

## System components

### Configuring

#### Engineering the drive system

##### Overview

The SIMOTICS FD motor series offers scope for optimizing the drive system that comprises the converter and the motor with regard to different criteria. This focuses on the following motor characteristics:

- **Increased efficiency:**

SIMOTICS FD motors specially designed for converter operation are characterized as standard by a high degree of efficiency – comparable to IE2 motors for line operation. For selected cooling methods (IC411 – 1LM1 self-ventilated, IC416 – 1LQ1 force-ventilated, IC71W – 1LH1 water-cooled) motors with increased efficiency are also available – comparable to IE3 motors for line operation. For motors with increased efficiency (position 7 of the Article No. = **3**) in frame size 315, depending on the individual case, the thermal utilization for converter operation can also comply with thermal class 130 (B) instead of thermal class 155 (F). The specified efficiencies apply to motor voltages, which are to be complied with according to EN 60034-1 for motor versions "N" according to EN 60034-12.

- **Minimal noise emission for operation on SINAMICS converters:**

Noise emission is minimized, especially in the range of rated speed, thanks to a perfectly matched drive system comprising a SINAMICS converter and SIMOTICS FD motor. This has been achieved on the one hand with a new electrical and mechanical design of the motor, and on the other hand using a new pulse pattern in the SINAMICS converter series that has been specially optimized for SIMOTICS FD motors.

- **Optimum voltage utilization:**

The voltage supplied by the converter is optimally utilized. This reduces the motor current and has a positive effect on the converter either in the form of higher current reserves or lower costs for the Motor Module.

The SIMOTICS FD motors have been specially tuned to the converters of the SINAMICS G130, SINAMICS G150, SINAMICS S120, SINAMICS S150 and SINAMICS G120P series. SIMOTICS FD must be selected as the motor type during commissioning of the SINAMICS converter in the STARTER commissioning tool, or in the user interface.

The motors can also be operated with other converters under certain boundary conditions.

##### General information

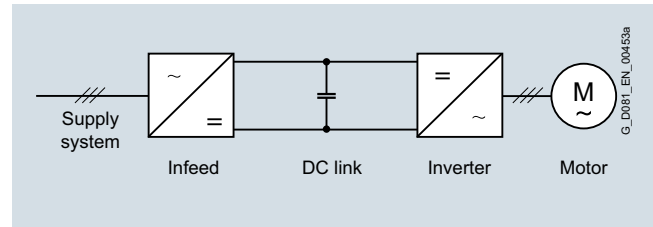
For optimum dimensioning of the motors with regard to heating and noise emission for converter operation, the following details are necessary:

- Type of infeed
- Maximum voltage available to the motor
- Converter pulse frequency, if applicable
- Required rated speed
- Required rated power, cooling method and degree of protection of the motor (see selection tables in Chapters 4 - 9)

The insulation system of the motors corresponds to thermal class 180 (H). The motors are utilized in accordance with thermal class 155 (F) as standard. For utilization of the motors in accordance with thermal class 130 (B) the power must be reduced by 14 % (derating factor 0.86).

##### Power supplied from the converter

To select a catalog version of the SIMOTICS FD motor series specifically designed for converter operation, the voltage available to the motor must be known. The line voltage and the configuration of the converter at the line side (infeed, rectifier or line-side converter – referred to below as the infeed) are important here.



Drive system

##### Uncontrolled infeed

If the infeed involves a line-commutated converter (uncontrolled infeed), i.e. a thyristor or diode rectifier (in some cases also an IGBT module), the maximum available motor voltage is lower than the line voltage. The DC link voltage and therefore the output voltage of the converter are not controlled and change as soon as fluctuations in the line voltage occur.

The SINAMICS converter series comprises two different variants of uncontrolled infeed:

- **Basic Infeed – SINAMICS G130, SINAMICS G150, SINAMICS S120 Basic Line Module (BLM, SINAMICS G120P):**
  - Line-commutated converters
  - Suitable for infeed operation (two-quadrant operation)
  - Power semiconductors: Thyristors/diodes
  - Line harmonics: Total harmonic distortion factor of the line current THD(I) up to 45 %
  - Low voltage stress on the motor winding
  - Low price, compact size
- **Smart Infeed – SINAMICS S120 Smart Line Modules (SLM):**
  - Line-commutated converters
  - Suitable for operation in infeed and regenerative feedback mode (4-quadrant operation)
  - Power semiconductors: IGBT modules
  - Line harmonics: Total harmonic distortion factor of the line current THD(I) up to 45 %
  - Low voltage stress on the motor winding
  - Medium price, medium size

The maximum voltage supplied to the motor by the converter in the case of SINAMICS converters (with optimized pulse pattern) is:

$$U_{\text{Motor max}} = 0.97 \cdot U_{\text{line}}$$

With converters of the SINAMICS G130 and SINAMICS G150 series, SINAMICS S120 Basic Line Modules, SINAMICS S120 Smart Line Modules and SINAMICS G120P, it is ensured at full line voltage (position 12 of the Article No.) that the rated motor voltages specified in this catalog are available.

