals do not protrude into the piping cross-section.

Caution!
Risk of short circuit!
Do not use electrically conductive sealing compounds such as graphite! An electrically conductive layer could form on the inside of the measuring tube and short-circuit the measuring signal.

2.4.2 Ground cable

If necessary, special ground cables can be ordered as accessories for potential equalization.

2.4.3 Screw tightening torques (Promag W)

Please note the following:
- The tightening torques listed below are for lubricated threads only.
- Always tighten the screws uniformly and in diagonally opposite sequence.
- Overtightening the screws will deform the sealing faces or damage the seals.
- The tightening torques listed below apply only to pipes not subjected to tensile stress.

Promag W tightening torques for EN (DIN)

Nominal diameter [mm]	EN (DIN) Pressure rating [bar]	Threaded fasteners	Max. tightening torque [Nm]	
			Hard rubber	Polyurethane
25	PN 40	4 × M 12	-	15
32	PN 40	4 × M 16	-	24
40	PN 40	4 × M 16	-	31
50	PN 40	4 × M 16	48	40
65*	PN 16	8 × M 16	32	27
65	PN 40	8 × M 16	32	27
80	PN 16	8 × M 16	40	34
80	PN 40	8 × M 16	40	34
100	PN 16	8 × M 16	43	36
100	PN 40	8 × M 20	59	50
125	PN 16	8 × M 16	56	48
125	PN 40	8 × M 24	83	71
150	PN 16	8 × M 20	74	63
150	PN 40	8 × M 24	104	88
200	PN 10	8 × M 20	106	91
200	PN 16	12 × M 20	70	61
200	PN 25	12 × M 24	104	92
250	PN 10	12 × M 20	82	71
250	PN 16	12 × M 24	98	85
250	PN 25	12 × M 27	150	134
300	PN 10	12 × M 20	94	81
300	PN 16	12 × M 24	134	118
300	PN 25	16 × M 27	153	138
350	PN 6	12 × M 20	111	120
350	PN 10	16 × M 20	112	118
350	PN 16	16 × M 24	152	165
350	PN 25	16 × M 30	227	252
400	PN 6	16 × M 20	90	98
400	PN 10	16 × M 24	151	167
400	PN 16	16 × M 27	193	215
400	PN 25	16 × M 33	289	326
450	PN 6	16 × M 20	112	126
450	PN 10	20 × M 24	153	133

Nominal diameter [mm]	EN (DIN) Pressure rating [bar]	Threaded fasteners	Max. tightening torque [Nm]	
			Hard rubber	Polyurethane
450	PN 16	20 × M 27	198	196
450	PN 25	20 × M 33	256	253
500	PN 6	20 × M 20	119	123
500	PN 10	20 × M 24	155	171
500	PN 16	20 × M 30	275	300
500	PN 25	20 × M 33	317	360
600	PN 6	20 × M 24	139	147
600	PN 10	20 × M 27	206	219
600 *	PN 16	20 × M 33	415	443
600	PN 25	20 × M 36	431	516
700	PN 6	24 × M 24	148	139
700	PN 10	24 × M 27	246	246
700	PN 16	24 × M 33	278	318
700	PN 25	24 × M 39	449	507
800	PN 6	24 × M 27	206	182
800	PN 10	24 × M 30	331	316
800	PN 16	24 × M 36	369	385
800	PN 25	24 × M 45	664	721
900	PN 6	24 × M 27	230	637
900	PN 10	28 × M 30	316	307
900	PN 16	28 × M 36	353	398
900	PN 25	28 × M 45	690	716
1000	PN 6	28 × M 27	218	208
1000	PN 10	28 × M 33	402	405
1000	PN 16	28 × M 39	502	518
1000	PN 25	28 × M 52	970	971
1200	PN 6	32 × M 30	319	299
1200	PN 10	32 × M 36	564	568
1200	PN 16	32 × M 45	701	753
1400	PN 6	36 × M 33	430	398
1400	PN 10	36 × M 39	654	618
1400	PN 16	36 × M 45	729	762
1600	PN 6	40 × M 33	440	417
1600	PN 10	40 × M 45	946	893
1600	PN 16	40 × M 52	1007	1100
1800	PN 6	44 × M 36	547	521
1800	PN 10	44 × M 45	961	895
1800	PN 16	44 × M 52	1108	1003
2000	PN 6	48 × M 39	629	605
2000	PN 10	48 × M 45	1047	1092
2000	PN 16	48 × M 56	1324	1261

* Designed acc. to EN 1092-1 (not to DIN 2501)

Promag W tightening torques for ANSI

Nominal diameter		ANSI	Threaded fasteners	Max. tightening torque			
		Pressure rating		Hard rubber		Polyurethane	
[mm]	[inch]	[lbs]		[Nm]	[lbf · ft]	[Nm]	[lbf · ft]
25	1"	Class 150	4 × ½"	-	-	7	5
25	1"	Class 300	4 × 5/8"	-	-	8	6
40	1 ½"	Class 150	4 × ½"	-	-	10	7
40	1 ½"	Class 300	4 × ¾"	-	-	15	11
50	2"	Class 150	4 × 5/8"	35	26	22	16
50	2"	Class 300	8 × 5/8"	18	13	11	8
80	3"	Class 150	4 × 5/8"	60	44	43	32
80	3"	Class 300	8 × ¾"	38	28	26	19
100	4"	Class 150	8 × 5/8"	42	31	31	23
100	4"	Class 300	8 × ¾"	58	43	40	30
150	6"	Class 150	8 × ¾"	79	58	59	44
150	6"	Class 300	12 × ¾"	70	52	51	38
200	8"	Class 150	8 × ¾"	107	79	80	59
250	10"	Class 150	12 × 7/8"	101	74	75	55
300	12"	Class 150	12 × 7/8"	133	98	103	76
350	14"	Class 150	12 × 1"	135	100	158	117
400	16"	Class 150	16 × 1"	128	94	150	111
450	18"	Class 150	16 × 1 1/8"	204	150	234	173
500	20"	Class 150	20 × 1 1/8"	183	135	217	160
600	24"	Class 150	20 × 1 ¼"	268	198	307	226

Promag W tightening torques for JIS

Nominal diameter	JIS	Threaded fasteners	Max. tightening torque [Nm]	
[mm]	Pressure rating		Hard rubber	Polyurethane
25	10K	4 × M 16	-	19
25	20K	4 × M 16	-	19
32	10K	4 × M 16	-	22
32	20K	4 × M 16	-	22
40	10K	4 × M 16	-	24
40	20K	4 × M 16	-	24
50	10K	4 × M 16	40	33
50	20K	8 × M 16	20	17
65	10K	4 × M 16	55	45
65	20K	8 × M 16	28	23
80	10K	8 × M 16	29	23
80	20K	8 × M 20	42	35
100	10K	8 × M 16	35	29

Nominal diameter [mm]	JIS Pressure rating	Threaded fasteners	Max. tightening torque [Nm]	
			Hard rubber	Polyurethane
100	20K	8 × M 20	56	48
125	10K	8 × M 20	60	51
125	20K	8 × M 22	91	79
150	10K	8 × M 20	75	63
150	20K	12 × M 22	81	72
200	10K	12 × M 20	61	52
200	20K	12 × M 22	91	80
250	10K	12 × M 22	100	87
250	20K	12 × M 24	159	144
300	10K	16 × M 22	74	63
300	20K	16 × M 24	138	124

Promag W tightening torques for AWWA

Nominal diameter		AWWA		Max. tightening torque			
				Hard rubber		Polyurethane	
[mm]	[inch]	Pressure rating	Threaded fasteners	[Nm]	[lbf · ft]	[Nm]	[lbf · ft]
700	28"	Class D	28 × 1 ¼"	247	182	292	215
750	30"	Class D	28 × 1 ¼"	287	212	302	223
800	32"	Class D	28 × 1 ½"	394	291	422	311
900	36"	Class D	32 × 1 ½"	419	309	430	317
1000	40"	Class D	36 × 1 ½"	420	310	477	352
1050	42"	Class D	36 × 1 ½"	528	389	518	382
1200	48"	Class D	44 × 1 ½"	552	407	531	392
1350	54"	Class D	44 × 1 ¾"	730	538	633	467
1500	60"	Class D	52 × 1 ¾"	758	559	832	614
1650	66"	Class D	52 × 1 ¾"	946	698	955	704
1800	72"	Class D	60 × 1 ¾"	975	719	1087	802
2000	78"	Class D	64 × 2"	853	629	786	580

Promag W tightening torques for AS 2129

Nominal diameter [mm]	AS 2129 Pressure rating	Threaded fasteners	Max. tightening torque [Nm] Hard rubber
50	Table E	4 × M 16	32
80	Table E	4 × M 16	49
100	Table E	8 × M 16	38
150	Table E	8 × M 20	64
200	Table E	8 × M 20	96
250	Table E	12 × M 20	98
300	Table E	12 × M 24	123

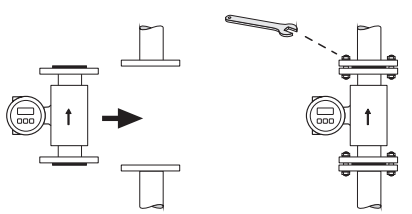
Nominal diameter [mm]	AS 2129 Pressure rating	Threaded fasteners	Max. tightening torque [Nm] Hard rubber
350	Table E	12 × M 24	203
400	Table E	12 × M 24	226
450	Table E	16 × M 24	226
500	Table E	16 × M 24	271
600	Table E	16 × M 30	439
700	Table E	20 × M 30	355
750	Table E	20 × M 30	559
800	Table E	20 × M 30	631
900	Table E	24 × M 30	627
1000	Table E	24 × M 30	634
1200	Table E	32 × M 30	727

Promag W tightening torques for AS 4087

Nominal diameter [mm]	AS 4087 Pressure rating	Threaded fasteners	Max. tightening torque [Nm] Hard rubber
50	Table E	4 × M 16	32
80	PN 16	4 × M 16	49
100	PN 16	4 × M 16	76
150	PN 16	8 × M 20	52
200	PN 16	8 × M 20	77
250	PN 16	8 × M 20	147
300	PN 16	12 × M 24	103
350	PN 16	12 × M 24	203
375	PN 16	12 × M 24	137
400	PN 16	12 × M 24	226
450	PN 16	12 × M 24	301
500	PN 16	16 × M 24	271
600	PN 16	16 × M 27	393
700	PN 16	20 × M 27	330
750	PN 16	20 × M 30	529
800	PN 16	20 × M 33	631
900	PN 16	24 × M 33	627
1000	PN 16	24 × M 33	595
1200	PN 16	32 × M 33	703

2.5 Installing the Promag P sensor

Caution!
- The plates mounted on the two sensor flanges protect the PTFE which is turned over the flanges and, consequently, should not be removed until **immediately prior** to mounting the sensor.
- The protective plates must always remain mounted while the device is in storage.
- Make sure that the lining at the flange is not damaged or removed.



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Note!
Screws, nuts, seals, etc. are not included in the scope of supply and must be supplied by the customer.

The sensor is installed between the two pipe flanges:
- The requisite torques must be observed → 25
- If grounding disks are used, follow the mounting instructions which will be enclosed with the shipment.

2.5.1 Seals

Comply with the following instructions when installing seals:
- **No** seals are required for PFA or PFTE measuring tube lining.
- For DIN flanges, only use seals to DIN EN 1514-1.
- Make sure that the mounted seals do not protrude into the piping cross-section.

Caution!
Risk of short circuit! Do not use electrically conductive sealing compounds such as graphite! An electrically conductive layer could form on the inside of the measuring tube and short-circuit the measuring signal.

2.5.2 Ground cable

If necessary, special ground cables can be ordered as accessories for potential equalization.

2.5.3 Installing the high-temperature version (with PFA lining)

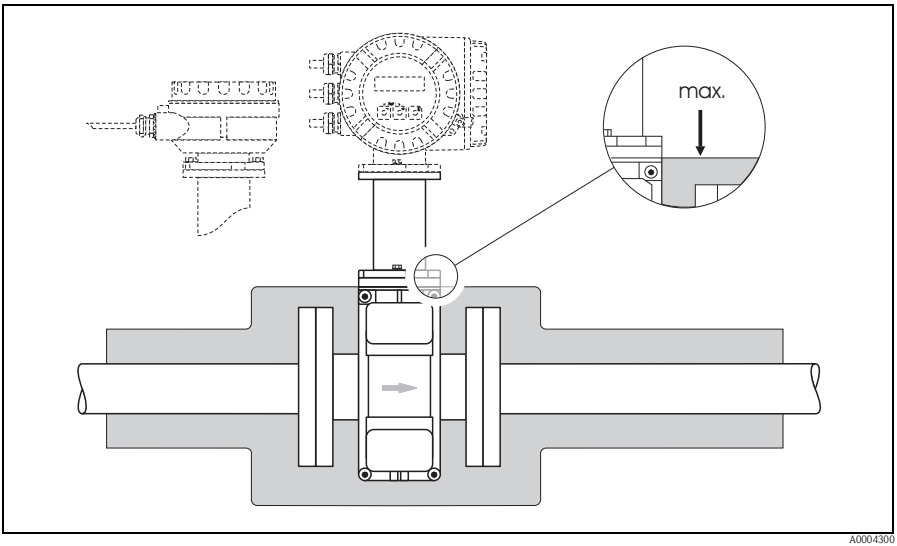
The high-temperature version has a housing support for the thermal separation of sensor and transmitter. The high-temperature version is always used for applications in which high ambient temperatures are encountered **in conjunction with** high fluid temperatures. The high-temperature version is obligatory if the fluid temperature exceeds +150 °C.

Note!
You will find information on permissible temperature ranges in the Operating Instructions of the CD-ROM

Insulation

Pipes generally have to be insulated if they carry very hot fluids, in order to avoid energy losses and to prevent accidental contact with pipes at temperatures that could cause injury. Guidelines regulating the insulation of pipes have to be taken into account.

Caution!
Risk of measuring electronics overheating. The housing support dissipates heat and its entire surface area must remain uncovered. Make sure that the sensor insulation does not extend past the top of the two sensor shells.



A0004300

2.5.4 Tightening torques for threaded fasteners (Promag P)

Please note the following:
- The tightening torques listed below are for lubricated threads only.
- Always tighten the screws uniformly and in diagonally opposite sequence.
- Overtightening the screws will deform the sealing faces or damage the seals.
- The tightening torques listed below apply only to pipes not subjected to tensile stress.

Promag P tightening torques for EN (DIN)

Nominal diameter [mm]	EN (DIN) Pressure rating [bar]	Threaded fasteners	Max. tightening torque [Nm]	
			PTFE	PFA
15	PN 40	4 × M 12	11	–
25	PN 40	4 × M 12	26	20
32	PN 40	4 × M 16	41	35
40	PN 40	4 × M 16	52	47
50	PN 40	4 × M 16	65	59
65 *	PN 16	8 × M 16	43	40
65	PN 40	8 × M 16	43	40
80	PN 16	8 × M 16	53	48
80	PN 40	8 × M 16	53	48
100	PN 16	8 × M 16	57	51
100	PN 40	8 × M 20	78	70
125	PN 16	8 × M 16	75	67
125	PN 40	8 × M 24	111	99
150	PN 16	8 × M 20	99	85
150	PN 40	8 × M 24	136	120
200	PN 10	8 × M 20	141	101
200	PN 16	12 × M 20	94	67
200	PN 25	12 × M 24	138	105
250	PN 10	12 × M 20	110	–
250	PN 16	12 × M 24	131	–
250	PN 25	12 × M 27	200	–
300	PN 10	12 × M 20	125	–
300	PN 16	12 × M 24	179	–
300	PN 25	16 × M 27	204	–
350	PN 10	16 × M 20	188	–
350	PN 16	16 × M 24	254	–
350	PN 25	16 × M 30	380	–
400	PN 10	16 × M 24	260	–
400	PN 16	16 × M 27	330	–
400	PN 25	16 × M 33	488	–
450	PN 10	20 × M 24	235	–
450	PN 16	20 × M 27	300	–

Nominal diameter [mm]	EN (DIN) Pressure rating [bar]	Threaded fasteners	Max. tightening torque [Nm] PTFE	PFA
450	PN 25	20 × M 33	385	–
500	PN 10	20 × M 24	265	–
500	PN 16	20 × M 30	448	–
500	PN 25	20 × M 33	533	–
600	PN 10	20 × M 27	345	–
600 *	PN 16	20 × M 33	658	–
600	PN 25	20 × M 36	731	–
* Designed acc. to EN 1092-1 (not to DIN 2501)				

Promag P tightening torques for ANSI

Nominal diameter [mm]	[inch]	ANSI Pressure rating [lbs]	Threaded fasteners	Max. tightening torque PTFE [Nm]	[lbf · ft]	PFA [Nm]	[lbf · ft]
15	½"	Class 150	4 × ½"	6	4	–	–
15	½"	Class 300	4 × ½"	6	4	–	–
25	1"	Class 150	4 × ½"	11	8	10	7
25	1"	Class 300	4 × 5/8"	14	10	12	9
40	1 ½"	Class 150	4 × ½"	24	18	21	15
40	1 ½"	Class 300	4 × ¾"	34	25	31	23
50	2"	Class 150	4 × 5/8"	47	35	44	32
50	2"	Class 300	8 × 5/8"	23	17	22	16
80	3"	Class 150	4 × 5/8"	79	58	67	49
80	3"	Class 300	8 × ¾"	47	35	42	31
100	4"	Class 150	8 × 5/8"	56	41	50	37
100	4"	Class 300	8 × ¾"	67	49	59	44
150	6"	Class 150	8 × ¾"	106	78	86	63
150	6"	Class 300	12 × ¾"	73	54	67	49
200	8"	Class 150	8 × ¾"	143	105	109	80
250	10"	Class 150	12 × 7/8"	135	100	–	–
300	12"	Class 150	12 × 7/8"	178	131	–	–
350	14"	Class 150	12 × 1"	260	192	–	–
400	16"	Class 150	16 × 1"	246	181	–	–
450	18"	Class 150	16 × 1 1/8"	371	274	–	–
500	20"	Class 150	20 × 1 1/8"	341	252	–	–
600	24"	Class 150	20 × 1 ¼"	477	352	–	–

Promag P tightening torques for JIS

Nominal diameter [mm]	JIS Pressure rating	Threaded fasteners	Max. tightening torque [Nm] PTFE	PFA
25	10K	4 × M 16	32	27
25	20K	4 × M 16	32	27
32	10K	4 × M 16	38	–
32	20K	4 × M 16	38	–
40	10K	4 × M 16	41	37
40	20K	4 × M 16	41	37
50	10K	4 × M 16	54	46
50	20K	8 × M 16	27	23
65	10K	4 × M 16	74	63
65	20K	8 × M 16	37	31
80	10K	8 × M 16	38	32
80	20K	8 × M 20	57	46
100	10K	8 × M 16	47	38
100	20K	8 × M 20	75	58
125	10K	8 × M 20	80	66
125	20K	8 × M 22	121	103
150	10K	8 × M 20	99	81
150	20K	12 × M 22	108	72
200	10K	12 × M 20	82	54
200	20K	12 × M 22	121	88
250	10K	12 × M 22	133	–
250	20K	12 × M 24	212	–
300	10K	16 × M 22	99	–
300	20K	16 × M 24	183	–

Promag P tightening torques for AS 2129

Nominal diameter [mm]	AS 2129 Pressure rating	Threaded fasteners	Max. tightening torque [Nm] PTFE
25	Table E	4 × M 12	21
50	Table E	4 × M 16	42

Promag P tightening torques for AS 4087

Nominal diameter [mm]	AS 4087 Pressure rating	Threaded fasteners	Max. tightening torque [Nm] PTFE
50	PN 16	4 × M 16	42

2.6 Installing the Promag H sensor

Depending on the order specifications, the sensor is supplied with or without ready-mounted process connections. Mounted process connections are fixed to the sensor with 4 or 6 hexagonal-headed bolts.

Caution!
Depending on the application and length of the pipe, the sensor may have to be supported or additionally secured. The sensor must be secured if using plastic process connections. An appropriate wall mounting kit can be ordered separately from Endress+Hauser as an accessory.

2.6.1 Seals

When mounting the process connections, make sure that the seals in question are free from dirt and centered correctly.

Caution!
- The screws must be securely tightened in the case of metal process connections. Together with the sensor, the process connection forms a metal connection that ensures defined seal compression.
- With regard to process connections made of plastic material, comply with the max. torques for lubricated threads (7 Nm / 5.2 lbf ft). A seal must always be used between the connection and counterflange for plastic flanges.
- The seals should be replaced periodically depending on the application, particularly if molded seals are used (aseptic version)! The intervals between seal replacement depend on the frequency of the cleaning cycles and the fluid and cleaning temperatures. Replacement seals can be ordered as an accessory.

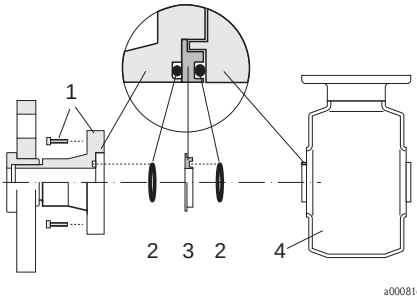
2.6.2 Using and mounting grounding rings (DN 2 to 25, 1/12" to 1")

In the case of process connections made of plastic (e.g. flange connections or adhesive couplings), potential equalization between the sensor and fluid must be ensured via additional grounding rings.
If grounding rings are missing, this can affect accuracy or result in the destruction of the sensor due to electrochemical electrode reduction.

Caution!
- Depending on the order option, appropriate plastic disks are used instead of grounding rings for the process connections. These plastic disks only act as a kind of "place holder" and do not have any potential equalization function whatsoever. In addition, they also assume an important sealing function at the sensor/connection interface. Thus, these plastic disks/seals should never be removed and should always be mounted for process connections without metal grounding rings!
- Grounding rings can be ordered separately from Endress+Hauser as an accessory.
  When ordering, make sure that the grounding rings are compatible with the electrode material. Otherwise there is the risk that electrodes can be damaged by electrochemical corrosion! For information on materials, see the Operating Instructions on the CD-ROM.

- Grounding rings, incl. seals, are mounted inside the process connections.
  The face-to-face length is not affected.

Installing the grounding rings



1 = Process connection hexagonal-headed bolts
2 = O-ring seals
4 = Sensor
3 = Grounding ring or plastic disk (place holder)

a. Release the 4 or 6 hexagonal-headed bolts (1) and remove the process connection from the sensor (4).
b. Remove the plastic disk (3) including the two O-ring seals (2) from the process connection.
c. Insert one of the O-ring seals (2) back into the groove of the process connection.
d. Place the metal grounding ring (3) into the process connection as illustrated.
e. Now insert the second O-ring seal (2) into the groove of the grounding ring.
f. Mount the process connection back onto the sensor. In doing so, make sure to observe the max. torques for lubricated threads (7 Nm) (5.2 lbf ft).

2.6.3 Welding the sensor into the pipe (weld nipples)

Caution!
Risk of destroying the electronics! Make sure that the welding system is not grounded via the sensor or transmitter.

a. Secure the sensor with a few welding points in the pipe.
   A welding jig suitable for this purpose can be ordered separately as an accessory.
b. Release the screws on the process connection flange and remove the sensor, including the seal, from the pipe.
c. Weld the process connection into the pipe.
d. Mount the sensor back into the pipe.
   In doing so, make sure the seals are clean and correctly positioned.

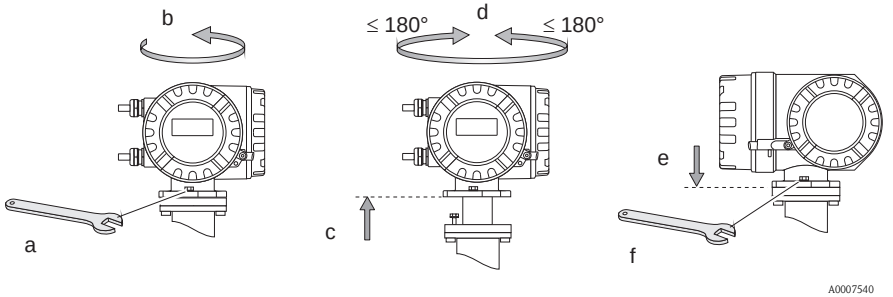
Note!
- When welding is performed correctly with thin-walled pipes carrying food, the seal is not damaged by the heat even when it is mounted. It is recommended, however, to disassemble the sensor and seal.
- For the disassembly work, it must be possible to open the pipe approx. 8 mm (0.31 in) in total.

2.7 Installing the transmitter housing

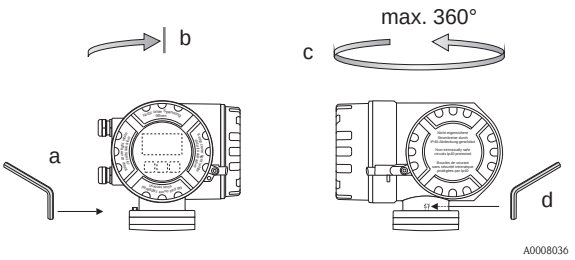
2.7.1 Turning the transmitter housing

Turning the aluminum field housing

Aluminum field housing for non-Ex area



Aluminum field housing for Zone 1 or Class I Div. 1



For Zone 1 or Class I Div. 1:

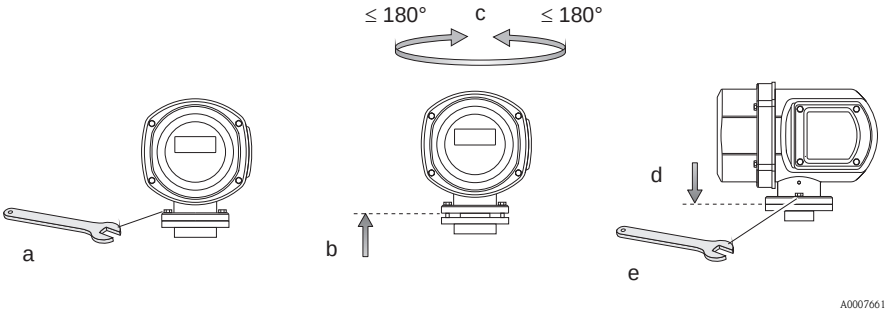
a. Release the setscrew.

b. Turn the transmitter housing gently clockwise until the stop (end of the thread).

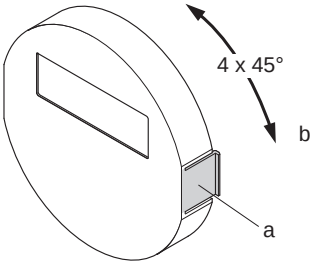
c. Turn the transmitter counterclockwise (max. 360°) to the desired position.

d. Retighten the setscrew.

Turning the stainless steel field housing



2.7.2 Turning the onsite display



a. Press in the side latches on the display module and remove the module from the cover plate of the electronics compartment.

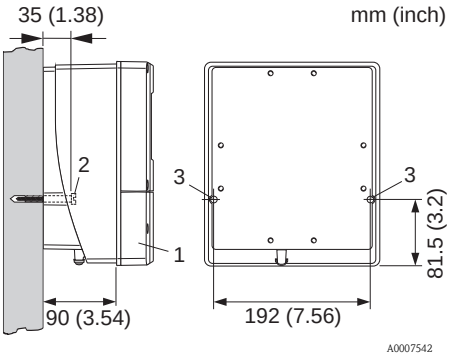
b. Turn the display to the desired position (max. 4 × 45° in both directions) and reset it onto the cover plate of the electronics compartment.

2.7.3 Installing the wall-mount housing

Caution!

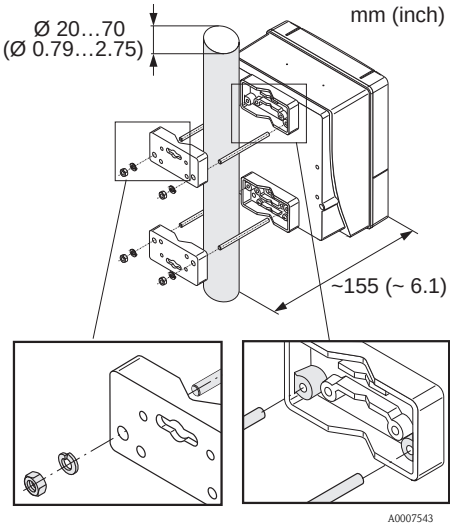
- Make sure that the ambient temperature does not exceed the permitted range.
- Always install the wall-mount housing in such a way that the cable entries point downwards.

Mounted directly on the wall



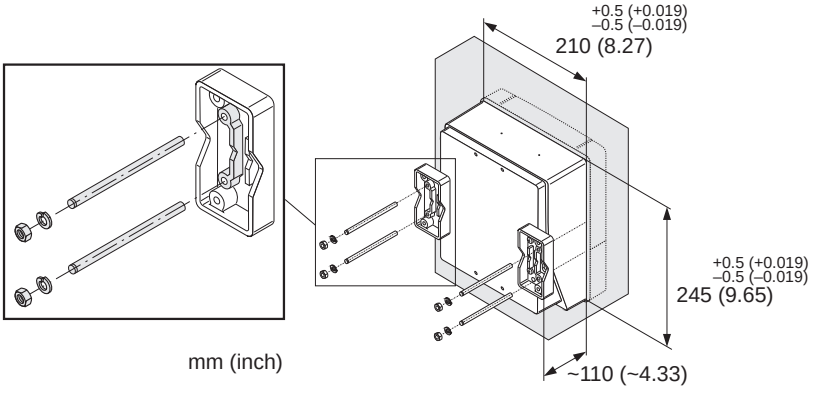
1. Connection compartment
2. Securing screws M6 (max. ø 6.5 mm (0.25"); screw head max. ø 10.5 mm (0.4")
3. Housing bores for securing screws

Pipe mounting



Caution!
Danger of overheating! If the device is mounted on a warm pipe, make sure that the housing temperature does not exceed +60 °C (+140 °F) which is the maximum temperature permitted.

Panel mounting



2.8 Post-installation check

- Is the measuring device damaged (visual inspection)?
- Does the device correspond to specifications at the measuring point, including process temperature and pressure, ambient temperature, minimum fluid conductivity, measuring range, etc.?
- Does the arrow on the sensor nameplate match the actual direction of flow through the pipe?
- Is the position of the measuring electrode plane correct?
- Were all screws tightened to the specified torques when the sensor was installed?
- Were the correct seals used (type, material, installation)?
- Are the measuring point number and labeling correct (visual inspection)?
- Were the inlet and outlet runs respected?
  - Inlet run $\geq 5 \times$ DN
  - Outlet run $\geq 2 \times$ DN
- Is the measuring device protected against moisture and direct sunlight?
- Is the sensor adequately protected against vibration (attachment, support)?
  Acceleration up to 2 g by analogy with IEC 600 68-2-8

3 Wiring

⚠ Warning!
Risk of electric shock! Components carry dangerous voltages.
- Never mount or wire the measuring device while it is connected to the power supply.
- Before connecting the power supply, check the safety equipment.
- Route the power supply and signal cables so they are securely seated.
- Seal the cable entries and covers tight.

☝ Caution!
Risk of damaging the electronic components!
- Connect the power supply in accordance with the connection data on the nameplate.
- Connect the signal cable in accordance with the connection data in the Operating Instructions or the Ex documentation on the CD-ROM.

In addition, for the remote version

☝ Caution!
Risk of damaging the electronic components!
- Only connect sensors and transmitters with the same serial number.
- Observe the cable specifications of the connecting cable → Operating Instructions on the CD-ROM.

✎ Note!
Install the connecting cable securely to prevent movement.

In addition, for measuring devices with fieldbus communication

☝ Caution!
Risk of damaging the electronic components!
- Observe the cable specification of the fieldbus cable → Operating Instructions on the CD-ROM.
- Keep the stripped and twisted lengths of cable shield as short as possible.
- Screen and ground the signal lines → Operating Instructions on the CD-ROM.
- When using in systems without potential equalization → Operating Instructions on the CD-ROM.

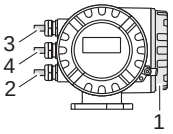
In addition, for Ex-certified measuring devices

⚠ Warning!
When wiring Ex-certified measuring devices, all the safety instructions, wiring diagrams, technical information etc. of the related Ex documentation must be observed
→ Ex documentation on the CD-ROM.

3.1 Connecting the various housing types

Wire the unit using the terminal assignment diagram inside the cover.

3.1.1 Compact version

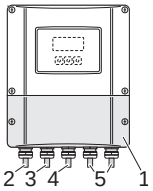


A0007545

Transmitter connection:

1 Connection diagram inside the connection compartment cover
2 Power supply cable
3 Signal cable or fieldbus cable
4 Optional

3.1.2 Remote version (transmitter): non-Ex Zone, Ex Zone 2, Class I Div. 2



A0012690

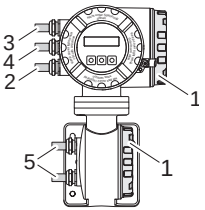
Transmitter connection:

1 Connection diagram inside the connection compartment cover
2 Power supply cable
3 Signal cable
4 Fieldbus cable

Connecting the connecting cable (→ 36):

5 Sensor/transmitter connecting cable

3.1.3 Remote version (transmitter): Ex Zone 1, Class I Div. 1



A0008218

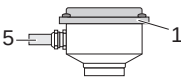
Transmitter connection:

1 Connection diagram inside the connection compartment cover
2 Power supply cable
3 Signal cable or fieldbus cable
4 Optional

Connecting the connecting cable (→ 36):

5 Sensor/transmitter connecting cable

3.1.4 Remote version (sensor)



A0008037

Transmitter connection:

1 Connection diagram inside the connection compartment cover

Connecting cable connection:

5 Sensor/transmitter connecting cable

3.2 Connecting the remote version connecting cable

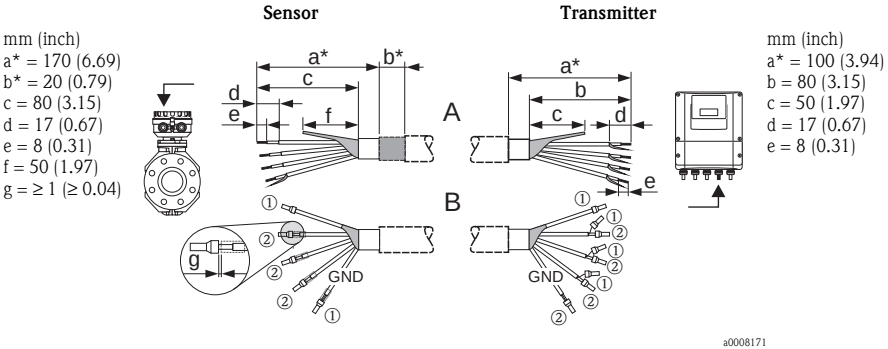
3.2.1 Connecting cable for Promag W, P and L

Connecting cable termination

Terminate the signal and coil current cables as shown in the figure below (Detail A).
Fit the fine-wire cores with cable end ferrules (Detail B).

Signal cable termination

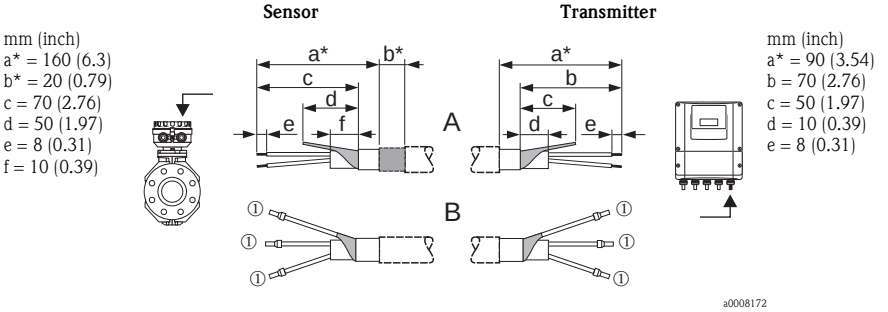
Make sure that the cable end ferrules do not touch the wire shields on the sensor side! Minimum distance = 1 mm (0.04 in), exception "GND" = green cable.



① = Cable end ferrules, red, ∅ 1.0 mm (0.04"); ② = Cable end ferrules, white, ∅ 0.5 mm (0.02")
* = Stripping for armored cables only

Coil current cable termination

Insulate one core of the three-core cable at the level of the core reinforcement; you only require two cores for the connection.



① = Cable end ferrules, red, ∅ 1.0 mm (0.04"); ② = Cable end ferrules, white, ∅ 0.5 mm (0.02")
* = Stripping for armored cables only

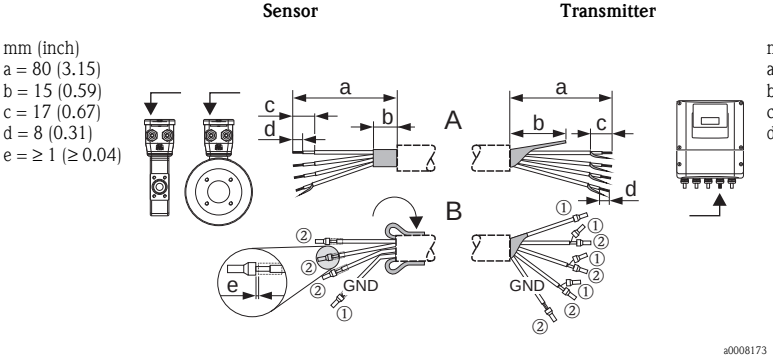
3.2.2 Promag H connecting cable

Connecting cable termination

Terminate the signal and coil current cables as shown in the figure below (Detail A).
Fit the fine-wire cores with cable end ferrules (Detail B).

Signal cable termination

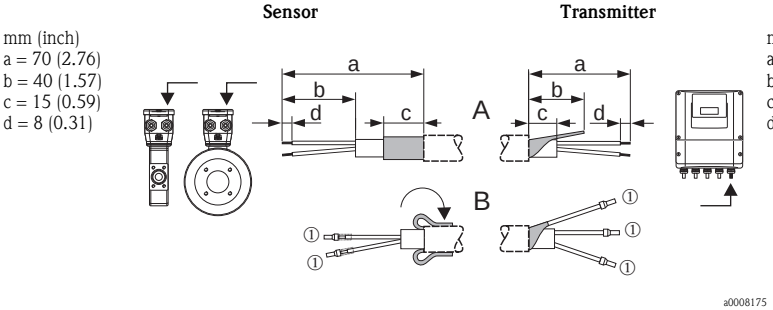
Make sure that the cable end ferrules do not touch the wire shields on the sensor side! Minimum distance = 1 mm (0.04 in), exception "GND" = green cable.



① = Cable end ferrules, red, ∅ 1.0 mm (0.04"); ② = Cable end ferrules, white, ∅ 0.5 mm (0.02")

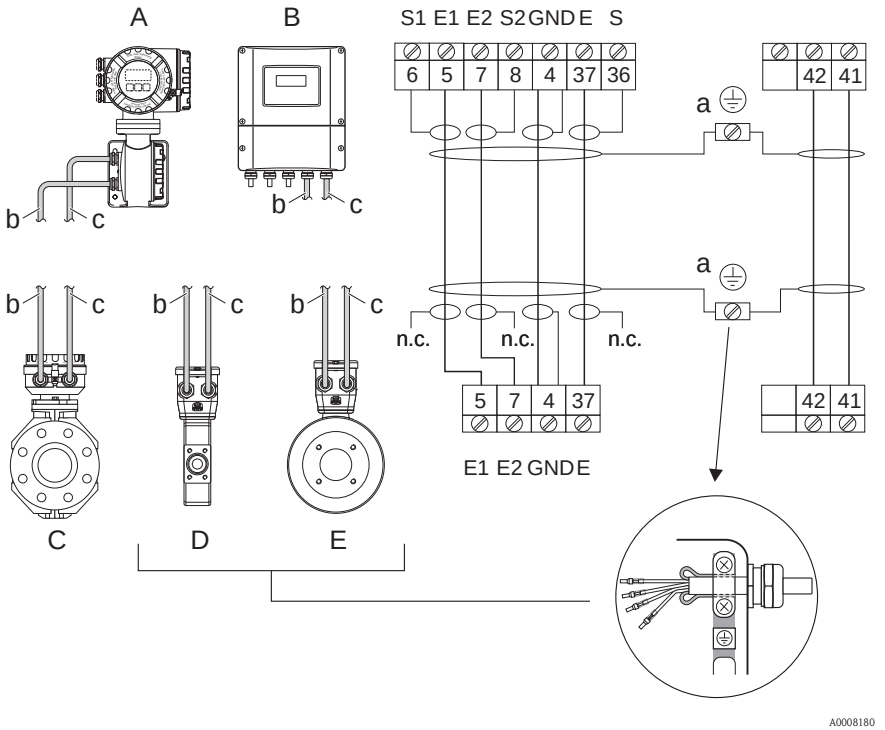
Coil current cable termination

Insulate one core of the three-core cable at the level of the core reinforcement; you only require two cores for the connection.



① = Cable end ferrules, red, ∅ 1.0 mm (0.04"); ② = Cable end ferrules, white, ∅ 0.5 mm (0.02")

3.2.3 Connecting cable connection



A Transmitter housing on connection housing, remote version
B Wall-mount housing on connection housing, remote version

C Sensor connection housing, remote version for Promag W, P, L
D Sensor connection housing, remote version for Promag H, DN ≤ 25
E Sensor connection housing, remote version for Promag H, DN ≥ 40

a Ground terminals (are provided for potential equalization connection)
b Coil circuit connecting cable
c Signal circuit connecting cable (electrodes)

n.c. = not connected, isolated cable shields

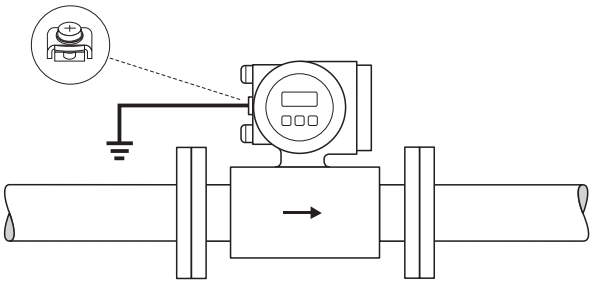
Cable colors for terminal numbers:
5/6 = brown
7/8 = white
4 = green
36/37 = yellow

3.3 Potential equalization

Perfect measurement is only ensured when the medium and the sensor have the same electrical potential. Most sensors have a reference electrode installed as standard, which guarantees the required potential connection. This usually means that the use of ground disks or other measures are unnecessary.

- Promag L, Promag W and Promag P
  Reference electrode available as standard.
- Promag H
  – No reference electrode available. There is always an electrical connection to the fluid via the metal process connection.
  – In the case of plastic process connections, potential equalization must be ensured through the use of grounding rings.

Standard situation
Potential equalization takes place via the ground terminal of the transmitter when using the device in metal, grounded pipes.



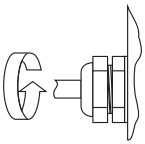
A0004375

✎ Note!
Potential equalization for other areas of application → Operating Instructions on the CD-ROM.

3.4 Degree of protection

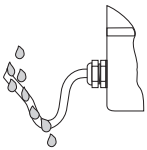
The devices meet all the requirements for IP 67.

After mounting in the field or service work, the following points have to be observed to ensure that IP 67 protection is retained:
- Install the measuring device in such a way that the cable entries do not point upwards.
- Do not remove the seal from the cable entry.
- Remove all unused cable entries and plug them with suitable/certified drain plugs.
- Use cable entries and drain plugs with a long-term operating temperature range in accordance with the temperature specified on the nameplate.



A0007549

Tighten the cable entries correctly.



A0007550

The cables must loop down before they enter the cable entries ("water trap").

3.5 Post-connection check

- Are cables or the device damaged (visual inspection)?
- Does the supply voltage match the information on the nameplate?
- Do the cables used comply with the necessary specifications?
- Do the mounted cables have adequate strain relief and are they routed securely?
- Is the cable type route completely isolated? Without loops and crossovers?
- Only remote version:
  - Is the flow sensor connected to the matching transmitter electronics?
  - Is the connecting cable between sensor and transmitter connected correctly?
- Are all screw terminals firmly tightened?
- Have all the measures for grounding and potential equalization been correctly implemented?
- Are all cable entries installed, firmly tightened and correctly sealed?
- Cable routed as a "water trap" in loops?
- Are all the housing covers installed and securely tightened?

In addition, for measuring devices with fieldbus communication:
- Are all the connecting components (T-boxes, junction boxes, connectors, etc.) connected with each other correctly?
- Has each fieldbus segment been terminated at both ends with a bus terminator?
- Has the max. length of the fieldbus cable been observed in accordance with the specifications?
- Has the max. length of the spurs been observed in accordance with the specifications?
- Is the fieldbus cable fully shielded and correctly grounded?

4 Hardware settings

This section only deals with the hardware settings needed for commissioning. All other settings (e.g. output configuration, write protection, etc.) are described in the associated Operating Instructions on the CD-ROM.

✎ Note!
No hardware settings are needed for measuring devices with HART or FOUNDATION Fieldbus-type communication.

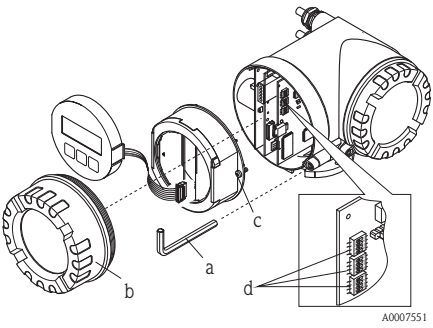
4.1 Device address

Has to be set for measuring devices with the following communication methods:
- PROFIBUS DP/PA

The device address can be configured via:
- Miniature switches → see description below
- Local operation → see **Software settings section** → 📄 48

Addressing via miniature switches

⚠ Warning!
Risk of electric shock! Risk of damaging the electronic components!
- All the safety instructions for the measuring device must be observed and all the warnings heeded → 📄 34.
- Use a workspace, working environment and tools purposely designed for electrostatically sensitive devices.

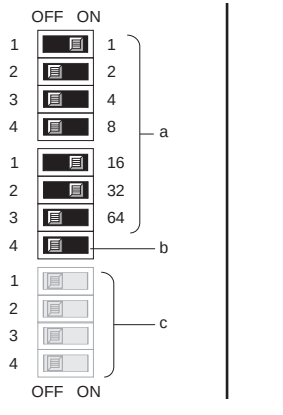


⚠ Warning!
Switch off the power supply before opening the device.

a. Loosen the cheese head screw of the securing clamp with an Allen key (3 mm)
b. Unscrew cover of the electronics compartment from the transmitter housing.
c. Loosen the securing screws of the display module and remove the onsite display (if present).
d. Set the position of the miniature switches on the I/O board using a sharp pointed object.

Installation is the reverse of the removal procedure.

PROFIBUS



Device address range: 0 to 126
Factory setting: 126

a. Miniature switches for device address
Example shown:
1+16+32 = device address 49

b. Miniature switches for the address mode (method of addressing):
- OFF (factory setting) = software addressing via local operation/operating program
- ON = hardware addressing via miniature switches

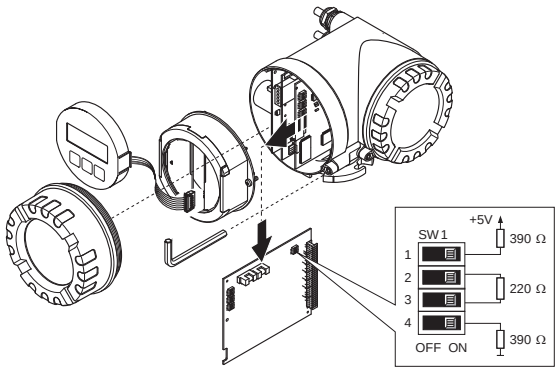
c. Miniature switches not assigned.

4.2 Terminating resistors

Note!
If the measuring device is used at the end of a bus segment, termination is required.
This can be performed in the measuring device by setting the terminating resistors on the I/O board. Generally, however, it is recommended to use an external bus terminator and not perform termination at the measuring device itself.

Has to be set for measuring devices with the following communication methods:
- PROFIBUS DP
  - Baudrate ≤ 1.5 MBaud → Termination can be performed at the measuring device, see graphic
  - Baudrate > 1.5 MBaud → An external bus terminator must be used

Warning!
Risk of electric shock! Risk of damaging the electronic components!
- All the safety instructions for the measuring device must be observed and all the warnings heeded → 34.
- Use a workspace, working environment and tools purposely designed for electrostatically sensitive devices.



Setting the terminating switch SW1 on the I/O board:
ON - ON - ON - ON

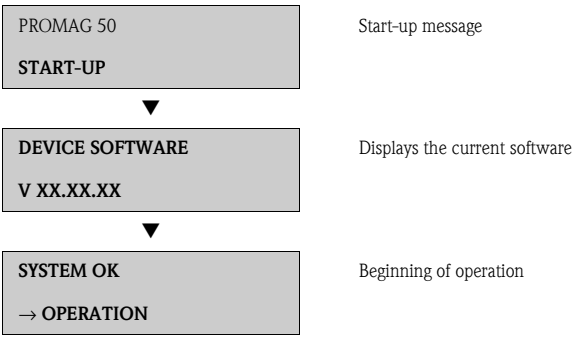
5 Commissioning

5.1 Switching on the measuring device

On completion of the installation (successful post-installation check), wiring (successful post-connection check) and after making the necessary hardware settings, where applicable, the permitted power supply (see nameplate) can be switched on for the measuring device.

When the power supply is switched on, the measuring device performs a number of power-up checks and device self-checks. As this procedure progresses the following messages can appear on the onsite display:

Display examples:

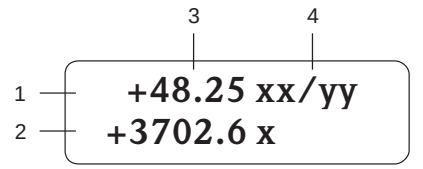


The measuring device starts operating as soon as the startup procedure is complete.
Various measured values and/or status variables appear on the display.

✎ Note!
If an error occurs during startup, this is indicated by an error message.
The error messages that occur most frequently when a measuring device is commissioned are described in the Troubleshooting section → 48.

5.2 Operation

5.2.1 Display elements

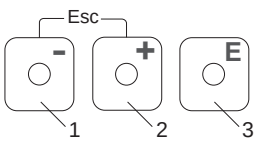


A0007557

Display lines/fields

1. Main line for primary measured values
2. Additional line for additional measured variables/status variables
3. Current measured values
4. Engineering units/time units

5.2.2 Operating elements



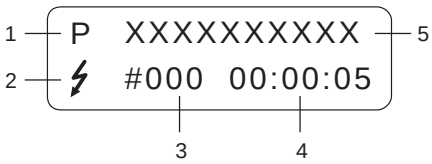
A0007559

Operating keys

1. (–) Minus key for entering, selecting
2. (+) Plus key for entering, selecting
3. Enter key for calling the function matrix, saving

When the +/– keys are pressed simultaneously (Esc):
- Exit the function matrix step-by-step:
- > 3 sec. = cancel data input and return to the measured value display

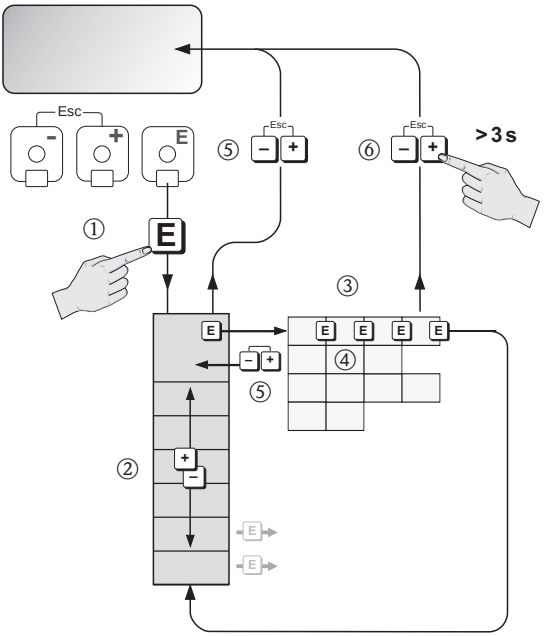
5.2.3 Displaying error messages



A0007561

1. Type of error:
   P = Process error, S = System error
2. Error message type:
   ϟ = Fault message, ! = Notice message
3. Error number
4. Duration of the last error that occurred:
   Hours: Minutes: Seconds
5. Error designation
   List of all error messages, see associated Operating Instructions on the CD-ROM

5.3 Navigating within the function matrix



1. E → Enter the function matrix (starting with measured value display)
2. ± → Select the group (e.g. OPERATION)
   E → Confirm selection
3. ± → Select function (e.g. LANGUAGE)
4. ± → Enter code **50** (only for the first time you access the function matrix)
   E → Confirm entry

   ± → Change function/selection (e.g. ENGLISH)
   E → Confirm selection
5. ± → Return to measured value display step by step
6. ± > 3 s → Return immediately to measured value display

5.4 Calling the Commissioning Quick Setup

All the functions needed for commissioning are called up automatically with the Quick Setup. The functions can be changed and adapted to the process in question.

1. E → Enter the function matrix (starting with measured value display)
2. ± → Select the group QUICK SETUP
   E → Confirm selection
3. QUICK SETUP COMMISSIONING function appears.
4. Intermediate step if configuration is blocked:
   ± → Enter the code **50** (confirm with E) and thus enable configuration
5. ± → Go to Commissioning Quick Setup
6. ± → Select YES
   E → Confirm selection
7. E → Start Commissioning Quick Setup
8. Configure the individual functions/settings:
   – Via ±-key, select option or enter number
   – Via E-key, confirm entry and go to next function
   – Via ±-key, return to Setup Commissioning function
   (settings already made are retained)

✎ Note!
Observe the following when performing the Quick Setup:
- Configuration selection: Select the ACTUAL SETTING option
- Unit selection: This is not offered again for selection after configuring a unit
- Output selection: This is not offered again for selection after configuring an output
- Automatic configuration of the display: select YES
  – Main line = Mass flow
  – Additional line = Totalizer 1
  – Information line = Operating/system conditions
- If asked whether additional Quick Setups should be executed: select NO

All the available functions of the measuring device and their configuration options as well as additional Quick Setups, if available, are described in detail in the "Description of Device Functions" Operating Instructions. The related Operating Instructions can be found on the CD-ROM.

The measuring device is ready for operation on completion of the Quick Setup.

5.5 Software settings

5.5.1 Device address

Has to be set for measuring devices with the following communication methods:
- PROFIBUS DP/PA → device address range 0 to 126, factory setting 126

The device address can be configured via:
- Miniature switches → see Hardware settings → 41
- Local operation → see description below

Note!
The COMMISSIONING SETUP must be executed before setting the device address.

Calling the Communication Quick Setup

1. E → Enter the function matrix (starting with measured value display)
2. ± → Select the group QUICK SETUP
   E → Confirm selection
3. → Select the QUICK SETUP COMMUNICATION function
4. Intermediate step if configuration is blocked: ± → Enter the code **50**
   (confirm with E) and thus enable the configuration
5. ± → Go to Communication Quick Setup
6. ± → Select YES; E → confirm selection
7. E → Start Communication Quick Setup
8. Configure the individual functions/settings:
   – Via ±-key, select option or enter number
   – Via E-key, confirm entry and go to next function
   – Via ±-key, return to Setup Commissioning function
   (settings already made are retained)

All the available functions of the measuring device and their configuration options as well as additional Quick Setups, if available, are described in detail in the "Description of Device Functions" Operating Instructions. The related Operating Instructions can be found on the CD-ROM.

The measuring device is ready for operation on completion of the Quick Setup.

5.6 Troubleshooting

A complete description of all the error messages is provided in the Operating Instructions on the CD-ROM.

Note!
The output signals (e.g. pulse, frequency) of the measuring device must correspond to the higher-order controller.

4.5 PUSHBUTTONS & SELECTOR SWITCHES

Sprecher & schuh – **D5P-MTS34-3LX025** – Stop pushbutton

Kraus & Naimer – **CAD11-A201-600-FT2** – Local / Remote Switch

Kraus & Naimer – **CAD11-A212 Engraved "FIRE-OFF-CONTROL"** – Selector Switch

sprecher+schuh

D7 Control and indication products 22.5 mm

Complete emergency stop operators - panel & enclosed type

Emergency stop operators

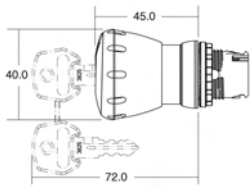
- Choice of "Auto Break" or standard normally closed contacts
- 30, 40 or 60 mm mushroom head
- Extra security key release

Pushbutton & Key operated types

D7P-MT64-PX01S

D7M-MK44-MX01S

Description	Contact	Plastic body Cat. No. [1])	Price $	Metal body Cat. No. [1])	Price $
Twist To Reset/Standard contact blocks					
30 mm Operator		D7P-MT34-PX01		D7M-MT34-MX01	
40 mm Operator		D7P-MT44-PX01		D7M-MT44-MX01	
60 mm Operator		D7P-MT64-PX01		D7M-MT64-MX01	
Key To Reset/Standard contact blocks					
40 mm Operator		D7P-MK44-PX01		D7M-MK44-MX01	
Twist To Reset/"Auto Break" Safety contact blocks					
30 mm Operator		D7P-MT34-PX01S		D7M-MT34-MX01S	
40 mm Operator		D7P-MT44-PX01S		D7M-MT44-MX01S	
60 mm Operator		D7P-MT64-PX01S		D7M-MT64-MX01S	
Key To Reset/"Auto Break" Safety contact blocks					
40 mm Operator		D7P-MK44-PX01S		D7M-MK44-MX01S	



Dimensions in (mm)

Enclosed emergency stop operators

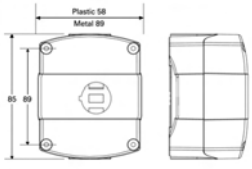
D71YM1

D71MM1

- Modern low profile enclosures
- Supplied complete
- Metric cable entry 20 mm
- Plastic or Metal enclosures

Description	Contact	Cat. No.	Price $
Plastic enclosures with emergency stop "Twist To Reset" operator			
Yellow enclosure 40 mm plastic operator		D71YM1	
Plastic enclosures with emergency stop "Twist Key To Reset" operator			
Yellow enclosure 40 mm plastic operator		D71YM4	
Metal enclosures with emergency stop "Twist To Reset" operator			
Grey enclosure 40 mm metal operator		D71MM1	
Metal enclosures with emergency stop "Twist Key To Reset" operator			
Grey enclosure 40 mm metal operator		D71MM4	

Note: [1]) Add suffix "bx" for special box/hang-sell packaging eg: D7P-MT34-PX01bx



Price Schedule 'A2'

sprecher+schuh

D7 Control and indication products 22.5 mm

Industrial control switches – emergency stop operators

2

D7P-MT44

D7M-MT64

Panel mounted front and rear elements

D7PMT ■ Plastic, twist to release emergency stop operators

D7MMT ■ Metal, twist to release emergency stop operators

D7PLMT ■ Plastic, twist to release illuminated emergency stop operators

D7MLMT ■ Metal, twist to release illuminated emergency stop operators

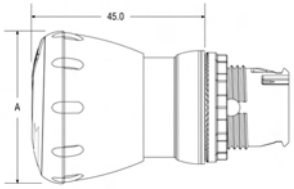
■ Protection class IP 66

■ Individually packaged

■ 2 part ordering

1 Mushroom operators

Description	Non-illuminated Plastic Cat. No.	Price $	Non-illuminated Metal Cat. No.	Price $	Illuminated Plastic Cat. No.	Price $	Illuminated Metal Cat. No.	Price $
30 mm Red operator	D7P-MT34		D7M-MT34		-		-	
40 mm Red operator	D7P-MT44		D7M-MT44		D7P-LMT44		D7M-LMT44	
60 mm Red operator	D7P-MT64		D7M-MT64		D7P-LMT64		D7M-LMT64	

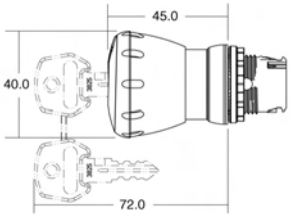


D7P-MK44

D7PMK ■ Plastic key-release emergency stop operators

D7MMK ■ Metal key-release emergency stop operators

Description	Non-illuminated Plastic Cat. No.	Price $	Non-illuminated Metal Cat. No.	Price $
40 mm Red operator	D7P-MK44		D7M-MK44	



D7PX / D7PQ ■ Pre-assembled clip-on rear elements with plastic coupling plate

D7MX / D7MQ ■ Pre-assembled clip-on rear elements with metal coupling plate

2 Contact/lamp blocks [3])

Description	Screw Cat. No.	Price $	Spring clamp Cat. No.	Price $	Metal screw Cat. No.	Price $	Metal spring clamp Cat. No.	Price $
1 N/O contact block	D7PX10		D7PQ10		D7MX10		D7MQ10	
1 N/C contact block	D7PX01		D7PQ01		D7MX01		D7MQ01	
1 N/O and 1 N/C contact block	D7PX11		D7PQ11		D7MX11		D7MQ11	
Safety "Auto Break" 1 N/C contact block	D7PX01S		-		D7MX01S		-	
1 N/O and 1 N/C contact block and integrated LED lamp block	D7PN[1]) [2])X11		D7PQ[1]) [2])Q11		D7MN[1]) [2])X11		D7MQ[1]) [2])Q11	

Notes: [1]) enter voltage 24V AC/DC = **3**, 120V AC = **5**, 240V AC = **7**

[2]) enter lamp colour **C** = clear (incandescent), **R** = Red LED, **G** = Green LED, **Y** = Yellow LED, **W** = White LED, **B** = Blue LED - Example D7PN3RX11 = 24 V AC/DC RED integrated LED lamp block (Price shown is for 110/240 VAC)

[3]) Safety "Auto Break" and additional contact blocks available refer page 2-34

Price Schedule 'A2'

D7 Control and indication products 22.5 mm
Technical information

Front-of-Panel (Operators) [1])

Mechanical Ratings			Plastic (D7P)	Metal (D7M)
Vibration (assembled to panel)		(G)	Tested at 10…2000 Hz, 1.52 mm displacement (peak-to-peak) max./G max. for 3 hr duration, no damage	
Shock		(G)	Tested at 1/2 cycle sine wave for 11 ms; no damage at 100 G	
Degree of protection [2])			UL Type 3/3R/4/4X/12/13 (IP 65/66)	UL Type 3/3R/4/12/13 (IP 65/66)
Mechanical durability per EN 60947 (Annex C)	10,000,000 Cycles		Pushbuttons, momentary mushroom	
	1,000,000 Cycles		Multi-function	
	500,000 Cycles		Push-pull mushroom	
	300,000 Cycles		E-stops, selector switches	
Operating forces (typical with one contact block)		(N)	Flush/extended = 5N E-stop = 36N Mushroom = 9N	
Operating torque (typical application with one contact block)		(N-m)	Selector switch = 0.25 N-m	
Environmental				
Temperature range (operating) [3])		(°C)	-25…+70 °C (-13…+158 °F)	
Temperature range (short-term storage)		(°C)	-25…+85 °C (-13…+185 °F)	
Humidity		(%)	50…95% RH from 25…60 °C (77…140 °F) per: procedure IV of MIL-STD-810C, Method 507.1 cycling test	

Back-of-Panel (Components) [1])

Electrical Ratings			
Standard contact block rating			AC 15, DC 13 to EN 60947-5-1 and UL 508, 17 V, 5 mA min. A600,Q600 600 V AC
Low voltage contact block [4])			5 V, 1 mA DC min. C300, R150, AC 15, DC 13 to EN 60947-5-1 and UL 508
Thermal current		(A)	10 A max. enclosed (40 °C ambient) to UL 508, EN 60947-5-1
Wire capacity			#18…12 AWG (0.75…2.5 mm [2])
	Screw terminal	(AWG)	Max. (2) #14 AWG or (1) #12 AWG
	Spring-clamp terminal	(AWG)	#18…14 AWG (0.75…1.5 mm [2])
Insulation voltage		(Ui)	Ui = 680 V (screw terminal) Ui = 300 V (screwless terminal)
Dielectric strength (minimum)			(V) 2200 V for one minute
External short circuit protection	Standard blocks		10 A type gL/gG cartridge fuse to EN 60269-2-1 or gN (Class J to UL 248-8 or Class C to UL 348-4)
	Low voltage contact blocks		6 A type gL/gG cartridge fuse to EN 60269-2-1 or gN (Class J to UL 248-8 or Class C to UL 348-4)
Electrical shock protection			Finger-safe conforming to IP2X

Notes: [1]) Performance data given in this publication is provided only as a guide for the user in determining suitability and do not constitute a performance warranty of any kind. Such data may represent the results of accelerated testing at elevated stress levels, and the user is responsible for correlating the data to actual application requirements.
[2]) Momentary mushroom operators are IP 65, multi-function operators have no Type 13 rating. Plastic operators with keys have no Type 4X rating.
[3]) Operating temperatures below 0 °C (32 °F) are based on the absence of freezing moisture and liquids.
[4]) Low voltage contacts are recommended for applications below 17 V, 5 mA.

