SINAMICS S110
The Basic Positioning Drive

Catalog PM 22 · 2009

Motion Control

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SINAMICS S110
The Basic Positioning Drive

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Dear Customer,

We are delighted to be able to present you with our new PM 22 catalog.

Our SINAMICS S110 product range for basic positioning applications for single drives is an expansion of our highly successful SINAMICS S120 modular drive system for single-axis and multi-axis applications. It covers a spectrum of outputs ranging from 0.12 kW to 90 kW.

In addition to reliable, precise and high-speed positioning capabilities, integrated safety functionality is another key feature of the SINAMICS S110 range. These functions are designed to help you implement all applicable safety guidelines for protection of personnel and machinery at very little extra cost or effort.

We hope that you will often enjoy using our new PM 22 catalog as a reference for placing new orders and look forward to receiving your queries about our products. Any ideas and suggestions for improvement will be gratefully received.

You can access our interactive catalog and online ordering system on the Internet at:

http://www.siemens.com/automation/mall

Up-to-date information about SINAMICS S110 is available on the Internet at:
http://www.siemens.com/sinamics-s110

Best regards,

Armin Huger
Head of General Motion Control

Siemens AG, Industry Sector, Drive Technologies, Motion Control Systems

Motion Control

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Motion Control
SINAMICS S110
The Basic Positioning Drive

Catalog PM 22 · 2009

IQNet
THE INTERNATIONAL CERTIFICATION NETWORK

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Answers for industry.

Siemens Industry answers the challenges in the manufacturing and the process industry as well as in the building automation business. Our drive and automation solutions based on Totally Integrated Automation (TIA) and Totally Integrated Power (TIP) are employed in all kinds of industry. In the manufacturing and the process industry. In industrial as well as in functional buildings.

Siemens offers automation, drive, and low-voltage switching technology as well as industrial software from standard products up to entire industry solutions. The industry software enables our industry customers to optimize the entire value chain – from product design and development through manufacture and sales up to after-sales service. Our electrical and mechanical components offer integrated technologies for the entire drive tra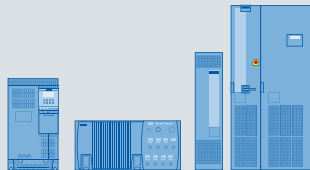in – from couplings to gear units, from motors to control and drive solutions for all engineering industries. Our technology platform TIP offers robust solutions for power distribution.

Check out the opportunities our automation and drive solutions provide. And discover how you can sustainably enhance your competitive edge with us.

SINAMICS
For each drive task the right drive
The drive family for future-oriented drive solutions

Overview

	Low voltage							Medium voltage
For basic applications		**For high-quality applications**			**For basic servo applications**	**For sophisticated applications**		**For high-power applications**
SINAMICS G110	SINAMICS G110D	SINAMICS G120	SINAMICS G120D	SINAMICS G130/G150	SINAMICS S110	SINAMICS S120	SINAMICS S150	SINAMICS GM150/SM150/GL150
V/f-control	*V/f*-control/FCC	*V/f*-control/vector control			Servo control	*V/f*-control/vector control/servo control		*V/f*-control/vector control
0.12 kW ... 3 kW	0.75 kW ... 7.5 kW	0.37 kW ... 250 kW	0.75 kW ... 7.5 kW	75 kW ... 1500 kW	0.12 kW ... 90 kW	0.12 kW ... 4500 kW	75 kW ... 1200 kW	0.8 MW ... 120 MW
Pumps, fans, conveyor belts	Conveyor technology	Pumps, fans, conveyor belts, compressors, mixers, mills, extruders			Single-axis positionning applications for mechanical engineering and plant construction	Motion Control applications in production machines, e.g. packaging, textile, printing and paper machines, plastic machines, machine tools, plants and process lines	Test bay drives, cross cutters, centrifuges	Pumps, fans, compressors, mixers, extruders, rolling mills, mining hoist drives

G_D211_EN_00243

Common Engineering Tools

SIZER - for simple planning and configuration   **STARTER – for fast commissioning, optimization and diagnostics**

Whatever the drive task, SINAMICS has just the right drive – and they can all be configured, parameterized, commissioned, and operated in the same way.

SINAMICS – fit for every drive application

- Wide range of power ratings from 0.12 kW to 120 MW
- Low-voltage and medium-voltage versions available
- Uniform functionality thanks to a shared hardware and software platform
- Shared engineering with only two tools for all drives:
  - SIZER for simple planning and configuring
  - STARTER for quick commissioning, optimization and diagnostics
- High degree of flexibility and combination capability

Uniformity within the SINAMICS family

The SINAMICS S110 positioning drive is designed for consistency with the SINAMICS S120 Motion Control drive system. In other words, if a drive equipped with SINAMICS S110 requires a higher performance, it is quick and easy to migrate over to the SINAMICS S120.

SINAMICS S110 scope of functions

**The basic positioning drive
for single-axis applications**

Overview

SINAMICS S110 – the basic positioning drive for single-axis applications

Many applications in mechanical engineering and plant construction require machine axes to be positioned quickly and precisely by the simplest possible method. It is often simply a case of moving a machine axis from position X to position Y reliably and with the required level of performance. The SINAMICS S110 drive converter is ideally suited to this type of application. It is specially designed to position single axes accurately and effectively.

SINAMICS S110 is the perfect solution for many applications. Typical examples are:

• Handling equipment

• Feed and withdrawal devices

• Stacking units

• Automatic assembly machines

• Laboratory automation

• Metalworking

• Machines used in the wood, glass and ceramic industries

• Printing machines

• Plastics processing machines

The so-called basic positioner (EPos) is an integral component of the SINAMICS S110. It provides a simple method of solving positioning tasks.

The SINAMICS S110 is designed for connection to both synchronous servo motors and asynchronous (induction) motors. It supports all the most popular types of encoder.

A variety of field bus interfaces is provided for linking the unit to a higher-level control system. Alternatively, it can be controlled via a ±10 V setpoint interface.

An outstanding feature of the SINAMICS S110 converter is its integrated safety functions (Safety Integrated) which make it easy to provide highly effective protection for personnel and machinery.

Flexible in application

SINAMICS S110 is a flexible, versatile system.

Synchronous servo motors and asynchronous (induction) motors with outputs up to 90 kW can be used to implement rotary or linear axes.
When DRIVE-CLiQ motors are used they can be connected simply by means of the integrated DRIVE-CLiQ interface. This means that the electronic rating plate of the motor can be easily read out, reducing the engineering time and overhead involved in commissioning the drive.

Furthermore, the SINAMICS S110 features an integrated encoder interface for optional use. It is capable of evaluating HTL and TTL encoders.

In addition to pure point-to-point positioning, SINAMICS S110 naturally offers also on-the-fly changeover from continuous operation to positioning mode in order, for example, to precisely position objects transported randomly on a conveyor belt. Even simple traversing profiles with different motion cycles and wait times can be executed automatically by SINAMICS S110.

The Control Unit of the SINAMICS S110 (CU305) is equipped with an integrated communication interface for linking the converter to an automation system. A CANopen or PROFIBUS interface can be ordered. Standardized protocols for linking to a higher-level control are supported – the PROFIdrive profile for positioning mode and the PROFIsafe profile for safety-related communication.

The converter is thus perfectly coordinated with the SIMATIC S7 automation system. The devices are linked by means of PROFIBUS and the SIMATIC S7 uses standard function blocks to communicate with the drive. In addition, the STARTER commissioning tool can be seamlessly integrated into STEP7, the SIMATIC's programming software.

BICO technology

Every drive contains a number of input and output variables which can be freely and independently interconnected using Binector Connector Technology (BICO). A binector is a logic signal which can assume the value 0 or 1. A connector is a numerical value, e.g. the actual speed or current setpoint.

Free function blocks

The "free function blocks" integrated in the CU305 Control Unit can be adapted easily but precisely to a very broad range of customized requirements. The available range of blocks includes simple logic blocks such as AND/OR elements, as well as more complex devices such as ramp-function generators, smoothing elements or limit-value monitors. All blocks can be flexibly interconnected using BICO (Binector-Connector) technology, ensuring that signals are processed quickly and internal to the drive which helps to reduce the load on the higher-level control.

Diagnostics optimally supported by trace function

The time characteristics of input and output variables associated with drives can be measured by the integrated trace function and displayed using the STARTER commissioning tool. The trace can record up to 4 signals simultaneously. The recording can be triggered as a function of freely selectable boundary conditions, e.g. the value of an input or output variable.

SINAMICS S110 scope of functions

■ Overview

The EPos basic positioner in the SINAMICS S110 drive system provides powerful and precise positioning functions. Due to its flexibility and adaptability, the basic positioner can be used for a wide range of positioning tasks.

The functions are easy to handle both during commissioning and during operation, and the comprehensive monitoring functions are outstanding.

Many applications can be carried out without external position controllers.

The EPos basic positioner is used to position linear and rotary axes (modulo) in absolute/relative terms with rotary as well as linear motor encoder or machine encoder (indirect measuring system).

EPos is a function module that can be activated on synchronous and asynchronous (induction) motors.

User-friendly configuring and commissioning including control panel (operation using PC) and diagnostics with the STARTER commissioning tool.

In addition to extremely flexible positioning functions, EPos offers a high degree of user-friendliness and reliability thanks to integral monitoring and compensation functions.

Different operating modes and their functionality increase flexibility and plant productivity, for example, by means of "on-the-fly" and bumpless correction of the motion control.

Preconfigured PROFIdrive positioning frames are available which, when selected, automatically establish the internal "connection" to the basic positioner.
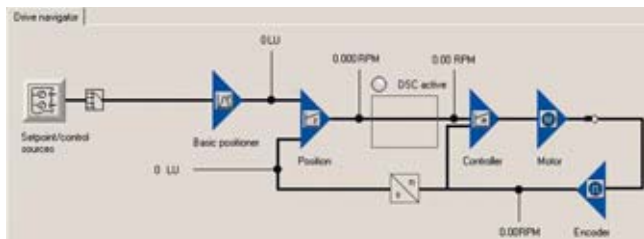
Position controller
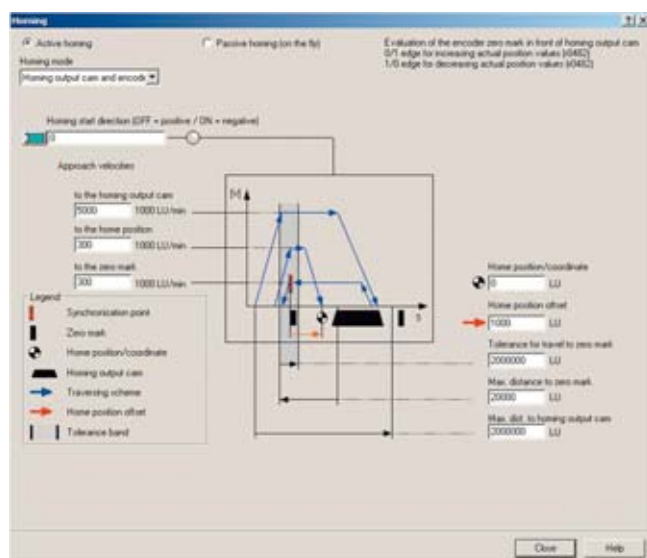
Going to home position

Functionality of the EPos basic positioner

Closed-loop position control with the following essential components
- Position actual value sensing (including the lower-level measuring probe evaluation and reference mark search)
- Position controller (including limits, adaptation and pre-control calculation)
- Monitoring functions (standstill, positioning and dynamic following error monitoring, cam signals)

Mechanical system
- Backlash compensation
- Modulo offset

Limits
- Speed/acceleration/delay/jerk limitation
- Software limit switch (traversing range limitation by means of position setpoint evaluation)
- Stop cams (traversing range limitation by means of hardware limit switch evaluation)

Homing and alignment
- Set reference point (for an axis at standstill)
- Search for reference (separate mode including reversing cam functionality, automatic reversal of direction, homing to "output cam and encoder zero mark" or only "encoder zero mark" or "external zero mark (BERO)")
- Flying referencing (seamless homing possible during "normal" traversing with the aid of the measuring input evaluation; generally evaluation, e.g. of a proximity sensor. Subordinate function for the modes "jog", "direct setpoint input/MDI" and "traversing blocks")
- Absolute encoder alignment

Traversing blocks mode (16 traversing blocks)
- Positioning using traversing blocks that can be stored in the drive unit including block change enable conditions and specific tasks for an axis that was previously referenced
- Traversing block editor using STARTER
- A traversing block contains the following information:
  - Job number and job (e.g. positioning, waiting, GOTO set jump, setting of binary outputs, travel to fixed stop)
  - Motion parameters (target position, override speed for acceleration and deceleration)
  - Mode (e.g.: hide block, continuation conditions such as "Continue_with_stop", "Continue_flying" and "Continue_externally using high-speed probe inputs")
  - Job parameters (e.g. waiting time, block step conditions)

Direct setpoint input (MDI) mode
- Positioning (absolute, relative) and setting-up (endless closed-loop position control) using direct setpoint inputs (e.g. via the PLC using process data)
- It is always possible to influence the motion parameters during traversing (on-the-fly setpoint acceptance) as well as on-the-fly change between the setup and positioning modes
- The direct setpoint specification operating mode (MDI) can also be used in positioning or setup mode if the axis is not homed. This means that on-the-fly synchronization and re-homing can be carried out with "flying referencing".

Jog mode
- Closed-loop position controlled traversing of the axis with the "endless position controlled" or "jog incremental" modes, which can be toggled between (traverse through a "step width")

SINAMICS S110 scope of functions

Safety Integrated

Overview

The integrated safety functions of SINAMICS S110 provide highly effective application-oriented protection for personnel and machinery. The current version of SINAMICS S110 offers the following Safety Integrated functions (terms as defined in IEC 61800-5-2):

• Safe Torque Off (STO)
• Safe Brake Control (SBC)
• Safe Stop 1 (SS1)
• Safe Stop 2 (SS2)
• Safe Operating Stop (SOS)
• Safely Limited Speed (SLS)
• Safe Speed Monitor (SSM)

The Safety Integrated functions are fully integrated into the drive system. They can be activated as follows:

• Via fail-safe digital inputs on the CU305 Control Unit
• via PROFIBUS with PROFIsafe

The Safety Integrated functions are implemented electronically and therefore offer short response times in comparison to solutions with externally implemented monitoring functions.

Legal framework

Machine manufacturers and plant constructors must ensure that their machines or plant cannot cause danger due to malfunctions, as well as preventing the general risks of electric shock, heat or radiation.

In Europe, for example, compliance with the machinery directive is required in law by the EU industrial safety directive. In order to ensure compliance with this directive, it is recommended that the corresponding harmonized European standards are applied. This triggers the "assumption of conformity" and gives manufacturers and operators the legal security in terms of compliance with both national regulations and the EU directive. The machine manufacturer uses the CE marking to document the compliance with all relevant directives and regulations in the free movement of goods.

Safety-related standards

Functional safety is specified in various standards. EN ISO 12100 and EN 1050, for example, are concerned with the construction and risk assessment of machines. EN 62061 (applicable only to electrical and electronic control systems) and EN ISO 13849-1, which will replace the previously relevant standard EN 954-1 from the end of 2009, define the functional and safety-related requirements of control systems with relevance to safety.

The above-mentioned standards define different safety requirements that the machine has to satisfy in accordance with the risk, frequency of a dangerous situation, probability of occurrence and the opportunities for recognizing impending danger.

• EN 954-1: Categories B, 1 … 4
• EN ISO 13849-1: Performance Level PL a … e
• EN 62061: Safety Integrity Level SIL 1 … 3

Trend toward integrated safety systems

The trend towards greater complexity and increasing modularity of machines has caused the safety functions to move away from the classical central safety functions (for example, deactivation of the complete machine using a main switch) and into the machine control system and the drives. This is often accompanied by a significant increase in productivity because the changeover times are shortened. Depending on the type of machine, it may even be possible to continue limited manufacturing while changeover is in progress.

Integrated safety functions act much faster than those of a conventional design. The safety of a machine is increased further with Safety Integrated. Furthermore, safety measures controlled by integrated safety systems are perceived as less of a hindrance by the operator of the machine due to the tailored operation, so the motivation to consciously bypass safety functions is significantly reduced.

SINAMICS S110 scope of functions

Function

Safety functions integrated into the drive with SINAMICS S110

SINAMICS S110 is characterized by a full range of integrated safety functions.

They satisfy the requirements of
- Category 3 according to EN 954-1 or EN ISO 13849-1
- Safety Integrity Level (SIL) 2 according to EN 61508
- Performance Level (PL) d according to EN ISO 13849-1

Safety Integrated functions of the SINAMICS S110 are generally certified by independent institutes. An up-to-date list of test certificates and manufacturer declarations are available on request from your local Siemens office.

The Safety Integrated functions currently available in SINAMICS S110 are listed below (terms as defined in IEC 61800-5-2):

Safe Torque Off (STO)

Functional description

This function prevents the drive from restarting unexpectedly, in accordance with EN 60204-1, Section 5.4. Safe Torque Off disables the drive pulses and disconnects the power supply to the motor (corresponds to Stop Category 0 of EN 60204-1). The drive is reliably torque-free. This state is monitored internally in the drive.

Application, customer benefits

STO has the immediate effect that the drive cannot supply any torque-generating energy. STO can be used wherever the drive will reach a standstill autonomously due to the load torque or friction in a sufficiently short time or when coasting down of the drive will not have any relevance for safety.
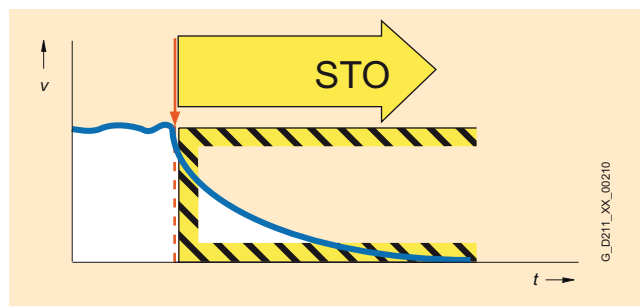
Safe Brake Control (SBC)

Functional description

Safe Brake Control SBC is used to control holding brakes which are operative at zero current, e.g. motor holding brakes. The brake control circuit is a fail-safe, two-channel design.

The Safe Brake Control is activated when the Safe Torque Off function is selected and when safety monitors with safe pulse disable are tripped.
- Note 1: Safe Brake Control does not detect mechanical faults in the brake itself, such as worn brake linings.
- Note 2: The Safe Brake Relay must be connected additionally on the PM340 Power Module.

Application, customer benefits

SBC can also be activated in combination with STO and SS1. SBC allows a holding brake to be safely activated on the motor after disconnection of the torque-generating energy in order to prevent, for example, suspended axes from sagging.
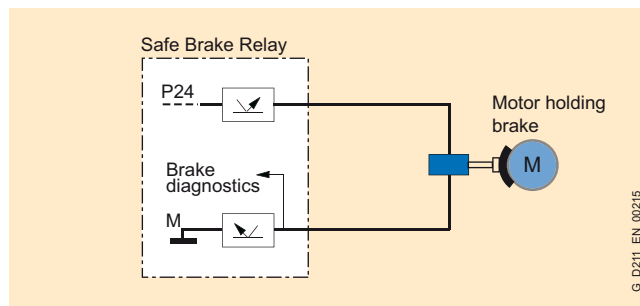
SINAMICS S110 scope of functions

Safety Integrated

■ **Function** (continued)

Safe Stop 1 (SS1)

Functional description

The Safe Stop 1 function can safely stop the drive in accordance with EN 60204-1, Stop Category 1. When the SS1 function is selected, the drive brakes along a quick stop ramp (OFF3) and automatically activates the Safe Torque Off and Safe Brake Control functions (if enabled) when the parameterized safety delay timer runs down.

Application, customer benefits

When the stop function of the drive is activated and movement does not come to a halt quick enough due to load inertia, it can be actively braked by the converter. This integrated quick braking function eliminates the need for costly mechanical brakes that are subject to wear.

Safe Stop 2 (SS2)

Functional description

The Safe Stop 2 function can safely stop the drive in accordance with EN 60204-1, Stop Category 2. When the SS2 function is selected, the drive brakes electrically along a quick-stop ramp (OFF3). In contrast to SS1, the drive control remains operational afterwards, i.e. the motor can supply the full torque required to maintain zero speed. Standstill is safely monitored (Safe Operating Stop function).

Application, customer benefits

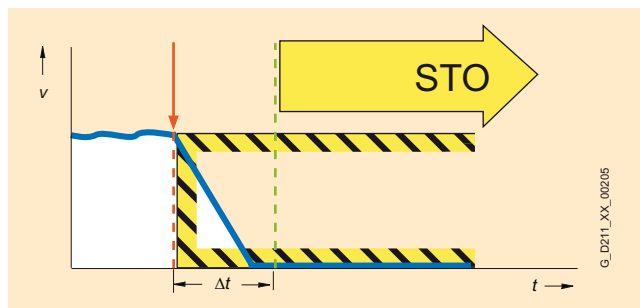As in the case of SS1, the drive is automatically braked when the stop function is selected. In contrast to SS1, the drive can also supply the full torque at standstill.
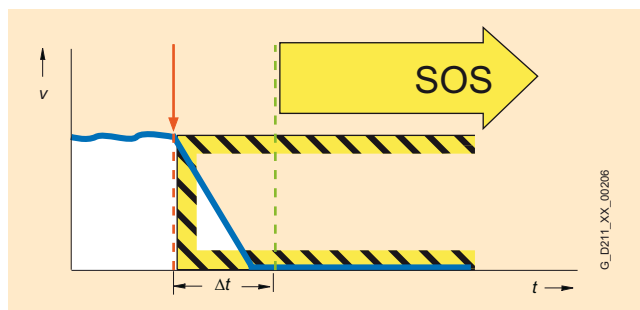
Safe Operating Stop (SOS)

Functional description

The Safe Operating Stop function represents safe standstill monitoring. The drive control remains in operation. The motor can therefore deliver the full torque to hold the current position. The actual position is reliably monitored. In contrast to safety functions SS1 and SS2, the speed setpoint is not influenced automatically. After SOS has been activated, the higher-level control must bring the drive to a standstill within a parameterized time and then hold the position setpoint.

