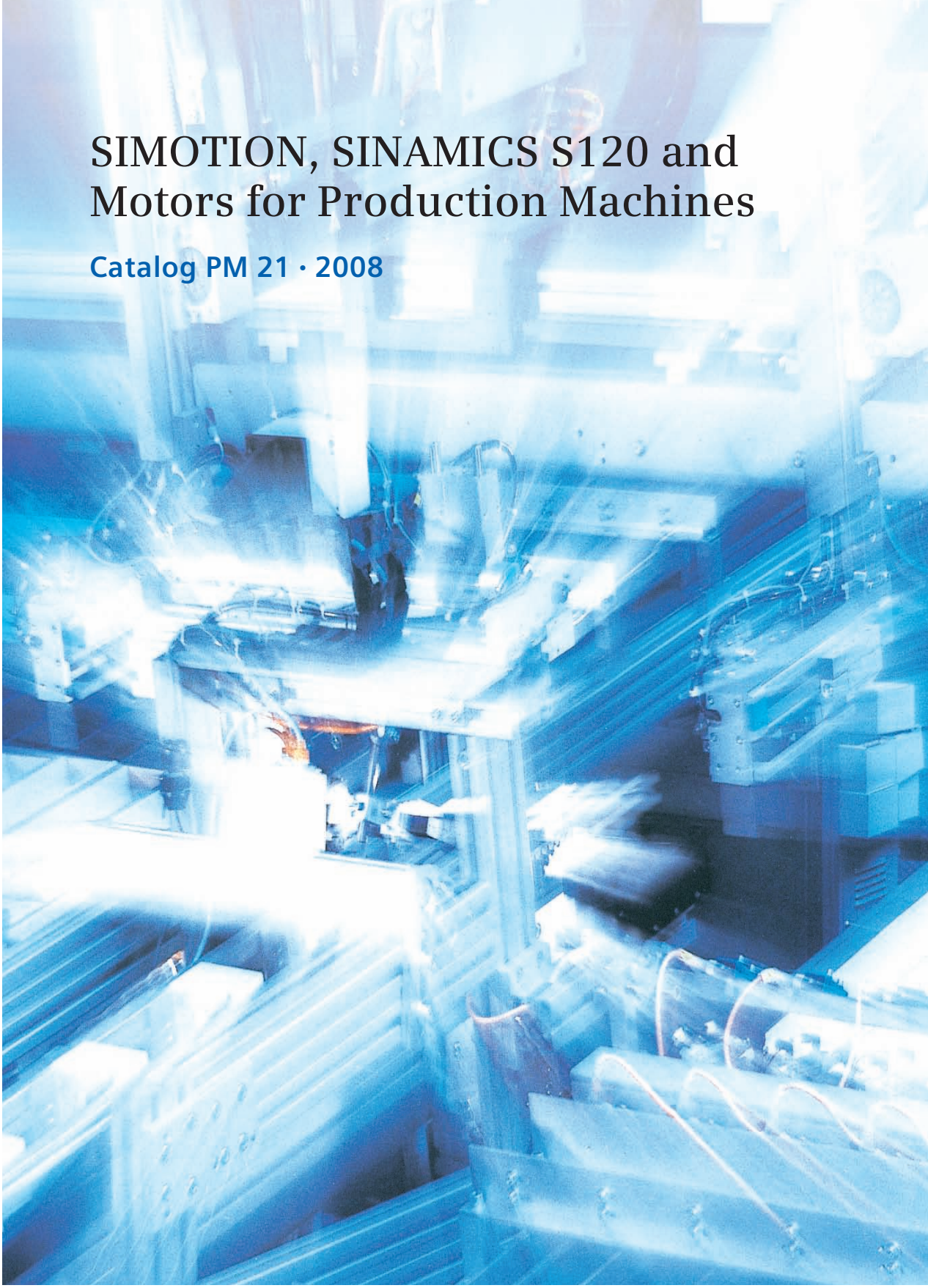
SIMOTION, SINAMICS S120 and Motors for Production Machines

Catalog PM 21 · 2008



Motion Control

www.siemens.com/motioncontrol

SIEMENS

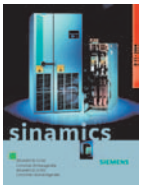
Related Catalogs

SINAMICS G110/SINAMICS G120 D 11.1
Inverter Chassis Units
SINAMICS G120D
Distributed Frequency Inverters

E86060-K5511-A111-A4-7600

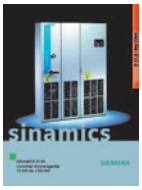
SINAMICS G130 D 11
Drive Converter Chassis Units
SINAMICS G150
Drive Converter Cabinet Units

E86060-K5511-A101-A3-7600



SINAMICS S150 D 21.3
Drive Converter Cabinet Units
75 kW to 1200 kW

E86060-K5521-A131-A1-7600



SINUMERIK & SINAMICS NC 61
Automation Systems
for Machine Tools

E86060-K4461-A101-A2-7600

SIMATIC ST 70
Products for
Totally Integrated Automation
and Micro Automation

E86060-K4670-A101-B1-7600

SIMATIC HMI ST 80
Human Machine
Interface Systems

E86060-K4680-A101-B5-7600

PC-based Automation ST PC

E86060-K4670-B101-B7-7600

Industrial Communication IK PI
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Catalog CA 01 CA 01
The Offline-Mall of
Automation and Drives

E86060-D4001-A110-C6-7600 (CD-ROM)
E86060-D4001-A510-C6-7600 (DVD)

A&D Mall

Online Information and
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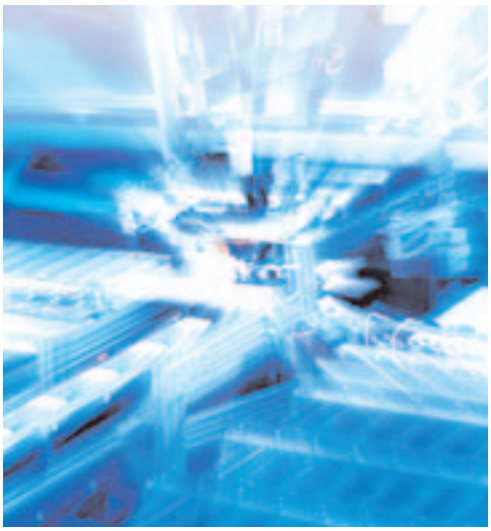
www.siemens.com/automation/mall

[1)] Language: German

Motion Control
SIMOTION, SINAMICS S120 and Motors for Production Machines

Catalog PM 21 · 2008



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Supersedes:
Catalog D 21.1 · 2006
Catalog PM 10 · 2005
Catalog News PM 10 · November 2006

The products contained in this catalog can also be found in the e-Catalog CA 01.
Order No.:
E86060-D4001-A110-C6-7600 (CD-ROM)
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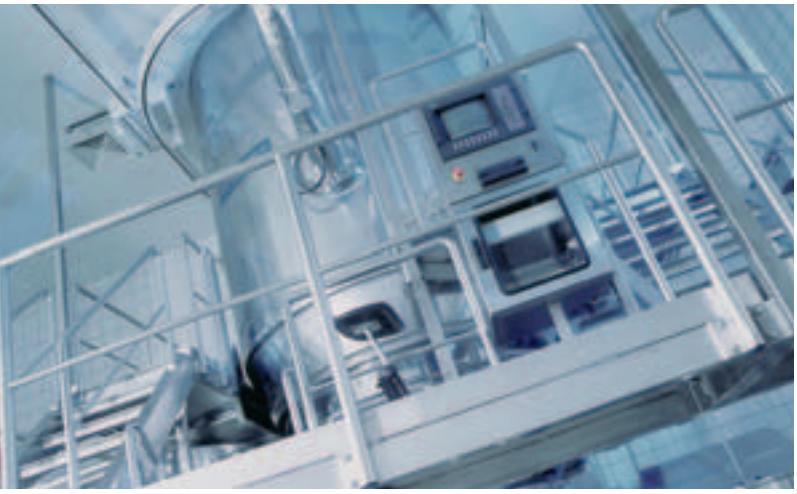
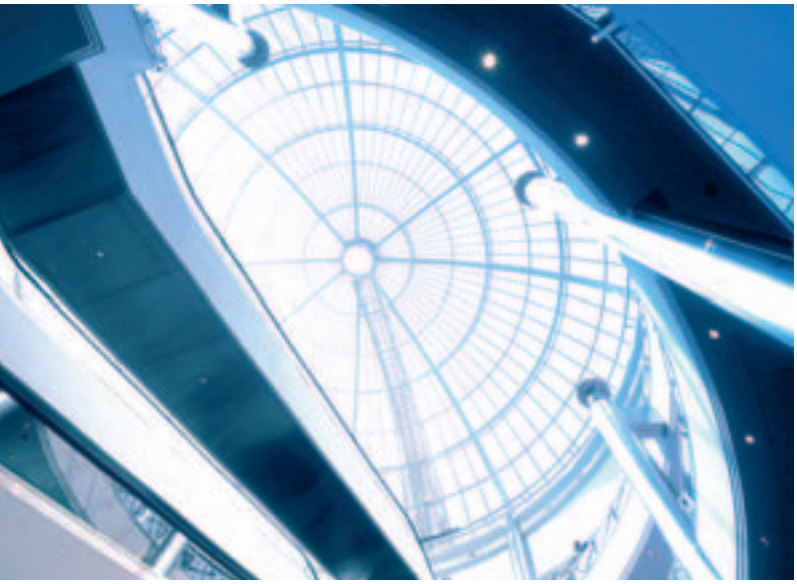




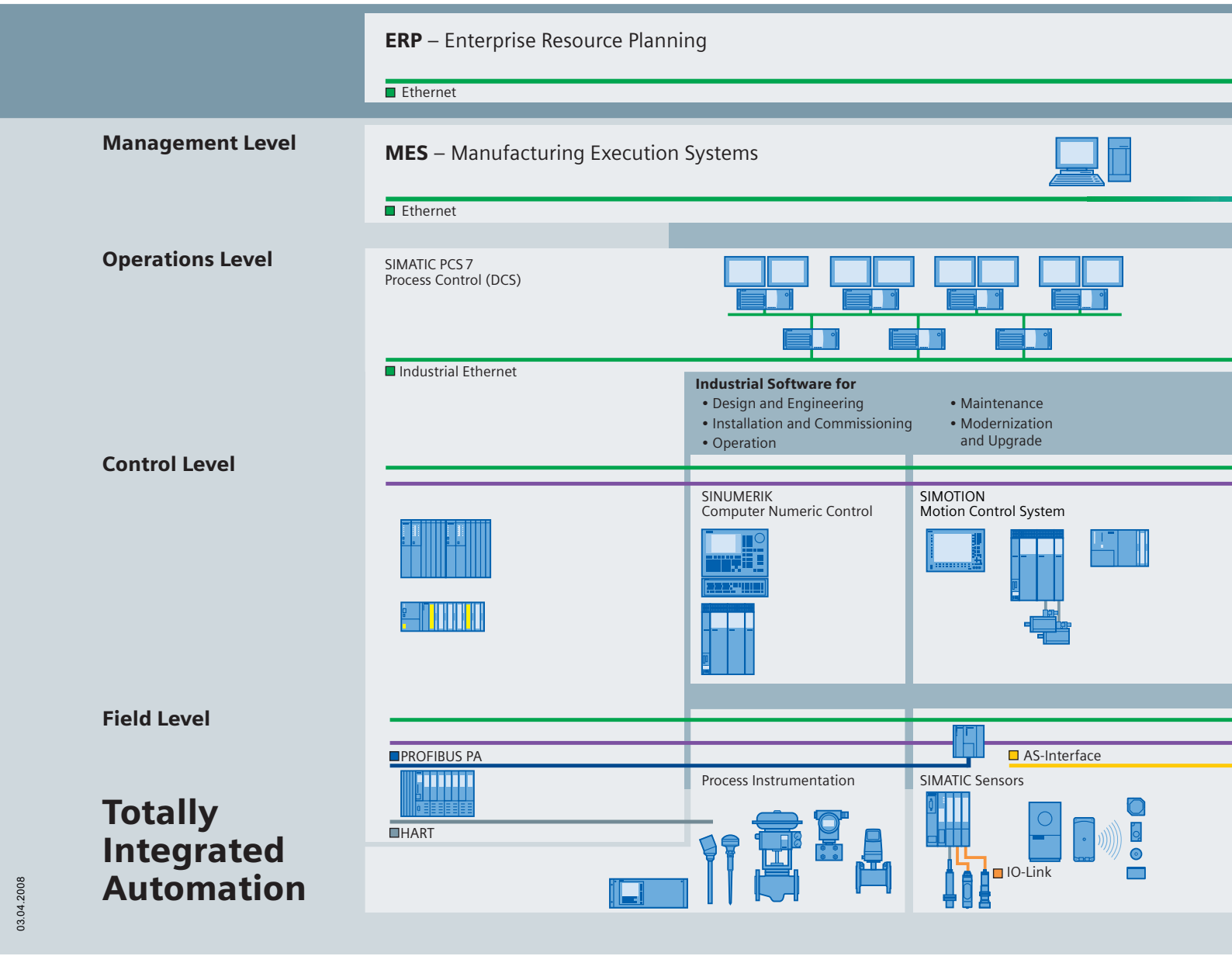
Answers for Industry.

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 train – 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.

The high quality of our products sets industry-wide benchmarks. High environmental aims are part of our eco-management, and we implement these aims consistently. Right from product design, possible effects on the environment are examined. Hence many of our products and systems are RoHS compliant (Restriction of Hazardous Substances). As a matter of course, our production sites are certified according to DIN EN ISO 14001, but to us, environmental protection also means most efficient utilization of valuable resources. The best example are our energy-efficient drives with energy savings up to 60 %.

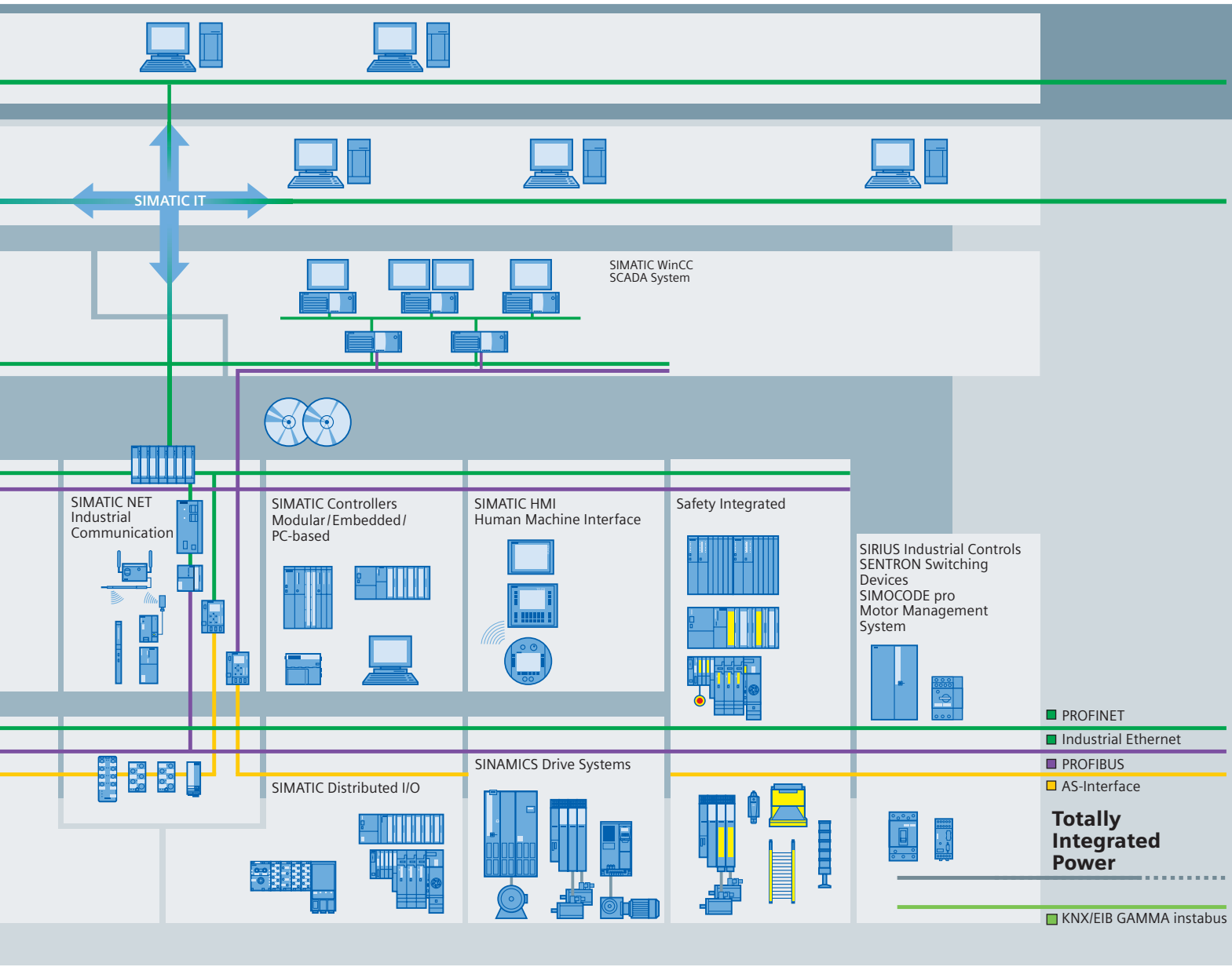
Check out the opportunities our automation and drive solutions provide. And discover how you can sustainably enhance your competitive edge with us.



Setting standards in productivity and competitiveness.

Totally Integrated Automation.

Thanks to Totally Integrated Automation, Siemens is the only provider of an integrated basis for implementation of customized automation solutions – in all industries from inbound to outbound.



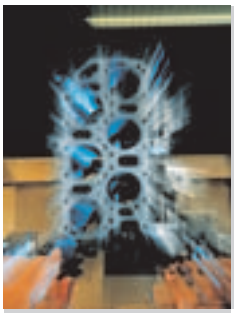
TIA is characterized by its unique continuity.

It provides maximum transparency at all levels with reduced interfacing requirements – covering the field level, production control level, up to the corporate management level. With TIA you also profit throughout the complete life cycle of your plant – starting with the initial planning steps through operation up to modernization, where we offer a high measure of investment security resulting from continuity in the further development of our products and from reducing the number of interfaces to a minimum.

The unique continuity is already a defined characteristic at the development stage of our products and systems.

The result: maximum interoperability – covering the controller, HMI, drives, up to the process control system. This reduces the complexity of the automation solution in your plant. You will experience this, for example, in the engineering phase of the automation solution in the form of reduced time requirements and cost, or during operation using the continuous diagnostics facilities of Totally Integrated Automation for increasing the availability of your plant.

Overview



Measuring systems

Built-on optoelectronic rotary encoders
Incremental encoders
Absolute encoders
SIMAG H2 hollow-shaft measuring system

6

Connection system MOTION-CONNECT

Power cables
Signal cables
Accessories
Length codes

7

SIMOTION

SIMOTION C – Controller-based
SIMOTION P – PC-based
SIMOTION D – Drive-based
SIMOTION software
SIMOTION Runtime Software
SIMOTION engineering software
SIMOTION Overview of functions

8

SIMOTION I/O components

Power supplies
SIMATIC S7-300 I/O
Distributed I/O
SINAMICS drive I/O
Other I/O modules

9

SIMOTION Human Machine Interface (HMI)

SIMATIC Mobile Panel 177/277
SIMATIC TP/OP 177B/277
SIMATIC MP 277/377
SIMATIC Panel PC 477B, 577, 677B
SIMATIC WinCC flexible ES/RT

10

Overview

1

System overview

Excellence in Motion Control

Motion Control Solutions "Made by Siemens"

The Motion Control Systems division of the Automation and Drives Group offers complete future-oriented automation solutions for machine tools and production machines.

Thanks to the strong innovation capacity, the sector know-how and the outstanding customer benefit of these solutions, Siemens is one of the leading suppliers of Motion Control systems worldwide.

Innovative products, systems, solutions and services for each sector

Siemens Motion Control systems achieve very high requirements: All products stand out through the use of the latest technologies, high functionality and quality. In addition, the individual systems and products are optimally matched to one another so that they can be easily and consistently combined into an economic machine solution.

Examples of this are the Motion Control system SIMOTION and the drive system SINAMICS. These products constitute an innovative system platform, with which you can optimally adapt the control system to your machine requirements. As a result you can find optimized, economic and future-oriented Motion Control solutions for different sectors such as the packaging, plastics and glass, timber and metal, textile and printing industries which can be easily expanded for increased requirements and combined with our high performance servo, linear, torque and standard motors.

Furthermore, Siemens supports its customers over the entire life cycle of a machine, e.g. with worldwide presales and aftersales service at more than 295 service points in 130 countries or with special services for Motion Control solutions such as application consulting and Mechatronics Support.

Application support: The safe path to top solutions

Several application centers in China, France, Germany, Italy, Turkey and the USA support the specialist and application consultants on site who accompany customer projects from planning through startup – from the idea to the operational machine.

Application consulting includes:

- Planning and implementing projects
- Technical verification with test configuration and simulation
- Development of requirements and functional specifications
- Application workshops and customer-specific training courses

Partnership for joint success

During this cooperation Siemens not only supports its customers, but also includes them as technology partners in the development process of systems and components which results in practical and future-oriented automation solutions.

In this way Siemens helps its customers to increase productivity, competitiveness and profitability over the long term.

Application areas of the SINAMICS drive family

Application

SINAMICS is the new family of drives from Siemens designed for machine and plant engineering applications. SINAMICS offers solutions for all drive tasks:

- Simple pump and fan applications in the process industry
- Applied single drives in centrifuges, presses, extruders, elevators, as well as conveyor and transport systems
- Drive line-ups in textile, plastic film, and paper machines, as well as in rolling mill plants
- Highly dynamic servo drives for machine tools, as well as packaging and printing machines

Variants

Depending on the application, the SINAMICS range offers the ideal variant for any drive task.

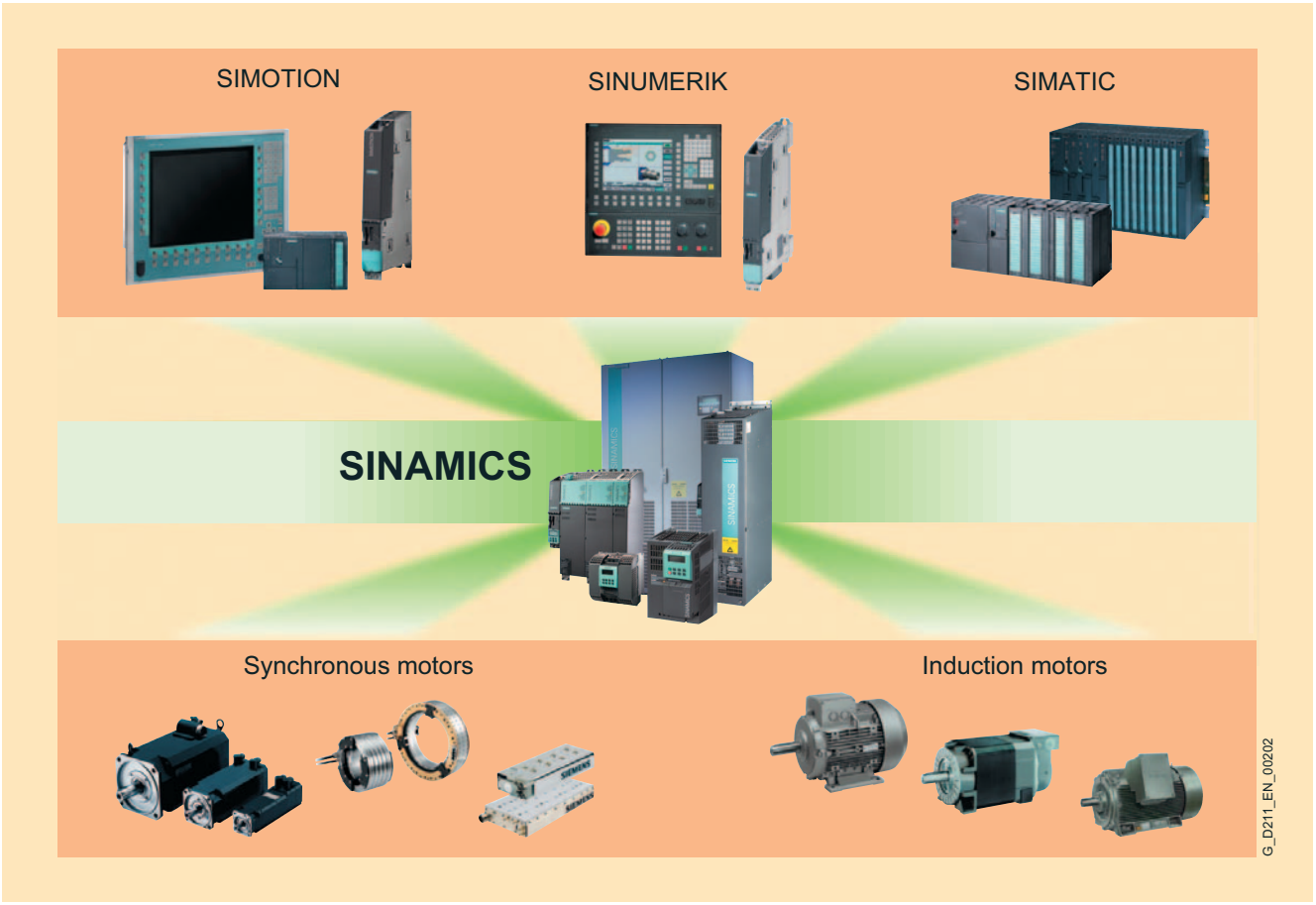
- SINAMICS G is designed for standard applications with asynchronous (induction) motors. These applications have less stringent requirements regarding the dynamics and accuracy of the motor speed.
- SINAMICS S handles complex drive tasks with synchronous and asynchronous (induction) motors and fulfills stringent requirements regarding
  - dynamics and accuracy,
  - integration of extensive technological functions in the drive control system.

Platform concept and Totally Integrated Automation

All SINAMICS versions are based on a platform concept. Common hardware and software components, as well as standardized tools for design, configuration and commissioning tasks, ensure high-level integration across all components. SINAMICS handles a wide variety of drive tasks with no system gaps. The different SINAMICS versions can be easily combined with each other.

SINAMICS is a part of the Siemens "Totally Integrated Automation" concept. Integrated SINAMICS systems covering configuration, data storage, and communication at the automation level ensure low-maintenance solutions with the SIMOTION, SINUMERIK and SIMATIC control systems.

The SINAMICS drive family



SINAMICS as part of the Siemens modular automation system

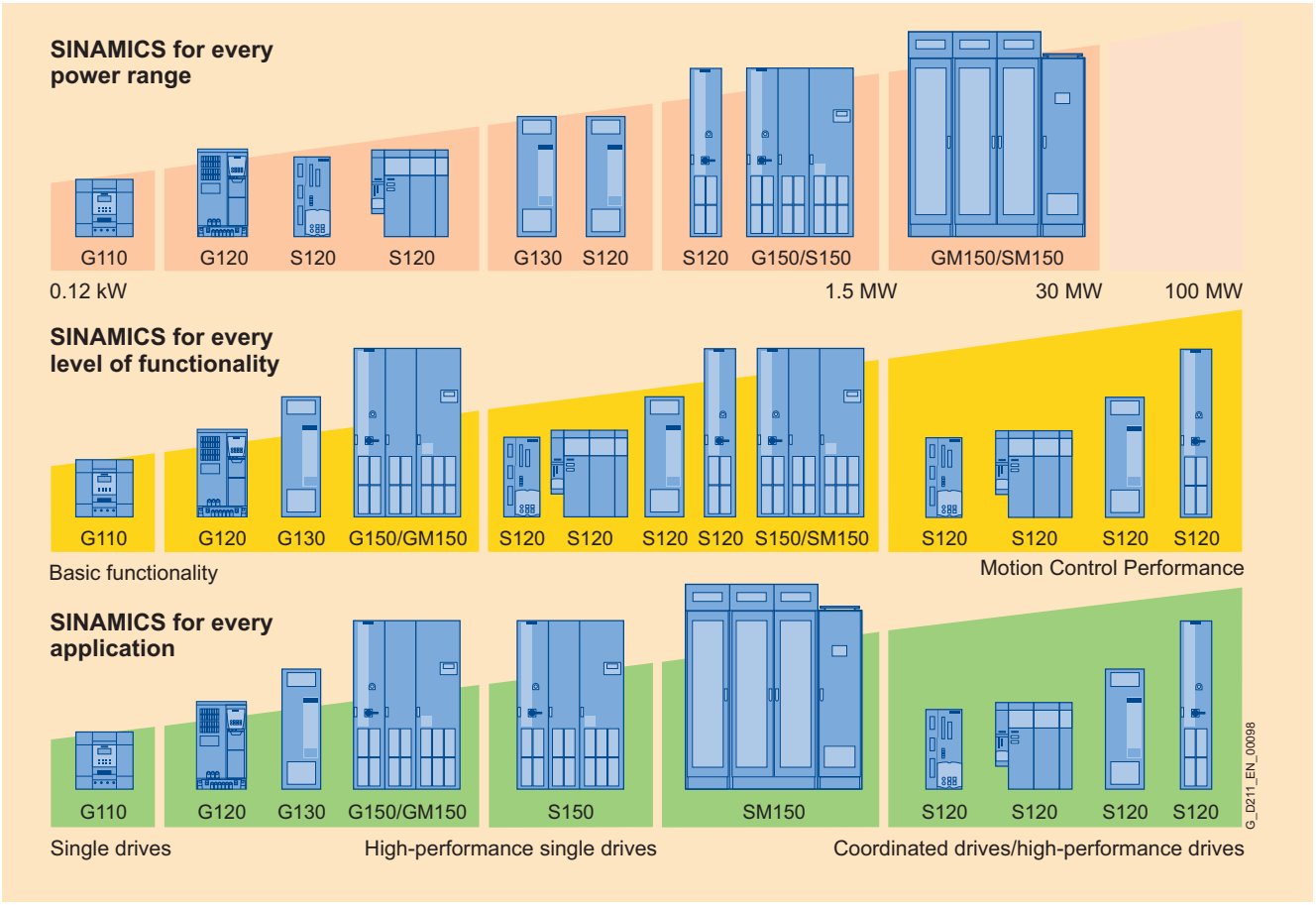
Quality according to DIN EN ISO 9001

SINAMICS conforms to the most exacting quality requirements. Comprehensive quality assurance measures in all development and production processes ensure a consistently high level of quality.

Of course, our quality assurance system is certified by an independent authority in accordance with DIN EN ISO 9001.

Suitable for global use

SINAMICS meets the requirements of relevant international standards and regulations – from the EN standards and IEC standards to UL and cULus regulations.



Tailored to suit different application areas, the SINAMICS range encompasses the following products:

Low-voltage converters (line supply < 1000 V)

- **SINAMICS G110** – the versatile drive for low outputs
- **SINAMICS G120** – the modular single drive for low to medium power ranges
- **SINAMICS G120D** – the distributed single drive providing a high degree of protection for installation without a control cabinet
- **SINAMICS G130** and **SINAMICS G150** – the universal drive solution for high-performance single drives
- **SINAMICS S120** – the flexible, modular drive system for demanding tasks
- **SINAMICS S150** – the sophisticated drive solution for high-performance single drives

Medium-voltage converters (line supply > 1000 V)

- **SINAMICS GM150** – the universal drive solution for single drives
- **SINAMICS SM150** – the sophisticated drive solution for single and multi-motor drives

The SINAMICS range is characterized by the following system properties:

- Uniform functionality based on a single platform concept
- Standardized engineering
- High degree of flexibility and combination capability
- Wide range of performance
- Designed for global use
- SINAMICS Safety Integrated
- Greater efficiency and effectiveness
- Multiple communications options
- Totally Integrated Automation

SINAMICS S120 built-in devices

Flexibility for successful machine concepts

As part of the SINAMICS drive family, the SINAMICS S120 drive is a modular system for high-performance applications in machine construction and plant engineering. SINAMICS S120 offers high-performance single-axis and multi-axis drives for a very broad range of industrial applications. By virtue of its scalability and flexibility, SINAMICS S120 is the ideal system for satisfying the ever increasing demand for more axes and better performance. SINAMICS S120 supports flexible machine designs and faster implementation of customized drive solutions.

The response to ever increasing demands

Modern machines must be built at ever lower cost, but deliver greater productivity. The SINAMICS S120 drive concept meets both these challenges! It is easy to configure and thus helps to reduce project completion times. Its excellent dynamic response and accuracy permit higher cycle rates for maximum productivity.