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D7 Control and indication products 22.5 mm
Technical information

2

Back-of-Panel (Operators) [1]), continued

Mechanical Ratings

Vibration (assembled to panel)		(G)	10...2000 Hz, 1.52 mm displacement (peak-to-peak) max./10 G max. 6 hr
Shock		(G)	Tested at 1/2 cycle sine wave for 11 ms and no damage at 100 G max.
Contact durability per EN 60947-5-1 (Annex C)			10,000,000 cycles
Contact operation	N/O		Slow make, double break
	N/C		Slow make, double break (positive opening)
	N/O E.M.		Early make, double break
	N/C L.B.		Late break, double break (positive opening)
Opening forces (typical)		(N)	3.4 N: each single circuit contact block
			5...6.6 N: each dual circuit contact block

Note: [1]) Performance data given in this publication is provided only as a guide for the user in determining suitability and do not constitute a performance warranty of any kind. Such data may represent the results of accelerated testing at elevated stress levels, and the user is responsible for correlating the data to actual application requirements.

Rated operating current I_e

	24 V	48 V	110 V	220 V	230/240 V
AC 1				10 A	10 A
AC 15	8 A	8 A	6 A	3 A	3 A
	380 V	400 V	415 V	500 V	690 V
AC 1					
AC 15	2.5 A	2 A	2.2 A	1.5 A	0.75 A

Rated operating current I_e, continued

DC 13	24 V	48 V	110 V	125 V	220 V
-01, -10	3 A	1.5 A	0.2 A	0.6 A	0.1 A
-01, -E10	1.3 A	0.4 A	0.13 A	0.13 A	65 mA
DC 13	250 V	400 V	440 V	500 V	600 V
-01, -10	0.3 A	0.2 A	0.04 A	0.15 A	0.13 A
-01, -E10	65 mA	26 mA	26 mA		

Short-circuit withstand
without welding 10 A slow (DT, gG)

Switching rate 6000 operations/hour

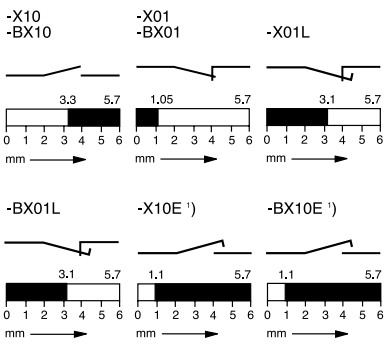
Fuse rating
permissible rated current fast (D, gF) 16 A
slow (DT, gG) 10 A

Electrical life

AC 11	0.1 A	1 A	2 A	3 A
No. of operations (millions)	10	3	1	0.5

Contact duty electronic circuit (H-type- bridges)
positive opening for: D7X01, D7BX01

Contact travel
D7



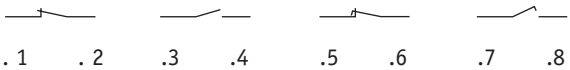
Terminal marking
according to DIN EN 50 013

Terminals 0.75...2.5 mm²
18...12 AWG

Versions

Panel mounting

-01 -10 01L 10E



. 1 . 2 .3 .4 .5 .6 .7 .8

- Snap-on to coupling plate
- 2 contact levels
- up to 3 contact blocks per contact level

Base mounting

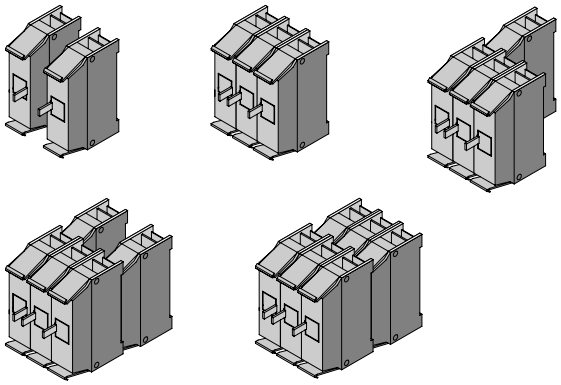
-01 -10 01L 10E

. 1 . 2 .3 .4 .5 .6 .7 .8

- Snap-on to the inside of the enclosure base or onto a DIN rail, or secure with two screwed fixing straps
- 3 contact blocks in one contact level possible

Possibilities to combine (Panel mounting)

Maximum of 6 contact blocks can be combined



D7 Control and indication products 22.5 mm
Technical information

Back-of-Panel (Components) [1]), continued

Lamp elements

D7-DOC

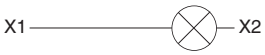
D7-N_
D7-Q_

D7-BN_

- Panel or base mount
- Small overall depth
- Easy to wire
- Screw or spring connection

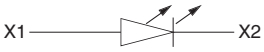
Versions

D7-DOC



Standard element
Operating voltage max. 250 V

D7-N
D7-BN
D7-Q



Technical information

D7-DOC

Lamp socket	Ba9s
Lamp rating max	2 W (2.6 W for pilot lights)
Insulation voltage	Ui 250 V
Terminal marking	according to DIN EN 50 013
Terminals	Screw / spring 0.75...2.5 mm²

D7-N
D7-BN
D7-Q

	Nominal Voltage	Range	Current Draw	Frequency
LED Module Ratings	24 V AC	10...29 V AC	31 mA	50/60 Hz
	24 V DC	10...30 V DC	24 mA	DC
	120 V AC	70...132 V AC	25 mA	50/60 Hz
	240 V AC	180...264 V AC	22 mA	50/60 Hz

sprecher+schuh

D7 Control and indication products 22.5 mm

Material listing

2

Component	For use with	Material used
Panel gasket	All operators	Nitrile
Diaphragm seal	Illuminated pushbutton, non-illuminated pushbutton	Automotive acceptable silicone
K-seal	Selector switch, key selector switch, push/twist-to-release E-stop, key E-stop, push/pull mushroom	Nitrile
Diaphragm retainer, return spring I	Illuminated pushbutton, non-illuminated pushbutton, momentary mushroom, push/twist-to-release E-stop, key E-stop, push/pull mushroom	Stainless steel
Return spring II	Reset, selector switch, key selector switch	Zinc coated music wire
Button cap/mushroom head	Non-illuminated pushbutton, momentary mushroom, reset, push/twist-to-release E-stop, key E-stop, push/pull mushroom, multi-function	PBT/polycarbonate blend
2 colour moulded button insert	Non-illuminated pushbutton	PBT/polycarbonate blend
Lens	Multi-function	Acetal
Lens knob	Illuminated pushbutton, illuminated momentary mushroom, illuminated selector switch	Polyamide
Plastic bezel/bushing I	Non-illuminated pushbutton, illuminated pushbutton, momentary mushroom, selector switch, key selector switch, push/twist-to-release E-stop, key E-stop, push/pull mushroom, multi-function	Glass-filled polyamide
Plastic bezel/bushing II, jam nut, knob	Reset, non-illuminated selector switch, pilot light	Glass-filled polyamide
Metal bezel/bushing	All metal operators	Zinc
Diffuser	Illuminated pushbutton, pilot light	Polycarbonate
Legend frames	-	Glass-filled nylon
Plastic mounting ring	All plastic operators	Glass-filled polyamide
Metal mounting ring	All metal operators	Chromated zinc
Plastic coupling plate	-	Glass-filled nylon
Metal coupling plate	-	Chromated zinc + stainless steel
Plastic enclosures	-	PBT/polycarbonate blend
Metal enclosure	-	Aluminium
Terminal screws	LED module, incandescent module, contact blocks	Zinc-plated steel with chromate
Terminals	LED module, incandescent module, contact blocks	Brass with silver-nickel contacts
Screwless	LED module, incandescent module, contact blocks	Stainless steel
Lamp socket	Incandescent module	Brass
Housing	Incandescent module, LED module	Glass-filled nylon
Low voltage terminals	Contact blocks	Gold-plated brass with silver-nickel contacts
Low voltage spanner	Contact blocks	Gold-plated brass with silver-nickel contacts
Spanner	Contact blocks	Brass with silver-nickel contacts

D7 Control and indication products 22.5 mm
Technical information

Back-of-Panel (Components) [1]), continued

Illumination			Plastic (D7P)	Metal (D7M)
LED dominant wavelength	Green	(nm)	525 nm	
	Red		629 nm	
	Yellow		590 nm	
	Blue		470 nm	
	White			
LED luminous intensity	Green	(mcd)	890 mcd	
	Red		890 mcd	
	Yellow		690 mcd	
	Blue		193 mcd	
	White		412 mcd	
Incandescent maximum wattage		(W)	1W	
Environmental				
Temperature range (operating) [2])		(°C)	-25...+70 °C (-13...+158 °F)	
Temperature range (short-term storage)		(°C)	-25...+85 °C (-13...+185 °F)	
Humidity		(%)	tested at 50...95 % relative humidity from 25...60 °C (77...140 °F) per: procedure IV of MIL-STD-810C, Method 507.1 cycling test	
Materials				
Springs			Stainless steel and zinc coated music wire	
Electrical contacts	Standard		Silver-nickel	
	Low voltage		Gold-plated over silver	
Terminals	Screw		Brass	
	Screwless		Silver-plated copper	

Environmental approval note: Front elements UL Recognised; Complete assemblies UL Approved.
See Table A2 (below) for your application.

This table is extracted from Sprecher + Schuh's UL 508A file and can be used to determine which D7 pilot device is approved for a particular enclosure type.

TABLE A2 - Openings in enclosure

Enclosure type	Openings may be closed by equipment marked...
2	2, 3, 3R, 3S, 4, 4X, 6, 6P, 11, 12, 12K, 13
3	3, 3R, 3S, 4, 4X, 6, 6P
3R	3, 3R, 3S, 4, 4X, 6, 6P
3S	3, 3R, 3S, 4, 4X, 6, 6P
4	4, 4X, 6, 6P
4X	4X
6	6, 6P
6P	6P
11	11
12, 12K	12, 12K, 13
13	13

Product certification

Certifications	UL. UR, CSA, CCC, CE
Standards	NEMA ICS-5; UL 508, EN 418, EN 60947-1, EN 60947-5-1, EN 60947-5-5
Terminal identification	IEC 60947-1
Shipping approvals	RINA, LR, ABS

Notes: [1]) Performance data given in this publication is provided only as a guide for the user in determining suitability and do not constitute a performance warranty of any kind. Such data may represent the results of accelerated testing at elevated stress levels, and the user is responsible for correlating the data to actual application requirements.
[2]) Operating temperatures below 0 °C (32 °F) are based on the absence of freezing moisture and liquids.

How to order

Disconnectors and Main Switches according to IEC 60947-3 see Catalog 500

Three types of data (shown below) are required for ordering Blue Line cam-operated switches. Code numbers for ordering are shown in this catalog.

1. Type of Switch

The type of switch required may be easily selected by referring to the table on page 3 which shows the thermal current, power rating and dimensions of each switch. For further technical details, refer to pages 40-43. Variations of contacts and terminals are shown below.

2. Switch Function

The code numbers for standard switches shown on pages 6-28 indicate the switch function, escutcheon plate, handle and any optional extras.

Additional coding to modify type and color of handle and escutcheon plate is explained below.

3. Type of Mounting

Types of mounting are shown on pages 29-35. Catalog **101** describes enclosures and optional extras.

Specify the mounting code to indicate required mounting.

CA10	A202-600	VE

Type of Switch

Extending the switch type coding the following combinations will define:

Amendment	Definition	For switch types
-1	with gold contacts[1]	CA10, CA11, CA10B, CA11B
-4	with quick connects	CA4
B	S0 switches with latching mechanism size S1	CA10, CA11, CA20, CA25, CAD12
C	S1 switches with latching mechanism size S2	C26, C32
L	with lockout-relay w/o manual release for std. sw.	CA10, C26, C32, C42
M	with lockout-relay with manual release for std. sw.	CA10, C26, C32, C42
X	with power failure release	CA10, CA11, CA20, CA25, CAD12, C26, C32, C42
Y	with power failure release and trip-free release	CA10, CA11, CA20
S	with snap action	CA10, CA11, CA20, CA25, C26, C32, C42 with 60° switching
R	with spring return latching mechanism	CA10

Example: Coding for switch type **CA10** with gold contacts is **CA10-1**.

Modification of Switches

The part number for switch function and options may be modified in cases where items are required other than standard. The modification may involve the escutcheon plate inscription, color combination of escutcheon plate and handle, type of escutcheon plate and handle or the optional extra.

Switch Size	Escutcheon Plate Frame	Handle	Escutcheon Plate Backing	Escutcheon Plate Lettering	Dash Number
S0, S1, S2, S3	electro-gray	electro-gray	brushed alu	black	-100
S0, S1, S2, S3	electro-gray	electro-gray	black	mat silver	-500
S00, S0, S1, S2, S3	black	black	brushed alu	black	-600
S00, S0, S1, S2, S3	black	black	black	mat silver	-700

[1]Technical data on request.

How to order

Modification of Switches

Color combinations of escutcheon plate and handle

The standard switch consists of a transparent escutcheon plate with brushed aluminum backing and black inscription. The escutcheon plate frame is black as well as the handle. Page 4 shows further color combinations of escutcheon plate and handle which are available. The appropriate dash number must be substituted in the switch function coding to specify other color combinations as required.

Example: The complete coding for switch type CA10 with a 3 pole ON/OFF switch function, electro-gray handle and electro-gray escutcheon plate frame with brushed aluminum backing and black inscription which reads 0-1 is as follows: **CA10 A202-100 E**.

The following is a list of special programs for escutcheon plate and handle combinations. They may be obtained by specifying any one of the following two (2) digit dash numbers as a part of the overall dash number. It is still necessary to prefix these two digit numbers with the first digit which represents the color combination desired.

Special programs for escutcheon plate and handle combinations

-000 = without escutcheon plate, without handle
- .01 = without escutcheon plate
- .02 = without handle
- .03 = with square escutcheon plate without lettering
- .04 = with rectangular escutcheon plate without lettering
- .05 = with square escutcheon plate without lettering and without handle
- .06 = with rectangular escutcheon plate without lettering and without handle
- .07 = standard escutcheon plate, without lettering on rectangular section
- .08 = with F-handle
- .09 = with P-handle
- .10 = escutcheon plate with frame and fixation ring only (if using switches with single hole mounting: **- .16**)
- .11 = without escutcheon plate, but with handle bearing plate
- .12 = with yellow escutcheon plate backing and red handle
- .14 = with B-handle
- .16 = escutcheon plate with frame and fixation ring only, if using switches with single hole mounting
- .17 = standard escutcheon plate and rectangular add-on escutcheon plate, if using switches with single hole mounting FT2

Example: The complete coding for switch type CA10 with a 3 pole ON/OFF switch function with electro-gray escutcheon plate frame, square escutcheon plate without lettering, brushed aluminum plate backing and electro-gray handle reads as follows: **CA10 A202-103 E**.

Handles, Escutcheon Plates and Optional Extras

The handles for standard switches shown on pages 6-28 are suitable for mounting units with four hole mounting. Alternative types of handles available are illustrated on pages 29-35.
When a handle, escutcheon plate or optional extra is required but not covered by the dash number, the code number for the selected component should be entered separately. A comprehensive range of available standard escutcheon plates is illustrated on pages 36 and 37. Non-standard or special escutcheon plate engravings are available at extra cost.
The large number of optional extras and enclosures is covered in Catalog **101**.

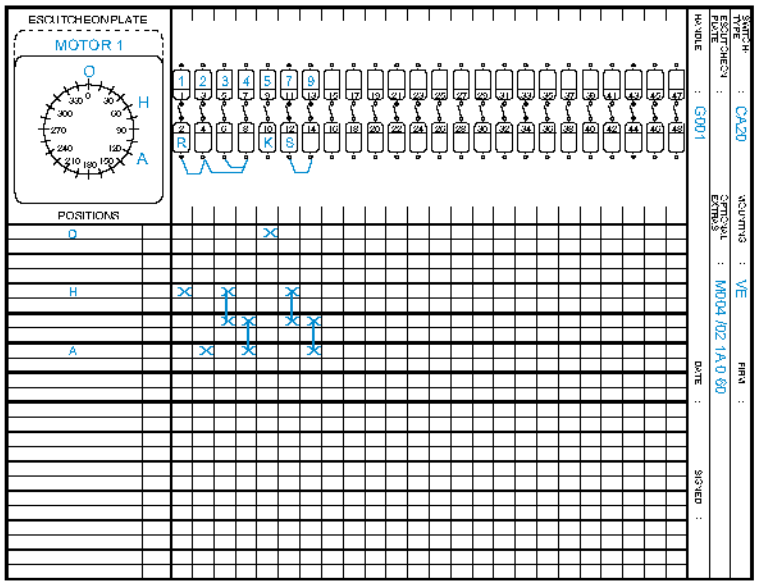
Switch Size

Blue Line switches are available in sizes S00, S0, S1, S2 and S3. These size codes indicate the dimensions of the mounting, the escutcheon plate and the handle, as well as the size of optional devices and enclosures.
Page 3 lists these sizes and the various switch types they include.

Ordering of Special Switches and Escutcheon Plates

When ordering special switches and escutcheon plates it is advisable to use our order form, as illustrated. The customer's requirements are shown in blue as an example.

For technical reasons, it may not be possible to follow the sequence of contacts requested by the customer. The final contact development which is sent with every switch will show the customer's original terminal markings.

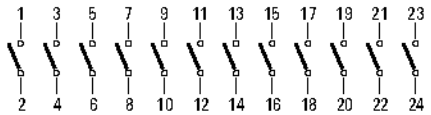


Order forms are available on request.

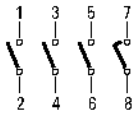
Switch Function and Configuration

C, CA, CAD, CL Switches

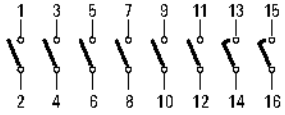
Function	Escutch. Plate	Type/Handle CA4 CA4-1 CL4	CAD.. CA10- CA25 CL10	CA10B- CA25B	C26- C315	Code	Stages	Connection Diagram
ON/OFF Switches with 60° Switching								
1 pole		↵	↵	↵	↵	A200-600	1	
2 pole		↵	↵	↵	↵	A201-600	1	
3 pole		↵	↵	↵	↵	A202-600	2	
3 pole with red handle		↵	↵	↵	↵	A202-626	2	
3 pole with V850 padlock attachment				↵	↵	A202-627	2	
4 pole		↵	↵	↵	↵	A203-600	2	
4 pole 1 pole preclose 6°[1]		↵	↵	↵	↵	A653-600	2	
5 pole		↵	↵	↵	↵	A341-600	3	
6 pole		↵	↵	↵	↵	A342-600	3	
7 pole		↵	↵	↵	↵	A343-600	4	
8 pole		↵	↵	↵	↵	A344-600	4	
8 pole 2 pole preclose 6°[1]		↵	↵	↵	↵	A654-600	4	
9 pole		↵	↵	↵	↵	A345-600	5	
10 pole		↵	↵	↵	↵	A346-600	5	
11 pole		↵	↵	↵	↵	A347-600	6	
12 pole		↵	↵	↵	↵	A348-600	6	
1 pole		↵	↵	↵	↵	A200-620	1	
2 pole		↵	↵	↵	↵	A201-620	1	
3 pole		↵	↵	↵	↵	A202-620	2	
4 pole		↵	↵	↵	↵	A203-620	2	
4 pole 1 pole preclose 6°[1]		↵	↵	↵	↵	A653-620	2	
5 pole		↵	↵	↵	↵	A341-620	3	
6 pole		↵	↵	↵	↵	A342-620	3	
7 pole		↵	↵	↵	↵	A343-620	4	
8 pole		↵	↵	↵	↵	A344-620	4	
8 pole 2 pole preclose 6°[1]		↵	↵	↵	↵	A654-620	4	
9 pole		↵	↵	↵	↵	A345-620	5	
10 pole		↵	↵	↵	↵	A346-620	5	
11 pole		↵	↵	↵	↵	A347-620	6	
12 pole		↵	↵	↵	↵	A348-620	6	
1 pole		↵	↵	↵	↵	A200-621	1	
2 pole		↵	↵	↵	↵	A201-621	1	
3 pole		↵	↵	↵	↵	A202-621	2	
4 pole		↵	↵	↵	↵	A203-621	2	
4 pole 1 pole preclose 6°[1]		↵	↵	↵	↵	A653-621	2	
5 pole		↵	↵	↵	↵	A341-621	3	
6 pole		↵	↵	↵	↵	A342-621	3	
1 pole		↵	↵	↵	↵	A200-622	1	
2 pole		↵	↵	↵	↵	A201-622	1	
3 pole		↵	↵	↵	↵	A202-622	2	
4 pole		↵	↵	↵	↵	A203-622	2	
4 pole 1 pole preclose 6°[1]		↵	↵	↵	↵	A653-622	2	
5 pole		↵	↵	↵	↵	A341-622	3	
6 pole		↵	↵	↵	↵	A342-622	3	
1 pole		↵	↵	↵	↵	A200-623	1	
2 pole		↵	↵	↵	↵	A201-623	1	
3 pole		↵	↵	↵	↵	A202-623	2	
4 pole		↵	↵	↵	↵	A203-623	2	
4 pole 1 pole preclose 6°[1]		↵	↵	↵	↵	A653-623	2	
5 pole		↵	↵	↵	↵	A341-623	3	
6 pole		↵	↵	↵	↵	A342-623	3	
1 pole		↵	↵	↵	↵	A200-624	1	
2 pole		↵	↵	↵	↵	A201-624	1	
3 pole		↵	↵	↵	↵	A202-624	2	
4 pole		↵	↵	↵	↵	A203-624	2	
4 pole 1 pole preclose 6°[1]		↵	↵	↵	↵	A653-624	2	
5 pole		↵	↵	↵	↵	A341-624	3	
6 pole		↵	↵	↵	↵	A342-624	3	
1 pole		↵	↵	↵	↵	A200-625	1	
2 pole		↵	↵	↵	↵	A201-625	1	
3 pole		↵	↵	↵	↵	A202-625	2	
4 pole		↵	↵	↵	↵	A203-625	2	
4 pole 1 pole preclose 6°[1]		↵	↵	↵	↵	A653-625	2	
5 pole		↵	↵	↵	↵	A341-625	3	
6 pole		↵	↵	↵	↵	A342-625	3	



1-12 pole



4 pole 1 pole preclose 6°



8 pole 2 pole preclose 6°

[1] for use in a three phase four-wire system with switched neutral

Switch Function and Configuration — C, CA, CAD, CL Switches

Function	Escutch. Plate	Type/Handle CA4 CA4-1 CL4	CAD.. CA10- CA25 CL10	CA10B- C43	C80- C315	Code	Stages	Connection Diagram
Double-throw Switches with Center „OFF“ 60° Switching								
1 pole		↵	↵	↵	↵	A210-600	1	1-4 pole
2 pole		↵	↵	↵	↵	A211-600	2	
3 pole		↵	↵	↵	↵	A212-600	3	
4 pole		↵	↵	↵	↵	A213-600	4	
4 pole	1 pole preclose 6°[3]	↵	↵	↵	↵	A913-600	4	
5 pole		↵	↵	↵	↵	A361-600	5	
6 pole		↵	↵	↵	↵[4]	A362-600	6	
7 pole		↵	↵	↵	↵	A363-600	7	
8 pole		↵	↵	↵	↵	A364-600	8	
8 pole	2 pole preclose 6°[3]	↵	↵	↵	↵	A664-600	8	
1 pole		↵	↵	↵	↵	A210-620	1	4 pole 1 pole preclose 6°
2 pole		↵	↵	↵	↵	A211-620	2	
3 pole		↵	↵	↵	↵	A212-620	3	
4 pole		↵	↵	↵	↵	A213-620	4	
4 pole	1 pole preclose 6°[3]	↵	↵	↵	↵	A913-620	4	
5 pole		↵	↵	↵	↵	A361-620	5	5 pole
6 pole		↵	↵	↵	↵[4]	A362-620	6	
7 pole		↵	↵	↵	↵	A363-620	7	
8 pole		↵	↵	↵	↵	A364-620	8	
8 pole	2 pole preclose 6°[3]	↵	↵	↵	↵	A664-620	8	6 and 7 pole
1 pole		↵	↵	↵	↵	A210-621	1	
2 pole		↵	↵	↵	↵	A211-621	2	
3 pole		↵	↵	↵	↵	A212-621	3	8 pole
1 pole		↵	↵	↵	↵	A210-622	1	
2 pole		↵	↵	↵	↵	A211-622	2	
3 pole		↵	↵	↵	↵	A212-622	3	8 pole 2 pole preclose 6°
1 pole		↵	↵	↵	↵	A210-623	1	
2 pole		↵	↵	↵	↵	A211-623	2	
3 pole		↵	↵	↵	↵	A212-623	3	
1 pole		↵	↵	↵	↵	A210-624	1	
2 pole		↵	↵	↵	↵	A211-624	2	
3 pole		↵	↵	↵	↵	A212-624	3	
4 pole		↵	↵	↵	↵	A213-624	4	
4 pole	1 pole preclose 6°[3]	↵	↵	↵	↵	A913-624	4	
Double-throw Switches with Center „OFF“ 90° Switching								
1 pole		↵	↵	↵	↵	A218-600	1	1-4 pole
2 pole		↵	↵	↵	↵	A219-600	2	
3 pole		↵	↵	↵	↵[1]	A299-600	3	
4 pole	1 pole preclose 60°	↵	↵	↵	↵[1]	A294-600	4	
1 pole		↵	↵	↵	↵	A218-620	1	
2 pole		↵	↵	↵	↵	A219-620	2	
3 pole		↵	↵	↵	↵[1]	A299-620	3	
4 pole	1 pole preclose 60°	↵	↵	↵	↵[1]	A294-620	4	
Double-throw Switches with Center „OFF“ and electrically isolated contacts								
1 pole		↵	↵	↵	↵	A710-600	1	1-4 pole
2 pole		↵	↵	↵	↵	A711-600	2	
3 pole		↵	↵	↵	↵	A712-600	3	
4 pole		↵	↵	↵	↵	A713-600	4	
4 pole	1 pole preclose 6°[3]	↵	↵	↵	↵	A963-600	4	4 pole 1 pole preclose 6°
1 pole	with spring return	↵	↵	↵	↵[2]	A714-600	1	
2 pole	to center	↵	↵	↵		A715-600	2	1 and 2 pole

[1] switch type C315 with ↵ handle [2] not available for switch type C315 [3] for use in a three phase four-wire system with switched neutral
[4] switch type C80 with ↵ handle

Mounting

C, CA, CAD, CL Switches

Single Hole Mounting	Terminals rotated 90°	Code	CA4 CA4-1 CL4	CAD.. CA10- CA25 CL10
With locking nut and shaft seal, protection IP 66			mm	mm
 Without escutcheon plate		FS1	16/22	
	●	FS1-V	16/22	
		FT1		22
	●	FT1-V		22
		FT3		22/30
	●	FT3-V		22/30
 With square escutcheon plate		FS2	16/22	
	●	FS2-V	16/22	
		FT2		22
	●	FT2-V		22
		FT4		22/30
	●	FT4-V		22/30
 With rectangular escutcheon plate		FS4	16/22	
	●	FS4-V	16/22	
 With size S1 escutcheon plate and heavy duty latching		FH3		22
	●	FH3-V		22
 Mounting key for locking nut		S00 T170 09		

Selection Data

	CA4		CA10		CA11	CA20	CA25			C42			
	CA4-1	CL4	CA10B	CL10	CA11B	CA20B	CA25B	C26	C32	C43	C80	C125	C315/C316

Rated Insulation Voltage U_i	IEC 60947-3, EN 60947-3[1]														
	VDE 0660 part 107[1]	V	440	440	690	690	690	690	690	690	690	690	690	690	690/1000
	SEV[4]	V	380	380	660	690	660	660	690	660	660	660	660	660	660
	UL/Canada	V	300	300	300	600	600	600	300	600	600	600	600	600	600
	CEE/NEMKO	V	400/380	–	380	–	400	400	–	400	400	400	400	–	–
	min. voltage	V							on request						
Rated Impulse Withstand Voltage U_{imp}		kV	4	4	6	6	6	6	6	6	6	6	6	6	6/8
Rated Thermal Current I_u/I_{th}	IEC 60947-3, EN 60947-3														
	VDE 0660 part 107	A	10	10	20	20	20	25	32	32	50	63	115	150	315
	SEV[4] 380 V	A	10	10	16	16	16	25	32	32	40	63	100	160	315
	660 V	A	–	–	12	12	12	25	32	32	40	63	–	–	315
	UL/Canada	A	10	10	20	20	20	30	30	40	50	65	100	150	240
Rated Operational Current I_e															
AC-21A Switching of resistive loads, including moderate overloads	IEC 60947-3, EN 60947-3 VDE 0660 part 107	A	10	10	20	20	20	25	32	32	40	63	100	150	315
AC-1 Resistive or low inductive loads	SEV[4] 380 V	A	10	10	16	16	16	25	32	32	40	63	100	160	315
	660 V	A	–	–	12	12	12	20	32	32	40	63	–	–	315
AC-22A Switching of combined resistive or low inductive loads including moderate overloads	IEC 60947-3, EN 60947-3 VDE 0660 part 107 220 V-500 V	A	10	10	20	20	20	25	32	32	40	63	100	150	315
	660 V-690 V	A	–	–	20	20	20	25	32	32	40	63	100	125	125
AC-15 Switching of control devices, contactors, valves etc.	IEC 60947-3, EN 60947-3 VDE 0660 part 107 220 V-240 V	A	2,5	2,5	5	5	5	8	12	14	16	–	–	–	–
	380 V-440 V	A	1,5	1,5	4	4	4	5	6	6	7	–	–	–	–
Pilot Duty	UL/Canada[4] Heavy		A300	C300	A300	A600	A600	A600	A300	A600	A600	A600	–	–	A600
Ampere Rating Resistive or low inductive loads	UL/Canada[4]	A	10	10	20	20	20	30	30	40	50	65	100	150	240
Resistive load/motor load	CEE	A	4/2	–	10/6	–	10/6	16/10	–	25/10	32/10	40/10	63/10	–	–
	NEMKO	A	6/4[2]	–	10/6	–	–	20/10	–	–	–	–	–	–	–
Breaking capacity	220 V-240 V	A	50	50	150	150	150	200	280	280	380	550	860	1100	2000
	380 V-440 V	A	50	50	150	150	150	200	250	250	360	550	860	1100	2000
	660 V-690 V	A	–	–	80	80	80	125	150	150	270	365	400	490	340
Power loss per contact at I_u		W	0,4/0,9	0,4	0,9	1	0,9	0,9	0,7	1,3	1,3	1,7	5,8	3,8	17
Resistance to vibration				min. 4 g, 2-100 Hz, 1,6 mm								on request			
Resistance to shock				min. 6 g, 6 ms								on request			
Short Circuit Protection															
Max. fuse size	(gL-characteristic)	A	10	10	25	25	25	35	35	50	63	80	125	200	315
Rated short-time withstand current	(1s-current)	A	60	90	140	140	140	280	480	350	800	1000	1300	2000	4200

DC Switching Capacity[6]

No. of series contacts	1	2	3	4	5	6	8		CA4		CA10		CA11	CA20	CA25						C315[3]
	Voltage V								CA4-1	CL4	CA10B	CL10	CA11B	CA20B	CA25B	C26S	C32S	C42S	C80	C125	C316[3]
Resistive loads	24	48	70	95	120	145	190	A	10	10	20	20	20	25	32	–	50	–	115	–	315
T < 1 ms	48	95	140	190	240	290	350		6	6	12	12	12	20	25	32	40	63	100	150	250
	60	120	180	240	300	360	450		2,5	2,5	4,5	4,5	4,5	7,5	10	23	27	30	–	–	–
	110	220	330	440	550	660	–		0,7	0,7	1	1	1	1,5	2	6,5	–	–	–	–	–
	220	440	660	–	–	–	–		0,3	0,3	0,4	0,4	0,4	0,5	0,6	1,2	–	–	–	–	–
	440	660	–	–	–	–	–		0,2	0,2	0,27	0,27	0,27	0,3	0,3	0,4	–	–	–	–	–
Inductive loads	24	48	70	95	120	145	190	A	6	6	12	12	12	20	25	32	40	63	100	150	250
T = 50 ms	30	60	90	120	150	180	240		3	3	5	5	5	9	12	25	30	55	33	50	70
	48	95	140	190	240	290	350		1	1	2	2	2	3	3	16	20	–	–	–	–
	60	120	180	240	300	360	450		0,7	0,7	1	1	1	1,5	1,5	11	15	–	–	–	–
	110	220	330	440	550	660	–		0,3	0,3	0,4	0,4	0,4	0,5	0,5	3,2	3,5	–	–	–	–

Rated Operational Current I_e

Ambient Temperature of Stages[5, 7]	open at 100 % I_u/I_{th}	55 °C during 24 hours with peaks up to 60 °C
	enclosed at 100 % I_{the}	35 °C during 24 hours with peaks up to 40 °C

[1] Valid for lines with grounded common neutral termination, overvoltage category III, pollution degree 3. Values for other supply systems on request. [2] Valid for CA4 only. [3] DC switching capacity applies to ON/OFF switches. Switching capacity for other configurations on request. [4] International Standards and Approvals, refer to page 39. [5] For electromagnetic optional extras see additional data in Catalog 101. [6] Values for switches with spring return on request. [7] Storage temperature: -40 °C to 85 °C (in case of temperature below -5 °C no shock load permissible).

Selection Data

					CA4		CA10		CA11	CA20	CA25			C42			C315
					CA4-1	CL4	CA10B	CL10	CA11B	CA20B	CA25B	C26	C32	C43	C80	C125	C316
Rated Utilization Category		IEC 60947-3, EN 60947-3 VDE 0660 part 107															
AC-2	Slip ring motor starting, reversing and plugging, star-delta starting CA4-C32	3 phase 3 pole	220 V-240 V	kW	2,5	2,5	4	4	4	5,5	7,5	8	10	18,5	30	37	55
			380 V-440 V		4,5	4,5	7,5	7,5	7,5	11	15	15	18,5	30	45	55	90
			500 V		–	–	10	10	10	15	18,5	18,5	22	40	55	75	110
			660 V-690 V		–	–	10	10	10	13	15	15	22	37	55	55	55
AC-3	Direct-on-line starting, star-delta starting C42-C315	3 phase 3 pole	220 V-240 V	kW	1,5	1,5	3	3	3	4	5,5	5,5	7,5	11	15	22	37
			380 V-440 V		2,2	2,2	5,5	5,5	5,5	7,5	11	11	15	18,5	30	37	55
			500 V		–	–	5,5	5,5	5,5	7,5	11	11	15	18,5	30	37	55
			660 V-690 V		–	–	5,5	5,5	5,5	7,5	11	11	15	18,5	30	30	37
		1 phase 2 pole	110 V-120 V	kW	0,3	0,3	0,6	0,6	0,6	1,5	2,2	2,2	2,5	3	3,7	5,5	11
			220 V-240 V		0,55	0,55	2,2	2,2	2,2	3	4	4	5,5	6	7,5	11	22
			380 V-440 V		0,75	0,75	3	3	3	3,7	5,5	5,5	7,5	11	13	18,5	30
AC-4	Direct-on-line starting, reversing, plugging and inching	3 phase 3 pole	220 V-240 V	kW	0,37	0,37	0,55	0,55	0,55	1,5	2,5	2,7	3,7	5,5	6	10	15
			380 V-440 V		0,55	0,55	1,5	1,5	1,5	3	5,5	5,5	6	7,5	11	15	25
			500 V		–	–	1,5	1,5	1,5	3	5,5	5,5	6	7,5	11	15	25
			660 V-690 V		–	–	1,5	1,5	1,5	3	5,5	5,5	6	7,5	11	15	22
		1 phase 2 pole	110 V-120 V	kW	0,15	0,15	0,3	0,3	0,3	0,45	0,75	0,75	1,1	1,2	1,5	2,2	4
			220 V-240 V		0,25	0,25	0,75	0,75	0,75	1,1	1,5	1,5	2,2	2,4	3	4	7,5
			380 V-440 V		0,5	0,5	1,5	1,5	1,5	2,2	3	3	3,7	4	5,5	7,5	11
AC-23A	Frequent switching of motors or other high inductive loads	3 phase 3 pole	220 V-240 V	kW	1,8	1,8	3,7	3,7	3,7	5,5	7,5	7,5	11	15	30	37	75
			380 V-440 V		3	3	7,5	7,5	7,5	11	15	15	22	30	45	75	132
			500 V		–	–	7,5	7,5	7,5	11	15	15	30	45	55	90	132
			660 V-690 V		–	–	7,5	7,5	7,5	11	15	15	22	40	45	55	37
		1 phase 2 pole	110 V-120 V	kW	0,37	0,37	0,75	0,75	0,75	1,5	2,2	2,2	2,5	4	5,5	11	18,5
			220 V-240 V		0,75	0,75	2,5	2,5	2,5	3	4	4	5,5	10	15	22	37
			380 V-440 V		1,1	1,1	3,7	3,7	3,7	5,5	7,5	7,5	11	18,5	22	37	55
Ratings		UL/Canada															
	Standard motor load DOL-Rating (similar AC-3)	3 phase 3 pole	110 V-120 V	HP	0,75	0,75	1,5	1,5	1,5	3	5	5	7,5	7,5	10	15	30
			220 V-240 V		1	1	3	3	3	7,5	10	10	15	15	20	25	75
			440 V-480 V		–	–	–	5	5	10	–	20	25	25	30	40	75
			550 V-600 V		–	–	–	5	5	10	–	25	30	30	40	50	60
		1 phase 2 pole	110 V-120 V	HP	0,33	0,33	0,5	0,5	0,5	1,5	2	2	3	3	5	7,5	15
			220 V-240 V		0,75	0,75	1	1	1	3	5	5	7,5	7,5	10	15	40
			277 V		0,75	0,75	2	2	2	3	5	5	7,5	7,5	10	15	40
			440 V-480 V		–	–	–	2	2	5	–	10	15	15	20	25	50
			550 V-600 V		–	–	–	2	2	5	–	15	20	20	25	30	50
	Heavy motor load Reversing-Rating (similar AC-4)	3 phase 3 pole	110 V-120 V	HP	–	–	0,5	–	0,5	1	2	2	3	5	7,5	10	15
			220 V-240 V		–	–	1	–	1	2	3	3	5	7,5	15	20	30
			440 V-600 V		–	–	–	–	3	5	–	10	15	20	25	30	40
		1 phase 2 pole	110 V-120 V	HP	–	–	0,17	–	0,17	0,33	1,5	1,5	1,5	2	3	5	7,5
			220 V-240 V		–	–	0,5	–	0,5	0,75	3	3	3	5	7,5	10	15
			277 V		–	–	0,6	–	0,6	1	3	3	3	5	7,5	10	15
Max. Permissible Wire Gage - Use copper wire only					2x	1x[2]	2x	1x[2]	2x	2x	2x	2x	2x	2x			
Single-core or stranded wire				mm²	1,5	0,5-1,5	2,5	0,5-2,5	2,5	4	6	6	10	16	35	70	185[1]
				AWG	14	20-16	12	20-14	12	10	8	8	8	6	2	2/0	MCM 350
					2x	1x[2]	2x	1x[2]	2x	2x	2x	2x	2x	2x			
Flexible wire (sleeving in accordance with DIN 46228)				mm²	1,5	0,5-1,5	2,5	0,5-2,5	2,5	4	4	6	6	10	25	50	150[1]
					(–)	(–)	(2,5)	(–)	(2,5)	(2,5)	(4)	(4)	(6)	(10)	(25)	(50)	
Flexible AWG wires (without sleeve)				AWG	16	20-16	14	20-14	14	12	10	10	8	6	3	1/0	MCM 300
Connecting wire - outside diameter				mm	–	1,5-2,8	–	1,5-3,6	–	–	–	–	–	–	–	–	–
Connecting wire - plug-in depth				mm	–	8,5	–	11,5	–	–	–	–	–	–	–	–	–
Permissible connecting ambiente temperature range				°C	–	5-40	–	5-40	–	–	–	–	–	–	–	–	–

[1]Cable lug must accept M12 screw. [2]The insulation material of the conductor has to be PVC (typical wire codes are H05V-K0,5 ... H07V-K1,5 or H05V-U0,5 ... H07V-U1,5 etc.). Other materials on request. Connected conductors, which have to be disconnected and re-connected again must be cut in order to ensure a proper electrical connection and to prevent a complete cut-off of the wire insulation. The permissible ambient temperature range when connecting the wires is 5-40 °C.

Technical Data

L Switches

Selection Data				L350 L351	L400	L600	L630 L631	L800	L1000 L1001	L1200	L1250 L1251	L1600	L2000
Rated Insulation Voltage U_i	IEC 60947-3, EN 60947-3[1]												
	VDE 0660 part 107[1]		V	690	690	690	690	690	690	690	690	690	690
	UL/Canada[2]		V	600	600	600	600	600	600	600	600	600	600
	min. voltage		V					on request					
Rated Impulse Withstand Voltage U_{imp}			kV	6	6	6	6	6	6	6	6	6	6
Rated Thermal Current I_u/I_{th}	IEC 60947-3, EN 60947-3 VDE 0660 part 107												
Ambient temp. +35 °C during 24 hours with peaks up to +40 °C			A	350	500	800	630	1100	1000	1450	1250	1900	2400
Ambient temp. +55 °C during 24 hours with peaks up to +60 °C			A	350	500	750	600	950	920	1300	1100	1700	2000
	UL/Canada[2]		A	350	400	630	630	800	1000	1200	1250	1600	2000
Rated Operational Current I_e													
AC-20A No-load operation	IEC 60947-3, EN 60947-3 VDE 0660 part 107	690 V	A	350	500	800	630	1100	1000	1450	1250	1900	2400
Occasional switching under load cos φ 0,8 (AC-20B)	3 phase, 3 pole and 1 phase, 2 pole	220 V-440 V	A	350	500	800	500	1000	630	1200	630	1200	1200
		500 V	A	350	450	500	450	630	500	800	500	800	800
		660 V-690 V	A	315	350	400	360	400	400	400	400	400	400
AC-21B Switching of resistive loads, including moderate overloads	3 phase, 3 pole and 1 phase, 2 pole	220 V-440 V	A	250	450	500	350	630	400	800	400	800	800
		500 V	A	250	400	450	315	500	350	630	350	630	630
		660 V-690 V	A	200	300	350	250	350	300	350	300	350	350
Interrupting Rating	UL/Canada[2]	600 V	A	200	300	300	200	300	200	300	200	200	200
	CSA	600 V	A	200	200	200	200	200	200	200	200	200	200
Rated Utilization Category	IEC 60947-3, EN 60947-3 VDE 0660 part 107												
AC-23B Occasional switching of motors or other high inductive loads	3 phase 3 pole	220 V-240 V	kW	45	75	75	45	75	45	75	45	75	75
		380 V-440 V	kW	90	132	132	90	132	90	132	90	132	132
		500 V	kW	110	132	132	110	132	110	132	110	132	132
		660 V-690 V	kW	65	65	65	65	65	65	65	65	65	65
Short Circuit Protection													
Max. fuse size		(aR-characteristic)	A	400	500	800	630	1250	1000	2x800	1250	2x1000	2x1250
Rated short-time withstand current		(1s-current)	A					on request					
Terminals													
		for connection screw		Cable lug or copper bus M12	M12	M16	M16	M16	M16	M16	M16	2xM16	4xM16
		length	mm	20	30	40	30	40	40	40	50	50	50
Ambient Temperature of Stages[3, 4]				55 °C during 24 hours with peaks up to 60 °C, permissible load see Rated Thermal Current.									

[1] Valid for lines with grounded common neutral termination, overvoltage category III, pollution degree 3. Values for other supply systems on request.
[2] International Standards and Approvals, refer to page 39. [3] For electromagnetic optional extras see additional data in Catalog 101. [4] Storage temperature: -40 °C to 85 °C (in case of temperature below -5 °C no shock load permissible).

Selection Data				CAD11	CAD12
Rated Insulation Voltage U_i	IEC 60947-3, EN 60947-3[1]				
	VDE 0660 part 107		V	600	600
	SEV[2]		V	600	600
	UL/Canada		V	300	300
	min. voltage		V	1	6
Rated Impulse Withstand Voltage U_{imp}				on request	
Rated Thermal Current I_u/I_{th}	IEC 60947-3, EN 60947-3				
	VDE 0660 part 107		A	6	6
	SEV[2]		A	5	5
	UL/Canada		A	6	6
Rated Operational Current I_e	IEC 60947-3, EN 60947-3				
	VDE 0660 part 107				
AC-21A Switching of resistive loads, including moderate overloads	UL/Canada[3]	1 V/6 V	A	6/3	–/6
		12 V/24 V	A	2/1	5/5
		48 V/110 V	A	0,8/0,4	4/3
		220 V/400 V	A	0,2/0,13	2/1,3
		440 V/500 V	A	0,1/0,08	1/0,8
		600 V	A	0,05	0,5
AC-1 Resistive or low inductive loads	SEV[2]	1 V/6 V	A	5/3	–/5
		12 V/24 V	A	2/1	5/5
		48 V/110 V	A	0,8/0,4	4/3
		220 V/380 V	A	0,2/0,13	2/1,3
		440 V/500 V	A	0,1/0,08	1/0,8
		600 V	A	0,05	0,5
Power loss per contact at I_u			W	0,5	0,2
Short Circuit Protection					
Max. fuse size		(gL-characteristic)	A	6	6
Rated short-time withstand current		(1s-current)	A	35	50
DC Switching Capacity[5]	IEC 60947-3, EN 60947-3				
	VDE 0660 part 107				
DC-1 Resistive load T = 1 ms	SEV[2]	1 V/6 V	A	4/2,5	–/4
	UL/Canada[3]	12 V/24 V	A	1,5/0,8	3/2,2
		48 V/60 V	A	0,3/0,27	1,2/1
		110 V/220 V	A	0,2/0,1	0,6/0,3
		240 V/500 V	A	0,08/0,03	0,25/0,1
		600 V	A	0,02	0,1
Max. Permissible Wire Gage - Use copper wire only					
				2x	2x
Single-core or stranded wire			mm^2	2,5	2,5
			AWG	12	12
				2x	2x
Flexible wire			mm^2	2,5	2,5
(sleeving in accordance with DIN 46228)				(2,5)	(2,5)
			AWG	14	14
Ambient Temperature of Stages[4, 6]		open at 100 % I_u/I_{th}		55 °C during 24 hours with peaks up to 60 °C	
		enclosed at 100 % I_{the}		35 °C during 24 hours with peaks up to 40 °C	

[1]Valid for lines with grounded common neutral termination, overvoltage category III, pollution degree 3. Values for other supply systems on request.
[2]International Standards and Approvals, refer to page 39. [3]Max. 300 V. [4]For electromagnetic optional extras see additional data in Catalog 101.
[5]Values for switches with spring return on request. [6]Storage temperature: -40 °C to 85 °C (in case of temperature below -5 °C no shock load permissible).

4.6 TERMINALS & LINKS

Phoenix Contact – **UT4-HESI LED 24 (5x20)** – Fused Terminal with LED 24v

Phoenix Contact – **M205** – Fuse Cartridges

Phoenix Contact – **UT4-MT P/P** – Disconnect Terminals

Phoenix Contact – **UT4-MTD-PE/S** – Earth Terminals

Phoenix Contact – **UBE** – Group Marker Carrier

Phoenix Contact – **PS6** – Test Plug Adapter

Phoenix Contact – **SZS 0.6x3.5** – Screw Driver

Phoenix Contact – **FBS** – Plug-In Bridge

Phoenix Contact – **MSTB 2.5/20-ST-2.08** – Disconnect Plugs

Phoenix Contact – **UMSTBVKZ 2.5/20-G-5.08** – Disconnect Blocks

Phoenix Contact – **KGS-MSTB 2.5/20** – Cable Housing

Phoenix Contact – **CP-MSTB + CR-MSTB** – Coding Pins

D&L – **2DLA18** – 18 Hole Neutral Link

D&L – **2DLAE18** – 18 Hole Earth Link

D&L – **DLBE12** – 12 Hole Instrument Earth Link

Clipsal – **L7** – 7 Hole Link

PHOENIX CONTACT

Extract from the online catalog

UT 4-HESI (5X20)

Order No.: 3046032

http://eshop.phoenixcontact.de/phoenix/treeViewClick.do?UID=3046032

Fuse modular terminal block, Connection method: Screw connection, Cross section: 0.14 mm² - 6 mm², AWG: 26 - 10, Nominal current: 6.3 A, Nominal voltage: 500 V, Width: 6.2 mm, Fuse type: G / 5 x 20, Fuse type: Glass, Mounting type: NS 35/7,5, NS 35/15, Color: black

Commercial data	
EAN	4017918956578
Pack	50 pcs.
Customs tariff	85369010
Weight/Piece	0.018103 KG
Catalog page information	Page 44 (CL-2009)

Product notes

WEEE/RoHS-compliant since: 01/01/2003

http://www.download.phoenixcontact.com
Please note that the data given here has been taken from the online catalog. For comprehensive information and data, please refer to the user documentation. The General Terms and Conditions of Use apply to Internet downloads.

Technical data

General

Number of levels	1
Number of connections	2
Color	black

UT 4-HESI (5X20) Order No.: 3046032
http://eshop.phoenixcontact.de/phoenix/treeViewClick.do?UID=3046032

Insulating material	PA
Inflammability class acc. to UL 94	V0

Dimensions

Width	6.2 mm
Length	57.8 mm
Height NS 35/7,5	73 mm
Height NS 35/15	80.5 mm

Technical data

Fuse	G / 5 x 20
Fuse type	Glass
Rated surge voltage	4 kV
Pollution degree	3
Surge voltage category	III
Insulating material group	I
Connection in acc. with standard	IEC 60947-7-3
Nominal current I_N	6.3 A
Nominal voltage U_N	500 V (if used as fuse terminal block)
	500 V (if used as disconnect terminal block)

Connection data

Conductor cross section solid min.	0.14 mm²
Conductor cross section solid max.	6 mm²
Conductor cross section stranded min.	0.14 mm²
Conductor cross section stranded max.	6 mm²
Conductor cross section AWG/kcmil min.	26
Conductor cross section AWG/kcmil max	10
Conductor cross section stranded, with ferrule without plastic sleeve min.	0.14 mm²
Conductor cross section stranded, with ferrule without plastic sleeve max.	4 mm²
Conductor cross section stranded, with ferrule with plastic sleeve min.	0.14 mm²
Conductor cross section stranded, with ferrule with plastic sleeve max.	4 mm²
2 conductors with same cross section, solid min.	0.14 mm²
2 conductors with same cross section, solid max.	1.5 mm²

UT 4-HESI (5X20) Order No.: 3046032
http://eshop.phoenixcontact.de/phoenix/treeViewClick.do?UID=3046032

2 conductors with same cross section, stranded min.	0.14 mm²
2 conductors with same cross section, stranded max.	1.5 mm²
2 conductors with same cross section, stranded, ferrules without plastic sleeve, min.	0.14 mm²
2 conductors with same cross section, stranded, ferrules without plastic sleeve, max.	1.5 mm²
2 conductors with same cross section, stranded, TWIN ferrules with plastic sleeve, min.	0.5 mm²
2 conductors with same cross section, stranded, TWIN ferrules with plastic sleeve, max.	2.5 mm²
Type of connection	Screw connection
Stripping length	9 mm
Internal cylindrical gage	A4
Screw thread	M3
Tightening torque, min	0.6 Nm
Tightening torque max	0.8 Nm

Certificates / Approvals

Certification	CB, CSA, CUL, DNV, GL, KEMA, LR, UL

CSA

Nominal voltage U_N	600 V
Nominal current I_N	6.3 A
AWG/kcmil	26-10

CUL

Nominal voltage U_N	600 V
Nominal current I_N	6.3 A
AWG/kcmil	26-10

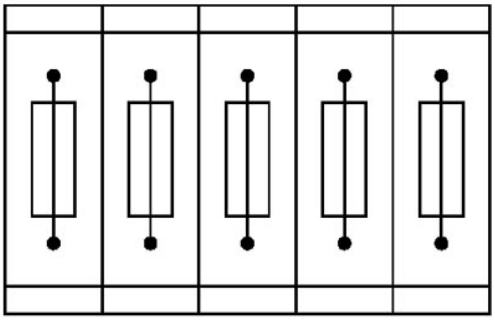
UL

Nominal voltage U_N	600 V
Nominal current I_N	6.3 A
AWG/kcmil	26-10

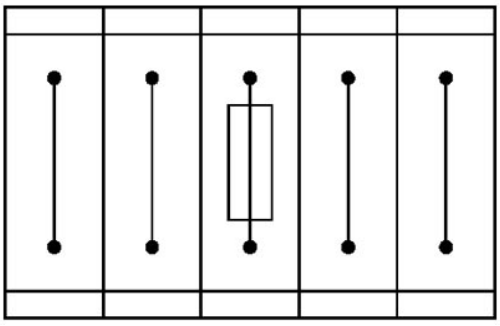
UT 4-HESI (5X20) Order No.: 3046032
http://eshop.phoenixcontact.de/phoenix/treeViewClick.do?UID=3046032

Drawings

Application drawing

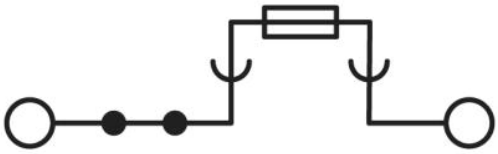


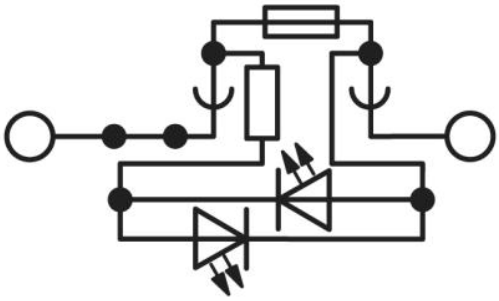
Fuse terminal blocks in interconnected arrangement,
block consisting of 5 fuse terminal blocks



Fuse terminal block in single arrangement,
block consisting of one fuse terminal block and 4 feed-through terminal blocks

Circuit diagram





UT 4-MT

Please note that the data given here has been taken from the online catalog. For comprehensive information and data, please refer to the user documentation at http://www.download.phoenixcontact.com. The General Terms and Conditions of Use apply to Internet downloads.

Extract from the online catalog

Universal terminal block with screw connection, cross section: 0.14 - 4 mm² , AWG: 26 - 10, width: 6.2 mm, color: Gray

Order No.	3046139
Ord designation	UT 4-MT
EAN	4017918975562
Pack	50 Pcs.
Customs tariff	85369010
Catalog page information	Page 20 (NTK-2005)

Technical data

General	
Number of levels	1
Number of connections	2
Color	gray
Insulating material	PA
Inflammability class acc. to UL 94	V0

Dimensions

Width	6.2 mm
Length	56.8 mm
Height NS 35/7,5	47.5 mm
Height NS 35/15	55 mm

Technical data

Maximum load current	16 A
Rated surge voltage	8 kV
Contamination class	3
Surge voltage category	III
Insulating material group	I
Connection in acc. with standard	IEC/ DIN VDE
Nominal current I_N	16 A
Nominal voltage U_N	500 V
Open side panel	nein

Connection data

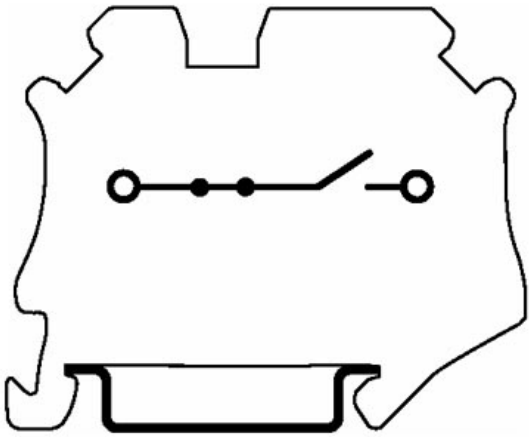
Conductor cross section, rigid min.	0.14 mm²
Conductor cross section, rigid max.	6 mm²
Conductor cross section flexible min.	0.14 mm²
Conductor cross section, flexible max.	4 mm²
Conductor cross section AWG/kcmil min.	26
Conductor cross section AWG/kcmil max	10
Conductor cross section flexible, with ferrule without plastic sleeve min.	0.25 mm²
Conductor cross section flexible, with ferrule without plastic sleeve max.	4 mm²
Conductor cross section flexible, with ferrule with plastic sleeve min.	0.25 mm²
Conductor cross section flexible, with ferrule with plastic sleeve max.	4 mm²
2 conductors with same cross section, solid min.	0.14 mm²
2 conductors with same cross section, solid max.	1.5 mm²
2 conductors with same cross section, flexible, min.	0.14 mm²
2 conductors with same cross section, flexible max.	1.5 mm²
2 conductors with same cross section, flexible, TWIN ferrules with plastic sleeve, min.	0.5 mm²
2 conductors with identical cross section, flexible TWIN ferrules with plastic sleeve, max.	2.5 mm²
2 conductors with same cross section, flexible, ferrules without plastic sleeve min.	0.25 mm²
2 conductors with same cross section, flexible, ferrules without plastic sleeve, max.	1.5 mm²
Type of connection	Screw connection
Stripping length	9 mm
Internal cylindrical gage	A4
Screw thread	M 3
Tightening torque, min	0.6 Nm

Certificates

CUL	
Nominal voltage U_N	600 V
Nominal current I_N	16 A
AWG/kcmil	26-10
UL	
Nominal voltage U_N	600 V
Nominal current I_N	16 A
AWG/kcmil	26-10

Drawings

Circuit diagram



Approval logo

Accessories

Item	Designation	Description
Assembly		
0801762	NS 35/ 7,5 CU UNPERF 2000MM	DIN rail, material: Copper, unperforated, height 7.5 mm, width 35 mm, length: 2 m
1207640	NS 35/ 7,5 PERF 755MM	NS 35 DIN rail, height 7.5 mm, length 755 mm
1207653	NS 35/ 7,5 PERF 955MM	NS35 DIN rail, height 7.5 mm, length 955 mm
1207666	NS 35/ 7,5 PERF 1155MM	NS 35 DIN rail, height 7.5 mm, length 1155 mm
0801733	NS 35/ 7,5 PERF 2000MM	DIN rail, material: Steel, perforated, height 7.5 mm, width 35 mm, length: 2 m
0801681	NS 35/ 7,5 UNPERF 2000MM	DIN rail, material: Steel, unperforated, height 7.5 mm, width 35 mm, length: 2 m
1201756	NS 35/15 AL UNPERF 2000MM	DIN rail, deep-drawn, high profile, unperforated, 1.5 mm thick, material: Aluminum, height 15 mm, width 35 mm, length 2 m
1201895	NS 35/15 CU UNPERF 2000MM	DIN rail, material: Copper, unperforated, 1.5 mm thick, height 15 mm, width 35 mm, length: 2 m
1207679	NS 35/15 PERF 755MM	NS 35 DIN rail, height 15 mm, length 755 mm
1207682	NS 35/15 PERF 955MM	NS 35 DIN rail, height 15 mm, length 955 mm
1207695	NS 35/15 PERF 1155MM	NS 35 DIN rail, height 15 mm, length 1155 mm
1201730	NS 35/15 PERF 2000MM	DIN rail, material: Steel, perforated, height 15 mm, width 35 mm, length: 2 m
1201714	NS 35/15 UNPERF 2000MM	DIN rail, material: Steel, unperforated, height 15 mm, width 35 mm, length: 2 m
1201798	NS 35/15-2,3 UNPERF 2000MM	DIN rail, material: Steel, unperforated, 2.3 mm thick, height 15 mm, width 35 mm, length: 2 m
Bridges		
3030336	FBS 2-6	Plug-in bridge for cross-connections in the terminal center, 2-pos., color: Red
3030242	FBS 3-6	Plug-in bridge for cross-connections in the terminal center, 3-pos., color: Red
3030255	FBS 4-6	Plug-in bridge for cross-connections in the terminal center, 4-pos., color: Red
3030349	FBS 5-6	Plug-in bridge for cross-connections in the terminal center, 5-pos., color: Red
3030271	FBS 10-6	Plug-in bridge for cross-connections in the terminal center, 10-pos., color: Red
3030365	FBS 20-6	Plug-in bridge for cross-connections in the terminal center, 20-pos., color: Red
3047060	RB UT 10-(2,5/4)	Reducing bridge, for connection from UT 10 to UT 4 or UT 2,5

UT 4-MT

Marking

0811228	X-PEN 0,35	Marker pen without ink cartridge, for manual labeling of markers, labeling extremely wipe-proof, line thickness 0.35 mm
1051016	ZB 6,LGS:FORTL.ZAHLEN	Zack strip, 10-section, printed horizontally: with the numbers, 1-10, 11-20 etc. up to 991-1000, color: white
5060935	ZB 6/WH-100:UNBEDRUCKT	Zack strip, unprinted: For individual labeling with M-PEN, ZB-T or CMS system, large batch, sufficient for labeling 1000 terminal blocks, for a terminal width of 6.2 mm, color: White
1050499	ZB 6:SO/CMS	Zack strip, 10-section, divisible, special printing, marking according to customer requirements

Plug/Adapter

0201689	MPS-IH BU	
0201676	MPS-IH RD	
0201663	MPS-IH WH	
0201744	MPS-MT	Test plug, consisting of: Metal part for 2.3 mm diameter socket hole
3030925	PAI-4	Test adapter, for 4 mm diameter test plug PS and safety test plug, makes contact in the bridge shaft
3030996	PS-6	Modular test plug, for individual assembly of test plug strips, for UT, ST, DT and QT terminal blocks, can be labeled with ZBF 6, color: Red

Tools

1205053	SZS 0,6X3,5	Screwdriver, bladed, matches all screw terminal blocks up to 4.0 mm² connection cross section, blade: 0.6 x 3.5 mm, without VDE approval

Extract from the online catalog

MSTB 2,5/10-ST-5,08

Order No.: 1757093

The figure shows a 10-position version of the product

http://eshop.phoenixcontact.de/phoenix/treeViewClick.do?UID=1757093

Plug component, Nominal current: 12 A, Rated voltage (III/2): 320 V, Pitch: 5.08 mm, Color: green, Metal surface: Sn

Commercial data	
GTIN (EAN)	4017918029623
sales group	E111
Pack	50 pcs.
Customs tariff	85366990
Weight/Piece	0.01727 KG
Catalog page information	Page 198 (CC-2009)

Product notes

WEEE/RoHS-compliant since: 01/01/2003

http://www.download.phoenixcontact.com
Please note that the data given here has been taken from the online catalog. For comprehensive information and data, please refer to the user documentation. The General Terms and Conditions of Use apply to Internet downloads.