If an alternative converter is to be used, it must be established in the context of project engineering that the rated motor voltage can be provided by the converter. Otherwise the operating data deviate from the catalog data and there is a risk of reduced overload capability or of excessive motor temperature which will reduce the lifetime.

**Overview** (continued)

Controlled infeed

If the infeed involves a self-commutated converter (controlled infeed), the maximum available motor voltage is higher than the line voltage. The DC link voltage and, therefore, also the output voltage of the converter is normally controlled so it is independent of any fluctuations in line voltage.

For converters of the SINAMICS S150 series that are equipped with an Active Line Module as well as SINAMICS S120 with Active Line Modules, the following applies:

- Self-commutated converter
- Suitable for operation in infeed and regenerative feedback mode (4-quadrant operation)
- Power semiconductors: IGBT modules
- Line harmonics: Total harmonic distortion factor of the line current THD(I) up to 3 %
- With reference to the supply network, with factory settings  $\cos\phi = 1$
- Higher voltage load on the motor winding than for uncontrolled infeed

The maximum voltage supplied to the motor by the converter in the case of SINAMICS converters (with optimized pulse pattern) is:

$$U_{\text{Motor max}} = 1.11 \cdot U_{\text{line}}$$

With converters of the SINAMICS S120 series with Active Line Modules and SINAMICS S150, it is ensured that the rated motor voltages specified in this catalog are available.

If an alternative converter is to be used, it must be established in the context of project engineering that the rated motor voltage can be provided by the converter. Otherwise the operating data deviate from the catalog data and there is a risk of reduced overload capability or of excessive motor temperature which will reduce the lifetime.

*Engineering the drive system*

A motor should be selected (according to voltage, speed and torque) following engineering of the drive system to ensure that all the benefits that arise from the motor and converter combination can be fully utilized. The motors of the SIMOTICS FD series are specifically matched to the SINAMICS converter series. This results in additional system advantages, such as reduced noise emission.

In contrast to simple selection of a motor, drive system engineering takes into account that the converter also contributes towards loading of the motor winding due to non-sinusoidal voltage and current.

In this catalog, SIMOTICS FD motors specially designed for converter operation are offered for the following line voltages:

- 400 V, 50 Hz
- 500 V, 50 Hz
- 690 V, 50 Hz
- 460 V, 60 Hz
- 575 V, 60 Hz

Motors for other line voltages can be supplied on request.

Depending on the type of infeed, it is possible to choose between motors whose rated voltages either lie below the line voltage (uncontrolled infeed) or above the line voltage (controlled infeed). Depending on which information is available for the drive system to be engineered, engineering can be performed in accordance with one of the two subsequent detail levels.

# System components

## Configuring

### Engineering the drive system

#### Overview (continued)

##### Options for engineering the drive system

###### Detail level 1

Simple motor selection – details of the converter are not known

###### Detail level 2

Engineering the drive system – details of the converter are known – certain properties of the drive system can be optimized

##### Engineering goal

- |   |  |
|---|--|
| <ul style="list-style-type: none"> <li>• Selection of a motor specifically for converter operation</li> </ul> | <ul style="list-style-type: none"> <li>• Selection of a motor specifically for converter operation</li> <li>• Optimum voltage utilization (low-cost drive system without derating of converter or motor)</li> <li>• Low noise emissions</li> </ul> |
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##### Preconditions

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| <ul style="list-style-type: none"> <li>• Line voltage is known</li> <li>• Required rated speed is known</li> <li>• Motor will only be operated on the converter</li> <li>• Type of infeed, or the converter, are unknown</li> </ul> | <ul style="list-style-type: none"> <li>• Line voltage is known</li> <li>• Required rated speed is known</li> <li>• Motor will only be operated on the converter</li> <li>• Type of infeed is known</li> <li>• For operation on the SINAMICS converter, the rated pulse frequency is 1.25 kHz or more (from <math>I_{rated} = 490</math> A for G150, S150, S120) or 2 kHz (for G120P).</li> <li>• For operation on an alternative converter, the pulse frequency is 2.5 kHz or higher.</li> </ul> |
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##### Engineering steps

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| <ul style="list-style-type: none"> <li>• Selection of the line voltage or inquiry about other line voltages (position 12 of the Article No.)</li> <li>• Selection of a catalog version for the uncontrolled infeed (position 6 of the Article No.: <b>2</b> for SINAMICS converter or <b>4</b> for alternative converter)</li> <li>• Rated motor power is reduced by the factor 0.85</li> </ul> | <ul style="list-style-type: none"> <li>• Selection of the line voltage or inquiry about other line voltages (position 12 of the Article No.)</li> <li>• Selection of a catalog version for:               <ul style="list-style-type: none"> <li>- Uncontrolled infeed (position 6 of Article No.: <b>2</b> for SINAMICS converter or <b>4</b> for alternative converter)</li> <li>- Controlled infeed (position 6 of Article No.: <b>1</b> for SINAMICS converter or <b>3</b> for alternative converter)</li> </ul> </li> <li>• The catalog data is applicable for operation with SINAMICS converter and under the described preconditions for operation on alternative converters (with the exception of sound pressure levels)</li> </ul> |
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##### Advantages of the drive system