Application, customer benefits

SOS is an ideal solution for applications for which the machine or parts of the machine must be at a safe standstill for certain machining steps, but the drive must also supply a holding torque. It is ensured that despite counter torque the drive remains in its current position. In contrast to SS1 and SS2, the drive does not brake automatically in this case. It expects the higher-level controller to ramp down the relevant axes as a coordinated group within an adjustable delay time. This can be used to prevent any damage to the machine or product.
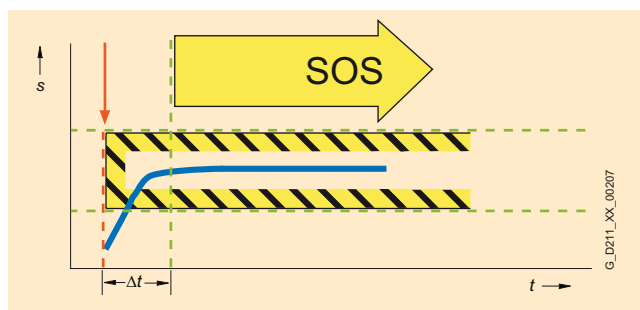
Function (continued)

Safely Limited Speed (SLS)

Functional description

The Safely Limited Speed function is used to monitor the drive for a programmable maximum speed. Four different limit values can be activated. As in the case of SOS, the speed setpoint is not automatically influenced. After SLS has been activated, the higher-level control must bring the drive down below the selected speed limit within a parameterizable time.

Application, customer benefits

When many machines are being set up, the operating personnel must be working on the machine that is in motion. This either occurs step-by-step because the danger area must be exited again and again during starting or the operator is working on the moving machine and is therefore exposed to increased risk. The SLS function can save a considerable amount of time here and the safety of the operating personnel is assured despite this. The speed of the drive can then be safely limited to a lower speed that is not dangerous.

The adjustable delay time before activation of SLS allows the drive control to ramp down coordinated axes in a defined manner. This can be used to prevent any damage to the product.
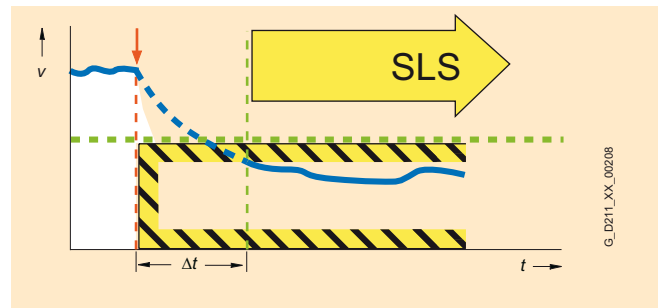
Safe Speed Monitor (SSM)

Functional description

The Safe Speed Monitor function supplies a safe checkback signal (active High) when the drive speed drops below a settable speed limit. In contrast to the functions described above, the drive does not react automatically when the speed is over the limit, but instead outputs a safe (low) checkback signal.

Application, customer benefits

The safe SSM checkback can be used in a higher-level controller for safety-related reactions, e.g. for enabling a protective door.
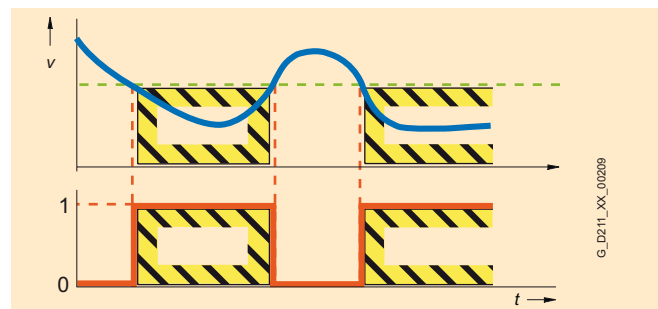
SINAMICS S110 scope of functions

Safety Integrated

■ **Function** (continued)

The Safety Integrated functions of the SINAMICS S110 drive system are grouped into Basic Functions and Extended Functions. No license is required for the Basic Functions when activated by the fail-safe terminals on the CU305.

The Extended Functions do require a license. These are activated by means of fail-safe terminals on the CU305 or by means of the safe communication via standard PROFIsafe. When a license is required the MMC memory card for the CU305 is also required.

- **Basic Functions**
  - Safe Torque Off (STO) [1]
  - Safe Brake Control (SBC)
  - Safe Stop 1 (SS1)
- **Extended Functions**
  - Safe Stop 1 (SS1) with SBR
  - Safe Stop 2 (SS2) with SBR
  - Safe Operating Stop (SOS)
  - Safely Limited Speed (SLS)
  - Safe Speed Monitor (SSM)

The functions SS1 (with SBR), SS2, SLS, SOS and SSM require safe speed/position sensing.

With extended functions SS1 and SS2, safe acceleration monitoring (SBR) is performed during braking to ensure that any faults during braking will be detected. Safe acceleration monitoring requires safe speed/position sensing.

Safe speed/position sensing

Incremental encoders or absolute encoders can be used for safe detection of speed or position on a drive. Safe actual value sensing relies on redundant evaluation of the incremental channels A/B that supply sin/cos signals of 1 V_{pp}.
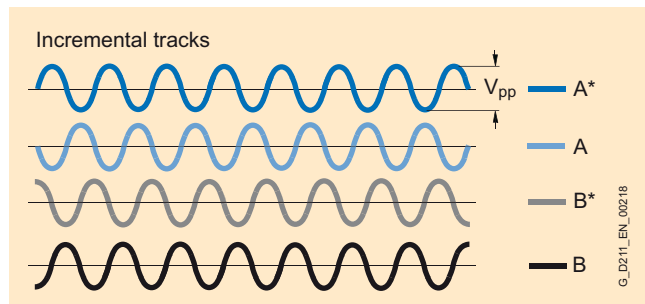
Signal progression for the incremental channels

When motors with a DRIVE-CLiQ interface are used (see synchronous and asynchronous (induction) motors), the speed/position actual values are generated directly in the motor as safe values and transferred to the Control Unit over a safe DRIVE-CLiQ communication link.

For motors without a DRIVE-CLiQ interface, the connection is made using additional Sensor Modules (SMC or SME; see Section SINAMICS S120 in Catalog PM 21).

Permissible encoder types

Encoders with photoelectric scanning capability must always be used for safe sensing of actual values. These optical encoders must supply sin/cos signals of 1 V_{pp} on the incremental channels A/B.

Basic absolute encoders (e.g. ECI, EQI) that offer an EnDat interface with additional sin/cos tracks, but operate according to an inductive measuring principle internally, are not permitted.

PROFIsafe

PROFIsafe is an open communications standard that supports standard and safety-related communication over the same communications cable (wired or wireless). A second, separate bus system is therefore not necessary. To ensure safe communication, the transmitted message frames are continuously monitored. Possible errors, such as lost or repeated messages or those received in the wrong order etc., are avoided in that safety-related messages are numbered consecutively, their arrival is monitored within a defined period, and an identifier for the sender and receiver of a message is transferred. A CRC (cyclic redundancy check) data security mechanism is also used.

With SINAMICS S110, PROFIsafe is currently only compatible with PROFIBUS. This will be extended to include PROFINET soon.

Licensing

The Safety Integrated basic functions do not require a license.

However, the extended functions of Safety Integrated do require a license. It is irrelevant which safety functions are used and how many.

The license can be ordered as an option with the memory card (order code **F01**). For memory card order numbers, please refer to the selection and ordering data.

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[1] The activation option using PROFIsafe currently requires an encoder and a license.

SINAMICS S110 scope of functions

■ Function (continued)

Overview of SINAMICS S110 Safety Integrated functions and associated boundary conditions

Function		Activation	Underlying function	Reaction	External set-point input effective	Encoder required	License required
Basic Functions	**STO**	• F-DI0 on CU305 • PROFIsafe	SBC (if activated)	–	No	No [1]	No [2]
	SBC	• With STO (directly or following expiry of the delay with SS1)	–	–	–	No	No
	SS1	• F-DI0 on CU305	STO following expiry of the parameterized delay, followed by SBC (if activated)	–	No	No	No
Extended Functions	**SS1 (with SBR)**	• F-DI0-2 on CU305 • PROFIsafe	Safe acceleration monitoring (SBR) during braking. STO and SBC (if activated) following expiry of the parameterized delay or speed decay below the minimum speed limit	STO	No	Yes	Yes
	SS2 (with SBR)	• F-DI0-2 on CU305 • PROFIsafe	Safe acceleration monitoring during braking. Following expiry of the parameterized delay SOS	STO	No	Yes	Yes
	SOS	• F-DI0-2 on CU305 • PROFIsafe		SS1	Yes	Yes	Yes
	SLS	• F-DI0-2 on CU305 • PROFIsafe		SS1, STO or SOS (parameterizable)	Yes	Yes	Yes
	SSM	• Always active		Indication only	Yes	Yes	Yes

The operating principle of Safety Integrated

Two independent switch-off signal paths

Two independent switch-off signal paths are available. All switch-off signal paths are low active, thereby ensuring that the system is always switched to a safe state if a component fails or in the event of an open circuit. If an error is discovered in the switch-off signal paths, the Safe Torque Off or Safe Stop 1 function is activated (depending on the parameterization, see the above table) and a system restart inhibited.

Two-channel monitoring structure

All the main hardware and software functions for Safety Integrated are implemented in two independent monitoring channels (e.g. switch-off signal paths, data management, data comparison). A cyclic crosswise comparison of the safety-relevant data in the two monitoring channels is carried out.

The monitoring functions in each monitoring channel work on the principle that a defined status must prevail before each action is carried out and a specific acknowledgement must be made after each action. If these expectations of a monitoring channel are not fulfilled, the drive coasts to a standstill (two-channel) and an appropriate message is output.

Forced dormant error detection using test stop

The functions and switch-off signal paths must be tested at least once within a defined time in order to meet requirements as per EN 954-1/ISO 13859-1 and IEC 61508 relating to prompt fault detection. This functionality must be implemented by means of test stop triggering either in cyclic manual mode or by the automated process. The test stop cycle is monitored and an alarm is output following a timeout.

A test stop does not require Power On. The acknowledgment is set by canceling the test stop request.

When the appropriate safety devices are implemented (e.g. protective doors), it can be assumed that running machinery will not pose any risk to personnel. For this reason, only an alarm is output to inform the user that a forced dormant error detection run is due, thereby requesting that this be carried out at the next available opportunity.

Examples of when forced dormant error detection runs are required:

• when the drives are at a standstill after the system has been switched on
• before the protective door is opened
• at defined intervals (e.g. every 8 hours)
• in automatic mode, time- and event-driven

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[1] The activation option using PROFIsafe currently requires an encoder.

[2] The activation option using PROFIsafe currently requires a license.

Engineering Software

SIZER configuration tool

Overview
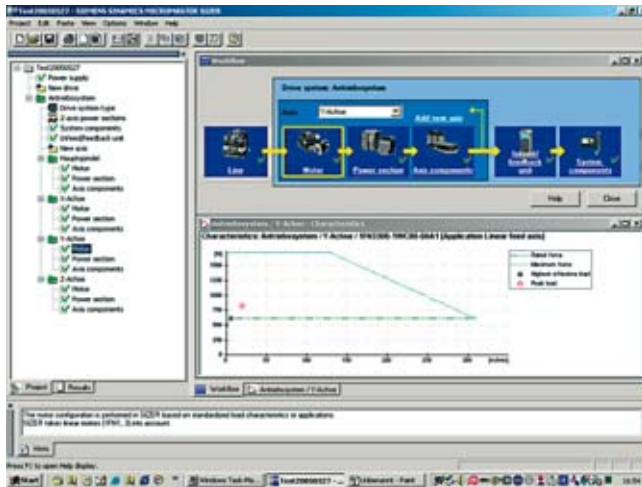
The easy configuration of the following drives and controls is carried out by the configuration tool SIZER:

- drive family SINAMICS
- drive family MICROMASTER 4
- CNC control SINUMERIK solution line
- Motion Controller SIMOTION
- SIMATIC Technology

The tool will support you during the technical configuration of hard- and firmware components required to complete a drive task. SIZER supports the complete configuration of a drive system from simple single drives to multi-axis applications.

SIZER supports all of the engineering steps in one workflow:

- Configuring the power supply
- Designing the motor and gearbox, including calculation of mechanical transmission elements
- Configuring of the drive components
- Selecting the required accessories
- Selecting the line-side and motor-side power options, e.g. cables, filters and reactors

When SIZER was being designed, particular importance was placed on high usability and a universal, function-based approach to the drive task. The extensive user guidance makes using the tool easy. Status information keeps you continually informed of the progress of the configuration process.

The SIZER user interface is available in English, French, German and Italian.

The drive configuration is saved in a project. In the project, the components and functions used are displayed in a hierarchical tree structure.

The project view permits the configuration of drive systems and the copying/inserting/modifying of drives already configured.

The configuration process produces the following results:

- A parts list of the components required (export to Excel, using the Excel data sheet to import in VSR)
- Technical specifications of the system
- Characteristic curves
- Comments on system reactions
- Location diagrams of the drive and control components
- Dimension sheets
- 2-D/3-D models for motors and drive components

These results are displayed in a results tree and can be reused for documentation purposes.

User support is provided by the technological online help menu, which provides the following information:

- Detailed technical data
- Information about the drive systems and their components
- Decision-making criteria for the selection of components
- Online help in Chinese, English, French, German, Italian and Japanese.

Minimum system requirements

PG or PC with Pentium II 400 MHz (Windows 2000),
Pentium III 500 MHz (Windows XP)

512 MB RAM (1 GB RAM recommended)

At least 2.7 GB of free hard disk space

An additional 100 MB of free hard disk space on Windows system drive

Monitor resolution, 1024 × 768 pixels

Windows 2000 SP4 / XP Professional SP2 / XP Home Edition SP2

Microsoft Internet Explorer 5.5 SP2

Selection and ordering data

	Order No.
SIZER configuration tool for SINAMICS and MICROMASTER	**6SL3070-0AA00-0AG0**
English, French, German, Italian	

Overview
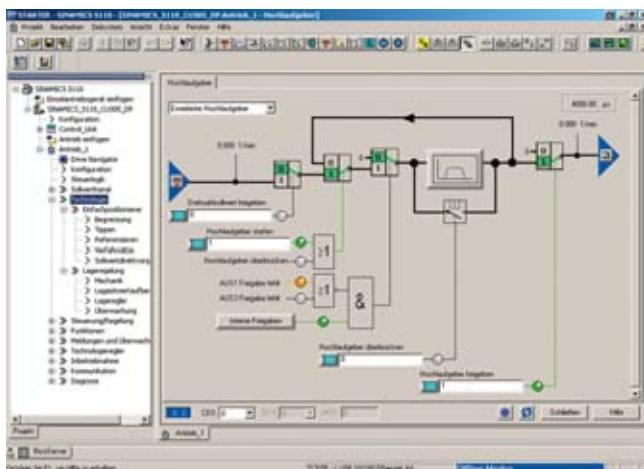
The easy-to-use STARTER drive/commissioning software can be used to:

- commissioning,
- optimization and
- diagnostics

This software can be operated either as a standalone PC application or can be integrated into the SCOUT engineering system (on SIMOTION) or via Drive ES Basic into SIMATIC STEP 7 (TIA-compliant). The basic functions and handling are the same in both cases.

In addition to the SINAMICS drives, the current version of STARTER also supports MICROMASTER 4 devices and inverters for the SIMATIC ET 200S FC distributed I/O system.

The project wizards can be used to create the drives within the structure of the project tree.

First-time users are supported by solution-based dialog menu, whereby a standard graphics-based display maximizes clarity when setting the drive parameters.

First commissioning is guided by wizards, which make all the basic settings in the drive. This enables a drive to be up and running after only setting a small number of parameters within the drive configuration procces.

The individual settings required are made using graphics-based parameterization screenforms, which also display the mode of operation.

Examples of individual settings that can be made include:

- terminals
- bus interface
- setpoint channel (e.g. fixed setpoints)
- speed control (e.g. ramp-function generator, limits)
- BICO interconnections
- diagnostics

Experts can gain rapid access to the individual parameters via the expert list and do not have to navigate dialogs.

An individual compilation of frequently used parameters can be saved in individual user lists.

In addition, the following functions are available for optimization purposes:

- self-optimization of controller settings
- trace
- diagnostics functions provide information about:
  - control/status words
  - parameter status
  - operating conditions
  - communication states

Performance

- Easy to use: Only a small number of settings need to be made for successful first commissioning: axis turning
- Solution-based dialog-based user guidance simplifies commissioning
- Self-optimization functions reduce manual effort for optimization
- The built-in trace function provides optimum support during commissioning, optimization and troubleshooting

Minimum hardware and software requirements

PG or PC with Pentium II 400 MHz (Windows 2000),
Pentium III 500 MHz (Windows XP)

512 MB RAM (1 GB RAM recommended)

Monitor resolution, 1024 × 768 pixels

Windows 2000 SP3, SP4 or XP Professional SP1, SP2
or Windows Server 2003 SP1

Microsoft Internet Explorer 5.01

Integration

For communication between PG/PC and CU305 a serial RS232-interface, a PROFIBUS or PROFINET (available soon) is used depending on the CU version.

Serial (RS232)

In the case of a point-to-point connection to the serial PC-interface, for example, the following zero modem cable can be used:
Order No.: 6ES7901-1BF00-0XA0

PROFIBUS

For example, PROFIBUS Communications Module CP 5512 (PCMCIA type 2 card + adapter with 9-pole SUB-D socket for connection to PROFIBUS. For Windows 2000/XP Professional and PCMCIA 32)
Order No.: 6GK1551-2AA00

and connection cable between CP 5512 and SINAMICS
Order No.: 6ES7901-4BD00-0XA0

Selection and ordering data

	Order No.
STARTER commissioning tool for SINAMICS and MICROMASTER English, French, German, Italian, Spanish	**6SL3072-0AA00-0AG0**

SINAMICS S110 components

CU305 Control Unit

Overview

CU305 Control Unit with BOP20

The CU305 Control Unit for the communication and open-loop/closed-loop control functions of a SINAMICS S110 is combined with the PM340 Power Module to create a powerful single drive.

Design

The CU305 features the following connections and interfaces as standard:

- 1 DRIVE-CLiQ socket, used solely to connect a DRIVE-CLiQ motor or a Sensor Module
- 1 PM-IF interface for communication with PM340 Power Modules in Blocksize format
- 1 interface to the BOP20 Basic Operator Panel
- 1 field bus communication interface via order selection:
  - PROFIBUS interface with PROFIdrive V4 profile (CU305 DP)
  - CAN open interface (CU305 CAN)
  - PROFINET interface with 2 ports and PROFIdrive V4 profile (CU305 PN available soon)
- 1 onboard encoder evaluation
  The following encoder signals can be evaluated:
  - Incremental encoder TTL/HTL
  - SSI encoder without incremental signals (available soon)
- 1 analog input: ±10 V, 13-bit resolution
- 3 parameterizable, fail-safe digital inputs (floating) or alternatively: 6 parameterizable digital inputs (floating)
- 1 parameterizable, fail-safe digital output (floating) or alternatively: 1 digital output (floating)
- 4 parameterizable bidirectional digital inputs/outputs (floating)
- 5 parameterizable digital inputs (floating)
- 1 serial RS232 interface
- 1 slot for a memory card on which the firmware, parameters and licenses can be stored
- 2 test sockets and one reference ground for commissioning support
- 1 x connection for the electronics power supply via the 24-V-DC power supply connector
- 1 PE/protective conductor connection
- 1 temperature sensor input (KTY84-130 or PTC)

Integration

The CU305 controls the PM340 via the PM-IF interface.

A BOP20 Basic Operator Panel can also be snapped directly onto the CU305 for parameterization and diagnostic purposes.

DRIVE-CLiQ motors or Sensor Modules (SMC10 or SMC20) can also be connected to the integrated DRIVE-CLiQ socket to permit the operation of motors without a DRIVE-CLiQ interface.

The status of the CU305 is indicated via multi-color LEDs.

The CU305 can be operated optionally with a memory card. The firmware and project data are stored on the plug-in card underneath, so that the CU305 can be replaced without the support of software tools. This memory card can also be used to perform standard commissioning on multiple drives of identical type. The card is available as an empty memory card or containing the latest drive firmware version. The safety license for the extended safety functions can be added to the MMC memory card. To use these extended safety functions, a memory card containing the safety license must be permanently inserted.

The CU305 and other connected components are commissioned and diagnosed with the STARTER commissioning tool.