Technical data

Dimensions / positions

Pitch	5.08 mm
Dimension a	45.72 mm
Number of positions	10
Screw thread	M3
Tightening torque, min	0.5 Nm

MSTB 2,5/10-ST-5,08 Order No.: 1757093
http://eshop.phoenixcontact.de/phoenix/treeViewClick.do?UID=1757093

Tightening torque max	0.6 Nm

Technical data

Insulating material group	I
Rated surge voltage (III/3)	4 kV
Rated surge voltage (III/2)	4 kV
Rated surge voltage (II/2)	4 kV
Rated voltage (III/2)	320 V
Rated voltage (II/2)	630 V
Connection in acc. with standard	EN-VDE
Nominal current I_N	12 A
Nominal voltage U_N	250 V
Nominal cross section	2.5 mm²
Maximum load current	12 A (with 2.5 mm^2 conductor cross section)
Insulating material	PA
Inflammability class acc. to UL 94	V0
Internal cylindrical gage	A3
Stripping length	7 mm
Nominal voltage, UL/CUL Use Group B	250 V
Nominal current, UL/CUL Use Group B	12 A
Nominal voltage, UL/CUL Use Group D	300 V
Nominal current, UL/CUL Use Group D	10 A

Connection data

Conductor cross section solid min.	0.2 mm²
Conductor cross section solid max.	2.5 mm²
Conductor cross section stranded min.	0.2 mm²
Conductor cross section stranded max.	2.5 mm²
Conductor cross section stranded, with ferrule without plastic sleeve min.	0.25 mm²
Conductor cross section stranded, with ferrule without plastic sleeve max.	2.5 mm²
Conductor cross section stranded, with ferrule with plastic sleeve min.	0.25 mm²
Conductor cross section stranded, with ferrule with plastic sleeve max.	2.5 mm²
Conductor cross section AWG/kcmil min.	24
Conductor cross section AWG/kcmil max	12

MSTB 2,5/10-ST-5,08 Order No.: 1757093
http://eshop.phoenixcontact.de/phoenix/treeViewClick.do?UID=1757093

2 conductors with same cross section, solid min.	0.2 mm²
2 conductors with same cross section, solid max.	1 mm²
2 conductors with same cross section, stranded min.	0.2 mm²
2 conductors with same cross section, stranded max.	1.5 mm²
2 conductors with same cross section, stranded, ferrules without plastic sleeve, min.	0.25 mm²
2 conductors with same cross section, stranded, ferrules without plastic sleeve, max.	1 mm²
2 conductors with same cross section, stranded, TWIN ferrules with plastic sleeve, min.	0.5 mm²
2 conductors with same cross section, stranded, TWIN ferrules with plastic sleeve, max.	1.5 mm²
Minimum AWG according to UL/CUL	30
Maximum AWG according to UL/CUL	12

Certificates / Approvals

Certification	CB, CSA, CUL, GOST, UL, VDE-PZI

CSA

Nominal voltage U_N	300 V
Nominal current I_N	10 A
AWG/kcmil	28-12

CUL

Nominal voltage U_N	300 V
Nominal current I_N	10 A
AWG/kcmil	30-12

UL

Nominal voltage U_N	300 V
Nominal current I_N	10 A
AWG/kcmil	30-12

MSTB 2,5/10-ST-5,08 Order No.: 1757093
http://eshop.phoenixcontact.de/phoenix/treeViewClick.do?UID=1757093

Accessories

Item	Designation	Description
Bridges		
1733172	EBP 3- 5	Insertion bridge, fully insulated, for plug connectors with 5.0 or 5.08 mm pitch, no. of positions: 3
1733185	EBP 4- 5	Insertion bridge, fully insulated, for plug connectors with 5.0 or 5.08 mm pitch, no. of positions: 4
1733198	EBP 5- 5	Insertion bridge, fully insulated, for plug connectors with 5.0 or 5.08 mm pitch, no. of positions: 5
1733208	EBP 6- 5	Insertion bridge, fully insulated, for plug connectors with 5.0 or 5.08 mm pitch, no. of positions: 6
General		
1733169	EBP 2- 5	Insertion bridge, fully insulated, for plug connectors with 5.0 or 5.08 mm pitch, no. of positions: 2
1783740	KGS-MSTB 2,5/10	Cable housing, Number of positions: 10, Dimension a: 50 mm, Color: green
Marking		
1051993	B-STIFT	Marker pen, for manual labeling of unprinted Zack strips, smear-proof and waterproof, line thickness 0.5 mm
0805108	SK 5,08/2,8:SO	Marker card, special printing, self-adhesive, labeled acc. to customer requirements, 14 identical marker strips per card, max. 25-position labeling per strip, color: White
0804293	SK 5,08/3,8:FORTL.ZAHLEN	Marker card, printed horizontally, self-adhesive, 12 identical decades marked 1-10, 11-20 etc. up to 91-(99)100, sufficient for 120 terminal blocks
0803883	SK U/2,8 WH:UNBEDRUCKT	Unprinted marker cards, DIN A4 format, pitch as desired, self-adhesive, with 50 stamped marker strips, 185 mm strip length, can be labeled with the CMS system or manually with the M-PEN
Plug/Adapter		
1734634	CP-MSTB	Keying profile, is inserted into the slot on the plug or inverted header, red insulating material
Tools		
1205053	SZS 0,6X3,5	Screwdriver, bladed, matches all screw terminal blocks up to 4.0 mm² connection cross section, blade: 0.6 x 3.5 mm, without VDE approval

MSTB 2,5/10-ST-5,08 Order No.: 1757093
http://eshop.phoenixcontact.de/phoenix/treeViewClick.do?UID=1757093

Additional products

Item	Designation	Description
General		
1823927	ICC 2,5/10-STZ-5,08	Plug component, Nominal current: 12 A, Rated voltage (III/2): 320 V, Pitch: 5.08 mm, Color: green, Metal surface: Sn, Corresponding male crimp contacts with current [A] and conductor cross section range [mm²] data: 10A/ICC-MT 0,5-1,0 (3190577); 10A/ICC-MT 0,5-1,0 BA (3190603); 12A/ICC-MT 1,5-2,5 (3190580); 12A/ICC-MT 1,5-2,5 BA (3190593). BA = Bandkontakte
1762457	MDSTB 2,5/10-G1-5,08	Header, Nominal current: 10 A, Rated voltage (III/2): 320 V, Pitch: 5.08 mm, Color: green, Metal surface: Sn, Assembly: Soldering, In combination with MVSTB or FKCV plug components, both an MVSTBW (or FKCVW) and an MVSTBR plug (or FKCVR) must be used. Combination with TMSTBP plug components is not possible!
1762583	MDSTBV 2,5/10-G1-5,08	Header, Nominal current: 10 A, Rated voltage (III/2): 320 V, Pitch: 5.08 mm, Color: green, Metal surface: Sn, Assembly: Soldering, In combination with MVSTB or FKCV plug components, both an MVSTBW (or FKCVW) and an MVSTBR plug (or FKCVR) must be used. Combination with TMSTBP plug components is not possible!
1770795	MSTB 2,5/10-G-5,08-LA	Header, Nominal current: 12 A, Rated voltage (III/2): 320 V, Pitch: 5.08 mm, Assembly: Soldering
1757323	MSTBA 2,5/10-G-5,08	Header, Nominal current: 12 A, Rated voltage (III/2): 320 V, Pitch: 5.08 mm, Color: green, Metal surface: Sn, Assembly: Soldering
1768024	MSTBA 2,5/10-G-5,08-LA	Header, Nominal current: 12 A, Rated voltage (III/2): 320 V, Pitch: 5.08 mm, Assembly: Soldering
1765030	MSTBHK 2,5/10-G-5,08	Plug component, Nominal current: 12 A, Rated voltage (III/2): 320 V, Pitch: 5.08 mm, Color: green, Metal surface: Sn, Assembly: DIN rail
1788800	MSTBVK 2,5/10-G-5,08	Plug component, Nominal current: 12 A, Rated voltage (III/2): 320 V, Pitch: 5.08 mm, Color: green, Metal surface: Sn, Assembly: DIN rail
1788619	MVSTBU 2,5/10-GB-5,08	Plug component, Nominal current: 12 A, Rated voltage (III/2): 320 V, Pitch: 5.08 mm, Color: green, Metal surface: Sn, Assembly: Direct mounting
1769544	SMSTB 2,5/10-G-5,08	Header, Nominal current: 12 A, Rated voltage (III/2): 320 V, Pitch: 5.08 mm, Color: green, Metal surface: Sn, Assembly: Soldering
1767452	SMSTBA 2,5/10-G-5,08	Header, Nominal current: 12 A, Rated voltage (III/2): 320 V, Pitch: 5.08 mm, Color: green, Metal surface: Sn, Assembly: Soldering
3002034	UK 3-MSTB-5,08	Feed-through modular terminal block, Type of connection: Special and hybrid connection, Screw connection, Cross section: 0.2 mm² - 4 mm², AWG 24 - 12, Width: 5.08 mm, Color: gray, Mounting type: NS 32, NS 35/15, NS 35/7,5

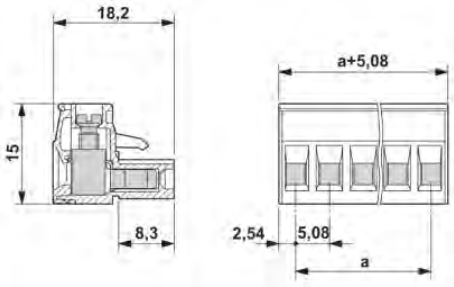
MSTB 2,5/10-ST-5,08 Order No.: 1757093
http://eshop.phoenixcontact.de/phoenix/treeViewClick.do?UID=1757093

3002076	UK 3-MVSTB-5,08	Feed-through modular terminal block, Nominal current: 12 A, Nominal voltage: 250 V, Cross section: 0.2 mm² - 4 mm², AWG: 24 - 12, Mounting type: NS 32, NS 35/15, NS 35/7,5, Pitch: 5.08 mm, Width: 5.1, Color: gray
3002102	UK 3-MVSTB-5,08-LA 24RD	Feed-through modular terminal block, Nominal current: 12 A, Nominal voltage: 250 V, Cross section: 0.2 mm² - 4 mm², AWG: 24 - 12, Mounting type: NS 32, NS 35/15, NS 35/7,5, Pitch: 5.08 mm, Width: 5.08, Color: gray
3002063	UK 3-MVSTB-5,08/EK	Feed-through modular terminal block, Nominal current: 12 A, Nominal voltage: 250 V, Cross section: 0.2 mm² - 4 mm², AWG: 24 - 12, Mounting type: NS 35/7,5, NS 35/15, NS 32, Pitch: 5.08 mm, Width: 5.1, Color: blue
3002131	UK 3D-MSTBV-5,08	Feed-through modular terminal block, Type of connection: Special and hybrid connection, Screw connection, Cross section: 0.2 mm² - 4 mm², AWG 24 - 12, Width: 5.08 mm, Color: gray, Mounting type: NS 32, NS 35/15, NS 35/7,5
3002144	UK 3D-MSTBV-5,08-LA 24RD	Feed-through modular terminal block, Type of connection: Screw connection, Screw connection, Number of positions: 1, Cross section: 0.2 mm² - 4 mm², AWG 24 - 12, Width: 5.1 mm, Color: gray, Mounting type: NS 32, NS 35/15, NS 35/7,5
3002173	UK 3D-MSTBV-5,08/EK	Feed-through modular terminal block, Type of connection: Screw connection, Screw connection, Cross section: 0.2 mm² - 4 mm², AWG 24 - 12, Width: 5.1 mm, Color: blue, Mounting type: NS 32, NS 35/15, NS 35/7,5
2770888	UKK 3-MSTB-5,08	End cover, Nominal current: 12 A, Nominal voltage: 250 V, Cross section: 0.2 mm² - 4 mm², AWG: 24 - 12, Mounting type: NS 35/7,5, NS 35/15, NS 32, Pitch: 5.08 mm, Width: 5.08, Color: gray
1876615	UKK 3-MSTB-5,08-PE	Feed-through modular terminal block, Nominal current: 12 A, Nominal voltage: 320 V, Cross section: 0.2 mm² - 4 mm², AWG: 24 - 12, Mounting type: NS 35/7,5, NS 35/15, NS 32, Pitch: 5.08 mm, Width: 5.08, Color: green-yellow
2770846	UKK 3-MSTBVH-5,08	Feed-through modular terminal block, Nominal current: 12 A, Nominal voltage: 250 V, Cross section: 0.2 mm² - 4 mm², AWG: 24 - 12, Mounting type: NS 35/7,5, NS 35/15, NS 32, Pitch: 5.08 mm, Width: 5.08, Color: gray
1788198	UMSTBVK 2,5/10-G-5,08	Plug component, Nominal current: 12 A, Rated voltage (III/2): 320 V, Pitch: 5.08 mm, Color: green, Metal surface: Sn, Assembly: DIN rail
1873016	ZFKK 1,5-MSTBV-5,08	Feed-through modular terminal block, Connection method: Special and hybrid connection, MSTB plug entry, Cross section: 0.2 mm² - 2.5 mm², Width: 5.1 mm, Color: gray

MSTB 2,5/10-ST-5,08 Order No.: 1757093
http://eshop.phoenixcontact.de/phoenix/treeViewClick.do?UID=1757093

Diagrams/Drawings

Dimensioned drawing



PHOENIX CONTACT

Extract from the online catalog

FBS 10-8

Order No.: 3030323

http://eshop.phoenixcontact.de/phoenix/treeViewClick.do?UID=3030323

Cross connector/jumper for modular terminal block, Number of positions: 10, Color: red

Commercial data	
EAN	4017918188634
Pack	10 pcs.
Customs tariff	85389099
Weight/Piece	0.01955 KG
Catalog page information	Page 330 (CL-2009)

Product notes

WEEE/RoHS-compliant since: 01/01/2003

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PHOENIX CONTACT

Extract from the online catalog

SZF 1-0,6X3,5

Order No.: 1204517

http://eshop.phoenixcontact.de/phoenix/treeViewClick.do?UID=1204517

Screwdriver, blade: 0.6 x 3.5 x 100 mm, length 180 mm

Commercial data	
GTIN (EAN)	4017918018948
sales group	C200
Pack	10 pcs.
Customs tariff	82054000
Weight/Piece	0.0368 KG
Catalog page information	Page 8 (NTK-2010)

Product notes

WEEE/RoHS-compliant since: 11/01/2008

http://www.download.phoenixcontact.com
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Technical data

General

Length (b)	181 mm
Width (a)	26 mm
Design	Phillips

SZF 1-0,6X3,5 Order No.: 1204517
http://eshop.phoenixcontact.de/phoenix/treeViewClick.do?UID=1204517

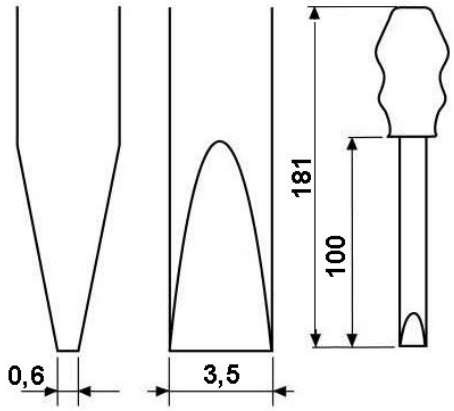
Blade thickness	0.6 mm
Blade width	3.5 mm
Blade height	100 mm
Weight	34 g
Test standard	DIN 5264

Certificates / Approvals

Certification	GOST

Diagrams/Drawings

Dimensioned drawing



Extract from the online catalog

PS-6/2,3MM RD

Order No.: 3038736

The illustration shows the version PS-5/2,3 MM RD

http://eshop.phoenixcontact.de/phoenix/treeViewClick.do?UID=3038736

Test plugs, Color: red

Commercial data	
GTIN (EAN)	4017918904166
sales group	A691
Pack	10 pcs.
Customs tariff	85369010
Weight/Piece	0.00143 KG
Catalog page information	Page 449 (CL-2009)

Product notes

WEEE/RoHS-compliant since: 01/01/2003

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Extract from the online catalog

UBE/D + ES/KMK 3

Order No.: 1004076

http://eshop.phoenixcontact.de/phoenix/treeViewClick.do?UID=1004076

Terminal strip marker carriers for marking terminal group, for mounting on the terminal strip NS 32 or NS 35/7.5, lettering field size: 40 x 17 mm

Commercial data	
EAN	4017918011888
Pack	10 pcs.
Customs tariff	85369010
Weight/Piece	0.0105 KG

Product notes

WEEE/RoHS-compliant since: 03/18/2004

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Technical data

General

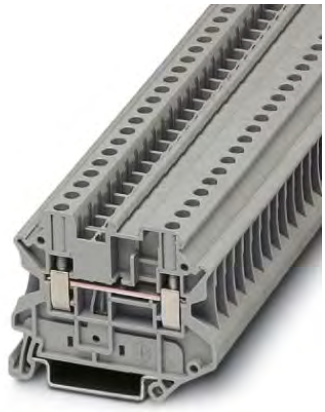
Color	gray
Base element material	PA
Inflammability class acc. to UL 94	V2
Ambient temperature (operation)	-40 °C ... 100 °C
Components	free from silicone and halogen

PHOENIX CONTACT

Extract from the online catalog

UT 4-MTD

Order No.: 3046184



http://eshop.phoenixcontact.de/phoenix/treeViewClick.do?UID=3046184

Feed-through modular terminal block, Type of connection: Screw connection, Cross section: 0.14 mm² - 6 mm², AWG 26 - 10, Width: 6.2 mm, Color: gray, Mounting type: NS 35/7,5, NS 35/15

Product notes

WEEE/RoHS-compliant since: 01/01/2003

Commercial data	
EAN	4017918956592
Pack	50 pcs.
Customs tariff	85369010
Weight/Piece	0.011431 KG
Catalog page information	Page 56 (CL-2009)

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Technical data

General

Number of levels	1
Number of connections	2
Color	gray

UT 4-MTD Order No.: 3046184
http://eshop.phoenixcontact.de/phoenix/treeViewClick.do?UID=3046184

Insulating material	PA
Inflammability class acc. to UL 94	V0

Dimensions

Width	6.2 mm
Length	57.8 mm
Height NS 35/7,5	47.5 mm
Height NS 35/15	55 mm

Technical data

Maximum load current	41 A (with 6 mm^2 conductor cross section)
Rated surge voltage	8 kV
Pollution degree	3
Surge voltage category	III
Insulating material group	I
Connection in acc. with standard	IEC 60947-7-1
Nominal current I_N	32 A
Nominal voltage U_N	800 V
Open side panel	ja

Connection data

Conductor cross section solid min.	0.14 mm²
Conductor cross section solid max.	6 mm²
Conductor cross section stranded min.	0.14 mm²
Conductor cross section stranded max.	6 mm²
Conductor cross section AWG/kcmil min.	26
Conductor cross section AWG/kcmil max	10
Conductor cross section stranded, with ferrule without plastic sleeve min.	0.14 mm²
Conductor cross section stranded, with ferrule without plastic sleeve max.	4 mm²
Conductor cross section stranded, with ferrule with plastic sleeve min.	0.14 mm²
Conductor cross section stranded, with ferrule with plastic sleeve max.	4 mm²
2 conductors with same cross section, solid min.	0.14 mm²
2 conductors with same cross section, solid max.	1.5 mm²
2 conductors with same cross section, stranded min.	0.14 mm²

UT 4-MTD Order No.: 3046184
http://eshop.phoenixcontact.de/phoenix/treeViewClick.do?UID=3046184

2 conductors with same cross section, stranded max.	1.5 mm²
2 conductors with same cross section, stranded, TWIN ferrules with plastic sleeve, min.	0.5 mm²
2 conductors with same cross section, stranded, TWIN ferrules with plastic sleeve, max.	2.5 mm²
2 conductors with same cross section, stranded, ferrules without plastic sleeve, min.	0.14 mm²
2 conductors with same cross section, stranded, ferrules without plastic sleeve, max.	1.5 mm²
Type of connection	Screw connection
Stripping length	9 mm
Internal cylindrical gage	A4
Screw thread	M3
Tightening torque, min	0.6 Nm
Tightening torque max	0.8 Nm

Certificates / Approvals

Certification	CB, CSA, CUL, DNV, GL, LR, UL, VDE-PZI
Certification Ex:	IECEx, KEMA-EX

CSA

Nominal voltage U_N	600 V
Nominal current I_N	30 A
AWG/kcmil	26-10

CUL

Nominal voltage U_N	600 V
Nominal current I_N	30 A
AWG/kcmil	26-10

UL

Nominal voltage U_N	600 V
Nominal current I_N	30 A
AWG/kcmil	26-10

UT 4-MTD Order No.: 3046184
http://eshop.phoenixcontact.de/phoenix/treeViewClick.do?UID=3046184

Accessories

Item	Designation	Description
Assembly		
3022276	CLIPFIX 35-5	Snap-on end bracket, for NS 35/7.5 or NS 35/15 DIN rail, can be fitted with Zack strip ZB 5 and ZBF 5, terminal strip marker KLM 2 and KLM, parking facility for FBS...5, FBS...6, KSS 5, KSS 6, width: 5,15 mm, color: gray
3047141	D-UT 2,5/4-TWIN	End cover, Width: 2.2 mm, Color: gray
0801762	NS 35/ 7,5 CU UNPERF 2000MM	DIN rail, material: Copper, unperforated, height 7.5 mm, width 35 mm, length: 2 m
1207640	NS 35/ 7,5 PERF 755MM	NS 35 DIN rail, height 7.5 mm, length 755 mm
1207653	NS 35/ 7,5 PERF 955MM	NS35 DIN rail, height 7.5 mm, length 955 mm
1207666	NS 35/ 7,5 PERF 1155MM	NS 35 DIN rail, height 7.5 mm, length 1155 mm
0801733	NS 35/ 7,5 PERF 2000MM	DIN rail, material: Steel, galvanized and passivated with a thick layer, perforated, height 7.5 mm, width 35 mm, length: 2 m
0801681	NS 35/ 7,5 UNPERF 2000MM	DIN rail, material: Steel, unperforated, height 7.5 mm, width 35 mm, length: 2 m
1201756	NS 35/15 AL UNPERF 2000MM	DIN rail, deep-drawn, high profile, unperforated, 1.5 mm thick, material: Aluminum, height 15 mm, width 35 mm, length 2 m
1201895	NS 35/15 CU UNPERF 2000MM	DIN rail, material: Copper, unperforated, 1.5 mm thick, height 15 mm, width 35 mm, length: 2 m
1207679	NS 35/15 PERF 755MM	NS 35 DIN rail, perforated, height 15 mm, length 755 mm
1207682	NS 35/15 PERF 955MM	NS 35 DIN rail, perforated, height 15 mm, length 955 mm
1207695	NS 35/15 PERF 1155MM	NS 35 DIN rail, perforated, height 15 mm, length 1155 mm
1201730	NS 35/15 PERF 2000MM	DIN rail, material: Steel, perforated, height 15 mm, width 35 mm, length: 2 m
1201714	NS 35/15 UNPERF 2000MM	DIN rail, material: Steel, unperforated, height 15 mm, width 35 mm, length: 2 m
1201798	NS 35/15-2,3 UNPERF 2000MM	DIN rail, material: Steel, unperforated, 2.3 mm thick, height 15 mm, width 35 mm, length: 2 m
Bridges		
3030336	FBS 2-6	Cross connector/bridge, Number of positions: 2, Color: red
3030242	FBS 3-6	Cross connector/bridge, Number of positions: 3, Color: red
3030255	FBS 4-6	Cross connector/bridge, Number of positions: 4, Color: red
3030349	FBS 5-6	Cross connector/bridge, Number of positions: 5, Color: red
3030271	FBS 10-6	Cross connector/bridge, Number of positions: 10, Color: red
3030365	FBS 20-6	Cross connector/bridge, Number of positions: 20, Color: red
3032224	FBS 50-6	Cross connector/bridge, Number of positions: 50, Color: red

UT 4-MTD Order No.: 3046184
http://eshop.phoenixcontact.de/phoenix/treeViewClick.do?UID=3046184

3047060	RB UT 10-(2,5/4)	Cross connector/bridge, Number of positions: 2, Color: red

Marking

1051993	B-STIFT	Marker pen, for manual labeling of unprinted Zack strips, smear-proof and waterproof, line thickness 0.5 mm
0811228	X-PEN 0,35	Marker pen without ink cartridge, for manual labeling of markers, labeling extremely wipe-proof, line thickness 0.35 mm
1051016	ZB 6,LGS:FORTL.ZAHLEN	Zack strip, 10-section, printed horizontally: with the numbers, 1-10, 11-20 etc. up to 991-1000, color: white
1051032	ZB 6,LGS:GLEICHE ZAHLEN	Zack marker strip, labeled horizontally: 10-section, with identical numbers, 1/1/1, 2/2/2 etc. up to 1000/1000/1000, color: white
1051029	ZB 6,QR:FORTL.ZAHLEN	Zack strip, 10-section, printed vertically: with consecutive numbers, 1-10, 11-20 a.s.o. up to 991-1000, color: white
1051045	ZB 6,QR:GLEICHE ZAHLEN	Zack marker, labeled vertically: 10-section, with identical numbers, 1/1/1, 2/2/2 etc. up to 1000/1000/1000, color: White
1050499	ZB 6:SO/CMS	Zack strip, 10-section, divisible, special printing, marking according to customer requirements
1051003	ZB 6:UNBEDRUCKT	Zack strip, unprinted, strips with 10 labels for individual labeling with M-PEN or CMS system, for terminal block width: 6.2 mm, color: white

Plug/Adapter

0201731	MPS-IH BK	Insulating sleeve, for MPS metal part, Color: black
0201702	MPS-IH GN	Insulating sleeve, for MPS metal part, Color: green
0201676	MPS-IH RD	Insulating sleeve, Color: red
0201663	MPS-IH WH	Insulating sleeve, for MPS metal part, Color: white
0201744	MPS-MT	Metal part
3030925	PAI-4	Test adapter, Color: gray
3030996	PS-6	Test adapter, Color: red

Tools

1205053	SZS 0,6X3,5	Screwdriver, bladed, matches all screw terminal blocks up to 4.0 mm² connection cross section, blade: 0.6 x 3.5 mm, without VDE approval

Diagrams/Drawings

Circuit diagram

ST-SI-UK 4

Description	Light indicator: Voltage [V AC/DC]	Current [mA]		Type		Order No.	Pcs. Pkt.
Fuse plug, for cartridge fuse inserts 5 x 20 mm, 26.5 mm high, color: black				**ST-SI-UK 4**	$I_{max.}$: 6.3 A [1] [2]	**09 21 01 1**	50
Fuse plug, as above, however with light indicator:	5 - 15	2 - 7.5		**ST-SILED 12-UK 4**	$I_{max.}$: 6.3 A [1] [2]	**09 21 02 4**	50
	15 - 30	3.5 - 7.5		**ST-SILED 24-UK 4**	6.3 A [1] [2]	**09 21 03 7**	50
	30 - 60	2.5 - 5.5		**ST-SILED 60-UK 4**	6.3 A [1] [2]	**09 21 04 0**	50
	110 - 250	0.5 - 1		**ST-SILA 250-UK 4**	6.3 A [1] [2]	**09 21 05 3**	50

Technical data		
Insulation material		PA
Inflammability class acc. to UL 94		V2
Temperature indices RTI / Ti		130 / 120
Approval data (UL and CSA)		
Nom. voltage / nom. current	UL: [V] / [A]	300 / 6.3
	CSA: [V] / [A]	300 / 10

[1]) With single arrangements.
[2]) Max. power dissipation see info.

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Extract from the online catalog

SZF 1-0,6X3,5

Order No.: 1204517

http://eshop.phoenixcontact.de/phoenix/treeViewClick.do?UID=1204517

Screwdriver, blade: 0.6 x 3.5 x 100 mm, length 180 mm

Commercial data	
GTIN (EAN)	4017918018948
sales group	C200
Pack	10 pcs.
Customs tariff	82054000
Weight/Piece	0.0368 KG
Catalog page information	Page 8 (NTK-2010)

Product notes

WEEE/RoHS-compliant since: 11/01/2008

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Technical data

General

Length (b)	181 mm
Width (a)	26 mm
Design	Phillips

SZF 1-0,6X3,5 Order No.: 1204517
http://eshop.phoenixcontact.de/phoenix/treeViewClick.do?UID=1204517

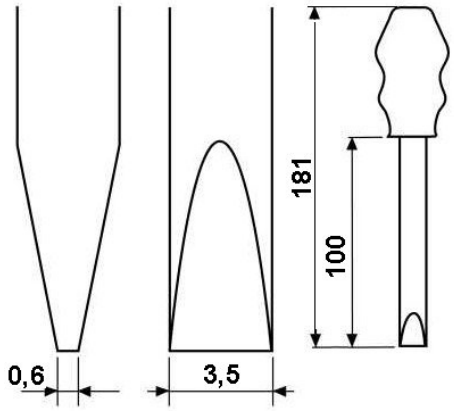
Blade thickness	0.6 mm
Blade width	3.5 mm
Blade height	100 mm
Weight	34 g
Test standard	DIN 5264

Certificates / Approvals

Certification	GOST

Diagrams/Drawings

Dimensioned drawing



Extract from the online catalog

MSTB 2,5/10-ST-5,08

Order No.: 1757093

The figure shows a 10-position version of the product

http://eshop.phoenixcontact.de/phoenix/treeViewClick.do?UID=1757093

Plug component, Nominal current: 12 A, Rated voltage (III/2): 320 V, Pitch: 5.08 mm, Color: green, Metal surface: Sn

Commercial data	
GTIN (EAN)	4017918029623
sales group	E111
Pack	50 pcs.
Customs tariff	85366990
Weight/Piece	0.01727 KG
Catalog page information	Page 198 (CC-2009)

Product notes

WEEE/RoHS-compliant since: 01/01/2003

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Technical data

Dimensions / positions

Pitch	5.08 mm
Dimension a	45.72 mm
Number of positions	10
Screw thread	M3
Tightening torque, min	0.5 Nm

MSTB 2,5/10-ST-5,08 Order No.: 1757093
http://eshop.phoenixcontact.de/phoenix/treeViewClick.do?UID=1757093

Tightening torque max	0.6 Nm

Technical data

Insulating material group	I
Rated surge voltage (III/3)	4 kV
Rated surge voltage (III/2)	4 kV
Rated surge voltage (II/2)	4 kV
Rated voltage (III/2)	320 V
Rated voltage (II/2)	630 V
Connection in acc. with standard	EN-VDE
Nominal current I_N	12 A
Nominal voltage U_N	250 V
Nominal cross section	2.5 mm²
Maximum load current	12 A (with 2.5 mm^2 conductor cross section)
Insulating material	PA
Inflammability class acc. to UL 94	V0
Internal cylindrical gage	A3
Stripping length	7 mm
Nominal voltage, UL/CUL Use Group B	250 V
Nominal current, UL/CUL Use Group B	12 A
Nominal voltage, UL/CUL Use Group D	300 V
Nominal current, UL/CUL Use Group D	10 A

Connection data

Conductor cross section solid min.	0.2 mm²
Conductor cross section solid max.	2.5 mm²
Conductor cross section stranded min.	0.2 mm²
Conductor cross section stranded max.	2.5 mm²
Conductor cross section stranded, with ferrule without plastic sleeve min.	0.25 mm²
Conductor cross section stranded, with ferrule without plastic sleeve max.	2.5 mm²
Conductor cross section stranded, with ferrule with plastic sleeve min.	0.25 mm²
Conductor cross section stranded, with ferrule with plastic sleeve max.	2.5 mm²
Conductor cross section AWG/kcmil min.	24
Conductor cross section AWG/kcmil max	12

MSTB 2,5/10-ST-5,08 Order No.: 1757093
http://eshop.phoenixcontact.de/phoenix/treeViewClick.do?UID=1757093

2 conductors with same cross section, solid min.	0.2 mm²
2 conductors with same cross section, solid max.	1 mm²
2 conductors with same cross section, stranded min.	0.2 mm²
2 conductors with same cross section, stranded max.	1.5 mm²
2 conductors with same cross section, stranded, ferrules without plastic sleeve, min.	0.25 mm²
2 conductors with same cross section, stranded, ferrules without plastic sleeve, max.	1 mm²
2 conductors with same cross section, stranded, TWIN ferrules with plastic sleeve, min.	0.5 mm²
2 conductors with same cross section, stranded, TWIN ferrules with plastic sleeve, max.	1.5 mm²
Minimum AWG according to UL/CUL	30
Maximum AWG according to UL/CUL	12

Certificates / Approvals

Certification	CB, CSA, CUL, GOST, UL, VDE-PZI

CSA

Nominal voltage U_N	300 V
Nominal current I_N	10 A
AWG/kcmil	28-12

CUL

Nominal voltage U_N	300 V
Nominal current I_N	10 A
AWG/kcmil	30-12

UL

Nominal voltage U_N	300 V
Nominal current I_N	10 A
AWG/kcmil	30-12

MSTB 2,5/10-ST-5,08 Order No.: 1757093
http://eshop.phoenixcontact.de/phoenix/treeViewClick.do?UID=1757093

Accessories

Item	Designation	Description
Bridges		
1733172	EBP 3- 5	Insertion bridge, fully insulated, for plug connectors with 5.0 or 5.08 mm pitch, no. of positions: 3
1733185	EBP 4- 5	Insertion bridge, fully insulated, for plug connectors with 5.0 or 5.08 mm pitch, no. of positions: 4
1733198	EBP 5- 5	Insertion bridge, fully insulated, for plug connectors with 5.0 or 5.08 mm pitch, no. of positions: 5
1733208	EBP 6- 5	Insertion bridge, fully insulated, for plug connectors with 5.0 or 5.08 mm pitch, no. of positions: 6
General		
1733169	EBP 2- 5	Insertion bridge, fully insulated, for plug connectors with 5.0 or 5.08 mm pitch, no. of positions: 2
1783740	KGS-MSTB 2,5/10	Cable housing, Number of positions: 10, Dimension a: 50 mm, Color: green
Marking		
1051993	B-STIFT	Marker pen, for manual labeling of unprinted Zack strips, smear-proof and waterproof, line thickness 0.5 mm
0805108	SK 5,08/2,8:SO	Marker card, special printing, self-adhesive, labeled acc. to customer requirements, 14 identical marker strips per card, max. 25-position labeling per strip, color: White
0804293	SK 5,08/3,8:FORTL.ZAHLEN	Marker card, printed horizontally, self-adhesive, 12 identical decades marked 1-10, 11-20 etc. up to 91-(99)100, sufficient for 120 terminal blocks
0803883	SK U/2,8 WH:UNBEDRUCKT	Unprinted marker cards, DIN A4 format, pitch as desired, self-adhesive, with 50 stamped marker strips, 185 mm strip length, can be labeled with the CMS system or manually with the M-PEN
Plug/Adapter		
1734634	CP-MSTB	Keying profile, is inserted into the slot on the plug or inverted header, red insulating material
Tools		
1205053	SZS 0,6X3,5	Screwdriver, bladed, matches all screw terminal blocks up to 4.0 mm² connection cross section, blade: 0.6 x 3.5 mm, without VDE approval

MSTB 2,5/10-ST-5,08 Order No.: 1757093
http://eshop.phoenixcontact.de/phoenix/treeViewClick.do?UID=1757093

Additional products

Item	Designation	Description
General		
1823927	ICC 2,5/10-STZ-5,08	Plug component, Nominal current: 12 A, Rated voltage (III/2): 320 V, Pitch: 5.08 mm, Color: green, Metal surface: Sn, Corresponding male crimp contacts with current [A] and conductor cross section range [mm²] data: 10A/ICC-MT 0,5-1,0 (3190577); 10A/ICC-MT 0,5-1,0 BA (3190603); 12A/ICC-MT 1,5-2,5 (3190580); 12A/ICC-MT 1,5-2,5 BA (3190593). BA = Bandkontakte
1762457	MDSTB 2,5/10-G1-5,08	Header, Nominal current: 10 A, Rated voltage (III/2): 320 V, Pitch: 5.08 mm, Color: green, Metal surface: Sn, Assembly: Soldering, In combination with MVSTB or FKCV plug components, both an MVSTBW (or FKCVW) and an MVSTBR plug (or FKCVR) must be used. Combination with TMSTBP plug components is not possible!
1762583	MDSTBV 2,5/10-G1-5,08	Header, Nominal current: 10 A, Rated voltage (III/2): 320 V, Pitch: 5.08 mm, Color: green, Metal surface: Sn, Assembly: Soldering, In combination with MVSTB or FKCV plug components, both an MVSTBW (or FKCVW) and an MVSTBR plug (or FKCVR) must be used. Combination with TMSTBP plug components is not possible!
1770795	MSTB 2,5/10-G-5,08-LA	Header, Nominal current: 12 A, Rated voltage (III/2): 320 V, Pitch: 5.08 mm, Assembly: Soldering
1757323	MSTBA 2,5/10-G-5,08	Header, Nominal current: 12 A, Rated voltage (III/2): 320 V, Pitch: 5.08 mm, Color: green, Metal surface: Sn, Assembly: Soldering
1768024	MSTBA 2,5/10-G-5,08-LA	Header, Nominal current: 12 A, Rated voltage (III/2): 320 V, Pitch: 5.08 mm, Assembly: Soldering
1765030	MSTBHK 2,5/10-G-5,08	Plug component, Nominal current: 12 A, Rated voltage (III/2): 320 V, Pitch: 5.08 mm, Color: green, Metal surface: Sn, Assembly: DIN rail
1788800	MSTBVK 2,5/10-G-5,08	Plug component, Nominal current: 12 A, Rated voltage (III/2): 320 V, Pitch: 5.08 mm, Color: green, Metal surface: Sn, Assembly: DIN rail
1788619	MVSTBU 2,5/10-GB-5,08	Plug component, Nominal current: 12 A, Rated voltage (III/2): 320 V, Pitch: 5.08 mm, Color: green, Metal surface: Sn, Assembly: Direct mounting
1769544	SMSTB 2,5/10-G-5,08	Header, Nominal current: 12 A, Rated voltage (III/2): 320 V, Pitch: 5.08 mm, Color: green, Metal surface: Sn, Assembly: Soldering
1767452	SMSTBA 2,5/10-G-5,08	Header, Nominal current: 12 A, Rated voltage (III/2): 320 V, Pitch: 5.08 mm, Color: green, Metal surface: Sn, Assembly: Soldering
3002034	UK 3-MSTB-5,08	Feed-through modular terminal block, Type of connection: Special and hybrid connection, Screw connection, Cross section: 0.2 mm² - 4 mm², AWG 24 - 12, Width: 5.08 mm, Color: gray, Mounting type: NS 32, NS 35/15, NS 35/7,5

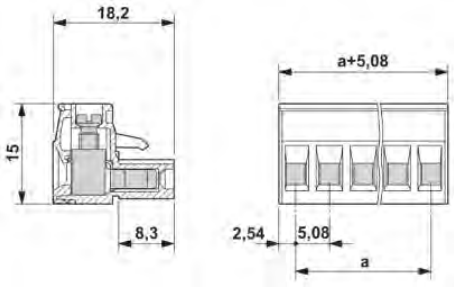
MSTB 2,5/10-ST-5,08 Order No.: 1757093
http://eshop.phoenixcontact.de/phoenix/treeViewClick.do?UID=1757093

3002076	UK 3-MVSTB-5,08	Feed-through modular terminal block, Nominal current: 12 A, Nominal voltage: 250 V, Cross section: 0.2 mm² - 4 mm², AWG: 24 - 12, Mounting type: NS 32, NS 35/15, NS 35/7,5, Pitch: 5.08 mm, Width: 5.1, Color: gray
3002102	UK 3-MVSTB-5,08-LA 24RD	Feed-through modular terminal block, Nominal current: 12 A, Nominal voltage: 250 V, Cross section: 0.2 mm² - 4 mm², AWG: 24 - 12, Mounting type: NS 32, NS 35/15, NS 35/7,5, Pitch: 5.08 mm, Width: 5.08, Color: gray
3002063	UK 3-MVSTB-5,08/EK	Feed-through modular terminal block, Nominal current: 12 A, Nominal voltage: 250 V, Cross section: 0.2 mm² - 4 mm², AWG: 24 - 12, Mounting type: NS 35/7,5, NS 35/15, NS 32, Pitch: 5.08 mm, Width: 5.1, Color: blue
3002131	UK 3D-MSTBV-5,08	Feed-through modular terminal block, Type of connection: Special and hybrid connection, Screw connection, Cross section: 0.2 mm² - 4 mm², AWG 24 - 12, Width: 5.08 mm, Color: gray, Mounting type: NS 32, NS 35/15, NS 35/7,5
3002144	UK 3D-MSTBV-5,08-LA 24RD	Feed-through modular terminal block, Type of connection: Screw connection, Screw connection, Number of positions: 1, Cross section: 0.2 mm² - 4 mm², AWG 24 - 12, Width: 5.1 mm, Color: gray, Mounting type: NS 32, NS 35/15, NS 35/7,5
3002173	UK 3D-MSTBV-5,08/EK	Feed-through modular terminal block, Type of connection: Screw connection, Screw connection, Cross section: 0.2 mm² - 4 mm², AWG 24 - 12, Width: 5.1 mm, Color: blue, Mounting type: NS 32, NS 35/15, NS 35/7,5
2770888	UKK 3-MSTB-5,08	End cover, Nominal current: 12 A, Nominal voltage: 250 V, Cross section: 0.2 mm² - 4 mm², AWG: 24 - 12, Mounting type: NS 35/7,5, NS 35/15, NS 32, Pitch: 5.08 mm, Width: 5.08, Color: gray
1876615	UKK 3-MSTB-5,08-PE	Feed-through modular terminal block, Nominal current: 12 A, Nominal voltage: 320 V, Cross section: 0.2 mm² - 4 mm², AWG: 24 - 12, Mounting type: NS 35/7,5, NS 35/15, NS 32, Pitch: 5.08 mm, Width: 5.08, Color: green-yellow
2770846	UKK 3-MSTBVH-5,08	Feed-through modular terminal block, Nominal current: 12 A, Nominal voltage: 250 V, Cross section: 0.2 mm² - 4 mm², AWG: 24 - 12, Mounting type: NS 35/7,5, NS 35/15, NS 32, Pitch: 5.08 mm, Width: 5.08, Color: gray
1788198	UMSTBVK 2,5/10-G-5,08	Plug component, Nominal current: 12 A, Rated voltage (III/2): 320 V, Pitch: 5.08 mm, Color: green, Metal surface: Sn, Assembly: DIN rail
1873016	ZFKK 1,5-MSTBV-5,08	Feed-through modular terminal block, Connection method: Special and hybrid connection, MSTB plug entry, Cross section: 0.2 mm² - 2.5 mm², Width: 5.1 mm, Color: gray

MSTB 2,5/10-ST-5,08 Order No.: 1757093
http://eshop.phoenixcontact.de/phoenix/treeViewClick.do?UID=1757093

Diagrams/Drawings

Dimensioned drawing



PHOENIX CONTACT

Extract from the online catalog

FBS 10-8

Order No.: 3030323

http://eshop.phoenixcontact.de/phoenix/treeViewClick.do?UID=3030323

Cross connector/jumper for modular terminal block, Number of positions: 10, Color: red

Commercial data	
EAN	4017918188634
Pack	10 pcs.
Customs tariff	85389099
Weight/Piece	0.01955 KG
Catalog page information	Page 330 (CL-2009)

Product notes

WEEE/RoHS-compliant since: 01/01/2003

http://www.download.phoenixcontact.com
Please note that the data given here has been taken from the online catalog. For comprehensive information and data, please refer to the user documentation. The General Terms and Conditions of Use apply to Internet downloads.

Extract from the online catalog

PS-6/2,3MM RD

Order No.: 3038736

The illustration shows the version PS-5/2,3 MM RD

http://eshop.phoenixcontact.de/phoenix/treeViewClick.do?UID=3038736

Test plugs, Color: red

Commercial data	
GTIN (EAN)	4017918904166
sales group	A691
Pack	10 pcs.
Customs tariff	85369010
Weight/Piece	0.00143 KG
Catalog page information	Page 449 (CL-2009)

Product notes

WEEE/RoHS-compliant since: 01/01/2003

http://www.download.phoenixcontact.com
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UT 4-MT

Please note that the data given here has been taken from the online catalog. For comprehensive information and data, please refer to the user documentation at http://www.download.phoenixcontact.com. The General Terms and Conditions of Use apply to Internet downloads.

Extract from the online catalog

Universal terminal block with screw connection, cross section: 0.14 - 4 mm² , AWG: 26 - 10, width: 6.2 mm, color: Gray

Order No.	3046139
Ord designation	UT 4-MT
EAN	4017918975562
Pack	50 Pcs.
Customs tariff	85369010
Catalog page information	Page 20 (NTK-2005)

Technical data

General	
Number of levels	1
Number of connections	2
Color	gray
Insulating material	PA
Inflammability class acc. to UL 94	V0

UT 4-MT

Dimensions

Width	6.2 mm
Length	56.8 mm
Height NS 35/7,5	47.5 mm
Height NS 35/15	55 mm

Technical data

Maximum load current	16 A
Rated surge voltage	8 kV
Contamination class	3
Surge voltage category	III
Insulating material group	I
Connection in acc. with standard	IEC/ DIN VDE
Nominal current I_N	16 A
Nominal voltage U_N	500 V
Open side panel	nein

Connection data

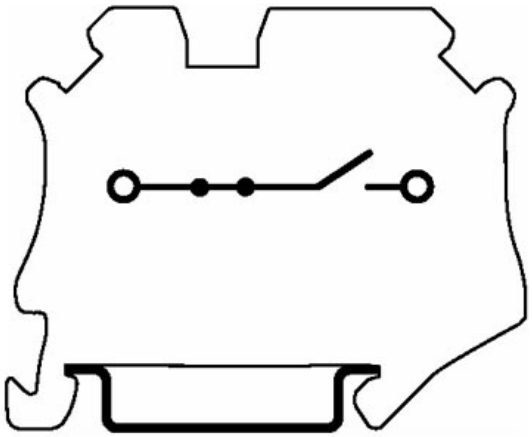
Conductor cross section, rigid min.	0.14 mm²
Conductor cross section, rigid max.	6 mm²
Conductor cross section flexible min.	0.14 mm²
Conductor cross section, flexible max.	4 mm²
Conductor cross section AWG/kcmil min.	26
Conductor cross section AWG/kcmil max	10
Conductor cross section flexible, with ferrule without plastic sleeve min.	0.25 mm²
Conductor cross section flexible, with ferrule without plastic sleeve max.	4 mm²
Conductor cross section flexible, with ferrule with plastic sleeve min.	0.25 mm²
Conductor cross section flexible, with ferrule with plastic sleeve max.	4 mm²
2 conductors with same cross section, solid min.	0.14 mm²
2 conductors with same cross section, solid max.	1.5 mm²
2 conductors with same cross section, flexible, min.	0.14 mm²
2 conductors with same cross section, flexible max.	1.5 mm²
2 conductors with same cross section, flexible, TWIN ferrules with plastic sleeve, min.	0.5 mm²
2 conductors with identical cross section, flexible TWIN ferrules with plastic sleeve, max.	2.5 mm²
2 conductors with same cross section, flexible, ferrules without plastic sleeve min.	0.25 mm²
2 conductors with same cross section, flexible, ferrules without plastic sleeve, max.	1.5 mm²
Type of connection	Screw connection
Stripping length	9 mm
Internal cylindrical gage	A4
Screw thread	M 3
Tightening torque, min	0.6 Nm

Certificates

CUL	
Nominal voltage U_N	600 V
Nominal current I_N	16 A
AWG/kcmil	26-10
UL	
Nominal voltage U_N	600 V
Nominal current I_N	16 A
AWG/kcmil	26-10

Drawings

Circuit diagram



Approval logo

Accessories

Item	Designation	Description
Assembly		
0801762	NS 35/ 7,5 CU UNPERF 2000MM	DIN rail, material: Copper, unperforated, height 7.5 mm, width 35 mm, length: 2 m
1207640	NS 35/ 7,5 PERF 755MM	NS 35 DIN rail, height 7.5 mm, length 755 mm
1207653	NS 35/ 7,5 PERF 955MM	NS35 DIN rail, height 7.5 mm, length 955 mm
1207666	NS 35/ 7,5 PERF 1155MM	NS 35 DIN rail, height 7.5 mm, length 1155 mm
0801733	NS 35/ 7,5 PERF 2000MM	DIN rail, material: Steel, perforated, height 7.5 mm, width 35 mm, length: 2 m
0801681	NS 35/ 7,5 UNPERF 2000MM	DIN rail, material: Steel, unperforated, height 7.5 mm, width 35 mm, length: 2 m
1201756	NS 35/15 AL UNPERF 2000MM	DIN rail, deep-drawn, high profile, unperforated, 1.5 mm thick, material: Aluminum, height 15 mm, width 35 mm, length 2 m
1201895	NS 35/15 CU UNPERF 2000MM	DIN rail, material: Copper, unperforated, 1.5 mm thick, height 15 mm, width 35 mm, length: 2 m
1207679	NS 35/15 PERF 755MM	NS 35 DIN rail, height 15 mm, length 755 mm
1207682	NS 35/15 PERF 955MM	NS 35 DIN rail, height 15 mm, length 955 mm
1207695	NS 35/15 PERF 1155MM	NS 35 DIN rail, height 15 mm, length 1155 mm
1201730	NS 35/15 PERF 2000MM	DIN rail, material: Steel, perforated, height 15 mm, width 35 mm, length: 2 m
1201714	NS 35/15 UNPERF 2000MM	DIN rail, material: Steel, unperforated, height 15 mm, width 35 mm, length: 2 m
1201798	NS 35/15-2,3 UNPERF 2000MM	DIN rail, material: Steel, unperforated, 2.3 mm thick, height 15 mm, width 35 mm, length: 2 m
Bridges		
3030336	FBS 2-6	Plug-in bridge for cross-connections in the terminal center, 2-pos., color: Red
3030242	FBS 3-6	Plug-in bridge for cross-connections in the terminal center, 3-pos., color: Red
3030255	FBS 4-6	Plug-in bridge for cross-connections in the terminal center, 4-pos., color: Red
3030349	FBS 5-6	Plug-in bridge for cross-connections in the terminal center, 5-pos., color: Red
3030271	FBS 10-6	Plug-in bridge for cross-connections in the terminal center, 10-pos., color: Red
3030365	FBS 20-6	Plug-in bridge for cross-connections in the terminal center, 20-pos., color: Red
3047060	RB UT 10-(2,5/4)	Reducing bridge, for connection from UT 10 to UT 4 or UT 2,5

UT 4-MT

Marking

0811228	X-PEN 0,35	Marker pen without ink cartridge, for manual labeling of markers, labeling extremely wipe-proof, line thickness 0.35 mm
1051016	ZB 6,LGS:FORTL.ZAHLEN	Zack strip, 10-section, printed horizontally: with the numbers, 1-10, 11-20 etc. up to 991-1000, color: white
5060935	ZB 6/WH-100:UNBEDRUCKT	Zack strip, unprinted: For individual labeling with M-PEN, ZB-T or CMS system, large batch, sufficient for labeling 1000 terminal blocks, for a terminal width of 6.2 mm, color: White
1050499	ZB 6:SO/CMS	Zack strip, 10-section, divisible, special printing, marking according to customer requirements

Plug/Adapter

0201689	MPS-IH BU	
0201676	MPS-IH RD	
0201663	MPS-IH WH	
0201744	MPS-MT	Test plug, consisting of: Metal part for 2.3 mm diameter socket hole
3030925	PAI-4	Test adapter, for 4 mm diameter test plug PS and safety test plug, makes contact in the bridge shaft
3030996	PS-6	Modular test plug, for individual assembly of test plug strips, for UT, ST, DT and QT terminal blocks, can be labeled with ZBF 6, color: Red

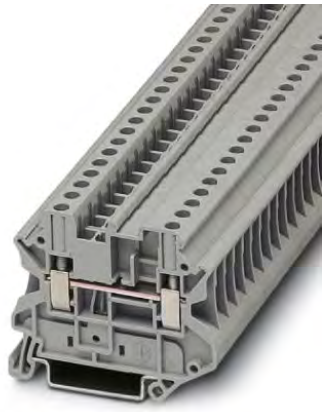
Tools

1205053	SZS 0,6X3,5	Screwdriver, bladed, matches all screw terminal blocks up to 4.0 mm² connection cross section, blade: 0.6 x 3.5 mm, without VDE approval

Extract from the online catalog

UT 4-MTD

Order No.: 3046184



http://eshop.phoenixcontact.de/phoenix/treeViewClick.do?UID=3046184

Feed-through modular terminal block, Type of connection: Screw connection, Cross section: 0.14 mm² - 6 mm², AWG 26 - 10, Width: 6.2 mm, Color: gray, Mounting type: NS 35/7,5, NS 35/15

Product notes

WEEE/RoHS-compliant since: 01/01/2003

Commercial data	
EAN	4017918956592
Pack	50 pcs.
Customs tariff	85369010
Weight/Piece	0.011431 KG
Catalog page information	Page 56 (CL-2009)

http://www.download.phoenixcontact.com
Please note that the data given here has been taken from the online catalog. For comprehensive information and data, please refer to the user documentation. The General Terms and Conditions of Use apply to Internet downloads.

Technical data

General

Number of levels	1
Number of connections	2
Color	gray

UT 4-MTD Order No.: 3046184
http://eshop.phoenixcontact.de/phoenix/treeViewClick.do?UID=3046184

Insulating material	PA
Inflammability class acc. to UL 94	V0

Dimensions

Width	6.2 mm
Length	57.8 mm
Height NS 35/7,5	47.5 mm
Height NS 35/15	55 mm

Technical data

Maximum load current	41 A (with 6 mm^2 conductor cross section)
Rated surge voltage	8 kV
Pollution degree	3
Surge voltage category	III
Insulating material group	I
Connection in acc. with standard	IEC 60947-7-1
Nominal current I_N	32 A
Nominal voltage U_N	800 V
Open side panel	ja

Connection data

Conductor cross section solid min.	0.14 mm²
Conductor cross section solid max.	6 mm²
Conductor cross section stranded min.	0.14 mm²
Conductor cross section stranded max.	6 mm²
Conductor cross section AWG/kcmil min.	26
Conductor cross section AWG/kcmil max	10
Conductor cross section stranded, with ferrule without plastic sleeve min.	0.14 mm²
Conductor cross section stranded, with ferrule without plastic sleeve max.	4 mm²
Conductor cross section stranded, with ferrule with plastic sleeve min.	0.14 mm²
Conductor cross section stranded, with ferrule with plastic sleeve max.	4 mm²
2 conductors with same cross section, solid min.	0.14 mm²
2 conductors with same cross section, solid max.	1.5 mm²
2 conductors with same cross section, stranded min.	0.14 mm²

UT 4-MTD Order No.: 3046184
http://eshop.phoenixcontact.de/phoenix/treeViewClick.do?UID=3046184

2 conductors with same cross section, stranded max.	1.5 mm²
2 conductors with same cross section, stranded, TWIN ferrules with plastic sleeve, min.	0.5 mm²
2 conductors with same cross section, stranded, TWIN ferrules with plastic sleeve, max.	2.5 mm²
2 conductors with same cross section, stranded, ferrules without plastic sleeve, min.	0.14 mm²
2 conductors with same cross section, stranded, ferrules without plastic sleeve, max.	1.5 mm²
Type of connection	Screw connection
Stripping length	9 mm
Internal cylindrical gage	A4
Screw thread	M3
Tightening torque, min	0.6 Nm
Tightening torque max	0.8 Nm

Certificates / Approvals

Certification	CB, CSA, CUL, DNV, GL, LR, UL, VDE-PZI
Certification Ex:	IECEx, KEMA-EX

CSA

Nominal voltage U_N	600 V
Nominal current I_N	30 A
AWG/kcmil	26-10

CUL

Nominal voltage U_N	600 V
Nominal current I_N	30 A
AWG/kcmil	26-10

UL

Nominal voltage U_N	600 V
Nominal current I_N	30 A
AWG/kcmil	26-10

UT 4-MTD Order No.: 3046184
http://eshop.phoenixcontact.de/phoenix/treeViewClick.do?UID=3046184

Accessories

Item	Designation	Description
Assembly		
3022276	CLIPFIX 35-5	Snap-on end bracket, for NS 35/7.5 or NS 35/15 DIN rail, can be fitted with Zack strip ZB 5 and ZBF 5, terminal strip marker KLM 2 and KLM, parking facility for FBS...5, FBS...6, KSS 5, KSS 6, width: 5,15 mm, color: gray
3047141	D-UT 2,5/4-TWIN	End cover, Width: 2.2 mm, Color: gray
0801762	NS 35/ 7,5 CU UNPERF 2000MM	DIN rail, material: Copper, unperforated, height 7.5 mm, width 35 mm, length: 2 m
1207640	NS 35/ 7,5 PERF 755MM	NS 35 DIN rail, height 7.5 mm, length 755 mm
1207653	NS 35/ 7,5 PERF 955MM	NS35 DIN rail, height 7.5 mm, length 955 mm
1207666	NS 35/ 7,5 PERF 1155MM	NS 35 DIN rail, height 7.5 mm, length 1155 mm
0801733	NS 35/ 7,5 PERF 2000MM	DIN rail, material: Steel, galvanized and passivated with a thick layer, perforated, height 7.5 mm, width 35 mm, length: 2 m
0801681	NS 35/ 7,5 UNPERF 2000MM	DIN rail, material: Steel, unperforated, height 7.5 mm, width 35 mm, length: 2 m
1201756	NS 35/15 AL UNPERF 2000MM	DIN rail, deep-drawn, high profile, unperforated, 1.5 mm thick, material: Aluminum, height 15 mm, width 35 mm, length 2 m
1201895	NS 35/15 CU UNPERF 2000MM	DIN rail, material: Copper, unperforated, 1.5 mm thick, height 15 mm, width 35 mm, length: 2 m
1207679	NS 35/15 PERF 755MM	NS 35 DIN rail, perforated, height 15 mm, length 755 mm
1207682	NS 35/15 PERF 955MM	NS 35 DIN rail, perforated, height 15 mm, length 955 mm
1207695	NS 35/15 PERF 1155MM	NS 35 DIN rail, perforated, height 15 mm, length 1155 mm
1201730	NS 35/15 PERF 2000MM	DIN rail, material: Steel, perforated, height 15 mm, width 35 mm, length: 2 m
1201714	NS 35/15 UNPERF 2000MM	DIN rail, material: Steel, unperforated, height 15 mm, width 35 mm, length: 2 m
1201798	NS 35/15-2,3 UNPERF 2000MM	DIN rail, material: Steel, unperforated, 2.3 mm thick, height 15 mm, width 35 mm, length: 2 m
Bridges		
3030336	FBS 2-6	Cross connector/bridge, Number of positions: 2, Color: red
3030242	FBS 3-6	Cross connector/bridge, Number of positions: 3, Color: red
3030255	FBS 4-6	Cross connector/bridge, Number of positions: 4, Color: red
3030349	FBS 5-6	Cross connector/bridge, Number of positions: 5, Color: red
3030271	FBS 10-6	Cross connector/bridge, Number of positions: 10, Color: red
3030365	FBS 20-6	Cross connector/bridge, Number of positions: 20, Color: red
3032224	FBS 50-6	Cross connector/bridge, Number of positions: 50, Color: red

UT 4-MTD Order No.: 3046184
http://eshop.phoenixcontact.de/phoenix/treeViewClick.do?UID=3046184

3047060	RB UT 10-(2,5/4)	Cross connector/bridge, Number of positions: 2, Color: red

Marking

1051993	B-STIFT	Marker pen, for manual labeling of unprinted Zack strips, smear-proof and waterproof, line thickness 0.5 mm
0811228	X-PEN 0,35	Marker pen without ink cartridge, for manual labeling of markers, labeling extremely wipe-proof, line thickness 0.35 mm
1051016	ZB 6,LGS:FORTL.ZAHLEN	Zack strip, 10-section, printed horizontally: with the numbers, 1-10, 11-20 etc. up to 991-1000, color: white
1051032	ZB 6,LGS:GLEICHE ZAHLEN	Zack marker strip, labeled horizontally: 10-section, with identical numbers, 1/1/1, 2/2/2 etc. up to 1000/1000/1000, color: white
1051029	ZB 6,QR:FORTL.ZAHLEN	Zack strip, 10-section, printed vertically: with consecutive numbers, 1-10, 11-20 a.s.o. up to 991-1000, color: white
1051045	ZB 6,QR:GLEICHE ZAHLEN	Zack marker, labeled vertically: 10-section, with identical numbers, 1/1/1, 2/2/2 etc. up to 1000/1000/1000, color: White
1050499	ZB 6:SO/CMS	Zack strip, 10-section, divisible, special printing, marking according to customer requirements
1051003	ZB 6:UNBEDRUCKT	Zack strip, unprinted, strips with 10 labels for individual labeling with M-PEN or CMS system, for terminal block width: 6.2 mm, color: white

Plug/Adapter

0201731	MPS-IH BK	Insulating sleeve, for MPS metal part, Color: black
0201702	MPS-IH GN	Insulating sleeve, for MPS metal part, Color: green
0201676	MPS-IH RD	Insulating sleeve, Color: red
0201663	MPS-IH WH	Insulating sleeve, for MPS metal part, Color: white
0201744	MPS-MT	Metal part
3030925	PAI-4	Test adapter, Color: gray
3030996	PS-6	Test adapter, Color: red

Tools

1205053	SZS 0,6X3,5	Screwdriver, bladed, matches all screw terminal blocks up to 4.0 mm² connection cross section, blade: 0.6 x 3.5 mm, without VDE approval

Diagrams/Drawings

Circuit diagram

Extract from the online catalog

UBE/D + ES/KMK 3

Order No.: 1004076

http://eshop.phoenixcontact.de/phoenix/treeViewClick.do?UID=1004076

Terminal strip marker carriers for marking terminal group, for mounting on the terminal strip NS 32 or NS 35/7.5, lettering field size: 40 x 17 mm

Commercial data	
EAN	4017918011888
Pack	10 pcs.
Customs tariff	85369010
Weight/Piece	0.0105 KG

Product notes

WEEE/RoHS-compliant since: 03/18/2004

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Technical data

General

Color	gray
Base element material	PA
Inflammability class acc. to UL 94	V2
Ambient temperature (operation)	-40 °C ... 100 °C
Components	free from silicone and halogen

Extract from the online catalog

UT 4-HESI (5X20)

Order No.: 3046032

http://eshop.phoenixcontact.de/phoenix/treeViewClick.do?UID=3046032

Fuse modular terminal block, Connection method: Screw connection, Cross section: 0.14 mm² - 6 mm², AWG: 26 - 10, Nominal current: 6.3 A, Nominal voltage: 500 V, Width: 6.2 mm, Fuse type: G / 5 x 20, Fuse type: Glass, Mounting type: NS 35/7,5, NS 35/15, Color: black

Commercial data	
EAN	4017918956578
Pack	50 pcs.
Customs tariff	85369010
Weight/Piece	0.018103 KG
Catalog page information	Page 44 (CL-2009)

Product notes

WEEE/RoHS-compliant since: 01/01/2003

http://www.download.phoenixcontact.com
Please note that the data given here has been taken from the online catalog. For comprehensive information and data, please refer to the user documentation. The General Terms and Conditions of Use apply to Internet downloads.