Applications in machine and plant engineering

Regardless of whether the application involves continuous material webs or cyclic, highly dynamic processes – SINAMICS S120 means increased machine performance in many sectors:

- Packaging machines
- Plastics processing machines
- Textile machines
- Printing machines
- Paper machines
- Hoisting equipment
- Handling and assembly systems
- Machine tools
- Rolling mills
- Test stands

Modularity for mechanical engineering

SINAMICS S120 is designed to allow free combination of power and control performance. Multi-axis drives with higher-level motion control can be implemented with the SINAMICS S120 modular system as easily as single-drive solutions.

Greater flexibility with central control intelligence

On the SINAMICS S120, the drive intelligence is combined with closed-loop control functions into Control Units.

These units are capable of controlling drives in Vector, Servo and *V/f* modes. They also perform the speed and torque control functions plus other intelligent drive functions for all axes on the drive.

Free performance selection for Vector and Servo control modes

The use of a SINAMICS S120 Vector control is recommended for drive solutions with continuous material webs, for example, wire-drawing machines, film and paper machines, as well as for hoisting gear, centrifuges and marine drives.

Servo control with SINAMICS S120 is employed for cyclic processes with precise, highly dynamic position control and servo motors, e.g. in textile, packaging, printing machines and machine tools.

SINAMICS S120 – functions for better efficiency

- Basic functions: Speed control, torque control, positioning functions
- Intelligent starting functions for independent restart after power supply interruption
- BICO technology with interconnection of drive-related I/Os for easy adaptation of the drive system to its operating environment
- Integrated safety functions for realizing the implementation of safety concepts
- Regulated infeed/regenerative feedback functions for preventing undesirable reactions on the supply, allowing recovery of braking energy and ensuring greater stability against line fluctuations.

DRIVE-CLiQ – the digital interface between all components

All SINAMICS S120 components, including the motors and encoders, are interconnected by a shared serial interface called DRIVE-CLiQ. DRIVE-CLiQ forms the backplane for the complete drive system.The standardized cables and connectors reduce the variety of different parts and cut storage costs. Converter boards (Sensor Modules) for converting standard encoder signals to DRIVE-CLiQ are available for third-party motors or retrofit applications.

Swift and automatic: The electronic rating plate

An important digital linkage element of the SINAMICS S120 drive system are the electronic rating plates integrated in every component. They allow all drive components to be detected automatically via a DRIVE-CLiQ link. As a result, data do not need to be entered manually during commissioning or component replacement – helping to ensure that drives are commissioned quickly and successfully! The electronic rating plates of the motors contain, for example, the parameters of the electrical equivalent circuit diagram and the characteristic data of the built-in motor encoder in addition to information such as order and identification numbers.

Modular design ensures flexibility and scalability

The multi-axis design, also, referred to as common DC bus, is very modular with a power offering of Line Modules and Motor Modules – both available in booksize compact, booksize and chassis formats. Line Modules function as the central energy supply to the voltage-source DC link. Line Modules are optionally available with regulated infeed/regenerative feedback to provide a constant DC link voltage. Motor Modules (DC/AC units) supply the motors with energy from the DC link. All the drive intelligence is organized into Control Units. The control units perform all the closed-loop control functions for the drive grouping. They also handle all other drive functions such as the interconnection of drive related I/O's, positioning functions, etc. and feature PROFIBUS DP or PROFINET as the central interface for linking to higher level automation systems.

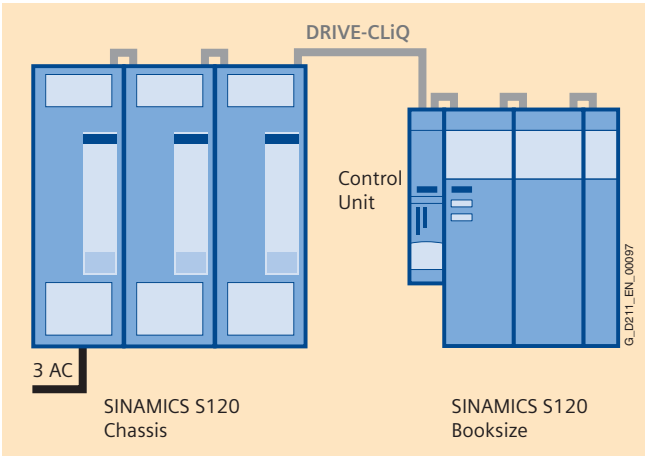
On single axis units, also referred to as AC drives, the rectifier and inverter power section are contained in one device, the Power Module – available in blocksize and chassis formats. For single axis applications, drive control functions are performed by a single axis Control Unit (e.g. CU310) mounted on to the Power Module. This separation of power and intelligence allows for maximum flexibility and scalability. Integration into multi-axis applications is easily accomplished by connecting a DRIVE-CLiQ link to a multi-axis Control Unit (e.g. CU320). This is accomplished by mounting a CU adapter (CUA31) on a blocksize Power Module in place of the single axis Control Unit.

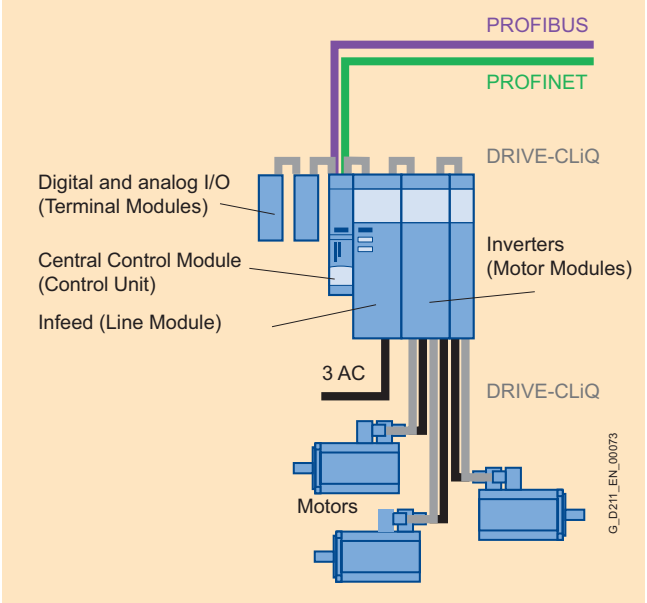
Together this integrated line offers the most optimal drive solution for any application servo or vector.

Blocksize, booksize compact, booksize and chassis formats

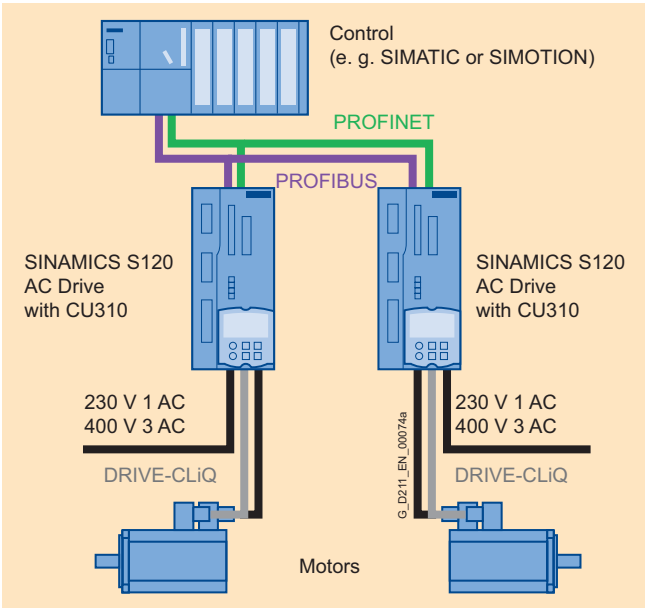
All formats can be combined as required

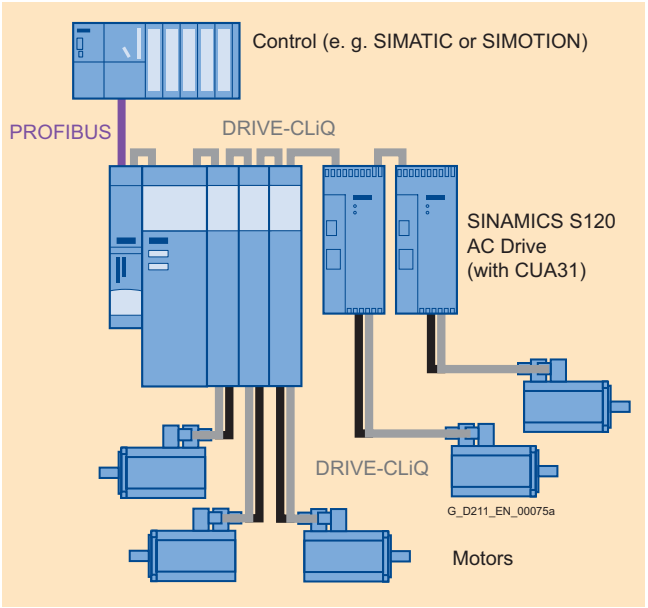
The different SINAMICS S120 formats can be combined freely thanks to their DRIVE-CLiQ interfaces, e.g. Line Modules in chassis format can be freely combined with Motor Modules in booksize format for multi-axis applications with high total output.





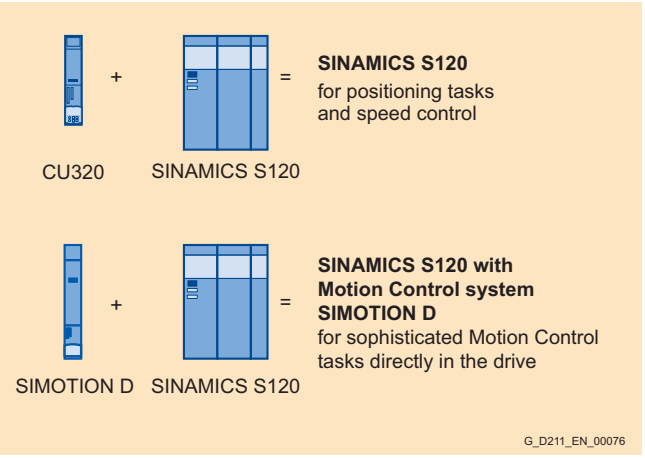
SINAMICS S120 built-in devices





SINAMICS S120 and SIMOTION – the perfect team

Modern machines must be capable of handling ever more complex Motion Control tasks and perform them with increasing accuracy and speed. In regards to this requirement, the SIMOTION Motion Control System and high-performance SINAMICS S120 drive system form a perfect team. The SIMOTION D variant, which is physically integrated in the SINAMICS S120 drive, is the ideal solution for machines with a large number of axes and stringent precision requirements. This distributed automation structure allows the machine to be segmented into various axis groupings, with each grouping controlled by a separate SIMOTION Motion Control System. The SIMOTION systems communicate either via PROFIBUS DP or PROFINET. Another important aspect: The compact machine design thanks to the distributed automation structure and a Control Unit directly in the drive.



Totally Integrated Automation – the unique automation platform

With Totally Integrated Automation (TIA), Siemens is the only single-source provider to offer an integrated spectrum of products and systems for all sectors. Tailored to meet individual customer requirements, sector-specific automation solutions can be implemented efficiently on the basis of TIA. Lower life-cycle costs for plant operation and a significant reduction in the time to market result in a marked improvement in productivity and greater investment security.

Easy – Totally Integrated Automation with SINAMICS S120

Apart from SIMATIC, SIMOTION and SINUMERIK, SINAMICS is also one of the core components of TIA. The STARTER commissioning tool is therefore an integral element of the TIA platform. It is thus possible to parameterize, program and commission all components in the automation system using a standardized engineering platform and without any gaps. The system-wide data management functions ensure consistent data and simplify archiving of the entire plant project.

PROFIBUS – the No. 1 fieldbus

PROFIBUS DP, the standard fieldbus of the TIA system, is supported by all SINAMICS S120 variants. It provides a high-performance, system-wide communication network which links all automation components: HMI, controls, drives and I/O devices.

PROFINET – for enhanced performance and open IT communication

SINAMICS S120 is also available with a PROFINET interface. This Ethernet-based bus enables control data to be exchanged at high speed via PROFINET IO with IRT or RT and makes SINAMICS S120 a suitable choice for integration in top-performance multi-axis applications.

At the same time, PROFINET also uses standard IT mechanisms (TCP/IP) to transport information, e.g. operating and diagnostic data, to higher-level systems. A SINAMICS S120 with this interface can thus easily be integrated into factory IT networks.

The components of the SINAMICS S120 drive system

SINAMICS S120 drive system

Line-side components

Line reactors

Line filters

Active Interface Modules

Line Modules

Basic Line Modules

Smart Line Modules

Active Line Modules

Power supply

For applicable 24 V device, see Catalog KT 10.1

DC link components

Braking Module

Braking resistors

Capacitor Module

Control Supply Module

Control Units

CU310

CU320

Control Units SIMOTION

D410

D425

D435

D445

CX32

Motor Modules

Single Motor Modules

Double Motor Modules

Sensor Modules
Terminal Modules
DRIVE-CLiQ Hub

Power Modules

Load-side components

Motor reactors

Sinusoidal filters

AC motors

Synchronous motors

1FT6 motors

1FT7 motors

1FK7 motors

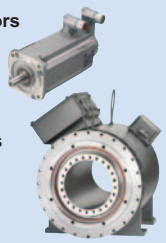
1FS6 motors

1FW3 torque motors

Gear units

Geared motors

Linear motors



Asynchronous motors

1PH7 motors

1PL6 motors

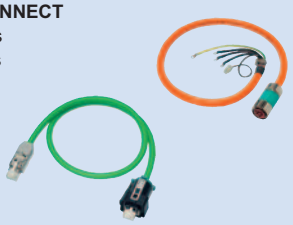
1PH4 motors

Connection system

MOTION-CONNECT

Power cables

Signal cables



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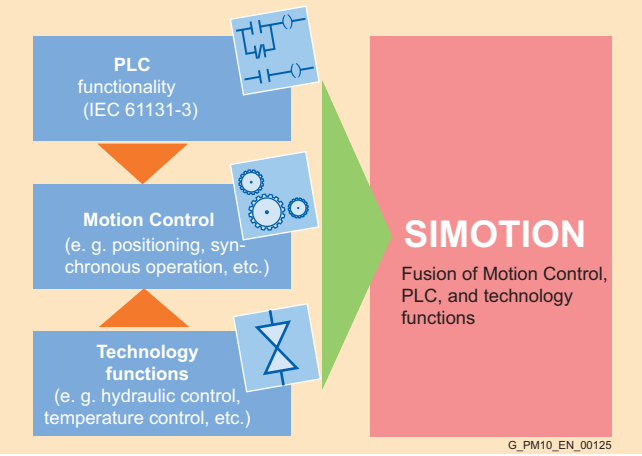
SIMOTION
The SIMOTION system

The system approach



SIMOTION is recommended for all machines with Motion Control tasks – from simple to high-performance. The focus is on a simple and flexible solution for the greatest possible range of Motion Control tasks. In order to achieve this in the best way possible, a new system approach has been introduced.

The fusion of Motion Control with two other control functions which are found in most machines: PLC and technology functions.

This approach enables Motion Control and complete machine control within the same system. The same applies to technology functions, such as pressure control of a hydraulic axis. A seamless switch can be made from position-controlled positioning mode to pressure control.

Combining the three open-loop control functions of Motion Control, PLC and technology functions has the following benefits:

- Reduced engineering overhead and increased machine performance
- Fast system response – Time-critical interfaces between the individual components are no longer required
- Simple, uniform and transparent programming as well as diagnostics of the entire machine

The SIMOTION system is made up of three components:

Engineering system

SCOUT enables Motion Control, PLC and technology functions to be incorporated in one comprehensive, integrated system and provides all the necessary tools: From programming and parameterization through testing and commissioning, to diagnostics.

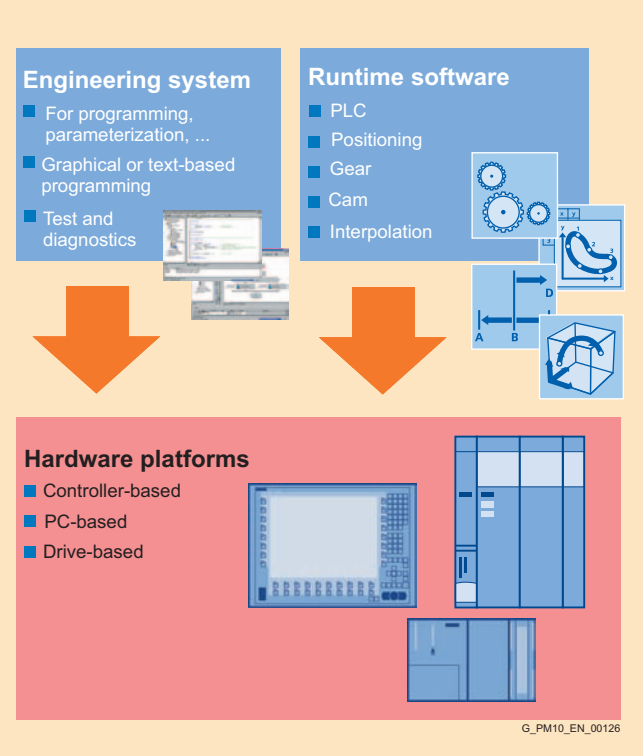
Runtime software

The runtime system offers an ingenious execution system for cyclic **and** sequential tasks. The runtime modules make the different PLC, Motion Control and technology functions available. By selecting the appropriate modules, the overall functionality of the system can be flexibly adapted to the machine.

Hardware platforms

The hardware platforms are the basis of the SIMOTION Motion Control System. The application created with the engineering system and the associated runtime software modules can be implemented on different hardware platforms.

You can therefore always select the platform that suits your machine best, as a controller, industrial PC or intelligent drive.



The fast path to the automation solution

Using these system components, our concept of ready-to-apply standard applications and complete machine solutions called SIMOTION Easy Set (Ready to Run), you can reduce your engineering costs as well as the duration of your project, allowing you to create your own automation solution more quickly.

SIMOTION
The hardware platforms

Automation systems are primarily identified by the following characteristics:

- System-specific characteristics, e.g. functionality and engineering
- Hardware-dependent characteristics, e.g. performance, design and expandability

However, mechanical engineering demands vary greatly, depending on the version of the machine in question.

Every hardware platform has its benefits when used in certain applications. The various platforms can also be combined very easily, which is a particular advantage in modular machines and plants. This is because the individual hardware platforms always contain the same system characteristics, i.e. functionality and engineering are always identical, irrespective of the platform used.

PROFIBUS or PROFINET can be used to create the link to the drives and the I/Os remotely.

PROFIBUS/PROFINET can also be used for communication with HMI devices such as SIMATIC HMI or higher-level controllers such as SIMATIC S7. This means that SIMATIC HMI panels as well as PCs with ProTool/Pro or WinCC flexible can be used as operator systems.

Even 3rd party applications can communicate with SIMOTION by means of the OPC interface.

SIMOTION D – Compact and integrated in the drive

In SIMOTION D, the SIMOTION functionality is integrated directly in the closed-loop control module of the SINAMICS S120 drive system. Therefore, the complete system (consisting of the open-loop control and the drive) is extremely compact and powerful. Two SIMOTION D versions are available: as a single-axis SIMOTION D410 system and as a multi-axis SIMOTION D4x5 system in different performance variants. This ensures a high degree of scalability and flexibility. The field of application ranges from single axes to high-performance multi-axis machines.
SIMOTION D4x5 is supplied with two integrated PROFIBUS interfaces supporting PROFIdrive and two integrated Industrial Ethernet interfaces. An optional Communication Board is used to connect via PROFINET. With SIMOTION D410, a PROFIBUS variant or a PROFINET variant can be selected.

SIMOTION C – Modularity and flexibility

SIMOTION C is a controller based on the SIMATIC S7-300 design. It is supplied with four integrated interfaces for analog or stepper drives and several integrated digital inputs and outputs. SIMOTION C can also be expanded using I/O modules from the SIMATIC S7-300 range. Furthermore, the controller is supplied with two PROFIBUS interfaces supporting PROFIdrive and an Industrial Ethernet interface, thus offering great flexibility in communication.

SIMOTION P – Open for other tasks

SIMOTION P350 is a PC-based Motion Control System. The operating system is Windows XP Professional, with a real-time expansion for SIMOTION. Apart from the SIMOTION machine applications, additional PC applications can execute at any time, e.g. the SIMOTION engineering system, an operator control application, process data evaluation, and other standard PC applications. Due to the high processor performance, SIMOTION P350 is optimized for applications with the highest performance requirements (e.g. hydraulic applications with highly dynamic position and pressure control loops).

Several panel variants in various screen sizes are available for operating the industrial PC. These panels can either be operated using a keyboard and mouse, or a touch screen. The drives and I/Os are connected via two PROFIBUS interfaces supporting PROFIdrive or PROFINET with an optional Communication Board.

SIMOTION
The runtime system

Multi-layer software architecture

With SIMOTION, motion tasks in many different machines are performed easily and uniformly.

To facilitate this, a very special, multi-layer architecture was chosen as the runtime system. All SIMOTION devices provide basic functionality such as PLC functionality with a command set according to IEC 61131-3 and a cam controller. You can expand this basic functionality using the included technology packages and function libraries.

Scalable functionality

The technology packages, function libraries and multi-layer architecture of the runtime system combine to achieve for the scalable functionality of SIMOTION.

Scalable

- Thanks to various functionality levels
- Thanks to software modules and technology packages with extensive functionality

Flexible

- Thanks to the integrated PLC following IEC 61131-3 standards
- Thanks to technology packages that can be used limitlessly
- Thanks to a broad functional scope with a complex command set as well as function blocks according to the PLCopen standard
- Thanks to the option to run servo, vector, stepper, and hydraulic drives
- Thanks to the ability to combine the various technology packages and function libraries
- Thanks to the various communication methods such as TCP, UDP, OPC, and OPC-XML

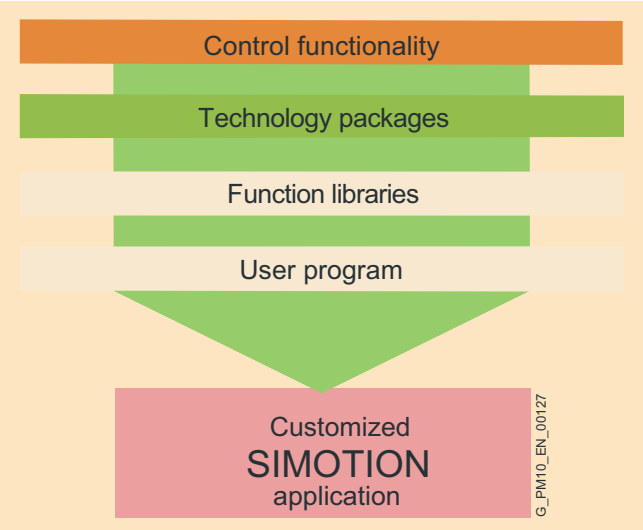
Expandable

- Thanks to standard functions of the function libraries
- Thanks to the ability to synchronize SIMOTION controllers together

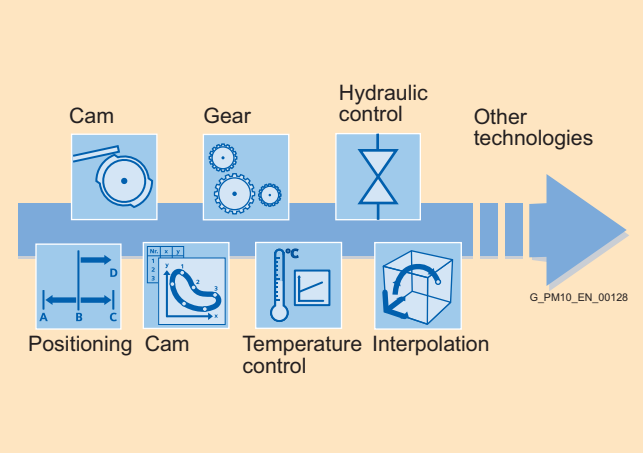
Technology packages

Each of these packages provides complete functionality for the technology in question. For example, the Motion Control technology package provides all functions for precise positioning movements, including camming.

It also handles the cyclic exchange of setpoints and actual values with the drive including position control, calculation of the movement profile, removal or overriding of motions, homing functions, encoder changeover, axis release, status information, and more.



In addition to the Motion Control technology package (including positioning, synchronous operation, output cam, and path interpolation), packages for other technologies, e.g. temperature control, are also available.



Function libraries

The function libraries offer standard functions

- For integration of special I/O modules (e.g. counter modules, communication modules, AS-Interface, etc.)
- For expanding the system functions (e.g. closed-loop controllers)

Modular user functions can also be stored as libraries for standardized implementation in projects.

Focus is on user friendliness

As the performance capability of a system grows, so do the requirements on its user-friendliness: With SCOUT, the engineering system for SIMOTION, particular emphasis has therefore been placed on user-friendliness:

- The engineering for Motion Control, PLC and technology as well as the drive configuration and commissioning are all performed in the same manner in the same engineering environment.
- All tasks are largely resolved in a graphical manner: Configuring, programming, testing and commissioning.
- Intuitive operation, context-sensitive help functions and automatic consistency checks make engineering easier, especially for those users who are new to Motion Control programming.
- All the tools that are associated with the SCOUT engineering system are integrated giving a uniform Look & Feel.

The SCOUT engineering system supports you step-by-step making the engineering easy and efficient.

SCOUT can be used in SIMATIC STEP 7, either with integrated data management and configuration, or as a stand-alone engineering tool (SCOUT Stand-Alone).

Programming for everyone

When programming SIMOTION you can choose between: Graphic programming using the MCC (Motion Control Chart), graphic configuration with DCC (Drive Control Chart), PLC style with LAD (Ladder Diagram)/FBD (Function Block Diagram), or with the ST (Structured Text) high-level, text-based, language – the SCOUT engineering system supports them all.

In addition to Motion Control commands (e.g. referencing of axis), commands for I/O access, logic and calculations, subroutine calls and control of the program flow are also available.

Complex motion relationships are also easy to set up using the graphical cam editors.

Central management with integrated tools

All the data for your complete machine can be managed in a single project: Configuration data, programs, movement profiles, drive data and HMI.

The appropriate tools are then called from the central project management, e.g. for entering a cam or for commissioning a drive.

Test and diagnostics

SCOUT supports the testing, commissioning and error diagnostics of SIMOTION applications with a series of tools, such as those providing program status, control variables, trace, and the axis control panel.

Notes

Communication

2

Overview

Overview

Most production machines use digital field bus systems today. These handle the communication between the controller, the device and the executing units, (i.e. sensors and actuators). There are two different types of communication in accordance with the data that is being exchanged: process communication and data communication.

Process communication

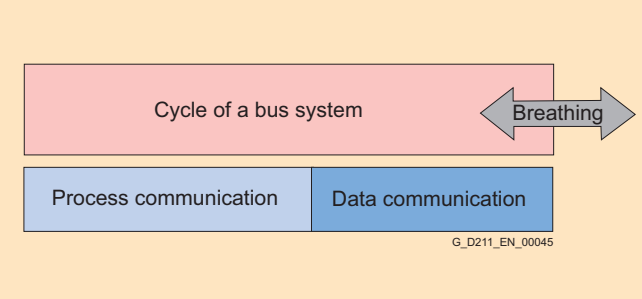
In the case of process communication, control data, setpoints and actual values are transferred cyclically between the higher-level controller and the devices at the field level. The data volume is comparatively low. For example, a drive only uses between 4 and 32 bytes of process data. The number of connected sensors and actuators is usually specified by the configuration, which makes the bus cycle of process communication very constant.

Data communication

Data communication is often required for engineering and is not directly linked to the execution of the production process. Data is sporadically (acyclically) exchanged between connected devices. The volume of data from this communication can be very large with over 100 bytes per device per communication task.

Cycle time of a bus system

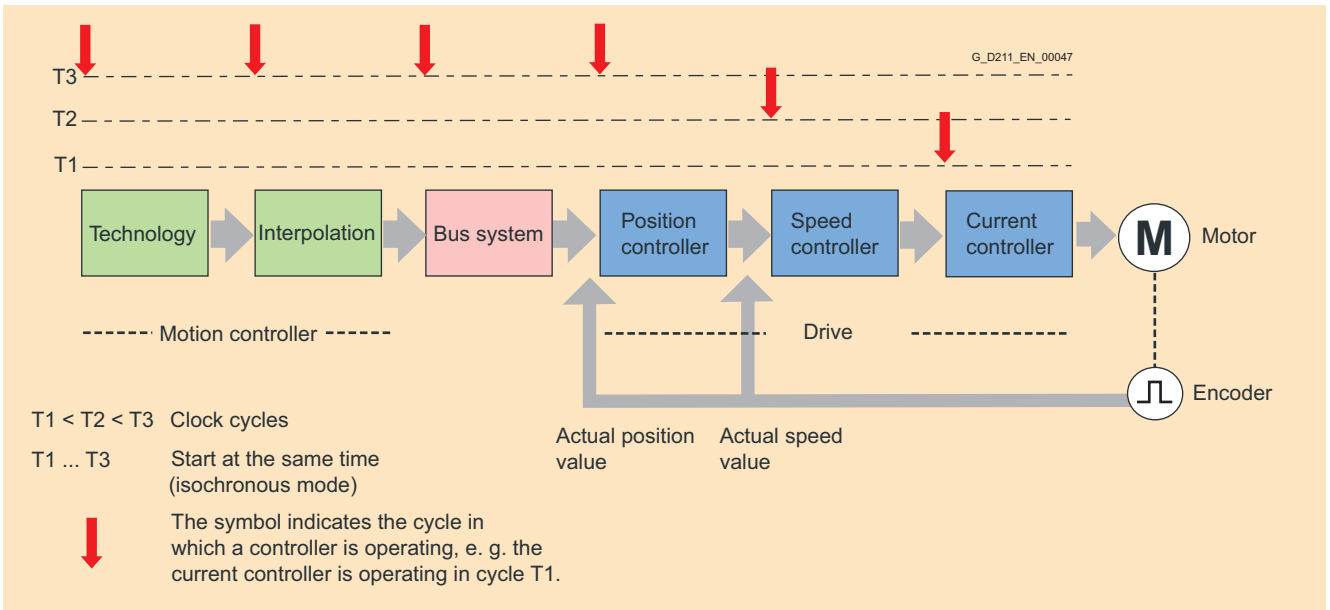
The cycle time of a bus system comprises of time segments for process communication and data communication. The overall cycle time is therefore not constant in the case of conventional bus systems, but it varies according to the amount of data communication, the cycle time is much shorter without data communication. Some say: The bus cycle breathes. However, this "breathing" is unsuitable for highly accurate applications in drive technology.



Breathing of the bus cycle

Demands placed on the fieldbus by digital drive controllers

Most current drives have a digital closed-loop control. This closed-loop control ensures that the controlled variable of the drive, for example the speed or position, are achieved and maintained. Such a digital closed-loop control comprises of several intertwined controls (position, speed, current, etc.). These must be matched to one another, and to achieve this, they must be synchronized. This synchronization is important in keeping the controls stable, to achieve the setpoints quickly and to accurately maintain them. If some of the components of the closed-loop control are located outside the drive, a bus system must be used to manage the communication between these components. The bus system must then operate synchronously just like closed-loop controls.

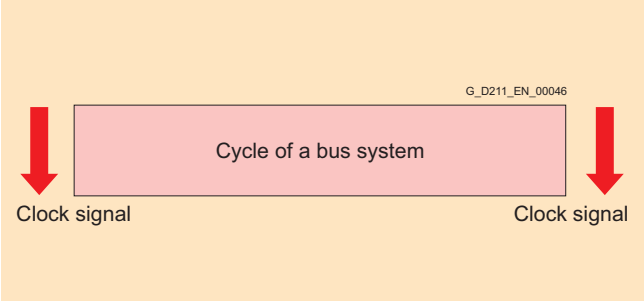


Digital drive control: Synchronous operation of all stations

Overview (continued)

The solution: Isochronous mode

To ensure that all the connected devices can communicate synchronously over the bus system, an additional clock signal is used to synchronize the cycle time of the bus system. This is also known as isochronous mode.



Constant bus cycle due to isochronous mode

For drives in the area of motion control systems, isochronous operation must be extremely quick and very accurate. It ensures that the length of the bus cycle varies only slightly.

This is then no longer referred to as the breathing of the bus cycle (large deviations), but as jitter (small deviations). Permissible values are < 1 µs.

Bus systems for motion control applications

So that a bus system can be used for motion control applications, the bus cycle must be constant and deterministic. Only deviations of less than 1 µs (jitter) from bus cycle to bus cycle can be tolerated.