■ **Integration**
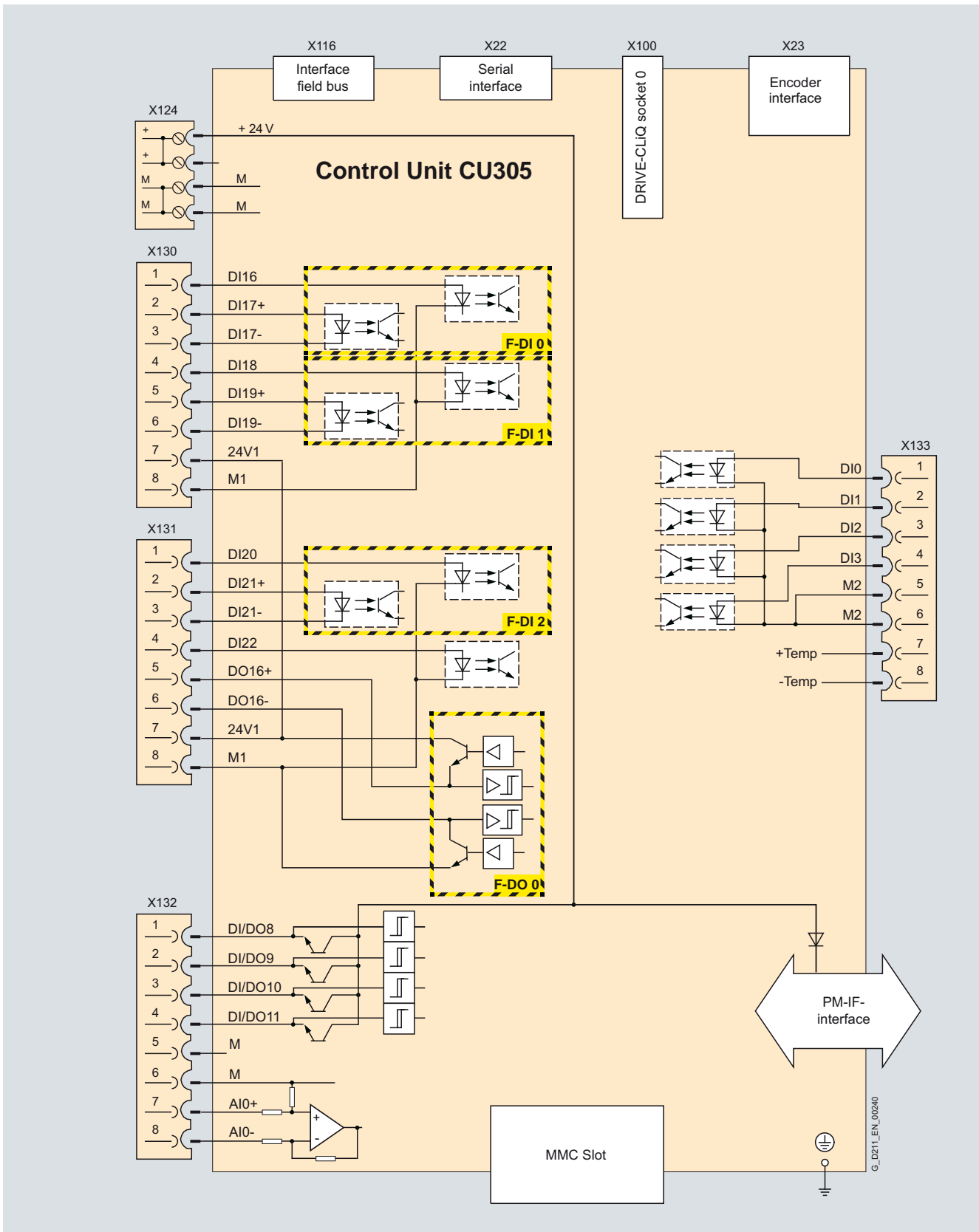
Terminal assignments on CU305 (DP or CAN)

SINAMICS S110 components

CU305 Control Unit

Technical specifications

	CU305 DP and CU305 CAN Control Units
Current demand at 24 V DC, max. without taking account of digital outputs and DRIVE-CLiQ supply	0.8 A for CU305 incl. 350 mA for HTL encoder + 0.5 A for PM340 Power Module
Max. conductor cross-section	2.5 mm^2
Fuse protection, max.	20 A
Digital inputs	In accordance with IEC 61131-2 Type 1
	3 floating fail-safe inputs
	5 bidirectional floating digital inputs/outputs
• Voltage	• -3 … +30 V
• Low level (an open digital input is interpreted as "low")	• -3 … +5 V
• High level	• 15 … 30 V
• Current consumption at 24 V DC, typ.	• 6 mA
• Delay time of digital inputs [1], approx.	
- L → H	15 µs
- H → L	55 µs
• Delay time of high-speed digital inputs [1], approx. (high-speed digital inputs can be used for position detection)	
• L → H	5 µs
• H → L	5 µs
• Max. conductor cross-section	• 1.5 mm^2
Digital outputs (continuously short-circuit-proof)	1 fail-safe digital output
	4 bidirectional non-floating digital inputs/digital outputs
• Voltage	• 24 V DC
• Load current per digital output [2], max.	• 100 mA
• Delay time [1], approx.	• 150 µs
• Max. conductor cross-section	• 1.5 mm^2
Analog input • Internal resistance	-10 … +10 V • 15 kΩ
Encoder evaluation	• Incremental encoder TTL/HTL • SSI encoder without incremental signals (available soon)
• Encoder supply	• 24 V DC/0.35 A or 5 V DC/0.35 A
• Encoder frequency, max.	• 500 kHz
• SSI baud rate	• 100 ... 250 kbaud depending on cable length
• Resolution absolute position SSI	• 30 bit
• Cable length, max.	
- TTL encoder	100 m (328 ft) (only bipolar signals permitted) [3]
- HTL encoder	100 m (328 ft) for unipolar signals 300 m (984 ft) for bipolar signals [3]
- SSI encoder	100 m (328 ft)
Power loss	< 20 W
PE connection	M5 screw
Dimensions	
• Width	• 73 mm (2.87 in)
• Height	• 183.2 mm (7.21 in)
• Depth	• 89.6 mm (3.53 in)
Weight, approx.	0.95 kg (2.09 lbs)
Approvals	cULus (File No.: E164110)

Selection and ordering data

Description	Order No.
CU305 DP Control Unit (without memory card)	**6SL3040-0JA00-0AA0**
CU305 CAN Control Unit (without memory card)	**6SL3040-0JA02-0AA0**

Accessories

Description	Order No.
MMC memory card for CU305 DP and CU305 CAN Control Units	
• empty	**6SL3054-4AG00-0AA0**
• with firmware version V4.1	**6SL3054-4EB00-0AA0**
• with firmware version V4.1 and safety license (extended functions)	**6SL3054-4EB00-0AA0-Z F01**
Safety license (extended functions) for a supplementary/separate order	**6SL3074-0AA10-0AA0**
PROFIBUS connectors	
• without programming device/PC connection	**6ES7972-0BA41-0XA0**
• with programming device/PC connection	**6ES7972-0BB41-0XA0**
STARTER commissioning tool	**6SL3072-0AA00-0AG0**

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[1] The specified delay times refer to the hardware. The actual reaction time depends on the time slice in which the digital input or output is processed.

[2] In order to use the digital outputs, an external 24 V power supply must be connected to terminal X124.

[3] Signal cables twisted in pairs and shielded.

SINAMICS S110 components

Overview

PM340 Power Modules Blocksize format, frame sizes FSA to FSF

The PM340 Power Modules in Blocksize format feature the following connections and interfaces as standard:

- Line connection
- PM-IF interface for connection of the PM340 and CU305 Control Unit. The PM340 also supplies power to the CU305 by means of an integrated power supply
- Terminals DCP/R1 and R2 for connection of an external braking resistor
- Motor connection made with screw terminals or screw studs
- Control circuit for the Safe Brake Relay for controlling a holding brake
- 2 PE/protective conductor connections

PM340 modules without integrated line filter are designed for connection to grounded (TN, TT) and non-grounded (IT) systems.
PM340 modules with integrated line filter are suitable for connection to TN systems only.

When utilizing the integrated Braking Module (Braking Chopper), the temperature of the external braking resistor must be monitored (i.e. thermostatic switch) to provide protection against thermal overloading.

Integration

The PM340 modules communicate with the CU305 via the PM-IF interface.

PM340 with CU305 DP and BOP20

SINAMICS S110 components

PM340 Power Modules Blocksize format

■ Integration
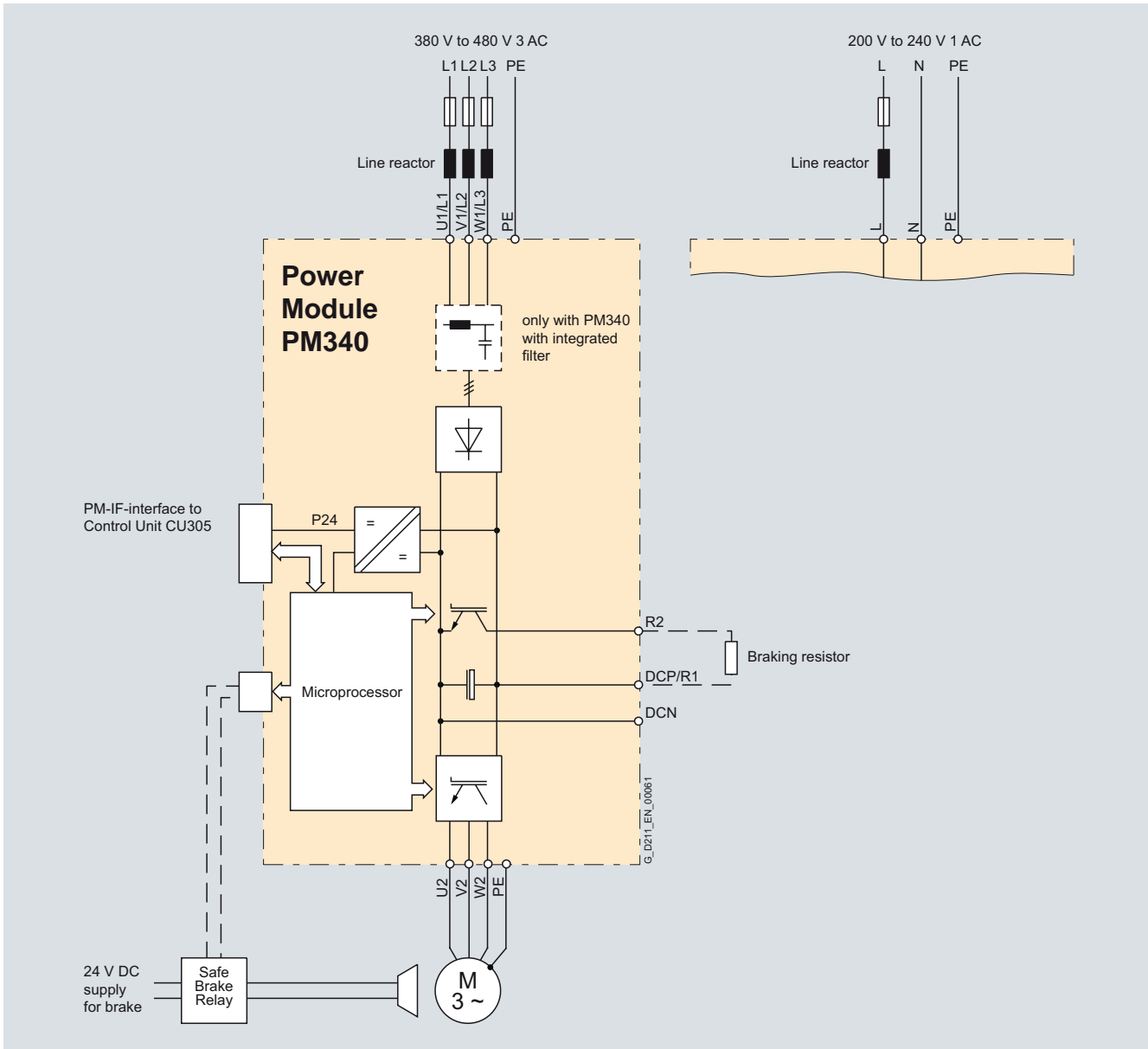
PM340 connection example

Integration

Many system components for PM340 Power Modules are de-signed as base components, i.e. the component is mounted on the baseplate and the PM340 in front of them in a space-saving construction. Up to two base components can be mounted one after another.

	FSA	FSB	FSC	FSD	FSE	FSF
Line filter	✓	–	–	–	–	–
Line reactor	✓	✓	✓	✓	✓	O
Braking resistor	✓	✓	O	O	O	O
Motor reactor	✓	✓	✓	O	O	O

✓ = suitable as base type
O = not suitable as base type
– = not available (use PM340 with integrated line filter)

Basic layout of a PM340 with line reactor as base component

The line-side reactors are equipped with terminals and the reac-tors at the PM340 end with a pre-assembled cable. When in-stalled, the mains terminals are at the top on frame sizes FSA to FSC, and at the bottom on frame sizes FSD and FSE.

PM340 in frame size FSA with line reactor and line filter

If a line filter is installed in addition to the line reactor on frame size FSA, the components must be arranged as shown in the figure above. In this case, the line connection is below.

PM340 in frame size FSA with line reactor and motor reactor

PM340 modules of frame size FSB and higher are available with integrated line filters, alleviating the need for an external line fil-ter.

For configurations involving more than two base-type system components, e.g. line reactor + motor reactor + braking resistor, individual components must be mounted to the side of the PM340. In this instance, the line and motor reactors must be in-stalled behind the PM340 and the braking resistor to the side.

SINAMICS S110 components

PM340 Power Modules Blocksize format

■ **Technical specifications**

General technical specifications	
Electrical data	
Line voltage (up to 2000 m (6562 ft) above sea level)	200 V ... 240 V 1 AC ±10 % (-15 % < 1 min) or
	380 ... 480 V 3 AC ±10 % (-15 % < 1 min)
Line frequency	47 … 63 Hz
Line power factor with rated power	
• Fundamental mode (cos φ_1)	> 0.96
• Total (λ)	
- 200 … 240 V 1 AC	0.45 … 0.7
- 380 … 480 V 3 AC	0.65 … 0.95
Overvoltage category acc. to EN 60664-1	Class III
Precharging frequency of the DC link, max.	1× every 30 s
DC link voltage, approx.	1.35 × line voltage
Output frequency	
• Control type Servo	0 … 650 Hz
Electronics power supply	24 V DC -15 %/+20 %
Radio interference suppression	
• Standard	No interference suppression
• With integrated line filter	Category C2 according to EN 61800-3
Environmental requirements	
Cooling method	Forced air cooling by means of built-in fan
Permissible ambient or coolant temperature (air) in operation for line-side components, Power Modules	0 … 40 °C (32 … 104 °F) without derating, > 40 … 55 °C (104 … 131 °F), see derating characteristics
Installation altitude	Up to 1000 m (3281 ft) above sea level without derating, > 1000 ... 4000 m (3281 ... 13124 ft) above sea level, see derating characteristics
Conformity	CE (low-voltage and EMC Directives)
Approvals	cULus
• 200 … 240 V 1 AC	
- Frame size FSA	File No. E192450
• 380 … 480 V 3 AC	
- Frame size FSA … FSC	File No. E121068
- Frame sizes FSD … FSF	File No. E192450
Safety Integrated	Safety Integrity Level 2 (SIL 2) according to IEC 61508, control category 3 according to EN 954-1 (for further information, see section headed "Safety Integrated")

SINAMICS S110 components

PM340 Power Modules Blocksize format

Selection and ordering data

Rated output current	Type rating	Frame size	PM340 Power Module in Blocksize format **without** line filter	PM340 Power Module in Blocksize format **with** integrated line filter
A	kW (HP)		Order No.	Order No.
Line voltage 200 … 240 V 1 AC				
0.9	0.12 (0.2)	FSA	6SL3210-1SB11-0UA0	6SL3210-1SB11-0AA0
2.3	0.37 (0.5)	FSA	6SL3210-1SB12-3UA0	6SL3210-1SB12-3AA0
3.9	0.75 (1)	FSA	6SL3210-1SB14-0UA0	6SL3210-1SB14-0AA0
Line voltage 380 … 480 V 3 AC				
1.3	0.37 (0.5)	FSA	6SL3210-1SE11-3UA0	–
1.7	0.55 (0.75)	FSA	6SL3210-1SE11-7UA0	–
2.2	0.75 (1)	FSA	6SL3210-1SE12-2UA0	–
3.1	1.1 (1.5)	FSA	6SL3210-1SE13-1UA0	–
4.1	1.5 (2)	FSA	6SL3210-1SE14-1UA0	–
5.9	2.2 (3)	FSB	6SL3210-1SE16-0UA0	6SL3210-1SE16-0AA0
7.7	3 (5)	FSB	6SL3210-1SE17-7UA0	6SL3210-1SE17-7AA0
10.2	4 (5)	FSB	6SL3210-1SE21-0UA0	6SL3210-1SE21-0AA0
18	7.5 (10)	FSC	6SL3210-1SE21-8UA0	6SL3210-1SE21-8AA0
25	11 (15)	FSC	6SL3210-1SE22-5UA0	6SL3210-1SE22-5AA0
32	15 (20)	FSC	6SL3210-1SE23-2UA0	6SL3210-1SE23-2AA0
38	18.5 (25)	FSD	6SL3210-1SE23-8UA0	6SL3210-1SE23-8AA0
45	22 (30)	FSD	6SL3210-1SE24-5UA0	6SL3210-1SE24-5AA0
60	30 (40)	FSD	6SL3210-1SE26-0UA0	6SL3210-1SE26-0AA0
75	37 (50)	FSE	6SL3210-1SE27-5UA0	6SL3210-1SE27-5AA0
90	45 (60)	FSE	6SL3210-1SE31-0UA0	6SL3210-1SE31-0AA0
110	55 (75)	FSF	6SL3210-1SE31-1UA0	6SL3210-1SE31-1AA0
145	75 (100)	FSF	6SL3210-1SE31-5UA0	6SL3210-1SE31-5AA0
178	90 (125)	FSF	6SL3210-1SE31-8UA0	6SL3210-1SE31-8AA0

Accessories

Example of shield connection kit for PM340 frame size FSB

Description	Order No.
Shield connection kit for PM340	
• Frame size FSA	6SL3262-1AA00-0BA0
• Frame size FSB	6SL3262-1AB00-0DA0
• Frame size FSC	6SL3262-1AC00-0DA0
• Frame sizes FSD and FSE	6SL3262-1AD00-0DA0
• Frame size FSF	6SL3262-1AF00-0DA0

SINAMICS S110 components

PM340 Power Modules Blocksize format

Characteristic curves

Overload capability
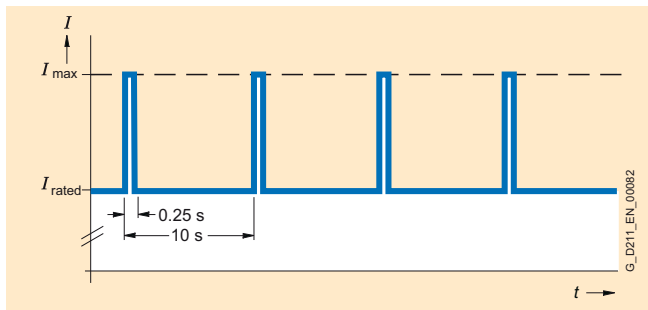
Duty cycle with initial load
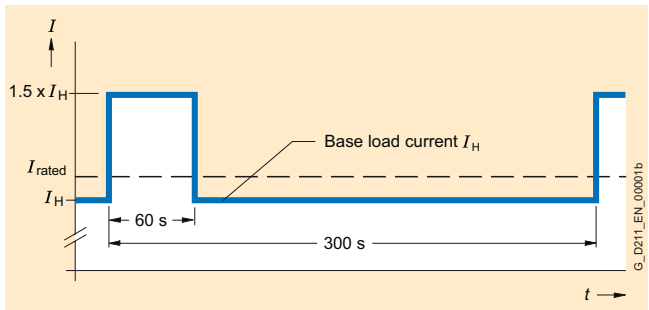
Load cycle with 60 s overload with a load cycle period of 300 s
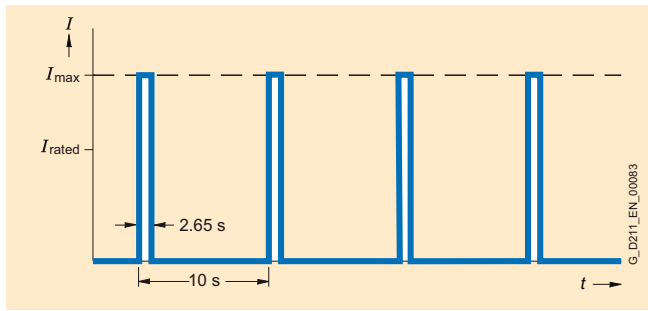
Duty cycle without initial load
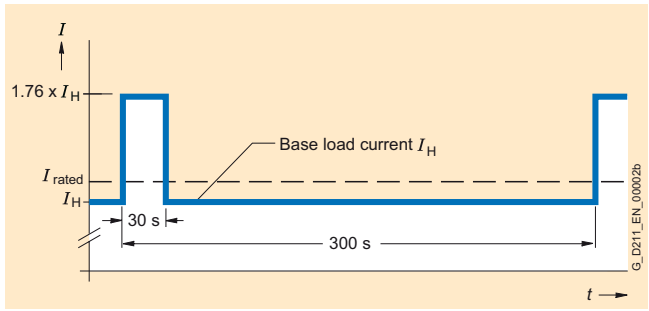
Load cycle with 30 s overload with a load cycle period of 300 s
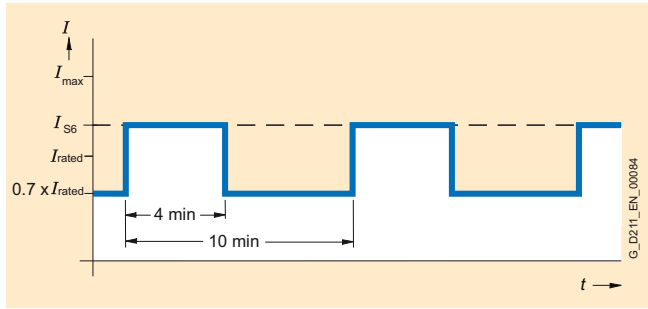
S6 duty cycle with initial load with a duty cycle duration of 600 s
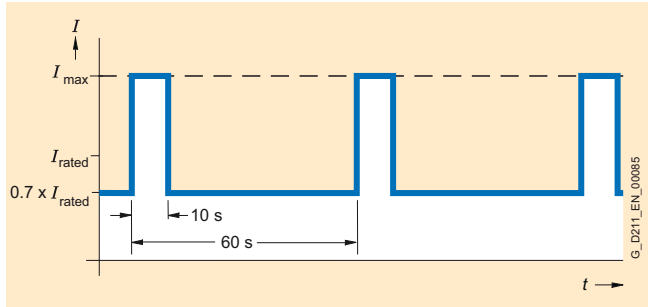
S6 duty cycle with initial load with a duty cycle duration of 60 s

Caracteristic curves (continued)

Derating characteristics

- Frame sizes FSA to FSE
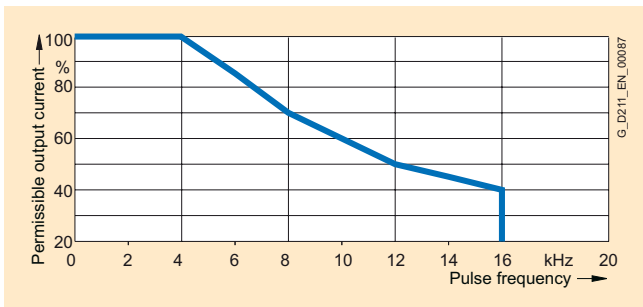
Output current as a function of pulse frequency