Technical data

General

Number of levels	1
Number of connections	2
Color	black

Insulating material	PA
Inflammability class acc. to UL 94	V0

Dimensions

Width	6.2 mm
Length	57.8 mm
Height NS 35/7,5	73 mm
Height NS 35/15	80.5 mm

Technical data

Fuse	G / 5 x 20
Fuse type	Glass
Rated surge voltage	4 kV
Pollution degree	3
Surge voltage category	III
Insulating material group	I
Connection in acc. with standard	IEC 60947-7-3
Nominal current I_N	6.3 A
Nominal voltage U_N	500 V (if used as fuse terminal block)
	500 V (if used as disconnect terminal block)

Connection data

Conductor cross section solid min.	0.14 mm²
Conductor cross section solid max.	6 mm²
Conductor cross section stranded min.	0.14 mm²
Conductor cross section stranded max.	6 mm²
Conductor cross section AWG/kcmil min.	26
Conductor cross section AWG/kcmil max	10
Conductor cross section stranded, with ferrule without plastic sleeve min.	0.14 mm²
Conductor cross section stranded, with ferrule without plastic sleeve max.	4 mm²
Conductor cross section stranded, with ferrule with plastic sleeve min.	0.14 mm²
Conductor cross section stranded, with ferrule with plastic sleeve max.	4 mm²
2 conductors with same cross section, solid min.	0.14 mm²
2 conductors with same cross section, solid max.	1.5 mm²

UT 4-HESI (5X20) Order No.: 3046032
http://eshop.phoenixcontact.de/phoenix/treeViewClick.do?UID=3046032

2 conductors with same cross section, stranded min.	0.14 mm²
2 conductors with same cross section, stranded max.	1.5 mm²
2 conductors with same cross section, stranded, ferrules without plastic sleeve, min.	0.14 mm²
2 conductors with same cross section, stranded, ferrules without plastic sleeve, max.	1.5 mm²
2 conductors with same cross section, stranded, TWIN ferrules with plastic sleeve, min.	0.5 mm²
2 conductors with same cross section, stranded, TWIN ferrules with plastic sleeve, max.	2.5 mm²
Type of connection	Screw connection
Stripping length	9 mm
Internal cylindrical gage	A4
Screw thread	M3
Tightening torque, min	0.6 Nm
Tightening torque max	0.8 Nm

Certificates / Approvals

Certification	CB, CSA, CUL, DNV, GL, KEMA, LR, UL

CSA

Nominal voltage U_N	600 V
Nominal current I_N	6.3 A
AWG/kcmil	26-10

CUL

Nominal voltage U_N	600 V
Nominal current I_N	6.3 A
AWG/kcmil	26-10

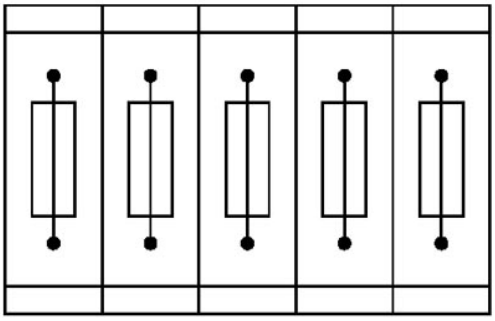
UL

Nominal voltage U_N	600 V
Nominal current I_N	6.3 A
AWG/kcmil	26-10

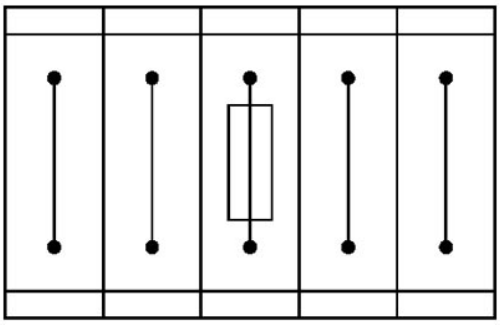
UT 4-HESI (5X20) Order No.: 3046032
http://eshop.phoenixcontact.de/phoenix/treeViewClick.do?UID=3046032

Drawings

Application drawing

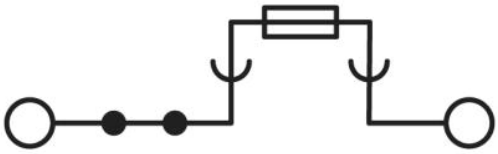


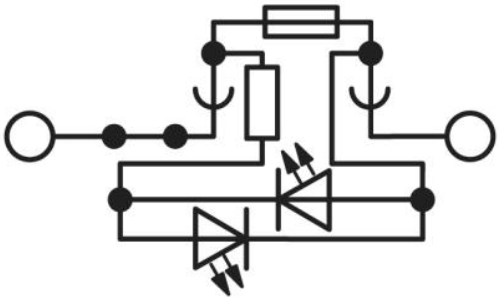
Fuse terminal blocks in interconnected arrangement,
block consisting of 5 fuse terminal blocks



Fuse terminal block in single arrangement,
block consisting of one fuse terminal block and 4 feed-through terminal blocks

Circuit diagram





CLIPSAL NEUTRAL / ACTIVE / METER LINKS

Clipsal Links are produced from Impact Resistant materials to prevent cracking in transit or during installation.

The transparent covers enable you to check wiring and locate the sealing screw at a glance. The sealing screw (nylon with brass insert) resists stripping. Voltage and amperage ratings are clearly marked on both the cover and brass bar.

All links are available with black or red covers and bases for neutral, active or meter applications as required by local authorities.

T-Type - 500 Volt 140 Ampere

L4T35
500V 140A 4 Hole Neutral Link with two screws per tunnel. Black base and cover.

L4T35R
500V 140A 4 Hole Active Link. Red base and cover.

Dimensions: 65 x 46 x 43mm.
Mounting centres: 28mm. 1 tunnel 8.7mm diameter accommodate 1 x 25mm^2 cable.
3 tunnels 7.7mm diameter accommodate 1 x 25mm^2 cable.
Certificate of Suitability No. CS2252N.


L4T35R

Mini Links with Cover

500V 100A
2 screws per tunnel.

L5
500V 100A 5 Hole Neutral Link with two screws per tunnel. Black base and cover.

L5R
500V 100A 5 Hole Active Link. Red base and cover.

Dimensions: 65 x 46 x 43mm.
Mounting centres: 46mm.
3 tunnels, 6.3mm diameter accommodate 1 x 16mm^2.
2 tunnels, 5.8mm diameter accommodate 1 x 16mm^2.

L5BW
500V 110A 5 Hole Back Wiring Neutral Link with two screws per tunnel. Black base and cover.

L5BWR
500V 110A 5 Hole Back Wiring Active Link. Red base and cover.

Dimensions: 65 x 46 x 43mm.
Mounting centres: 46mm.
5 tunnels, 7mm diameter accommodate 1 x 25mm^2.
Transparent black cover, with cut outs.

L6
500V 100A 6 Hole Neutral Link with two screws per tunnel. Black base and cover.

L6R
500V 100A 6 Hole Active Link. Red base and cover.

Dimensions: 65 x 46 x 43mm.
Mounting centres: 46mm.
3 tunnels, 6.3mm diameter accommodate 1 x 16mm^2 cable.
3 tunnels, 5.8mm diameter accommodate 1 x 16mm^2 cable.

L6/25
500V 110A 6 Hole Neutral Link with 2 screws per tunnel. Black base and cover.

L6/25R
500V 110A 6 Hole Active Link. Red base and cover.

Dimensions: 65 x 46 x 43mm.
Mounting centres: 46mm.
2 tunnels, 7.5mm diameter accommodate 2 x 25mm^2 cable.
1 tunnel, 5.5mm diameter accommodates 1 x 16mm^2 cable.
3 tunnels, 4.7mm diameter accommodate 3 x 10mm^2 cable.
Transparent black cover with cut-outs.

L7
500V 100A 7 Hole Neutral Link with two screws per tunnel. Black base and cover.


L7

4.7 TELEMETRY & POWER

Schneider – **SCADAPACK ES** – Telemetry Unit

Clipsal – **2015/15 + 90B** – 1Phase 15A Outlet

Mennekes – **3658** – 3Phase +N+E Inlet

Powerbox – **PB251-24CM** - 24VDC 10A Power Supply

Yuasa – **NP7-12FR** – 12v 7Ah Battery

SCADAPack 330E | 334E

Smart RTU

Schneider Electric

Built on a native DNP3 architecture, the SCADAPack 330E and 334E feature high-performance 32-bit processing, high-speed LAN, serial and USB communications, integrated power supply, advanced power-management, and a wide range of digital and analog I/O in a cost-effective, compact Smart RTU. The level 4 compliant DNP3 protocol comes with optional AGA12 encryption to improve message security for critical operations, and support for the open protocols of Modbus and IEC60870-5 is also offered. The SCADAPack 330E / 334E can be programmed locally or remotely using the IEC61131-3 programming language and is optionally configurable directly from ClearSCADA host software.

This product offers a small footprint, enabling compact mounting enclosures for applications where space is at a premium. The SCADAPack 330E is well suited for applications that require a communications hub but no I/O, while the SCADAPack 334E adds a variety of integrated I/O. Note that the SCADAPack 334E has the same I/O offering as the SCADAPack 314E but includes an Ethernet port and a third serial port.

Product Data Sheet SCADAPack 330E | 334E
Specifications

>	P330E: 5210 controller board only
Controller	
Processors	• CPU: 32-bit ARM7 microcontroller, 32 MHz clock, integrated watchdog timer • Microcontroller co-processor, 20 MHz clock
Memory	16MB FLASH ROM, 4MB CMOS RAM, 4kB EEPROM
Non-Volatile RAM	CMOS SRAM with lithium battery retains contents for 2 years with no power
Event Logging Capacity	20,000 events
Maximum Database Points	1,000 typical
I/O	
Counter Inputs	• 1, 0-10Hz or 0-5kHz (dry contact) • 2, 0-10kHz (turbine or dry contact)
Communications	
Serial Ports COM1, COM2	• RS-232 port, 8-pin modular RJ45 jack, full or half duplex, or • RS-485 port, 2-wire, half duplex
Serial Port COM3	• RS-232 port, 8-pin modular RJ45 jack, full or half duplex with RTS/CTS control and operator interface power control
Baud Rates	300, 600, 1200, 2400, 4800, 9600, 19200, 38400, 57600, and 115200
Serial Protocols	DNP3 Slave, DNP3 Master, IEC60870-5-101 Slave, IEC60870-5-103 Master, Modbus RTU Master, Modbus RTU Slave, DF1
Ethernet Port	RJ45, 10/100BaseT
Ethernet Protocols	DNP3 in TCP Master/Slave, DNP3 in UDP Master/Slave, Modbus/TCP Client and Server, IEC60870-5-104 Slave, NTP Server, Telnet Server, FTP Server, BOOTP Server
USB Peripheral Port	USB 2.0 compliant “B”-type receptacle, DNP3 protocol
Wireless[1]	Spread spectrum radio at 900MHz[2] and 2.4GHz[2]
General	
I/O Terminations	6-pole removable terminal block, 12 to 22AWG, 15A contacts
Dimensions	5.65 inch (144mm) wide, 5.00 inch (127mm) high, 1.80 inch (45mm) deep
Packaging	Corrosion resistant zinc-plated steel with black enamel paint
Environment	5% RH to 95%, non-condensing, –40°C (–40°F) to 70°C (158°F)
Power Input	• 11 - 30VDC, 3.5W typical • Add 25 to 100mW when enabling the LEDs • 12W at 24V maximum, 5V supply fully loaded
Warranty	3 years on parts and labor
Certifications	
Hazardous Locations North America	Suitable for use in Class I, Division 2, Groups A, B, C and D Hazardous Locations. Temperature Code T4 CSA certified to the requirements of: • CSA Std. C22.2 No. 213-M1987 - Hazardous Locations. • UL Std. No. 1604 - Hazardous (Classified) Locations.
Hazardous Locations - Europe	ATEX II 3G, Ex nA IIC T4 per EN 60079-15, protection type n (Zone 2). Does not include Wireless versions.
Hazardous Locations	IECEx, Ex nA IIC T4 per IEC 60079-15, protection type n (Zone 2) Does not include Wireless versions.

1 Available only with optional integrated wireless modules or with stand-alone wireless modules.
2 Not applicable in all countries.

Disclaimer: Schneider Electric reserves the right to change product specifications. For more information visit www.controlmicrosystems.com.

Product Data Sheet SCADAPack 330E | 334E
Specifications

> P334E: 5210 controller board and integrated 5607 I/O board

Controller	
Processors	• CPU: 32-bit ARM7 microcontroller, 32 MHz clock, integrated watchdog timer • Microcontroller co-processor, 20 MHz clock
Memory	16MB FLASH ROM, 4MB CMOS RAM, 4kB EEPROM
Non-Volalite RAM	CMOS SRAM with lithium battery retains contents for 2 years with no power
Event Logging Capacity	20,000 events
Maximum Database Points	1,000 typical
I/O	
Analog Inputs	8, 0-20/4-20mA / 0-5/0-10V (15-bit) software configurable
Analog Outputs	• Standard: None • 2, 0-20/4-20mA (12-bit) with optional 5305 on 5607 I/O board
Digital I/O	• 16, 12/24V, 48V, 115/125V, 240V digital inputs • 10 relay outputs: dry contact or DC solid state, dry contact rating: 3A, 30VDC or 240VAC (resistive), DC solid state rating: 3A, 60 VDC
Counter Inputs	1, 0-10Hz or 0-5kHz (dry contact); 2, 0-10kHz (turbine or dry contact)
Communications	
Serial Ports COM1, COM2	• RS-232 port, 8-pin modular RJ45 jack, full or half duplex, or • RS-485 port, 2-wire, half duplex
Serial Port COM3	RS-232 port, 8-pin modular RJ45 jack, full or half duplex with RTS/CTS control and operator interface power control
Baud Rates	300, 600, 1200, 2400, 4800, 9600, 19200, 38400, 57600, and 115200
Serial Protocols	DNP3 Slave, DNP3 Master, IEC60870-5-101 Slave, IEC60870-5-103 Master, Modbus RTU Master, Modbus RTU Slave, DF1
Ethernet Port	RJ45, 10/100BaseT
Ethernet Protocols	DNP3 in TCP Master/Slave, DNP3 in UDP Master/Slave, Modbus/TCP Client and Server, IEC60870-5-104 Slave, NTP Server, Telnet Server, FTP Server, BOOTP Server
USB Peripheral Port	USB 2.0 compliant “B”-type receptacle, DNP3 protocol
Wireless[1]	Spread spectrum radio at 900MHz[2] and 2.4GHz[2]
General	
I/O Terminations	5, 6 and 9-pole removable terminal blocks, 12 to 22AWG, 15A contacts
Dimensions	5.65 inch (144mm) wide, 6.50 inch (165mm) high, 2.80 inch (72mm) deep
Packaging	Corrosion resistant zinc-plated steel with black enamel paint
Environment	5% RH to 95%, non-condensing, –40°C (–40°F) to 70°C (158°F)
Power	
5210 Controller Board	• 11 - 30VDC, 8.5W typical • Add 25 to 100mW when enabling the LEDs • 12W at 24V maximum, 5V supply fully loaded
5607 I/O Module	• 11 - 30VDC, 10.3mA plus analog outputs • 325mA (max.) at 5V required from 5210 controller board
Warranty	3 years on parts and labor
Certifications	
Hazardous Locations North America	Suitable for use in Class I, Division 2, Groups A, B, C and D Hazardous Locations. Temperature Code T4 CSA certified to the requirements of: • CSA Std. C22.2 No. 213-M1987 - Hazardous Locations. • UL Std. No. 1604 - Hazardous (Classified) Locations.
Hazardous Locations - Europe	ATEX II 3G, Ex nA IIC T4 per EN 60079-15, protection type n (Zone 2). Does not include Wireless versions.
Hazardous Locations	IECEx, Ex nA IIC T4 per IEC 60079-15, protection type n (Zone 2) Does not include Wireless versions.

1 Available only with optional integrated wireless modules or with stand-alone wireless modules.
2 Not applicable in all countries.

Disclaimer: Schneider Electric reserves the right to change product specifications. For more information visit www.controlmicrosystems.com.

Product Data Sheet SCADAPack 330E | 334E
Model Code

	P334-EA55-AB00 represents a sample code for a SCADAPack 334E with 12V dry contact relay outputs
Model	**Select: Controller**
P330	SCADAPack 330E , 32 Bit controller, 3 Accumulators
P334	SCADAPack 334E, with Model 5607 I/O board, comes with above I/O plus 8 Analog I/P, 16 Digital I/P and 10 Digital O/P
Code	**Select: Platform**
E	E Firmware platform (Configuration Software included), executes two IEC61131-3 kernels, Workbench required
Code	**Select: SCADA Security**
A	None
B	AGA-12 SCADA Encryption Security
Code	**Select: Protocol Option**
5	Modbus, DNP3, DF1, Modbus/TCP, TCP/IP, IEC 60870-5-101/104 Slave (included in all controllers)
6	Adds IEC 60870-5-103 Master, Protection Relay Protocol (for data transmission with IEDs)
Code	**Select: License Option**
5	DNP3 Data Concentrator License (limit of 500 points from 10 IEDs), supports multiple DNP3 Masters (up to 3 Masters)
Code	**Select: Analog Inputs**
A	P330 : None P334 : adds 8 selectable as 0-20mA, 4-20mA, 0-5V or 0-10V
Code	**Select: Digital Inputs/Outputs**
A	P330 : None
B	P334 : 16 Digital Inputs (12/24V) and 10 Dry Contact Relay outputs
C	P334 : 16 Digital Inputs (48V) and 10 Dry Contact Relay outputs
D	P334 : 16 Digital Inputs (120V) and 10 Dry Contact Relay outputs
E	P334 : 16 Digital Inputs (240V) and 10 Dry Contact Relay outputs
F	P334 : 16 Digital Inputs (12/24V) and 10 Solid State Relay outputs, ATEX Certified (with no Integrated radio)
G	P334 : 16 Digital Inputs (48V) and 10 Solid State Relay outputs
H	P334 : 16 Digital Inputs (120V) and 10 Solid State Relay outputs
I	P334 : 16 Digital Inputs (240V) and 10 Solid State Relay outputs
Code	**Select: Analog Outputs**
0	None
1	P334 only : 2 channel Analog Output option, 0-20 mA
Code	**Select: Integrated Communication Interfaces**
0	None
	FreeWave & MDS Radios (requires one RS232 port)
1	900Mhz FreeWave Spread Spectrum Radio
2	2.4GHz FreeWave Spread Spectrum Radio
A	900MHz MDS Spread Spectrum Radio
	Trio Radios - 900MHz (requires one RS232 port)
B	900MHz Trio Spread Spectrum Radio with encryption, 902-928MHz (FCC / IC)
C	900MHz Trio Spread Spectrum Radio with encryption, 915-928MHz (AUS)
D	900MHz Trio Spread Spectrum Radio, 915-928MHz (BRAZIL)
E	900MHz Trio Spread Spectrum Radio, 921-928MHz (NZ)
	Trio Radios - 2.4GHz (requires one RS232 port)
J	2.4GHz Trio Spread Spectrum Radio, ETSI/100mW, ATEX (EUROPE)
K	2.4GHz Trio Spread Spectrum Radio with Encryption, 500mW (CANADA, USA & AUSTRALIA)
L	2.4GHz Trio Spread Spectrum Radio, 500mW (OUTSIDE OF EUROPE, CANADA, USA & AUSTRALIA)

HOW TO ORDER SWITCHED SOCKET OUTLETS

Switched Socket Outlets are often referred to as GPOs (General Purpose Outlets), Powerpoints or Power Outlets. So that there is no confusion, the description 'Switched Socket Outlets' will be used throughout this brochure. Single and Twin Socket Outlets are available in 2000 Series in horizontal and vertical formats.

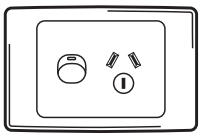
Catalogue Numbers will vary depending on the number of sockets and whether the product is horizontally or vertically mounted.

This number indicates the **number of switched sockets** included in the product. The plate size remains the same for both single and twin switched socket outlets, only the number of switches and sockets vary.

2 0 1 5 V

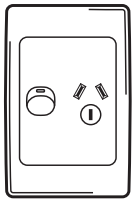
The letter **'V'** indicates that the product is **vertically mounted.** Where there is no letter **'V'**, the product is **horizontally mounted.**

Single Horizontal



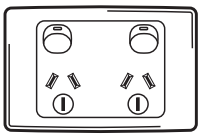
2015

Single Vertical



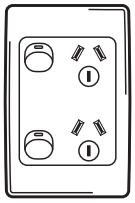
2015V

Twin Horizontal



2025

Twin Vertical



2025V

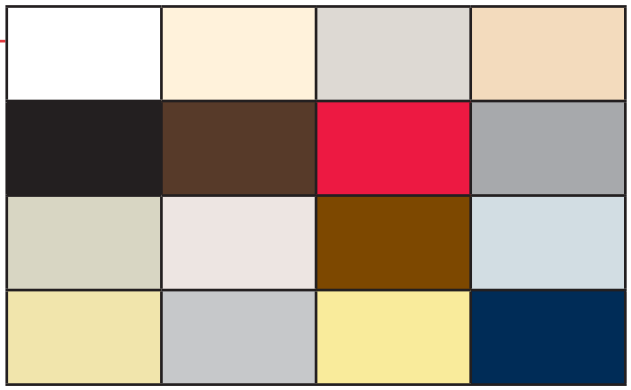
Please note: Single Automatically Switched Socket Outlets are also available (Catalogue Number 2010 - Page 28).

Special Features and Options

2000 Series Switched Socket Outlets may also be ordered with special features, including an extra switch mechanism, safety shutters, neons, double pole switched versions, deep plate format products and more. Please see the main part of the brochure for Combination (Page 30) and Automatic (Page 28) versions with special features.

Ordering Colours

When ordering Switched Socket Outlets, colour variations also have to be taken into consideration, as the Catalogue Number will change depending on the colour of the product. Each colour has its own 'code', for example, the code for White Electric is **'WE'** and the code for Cream is **'CM'**. The Catalogue Number for a 2000 Series Twin Switched Socket Outlet in White Electric is 2025,**WE**.

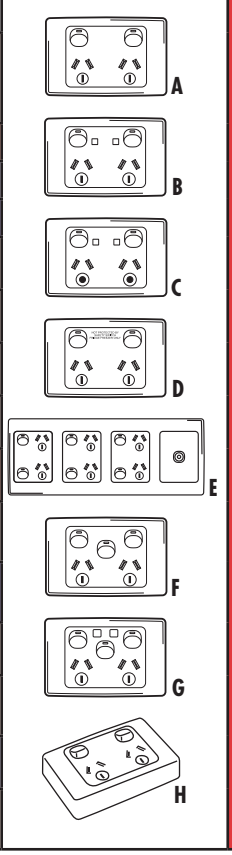


Refer to '2000 Series Colours' on page 12 for colour options and their corresponding codes.

STANDARD SIZE TWIN SWITCHED SOCKET OUTLETS - HORIZONTALLY MOUNTED

Cat. No.	Length	Width	Depth	Mounting Centres
2025, 2025S, 2025N, 2025L, 2025XA, 2025XAN, 2025FO	116mm	76mm	28mm	84mm apart
2025QC	116mm	76mm	31mm	84mm apart
2025SM	116mm	76mm	30mm	84mm apart
2025V3/30PF	290mm	116mm	13mm	See template

2025	A	Twin Switched Socket Outlet, 250V/10A.
2025S	A	Twin Switched Socket Outlet, 250V/10A, with safety shutters.
2025N	B	Twin Switched Socket Outlet, 250V/10A, with safety shutters and neons.
2025L	C	Twin Switched Socket Outlet, 250V/10A, with round earth pin.
2025QC	A	Twin Switched Socket Outlet, 250V/10A, Quick Connect.
2025FO	D	Twin Switched Socket Outlet, 250V/10A, printed with 'NOT PROTECTED BY SAFETY SWITCH. FRIDGE/FREEZER ONLY'.
2025V3/30PF	E	"Powertainment™" Six Socket Outlets, F-Type Pay TV Outlet in 2000/4 Surround, 250V/10A.
2025XA	F	Twin Switched Socket Outlet, 250V/10A, with removable extra switch.
2025XAN	G	Twin Switched Socket Outlet, 250V/10A with safety shutters, neons and removable extra switch.
2025SM	H	Twin Switched Socket Outlet, 250V/10A, with surface mounting kit.
2025XAS	F	Twin Switched Socket Outlet, 250V/10A, with removable extra switch and safety shutters.

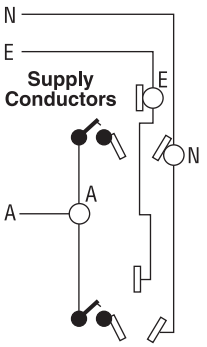


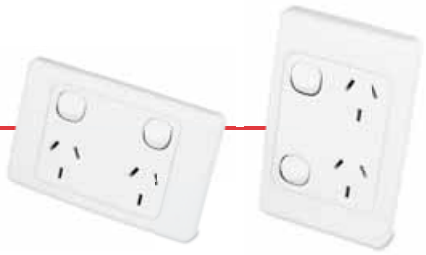
All models accommodate 4 x 2.5mm² cables. 30 Series Switch Terminals accommodate 3 x 2.5mm² on the 2025XA and 2025XAN. All models have a base projection of 13mm, except for 2025QC which has a base projection of 14mm.

* Refer to **Page 62** for more information on "Powertainment™".
* Refer to **Page 53** for mounting templates.

SCHEMATIC WIRING DIAGRAMS

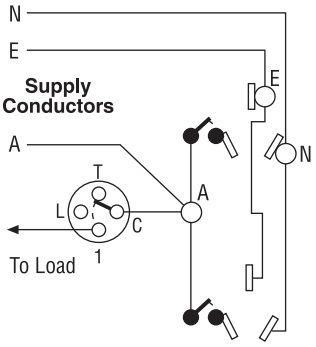
Standard Pattern Mounting Twin Combination





2025 2025V

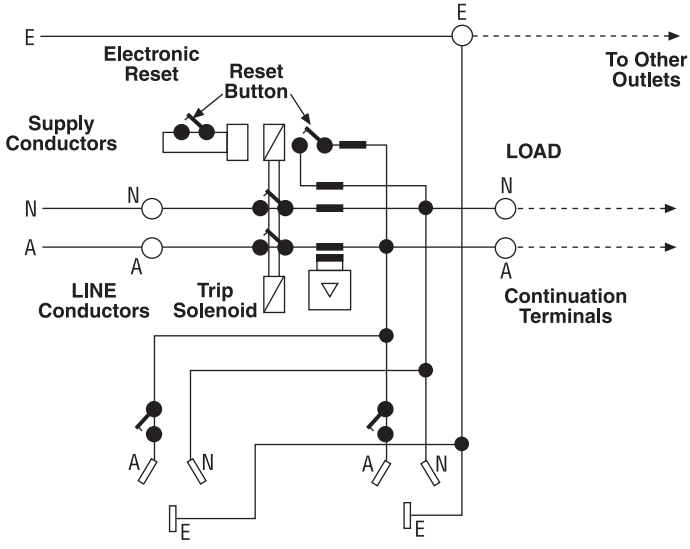
Twin Switched Sockets with Extra Switch



2025XA 2025VXA

Earth Leakage Protected Twin Switched Sockets

2025RC



PB251 Series

220-330 WATTS DC UPS

Features

- **Ultra-low noise output**
- **Independent battery charging output**
- **DC output OK & battery OK alarms & LEDs**
- **Battery-LVD and alarm**
- **Over-temperature protection**
- **Battery fuse fail LED**

Specifications

INPUT

Voltage:	190 to 264 vac, or 190 to 400VDC
Line regulation:	0.2%typical
Current:	1.4A maximum
Inrush current:	10A maximum
Frequency:	45 to 65 Hz

OUTPUT

Voltage	See table
Current	See table
Load regulation	0.5%typical
Current limit type - load cct	Constant current
Current limit type - batt. cct	Constant current
Short circuit protection	Indefi nite, auto-resetting
Over-voltage protection	17.5 to 20V latching (13.8Vdc output) 31.5 to 39V latching (27.6Vdc output)
Ripple & noise 100 MHz bandwidth	28mVp-p (13.8Vdc output) 55mVp-p (27.6Vdc output)

ENVIRONMENTAL

Operating temperature	0 to 70^{o}C ambient with derating, 5...90% relative humidity (non-condensing)
Over-temperature protection	Automatic & auto-resetting
Cooling requirement	Natural convection
Efficiency	80% minimum

STANDARDS & APPROVALS

Safety	Complies with AS/NZS 60950, class 1, NSW Office of Fair Trading Approval N20602
EMC	Emissions comply with AS/NZS CISPR11, Group 1, Class B. Complies with ACA EMC Scheme, Safety & EMC Regulatory Compliance Marked
Isolation i/p-o/p i/p-ground o/p-ground	4242VDC for 1 minute 2121VDC for 1 minute 707VDC for 1 minute

ALARMS & BATTERY FUNCTIONS

Converter ON/OK alarm	Indicated by voltage-free changeover relay contacts &
green LED	ON=PSU OK
Battery low (& fuse) alarm	10.2 to 12.6V for 12V battery, adjustable 20.4 to 25.2V for 24V battery, adjustable Indicated by voltage-free changeover relay contacts & green LED: ON=BATT OK
Low voltage disconnect	9.6 to 12V for 12V battery, adjustable 19.2 to 24V2 for 4V battery, adjustable
Charger over-load protection	Auto-resetting electronic circuit breaker
Reverse polarity protection	Internal battery fuse
Battery to load voltage drop	0.2 to. 0.25V typical

MECHANICAL

Case size	264 L x 172 W x 67 H mm
Case size with heatsink	264 L x 186 W x 67 H mm
Rack size	232 D x 19" W x 2RU H
Weight	1.9 kg
Weight with heatsink	2.1 kg
Weight (rack mounted version)	5.5 kg

Selection Table

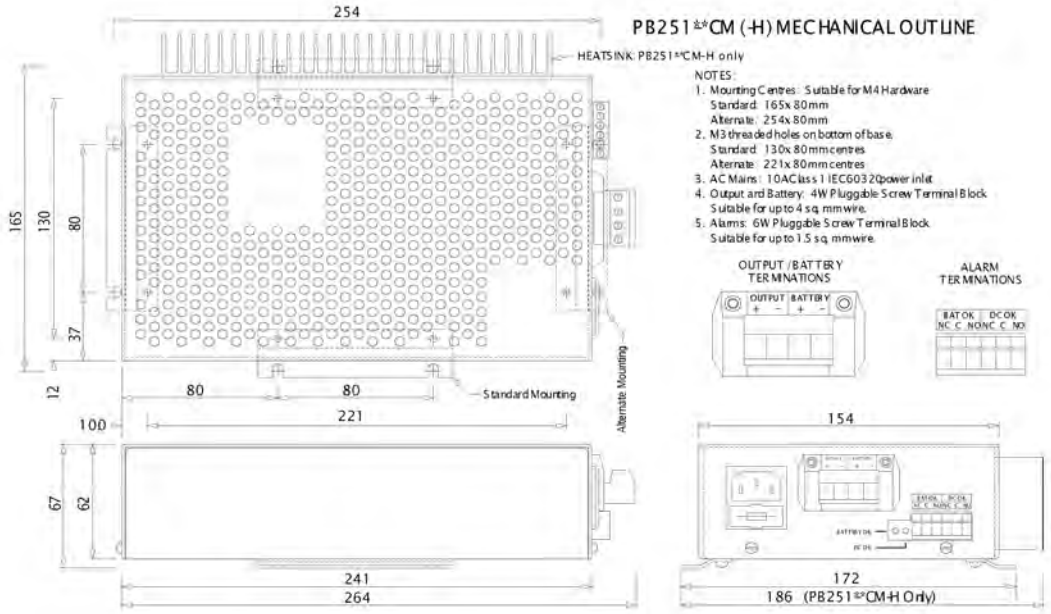
MODEL NUMBER	OUTPUT VDC	OUTPUT I_{LOAD}	OUTPUT I_{BATT}	OUTPUT POWER
PB251-12CM	13.8V	16A	2A	220W
PB251-12CM-H	13.8V	20A	2A	275W
PB251-24CM	27.6V	11A	2A	300W
PB251-24CM-H	27.6V	12A	2A	330W
PB251-12RML	13.8V	20A	4A	275W
PB251-12B	13.8V	20A	4A	275W
PB251-24RML	27.6V	12A	2A	330W

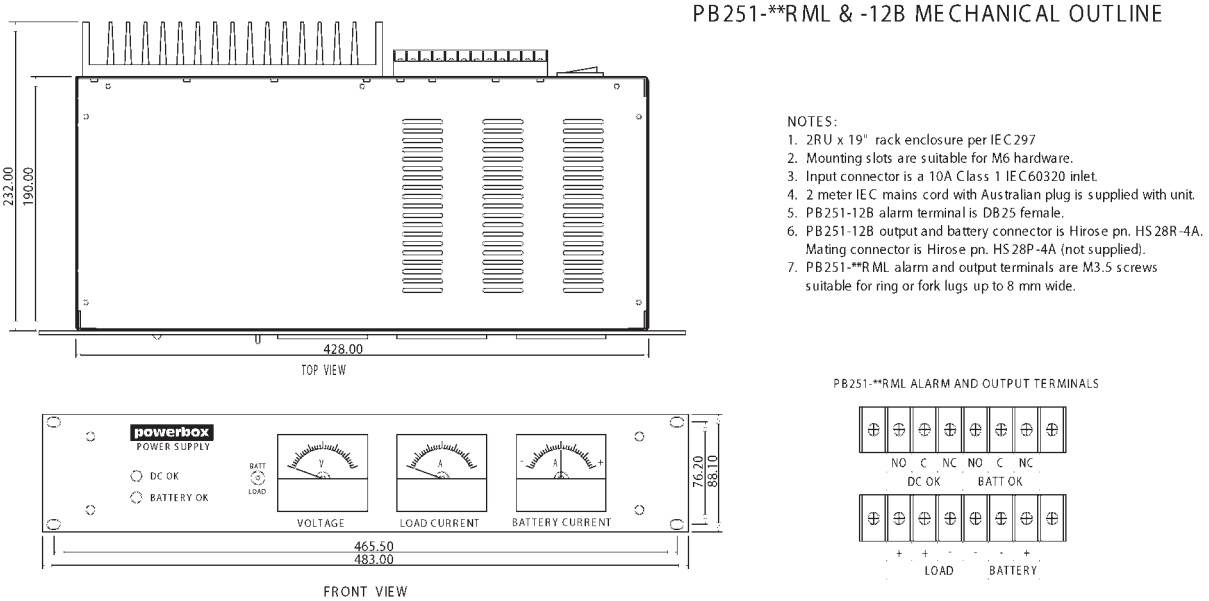
Note: Non standard battery charging current available on request. ie PB251-12CM-H-10 for 10A.

PB251 Series

275-330 WATTS DC UPS

Technical Illustrations





Data Sheet

NP SERIES - **NP7-12**

Reliability is your Security

Utilizing the latest advance design Oxygen Recombination Technology, Yuasa have applied their 80 years of experience in the lead acid battery field to produce the optimum design of Sealed Lead Acid batteries.

FEATURES

- Superb recovery from deep discharge.
- Electrolyte suspension system.
- Gas Recombination.
- Multipurpose: Float or Cyclic use.
- Usable in any orientation
- Superior energy density.
- Lead calcium grids for extended life.
- Manufactured World wide.
- Application specific designs.

Technical Features

Sealed Construction

Yuasa's unique construction and sealing technique ensures no electrolyte leakage from case or terminals.

Electrolyte Suspension System

All NP batteries utilize Yuasa's unique electrolyte suspension system incorporating a microfine glass mat to retain the maximum amount of electrolyte in the cells. The electrolyte is retained in the separator material and there is no free electrolyte to escape from the cells. No gels or other contaminants are added.

Control of Gas Generation

The design of Yuasa's NP batteries incorporates the very latest oxygen recombination technology to effectively control the generation of gas during normal use.

Low Maintenance Operation

Due to the perfectly sealed construction and the recombination of gasses within the cell, the battery is almost maintenance free.

Terminals

NP batteries are manufactured using a range of terminals which vary in size and type. Please refer to details as shown.

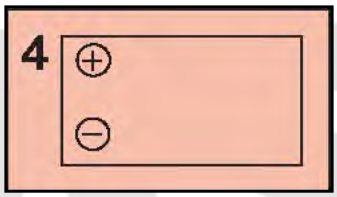
Operation in any Orientation

The combination of sealed construction and Yuasa's unique electrolyte suspension system allows operation in any orientation, with no loss of performance or fear of electrolyte leakage.

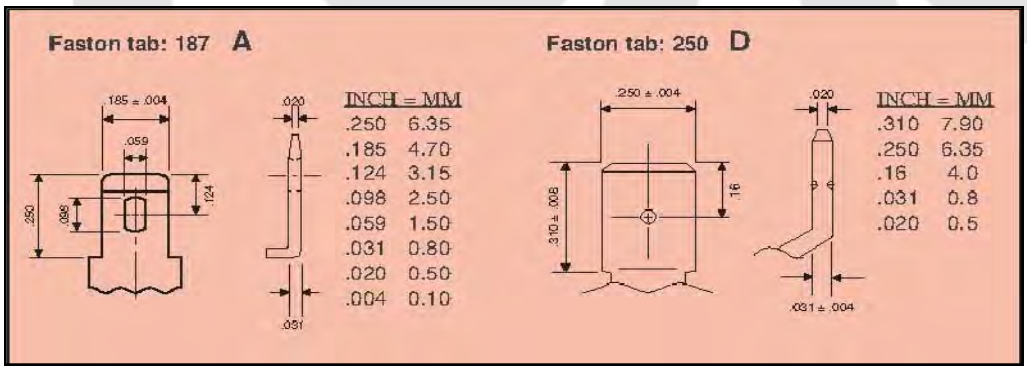
Valve Regulated Design

The batteries are equipped with a simple, safe low pressure venting system which releases excess gas and automatically reseals should there be a build up of gas within the battery due to severe overcharge. Note. On no account should the battery be charged in a sealed container.

Layout



Terminals



General Specifications

Nominal Capacity (Ah)	NP7-12
20hr to 1 .75vpc 30ºC	7
1 0hr to 1 .75vpc 20ºC	6.4
5hr to 1.70vpc 20ºC	5.9
1 hr to 1 .60vpc 20ºC	4.2
Voltage	12
Energy Density (Wh.L.20hr)	91
Specific Energy (Wh.kg.20hr)	32
Int. Resistance (m.Ohms)	25
Maximum discharge (A)	40/75
Short Circuit current (A)	210
Dimensions (mm)	
Length	151
Width	65
Height overall	97.5
Weight (Kg)	2.65
Terminal	A/D
Layout	4
Terminal Torque Nm	-

Data Sheet

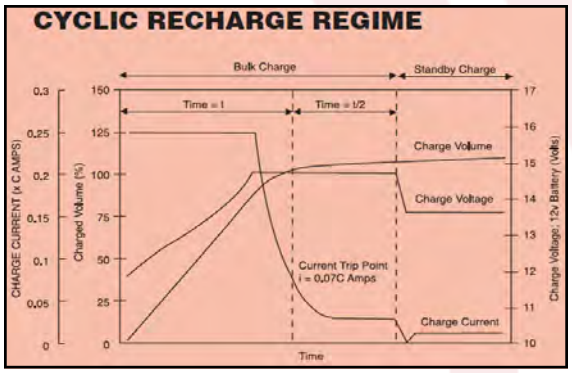
NP SERIES - **NP7-12**

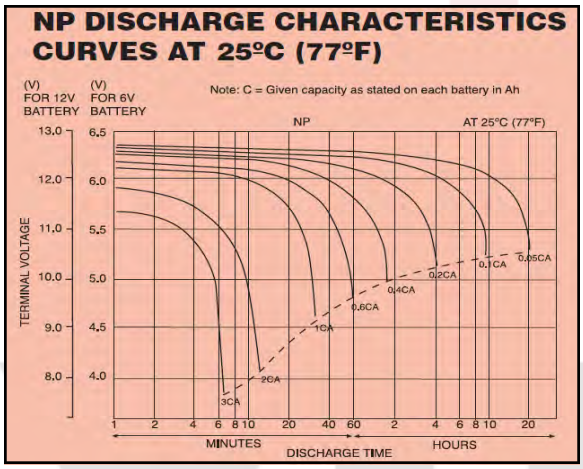
Lead Calcium Grids
The heavy duty lead calcium alloy grids provide an extra margin of performance and life in both cyclic and float applications and give unparalleled recovery from deep discharge.

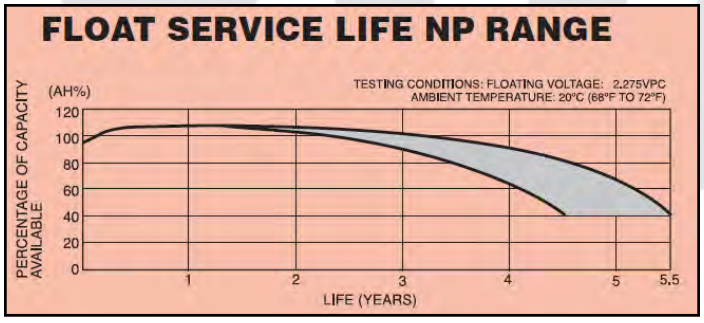
Long Cycle Service Life
Depending upon the average depth of discharge, over a thousand discharge/charge cycles can be expected.

Float Service Life
The expected service life is five years in float standby applications.

Separators
The use of the special separator material provides a very efficient insulation between plates preventing inter-plate short circuits and prohibiting the shedding of active materials.



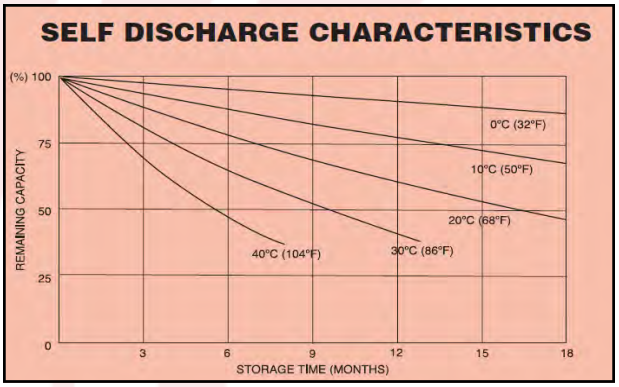


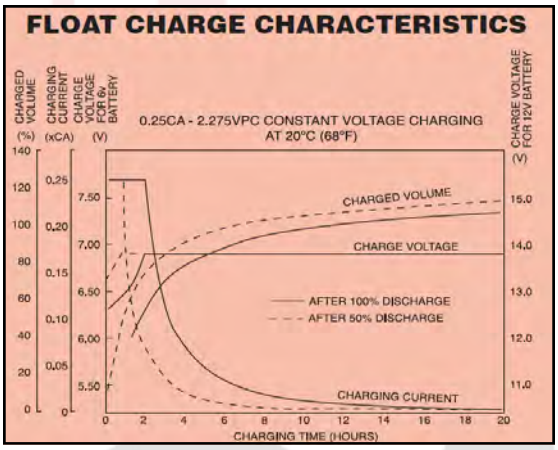


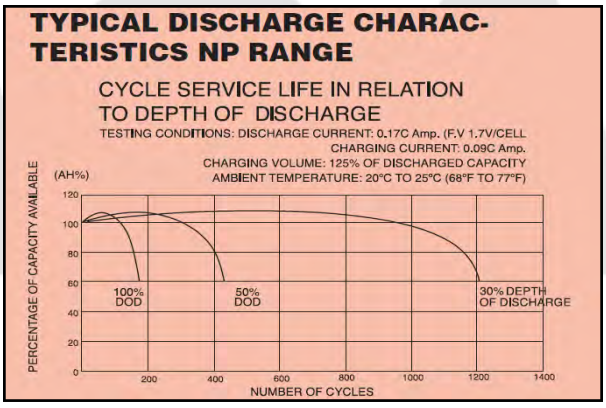
Long shelf Life
The extremely low self discharge rate allows the battery to be stored for extended periods up to one year at normal ambient temperatures with no permanent loss of capacity.

Operating Temperature Range
The batteries can be used over a broad temperature range permitting considerable flexibility in system design and location.

Charge – 15°C to 50°C
Discharge – 20°C to 60°C
Storage – 20°C to 50°C (fully charged battery)







Yuasa Battery Inc.
2901 Montrose Ave
Laureldale, PA 19605
www.yuasabatteries.com

Registered number 1548820

Distributed by

4.8 ACCESSORIES

Wavecom – **GSM** - Modem

Trio Datacom – **DR900-06A02-D0** - Radio

Powerbox – **VTA12SC24** – 24v/13.8VDC Converter (Radio)

Innovative Energies – **IE XR/MV-8** – 24v/9VDC Converter (GSM)

RF Industries – **TLA2000** - Antenna

Trio Datacom – **Yagi Ant13al** - Antenna

wavecom
Make it wireless

Fastrack Supreme User Guide
WA_DEV_Fastrk_UGD_001

Plug and Play Wireless CPU®

FASTRACK Supreme User Guide

Reference: WA_DEV_Fastrk_UGD_001
Revision: 001e
Date: 5 june, 2007

OPEN AT

Supports Open AT® embedded ANSI C applications

Document History

Revision	Date	List of revisions	
001	9 February, 07	First Issue	
001a	23 February, 2007	Update DC cable GPIO mapping, add AutoShutDown	
001b	21 May, 07	Add detail of IES, RTC and serial port autoshutdown	
001c	1 Jun, 07	Change to Quad Band	
001d	4 Jun, 07	Update label/packaging photo	
001e	5 Jun, 07	Comment	

Overview

The FASTRACK Supreme 10 and FASTRACK Supreme 20 are discrete, rugged cellular Plug & Play Wireless CPU® offering state-of-the-art GSM/GPRS (and EGPRS for FASTRACK Supreme 20) connectivity for machine to machine applications.

Proven for reliable, stable performance on wireless networks worldwide, Wavecom's latest generation of FASTRACK Supreme continues to deliver rapid time to market and painless integration.

Having comparable size with the previous M1306B generation, and updated with new features, the FASTRACK Supreme offers an Internal Expansion Socket (IES) interface accessible for customer use. Expanding application features is easy without voiding the warrantee of the FASTRACK Supreme by simply plugging in of an Internal Expansion Socket Module (IESM) board.

Fully certified, the quad band 850/900/1800/1900 MHz FASTRACK Supreme 10 offers GPRS Class 10 capability and FASTRACK Supreme 20 offers GPRS/EGPRS Class 10 capability. Both support a powerful open software platform (Open AT®). Open AT® is the world's most comprehensive cellular development environment, which allows embedded standard ANSI C applications to be natively executed directly on the Wireless CPU®.

FASTRACK Supreme is controlled by firmware through a set of AT commands.

This document describes the FASTRACK Supreme and gives information on the following topics:

- general presentation,
- functional description,
- basic services available,
- technical characteristics,
- installing and using the FASTRACK Supreme,
- user-level troubleshooting.
- recommended accessories to be used with the product.

Note:

This document covers the FASTRACK Supreme Plug & Play alone and does not include

- The programmable capabilities provided via the use of Open AT® Software Suites.
- The development guide for IESM for expanding the application feature through the IES interface.

For detailed, please refer to the documents shown in the "Reference documents" section.

RoHS Directive

The FASTRACK Supreme is now compliant with RoHS Directive 2002/95/EC, which sets limits for the use of certain restricted hazardous substances. This directive states that "from 1st July 2006, new electrical and electronic equipment put on the market does not contain lead, mercury, cadmium, hexavalent chromium, polybrominated biphenyls (PBB), and polybrominated diphenyl ethers (PBDE)".

Plug & Plays which are compliant with this directive are identified by the RoHS logo on their label.

Disposing of the product

This electronic product is subject to the EU Directive 2002/96/EC for Waste Electrical and Electronic Equipment (WEEE). As such, this product must not be disposed off at a municipal waste collection point. Please refer to local regulations for directions on how to dispose off this product in an environmental friendly manner.

Cautions

Information furnished herein by WAVECOM is accurate and reliable. However, no responsibility is assumed for its use. Please read carefully the safety recommendations given in Section 9 for an application based on FASTRACK Supreme Plug & Play.

Trademarks

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Copyright

Web Site Support

General information about Wavecom and its range of products:	www.wavecom.com
Specific support is available for the FASTRACK Supreme Plug & Play Wireless CPU®:	TBD
Open AT® Introduction:	www.wavecom.com/OpenAT
Developer community for software and hardware:	www.wavecom.com/forum

Contents

List of Figures

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1 References

1.1 Reference Documents

For more details, several reference documents may be consulted. The Wavecom reference documents are provided in the Wavecom documents package contrary to the general reference documents, which are not Wavecom owned.

1.1.1 Open AT® Software Documentation

[1] Getting started with Open AT® (Ref.WM_ASW_OAT_CTI_001)

[2] Open AT® Tutorial (Ref.WM_ASW_OAT_UGD_001)

[3] Tools Manual (Ref. WM_ASW_OAT_UGD_003)

[4] Open AT® Programming Guide (Ref. TBD)

[5] Open AT® Customer Release Note (Ref. WM_ASW_OAT_DVD_00062)

Remark: The document above is for Open AT3.12 and FASTRACK Supreme will use new release of Open AT4.21. Reference document not yet available and TBC.

1.1.2 AT Software Documentation

[6] AT commands interface Guide for X51 (Ref. WM_ASW_OAT_UGD_00016)

[7] Customer Release Note X51 (Ref. WM_ASW_OAT_DVD_00120)

Remark: The document above is for X51 and FASTRACK Supreme will use new release of FW6.63. Reference document not yet available and TBC.

1.1.3 Firmware Upgrade Documents

[8] Firmware upgrade procedure (Ref. WM_SW_GEN_UGD_001)

1.1.4 Delta between M1306B Documents

[9] Delta between M1306B and FASTRACK Supreme (Ref. WA_DEV_Fastrk_UGD_004)

1.1.5 IESM Related Documents

[10] IESM Product Technical Specification (Ref. WA_DEV_Fastrk_PTS_001)

[11] IESM-GPS+USB User Guide (Ref. WA_DEV_Fastrk_UGD_002)

[12] IESM-GPS+USB Installation Guide (Ref. WA_DEV_Fastrk_UGD_003)

[13] IESM-IO+USB Installation Guide (Ref. WA_DEV_Fastrk_UGD_005)

[14] IESM-IO+USB User Guide (Ref. WA_DEV_Fastrk_UGD_006)

Note:

New versions of software may be available. Wavecom recommends customers to check the web site for the latest documentation.

1.2 Abbreviations

Abbreviation	Definition
AC	**A**lternating **C**urrent
ACM	**A**ccumulated **C**all **M**eter
AMR	**A**daptive **M**ulti-**R**ate
AT	**AT**tention (prefix for Wireless CPU® commands)
CLK	**CL**oc**K**
CMOS	**C**omplementary **M**etal **O**xide **S**emiconductor
CS	**C**oding **S**cheme
CTS	**C**lear **T**o **S**end
dB	**D**eci**b**el
dBc	**D**eci**b**el relative to the **C**arrier power
dBi	**D**eci**b**el relative to an **I**sotropic radiator
dBm	**D**eci**b**el relative to one **m**illiwatt
DC	**D**irect **C**urrent
DCD	**D**ata **C**arrier **D**etect
DCE	**D**ata **C**ommunication **E**quipment
DCS	**D**igital **C**ellular **S**ystem
DSR	**D**ata **S**et **R**eady
DTE	**D**ata **T**erminal **E**quipment
DTMF	**D**ual **T**one **M**ulti-**F**requency
DTR	**D**ata **T**erminal **R**eady
EEPROM	**E**lectrically **E**rasable **P**rogrammable **R**ead-**O**nly **M**emory
EFR	**E**nhanced **F**ull **R**ate
E-GSM	**E**xtended **GSM**
EMC	**E**lectro**M**agnetic **C**ompatibility
EMI	**E**lectro**M**agnetic **I**nterference
ESD	**E**lectro**S**tatic **D**ischarges
ETSI	**E**uropean **T**elecommunications **S**tandards **I**nstitute
FIT	**Series of connectors (micro-FIT)**
FR	**F**ull **R**ate

Abbreviation	Definition
FTA	**F**ull **T**ype **A**pproval
GCF	**G**lobal **C**ertification **F**orum
GND	**G**rou**ND**
GPIO	**G**eneral **P**urpose **I**nput **O**utput
GPRS	**G**eneral **P**acket **R**adio **S**ervice
GSM	**G**lobal **S**ystem for **M**obile communications
HR	**H**alf **R**ate
I	**I**nput
IEC	**I**nternational **E**lectrotechnical **C**ommission
IES	**I**nternal **E**xpansion **S**ocket
IESM	**I**nternal **E**xpansion **S**ocket **M**odule
IMEI	**I**nternational **M**obile **E**quipment **I**dentification
I/O	**I**nput / **O**utput
LED	**L**ight **E**mitting **D**iode
MAX	**MAX**imum
ME	**M**obile **E**quipment
MIC	**MIC**rophone
Micro-Fit	**Family of connectors from Molex**
MIN	**MIN**imum
MNP	**M**icrocom **N**etworking **P**rotocol
MO	**M**obile **O**riginated
MS	**M**obile **S**tation
MT	**M**obile **T**erminated
NOM	**NOM**inal
O	**O**utput
Pa	**Pa**scal (for speaker sound pressure measurements)
PBCCH	**P**acket **B**roadcast **C**ontrol **CH**annel
PC	**P**ersonal **C**omputer
PCL	**P**ower **C**ontrol **L**evel
PDP	**P**acket **D**ata **P**rotocol
PIN	**P**ersonal **I**dentity **N**umber
PLMN	**P**ublic **L**and **M**obile **N**etwork
PUK	**P**ersonal **U**nblocking **K**ey
RF	**R**adio **F**requency

Abbreviation	Definition
RFI	**R**adio **F**requency **I**nterference
RI	**R**ing **I**ndicator
RMS	**R**oot **M**ean **S**quare
RTS	**R**equest **T**o **S**end
RX	**R**eceive
SIM	**S**ubscriber **I**dentification **M**odule
SMA	**S**ub**M**iniature version **A** RF connector
SMS	**S**hort **M**essage **S**ervice
SNR	**S**ignal-to-**N**oise **R**atio
SPL	**S**ound **P**ressure **L**evel
SPK	**Sp**ea**K**er
SRAM	**S**tatic **RAM**
TCP/IP	**T**ransmission **C**ontrol **P**rotocol / **I**nternet **P**rotocol
TDMA	**T**ime **D**ivision **M**ultiple **A**ccess
TU	**T**ypical **U**rban fading profile
TUHigh	**T**ypical **U**rban, **High** speed fading profile
TX	**T**ransmit
TYP	**TYP**ical
VSWR	**V**oltage **S**tationary **W**ave **R**atio

2 Packaging

2.1 Contents

The complete package content of the FASTRACK Supreme consists of (see):

- one packaging box (**A**),
- one FASTRACK Supreme (**B**),
- two holding bridles (**C**),
- one power supply cable with fuse integrated (**D**)
- a mini notice (**E**) with:
    - a summary of the main technical features,
    - safety recommendations,
    - EC declaration of conformity.

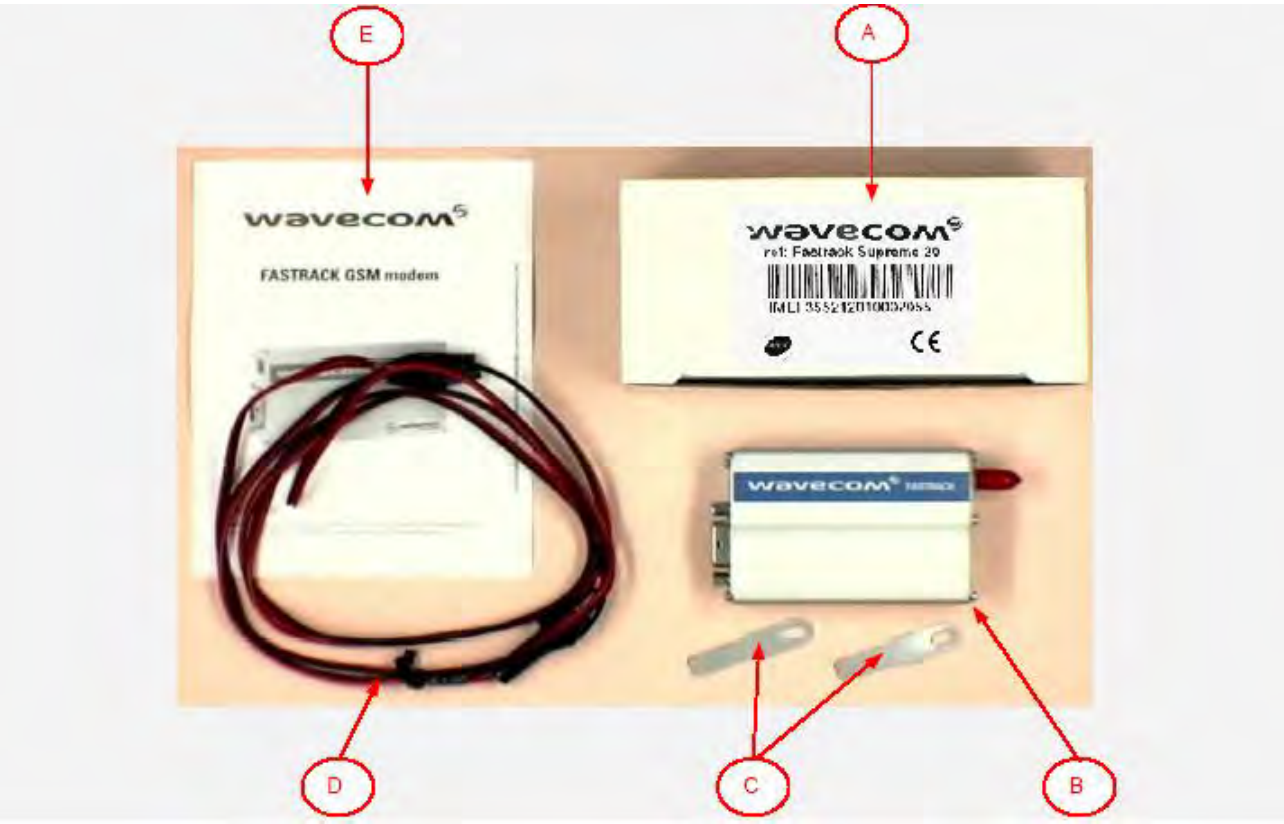

Figure 1: Complete package contents

2.2 Packaging Box

The packaging box is a carton box (see) with the following external dimensions:

- width: 54.5 mm,
- height: 68 mm,
- length: 108 mm.

A packaging label is slicked on the packaging box cover and supports the:

- WAVECOM logo,
- Product reference (Supreme),
- CE marking
- 15-digit IMEI code
- Open AT® Logo
- RoHS logo
- WEEE logo

Figure 2: Packaging box

The packaging label dimensions are:

- height: 40 mm,
- length: 65 mm.

2.3 Production Labelling

A production label (see Figure 3) located at the FASTRACK Supreme back side gives the following information:

- product reference (**FASTRACK Supreme 10** or **FASTRACK Supreme 20**),
- part number (WM19183),
- CE marking,
- 15-digit IMEI code,
- OpenAT® logo

Figure 3: Production Label

3 General Presentation

3.1 Description

The FASTRACK Supreme description is given in the Figure 4 below.

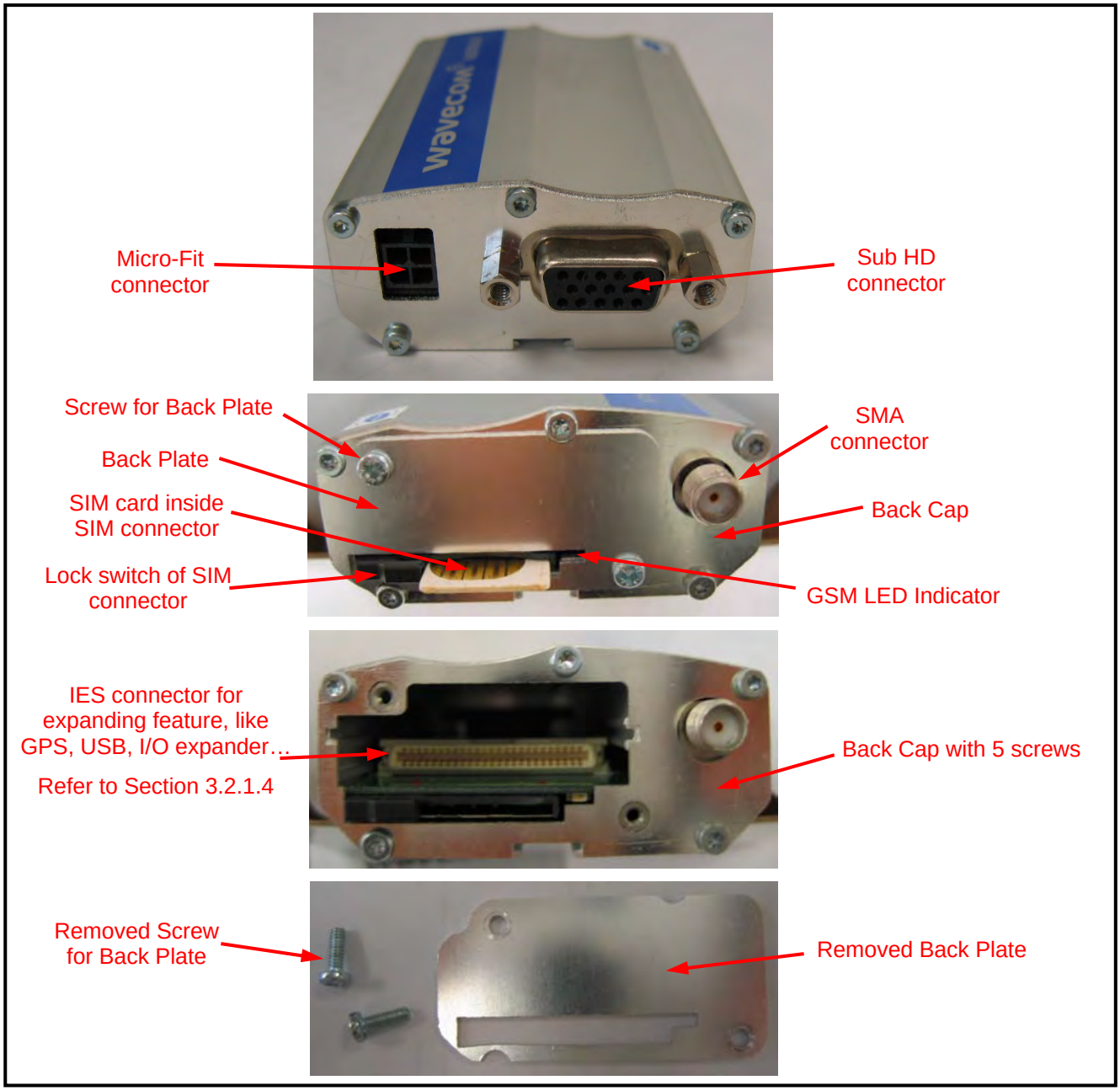

Figure 4: FASTRACK Supreme general description

CAUTION: Users are free to remove the back plate for IESM board plug in/unplug without voiding the warrantee of the FASTRACK Supreme. **However, the warrantee will be voided if unscrewing any screw of the back cap.**

In addition, two holding bridles are provided to tighten the FASTRACK Supreme on a support.