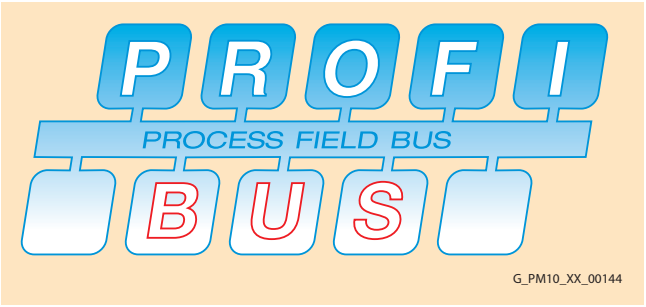
To fulfill these requirements with conventional bus systems, an additional bus system is frequently implemented for high-volume, non-time-critical data communication, such as Industrial Ethernet.

PROFIBUS DP and PROFINET satisfy the requirements for real-time and isochronous real-time communication. PROFINET also supports communication via standard TCP/IP on the network.

Industrial Ethernet – the predecessor of PROFINET – is not suitable for real-time communication, but for data communication using standard IT protocols such as TCP/IP and UDP/IP.

PROFIBUS

Overview



PROFIBUS – The most successful open fieldbus in automation

The demands of users for an open, vendor-independent communication system resulted in the specification and standardization of the PROFIBUS protocol.

PROFIBUS defines the technical and functional features of a serial fieldbus system with which distributed programmable field controllers of the low-end (sensor/actuator level) to mid performance range (cell level) can be networked.

Standardization according to IEC 61158 / EN 50170 provides future protection for your investment.

Through the conformity and interoperability test performed by the test laboratories authorized by PROFIBUS & PROFINET International (PI) and the certification of the devices by PI, the user can rest assured that quality and functionality are also ensured for multi-vendor installations.

PROFIBUS variants

Three different PROFIBUS variants have been defined to fulfill the wide range of different requirements at the field level:

PROFIBUS FMS – (Fieldbus Message Specification) The universal solution for communication tasks on the field and cell level of the industrial communication hierarchy.

PROFIBUS PA – (Process Automation) The variant for applications in process automation. PROFIBUS PA uses the intrinsically safe transmission technology specified in IEC 61158-2.

PROFIBUS DP – (Distributed Peripherals) This variant, which is optimized for speed, is tailored especially for the communication of automation systems with distributed I/O stations and drives. PROFIBUS DP is characterized by its very short response times and high degree of fault tolerance and replaces cost-intensive parallel signal transmission with 24 V and the measured value transmission with 0/4 … 20 mA technology.

Design

Bus nodes for PROFIBUS DP

PROFIBUS DP distinguishes between two different master classes and one slave class:

DP master Class 1

The DP master Class 1 is the central component in PROFIBUS DP. The central master station exchanges information with distributed stations (DP slaves) in a fixed, repeated message cycle.

DP master Class 2

Devices of this type are used (programming, configuration or control devices) during start-up, for configuring the DP system, for diagnostics or controlling the plant during normal operation. A DP master Class 2 can be used, for example, to read the input, output, diagnostics and configuration data of the slaves.

Design (continued)

DP slave

A DP slave is an I/O device which receives output information or setpoints from the DP master and sends input information, measured values or actual values to the DP master in response. A DP slave never sends data automatically, it must always be prompted by the DP master.

The volume of input and output data depends on the device and can be up to 244 bytes per DP slave and transfer direction.

Function

Functional scope in DP masters and DP slaves

The functional scope can differ between DP masters and PROFIBUS DP slaves. The functional scope is different for DP-V0, DP-V1 and DP-V2.

DP-V0 communication functions

The DP-V0 master functions comprise the functions "Configuration", "Parameter Assignment", "Read Diagnostics Data" as well as cyclic reading of input data/actual values and writing output data/setpoints.

DP-V1 communication functions

The DP-V1 function expansions make it possible to perform acyclic read and write functions as well as processing cyclic data communication. This type of slave must be supplied with extensive parameterization data during start-up and during normal operation. These acyclically transferred parameterization data are only rarely changed in comparison to the cyclic setpoints, actual values, and measured values, and are transferred at lower priority in parallel with the cyclic high-speed user data transfer. Detailed diagnostic information can be transferred in the same way.

DP-V2 communication functions

The extended DP-V2 master functions mainly comprise functions for isochronous operation and direct data exchange between DP slaves.

- Isochronous mode:
  Isochronous mode is implemented by means of an equidistant signal in the bus system. This cyclic, equidistant cycle is sent by the DP master to all bus nodes in the form of a Global Control Telegram. Master and slaves can then synchronize their applications with this signal. The signal jitter between cycles is less than 1 µs.
- Slave-to-slave communication:
  The "publisher/subscriber" model is used to implement slave-to-slave communication. Slaves declared as publishers make their input data/actual values and measured values available to other slaves, the subscribers, for reading. This is performed by sending the response frame to the master as a broadcast. Slave-to-slave communication is therefore a cyclic process.

PROFIBUS for SINAMICS and SIMOTION

SINAMICS and SIMOTION use the PROFIBUS protocol PROFIBUS DP.

SINAMICS S120 drives can operate only as DP slaves and support all communication functions, i.e. DP-V0, DP-V1 and DP-V2.

The SIMOTION systems can be used both as DP masters and DP slaves. The DP-V0, DP-V1 and DP-V2 communication functions are supported.

Overview

Ethernet is the basic Internet technology for worldwide networking. The many possibilities of intranet and Internet, which have been available for office applications for a long time, are now utilized for production automation with Industrial Ethernet.

IT technology as well as the use of distributed automation systems is continuously increasing. This entails breaking up complex control tasks into small, simple control systems close to the drive. This increases the demand for communication and consequently a comprehensive and powerful communication system.

Industrial Ethernet offers a powerful area and cell network according to IEEE 802.3 (ETHERNET) for industrial applications.

Benefits

Ethernet with 100 Mbaud data rate and full duplex capability is the ideal basis. With a share of over 80 %, Ethernet is now the number one network worldwide offering important features and essential advantages:

- Fast start-up thanks to the simplest connection method
- High availability since existing networks can be extended without any adverse effects
- Almost unlimited communication performance because scalable performance is available through switching technology and high data rates when required
- Networking of different application areas such as office and production areas
- Company-wide communication based on WAN (Wide Area Network) technology or the Internet
- Investment protection from continuous compatibility with further developments

In order to make Ethernet suitable for industrial applications, considerable expansions with respect to functionality and design are required:

- Network components for use in harsh industrial environments
- Fast assembly of the RJ45 connectors
- Failure protection through redundancy
- Expanded diagnostics and message concept
- Use of future-oriented network components (e.g. switches)

SIMATIC NET offers corresponding network components and products.

Design

Industrial Ethernet for SINAMICS and SIMOTION

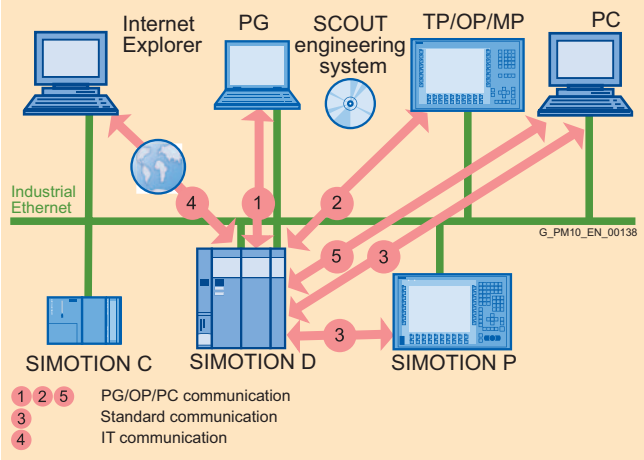
SINAMICS S120 Control Units can be integrated into an Industrial Ethernet architecture using the Communication Boards for PROFINET. The following communication types are supported:

- IO communication
- Engineering

SIMOTION can be integrated into any Industrial Ethernet communication architecture because each SIMOTION device offers at least one Ethernet interface as standard.

Industrial Ethernet is used in SIMOTION for data communication. Cyclic process communication with SINAMICS drives and distributed I/O is implemented over PROFIBUS DP or PROFINET IO and PROFIdrive.

Function



Communication with SIMOTION over Industrial Ethernet

PG/OP communication (1, 2, 5)

- Engineering and diagnostics with SIMOTION SCOUT (1)
- Connection of SIMATIC HMI panels with Ethernet interface using ProTool Pro (only PC-based) or WinCC flexible (2)
- For example, open communication of vendor-specific HMI tools over OPC server from SIMATIC NET (5)

Standard communication (3)

This uses the basic protocols UDP and TCP/IP, which are also used with Ethernet. SIMOTION offers the corresponding system functions for UDP and TCP/IP communication. This permits data to be exchanged over TCP/IP and UDP communication between:

- Different SIMOTION devices (3)
- SIMOTION and SIMATIC S7 devices (3)
- SIMOTION devices and any other device which uses standard TCP/IP or UDP communication. Such devices can be any kind of PC with any kind of operating system or other programmable controllers (3)

IT communication (4)

IT communication is performed using protocols which are based on the basic TCP/IP protocol. The most important IT protocols are:

HTTP: Hypertext Transfer Protocol

FTP: File Transfer Protocol

SMTP: Simple Mail Transfer Protocol

SNMP: Simple Network Management Protocol

SIMOTION supports the HTTP and FTP. In addition, the following communication options are available for SIMOTION:

- Web pages in the SIMOTION device (4)
  A standard Internet browser can be used to access predefined web pages with diagnostics information on the SIMOTION device. Furthermore, user-defined web pages can be stored in the SIMOTION device which contain information defined by the user.
- OPC XML-DA (4)
  SIMOTION offers an OPC XML-DA server integrated into the device. This server supplies SIMOTION process data. Communication from any external device is performed with the SOAP protocol (in accordance with the specification of the OPC Foundation), which is integrated into the HTTP protocol.

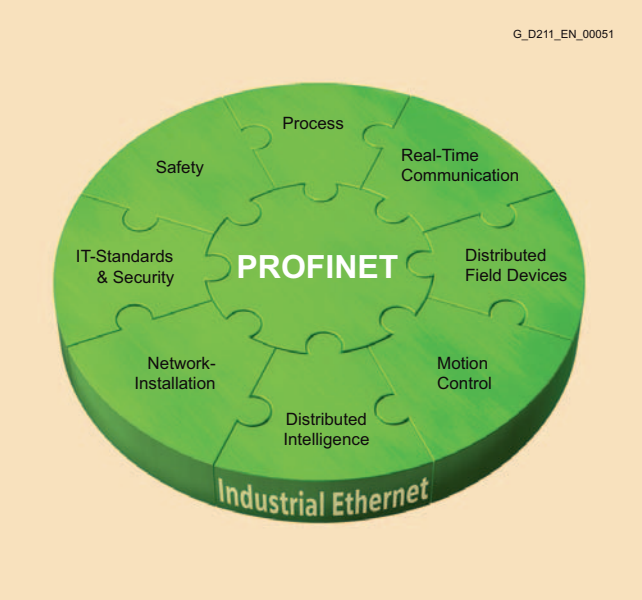
PROFINET

Overview

G_D211_XX_00050

PROFINET is the innovative and open Industrial Ethernet standard (IEC 61158) for industrial automation. With PROFINET, IT communication, data communication and cyclic process communication are combined on one communication medium. PROFINET thus permits integrated communication from the control level down through to the field level, offers plant-wide engineering and uses well-proven standards from the IT world, such as TCP/IP and UDP.

Existing fieldbus systems such as PROFIBUS can be easily integrated without any modification of existing devices.



PROFINET satisfies all the requirements of industrial automation:

- Industry-standard installation technology
- Real-time capability
- Deterministic behavior
- Integration of distributed field devices
- Simple network administration and diagnostics
- Protection against unauthorized access
- Efficient, cross-vendor engineering as well as
- Isochronous motion control applications.

PROFINET relies on switch technology and has expanded this technology for isochronous real-time applications. Switch technology enables the network topology to be optimized to the requirements of the machine. Collisions are prevented allowing optimal data throughput.

Function

PROFINET communication

Data communication

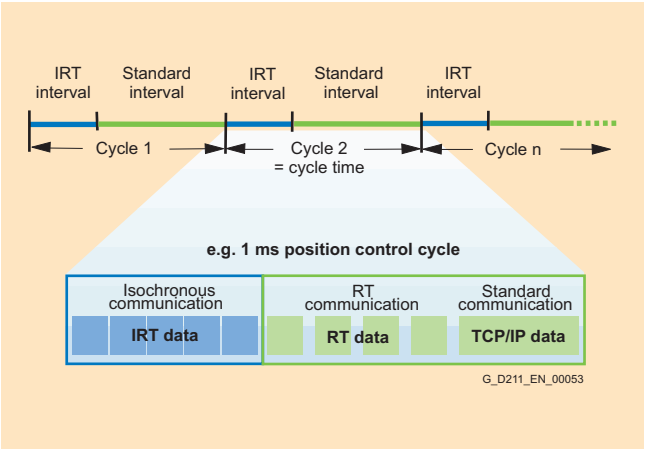
PROFINET uses standard TCP/IP for non-time-critical data communication, e.g. for parameter assignment, configuration and diagnostics.

Process communication/Real-time communication

Real-time communication for process data transfer and non-time-critical data communication is performed on the same cable in the case of PROFINET IO. PROFINET IO offers the following performance levels for real-time communication:

- Real-Time (RT):
  RT uses the option of prioritizing the communication stack of the bus nodes. This permits high-performance data transmission with standard network components.
- Isochronous Real-Time (IRT):
  IRT permits strict deterministic, cyclic data transmission with short response times and minimum jitter for high-performance motion control applications. This feature is implemented with a special ASIC, the ERTEC (Enhanced Real Time Ethernet Controller), in the corresponding interfaces (switch integrated into device) or network components (switch).

In PROFINET, the communication cycle is subdivided into different, time-specific intervals. The first interval is used for isochronous real-time communication (IRT), followed by real-time communication (RT) and standard TCP/IP communication. The temporal sequence of the individual messages for each network section can be calculated with a special algorithm which takes the topology into account. This permits a switch to forward the IRT messages without delay from the input port to the specified output port and then to the target device.



Function (continued)

Device classes for PROFINET IO

PROFINET IO recognizes several different device classes within a PROFINET IO system:

IO Supervisor

An IO Supervisor is typically an engineering station that is granted time-limited access to the field devices for parameterization, commissioning or diagnostics. Engineering data is transferred over the standard TCP/IP channel of PROFINET IO.

IO Controller

An IO Controller is typically a programmable logic controller (PLC) or a motion control system, e.g. SIMATIC S7 or SIMOTION. The IO Controller transmits control signals and setpoints to the IO Devices that are assigned to it and reads actual values and any alarms from the subordinate IO Devices. Communication is performed between the IO Controller and the IO Devices – depending on the requirements of the application – in real-time (RT) or isochronous real-time (IRT).

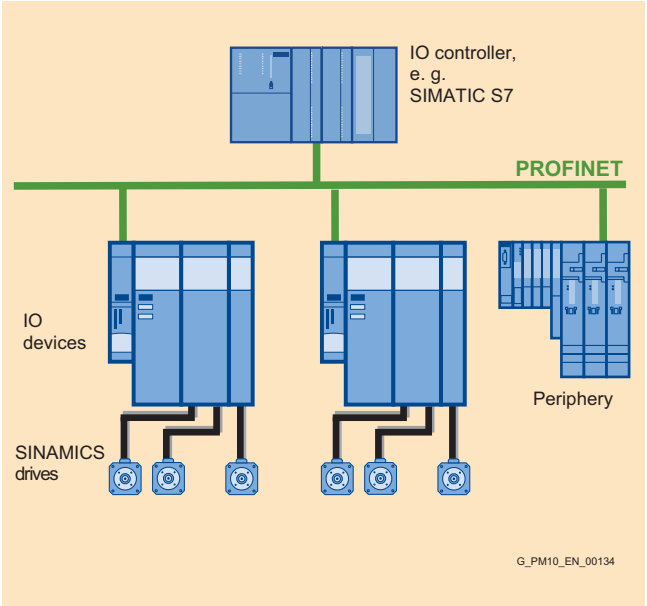
IO Device

IO Devices are typically distributed I/O systems and drives, such as SIMATIC ET 200S and SINAMICS S120. IO Devices receive control signals and setpoints from a higher-level IO Controller and represent the direct interface to the process. They send actual values to the higher-level IO Controller so that it can update its internal process image.

Device concept for a PROFINET IO System

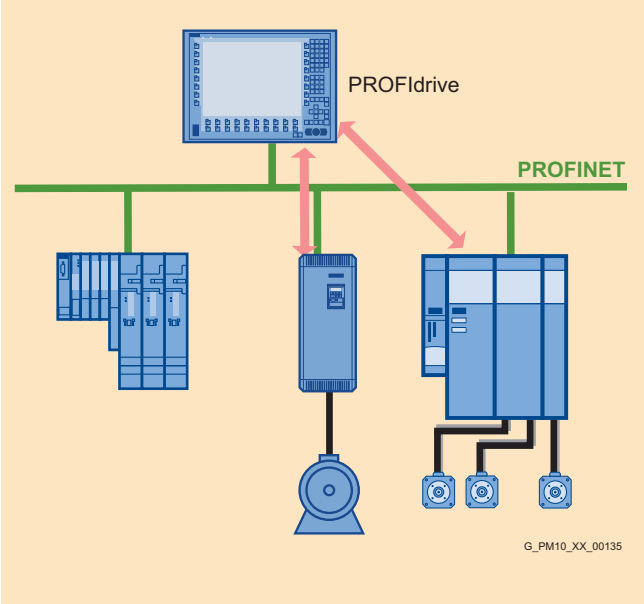
A PROFINET IO System comprises, in the simplest case, one IO Controller and several IO Devices that are assigned to it. The IO Devices are initialized and parameterized by the IO Controller on startup. The controller and its devices together constitute a PROFINET I/O System (compare master-slave system for PROFIBUS).

The IO Controller updates its internal process image via cyclic process communication with the assigned IO Devices. The process image is updated cyclically in real-time (RT, devices are typically distributed I/O devices) or isochronous real-time (IRT, devices are typically servo drives) depending on requirements and device characteristics. In addition, PROFINET permits communication between controllers and devices of different I/O systems.



PROFIdrive – The standardized drive profile for PROFIBUS and PROFINET

The functional interface between the controller and the SINAMICS drives for PROFINET and PROFIBUS is defined by the PROFIdrive drive profile V4 of PROFIBUS International. It is not necessary to change a user program to transfer from PROFIBUS to PROFINET.



PROFINET IO with RT: The right choice for standard drive applications

With typical cycle times between 4 ms and 10 ms, PROFINET IO with RT offers the same performance characteristics as PROFIBUS as regards cyclic data transmission.

Thus all standard drive applications of PROFIdrive application categories 1 to 3 can be automated. These drive applications are characterized by the specified speed, torque and current setpoints, or by target positions, which do not have to be linked isochronously.

Note: In the case of real-time communication (RT), the process data can also be transferred wirelessly using wireless LAN products.

PROFINET IO with IRT: The right choice for demanding motion control applications in isochronous mode

In this case, a motion control system (e.g. SIMOTION) controls or synchronizes axes via PROFINET. This requires cyclic, isochronous data exchange with the drives where the following criteria must be met:

- Synchronization of the control-loop pulses with the bus cycle
- Closing of the control loops over the bus
- Time-synchronized acquisition of the actual position values
- Time-synchronized activation of the setpoints

PROFINET IO with IRT fulfills these requirements. By configuring the application, e.g. synchronous operation of two axes, the IRT messages are determined implicitly and the corresponding configuration data is generated.

Function (continued)

Motion control architectures with SIMOTION and SINAMICS

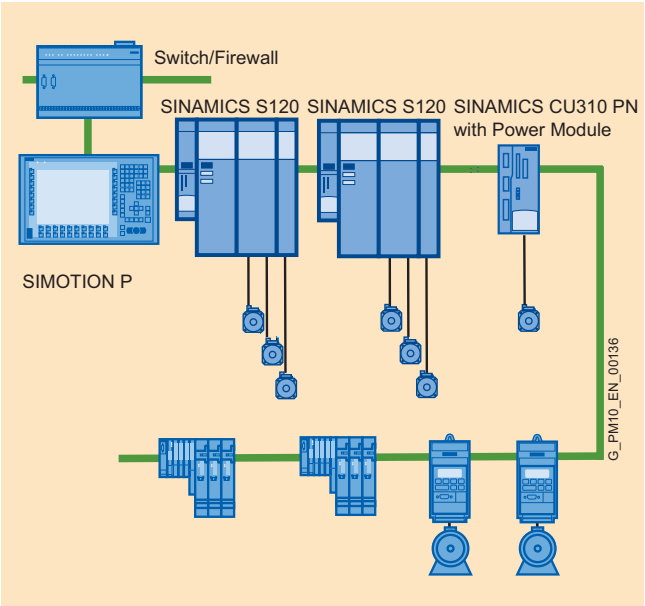
With SIMOTION and SINAMICS, a range of different automation structures can be implemented over PROFINET. In this case, central architectures can be supported with one controller (e.g. SIMOTION P) as well as decentralized, distributed architectures with several distributed controllers (e.g. SIMOTION D4xx with SINAMICS S120).

When SIMOTION is integrated in a complete automation system, hierarchic automation structures often result.

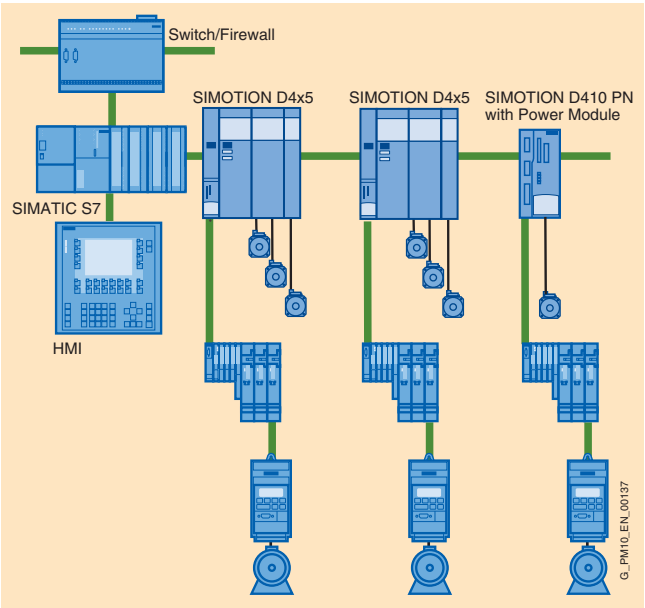
Both hierarchic automation structures and modular machine concepts can be implemented easily and without additional components due to the option of configuring SIMOTION as controller and device on the same PROFINET interface:

- On one hand, SIMOTION as a device can communicate with a higher-level controller, e.g. a SIMATIC S7 PLC or a non-Siemens PLC.
- On the other hand, SIMOTION as a controller can simultaneously communicate with local IO Devices, e.g. drives and I/O modules.

Multiple axes can also be synchronized over more than one SIMOTION controller using IRT controller-controller communication and IRT controller-device communication. This functionality is called distributed synchronous operation.

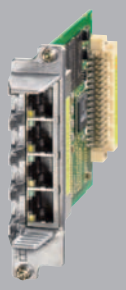


Central motion control architecture



Distributed motion control architecture

Overview

	SIMOTION			SINAMICS	
	P350-3	D4x5	D410 PN	Control Unit CU320	Control Unit CU310 PN
					
PROFINET - functionality through	MCI-PN Communication Board	CBE30 Communication Board		CBE20 Communication Board	
			Is part of the basic functionality of the Control Unit		Is part of the basic functionality of the Control Unit
Number of PROFINET interfaces	Integrated 4-port switch	Integrated 4-port switch	Integrated 2-port switch	Integrated 4-port switch	Integrated 2-port switch
Communi-cation as	Controller and device	Controller and device	Controller and device	Device	Device
Protocols	TCP, UDP, RT, IRT	TCP, UDP, RT, IRT	TCP, UDP, RT, IRT	TCP, RT, IRT	TCP, RT, IRT

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PROFINET for SIMOTION and SINAMICS

SIMOTION and SINAMICS are completely integrated into the PROFINET landscape of Automation and Drives. Interaction with the following PROFINET components is possible.

- Distributed I/O on SIMOTION
- SINAMICS on SIMATIC S7-CPU
- SIMOTION as I-Device on SIMATIC S7-CPU
- Active network components (e.g. SCALANCE) with SIMOTION and SINAMICS
- Wireless with SIMOTION and SINAMICS

When an automation topology is configured, the real-time classes RT and IRT can be used alongside each other on the same network or cable. It must, however, be noted that not all devices support both real-time classes RT and IRT. For devices that should be synchronized with IRT, it is important that all the PROFINET components that lie in between support the IRT real-time class, especially the SCALANCE switches of the X200 family.

PROFIdrive

Overview

PROFIdrive – The standardized drive profile for PROFIBUS and PROFINET

PROFIdrive defines the device behavior and the access procedure to internal drive data for electrical drives on PROFIBUS and PROFINET, from simple frequency converters up to high-performance servo controllers.

It contains a detailed description of how the communication functions "slave-to-slave communication", "constant bus cycle time" and "isochronous operation" are used for drive applications. In addition, it clearly specifies all device characteristics which influence interfaces connected to a controller over PROFIBUS or PROFINET. This includes the sequence control, encoder interface, standardization of values, definition of standard messages, access to drive parameters, and more.

The PROFIdrive profile supports both central as well as distributed Motion Control concepts.

What are profiles?

Profiles specify specific properties and responses for devices and systems in automation. In this manner, manufacturers and users pursue the goal of defining common standards. Devices and systems that comply with a multi-vendor profile can interoperate on a fieldbus and can be operated interchangeably to a certain extent.

Do different profile types exist?

A distinction is made between application profiles (general or specific) and system profiles:

- Application profiles (also known as device profiles) mainly refer to devices (drives) and contain an agreed selection of bus communication modes, as well as specific device applications.
- System profiles describe system classes and include the master functionality, program interfaces and integration methods.

Is PROFIdrive future-proof?

PROFIdrive has been specified by PROFIBUS and PROFINET International and has been laid down in IEC 61800-7 as a future-proof standard.

The basic philosophy: Keep it simple

The PROFIdrive profile tries to keep the drive interface as simple as possible and free from technology functions. This philosophy ensures that reference models as well as the functionality and performance of the PROFIBUS/PROFINET master have no or very little influence on the drive interface.

One drive profile – Different application categories

The integration of drives into automation solutions depends strongly upon the drive task. To cover the extensive range of drive applications from the simple frequency converter up to highly dynamic, synchronized multi-axis systems with a single profile, PROFIdrive defines six application categories which define most drive applications:

- Category 1 – Standard drives (such as pumps, fans, stirring units, etc.)
- Category 2 – Standard drives with technology functions
- Category 3 – Positioning drives
- **Category 4 – Motion control drives with central, higher-level motion control intelligence and the patented "Dynamic Servo Control" position control concept**
- Category 5 – Motion control drives with central, higher-level motion control intelligence and position setpoint interface
- Category 6 – Motion control drives with distributed motion control intelligence integrated in the drives

Design

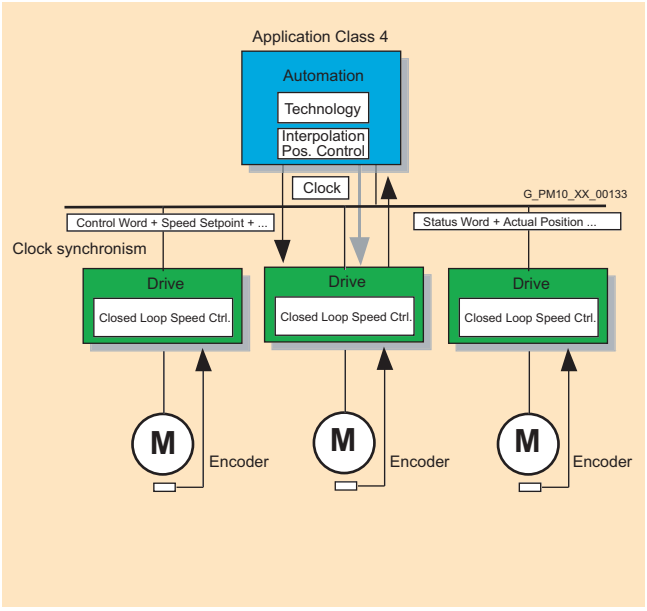
The PROFIdrive device model

PROFIdrive defines a device model based on function modules which cooperate in the device and generate the intelligence of the drive system. These modules have objects assigned to them which are described in the profile and are defined with respect to their functions. The overall functionality of a drive is therefore described through the sum of its parameters.

In contrast to other drive profiles, PROFIdrive defines only the access mechanisms to the parameters as well as a subset of profile parameters (about 30) such as the fault buffer, drive control and device identification.

All other parameters are vendor-specific which gives drive manufacturers great flexibility with respect to implementing control functions. The elements of a parameter are accessed acyclically over data records.

PROFIdrive uses DP-V0, DP-V1 and the DP-V2 expansions for PROFIBUS and the "Slave-to-slave communication" and "Isochronous mode" functions contained therein as the communication protocol or PROFINET IO with the real-time classes RT and IRT. In SIMOTION the drive interface has been implemented according to the PROFIdrive V4 profile and application categories 1 to 4 (category 4 with and without DSC) and is simply referred to as the PROFIdrive interface below.



PROFIdrive for Motion Control

Category 4 is the most important category for highly dynamic and highly complex Motion Control tasks. This application category describes in detail the master/slave relationship between the controller and the drives which are connected to each other over PROFIBUS and PROFINET.

The DSC (Dynamic Servo Control) function significantly improves the dynamic response and stiffness of the position control circuit by minimizing the dead times which usually occur for speed setpoint interfaces with an additional, relatively simple feedback network in the drive. The position control loop is closed in the drive which permits very fast position control cycles (e.g. 125 µs for SINAMICS S120) and thus limits dead times exclusively to the control behavior.

PROFIdrive for SIMOTION and SINAMICS

In SIMOTION and SINAMICS S120, the drive interface has been implemented according to the PROFIdrive profile V4 and application categories 1 to 4 (category 4 with and without DSC) and is referred to below as the PROFIdrive interface.

When SINAMICS S120 is used in SIMOTION, application category 4 with DSC is used by default.

Notes

SINAMICS S120

3

3

SINAMICS S120		Overview, Design	Selection and ordering data	Technical specifications
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	Overview	3/4	–	–
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Control Units				
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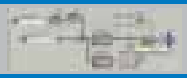
	CU310 DP Control Unit	3/14	3/16	3/16
	CU310 PN Control Unit	3/17	3/19	3/19
	CU320 Control Unit	3/20	3/22	3/22
	CompactFlash Card for CU310 and CU320	3/23	3/23	–
Engineering Software				
	STARTER	3/25	3/25	–
	Drive ES	3/26	3/26	–
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	Power Modules in blocksize format	3/27	3/36	3/30
	Line reactors Line filters Line-side components	3/39 3/43 3/46	3/42 3/43 3/44	3/40 3/43 –
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	Line reactors Line filters Line-side components	3/51 3/52 3/53	3/51 3/52 3/53	3/51 3/52 –
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	Line reactors Line filters Line-side components	3/95 3/96 3/97	3/95 3/96 3/97	3/95 3/96 –
	Smart Line Modules in chassis format	3/98	3/98	3/100
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	Active Line Modules in booksize format	3/107	3/112	3/110
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	Active Line Modules in chassis format	3/122	3/128	3/124
	Active Interface Modules	3/129	3/133	3/131
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SINAMICS S120	Overview, Design	Selection and ordering data	Technical specifications
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 Single Motor Modules			
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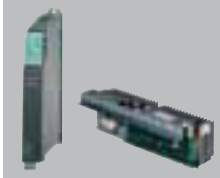
Booksize compact format Booksize format	3/164 3/170	3/164 3/174	3/166 3/172
DC link components			
 Braking Modules			
Booksize format Chassis format	3/177 3/179	3/178 3/182	3/178 3/180
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CBE10 CBE20	3/207 3/208	3/207 3/208	3/207 3/208
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DMC20 DRIVE-CLiQ Hub Module	3/213	3/213	3/213
TB30 Terminal Board	3/215	3/215	3/215
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TM15 TM31 TM41 TM54F	3/217 3/219 3/222 3/225	3/217 3/219 3/222 3/225	3/217 3/219 3/222 3/225
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System overview

Overview

With its separate power unit and Control Unit, the SINAMICS S120 drive system can be perfectly adapted to a wide variety of different drive tasks.

The Control Unit is selected according to the number of drives to be controlled and the required performance level, while the power unit must be rated to meet the energy requirements of the system. The connection between the Control Unit and power unit is made very simply using the digital system interface DRIVE-CLiQ.

Control Units

CU310 DP, CU320 and SIMOTION D4x5 Control Units

CU310 DP and CU310 PN Control Unit

CU310 Control Units are designed to control a single drive. They feature as standard a PROFIBUS interface (CU310 DP) or PROFINET interface (CU310 PN) and a TTL/HTL encoder evaluation circuit.