- Frame sizes FSF
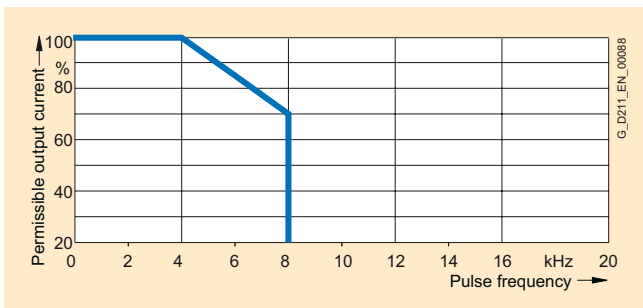
Output current as a function of pulse frequency
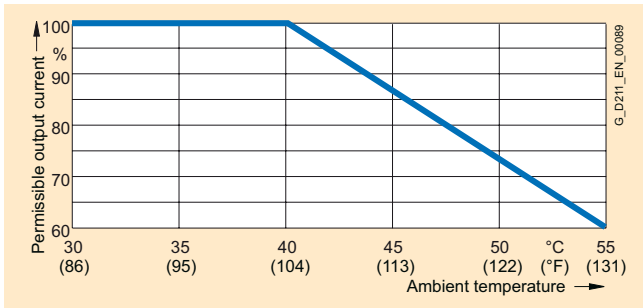
Output current as a function of ambient temperature
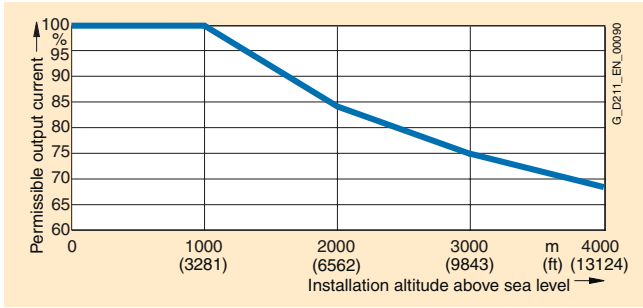
Output current as a function of installation altitude
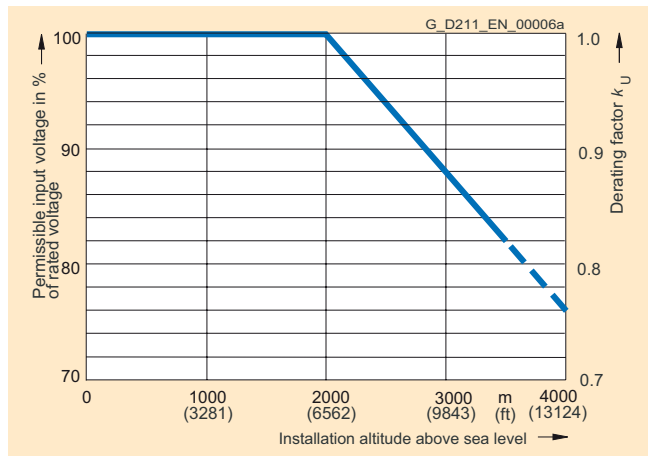
Voltage derating as a function of installation altitude

SINAMICS S110 components
Line-side components

Line reactors

■ **Selection and ordering data**

Rated output current	Rated power	Suitable for PM340 Power Module		Line reactor
A	kW (HP)	Type	Frame size	Order No.
Line voltage 200 … 240 V 1 AC				
0.9	0.12 (0.2)	6SL3210-1SB11-0...	FSA	**6SE6400-3CC00-4AB3**
2.3	0.37 (0.5)	6SL3210-1SB12-3...		
3.9	0.75 (1)	6SL3210-1SB14-0...	FSA	**6SE6400-3CC01-0AB3**
Line voltage 380 … 480 V 3 AC				
1.3	0.37 (0.5)	6SL3210-1SE11-3UA0	FSA	**6SE6400-3CC00-2AD3**
1.7	0.55 (0.75)	6SL3210-1SE11-7UA0		
2.2	0.75 (1)	6SL3210-1SE12-2UA0	FSA	**6SE6400-3CC00-4AD3**
3.1	1.1 (1.5)	6SL3210-1SE13-1UA0		
4.1	1.5 (2)	6SL3210-1SE14-1UA0	FSA	**6SE6400-3CC00-6AD3**
5.9	2.2 (3)	6SL3210-1SE16-0...	FSB	**6SL3203-0CD21-0AA0**
7.7	3 (5)	6SL3210-1SE17-7...		
10	4 (5)	6SL3210-1SE21-0...	FSB	**6SL3203-0CD21-4AA0**
18	7.5 (10)	6SL3210-1SE21-8...	FSC	**6SL3203-0CD22-2AA0**
25	11 (15)	6SL3210-1SE22-5...		
32	15 (20)	6SL3210-1SE23-2...	FSC	**6SL3203-0CD23-5AA0**
38	18.5 (25)	6SL3210-1SE23-8...	FSD	**6SL3203-0CJ24-5AA0**
45	22 (30)	6SL3210-1SE24-5...		
60	30 (40)	6SL3210-1SE26-0...	FSD	**6SL3203-0CD25-3AA0**
75	37 (50)	6SL3210-1SE27-5...	FSE	**6SL3203-0CJ28-6AA0**
90	45 (60)	6SL3210-1SE31-0...		
110	55 (75)	6SL3210-1SE31-1...	FSF	**6SE6400-3CC11-2FD0**
145	75 (100)	6SL3210-1SE31-5...		
178	90 (125)	6SL3210-1SE31-8...	FSF	**6SE6400-3CC11-7FD0**

Line filter

■ **Selection and ordering data**

Suitable for Power Module PM340 Frame size FSA	Line filter
Type	Order No.
Line voltage 380 … 480 V 3 AC	
6SL3210-1SE11-... 6SL3210-1SE12-... 6SL3210-1SE13-... 6SL3210-1SE14-...	**6SE6400-2FA00-6AD0**

Overview

Braking resistors in Blocksize format, frame size FSA and FSC

The PM340 Power Modules cannot regenerate into the line supply. For regenerative operation, e.g. the braking of a rotating mass, a braking resistor must be connected to convert the resulting energy into heat.

The braking resistor is connected at terminals DCP/R1 and R2.

The braking resistors can be installed at the side next to the PM340 Power Modules. The braking resistors for the FSA and FSB frame sizes are designed as base components. If the PM340 Power Modules of the FSA or FSB frame sizes are operated without line reactor, the braking resistors can also be installed under the Power Modules.

The braking resistors for the Power Modules of the FSC to FSF frame sizes should be placed outside the control cabinet or the switchgear room in order to direct the resulting heat loss away from the Power Modules, thereby allowing a corresponding reduction in the level of air conditioning required.

The braking resistors are designed with a temperature switch. The temperature switch must be evaluated to prevent consequential damage if the braking resistor overheats. This can be done, for example, via an entry of the Control Unit while configuring a correspondant error.

Selection and ordering data

Description	Suitable for PM340 Power Module Blocksize format	Order No.
DC link voltage 240 … 360 V DC (Line voltage 200 … 240 V 1 AC)		
Braking resistor		
• 180 Ω	Frame size FSA	**6SE6400-4BC05-0AA0**
DC link voltage 510 … 720 V DC (Line voltage 380 … 480 V 3 AC)		
Braking resistor		
• 390 Ω	Frame size FSA	**6SE6400-4BD11-0AA0**
• 160 Ω	Frame size FSB	**6SL3201-0BE12-0AA0**
• 56 Ω	Frame size FSC	**6SE6400-4BD16-5CA0**
• 27 Ω	Frame size FSD	**6SE6400-4BD21-2DA0**
• 15 Ω	Frame size FSE	**6SE6400-4BD22-2EA0**
• 8.2 Ω	Frame size FSF	**6SE6400-4BD24-0FA0**

Characteristic curves
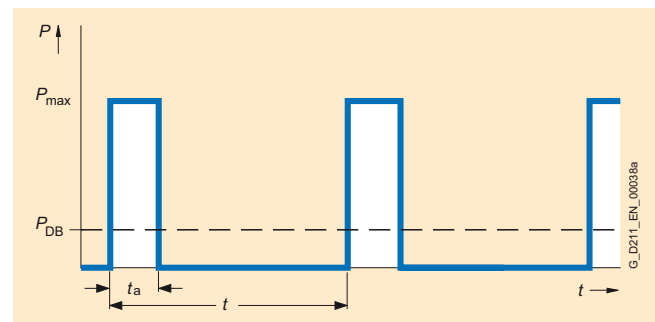
Load diagram for Braking Module in Blocksize format

t_a = 12 s
t = 240 s

More information

For further information see Catalog PM 21.
http://www.siemens.com/motioncontrol/docu

SINAMICS S110 components
DC link components

Braking resistors

■ Technical specifications

DC link voltage 240 … 360 V DC	Braking resistor 6SE6400-4BC05-0AA0
Resistor	180 Ω
Rated power P_{DB}	0.05 kW
Peak power P_{max}	1 kW
Degree of protection [1]	IP20
Power connections	3 × 1.5 mm² (shielded)
• Length	0.5 m (1.64 ft)
Thermostatic switch (NC contact)	
• Switching capacity	250 V AC/max. 2.5 A
• Conductor cross section	0.5 … 2.5 mm²
Dimensions	
• Width	72 mm (2.83 in)
• Height	230 mm (9.06 in)
• Depth	43.5 mm (1.71 in)
Weight, approx.	1.0 kg (2.2 lbs)
Approvals	cURus
Suitable for PM340 Power Module Blocksize format	FSA

DC link components 510 V … 720 V DC		Braking resistor 6SE6400-4BD11-0AA0	6SL3201-0BE12-0AA0	6SE6400-4BD16-5CA0	6SE6400-4BD21-2DA0	6SE6400-4BD22-2EA0	6SE6400-4BD24-0FA0
Resistor	W	390	160	56	27	15	8.2
Rated power P_{DB}	kW	0.1	0.2	0.65	1.2	2.2	4.0
Peak power P_{max}	kW	1.7	4.1	12	24	44	80
Degree of protection [1]		IP20	IP20	IP20	IP20	IP20	IP20
Power connections		3 × 1.5 mm² (shielded)	3 × 1.5 mm² (shielded)	3 × 1.5 mm² (shielded)	M6 screw studs	M6 screw studs	M6 screw studs
• Length	m	0.5 (1.64 ft)	0.5 (1.64 ft)	0.9 (2.95 ft)	–	–	–
Thermostatic switch (NC contact)							
• Switching capacity		250 V AC/ max. 2.5 A	250 V AC/ max. 2.5 A	250 V AC/ max. 2.5 A	250 V AC/ max. 2.5 A	250 V AC/ max. 2.5 A	250 V AC/ max. 2.5 A
• Conductor cross-section	mm²	0.5 … 2.5	0.5 … 2.5	0.5 … 2.5	0.5 … 2.5	0.5 … 2.5	0.5 … 2.5
Dimensions							
• Width	mm	72 (2.83 in)	153 (6.02 in)	185 (7.28 in)	270 (10.63 in)	270 (10.63 in)	400 (15.75 in)
• Height	mm	230 (9.06 in)	329 (12.95 in)	285 (11.22 in)	515 (20.28 in)	645 (25.39 in)	650 (25.59 in)
• Depth	mm	43.5 (1.71 in)	43.5 (1.71 in)	150 (5.91 in)	175 (6.89 in)	175 (6.89 in)	315 (12.40 in)
Weight, approx.	kg	1.0 (2.2 lbs)	1.6 (3.5 lbs)	3.8 (8.4 lbs)	7.4 (16.3 lbs)	10.6 (23.4 lbs)	16.7 (36.8 lbs)
Approvals		cURus	cURus	cURus	cURus	cURus	cURus
Suitable for PM340 Power Module Blocksize format		FSA	FSB	FSC	FSD	FSE	FSF

[1] With correctly connected load connection cable.

BOP20 Basic Operator Panel

Overview

BOP20 Basic Operator Panel

The BOP20 Basic Operator Panel can be inserted on any CU305 Control Unit and may be used for fault acknowledgement, for parameter setting and for read-out of diagnostic information (e.g. warnings and faults).

Design

The BOP20 basic operator panel has a backlit two-line display area and 6 keys.

The integrated plug connector on the back is used for the power supply of the BOP20 and the communication with the Control Unit.

Integration

CU305 with mounted BOP20

Selection and ordering data

Description	Order No.
BOP20 Basic Operator Panel	**6SL3055-0AA00-4BA0**

SINAMICS S110 components
Supplementary system components

Safe Brake Relay

■ Overview

In the case of the Safe Brake Relay, the brake is controlled in accordance with EN 954-1 safety class 3 and IEC 61508 SIL2 (available soon).

■ Design

The Safe Brake Relay can be installed below the Power Module on the shield connection plate.

The supplied Safe Brake Relay includes the cable harness (CTRL) for connection with the Power Module.

The Safe Brake Relay has the following connections and interfaces:

• 1 two-channel transistor output stage to control the motor brake solenoid
• 1 connection for the cable harness (CTRL) to the Power Module in Blocksize format
• 1 connection for the 24 V DC power supply

The connection between the 24 V DC supply and the Safe Brake Relay must be kept as short as possible.

■ Technical specifications

	Safe Brake Relay
Supply voltage	20.4 … 28.8 V DC
	Recommended rated supply voltage 26 V DC
	(to compensate for voltage drop in feeder cable to 24 V DC motor brake solenoid)
Current requirement	
• of motor brake, max.	2 A
• with 24 V DC, max.	0.05 A + the current requirement of motor brake
Conductor cross-section, max.	2.5 mm^2
Dimensions	
• Width	69 mm (2.72 in)
• Height	63 mm (2.48 in)
• Depth	33 mm (1.30 in)
Weight, approx.	0.17 kg (0.37 lb)

■ Selection and ordering data

Description	Order No.
Safe Brake Relay (including cable harness for connection to Power Module)	**6SL3252-0BB01-0AA0**

■ Integration
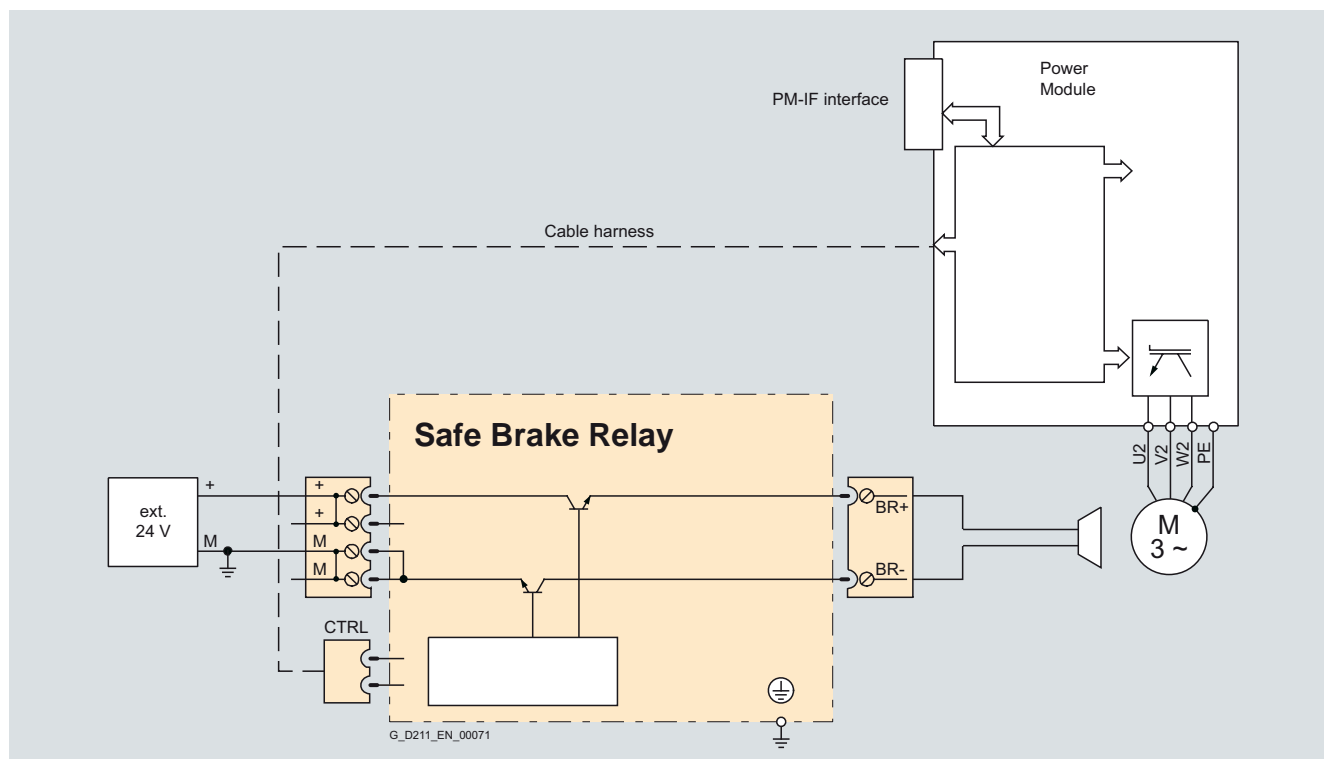
Connection example of Safe Brake Relay

The 24 V DC solenoid of the motor brake is directly connected to the Safe Brake Relay. External overvoltage limiters are not required.

Overview

The SMC10 Sensor Module Cabinet-Mounted is required to evaluate the encoders of motors without a DRIVE-CLiQ interface. External encoders can also be connected via the SMC10.

The following encoder signals can be evaluated:

- 2-pole resolver
- Multipole resolver

Design

The SMC10 features the following interfaces as standard:

- 1 DRIVE-CLiQ interface
- 1 encoder connection, including motor temperature detection (KTY84-130 or PTC) via SUB-D connector
- 1 connection for the electronics power supply via the 24 V DC power supply connector
- 1 PE/ground conductor connection

The status of the SMC10 Sensor Module Cabinet-Mounted is indicated via a multi-color LED. The SMC10 Sensor Module Cabinet-Mounted can be snapped on a TH 35 top-hat rail in accordance with EN 60715 (IEC 60715).

The signal cable shield is connected via the encoder system connector and can also be connected to the SMC10 via a shield connection terminal, e.g. Phoenix Contact type SK8 or Weidmüller type KLBÜ CO 1.

Integration

The SMC10 communicates with a Control Unit via DRIVE-CLiQ.

Technical specifications

SMC10 Sensor Module Cabinet-Mounted	
Current requirement, max. at 24 V DC, not taking encoder into account	0.2 A
• Conductor cross-section, max.	2.5 mm^2
• Fuse protection, max.	20 A
Power loss	< 10 W
Encoders which can be evaluated	• 2-pole resolvers • Multipole resolvers
• Excitation voltage, rms	4.1 V
• Excitation frequency	5 ... 10 kHz depending on the current controller clock cycle of the Motor Module or Power Module
• Transformation ratio	0.5
• Encoder frequency, max.	2 kHz (120,000 rpm) depending on the number of resolver pole pairs and current controller clock cycle of the Motor Module or Power Module
• Signal subdivision (interpolation), max.	16384 times (14 bit)
• Cable length to encoder, max.	130 m (427 ft)
PE connection	M4 screw
Dimensions	
• Width	50 mm (1.97 in)
• Height	150 mm (5.91 in)
• Depth	111 mm (4.37 in)
Weight, approx.	0.8 kg (1.76 lb)
Approvals	cULus (File No.: E164110)

Selection and ordering data

Description	Order No.
SMC10 Sensor Module Cabinet-Mounted (without DRIVE-CLiQ cable)	**6SL3055-0AA00-5AA0**

SINAMICS S110 components
Supplementary system components

SMC20 Sensor Module Cabinet-Mounted

■ Overview

The SMC20 Sensor Module Cabinet-Mounted is required to evaluate the encoders of motors without a DRIVE-CLiQ interface. External encoders can also be connected via the SMC20.

The following encoder signals can be evaluated:

- Incremental encoder sin/cos 1 V_{pp}
- Absolute encoder EnDat
- SSI encoder with incremental signals sin/cos 1 V_{pp}

The motor temperature can also be detected using KTY84-130 or PTC thermistors.

■ Design

The SMC20 features the following interfaces as standard:
- 1 DRIVE-CLiQ interface
- 1 encoder connection, including motor temperature detection (KTY84-130 or PTC) via SUB-D connector
- 1 connection for the electronics power supply via the 24 V DC power supply connector
- 1 PE/ground conductor connection

The status of the SMC20 is indicated via a multi-color LED. It can be snapped on a TH 35 top-hat rail in accordance with EN 60715 (IEC 60715).

The signal cable shield is connected via the encoder system connector and can also be connected to the SMC20 via a shield connection terminal, e.g. Phoenix Contact type SK8 or Weidmüller type KLBÜ CO 1.

■ Integration

The SMC20 communicates with a Control Unit via DRIVE-CLiQ.

■ Technical specifications

SMC20 Sensor Module Cabinet-Mounted	
Current requirement, max. at 24 V DC, not taking encoder into account	0.2 A
• Conductor cross-section, max.	2.5 mm^2
• Fuse protection, max.	20 A
Power loss	< 10 W
Encoders which can be evaluated	• Incremental encoder sin/cos 1 V_{pp} • Absolute encoder EnDat • SSI encoder with incremental signals sin/cos 1 V_{pp}
• Encoder supply	5 V DC/0.35 A
• Encoder frequency incremental signals, max.	500 kHz
• Signal subdivision (interpolation), max.	16384 times (14 bit)
• SSI baud rate	100 kBaud
• Cable length to encoder, max.	100 m (328 ft)
PE connection	M4 screw
Dimensions	
• Width	30 mm (1.18 in)
• Height	150 mm (5.91 in)
• Depth	111 mm (4.37 in)
Weight, approx.	0.45 kg (0.99 lb)
Approvals	cULus (File No.: E164110)

■ Selection and ordering data

Description	Order No.
SMC20 Sensor Module Cabinet-Mounted (without DRIVE-CLiQ cable)	**6SL3055-0AA00-5BA2**

Synchronous motors

Overview

1FK7 motors are extremely compact, permanent-magnet synchronous motors. The available options, gearboxes and encoders, together with the expanded product range, mean that the 1FK7 motors can be optimally adapted to any application. They therefore also satisfy the permanently increasing demands of state-of-the-art machine generations.

1FK7 motors can be combined with the SINAMICS S110 drive system to create a powerful system with high functionality. The integrated encoder systems for speed and position control can be selected depending on the application.

The motors are designed for operation without external cooling as the heat is dissipated through the motor surface. 1FK7 motors have a high overload capability.