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| <ul style="list-style-type: none"> <li>• The required rated motor voltage is available.</li> <li>• Irrespective of the pulse frequency, type of infeed and converter type, compliance with the thermal class specified in the catalog is assured.</li> </ul> | <ul style="list-style-type: none"> <li>• The required rated motor voltage is available and will be optimally utilized.</li> <li>• For operation on a SINAMICS converter:               <ul style="list-style-type: none"> <li>- Low-noise motor (<math>L_{PA} \leq 79</math> dB(A))</li> <li>- Integration in the "STARTER commissioning tool" software and the Advanced Operation Panel (AOP) of the converter</li> <li>- Operation of a motor with a winding system on two parallel converter Motor Modules is possible as standard</li> <li>- Recommended SINAMICS converter for the respective catalog version</li> <li>- Optimized pulse pattern for SIMOTICS FD</li> </ul> </li> </ul> |
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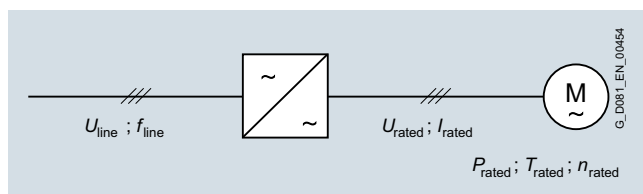
##### Constraints with unknown converter

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|--|--|
| <ul style="list-style-type: none"> <li>• Rated motor power is reduced by the factor 0.85</li> <li>• The A-weighted sound pressure level specified cannot be used for engineering because the pulse frequency and the modulation technique of the converter are unknown.</li> </ul> | <ul style="list-style-type: none"> <li>• For operation on an alternative converter, the specified A-weighted sound pressure level is only a guide value due to the unknown modulation technique.</li> <li>• Operation with optimized pulse patterns is normally assumed. If operation with space-vector modulation is planned, constraints may exist with regard to the pulse frequency and operation of a motor with a winding system on a SINAMICS converter with two parallel Motor Modules.</li> </ul> |
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**Overview** (continued)Simple motor selection – detail level 1

A motor can also be selected without precise knowledge of the converter. In this case, the motor is the central focus of the engineering and not the drive system and its optimization. Simple motor selection focuses on the large majority of applications for which an uncontrolled infeed is sufficient and the functions of a controlled infeed (e.g. four-quadrant operation or low line harmonics) are not required. Applications in which an uncontrolled infeed is normally sufficient include excavators, conveyor drives, bow thrusters, wood chippers, centrifugal pumps, fans, mills, propellers, pumps or shredders. Even in applications with a quadratic torque characteristic, controlled infeed is not normally required.

For engineering at detail level 1, the line voltage must be known.



Drive system – simple motor selection (detail level 1)

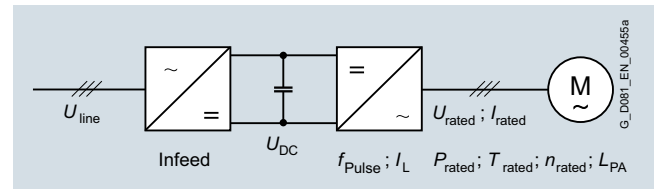
When selecting a SIMOTICS FD motor from the catalog, it is important to note:

- For all line voltages, the versions **for uncontrolled infeed** are required.
- The converter must be able to provide the rated voltage of the motor. Otherwise, the motor current rises and there is a risk of excessive motor temperature which reduces the lifetime of the motor.
- Due to the unknown infeed and modulation technique of the converter, the rated power specified in the catalog must be reduced (**reduction factor 0.85**).
- The maximum A-weighted sound pressure levels specified in the catalog cannot be used, because the modulation technique of the converter is unknown.

Engineering the drive system – detail level 2

Engineering at detail level 2 involves, in addition to the motor selection, engineering of an optimized drive system due to knowledge of the converter – especially the infeed – with regard to:

- Noise emission (when operated with a SINAMICS converter)
- Voltage utilization and therefore motor or converter current consumption
- Power and torque or frame size



Drive system – engineering of the drive system at detail level 2

For engineering at detail level 2, the following must be known:

- Line voltage and, where applicable, line frequency
- Uncontrolled or controlled infeed
- Rated pulse frequency of the converter

When selecting a SIMOTICS FD motor from the catalog, it is important to note:

- For each combination of line voltage and infeed, a SIMOTICS FD motor can be selected that optimally utilizes the available converter output voltage.
- For operation on SINAMICS converter (firmware 4.6), operation with optimized pulse patterns is already possible from the rated pulse frequency  $f_{\text{pulse}} = 1.25 \text{ kHz}$  and higher without derating.
- If the converter is **not** a SINAMICS G130, SINAMICS G150, SINAMICS S120, SINAMICS S150 or SINAMICS G120P, the pulse frequency must be at least 2.5 kHz, otherwise the risk of excessive motor temperature rise and noise emission prevails.
- The maximum A-weighted sound pressure levels specified are applicable for operation on SINAMICS G130, SINAMICS G150, SINAMICS S120, SINAMICS S150 or SINAMICS G120P converters.