CU320 Control Unit

The CU320 Control Unit has been designed to control multiple drives. A CU320 is capable of operating up to

- 8 drives in *V/f* Control mode or
- 6 drives in Servo Control mode or
- 4 drives in Vector Control mode.

The CU320 Control Unit can be used to create links between individual drives and implement simple technology functions.

SIMOTION D Control Units

A SIMOTION D Control Unit is used for applications requiring coordinated motion control such as synchronous operation, electronic gear, cam disk or complex technology functions. SIMOTION D Control Units are available in a range of performance variants:

- SIMOTION D410 for controlling 1 axis
- SIMOTION D425 for controlling up to 16 axes
- SIMOTION D435 for controlling up to 32 axes
- SIMOTION D445 for controlling up to 64 axes

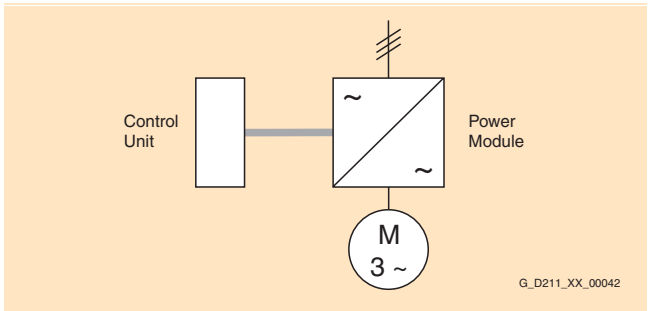
The STARTER commissioning tool is used to commission and diagnose the various types of Control Units. The SCOUT engineering system, which includes the STARTER tool, is required for SIMOTION D Control Units.

For further information about STARTER and SCOUT, see Engineering Software.

Power Modules

The stand alone version of a SINAMICS S120 drive system consists of a CU310 or D410 Control Unit and a Power Module. A mains rectifier, a voltage-source DC link and an inverter for supplying a motor are integrated in the Power Module.

Power Module in blocksize format with CU310 DP Control Unit



Power Modules are designed for single drives which are not capable of regenerating energy to the supply. Generated energy produced during braking is converted to heat via braking resistors.

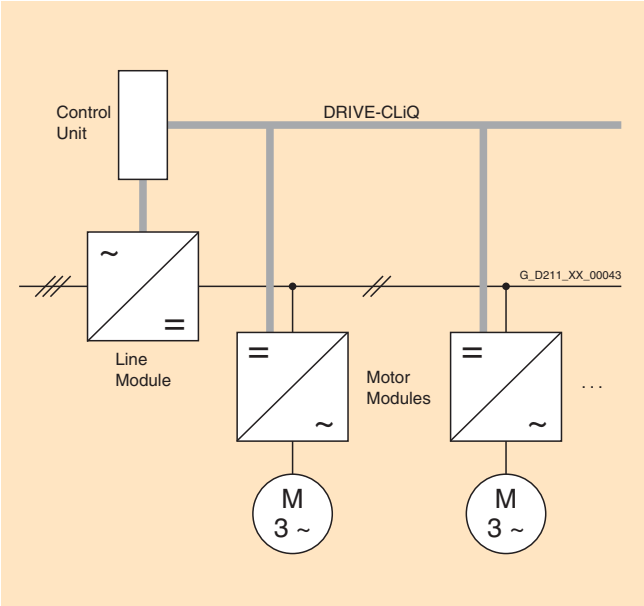
Power Modules can also be operated by a CU320 or a SIMOTION D4x5 Control Unit, e.g. in configurations where a single drive has been added to a multi-axis drive grouping. In this case, the Power Modules of the booksize format must be equipped with the CUA31/CUA32 control unit adapter. This is connected with the CU320 or SIMOTION D4x5 Control Unit using DRIVE-CLiQ. Power Modules in chassis format can be directly connected to the mullti-axis Control Unit using a DRIVE-CLiQ cable.

Overview (continued)

Motor Modules

A voltage-source DC link and an inverter for supplying a motor are integrated in the Motor Module.

CU320 Control Unit, Line Module and two Motor Modules in booksize format



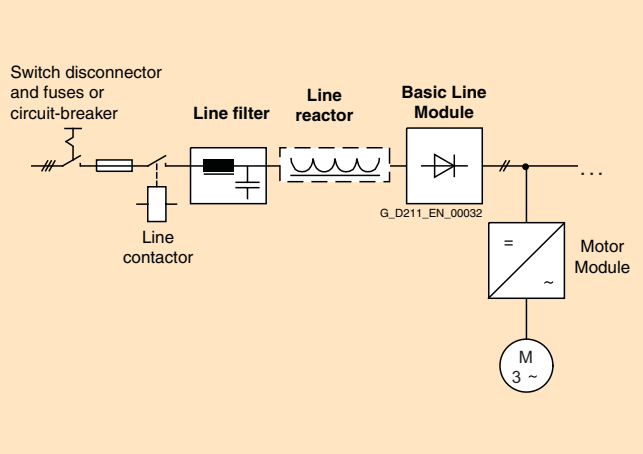
Motor Modules are designed for multi-axis drive systems and are controlled by either a CU320 or a SIMOTION D4x5 Control Unit. Motor Modules are interconnected by means of a shared DC busbar. Since the Motor Modules share the same DC link, they can exchange energy with one another, i.e. if one Motor Module operating in generator mode produces energy, the energy can be used by another Motor Module operating in motor mode. The voltage-source DC link is suppied with line voltage by a Line Module.

Line Modules

Line Modules generate a DC voltage from the line voltage and supply Motor Modules with energy via the voltage-source DC link.

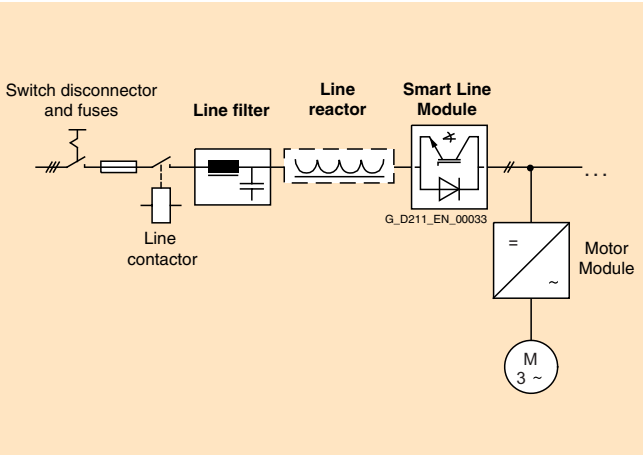
Basic Line Modules

Basic Line Modules are designed only for infeed operation, i.e. they are not capable of recovering regenerative energy to the supply system. If regenerative energy is produced, e.g. when drives brake, it must be converted to heat by means of a Braking Module and a braking resistor. When a Basic Line Module is used as the infeed, the matching line reactor must be installed. A line filter can be installed optionally to restrict conducted interference to Class C2 limits (EN 61800-3).



Smart Line Modules

Smart Line Modules can supply energy and return regenerative energy to the supply system. A Braking Module and braking resistor are required only if the drives need to be decelerated in a controlled manner after a power failure (i.e. when energy cannot be recovered to the supply). When a Smart Line Module is used as the infeed, the matching line reactor must be installed. A line filter can be installed optionally to restrict conducted interference to Class C2 limits (EN 61800-3).



System overview

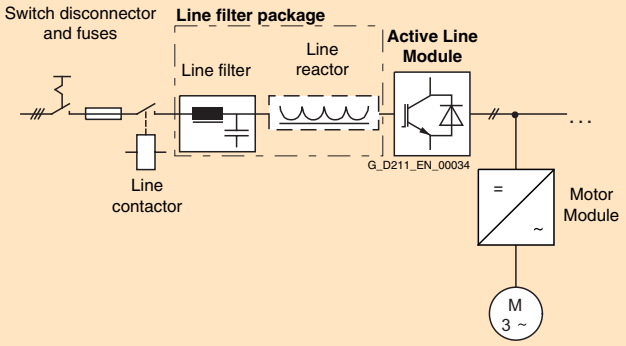
Overview (continued)

Active Line Modules

Active Line Modules can supply energy and return regenerative energy to the supply system. A Braking Module and braking resistor are required only if the drives need to be decelerated in a controlled manner after a power failure (i.e. when energy cannot be recovered to the supply). In contrast to Basic Line Modules and Smart Line Modules, however, Active Line Modules generate a regulated DC voltage which remains constant despite fluctuations in the line voltage. In this case, the line voltage must remain within the permissible tolerance range. Active Line Modules draw a virtually sinusoidal current from the supply which limits any harmful harmonics.

- Active Line Modules in booksize format

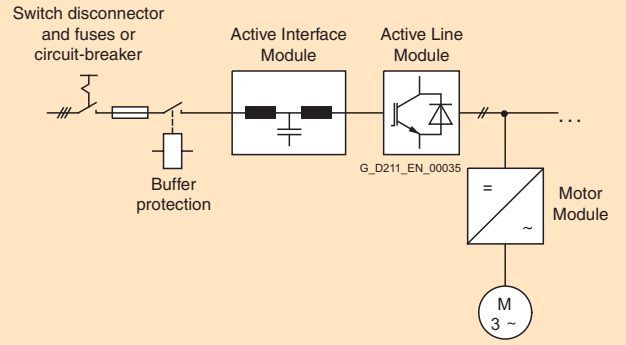
When 16 kW and 36 kW Active Line Modules are used as infeed, the matching line reactor must be installed. To minimize interference emission, the Active Line Module should always be operated with a combination of line filter and line reactor. A line reactor and line filter can be supplied in the form of a line filter package.



For the Active Line Modules 55 kW, 80 kW and 120 kW, the corresponding Active Interface Module must be selected. The Active Interface Module includes a line reactor and line filter designed for optimal functionality. For block diagram, see Active Line Modules in chassis format.

- Active Line Modules in chassis format

All the components required to operate an Active Line Module are integrated in the Active Interface Module. An external bridging contactor is required in addition for frame sizes HX and JX.



Please refer to the System description for more information about designing a drive system with SINAMICS S120.

Power Modules, Motor Modules and Line Modules are available in booksize, booksize compact, blocksize and chassis format:

- Power Modules in blocksize and chassis formats for single axis,
- Motor Modules and Line Modules in booksize, booksize compact and chassis formats.

Booksize format

Booksize format units are optimized for multi-axis applications and are mounted adjacent to one another. The connection for the shared voltage-source DC link is an integral feature.

The booksize format offers a greater range of cooling options:

Internal air cooling

In this standard solution, the power loss from the electronics and power units of the drive components is removed by natural cooling or by a forced-ventilation system and routed to the interior of the control cabinet.

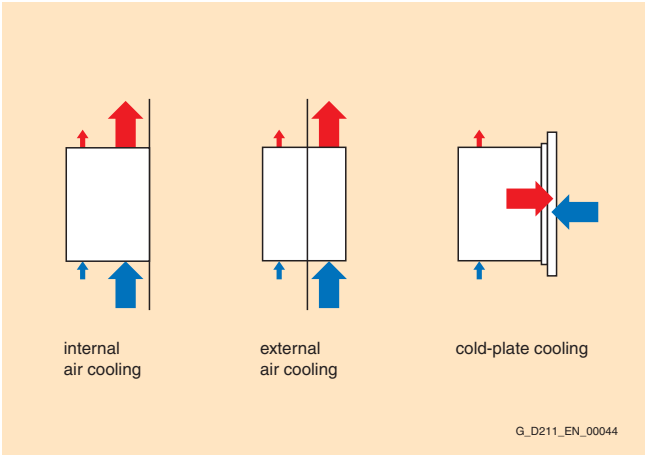
External air cooling

External air cooling uses the "through-hole" method. The components' power unit heat sinks pass through the mounting surface in the control cabinet and can thus release the heat losses of the power circuit to a separate external cooling circuit. The only heat loss that remains in the cabinet is emitted by the electronics. Degree of protection IP54 can be achieved at this "mechanical interface". The heat sink, with its cooling fins and the fan unit (part of the scope of supply), protrudes through the back into a separate ventilation area, which can also open outwards.

Overview (continued)

Cold plate cooling

Units designed with cold plate cooling can pass the power unit heat losses to an external heat sink via a thermal interface on the unit's rear panel. This external heat sink is water-cooled, for example.



In booksize compact format

Derived from the booksize format we developed the booksize compact format for machines with particularly high requirements for the compactness of their drives. The booksize compact format combines all benefits of the booksize format and provides the same performance with an even smaller overall height and an extended overload capability. The booksize compact format is thus particularly well suitable for integration into machines with high dynamic requirements and confined installation conditions.

The booksize compact format has the same design for the cooling methods of internal air cooling and cold plate cooling.

Blocksize format

Blocksize format units are optimized for single-axis applications and are available only as Power Modules.

The CU310 Control Unit can be snapped onto them directly. The units are cooled by an internal air cooling circuit.

Chassis format

Higher-output units (approximately 100 kW (150 HP) and above) are constructed in chassis format. These are available as Line Modules, Power Modules and Motor Modules. Chassis format units are cooled by an internal air cooling circuit. For special applications, e.g. for extrusion or marine applications, liquid-cooled units are available. The CU310 Control Unit can be integrated in the Power Modules.

System overview

Overview (continued)

Liquid-cooled units

Liquid-cooled units are also available from the SINAMICS S120 drive system in chassis format.

The spectrum extends from

- Power Modules for feeding an individual drive
- Line Modules with and without line regeneration
- Motor Modules for implementing multi-motor drives.

Power Modules as liquid-cooled version

The liquid-cooled Power Modules are described in Catalog PM 21 on Page 3/54. Information about multi-motor drives comprising Line Modules and Motor Modules can be found in Catalog D 21.3.

Highlights of the liquid-cooled devices

- Up to 60 % smaller footprint than air-cooled devices
- All main components such as power semiconductors, DC link capacitors and symmetrical resistances are cooled by the cooling circuit
- Uniform pressure drop of 0.7 bar
- No derating when anti-freeze is used
- Low noise

Cabinet units in liquid-cooled version

Components of the SINAMICS S120 drive system in the liquid-cooled version are also available as cabinet units. These are designed to the specific requirements and represent a tailor-made all-in-one solution for every drive task.

Further information is available on request.

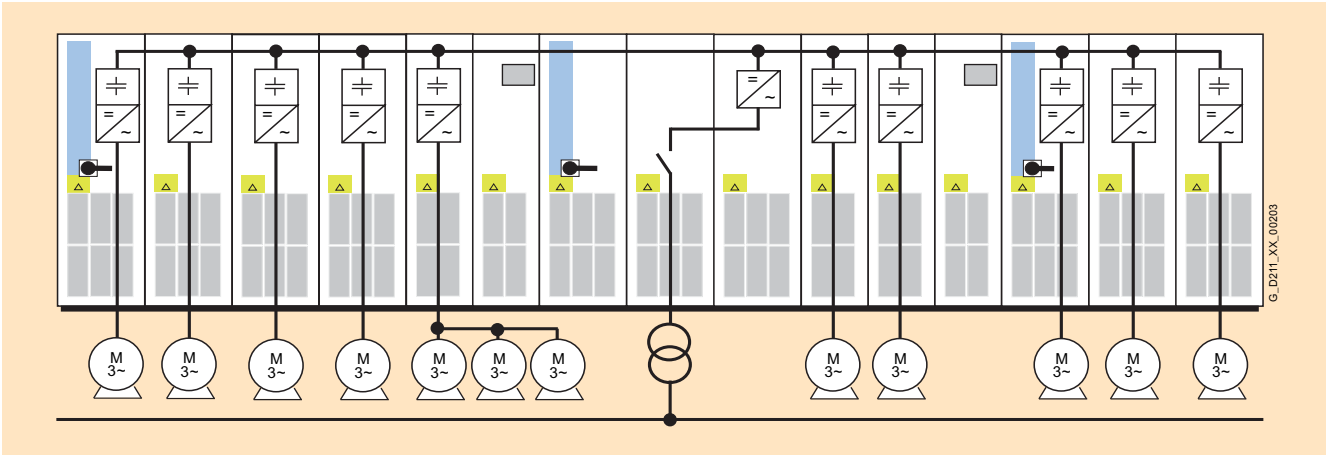
Overview (continued)

Cabinet Module format

Apart from the drive units described in this catalog, SINAMICS S120 Cabinet Modules represent a cabinet-system that is specially designed for use in plant construction. These cabinets can be combined with a total output of up to 4500 kW (6000 HP).

The modular system is ideally suited to multi-motor drives with a central supply infeed and a common DC bus, of the type typically used in paper-making machines, roller mills, test stands, or hoisting gear. The modular concept allows all components to be combined to fulfill the application requirements.

For the Cabinet Modules, three infeeds are available (Basic Line Module, Smart Line Module and Active Line Module) as well as special Braking Modules and Auxiliary Modules. The S120 Cabinet Modules system is available with IP20, IP21, IP23, IP43 and IP54 degrees of cabinet protection selectable for the installation requirements. Communication between the Power Modules and the central Control Unit takes place via DRIVE-CLiQ.



Example of a drive line-up with SINAMICS S120 Cabinet Modules for a multi-motor drive

The power range can be extended as required by means of a parallel connection of up to 4 individual modules.

Further information is available on request

Customized application

SINAMICS S120 devices can be purchased in custom formats as a complete system solution. The user profits from the know-how of the drive specialists and no longer has to consider the thermal design of the application. Especially in applications with devices that use cold plate cooling, external air cooling and liquid-cooled devices in chassis format, the user obtains a technically reliable solution and saves time on engineering. The system solution ranges, for example, from a drive line-up in booksize format with cold plate cooling completely installed on a common cooling plate through to complete control cabinets with a cooling system and temperature/condensation control.

Further information is available from the Siemens branch offices.

Varnished modules

The following units are equipped as standard with varnished or partially varnished modules:

- Blocksize format units
- Booksize format units
- Chassis format units
- Control Units (SIMOTION D410/D425/435, CX32, SINAMICS CU320/CU310)
- Sensor Modules
- Terminal modules

The varnish coating protects the sensitive SMD components against corrosive gases, chemically active dust and moisture.

The selection of Control Unit and Power Module as well as the motor modules defines the structure of the drive system. The range of system components provided allows optimum adaptation of the drive system to the application.

System components

System components are divided into the following categories:

- ***DC link components***
  e.g. Braking Modules and braking resistors
- ***Power components on the output side***
  e.g. motor reactors
- ***Supplementary system components***
  e.g. Terminal Modules, operator panels and communication boards
- ***Encoder system connection***
  for connecting various types of encoders to SINAMICS S120

General technical specifications

Technical specifications

Unless specified otherwise, the following technical specifications are valid for all the following components of the SINAMICS S120 drive system.

Electrical data	
Electronic power supply	24 V DC, -15 % +20 % implemented as PELV circuit in accordance with EN 61800-5-1 Mass = Negative polarity grounded via the electronics
Mechanical data	
Vibratory load	
• Transport [1]	
- All units and components except for chassis format	- Class 2M3 to EN 60721-3-2
- Chassis format	- Class 2M2 to EN 60721-3-2
• Operation	Test values in accordance with EN 60068-2-6 test Fc: 10 … 58 Hz: Constant deflection 0.075 mm 58 … 150 Hz: Constant acceleration = 9.81 m/s^2 (1 × *g*)
Shock stressing	
• Transport [1]	
- All units and components except for chassis format	- Class 2M3 to EN 60721-3-2
- Chassis format	- Class 2M2 to EN 60721-3-2
• Operation	Test values in accordance with EN 60068-2-27 test Ea:
- Booksize, booksize compact and blocksize formats, frame sizes FSA to FSC	147 m/s^2 (15 x *g*)/11 ms
- Blocksize format, frame sizes FSD to FSF	- 49 m/s^2 (5 × *g*)/30 ms
- Chassis format	- 98 m/s^2 (10 × *g*)/20 ms
Ambient conditions [2]	
Protection Class	Class I (with protective conductor system) and class III (PELV) to EN 61800-5-1
Shock protection	DIN VDE 0106 Part 100 and BGV A 3 when used properly
Permissible ambient/coolant temperature (air) during operation	
• For line-side components, Power Modules, Line Modules and Motor Modules	0 … 40 °C (32 … 104 °F) without derating, > 40 … 55 °C (104 … 131 °F), see derating characteristics
• For Control Units, additional system components, DC link components and Sensor Modules	0 … 55 °C (32 … 131 °F) up to 2000 m (6562 ft) above sea level
Climatic ambient conditions	
• Storage [1]	Class 1K3 to EN 60721-3-1 Temperature -40 … +70 °C (-40 … +158 °F)
• Transport [1]	Class 2K4 to EN 60721-3-2 Temperature -40 … +70 °C (-40 … +158 °F) Max. air humidity 95 % at 40 °C (104 °F)
• Operation	Class 3K3 to EN 60721-3-3 Condensation, splashwater and ice formation are not permitted (EN 60204, Part 1)
Environmental class/harmful chemical substances	
• Storage [1]	Class 1C2 to EN 60721-3-1
• Transport [1]	Class 2C2 to EN 60721-3-2
• Operation	Class 3C2 to EN 60721-3-3
Organic/biological influences	
• Storage [1]	Class 1B1 to EN 60721-3-1
• Transport [1]	Class 2B1 to EN 60721-3-2
• Operation	Class 3B1 to EN 60721-3-3
Degree of contamination	2 to EN 61800-5-1

European directives	
73/23/EEC	Low-voltage directive: Legal guideline of the EU member states concerning electrical equipment for use within specified voltage limits
89/336/EEC	EMC directive: Legal guidelines of the EU member states for electromagnetic compatibility
98/37/EC	Machinery directive: Legal guidelines of the EU member states for machines
European Standards	
EN 954-1	Safety of machinery – safety-related parts of control systems; Part 1: General design principles
EN 61508-1	Functional safety of electrical/electronic/programmable electronic safety-related systems Part 1: General requirements
EN 60204-1	Electrical equipment of machines Part 1: General definitions
EN 61800-3	Variable-speed electric drives Part 3: EMC product standard including specific test methods
EN 61800-5-1	Adjustable-speed electrical power drive systems Part 5: Safety requirements Main section 1: Electrical and thermal requirements
North American standards	
UL508C	Power Conversion Equipment
CSA C22.2 No. 14	Industrial Control Equipment

Approvals	
cULus, cURus	Testing by UL (Underwriters Laboratories, http://www.ul.com) according to UL and CSA standards

Test symbol:

UL	for end products, tested by UL in accordance with the UL standard
cUL	for end products, tested by UL in accordance with the CSA standard
cULus	for end products, tested by UL in accordance with the UL and CSA standards
	for mounting parts in end products, tested by UL in accordance with the UL standard
c	for mounting parts in end products, tested by UL in accordance with the CSA standard
cus	for mounting parts in end products, tested by UL in accordance with the UL and CSA standards

[1] In transport packaging.

[2] Modules are varnished or partially varnished to protect the sensitive components against corrosive gases, chemically active dust and moisture.

Overview

New system architecture with a central Control Unit

Electronically coordinated individual drives work together to perform your drive tasks. Higher-level controllers operate the drives to achieve the required coordinated movement. This requires cyclic data exchange between the controller and the drives. This exchange usually took place via a field bus, which required a great deal of time and effort for installation and configuration. SINAMICS S120 takes a different approach: A central Control Unit controls the drives for all connected axes and also establishes the technological links between the drives and/or axes. Since all the required data is stored in the central Control Unit, it does not need to be transferred. Inter-axis connections can be established within a Control Unit and easily configured in the STARTER commissioning tool using a mouse.

- Simple technological tasks can be carried out automatically by the SINAMICS S120 Control Unit
- The **CU310 DP** or **CU310 PN** Control Unit are available for single drives
- The **CU320** Control Unit is designed for multi-axis applications
- Sophisticated motion control tasks can be implemented with the support of the more powerful Control Units **D410**, **D425**, **D435** and **D445** of **SIMOTION D** (graded according to performance)

Each of these Control Units is based on an object-oriented SINAMICS S120 standard firmware, which contains all the popular control modes and can be scaled to meet even the most advanced performance requirements.

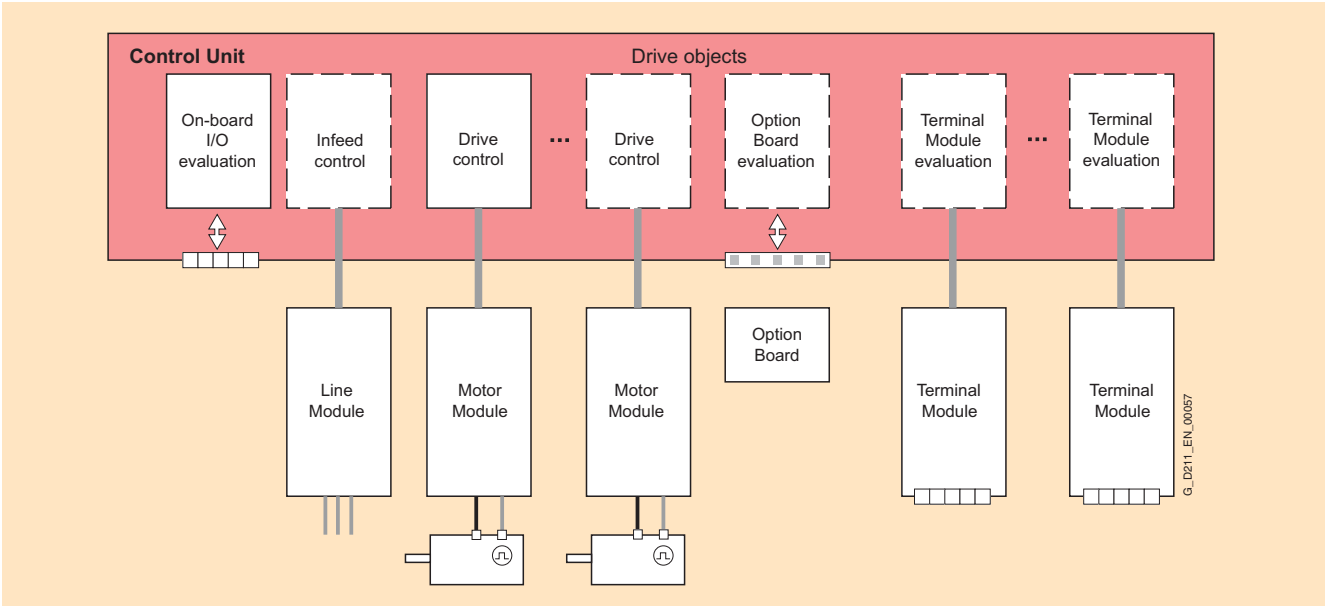
The drive controls are supplied as ready-to-configure drive objects:

- for the "Infeed Control",
- for the broad scope of rugged asynchronous (induction) motor applications "Vector Control" and *V/f* control
- for permanent-field synchronous motors with demanding dynamic requirements "Servo Control"

The most commonly used *V/f* control modes are stored in the "Vector Control" drive object and are ideal for implementing even simple applications such as, for example, group drives with SIEMOSYN motors.

Drive objects

A drive object is a self-contained software function with its own parameters and, if necessary, its own fault messages and alarms.



Technology packages

SIMOTION D Control Units support the coordinated motion control of multiple drives. In addition to drive objects, these Control Units also offer technology objects such as, for example, "cam controller", "synchronism", "cam disk" and "temperature control", and these objects are grouped to form technology packages. Users can create their own objects and set up links between all configured objects.

Comprehensive package of open-loop and closed-loop control functions

A wide variety of standard functions such as setpoint input, data set changeover, controller optimization, kinetic buffering, etc. ensure a high degree of operational reliability and excellent flexibility of application.

Control Units

3

Overview (continued)

Overview of key open-loop and closed-loop control functions

	Closed-loop control types S120	Open-loop control types S120	Main functions S120 for booksize/chassis	Comment, note
Infeed Control	• Booksize - Current control with/without mains sensor - V_{DC} control with/without mains sensor • Chassis - Current control with mains sensor - V_{DC} control with mains sensor	• Booksize - Smart Line Modules can be selected • Chassis - Basic Line Modules can be selected	• Mains identification • Controller optimization • Harmonics filter • Automatic restart	The mains sensor is the VSM 10 Voltage Sensing Module; "current" is the line current; 3-phase with line frequency
Vector Control	• Asynchronous motor - Torque control with/without encoder - Speed control with/without encoder • Torque motor - Torque control with encoder - Speed control with/without encoder • For asynchronous and torque motors - Position control with encoder	- Linear/parabolic characteristic - Fixed-frequency characteristic (textile) - Independent voltage setpoint input	• Data set changeover • Extended setpoint input • Motor identification • Current/speed controller optimization • Technology controller • Basic positioner • Automatic restart • Flying restart with/without encoder • Kinetic buffering • Synchronization • Droop • Brake control	Mixed operation with *V/f* control modes is possible; it is for this reason that the *V/f* control modes are stored only once in the "Vector Control" drive object Position control can be selected as a function module from both Servo and Vector mode. Synchronous motors (1FK and 1FT) and linear motors can be operated only in Servo mode.
Servo Control	• Asynchronous motor - Torque control with encoder - Speed control with/without encoder • Synchronous motor, linear motor and torque motor - Torque control with encoder - Speed control with encoder • For all motor types - Position control with encoder	- Linear/parabolic characteristic - Fixed-frequency characteristic (textile) - Independent voltage setpoint input	• Data set changeover • Setpoint input • Motor identification • Damping application • Technology controller • Basic positioner • Brake control	Mixed operation with *V/f* control modes is possible; it is for this reason that the *V/f* control modes are stored only once in the "Vector Control" drive object Position control can be selected as a function module from both Servo and Vector mode.

Overview (continued)

BICO technology

Every drive object contains a large 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.

Drive Control Chart (DCC)

DCC Drive Control Chart for SINAMICS S120 for simple, graphical configuration of closed-loop process control, logic and arithmetic functions at the drive level.

It expands the possibilities for easy configuring of technology functions for the SIMOTION Motion Control system as well as for the SINAMICS S120 drive system.

The user-friendly DCC editor supports easy graphical configuration and a clear presentation of control loop structures.

The associated block library contains a large choice of closed-loop control, calculation and logic modules as well as more complex control and function modules.

Drive Control Chart for SINAMICS S120 therefore provides a convenient basis for resolving drive-level open-loop and closed-loop control tasks directly in the converter.

Function module

The basic positioner "EPos" can be called on all SINAMICS S120 Control Units as an additionally activatable function module. The basic positioner can be used on point-to point and basic motion control tasks without the need for an external controller.

The **"Technology controller"** is designed as a PID controller. It is suitable for implementing controls for regulating variables such as fill level, temperature, tension, pressure, flow rate and dancer position.

Integral safety functions (Safety Integrated)

The Control Units support comprehensive safety functions.

The integrated safety functions are the Safety Integrated basic functions

- STO = Safe Torque Off
- SBC = Safe Brake Control
- SS1 = Safe Stop 1

And the Safety Integrated extended functions that require a license

- SS2 = Safe Stop 2
- SOS = Safe Operating Stop
- SLS = Safely Limited Speed
- SSM = Safe Speed Monitor

(abbreviations in accordance with IEC 61800-5-2)

If the extended safety functions are used, licenses, supplementary system components such as TM54F terminal modules, or suitable safety controls will be necessary. For further information on the integrated safety functions, see the "Safety Integrated" section.

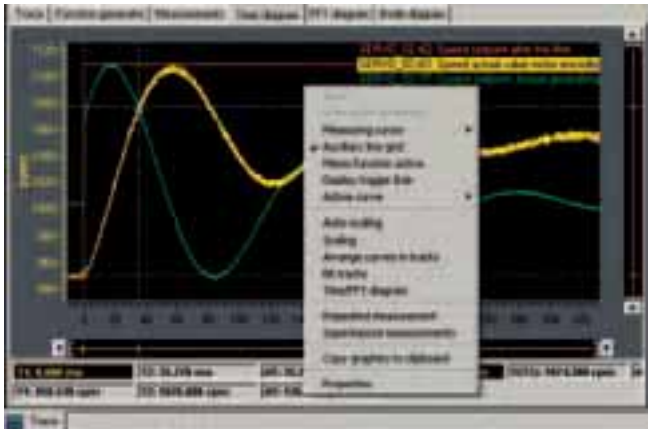
CompactFlash card

The functions of the SINAMICS S120 drives are stored on a CompactFlash card. This card contains the firmware and parameter settings for all drives in the form of a project. The CompactFlash card can also hold additional projects, which means that the correct project can be accessed immediately when series machines of different types are commissioned. When the Control Unit has booted, the data on the CompactFlash card are read and loaded to the RAM.

The firmware is organized in objects. Drive objects are used to implement open-loop and closed-loop control functions for Line Modules, Motor Modules, Power Modules and other system components connected by DRIVE-CLiQ.