Benefits

1FK7 Compact motors offer:

- Space-saving installation due to extremely high power density
- For universal applications
- Wide range of motors

1FK7 High Dynamic motors offer:

- Extremely high dynamic response due to low rotor moment of inertia

Application

- Machine tools
- Robots and manipulators
- Stacking units
- Mounting machines
- Lab automation
- Metal working
- Wood, glass, ceramics and stone working
- Printing machines
- Plastics machines

Technical specifications

Type of motor	Permanent-magnet synchronous motor
Magnet material	Rare-earth magnet material
Cooling	Natural cooling
Temperature monitoring	KTY 84 temperature sensor in the stator winding
Insulation of the stator winding in accordance with EN 60034-1 (IEC 60034-1)	Temperature class 155 (F) for a winding temperature rise of $\Delta T = 100$ K at an ambient temperature of 40 °C (104 °F)
Type of construction in accordance with EN 60034-7 (IEC 60034-7)	IM B5 (IM V1, IM V3)

[1] 1FK701 only available in degree of protection IP54 and anthracite paint finish, no rating plate in NDE cover, planetary gearbox not available.

1FK7 motors for SINAMICS S110

Degree of protection in accordance with EN 60034-5 (IEC 60034-5) [1]	IP64
Shaft extension on the drive end in accordance with DIN 748-3 (IEC 60072-1)	Plain shaft
Shaft and flange accuracy in accordance with DIN 42955 (IEC 60072-1) [2]	Tolerance N
Vibration magnitude in accordance with EN 60034-14 (IEC 60034-14)	Grade A maintained up to rated speed
Sound pressure level L_{pA} (1 m) in accordance with DIN EN ISO 1680, max.	
• 1FK701 ... 1FK704	55 dB (A)
• 1FK706	65 dB (A)
• 1FK708 ... 1FK710	70 dB (A)

Built-in encoder systems for motors without DRIVE-CLiQ interface	• Incremental encoder sin/cos 1 V_{pp} 2048 S/R
	• Absolute encoder, multi-turn with EnDat interface (traversing range 4096 revolutions)
	  1FK704 ... 1FK710: 2048 S/R
	  1FK702 ... 1FK703: 512 S/R
	  1FK704 ... 1FK710: 32 S/R
	  1FK701 ... 1FK703: 16 S/R
	• Multi-pole resolver (number of poles corresponds to number of pole pairs of the motor)
	• 2-pole resolver

Built-in encoder systems for motors with DRIVE-CLiQ interface	• 22 bit incremental encoder (2048 S/R internal)
	• Absolute encoder single-turn + 12 bit multi-turn (traversing range 4096 revolutions)
	  1FK704 ... 1FK710:
	  22 bit single-turn (2048 S/R internal)
	  1FK702 ... 1FK703:
	  20 bit single-turn (512 S/R internal)
	  1FK704 ... 1FK710:
	  16 bit single-turn (32 S/R internal)
	  1FK702 ... 1FK703:
	  15 bit single-turn (16 S/R internal)
	• 15 bit resolver
	• 14 bit resolver

Connection	Connectors for signals and power can be rotated (270°)
Paint finish [1]	Unpainted
2nd rating plate [1]	Attached in the NDE cover
3rd rating plate	Enclosed separately
Options [1]	• Shaft extension on the drive end with fitted key and keyway (half-key balancing) • Built-in holding brake • Degree of protection IP65, plus DE flange IP67 • Planetary gearbox, assembled (requirement: plain shaft extension, degree of protection IP64 for LP+ and IP65 for SP+) • Anthracite paint finish RAL 7016

S/R = signals/revolution

More information

For further information see Catalog PM 21.
http://www.siemens.com/motioncontrol/docu

[2] Shaft extension run-out, concentricity of centering ring and shaft, and perpendicularity of flange to shaft.

Synchronous motors

1FK7 Compact motors
Natural cooling

Selection and ordering data

Rated speed	Shaft height	Rated power	Static torque	Rated torque[1]	Rated current	1FK7 Compact synchronous motor Natural cooling	Number of pole pairs	Rotor moment of inertia (without brake)	Weight (without brake)
n_{rated}	SH	P_{rated} at ΔT=100 K	M_0 at ΔT=100 K	M_{rated} at ΔT=100 K	I_{rated} at ΔT=100 K			J	m
rpm		kW (HP)	Nm (lb_f-ft)	Nm (lb_f-ft)	A	Order No.		10^{-4} kgm² (10^{-3} lb_f-in-s²)	kg (lb)
2000	100	4.29 (5.75)	27.0 (19.9)	20.5 (15.1)	9.6	**1FK7101-5AC71-1■ ■ ■**	4	79.9 (70.7)	21.0 (46.3)
		5.23 (7.01)	36.0 (26.6)	25.0 (18.4)	11.5	**1FK7103-5AC71-1■ ■ ■**	4	105.0 (92.9)	29.0 (63.9)
		7.75 (10.4)	48.0 (35.4)	37.0 (27.3)	16.0	**1FK7105-5AC71-1■ ■ ■**	4	156.0 (138)	39.0 (86.2)
3000	48	0.82 (1.1)	3.0 (2.2)	2.6 (1.9)	1.95	**1FK7042-5AF71-1■ ■ ■**	4	3.01 (2.66)	4.9 (10.8)
	63	1.48 (2.0)	6.0 (4.4)	4.7 (3.5)	3.7	**1FK7060-5AF71-1■ ■ ■**	4	7.95 (7.04)	7.0 (15.4)
		2.29 (3.1)	11.0 (8.2)	7.3 (5.4)	5.6	**1FK7063-5AF71-1■ ■ ■**	4	15.1 (13.3)	11.5 (25.4)
	80	2.14 (2.9)	8.0 (5.9)	6.8 (5.0)	4.4	**1FK7080-5AF71-1■ ■ ■**	4	15.0 (13.2)	10.0 (22.1)
		3.3 (4.4)	16.0 (11.8)	10.5 (7.7)	7.4	**1FK7083-5AF71-1■ ■ ■**	4	27.3 (24.1)	14.0 (30.9)
	100	3.77 (5.1)	18.0 (13.3)	12.0 (8.8)	8.0	**1FK7100-5AF71-1■ ■ ■**	4	55.3 (48.9)	19.0 (41.9)
		4.87 (6.5)	27.0 (19.9)	15.5 (11.4)	11.8	**1FK7101-5AF71-1■ ■ ■**	4	79.9 (70.7)	21.0 (46.3)
		5.37 (7.2)[2]	36.0 (26.6)	20.5 (15.1)[2]	16.5[2]	**1FK7103-5AF71-1■ ■ ■**	4	105.0 (92.9)	29.0 (63.9)
		8.17 (11.0)	48.0 (35.4)	26.0 (19.2)	18.0	**1FK7105-5AF71-1■ ■ ■**	4	156.0 (138)	39.0 (86.2)
4500	63	1.74 (2.3)	6.0 (4.4)	3.7 (2.7)	4.1	**1FK7060-5AH71-1■ ■ ■**	4	7.95 (7.04)	7.0 (15.4)
		2.09 (2.8)[3]	11.0 (8.2)	5.0 (3.7)[3]	6.1[3]	**1FK7063-5AH71-1■ ■ ■**	4	15.1 (13.3)	11.5 (25.4)
	80	2.39 (3.2)[3]	8.0 (5.9)	5.7 (4.2)[3]	5.6[3]	**1FK7080-5AH71-1■ ■ ■**	4	15.0 (13.2)	10.0 (22.1)
		3.04 (4.1)[4]	16.0 (11.8)	8.3 (6.1)[4]	9.0[4]	**1FK7083-5AH71-1■ ■ ■**	4	27.3 (24.1)	14.0 (30.9)
6000	20	0.05 (0.1)	0.18 (0.1)	0.08 (0.1)	0.85	**1FK7011-5AK71-1■ ■ 3**	4	0.064 (0.06)	0.9 (2.0)
		0.10 (0.1)	0.35 (0.3)	0.16 (0.1)	0.85	**1FK7015-5AK71-1■ ■ 3**	4	0.083 (0.08)	1.1 (2.4)
	28	0.43 (0.6)	0.85 (0.6)	0.6 (0.4)	1.4	**1FK7022-5AK71-1■ ■ ■**	3	0.28 (0.25)	1.8 (4.0)
	36	0.50 (0.7)	1.1 (0.8)	0.8 (0.6)	1.3	**1FK7032-5AK71-1■ ■ ■**	3	0.61 (0.54)	2.7 (6.0)
		0.63 (0.8)	1.6 (1.2)	1.0 (0.7)	1.3	**1FK7034-5AK71-1■ ■ ■**	3	0.9 (0.80)	3.7 (8.2)
	48	0.69 (0.9)	1.6 (1.2)	1.1 (0.8)	1.7	**1FK7040-5AK71-1■ ■ ■**	4	1.69 (1.50)	3.5 (7.7)
		1.02 (1.4)[5]	3.0 (2.2)	1.95 (1.4)[5]	3.1[5]	**1FK7042-5AK71-1■ ■ ■**	4	3.01 (2.66)	4.9 (10.8)

Encoder systems for motors without DRIVE-CLiQ-interface:	Incremental encoder sin/cos 1 V$_{pp}$ 2048 S/R		A
	Absolute encoder EnDat 2048 S/R [1] (not for 1FK701 to 1FK703)		E
	Absolute encoder EnDat 512 S/R [1] (only for 1FK702 to 1FK703)		H
	Absolute encoder EnDat 32 S/R [1] (not for 1FK701 to 1FK703)		G
	Absolute encoder EnDat 16 S/R [1] (only for 1FK701 to 1FK703)		J
	Multi-pole resolver		S
	2-pole resolver		T
Encoder systems for motors with DRIVE-CLiQ-interface [6]:	22 bit incremental encoder (not for 1FK701)		D
	22 bit absolute encoder, single-turn +12 bit multi-turn [1] (not for 1FK701 bis 1FK703)		F
	20 bit absolute encoder, single-turn +12 bit multi-turn [1] (only for 1FK702/1FK703)		L
	16 bit absolute encoder, single-turn +12 bit multi-turn [1] (not for 1FK701 bis 1FK703)		K
	15 bit absolute encoder, single-turn +12 bit multi-turn [1] (only for 1FK702/1FK703)		V
	15 bit resolver (not for 1FK701)		U
	14 bit resolver (not for 1FK701)		P
Shaft extension:	**Shaft and flange accuracy:**	**Holding brake:**	
Fitted key and keyway	Tolerance N	without	A
Fitted key and keyway	Tolerance N	with	B
Plain shaft	Tolerance N	without	G
Plain shaft	Tolerance N	with	H
Degree of protection:	IP64 (not for 1FK701)		0
	IP65 and DE flange IP67 (not for 1FK701)		2
	IP64 (IP54 for 1FK701) and anthracite paint finish		3
	IP65 and DE flange IP67, anthracite paint finish (not for 1FK701)		5

■ **Selection and ordering data**

Motor type (continued)	Static current	SINAMICS S110 Power Module		Power cable with complete shield		
		Rated output current [7]	Blocksize format	Motor connection (and brake connection) via power connector		
				Power connector	Cable cross-section [8]	Pre-assembled cable MOTION-CONNECT 500
	I_0 at M_0 ΔT=100 K	I_{rated}				
	A	A	Order No.	Size	mm²	Order No.
1FK7101-5AC71...	12.3	18.0	**6SL3210-1SE21-8■A0**	1.5	4 x 1.5	**6FX5002-5■G21-....**
1FK7103-5AC71...	14.7	18.0	**6SL3210-1SE21-8■A0**	1.5	4 x 1.5	**6FX5002-5■G21-....**
1FK7105-5AC71...	20.0	25.0	**6SL3210-1SE22-5■A0**	1.5	4 x 2.5	**6FX5002-5■G31-....**
1FK7042-5AF71...	2.2	2.2	**6SL3210-1SE12-2UA0**	1	4 x 1.5	**6FX5002-5■G01-....**
1FK7060-5AF71...	4.5	5.9	**6SL3210-1SE16-0■A0**	1	4 x 1.5	**6FX5002-5■G01-....**
1FK7063-5AF71...	8.0	10.2	**6SL3210-1SE21-0■A0**	1	4 x 1.5	**6FX5002-5■G01-....**
1FK7080-5AF71...	4.8	5.9	**6SL3210-1SE16-0■A0**	1	4 x 1.5	**6FX5002-5■G01-....**
1FK7083-5AF71...	10.4	18.0	**6SL3210-1SE21-8■A0**	1	4 x 1.5	**6FX5002-5■G01-....**
1FK7100-5AF71...	11.2	18.0	**6SL3210-1SE21-8■A0**	1	4 x 1.5	**6FX5002-5■G01-....**
1FK7101-5AF71...	19.0	25.0	**6SL3210-1SE22-5■A0**	1.5	4 x 2.5	**6FX5002-5■G31-....**
1FK7103-5AF71...	27.5	32.0	**6SL3210-1SE23-2■A0**	1.5	4 x 4	**6FX5002-5■G41-....**
1FK7105-5AF71...	31.0	32.0	**6SL3210-1SE23-2■A0**	1.5	4 x 10	**6FX5002-5■G61-....**
1FK7060-5AH71...	6.2	7.7	**6SL3210-1SE17-7■A0**	1	4 x 1.5	**6FX5002-5■G01-....**
1FK7063-5AH71...	12.0	18.0	**6SL3210-1SE21-8■A0**	1	4 x 1.5	**6FX5002-5■G01-....**
1FK7080-5AH71...	7.4	7.7	**6SL3210-1SE17-7■A0**	1	4 x 1.5	**6FX5002-5■G01-....**
1FK7083-5AH71...	15.0	18.0	**6SL3210-1SE21-8■A0**	1	4 x 1.5	**6FX5002-5■G01-....**
1FK7011-5AK71...	1.5	1.7	**6SL3210-1SE11-7UA0**	0.5	4 x 1.5	**6FX5002-5DA30-....**
1FK7015-5AK71...	1.5	1.7	**6SL3210-1SE11-7UA0**	0.5	4 x 1.5	**6FX5002-5DA30-....**
1FK7022-5AK71...	1.8	2.2	**6SL3210-1SE12-2UA0**	1	4 x 1.5	**6FX5002-5■G01-....**
1FK7032-5AK71...	1.7	1.7	**6SL3210-1SE11-7UA0**	1	4 x 1.5	**6FX5002-5■G01-....**
1FK7034-5AK71...	1.9	2.2	**6SL3210-1SE12-2UA0**	1	4 x 1.5	**6FX5002-5■G01-....**
1FK7040-5AK71...	2.25	3.1	**6SL3210-1SE13-1UA0**	1	4 x 1.5	**6FX5002-5■G01-....**
1FK7042-5AK71...	4.4	5.9	**6SL3210-1SE16-0■A0**	1	4 x 1.5	**6FX5002-5■G01-....**

Line filter:		
without line filter	**U**	
with integrated line filter	**A**	

Without brake cores		**C**
With brake cores		**D**

For length code as well as power and signal cables, see MOTION-CONNECT connection system.	**....**

[1] If the absolute encoder is used, M_{rated} is reduced by 10 %.

[2] These values refer to n = 2500 rpm.

[3] These values refer to n = 4000 rpm.

[4] These values refer to n = 3500 rpm.

[5] These values refer to n = 5000 rpm.

[6] Motors with shaft height 20 are not available with a DRIVE-CLiQ interface. The encoder systems are connected via the SMC (Sensor Module Cabinet-Mounted).

[7] With default setting of the pulse frequency.

[8] The current carrying capacity of the power cables complies with EN 60204-1 for installation type C, for continuous duty at an ambient air temperature of 40 °C (104 °F).

Synchronous motors

1FK7 High Dynamic motors
Natural cooling

Selection and ordering data

Rated speed	Shaft height	Rated power	Static torque	Rated torque[1]	Rated current	1FK7 High Dynamic synchronous motor Natural cooling	Number of pole pairs	Rotor moment of inertia (without brake)	Weight (without brake)
n_{rated}	SH	P_{rated} at $\Delta T=100$ K	M_0 at $\Delta T=100$ K	M_{rated} at $\Delta T=100$ K	I_{rated} at $\Delta T=100$ K			J	m
rpm		kW (HP)	Nm (lb_f-ft)	Nm (lb_f-ft)	A	Order No.		10^{-4} kgm^2 (10^{-3} lb_f-in-s^2)	kg (lb)
3000	48	1.1 (1.48)	4.0 (2.9)	3.5 (2.6)	4	**1FK7044-7AF71-1■ ■ ■**	3	1.28 (1.13)	7.7 (17)
	63	1.7 (2.28)	6.4 (4.7)	5.4 (4.0)	5.3	**1FK7061-7AF71-1■ ■ ■**	3	3.4 (3.01)	10.0 (22.1)
		2.51 (3.37)	12.0 (8.8)	8.0 (5.9)	7.5	**1FK7064-7AF71-1■ ■ ■**	3	6.5 (5.75)	15.5 (34.2)
	80	3.14 (4.21) [2]	22.0 (16.2)	12.0 (8.8) [2]	12.5 [2]	**1FK7085-7AF71-1■ ■ ■**	4	23.0 (20.3)	23.5 (51.8)
		3.77 (5.06) [3]	28.0 (20.6)	18.0 (13.3) [3]	14.5 [3]	**1FK7086-7AF71-1■ ■ ■**	4	23.0 (20.3)	23.5 (51.8)
4500	48	1.23 (1.65)	3.1 (2.3)	2.6 (1.9)	4	**1FK7043-7AH71-1■ ■ ■**	3	1.0 (0.89)	6.3 (13.9)
		1.41 (1.89)	4.0 (2.9)	3.0 (2.2)	4.9	**1FK7044-7AH71-1■ ■ ■**	3	1.28 (1.13)	7.7 (17)
	63	2.03 (2.72)	6.4 (4.7)	4.3 (3.2)	5.9	**1FK7061-7AH71-1■ ■ ■**	3	3.4 (3.01)	10.0 (22.1)
		2.36 (3.16)	12.0 (8.8)	5.0 (3.7)	7	**1FK7064-7AH71-1■ ■ ■**	3	6.5 (5.75)	15.5 (34.2)
6000	36	0.57 (0.76)	1.3 (1.0)	0.9 (0.7)	1.5	**1FK7033-7AK71-1■ ■ ■**	3	0.27 (0.24)	3.1 (6.8)
	48	1.26 (1.69)	3.1 (2.3)	2.0 (1.5)	4.4	**1FK7043-7AK71-1■ ■ ■**	3	1.0 (0.89)	6.3 (13.9)

Encoder systems for motors without DRIVE-CLiQ-interface:	Incremental encoder sin/cos 1 V$_{pp}$ 2048 S/R	**A**
	Absolute encoder EnDat 2048 S/R [1] (not for 1FK703)	**E**
	Absolute encoder EnDat 512 S/R [1] (only for 1FK703)	**H**
	Absolute encoder EnDat 32 S/R [1] (not for 1FK703)	**G**
	Absolute encoder EnDat 16 S/R [1] (only for1FK703)	**J**
	Multi-pole resolver	**S**
	2-pole resolver	**T**

Encoder systems for motors with DRIVE-CLiQ-interface:	22 bit incremental encoder	**D**
	22 bit absolute encoder, single-turn +12 bit multi-turn [1] (not for 1FK703)	**F**
	20 bit absolute encoder, single-turn +12 bit multi-turn [1] (only for 1FK703)	**L**
	16 bit absolute encoder, single-turn +12 bit multi-turn [1] (not for 1FK703)	**K**
	15 bit absolute encoder, single-turn +12 bit multi-turn [1] (only for 1FK703)	**V**
	15 bit resolver	**U**
	14 bit resolver	**P**

Shaft extension:	**Shaft and flange accuracy:**	**Holding brake:**	
Fitted key and keyway	Tolerance N	without	**A**
Fitted key and keyway	Tolerance N	with	**B**
Plain shaft	Tolerance N	without	**G**
Plain shaft	Tolerance N	with	**H**

Degree of protection:	IP64	**0**
	IP65 and DE flange IP67	**2**
	IP64 and anthracite paint finish	**3**
	IP64 and DE flange IP67, anthracite paint finish	**5**

■ **Selection and ordering data**

Motor type (continued)	Static current	SINAMICS S110 Power Module		Power cable with complete shield Motor connection (and brake connection) via power connector		
		Rated output current [4]	Blocksize format	Power connector	Cable cross-section [5]	Pre-assembled cable MOTION-CONNECT 500
	I_0 at M_0 ΔT=100 K	I_{rated}				
	A	A	Order No.	Size	mm^2	Order No.
1FK7044-7AF71...	4.5	5.9	**6SL3210-1SE16-0■A0**	1	4 x 1.5	**6FX5002-5■G01-....**
1FK7061-7AF71...	6.1	7.7	**6SL3210-1SE17-7■A0**	1	4 x 1.5	**6FX5002-5■G01-....**
1FK7064-7AF71...	11.0	18.0	**6SL3210-1SE21-8■A0**	1	4 x 1.5	**6FX5002-5■G01-....**
1FK7085-7AF71...	22.5	25.0	**6SL3210-1SE22-5■A0**	1.5	4 x 4	**6FX5002-5■G41-....**
1FK7086-7AF71...	21.0	25.0	**6SL3210-1SE22-5■A0**	1.5	4 x 4	**6FX5002-5■G41-....**
1FK7043-7AH71...	4.5	5.9	**6SL3210-1SE16-0■A0**	1	4 x 1.5	**6FX5002-5■G01-....**
1FK7044-7AH71...	6.3	7.7	**6SL3210-1SE17-7■A0**	1	4 x 1.5	**6FX5002-5■G01-....**
1FK7061-7AH71...	8.0	10.2	**6SL3210-1SE21-0■A0**	1	4 x 1.5	**6FX5002-5■G01-....**
1FK7064-7AH71...	15.0	18.0	**6SL3210-1SE21-8■A0**	1	4 x 1.5	**6FX5002-5■G01-....**
1FK7033-7AK71...	2.2	3.1	**6SL3210-1SE13-1UA0**	1	4 x 1.5	**6FX5002-5■G01-....**
1FK7043-7AK71...	6.4	7.7	**6SL3210-1SE17-7■A0**	1	4 x 1.5	**6FX5002-5■G01-....**

Line filter:		
without line filter	**U**	
with integrated line filter	**A**	
Without brake cores		**C**
With brake cores		**D**
For length code as well as power and signal cables, see MOTION-CONNECT connection system.		**....**

[1] If the absolute encoder is used, M_{rated} is reduced by 10 %.

[2] These values refer to n = 2500 rpm.

[3] These values refer to n = 2000 rpm.

[4] With default setting of the pulse frequency.

[5] The current carrying capacity of the power cables complies with EN 60204-1 for installation type C, for continuous duty at an ambient air temperature of 40 °C (104 °F).