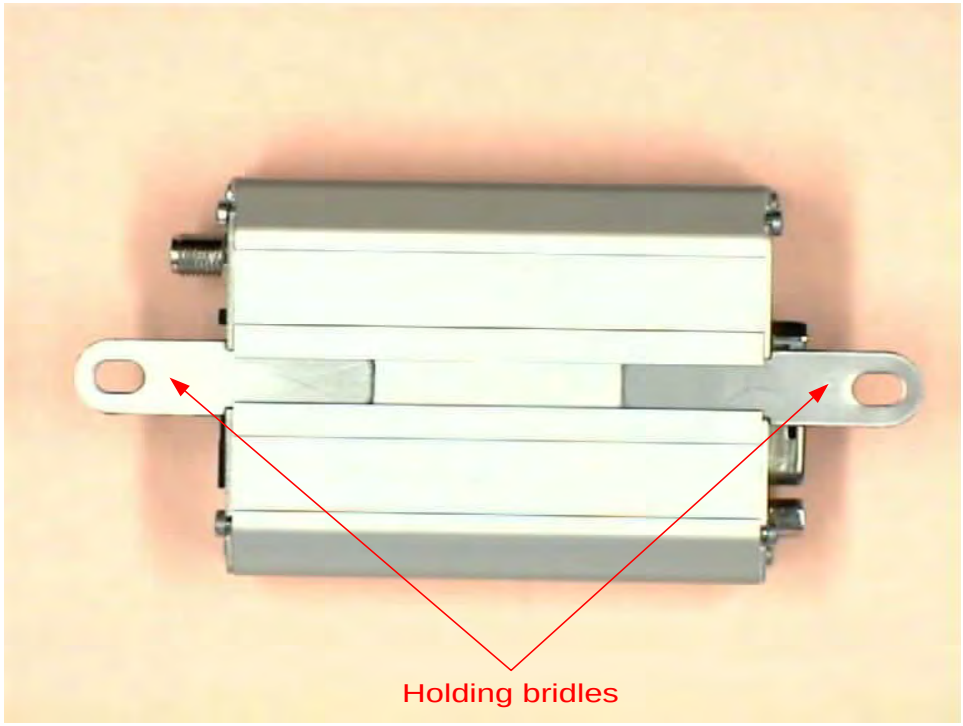

Figure 5: FASTRACK Supreme holding bridles

3.2 External Connections

3.2.1 Connectors

3.2.1.1 Antenna Connector

The antenna connector is a SMA type connector for a 50 Ω RF connection.

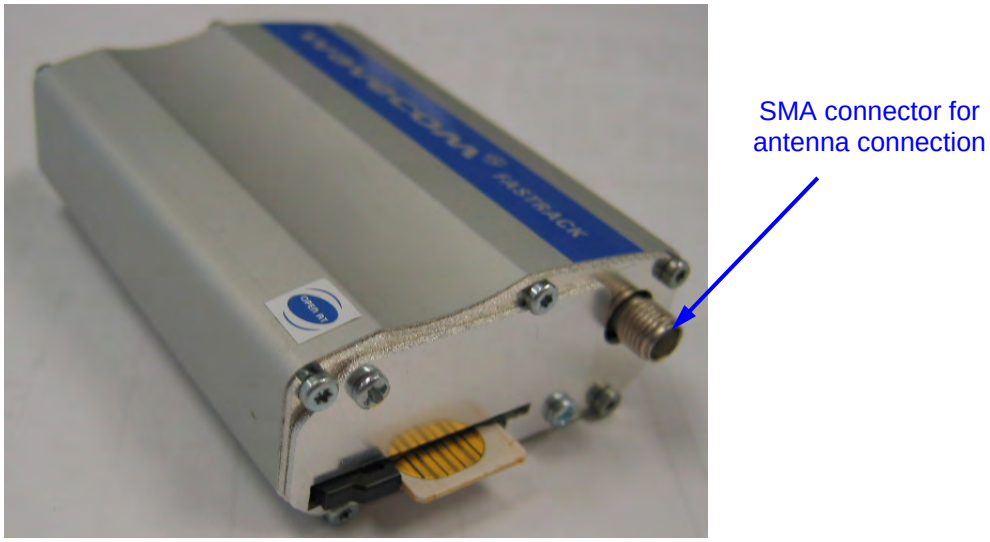

Figure 6: SMA connector for antenna connection

3.2.1.2 Power Supply Connector

The power supply connector is a 4-pin Micro FIT connector for:

- external DC Power Supply connection,
- GPIOs connection (two General Purpose Input/Output signals available).

Figure 7: Power supply connector

Table 1: Power supply connector pin description

Pin #	Signal	I/O	I/O type	Description	Reset State	Comment
1	V+BATTERY	I	Power supply	Battery voltage input: ▪ 5.5 V Min. ▪ 13.2 V Typ. ▪ 32 V Max.		High current
2	GND		Power supply	Ground		
3	GPIO21	I/O	2V8	General Purpose Input/output	Undefined	Not mux
4	GPIO25	I/O	2V8	General Purpose Input/output	Z	Multiplex with INT1

Warning:

Both pin 3 and pin 4 are used by GPIO interface. It is strictly prohibited to connect them to any power supply at the risk of damage to the FASTRACK Supreme.

3.2.1.3 Sub HD 15-pin Connector

The Sub D high density 15-pin connector is used for:

- RS232 serial link connection,
- Audio lines (microphone and speaker) connection,
- BOOT and RESET signal connection.

Figure 8: Sub HD 15-pin connector

Table 2: Sub HD 15-pin connector description

Pin #	Signal (CCITT / EIA)	I/O	I/O type	Description	Comment
1	CDCD/CT109	O	STANDARD RS232	RS232 Data Carrier Detect	
2	CTXD/CT103	I	STANDARD RS232	RS232 Transmit serial data	
3	BOOT	I	CMOS	Boot	This signal must not be connected. Its use is strictly reserved to Wavecom or competent retailers.
4	CMIC2P	I	Analog	Microphone positive line	
5	CMIC2N	I	Analog	Microphone negative line	
6	CRXD/CT104	O	STANDARD RS232	RS232 Receive serial data	
7	CDSR/CT107	O	STANDARD RS232	RS232 Data Set Ready	
8	CDTR/CT108-2	I	STANDARD RS232	RS232 Data Terminal Ready	
9	GND	-	GND	Ground	

Pin #	Signal (CCITT / EIA)	I/O	I/O type	Description	Comment
10	CSPK2P	O	Analog	Speaker positive line	
11	CCTS/CT106	O	STANDARD RS232	RS232 Clear To Send	
12	CRTS/CT105	I	STANDARD RS232	RS232 Request To Send	
13	CRI/CT125	O	STANDARD RS232	RS232 Ring Indicator	
14	RESET	I/O	Schmitt	Supreme Plug & Play reset	Active low
15	CSPK2N	O	Analog	Speaker negative line	

3.2.1.4 IES Connector

The IES connector is a 50 pins board-to-board connector for expanding application features like GPS, USB, I/O expander… Currently there are already 3 IESM boards available for customer to expand the FASTRACK Supreme features immediately. They are:

- IESM-GPS+USB+I/O
- IESM-GPS+USB
- IESM-USB+I/O

For detail, please refer to Document in Section 1.1.5.

For sales and support, please contact Wavecom sales/FAE or your distributor.

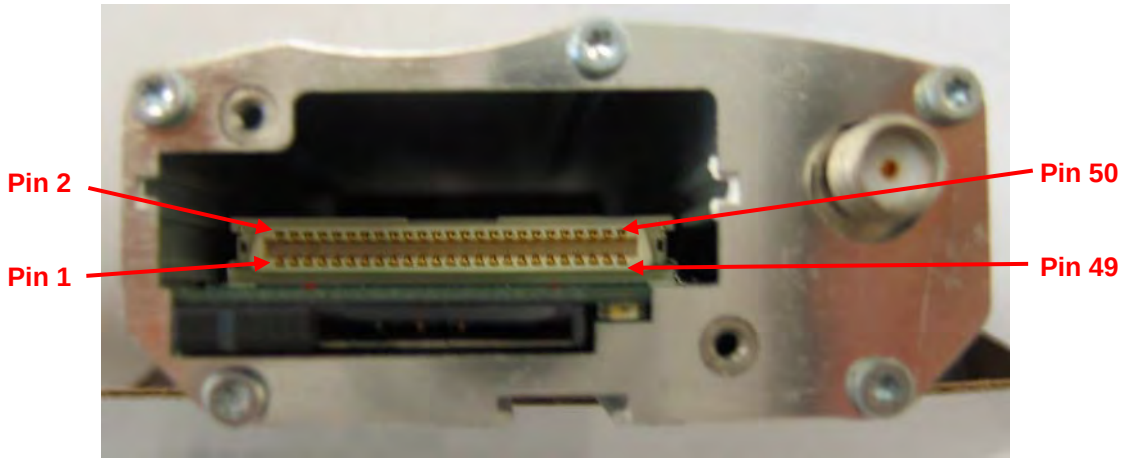

Figure 9: IES connector for feature expansion

Table 3: IES Connector Description

Pin Number	Signal Name		I/O type	Voltage	I/O*	Reset State	Description	Dealing with unused pins
	Nominal	Mux						
1	GND						Ground	
2	GND						Ground	
3	GPIO4	COL0	C8	GSM-1V8	I/O	Pull-up	Keypad column 0	NC
4	GPIO5	COL1	C8	GSM-1V8	I/O	Pull-up	Keypad column 1	NC
5	GPIO6	COL2	C8	GSM-1V8	I/O	Pull-up	Keypad column 2	NC
6	GPIO7	COL3	C8	GSM-1V8	I/O	Pull-up	Keypad column 3	NC
7	VPAD-USB			VPAD-USB	I		USB Power supply input	NC
8	USB-DP			VPAD-USB	I/O		USB Data	NC
9	USB-DM			VPAD-USB	I/O		USB Data	NC
10	GSM-1V8*			GSM-1V8	O		1.8V Supply Output (for GPIO pull-up only)	NC
11	GSM-2V8*			GSM-1V8	O		2.8V Supply Output (for GPIO pull-up only)	NC
12	BOOT			GSM-1V8	I		Not Used	Add a test point / a jumper/ a switch to VCC_1V8 (Pin 10) in case Download Specific mode is used (See product specification for details)
13	~RESET		C4	GSM-1V8	I/O		RESET Input	NC or add a test point
14	AUX-ADC		A2	Analog	I		Analog to Digital Input	Pull to GND
15	~SPI1-CS	GPIO31	C1	GSM-2V8	O	Z	SPI1 Chip Select	NC
16	SPI1-CLK	GPIO32	C1	GSM-2V8	O	Z	SPI1 Clock	NC
17	SPI1-I	GPIO30	C1	GSM-2V8	I	Z	SPI1 Data Input	NC
18	SPI1-IO	GPIO29	C1	GSM-2V8	I/O	Z	SPI1 Data Input / Output	NC
19	SPI2-CLK	GPIO32	C1	GSM-2V8	O	Z	SPI2 Clock	NC
20	SPI2-IO	GPIO33	C1	GSM-2V8	I/O	Z	SPI2 Data Input / Output	NC
21	~SPI2-CS	GPIO35	C1	GSM-2V8	O	Z	SPI2 Chip Select	NC
22	SPI2-I	GPIO34	C1	GSM-2V8	I	Z	SPI2 Data Input	NC
23	CT104-RXD2	GPIO15	C1	GSM-1V8	O	Z	Auxiliary RS232 Receive	Add a test point for firmware upgrade
24	CT103-TXD2	GPIO14	C1	GSM-1V8	I	Z	Auxiliary RS232 Transmit	(TXD2) Pull-up to VCC_1V8 with 100kΩ and add a test point for firmware update
25	~CT106-CTS2	GPIO16	C1	GSM-1V8	O	Z	Auxiliary RS232 Clear To Send	(CTS2) Add a test point for firmware update
26	~CT105-RTS2	GPIO17	C1	GSM-1V8	I	Z	Auxiliary RS232 Request To Send	(RTS2) Pull-up to VCC_1V8 with 100kΩ and add a test point for

Pin Number	Signal Name		I/O type	Voltage	I/O*	Reset State	Description	Dealing with unused pins
	Nominal	Mux						
								firmware update
27	GPIO8	COL4	C8	GSM-1V8	I/O	Pull-up	Keypad column 4	NC
28	GPIO26	SCL	A1	Open Drain	O	Z	I²C Clock	NC
29	GPIO19		C1	GSM-2V8	I/O	Z		NC
30	GPIO27	SDA	A1	Open Drain	I/O	Z	I²C Data	NC
31	GPIO20		C1	GSM-2V8	I/O	Undefined		NC
32	INT0	GPIO3	C1	GSM-1V8	I	Z	Interruption 0 Input	If INT0 is not used, it should be configured as GPIO
33	GPIO23	**	C1	GSM-2V8	I/O	Z		NC
34	GPIO22	**	C1	GSM-2V8	I/O	Z		NC
35	~CT108-2-DTR1	GPIO41	C1	GSM-2V8	I	Z	Main RS232 Data Terminal Ready	(DTR1) Pull-up to VCC_2V8 with 100kΩ
36	PCM-SYNC			GSM-1V8	O	Pull-down	PCM Frame Synchro	NC
37	PCM-IN		C5	GSM-1V8	I	Pull-up	PCM Data Input	NC
38	PCM-CLK			GSM-1V8	O	Pull-down	PCM Clock	NC
39	PCM-OUT			GSM-1V8	O	Pull-up	PCM Data Output	NC
40	AUX-DAC			Analog	O		Digital to Analog Output	NC
41	VCC-2V8			VCC_2V8	O		LDO 2.8V Supply Output	NC
42	GND						Ground	
43	DC-IN			DC-IN from 5.5V~32VDC	O		DC voltage input through Micro-Fit connector	NC
44	DC-IN			DC-IN from 5.5V~32VDC	O		DC voltage input through Micro-Fit connector	NC
45	GND						Ground	
46	4V			4V	O		4V DC/DC converter Output	NC
47	4V			4V	O		4V DC/DC converter Output	NC
48	GND						Ground	
49	GND						Ground	
50	GND						Ground	

3.2.2 Power supply cable

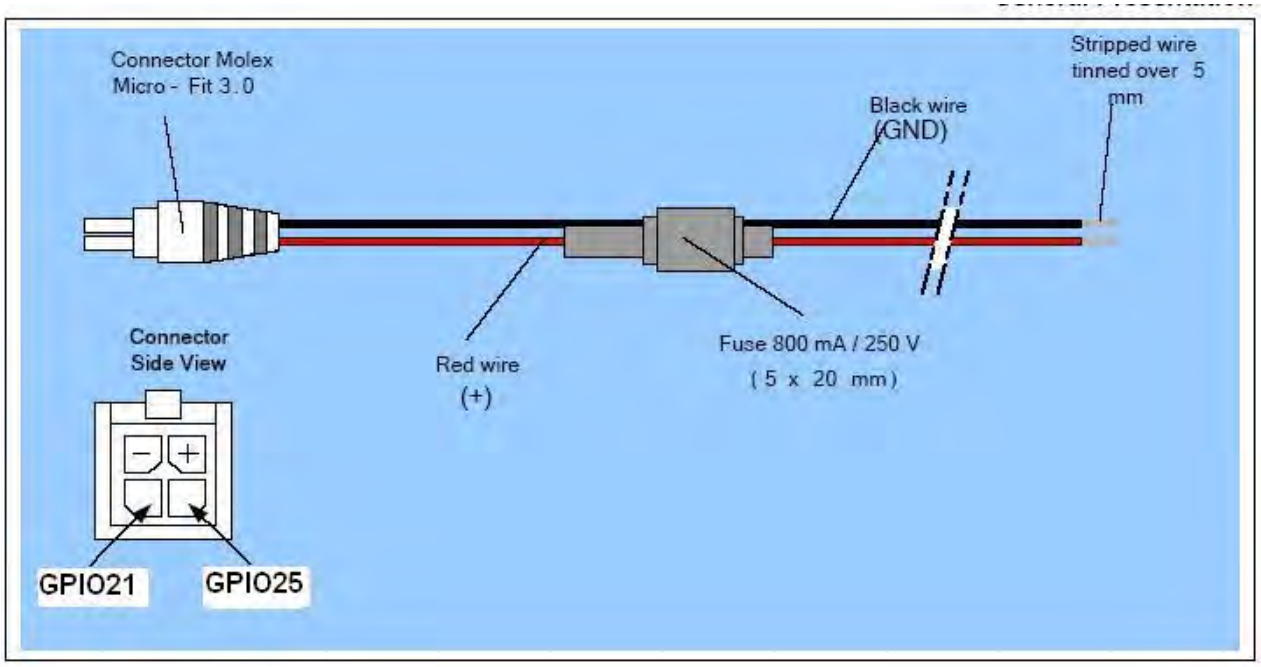

Figure 10: Power supply cable

Component	Characteristics
Micro-Fit connector 4-pin	Part number: MOLEX 43025-0400
Cable	Cable length: ~1.5 m
Wire	Core: tinned copper 24 x 0.2 mm
	Section: 0.75 mm^2

4 Features and Services

4.1 Basic Features and Services

Basic features of the FASTRACK Supreme and available services are summarized in the table below.

Table 4: Basic features of the FASTRACK Supreme

Features	GSM850 / GSM900	DCS1800 / PCS1900
Open AT®	Open AT® programmable: Native execution of embedded standard ANSI C applications, Custom AT command creation, Custom application library creation, Standalone operation.	
Standard	850MHz / 900 MHz. E-GSM compliant. Output power: class 4 (2W). Fully compliant with ETSI GSM phase 2 + small MS.	1800 MHz / 1900MHz Output power: class 1 (1W). Fully compliant with ETSI GSM phase 2 + small MS.
GPRS	Class 10. PBCCH support. Coding schemes: CS1 to CS4. Compliant with SMG31bis. Embedded TCP/IP stack.	
EGPRS	Output power: 0.5W	Output power: 0.4W
(for FASTRACK Supreme 20 only)	Class 10. PBCCH support. Coding schemes: MCS1 to MCS9. Compliant with SMG31bis. Embedded TCP/IP stack.	

Features	GSM850 / GSM900	DCS1800 / PCS1900
Interfaces	RS232 (V.24/V.28) Serial interface supporting: ▪ Baud rate (bits/s): 300, 600, 1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200, 230400, 460800 and 921600. ▪ Autobauding (bits/s): from 1200 to 921600. 2 General Purpose Input/Output gates (GPIOs) available. 1.8 V / 3 V SIM interface. AT command set based on V.25ter and GSM 07.05 & 07.07. Open AT® interface for embedded application. Open AT® Plug-In Compatible.	
SMS	Text & PDU. Point to point (MT/MO). Cell broadcast.	
Data	Data circuit asynchronous. Transparent and Non Transparent modes. Up to 14.400 bits/s. MNP Class 2 error correction. V42.bis data compression.	
Fax	Automatic fax group 3 (class 1 and Class 2).	
Audio	Echo cancellation Noise reduction Telephony. Emergency calls. Full Rate, Enhanced Full Rate, Half Rate operation and Adaptive Multi-Rate (FR/EFR/HR/AMR). Dual Tone Multi Frequency function (DTMF).	

Features	GSM850 / GSM900	DCS1800 / PCS1900
GSM supplement services	Call forwarding. Call barring. Multiparty. Call waiting and call hold. Calling line identity. Advice of charge. USSD	
Other	DC power supply Real Time Clock with calendar Complete shielding	

For other detailed technical characteristics, refer to Section 8.

4.2 Additional NEW Features

4.2.1 Support Additional GSM850/PCS1900 Bands

Apart from GSM900/DCS1800, the FASTRACK Supreme Plug & Play now supports also the GSM850/PCS1900 bands. FASTRACK Supreme is fully compliant to PTCRB and FCC also.

4.2.2 IES Interface for Easy Expansion of Application Features

The FASTRACK Supreme Plug & Play offers a 50 pin Internal Expansion Socket (IES) Interface accessible for customer use. It is the additional interface which is easy for customers to expand their application features without voiding the warrantee of the FASTRACK Supreme, by simply plugging in an Internal Expansion Socket Module (IESM) board through the matting connector of the IES interface.

Thanks to the flexible IES interface, customers are ready to expand the application features by plugging in the corresponding Internal Expansion Socket Module (IESM) of GPS, I/O expander…, etc.

For brief description of the interface, please refer to Section 3.2.1.4.

For technical detail, please refer to Document [11] or contact your Wavecom distributor or Wavecom FAE.

4.2.3 Serial Port Auto Shut Down or Improving Power Consumption

In order to save power consumption when there is no data communication between the Plug & Play and the DTE, FASTRACK Supreme has now implement the Serial Port Auto Shut Down feature. User can activate or deactivate the Serial Port Auto Shut Down mode by simple AT-command.

For detail, please refer to Section 7.3.4.

4.2.4 Real Time Clock (RTC) for Saving Date and Time

The FASTRACK Supreme has now implemented the Real Time Clock for saving date and time when the Plug & Play is unplugged from the DC power supply through the DC power cable.

For detail, please refer to Section 7.8.

4.2.5 SIM Card Lock Feature

The FASTRACK Supreme has now implemented a SIM connector having a carrier with lock. This helps ensuring the user to have proper SIM card insertion and locked before proper use of GSM network.

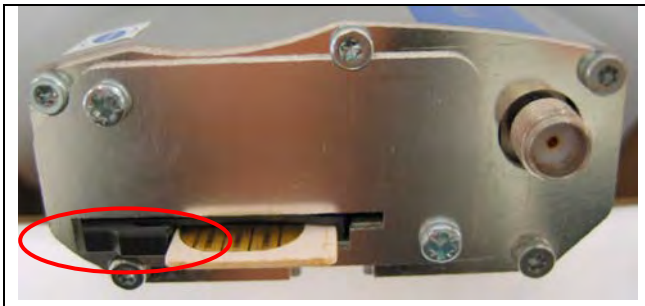	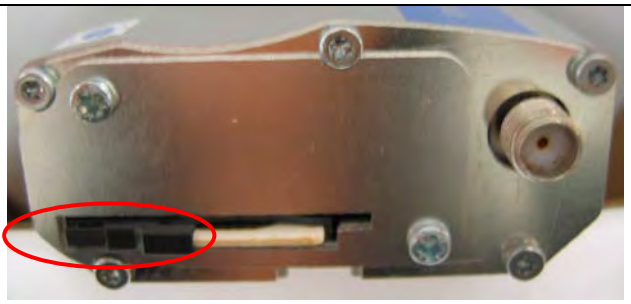
SIM card is inserted but not locked. GSM network is not ready for use. Only emergency call 112 is possible.	SIM card is inserted and being locked properly. GSM network is ready for use.

Figure 11: SIM card lock feature

5 Using the FASTRACK Supreme Plug & Play

5.1 Getting Started

5.1.1 Mount the FASTRACK Supreme

To mount the FASTRACK Supreme on its support, bind it using the holding bridles as shown in the Figure 12 below.

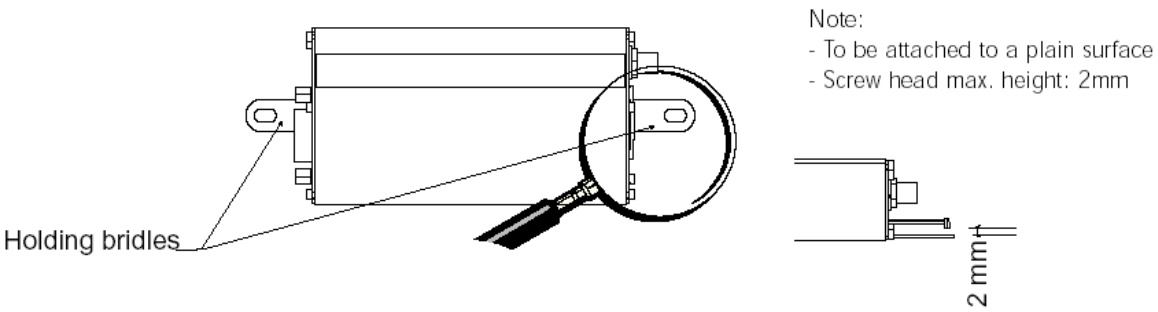

Figure 12: FASTRACK Supreme mounting

For the drill template, refer to Figure 18.

5.1.2 Set up the FASTRACK Supreme

To set up the FASTRACK Supreme, perform the following operations:

- Insert the SIM card into the SIM card holder of the FASTRACK Supreme.
- Lock the SIM card by sliding the lever towards the SIM card.
- Connect the antenna to the SMA connector.
- Connect both sides of the serial and control cable (15-pin Sub HD connector on the FASTRACK Supreme side).
- Connect the power supply cable to the external power supply source.

Note:

For automotive application, it is recommended to connect the V+BATTERY line of the FASTRACK Supreme directly to the battery positive terminal.

- Plug the power supply cable into the FASTRACK Supreme and switch on the external power supply source.
- The FASTRACK Supreme is ready to work. Refer to Section 5.10 for the description of AT commands used to configure the FASTRACK Supreme.

5.1.3 Check the communication with the FASTRACK Supreme

To check the communication with the FASTRACK Supreme, do the following operations:

- Connect the RS232 link between the DTE (port COM) and the FASTRACK Supreme (DCE).
- Configure the RS232 port of the DTE as follows:
  - Bits per second: **115.200 bps**,
  - Data bits: **8**,
  - Parity: **None**,
  - Stop bits: **1**,
  - Flow control: **hardware**.
- Using a communication software such as a HyperTerminal, enter the **AT↵** command. The response of the FASTRACK Supreme must be **OK** displayed in the HyperTerminal window.
- If the communication cannot be established with the FASTRACK Supreme, do the following:
  - Check the RS232 connection between the DTE and the FASTRACK Supreme (DCE),
  - Check the configuration of the port COM used on the DTE.
- Example of AT commands which can be used after getting started the FASTRACK Supreme:
  - **AT+CGMI**: FASTRACK Supreme answer is "WAVECOM MODEM" when serial link is OK.
  - **AT+CPIN=xxxx**: to enter a PIN code xxxx (if activated).
  - **AT+CSQ**: to verify the received signal strength.
  - **AT+CREG?**: to verify the registration of the FASTRACK Supreme Plug & Play on the network.
  - **ATD<phone number>;**: to initiate a voice call.
  - **ATH**: to hang up (end of call).

For further information on these AT commands and their associated parameters, refer to "AT Commands Interface Guide" [6].

5.1.4 Reset the FASTRACK Supreme

To reset the FASTRACK Supreme, a hardware reset signal is available on pin 14 of the Sub HD 15-pin connector (RESET).

The FASTRACK Supreme reset is carried out when this pin is low for at least 200 µs.

Warning This signal has to be considered as an emergency reset only. For further details on the FASTRACK Supreme reset, refer to Section 7.7.

5.2 Specific Recommendations when Using the FASTRACK Supreme on Trucks

Warning: The power supply connection of the FASTRACK Supreme must NEVER be directly connected to the truck battery.

5.2.1 Recommended Power Supply Connection on Trucks

All trucks have a circuit breaker on the exterior of the cabin. The circuit breaker is used for safety reasons: if a fire blazes in the trucks, (for example, on the wiring trunk) the driver may cut the current source to avoid any damage (explosion). The circuit breaker is connected to the truck ground, most often associated with the fuse box.

Most of truck circuit breakers do not cut the Positive Supply line of the battery, but cut the ground line of the later.

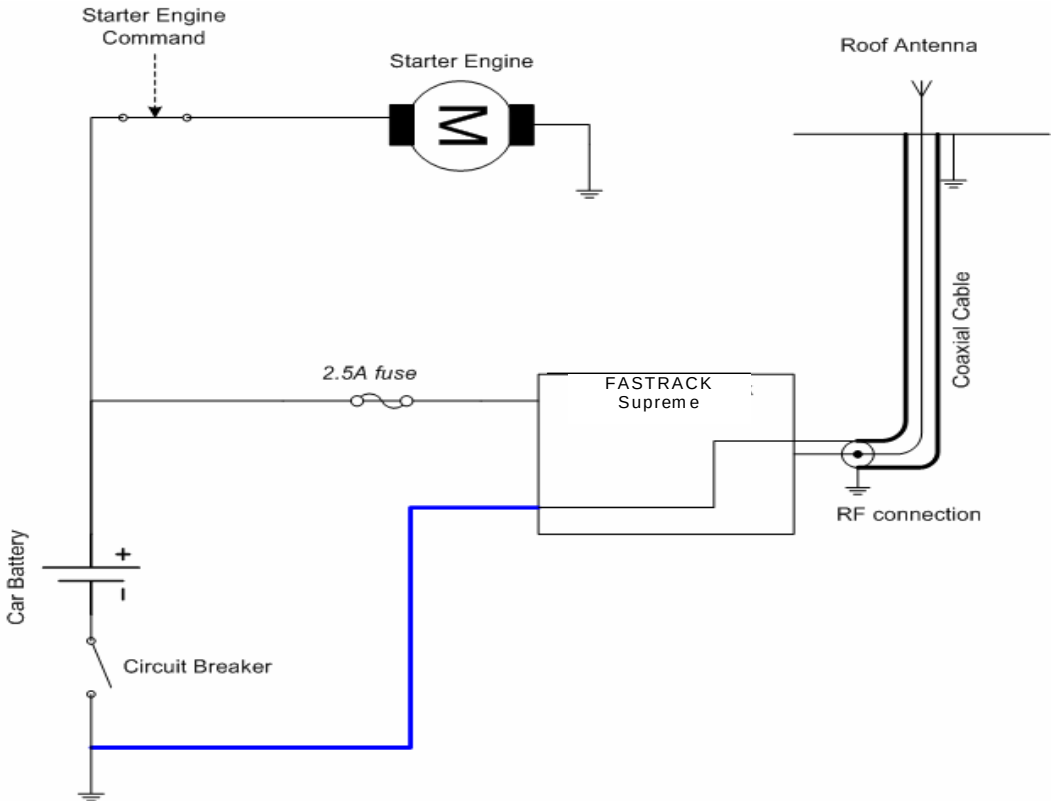

Figure 13: Recommended power supply connection on trucks

Figure 13 gives the recommended power supply connection where the ground connection of the FASTRACK Supreme is not directly connected to the battery but is connected after the Circuit Breaker (on the truck ground or the fuse box).

5.2.2 Technical Constraints on Trucks

It is highly not recommended to connect directly the power supply on the battery rather than on the circuit breaker. The FASTRACK Supreme may be damaged when starting the truck if the circuit breaker is switched OFF (in this case, the truck ground and the battery ground will be connected through the FASTRACK Supreme as shown in the figure below).

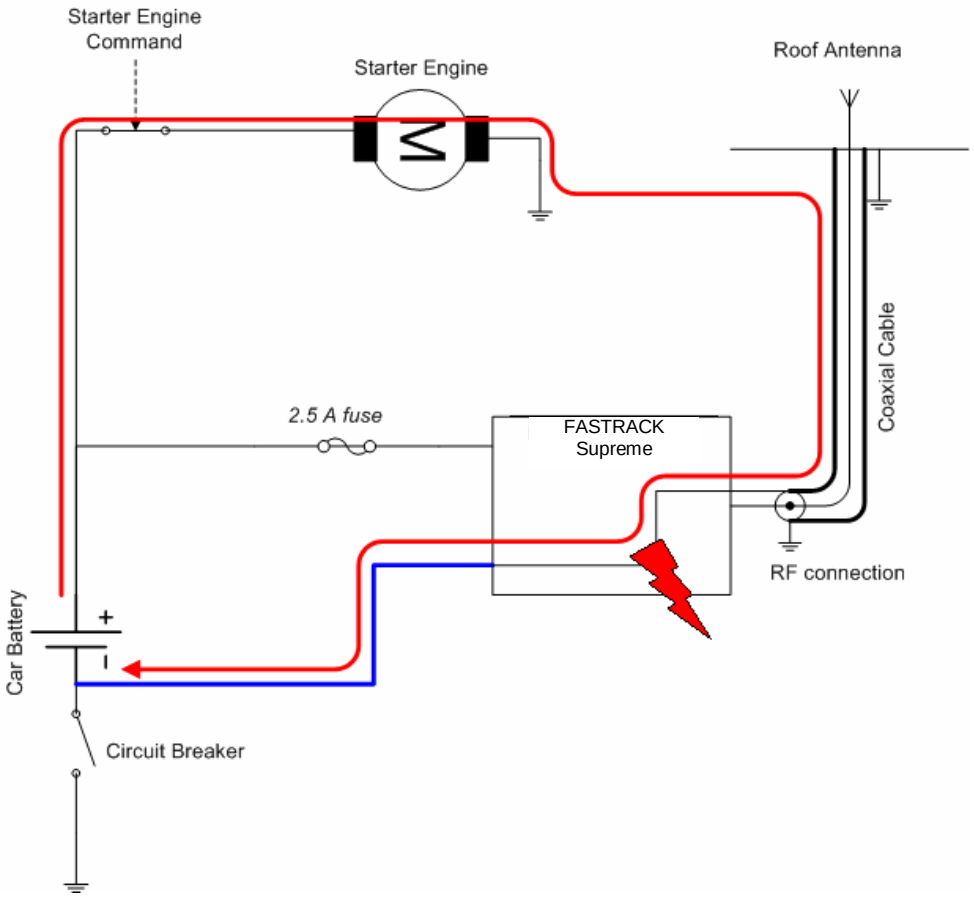

Figure 14: Example of electrical connection which may dramatically damage the FASTRACK Supreme

Figure 14 gives an example of electrical connection which may dramatically damage the FASTRACK Supreme when its ground connection is directly connected to the battery ground.

In this example, when the circuit breaker is switched OFF, the current flows through the FASTRACK Supreme and powers the electrical circuit of the truck (for example, dashboard).

Furthermore, when the Starter Engine command will be used, it will destroy the cables or the FASTRACK Supreme.

Since the internal tracks are not designed to support high current (up to 60 A when starting the truck), they will be destroyed.

5.3 FASTRACK Supreme Operational Status

The FASTRACK Supreme operational status is given by the red LED status located next to the SIM connector on the FASTRACK Supreme panel.

The Table 5 below gives the meaning of the various statuses available.

Table 5: FASTRACK Supreme operational status

LED Status	LED light activity	FASTRACK Supreme Plug & Play status
ON	LED ON permanent	FASTRACK Supreme is switched ON but not registered on the network
	LED Flashing slowly	FASTRACK Supreme is switched ON and registered on the network, but no communication is in progress (Idle mode)
	LED Flashing rapidly	FASTRACK Supreme is switched ON and registered on the network, and a communication is in progress
OFF	LED OFF	FASTRACK Supreme is switched OFF, or Flash LED is disabled* by the user.

* : Flash LED can be disabled by user when in Slow Standby mode in order to save power consumption. For detail, please refer to Section 7.9.

5.4 Echo Function Disabled

If no echo is displayed when entering an AT command, that means:

- The "local echo" parameter of your communication software (such as HyperTerminal) is disabled.
- The FASTRACK Supreme echo function is disabled.

To enable the FASTRACK Supreme echo function, enter the **ATE1**.

When sending AT commands to the FASTRACK Supreme by using a communication software, it is recommended:

- to disable the "local echo" parameter of your communication software (such as HyperTerminal),
- to enable the FASTRACK Supreme echo function (**ATE1** command).

In a Machine To Machine communication with the FASTRACK Supreme, it is recommended to disable the FASTRACK Supreme echo function (**ATE0** command) in order to avoid useless CPU processing.

For further information on **ATE0** and **ATE1** commands, refer to "AT Commands Interface Guide" [6].

5.5 Verify the Received Signal Strength

The FASTRACK Supreme establishes a call only if the received signal is sufficiently strong.

To verify the received signal strength, do the following operations:

- Using a communication software such as HyperTerminal, enter the AT command **AT+CSQ.**
  The response returned has the following format:
  +CSQ: <rssi>,<ber> with:
  - **<rssi>** = received signal strength indication,
  - **<ber>** = channel bit error rate.
- Verify the **<rssi>** value returned using the Table 6 below.

Table 6: Values of received signal strength

Value of received signal strength indication (<rssi>)	Interpretation of the received signal strength
0 - 10	Insufficient(*)
11 - 31	Sufficient(*)
32 - 98	Not defined
99	No measure available

(*) Based on general observations.

For further information on AT commands, refer to "AT Commands Interface Guide" [6].

5.6 Check the Pin Code Status

To check that the pin code has been entered, use a communication software such as a HyperTerminal, then enter **AT+CPIN?** command.

The table below gives the main responses returned:

Table 7: AT+CPIN Responses

AT+CPIN response (*)	Interpretation
+CPIN: READY	Code PIN has been entered
+CPIN: SIM PIN	Code PIN has not been entered

(*)For further information on the other possible responses and their meaning, refer to "AT Commands Interface Guide" [6].

5.7 Switch between EU/US Band(s)

To switch between EU/US band(s) for the FASTRACK Supreme, use a communication software such as a HyperTerminal, then enter **AT+WMBS=<band>[,<param>]** command.

The table below gives the commands for various band(s) selection:

Table 8: AT+WMBS Band Selection

AT+WMBS response (*)	Interpretation
AT+WMBS=0,x	Select mono band mode 850MHz.
AT+WMBS=1,x	Select mono band mode extended 900MHz
AT+WMBS=2,x	Select mono band mode 1800MHz
AT+WMBS=3,x	Select mono band mode 1900MHz
AT+WMBS=4,x	Select dual band mode 850/1900MHz
AT+WMBS=5,x	Select dual band mode extended 900MHz/1800MHz
AT+WMBS=6,x	Select dual band mode extended 900MHz/1900MHz

(*)For further information on the other possible responses and their meaning, refer to "AT Commands Interface Guide" [6].

Remark:

x=0 : The Plug & Play will have to be reset to start on specified band(s).

x=1 : The change is effective immediately. This mode is forbidden while in communication and during Plug & Play initialization.

Refer to "AT Commands Interface Guide" [6] for further information on AT commands.

5.8 Check the Band(s) Selection

To check the band selection for the FASTRACK Supreme, use a communication software such as a HyperTerminal, then enter **AT+WMBS?** command.

The table below gives the main responses returned:

Table 9: AT+WMBS Responses

AT+WMBS response (*)	Interpretation
+WMBS: 0,x	Mono band mode 850MHz is selected
+WMBS: 1,x	Mono band mode extended 900MHz is selected
+WMBS: 2,x	Mono band mode 1800MHz is selected
+WMBS: 3,x	Mono band mode 1900MHz is selected
+WMBS: 4,x	Dual band mode 850/1900MHz are selected
+WMBS: 5,x	Dual band mode extended 900MHz/1800MHz are selected
+WMBS: 6,x	Dual band mode extended 900MHz/1900MHz are selected

(*)For further information on the other possible responses and their meaning, refer to "AT Commands Interface Guide" [6].

5.9 Verify the FASTRACK Supreme Network Registration

1. Make sure a valid SIM card has been previously inserted and locked in the FASTRACK Supreme SIM card holder.
2. Using a communication software such as a HyperTerminal, enter the following AT commands:
   a. **AT+CPIN=xxxx** to enter PIN code xxxx.
   b. **AT+WMBS?** To check the current band setting in the Plug & Play
   c. **AT+WMBS=<Band>[,<param>]** To switch band/mode when needed
   d. **AT+CREG?.** To ascertain the registration status.

      The format of the returned response is as follows:

      +CREG: <mode>,<stat> with:

   - ***<mode>*** = unsolicited registration message configuration,
   - ***<stat>*** = registration state.
3. Verify the state of registration according the returned value given in the table below.

Table 10: Values of network registration

Returned Value (*) <mode>,<stat>	Network registration
+CREG: 0,0	No (not registered)
+CREG: 0,1	Yes (registered, home network)
+CREG: 0,5	Yes (registered, roaming)

(*)For further information on the other returned values and their meaning, refer to "AT Commands Interface Guide" [6].

If the FASTRACK Supreme is not registered, perform the following procedure:

- Check the connection between the FASTRACK Supreme and the antenna.
- Verify the signal strength to determine the received signal strength (refer to Section 5.5).

Note: For information on AT command relating to the network registration in GPRS mode, and in particular: CGREG, CGCLASS, CGATT, refer to "AT Commands Interface Guide" [6].

5.10 Main AT Commands for the Plug & Play

The table below lists the main AT commands required for starting the Plug & Play.

For other AT commands available or further information on the AT commands, refer to "AT Commands Interface Guide" [6].

Table 11: Main usual AT commands for the Plug & Play

Description	AT commands	FASTRACK Supreme Plug & Play response	Comment
Check for selected band(s)	AT+WMBS?	+WMBS:<Band>,<ResetFlag> OK	Current selected band mode is return
Band(s) switch	AT+WMBS=<Band>	OK	Band switch is accepted, Plug & Play has to be reset for change to be effective
	AT+WMBS=<Band>,0	OK	Band switch is accepted, Plug & Play has to be reset for change to be effective
	AT+WMBS=<Band>,1	OK	Band switch is accepted and GSMS stack restarted
	AT+WMBS=<Band>	+CME ERROR: 3	Band not allowed
Enter PIN Code	AT+CPIN=xxxx (xxxx = PIN code)	OK	PIN Code accepted.
		+CME ERROR: 16	Incorrect PIN Code (with +CMEE = 1 mode) (1*)
		+CME ERROR: 3	PIN code already entered (with +CMEE = 1 mode) (1*)
Network registration checking	AT+CREG?	+CREG: 0,1	FASTRACK Supreme Plug & Play registered on the network.
		+CREG: 0,2	FASTRACK Supreme Plug & Play not registered on the network, registration attempt.

Description	AT commands	FASTRACK Supreme Plug & Play response	Comment
		+CREG: 0,0	FASTRACK Supreme Plug & Play not registered on the network, no registration attempt.
Receiving an incoming call	ATA	OK	Answer the call.
Initiate a call	ATD<phone number>; (Don't forget the « ; » at the end for « voice » call)	OK	Communication established.
		+CME ERROR: 11	PIN code not entered (with +CMEE = 1 mode).
		+CME ERROR: 3	AOC credit exceeded or a communication is already established.
Initiate an emergency call	ATD112; (Don't forget the « ; » at the end for « voice » call)	OK	Communication established.
Communication loss		NO CARRIER	
Hang up	ATH	OK	
Store the parameters in EEPROM	AT&W	OK	The configuration settings are stored in EEPROM.

(1*) The command "AT+CMEE=1" switch to a mode enabling more complete error diagnostics.

5.11 Firmware Upgrade Procedure

The firmware upgrade procedure is used to update the firmware embedded into the FASTRACK Supreme.

That procedure consists in downloading the firmware into internal memories through the RS232 serial link available on the SUB-D 15-pin connector.

Refer to "Firmware upgrade procedure" [8] for a detailed description of this procedure.

6 Troubleshooting

This section of the document describes possible problems encountered when using the FASTRACK Supreme and their solutions.

To review other troubleshooting information, refer the 'FAQs' (Frequently Asked Questions) page at www.wavecom.com or use the following link:
http://www.wavecom.com/support/faqs.php

6.1 No Communication with the FASTRACK Supreme through the Serial Link

If the FASTRACK Supreme does not answer to AT commands through the serial link, refer to the table below for possible causes and solutions.

Table 12: Solutions for no connection with FASTRACK Supreme through serial link

If the Supreme returns	then ask	Action
Nothing	Is the FASTRACK Supreme powered correctly?	Make sure the external power supply is connected to the FASTRACK Supreme and provides a voltage in the range of 5.5 V to 32 V.
	Is the serial cable connected at both sides?	Check the serial cable connection
	Does the serial cable follow correctly pin assignment shown in paragraph 3.2.1.2.	Connect the cable by following pin assignment given in paragraph 3.2.1.1.
Nothing or non-significant characters	Is the communication program properly configured on PC?	Ensure the setting of the communication program is fit to setting of FASTRACK Supreme. FASTRACK Supreme factory setting is: Data bits = 8 Parity = none Stop bits = 1 Baud = 115 200 bps. Flow control = hardware
	Is there another program interfering with the communication program (i.e. Conflict on communication port access)	Close the interfering program.

6.2 Receiving "ERROR" Message

The FASTRACK Supreme returns an "**ERROR"** message (in reply to an AT command) in the following cases:

- AT command syntax is incorrect: check the command syntax (refer to "AT Commands Interface Guide" [6]),
- AT command syntax is correct, but transmitted with wrong parameters:
- Enter the **AT+CMEE=1** command in order to change the error report method to the verbose method, which includes the error codes.
- Enter again the AT command which previously caused the reception of "ERROR" message in order to get the Mobile Equipment error code.

When the verbose error report method is enabled, the response of the FASTRACK Supreme in case of error is as follows:

- Either +CME ERROR: <error result code>,
- Or +CMS ERROR: <error result code>.

Refer to "AT Commands Interface Guide" [6] for error result code description and further details on the **AT +CMEE** command.

Note: It is strongly recommended to always enable the verbose error report method to get the Mobile Equipment error code (enter **AT +CMEE=1** command).

6.3 Receiving "NO CARRIER" Message

If the FASTRACK Supreme returns a **"NO CARRIER"** message upon an attempted call (voice or data), then refer to the table below for possible causes and solutions.

Table 13: Solutions for "NO CARRIER" message

If the Supreme returns…	Then ask…	Action…
"**NO CARRIER**"	Is the received signal strong enough?	Refer to section 5.5 to verify the strength of the received signal.
	Is the FASTRACK Supreme registered on the network?	Refer to section 5.9 to verify the registration.
	Is the antenna properly connected?	Refer to section 8.2.7.3 for antenna requirements.
	Is the band selection correction?	Refer to Section 7.2 for band switch
"**NO CARRIER**" (when trying to issue a voice communication)	Is the semicolon (;) entered immediately after the phone number in the AT command?	Ensure that the semicolon (;) is entered immediately after the phone number in the AT command. e.g. **ATD######;**
"**NO CARRIER**" (when trying to issue a data communication)	Is the SIM card configured for data / fax calls?	Configure the SIM card for data / fax calls (Ask your network provider if necessary).
	Is the selected bearer type supported by the called party?	Ensure that the selected bearer type is supported by the called party.
	Is the selected bearer type supported by the network?	Ensure that the selected bearer type is supported by the network. If no success, try bearer selection type by AT command: AT+CBST=0,0,3

If the FASTRACK Supreme returns a "**NO CARRIER"** message, you may have the **extended error code** by using AT command **AT+CEER**. Refer to the table below for interpretation of **extended error code**.

Table 14: Interpretation of extended error code

Error Code	Diagnostic	Hint
1	Unallocated phone number	
16	Normal call clearing	
17	User busy	
18	No user responding	
19	User alerting, no answer	
21	Call rejected	
22	Number changed	
31	Normal, unspecified	
50	Requested facility not subscribed	Check your subscription (data subscription available?).
68	ACM equal or greater than ACMmax	Credit of your pre-paid SIM card expired.
252	Call barring on outgoing calls	
253	Call barring on incoming calls	
3, 6, 8, 29, 34, 38, 41, 42, 43, 44, 47, 49, 57, 58, 63, 65, 69, 70, 79, 254	Network causes	See "AT Commands Interface Guide" [6] for further details or call network provider.

Note: For all other codes, and/or details, see AT commands documentation [6].

7 Functional Description

7.1 Architecture

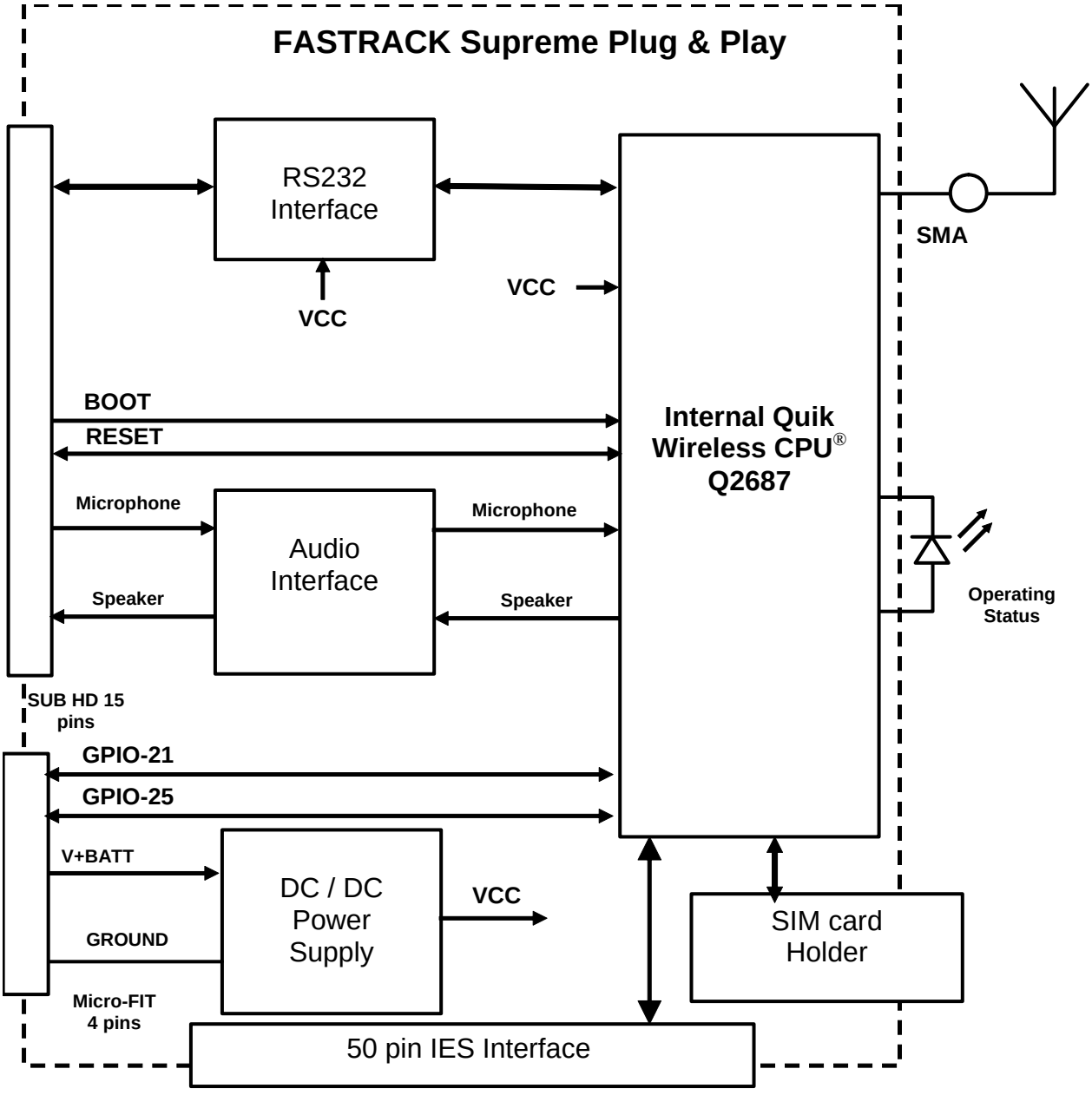

Figure 15: Functional architecture

7.2 EU and US Bands

7.2.1 General Presentation

The FASTRACK Supreme is a quad band Plug & Play. It supports either EU bands (EGSM900/DCS1800) or US bands (GSM850/ PCS1900), depending on the band setting within the Plug & Play. Users are free to switch between EU bands and US bands by simple AT commands when the selected bands are supported.

7.2.2 AT COMMAND for Bands Switch

EU/US band is easily switched/checked by AT command **AT+WMBS**.

For detail, please refer to Section 5.7 and 5.8.

7.3 Power Supply

7.3.1 General Presentation

The FASTRACK Supreme is supplied by an external DC voltage (V+BATTERY) from +5.5 V to +32 V at 2.2 A.

Main regulation is made with an internal DC/DC converter in order to supply all the internal functions with a DC voltage.

Correct operation of the FASTRACK Supreme in communication mode is not guaranteed if input voltage (V+BATTERY) falls below 5.5 V.

Note: The minimum input voltage specified here is at the FASTRACK Supreme input. Be careful of the input voltage decrease caused by the power cable. See paragraph 8.2.1 for more information.

7.3.2 Protections

The FASTRACK Supreme is protected by a 800 mA / 250 V fuse directly bonded on the power supply cable.

The FASTRACK Supreme is also protected against voltage over +32 V.

Filtering guarantees:

- EMI/RFI protection in input and output,
- Signal smoothing.

7.4 RS232 Serial Link

7.4.1 General Presentation

The RS232 interface performs the voltage level adaptation (V24/CMOS ⇔ V24/V28) between the internal FASTRACK Supreme Plug & Play (DCE) and the external world (DTE).

The RS232 interface is internally protected (by ESD protection) against electrostatic surges on the RS232 lines.

Filtering guarantees:

- EMI/RFI protection in input and output,
- Signal smoothing.

Signals available on the RS232 serial link are:

- TX data (CT103/TX),
- RX data (CT104/RX),
- Request To Send (CT105/RTS),
- Clear To Send (CT106/CTS),
- Data Terminal Ready (CT108-2/DTR),
- Data Set Ready (CT107/DSR),
- Data Carrier Detect (CT109/DCD),
- Ring Indicator (CT125/RI).

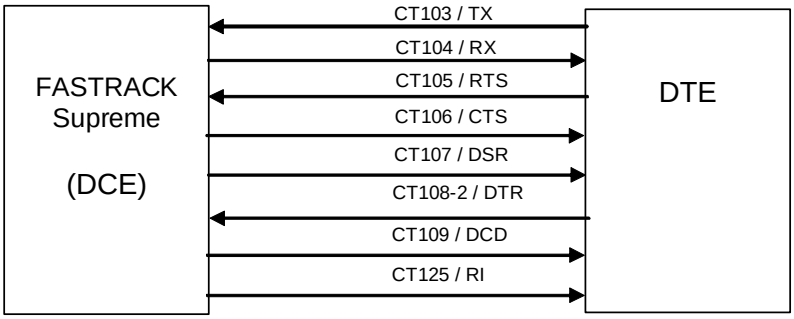

Figure 16: RS232 Serial Link signals

RS232 interface has been designed to allow flexibility in the use of the serial interface signals. However, the use of TX, RX, CTS and RTS signals is mandatory, which is not the case for DTR, DSR, DCD and RI signals which can be not used.

7.4.2 Autobauding Mode

The autobauding mode allows the FASTRACK Supreme to detect the baud rate used by the DTE connected to the RS232 serial link.

Autobauding mode is controlled by AT commands. See "AT Commands Interface Guide" [6] for details on this function.

7.4.3 Pin Description

Signal	Sub HD connector Pin number	I/O	I/O type RS232 STANDARD	Description
CTXD/CT103	2	I	TX	Transmit serial data
CRXD/CT104	6	O	RX	Receive serial data
CRTS/CT105	12	I	RTS	Request To Send
CCTS/CT106	11	O	CTS	Clear To Send
CDSR/CT107	7	O	DSR	Data Set Ready
CDTR/CT108-2	8	I	DTR	Data Terminal Ready
CDCD/CT109	1	O	DCD	Data Carrier Detect
CRI/CT125	13	O	RI	Ring Indicator
CT102/GND	9		GND	Ground

7.4.4 Serial Port Auto shut down Feature

The UART1 can be shut down when there is no activity between the DTE and the FASTRACK Supreme Plug & Play. This can help for improving power consumption performance.

Serial Port Auto shut down feature is easily controlled by AT command **AT+WASR**.

- **AT+WASR=1** for entering the serial port auto shut down mode
- **AT+WASR=0** for exiting the serial port auto shut down mode

Refer to "AT Commands Interface Guide" [6] for further information on AT commands.

CAUTION: GPIO24 is reserved for serial port auto shut down feature. It is prohibited for customer use. Improper access to GPIO24 by customer may lead to unexpected behavior on UART1 performance.

7.5 General Purpose Input/Output (GPIO)

The FASTRACK Supreme provides two General Purpose Input / Output lines available for external use: GPIO21 and GPIO25.

These GPIOs may be controlled by AT commands:

- **AT+WIOW** for a write access to the GPIO value, when the GPIO is used as an output,
- **AT+WIOR** for a read access to the GPIO value, when the GPIO is used as an input.

Refer to "AT Commands Interface Guide" [6] for further information on AT commands.

After reset, both GPIOs are configured as inputs. The **AT+WIOM** command has to be used to change this configuration (refer to "AT Commands Interface Guide" [6] for further details).

Pin description

Signal	Power Supply connector (4-pin Micro-Fit)	I/O	I/O Voltage	Reset state	Description	Mulitplex with
GPIO21	3	I/O	2V8	Undefined	General Purpose I/O	No mux
GPIO25	4	I/O	2V8	Z	General Purpose I/O	INT1

Notes:

- The power supply cable may need to be modified due to the GPIO signals (GPIO21 & GPIO25) available on the 4-pin Micro-FIT connector of the FASTRACK Supreme.
- The previous generation M1306B have GPIO4 and GPIO5 being replaced by GPIO21 and GPIO25 respectively, for which both are of LOW level at reset state.

7.6 BOOT

This signal must not be connected. Its use is strictly reserved to Wavecom or competent retailers.

Caution: Previous generation M1306B has BOOT signal of HIGH level at 2.8V. But the FASTRACK Supreme now of 1.8V BOOT instead.

7.7 RESET

7.7.1 General presentation

This signal is used to force a reset procedure by providing low level during at least 200 µs.

This signal must be considered as an emergency reset only. A reset procedure is automatically driven by an internal hardware during the power-up sequence.

This signal may also be used to provide a reset to an external device. It then behaves as an output. If no external reset is necessary, this input may be left open, if used (emergency reset), it has to be driven either by an open collector or an open drain output:

- RESET pin 14 = 0, for FASTRACK Supreme Reset,
- RESET pin 14 = 1, for normal mode.

Pin description

Signal	Sub HD 15-Pin connector Pin number	I/O	I/O type	Voltage	Description
RESET	14	I/O	Open Drain	1V8	FASTRACK Supreme Reset

Caution: Previous generation M1306B has RESET signal of HIGH level at 2.8V. But the FASTRACK Supreme now of 1.8V RESET instead.

Additional comments on RESET:

The RESET process is activated either by the external RESET signal or by an internal signal (coming from a RESET generator). This automatic reset is activated at Power-up.

The FASTRACK Supreme remains in RESET mode as long as the RESET signal is held low.

Caution: This signal should be used only for "emergency" reset.

A software reset is always preferred to a hardware reset.

Note: See "AT Commands Interface Guide" [6] for further information on software reset.

7.7.2 Reset Sequence

To activate the "emergency" reset sequence, the RESET signal has to be set to low for 200 µs minimum.

As soon as the reset is done, the AT interface answers "OK" to the application. For this, the application must send **AT↵.**

If the application manages hardware flow control, the AT command may be sent during the initialization phase. Another solution is to use the **AT+WIND** command to get an unsolicited status from the FASTRACK Supreme.

For further details, refer to AT commands "AT Commands Interface Guide" [6].

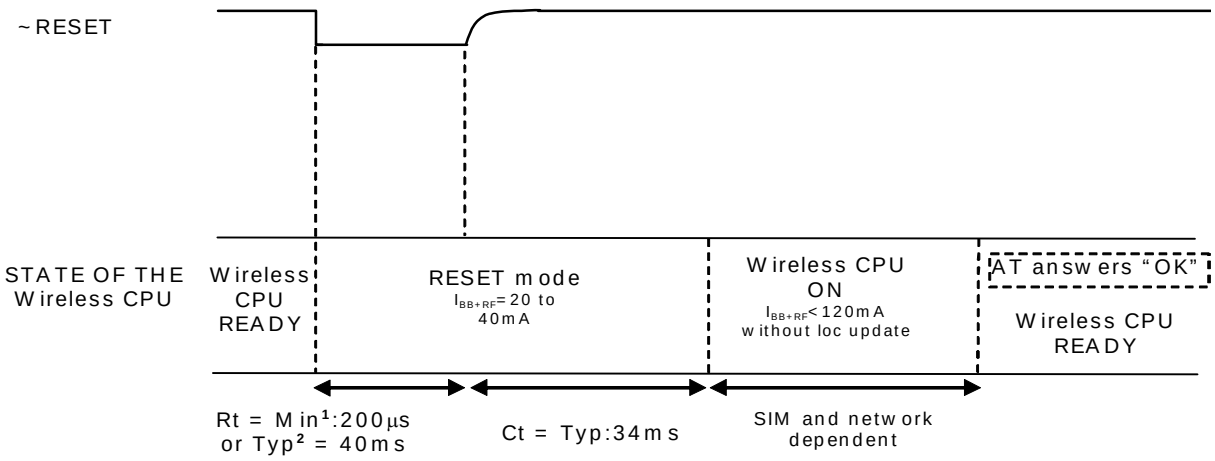

Figure 17: Reset sequence diagram

7.8 Audio

Audio interface is a standard one for connecting a phone handset.

Echo cancellation and noise reduction features are also available to improve the audio quality in case of hand-free application.

7.8.1 Microphone Inputs

The microphone inputs are differential ones in order to reject common mode noise and TDMA noise.

They already include the convenient biasing for an electret microphone (0.5 mA and 2 Volts) and are ESD protected.

This electret microphone may be directly connected to these inputs allowing an easy connection to a handset.

The microphone impedance must be around 2 kΩ.

AC coupling is already embedded in the Wireless CPU®.

The gain of the microphone inputs is internally adjusted and may be tuned from 30 dB to 51 dB using an **AT +VGT** command (refer to AT commands documentation [6]).

Pin description

Signal	Sub D 15-pin Pin #	I/O	I/O type	Description
CMIC2P	4	I	Analog	Microphone positive input
CMIC2N	5	I	Analog	Microphone negative input

7.8.2 Speaker Outputs

This connection is differential to reject common mode noise and TDMA noise.

Speaker outputs are connected to internal push-pull amplifiers and may be loaded down between 32 to 150 Ohms and up to 1 nF (see details in table *Speaker gain vs Max output voltage,* in "AT Commands Interface Guide" [6]). These outputs may be directly connected to a speaker.

The output power may be adjusted by step of 2 dB. The gain of the speaker outputs is internally adjusted and may be tuned using an **AT +VGR** command (refer to AT commands documentation [6]).

Pin description

Signal	Sub D 15-pin Pin #	I/O	I/O type	Description
CSPK2P	10	O	Analog	Speaker positive output
CSPK2N	15	O	Analog	Speaker negative output

7.9 Real Time Clock (RTC)

The FASTRACK Supreme has now implemented the Real Time Clock for saving date and time when the Plug & Play is unplugged from the DC power supply through the DC power cable.

Item		Min	Typical	Max
Charging Time start from fully discharged to fully charged			940 min	
RTC Time Period*	Guarantee		2475 min	
	Non-guarantee		5225 min	

Remark: The RTC time period is measured from the RTC battery is fully charged before being unplugged from the DC power source.

7.10 FLASH LED

The FASTRACK Supreme has a red LED indicator to show the status of the GSM network. For detail description of the various status, please refer to Section 5.3.

However, during operation mode of Slow Standby, there will be no network registration and so the red LED indicator will always be ON. It is possible for user to deactivate the LED indication during Slow Standby mode, in order to reduce power consumption.

The Flash LED can be deactivated by AT command *at+whcnf=1,0*
The Flash LED can be activated by AT command *at+whcnf=1,1*

However, the new setting will be taken into account only after a restart. For detail, please refer to Document[6].

8 Technical Characteristics

8.1 Mechanical Characteristics

Table 15: Mechanical characteristics

Dimensions	73 x 54.5 x 25.5 mm (excluding connectors)
Overall Dimension	88 x 54.5 x 25.5 mm
Weight	≈ 80 grams (FASTRACK Supreme only) < 120 grams (FASTRACK Supreme + bridles + power supply cable)
Volume	101.5 cm^3
Housing	Aluminum profiled

The next page gives the dimensioning diagram of the FASTRACK Supreme including the clearance areas to take into account for the FASTRACK Supreme installation.