Diagnostics optimally supported by trace function

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



CU310 DP Control Unit

Overview

The CU310 DP Control Unit provides the communications and open-loop/closed-loop control functions for a Power Module. The CU310 DP combined with a Power Module and CompactFlash card creates a powerful single-axis AC drive with a PROFIBUS interface to a higher-level control.

Design

CU310 DP Control Unit features the following interfaces as standard:

- 1 DRIVE-CLiQ socket for communication with other DRIVE-CLiQ devices, e.g. Sensor or Terminal Modules
- 1 PM-IF interface for communication with Power Modules in blocksize format
- 1 interface to the BOP20 Basic Operator Panel
- 1 PROFIBUS interface with PROFIdrive V4 profile
- 1 encoder evaluation
  The following encoder signals can be evaluated:
  - Incremental encoder TTL/HTL
  - SSI encoder without incremental signals
- 4 parameterizable digital inputs (floating)
- 4 parameterizable bidirectional digital inputs/digital outputs (non-floating)
- 1 serial RS232 interface
- 1 slot for the CompactFlash Card on which firmware and parameters are stored
- 3 test sockets and one reference ground for commissioning support
- 1 connection for the electronic power supply via the 24 V DC power supply connector
- 1 PE/ground conductor connection
- 1 safe standstill input (enable pulses) for controlling the connected PM340 Power Module
- 1 temperature sensor input (KTY84-130 or PTC)

The status of the CU310 DP Control Unit is indicated via multi-color LEDs.

A BOP20 Basic Operator Panel can also be snapped directly onto the CU310 DP Control Unit for diagnostic purposes.

As the firmware and parameter settings are stored on a plug-in CompactFlash card, the Control Unit can be changed without the need for software tools.

Integration

The CU310 DP Control Unit drives Power Modules in blocksize format via the PM-IF interface. In this case, other DRIVE-CLiQ components such as Sensor or Terminal Modules, can be connected to the DRIVE-CLiQ socket on the CU310 DP Control Unit.

Power Modules in chassis format are driven by the CU310 DP Control Unit via the DRIVE-CLiQ interface. With this option, Sensor and Terminal Modules must be connected to the free DRIVE-CLiQ sockets on the Power Module.

Parameter settings can be changed with the BOP20 Basic Operator Panel. The BOP20 panel can also be snapped onto the CU310 DP Control Unit during operation for diagnostic purposes.

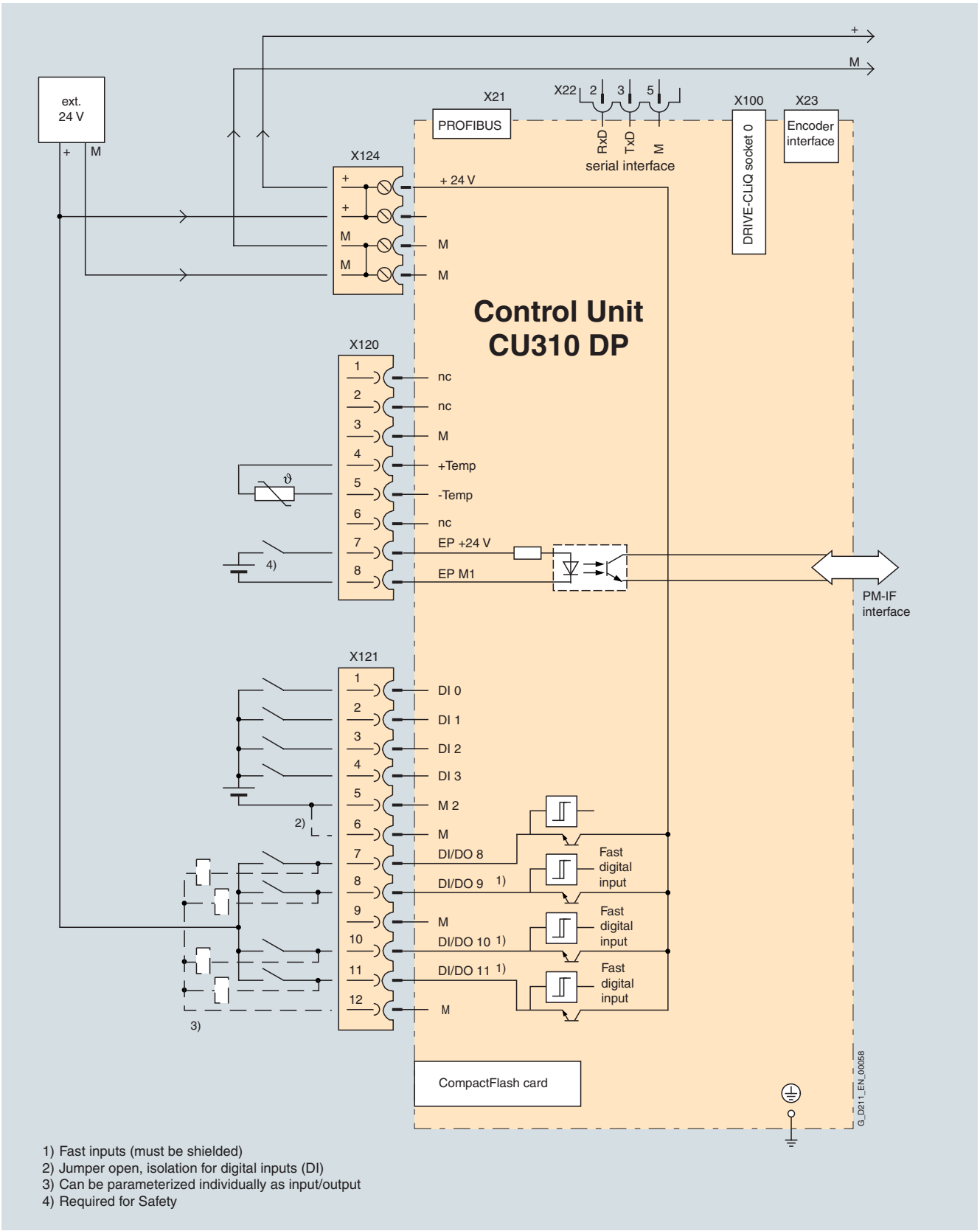
The CU310 DP Control Unit and other connected components are commissioned and diagnosed with the STARTER commissioning tool. The CU310 DP Control Unit requires a CompactFlash Card with firmware version 2.4 or higher.

A CU310 DP Control Unit communicates with the higher-level control system using PROFIBUS and the PROFIdrive V4 profile.

An external 24 V supply can be connected to the CU310 to power the Control Unit when the incoming supply to the Power Module is not energized.

3

Integration (continued)



1) Fast inputs (must be shielded)
2) Jumper open, isolation for digital inputs (DI)
3) Can be parameterized individually as input/output
4) Required for Safety

Connection example of CU310 DP Control Unit

CU310 DP Control Unit

Technical specifications

CU310 DP Control Unit	
Current requirement at 24 V DC, max. without taking account of digital outputs and DRIVE-CLiQ supply	0.35 A for CU310 DP + 0.5 A for PM340 Power Module
• Conductor cross-section, max.	2.5 mm^2
• Fuse protection, max.	20 A
Digital inputs	In accordance with IEC 61131-2 Type 1 4 x floating digital inputs 4 bidirectional non-floating digital inputs/digital 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.	10 mA
• Delay time of digital inputs [1], approx.	
- L → H	50 µs
- H → L	100 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	50 µs
• Conductor cross-section, max.	0.5 mm^2
Digital outputs (sustained-short-circuit-proof)	4 bidirectional non-floating digital inputs/digital outputs
• Voltage	24 V DC
• Load current per digital output [2], max.	500 mA
• Delay time [1], approx.	150 µs
• Conductor cross-section, max.	0.5 mm^2
Encoder evaluation	• Incremental encoder TTL/HTL • SSI encoder without incremental signals
• Encoder supply	24 V DC/0.35 A or 5 V DC/0.35 A
• Encoder frequency, max.	300 kHz
• SSI baud rate	100 ... 250 kBaud
• 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
Approvals	cULus (File No.: E164110)

Selection and ordering data

Description	Order No.
CU310 DP Control Unit (without CompactFlash Card)	**6SL3040-0LA00-0AA1**

Accessories

Description	Order No.
PROFIBUS connector	
• Without PG/PC connection	**6ES7972-0BA41-0XA0**
• With PG/PC connection	**6ES7972-0BB41-0XA0**
STARTER commissioning tool	**6SL3072-0AA00-0AG0**

1) The specified delay times refer to the hardware. The actual reaction time depends on the time slot 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.

Overview

The CU310 PN Control Unit is designed for the communication and open-loop/closed-loop control functions of a Power Module. The CU310 PN combined with a Power Module and CompactFlash card creates a powerful single-axis AC drive. The communication link to the higher-level control is provided by PROFINET IO.

Design

CU310 PN Control Units feature the following interfaces as standard:

- 1 DRIVE-CLiQ socket for communication with other DRIVE-CLiQ devices, e.g. Sensor or Terminal Modules
- 1 PM-IF interface for communication with Power Modules in blocksize format
- 1 interface to the BOP20 Basic Operator Panel
- 1 PROFINET interface with 2 ports (RJ45 sockets) with PROFIdrive V4 profile
- 1 encoder evaluation
  The following encoder signals can be evaluated:
  - Incremental encoder TTL/HTL
  - SSI encoder without incremental signals
- 4 parameterizable digital inputs (floating)
- 4 parameterizable bidirectional digital inputs/digital outputs (non-floating)
- 1 serial RS232 interface
- 1 slot for the CompactFlash Card on which firmware and parameters are stored
- 3 test sockets and one reference ground for commissioning support
- 1 connection for the electronic power supply via the 24 V DC power supply connector
- 1 safe standstill input (enable pulses) for controlling the connected PM340 Power Module
- 1 temperature sensor input (KTY84-130 or PTC)
- 1 PE/ground conductor connection

The status of the CU310 PN Control Unit is indicated via multi-color LEDs.

A BOP20 Basic Operator Panel can also be snapped directly onto the CU310 PN Control Unit for diagnostic purposes.

As the firmware and parameter settings are stored on a plug-in CompactFlash card, the Control Unit can be changed without the need for software tools.

Integration

The CU310 PN Control Unit drives Power Modules in blocksize format via the PM-IF interface. In this case, other DRIVE-CLiQ components such as Sensor or Terminal Modules can be connected to the DRIVE-CLiQ socket on the CU310 PN Control Unit.

Power Modules in chassis format are driven by the CU310 DP Control Unit via the DRIVE-CLiQ interface. With this option, Sensor and Terminal Modules must be connected to the free DRIVE-CLiQ sockets on the Power Module.

Parameter settings can be changed with the BOP20 Basic Operator Panel. The BOP20 panel can also be snapped onto the CU310 PN Control Unit during operation for diagnostic purposes.

The CU310 PN Control Unit and other connected components are commissioned and diagnosed with the STARTER commissioning tool. The CU310 PN Control Unit requires a CompactFlash Card with firmware version 2.4 or higher.

A CU310 PN Control Unit communicates with the higher-level control system using PROFINET IO and the PROFIdrive V4 profile.

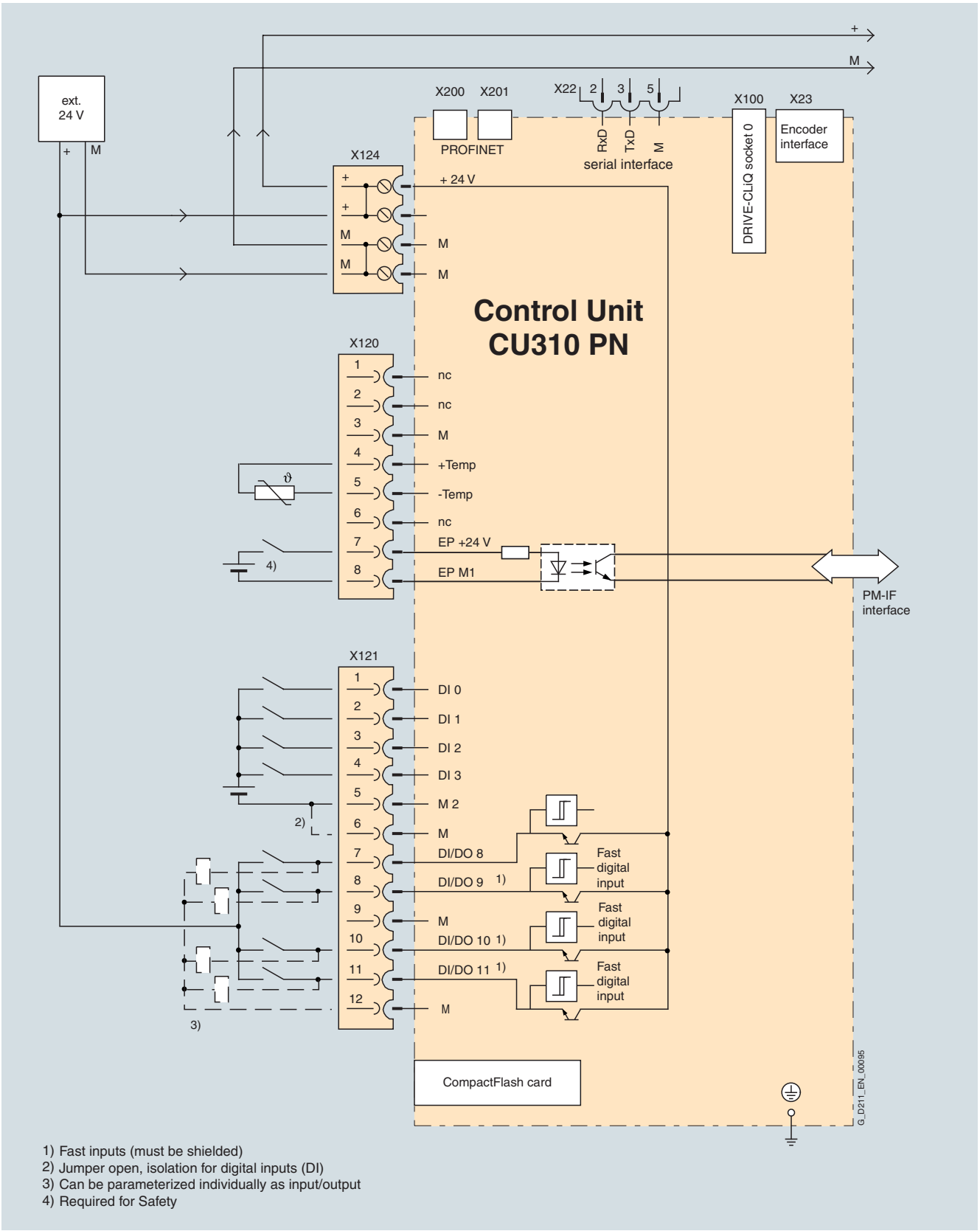
The SINAMICS S120 drive system with CU310 PN then assumes the function of a PROFINET IO device and can perform the following functions:

- PROFINET IO device
- 100 Mbit/s full duplex
- Supports real-time classes of PROFINET IO:
  - RT (Real-Time)
  - IRT (Isochronous Real-Time), minimum send cycle 500 µs
- Connects to controls as PROFINET IO devices using PROFIdrive compliant with Specification V4
- Standard TCP/IP communication for engineering processes using the STARTER commissioning tool
- Integrated 2-port switch with 2 RJ45 sockets based on the ERTEC ASIC. The optimum topology (line, star, tree) can therefore be configured without additional external switches.

An external 24 V supply can be connected to the CU310 to power the Control Unit when the incoming supply to the Power Module is not energized.

3

Integration (continued)



1) Fast inputs (must be shielded)
2) Jumper open, isolation for digital inputs (DI)
3) Can be parameterized individually as input/output
4) Required for Safety

Connection example of CU310 PN Control Unit

Technical specifications

CU310 PN Control Unit	
Current requirement at 24 V DC, max. without taking account of digital outputs and DRIVE-CLiQ supply	0.4 A for CU310 PN + 0.5 A for PM340 Power Module
Conductor cross-section, max.	2.5 mm^2
Fuse protection, max.	20 A
Digital inputs	In accordance with IEC 61131-2 Type 1 4 x floating digital inputs 4 bidirectional non-floating digital inputs/digital 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.	10 mA
• Delay time of digital inputs [1], approx.	
- L → H	50 µs
- H → L	100 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	50 µs
• Conductor cross-section, max.	0.5 mm^2
Digital outputs (sustained-short-circuit-proof)	4 bidirectional non-floating digital inputs/digital outputs
• Voltage	24 V DC
• Load current per digital output [2], max.	500 mA
• Delay time [1], approx.	150 µs
• Conductor cross-section, max.	0.5 mm^2
Encoder evaluation	• Incremental encoder TTL/HTL • SSI encoder without incremental signals
• Encoder supply	24 V DC/0.35 A or 5 V DC/0.35 A
• Encoder frequency, max.	300 kHz
• SSI baud rate	100 ... 250 kBaud
• 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 lb)
Approvals	cULus (File No.: E164110)

Selection and ordering data

Description	Order No.
CU310 PN Control Unit (without CompactFlash Card)	**6SL3040-0LA01-0AA1**

Accessories

Description	Order No.
STARTER commissioning tool	**6SL3072-0AA00-0AG0**
Industrial Ethernet FC	
• RJ45 Plug 180 (1 unit)	**6GK1901-1BB10-2AA0**
• RJ45 Plug 180 (10 unit)	**6GK1901-1BB10-2AB0**
• Stripping tool	**6GK1901-1GA00**
• Standard Cable GP 2x2	**6XV1840-2AH10**
• Flexible Cable GP 2x2	**6XV1870-2B**
• Trailing Cable GP 2x2	**6XV1870-2D**
• Trailing Cable 2x2	**6XV1840-3AH10**
• Marine Cable 2x2	**6XV1840-4AH10**

For further information about connectors and cables, refer to Catalog IK PI.

1) The specified delay times refer to the hardware. The actual reaction time depends on the time slot 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.

CU320 Control Unit

Overview

The communication, open-loop and closed-loop control functions for one or more Motor Modules and the Line Module are executed in a CU320 Control Unit. The CU320 Control Unit is designed for multi-axis operation.

Design

CU320 Control Unit, without guard cover

CU320 Control Unit features the following interfaces as standard:

- 4 x DRIVE-CLiQ sockets for communication with other DRIVE-CLiQ devices, e.g., Motor Modules, Active Line Modules, Sensor Modules, Terminal Modules
- 1 PROFIBUS interface with PROFIdrive V4 profile
- 8 parameterizable digital inputs (floating)
- 8 parameterizable bidirectional digital inputs/digital outputs (non-floating), of which 6 are high-speed digital inputs
- 1 serial RS232 interface
- 1 interface for the BOP20 Basic Operator Panel
- 1 slot for the CompactFlash Card on which firmware and parameters are stored
- 1 slot for mounting an option module (e.g. TB30 Terminal Board)
- 3 test sockets and one reference ground for commissioning support
- 1 connection for the electronic power supply via the 24 V DC power supply connector
- 1 PE (protective earth) connection
- 1 ground connection

A shield connection for the signal cable shield on the option module is located on the CU320 Control Unit.

The available option slot is used to expand the interfaces, for example, to include additional terminals or for communication purposes.

The status of the CU320 Control Unit is indicated via multi-color LEDs.

As the firmware and parameter settings are stored on a plug-in CompactFlash card, the Control Unit can be changed without the need for software tools.

The CU320 Control Unit can be mounted on the side of the Line Module in booksize format via brackets integrated in a Line Module. The CU320 Control Unit can also be fixed to the wall of the control cabinet using the integrated fixing lugs. As the CU320 Control Unit is not as deep as the Line Modules, suitable spacers are available to increase the depth of the CU320 Control Unit to 270 mm (10.63 in).

Integration

DRIVE-CLiQ components, for example, Motor Modules and Active Line Modules, can be connected to a CU320 Control Unit. The number of modules depends on the performance required, including duty type and additional functions.

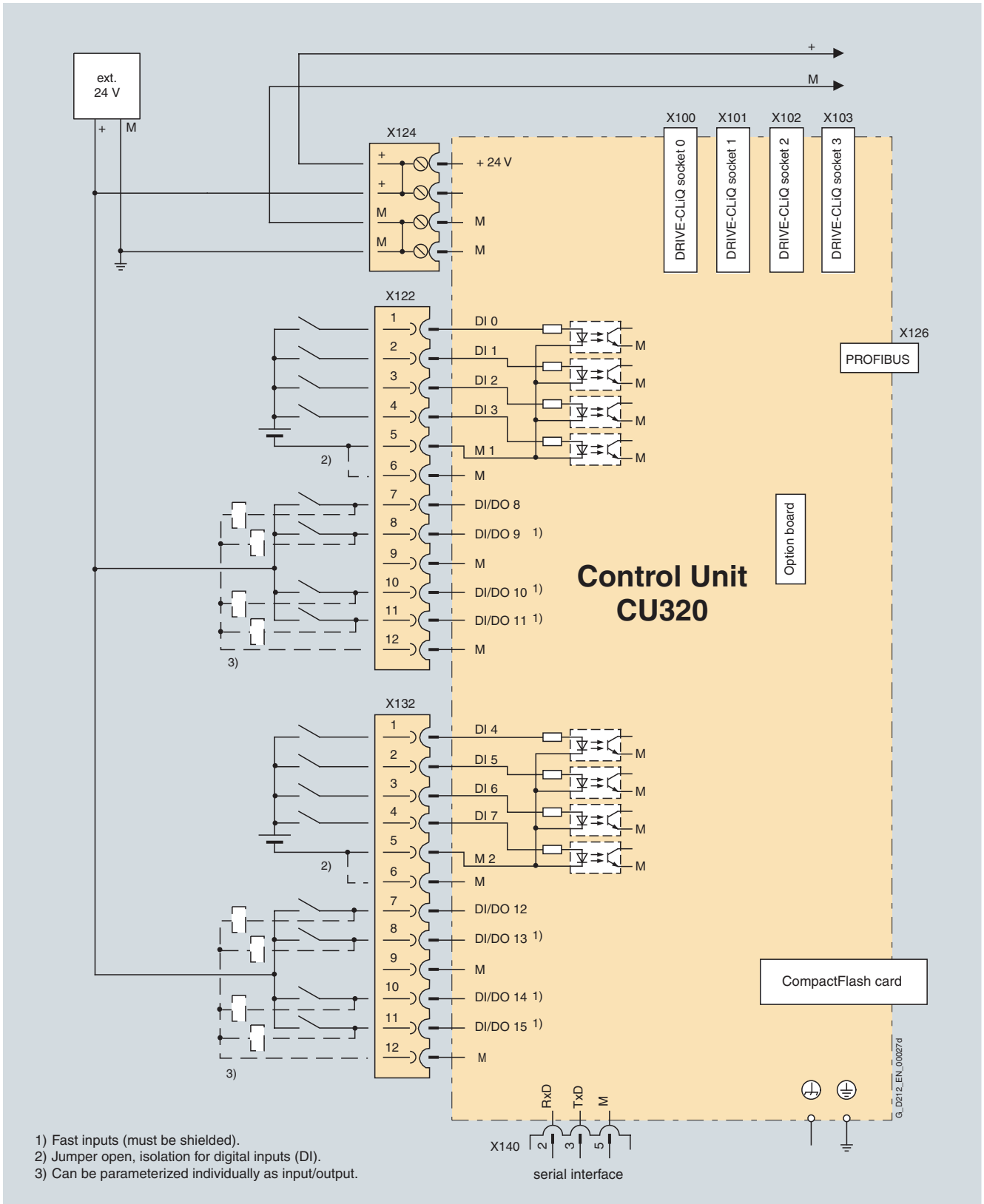
The BOP20 panel can also be snapped onto the CU320 Control Unit during operation for diagnostic purposes.

The CU320 Control Unit and other connected components are commissioned and diagnosed with the STARTER commissioning tool.

Communication between a CU320 Control Unit and the connected components takes place via DRIVE-CLiQ.

If an application requires more than one Control Unit, the number can be increased accordingly. The Control Units are then interconnected on a higher-level controller via PROFIBUS with the PROFIdrive V4 profile.

Integration (continued)



Connection example of CU320 control unit

CU320 Control Unit

Technical specifications

CU320 Control Unit	
Current requirement at 24 V DC, max. without taking account of digital outputs, expansion option slot and DRIVE-CLiQ supply	0.8 A
Conductor cross-section, max.	2.5 mm^2
Fuse protection, max.	20 A
Digital inputs	In accordance with IEC 61131-2 Type 1
	8 x floating digital inputs
	8 bidirectional non-floating digital inputs/digital 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.	10 mA
• Delay time of digital inputs [1], approx.	
- L → H	50 µs
- H → L	100 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	50 µs
• Conductor cross-section, max.	0.5 mm^2
Digital outputs (sustained-short-circuit-proof)	8 bidirectional non-floating digital inputs/digital outputs
• Voltage	24 V DC
• Load current per digital output, max.	500 mA
• Delay time, approx. [1]	150 µs
• Conductor cross-section, max.	0.5 mm^2
Power loss	20 W
PE connection	M5 screw
Ground connection	M5 screw
Dimensions	
• Width	50 mm (1.97 in)
• Height	270 mm (10.63 in)
• Depth	226 mm (8.90 in)
Weight, approx.	1.5 kg (3 lb)
Approvals	cULus (File No.: E164110)

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

Selection and ordering data

Description	Order No.
CU320 Control Unit (without CompactFlash Card)	**6SL3040-0MA00-0AA1**

Accessories

Description	Order No.
PROFIBUS connector	
• Without PG/PC connection	**6ES7972-0BA41-0XA0**
• With PG/PC connection	**6ES7972-0BB41-0XA0**
Spacers (2 units) for increasing the depth of the CU320 Control Unit to 270 mm (10.63 in) (if the brackets on the side are not to be used, but the depth still has to be 270 mm (10.63 in)).	**6SL3064-1BB00-0AA0**
STARTER commissioning tool	**6SL3072-0AA00-0AG0**

Overview

The CompactFlash card contains the firmware and parameter settings. It is inserted into the appropriate slot on the CU310 or CU320 Control Unit.

Design

A CU320 Control Unit can perform the communication, open-loop and closed-loop control functions for several Motor Modules. The computing capacity requirement increases in proportion to the number of connected Motor Modules and system components and in relation to the dynamic response required. The full computing capacity of the CU320 Control Unit is only available on systems with performance expansion 1.

The CU310 Control Unit has been designed to control a single axis. Performance expansion 1 is not required in this case.

In addition to the firmware, the CompactFlash Card also contains licensing codes which are required to enable firmware options (performance expansion 1 and the Safety Integrated extended functions in the current version). The Safety Integrated extended functions ("Safe Stop 2", "Safe Operating Stop", "Safely-Limited Speed", "Safe Speed Monitor") must be ordered for each axis using short option codes (**F..**).

The computing capacity requirement and utilization of the CU320 Control Unit can be calculated with the SIZER configuration tool.

The firmware options can also be enabled on-site, for example, if the performance expansions required are not known at the time of placing the order or the Safety Integrated extended functions are to be enabled retrospectively. You will need the serial number of the CompactFlash Card and the order number of the firmware option to be enabled. With this information, you can purchase the associated license code from a license database and enable the firmware option. The license code is only valid for the CompactFlash Card declared and cannot be transferred to other CompactFlash Cards.

Selection and ordering data

Description	Order No.
CompactFlash Card for CU310 DP, CU310 PN, CU320 Control Units with current firmware version including Certificate of License	
• Without performance expansion	**6SL3054-0AA00-1AA0**
• With performance expansion 1 firmware option	**6SL3054-0AA01-1AA0**
• With safety license for 1 axis	
- Without performance expansion	**6SL3054-0AA00-1AA0-Z F01**
- With performance expansion 1 firmware option	**6SL3054-0AA01-1AA0-Z F01**
• With safety license for 2 axes	
- Without performance expansion	**6SL3054-0AA00-1AA0-Z F02**
- With performance expansion 1 firmware option	**6SL3054-0AA01-1AA0-Z F02**
• With safety license for 3 axes	
- Without performance expansion	**6SL3054-0AA00-1AA0-Z F03**
- With performance expansion 1 firmware option	**6SL3054-0AA01-1AA0-Z F03**
• With safety license for 4 axes	
- With performance expansion 1 firmware option	**6SL3054-0AA01-1AA0-Z F04**
• With safety license for 5 axes	
- With performance expansion 1 firmware option	**6SL3054-0AA01-1AA0-Z F05**
Firmware license	
• Performance expansion 1 option including Certificate of License for upgrading the license of a CompactFlash Card	**6SL3074-0AA01-0AA0**
• Safety Integrated Extended Functions option including Certificate of License for one axis for upgrading the license of a CompactFlash Card. This option must be ordered once per axis, up to 5 times for one CompactFlash Card	**6SL3074-0AA10-0AA0**

CompactFlash Card for CU310 and CU320

More information

Firmware version

The firmware version is encoded in the order (part) number of the CompactFlash Card supplied. If the CompactFlash Card with Order No. 6SL3054-0AA0❑-1AA0 is ordered for the current firmware version, its order number is different to the order number of the CompactFlash Card supplied.

The firmware version is encoded as follows in the order number printed on the CompactFlash Card:

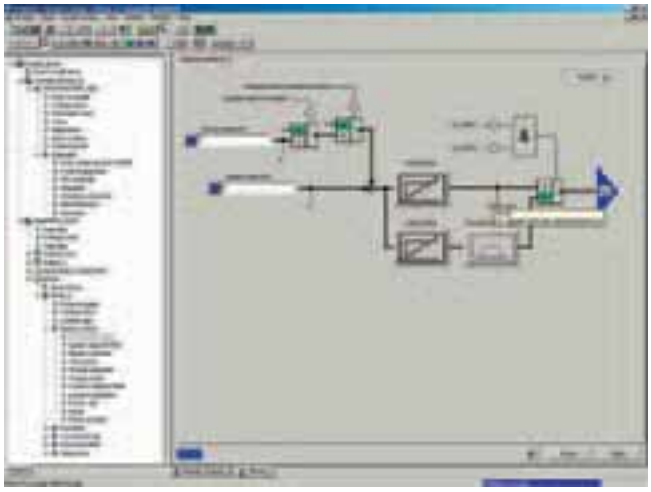
Order No.:	6SL3054-	0 ■ ■	0 ■	-1AA0
Firmware version		↑		
	1	B		
	2	C		
	3	D		
	4	E		
Version		↑		
	.1	B		
	.2	C		
	.3	D		
	.4	E		
	.5	F		
	.6	G		
			↑	
Without performance expansion			0	
With performance expansion 1			1	

Example 1:
A CompactFlash Card with order number 6SL3054-0AA00-1AA0 is ordered (current firmware version as specified in the catalog). The CompactFlash Card with the most recent firmware version is confirmed and shipped, e.g. order number 6SL3054-0CF00-1AA0 for firmware version 2.5. For spare parts a specific firmware version can be ordered, e.g. 6SL3054-0CD00-1AA0 for firmware version 2.3.

Example 2:
A CompactFlash Card with firmware version 2.5 and a Safety license for a CU310 PN Control Unit are required:
Order No. 6SL3054-0CF00-1AA0-Z
F01

Example 3:
A CompactFlash Card with firmware version 2.5, performance expansion 1 and 3 Safety licenses for a CU320 Control Unit are required:
Order No. 6SL3054-0CF01-1AA0-Z
F03

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 STEP 7 (with Drive ES Basic). 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.

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

- self-optimization
- trace (depending on drive)

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)

256 MB RAM (512 MB recommended)

Monitor resolution, 1024×768 pixels

Windows 2000 SP3, XP Professional SP1

Microsoft Internet Explorer 5.01

Integration

A PROFIBUS Communications Module and a connecting cable are required to make the communication link between the PG/PC and a control unit.

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 PROFIBUS
Order No.: 6ES7901-4BD00-0XA0

PC converter connection sets are available for MICROMASTER 4, SINAMICS G110 and SINAMICS G120 for a safe point-to-point connection to the PC.
Order No. for MICROMASTER 4: 6SE6400-1PC00-0AA0
(the scope of supply includes a 9-pole SUB-D connector and an RS232 standard cable, 3 m (9.8 ft)

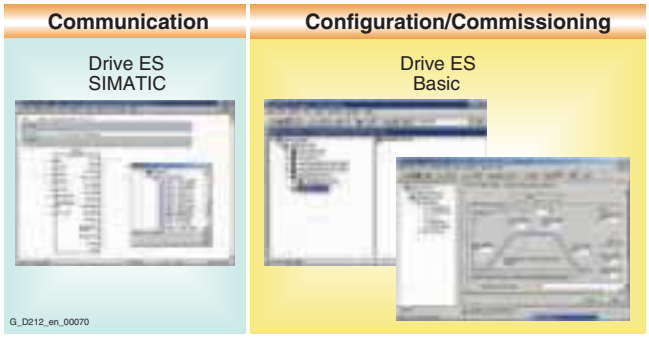
Order No. for SINAMICS G110 and SINAMICS G120:
6SL3255-0AA00-2AA1
(the scope of supply includes a 9-pole SUB-D connector and an RS232 standard cable, 3 m (9.8 ft), and the STARTER startup tool on CD-ROM)

Selection and ordering data

	Order No.
STARTER commissioning tool for SINAMICS and MICROMASTER English/French/German/Italian/Spanish	**6SL3072-0AA00-0AG0**
DCC-SINAMICS V2.0 SP1 Add-on for STARTER V4.1 SP1 (single Engineering-License, with database DCC) DCC-Editor + DCB-library for the applications with SINAMICS S120 V2.5 SP1 English/French/German/Italian/Spanish	**6AU1810-1HA20-1XA0**

Drive ES engineering system

Overview



Drive ES is the engineering system used to integrate Siemens drive technology into the SIMATIC automation world easily, efficiently and cost-effectively in terms of communication, configuration and data management. The STEP 7 Manager user interface provides the ideal basis for this.