Synchronous motors

1FK7 Compact/High Dynamic motors
Natural cooling

Selection and ordering data

Rated speed	Shaft height	Rated power	Static torque	Rated torque	Rated current	1FK7 Compact/High Dynamic synchronous motor Natural cooling Connection to SINAMICS 230 V 1 AC	Number of pole pairs	Rotor moment of inertia (without brake)	Weight (without brake)
n_{rated}	SH	P_{rated} at ΔT=100 K	M_0 at ΔT=100 K	M_{rated} at ΔT=100 K	I_{rated} at ΔT=100 K			J	m
rpm		kW (HP)	Nm (lb_f-ft)	Nm (lb_f-ft)	A	Order No.		10^{-4} kgm^2 (10^{-3} lb_f-in-s^2)	kg (lb)
3000	36	0.31 (0.42)	1.15 (0.8)	1.0 (0.7)	1.6	**1FK7032-5AF21-1**■ ■ ■	3	0.61 (0.54)	2.7 (5.9)
		0.38 (0.51)	1.3 (1.0)	1.2 (0.9)	2.0	**1FK7033-7AF21-1**■ ■ ■	3	0.27 (0.24)	3.1 (6.8)
		0.46 (0.62)	1.6 (1.2)	1.45 (1.1)	1.8	**1FK7034-5AF21-1**■ ■ ■	3	0.9 (0.8)	3.7 (8.2)
	48	0.82 (1.1)	3.0 (2.2)	2.6 (1.9)	3.5	**1FK7042-5AF21-1**■ ■ ■	4	3.01 (2.66)	4.9 (10.8)
		0.79 (1.06)	2.7 (2.0)	2.5 (1.8)	3.8	**1FK7043-7AF21-1**■ ■ ■	3	1.0 (0.89)	6.3 (13.9)
6000	20	0.05 (0.1)	0.18 (0.1)	0.08 (0.1)	0.5	**1FK7011-5AK21-1**■ ■ 3	4	0.064 (0.06)	0.9 (2.0)
		0.10 (0.1)	0.35 (0.3)	0.16 (0.1)	0.5	**1FK7015-5AK21-1**■ ■ 3	4	0.083 (0.08)	1.1 (2.4)
	28	0.38 (0.51)	0.85 (0.6)	0.6 (0.4)	1.4	**1FK7022-5AK21-1**■ ■ ■	3	0.28 (0.25)	1.8 (4.0)

Synchronous motor:	1FK7 Compact	**5**	
	1FK7 High Dynamic	**7**	
Encoder systems for motors without DRIVE-CLiQ-interface:	Incremental encoder sin/cos 1 V$_{pp}$ 2048 S/R	**A**	
	Absolute encoder EnDat 2048 S/R [1] (only for 1FK704)	**E**	
	Absolute encoder EnDat 512 S/R [1] (not for 1FK704)	**H**	
	Absolute encoder EnDat 32 S/R [1] (only for 1FK704)	**G**	
	Absolute encoder EnDat 16 S/R [1] (not for 1FK704)	**J**	
	Multi-pole resolver	**S**	
	2-pole resolver	**T**	
Encoder systems for motors with DRIVE-CLiQ-interface: [2]	22 bit incremental encoder (not for 1FK701)	**D**	
	22 bit absolute encoder, single-turn +12 bit multi-turn [1] (only for 1FK704)	**F**	
	20 bit absolute encoder, single-turn +12 bit multi-turn [1] (only for 1FK702/1FK703)	**L**	
	16 bit absolute encoder, single-turn +12 bit multi-turn [1] (only for 1FK704)	**K**	
	15 bit absolute encoder, single-turn +12 bit multi-turn [1] (only for 1FK702/1FK703)	**V**	
	15 bit resolver (not for 1FK701)	**U**	
	14 bit resolver (not for 1FK701)	**P**	

Shaft extension:	Shaft and flange accuracy:	Holding brake:	
Fitted key and keyway	Tolerance N	without	**A**
Fitted key and keyway	Tolerance N	with	**B**
Plain shaft	Tolerance N	without	**G**
Plain shaft	Tolerance N	with	**H**

Degree of protection:		
	IP64 (not for 1FK701)	**0**
	IP65 and DE flange IP67 (not for 1FK701)	**2**
	IP64 (IP54 for 1FK701) and anthracite paint finish	**3**
	IP65 and DE flange IP67, anthracite paint finish (not for 1FK701)	**5**

Synchronous motors

■ Selection and ordering data

Motor type (continued)	Static current	SINAMICS S110 Power Module		Power cable with complete shield		
		Rated output current [3]	Blocksize format	Motor connection (and brake connection) via power connector		
				Power connector	Cable cross-section [4]	Pre-assembled cable MOTION-CONNECT 500
	I_0 at M_0 ΔT=100 K	I_{rated} at M_0 ΔT=100 K				
	A	A	Order No.	Size	mm^2	Order No.
1FK7032-5AF21...	1.7	2.3	**6SL3210-1SB12-3■A3**	1	4 x 1.5	**6FX5002-5■G01-....**
1FK7033-7AF21...	2.2	2.3	**6SL3210-1SB12-3■A3**	1	4 x 1.5	**6FX5002-5■G01-....**
1FK7034-5AF21...	1.9	2.3	**6SL3210-1SB12-3■A3**	1	4 x 1.5	**6FX5002-5■G01-....**
1FK7042-5AF21...	3.9	3.9	**6SL3210-1SB14-0■A3**	1	4 x 1.5	**6FX5002-5■G01-....**
1FK7043-7AF21...	3.9	3.9	**6SL3210-1SB14-0■A3**	1	4 x 1.5	**6FX5002-5■G01-....**
1FK7011-5AK21...	0.85	0.9	**6SL3210-1SB11-0■A3**	0.5	4 x 1.5	**6FX5002-5DA30-....** [5]
1FK7015-5AK21...	0.85	0.9	**6SL3210-1SB11-0■A3**	0.5	4 x 1.5	**6FX5002-5DA30-....** [5]
1FK7022-5AK21...	1.8	2.3	**6SL3210-1SB12-3■A3**	1	4 x 1.5	**6FX5002-5■G01-....**

Line filter:		
without line filter	**U**	
with integrated line filter	**A**	

Without brake cores		**C**
With brake cores		**D**

For length code as well as power and signal cables, see MOTION-CONNECT connection system.	**....**

[1] If the absolute encoder is used, M_{rated} is reduced by 10 %.

[2] Motors of shaft height 20 are not available with a DRIVE-CLiQ interface. The encoder systems are connected via the SMC (Sensor Module Cabinet-Mounted).

[3] With default setting of the pulse frequency.

[4] The current carrying capacity of the power cables complies with EN 60204-1 for installation type C, for continuous duty at an ambient air temperature of 40 °C (104 °F).

[5] This power cable is fitted with a connector with M17 thread at the motor end and brake cores as standard (4 x 1.5 mm^2 + 2 x 1.5 mm^2).

Asynchronous motors

1PH7 motors for SINAMICS S110

■ Overview

1PH7 AC motors, shaft heights 100 to 160

1PH7 AC motors, shaft heights 180 and 225

The 1PH7 AC motors are compact, force-ventilated squirrel-cage asynchronous (induction) motors with degree of protection IP55. The motors are ventilated using a mounted external fan unit.

The motor can be ordered either with the air flow from the motor drive end (DE) to the motor non-drive end (NDE) – or vice versa.

These motors have been designed specifically for use in conjunction with converters. Depending on the control requirements, the appropriate encoder systems are available for the motors. These encoders are used to sense the motor speed and indirect position.

■ Benefits

- High power density with small motor dimensions
- High degree of protection
- Wide speed control ranges
- Speed down to zero without reducing the torque
- Ruggedness
- Essentially maintenance-free
- Bearing for high cantilever load
- High rotational accuracy, even at the lowest speeds
- Integrated encoder system to sense the motor speed, connected using a connector or DRIVE-CLiQ interface
- Terminal box to connect up power cables
- Motor temperature monitoring with KTY 84
- Various types of cooling systems
- Basic external cooling using a pipe connection
- Optional bearing versions with re-lubrication device and insulated bearings (NDE)

■ Application

- Installation in dry inside areas (no corrosive atmosphere)
- Crane systems:
  - Hoisting and closing gears for cranes
  - Hoisting and traversing gears for high-bay racking vehicles
- Printing industry:
  - Single and main drives for printing machines
- Rubber, plastic, wire, and glass manufacturing:
  - Drives for extruders, calenders, rubber injection machines, foil machines, fleece plants
  - Wire-drawing machines, cable-stranding machines, etc.
- General applications
  - coiler and winder drives

Asynchronous motors

▌ Technical specifications

Insulation of the stator winding in accordance with EN 60034-1 (IEC 60034-1)	Temperature class 155 (F) for a coolant temperature of up to +40 °C (+104 °F)
Cooling in accordance with EN 60034-6 (IEC 60034-6)	Forced ventilation, fan mounted axially at NDE
Temperature monitoring	KTY 84 temperature sensor in the stator winding
Motor fan ratings	400 V 3 AC, 50/60 Hz 480 V 3 AC, 60 Hz
Type of construction in accordance with EN 60034-7 (IEC 60034-7)	IM B3, IM B5, IM B35
Degree of protection in accordance with EN 60034-5 (IEC 60034-5)	IP55 (fan IP54)
Shaft extension on the drive end in accordance with DIN 748-3 (IEC 60072-1)	With fitted key, half-key balancing
Shaft and flange accuracy in accordance with DIN 42955 (IEC 60072-1) [1]	
• SH 100 … SH 160	Tolerance R (reduced)
• SH 180 and SH 225	Tolerance N (normal)
Vibration magnitude in accordance with EN 60034-14 (IEC 60034-14)	Grade R (reduced)
Sound pressure level in accordance with DIN EN ISO 1680 Tolerance +3 dB	Sound pressure level as a function of air-flow direction
Encoder systems, built-in for motors without DRIVE-CLiQ interface	• Incremental encoder HTL 1024 S/R • Incremental encoder sin/cos 1 V_{pp} 2048 S/R • Absolute encoder EnDat 2048 S/R
Encoder systems, built-in for motors with DRIVE-CLiQ interface	• 22 bit incremental encoder (2048 S/R internal) with 11 bit commutation position • 22 bit incremental encoder (2048 S/R internal) • Absolute encoder 22 bit single-turn (2048 S/R internal) +12 bit multi-turn
Connection	
• Connector for signals	Mating connector not supplied
• Terminal box for power	Terminal box at top
Paint finish	Standard finish anthracite, RAL 7016
• SH 100 … SH 160	Without finish
• SH 180 and SH 225	Primed

S/R = signals/revolution

▌ Characteristic curves
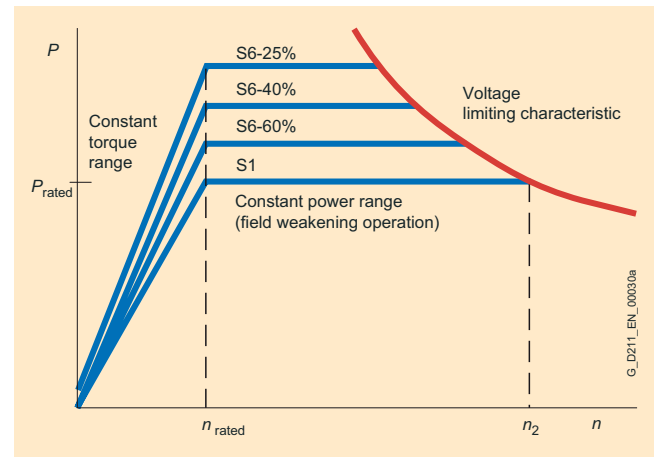
Power/speed characteristic

▌ More information

For further information see Catalog PM 21.
http://www.siemens.com/motioncontrol/docu

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[1] Shaft extension run-out, concentricity of centering ring and shaft, and perpendicularity of flange to shaft.

Asynchronous motors

1PH7 motors
Forced ventilation

■ **Selection and ordering data**

Rated speed	Shaft height	Rated power	Rated torque	Rated current	Rated voltage	Speed during field weakening [1]	Continuous speed max. [2]	Speed max. [3]	1PH7 asynchronous (induction) motor
n_{rated}	SH	P_{rated}	M_{rated}	I_{rated}	V_{rated}	n_2	n_{S1}	n_{max}	
rpm		kW (HP)	Nm (lb$_f$-ft)	A	V	rpm	rpm	rpm	Order No.
400	160	9.5 (12.74)	227 (167)	30	274	2630 [4]	3700 [4]	6500 [4]	**1PH7163-■ ■ B ■ ■ - ■ . . .**
		13.0 (17.43)	310 (229)	37	294	2140 [4]	3700 [4]	6500 [4]	**1PH7167-■ ■ B ■ ■ - ■ . . .**
1150	100	4.3 (5.8)	36 (26.6)	10	391	2400	5500	9000 [4]	**1PH7103-■ ■ D ■ ■ - ■ . . .**
		7.2 (9.7)	60 (44.3)	17.5	360	4170	5500	9000 [4]	**1PH7107-■ ■ D ■ ■ - ■ . . .**
	132	13.5 (18.1)	112 (82.6)	29	381	3000	4500	8000 [4]	**1PH7133-■ ■ D ■ ■ - ■ . . .**
		19.5 (26.2)	162 (119)	43	367	3930	4500	8000 [4]	**1PH7137-■ ■ D ■ ■ - ■ . . .**
	160	25.0 (33.5)	208 (153)	55	364	3500	3700	6500 [4]	**1PH7163-■ ■ D ■ ■ - ■ . . .**
		31.0 (41.6)	257 (190)	70	357	4840	3700	6500 [4]	**1PH7167-■ ■ D ■ ■ - ■ . . .**

Fans:	External fan unit, heavy-gauge threaded cable entry in terminal box		**2**
	Without external fan unit, for pipe connection, heavy-gauge threaded cable entry in terminal box		**6**
	External fan unit, metric cable entry in terminal box		**7**
	Without external fan unit, for pipe connection, metric cable entry in terminal box		**8**
Encoder systems for motors without DRIVE-CLiQ interface:	Without encoder		**A**
	Absolute encoder EnDat 2048 S/R		**E**
	Incremental encoder HTL 1024 S/R		**H**
	Incremental encoder HTL 2048 S/R		**J**
	Incremental encoder sin/cos 1 V_{pp} with C and D tracks		**M**
	Incremental encoder sin/cos 1 V_{pp} without C and D tracks		**N**
Encoder systems for motors with DRIVE-CLiQ interface:	22 bit absolute encoder single-turn + 12 bit multi-turn		**F**
	22 bit incremental encoder with 11 bit commutation position		**D**
	22 bit incremental encoder		**Q**
Terminal box/ cable entry (view DE):	Top/from right		**0**
	Top/from NDE		**2**
	Top/from left		**3**
Type:	IM B3 (IM V5, IM V6)		**0**
	IM B5 (IM V1, IM V3) available only for shaft heights 100 and 132		**2**
	IM B35 (IM V15, IM V35)		**3**
Holding brake with emergency stop function [5]:	Without brake		**0**
	Brake supply voltage 230 V 1 AC, 50/60 Hz	With brake	**1**
		With brake (includes microswitch)	**2**
		With brake (includes manual release)	**3**
		With brake (includes manual release and microswitch)	**4**
	Brake supply voltage 24 V DC	With brake	**5**
		With brake (includes microswitch)	**6**
		With brake (includes manual release)	**7**
		With brake (includes manual release and microswitch)	**8**

Asynchronous motors

■ Selection and ordering data

Power factor	Magnetizing current	Effi-ciency	Rated fre-quency	Moment of inertia	Weight, approx.	1PH7 asynchronous (induction)motor	SINAMICS S110 Power Module	
							Rated output current	Blocksize format
	I_μ	η_{rated}	f_{rated}	J			I_{rated}	
cos φ	A		Hz	kgm^2 (lb$_f$-in-s^2)	kg (lb)	Order No.	A	Order No.
0.88	11.5	0.809	14.3	0.185 (1.64)	175 (386)	**1PH7163- . . B . . - . ■ ■ ■**	32	**6SL3210-1SE23-2 ■ A0**
0.88	14.0	0.814	14.3	0.228 (2.02)	210 (463)	**1PH7167- . . B . . - . ■ ■ ■**	38	**6SL3210-1SE23-8 ■ A0**
0.81	5.0	0.813	40.6	0.017 (0.15)	40 (88.2)	**1PH7103- . . D . . - . ■ ■ ■**	10.2	**6SL3210-1SE21-0 ■ A0**
0.81	8.8	0.838	40.3	0.029 (0.26)	65 (143)	**1PH7107- . . D . . - . ■ ■ ■**	18	**6SL3210-1SE21-8 ■ A0**
0.85	13.0	0.877	39.7	0.076 (0.67)	90 (198)	**1PH7133- . . D . . - . ■ ■ ■**	32	**6SL3210-1SE23-2 ■ A0**
0.86	19.0	0.887	39.6	0.109 (0.96)	150 (331)	**1PH7137- . . D . . - . ■ ■ ■**	45	**6SL3210-1SE24-5 ■ A0**
0.84	25.0	0.904	39.2	0.185 (1.64)	175 (386)	**1PH7163- . . D . . - . ■ ■ ■**	60	**6SL3210-1SE26-0 ■ A0**
0.83	34.0	0.909	39.1	0.228 (2.02)	210 (463)	**1PH7167- . . D . . - . ■ ■ ■**	75	**6SL3210-1SE27-5 ■ A0**

Output type:	**Vibrat. magnitude:**	**Shaft and flange accuracy:**	
Coupling/belt	Grade R	Tolerance R	**B**
Coupling/belt	Grade S	Tolerance R	**C**
Coupling/belt	Grade SR	Tolerance R	**D**
Coupling/belt	Grade N	Tolerance N (with brake mounting)	**K**
Increased max. speed [6]	Grade SR	Tolerance R	**L**

Shaft extension (DE):	**Balancing:**	**Direction of air flow (fan):**	
Fitted key	Half-key	DE → NDE	**A**
Fitted key	Half-key	NDE → DE [7]	**B**
Fitted key	Full-key	DE → NDE	**C**
Fitted key	Full-key	NDE → DE [7]	**D**
Plain shaft	–	DE → NDE	**J**
Plain shaft	–	NDE → DE [7]	**K**

Seal:	**Paint finish:**	
–	None	**0**
Flange/shaft seal ring [8]	None	**2**
–	Anthracite RAL 7016, standard paint finish	**3**
Flange/shaft seal ring [8]	Anthracite RAL 7016, standard paint finish	**5**
–	Anthracite RAL 7016, special paint finish	**6**
Flange/shaft seal ring [8]	Anthracite RAL 7016, special paint finish	**8**

Special version:	Specify supplementary order code and plain text if applicable (see Options).	**–Z**

Line filter:		
without line filter		**U**
with integrated line filter		**A**

[1] n_2: Max. permissible thermal speed at constant output or speed, which is at the voltage limit when $P=P_{rated}$.

[2] n_{S1}: Max. permissible speed that is continuously permitted without speed duty cycles.

[3] n_{max}: Maximum speed which must not be exceeded.

[4] The speed is limited to lower values in some cases. The following restriction applies: Max. output frequency < 5 × motor rated frequency.

[5] Version with brake is possible if:
12th data position "2" or "3",
14th data position "K",
15th data position "A", "B", "J" or "K",
16th data position "0", "3" or "6".

[6] Max. possible speed (see also selection guide):
SH 100: 12000 rpm, SH 132: 10000 rpm, SH 160: 8000 rpm, with plain shaft only (15th position "J" or "K" and 16th position "0", "3" or "6").

[7] Preferred direction of air flow in a polluted environment.

[8] Only appropriate if oil spray/mist occasionally gets onto the sealing ring. A sealing ring is not possible for type IM B3 (IM V5, IM V6) or version with increased maximum speed.

Asynchronous motors

1PH7 motors
Forced ventilation

■ **Selection and ordering data**

Rated speed	Shaft height	Rated power	Rated torque	Rated current	Rated voltage	Speed during field weakening [1]	Continuous speed max. [2]	Speed, max. [3]	1PH7 asynchronous (induction) motor
n_{rated}	SH	P_{rated}	M_{rated}	I_{rated}	V_{rated}	n_2	n_{S1}	n_{max}	
rpm		kW (HP)	Nm (lb_f-ft)	A	V	rpm	rpm	rpm	Order No.
1750	100	4.3 (5.77)	24 (17.7)	10	398	6130	5500	9000 [4]	**1PH7101-**■■**F**■■**-**■ . . .
		6.3 (8.45)	34 (25.1)	13	398	3500	5500	9000 [4]	**1PH7103-**■■**F**■■**-**■ . . .
		8.0 (10.7)	44 (32.5)	17.5	398	5940	5500	9000 [4]	**1PH7105-**■■**F**■■**-**■ . . .
		10.0 (13.4)	55 (40.6)	23	381	4500	5500	8750	**1PH7107-**■■**F**■■**-**■ . . .
	132	13.0 (17.4)	71 (52.4)	24	398	4830	4500	8000	**1PH7131-**■■**F**■■**-**■ . . .
		17.5 (23.5)	96 (70.8)	34	398	4990	4500	8000	**1PH7133-**■■**F**■■**-**■ . . .
		21.5 (28.8)	117 (86.3)	42	398	5570	4500	8000	**1PH7135-**■■**F**■■**-**■ . . .
		25.0 (33.5)	136 (100)	56	357	4000	4500	8000	**1PH7137-**■■**F**■■**-**■ . . .
	160	34.0 (45.6)	186 (137)	72	364	4000	3700	6500	**1PH7163-**■■**F**■■**-**■ . . .
		41.0 (55)	224 (165)	79	398	2750	3700	6500	**1PH7167-**■■**F**■■**-**■ . . .
2300	100	7.5 (10.1)	31 (22.9)	17	388	6000	5500	9000	**1PH7103-**■■**G**■■**-**■ . . .
		12.0 (16.1)	50 (36.9)	26	400	6000	5500	9000	**1PH7107-**■■**G**■■**-**■ . . .
	132	22.5 (30.2)	93 (68.6)	45	398	4000	4500	8000	**1PH7133-**■■**G**■■**-**■ . . .
		29.0 (38.9)	120 (88.5)	56	398	4000	4500	8000	**1PH7137-**■■**G**■■**-**■ . . .
	160	38.0 (51)	158 (117)	82	398	3000	3700	6500	**1PH7163-**■■**G**■■**-**■ . . .
		44.0 (59)	183 (135)	85	398	3000	3700	6500	**1PH7167-**■■**G**■■**-**■ . . .