Rated motor voltages dependent on the line voltage and infeed

SIMOTICS FD										
Line voltage $U_{\text{line}}$	400 V		460 V		500 V		575 V		690 V	
Line frequency $f_{\text{line}}$	50 Hz		60 Hz		50 Hz		60 Hz		50 Hz	
Line voltage – 12th position of the Article No.	1		5		2		6		3	
Infeed	uncontrolled	controlled	uncontrolled	controlled	uncontrolled	controlled	uncontrolled	controlled	uncontrolled	controlled
System description – 6th position of the Article No.	2; 4	1; 3	2; 4	1; 3	2; 4	1; 3	2; 4	1; 3	2; 4	1; 3
Rated motor voltage $U_{\text{rated}}$	380 V	425 V	440 V	480 V	480 V	520 V	550 V	610 V	660 V	730 V
Insulation system	IVIC-C advanced		IVIC-C advanced		IVIC-C advanced	IVIC-C premium	IVIC-C premium		IVIC-C premium	

When the motor is selected correctly, it operates with optimized pulse patterns from approximately 87 % of the rated speed upwards.

If operation is planned with space-vector modulation instead of with optimized pulse patterns, the converter pulse frequency results in derating for the converter if it is above the rated pulse frequency of the converter. If the converter pulse frequency is less than 2.5 kHz, this results in derating of the motor.

## System components

### Configuring

#### Engineering the drive system

##### Overview (continued)

##### SIMOTICS FD motor on SINAMICS converter

The SIMOTICS FD motors are designed for operation with optimized pulse patterns.

The optimized pulse patterns for SIMOTICS FD are activated if

- The motor type is selected as "SIMOTICS FD" on commissioning (SINAMICS parameter p300).
- The modulation type is converted to optimized pulse pattern (SINAMICS parameter p1802 = 19).
- With SINAMICS G converters parameters are assigned automatically when the motor type is selected, and with SINAMICS S converters they are assigned manually.
- **Note:** With SINAMICS S converters, space-vector modulation is preset and can be changed manually depending on the application to optimized pulse patterns for SIMOTICS FD.

If operation is planned up to the mechanical speed limit, it must be ensured that the ratio of converter pulse frequency  $f_p$  to electrical motor frequency is approx. 12.5. With an electrical supply frequency of more than 100 Hz the converter rated pulse frequency must therefore be increased from  $f_p = 1.25$  kHz to  $f_p = 2.5$  kHz. This results in derating of the converter.

Operation with  $U/F$  control is not generally normal or permitted in the SIMOTICS FD motor power range. The motor should be operated with a variable speed (for SINAMICS: vector mode).

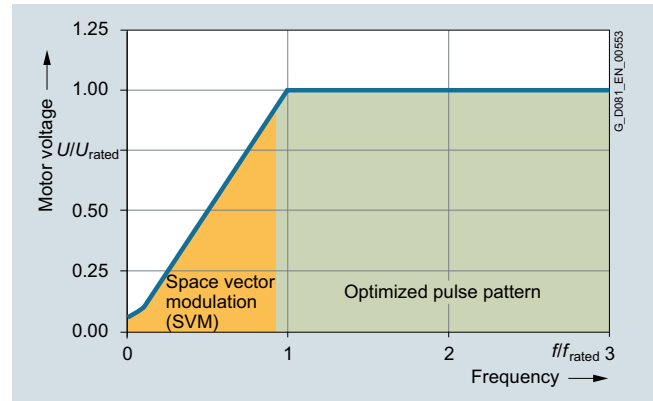
Operation on the SINAMICS converter with optimized pulse patterns takes place initially as standard with space-vector modulation up to around 87 % of the rated speed. Above this limit the operation then takes place with optimized pulse patterns (see figure "Modulation types"). The thermal torque limit characteristics for operation on the SINAMICS converter with optimized pulse patterns apply to this operation mode (see Chapter 2 section "Thermal torque limits (continuous duty)").