Various software packages are available for SINAMICS:

- **Drive ES Basic**
  for first-time users of the world of Totally Integrated Automation and the option for routing beyond network limits along with the use of the SIMATIC TeleService.
  Drive ES Basic is the basic software program for setting the parameters of all drives online and offline.
  Drive ES Basic enables both the automation system and drives to the handled via the SIMATIC Manager user interface.
  Drive ES Basic is the starting point for common data archiving for complete projects and for extending the use of the SIMATIC teleservice to drives. Drive ES Basic provides the configuration tools for the new Motion Control functions - slave-to-slave communication, equidistance and isochronous operation with PROFIBUS DP.
- **Drive ES SIMATIC**
  simple parameterization of the STEP 7 communication instead of programming.
  In order to use Dive ES SIMATIC, STEP 7 must be installed. It features a SIMATIC function block library, thereby making the programming of the PROFIBUS interface in the SIMATIC CPU for the drives easy and secure.
  There is no need for separate, time-consuming programming of the data exchange between the SIMATIC CPU and the drive.
  All Drive ES users need to remember is:
  Copy – Modify – Download – Ready.
  Customized, fully-developed function blocks are copied from the library into user-specific projects.
  Frequently-used functions are set to run in program format:
  - Read out complete diagnostics buffer automatically from the drive
  - Download complete parameter set automatically from the SIMATIC CPU into the drive, e.g. when a device has to be replaced.
  - Load part parameter sets (e.g. for recipe and product change) automatically from the SIMATIC CPU
  - Complete parameter assignment or partial parameter sets are uploaded from the drive into the SIMATIC CPU, i.e. updated.

  In Version V5.4 SP1 and higher, Drive ES SIMATIC also supports the Siemens drives in a proxy concept in the PCS 7 Maintenance Station.
- **Drive ES PCS 7**
  integrates drives with the PROFIBUS interface into the SIMATIC PCS 7 process control system.
  Drive ES PCS 7 can only be used with SIMATIC PCS 7 Version 5.2 and higher. Drive ES PCS 7 provides a function block library with function blocks for the drives and the corresponding faceplates for the operator station, which enables the drives to be operated from the PCS 7 process control system.
  In PCS7 V6.1 and higher, the Drive ES blocks also support the Siemens drives in a proxy concept in the PCS 7 Maintenance Station.

For further information please visit us on the internet at:

http://www.siemens.com/drivesolutions

Selection and ordering data

	Order No.
Drive ES Basic V5.4 SPx [1]	
• Configuration software for the integration of drives into Totally Integrated Automation • Precondition: STEP 7 V5.3 SP3 and higher, SP3 • Supply format: on CD-ROM Ger., Eng., Fr., Sp., It. with electronic documentation	
Single license	**6SW1700-5JA00-4AA0**
Single license without data carrier, 60 units	**6SW1700-5JA00-4AA1**
Update service for single license	**6SW1700-0JA00-0AB2**
Update service for single license without data carrier	**6SW1700-0JA00-1AB2**
Upgrade from V5.x to V5.4	**6SW1700-5JA00-4AA4**
Drive ES SIMATIC V5.4 SPx [1]	
• Function block library for SIMATIC for the parameterization of communication with the drives • Precondition: STEP 7 V5.3 SP3 and higher, SP3 • Supply format: on CD-ROM Ger., Eng., Fr., Sp., It. with electronic documentation	
Single license, incl. 1 x Runtime license	**6SW1700-5JC00-4AA0**
Runtime license	**6SW1700-5JC00-1AC0**
Update Service for single license	**6SW1700-0JC00-0AB2**
Upgrade from V5.x to V5.4	**6SW1700-5JC00-4AA4**
Drive ES PCS 7 V6.1 SPx [1]	
• Function block library for PCS 7 for the integration of drives • Precondition: PCS 7 V6.1 • Supply format: on CD-ROM Ger., Eng., Fr., Sp., It. with electronic documentation	
Single license, incl. 1 x Runtime license	**6SW1700-6JD00-1AA0**
Runtime license	**6SW1700-5JD00-1AC0**
Software Update Service for single license	**6SW1700-0JD00-0AB2**
Upgrade from V5.x to V6.1	**6SW1700-6JD00-1AA4**
Drive ES PCS 7 V7.0 SPx [1]	
• Function block library for PCS 7 for the integration of drives • Precondition: PCS 7 V7.0 • Supply format: on CD-ROM Ger., Eng., Fr., Sp., It. with electronic documentation	
Single license, incl. 1 x Runtime license	**6SW1700-7JD00-0AA0**
Update Service for single license	**6SW1700-0JD00-0AB2**
Upgrade from V5.x to V7.0	**6SW1700-7JD00-0AA4**

[1] Orders are automatically delivered with the up-to-date Service Pack (SP).

Design

PM340 Power Modules in 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 Power Module and CU310/SIMOTION D410 Control Unit or CUA31/CUA32 Control Unit Adapter. The PM340 Power Module also supplies power to the CU310/SIMOTION D410 Control Unit or CUA31/CUA32 Control Unit Adapter 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 to control a holding brake
- 2 PE (protective earth) connections

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

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

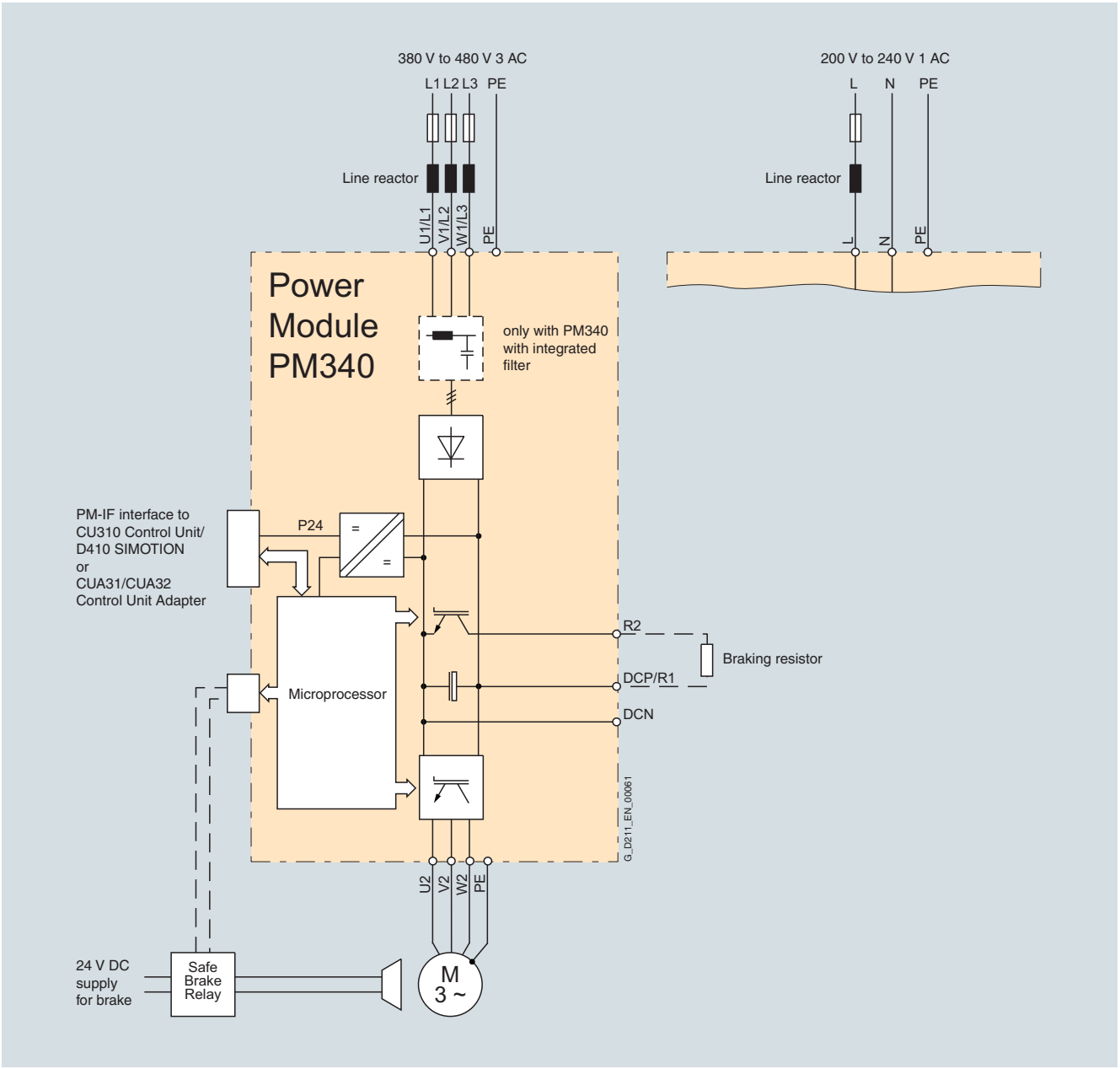
Integration

PM340 Power Module in blocksize format
with CU310 DP Control Unit

PM340 Power Module in blocksize format
with CUA31 Control Unit Adapter

Integration (continued)

The PM340 Power Modules in blocksize format communicate with the CU310/SIMOTION D410 Control Unit or the CUA31/CUA32 Control Unit Adapter via the PM-IF interface.



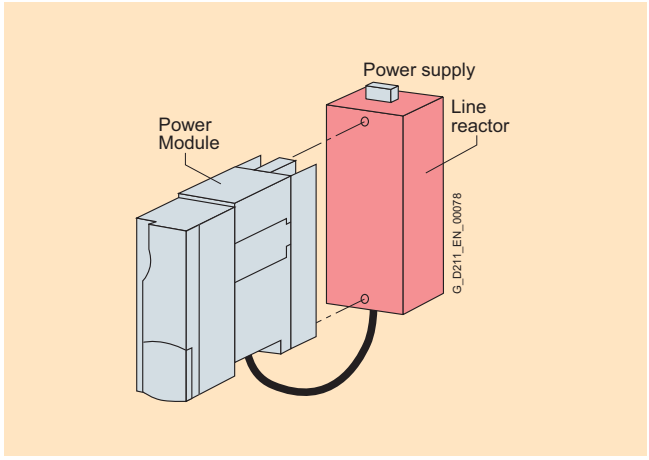
Connection example of PM340 Power Module in blocksize format

Integration (continued)

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

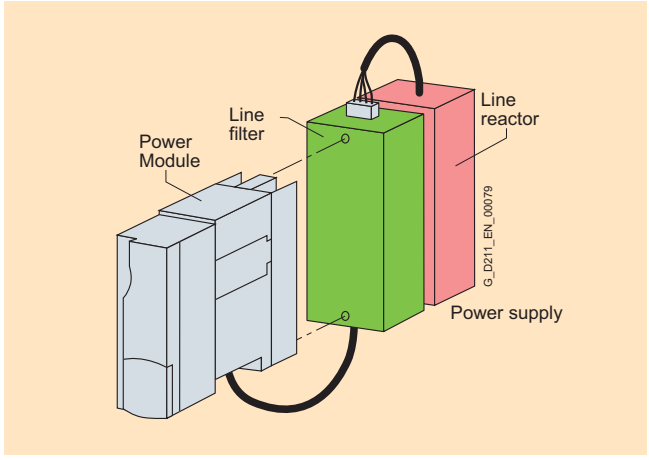
	FSA	FSB	FSC	FSD	FSE	FSF
Line filter	✓					
Line reactor	✓	✓	✓	✓	✓	o
Braking resistor	✓	✓	o	o	o	o
Motor reactor	✓	✓	✓	o	o	o

✓ suitable as base-type
o not suitable as base-type
not available (use Power Modules with integrated line filter)



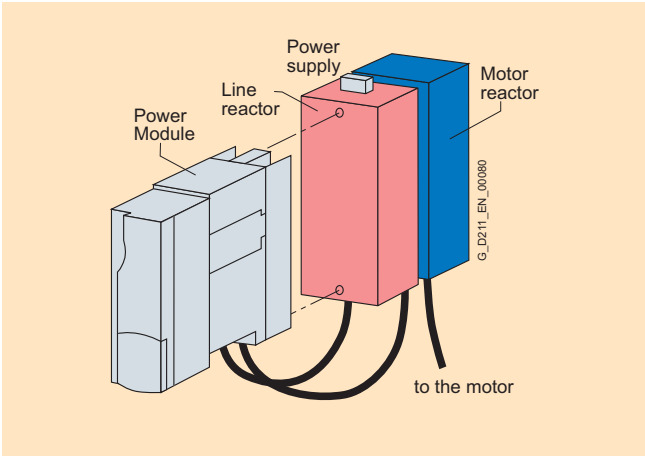
Basic layout of a PM340 Power Module with line reactor as base component

The line-side reactors are equipped with terminals on the line side and with a pre-assembled cable on the Power Module side. When installed, the mains terminals are at the top on frame sizes FSA to FSC, and at the bottom on frame sizes FSD and FSE.



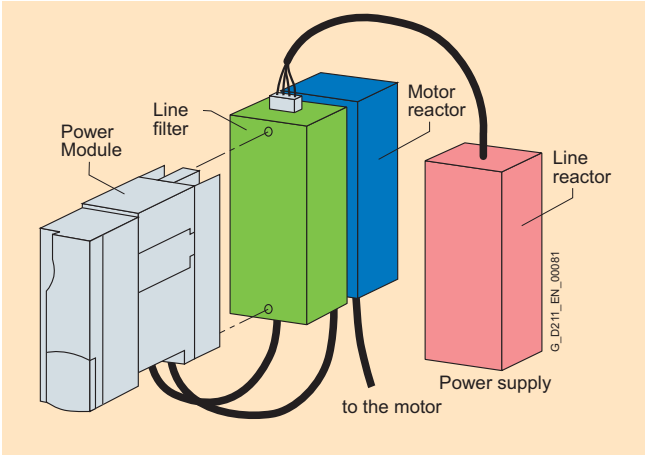
Power Module PM340 frame size FSA with line reactor and line filter

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 diagram above. In this case, the line connection is at the bottom.



Power Module PM340 frame size FSA with line reactor and motor reactor

Power Modules of frame size FSB and higher are available with integrated line filters, alleviating the need for an external line filter.



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 Power Module. In this instance, the line and motor reactors must be installed behind the Power Module and the braking resistor to the side.

Power Modules in blocksize format

Technical specifications

General technical specifications	
Electrical data	
Line connection 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 to EN 60664-1	Class III
Precharging frequency of the DC link, max.	1× every 30 s
DC link voltage, approx.	1.35 x line voltage
Output frequency	
• Control type Servo	0 … 650 Hz [1]
• Control type Vector	0 … 300 Hz [1]
• Control type *V/f*	0 … 600 Hz [1]
Electronic power supply	24 V DC -15 %/+20 %
Interference suppression	
• Standard	No radio interference suppression
• With integrated line filter	Category C2 to EN 61800-3
Ambient conditions	
Type of cooling	Forced air cooling through a 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
Site 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 sizes FSA … FSC	File No. E121068
- Frame sizes FSD … FSF	File No. E192450
Safety Integrated	Safety Integrity Level 2 (SIL 2) to IEC 61508, control category 3 to EN 954-1 (for further information, see the Safety Integrated section)

[1] Note correlation between max. output frequency, pulse frequency and current derating, see System description.

Technical specifications (continued)

Line voltage 200 ... 240 V 1 AC		PM340 Power Modules in blocksize format 6SL3210-1SB11-0...	6SL3210-1SB12-3...	6SL3210-1SB14-0...
Output current				
• Rated current I_{rated}	A	0.9	2.3	3.9
• Base-load current I_H	A	0.8	2.0	3.4
• For S6 duty (40 %) I_{S6}	A	1.4	3.3	5.5
• I_{max}	A	2.0	4.6	7.8
Type rating [3] based on I_{rated}	kW (HP)	0.12 (0.2)	0.37 (0.5)	0.75 (0.75)
Rated pulse frequency	kHz	4	4	4
Power loss	kW	0.06	0.075	0.11
Cooling air requirement	m^3/s (ft^3/s)	0.005 (0.02)	0.005 (0.02)	0.005 (0.02)
Sound pressure level L_{pA} (1 m)	dB	< 45	< 45	< 45
24 V DC power supply for the Control Unit	A	1.0	1.0	1.0
Rated input current [1] with/without line reactor	A	1.4/2.2	4/6	6.5/10
Resistance value of the external braking resistor	Ω	≥ 180	≥ 180	≥ 180
Cable length to braking resistor, max.	m (ft)	15 (49)	15 (49)	15 (49)
Line connection L, N		Screw-type terminals	Screw-type terminals	Screw-type terminals
• Conductor cross-section	mm^2	1.0 … 2.5	1.0 … 2.5	1.0 … 2.5
Motor connection U2, V2, W2		Screw-type terminals	Screw-type terminals	Screw-type terminals
• Conductor cross-section	mm^2	1.0 … 2.5	1.0 … 2.5	1.0 … 2.5
DC link connection, connection for the braking resistor DCP/R1, DCN, R2		Screw-type terminals	Screw-type terminals	Screw-type terminals
• Conductor cross-section	mm^2	1.0 … 2.5	1.0 … 2.5	1.0 … 2.5
PE connection		M4 screw	M4 screw	M4 screw
Motor cable length [2], **max.** (without external options)				
• Shielded	m (ft)	50 (164)	50 (164)	50 (164)
• Unshielded	m (ft)	75 (246)	75 (246)	75 (246)
Degree of protection		IP20	IP20	IP20
Dimensions				
• Width	mm (in)	73 (2.87)	73 (2.87)	73 (2.87)
• Height	mm (in)	173 (6.81)	173 (6.81)	173 (6.81)
• Depth				
- PM340	mm (in)	145 (5.71)	145 (5.71)	145 (5.71)
- PM340 with CU310	mm (in)	234.6 (9.24)	234.6 (9.24)	234.6 (9.24)
- PM340 with CUA31/CUA32	mm (in)	175.3 (6.90)	175.3 (6.90)	175.3 (6.90)
Frame size		FSA	FSA	FSA
Weight, approx.	kg (lb)	1.2 (3)	1.3 (3)	1.3 (3)

1) The input current depends on the motor load and line impedance. The input currents apply for rated power loading (based on I_{rated}) for a line impedance corresponding to u_k = 1 %.

2) Max. motor cable length 15 m (49 ft) (shielded) for PM340 Power Modules with integrated line filter to maintain the limit values of EN 61800-3 Category C2.

3) Nominal HP based on Asynchronous motors (induction motors). For specific sizing select drive based on motor nameplate current and overload.

Technical specifications (continued)

Line voltage 380 ... 480 V 3 AC		PM340 Power Modules in blocksize format				
		6SL3210-1SE11-3UA0	6SL3210-1SE11-7UA0	6SL3210-1SE12-2UA0	6SL3210-1SE13-1UA0	6SL3210-1SE14-1UA0
Output current						
• Rated current I_{rated}	A	1.3	1.7	2.2	3.1	4.1
• Base-load current I_H	A	1.1	1.5	1.9	2.7	3.6
• For S6 duty (40 %) I_{S6}	A	1.3	2.0	2.5	3.5	4.5
• I_{max}	A	2.6	3.4	4.4	6.2	8.2
Type rating [1]						
• Based on I_{rated}	kW (HP)	0.37 (0.5)	0.55 (0.75)	0.75 (1)	1.1 (1.5)	1.5 (2)
• Based on I_H	kW (HP)	0.37 (0.5)	0.55 (0.5)	0.75 (0.75)	1.1 (1)	1.5 (2)
Rated pulse frequency	kHz	4	4	4	4	4
Power loss	kW	0.10	0.10	0.10	0.11	0.11
Cooling air requirement	m^3/s (ft^3/s)	0.005 (0.2)	0.005 (0.2)	0.005 (0.2)	0.005 (0.2)	0.005 (0.2)
Sound pressure level L_{pA} (1 m)	dB	< 45	< 45	< 45	< 45	< 45
24 V DC power supply for the Control Unit	A	1.0	1.0	1.0	1.0	1.0
Rated input current [2] with/without line reactor	A	1.3/1.7	1.7/2.2	2.2/2.6	3.1/3.9	4.1/4.8
Resistance value of the external braking resistor	Ω	≥ 390	≥ 390	≥ 390	≥ 390	≥ 390
Cable length to braking resistor, max.	m (ft)	15 (49)	15 (49)	15 (49)	15 (49)	15 (49)
Line connection L1, L2, L3		Screw-type terminals	Screw-type terminals	Screw-type terminals	Screw-type terminals	Screw-type terminals
• Conductor cross-section	mm^2	1.0 … 2.5	1.0 … 2.5	1.0 … 2.5	1.0 … 2.5	1.0 … 2.5
Motor connection U2, V2, W2		Screw-type terminals	Screw-type terminals	Screw-type terminals	Screw-type terminals	Screw-type terminals
• Conductor cross-section	mm^2	1.0 … 2.5	1.0 … 2.5	1.0 … 2.5	1.0 … 2.5	1.0 … 2.5
DC link connection, connection for braking resistor DCP/R1, DCN, R2		Screw-type terminals	Screw-type terminals	Screw-type terminals	Screw-type terminals	Screw-type terminals
• Conductor cross-section	mm^2	1.0 … 2.5	1.0 … 2.5	1.0 … 2.5	1.0 … 2.5	1.0 … 2.5
PE connection		M4 screw	M4 screw	M4 screw	M4 screw	M4 screw
Motor cable length [3], **max.**						
• Shielded	m (ft)	50 (164)	50 (164)	50 (164)	50 (164)	50 (164)
• Unshielded	m (ft)	75 (246)	75 (246)	75 (246)	75 (246)	75 (246)
Degree of protection		IP20	IP20	IP20	IP20	IP20
Dimensions						
• Width	mm (in)	73 (2.87)	73 (2.87)	73 (2.87)	73 (2.87)	73 (2.87)
• Height	mm (in)	173 (6.81)	173 (6.81)	173 (6.81)	173 (6.81)	173 (6.81)
• Depth						
- PM340	mm (in)	145 (5.71)	145 (5.71)	145 (5.71)	145 (5.71)	145 (5.71)
- PM340 with CU310	mm (in)	234.6 (9.24)	234.6 (9.24)	234.6 (9.24)	234.6 (9.24)	234.6 (9.24)
- PM340 with CUA31/CUA32	mm (in)	175.3 (6.90)	175.3 (6.90)	175.3 (6.90)	175.3 (6.90)	175.3 (6.90)
Frame size		FSA	FSA	FSA	FSA	FSA
Weight, approx.	kg (lb)	1.2 (3)	1.2 (3)	1.2 (3)	1.2 (3)	1.2 (3)

1) Nominal HP based on Asynchronous motors (induction motors) and 460 V AC. For specific sizing select drive based on motor nameplate current and overload.

2) The input current depends on the motor load and line impedance. The input currents apply for rated power loading (based on I_{rated}) for a line impedance corresponding to u_k = 1 %.

3) Max. motor cable length 25 m (82 ft) (shielded) for PM340 Power Modules with integrated line filter to maintain the limit values of EN 61800-3 Category C2.

Technical specifications (continued)

Line voltage 380 ... 480 V 3 AC		PM340 Power Modules in blocksize format 6SL3210-1SE16-0...	6SL3210-1SE17-7...	6SL3210-1SE21-0...	6SL3210-1SE21-8...	6SL3210-1SE22-5...	6SL3210-1SE23-2...
Output current							
• Rated current I_{rated}	A	5.9	7.7	10.2	18	25	32
• Base-load current I_H	A	5.2	6.8	9.1	14	21	27
• For S6 duty (40 %) I_{S6}	A	6.4	8.3	10.8	19.6	27.8	37.1
• I_{max}	A	11.8	15.4	20.4	26.4	38	52
Type rating [1]							
• Based on I_{rated}	kW (HP)	2.2 (3)	3 (5)	4 (5)	7.5 (10)	11 (15)	15 (20)
• Based on I_H	kW (HP)	2.2 (3)	3 (4)	4 (5)	5.5 (10)	7.5 (15)	11 (20)
Rated pulse frequency	kHz	4	4	4	4	4	4
Power loss	kW	0.14	0.16	0.18	0.24	0.30	0.40
Cooling air requirement	m^3/s (ft^3/s)	0.009 (0.3)	0.009 (0.3)	0.009 (0.3)	0.038 (1.3)	0.038 (1.3)	0.038 (1.3)
Sound pressure level L_{pA} (1 m)	dB	< 50	< 50	< 50	< 60	< 60	< 60
24 V DC power supply for the Control Unit	A	1.0	1.0	1.0	1.0	1.0	1.0
Rated input current [2] with/without line reactor	A	5.6/6.7	7.5/8.9	9.8/12.4	17.1/23.1	24.6/32.6	33/39
Resistance value of the external braking resistor	Ω	≥ 160	≥ 160	≥ 160	≥ 56	≥ 56	≥ 56
Cable length to braking resistor, max.	m (ft)	15 (49)	15 (49)	15 (49)	15 (49)	15 (49)	15 (49)
Line connection L1, L2, L3		Screw-type terminals	Screw-type terminals	Screw-type terminals	Screw-type terminals	Screw-type terminals	Screw-type terminals
• Conductor cross-section	mm^2	1.0 … 6	1.0 … 6	1.0 … 6	2.5 … 10	2.5 … 10	2.5 … 10
Motor connection U2, V2, W2		Screw-type terminals	Screw-type terminals	Screw-type terminals	Screw-type terminals	Screw-type terminals	Screw-type terminals
• Conductor cross-section	mm^2	1.0 … 6	1.0 … 6	1.0 … 6	2.5 … 10	2.5 … 10	2.5 … 10
DC link connection, connection for braking resistor DCP/R1, DCN, R2		Screw-type terminals	Screw-type terminals	Screw-type terminals	Screw-type terminals	Screw-type terminals	Screw-type terminals
• Conductor cross-section	mm^2	1.0 … 6	1.0 … 6	1.0 … 6	2.5 … 10 10	2.5 … 10 10	2.5 … 10 10
PE connection		M5 screw	M5 screw	M5 screw	M5 screw	M5 screw	M5 screw
Motor cable length [3], **max.**							
• Shielded	m (ft)	50 (164)	50 (164)	50 (164)	50 (164)	50 (164)	50 (164)
• Unshielded	m (ft)	75 (246)	75 (246)	75 (246)	75 (246)	75 (246)	75 (246)
Degree of protection		IP20	IP20	IP20	IP20	IP20	IP20
Dimensions							
• Width	mm (in)	153 (6.02)	153 (6.02)	153 (6.02)	188.4 (7.42)	188.4 (7.42)	188.4 (7.42)
• Height	mm (in)	270 (10.63)	270 (10.63)	270 (10.63)	333.4 (13.13)	333.4 (13.13)	333.4 (13.13)
• Depth							
- PM340	mm (in)	165 (6.50)	165 (6.50)	165 (6.50)	185 (7.28)	185 (7.28)	185 (7.28)
- PM340 with CU310	mm (in)	254.6 (10.02)	254.6 (10.02)	254.6 (10.02)	274.6 (10.81)	274.6 (10.81)	274.6 (10.81)
- PM340 with CUA31/CUA32	mm (in)	195.3 (7.69)	195.3 (7.69)	195.3 (7.69)	215.3 (8.48)	215.3 (8.48)	215.3 (8.48)
Frame size		FSB	FSB	FSB	FSC	FSC	FSC
Weight, approx.	kg (lb)	4.0 (9)	4.0 (9)	4.0 (9)	6.5 (14)	6.5 (14)	6.5 (14)

1) Nominal HP based on Asynchronous motors (induction motors) and 460 V AC. For specific sizing select drive based on motor nameplate current and overload.

2) The input current depends on the motor load and line impedance. The input currents apply for rated power loading (based on I_{rated}) for a line impedance corresponding to u_k = 1 %.

3) Max. motor cable length 25 m (82 ft) (shielded) for PM340 Power Modules with integrated line filter to maintain the limit values of EN 61800-3 Category C2.

Technical specifications (continued)

Line voltage 380 ... 480 V 3 AC		PM340 Power Modules in blocksize format 6SL3210-1SE23-8...	6SL3210-1SE24-5...	6SL3210-1SE26-0...	6SL3210-1SE27-5...	6SL3210-1SE31-0...
Output current						
• Rated current I_{rated}	A	38	45	60	75	90
• Base-load current I_H	A	33	40	48	65	80
• For S6 duty (40 %) I_{S6}	A	49	58	78	98	117
• I_{max}	A	64	76	90	124	150
Type rating [1]						
• Based on I_{rated}	kW (HP)	18.5 (25)	22 (30)	30 (40)	37 (50)	45 (60)
• Based on I_H	kW (HP)	15 (20)	18.5 (30)	22 (30)	30 (50)	37 (60)
Rated pulse frequency	kHz	4	4	4	4	4
Power loss	kW	0.38	0.51	0.69	0.99	1.21
Cooling air requirement	m^3/s (ft^3/s)	0.022 (0.8)	0.022 (0.8)	0.039 (1.4)	0.022 (0.8)	0.039 (1.4)
Sound pressure level L_{pA} (1 m)	dB	< 60	< 60	< 61	< 60	62
24 V DC power supply for the Control Unit	A	1.0	1.0	1.0	1.0	1.0
Rated input current [2] with/without line reactor	A	40/46	47/53	63/72	78/88	94/105
Resistance value of the external braking resistor	Ω	≥ 27	≥ 27	≥ 27	≥ 15	≥ 15
Cable length to braking resistor, max.	m (ft)	15 (49)	15 (49)	15 (49)	15 (49)	15 (49)
Line connection L1, L2, L3		M6 screw stud	M6 screw stud	M6 screw stud	M6 screw stud	M6 screw stud
• Conductor cross-section	mm^2	10 … 35	10 … 35	10 … 35	10 … 35	10 … 35
Motor connection U2, V2, W2		M6 screw stud	M6 screw stud	M6 screw stud	M6 screw stud	M6 screw stud
• Conductor cross-section	mm^2	10 … 35	10 … 35	10 … 35	10 … 35	10 … 35
DC link connection, connection for braking resistor DCP/R1, DCN, R2		M6 screw stud	M6 screw stud	M6 screw stud	M6 screw stud	M6 screw stud
• Conductor cross-section	mm^2	10 … 35	10 … 35	10 … 35	10 … 35	10 … 35
PE connection		M6 screw	M6 screw	M6 screw	M6 screw	M6 screw
Motor cable length [3], **max.**						
• Shielded	m (ft)	70 (230)	70 (230)	70 (230)	70 (230)	70 (230)
• Unshielded	m (ft)	100 (328)	100 (328)	100 (328)	100 (328)	100 (328)
Degree of protection		IP20	IP20	IP20	IP20	IP20
Dimensions						
• Width	mm (in)	275 (10.83)	275 (10.83)	275 (10.83)	275 (10.83)	275 (10.83)
• Height PM340 without/with int. filter		418.3/511 (16.47/20.12)	418.3/511 (16.47/20.12)	418.3/511 (16.47/20.12)	498.3/633 (19.62/24.92)	498.3/633 (19.62/24.92)
• Depth						
- PM340	mm (in)	203.5 (8.01)	203.5 (8.01)	203.5 (8.01)	203.5 (8.01)	203.5 (8.01)
- PM340 with CU310	mm (in)	293.1 (11.54)	293.1 (11.54)	293.1 (11.54)	293.1 (11.54)	293.1 (11.54)
- PM340 with CUA31/CUA32	mm (in)	233.8 (9.20)	233.8 (9.20)	233.8 (9.20)	233.8 (9.20)	233.8 (9.20)
Frame size		FSD	FSD	FSD	FSE	FSE
Weight, approx. PM340 without/with int. filter	kg (lb)	15.9/19.3 (35/43)	15.9/19.3 (35/43)	15.9/19.3 (35/43)	19.8/27.1 (44/60)	19.8/27.1 (44/60)

1) Nominal HP based on Asynchronous motors (induction motors) and 460 V AC. For specific sizing select drive based on motor nameplate current and overload.