Fans:		External fan unit, heavy-gauge threaded cable entry in terminal box	**2**
		Without external fan unit, for pipe connection, heavy-gauge threaded cable entry in terminal box	**6**
		External fan unit, metric cable entry in terminal box	**7**
		Without external fan unit, for pipe connection, metric cable entry in terminal box	**8**

Encoder systems for motors without DRIVE-CLiQ interface:		Without encoder	**A**
		Absolute encoder EnDat 2048 S/R	**E**
		Incremental encoder HTL 1024 S/R	**H**
		Incremental encoder HTL 2048 S/R	**J**
		Incremental encoder sin/cos 1 V_{pp} with C and D tracks	**M**
		Incremental encoder sin/cos 1 V_{pp} without C and D tracks	**N**

Encoder systems for motors with DRIVE-CLiQ interface:		22 bit absolute encoder single-turn + 12 bit multi-turn	**F**
		22 bit incremental encoder with 11 bit commutation position	**D**
		22 bit incremental encoder	**Q**

Terminal box/ cable entry (view DE):		Top/from right	**0**
		Top/from NDE	**2**
		Top/from left	**3**

Type:		IM B3 (IM V5, IM V6)	**0**
		IM B5 (IM V1, IM V3) available only for shaft heights 100 and 132	**2**
		IM B35 (IM V15, IM V35)	**3**

Holding brake with emergency stop function [5]:		Without brake	**0**
	Brake supply voltage 230 V 1 AC, 50/60 Hz	With brake	**1**
		With brake (includes microswitch)	**2**
		With brake (includes manual release)	**3**
		With brake (includes manual release and microswitch)	**4**
	Brake supply voltage 24 V DC	With brake	**5**
		With brake (includes microswitch)	**6**
		With brake (includes manual release)	**7**
		With brake (includes manual release and microswitch)	**8**

Asynchronous motors

Selection and ordering data

Power factor	Magnetizing current	Effi-ciency	Rated fre-quency	Moment of inertia	Weight, approx.	1PH7 asynchronous (induction) motor	SINAMICS S110 Power Module	
							Rated output current	Blocksize format
	I_μ	η_{rated}	f_{rated}	J			I_{rated}	
cos φ	A		Hz	kgm^2 (lb$_f$-in-s^2)	kg (lb)	Order No.	A	Order No.
0.75	5.7	0.855	60.0	0.017 (0.15)	40 (88.2)	**1PH7101-..F..-.** ■■■	10.5	**6SL3210-1SE21-0** ■**A0**
0.84	5.3	0.849	61.0	0.017 (0.15)	40 (88.2)	**1PH7103-..F..-.** ■■■	18	**6SL3210-1SE21-8** ■**A0**
0.77	9.3	0.875	60.0	0.029 (0.26)	65 (143)	**1PH7105-..F..-.** ■■■	18	**6SL3210-1SE21-8** ■**A0**
0.80	10.6	0.870	60.3	0.029 (0.26)	65 (143)	**1PH7107-..F..-.** ■■■	25	**6SL3210-1SE22-5** ■**A0**
0.88	8.1	0.902	59.7	0.076 (0.67)	90 (198)	**1PH7131-..F..-.** ■■■	25	**6SL3210-1SE22-5** ■**A0**
0.85	14.0	0.900	59.7	0.076 (0.67)	90 (198)	**1PH7133-..F..-.** ■■■	38	**6SL3210-1SE23-8** ■**A0**
0.86	16.0	0.906	59.5	0.109 (0.96)	150 (331)	**1PH7135-..F..-.** ■■■	45	**6SL3210-1SE24-5** ■**A0**
0.85	23.0	0.902	59.5	0.109 (0.96)	150 (331)	**1PH7137-..F..-.** ■■■	60	**6SL3210-1SE26-0** ■**A0**
0.86	28.0	0.915	59.2	0.185 (1.64)	175 (386)	**1PH7163-..F..-.** ■■■	75	**6SL3210-1SE27-5** ■**A0**
0.86	30.0	0.920	59.2	0.228 (2.02)	210 (463)	**1PH7167-..F..-.** ■■■	90	**6SL3210-1SE31-0** ■**A0**
0.79	8.2	0.866	78.8	0.017 (0.15)	40 (88.2)	**1PH7103-..G..-.** ■■■	18	**6SL3210-1SE21-8** ■**A0**
0.80	12.0	0.878	78.7	0.029 (0.26)	65 (143)	**1PH7107-..G..-.** ■■■	32	**6SL3210-1SE23-2** ■**A0**
0.86	17.0	0.900	78.0	0.076 (0.67)	90 (198)	**1PH7133-..G..-.** ■■■	45	**6SL3210-1SE24-5** ■**A0**
0.87	21.0	0.903	77.8	0.109 (0.96)	150 (331)	**1PH7137-..G..-.** ■■■	60	**6SL3210-1SE26-0** ■**A0**
0.83	43.0	0.900	77.3	0.185 (1.64)	175 (386)	**1PH7163-..G..-.** ■■■	90	**6SL3210-1SE31-0** ■**A0**
0.84	40.0	0.911	77.4	0.228 (2.02)	210 (463)	**1PH7167-..G..-.** ■■■	90	**6SL3210-1SE31-0** ■**A0**

Output type:	**Vibrat. magnitude:**	**Shaft and flange accuracy:**	
Coupling/belt	Grade R	Tolerance R	**B**
Coupling/belt	Grade S	Tolerance R	**C**
Coupling/belt	Grade SR	Tolerance R	**D**
Coupling/belt	Grade N	Tolerance N (with brake mounting)	**K**
Increased max. speed [6]	Grade SR	Tolerance R	**L**

Shaft extension (DE):	**Balancing:**	**Direction of air flow (fan):**	
Fitted key	Half-key	DE → NDE	**A**
Fitted key	Half-key	NDE → DE [7]	**B**
Fitted key	Full-key	DE → NDE	**C**
Fitted key	Full-key	NDE → DE [7]	**D**
Plain shaft	–	DE → NDE	**J**
Plain shaft	–	NDE → DE [7]	**K**

Seal:	**Paint finish:**	
–	None	**0**
Flange/shaft seal ring [8]	None	**2**
–	Anthracite RAL 7016, standard paint finish	**3**
Flange/shaft seal ring [8]	Anthracite RAL 7016, standard paint finish	**5**
–	Anthracite RAL 7016, special paint finish	**6**
Flange/shaft seal ring [8]	Anthracite RAL 7016, special paint finish	**8**

Special versions:	Specify supplementary order code and plain text if applicable (see Options).	**–Z**

Line filter:	
without line filter	**U**
with integrated line filter	**A**

[1] n_2: Max. permissible thermal speed at constant output or speed, which is at the voltage limit when $P=P_{rated}$.

[2] n_{S1}: Max. permissible speed that is continuously permitted without speed duty cycles.

[3] n_{max}: Maximum speed which must not be exceeded.

[4] The speed is limited to lower values in some cases. The following restriction applies: Max. output frequency < 5 × motor rated frequency.

[5] Version with brake is possible if:
12th data position "2" or "3",
14th data position "K",
15th data position "A", "B", "J" or "K",
16th data position "0", "3" or "6".

[6] Max. possible speed (see also selection guide):
SH 100: 12000 rpm, SH 132: 10000 rpm, SH 160: 8000 rpm, with plain shaft only (15th position "J" or "K" and 16th position "0", "3" or "6").

[7] Preferred direction of air flow in a polluted environment.

[8] Only appropriate if oil spray/mist occasionally gets onto the sealing ring. A sealing ring is not possible for type IM B3 (IM V5, IM V6) or version with increased maximum speed.

Asynchronous motors

1PH7 motors
Forced ventilation

■ **Selection and ordering data**

Rated speed	Shaft height	Rated power	Rated torque	Rated current	Rated voltage	Speed during field weakening [1]	Continuous speed, max. [2]	Speed, max. [3]	1PH7 asynchronous (induction) motor
n_{rated}	SH	P_{rated}	M_{rated}	I_{rated}	V_{rated}	n_2	n_{S1}	n_{max}	
rpm		kW (HP)	Nm (lbf-ft)	A	V	rpm	rpm	rpm	Order No.
400	180	16.3 (21.9)	390 (288)	51	271	2900 [4]	3500 [4][5]	5000 [4]	**1PH7184- ■ ■ B ■ ■-■** . . .
		21.2 (28.4)	505 (373)	67	268	3300 [4]	3500 [4][5]	5000 [4]	**1PH7186- ■ ■ B ■ ■-■** . . .
	225	30.4 (40.8)	725 (535)	88	268	2700 [4]	3100 [4][5]	4500 [4]	**1PH7224- ■ ■ B ■ ■-■** . . .
		39.2 (52.6)	935 (690)	114	264	2900 [4]	3100 [4][5]	4500 [4]	**1PH7226- ■ ■ B ■ ■-■** . . .
		48.0 (64.4)	1145 (845)	136	272	2900 [4]	3100 [4][5]	4500 [4][5]	**1PH7228- ■ ■ B ■ ■-■** . . .
1150	180	44.0 (59)	366 (270)	89	383	4200	3500 [5]	5000	**1PH7184- ■ ■ D ■ ■-■** . . .
		58.0 (77.8)	482 (356)	116	390	4400	3500 [5]	5000	**1PH7186- ■ ■ D ■ ■-■** . . .
	225	81.0 (109)	670 (494)	160	385	2900	3100 [5]	4500	**1PH7224- ■ ■ D ■ ■-■** . . .
1750	180	60.0 (80.5)	327 (241)	120	388	5000	3500 [5]	5000	**1PH7184- ■ ■ F ■ ■-■** . . .
		85.0 (114)	465 (343)	169	385	5000	3500 [5]	5000	**1PH7186- ■ ■ F ■ ■-■** . . .
2900	180	81.0 (109)	265 (196)	158	395	5000	3500 [5]	5000	**1PH7184- ■ ■ L ■ ■-■** . . .

Fans:	External fan unit, heavy-gauge threaded cable entry in terminal box	2
	Without external fan unit, for pipe connection, PG cable entry in terminal box	6
	External fan unit, metric cable entry in terminal box	7
	Without external fan unit, for pipe connection, metric cable entry in terminal box	8
Encoder systems for motors without DRIVE-CLiQ interface:	Without encoder	A
	Absolute encoder EnDat 2048 S/R	E
	Incremental encoder HTL 1024 S/R	H
	Incremental encoder HTL 2048 S/R	J
	Incremental encoder sin/cos 1 V_{pp} with C and D track	M
	Incremental encoder sin/cos 1 V_{pp} without C and D track	N
Encoder systems for motors with DRIVE-CLiQ interface:	22 bit absolute encoder single-turn + 12 bit multi-turn	F
	22 bit incremental encoder with 11 bit commutation position	D
	22 bit incremental encoder	Q
Terminal box/ cable entry (view DE):	Top/from right	0
	Top/from DE	1
	Top/from NDE	2
	Top/from left	3
Type:	IM B3	0
	IM B3 — Hoisting system for different types (IM B6, IM B7, IM B8, IM V5, IM V6)	1
	IM B35 (only for 1PH7184 with flange A 400, 1PH7186 with flange A 450, 1PH722. with flange A 550)	3
	IM B35 (only for 1PH7184 with flange A 450)	4
	IM B35 (only for 1PH7184 with flange A 400, 1PH7186 with flange A 450, 1PH722. with flange A 550) — Hoisting system for different types (IM V15, IM V35)	5
	IM B35 (only for 1PH7184 with flange A 450) — Hoisting system for different types (IM V15, IM V35)	6
Holding brake with emergency stop function (suitable for coupling output in type IM B3) [6]:	Without brake	0
	With brake (includes emergency release screws and microswitch)	2
	With brake (includes manual release and microswitch)	4

Asynchronous motors

■ Selection and ordering data

Power factor	Magnetizing current	Efficiency	Rated frequency	Moment of inertia	Weight, approx.	1PH7 asynchronous (induction) motor	SINAMICS S110 Power Module	
							Rated output current	Blocksize format
$\cos \varphi$	I_μ A	η_{rated}	f_{rated} Hz	J kgm² (lb$_f$-in-s²)	kg (lb)	Order No.	I_{rated} A	Order No.
0.84	26.0	0.830	14.2	0.503 (4.45)	370 (816)	**1PH7184- . . B . . -. ■ ■ ■**	60	**6SL3210-1SE26-0 ■ A0**
0.81	38.5	0.845	14.0	0.666 (5.89)	440 (970)	**1PH7186- . . B . . -. ■ ■ ■**	75	**6SL3210-1SE27-5 ■ A0**
0.87	36.5	0.864	14.0	1.479 (13.1)	630 (1389)	**1PH7224- . . B . . -. ■ ■ ■**	90	**6SL3210-1SE31-0 ■ A0**
0.86	49.0	0.880	14.0	1.930 (17.1)	750 (1654)	**1PH7226- . . B . . -. ■ ■ ■**	145	**6SL3210-1SE31-5 ■ A0**
0.85	60.5	0.888	13.9	2.326 (20.6)	860 (1896)	**1PH7228- . . B . . -. ■ ■ ■**	145	**6SL3210-1SE31-5 ■ A0**
0.82	42.0	0.920	39.2	0.503 (4.45)	370 (816)	**1PH7184- . . D . . -. ■ ■ ■**	90	**6SL3210-1SE31-0 ■ A0**
0.81	58.0	0.925	39.1	0.666 (5.89)	440 (970)	**1PH7186- . . D . . -. ■ ■ ■**	145	**6SL3210-1SE31-5 ■ A0**
0.81	79.0	0.938	38.9	1.479 (13.1)	630 (1389)	**1PH7224- . . D . . -. ■ ■ ■**	178	**6SL3210-1SE31-8 ■ A0**
0.78	64.0	0.934	59.0	0.503 (4.45)	370 (816)	**1PH7184- . . F . . -. ■ ■ ■**	145	**6SL3210-1SE31-5 ■ A0**
0.80	84.0	0.940	59.0	0.666 (5.89)	440 (970)	**1PH7186- . . F . . -. ■ ■ ■**	178	**6SL3210-1SE31-8 ■ A0**
0.80	77.0	0.934	97.4	0.503 (4.45)	370 (816)	**1PH7184- . . L . . -. ■ ■ ■**	178	**6SL3210-1SE31-8 ■ A0**

Output type:	Vibrat. magnitude:	Shaft and flange accuracy:	
Coupling	Grade R	Tolerance N	**A**
Coupling	Grade R	Tolerance R	**B**
Coupling	Grade S	Tolerance R	**C**
Coupling	Grade SR	Tolerance R	**D**
Belt	Grade R	Tolerance N	**E**
Belt	Grade R	Tolerance R	**F**
Increased cantil. forces	Grade R	Tolerance N	**G**
Increased cantil. forces	Grade R	Tolerance R	**H**
Increased max. speed [7]	Grade S	Tolerance R	**J**

Shaft extension (DE):	Balancing:	Direction of air flow (fan):	
Fitted key	Half-key	DE → NDE	**A**
Fitted key	Half-key	NDE → DE [8]	**B**
Fitted key	Full-key	DE → NDE	**C**
Fitted key	Full-key	NDE → DE [8]	**D**
Plain shaft	–	DE → NDE	**J**
Plain shaft	–	NDE → DE [8]	**K**

Seal:	Paint finish:	
–	Primed	**0**
Flange/shaft seal ring [9]	Primed	**2**
–	Anthracite RAL 7016, standard paint finish	**3**
Flange/shaft seal ring [9]	Anthracite RAL 7016, standard paint finish	**5**
–	Anthracite RAL 7016, special paint finish	**6**
Flange/shaft seal ring [9]	Anthracite RAL 7016, special paint finish	**8**

Special versions:	Specify suppl. order code and plain text if applicable (see Options).	**–Z**

Line filter:	
without line filter	**U**
with integrated line filter	**A**

[1] n_2: Max. permissible thermal speed at constant output or speed, which is at the voltage limit when $P=P_{rated}$.

[2] n_{S1}: Max. permissible speed that is continuously permitted without speed duty cycles.

[3] n_{max}: Maximum speed which must not be exceeded.

[4] The speed is limited to lower values in some cases. The following restriction applies: Max. output frequency < 5 × motor rated frequency.

[5] The speed is reduced for increased cantilever forces, see selection guides.

[6] Version with brake: 12th data position "0", 14th data position "A", 15th data position "A" or "B", 16th data position "0", "3" or "6".

[7] For axis height 180 n_{max} = 7000 rpm, 1PH7224 n_{max} = 5500 rpm, coupling output only possible and 16th data position "0", "3" or "6".

[8] Preferred direction of air flow in a polluted environment.

[9] Only appropriate if oil spray/mist occasionally gets onto the sealing ring. A sealing ring is not possible for type IM B3 (IM V5, IM V6), version with increased maximum speed, version for belt output or increased cantilever forces.

Connection system
MOTION-CONNECT

MOTION-CONNECT

Overview

MOTION-CONNECT cables are suitable for use with many different types of machine tool and production machines.

The power cables and signal cables can be ordered by the meter or pre-assembled.

MOTION-CONNECT 500 is the option for mainly fixed installation.

Benefits

The use of pre-assembled MOTION-CONNECT cables will ensure high quality and system-tested, problem-free operation. The cables can be supplied in exact meter lengths. Intermediate lengths are also available in 0.1 m (3.94 in) increments.

Power and signal cables can be extended or configured as required.

Application

Degree of protection of pre-assembled power and signal cables and their extensions when closed and inserted: IP67.

Note:

When cable lengths (basic cables and extensions) are determined for the systems and applications described in this catalog, the technically permissible maximum cable lengths (e.g. ≤ 25 m (82 ft)) specified in the catalog must be observed. Malfunctions can occur if longer cables are used.

Siemens AG assumes no liability for correct transmission of signals or power in this case.

When the power and/or signal cables include more than one additional intermediate connection, the maximum permissible cable length is reduced by 2 m (6.56 ft) for each interruption point.

The cables are not suitable for outdoor use.

Function

G_NC01_XX_00289
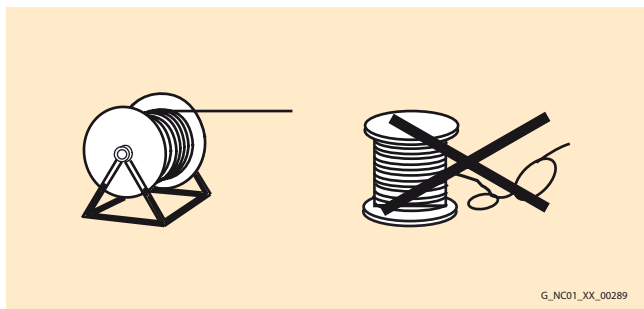
The cables must be removed from the drum without twisting, i.e., the cables must be unwound and must never be lifted over the drum flange in loops.

More information

Current carrying capacity for power and signal cables

The current carrying capacity of PVC/PUR-insulated copper cables is specified for installation types B1, B2 and C under continuous operating conditions in the table with reference to an ambient air temperature of 40 °C (104 °F). For other ambient temperatures, the values must be corrected using the derating factors in the corresponding table.

Cross-section	Current carrying capacity rms 50/60 Hz AC or DC for installation type			Standard
	B1	B2	C	
mm^2	A	A	A	
Electronic				**EN 60204-1**
0.20	–	4.3	4.4	
0.50	–	7.5	7.5	
0.75	–	9	9.5	
Power				**EN 60204-1**
0.75	8.6	8.5	9.8	
1.00	10.3	10.1	11.7	
1.50	13.5	13.1	15.2	
2.50	18.3	17.4	21	
4	24	23	28	
6	31	30	36	
10	44	40	50	
16	59	54	66	
25	77	70	84	
35	96	86	104	
50	117	103	125	
70	149	130	160	
95	180	165	194	
120	208	179	225	
150	–	–	259 extrapolated	
185	–	–	296 extrapolated	
>185	Values must be taken from the standard IEC 60364-5-52			

Derating-factors for power and signal cables

Ambient air temperature	Derating-factor according to EN 60204-1 Table D1.1
°C	
30 (86 °F)	1.15
35 (95 °F)	1.08
40 (104 °F)	1.00
45 (113 °F)	0.91
50 (122 °F)	0.82
55 (131 °F)	0.71
60 (140 °F)	0.58

Note:

MOTION-CONNECT cables are approved for a maximum horizontal travel distance of 5 m (16.41 ft).

■ Technical specifications

Signal cables	DRIVE-CLiQ	DRIVE-CLiQ MOTION-CONNECT 500	MOTION-CONNECT 500
Type	6FX2...-1DC..-....	6FX5...-.DC..-....	6FX500.-.....-....
Approvals			
• VDE	yes	yes	yes
• cUL or UL/CSA	UL STYLE 2502/CSA-N.210.2-M90	UL STYLE 2502/CSA-N.210.2-M90	UL758-CSA-22.2-N.210.2-M90
• UL-CSA File Nr.[1]	yes	yes	yes
Rated voltage according to EN 50395	30 V	30 V	30 V
Test voltage, rms	500 V	500 V	500 V
Operating temperature on the surface			
• Fixed installation	-20 … +80 °C (-4 °F ... 176 °F)	-20 … +80 °C (-4 °F ... 176 °F)	-20 … +80 °C (-4 °F ... 176 °F)
• Flexible installation	–	0 … 60 °C (32 °F ... 140 °F)	0 … 60 °C (32 °F ... 140 °F)
Tensile load, max.			
• Fixed installation	45 N/mm^2	80 N/mm^2	50 N/mm^2
• Flexible installation	–	30 N/mm^2	20 N/mm^2
Smallest bending radius			
• Fixed installation	50 mm (1.97 in)	35 mm (1.38 in)	60 mm (2.36 in)
• Flexible installation	–	125 mm (4.92 in)	100 mm (3.94 in)
Tosional stress	–	Absolute 30°/m	Absolute 30°/m
Bending	–	100 000	2 Mio.
Traversing velocity	–	30 m/min	180 m/min
Bending	–	2 m/s^2	5 m/s^2
Insulation material incl. jacket	CFC/silicone-free	CFC/silicone-free	CFC/silicone-free
Oil resistance	EN 60811-2-1	EN 60811-2-1 (only mineral oil)	EN 60811-2-1 (only mineral oil)
Outer jacket	PVC Gray RAL 7032	PVC DESINA color green RAL 6018	PVC DESINA color green RAL 6018
Flame retardant	EN 60332-1-1 to 1-3	EN 60332-1-1 to 1-3	EN 60332-1-1 to 1-3

For connecting components with DRIVE-CLiQ-connection, possesing an internal or external 24 V DC power supply

For connecting components with DRIVE-CLiQ connection, for higher requirements like mechanical load and oil resistance , e. g. for connection out of a cabinet. This cable has 24 V DC cores.