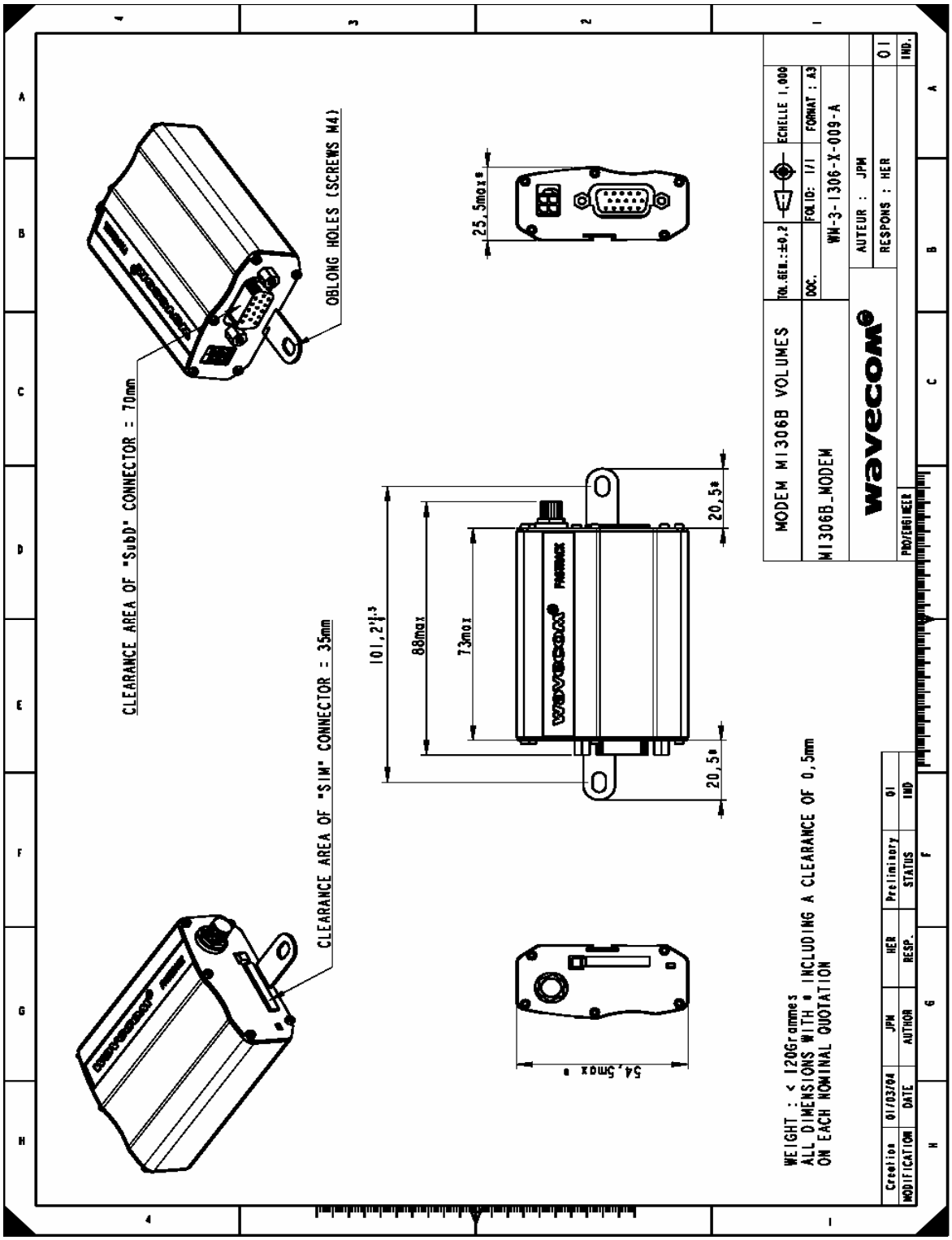

Figure 18: Dimensioning diagram

8.2 Electrical Characteristics

8.2.1 Power Supply

Table 16: Electrical characteristics

Operating Voltage ranges	5.5 V to 32 V DC.
Maximum current	480 mA Average at 5.5V. 2.1 A Peak at 5.5 V. (TBC)

Note:

The FASTRACK Supreme is permanently powered once the power supply is connected. The following table describes the consequences of over-voltage and under-voltage with the FASTRACK Supreme.

Warning:

All the input voltages specification described in this Section are at the FASTRACK Supreme input. While powering the FASTRACK Supreme, take into account the input drop caused by the power cable. With the delivered cable, this input drop is around 700 mV at 5.5 V and 220 mV at 32V.

Table 17: Effects of power supply defect

If the voltage	then
falls below 5.5 V,	the GSM communication is not guaranteed.
is over 32 V (Transient peaks),	the FASTRACK Supreme guarantees its own protection.
Is over 32 V (continuous overvoltage)	the protection of the FASTRACK Supreme is done by the fuse (the supply voltage is disconnected).

The fuse is a 800 mA / 250 V FAST-ACTING 5*20mm. See Section 10 for recommended references.

The following table provides information on power consumption of the FASTRACK Supreme, assuming an operating temperature of +25 °C and using a 3 V SIM card.

8.2.2 Power Consumption

The following table provides information on power consumption of the FASTRACK Supreme, assuming an operating temperature of +25 °C and using a 3 V SIM card.

Table 18: Power consumption (1*)

Power Consumption in E-GSM 900/DCS 1800 MHz - GPRS class 10				E-GSM 900	DCS 1800
GSM	I_{peak}	**GSM900**: During **TX** bursts @ **PCL5** **DCS1800** : During **TX** bursts @ **PCL0**	@ 5.5V	TBC	TBC
			@ 13.2V	TBC	TBC
			@ 32V	TBC	TBC
	I_{avg}	**GSM900 : Average @ PCL5** **DCS1800 : Average @ PCL0**	@ 5.5V	TBC	TBC
			@ 13.2V	TBC	TBC
			@ 32V	TBC	TBC
GPRS Class 2	I_{peak}	**GSM900**: During **1TX** bursts @ **PCL5** **DCS1800** : During **1TX** bursts @ **PCL0**	@ 5.5V	TBC	TBC
			@ 13.2V	TBC	TBC
			@ 32V	TBC	TBC
	I_{avg}	GSM900 : **Average 1TX/1RX @PCL5** DCS1800 : **Average 1TX/1RX @PCL0**	@ 5.5V	TBC	TBC
			@ 13.2V	TBC	TBC
			@ 32V	TBC	TBC
GPRS Class 10	I_{peak}	**GSM900**: During 2**TX** bursts @ **PCL5 (Gamma 3)** **DCS1800** : During 2**TX** bursts @ **PCL0 (Gamma 2)**	@ 5.5V	TBC	TBC
			@ 13.2V	TBC	TBC
			@ 32V	TBC	TBC
	I_{avg}	GSM900 : **Average 2TX/3RX @ PCL5 (Gamma 3)** DCS1800 : **Average 2TX/3RX @ PCL0 (Gamma 2)**	@ 5.5V	TBC	TBC
			@ 13.2V	TBC	TBC
			@ 32V	TBC	TBC
EGPRS Class 2	I_{peak}	**GSM900**: During **1TX** bursts @ **PCL8 (Gamma 6)** **DCS1800** : During **1TX** bursts @ **PCL2 (Gamma 5)**	@ 5.5V	TBC	TBC
			@ 13.2V	TBC	TBC
			@ 32V	TBC	TBC
	I_{avg}	GSM900 : **Average 1TX/1RX @ PCL8 (Gamma 6)** DCS1800 : **Average 1TX/1RX @ PCL2 (Gamma 5)**	@ 5.5V	TBC	TBC
			@ 13.2V	TBC	TBC
			@ 32V	TBC	TBC

Power Consumption in E-GSM 900/DCS 1800 MHz - GPRS class 10				E-GSM 900	DCS 1800
EGPRS Class 10	I_{peak}	**GSM900**: During **2TX** bursts @ **PCL8 (Gamma 6)** **DCS1800** : During 2**TX** bursts @ **PCL2 (Gamma 5)**	@ 5.5V	TBC	TBC
			@ 13.2V	TBC	TBC
			@ 32V	TBC	TBC
	I_{avg}	GSM900 : **Average 2TX/3RX @ PCL8 (Gamma 6)** DCS1800 : **Average 2TX/3RX @ PCL2 (Gamma 5)**	@ 5.5V	TBC	TBC
			@ 13.2V	TBC	TBC
			@ 32V	TBC	TBC
I_{avg} in Fast Idle mode Page 9 (2*)		Serial port auto shut down deactivated	@ 5.5V	33	TBC
			@ 13.2V	TBC	TBC
			@ 32V	TBC	TBC
		Serial port auto shut down activated	@ 5.5V	17	TBC
			@ 13.2V	TBC	TBC
			@ 32V	TBC	TBC
I_{avg} in Slow Idle mode Page 9 (3*)		Serial port auto shut down deactivated	@ 5.5V	23	TBC
			@ 13.2V	TBC	TBC
			@ 32V	TBC	TBC
		Serial port auto shut down activated	@ 5.5V	5	TBC
			@ 13.2V	TBC	TBC
			@ 32V	TBC	TBC
I_{avg} in Fast Standby mode (4*)		Serial port auto shut down deactivated	@ 5.5V	52	TBC
			@ 13.2V	TBC	TBC
			@ 32V	TBC	TBC
		Serial port auto shut down activated	@ 5.5V	35	TBC
			@ 13.2V	TBC	TBC
			@ 32V	TBC	TBC

Power Consumption in E-GSM 900/DCS 1800 MHz - GPRS class 10			E-GSM 900	DCS 1800
I_{avg} in Slow Standby mode (with FLASH LED activated) (4*)	Serial port auto shut down deactivated	@ 5.5V	24	TBC
		@ 13.2V	TBC	TBC
		@ 32V	TBC	TBC
	Serial port auto shut down activated	@ 5.5V	8	TBC
		@ 13.2V	TBC	TBC
		@ 32V	TBC	TBC
I_{avg} in Slow Standby mode (with FLASH LED deactivated) (4*)	Serial port auto shut down deactivated	@ 5.5V	TBC	TBC
		@ 13.2V	TBC	TBC
		@ 32V	TBC	TBC
	Serial port auto shut down activated	@ 5.5V	4	TBC
		@ 13.2V	TBC	TBC
		@ 32V	TBC	TBC

(1*):The power consumption might vary by 5 % over the whole operating temperature range (-20 °C to +55 °C).
(2*): In this Mode, the RF function is active and the FASTRACK Supreme synchronized with the network, but there is no communication.
(3*): In this Mode, the RF function is disabled, but regularly activated to keep the synchronization with the network. This Mode works only when the DTE send AT command to shut down the serial link by software approach (DTE turns DTR in inactive state).
(4*): In this Mode, the RF function is disabled, and there is no synchronization with the network.

8.2.3 Audio Interface

The audio interface is available through the Sub HD 15-pin connector.

Table 19: Audio parameters caracteristics

Audio parameters	Min	Typ	Max	Unit	Comments
Microphone input current @2 V/2 kΩ		0.5		mA	
Absolute microphone input voltage			100	mVpp	AC voltage
Speaker output current 150 Ω //1 nF		16		mA	
Absolute speaker impedance	32	50		Ω	
Impedance of the speaker amplifier output in differential mode			1	Ω	+/-10 %

Table 20: Microphone inputs internal audio filter characteristics

Frequency	Gain
0-150 Hz	< -22 dB
150-180 Hz	< -11 dB
180-200 Hz	< -3 dB
200-3700 Hz	0 dB
>4000 Hz	< -60 dB

Table 21: Recommended characteristics for the microphone:

Feature	Value
Type	Electret 2 V / 0.5 mA
Impedance	Z = 2 kΩ
Sensitivity	-40 dB to –50 dB
SNR	> 50 dB
Frequency response	compatible with the GSM specifications

Table 22: Recommended characteristics for the speaker:

Feature	Value
Type	10 mW, electro-magnetic
Impedance	Z = 32 to 50 Ω
Sensitivity	110 dB SPL min. (0 dB = 20 µPa)
Frequency response	compatible with the GSM specifications

8.2.4 General Purpose Input/Output

Both GPIO21 and GPIO25 may be interfaced with a component that comply with 3 Volts CMOS levels.

Table 23: Operating conditions

Parameter	I/O type	Min	Typ	Max	Condition
V_{IL}	CMOS			0.84 V	
V_{IH}	CMOS	1.96 V			
V_{OL}	CMOS			0.4 V	I_{OL} = -4 mA
V_{OH}	CMOS	2.4 V			I_{OH} = 4 mA
I_{OH}				4mA	
I_{OL}				-4mA	

Clamping diodes are present on I/O pads.

8.2.5 SIM Interface

Table 24: SIM card characteristics

SIM card	1.8V / 3 V

8.2.6 RESET Signal

Table 25: Electrical characteristics

Parameter	Min	Typ	Max	Unit
Input Impedance (R)*		330K		kΩ
Input Impedance (C)		10n		nF

*Internal pull-up

Table 26: Operating conditions

Parameter	Minimum	Typ	Maximum	Unit
~RESET time (Rt) [1]	200			µs
~RESET time (Rt) [2] at power up only	20	40	100	ms
Cancellation time (Ct)		34		ms
V_H	0.57			V
V_{IL}	0		0.57	V
V_{IH}	1.33			V

* $V_{H:}$ Hysterisis Voltage

1 This reset time is the minimum to be carried out on the ~RESET signal when the power supply is already stabilized.

2 This reset time is internally carried out by the Wireless CPU power supply supervisor only when the Wireless CPU power supplies are powered ON.

8.2.7 RF Characteristics

8.2.7.1 Frequency Ranges

Table 27: Frequency ranges

Characteristic	GSM 850	E-GSM 900	DCS 1800	PCS 1900
Frequency TX	824 to 849 MHz	880 to 915 MHz	1710 to 1785 MHz	1850 to 1910 MHz
Frequency RX	869 to 894 MHz	925 to 960 MHz	1805 to 1880 MHz	1930 to 1990 MHz

8.2.7.2 RF Performances

RF performances are compliant with the ETSI recommendation GSM 05.05.

The RF performances for receiver and transmitter are given in the table below.

Table 28: Receiver and transmitter RF performances

Receiver	
E-GSM900/GSM850 Reference Sensitivity	-104 dBm Static & TUHigh
DCS1800/PCS1900 Reference Sensitivity	-102 dBm Static & TUHigh
Selectivity @ 200 kHz	> +9 dBc
Selectivity @ 400 kHz	> +41 dBc
Linear dynamic range	63 dB
Co-channel rejection	>= 9 dBc
Transmitter	
Maximum output power (E-GSM 900/GSM850) at ambient temperature	33 dBm +/- 2 dB
Maximum output power (DCS1800/PCS1900) at ambient temperature	30 dBm +/- 2 dB
Minimum output power (E-GSM 900/GSM850) at ambient temperature	5 dBm +/- 5 dB
Minimum output power (DCS1800/PCS1900) at ambient temperature	0 dBm +/- 5 dB

8.2.7.3 External Antenna

The external antenna is connected to the FASTRACK Supreme via the SMA connector.

The external antenna must fulfill the characteristics listed in the table below.

Table 29: **External antenna characteristics**

Antenna frequency range	Quad-band GSM 850/GSM900/DCS1800/PCS1900 MHz
Impedance	50 Ohms nominal
DC impedance	0 Ohm
Gain (antenna + cable)	0 dBi
VSWR (antenna + cable)	2

Note: Refer to Section 10 for recommended antenna.

8.3 Environmental Characteristics

The FASTRACK Supreme Plug & Play is compliant with the following operating class. To ensure the proper operation of the FASTRACK Supreme, the temperature of the environment must be within a specific range as described in the table below.

Table 30: Ranges of temperature

Conditions	Temperature range
Operating / Class A	-20 °C to +55°C
Operating / Class B	-30 °C to +85°C
Storage	-40 °C to +85°C

Function Status Classification:

Class A:

The FASTRACK Supreme remains fully functional, meeting GSM performance criteria in accordance with ETSI requirements, across the specified temperature range.

Class B:

The FASTRACK Supreme remains fully functional, across the specified temperature range. Some GSM parameters may occasionally deviate from the ETSI/PTCRB specified requirements and this deviation does not affect the ability of the FASTRACK Supreme to connect to the cellular network and function fully, as it does within the Class A range.

The detailed climatic and mechanics standard environmental constraints applicable to the FASTRACK Supreme are listed in the table below:

Table 31: Environmental standard constraints

Environmental Tests (IEC TR 60721-4)		**Environmental Classes (IEC 60721-3)**			
Tests	**Standards**	**Storage (IEC 60721-3-1) Class IE13**	**Transportation** (IEC 60721-3-2) Class IE23	**Operation**	
				Stationary (IEC 60721-3-3) **Class IE35**	Non-Stationary **(IEC 60721-3-7) Class IE73**
Cold	IEC 60068-2-1 : Ab/Ad	-25°C, 16 h	-40°C, 16 h	-5°C, 16 h	-5°C, 16 h
Dry heat	IEC 60068-2-2 : Bb/Bd	+70°C, 16 h	+70°C, 16 h	+55°C, 16 h	+55°C, 16 h
Change of temperature	IEC 60068-2-14 : Na/Nb	-33°C to ambient 2 cycles, t1=3 h 1 °C.min^{-1}	-40°C to ambient 5 cycles, t1=3 h t2<3 min	-5°C to ambient 2 cycles, t1=3 h 0,5 °C.min^{-1}	-5°C to ambient 5 cycles, t1=3 h t2<3 min
Damp heat	IEC 60068-2-56 : Cb	+30°C, 93% RH 96 h	+40°C, 93% RH 96 h minimum	+30°C, 93% RH, 96 h	+30°C, 93% RH, 96 h
Damp heat, cyclic	60068-2-30 : Db Variant 1 or 2	+40°C, 90% to 100% RH One cycle Variant 2	+55°C, 90% to 100% RH Two cycles Variant 2	+30°C, 90% to 100% RH Two cycles Variant 2	+40°C, 90% to 100% RH Two cycles Variant 1
Vibration (sinusoidal)	IEC 60068-2-6 : Fc	1-200 Hz 2 m.s^{-2} 0,75 mm 3 axes 10 sweep cycles	1-500 Hz 10 m.s^{-2} 3,5 mm 3 axes 10 sweep cycles	1-150 Hz 2 m.s^{-2} 0,75 mm 3 axes 5 sweep cycles	1-500 Hz 10 m.s^{-2} 3,5 mm 3 axes 10 sweep cycles
Vibration (random)	IEC 60068-2-64 : Fh	-	10-100 Hz / 1,0 m^2.s^{-3} 100-200 Hz / -3 dB.octave^{-1} 200-2000 Hz / 0,5 m^2.s^{-3} 3 axes 30 min	-	-
Shock (half-sine)	IEC 60068-2-27 : Ea	-	-	50 m.s^{-2} 6 ms 3 shocks 6 directions	150 m.s^{-2} 11 ms 3 shocks 6 directions
Bump	IEC 60068-2-29 : Eb	-	250 m.s^{-2} 6 ms 50 bumps vertical direction	-	-
Free fall	ISO 4180-2	-	Two falls in each specified attitude	-	2 falls in each specified attitude 0,025 m (<1kg)
Drop and topple	IEC 60068-2-31 : Ec	-	One drop on relevant corner One topple about each bottom edge	-	One drop on each relevant corner One topple on each of 4 bottom edges

Notes:

Short description of Class IE13 (*For more information see standard IEC 60721-3-1)*

"Locations without controlled temperature and humidity, where heating may be used to raise low temperatures, locations in buildings providing minimal protection against daily variations of external climate, prone to receiving rainfall from carrying wind".

Short description of Class IE23 (*For more information, see standard IEC 60721-3-2)*

"Transportation in unventilated compartments and in conditions without protection against bad weather, in all sorts of trucks and trailers in areas of well developed road network, in trains equipped with buffers specially designed to reduce shocks and by boat".

Short description of Class IE35 (*For more information see standard IEC 60721-3-3)*

"Locations with no control on heat or humidity where heating may be used to raise low temperatures, to places inside a building to avoid extremely high temperatures, to places such as hallways, building staircases, cellars, certain workshops, equipment stations without surveillance".

Short description of Class IE73 (*For more information see standard IEC 60721-3-7)*

"Transfer to places where neither temperature nor humidity are controlled but where heating may be used to raise low temperatures, to places exposed to water droplets, products can be subjected to ice formation, these conditions are found in hallways and building staircases, garages, certain workshops, factory building and places for industrial processes and hardware stations without surveillance".

Warning: The specification in the above table applies to the FASTRACK Supreme product only. Customers are advised to verify that the environmental specification of the SIM Card used is compliant with the FASTRACK Supreme environmental specifications. Any application must be qualified by the customer with the SIM Card in storage, transportation and operation.

The use of standard SIM cards may drastically reduce the environmental conditions in which the Product can be used. These cards are particularly sensible to humidity and temperature changes. These conditions may produce oxidation of the SIM card metallic layers and cause, in the long term, electrical discontinuities. This is particularly true in left alone applications, where no frequent extraction/insertion of the SIM card is performed.

In case of mobility when the application is moved through different environments with temperature variations, some condensation may appear. These events have a negative impact on the SIM and may favor oxidation.

If the use of standard SIM card, with exposition to the environmental conditions described above, can not be avoided, special care must be taken in the integration of the final application in order to minimize the impact of these conditions. The solutions that may be proposed are:

- Lubrication of the SIM card to protect the SIM Contact from oxidation.
- Putting the FASTRACK Supreme Plug & Play in a waterproof enclosure with desiccant bags.

Lubrication of the SIM card had been tested by Wavecom (using Tutela Fluid 43EM from MOLYDUVAL) and gives very good results.

If waterproof enclosure with a desiccant solution is used, check with your desiccant retailer the quantity that must be used according to the enclosure dimensions. Ensure humidity has been removed before sealing the enclosure.

Any solution selected must be qualified by the customer on the final application.

To minimize oxidation problem on the SIM card, its manipulation must be done with the greatest precautions. In particular, the metallic contacts of the card must never be touched with bare fingers or any matter which

may contain polluted materials liable to produce oxidation (such as, e.g. substances including chlorine). In case a cleaning of the Card is necessary, a dry cloth must be used (never use any chemical substance).

8.4 Conformity

The complete product complies with the essential requirements of article 3 of R&TTE 1999/5/EC Directive and satisfied the following standards:

Domain	Applicable standard
Safety standard	EN 60950 (ed.1999)
Efficient use of the radio frequency spectrum	EN 301 419-(v 4.1.1) EN 301 511 (V 7.0.1)
EMC	EN 301 489–1 (edition 2002) EN 301 489-7 (edition 2002)
Global Certification Forum – Certification Criteria	GCF-CC V3.13.0
PTCRB	
FCC	
IC	

8.5 Protections

8.5.1 Power Supply

The FASTRACK Supreme is protected by a 800 mA / 250 V fuse directly bonded on the power supply cable.

The model of fuse used is: **FSD 800 mA / 250 V FAST-ACTING**.

8.5.2 Overvoltage

The FASTRACK Supreme is protected against voltage over +32 V.

When input voltages exceed +32 V, the supply voltage is disconnected in order to protect the internal electronic components from an overvoltage.

8.5.3 Electrostatic Discharge

The FASTRACK Supreme withstands ESD according to IEC 1000-4-2 requirements for all accessible parts of the FASTRACK Supreme except the RF part:

- 8 kV of air discharge,
- 4 kV of contact discharge.

8.5.4 Miscellaneous

Filtering guarantees:

- EMI/RFI protection in input and output,
- Signal smoothing.

9 Safety recommendations

9.1 General Safety

It is important to follow any special regulations regarding the use of radio equipment due in particular to the possibility of radio frequency (RF) interference. Please follow the safety advice given below carefully.

Switch OFF your Wireless CPU®:

- When in an aircraft. The use of cellular telephones in an aircraft may endanger the operation of the aircraft, disrupt the cellular network and is illegal. Failure to observe this instruction may lead to suspension or denial of cellular telephone services to the offender, or legal action or both,
- When at a refueling point,
- When in any area with a potentially explosive atmosphere which could cause an explosion or fire,
- In hospitals and any other place where medical equipment may be in use.

Respect restrictions on the use of radio equipment in:

- Fuel depots,
- Chemical plants,
- Places where blasting operations are in progress,
- Any other area where signalization reminds that the use of cellular telephone is forbidden or dangerous.
- Any other area where you would normally be advised to turn off your vehicle engine.

There may be a hazard associated with the operation of your FASTRACK Supreme Plug & Play close to inadequately protected personal medical devices such as hearing aids and pacemakers. Consult the manufacturers of the medical device to determine if it is adequately protected.

Operation of your FASTRACK Supreme Plug & Play close to other electronic equipment may also cause interference if the equipment is inadequately protected. Observe any warning signs and manufacturers' recommendations.

The FASTRACK Supreme Plug & Play is designed for and intended to be used in "***fixed***" and "***mobile***" applications:

- **"*Fixed*"** means that the device is physically secured at one location and is not able to be easily moved to another location.
- **"*Mobile*"** means that the device is designed to be used in other than fixed locations and generally in such a way that a separation distance of at least 20 cm (8 inches) is normally maintained between the transmitter's antenna and the body of the user or nearby persons.

The FASTRACK Supreme Plug & Play is not designed for and intended to be used in portable applications (within 20 cm or 8 inches of the body of the user) and such uses are strictly prohibited.

9.2 Vehicle Safety

Do not use your FASTRACK Supreme Plug & Play while driving, unless equipped with a correctly installed vehicle kit allowing 'Hands-Free' Operation.

Respect national regulations on the use of cellular telephones in vehicles. Road safety always comes first.

If incorrectly installed in a vehicle, the operation of FASTRACK Supreme Plug & Play telephone could interfere with the correct functioning of vehicle electronics. To avoid such problems, make sure that the installation has been performed by a qualified personnel. Verification of the protection of vehicle electronics should form part of the installation.

The use of an alert device to operate a vehicle's lights or horn on public roads is not permitted.

9.3 Care and Maintenance

Your FASTRACK Supreme Plug & Play is the product of advanced engineering, design and craftsmanship and should be treated with care. The suggestion below will help you to enjoy this product for many years.

Do not expose the FASTRACK Supreme Plug & Play to any extreme environment where the temperature or humidity is high.

Do not use or store the FASTRACK Supreme Plug & Play in dusty or dirty areas. Its moving parts (SIM holder for example) can be damaged.

Do not attempt to disassemble the Wireless CPU®. There are no user serviceable parts inside.

Do not expose the FASTRACK Supreme Plug & Play to water, rain or spilt beverages. It is not waterproof.

Do not abuse your FASTRACK Supreme Plug & Play by dropping, knocking, or violently shaking it. Rough handling can damage it.

Do not place the FASTRACK Supreme Plug & Play alongside computer discs, credit or travel cards or other magnetic media. The information contained on discs or cards may be affected by the Wireless CPU®.

The use of third party equipment or accessories, not made or authorized by Wavecom may invalidate the warranty of the Wireless CPU®.

Do contact an authorized Service Center in the unlikely event of a fault in the Wireless CPU®.

9.4 Your Responsibility

This FASTRACK Supreme Plug & Play is under your responsibility. Please treat it with care respecting all local regulations. It is not a toy. Therefore, keep it in a safe place at all times and out of the reach of children.

Try to remember your Unlock and PIN codes. Become familiar with and use the security features to block unauthorized use and theft.

10 Recommended Accessories

Accessories recommended by Wavecom for the FASTRACK Supreme are given in the table below.

Table 32: List of recommended accessories

Designation	Part number	Supplier
Quad-band antenna	1140.26	ALLGON
	MA112VX00	MAT Equipement
	MCA1890 MH/PB/SMA m	HIRSCHMANN
SMA/FME Antenna adaptor		PROCOM
Power adaptor (Europe)	EGSTDW P2 EF9W3 24W Out:12 V - 2A In: 100 to 240 V – 50/60 Hz – 550 mA Mounted with micro-fit connector	EGSTDW (for power adaptor) MOLEX (for micro-fit connector)*
Fuse	F800L250V	Shanghai Fullness
IESM GPS + USB	M13SUE01	WAVECOM
IESM IO + USB	M13SUE02	WAVECOM
IESM IO + USB + GPS	M13SUE03	WAVECOM

* Information not available for this preliminary version.

11 Online Support

Wavecom provides an extensive range on online support which includes the following areas of Wavecom's wireless expertise:

- the latest version of this document
- new versions of our Operating System user guides
- comprehensive support for Open AT®
- regulatory certifications
- carrier certifications
- application notes

To gain access to this support, simply visit our web site at www.wavecom.com or click on the desire link in Page. Privileged access via user login is provided to Wavecom authorized distributors.

D Series
Data Radio Modem
DR900 - Digital Radios

Trio DataCom's ***D Series*** *are high performance cost effective data radio modems designed as an alternative to hard wired data transport. Transmit your data over radio with a fully integrated data radio modem designed for fixed point-to-point and point-to-multipoint applications.*

The **D Series** is available as either a half duplex or a full duplex* 853-929 MHz +/- 5MHz radio, including a fully integrated 4800 / 9600 bps data modem. These units operate equally well in either a stand-alone configuration, or as part of a large communication system.

This complete package forms an attractively priced product for the transmission of data over radio in fixed applications thus providing a viable alternative to costly networks of buried media.

Features:

- Fully integrated half and full duplex* radio and modem
- Transparent and non-intrusive remote diagnostic facilities (Optional)
- Inbuilt data routing and multiplexing capabilties, multi-port operation
- Simultaneous delivery of multiple protocols using Trio DataCom's unique MultiStream™ technology
- Digital Signal Processing (DSP) modem
- Selectable 300-19,200 bps asynchronous RS232 user interface
- Built-in antenna diplexer*
- Integrated supervisory data channel
- Unique collision avoidance facility, for unsolicited report-by-exception
- Software selectable configuration parameters
- Internal repeater operation
- Housed in an attractive yet robust metal enclosure
- Range of ancillary equipment - full duplex base / repeater stations and hot-standby base station

Radio

The **D Series** radio has been designed to meet worldwide regulatory guidelines, including FCC, and has adjustable power output up to 5 Watts. This fully synthesised radio is programmable in 6.25/7.5 kHz increments to accommodate various worldwide channel spacings. The receiver section has a wide tuning range with an excellent signal-to-noise ratio. Exceptional frequency stability is achieved by intelligent microprocessor controlled temperature compensation. An extended operating temperature range of -30 to 60º C makes the unit ideal for commercial and industrial applications.

Modem

The in-built modem includes a custom DSP developed for data communications over narrow band radio systems.

This system offers minimum occupied bandwidth and optimal data integrity (using the standard HDLC protocol with CCITT CRC error detection) inhibiting the transfer of any rogue unwanted data caused by interference or squelch headers / tails.

The Trio DataCom DSP provides:

- the interface between the asynchronous RS232 user communication and the synchronous radio link layer.
- an inbuilt multipexer / router which allows for simultaneous transportation of multiple protocols over the one radio network.

Applications

The **D Series** is ideal for use in a variety of sophisticated and critical SCADA and Distributed Information Systems, where complex routing of multiple data protocols and remote diagnostics and wireless network management are important factors.

Remote units and a number of full duplex base station / repeater models, suitable for a variety of requirements, make up the **D Series**. At the top of the range, the DH model is a genuine, duplicated hot standby base for systems where nothing short of ultra reliability is acceptable.

Telemetry Systems - Utilities (Gas, Water, Electricity), Railways, Mining, Telecommunications, Industry. Where network status, system control, data collection and fault conditions are required.

Transaction Processing - Point of Sale Credit Terminals, Stock Control, Direct Order, Banks, Building Societies, Stock Brokers, Gambling Organizations, etc, where Point of Sale, inventory, credit, or transaction data requires collection and distribution.

Common Carrier Data Services - The high speed, low cost and spectrum efficiency of this device make it well suited to all forms of common carrier data networking.

Alarm Monitoring - Fire, Power, Intrusion & Essential Services Alarm Reporting.

designs products & solutions

* Available for DR900 full duplex 1 W version (853 ± 5 MHz / 929 ± 5 MHz)

D Series - Data Radio Modem

DR900 - Digital Radios

Configuration

Configuration using Trio's **D Series** programming software (DRProg) is completely Windows® based for all parameters, such as; frequency, transmitter power, digital mute level, PTT timer, system configurations, port settings.

Network Management & Diagnostic (Optional)

A large distributed network, or even a simple point-to-point link, requires comprehensive fault reporting and diagnostics to ensure a high level of availability. Trio **D Series** data radio modem products offer sophisticated in-built diagnostics using the optional **TView**™ software. This capability allows the customer to remotely monitor and maintain their system, minimising the likelihood of failures, by pointing out component degradation and decreasing the time to diagnose and repair. There is no necessity to visit the master station or interfere with the host data integrity, other than additional data transfer. For further details, consult the **TView** data sheet.

Collision Avoidance

A unique fully integrated, yet independent, low speed supervisory data channel embedded within the primary bit-stream provides collision avoidance facilities which are transparent to the user. The use of this feature makes this product ideally suited for reliable, error free data transmissions between stations in high density point-to-multipoint data networks.

The benefits include:

- Multiple asynchronous applications operating on the one radio channel.
- Enhanced performance of report-by-exception networks.

Related Products

- Base Stations (DB900)
- Hot Standby Base Station (DH900)
- 9 Port Stream Router Multiplexer (MSR)
- Network Management and Diagnostic Software (TView™)
- D Series Programming Software (DRProg™)

Specifications:

RADIO

Frequency Range**	853-929 MHz +/- 5MHz
Channel Selection	Fully programmable
Frequency Splits	76 MHz Tx/Rx frequency split available including simplex
Frequency Stability	±1ppm (-10 to 60°C ambient, opt. -30 to 70°C) Higher frequency stability options are available due to intelligent processor controlled temperature compensation
Aging	<= 1ppm/annum
Half / Full Duplex	half duplex or full duplex*
Data Rate (rf)	4800 / 9600 bps
Configuration	All configuration via Windows software

TRANSMITTER

Tx Power	5 W (+37 dBm) or 1 W* (+30 dBm) (software programmable)
Modulation	Narrow band digital filtering binary GMSK
Occupied Bandwidth	Meets various international regulatory guidelines for point-to-point and point-to-multipoint
Tx Attach Time	< 1 mSecond
Timeout Timer	Programmable 1-255 seconds
Tx Spurious	<= -65 dBm

RECEIVER

Sensitivity	-115 dBm for 12 dB SINAB
Blocking	> 75 dB (EIA)
Intermodulation	<= 70 dB (EIA)
Spurious Response	<= 70 dB (EIA)
Select. and Desense	70 dB (EIA)
AFC Tracking	±3 kHz tracking @ -90 dBm/attack time <10 mS
Mute	Programmable digital mute

CONNECTIONS

User Data Port	2 x DB9 RS232 female ports
Antenna	SMA female bulkhead (optional N)
Power	2 pin locking. Mating connector supplied

MODEM

Data Serial Port #1	Full duplex, DB9 RS232, DCE (modem), 300-19,200 bps asynchronous, hardware/software handshaking
Data Serial Port #2	Full duplex, DB9 RS232, 300-9600 bps asynchronous, software handshaking
Data Storage	On-board RAM
Channel Data Rate	4800 / 9600 bps, full duplex
Bit Error Rate	< $1x10^{-6}$ @ -103 dBm (4800 bps) < $1x10^{-6}$ @ -105 dBm (9600 bps)
Collision Avoidance	Trio DataCom's unique supervisory channel C/DSMA collision avoidance system
MultiStream™	Trio DataCom's unique simultaneous delivery of multiple data streams (protocols)

GENERAL

Power Supply	13.8 Vdc nominal (11-16 Vdc)
Transmit Current	600 mA max. @ 1 W 1700 mA max. @ 5 W
Receive Current	175 mA
Dimensions	260 x 161 x 65 mm (robust metal enclosure)
Weight	1.3 kg

* Available for DR900 full duplex 1 W version (853 ± 5 MHz / 929 ± 5 MHz)

** Various sub-frequency bands available.

Note: Model codes previously known as xxxDR are now depicted as DRxxx.

designs products & solutions

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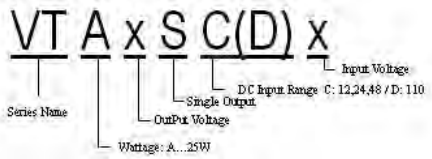
ETA-USA
HIGH QUALITY SWITCHING POWER SUPPLIES

DC/DC SWITCHING POWER SUPPLY
DC INPUT 12,24,48, 110
SINGLE OUTPUT
25WATTS

VTA-SCx/VTA-SD SERIES

Dimension: 85W × 135L × 31H

General Description



Features

1. Variety of Models
2. Chassis mount type
3. Compact and High Efficiency

DC INPUT: 12V

Input Characteristics	Unit	VTA05SC12	VTA12SC12	VTA15SC15	VTA24SC12	VTA48SC12
Input Voltage	Vdc	DC 12V				
Input Voltage Range	Vdc	DC 9.2V-16V				
Input Current(typ)	A	2.9	2.92	2.87	3.0	2.63
Inrush Current *1	A	Not Specified				
Efficiency (typical) *2	%	72	72	74	73	76
MTBF	H	880'000				
Switching Frequency	kHz	60 Fix.	60 Fix.	60 Fix.	60 Fix.	60 Fix.

DC INPUT: 24V

Input Characteristics	Unit	VTA05SC24	VTA12SC24	VTA15SC24	VTA24SC24	VTA48SC24
Input Voltage	Vdc	DC 24V				
Input Voltage Range	Vdc	DC 19-32V				
Input Current(typ)	A	1.34	1.33	1.36	1.34	1.28
Inrush Current *1	A	Not Specified				
Efficiency (typical) *2	%	75	78	79	78	82
MTBF	H	880'000				
Switching Frequency	kHz	60 Fix.	60 Fix.	60 Fix.	60 Fix.	60 Fix.

DC INPUT: 48V

Input Characteristics	Unit	VTA05SC48	VTA12SC48	VTA15SC48	VTA24SC48	VTA48SC48
Input Voltage	Vdc	DC 48V				
Input Voltage Range	Vdc	DC 38-63V				
Input Current(typ)	A	0.68	0.66	0.65	0.67	0.6
Inrush Current *1	A	Not Specified				
Efficiency (typical) *2	%	78	80	82	82	84
MTBF	H	860'000				
Switching Frequency	kHz	60 Fix.	60 Fix.	60 Fix.	60 Fix.	60 Fix.

DC INPUT: 110V

Input Characteristics	Unit	VTA05SD	VTA12SD	VTA15SD	VTA24SD	VTA48SD
Input Voltage	Vdc	DC 110V				
Input Voltage Range	Vdc	DC 85-140V				
Input Current(typ)	A	0.30	0.29	0.30	0.31	0.28
Inrush Current *1	A	Not Specified				
Efficiency (typical) *2	%	76	78	78	78	78
MTBF	H	790'000				
Switching Frequency	kHz	80 Fix.	80 Fix.	80 Fix.	80 Fix.	80 Fix.

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VTA-SC / VTA-SD

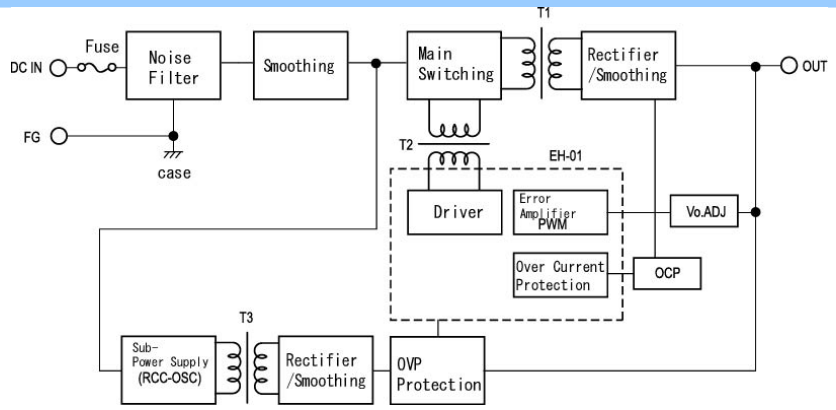
Output Characteristic	Unit	Models				
		VTA05SCx / SD	VTA12SCx / SD	VTA15SCx / SD	VTA24SCx / SD	VTA48SCx / SD
Output Voltage	V	5	12	15	24	48
Output Current	A	5.0	2.1	1.7	1.1	0.5
Voltage Adjust Range	V	+/-10% of Rated Output Voltage(at no load within input range)				
Ripple Noise(max) *3	mVpp	100	170	200	290	530
Rise up time	mS	100mS(maximum) at 25℃ and rated input/output				
Hold up time	mS	10mS				
Regulation						
a. Line Regulation (max)	mV	40	96	120	192	384
b. Load Regulation (max)	mV	45	108	135	216	432
c. Temperature Coefficient *4	℃	0.03%/℃				
d. Drift(maximum) *5	mV	40	75	90	135	255
e. Dynamic Load Regulation (typ.) *6	mV	150	360	450	720	1440
f. Recovery Time *6	mS	0.5mS				

Conditions:
*1 at cold start
*2 at rated input/output
*3 measured by a bayonet probe at the output connector at a 0 to 100MHz bandwidth
*4 at 0 to +50℃
*5 for 7hour period after 1hour warm-up at 25℃ and rated input/output
*6 when output current changed between 25% and 75% of rated output current rapidly at rated input

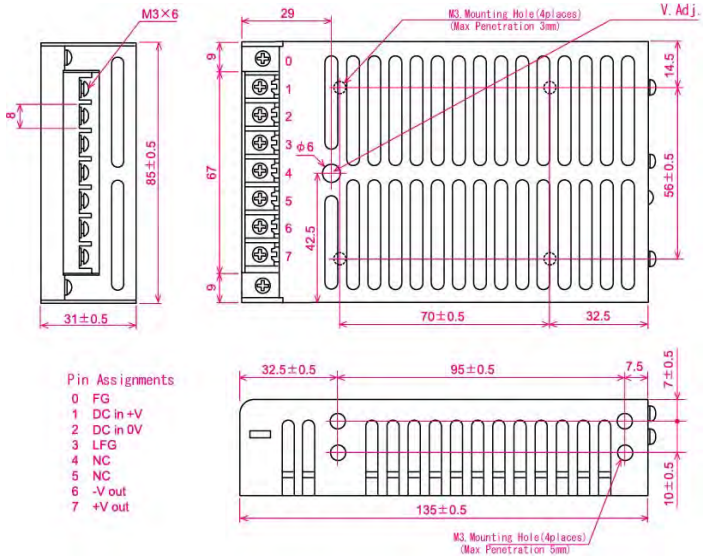
Environmental Specification	
Operating Temperature	0 to +50℃
Operating Humidity	85%RH(non-condensing)
Storage Temperature	-20 to +85℃
Storage Humidity	-
Withstanding Voltage	Primary-Secondary AC1,500Vfor 1minute (Vin=110 2000) Primary-Frame Ground AC1,500V for 1minute (Vin=110 2000) Secondary-Frame Ground AC500V for 1minute
Isolation Resistance	Primary-Secondary-Frame Ground 50MΩ(minimum) by DC500V insulation tester
Vibration	5-10Hz:10mm double amplitude,10-55Hz:19.6m/s2,20minutes' period for 60minutes each along X,Y,Z axes(non-operating)
Shock	294m/s2
Cooling	Convection
Functions	
Over current Protection	Current Limiting with automatic recovery
Over voltage Protection	Output shutdown
Remote Sense	not available
Remote On/Off	not available
Reverse Voltage Protection	by internal fuse
Line Conduction Noise	Not specified
Weight [g](typical)	380 G
Dimension [mm]	85W × 135L × 31H

ETA-USA
HIGH QUALITY SWITCHING POWER SUPPLIES

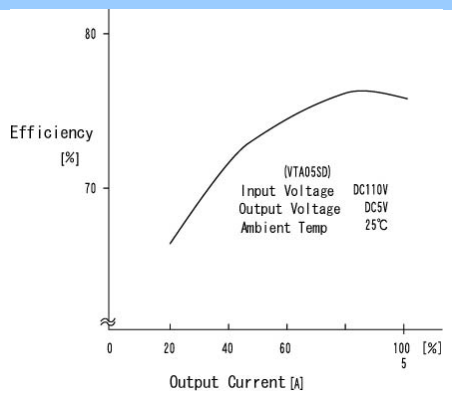
BLOCK DIAGRAM



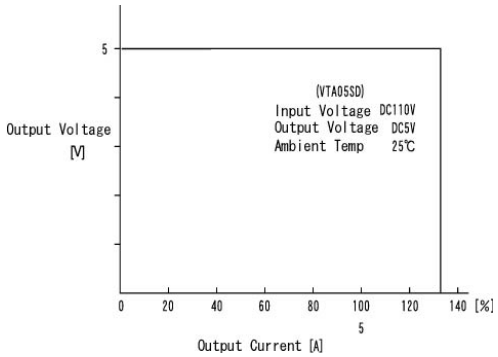
DIMENSION DIAGRAM (mm)



EFFICIENCY CURVE



OCP CURVE



Cellular Transit Antenna

890-960 MHz
1710-1880 MHz

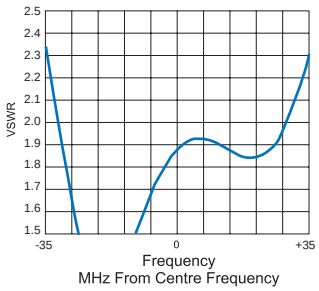
TLA2000
TLA3000

The TLA2000 is an ideal antenna solution for GSM data applications in both fixed and mobile situations. Designed to offer true dual band performance the TLA2000 is ready for use with the latest GSM (GPRS) modems. With a high impact resistant vacuum formed ABS radome and neoprene mounting gasket, the TLA2000 can be used for indoor or outdoor applications.

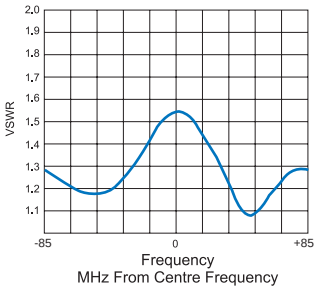
- Applications include public vending machines, ATM kiosks and industrial automotive use
- Designed for use on conductive or nonconductive surfaces
- TLA3000 model incorporates integrated GPS antenna

TLA2000/3000

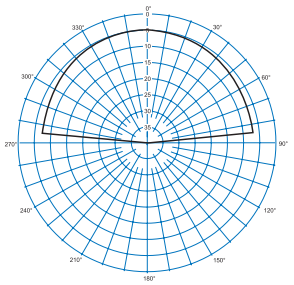
Typical VSWR response GSM900



Typical VSWR response GSM1800



Typical E-Plane response @ 890MHz



Electrical

Model No.	TLA2000/3000
Gain *dBi*	2
Frequency *MHz*	890 - 960 / 1710 - 1880
Power *W*	10
Tuned Bandwidth	Entire specified band @<2.5:1 VSWR
Tuning	Pre-tuned

Mechanical

Model No.	TLA2000	TLA3000
Construction	White Geloy ASA radome	
Diameter *mm*	135	
Height *mm*	61 (including gasket)	
Mounting	M4 hardware (not included)	
Cable and Connector	500mm low loss 9014 RG58 type	Cellular: 5m 9014 RG58 type - FME connector GPS: 5m low loss RG174 type - MCX connector

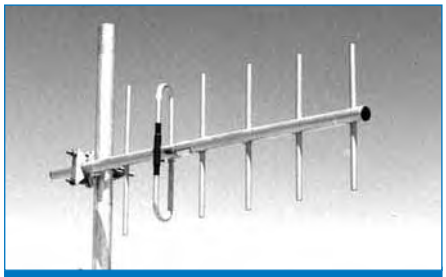
GPS Specifications

Fo	1575.42 MHz
Operation Temperature	-40 to +85°C
Storage Temperature	-40 to +100°C
System Gain at Fo	28dBi including cable and filter losses
Impedance	50 Ohm
Polarization	RHCP
VSWR at Fo	1.5:1
Noise Figure at Fo	<1.8 dB max.
Power Input	+2.5Vdc to +12Vdc input, Auto Switching
Power Consumption	11mA to 13mA (max)
Power Input	Reverse Polarity Short Circuit Shutdown
Over-Current	Thermal over-current shutdown >+150°C

UHF Directional Yagi Antennas

300-600 MHz

YB Series



YB6

YB16

The YB Series are high gain yagi antennas which will provide excellent point to point communication in RF control, short or long haul link and other applications calling for highly directional antennas. YB Series antennas exhibit narrow beamwidths and high front to back ratios to help minimise potential interference to and from other systems.

The feed element of each antenna is of full folded dipole construction thus offering maximum bandwidth and reliability. The dipole element is welded to the boom to ensure low intermodulation performance and maximum durability. The passive elements are through mounted to the circular boom section and welded at each side to further minimise the potential for both corrosion and generation of intermodulation products. The alodined protective finish provides a conductive surface to ensure effective earthing of the antenna when mounting.

Constructed with 2 to 16 elements, YB Series yagi antennas offer a choice of gain and beamwidth characteristics and can be configured in stacks or bays for higher gain applications in either horizontally or vertically polarised systems. Application details on phasing and mounting yagi antennas are included in the technical notes section of this catalogue.

Yagi antennas rest at ground potential to provide excellent lightning protection and reduced precipitation static noise.

Termination is via an 'N' female coaxial connector fitted to a short Durathene cable tail. Durathene polyethylene jacketed cable provides superior resistance to weathering and abrasion and is less susceptible to bird attack than standard PVC sheathed cables.

For extreme climatic or corrosive applications, the stainless steel YBSS Series or black ruggedised RDA Series yagis should be considered.

- All welded construction for maximum and reliable performance
- Narrow beamwidths & high front to back ratios effective in reducing interference
- Alodine finish provides an excellent conductive surface for earthing
- Can be configured in stacks or bays for higher gain applications using PH and PHE series phasing harnesses

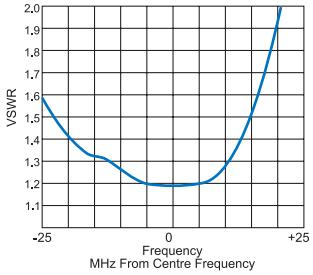
Bracing kit available
Part No. M-4528

UHF Directional Yagi Antennas

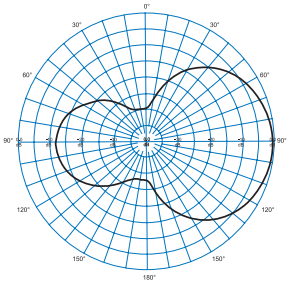
300-600 MHz

YB Series

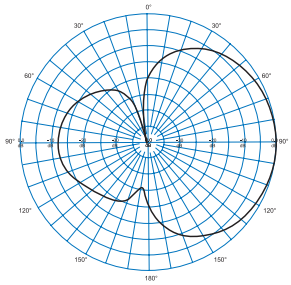
Typical VSWR response (YB03-99)



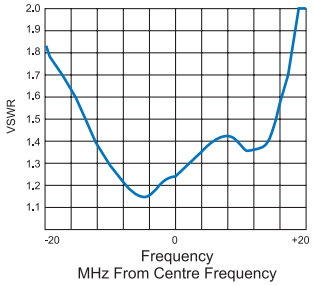
YB03-99 - E Plane



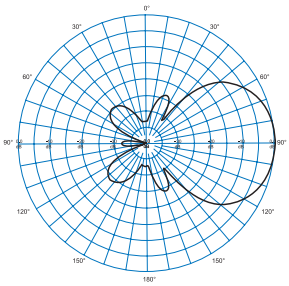
YB03-99 - H Plane



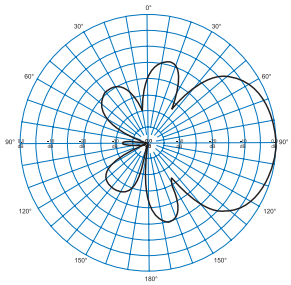
Typical VSWR response (YB6-61)



YB6-61 - E Plane



YB6-61 - H Plane



Electrical

Model Number	YB02-99	YB03-99	YB6-65	YB6-61	YB6-62	YB6-75	YB6-99
Nominal Gain *dBi (dBd)*	5 (3)	8 (6)	11 (9)				
Frequency *MHz*	300 - 600	350 - 600	400 - 420	450 - 480	480 - 520	580 - 600	350 - 600
Tuned Bandwidth	5%		Full band				5%
VSWR (Return Loss)	<1.5 :1 (14dB)						
Nominal Impedance Ω	50						
Vertical Beamwidth	77°	63°	47°				
Horizontal Beamwidth	161°	98°	56°				
Front / Back Ratio *dB*	9	13	18 (Typical)				
Input Power *W*	100						

Mechanical

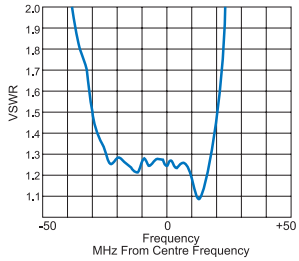
Model Number		YB02-99	YB03-99	YB6-65	YB6-61	YB6-62	YB6-75	YB6-99
Construction		All welded aluminium with alodined finish						
Length *m*		0.6	0.7	0.9	1.0	0.8	0.8	1.3
Weight *kg*		0.4	0.5	0.7	0.7	0.6	0.6	0.8
Termination		N female with short 9008 cable tail						
Mounting Area		100mm x 25mm diam. alodined aluminium						
Suggested Clamps		1 X UNV						
Projected Area *cm²*	No ice	283	337	485	477	394	349	600
	With ice	676	811	1169	1099	967	857	1367
Wind Load (Thrust) @ 160km/h *N*		33	40	57	56	47	41	71
Wind Gust Rating *km/h*		>240						
Torque @160 km/h *Nm*		6	10	22	24	16	13	42

UHF Directional Yagi Antennas

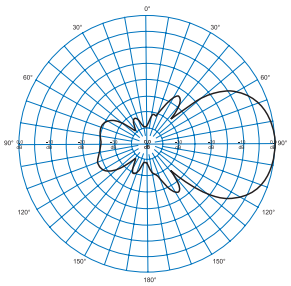
300-600 MHz

YB Series

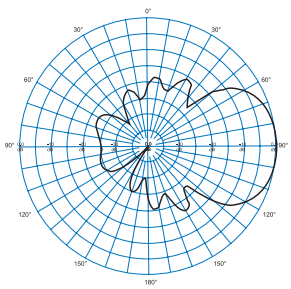
Typical VSWR response (YB9-61)



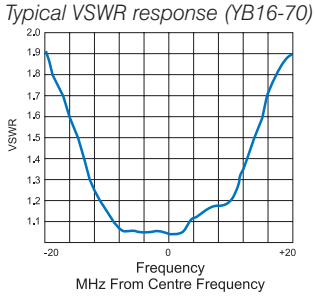
YB9-61 - E Plane



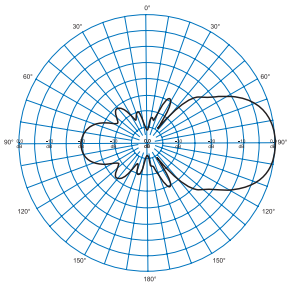
YB9-61 - H Plane



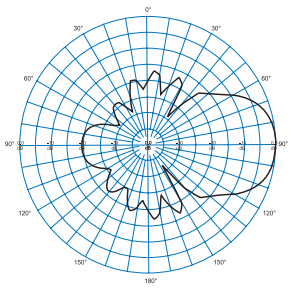
Typical VSWR response (YB16-70)



YB16-70 - E Plane



YB16-70 - H Plane



Electrical

Model Number	YB9-65	YB9-61	YB9-62	YB9-99	YB16-65	YB16-70	YB16-71	YB16-63	YB16-72	YB16-99
Nominal Gain *dBi (dBd)*	13 (11)				14 (12)					
Frequency *MHz*	400 - 420	450 - 480	480 - 520	400 - 600	400 - 420	450 - 470	470 - 490	480 - 500	500 - 520	400 - 600
Tuned Bandwidth	Full band			5.0%	Full band					5.0%
VSWR (Return Loss)	<1.5 :1 (14dB)									
Nominal Impedance Ω	50									
Vertical Beamwidth	46°			42°	34°					
Horizontal Beamwidth	54°			48°	36°					
Front / Back Ratio *dB*	18 (Typical)									
Input Power *W*	100									

Mechanical

Model Number		YB9-65	YB9-61	YB9-62	YB9-99	YB16-65	YB16-70	YB16-71	YB16-63	YB16-72	YB16-99
Construction		All welded aluminium with alodined finish									
Length *m*		2.0	1.8	1.6	2.0	2.5	2.3	2.3	2.2	2.2	2.5
Weight *kg*		1.2	1.0	1.0	1.2	1.7	1.5	1.5	1.4	1.4	1.7
Termination		N female with short 9008 cable tail									
Mounting Area		100mm x 25mm diam. alodined aluminium									
Suggested Clamps		1 X UCR1				1 X UCR1 + 1 x M-4528 bracing kit					
Projected Area *cm²*	No ice	859	771	694	859	1186	1048	1030	989	981	1186
	With ice	2078	1842	1640	2078	2983	2666	2617	2530	2507	2983
Wind Load (Thrust) @ 160km/h *N*		102	91	82	102	141	124	122	117	116	141
Wind Gust Rating *km/h*		207	220	240	207	147	165	165	173	173	147
Torque @160 km/h *Nm*		92	75	60	92	165	130	128	117	116	165

5 SWITCHBOARD WORKS TEST RESULTS

Form No. F1017/3

J. & P. RICHARDSON INDUSTRIES PTY LTD
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Ph: (07) 3271 2911 - Fax: (07) 3271 3623
E-mail: jpr@jpr.com.au

SWITCHBOARD & SHEETMETAL INSPECTION REPORT

Customer Name: QUU			Job No: C54900.		
Item: WB002 HUDDART STREET. 1 x WATER BOOSTER SWITCHBOARD			Drawing No:		
TASK	**PRODUCT DETAIL**	**INSPECTED BY**	**DATE**	**PASS / FAIL**	**CORRECTIVE ACTION REQUEST OR COMMENTS**
Design	Documents	D.MC	19-12-11	P	
Drafting	Documents	D.MC.	19-12-11	P	
Sheetmetal (Refer F1018 for details)	Switchboard	D.C	16-1-12	P	
	Doors	D.C	16-1-12	P	
	Cell/Panels				
Painting					
Process	Powder / Wet				
Min DFT (40 STD)					
Cure Test					
Colour Exterior					
Colour Internal					
Colour Panels			18/a/12	P	
Cubicle Erection					
Electrical Fitout (In accordance with drawings)		R CARTER			
Inspection & Test (Refer to F1019)		G SMITHERS	16-1-12	P	
Packing					STRETCH

Comments:

all tags are done. 18/01/12

NOTE: - Manufacture is not to proceed to the next process unit the item has passed inspection

Affix Status Here: -

Yellow	Awaiting Inspection
Green	Inspection & Test Passed
Red	Inspection & Test Failed, Awaiting Rectification

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SWITCHBOARD / SHEETMETAL INSPECTION CHECKLIST

CLIENT: QUU				JOB NO: C 54900
PRODUCT DESCRIPTION: WB002 HUDDART STREET 1X WATER BOOSTER SWITCH BOARD				DRAWING & SCHEDULE NUMBERS
CONSTRUCTION	QUALITY		COMPLIANCE WITH DRAWINGS		REMARKS OR ACTION
	GOOD	POOR	YES	NO	
1. Folds	✓				
2. Welds	✓				
3. Edges / File	✓				
4. Gauge			✓		
5. Material			✓		
6. Ventilation Openings / Filter Bracket			✓		
7. Water Ingress Test			✓		
8. Equipment Mounting Arrangement			✓		
9. Doors Stiffened			✓		
10. Escutcheons and Lexan Covers			✓		
11. Cable Saddles			✓		
12. Grinding			✓		
13. Door Stays Fitted			✓		
14. Earth Studs			✓		
15. Rubber Retainer			—		
16. Drawing Holder			✓		
17. Hat Sections			—		
18. Locking Bars Fitted			✓		
19. External Crevice Welded and Ground			✓		
20. Legend Cards			✓		
21. General Conditions Satisfactory			✓		
22. Cabinet Clean			✓		
23. Job Name and Number Marked on Board and Panels			✓		
24. Lap Top Tray			✓		
25. Gland Plates Fitted			✓		
26. Sunshields Fitted			✓		

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SWITCHBOARD / SHEETMETAL INSPECTION CHECKLIST

CONSTRUCTION	QUALITY		COMPLIANCE WITH DRAWINGS		REMARKS OR ACTION
	GOOD	POOR	YES	NO	
27. **Mullion Welded to Divider**			✓		
28. **Double Hinge Meter Panel Fitted**			✓		
29. **Plinth Fitted**			✓		
30. **Wall Mount Brackets**			—		
31. **Light Switch Brackets**			✓		
32. **Cowls**			—		
INSPECTED BY: D. CRANE	**DATE:** 16. 1. 12				

AFFIX STATUS HERE

Yellow	Awaiting Inspection
Green	Inspected/Tested Passed
Red	Inspected/Tested Awaiting Rectification

DC

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SWITCHBOARD ELECTRICAL INSPECTION & TEST REPORT

Customer Name: QLD URBAN UTILITIES							
Project: HUDDART ST WATER BOOSTER SWBd							
JPR Job No: M54900			**Item:** WB002				
Constructed by: R CARTER			**Tested by:** G STRANKS		**Date:** 16-4-12		
Item check list:		***To comply with Drawings, Documents & Specification***					
Main Functional Unit/s	Qty		Size		Settings		
Fuse Fittings	Qty	✓	Size	✓	Fuse Size	✓	
Circuit Breakers	Qty	✓	Size	✓	Settings	✓	
Motor Protection C.B.	Rating	✓	Setting	✓	Function	✓	
Neutral	Reqd	✓	Size	✓	ID	✓	
Equipment Earthing	Checked	✓	Size	✓		✓	
C.T.s	Qty		Rating		Pri Inject.		
Meters	Qty		Rating		Function		
Contactors	Qty	✓	Rating	✓	Voltage	✓	
Overloads	Qty		Rating		Function		
Relays	Qty	✓	Rating	✓	Voltage	✓	
Timers	Qty		Rating		Voltage		
Control Switches	Qty	✓	Rating	✓	Function	✓	
Push Buttons	Qty	✓	Rating	✓	Function	✓	
Pilot Lights	Qty		Rating		Voltage		
Transformers	Qty		Rating		Voltage		
ATT/VFD/Soft Starter	Qty	✓	Rating	✓	Function	✓	
DC Supply	Qty	✓	Rating	✓	Voltage	✓	
Terminals	Qty	✓	Size	✓	ID	✓	
Engraving	Qty	✓	Size	✓	ID	✓	
Cabling	Type	✓	Size	✓	ID	✓	
Busbars	Type		Size		ID		
Escutcheons / Shrouds	Type	✓	Label	✓	IP rating	✓	
S.A. Metering CTs	Qty		Rating				
S.A Metering Links	Type						
S.A. Meters	Type		Size				
JPR Label	Fitted	✓	Stamped	✓	Safety Stkr	✓	
Legend Card	Qty	✓	Correct				
PLC/Telemetry	Qty		Size				
Power Monitor Relay	Qty		Rating		Function		
General Check List:							
IP Sealing	Rating						
Door Latches/Hinges	Qty	✓	Type	✓	Operation	✓	
Ventilation	Required	✓	Type	✓	Operation		
Circuit Schedule	Markup	✓	Checked	✓	Supplied		
Terminal Tightness	Power	✓	Control	✓	Result	✓	
Busbar System	Clearances		Joints		ID		
Earth Continuity	Body to E	✓	Doors to E	✓	Panels to E	✓	
Cubicle Cleaned		✓					
Paint Finish Intact		✓					
Polarity Check	R - R	✓	W - W	✓	B - B	✓	
Function	Power	✓	Control	✓	PLC/Telem		
Continuity Check	R - R	✓	W - W	✓	B - B	✓	N - N ✓
Comments:							

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SWITCHBOARD CONTINUITY & INSULATION TEST REPORT

Customer Name: QLD URBAN UTILITIES		
Project: HUDDART ST WARTER BOOSTER SWBD		
JPR Job No: M54900	Switchboard: W BOO2	
Constructed by: R. CARTER	Tested by: G. STRANGE	Date: 16-4-12

CONTINUITY TEST

From	To	Red	White	Blue	Neutral

Sketch:

INSULATION TESTS TO SECTION 3 OF AS3017

Designation	1000 V Test (MΩ)	2.5 kV Test (1min)	1000 V Test (MΩ)
Red to Earth	400		
White to Earth	400		
Blue to Earth	400		
Neutral to Earth	[illegible]		
Red to White	400		
Red to Blue	400		
White to Blue	400		

Comments:

FILE: EMC0381/BL 03/01/03 PAGE 1 OF

JOB SAFETY ANALYSIS

LIVE LOW VOLTAGE WORK

TESTING SWITCHBOARDS AND CONTROL PANELS WITHIN OUR MANUFACTURING PREMISES

APPROVED BY: Eric McCulloch (WHSO)

LOCATION: WACOL WORKSHOP DATE: 16.4.12

AUTHORISATIONS		PERSONAL PROTECTIVE EQUIPMENT	
• Authorisation from person in charge (Signature)	☑ YES	• Long cotton clothing • Insulating work gloves in test • Insulating mats / covers in test • Switchboard rescue kit in test	☐ YES ☑ YES ☐ YES ☑ YES

TASK		
LIVE LOW VOLTAGE WORK TESTING SWITCHBOARDS AND CONTROL PANELS WITHIN OUR MANUFACTURING PREMISES	• Isolation points identified and accessible	☐ YES
	• Work area clear of obstructions	☐ YES
	• Unauthorised access prevented to work area	☐ YES
	• P.P.E. is fit for purpose	☐ YES
	• Test equipment is fit for purpose	☐ YES
	• Written authority to proceed has been obtained from a person in charge	☐ YES
	• JPR authorisation to conduct live work is current	☐ YES
	• Approved dedicated power supply only used for testing.	☐ YES
	• Approved dedicated power supply in current test	☐ YES
OPTION	(A) RCD protected outputs used at power supply	☐ YES
	> RCD protection checked daily prior to use	☐ YES
	> Safety Observer is / is not required	☐ YES
OPTION	(B) Non RCD protected outputs used at power supply	☐ YES
	> Supervisor consulted prior to use	☐ YES
	> Safety Observer is in attendance	☐ YES

I understand and am fully aware of the requirements of this job safety analysis.