2) The input current depends on the motor load and line impedance. The input currents apply for rated power loading (based on I_{rated}) for a line impedance corresponding to u_k = 1 %.

3) Max. motor cable length 25 m (82 ft) (shielded) for PM340 Power Modules with integrated line filter to maintain the limit values of EN 61800-3 Category C2.

Technical specifications (continued)

Line voltage 380 ... 480 V 3 AC		PM340 Power Modules in blocksize format 6SL3210-1SE31-1...	6SL3210-1SE31-5...	6SL3210-1SE31-8...
Output current				
• Rated current I_{rated}	A	110	145	178
• Base-load current I_H	A	95	115	155
• For S6 duty (40 %) I_{S6}	A	143	188	231
• I_{max}	A	180	220	290
Type rating [1]				
• Based on I_{rated}	kW (HP)	55 (75)	75 (100)	90 (125)
• Based on I_H	kW (HP)	45 (60)	55 (75)	75 (100)
Rated pulse frequency	kHz	4	4	4
Power loss	kW	1.42	1.93	2.31
Cooling air requirement	m^3/s (ft^3/s)	0.094 (3.3)	0.094 (3.3)	0.117 (4.1)
Sound pressure level L_{pA} (1 m)	dB	< 60	< 60	65
24 V DC power supply for the Control Unit	A	1.0	1.0	1.0
Rated input current [2] with/without line reactor	A	115/129	151/168	186/204
Resistance value of the external braking resistor	Ω	≥ 8.2	≥ 8.2	≥ 8.2
Cable length to braking resistor, max.	m (ft)	15 (50)	15 (50)	15 (50)
Line connection U1/L1, V1/L2, W1/L3		M8 screw stud	M8 screw stud	M8 screw stud
• Conductor cross-section, max.	mm^2	120 or 2 × 50	120 or 2 × 50	120 or 2 × 50
Motor connection U2, V2, W2		M8 screw stud	M8 screw stud	M8 screw stud
• Conductor cross-section, max.	mm^2	120 or 2 × 50	120 or 2 × 50	120 or 2 × 50
DC link connection, connection for braking resistor DCP/R1, DCN, R2		M8 screw stud	M8 screw stud	M8 screw stud
• Conductor cross-section, max.	mm^2	120 or 2 × 50	120 or 2 × 50	120 or 2 × 50
PE connection		M8 screw	M8 screw	M8 screw
Motor cable length [3]**, max.**				
• Shielded	m (ft)	70 (230)	70 (230)	70 (230)
• Unshielded	m (ft)	100 (328)	100 (328)	100 (328)
Degree of protection		IP20	IP20	IP20
Dimensions				
• Width	mm (in)	350 (13.78)	350 (13.78)	350 (13.78)
• Height PM340 without/with int. filter	mm (in)	634/934 (24.96/36.77)	634/934 (24.96/36.77)	634/934 (24.96/36.77)
• Depth				
- PM340	mm (in)	315.5 (12.42)	315.5 (12.42)	315.5 (12.42)
- PM340 with CU310	mm (in)	405.1 (15.95)	405.1 (15.95)	405.1 (15.95)
- PM340 with CUA31/CUA32	mm (in)	345.8 (13.61)	345.8 (13.61)	345.8 (13.61)
Frame size		FSF	FSF	FSF
Weight, approx. PM340 without/with int. filter	kg (lb)	50.7/66.7 (112/147)	50.7/66.7 (112/147)	50.7/66.7 (112/147)

1) Nominal HP based on Asynchronous motors (induction motors) and 460 V AC. For specific sizing select drive based on motor nameplate current and overload.

2) The input current depends on the motor load and line impedance. The input currents apply for rated power loading (based on I_{rated}) for a line impedance corresponding to u_k = 1 %.

3) Max. motor cable length 25 m (82 ft) (shielded) for PM340 Power Modules with integrated line filter to maintain the limit values of EN 61800-3 Category C2.

Power Modules in 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 (0.75)	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**

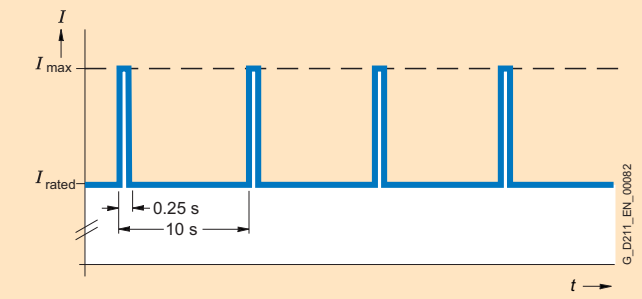
Accessories

Example of shield connection kit for PM340 frame size FSB

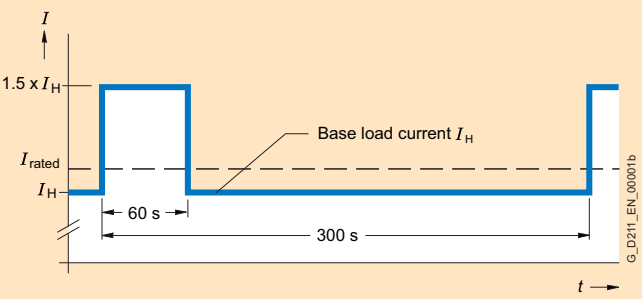
Description	Order No.
Shield connection kit for PM340	
• Frame size FSA	**6SL3262-1AA00-0BA0**
• Frame size FSB	**6SL3262-1AB00-0DA0**
• Frame size FSC	**6SL3262-1AC00-0DA0**
• Frame sizes FSD and FSE	**6SL3262-1AD00-0DA0**
• Frame size FSF	**6SL3262-1AF00-0DA0**

Characteristics

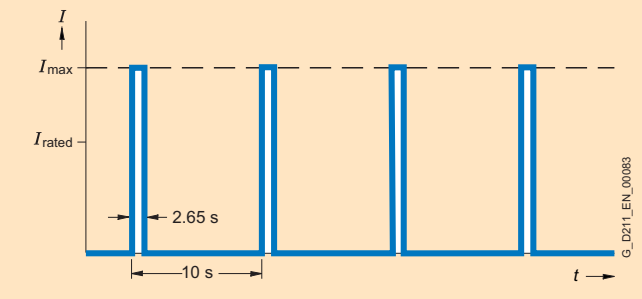
Overload capability



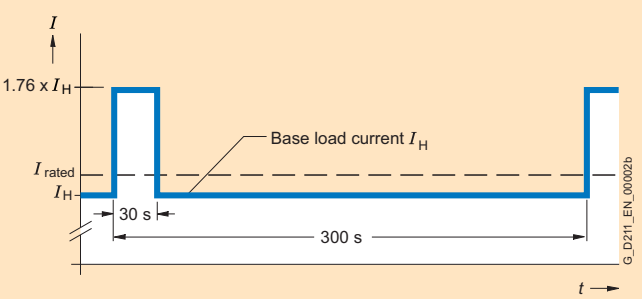
Load cycle with previous load



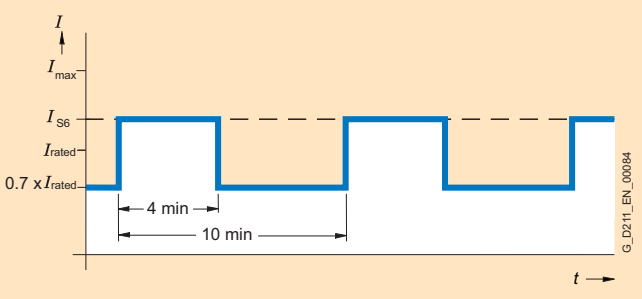
Load cycle with 60 s overload with a load cycle period of 300 s



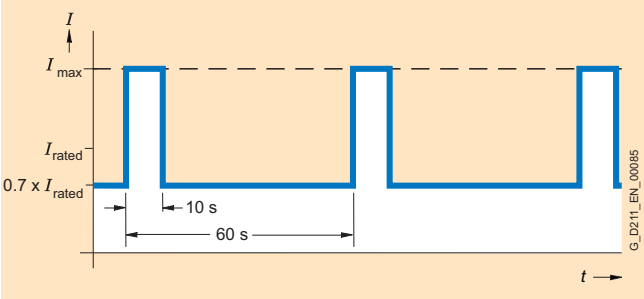
Load cycle without previous load



Load cycle with 30 s overload with a load cycle period of 300 s



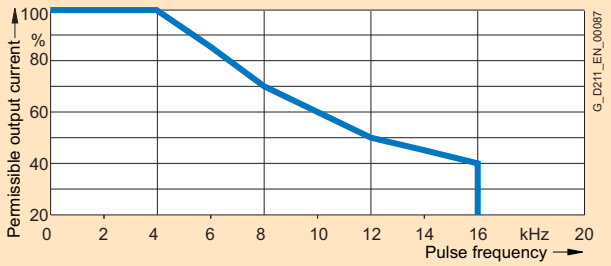
S6 load cycle with previous load with a load cycle period of 600 s



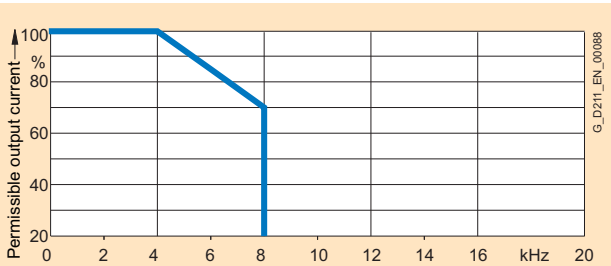
S6 load cycle with previous load with a load cycle period of 60 s

Characteristics (continued)

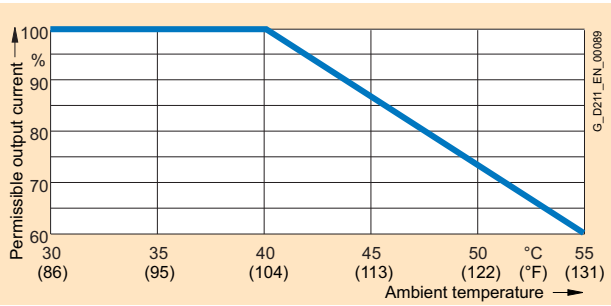
Derating characteristics



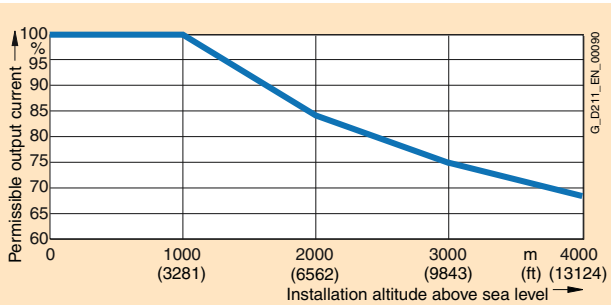
Frame sizes FSA to FSE: Output current dependent on pulse frequency



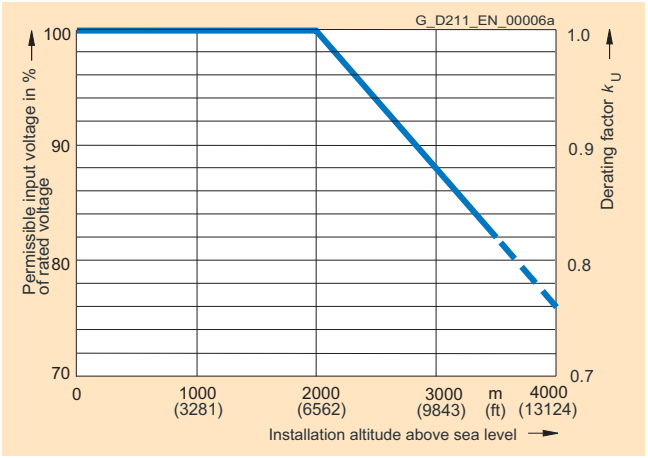
Frame size FSF: Output current dependent on pulse frequency



Output current dependent on ambient temperature



Output current dependent on installation altitude



Voltage derating dependent on installation altitude

Overview

Line reactors for PM340 Power Modules frame sizes FSA to FSE

Line reactor for PM340 Power Modules frame size FSF

Line reactors limit the low-frequency harmonic effects and reduce the load on the rectifiers of the Power Modules. A line reactor is not required where the effective supply impedance equals $u_k \geq 1$ %. The voltage drop u_k across the supply impedance increases with the current. It is therefore easier to fulfil the specified condition as the rated output of the Power Modules increases. For further information see System description.

Integration

The line reactors for PM340 Power Modules of frame sizes FSA to FSE are designed as base components. The line reactor is attached to the mounting surface and the Power Module is mounted directly on the line reactor. The cables to the Power Module are already connected at the line reactor.

The line reactor is connected to the line connection through terminals.

PM340 Power Module frame size FSB with base line reactor and shield connection kit

3

Technical specifications

Line voltage 200 ... 240 V 1 AC		Line reactor 6SE6400-3CC00-4AB3	6SE6400-3CC01-0AB3
Rated current	A	3.4	8.1
Power loss, approx. at 50/60 Hz	W	12.5/15	11.5/14.5
Line connection U1, V1, W1		Screw-type terminals	Screw-type terminals
• Conductor cross-section	mm^2	6	6
Load connection		Cable	Cable
• Conductor cross-section		3 × AWG16 (1.5 mm^2)	3 × AWG16 (1.5 mm^2)
• Length, approx.	m (ft)	0.38 (1.25)	0.38 (1.25)
PE connection		M5 screw stud	M5 screw stud
Degree of protection [1]		IP20	IP20
Dimensions			
• Width	mm (in)	75.5 (2.97)	75.5 (2.97)
• Height	mm (in)	201 (7.91)	201 (7.91)
• Depth	mm (in)	50 (1.97)	50 (1.97)
Weight, approx.	kg (lb)	1.3 (3)	1.3 (3)
Approvals		cURus	cURus
Suitable for Power Module, blocksize format	Type (rated output current)	6SL3210-1SB11-0... (0.9 A) 6SL3210-1SB12-3... (2.3 A)	6SL3210-1SB14-0... (3.9 A)

Line voltage 380 ... 480 V 3 AC		Line reactor 6SE6400-3CC00-2AD3	6SE6400-3CC00-4AD3	6SE6400-3CC00-6AD3	6SL3203-0CD21-0AA0	6SL3203-0CD21-4AA0	6SL3203-0CD22-2AA0
Rated current	A	1.9	3.5	4.8	9	11.6	25
Power loss at 50/60 Hz	W	6/7	12.5/15	7.5/9	9/11	27/32	98/118
Line connection U1, V1, W1		Screw-type terminals	Screw-type terminals	Screw-type terminals	Screw-type terminals	Screw-type terminals	Screw-type terminals
• Conductor cross-section	mm^2	6	6	6	6	6	6
Load connection		Cable	Cable	Cable	Cable	Cable	Cable
• Conductor cross-section		3 × AWG16 (1.5 mm^2)	3 × AWG16 (1.5 mm^2)	3 × AWG16 (1.5 mm^2)	3 × AWG16 (1.5 mm^2)	3 × AWG16 (1.5 mm^2)	4 × AGW10 (2.5 mm^2)
• Length, approx.	m (ft)	0.38 (1.25)	0.38 (1.25)	0.38 (1.25)	0.46 (1.51)	0.46 (1.51)	0.49 (1.61)
PE connection		Screw stud M5	Screw stud M5	Screw stud M5	Screw stud M5	Screw stud M5	Screw stud M5
Degree of protection [1]		IP20	IP20	IP20	IP20	IP20	IP20
Dimensions							
• Width	mm (in)	75.5 (2.97)	75.5 (2.97)	75.5 (2.97)	153 (6.02)	153 (6.02)	190 (7.48)
• Height	mm (in)	201 (7.91)	201 (7.91)	201 (7.91)	290 (11.42)	290 (11.42)	370 (14.57)
• Depth	mm (in)	50 (1.97)	50 (1.97)	50 (1.97)	70 (2.76)	70 (2.76)	50 (1.97)
Weight, approx.	kg (lb)	1.2 (3)	1.3 (3)	1.3 (3)	3.4 (7.50)	3.4 (7.50)	6.3 (14)
Approvals		cURus	cURus	cURus	cURus	cURus	cURus
Suitable for Power Module, blocksize format	Type (rated output current)	6SL3210-1SE11-3... (1.3 A) 6SL3210-1SE11-7... (1.7 A)	6SL3210-1SE12-2... (2.2 A) 6SL3210-1SE13-1... (3.1 A)	6SL3210-1SE14-1... (4.1 A)	6SL3210-1SE16-0... (5.9 A) 6SL3210-1SE17-7... (7.7 A)	6SL3210-1SE21-0... (10 A)	6SL3210-1SE21-8... (18 A) 6SL3210-1SE22-5... (25 A)

[1] With correctly connected load connection cable.

Technical specifications (continued)

Line voltage 380 ... 480 V 3 AC		Line reactor 6SL3203-0CD23-5AA0	6SL3203-0CJ24-5AA0	6SL3203-0CD25-3AA0	6SL3203-0CJ28-6AA0	6SE6400-3CC11-2FD0	6SE6400-3CC11-7FD0
Rated current	A	31.3	47	63	94	151	186
Power loss at 50/60 Hz	W	37/44	90/115	90/115	170/215	280/360	280/360
Line connection U1, V1, W1		Screw-type terminals	Screw-type terminals	Screw-type terminals	Screw-type terminals	Flat connector for M10 screw	Flat connector for M10 screw
• Conductor cross-section	mm^2	16	16	16	50	–	–
Load connection		Cable	Cable	Cable	Cable	Flat connector for M10 screw	Flat connector for M10 screw
• Conductor cross-section		4 × AWG10 (2.5 mm^2)	4 × 16 mm^2	4 × 16 mm^2	4 × 35 mm^2	–	–
• Length, approx.	m (ft)	0.49 (1.61)	0.7 (2.30)	0.7 (2.30)	0.7 (2.30)		
PE connection		Screw stud M5	M8 screw	M8 screw	M8 screw	Screw stud M8	Screw stud M8
Degree of protection [1]		IP20	IP20	IP20	IP20	IP00	IP00
Dimensions							
• Width	mm (in)	190 (7.48)	275 (10.83)	275 (10.83)	275 (10.83)	240 (9.45)	240 (9.45)
• Height	mm (in)	370 (14.57)	455 (17.91)	455 (17.91)	577 (22.72)	228 (8.98)	228 (8.98)
• Depth	mm (in)	50 (1.97)	83.5 (3.29)	83.5 (3.29)	93.5 (3.68)	141 (5.55)	141 (5.55)
Weight, approx.	kg (lb)	6.4 (14)	13 (29)	13 (29)	19 (42)	25 (55)	25 (55)
Approvals		cURus	cURus	cURus	cURus	cURus	cURus
Suitable for Power Module, blocksize format	Type (rated output current)	6SL3210-1SE23-2... (32 A)	6SL3210-1SE23-8... (38 A) 6SL3210-1SE24-5... (45 A)	6SL3210-1SE26-0... (60 A)	6SL3210-1SE27-5... (75 A) 6SL3210-1SE31-0... (90 A)	6SL3210-1SE31-1... (110 A) 6SL3210-1SE31-5... (145 A)	6SL3210-1SE31-8... (178 A)

[1] With correctly connected load connection cable.

3

Selection and ordering data

Rated output current	Type rating	Suitable for Power Module, blocksize format		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 (0.75)	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**

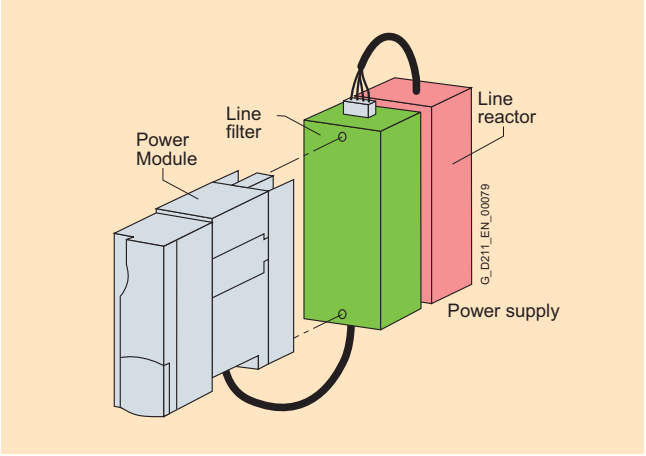
Overview

In plants with strict EMC requirements, the line filter for frame size FSA restricts the conducted interference emanating from the PM340 Power Module to the limit values of Class C2 as defined in EN 61800-3. The line filter is suited only for direct connection to TN (grounded) systems.

Note: The line filter is designed only for PM340 Power Modules of frame size FSA and a line voltage of 380 V to 480 V 3 AC. All other PM340 Power Modules are available with integrated line filter.

Integration

Line filter, line reactor and Power Module can be mounted in front of one another.



Technical specifications

Line voltage 380 ... 480 V 3 AC	Line filter
Rated current	6 A
Power loss	< 5 W
Line connection L1, L2, L3	Screw-type terminals
• Conductor cross-section	2.5 mm^2
PE connection	M4 screw stud
Load connection U, V, W	Shielded cable
• Conductor cross-section	3 × 2.5 mm^2
• Length, approx.	0.4 m (1.3 ft)
Degree of protection	IP20 (with correctly connected load connection cable)
Dimensions	
• Width	73.5 mm (2.89 in)
• Height	200 mm (7.87 in)
• Depth	44 mm (1.73 in)
Weight, approx.	0.5 kg (1 lb)
Approvals	cURus
Suitable for Power Module, blocksize format Type (rated output current)	6SL3210-1SE11-... (1.3 A and 1.7 A) 6SL3210-1SE12-... (2.2 A) 6SL3210-1SE13-... (3.1 A) 6SL3210-1SE14-... (4.1 A)

Selection and ordering data

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

Power Modules in blocksize format
Recommended line-side components

Overview

Suitable line-side power components are assigned depending on the power rating of the Power Modules.

The following tables list recommended components and apply for ambient temperatures up to 40 °C (104 °F)

Further information about the line contactors, switch disconnectors, fuses and circuit-breakers specified in the tables can be found in the Catalogs LV 1, LV 1T and ET B1.

Assignment of line-side power components to Power Modules in blocksize format

Rated output current	Type rating	Suitable for Power Module, blocksize format	**Line contactor (Insta contactor)**	**Circuit-breaker IEC 60947 and UL489/CSA C22.2 No. 5-02**	**UL/CSA fuse, Class J Available from: Ferraz Shawmut http://www.ferrazshawmut.com**		
A	kW (HP)	Type 6SL3210-	Type	Order No.	Reference No.	Rated current	Size
Line voltage 200 ... 240 V 1 AC							
0.9	0.12 (0.2)	1SB11-0...	**5TT57...**	**5SJ4206-7HG41**	AJT6	6 A	21 × 57
2.3	0.37 (0.5)	1SB12-3...	**5TT57...**	**5SJ4210-7HG41**	AJT10	10 A	21 × 57
3.9	0.75 (0.75)	1SB14-0...	**5TT57...**	**5SJ4216-7HG41**	AJT15	15 A	21 × 57

Rated output current	Type rating	Suitable for Power Module, blocksize format	**Line contactor**	**Circuit-breaker IEC 60947**	**Circuit-breaker UL489/CSA C22.2 No. 5-02**	**Main switch**
A	kW (HP)	Type 6SL3210-	Type	Order No.		Order No.
Line voltage 380 ... 480 V 3 AC						
1.3	0.37 (0.5)	1SE11-3UA0	**3RT1015-...**	**3RV1021-1DA10**	–	**3LD2003-1TP51**
1.7	0.55 (0.75)	1SE11-7UA0	**3RT1015-...**	**3RV1021-1DA10**	–	**3LD2003-1TP51**
2.2	0.75 (1)	1SE12-2UA0	**3RT1015-...**	**3RV1021-1FA10**	–	**3LD2003-1TP51**
3.1	1.1 (1.5)	1SE13-1UA0	**3RT1015-...**	**3RV1021-1GA10**	–	**3LD2003-1TP51**
4.1	1.5 (2)	1SE14-1UA0	**3RT1015-...**	**3RV1021-1HA10**	–	**3LD2003-1TP51**
5.9	2.2 (3)	1SE16-0...	**3RT1015-...**	**3RV1021-1KA10**	–	**3LD2003-1TP51**
7.7	3 (5)	1SE17-7...	**3RT1015-...**	**3RV1021-4AA10**	–	**3LD2003-1TP51**
10	4 (5)	1SE21-0...	**3RT1016-...**	**3RV1021-4BA10**	–	**3LD2103-1TP51**
18	7.5 (10)	1SE21-8...	**3RT1025-...**	**3RV1031-4EA10**	–	**3LD2203-0TK51**
25	11 (15)	1SE22-5...	**3RT1026-...**	**3RV1031-4FA10**	–	**3LD2504-0TK51**
32	15 (20)	1SE23-2...	**3RT1034-...**	**3RV1031-4HA10**	–	**3LD2504-0TK51**
38	18.5 (25)	1SE23-8...	**3RT1035-...**	**3RV1042-4JA10**	–	**3LD2504-0TK51**
45	22 (30)	1SE24-5...	**3RT1036-...**	**3RV1042-4KA10**	–	**3LD2504-0TK51**
60	30 (40)	1SE26-0...	**3RT1044-...**	**3RV1042-4MA10**	**3VL2191-3KN30-0AA0**	**3LD2704-0TK51**
75	37 (50)	1SE27-5...	**3RT1045-...**	**3VL1712-1DD33-0AA0**	**3VL2110-3KN30-0AA0**	**3LD2704-0TK51**
90	45 (60)	1SE31-0...	**3RT1046-...**	**3VL1716-1DD33-0AA0**	**3VL2112-3KN30-0AA0**	**3LD2804-0TK51**
110	55 (75)	1SE31-1...	**3RT1054-...**	**3VL3720-1DC36-0AA0**	**3VL2115-3KN30-0AA0**	**3KA5330-1EE01**
145	75 (100)	1SE31-5...	**3RT1056-...**	**3VL3720-1DC36-0AA0**	**3VL3120-3KN30-0AA0**	**3KA5530-1EE01**
178	90 (125)	1SE31-8...	**3RT1064-...**	**3VL4725-1DC36-0AA0**	**3VL3125-3KN30-0AA0**	**3KA5530-1EE01**

Overview (continued)

Rated output current	Type rating	Suitable for Power Module, blocksize format	**Fuse switch disconnector**	**Switch disconnector with fuse holders**	**Fuse**	**UL/CSA fuse, Class J** [1] **Available from: Ferraz Shawmut http://ferrazschawmut.com**		
A	kW (HP)	Type 6SL3210-	Order No.	Order No.	Order No.	Reference No.	Rated current	Size
Line voltage 380 ... 480 V 3 AC								
1.3	0.37 (0.5)	1SE11-3UA0	**3NP4010-0CH01**	**3KL5030-1EB01**	**3NA3804**	AJT4	4 A	21 × 57
1.7	0.55 (0.75)	1SE11-7UA0	**3NP4010-0CH01**	**3KL5030-1EB01**	**3NA3804**	AJT4	4 A	21 × 57
2.2	0.75 (1)	1SE12-2UA0	**3NP4010-0CH01**	**3KL5030-1EB01**	**3NA3801**	AJT6	6 A	21 × 57
3.1	1.1 (1.5)	1SE13-1UA0	**3NP4010-0CH01**	**3KL5030-1EB01**	**3NA3803**	AJT8	8 A	21 × 57
4.1	1.5 (2)	1SE14-1UA0	**3NP4010-0CH01**	**3KL5030-1EB01**	**3NA3803**	AJT10	10 A	21 × 57
5.9	2.2 (3)	1SE16-0...	**3NP4010-0CH01**	**3KL5030-1EB01**	**3NA3803**	AJT10	10 A	21 × 57
7.7	3 (5)	1SE17-7...	**3NP4010-0CH01**	**3KL5030-1EB01**	**3NA3805**	AJT12	12 A	21 × 57
10	4 (5)	1SE21-0...	**3NP4010-0CH01**	**3KL5030-1EB01**	**3NA3805**	AJT15	15 A	21 × 57
18	7.5 (10)	1SE21-8...	**3NP4010-0CH01**	**3KL5030-1EB01**	**3NA3810**	AJT25	25 A	21 × 57
25	11 (15)	1SE22-5...	**3NP4010-0CH01**	**3KL5030-1EB01**	**3NA3814**	AJT35	35 A	27 × 60
32	15 (20)	1SE23-2...	**3NP4010-0CH01**	**3KL5030-1EB01**	**3NA3817**	AJT45	45 A	27 × 60
38	18.5 (25)	1SE23-8...	**3NP4010-0CH01**	**3KL5030-1EB01**	**3NA3820**	AJT50	50 A	27 × 60
45	22 (30)	1SE24-5...	**3NP4010-0CH01**	**3KL5030-1EB01**	**3NA3822**	AJT60	60 A	27 × 60
60	30 (40)	1SE26-0...	**3NP4010-0CH01**	**3KL5230-1EB01**	**3NA3824**	AJT90	90 A	29 × 117
75	37 (50)	1SE27-5...	**3NP4010-0CH01**	**3KL5230-1EB01**	**3NA3830**	AJT100	100 A	29 × 117
90	45 (60)	1SE31-0...	**3NP4070-0CH01**	**3KL5230-1EB01**	**3NA3832**	AJT125	125 A	41 × 146
110	55 (75)	1SE31-1...	**3NP4070-0CH01**	**3KL5330-1EB01**	**3NA3836**	AJT150	150 A	41 × 146
145	75 (100)	1SE31-5...	**3NP4270-0CA01**	**3KL5530-1EB01**	**3NA3140**	AJT200	200 A	41 × 146
178	90 (125)	1SE31-8...	**3NP4270-0CA01**	**3KL5530-1EB01**	**3NA3144**	AJT250	250 A	54 × 181

[1] Not for use in 3NP and 3KL disconnectors.

Power Modules in chassis format

Design

Power Module in chassis format

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

- 1 line connection
- 2 DC link connections for options such as Braking Modules
- 3 DRIVE-CLiQ sockets
- 1 safe standstill input (enable pulses)
- 1 temperature sensor input (KTY84-130 or PTC)
- 1 electronic power supply connection
- 1 motor connection
- 2 PE (protective earth) connections

The CU310 Control Unit can be mounted in Power Modules of chassis format.