If the drive system is to be operated on the SINAMICS converter with space-vector modulation over the entire speed range, then the torque must be reduced in accordance with the converter pulse frequency:

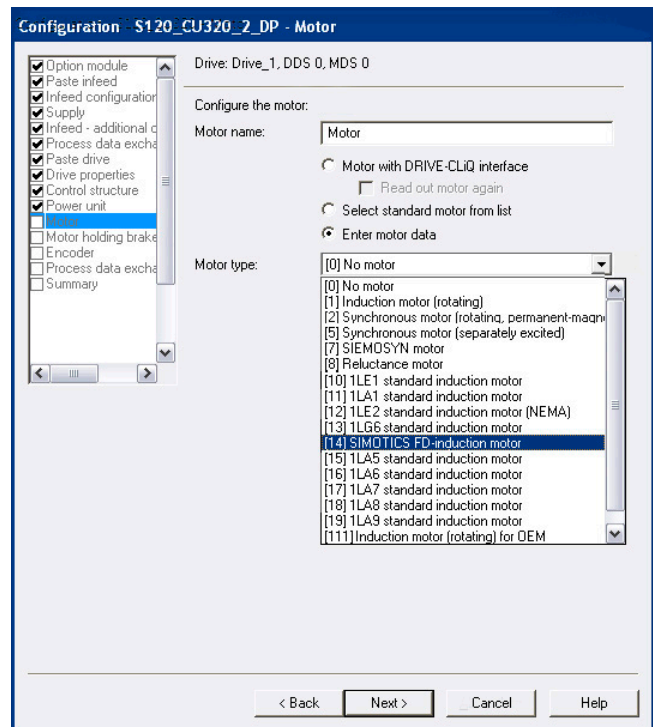
- Space-vector modulation with converter pulse frequency of 1.25 kHz: Reduction factor 0.85
- Space-vector modulation with converter pulse frequency of 2 kHz: Reduction factor 0.95
- Space-vector modulation with converter pulse frequency of 2.5 kHz: Reduction factor 1

The thermal torque limit characteristics for operation on the SINAMICS converter with space-vector modulation or an alternative converter apply to this operation mode (see Chapter 2 section "Thermal torque limits (continuous duty)").

Operation with space-vector modulation over the entire speed range may be required for certain applications, e.g. if multiple motors are due to be operated with synchronous speed.



Modulation types



Selecting SIMOTICS FD in the STARTER commissioning tool

##### SIMOTICS FD motor on alternative converters

If a SIMOTICS FD motor is operated on an alternative converter that does not belong to the SINAMICS series G130, G150, S120, S150 or G120P, it is important to note the following:

- The selection and ordering data for operation on a SINAMICS converter also applies to operation on an alternative converter when the rated motor voltage is available and the rated pulse frequency of the converter is at least 2.5 kHz.
- The A-weighted sound pressure levels specified for operation on a SINAMICS converter do not apply for operation on an alternative converter, due to the unknown modulation technique.
- A distinction is made between the standard version (position 5 of Article No. = 4 for series 1.M1, 1.L1, 1.P1, 1.Q1, 1.H1 and 1.N1) and the increased power version (position 5 of Article No. = 5 for series 1.P1 and 1.Q1).
- A distinction is made between controlled infeed (position 6 of Article No. = 3) and uncontrolled infeed (position 6 of Article No. = 4).



**Overview** (continued)**Catalog versions and special versions****Catalog versions****Rated motor speeds**

To select a catalog version, in addition to the available voltage (see section "Voltage supply") the required motor speed must also be known. The rated speeds of the catalog versions are assigned to the line supplies listed in this section in accordance with the line frequency. For the line voltages 400 V, 460 V, 500 V, 575 V and 690 V catalog versions are available with the rated speeds.

$U_{\text{line}}, f_{\text{line}}$	Rated speed			
400 V, 50 Hz	750 rpm	1000 rpm	1500 rpm	3000 rpm
500 V, 50 Hz				
690 V, 50 Hz				
460 V, 60 Hz	900 rpm	1200 rpm	1800 rpm	3600 rpm
575 V, 60 Hz				

Due to the converter supply, the rated motor speed does not depend on the line frequency. The rated speeds of 750 rpm to 1200 rpm are covered by the 6-pole version and the rated speeds of 1500 rpm to 3600 rpm are covered by the 4-pole version. If other rated motor speeds are required, it can be clarified on request whether it is necessary for the windings to be modified.

	Speed code position 13 of the Article No.	System description code position 6 of the Article No.	Additional ordering data with order code and plain text if required
Different speed	9	1, 2, 3, 4	<b>N1Y</b> • and customer specifications

Can only be ordered with additional price.

Different speed (position 13 of the Article No. **9**) not possible for line motors (DOL) with 3000/3600 rpm.

The rated speed must be specified in plain text in the order. If the rated motor voltage corresponds to the catalog version, the required rated power must be specified in addition. If the rated motor voltage does not correspond to the catalog version, **M1Y** must be ordered in addition, and the required rated power must be specified there.

The different rated speed must not exceed the mechanical speed limit.

**Recommended SINAMICS converters**

In the catalog, a suitable converter of the SINAMICS series is assigned to every motor of the SIMOTICS FD series that is specially designed for converter operation. This assignment is a recommendation. If the complete drive system is to be ordered, engineering of the drive system is required in accordance with detail level 2.