External connection for sensor interconnection

[1] The respective registration number is printed on the cable jacket.

Connection system
MOTION-CONNECT

Signal cables

■ **Integration**

Overview cables for SINAMICS S110

SINAMICS S110

Power Module PM340

Control Unit CU305

Motor connection for motors with DRIVE-CLiQ interface — X100

6FX5002-2DC10-....
≤ 100 m

Absolute value encoder with DRIVE-CLiQ 6FX2001-5.D..

Motor encoder for motors with DRIVE-CLiQ interface 1FK/1FT/1PH

6FX2002-1DC00-....
≤ 50 m

Sensor Module Cabinet-Mounted SMC10 for resolver evaluation

6FX5002-2CF20-....
≤ 50 m (multi-pole resolver)
≤ 130 m (2-pole resolver)

Resolver motor 1FK701

6FX5002-2CF02-....
≤ 50 m (multi-pole resolver)
≤ 130 m (2-pole resolver)

Resolver motor 1FK7/1PH7

Sensor Module Cabinet-Mounted SMC20 for sin/cos-and EnDat-encoder

6FX5002-2CA20-....
≤ 100 m

Incremental encoder sin/cos 1 V_{pp} in 1FK701

6FX5002-2CA31-....
≤ 100 m

Incremental encoder sin/cos 1 V_{pp} with C/D track in 1FK7/1PH7

6FX8002-2CA80-....
≤ 50 m

Incremental encoder sin/cos 1 V_{pp} without C/D track in 1PH7

6FX5002-2CG00-....
≤ 50 m

Incremental encoder sin/cos 1 V_{pp} 6FX2001-3...

6FX5002-2EQ20-....
≤ 100 m

Absolute value encoder with EnDat in 1FK701

6FX5002-2EQ10-....
≤ 100 m

Absolute value encoder with EnDat in 1FK7/1PH7

6FX5002-2CH00-....
≤ 100 m

Absolute value encoder with EnDat 6FX2001-5.E.

Direct connection motor encoder HTL/TTL — X23

6FX.002-2CR00-....
≤ 100 m at 5 V DC

Incremental encoder TTL RS 422 (5 V) 6FX2001-2...

6FX.002-2CD24-....
≤ 100 m at 5 V DC

Incremental encoder TTL RS 422 (24 V) 6FX2001-2...

6FX5002-2AH11-....
≤ 100 m at 5 V DC

Incremental encoder HTL im Motor 1PH/1PL6

6SX7002-0AN30-....
≤ 100 m at 5 V DC

Incremental encoder HTL 1XP8001 type on motor 1LA[1]

Motor connection — U2 V2 W2

Pre-assembled power cables see power cables for motors (max. cable length see Technical Data of the Power Modules)

Motors

Connector with pin contacts
Connector with socket contacts
Open core ends

[1] Not for 2KG geared motor.

G_D211_EN_00241

Technical specifications

Power cables	MOTION-CONNECT 500
Type	**6FX500.-....-....**
Approvals	
• VDE [1]	yes
• cUL or UL/CSA	UL758-CSA-C22.2-N.210.2-M90
• UL-CSA File Nr. [2]	yes
Rated voltage V_0/V **in accordance with EN 50395**	
• Power conductors	600 V/1 000 V
• Signal conductors	24 V (EN) 1 000 V (UL/CSA)
Test voltage, rms	
• Power conductors	4 kV
• Signal conductors	2 kV
Operating temperature **on the surface**	
• Fixed installation	-20 … +80 °C (-4 °F ... 176 °F)
• Flexible installation	0 … 60 °C (32 °F ... 140 °F)
Tensile load, max.	
• Fixed installation	50 N/mm^2
• Flexible installation	20 N/mm^2
Smallest bending radius	
• Fixed installation	$5 \times D_{max}$
• Flexible installation	See power cables
Torsional stress	Absolute 30°/m
Bending	100 000
Traversing velocity	30 m/min
Acceleration	2 m/s^2
Insulation material	FCKW-/silicone-free
Oil resistance	EN 60811-2-1 (only mineral oil)
Outer jacket	PVC
	DESINA color orange RAL 2003
Flame-retardant	EN 60332-1-1 to 1-3

For the connection of synchronous and asynchronous (induction) motors to the Power Modules.

The pre-assembled MOTION-CONNECT 500 power cables are of high quality and offer safety with problem-free functioning.

[1] The respective registration number is printed on the cable jacket (only valid for power cables).

[2] The file number is printed on the cable jacket.

Connection system
MOTION-CONNECT

Power cables

Technical specifications

Power cables MOTION-CONNECT 500 without brake cores for motors connected to Power Module AC/AC-devices

Connection method, Power-Module end	Number of cores × cross-section mm²	Connector size motor end	Pre-assembled cable for 1FT/1FK motors Order No.	D_{max} mm (in)	Cable sold by the meter [1] for motors with terminal box Order No.	Weight (without connector) kg/m (lb/ft)	Smallest perm. bending radius [2] mm (in)
Exposed core ends	4 × 1.5	1	**6FX5002-5CG01-....**	8.4 (0.33)	**6FX5008-1BB11-....**	0.12 (0.08)	155 (6.10)
		1.5	**6FX5002-5CG21-....**				
	4 × 2.5	1	**6FX5002-5CG11-....**	10.0 (0.39)	**6FX5008-1BB21-....**	0.21 (0.14)	180 (7.09)
		1.5	**6FX5002-5CG31-....**				
	4 × 4	1.5	**6FX5002-5CG41-....**	11.4 (0.45)	**6FX5008-1BB31-....**	0.27 (0.18)	210 (8.27)
	4 × 6	1.5	**6FX5002-5CG51-....**	13.6 (0.54)	**6FX5008-1BB41-....**	0.37 (0.25)	245 (9.65)
	4 × 10	1.5	**6FX5002-5CG61-....**	20.0 (0.79)	**6FX5008-1BB51-....**	0.73 (0.49)	360 (14.17)
		3	**6FX5002-5CG13-....**				
	4 × 16	3	**6FX5002-5CG23-....**	24.2 (0.95)	**6FX5008-1BB61-....**	1.10 (0.74)	440 (17.32)
Sold by the meter	4 × 25	–	**–**	28.0 (1.10)	**6FX5008-1BB25-....**	1.62 (1.09)	505 (19.88)
	4 × 35	–	**–**	31.5 (1.24)	**6FX5008-1BB35-....**	1.93 (1.30)	570 (22.44)
	4 × 50	–	**–**	38.0 (1.50)	**6FX5008-1BB50-....**	3.04 (2.04)	685 (26.97)
	4 × 70	–	**–**	42.6 (1.68)	**6FX5008-1BB70-....**	3.96 (2.66)	770 (30.31)
	4 × 95	–	**–**	51.7 (2.04)	**6FX5008-1BB05-....**	5.55 (3.73)	935 (36.81)
	4 × 120	–	**–**	56.0 (2.20)	**6FX5008-1BB12-....**	6.69 (4.50)	1010 (39.76)
Length codes			**....**		**....**		

Power cables MOTION-CONNECT 500 with brake cores for motors connected to Power Module AC/AC devices

Connection method, Power-Module end	Number of cores × cross-section mm²	Connector size motor end	Pre-assembled cable for 1FT/1FK motors Order No.	D_{max} mm (in)	Cable sold by the meter [1] for motors with terminal box Order No.	Weight (without connector) kg/m (lb/ft)	Smallest perm. bending radius [2] mm (in)
Exposed core ends	4 × 1.5 + 2 × 1.5	0.5	**6FX5002-5DA30-....**	10.8 (0.43)	**6FX5008-1BA11-....**	0.22 (0.15)	195 (7.68)
		1	**6FX5002-5DG01-....**				
		1.5	**6FX5002-5DG21-....**				
	4 × 2.5 + 2 × 1.5	1	**6FX5002-5DG11-....**	12.4 (0.49)	**6FX5008-1BA21-....**	0.25 (0.15)	225 (8.86)
		1.5	**6FX5002-5DG31-....**				
	4 × 4 + 2 × 1.5	1.5	**6FX5002-5DG41-....**	14.0 (0.55)	**6FX5008-1BA31-....**	0.35 (0.24)	255 (10.04)
	4 × 6 + 2 × 1.5	1.5	**6FX5002-5DG51-....**	16.1 (0.63)	**6FX5008-1BA41-....**	0.49 (0.33)	290 (11.42)
	4 × 10 + 2 × 1.5	1.5	**6FX5002-5DG61-....**	21.7 (0.85)	**6FX5008-1BA51-....**	0.81 (0.54)	395 (15.55)
		3	**6FX5002-5DG13-....**				
	4 × 16 + 2 × 1.5	3	**6FX5002-5DG23-....**	25.0 (0.98)	**6FX5008-1BA61-....**	1.12 (0.75)	450 (17.72)
	4 × 25 + 2 × 1.5	3	**6FX5002-5DG33-....**	29.4 (1.16)	**6FX5008-1BA25-....**	1.62 (1.09)	530 (20.87)
	4 × 35 + 2 × 1.5	3	**6FX5002-5DG43-....**	32.6 (1.28)	**6FX5008-1BA35-....**	2.06 (1.38)	590 (23.23)
	4 × 50 + 2 × 1,5	3	**6FX5002-5DG53-....**	38.0 (1.50)	**6FX5008-1BA50-....**	3.04 (2.04)	685 (27.97)
Length codes			**...**		**...**		

[1] Power cables of 1.5 mm² and 2.5 mm² are supplied in coils or on disposable drums in lengths of 50 m, 100 m, 200 m and 500 m (164 ft, 328 ft, 656 ft, 1640 ft). Power cables of ≥ 4 mm² can be ordered to the meter in lengths of up to 100 m (328 ft) and in fixed lengths above 100 m (328 ft) on disposable cables.

[2] Valid for routing in cable carrier

■ Overview

Designation	Type				
Length code for pre-assembled cables					
	6FX....-.....- ■ ■ ■ ■				
	6SX....-.....- ■ ■ ■ **0**				
0 m (0 ft)		**1**			
100 m (328 ft)		**2**			
200 m (656 ft)		**3**			
300 m (984 ft)		**4**			
0 m (0 ft)			**A**		
10 m (32.81 ft)			**B**		
20 m (65.62 ft)			**C**		
30 m (98.43 ft)			**D**		
40 m (131.24 ft)			**E**		
50 m (164.05 ft)			**F**		
60 m (196.86 ft)			**G**		
70 m (229.67 ft)			**H**		
80 m (262.48 ft)			**J**		
90 m (295.29 ft)			**K**		
0 m (0 ft)				**A**	
1 m (3.28 ft)				**B**	
2 m (6.56 ft)				**C**	
3 m (9.84 ft)				**D**	
4 m (13.12 ft)				**E**	
5 m (16.41 ft)				**F**	
6 m (19.69 ft)				**G**	
7 m (22.97 ft)				**H**	
8 m (26.25 ft)				**J**	
9 m (29.53 ft)				**K**	
0 m (0 ft)					**0**
0.1 m (3.94 in)					**1**
0.2 m (7.87 in)					**2**
0.3 m (11.81 in)					**3**
0.4 m (15.75 in)					**4**
0.5 m (19.69 in)					**5**
0.6 m (23.62 in)					**6**
0.7 m (27.56 in)					**7**
0.8 m (31.5 in)					**8**
Examples:	1.0 m (3.28 ft):	1	A	B	0
	2.2 m (7.22 ft):	1	A	C	2
	8.0 m (26.25 ft):	1	A	J	0
	299.0 m (981.00 ft):	3	K	K	0

	Type-No.
Length codes for power cables, sold by the meter [1]	
• 50 m (164 ft)	**6FX5008-.....-1FA0**
• 100 m (328 ft)	**6FX5008-.....-2AA0**
• 200 m (656 ft)	**6FX5008-.....-3AA0**
• 500 m (1640 ft)	**6FX5008-.....-6AA0**

[1] Power cables of up to 4 mm² can be ordered to the meter in lengths up to 100 m (328 ft), and in fixed lengths above 100 m (328 ft) on disposable drums. Power cables of 1.5 mm² and 2.5 mm² are supplied in coils or on disposable drums in lengths of 50 m, 100 m, 200 m und 500 m (164 ft, 328 ft, 656 ft, 1640 ft).

■ More information

Length definition for pre-assembled cables

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Signal cables

G_D211_XX_00245
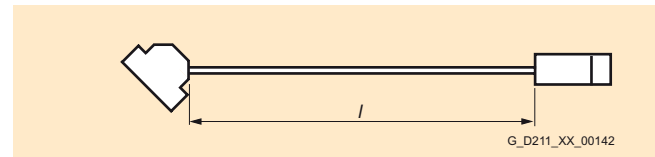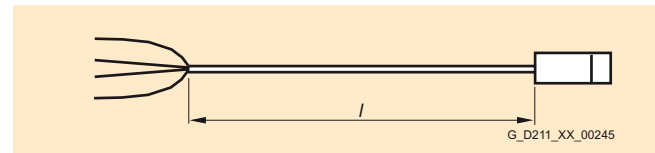
Power cables

Tolerance:
- Cable lengths up to 10 m (32.8 ft): ± 2 %
- Cable lengths of 10 m (32.8 ft): ± 1 %

Appendix
Customer Support

Our Services for Every Phase of Your Project

Planning & Design	Project engineering & Developement	Installation & commissioning	Operation & maintenance	Modernization

On-line support

Technical support

Technical consulting

Design and software-engineering

Field Service

Repairs and spare parts

Optimization and modernization

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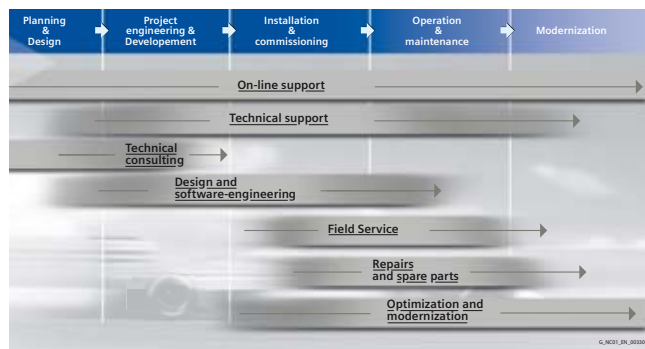
In the face of harsh competition you need optimum conditions to keep ahead all the time:
A strong starting position. A sophisticated strategy and team for the necessary support – in every phase.
Service & Support from Siemens provides this support with a complete range of different services for automation and drives.

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Our specialists know when and where to act to keep the productivity and cost-effectiveness of your system running in top form.

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Competent consulting in technical questions covering a wide range of customer-oriented services for all our products and systems.

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Fax: +49 (0)180 50 50 223
E-Mail:
adsupport@siemens.com

http://www.siemens.com/automation/support-request

In the United States, call toll-free:
Phone: +1 800 33 7421
Fax: +1 423 262 2200
E-Mail: solutions.support @sea.siemens.com

In Canada, call:
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Fax: +1 423 262 2200
E-Mail: cic@siemens.ca

In Asia, call:
Phone: +86 10 6475 7575
Fax: +86 10 6474 7474
E-Mail:
adsupport.asia@siemens.com

Technical Consulting

Support in the planning and designing of your project from detailed actual-state analysis, target definition and consulting on product and system questions right to the creation of the automation solution. [1]

Configuration and Software Engineering

Support in configuring and developing with customer-oriented services from actual configuration to implementation of the automation project. [1]

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With Service On Site we offer services for startup and maintenance, essential for ensuring system availability.

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In the United States, call toll-free:
Phone: +1 800 33 7421

In Canada, call:
Phone: +1 888 303 3353

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In the operating phase of a machine or automation system we provide a comprehensive repair and spare parts service ensuring the highest degree of operating safety and reliability.

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Phone: +49 (0)180 50 50 448 [1][2]

In the United States, call toll-free:
Phone: +1 800 241 4453

In Canada, call:
Phone: +1 888 303 3353

Optimization and Upgrading

To enhance productivity and save costs in your project we offer high-quality services in optimization and upgrading. [1]

Product registration

To guarantee our servicing performance (availability of spare parts, hotline function, readiness of personnel), we offer you product registration for our SINAMICS drive equipment. Feedback on the final position (installation/operation location) and naming of contact partners allow a servicing response without delay. The feedback can be made either using a feedback form (enclosed with each converter) or over the Internet:

http://www.siemens.com/reg

[1] For country-specific telephone numbers go to our Internet site at:
http://www.siemens.com/automation/service&support

[2] 0.14 €/min from the German fixed network

Online Services

**Information and Ordering
in the Internet and on DVD**

Appendix
Contact partners

Siemens Contacts Worldwide

Siemens Industry Automation and Drive Technologies in the WWW

A detailed knowledge of the range of products and services available is essential when planning and configuring automation systems. It goes without saying that this information must always be fully up-to-date.

Siemens Industry Automation and Drive Technologies has therefore built up a comprehensive range of information in the World Wide Web, which offers quick and easy access to all data required.

Under the address

http://www.siemens.com/automation

you will find everything you need to know about products, systems and services.

Product Selection Using the Offline Mall of Industry

Detailed information together with convenient interactive functions:
The Offline Mall CA 01 covers more than 80,000 products and thus provides a full summary of the Siemens Industry Automation and Drive Technologies product base.

Here you will find everything that you need to solve tasks in the fields of automation, switchgear, installation and drives. All information is linked into a user interface which is easy to work with and intuitive.

After selecting the product of your choice you can order at the press of a button, by fax or by online link.

Information on the Offline Mall CA 01 can be found in the Internet under

http://www.siemens.com/automation/ca01

or on DVD.

Easy Shopping with the Industry Mall

The Industry Mall is the virtual department store of Siemens AG in the Internet. Here you have access to a huge range of products presented in electronic catalogs in an informative and attractive way.

Data transfer via EDIFACT allows the whole procedure from selection through ordering to tracking of the order to be carried out online via the Internet.

Numerous functions are available to support you.

For example, powerful search functions make it easy to find the required products, which can be immediately checked for availability. Customer-specific discounts and preparation of quotes can be carried out online as well as order tracking and tracing.

Please visit the Industry Mall on the Internet under:

http://www.siemens.com/automation/mall

Siemens Contacts Worldwide

At

http://www.siemens.com/automation/partner

you can find details of Siemens contact partners worldwide responsible for particular technologies.

You can obtain in most cases a contact partner for
• Technical Support,
• Spare parts/repairs,
• Service,
• Training,
• Sales or
• Consultation/engineering.

You start by selecting a
• Country,
• Product or
• Sector

By further specifying the remaining criteria you will find exactly the right contact partner with his/her respective expertise.

Appendix

Conditions of sale and delivery
Export regulations

■ Terms and Conditions of Sale and Delivery

By using this catalog you can acquire hardware and software products described therein from Siemens AG subject to the following terms. Please note! The scope, the quality and the conditions for supplies and services, including software products, by any Siemens entity having a registered office outside of Germany, shall be subject exclusively to the General Terms and Conditions of the respective Siemens entity. The following terms apply exclusively for orders placed with Siemens AG.

For customers with a seat or registered office in Germany

The "General Terms of Payment" as well as the "General Conditions for the Supply of Products and Services of the Electrical and Electronics Industry" shall apply.

For software products, the "General License Conditions for Software Products for Automation and Drives for Customers with a Seat or registered Office in Germany" shall apply.

For customers with a seat or registered office outside of Germany

The "General Terms of Payment" as well as the "General Conditions for Supplies of Siemens, Automation and Drives for Customers with a Seat or registered Office outside of Germany" shall apply.

For software products, the "General License Conditions for Software Products for Automation and Drives for Customers with a Seat or registered Office outside of Germany" shall apply.

General

The dimensions are in mm. In Germany, according to the German law on units in measuring technology, data in inches only apply to devices for export.

Illustrations are not binding.

Insofar as there are no remarks on the corresponding pages, - especially with regard to data, dimensions and weights given – these are subject to change without prior notice.

The prices are in € (Euro) ex works, exclusive packaging.

The sales tax (value added tax) is not included in the prices. It shall be debited separately at the respective rate according to the applicable legal regulations.

Prices are subject to change without prior notice. We will debit the prices valid at the time of delivery.

Surcharges will be added to the prices of products that contain silver, copper, aluminum, lead and/or gold if the respective basic official prices for these metals are exceeded. These surcharges will be determined based on the official price and the metal factor of the respective product.

The surcharge will be calculated on the basis of the official price on the day prior to receipt of the order or prior to the release order.
The metal factor determines the official price as of which the metal surcharges are charged and the calculation method used. The metal factor, provided it is relevant, is included with the price information of the respective products.

An exact explanation of the metal factor and the text of the Comprehensive Terms and Conditions of Sale and Delivery are available free of charge from your local Siemens business office under the following Order Nos.:

- 6ZB5310-0KR30-0BA1
  (for customers based in Germany)
- 6ZB5310-0KS53-0BA1
  (for customers based outside Germany)

or download them from the Internet
http://www.siemens.com/automation/mall
(Germany: A&D Mall Online-Help System)

■ Export regulations

The products listed in this catalog / price list may be subject to European / German and/or US export regulations.

Therefore, any export requiring a license is subject to approval by the competent authorities.

According to current provisions, the following export regulations must be observed with respect to the products featured in this catalog / price list:

AL	Number of the German Export List
	Products marked other than "N" require an export license. In the case of software products, the export designations of the relevant data medium must also be generally adhered to.
	Goods labeled with an "AL" not equal to "N" are subject to a European or German export authorization when being exported out of the EU.
ECCN	Export Control Classification Number
	Products marked other than "N" are subject to a reexport license to specific countries.
	In the case of software products, the export designations of the relevant data medium must also be generally adhered to.
	Goods labeled with an "ECCN" not equal to "N" are subject to a US re-export authorization.

Even without a label or with an "AL: N" or "ECCN: N", authorization may be required due to the final destination and purpose for which the goods are to be used.

The deciding factors are the AL or ECCN export authorization indicated on order confirmations, delivery notes and invoices.

Errors excepted and subject to change without prior notice.

A&D/VuL_ohne MZ/En 05.09.06

Catalogs

Industry Automation, Drive Technologies and Electrical Installation Technology

Further information can be obtained from our branch offices listed in the appendix or at www.siemens.com/automation/partner

PDF: These catalogs are only available as pdf files.

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