Signatures:	1.	2.	3.	4.	5.

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SWITCHBOARD ELECTRICAL INSPECTION & TEST REPORT
EARTH LEAKAGE TEST

Customer Name: QLD URBAN UTILITIES					
JPR Job No: M 54900		**Item:** WB002 HUDDART ST WATER BOOSTER SWBD			
Constructed by: R. CARTER		**Tested by:** C. STANKS		**Date:** 16-4-12	
Test Unit	**Megger RCDT330**		**Other**		

Circuit Breaker	*Phase*	*Rated Current (mA)*		*Trip Current (mA)*		*Trip Time (mS)*	*Comments*
Q 9	R	30		25		28.6	
Q 12	B	30		25		28.6	

Comments:-

FILE: TMC038 (TBL 03/01/03 PAGE 1 O

JOB SAFETY ANALYSIS

LIVE LOW VOLTAGE WORK

TESTING SWITCHBOARDS AND CONTROL PANELS WITHIN OUR MANUFACTURING PREMISES

APPROVED BY: Eric McCulloch (WHSO)

LOCATION: WACOL WORKSHOP DATE: 17/4/12

AUTHORISATIONS		PERSONAL PROTECTIVE EQUIPMENT	
• Authorisation from person in charge (Signature)	☑ YES	• Long cotton clothing	☐ YES
		• Insulating work gloves in test	☐ YES
		• Insulating mats / covers in test	☐ YES
		• Switchboard rescue kit in test	☐ YES

TASK		
LIVE LOW VOLTAGE WORK	• Isolation points identified and accessible	☐ YES
	• Work area clear of obstructions	☐ YES
	• Unauthorised access prevented to work area	☐ YES
	• P.P.E. is fit for purpose	☐ YES
	• Test equipment is fit for purpose	☐ YES
	• Written authority to proceed has been obtained from a person in charge	☐ YES
TESTING SWITCHBOARDS AND CONTROL PANELS WITHIN OUR MANUFACTURING PREMISES	• JPR authorisation to conduct live work is current	☐ YES
	• Approved dedicated power supply only used for testing.	☐ YES
	• Approved dedicated power supply in current test	☐ YES
OPTION	(A) RCD protected outputs used at power supply	☐ YES
	> RCD protection checked daily prior to use	☐ YES
	> Safety Observer is / is not required	☐ YES
OPTION	(B) Non RCD protected outputs used at power supply	☐ YES
	> Supervisor consulted prior to use	☐ YES
	> Safety Observer is in attendance	☐ YES

I understand and I am fully aware of the requirements of this job safety analysis

6 “AS CONSTRUCTED” DRAWINGS

QUEENSLAND UrbanUtilities

WB002
HUDDART ST, ALDERLEY
WATER BOOSTER

SITE COVER SHEET

ELECTRICAL DRAWINGS INDEX

DWG N°.	TITLE	SHEET	REVISIONS
486/4/9-0378-001	ELECTRICAL DRAWING INDEX	01	0 A
486/4/9-0378-002	BLOCK DIAGRAM	02	0 A
486/4/9-0378-003	AC POWER DISTRIBUTION SCHEMATIC DIAGRAM	03	0 A
486/4/9-0378-004	PUMPS POWER & CONTROL SCHEMATIC DIAGRAM	04	0 A
486/4/9-0378-005	DC POWER DISTRIBUTION SCHEMATIC DIAGRAM	05	0 A
486/4/9-0378-006	COMMON CONTROLS SCHEMATIC DIAGRAM	06	0 A
486/4/9-0378-007	RTU DIGITAL INPUTS TERMINATION DIAGRAM	07	0 A
486/4/9-0378-008	RTU DIGITAL OUTPUTS & ANALOG INPUTS TERMINATION DIAGRAM	08	0 A
486/4/9-0378-009	PUMPS CONTROL TERMINATION DIAGRAM	09	0 A
486/4/9-0378-010	SWITCHBOARD EQUIPMENT LIST	10	0 A
486/4/9-0378-011	SWITCHBOARD CABLE SCHEDULE	11	0 A
486/4/9-0378-012	SWITCHBOARD LABEL SCHEDULE	12	0 A
486/4/9-0378-013	SWITCHBOARD CONSTRUCTION NOTES & DETAILS	13	0 A
486/4/9-0378-014	SWITCHBOARD CONSTRUCTION DETAILS	14	0 A
486/4/9-0378-015	SWITCHBOARD GENERAL ARRANGEMENT	15	0 A
486/4/9-0378-016	SITE LAYOUT	16	0 A
486/4/9-0378-017	spare		
486/4/9-0378-018	spare		
486/4/9-0378-019	spare		
486/4/9-0378-020	spare		

STANDARD VARIABLES

DESCRIPTION	VALUES			
WATER BOOSTER PLANT ID	WB002			
MAIN FLOWMETER ID,	F0092			
PRESSURE INLET ID, PRESSURE OUTLET ID	P0237, P0238			
STREETNAME, SUBURB	HUDDART ST, ALDERLEY			
DRAWING NUMBER	486/4/9-0378			
SUPPLY AUTHORITY POLE No	35572			
INCOMING MAINS SUPPLY CABLE sqmm	20 MM			
MAIN EARTHING CABLE sqmm	6 MM			
CT METERING ISOLATOR	100A A, DINTMS1003			
NORMAL SUPPLY MAIN SWITCH	100A, XS125CJ100			
GENERATOR SUPPLY MAIN SWITCH	100A, XS125CJ100			
Grundfos PumpSet Assy Part No	CRE45-2			
PUMP KW RATING (1, 2, 3, 4,& 5)	7.5 kW	7.5 kW	7.5 kW	7.5 kW
PUMP CIRCUIT BREAKER (1, 2, 3, 4,& 5)	DTCB15332C	DTCB15332C	DTCB15332C	DTCB15332C
PUMP MOTOR SUPPLY CABLE sqmm (1, 2, 3, 4,& 5)	2.5 MM mm 3C+E	2.5 MM mm 3C+E	2.5 MM mm 3C+E	2.5 MM mm 3C+E
MAIN FLOWMETER RANGE	T.B.A.			
RADIO	DR900-06A02-DO			

STANDARD DESIGN OPTIONS

OPTION	DESCRIPTION	FITTED
A1	PUMP 3 FITTED	YES ☒
A2	PUMP 4 FITTED	YES ☒
~~A3~~	~~PUMP 5 FITTED~~	☐ NO
~~B~~	~~BYPASS FLOWMETER FITTED~~	☐ NO
C1	eNET RTU	YES ☒
~~C2~~	~~MD3311 RTU~~	☐ NO
D1	GSM MODEM	YES ☒
~~D2~~	~~PSTN MODEM~~	☐ NO
E	TRIO RADIO	YES ☒
F1	PUMP BOX SUMP PUMP	YES ☒
~~F2~~	~~FLOWMETER PIT SUMP PUMP~~	☐ NO
~~G~~	~~PUMP BOX VENTILATION FAN~~	☐ NO

TEST
"ISSUED FOR CONSTRUCTION" S97
SIGN 19/12/11

MS4900

Sheet 01

ISSUED FOR CONSTRUCTION

ELECTRICAL AS BUILT DETAILS

REV	
-	COMPANY -
	CONTRACTOR LICENCE No. -
	ELECTRICIAN - DATE: -

No.	DATE	AMENDMENT	DRN.	APD.
A	05.11	ISSUED FOR CONSTRUCTION	DPM	G.A.
O	08.08	ISSUED FOR TENDER	DPM	A.W.

DRAFTED	P.Mostert		
DRAFTING CHECK	P.Hague		
CAD FILE	49-0378set_RevA.dwg		
B.C.C. FILE No.	WQJD/BDWDAA03		
Original Signed by P.Mostert		16.08.2008	
DESIGN	R.P.E.Q. No.	DATE	
Original signed by A.Witthoft	0896	16.08.2008	
DESIGN CHECK	R.P.E.Q. No.	DATE	
Original Signed by R.Janfada		16.08.2008	
MANAGER ENGINEERING SERVICES		DATE	
Original Signed by G.Anderson		16.08.2008	
CLIENT DELEGATE		DATE	

QUEENSLAND UrbanUtilities

SITE: WB002 Huddart St WATER BOOSTER

TITLE: ELECTRICAL DRAWING INDEX

SHEET No.

Queensland Urban Utilities DRAWING No. 486/4/9-0378-001

AMEND. A

G:\194 WATER SUPP\268 Drafting\0248 Plans\Electrical\3. WATERNETWORKS\2. Boosters-Pumps\WB002 Huddart St\49-0378set_RevA.dwg Last Saved by 082870 on Monday, 8 August 2011 2:51:28 PM

NOTE:
double lines indicate
operator interface

TRIO ANTENNA

GSM ANTENNA

WATER BOOSTER SWITCHBOARD

NORMAL
415VAC 10kA

MTRG COMPARTMENT

POWER COMP

CONTROL COMPARTMENT

ISOL 100AA

KWH

GENSET

MTS

MAIN SWITCH 100AA

60A

EARTH

GND

SD1

SURGE PROTN

SF1

AC FILTER

4A

2A

2A

2A

24VDC BATT

PS1

PWR SUPPLY

240vac/24vdc

24VDC

ALARM RLY

SDAR

Grundfos CU351

MPC

Grundfos G100

G'WAY

MODbus

RTU

SURGE PROTN

RADIO

GSM MODEM

GND

24VDC

24VDC

24VDC

DATA

DATA

PLG/SKT

LOCAL/ REMOTE SELECTOR

PUMPS STOP

PSR

P1 P2 P3 P4

PSR I/L

DIGITAL INPUTS

DIGITAL OUTPUTS

4-20mA

4-20mA

GENIbus

GENIbus

GENIbus

GENIbus

F/M

P1 P2 P3 P4

MAN RUN

6A

6A

16A 30mA

2A

32A

32A

32A

32A

PHASE FAIL

LEVEL RELAY

SLR CONT

P1 P2 P3 P4

STN FIRE SW

FSW1

STN FIRE SW FIRE/OFF/CONTROL MODE SELECTOR

TO PUMP MOTOR VFDs

SUMP HIGH LEVEL

AUTO SUMP PUMP

P0237

PinTx

VFD

GENIbus

PSR I/L

MAN RUN

75 kW

P1

P2

P3

P4

P0238

PoutTx

WATER IN

WATER OUT

WATER BOOSTER F/M FLOWMETER PIT

GRUNDFOS CRE45-2

WATER BOOSTER PUMP BOX

ELECTRICAL AS BUILT DETAILS

REV	COMPANY - CONTRACTOR LICENCE No. - ELECTRICIAN - DATE: -
-	

No	DATE	AMENDMENT	DRN.	APD.
A	05.11	ISSUED FOR CONSTRUCTION	DPM	G.A.
O	08.08	ISSUED FOR TENDER	DPM	A.W.

DRAFTED	P.Mostert		
DRAFTING CHECK	P.Hague		
CAD FILE	49-0378set_RevA.dwg		
B.C.C. FILE No.	WQJD/BDWDAA03		

Original Signed by P.Mostert		18.08.2008		
DESIGN	R.P.E.Q. No.	DATE		
Original signed by A.Witthoft	0896	18.08.2008		
DESIGN CHECK	R.P.E.Q. No.	DATE		

Original Signed by R.Janfada		18.08.2008
MANAGER ENGINEERING SERVICES		DATE
Original Signed by G.Anderson		18.08.2008
CLIENT DELEGATE		DATE

QUEENSLAND UrbanUtilities

SITE
WB002 Huddart St
WATER BOOSTER

TITLE
BLOCK DIAGRAM

SHEET No.
Queensland Urban Utilities DRAWING No. 486/4/9-0378-002
AMEND. A

Sheet 02

ISSUED FOR CONSTRUCTION

G:\194 WATER SUPPLY\Drafting\0248 Plans\Electrical\3. WATERNETWORKS\2. Boosters-Pumps\WB002 Huddart St\49-0378set_RevA.dwg Last Saved by 062670 on Monday, 8 August 2011 2:17:48 PM

3 PHASE 415VAC
SUPPLY FROM POLE No. 35572
CABLE SIZE 20 MM
N R W B

MTRG ISOLATOR 100A
ENERGEX DIRECT METERING
LOCKABLE METERING COMPARTMENT

GENERATOR EXTERNAL CONNECTION PLUG
R W B N E

E
MEN LINK
EARTH
MAIN NEUTRAL

F1 610 611 612
63A
SR1,2,3 80kA
SDM-1 SDM-2 SDM-3

MTS
MANUAL TRANSFER SWITCH

Q1 NORMAL SUPPLY MAIN SWITCH 100A (NOTE 1, 2)

Q2 GEN. SUPPLY MAIN SWITCH 100A (NOTE 1, 2)

NOTES

1. INCOMING MAIN, GENERATOR, & DIST. BOARD CIRCUIT BREAKERS SHALL BE SHROUDED ON BOTH LINE & LOAD SIDES.
2. CIRCUIT BREAKER RATINGS TO SUIT FAULT LEVEL & LOAD. ENSURE TYPE 2 CO-ORDINATION WITH CONTACTORS & OVERLOADS TO IEC 947-4-1.
3. ALL WIRES & CABLE CORES ARE FERRULED WITH GRAFOPLAST SI2000 COMPATIBLE LABELLING

SF1
620 N6
CRITEC SURGE FILTER
SN1

Q8 620 621 622 6A
PFRS
STATION MAINS POWER FAILURE RELAY REF 06:B2

GPO IN RTU CUBICLE (LAPTOP)

Q9 640 N9 16A 30mA
GPO IN DISTRIBUTION CUBICLE

Q10 650 N10 6A
SLR-1 REF 04:H13
651
FLUORO IN CUBICLE
SPARE

Q12
Q13 680 N13 6A 30mA
PUMP BOX SUMP PUMP
P-Q12
10A OUTLET
PUMP BOX
AUTO SUMP PUMP

FILTERED NEUTRAL

623 Q20 4A 624 N20
RTU 24VDC POWER SUPPLY REF 05:B2

623 Q21 4A 625 N21

623 Q22 4A 626 N22
GRUNDFOS HYDRO MPE
CU351

623 Q23 4A 627 N23
GRUNDFOS G100 GATEWAY REF 05:H8
CU200

E N R W B
CONTINUED ON SHT 04 A1

AC POWER SUPPLY

SURGE DIVERTERS SD1 SD2 SD3
FILTER SF1
SD12 SD23 SD3

SD ALARM RELAY
SD+ SDAR SD-
L N 12 16
CLOSE = HEALTHY

SURGE DIVERTER AND FILTER OK REF 06:B2
DI02+
DI02-

FUNCTION TEST
J & P RICHARDSON IND.
NAME: TERRY WRIGHT LICENCE: 756
DATE: 8-5-12
SIGNATURE: TWright

POINT TO POINT TEST
J & P RICHARDSON IND.
NAME: TERRY WRIGHT LICENCE: 756
DATE: 8-5-12
SIGNATURE: TWright

LEGEND:
- VDF TERMINAL
- PLC/RTU MARSH FUSE TERM
- PLC/RTU MARSH LINK TERM
- DISCONNECT PLUG

RTU
- DI1-02 DIGITAL INPUT
- DO1-02 DIGITAL OUTPUT
- AI1-02 ANALOG INPUT
- AO1-02 ANALOG OUTPUT

Sheet 03

ISSUED FOR CONSTRUCTION

ELECTRICAL AS BUILT DETAILS	
REV	COMPANY -
-	CONTRACTOR LICENCE No. -
	ELECTRICIAN - DATE: -

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DESIGN CHECK	Original signed by A.Witthoft	0896	16.08.2008
MANAGER ENGINEERING SERVICES	Original Signed by R.Janfada		16.08.2008 DATE
CLIENT DELEGATE	Original Signed by G.Anderson		16.08.2008 DATE

Queensland Urban Utilities

SITE: WB002 Huddart St WATER BOOSTER

TITLE: AC POWER DISTRIBUTION SCHEMATIC DIAGRAM

SHEET No.: Queensland Urban Utilities DRAWING No. 486/4/9-0378-003 AMEND. A

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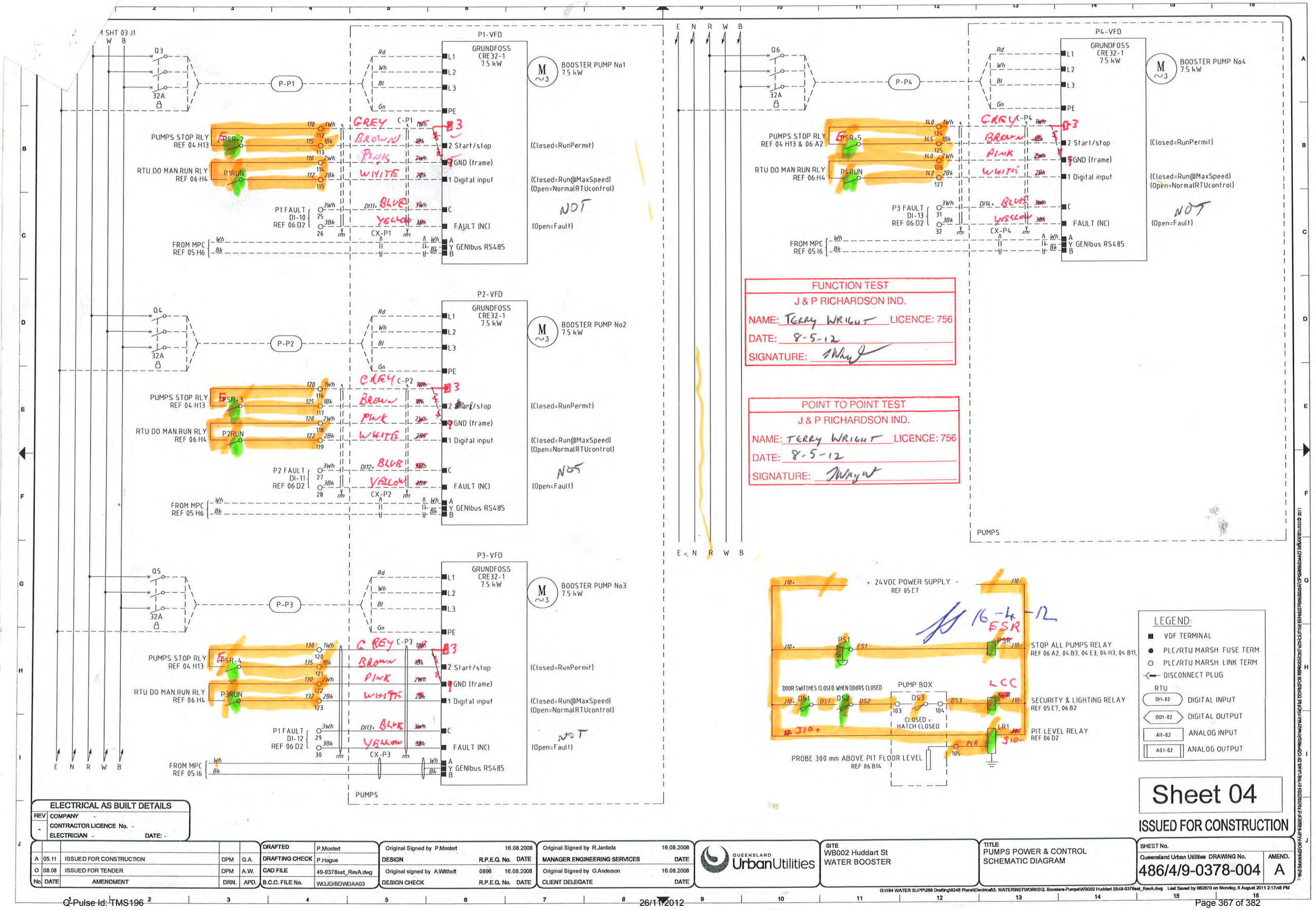

ELECTRICAL AS BUILT DETAILS

REV	
-	COMPANY -
	CONTRACTOR LICENCE No. -
	ELECTRICIAN - DATE: -

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Original Signed by R.Janfada		16.08.2008
MANAGER ENGINEERING SERVICES		DATE
Original Signed by G.Anderson		16.08.2008
CLIENT DELEGATE		DATE

QUEENSLAND UrbanUtilities

SITE: WB002 Huddart St WATER BOOSTER

TITLE: PUMPS POWER & CONTROL SCHEMATIC DIAGRAM

SHEET No.: Queensland Urban Utilities DRAWING No. 486/4/9-0378-004 AMEND. A

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240VAC SUPPLY (SHROUDED) REF 03 E7

PS1

LOAD J1+ J1- 10AMP J2+ J2-

BATT J1B+ J1B- 10AMP J1A+ J1A-

BOK COM DI03+ NC DI03- BATTERY OK REF 06 B2 0 = Fault, 1 = Healthy

RTU COM DI04+ NC DI04- POWER ON REF 06 B2 0 = Fault, 1 = Healthy

TEMPERATURE PROBE LOCATED AT BATTERIES

RTU POWER SUPPLY 10A 24VDC

24V DC / 13.8V DC J3+ J3- J4A+ J4A-

5AMP J4+ J4- RADIO X01 SD2 X02 X03 X04

Rx TBA Tx TBA

rd bk 800mA wavecom FASTRACK suprema GSM modem

5AMP J5+ J5- 2-17 2-18 J5+ J5-

5AMP J6+ J6- RTU 24VDC CARD SUPPLY REF 06 A8, 06 A2, 06 E3, 06 H4

5AMP J7+ rd J7- bk

5AMP J8+ J8- DELIVERY FLOWMETER REF 06 B11

5AMP J9+ J9- SLR-1 651 REF 04 H13 LED LIGHT BAR IN CUBICLE

ADAM -4520 24V+ J5+ 0V J5-

5AMP J10+ J10- MISCELLANEOUS DC CCTS REF 04 G12

DI+ DO-

NOT USED

DC IN DC OUT PORT 0 PORT 1 PORT 2 RADIO LAN/LINE

REFER SHEET 06

CABLE X03 TERMINATION DIAGRAM eNet RTU -------- TRIO RADIO

White	RJ11-1	DB9-M-1
Black	RJ11-2	DB9-M-2
Red	RJ11-3	DB9-M-3
Green	RJ11-4	DB9-M-4
Yellow	RJ11-5	DB9-M-5
Blue	RJ11-6	DB9-M-6
		DB9-M-7
		DB9-M-8
		DB9-M-9

CABLE X04 TERMINATION DIAGRAM eNet RTU ---------- GSM MODEM

White	RJ12-1	DB15-M-1
Black	RJ12-2	DB15-M-2
Red	RJ12-3	DB15-M-6
Green	RJ12-4	DB15-M-8
Yellow	RJ12-5	DB15-M-9
Blue	RJ12-6	DB15-M-11
		DB15-M-12

PDS COMPACT eNET SERIES RTU

ETHERNET INPUTS OUTPUTS PDA DIAGNOSTICS

SEE PAGE 6.

J6+ AI02- Pin to RTU AI02 REF 06 F10

J6+ AI03- Pout to RTU AI03 REF 06 F10

J6+ J6- 24VDC REF 05 C7

CU 351 MPC

Pin P0237 Pout P0238 PUMPS

Wh Bk PP094+ PP094- 106 107 108 109 110 111 10AA 10BA

LOOP ISOLATOR Phoenix MINI MCR-SL-I-I J6+ J6-

50+ 51 AI1 53+ 54 AI2 55 GND 58

EXT GENIbus B Y A

DO1 70 72 DI09+ DI09- MPC FAULT TO RTU REF 06 C2 AND 07 F10

DISABLE MPC X1 DL2 12A

240VAC SUPPLY (SHROUDED) REF 02 E7 SW N23

INT GENIbus A1 Y1 B1

Grundfos MPC 351 CU

CX-P1 TO P1 REF 04 C2

CX-P2 TO P2 REF 04 F2

CX-P3 TO P3 REF 04 I2

CX-P4 TO P4 REF 04 C10

CU 200 G100

240VAC SUPPLY (SHROUDED) REF 02 E7 627 SW N23

Grundfos G100

FUNCTION TEST

J & P RICHARDSON IND.

NAME: TERRY WRIGHT LICENCE: 756

DATE: 8-5-12

SIGNATURE:

POINT TO POINT TEST

J & P RICHARDSON IND.

NAME: TERRY WRIGHT LICENCE: 756

DATE: 8-5-12

SIGNATURE:

LEGEND

- VDF TERMINAL
- PLC/RTU MARSH FUSE TERM
- PLC/RTU MARSH LINK TERM
- DISCONNECT PLUG

RTU

- DI1-02 DIGITAL INPUT
- DO1-02 DIGITAL OUTPUT
- AI1-02 ANALOG INPUT
- AO1-02 ANALOG OUTPUT

NOTES

1 ALL WIRES & CABLE CORES ARE FERRULED WITH GRAFOPLAST SI2000 COMPATIBLE LABELLING

2 ALL FUSES ARE 500mA EXCEPT WHERE NOTED OTHERWISE

Sheet 05

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DRAFTING CHECK	P.Hague		
CAD FILE	43-0378set_RevA.dwg		
B.C.C. FILE No.	WQJD/BDWDAA03		
DESIGN	Original Signed by P.Mostert	R.P.E.Q. No.	16.08.2008 DATE
DESIGN CHECK	Original signed by A.Witthoft	0896	16.08.2008 DATE
MANAGER ENGINEERING SERVICES	Original Signed by R.Janfada		16.08.2008 DATE
CLIENT DELEGATE	Original Signed by G.Anderson		16.08.2008 DATE

Queensland Urban Utilities

SITE: WB002 Huddart St WATER BOOSTER

TITLE: DC POWER DISTRIBUTION SCHEMATIC DIAGRAM

SHEET No.: Queensland Urban Utilities DRAWING No. 486/4/9-0378-005 AMEND. A

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RTU DIGITAL INPUTS

+ 24VDC POWER SUPPLY - REFER SHEET 05.C7

- DI-00 PUMP STOP RELAY REF 04.H13
- DI-01 STATION MAINS POWER REF 03.E3
- DI-02 SURGE DIVERTER AND FILTER OK REF 03.E11
- DI-03 RTU BATTERY OK REF 05.B3
- DI-04 RTU CONTROL POWER REF 05.C3
- DI-05 DOOR STATUS REF 04.H13
- DI-06 STATION LOCAL REMOTE SWITCH
- DI-07 FIRE MODE SELECTED
- DI-08 CONTROL MODE SELECTED
- DI-09 MPC FAULT REF 05.G5
- DI-10 PIT FLOODED REF 04.C14
- DI-11 P1 FAULT REF 04.C04
- DI-12 P2 FAULT REF 04.F04
- DI-13 P3 FAULT REF 04.I04
- DI-14 P4 FAULT REF 04.C12
- DI-15 RESERVED FOR P5 FAULT

+ 24VDC POWER SUPPLY - REFER SHEET 05.C7

- DI-16 SPARE
- DI-17 SPARE
- DI-18 SPARE
- DI-19 SPARE
- DI-20 SPARE
- DI-21 SPARE
- DI-22 SPARE
- DI-23 SPARE

RTU DIGITAL OUTPUTS

+ 24VDC POWER SUPPLY - REFER SHEET 05.C7

- DO-01 PUMP #1 MANUAL RUN COMMAND REF 04.C3
- DO-02 PUMP #2 MANUAL RUN COMMAND REF 04.F3
- DO-03 PUMP #3 MANUAL RUN COMMAND REF 04.I3
- DO-04 PUMP #4 MANUAL RUN COMMAND REF 04.B11
- DO-05 RESERVED FOR PUMP #5 MANUAL RUN COMMAND
- DO-06 SPARE
- DO-07 SPARE
- DO-08 SPARE

DISABLE MPC REF 05:H3

RTU ANALOG INPUTS

+ 24VDC POWER SUPPLY - REFER SHEET 05.B7

DELIVERY FLOWMETER

E+H PROMATIC 10 FLOWMETER SENSOR — IFM-D-1, IFM-D-2 — FLOWMETER PIT

E+H PROMATIC 10 FLOWMETER Tx

- AI00 DELIVERY FLOWMETER
- 24VDC SUPPLY REF 05.D7
- AI01 RESERVED FOR LOW ZONE FLOWMETER

ANALOG INPUTS part of GRUNDFOS PUMP PAK

- AI02 Pin
- AI03 Pout
- AI04 SPARE
- AI05 SPARE

INLET PRESURE SENSOR part of GRUNDFOS PUMP PAK

OUTLET PRESURE SENSOR part of GRUNDFOS PUMP PAK

LOOP ISOLATOR Phoenix MINI MCR-SL-I-I

SEE CLEAN SHEET 6

NOTES

1. ALL WIRES & CABLE CORES ARE FERRULED WITH GRAFOPLAST SI2000 COMPATIBLE LABELLING.
2. ALL FUSES ARE 500mA EXCEPT WHERE NOTED OTHERWISE.

LEGEND:

- VDF TERMINAL
- PLC/RTU MARSH. FUSE TERM.
- PLC/RTU MARSH. LINK TERM.
- DISCONNECT PLUG
- RTU
- DI1-02 DIGITAL INPUT
- DO1-02 DIGITAL OUTPUT
- AI1-02 ANALOG INPUT
- AO1-02 ANALOG OUTPUT

FUNCTION TEST

J & P RICHARDSON IND.

NAME: TERRY WRIGHT LICENCE: 756

DATE: 8-5-12

SIGNATURE:

POINT TO POINT TEST

J & P RICHARDSON IND.

NAME: TERRY WRIGHT LICENCE: 756

DATE: 8-5-12

SIGNATURE:

Sheet 06

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DRAFTING CHECK	P.Hague		
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B.C.C. FILE No.	WQJD/BDWDAA03		

Original Signed by P.Mostert	16.08.2008	Original Signed by R.Janfada	16.08.2008
DESIGN	R.P.E.Q. No. DATE	MANAGER ENGINEERING SERVICES	DATE
Original signed by A.Withoft	0896 16.08.2008	Original Signed by G.Anderson	16.08.2008
DESIGN CHECK	R.P.E.Q. No. DATE	CLIENT DELEGATE	DATE

QUEENSLAND Urban Utilities

SITE: WB002 Huddart St WATER BOOSTER

TITLE: COMMON CONTROLS SCHEMATIC DIAGRAM

SHEET No.

Queensland Urban Utilities DRAWING No. 486/4/9-0378-006 AMEND. A

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RTU DIGITAL INPUTS

+ 24VDC POWER SUPPLY - REFER SHEET 05:C7

DI-24V

01	2A	J6+	J6-	02	DI1-COM	P1-19	CM	DI1-COM
03	DI00+	PSR-1	DI00-	04	DI00	P1-01	01	DI-00
05	DI01+	PFRS-1	DI01-	06	DI01	P1-02	02	DI-01
07	DI02+	SADR-1	DI02-	08	DI02	P1-03	03	DI-02
09	DI03+	BOK	DI03-	10	DI03	P1-04	04	DI-03
11	DI04+	RTU	DI04-	12	DI04	P1-05	05	DI-04
13	DI05+	SLR-2	DI05-	14	DI05	P1-06	06	DI-05
15	DI06+	REM LOC S10	DI06-	16	DI06	P1-07	07	DI-06
17			DI07	18	DI07	P1-08	08	DI-07
19			DI08	20	DI08	P1-09	09	DI-08
21	DI09+	MPC-DO1	DI09-	22	DI09	P1-10	10	DI-09
23	DI10+	LR1-1	DI10-	24	DI10	P1-11	11	DI-10
25	DI11+	P1-FAULT	DI11-	26	DI11	P1-12	12	DI-11
27	DI12+	P2-FAULT	DI12-	28	DI12	P1-13	13	DI-12
29	DI13+	P3-FAULT	DI13-	30	DI13	P1-14	14	DI-13
31	DI14+	P4-FAULT	DI14-	32	DI14	P1-15	15	DI-14
33	DI15+		DI15-	34	DI15	P1-16	16	DI-15

- PUMP STOP RELAY REF 04:H13
- STATION MAINS POWER REF 03:E3
- SURGE DIVERTER AND FILTER OK REF 03:E11
- RTU BATTERY OK REF 05:B3
- RTU CONTROL POWER REF 05:C3
- DOOR STATUS REF 04:H13
- STATION LOCAL REMOTE SWITCH
- MPC FAULT REF 05:G5
- PIT FLOODED REF 04:C14
- P1 FAULT REF 04:E04
- P2 FAULT REF 04:F04
- P3 FAULT REF 04:I04
- P4 FAULT REF 04:C12
- RESERVED FOR P5 FAULT

+ 24VDC POWER SUPPLY - REFER SHEET 05:C7

DI2-24V

35	2A	J6+	J6-	36	DI2-COM	P1-19	CM	DI2-COM
37	DI16+		DI16-	38	DI16	P4-01	17	DI-16
39	DI17+		DI17-	40	DI17	P4-02	18	DI-17
41	DI18+		DI18-	42	DI18	P4-03	19	DI-18
43	DI19+		DI19-	44	DI19	P4-04	20	DI-19
45	DI20+		DI20-	46	DI20	P4-05	21	DI-20
47	DI21+		DI21-	48	DI21	P4-06	22	DI-21
49	DI22+		DI22-	50	DI22	P4-07	23	DI-22
51	DI23+		DI23-	52	DI23	P4-08	24	DI-23

- SPARE
- SPARE
- SPARE
- SPARE
- SPARE
- SPARE
- SPARE
- SPARE

RTU DIGITAL OUTPUTS

+ 24VDC POWER SUPPLY - REFER SHEET 05:C7

		CM	DO1+24V	P2-09	DO1+24V	53	J6+	J6-	54	DO1-COM
DO-01	DO1 NO	DO01	DO01	P2-01	55	P1RUN		56	P1RUN
DO-02	DO2 NO	DO02	DO02	P2-02	57	P2RUN		58	P2RUN
DO-03	DO3 NO	DO03	DO03	P2-03	59	P3RUN		60	P3RUN
DO-04	DO4 NO	DO04	DO04	P2-04	61	P4RUN		62	P4RUN
DO-05	DO5 NO	DO05	DO05	P2-05	63			64	
DO-06	DO6 NO	DO06	DO06	P2-06	65			66	
DO-07	DO7 NO	DO07	DO07	P2-07	67			68	
DO-08	DO8 NO	DO08	DO08	P2-08	69			70	

- PUMP #1 MANUAL RUN COMMAND REF 04:C3
- PUMP #2 MANUAL RUN COMMAND REF 04:F3
- PUMP #3 MANUAL RUN COMMAND REF 04:I3
- PUMP #4 MANUAL RUN COMMAND REF 04:B11
- RESERVED FOR PUMP #5 MANUAL RUN COMMAND
- SPARE
- SPARE
- SPARE

+ 24VDC POWER SUPPLY - REFER SHEET 05:B7

71	2A	J6+	J6-
72			
73			
74			
75			
76			

RTU ANALOG INPUTS

DELIVERY FLOWMETER

E+H PROMATIC 10 FLOWMETER SENSOR

E+H PROMATIC 10 FLOWMETER Tx

5-S1	7-E2	IFM-D-1	6-S1	5-E1	7-E2	8-S2	4-GND	37-E	36-S	26+	27-	1	2
4-GND	37-E	IFM-D-2	41	42									

FLOWMETER PIT

- A100A 500mA A100+ 77 P3-01 A100+ 0+ A100 DELIVERY FLOWMETER
- A100- 78 P3-02 A100- 0-
- J8+ J8- 24VDC SUPPLY REF 05:D7

- 500mA A101+ 79 P3-03 A101+ 1+ A101 RESERVED FOR LOW ZONE FLOWMETER
- A101- 80 P3-04 A101- 1-

ANALOG INPUTS part of GRUNDFOS MPC

4-20mA A11 Pin — J6- S8 — A102-A — S1

4-20mA A12 Pout — S4 — A103-A — LOOP ISOLATOR Phoenix MINI MCR-SL-I-I — A103-B — 110 109 111 — A103-

INLET PRESURE SENSOR part of GRUNDFOS PUMP PAK

4-20mA — 107 106 108 — A102-

- J6+ 500mA A102+ 81 P3-05 A102+ 3+ A102 Pin
- A102- 82 P3-06 A102- 3-

OUTLET PRESURE SENSOR part of GRUNDFOS PUMP PAK

4-20mA

- 500mA A103+ 83 P3-07 A103+ 4+ A103 P out
- A103- 84 P3-08 A103- 4-
- 500mA A104+ 85 P3-09 A104+ 5+ A104 SPARE
- A104- 86 P3-10 A104- 5-
- 500mA A105+ 87 P3-11 A105+ 6+ A105 SPARE
- A105- 88 P3-12 A105- 6-

NOTES

1. ALL WIRES & CABLE CORES ARE FERRULED WITH GRAFOPLAST SI2000 COMPATIBLE LABELLING
2. ALL FUSES ARE 500mA EXCEPT WHERE NOTED OTHERWISE.

LEGEND:

- VDF TERMINAL
- PLC/RTU MARSH. FUSE TERM.
- PLC/RTU MARSH. LINK TERM
- DISCONNECT PLUG

RTU

- DI1-02 DIGITAL INPUT
- DO1-02 DIGITAL OUTPUT
- AI1-02 ANALOG INPUT
- AO1-02 ANALOG OUTPUT

Sheet 06

ISSUED FOR CONSTRUCTION

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DRAFTING CHECK	P.Hague		
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B.C.C. FILE No.	WQJD/BDWDAA03		
Original Signed by P.Mostert		16.08.2008	
DESIGN	R.P.E.Q. No.	DATE	
Original signed by A.Wilhoft	0896	16.08.2008	
DESIGN CHECK	R.P.E.Q. No.	DATE	
Original Signed by R.Janfada		16.08.2008	
MANAGER ENGINEERING SERVICES		DATE	
Original Signed by G.Anderson		16.08.2008	
CLIENT DELEGATE		DATE	

QUEENSLAND Urban Utilities

SITE: WB002 Huddart St WATER BOOSTER

TITLE: COMMON CONTROLS SCHEMATIC DIAGRAM

SHEET No.

Queensland Urban Utilities DRAWING No. 486/4/9-0378-006 AMEND. A

G:\194 WATER SUPPLY\258 Drafting\6248 Plans\Electrical\3. WATER\NETWORK\B2. Boosters-Pumps\WB002 Huddart St\49-0378sct_RevA.dwg Last Saved by 062670 on Monday, 8 August 2011 2:17:48 PM

SWITCHBOARD

FIELD

24VDC

REFER SHEET 05

REFER SHEET 05

RTU eNET REFER SHT 05

DISCONNECT PLUG 1

DI1

DIGITAL INPUTS

DIGITAL INPUTS

DISCONNECT PLUG 4

(REF SHT 13 FOR PLG/SKT CODING PINS)

CONTINUED ON SHT 08

CONT ON SHEET 08

CONT ON SHEET 09

PUMPS STOP PBUTTON OK

STATION MAINS POWER OK

SURGE DIVERTER OK

BATTERY SYSTEM OK

RTU POWER OK

PS1
RTU POWER SUPPLY
10A 24VDC
POWER BOX PB251-24CM

ALL DOORS CLOSED

REMOTE CONTROL SELECTED

MPC OK

PIT FLOODED

FIRE MODE SELECTED

PSW CONTROL MODE SELECTED

LEGEND

- C?? CABLE IDENTIFIER
- DISCONNECT PLUG
- 5A FUSE TERMINAL
- 5 DISCONNECT LINK TERMINAL

NOTES

1 ALL WIRES & CABLE CORES ARE FERRULED WITH GRAFOPLAST SI2000 COMPATIBLE LABELLING.

2 ALL FUSES ARE 500mA EXCEPT WHERE NOTED OTHERWISE.

Sheet 07

ISSUED FOR CONSTRUCTION

No	DATE	AMENDMENT	DRN.	APD.
A	05.11	ISSUED FOR CONSTRUCTION	DPM	G.A.
O	08.08	ISSUED FOR TENDER	DPM	A.W.

DRAFTED	P.Mostert		
DRAFTING CHECK	P.Hague		
CAD FILE	49-0378set_RevA.dwg		
B.C.C. FILE No.	WQJD/BDWDAA03		

Original Signed by P.Mostert		16.08.2008	
DESIGN	R.P.E.Q. No.		DATE
Original signed by A.Witthoft	0896	16.08.2008	
DESIGN CHECK	R.P.E.Q. No.		DATE

Original Signed by R.Janfada		16.08.2008
MANAGER ENGINEERING SERVICES		DATE
Original Signed by G.Anderson		16.08.2008
CLIENT DELEGATE		DATE

QUEENSLAND UrbanUtilities

SITE
WB002 Huddart St
WATER BOOSTER

TITLE
RTU DIGITAL INPUTS
TERMINATION DIAGRAM

SHEET No.
Queensland Urban Utilities DRAWING No. 486/4/9-0378-007
AMEND. A

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SWITCHBOARD

FIELD

CONT'D FROM SHT 07

RTU
eNET
REFER SHT 05

DISCONNECT PLUG 2

DO1

DIGITAL OUTUTS

DO1 NC COM NO DO0 gy
DO2 NC COM NO DO1 gy
DO3 NC COM NO DO2 gy
DO4 NC COM NO DO3 gy
DO5 NC COM NO DO4 gy
DO6 NC COM NO DO5 gy
DO7 NC COM NO DO6 gy
DO8 NC COM NO DO7 gy

DO1+24V or 9 or DO1+24V
DO1-COM 1 gy DO0
2 gy DO1
3 gy DO2
4 gy DO3
5 gy DO4
6 gy DO5
7 gy DO6
8 gy DO7
10 vi J7

2A 53 J6+ or
54 J6- vi
55 DO0+ gy
56 DO0- gy
57 DO1+ gy
58 DO1- gy
59 DO2+ gy
60 DO2- gy
61 DO3+ gy
62 DO3- gy
63 DO4+ gy
64 DO4- gy
65 DO5+
66 DO5-
67
68
69
70

P1RUN PUMP1 MANUAL RUN COMMAND
P2RUN PUMP2 MANUAL RUN COMMAND
P3RUN PUMP3 MANUAL RUN COMMAND
P4RUN PUMP4 MANUAL RUN COMMAND
P5RUN PUMP5 MANUAL RUN COMMAND
x1 DISABLE MPC COMMAND

17 J5+
18 J5-
REF 05 B8

(REF. SHT 13 FOR PLG/SKT CODING PINS)

CONT FROM SHEET 07

AI1

or AI1+24V
AI1+24V
AI1+24V
AI1+24V
AI1+24V

71 2A J8+ or
72 J8- vi
73
74
75
76
77 AI00A gy
78 AI00- gy
79
80
81
82
83
84
85
86
87
88
89

reserved for bypass flowmeter

DISCONNECT PLUG 3

ANALOG OUTPUTS

AI00 0 + - AI00+ gy 1 gy AI00-
AI01 1 + - AI01+ gy 2 gy AI01-
AI02 2 + - AI02+ gy 3 gy AI02-
AI03 3 + - AI03+ gy 4 gy AI03-
AI04 4 + - AI04+ gy 5 gy AI04-
AI05 5 + - AI05+ gy 6 gy AI05-
7
8
9
10
11
12
13
14
15
16
20 E

(REF. SHT 13 FOR PLG/SKT CODING PINS)

E+H PROMATIC 10
FLOWMETER Tx

AI00A
AI00-
INST EARTH

24VDC SUPPLY
REF 05 D7
J8+
J8-

26+ 6-S1
27- 5-E1
7-E2
8-S2
4-GND
37-E
36-S
E
41
42

IFM-D-1
IFM-D-2

DELIVERY FLOWMETER

E+H PROMATIC 10
FLOWMETER SENSOR

5-E1
7-E2
4-GND
37-E
E
41
42

FLOWMETER PIT

LEGEND

C?? CABLE IDENTIFIER
DISCONNECT PLUG
5 FUSE TERMINAL
5 DISCONNECT LINK TERMINAL

NOTES

1 ALL WIRES & CABLE CORES ARE FERRULED WITH GRAFOPLAST SI2000 COMPATIBLE LABELLING
2 ALL FUSES ARE 500mA EXCEPT WHERE NOTED OTHERWISE

Sheet 08

ISSUED FOR CONSTRUCTION

No.	DATE	AMENDMENT	DRN.	APD.
A	05.11	ISSUED FOR CONSTRUCTION	DPM	G.A.
O	08.08	ISSUED FOR TENDER	DPM	A.W.

DRAFTED	P.Mostert		
DRAFTING CHECK	P.Hague		
CAD FILE	49-0378set_RevA.dwg		
B.C.C. FILE No.	WQJD/BDWDAA03		

Original Signed by P.Mostert		16.08.2008	
DESIGN	R.P.E.Q. No.	DATE	
Original signed by A.Witthoft	0896	16.08.2008	
DESIGN CHECK	R.P.E.Q. No.	DATE	

Original Signed by R.Janfada		16.08.2008
MANAGER ENGINEERING SERVICES		DATE
Original Signed by G.Anderson		16.08.2008
CLIENT DELEGATE		DATE

QUEENSLAND Urban Utilities

SITE
WB002 Huddart St
WATER BOOSTER

TITLE
RTU DIGITAL OUTPUTS & ANALOG INPUTS TERMINATION DIAGRAM

SHEET No.
Queensland Urban Utilities DRAWING No. 486/4/9-0378-008
AMEND. A

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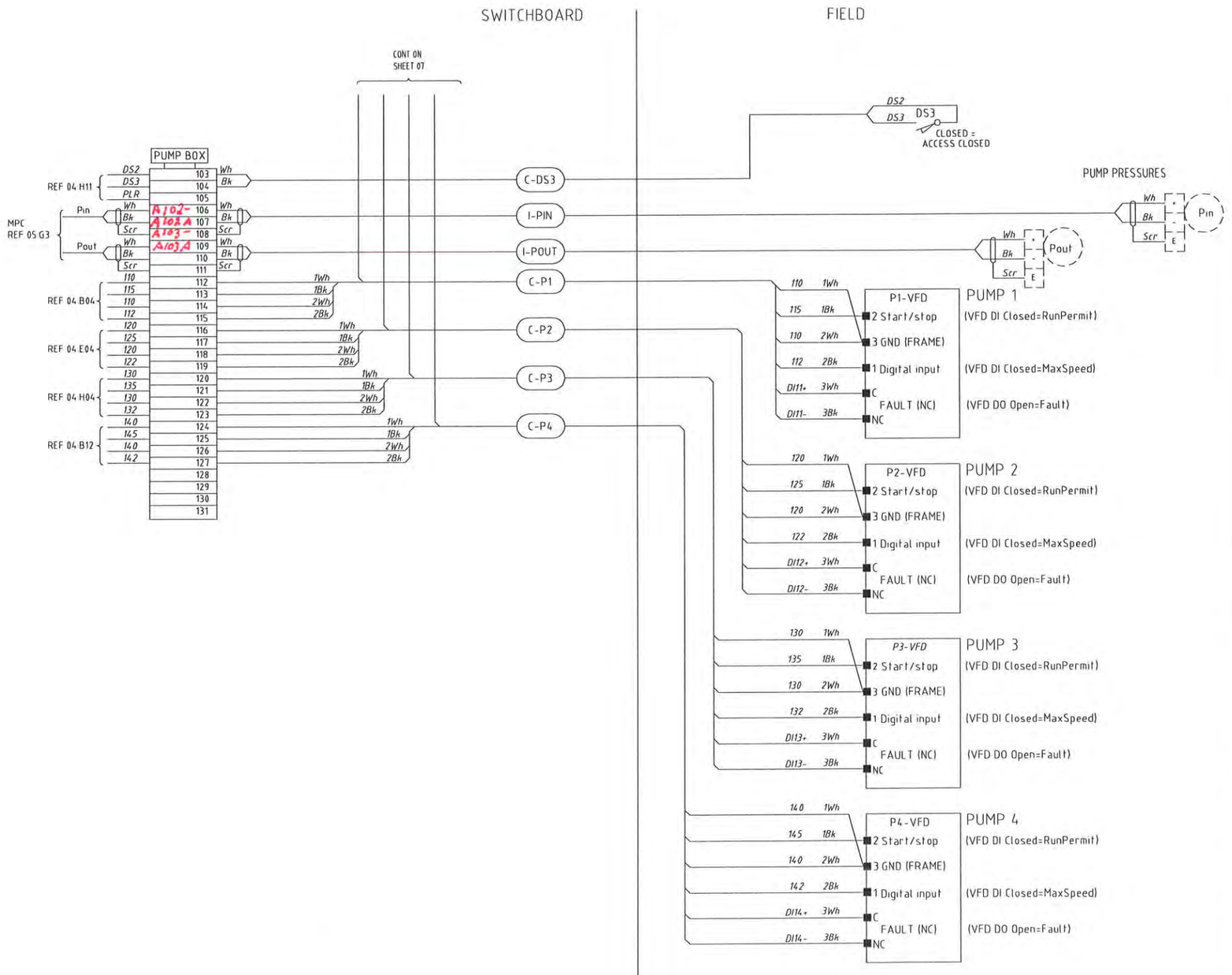

Sheet 09

ISSUED FOR CONSTRUCTION

No.	DATE	AMENDMENT	DRN.	APD.
A	05.11	ISSUED FOR CONSTRUCTION	DPM	G.A.
O	08.08	ISSUED FOR TENDER	DPM	A.W.

DRAFTED	P.Mostert		
DRAFTING CHECK	P.Hague		
CAD FILE	49-0378set_RevA.dwg		
B.C.C. FILE No.	WQJD/BDWDAA03		

Original Signed by P.Mostert	16.08.2008	Original Signed by R.Janfada	16.08.2008
DESIGN	R.P.E.Q. No. DATE	MANAGER ENGINEERING SERVICES	DATE
Original signed by A.Witthoft	0896 16.08.2008	Original Signed by G.Anderson	16.08.2008
DESIGN CHECK	R.P.E.Q. No. DATE	CLIENT DELEGATE	DATE

QUEENSLAND Urban Utilities

SITE: WB002 Huddart St, WATER BOOSTER

TITLE: PUMPS CONTROL TERMINATION DIAGRAM

SHEET No.

Queensland Urban Utilities DRAWING No.: 486/4/9-0378-009

AMEND.: A

G:\194 WATER SUPPY268 Drafting\B248 Plans\Electrical\3. WATERNETWORKS\2. Boosters-Pumps\WB002 Huddart St\49-0378set_RevA.dwg Last Saved by 062670 on Monday, 8 August 2011 2:17:48 PM

ITEM	Q.TY	DESCRIPTION	MANUFACTURER	CATALOGUE No	REMARKS
1	1	METERING ISOLATOR 100A A	TERASAKI	DNTMS1003	
2	1	Q1 NORMAL SUPPLY MAIN SWITCH 100A A	TERASAKI	~~XS125C/100~~ E125-NJ 100A	
3	1	Q2 GENERATOR SUPPLY MAIN SWITCH 100A A	TERASAKI	~~XS402C/100~~ E125-NJ 100A	
4.1	1	Q3 PUMP 1 CIRCUIT BREAKER 32 A + CAPTIVE LOCK DOG	TERASAKI	DTC(B15332C + DTLDC	10kA 3P 32A "D" curve
4.2	1	Q4 PUMP 2 CIRCUIT BREAKER 32 A + CAPTIVE LOCK DOG	TERASAKI	DTC(B15332C + DTLDC	10kA 3P 32A "D" curve
4.3	1	Q5 PUMP 3 CIRCUIT BREAKER 32 A + CAPTIVE LOCK DOG	TERASAKI	DTC(B15332C + DTLDC	10kA 3P 32A "D" curve
4.4	1	Q6 PUMP 4 CIRCUIT BREAKER 32 A + CAPTIVE LOCK DOG	TERASAKI	DTC(B15332C + DTLDC	10kA 3P 32A "D" curve
		RESERVED			
5					
6					
7	1	Q8 PHASE FAIL RLY & DC PWR SUPPLY CB	TERASAKI	DTC(B10306C	10kA 3P 6A "C" curve
8	1	Q9 SWBD GPO CIRCUIT BREAKER	TERASAKI	DSRCBH-16-30A	10kA 1P 16A 30mA RCD
9	1	Q10 SWBD INT LIGHTING CIRCUIT BREAKER	TERASAKI	DTC(B10106C	10kA 1P 6A "C" curve
10					
11	1	Q12 PUMP BOX SUMP PUMP CIRCUIT BREAKER	TERASAKI	DSRCBH-06-30A	10kA 1P 6A 30mA RCD
12					10kA 1P 6A 30mA RCD
13					
14					
15	1	INSULATED 3P BUS COMB	TERASAKI	ICL213	21 POLE
16	3	BUS COMB MAIN TERMINALS	TERASAKI	DTCF35	35sqmm
17	1	Q20 DC POWER SUPPLY CIRCUIT BREAKER	TERASAKI	DTC(B10104C	10kA 1P 4A "C" curve
18	1	Q21 SURGE DIVERTERS RELAY CIRCUIT BREAKER	TERASAKI	DTC(B10104C	10kA 1P 4A "C" curve
19	1	Q22 GRUNDFOSS MPC CIRCUIT BREAKER	TERASAKI	DTC(B10104C	10kA 1P 4A "C" curve
20	1	Q23 GRUNDFOSS G100 CIRCUIT BREAKER	TERASAKI	DTC(B10104C	10kA 1P 4A "C" curve
21	1	INSULATED 3P BUS COMB	TERASAKI	ICL081	8 POLE
22	1	BUS COMB MAIN TERMINALS	TERASAKI	DTCF35	35sqmm
29	3	F1 - SURGE DIVERTER CIRCUIT FUSES	NHP	TIS 63AMP 60MS 100A	FUSES & HOLDERS
30	3	SURGE DIVERTER	CRITEC	TDS-180-45-277	
31	1	SURGE DIVERTER ALARM RELAY - SDAR	CRITEC	DAR-275V	
32	1	SURGE REDUCTION FILTER RTU	CRITEC	TDF-10A-240V	
33					
34	1	STATION MAINS PHASE FAILURE RELAY - PFRS	CROMPTON INSTRUMENTS	252-PSGW	
35					
36					
37					
38	1	MAIN NEUTRAL LINK	D&L ELEC	2DLA18	INSULATED
39	1	MAIN EARTH LINK	D&L ELEC	2DLAE18	
40	1	INSTRUMENT EARTH LINK	D&L ELEC	DLBE12	INSULATED
41	1	FILTERED SUPPLY NEUTRAL LINK	CLIPSAL	L7	INSULATED
42	2	1 PHASE OUTLET 15A	CLIPSAL	15/15+90B (SHROUD)	
43					
44					
45	1	3 PHASE N&E APPLIANCE INLET 63 A - GEN POWER	MENNEKES	3658	3p+N+E c/w 40787 Protective Cover
46					
47					
48					
49					
50					
51					
52					
53	1	PUMPS STOP RELAY - PSR	SPRECHER & SCHUH	CS 7C-40E24V	DIN RAIL MTG 4 N.O. 24VDC RELAY
54	1	PUMPS STOP RELAY AUX CONTACT BLOCK	SPRECHER & SCHUH	CS 7-PV-20 22	AUX BLOCK 2 N.O.
55	1	PUMP 1 MANUAL RUN RELAY - P1RUN	NHP FINDER	38.51.24VDC	DIN RAIL MTG 1 C/O 24V RELAY
56	1	PUMP 2 MANUAL RUN RELAY - P2RUN	NHP FINDER	38.51.24VDC	DIN RAIL MTG 1 C/O 24V RELAY
57	1	PUMP 3 MANUAL RUN RELAY - P3RUN	NHP FINDER	38.51.24VDC	DIN RAIL MTG 1 C/O 24V RELAY
58	1	PUMP 4 MANUAL RUN RELAY - P4RUN	NHP FINDER	38.51.24VDC	DIN RAIL MTG 1 C/O 24V RELAY
59	1	DISABLE MPC RELAY-K01	"	"	"
60					
61					
62					

ITEM	Q.TY	DESCRIPTION	MANUFACTURER	CATALOGUE No	REMARKS
63					
64					
65	1	STOP ALL PUMPS PUSHBUTTON - S1	SPRECHER & SCHUH	DSP-MTS343LX02S	
66					
67					
68					
69					
70					
71					
72					
73					
74	1	LR1 - SUMP PUMP LEVEL RELAY	MULTITRODE	MTR	24VDC
75	1	SINGLE POINT PROBES	MULTITRODE	0.2/1-'x'	'x' = CABLE LENGTH TO SUIT
76					
77					
78					
79	1	LLC - SW/BD LIGHTING CONTROL RELAY	SPRECHER & SCHUH	CS 7C-22E24V	DIN RAIL MTG 2 C O 24VDC RELAY
80					
81	1	S11 - FIRE MODE SWITCH	KRAUS & NAIMER	CAD11/A212	ENGRAVE "FIRE OFF (MODE)"
82	1	S10 - STATION LOCAL/REMOTE SWITCH	KRAUS & NAIMER	CAD11/A201	ENGRAVE 'LOCAL REMOTE'
83					
84	1	FLOWMETER	ENDRES & HAUSER	PROMATIC ~~50~~	~~EXISTING~~
86	1	GRUNDFOS PUMP CONTROL PANEL	GRUNDFOS	~~MPC~~ CU3510	PART OF GRUNDFOS HYDROPAK
87					
88	1	GRUNDFOS GATEWAY	GRUNDFOS	~~G100~~ CIU200	PART OF GRUNDFOS HYDROPAK
89					
90					
91					
92					
93	1	RTU POWER SUPPLY 24VDC 10A	POWERBOX	PB751-24CM	
94	1	TELEMETRY UNIT	SCHNEIDER	~~PDS COMPACT~~ SCADAPACK ES	
95	1	RADIO - 24V/13.8VDC CONVERTER	POWERBOX	~~PB11-2412G~~ VTA125C24	
96	1	GSM - 24V/9VDC CONVERTER	INOVATIVE ENERGIES	IE XR/MV-8	
97	2	BATTERIES	YUASA	~~UXH7-12~~	WP7-12FR 12V 7AH
98	1	GSM MODEM	WAVECOM	SUPREME	FASTRAK XTEND
99	1	GSM CELLULAR TRANSIT ANTENNA	RF INDUSTRIES	TLA2000	
100	1	RADIO	TRIO	DR900-06A02-DO	DR900-06A02-DO
101	1	ANTENNA	TRIO	YAGI ANT13AL	c/w N Series connector
102	1	RADIO COAX SURGE PROTECTION UNIT	POLYPHASER CORP.	IS-50NX-C2	
103	1	ANTENNA MAST	SWBD BUILDER		
104	1	COAX CABLE (INTERNAL CABLE No X01)	TRIO	RG58 - SMA - N male - 0.5m	RADIO TO SURGE DIVERTER
105	1	COAX CABLE (EXTERNAL CABLE No X02)	R.F. INDUSTRIES	CNT400	SURGE DIVERTER TO ANTENNA
106	1	COAX PLUG	R.F. INDUSTRIES	N Series (MALE)	
107	1	U CLAMPS	R.F. INDUSTRIES	UNV	
108					
109					
110					
111					
112	2	SW/BD DOOR MICRO SWITCHES	CAMSCO	SM202	7 OFF N/O
113	1	300mm 8.25vDC 36x5050 SMD LED Lightbar - Cool White	LED SHOP AU	#7700	www.ledshoponline.com
114	2	CORROSION INHIBITOR	CORTEC	VPCI-110 OR 111	FROM AP CONTROLS
115					
116					
117					
118					
119					
120					
121					
122					
123					
124					

ITEM	Q.TY	DESCRIPTION	MANUFACTURER	CATALOGUE No	REMARKS
125					
126					
127					
128					
129					
		SWITCHBOARD TERMINALS			
130.1	21	FUSED TERMINALS with LED 24V INDICATION	PHOENIX CONTACT	UT4-HESILED24 (5x20)	
130.2	21	FUSE CARTRIDGES	PHOENIX CONTACT	M205	RATINGS AS REQUIRED
130.3	95	DISCONNECT TERMINALS	PHOENIX CONTACT	UT4-MT P/P	
130.4	5	EARTH TERMINALS	PHOENIX CONTACT	UT4-MTD-PE/S	
130.5	5	GROUP MARKER CARRIER	PHOENIX CONTACT	UBE	
130.6	2	TEST PLUG ADAPTOR	PHOENIX CONTACT	PS-6	
130.7	1	SCREW DRIVER	PHOENIX CONTACT	SZS 0.6 x 3.5	
130.8	Lot	PLUG-IN BRIDGE	PHOENIX CONTACT	FBS	AS REQUIRED
131					
132					
133					
134	3	DISCONNECT PLUGS	PHOENIX CONTACT	MSTB 2,5/20-ST-5.08	
135					
136	3	DISCONNECT BLOCKS	PHOENIX CONTACT	UMSTBVK2,5/20-G-5.08	
137					
138	3	CABLE HOUSING	PHOENIX CONTACT	KGS-MSTB2.5/20	
139					
140	3	CODING PINS	PHOENIX CONTACT	CP-MSTB + CR-MSTB	
141					
142					
143					
144					
145					
146					
147					
148					
149					
150					
151					
152					
153	1	SUMP PUMP NON-SWITCHED 240V 15A OUTLET IP56	CLIPSAL	?	BY SITE ELEC CONTRACTOR
154	1	GRUNDFOS 150L AUTO 240VAC SUMP PUMP	GRUNDFOSS	?	BY SITE ELEC CONTRACTOR
155					
156					
157					
158					
159					
160					

Sheet 10

ISSUED FOR CONSTRUCTION

No	DATE	AMENDMENT	DRN.	APD.
A	05.11	ISSUED FOR CONSTRUCTION	DPM	G.A.
O	08.08	ISSUED FOR TENDER	DPM	A.W.

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DRAFTING CHECK	P.Hague	
CAD FILE	49-0378set_RevA.dwg	
B.C.C. FILE No.	WQJD/BDWDAA03	

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Original signed by A.Witthoft	0896		16.08.2008
DESIGN CHECK	R.P.E.Q. No.		DATE

Original Signed by R.Janfada	16.08.2008
MANAGER ENGINEERING SERVICES	DATE
Original Signed by G.Anderson	16.08.2008
CLIENT DELEGATE	DATE

QUEENSLAND Urban Utilities

SITE: WB002 Huddart St WATER BOOSTER

TITLE: SWITCHBOARD EQUIPMENT LIST

SHEET No.