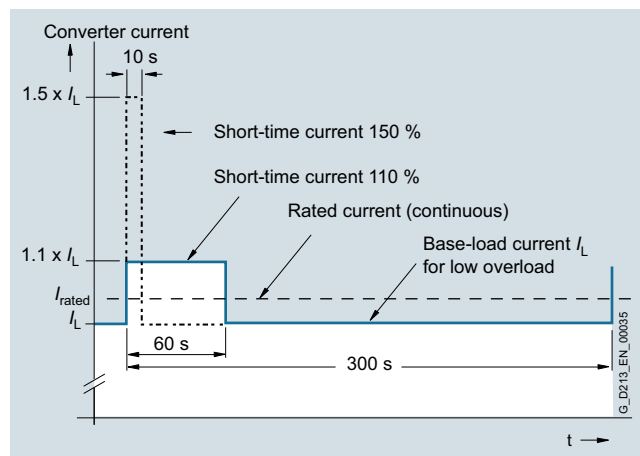
Converter assignment is based on the following assumptions:

- The recommendation is applicable for an ambient temperature of up to 40 °C and 1000 m above sea level.
- The rated motor current corresponds to the reduced base-load current  $I_L$  of the converter for the standard load cycle "Minimal overloading of the converter" (see diagram below). The current  $I_L$  is slightly less than the rated output current of the converter (by approx. 3 to 6 %).
- The line voltage assumed on motor selection is available to the converter.

- For converters with uncontrolled infeed, cabinet units of the SINAMICS G120P or SINAMICS G150 series are recommended.
- For converters with uncontrolled infeed, it is assumed that no special requirements exist (e.g.: line harmonics) and infeed operation will be used exclusively (no regenerative feedback – two-quadrant operation).
- For converters with controlled infeed, cabinet units of the SINAMICS S150 series are recommended.
- When converters of the SINAMICS series are recommended, chassis units can also be used as an alternative.

For the reduced base-load current  $I_L$  of the overall converter, the following applies in the case of parallel connection of two power units:

- For connection in parallel, the SINAMICS S150 should be replaced with SINAMICS S120 CM. For SINAMICS S120 CM in the version with "parallel connection of Motor Modules", the reduced base-load current  $I_L$  for the single device is doubled and the total current is reduced by 5 %.



Definition of the standard load cycle "Minimal overloading of the converter"

Due to the numerous assumptions on which the assignment of converters of the SINAMICS series is based, it must be ensured that the assumptions quoted actually apply for the planned application when the drive system is engineered. This must apply for every point, otherwise the recommendation is invalid, especially:

- When the motor is to be operated with short-time or periodic overloading, and currents higher than the rated motor current are necessary.  
**Note:** Not all rated motor currents fully utilize the reduced base-load current of the converter, which is why the recommended converter may already have current reserves. To evaluate the existing current reserves, the rated motor current can be compared with the respective reduced base-load current of the converter (see the following table).
- When operation with space-vector modulation is planned, the converter is not operated with the optimized pulse patterns for SIMOTICS FD motors. In this case, the pulse frequency of the converter must be at least 2.5 kHz or the power must be reduced.
- Furthermore, with uncontrolled infeed and operation exclusively in space-vector modulation, the motor only has a maximum voltage available to it of

$$U_{\text{Motor max.}} = 0.92 \cdot U_{\text{line}}$$

## System components

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##### Overview (continued)

Reduced base-load currents  $I_L$  of the SINAMICS converters (SINAMICS G120P, SINAMICS G150 and SINAMICS G130 or SINAMICS S150 and SINAMICS S120 technically comparable) – for engineering purposes  $I_L$  can be regarded as equal to the motor current

Power	Number of Motor Modules	$I_L$	$f_p$	Type	Number of Motor Modules	$I_L$	$f_p$	Type	Number of Motor Modules	$I_L$	$f_p$	Type
kW		A	kHz			A	kHz			A	kHz	
<b>SINAMICS G120P converter – uncontrolled infeed</b>												
$U_{line,min}/U_{line,max}$ : 380/480 V												
110	1	200	2	6SL3710-1PE32-1AA0								
132	1	240	2	6SL3710-1PE32-5AA0								
160	1	290	2	6SL3710-1PE33-0AA0								
200	1	360	2	6SL3710-1PE33-7AA0								
250	1	450	2	6SL3710-1PE34-6AA0								
315	1	570	2	6SL3710-1PE35-8AA0								
355	1	640	2	6SL3710-1PE36-6AA0								
400	1	710	2	6SL3710-1PE37-4AA0								
<b>SINAMICS G150 converter – uncontrolled infeed</b>												
$U_{line,min}/U_{line,max}$ : 380/480 V					$U_{line,min}/U_{line,max}$ : 500/600 V				$U_{line,min}/U_{line,max}$ : 660/690 V			
75	–				–				1	80	1.25	6SL3710-1GH28-5AA3
90	–				–				1	95	1.25	6SL3710-1GH31-0AA3
110	1	205	2	6SL3710-1GE32-1AA3	1	171	1.25	6SL3710-1GF31-8AA3	1	115	1.25	6SL3710-1GH31-2AA3
132	1	250	2	6SL3710-1GE32-6AA3	1	208	1.25	6SL3710-1GF32-2AA3	1	142	1.25	6SL3710-1GH31-5AA3
160	1	302	2	6SL3710-1GE33-1AA3	1	250	1.25	6SL3710-1GF32-6AA3	1	171	1.25	6SL3710-1GH31-8AA3
200	1	370	2	6SL3710-1GE33-8AA3	1	320	1.25	6SL3710-1GF33-3AA3	1	208	1.25	6SL3710-1GH32-2AA3
250	1	477	2	6SL3710-1GE35-0AA3	1	400	1.25	6SL3710-1GF34-1AA3	1	250	1.25	6SL3710-1GH32-6AA3
315	1	590	1.25	6SL3710-1GE36-1AA3	1	452	1.25	6SL3710-1GF34-7AA3	1	320	1.25	6SL3710-1GH33-3AA3
400	1	725	1.25	6SL3710-1GE37-5AA3	1	560	1.25	6SL3710-1GF35-8AA3	1	400	1.25	6SL3710-1GH34-1AA3
450	1	820	1.25	6SL3710-1GE38-4AA3	–				1	452	1.25	6SL3710-1GH34-7AA3
500	–				1	710	1.25	6SL3710-1GF37-4AA3	–			
560	1	960	1.25	6SL3710-1GE41-0AA3	1	790	1.25	6SL3710-1GF38-1AA3	1	560	1.25	6SL3710-1GH35-8AA3
630	2	1092	1.25	6SL3710-2GE41-1AA3	2	836	1.25	6SL3710-2GF38-6AA3	–			
710	2	1340	1.25	6SL3710-2GE41-4AA3	2	1036	1.25	6SL3710-2GF41-1AA3	1	710	1.25	6SL3710-1GH37-4AA3
800	–				–				1	790	1.25	6SL3710-1GH38-1AA3
900	2	1516	1.25	6SL3710-2GE41-6AA3	–				–			
1000	–				2	1314	1.25	6SL3710-2GF41-4AA3	2	1036	1.25	6SL3710-2GH41-1AA3
1350	–				–				2	1314	1.25	6SL3710-2GH41-4AA3
1500	–				–				2	1462	1.25	6SL3710-2GH41-5AA3
1750	–				–				2	1720	1.25	6SL3710-2GH41-8EA3
1950	–				–				3	1940	1.25	6SL3710-2GH42-0EA3
2150	–				–				3	2150	1.25	6SL3710-2GH42-2EA3
2400	–				–				3	2390	1.25	6SL3710-2GH42-4EA3
2700	–				–				4	2685	1.25	6SL3710-2GH42-7EA3
<b>SINAMICS S150 converter – controlled infeed</b>												
$U_{line,min}/U_{line,max}$ : 380/480 V					$U_{line,min}/U_{line,max}$ : 500/690 V							
75	–				1	80	1.25	6SL3710-7LG28-5AA3				
90	–				1	95	1.25	6SL3710-7LG31-0AA3				
110	1	205	2	6SL3710-7LE32-1AA3	1	115	1.25	6SL3710-7LG31-2AA3				
132	1	250	2	6SL3710-7LE32-6AA3	1	142	1.25	6SL3710-7LG31-5AA3				
160	1	302	2	6SL3710-7LE33-1AA3	1	170	1.25	6SL3710-7LG31-8AA3				
200	1	370	2	6SL3710-7LE33-8AA3	1	208	1.25	6SL3710-7LG32-2AA3				
250	1	477	2	6SL3710-7LE35-0AA3	1	250	1.25	6SL3710-7LG32-6AA3				
315	1	590	1.25	6SL3710-7LE36-1AA3	1	320	1.25	6SL3710-7LG33-3AA3				
400	1	725	1.25	6SL3710-7LE37-5AA3	1	400	1.25	6SL3710-7LG34-1AA3				
450	1	820	1.25	6SL3710-7LE38-4AA3	1	452	1.25	6SL3710-7LG34-7AA3				
560	1	960	1.25	6SL3710-7LE41-0AA3	1	560	1.25	6SL3710-7LG35-8AA3				
710	1	1230	1.25	6SL3710-7LE41-2AA3	1	710	1.25	6SL3710-7LG37-4AA3				
800	1	1370	1.25	6SL3710-7LE41-4AA3	1	790	1.25	6SL3710-7LG38-1AA3				
900	–				1	880	1.25	6SL3710-7LG38-8AA3				
1000	–				1	1000	1.25	6SL3710-7LG41-0AA3				
1200	–				1	1230	1.25	6SL3710-7LG41-3AA3				

More information about SINAMICS converters can be found in the SINAMICS Engineering Manual.

**Overview** (continued)Special versions**Modified windings – Special versions for non-standard voltage or speed**

For versions of the SIMOTICS FD series that are not listed in the catalog, individual inquiries regarding winding modification are necessary. A winding modification may be required for:

1. A combination of defined supply and rated speed codes that is not listed in the catalog.
2. Non-standard supply systems for which a code has not been defined.
3. Non-standard rated speeds for which a code has not been defined.