Queensland Urban Utilities DRAWING No. 486/4/9-0378-010

AMEND. A

G:\194 WATER SUPPY\268 Drafting\0248 Plans\Electrical\3. WATERNETWORKS\2. Boosters-Pumps\WB002 Huddart St\49-0378set_RevA.dwg Last Saved by 082870 on Monday, 8 August 2011 2:17:48 PM

CABLE No	STATUS	SIZE	CORES	TYPE	LENGTH (m)	FROM	TO	CABLE FUNCTION	NOTES
P01	NEW	20 MMmm²	4C	PVC/CU/PVC		ENERGEX Supply POINT	Switchboard	Incoming Mains Supply	
P02	NEW	6 MMmm²	1C	Building Wire		Switchboard	Earth stake	Main Earth	
P-P1	NEW	2.5 MMmm²	3C+E	PVC/PVC		Switchboard	Booster Pump 1 Motor	Pump 1 - 3 Phase supply	
P-P2	NEW	2.5 MMmm²	3C+E	PVC/PVC		Switchboard	Booster Pump 2 Motor	Pump 2 - 3 Phase supply	
P-P3	NEW	2.5 MMmm²	3C+E	PVC/PVC		Switchboard	Booster Pump 3 Motor	Pump 3 - 3 Phase supply	
P-P4	NEW	2.5 MMmm²	3C+E	PVC/PVC		Switchboard	Booster Pump 4 Motor	Pump 4 - 3 Phase supply	
C-DS3	NEW	1.5mm²	2C+E	PVC/PVC		Switchboard	Door Switch	Security Lighting	
PLR	NEW		Vendor	Vendor		Switchboard	Multilrode Probe includes cable	Sump Pump	
C-P1	NEW	1.0mm²	3PR	PVC/PVC		Switchboard	Pump Box Pump1	Pump 1 Control & Interlocks	
C-P2	NEW	1.0mm²	3PR	PVC/PVC		Switchboard	Pump Box Pump 2	Pump 2 Control & Interlocks	
C-P3	NEW	1.0mm²	3PR	PVC/PVC		Switchboard	Pump Box Pump 3	Pump 3 Control & Interlocks	
C-P4	NEW	1.0mm²	3PR	PVC/PVC		Switchboard	Pump Box Pump 4	Pump 4 Control & Interlocks	
C-P5	NEW	1.0mm²	3PR	PVC/PVC		Switchboard	Pump Box Pump 5	Pump 5 Control & Interlocks	
CX-P1	NEW		1PR	REXON B20		Switchboard - MPC GENIbus	Pump Box Pump1	GENIbus - Pump1	
CX-P2	NEW		1PR	REXON B20		Switchboard - MPC GENIbus	Pump Box Pump 2	GENIbus - Pump2	
CX-P3	NEW		1PR	REXON B20		Switchboard - MPC GENIbus	Pump Box Pump 3	GENIbus - Pump3	
CX-P4	NEW		1PR	REXON B20		Switchboard - MPC GENIbus	Pump Box Pump 4	GENIbus - Pump4	
I-PIN	NEW		1PR	Vendor		Switchboard - MPC	Suction Pressure Transmitter	Suction Pressure	
I-POUT	NEW			Vendor		Switchboard - MPC	Delivery Pressure Transmitter	Delivery Pressure	
IFM-D-1	NEW		Vendor	Vendor		Switchboard - Flowmeter Tx	Flowmeter	Delivery Flowmeter	
IFM-D-2	NEW		Vendor	Vendor		Switchboard - Flowmeter Tx	Flowmeter	24vdc	
X01	NEW		COAX	RG58		Switchboard - RADIO	Switchboard - Surge Diverter SD2	Trio Radio Antenna Feeder	
X02	NEW		COAX	RG213		Switchboard - SURGE DIVERTER SD2	Switchboard - Antenna	Trio Radio Antenna Feeder	
X03	NEW		COAX	Special		Switchboard - RTU	Switchboard - Radio	Trio Radio Data	
X04	NEW		COAX	Special		Switchboard - RTU	Switchboard - GSM Modem	GSM Modem Data	

NOTE:

1. THE CONTRACTOR IS RESPONSIBLE IN DETERMINING THE ACTUAL CABLE LENGTHS REQUIRED ON SITE.
2. SIZE MAINS CABLE FOR LENGTH OF CABLE RUN FROM ENERGEX POINT OF SUPPLY TO SWITCHBOARD.
3. CABLE LENGTHS TO BE MARKED UP ON AS BUILTS

Sheet 11

ISSUED FOR CONSTRUCTION

No.	DATE	AMENDMENT	DRN.	APD.
A	05.11	ISSUED FOR CONSTRUCTION	DPM	G.A.
O	08.08	ISSUED FOR TENDER	DPM	A.W.

DRAFTED	P.Mostert	Original Signed by P.Mostert 16.08.2008	Original Signed by R.Janfada 16.08.2008
DRAFTING CHECK	P.Hague	DESIGN R.P.E.Q. No. DATE	MANAGER ENGINEERING SERVICES DATE
CAD FILE	49-0378set_RevA.dwg	Original signed by A.Withott 0896 16.08.2008	Original Signed by G.Anderson 16.08.2008
B.C.C. FILE No.	WQJD/BDWDAA03	DESIGN CHECK R.P.E.Q. No. DATE	CLIENT DELEGATE DATE

QUEENSLAND Urban Utilities

SITE: WB002 Huddart St WATER BOOSTER

TITLE: CABLE SCHEDULE

SHEET No.

Queensland Urban Utilities DRAWING No. 486/4/9-0378-011

AMEND. A

G:\194 WATER SUPP\268 Drafting\6248 Plant\Electrical\3. WATERWETWORKS\2. Boosters-Pumps\WB002 Huddart St\49-0378set_RevA.dwg Last Saved by 062870 on Monday, 8 August 2011 2:17:48 PM

ITEM #	OPT	DESCRIPTION	LABEL 1	LABEL 2 & 3 (IF NECESSARY)	TEXT HEIGHT	MATERIAL / COLOUR
02		ENERGEX SUPPLY	NORMAL SUPPLY MAIN SWITCH Q1		10mm 4mm	TRAFFOLYTE B/W/B
03		GENERATOR SUPPLY	GENERATOR SUPPLY MAIN SWITCH Q2		10mm 4mm	TRAFFOLYTE B/W/B
04 1		PUMP CIRCUIT BREAKER	BOOSTER PUMP No 1 Q3		4mm 4mm	TRAFFOLYTE W/B/W
04 2		PUMP CIRCUIT BREAKER	BOOSTER PUMP No 2 Q4		4mm 4mm	TRAFFOLYTE W/B/W
04 3	A1	PUMP CIRCUIT BREAKER	BOOSTER PUMP No 3 Q5		4mm 4mm	TRAFFOLYTE W/B/W
04 4	A2	PUMP CIRCUIT BREAKER	BOOSTER PUMP No 4 Q6		4mm 4mm	TRAFFOLYTE W/B/W
04 5	A3					
7		PHASE FAILURE CIRCUIT BREAKER	PHASE FAILURE & DC POWER SUPPLY Q8		4mm 4mm	TRAFFOLYTE W/B/W
8		SWBD GPOs CIRCUIT BREAKER	SWBD GPO Q9		4mm 4mm	TRAFFOLYTE W/B/W
9		SWBD LIGHTING CIRCUIT BREAKER	~~SWBD LIGHTING~~ Q10 - SPARE		4mm 4mm	TRAFFOLYTE W/B/W
11		PUMP BOX SUMP PUMP CIRCUIT BREAKER	PUMP BOX SUMP PUMP Q12		4mm 4mm	TRAFFOLYTE W/B/W
14		SPARE CIRCUIT BREAKER	SPARE Q14		4mm 4mm	TRAFFOLYTE W/B/W
17		DC POWER SUPPLY CIRCUIT BREAKER	24VDC POWER SUPPLY Q20		4mm 4mm	TRAFFOLYTE W/B/W
18		SURGE DIVERTER RELAY CIRCUIT BREAKER	SURGE DIVERTER RELAY Q21		4mm 4mm	TRAFFOLYTE W/B/W
19		GRUNDFOS MPC CIRCUIT BREAKER	GRUNDFOS MPC Q22		4mm 4mm	TRAFFOLYTE W/B/W
20		GRUNDFOS G100 CIRCUIT BREAKER	GRUNDFOS G100 Q23		4mm 4mm	TRAFFOLYTE W/B/W
29		SURGE DIVERTER FUSES	SURGE DIVERTER FUSES 400/63A	FED FROM LINE SIDE OF MAIN SWITCH	4mm 4mm	TRAFFOLYTE W/B/W - R/W/R
30		SURGE DIVERTERS	LIGHTNING ARRESTORS	SD1 SD2 SD3	4mm	TRAFFOLYTE W/B/W
31		SURGE DIVERTER ALARM RELAY	SDAR		4mm 4mm	TRAFFOLYTE W/B/W
32		SURGE REDUCTION FILTER	RTU SURGE REDUCTION FILTER		4mm 4mm	TRAFFOLYTE W/B/W
34		PHASE FAILURE RELAY	STATION MAINS POWER FAIL - PFRS		4mm 4mm	TRAFFOLYTE ~~B/W/R~~ W/B/W
38		MAIN NEUTRAL LINK	MAIN NEUTRAL		4mm	TRAFFOLYTE W/B/W
39		MAIN EARTH LINK	MAIN EARTH		4mm	TRAFFOLYTE W/B/W
40		INSTRUMENT EARTH LINK	INSTRUMENT EARTH		4mm	TRAFFOLYTE W/B/W
41		FILTERED SUPPLY NEUTRAL LINK	FILTERED SUPPLY NEUTRAL		4mm 4mm	TRAFFOLYTE W/B/W
43		LAPTOP GPO	LAPTOP GPO ONLY		4mm	TRAFFOLYTE W/B/W
45		GENERATOR POWER CONNECTION SOCKET	GENERATOR CONNECTION		6mm 6mm	TRAFFOLYTE W/B/W
53		PUMPS ENERG STOP RELAY	ESR		4mm	TRAFFOLYTE W/B/W
54		PUMPS MANUAL RUN RELAY	MRUN 2	P1, P2, P3, P4,	4mm	TRAFFOLYTE W/B/W

ITEM #	OPT	DESCRIPTION	LABEL 1	LABEL 2 & 3 (IF NECESSARY)	TEXT HEIGHT	MATERIAL / COLOUR
65		ALL PUMPS STOP PUSHBUTTON	STOP ALL PUMPS		6mm	TRAFFOLYTE W/B/W
74		PUMP BOX FLOODED RELAY	LR1		6mm	TRAFFOLYTE W/B/W
79		SWITCHBOARD LIGHTING CONTROL CONTACTOR	LCC		6mm	TRAFFOLYTE W/B/W
81		FIRE MODE SELECTOR SWITCH	FIRE MODE		6mm	TRAFFOLYTE W/B/W
82		STATION LOCAL/REMOTE SELECTOR SWITCH	CONTROL MODE		6mm	TRAFFOLYTE W/B/W
85A		DELIVERY FLOWMETER TRANSMITTER	DELIVERY FLOWMETER		6mm	TRAFFOLYTE W/B/W
93	1	RTU 240VAC/24VDC POWER SUPPLY	RTU 24VDC POWER SUPPLY		6mm 6mm	TRAFFOLYTE W/B/W
94		TELEMETRY UNIT	RTU		6mm	TRAFFOLYTE W/B/W
95	E	RADIO 24V/13.8VDC CONVERTER	24/12 VDC CONVERTER - RADIO		6mm 6mm	TRAFFOLYTE W/B/W
97		BATTERY	BATTERY		6mm	TRAFFOLYTE W/B/W
98		MODEM	MODEM		6mm	TRAFFOLYTE W/B/W
100	E	RADIO	RADIO		6mm	TRAFFOLYTE W/B/W
102	E	RADIO COAX SURGE PROTECTION	RADIO SURGE PROTECTION		6mm	TRAFFOLYTE W/B/W
		TERMINAL HEADER	RTU POWER SUPPLIES		6mm 6mm	TRAFFOLYTE W/B/W
		TERMINAL HEADER	DIGITAL INPUTS DI1		6mm 6mm	TRAFFOLYTE W/B/W
		TERMINAL HEADER	DIGITAL OUTPUTS DO1		6mm 6mm	TRAFFOLYTE W/B/W
		TERMINAL HEADER	ANALOG INPUTS AI1		6mm 6mm	TRAFFOLYTE W/B/W
		HEADER LABEL (Incomer Section)	MEN BEHIND		6mm	TRAFFOLYTE W/B/W
		HEADER LABEL (MainSwitch Section)	SURGE DIVERTER FUSES BEHIND		6mm	TRAFFOLYTE W/B/W
		HEADER LABEL (Above Circuit Breakers)	NON FILTERED SUPPLY		6mm 6mm	TRAFFOLYTE W/B/W
		HEADER LABEL (Above Circuit Breakers)	FILTERED SUPPLY		6mm 6mm	TRAFFOLYTE W/B/W

EXTERNAL LABEL LIST

LABEL	TEXT	TEXT HEIGHT	PAINT FILL LETTERING	SIZE	QTY	OPT
A	WB087	20mm	Black	150x35	1	
B	RTU	10mm	Black	50x20	1	
		10mm	Black	100x20	1	
D	WARNING THIS SITE IS MONITORED BY NETWORK CONTROL PLEASE INFORM THE OPERATOR BEFORE ISOLATING PUMPS OR STATION	8mm	Black	250x100	1	
E	PLEASE CHECK THAT THE STATION IS IN REMOTE MODE BEFORE LEAVING SITE	8mm	Black	210x60	1	
H	MAIN SWITCHES	10mm	Black	120x20	1	
I	DISTRIBUTION BOARD	10mm	Black	150x20	1	
J	FIRE CONTROL SWITCH	10mm	Black	150x20	1	
K	GENERATOR INLET	10mm	Black	120x20	1	
M	SUPPLY AUTHORITY METERING	10mm	Black	200x20	1	
N	DANGER 415V	10mm	Red	100x20	1	
O	DANGER - 2 SOURCES OF SUPPLY	10mm	Red	220x70	1	
	EXTERNAL LABELS 1mm THICK 316 GRADE STAINLESS STEEL FIXED WITH M3 316 STAINLESS STEEL METAL THREADS					

LZAUZ 10 DMC 15-5-12.

DETAIL Q

DETAIL F SAFETY SIGN - DANGER ELECTRICAL EQUIPMENT etc

280x190x2mm (+ 4x4mm FIXING HOLES) ALUNIMUM POWDER COATED WHITE
5 COLOR SCREEN PRINTED +ANTI-GRAFITTI LAMINATE
FREE ISSUED BY BW TO SWBD MANUFACTURER

Sheet 12

ISSUED FOR CONSTRUCTION

No.	DATE	AMENDMENT	DRN.	APD.
A	05.11	ISSUED FOR CONSTRUCTION	DPM	G.A.
O	08.08	ISSUED FOR TENDER	DPM	A.W.

DRAFTED	P.Mostert		
DRAFTING CHECK	P.Hague		
CAD FILE	49-0378set_RevA.dwg		
B.C.C. FILE No.	WQJD/BDWDAA03		

Original Signed by P.Mostert		16.08.2008	
DESIGN	R.P.E.Q. No.	DATE	
Original signed by A.Witthoft	0896	16.08.2008	
DESIGN CHECK	R.P.E.Q. No.	DATE	

Original Signed by R.Janfada		16.08.2008
MANAGER ENGINEERING SERVICES		DATE
Original Signed by G.Anderson		16.08.2008
CLIENT DELEGATE		DATE

QUEENSLAND Urban Utilities

SITE: WB002 Huddart St WATER BOOSTER

TITLE: SWITCHBOARD LABEL SCHEDULE

SHEET No.

Queensland Urban Utilities DRAWING No. 486/4/9-0378-012

AMEND. A

G:\194 WATER SUPP\268 Drafting\6248 Plans\Electrical\3. WATERNETWORKS\2. Boosters-Pumps\WB002 Huddart SM49-0378set_RevA.dwg Last Saved by 082870 on Monday, 8 August 2011 2:17:46 PM

CONSTRUCTION

Cubicle construction 3mm Marine grade Aluminium (5251)
Plinth construction 160x60 channel 6061 T6 Grade Aluminium.
Folded, "Pulse MIG" & "TIG welded with all visible seams and joints fully welded, free from splatter and ground smooth where needed.
External doors and covers fitted with Emka 1011-207 self grip seal.
"D" Handles fitted where indicated on the drawings.
M6 Earth studs fixed to the interior of all doors and hinged escutcheons and on adjacent cubicle interior surfaces.
Door stiffeners, door stays, cable straps, and document holders etc fitted where shown on the drawings. ALN
Door stiffeners to be ~~S/Steel~~ and of sufficent strength to prevent being deformed when subjected to reasonable loads. Minimum 3mm ~~S/Steel~~ ALN
Lift-off covers and mounting panels fixed with M8 studs & chrome acorn nuts.
Gland plates manufactured from 6mm Bakelite.
Gland plate openings reinforced with 25x10mm flat aluminium bar. (Detail F)
Cable glands to be fitted with compression side installed within cubicle. (Detail G)
Gland plate seals attached to cubicle not gland plate.
Gland plate fixings are NOT more than 100 mm apart.
Gland plates are NOT to be split.
Provide Shrouding to all live parts to IP20 where required.
Hinges (external) Selectrix HIB650ss-316 Stainless Steel.
Star washers fitted under all hinge screws.
Hinged escutcheons fixed with Emka 1/4 turn 1000-U142.

Doors 1 & 3

Dirak Swing Handle 207-9295 Stainless Steel.
Selectrix 1107-U123 3pt cam.
Lockwood 71 Barel Lock.
Emka 1049-U3 roller rod.
Key Codes DOOR 1 = RC496A, DOOR 3 = RC496AB

Doors 2

Selectrix Swing Handle 1107-SS02-316 Stainless Steel.
Selectrix 1107-U123 3pt cam.
Emka 1049-U3 roller rod.
ENERGEX padlock 45mm brass pin tumbler. Key No325.

OPERATING PARAMETERS

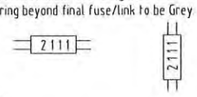
Standard	AS 3439.1
Current & Frequency	AC 50Hz
Rated Operational Voltage Ue	415 VAC
Rated Insulation Voltage Ui	660 V
Rated Auxiliary Voltage	240 VAC / 24 VDC
Rated Current (Main Bus)	300 AMPS
Short Circuit Current Isc	15.7 kA
Duration of Isc	2 sec
Degree of Protection	IP 55 to AS 1939
Measure of Protection by barriers and enclosures	
Service Conditions	Outdoors
Mass	Not exceeding 2000kg
Forms of Segregation	Form 1
Earthing System	TN-S
Ambient Temperature	45°C Max

PAINTING

Aluminium Surface Preparation
Finish smooth all exposed welds, clean, descale, and degrease all surfaces.
Surfaces pretreatment in accordance with AS 1580 & AS 3715 using
Novox LF acid etch cleaner, Novacoat 12 conversion coating, & clean water rinses.
Apply DULUX ALPHATECH 3000 powder coat to manufacturer's recommendations.
CUBICLE & EXTERNAL COMPONENTS - DULUX Mist Green (36648) matt finish
INTERIOR ITEMS (mounting panels, escutcheons, etc.) - DULUX Bright White (32166)
Minimum Dry Film Thickness all surfaces 50 microns

WIRING

All wiring to be PVC V90 HT 0.6/1Kv Grade with tinned conductor.
Control and instrumentation wiring has flexible copper conductors, and is colour coded as detailed below, numbered each end, and terminated by the use of appropriate pre-insulated crimp lugs or pins. A PROPRIETARY ADDUCTOR BIN ISLD MAYBRAKE TO TERMINATE TWO WIRES
Separate lugs or pins shall be used for each conductor.
Not more than two wires shall be connected to any terminal.
Not more than one wire shall be connected on one side of any tunnel type terminal.
Where multiple connections are required on tunnel terminals, proprietary terminal link bars shall be used.
Power wiring to be minimum 2.5sqmm stranded copper conductors, phase colour coded as detailed below.
Control wiring to be minimum 1.0sqmm flexible copper conductors, colour coded as detailed below.
Low level control signals to be minimum 0.5sqmm flexible copper conductors. colour coded as detailed below.
4-20mA analog signals (internal & external) wired in shielded pair minimum size 0.5sqmm, overall screened, and earthed at one end only.
All 240VAC terminals located in the RTU or PLC sections shall be shrouded and labelled - "Danger 240VAC"
Earth cables minimum 2.5sqmm flexible.
Doors and hinged escutcheons bonded with 4sqmm flexible earth strap.
Wire numbering will be equal to Grafoplast SI2000 system.
Wire numbers are readable left to right,bottom to top as shown.
Color of DC wiring beyond final fuse/link to be Grey.



COLOUR CODE

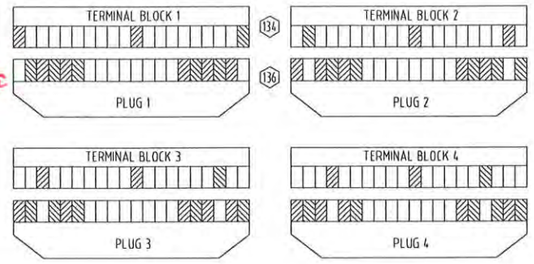
Phase wiring (A,B &C)	Red, White, Blue	2.5sqmm (min)
Potential Metering (240/415 VAC)	Red, White, Blue, Black	1.5sqmm
Current Metering (Secondary)	Red, White, Blue, Grey	2.5sqmm
240 VAC Control Active	Red	1.0sqmm
240 VAC Neutral	Black	1.0sqmm
24 VDC Positive supplies	Orange	1.0sqmm
24 VDC Negative supplies	Violet	1.0sqmm
24 VDC Wiring (Other than supplies)	Grey	1.0sqmm
RTU & PLC Wiring	Grey	0.5sqmm
Electrode Wiring	Salmon	1.0sqmm
Intrinsically safe wiring	Blue	1.5sqmm
Earth	Green/Yellow	2.5sqmm (min)
Door & Escutcheon Earth Bonds	Green/Yellow	4 sqmm

LABELS

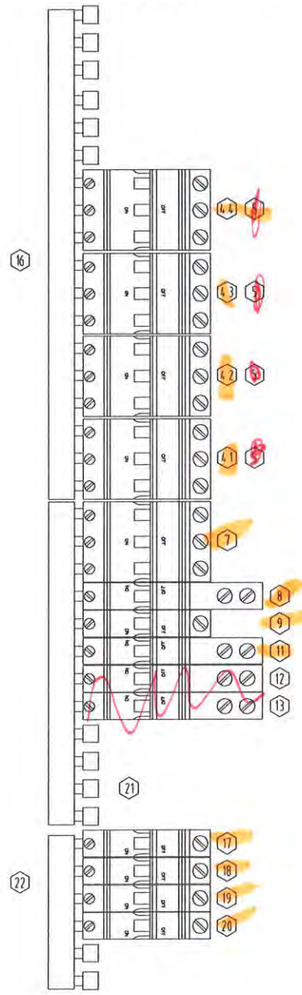
Internal labels W/B/W engraved traffolyte to label schedule.
Warning labels R/W/R engraved traffolyte

Main switch labels	MAIN SWITCH 100A	10mm / 4mm	Material Traffolyte Colour B/W/B
Pump CB labels	PUMP No1 32A	6mm / 4mm	Material Traffolyte Colour W/B/W
Compartment labels	RTU	10mm	Material Stainless Steel
Warning labels	DANGER 415V ISOLATE ELSE WHERE	7mm / 5mm	Material Traffolyte Colour R/W/R

Internal labels secured by M3 chrome plated metal threads
CB's to be identified with individual labels as per label schedule
Labels obstructed by switchboard wiring are relocated to adjacent duct lid
Labels secured by M3 nylon threads
The duct lid is secured by a single cable tie at one corner
External labels secured by M3 316 stainless steel metal threads

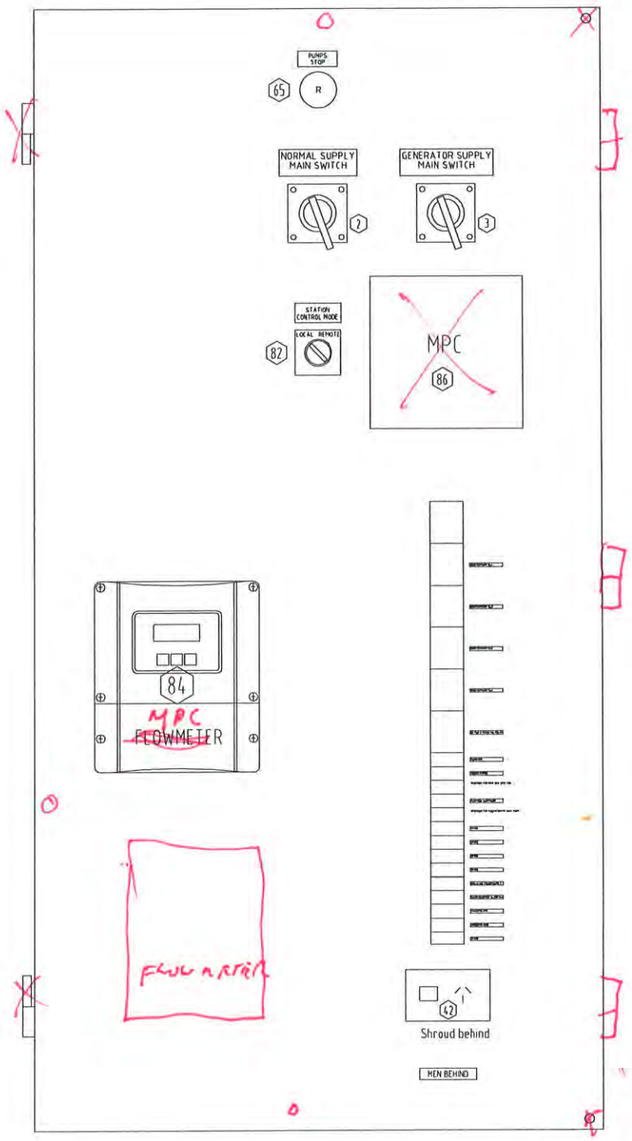


RTU DISCONNECT PLUGS
CODING DETAILS
CODING PIN 190



DETAIL M

SUB-DISTRIBUTION BOARD ARRANGEMENT



ESCUTCHEON LAYOUT

DETAIL S

Sheet 13

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No.	DATE	AMENDMENT	DRN.	APD.
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O	08.08	ISSUED FOR TENDER	DPM	A.W.

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Original signed by A.Witthoft	0896	16.08.2008	Original Signed by G.Anderson	16.08.2008
DESIGN CHECK	R.P.E.Q. No.	DATE	CLIENT DELEGATE	DATE

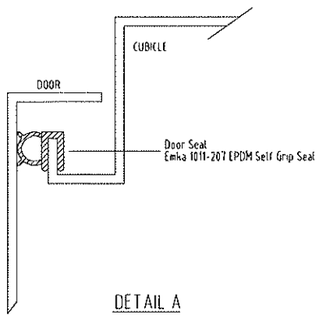
QUEENSLAND Urban Utilities

SITE: WB002 Huddart St WATER BOOSTER

TITLE: SWITCHBOARD CONSTRUCTION NOTES & DETAILS

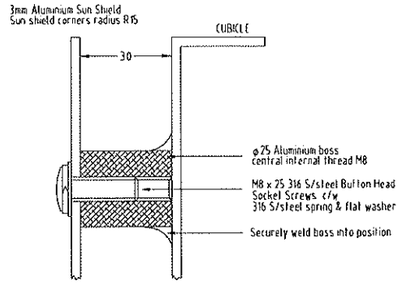
SHEET No.
Queensland Urban Utilities DRAWING No. 486/4/9-0378-013
AMEND. A

G:\194 WATER SUPP\268 Drafting\6248 Plans\Electrical\3. WATER\NETWORKS\2. Boosters-Pumps\WB002 Huddart St\49-0378set_RevA.dwg Last Saved by 062870 on Monday, 8 August 2011 2:17:48 PM



DETAIL A

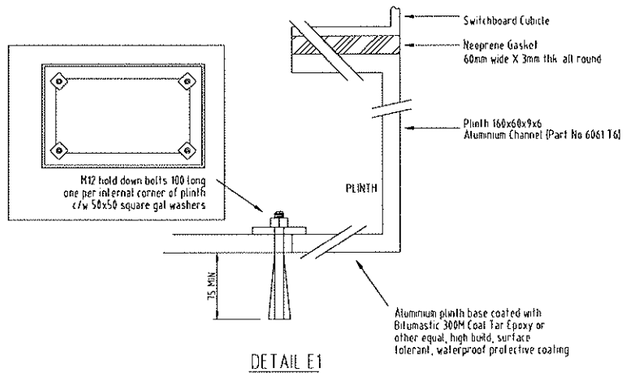
(DOOR SEAL)



Note Screws are not to penetrate cubicle metalwork

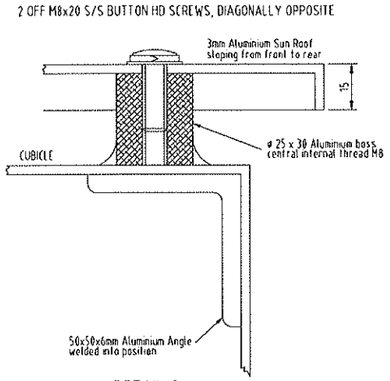
DETAIL B

(SUN SHIELD MOUNTING TO SIDES, REAR AND DOORS)



DETAIL E1

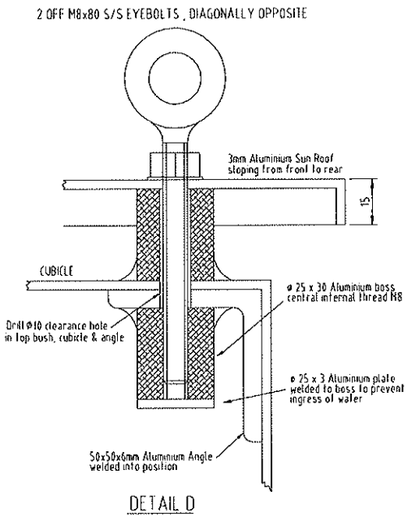
(PLINTH FIXING DETAIL)



DETAIL C

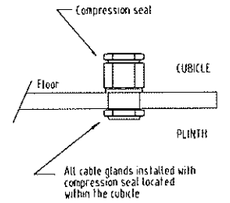
(SUN ROOF FIXING DETAIL)
(2 OFF M8x20 S/S BUTTON HD DIAGONALLY OPPOSITE)

Note Screws are not to penetrate cubicle metalwork



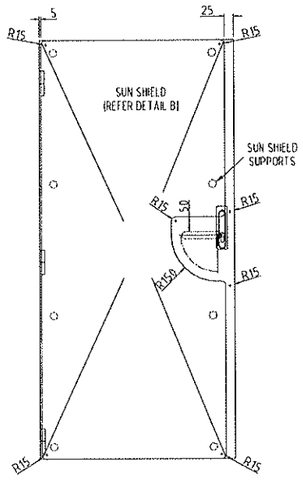
DETAIL D

(EYE BOLT FIXING DETAIL - 2 OFF M8x80 s/s , DIAGONALLY OPPOSITE)
(REPLACE EYEBOLTS WITH M8x50 s/s BUTTON SCREWS AT SITE)



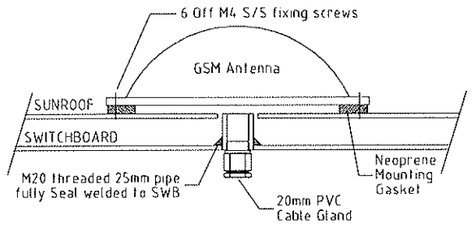
DETAIL G

(CABLE GLAND INSTALLATION DETAIL)



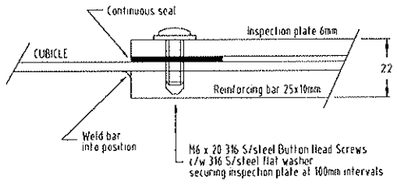
DETAIL K

(DOOR SUN SHIELD DETAIL)



DETAIL X

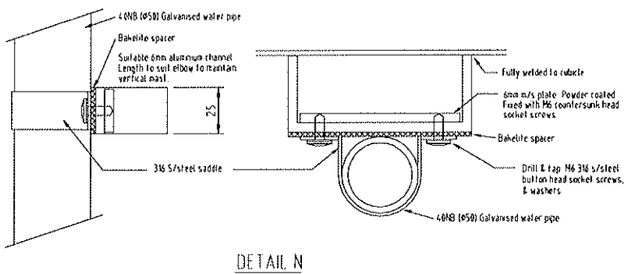
(GSM ANTENNA MOUNTING DETAIL)



Note Screws are not to penetrate reinforcing bar

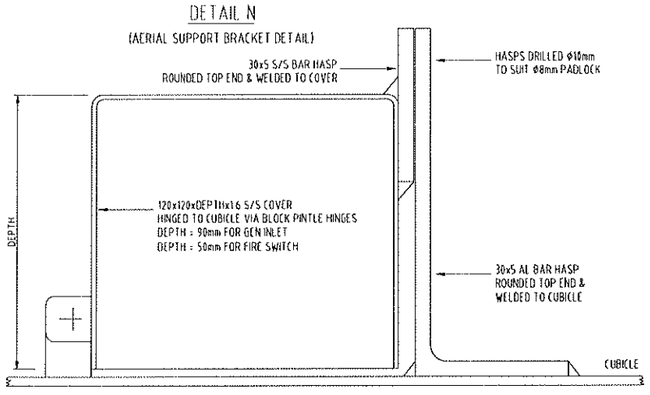
DETAIL F

(INSPECTION PLATE FIXING DETAIL)



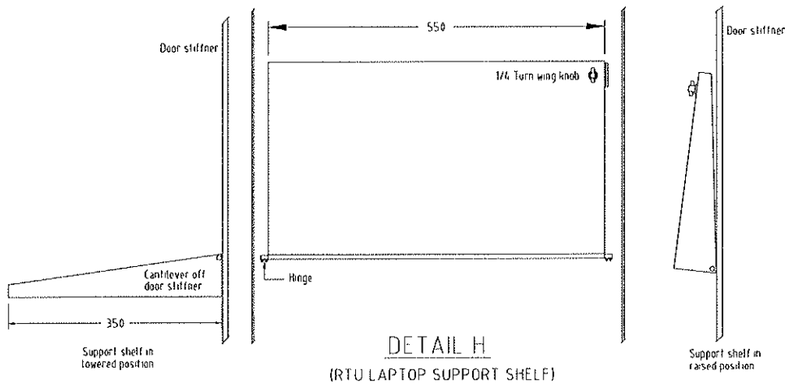
DETAIL N

(AERIAL SUPPORT BRACKET DETAIL)



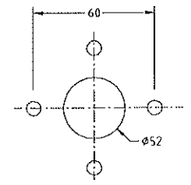
DETAIL R

(FIRE SWITCH / GEN INLET - HINGED PADLOCKABLE COVER)



DETAIL H

(RTU LAPTOP SUPPORT SHELF)



(Fit 3mm neoprene gasket between plinth & flange)
(Fixings 316 s/steel bolts, nuts, flat & spring washers)

DETAIL P

(AERIAL FLANGE MOUNTING DETAIL)

Sheet 14

ISSUED FOR CONSTRUCTION

No	DATE	AMENDMENT	DRN.	APD.
A	05.11	ISSUED FOR CONSTRUCTION	DPM	G.A.
O	08.08	ISSUED FOR TENDER	DPM	A.W.

DRAFTED	P.Mostert		
DRAFTING CHECK	P.Hague		
CAD FILE	49-0378set_RevA.dwg		
B.C.C. FILE No.	WQJD/BDWDAA03		

Original Signed by P.Mostert		16.08.2008	
DESIGN	R.P.E.Q. No.	DATE	
Original signed by A.Witholt	0896	16.08.2008	
DESIGN CHECK	R.P.E.Q. No.	DATE	

Original Signed by R.Janfada		16.08.2008
MANAGER ENGINEERING SERVICES		DATE
Original Signed by G.Anderson		16.08.2008
CLIENT DELEGATE		DATE

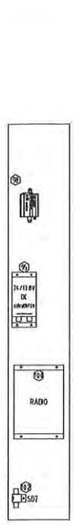
QUEENSLAND Urban Utilities

SITE
WB002 Huddart St
WATER BOOSTER

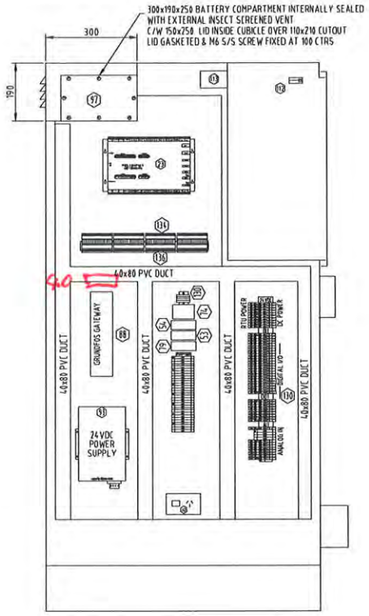
TITLE
SWITCHBOARD
GENERAL ARRANGEMENT

SHEET No.
Queensland Urban Utilities DRAWING No. 486/4/9-0378-014
AMEND. A

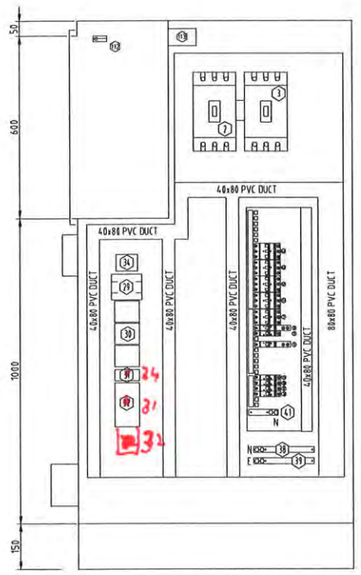
G:\184 WATER SUPPLY\268 Drafting\0248 Plans\Electrical\3. WATER NETWORKS\2. Boosters-Pumps\WB002 Huddart St\49-0378set_RevA.dwg Last Saved by 062670 on Monday, 8 August 2011 2:17:46 PM



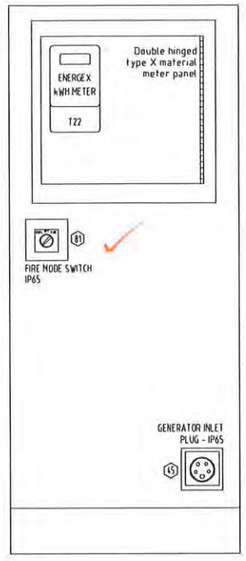
RHS PANEL



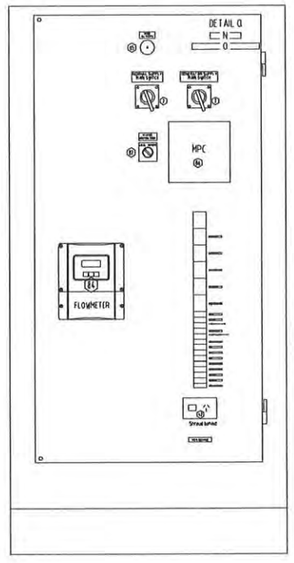
FRONT
DOOR REMOVED



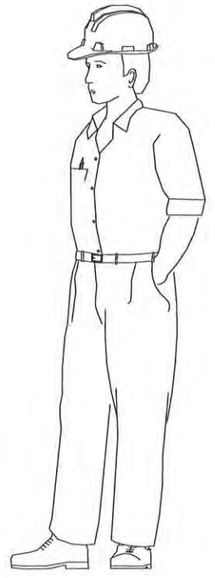
REAR
DOOR & ESCUTHEON REMOVED

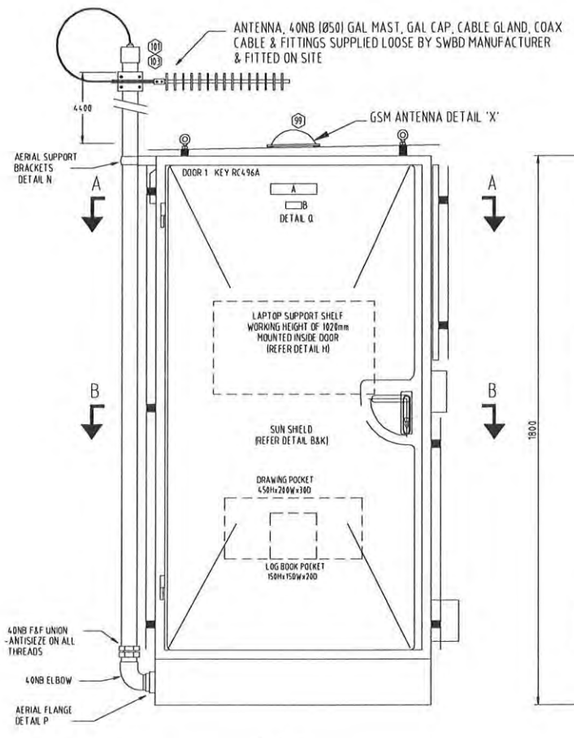


RIGHT SIDE VIEW
DOOR & SUN SHIELD REMOVED



ESCUTHEON LAYOUT





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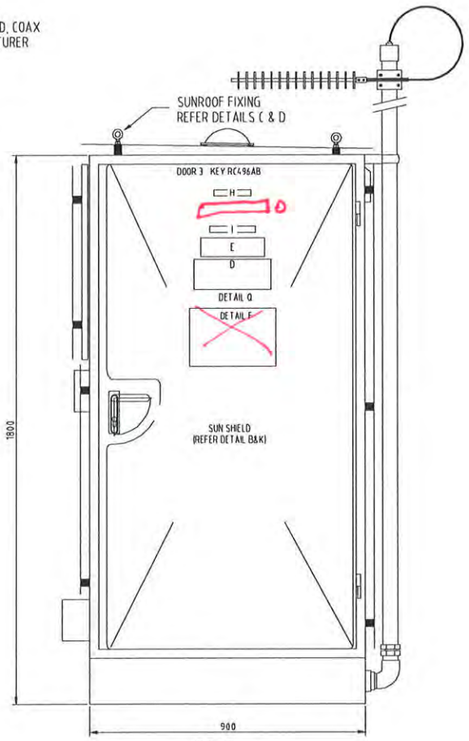

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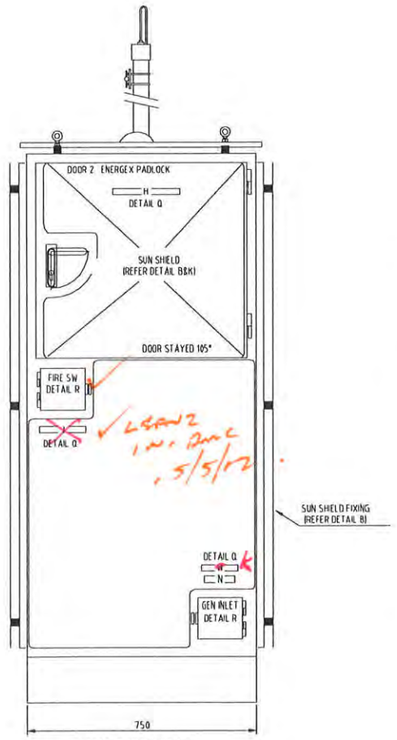
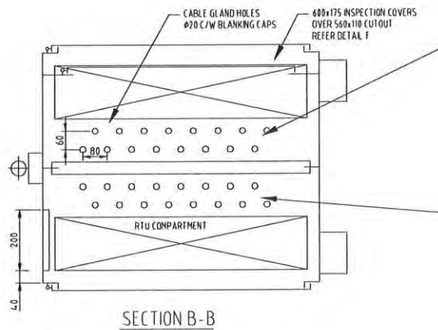
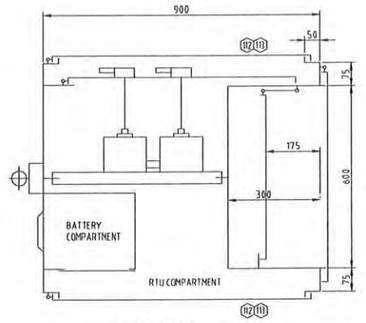


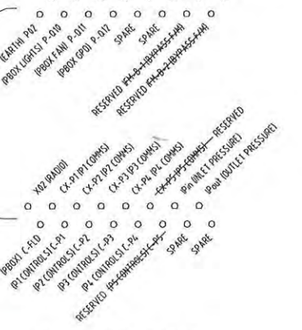
RIGHT SIDE VIEW



SECTION B-B



SECTION A-A



CABLE ENTRY LAYOUT
REFER DETAIL G

Sheet 15

ISSUED FOR CONSTRUCTION

No.	DATE	AMENDMENT	DRN.	APD.
A	05.11	ISSUED FOR CONSTRUCTION	DPM	G.A.
O	08.08	ISSUED FOR TENDER	DPM	A.W.

DRAFTED	P.Mostert		
DRAFTING CHECK	P.Hague		
CAD FILE	49-0378set_RevA.dwg		
B.C.C. FILE No.	WQJD/BDWDAA03		

Original Signed by P.Mostert		16.08.2008	
DESIGN	R.P.E.Q. No.	DATE	
Original signed by A.Witthoft	0896	16.08.2008	
DESIGN CHECK	R.P.E.Q. No.	DATE	

Original Signed by R.Janfada		16.08.2008
MANAGER ENGINEERING SERVICES		DATE
Original Signed by G.Anderson		16.08.2008
CLIENT DELEGATE		DATE

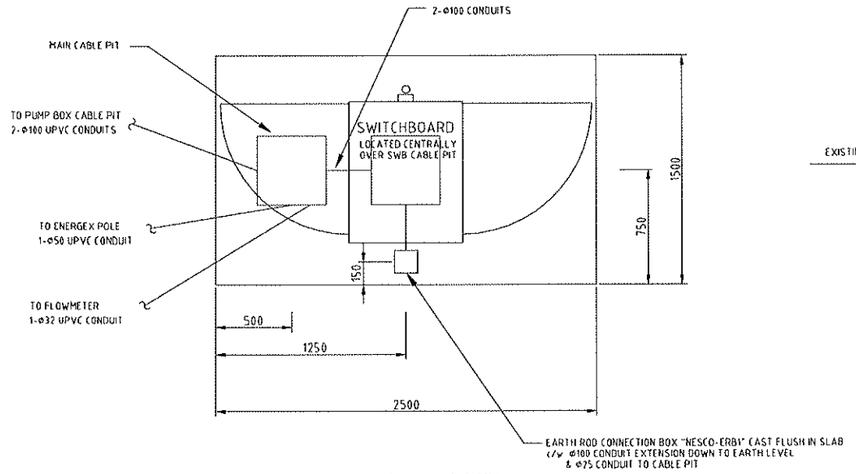
QUEENSLAND Urban Utilities

SITE
WB002 Huddart St
WATER BOOSTER

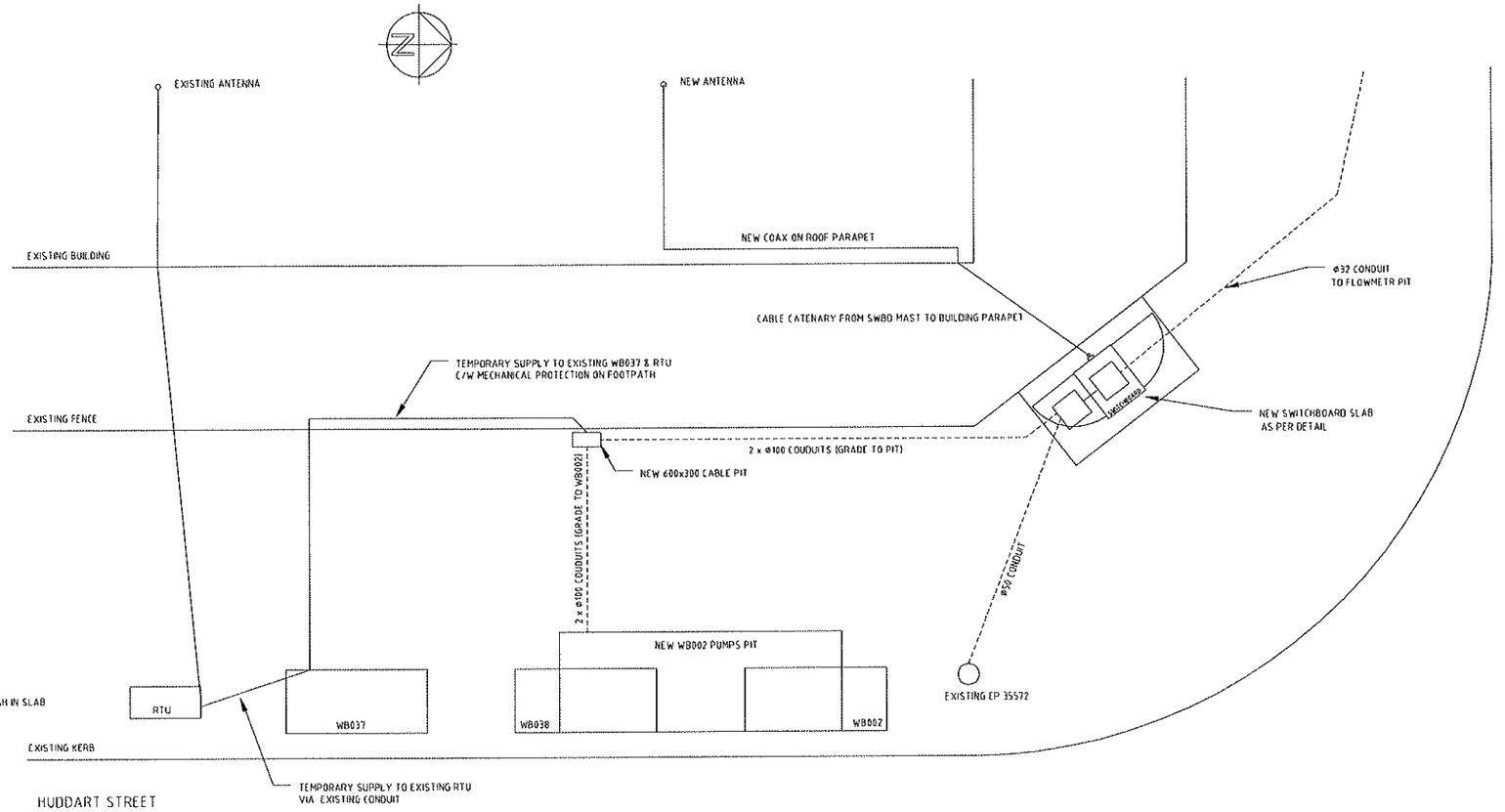
TITLE
SWITCHBOARD
GENERAL ARRANGEMENT

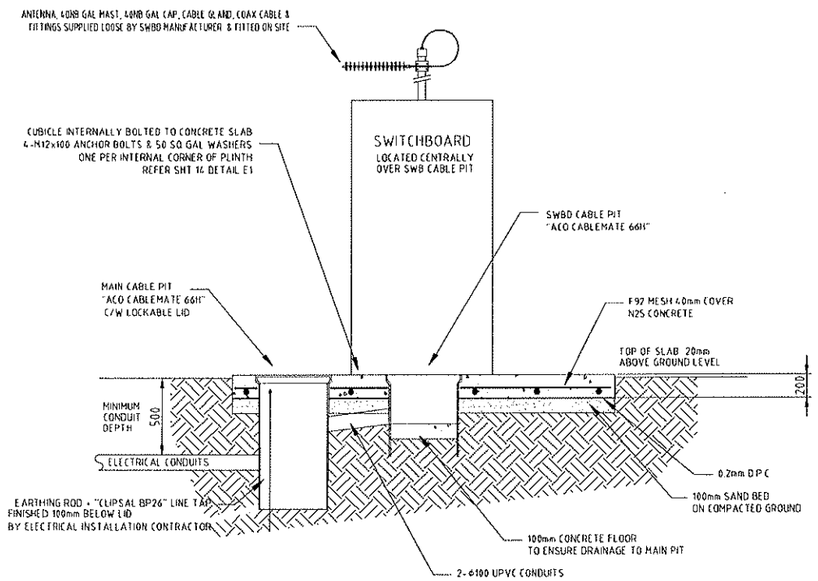
SHEET No.
Queensland Urban Utilities DRAWING No. 486/4/9-0378-015
AMEND. A

G:\184 WATER SUPPLY\Drafting\8246 Plans\Electrical\5. WATER NETWORKS\2. Boosters Pumps\WB002 Huddart St\49-0378set_RevA.dwg - Last Saved by 082670 on Monday, 6 August 2012 2:47:40 PM



SWITCHBOARD SLAB DETAIL





SWITCHBOARD SLAB SIDE SECTIONAL ELEVATION

ABANDON EXISTING
FLOWMETER SENSOR

SITE PLAN

NTS

FOR CIVIL WORKS REFER DRG. 486/4/9-0378-026

CONSTRUCTION STAGES

1 CONSTRUCT NEW WB002 SWITCHBOARD SLAB & CONDUITS & PIT

2 INSTALL NEW WB002 SWITCHBOARD
2.1 CUT OVER EXISTING RTU SWBD & WB037 SUPPLIES TO NEW SWITCHBOARD
2.2 RELOCATE EXISTING FLOWMETER Tx TO NEW SWITCHBOARD
2.3 CUT OVER EXISTING FLOWMETER SENSOR CABLES TO NEW SWITCHBOARD

3 DECOMMISSION EXISTING OLD WB002 & WB038
3.1 REMOVE OLD WB002 & WB038 & CONDUITS
3.2 REMOVE OLD POLE MOUNTED METERING/DISTRIBUTION SWBD

4 CONSTRUCT NEW WB002 PUMPS PIT & NEW CONDUITS CONNECTION TO PUMPS PIT
4.1 COMMISSION NEW WB002 PUMPS

5.0 DECOMMISION EXISTING RTU & WB037
5.1 REMOVE TEMPORARY CABLES & RTU & WB037 & CONDUITS

Sheet 16

ISSUED FOR CONSTRUCTION

No	DATE	AMENDMENT	DRN.	APD.
A	05.11	ISSUED FOR CONSTRUCTION	DPM	G.A.
O	08.08	ISSUED FOR TENDER	DPM	A.W.

DRAFTED	P.Moslert	Original Signed by P.Moslert	16.08.2008
DRAFTING CHECK	P.Hague	DESIGN R.P.E.Q. No.	DATE
CAD FILE	49-0378set_RevA.dwg	Original signed by A.Witholt 0896	16.08.2008
B.C.C. FILE No.	WQJD/BDWDAA03	DESIGN CHECK R.P.E.Q. No.	DATE

Original Signed by R.Jansada	16.08.2008
MANAGER ENGINEERING SERVICES	DATE
Original Signed by G.Anderson	16.08.2008
CLIENT DELEGATE	DATE

QUEENSLAND Urban Utilities

SITE
WB002 Huddart St
WATER BOOSTER

TITLE
SWITCHBOARD
SITE ARRANGEMENT

SHEET No.
Queensland Urban Utilities DRAWING No. 486/4/9-0378-016
AMEND. A

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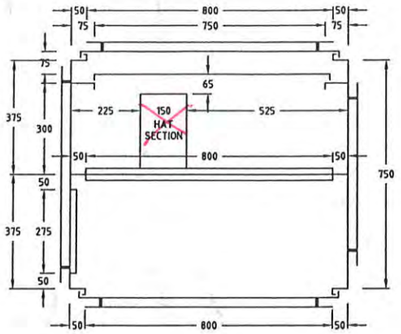

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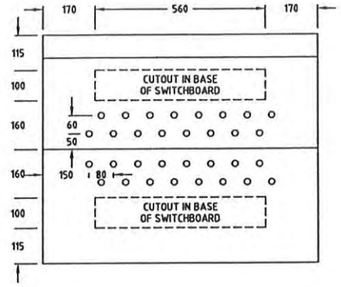

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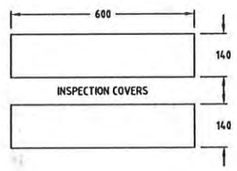

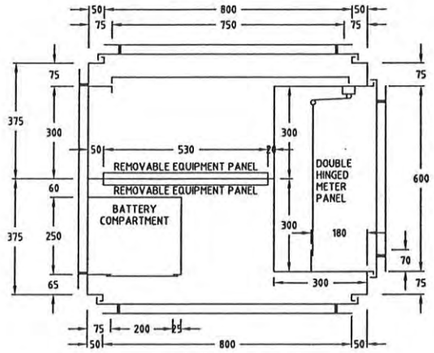

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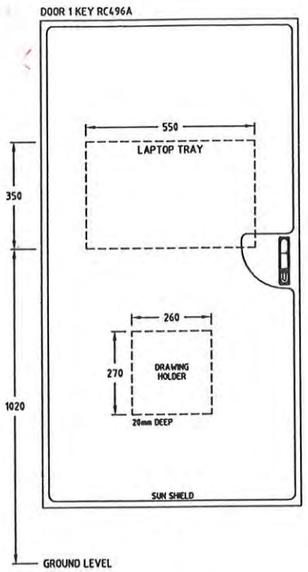

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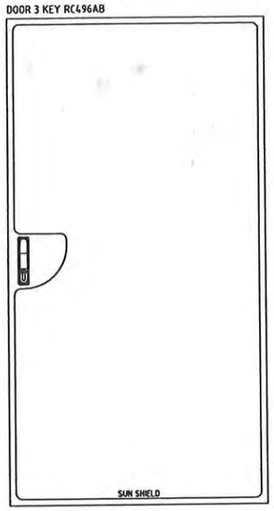

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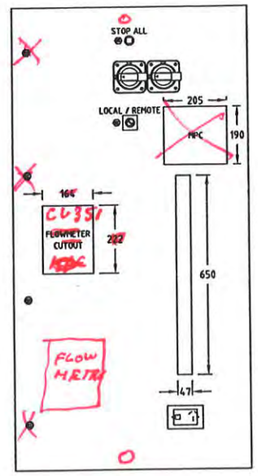
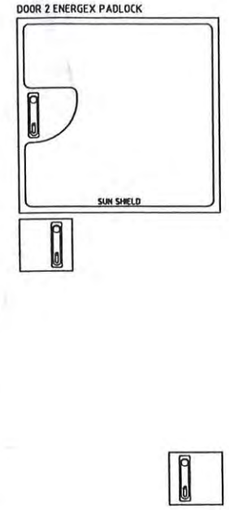
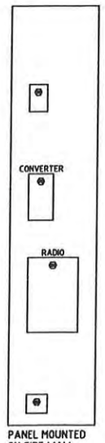


REAR ESCUTCHEON

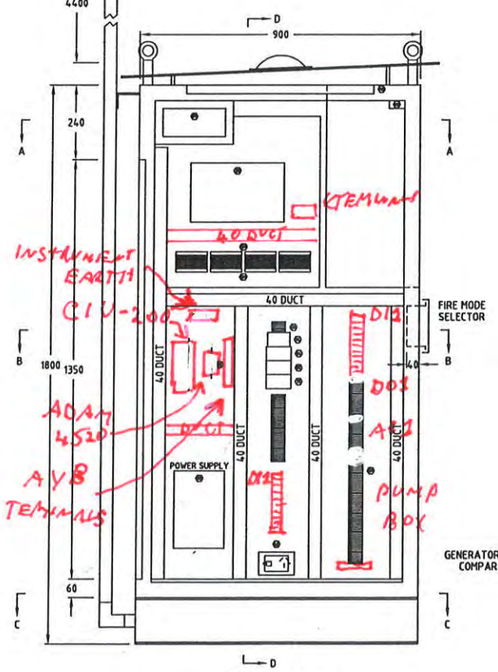


RIGHT SIDE DOOR & LOACKABLE COVERS

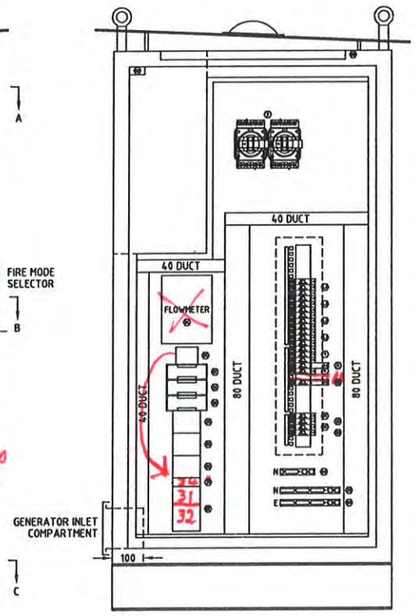
FDFD
FDF



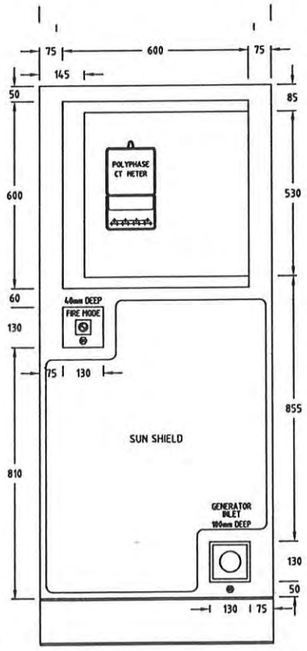
PANEL MOUNTED ON SIDE WALL



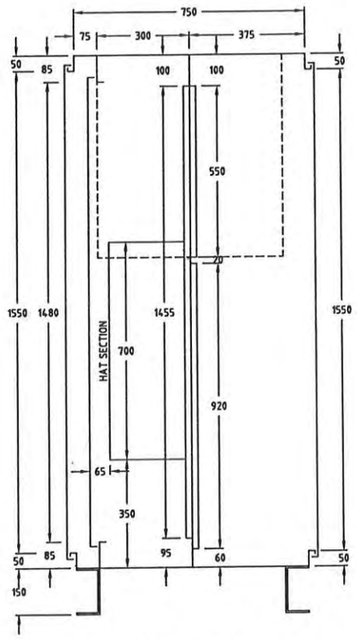
FRONT VIEW



REAR VIEW



RIGHT SIDE VIEW



SECTION D-D

TEST
"ISSUED FOR CONSTRUCTION" S97
SIGN 19/12/11

M54900

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FILE NAME:							DESIGNED	D.MC	
							TRACED	D.MC	TITLE: QUEENSLAND URBAN UTILITIES WB002 HUDDART STREET WATER BOOSTER SWITCHBOARD GENERAL ARRANGEMENT
							CHECKED		
							DATE	16-12-11	
							APPROVED		DRAWING No: E11-C54900/A0
							CLIENT NAME	QUEENSLAND URBAN UTILITIES	AMENDMENT
LAST AMENDMENT DATE:		LETTER	DESCRIPTION	DATE	AM'D BY	CHK'D	JOB No.	C54900	

7 SERVICE & MAINTENANCE

This product is designed to operate under specific environmental, supply and load conditions. Should these conditions change, consult a licenced electrician or electrical engineer before operating this product.

These procedures are to be performed only by a licenced electrician as they may expose live equipment.

The Switchgear and Controlgear Assembly is essentially maintenance free, however the following safety measures and routine maintenance is recommended.

Where fitted, ensure cabinet vents and filters are clear and clean.
During operation, ensure all doors and covers are secure and closed.
All faults are to be investigated and repaired by an appropriately licenced electrician.
All components to be operated in accordance with manufacturers data.
The protective devices within switchboards are designed to operate in the event of a short circuit or overload condition. In the event of these devices operating under such conditions the device or devices must be inspected and tested by a suitably trained person to ascertain its condition prior to reconnecting the protective device to the supply.

Periodic checks should ensure

The switchboard is clean and free of any contaminants, which could reduce the insulation properties of the switchboard.
All entries are sealed to ensure no vermin can enter.
There is no evidence of overheating, arcing or moisture.
The earthing system is maintained and is adequate to allow correct operation of protective devices.
Insulation resistance is maintained to appropriate levels.
Check terminations for correct tension.
Test operation of protective devices.
Re-calibrate instrument loops as required.

Refer to AS-CONSTRUCTED electrical drawings for details of protection equipment settings.

No special tools or equipment are required to perform routine maintenance.