Case 1 can be described with the Article No. without an additional order code. For case 2 and case 3, the appropriate order codes and plain text details are required.

- Non-standard line voltage (12th position of the Article No.: **9**): Order code **M1Y** and non-standard line voltage and/or rated motor voltage specified in plain text
- Non-standard rated speed (13th position of the Article No.: **9**): Order code **N1Y** and non-standard rated speed specified in plain text

Non-standard motor and load data possible on request.

**Noise emission when operated on a SINAMICS converter**

The variants of the SIMOTICS FD motor series that can be selected in the catalog have been designed such that the maximum A-weighted sound pressure levels listed in the tables below are not exceeded in no-load operation at the rated operating point when connected to a SINAMICS converter.

This has been achieved thanks to the following measures:

- Optimized electrical design: reduced, electromagnetic noise generation
- Optimized mechanical design: improved radiation characteristics
- The choice of rated voltages, whereby the maximum converter output voltages supplied are optimally utilized
- Operation of the SINAMICS converter with an optimized pulse pattern: Reduced electromagnetically generated noise, especially in the range of the rated speed ("rated range" in the diagrams below)
- Choice of suitable built-in fan (for 1LM1 and 1LL1): Limiting of the aerodynamic noise
- Dimensioning of new separately driven fan: Limiting of the noise from the separately driven fan

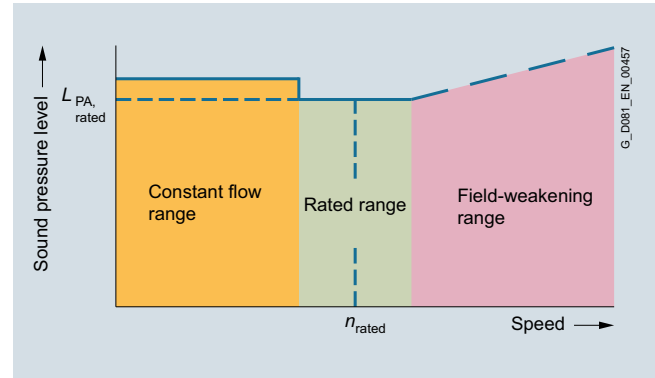
Motors of the SIMOTICS FD series can be selected in the "STARTER commissioning tool" software and in the Advanced Operation Panel (AOP) as a motor type. This ensures that operation using the named modulation technique is assured for all SIMOTICS FD motors in the respective range close to the rated speed.

**A-weighted sound pressure levels under no-load operation on SINAMICS converter at rated speed (tolerance +3 dB)**

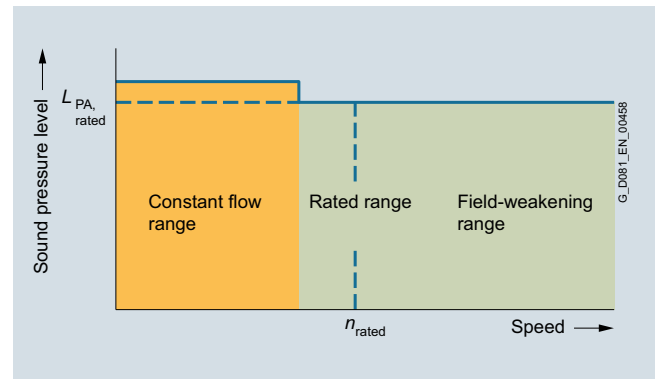
SIMOTICS FD series	$L_{PA}$ in dB(A)
1LM1, 1LL1, 1LN1	79
1LQ1, 1LP1 (5th position of the Article No. = 2)	79
(5th position of the Article No. = 3)	85
1LH1	78

For engineering a noise-optimized system, it is therefore important to:

- Select a motor with a rated voltage that matches the line voltage and the infeed of the SINAMICS converter.
- Select a motor with a rated speed that is lower than or equal to the speed(s) to be expected during operation.
- Upgrade the hardware and software of the SINAMICS converter if an existing SINAMICS converter (16th position of the SINAMICS Article No.: **0**, **1** or **2**) is to be used.



Schematic diagram of sound pressure level (1LM1, 1LL1)



Schematic diagram of sound pressure level (1LP1, 1LQ1, 1LH1, 1LN1)

The noise emission was able to be reduced in particular close to the rated speed (rated range). If a constant torque drive (mainly 1LP1, 1LQ1, 1LH1 and 1LN1) is implemented for low noise generation, it must be ensured during engineering that the lower operating speeds remain within the rated range. This can be achieved, for example, through the correct choice of rated speed. In self-ventilated motors (1LM1, 1LL1), the aerodynamic noise generated by the built-in fan dominates with increasing speed above the rated range. For drives of this type, the high operating speeds must be close to the rated speed.

**EMC**

The system comprising SIMOTICS FD in combination with SINAMICS has been checked according to the guidelines for electromagnetic compatibility 2014/30/EU and the regulations of the EMC directives. System compatibility is only provided with EMC-compliant grounding and if shielded power cables are used whose shield is conductively bonded over a large area to the metal motor terminal box.