The scope of supply of the Power Modules includes:

- 1 DRIVE-CLiQ cable for connection to the CU310/SIMOTION D410 Control Unit
- 1 24 V supply cable for connection to the CU310/SIMOTION D410 Control Unit
- 1 mounting plate for attaching the CU310/SIMOTION D410 Control Unit

Selection and ordering data

Rated output current	Rated power	**Power Module in chassis format**
A	kW (HP) [1]	Order No.
Line voltage 380 ... 480 V 3 AC		
210	110 (150)	**6SL3310-1TE32-1AA0**
260	132 (200)	**6SL3310-1TE32-6AA0**
310	160 (250)	**6SL3310-1TE33-1AA0**
380	200 (300)	**6SL3310-1TE33-8AA0**
490	250 (400)	**6SL3310-1TE35-0AA0**

Accessories

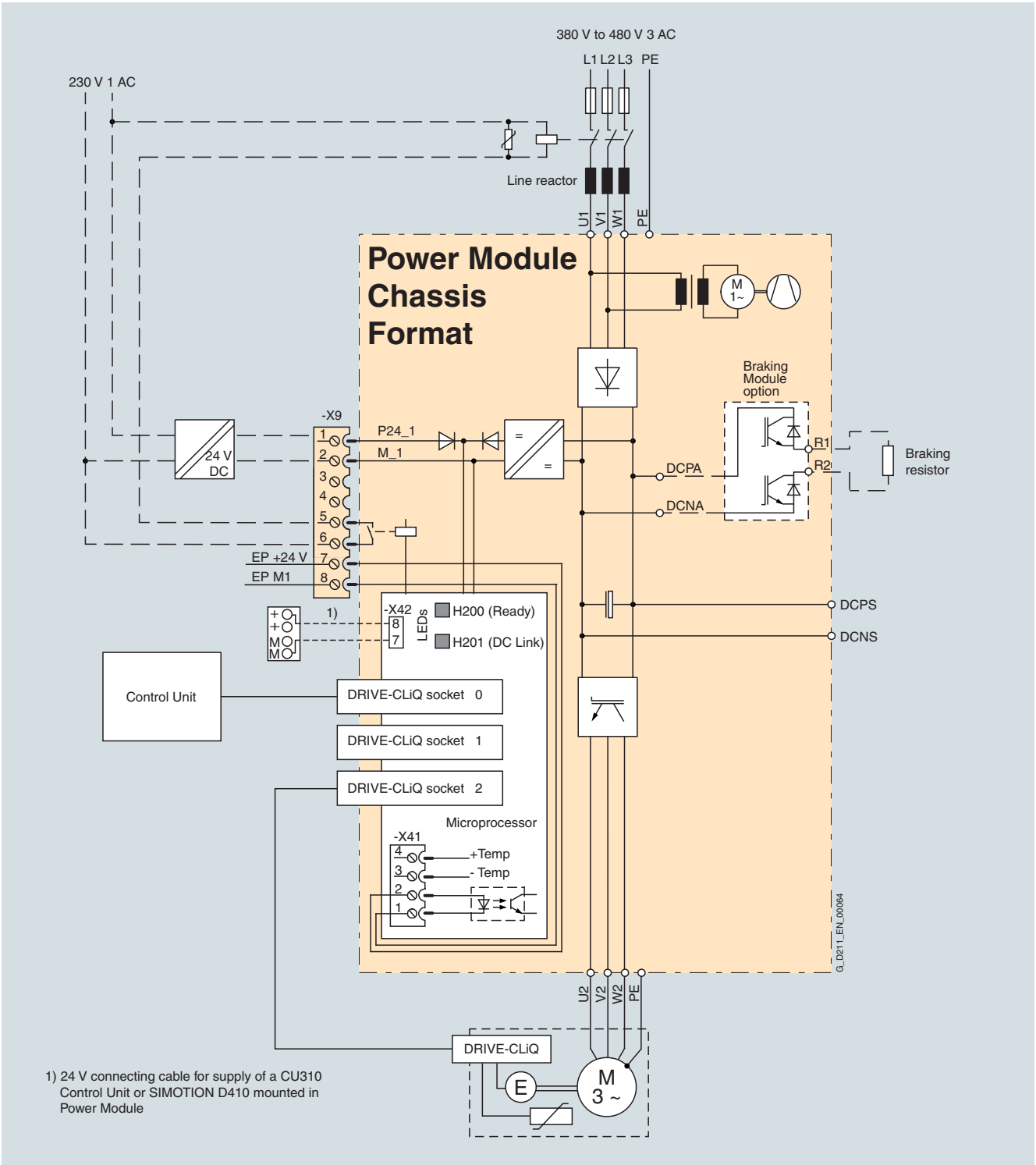
Description	Order No.
Warning signs in foreign languages This label set can be glued over the standard German or English labels to provide warnings in other languages. One set of labels is supplied with the devices. The following languages are available in each label set: Chinese Simplified, Danish, Dutch, Finnish, French, Greek, Italian, Japanese, Korean, Polish, Portuguese/Brazilian, Russian, Swedish, Spanish, Czech, Turkish	**6SL3166-3AB00-0AA0**

[1] Nominal HP based on Asynchronus motors (induction motors). See technical specifications for specific sizing.

Integration

The Power Modules in chassis format communicate with the higher-level Control Unit via DRIVE-CLiQ.

The Control Unit in this case could be a CU310 or CU320 or a SIMOTION D Control Unit.



Connection example of a Power Module in chassis format

Note: The integrated 24 V power supply is permitted to be loaded with up to 2 A on connector X42. When the Control Unit is supplied over the integrated power supply, particular attention must be paid to the summed load of the digital outputs so that the 2 A maximum is not exceeded.

Power Modules in chassis format

Technical specifications

General technical specifications	
Electrical data	
Line connection voltage (up to 2000 m (6562 ft) above sea level)	380 ... 480 V 3 AC ±10 % (-15 % < 1 min)
Line frequency	47 … 63 Hz
Line Power factor with a 3 AC line connection voltage and rated power	
• Fundamental Power factor (cos φ_1)	> 0.96
• Total (λ)	0.75 … 0.93
Overvoltage category to EN 60664-1	Class III
Precharging frequency of the DC link, max.	1× every 300 s
DC link voltage, approx.	1.35 x line voltage
Output frequency	
• Control type Servo	0 … 650 Hz [1]
• Control type Vector	0 … 300 Hz [1]
• Control type *V/f*	0 … 300 Hz [1]
Electronics power supply	24 V DC -15 %/+20 %
Line contactor control Terminal strip X9/5-6	240 V AC/ max. 8 A 30 V DC/ max. 1 A
Radio Interference suppression	
• Standard (in combination with line reactor)	Category C3 to EN 61800-3
• With line filter and line reactor	Category C2 to EN 61800-3
Ambient conditions	
Type of cooling	Increased air cooling trough a built-in fan
Permissible ambient and coolant temperature (air) during operation for line-side components, Power Modules	0 … 40 °C (32 … 104 °F) without derating, > 40 … 55 °C (104 … 131 °F), see derating characteristics
Site altitude	Up to 2000 m (6562 ft) above sea level without derating, > 2000 ... 4000 m (6562 ... 13124 ft) above sea level see derating characteristics
Certificates	
Conformity	CE (low-voltage and EMC Directives)
Approvals	cULus (File No. E192450)
Safety Integrated	Safety Integrity Level 2 (SIL 2) to IEC 61508, control category 3 to EN 954-1 (for further information see the Safety Integrated section)

[1] Note correlation between max. output frequency, pulse frequency and current derating, see System description.

Technical specifications (continued)

Line voltage 380 ... 480 V 3 AC		Power Modules in chassis format 6SL3310-1TE32-1AA0	6SL3310-1TE32-6AA0	6SL3310-1TE33-1AA0	6SL3310-1TE33-8AA0	6SL3310-1TE35-0AA0
Output current						
• Rated current I_{rated}	A	210	260	310	380	490
• Base-load current I_L	A	205	250	302	370	477
• Base-load current I_H	A	178	233	277	340	438
• For S6 duty (40 %) I_{S6}	A	230	285	340	430	540
• I_{max}	A	307	375	453	555	715
Type rating [1]						
• Based on I_{rated}	kW (HP)	110 (150)	132 (200)	160 (250)	200 (300)	250 (400)
• Based on I_H	kW (HP)	90 (150)	110 (150)	132 (200)	160 (250)	200 (350)
Rated pulse frequency	kHz	2	2	2	2	2
Current requirement with 24 V DC, max. [2]	A	0.9	0.9	1.2	1.2	1.2
Power loss	kW	2.54	3.36	4.07	4.67	5.96
Cooling air requirement	m^3/s (ft^3/s)	0.17 (6)	0.23 (8.1)	0.36 (12.7)	0.36 (12.7)	0.36 (12.7)
Sound pressure level L_{pA} (1 m) at 50/60 Hz	dB(A)	66/67	68/72	68/72	68/72	68/72
Rated input current	A	229	284	338	395	509
Line connection U1, V1, W1		Flat connector for M10 screw	Flat connector for M10 screw	Flat connector for M10 screw	Flat connector for M10 screw	Flat connector for M10 screw
• Conductor cross-section, max.	mm^2	2 × 185	2 × 185	2 × 240	2 × 240	2 × 240
DC link connection DCPA, DCNA (option Braking Module)		Flat connector for M8 screw	Flat connector for M8 screw	Flat connector for M8 screw	Flat connector for M8 screw	Flat connector for M8 screw
• Conductor cross-section, max.	mm^2	1 × 35	1 × 35	1 × 50	1 × 50	1 × 50
DC link connection DCPS, DCNS (option dV/dt filter)		Flat connector for M8 screw	Flat connector for M8 screw	Flat connector for M8 screw	Flat connector for M8 screw	Flat connector for M8 screw
• Conductor cross-section, max.	mm^2	1 × 35	1 × 35	1 × 70	1 × 70	1 × 70
Motor connection U2, V2, W2		Flat connector for M10 screw	Flat connector for M10 screw	Flat connector for M10 screw	Flat connector for M10 screw	Flat connector for M10 screw
• Conductor cross-section, max.	mm^2	2 × 185	2 × 185	2 × 240	2 × 240	2 × 240
PE connection		Flat connector for M10 screw	Flat connector for M10 screw	Flat connector for M10 screw	Flat connector for M10 screw	Flat connector for M10 screw
• Conductor cross-section, max.	mm^2	2 × 185	2 × 185	2 × 240	2 × 240	2 × 240
Motor cable length [3], **max.**						
• Shielded	m (ft)	300 (984)	300 (984)	300 (984)	300 (984)	300 (984)
• Unshielded	m (ft)	450 (1476)	450 (1476)	450 (1476)	450 (1476)	450 (1476)
Degree of protection		IP20	IP20	IP20	IP20	IP20
Dimensions						
• Width	mm (in)	326 (12.83)	326 (12.83)	326 (12.83)	326 (12.83)	326 (12.83)
• Height	mm (in)	1400 (55.12)	1400 (55.12)	1533 (60.35)	1533 (60.35)	1533 (60.35)
• Depth	mm (in)	356 [4] (14.02)	356 [4] (14.02)	549 (21.61)	549 (21.61)	549 (21.61)
Frame size		FX	FX	GX	GX	GX
Weight, approx.	kg (lb)	104 (229)	104 (229)	162 (357)	162 (357)	162 (357)

1) Nominal HP based on Asynchronous motors (induction motors) and 460 V AC. For specific sizing select drive based on motor nameplate current and overload.

2) Current consumption of Power Module only. If a Control Unit is supplied with 24 V DC over the Power Module, its current consumption must be added.

3) Motor cable length, max. 100 m (328 ft) (shielded) in conjunction with a line filter to maintain the limit values of EN 61800-3 Category C2.

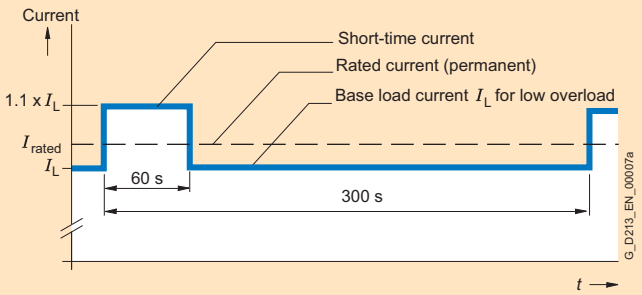
4) Depth = 421 mm (16.47 in) including front cover when CU310 Control Unit is installed.

3

Characteristics

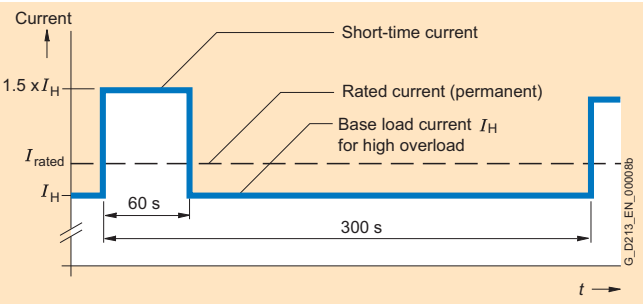
Overload capability

The base-load current I_L is based on a load cycle of 110 % for 60 s or 150 % for 10 s with a load cycle period of 300 s.

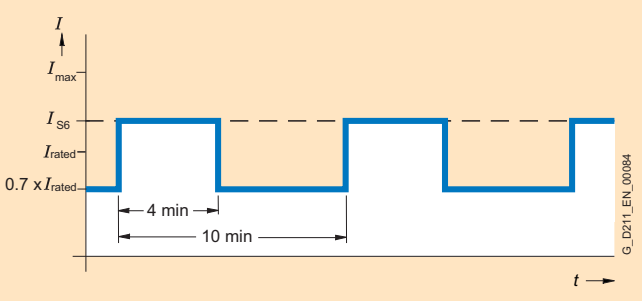


Low overload

The base-load current I_H is based on a load cycle of 150 % for 60 s or 160 % for 10 s with a load cycle period of 300 s.



High overload

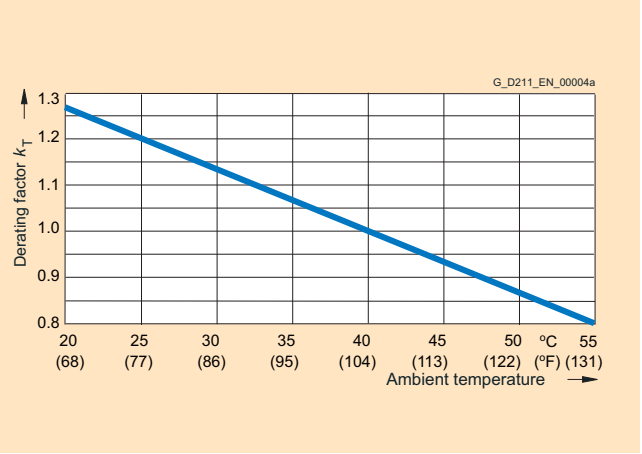


S6 load cycle with initial load with a load cycle period of 600 s

Derating factors

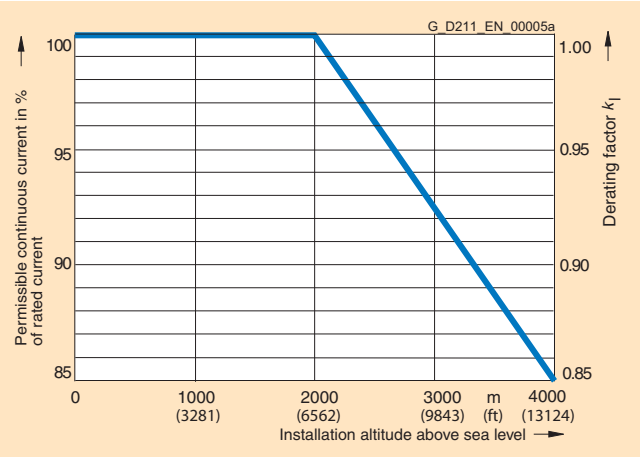
Output current dependent on pulse frequency

Power Module in chassis format	Rated output current	**Derating factor**
Type	A	for a pulse frequency of 4 kHz
6SL3310-1TE32-1AA0	210	0.82
6SL3310-1TE32-6AA0	260	0.83
6SL3310-1TE33-1AA0	310	0.88
6SL3310-1TE33-8AA0	380	0.87
6SL3310-1TE35-0AA0	490	0.78

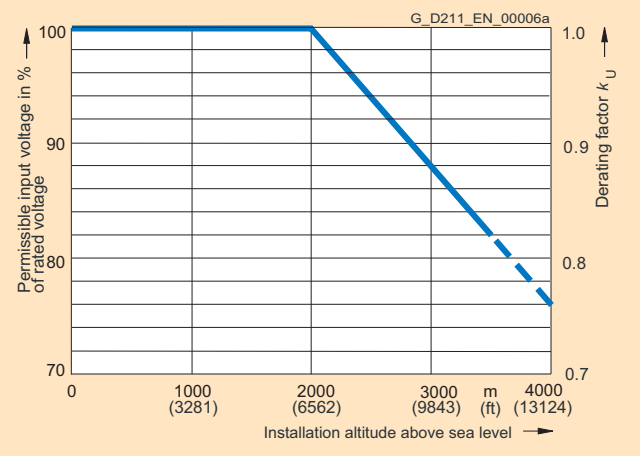


Current derating dependent on ambient temperature

Note: A factor $k_T > 1$ is to be taken into account only in conjunction with current derating as a function of installation altitude, see System description.



Current derating dependent on installation altitude



Voltage derating dependent on installation altitude

Overview

Line reactors limit the low-frequency harmonic effects and reduce the load on the rectifiers of the Power Modules. The higher the rated output of the Power Modules, the lower the required inductance of the line reactor. A line reactor is not required where the effective supply impedance equals u_k > 3 %. For further information, see System description.

Technical specifications

Line voltage 380 ... 480 V 3 AC		Line reactor 6SL3000-0CE32-3AA0	6SL3000-0CE32-8AA0	6SL3000-0CE33-3AA0	6SL3000-0CE35-1AA0
Rated current	A	224	278	331	508
Power loss at 50/60 Hz	kW	0.24/0.27	0.21/0.25	0.23/0.27	0.31/0.37
Line connection 1U1, 1V1, 1W1		Flat connector for M10 screw	Flat connector for M10 screw	Flat connector for M10 screw	Flat connector for M12 screw
Load connection 1U2, 1V2, 1W2		Flat connector for M10 screw	Flat connector for M10 screw	Flat connector for M10 screw	Flat connector for M12 screw
PE connection		M6 screw	M6 screw	M6 screw	M6 screw
Degree of protection		IP00	IP00	IP00	IP00
Dimensions					
• Width	mm (in)	270 (10.63)	270 (10.63)	270 (10.63)	300 (11.81)
• Height	mm (in)	248 (9.76)	248 (9.76)	248 (9.76)	269 (10.59)
• Depth	mm (in)	200 (7.87)	200 (7.87)	200 (7.87)	212.5 (8.37)
Weight, approx.	kg (lb)	24.4 (54)	26 (57)	27.8 (61)	38 (84)
Approvals		cURus	cURus	cURus	cURus
Suitable for Power Module in chassis format	Type (rated output current)	6SL3310-1TE32-1... (210 A) 6SL3315-1TE32-1... (210 A)	6SL3310-1TE32-6... (260 A) 6SL3315-1TE32-6... (260 A)	6SL3310-1TE33-1... (310 A) 6SL3315-1TE33-1... (310 A)	6SL3310-1TE33-8... (380 A) 6SL3310-1TE35-0... (490 A) 6SL3315-1TE35-0... (490 A)

Selection and ordering data

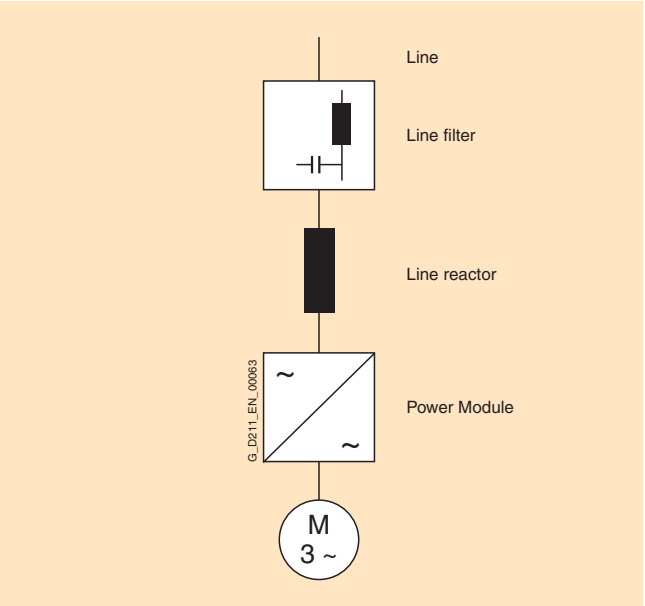
Rated output current A	Type rating kW (HP)	Suitable for Power Module Type	Line reactor Order No.
Line voltage 380 ... 480 V 3 AC			
210	110 (150)	6SL3310-1TE32-1AA0 6SL3315-1TE32-1AA0	**6SL3000-0CE32-3AA0**
260	132 (200)	6SL3310-1TE32-6AA0 6SL3315-1TE32-6AA0	**6SL3000-0CE32-8AA0**
310	160 (250)	6SL3310-1TE33-1AA0 6SL3315-1TE33-1AA0	**6SL3000-0CE33-3AA0**
380	200 (300)	6SL3310-1TE33-8AA0	**6SL3000-0CE35-1AA0**
490	250 (400)	6SL3310-1TE35-0AA0 6SL3315-1TE35-0AA0	

Power Modules in chassis format
Line filters

Overview

In plants with strict EMC requirements, line filters work together with line reactors to restrict the conducted interference emanating from the Power Modules to the limit values of Category C2 as defined in EN 61800-3. Line filters are suited only for direct connection to TN (grounded) systems.

Integration



Technical specifications

Line voltage 380 ... 480 V 3 AC		Line filter 6SL3000-0BE32-5AA0	6SL3000-0BE34-4AA0	6SL3000-0BE36-0AA0
Rated current	A	250	440	600
Power loss	kW	0.05	0.05	0.06
Line connection 1U1, 1V1, 1W1		Flat connector for M10 screw	Flat connector for M10 screw	Flat connector for M10 screw
Load connection 1U2, 1V2, 1W2		Flat connector for M10 screw	Flat connector for M10 screw	Flat connector for M10 screw
Degree of protection		IP00	IP00	IP00
Dimensions				
• Width	mm (in)	360 (14.17)	360 (14.17)	400 (15.75)
• Height	mm (in)	240 (9.45)	240 (9.45)	265 (10.43)
• Depth	mm (in)	116 (4.57)	116 (4.57)	140 (5.51)
Weight, approx.	kg (lb)	12.5 (28)	12.5 (28)	19 (42)
Approvals		UR, cUR	UR, cUR	UR, cUR
Suitable for Power Module in chassis format	Type (rated output current)	6SL3310-1TE32-1... (210 A)	6SL3310-1TE32-6... (260 A) 6SL3310-1TE33-1... (310 A) 6SL3310-1TE33-8... (380 A)	6SL3310-1TE35-0... (490 A)

Selection and ordering data

Rated output current	Type rating	Suitable for Power Module	**Line filter**
A	kW (HP)	Type	Order No.
Line voltage 380 ... 480 V 3 AC			
210	110 (150)	6SL3310-1TE32-1AA0	**6SL3000-0BE32-5AA0**
260	132 (200)	6SL3310-1TE32-6AA0	**6SL3000-0BE34-4AA0**
310	160 (250)	6SL3310-1TE33-1AA0	
380	200 (300)	6SL3310-1TE33-8AA0	
490	250 (400)	6SL3310-1TE35-0AA0	**6SL3000-0BE36-0AA0**

Overview

Suitable line-side power components are assigned depending on the power rating of the Power Modules.

The following tables list recommended components and apply for ambient temperatures up to 40 °C (104 °F).

Further information about the line contactors, switch disconnectors, fuses and circuit-breakers specified in the tables can be found in Catalogs LV 1, LV 1T and ET B1.

Assignment of line-side power components to Power Modules in chassis format

Rated output current	Type rating	Suitable for Power Module in chassis format	**Line contactor**	**Circuit-breaker IEC 60947**	**Circuit-breaker UL489/CSA C22.2 No. 5-02**
A	kW (HP)	Type 6SL3310-	Type	Order No.	Order No.
Line voltage 380 ... 480 V 3 AC					
210	110 (150)	1TE32-1AA0	**3RT1064-...**	**3VL4725-1DC36-0AA0**	**3VL3125-3KN30-0AA0**
260	132 (200)	1TE32-6AA0	**3RT1065-...**	**3VL4731-1DC36-0AA0**	**3VL4130-3KN30-0AA0**
310	160 (250)	1TE33-1AA0	**3RT1066-...**	**3VL4740-1DC36-0AA0**	**3VL4135-3KN30-0AA0**
380	200 (300)	1TE33-8AA0	**3RT1075-...**	**3VL5750-1DC36-0AA0**	**3VL4140-3KN30-0AA0**
490	250 (400)	1TE25-0AA0	**3RT1076-...**	**3VL5763-1DC36-0AA0**	**3VL4560-3KN30-0AA0**

Rated output current	Type rating	Suitable for Power Module in chassis format	**Main switch**	**Fuse switch disconnector**	**Switch disconnector with fuse holders**
A	kW (HP)	Type 6SL3310-	Order No.	Order No.	Order No.
Line voltage 380 ... 480 V 3 AC					
210	110 (150)	1TE32-1AA0	**3KA5530-1EE01**	**3NP4270-0CA01**	**3KL5530-1EB01**
260	132 (200)	1TE32-6AA0	**3KA5730-1EE01**	**3NP4370-0CA01**	**3KL5730-1EB01**
310	160 (250)	1TE33-1AA0	**3KA5730-1EE01**	**3NP4370-0CA01**	**3KL5730-1EB01**
380	200 (300)	1TE33-8AA0	**3KA5730-1EE01**	**3NP4370-0CA01**	**3KL5730-1EB01**
490	250 (400)	1TE25-0AA0	**3KA5830-1EE01**	**3NP4470-0CA01**	**3KL6130-1EB01**

Rated output current	Type rating	Suitable for Power Module in chassis format	**Fuse**	**UL/CSA fuse, Class J** [1] **Available from: Ferraz Shawmut http://www.ferrazshawmut.com**		
A	kW (HP)	Type 6SL3310-	Order No.	Reference No.	Rated current	Size
Line voltage 380 ... 480 V 3 AC						
210	110 (150)	1TE32-1AA0	**3NA3144**	AJT250	250 A	54 × 181
260	132 (200)	1TE32-6AA0	**3NA3250**	AJT300	300 A	54 × 181
310	160 (250)	1TE33-1AA0	**3NA3254**	AJT350	350 A	54 × 181
380	200 (300)	1TE33-8AA0	**3NA3260**	AJT400	400 A	54 × 181
490	250 (400)	1TE25-0AA0	**3NA3372**	AJT600	600 A	64 × 203

[1] Not for use in 3NP and 3KL disconnectors.

Liquid-cooled Power Modules in chassis format

Design

Liquid-cooled Power Modules in chassis format

The liquid-cooled Power Modules in chassis format are suitable for applications in confined spaces and plants/machines that cannot be equipped with air-cooled devices due to air quality. The liquid-cooled Power Modules in chassis format impress customers with their extremely compact dimensions and low noise level. The liquid-cooled Power Module can be installed vertically or horizontally on the rear panel of the control cabinet. The connections for the coolant are located at the bottom of the Power Module in the case of vertical mounting.

The power connections for the supply system and DC link are connected externally and the motor connections are routed downwards.

The liquid-cooled Power Modules in chassis format feature the following connections and interfaces as standard:

- 1 line connection
- 1 DC link connection
- 3 DRIVE-CLiQ sockets
- 1 safe standstill input (enable pulses)
- 1 temperature sensor input (KTY84-130 or PTC)
- 1 electronic power supply connection
- 1 motor connection
- 2 PE (protective earth) connections
- 2 coolant connections

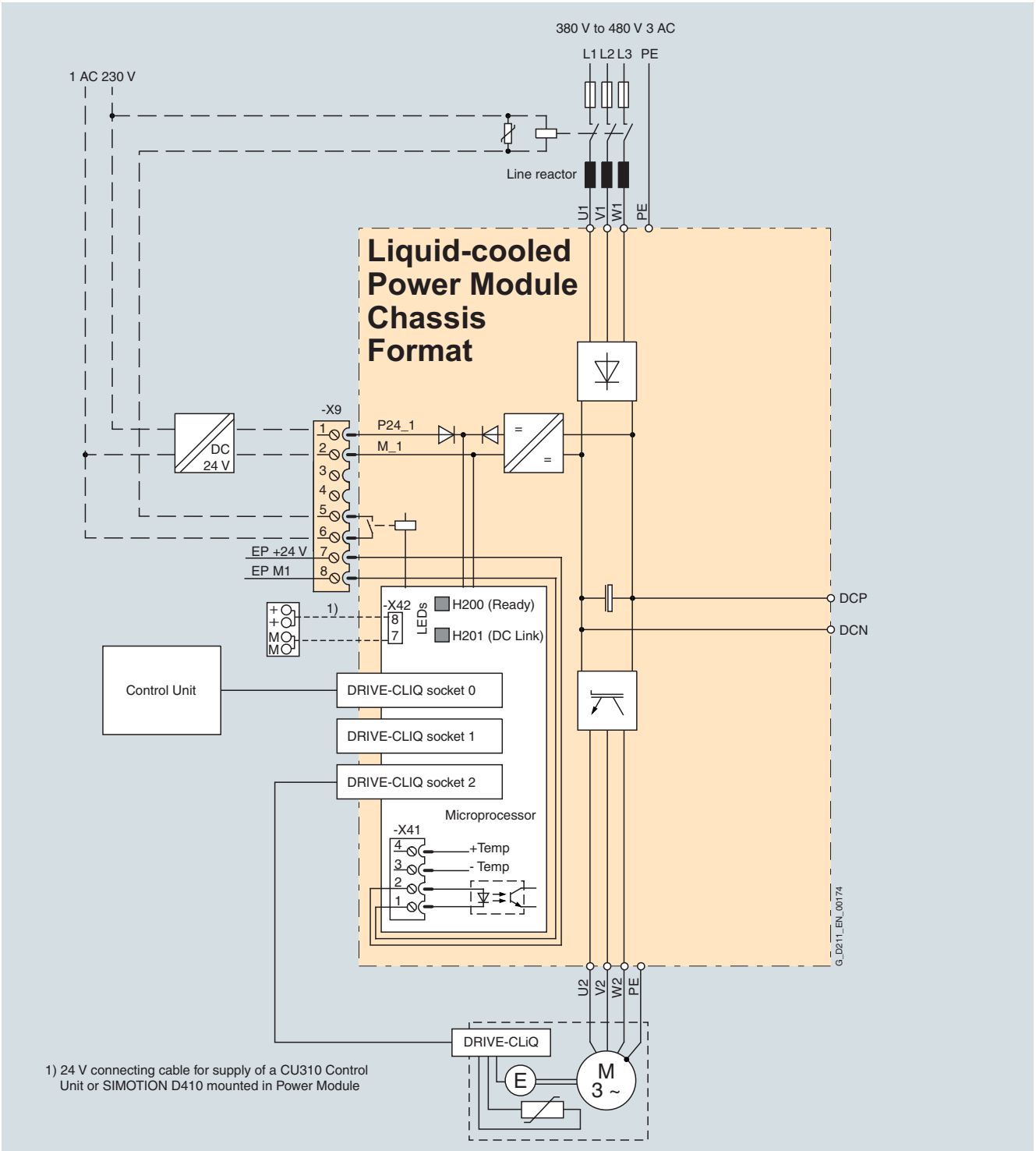
The CU310 Control Unit can be mounted in the liquid-cooled Power Modules of chassis format.

The scope of supply of the Power Modules includes:

- 1 DRIVE-CLiQ cable for connection to the CU310/SIMOTION D410 Control Unit
- 1 24 V connecting cable for power supply of the CU310/SIMOTION D410 Control Unit
- 1 CD-ROM with manual in PDF version
- 1 set of warning signs in foreign languages
- 2 seals for coolant connections
- 2 protective caps for coolant connections

Integration

The liquid-cooled Power Modules in chassis format communicate with the higher-level Control Unit via DRIVE-CLiQ. The Control Unit in this case could be a CU310 or CU320 or a SIMOTION D Control Unit. An external 24 V DC supply is required to operate liquid-cooled Power Modules.



Typical connection of a liquid-cooled Power Module in chassis format

Note: The integrated 24 V power supply is permitted to be loaded with up to 2 A on connector X42. When the Control Unit is supplied over the integrated power supply, particular attention must be paid to the summed load of the digital outputs so that the 2 A maximum is not exceeded.

Liquid-cooled Power Modules in chassis format

Technical specifications

General technical specifications	
Electrical data	
Line connection voltage (up to 2000 m (6562 ft) above sea level)	380 ... 480 V 3 AC ±10 % (-15 % < 1 min)
Line frequency	47 … 63 Hz
Line Power factor with a 3 AC line connection voltage and rated power	
• Fundamental Power factor ($\cos \phi_1$)	> 0.96
• Total (λ)	0.75 … 0.93
Overvoltage category to EN 60664-1	Class III
Precharging frequency of the DC link	No limitation
DC link voltage, approx.	1.35 x line voltage
Output frequency	
• Control type Servo	0 … 650 Hz [1]
• Control type Vector	0 … 300 Hz [1]
• Control type *V/f*	0 … 300 Hz [1]
Electronics power supply	24 V DC -15 %/+20 %
Line contactor control Terminal strip X9/5-6	240 V AC/max. 8 A 30 V DC/max. 1 A
Radio Interference suppression	
• Standard (in combination with line reactor)	Category C3 to EN 61800-3

General technical specifications	
Ambient conditions	
Type of cooling	Liquid cooling with integrated heat exchanger in stainless-steel version
Coolant [2]	
- pH value	6.0 … 9.0
- Chloride	< 200 mg/l
- Sulfate	< 240 mg/l
- Hardness	< 2.5 mmol/l [3]
- Conductivity	< 2000 µS/cm
- Colony number	< 1000 col/ml [4]
- Max. size of entrained particles	< 100 µm
Cooling circuit	
- System pressure with reference to atmospheric pressure, max.	600 kPa
- Pressure drop at rated volumetric flow	70 kPa
- Recommended pressure range	80 … 200 kPa
- Inlet temperature of liquid coolant	Dependent on the ambient temperature, condensation is not permitted 0 … 45 °C (32 … 113 °F) without derating > 45 … 50 °C (113 … 122 °F) see derating characteristics (temperature range between 0 °C and 5 °C (32 … 41 °F) with anti-freeze only; recommended anti-freeze: "Antifrogen N" from Clariant)
Permissible ambient temperature (air) during operation	Dependent on the inlet temperature of the coolant, condensation is not permissible 0 … 45 °C (32 … 113 °F) without derating, > 45 … 50 °C (113 … 122 °F) see derating characteristics
Site altitude	Up to 2000 m (6562 ft) above sea level without derating, > 2000 ... 4000 m (6562 ... 13124 ft) above sea level see derating characteristics
Certificates	
Conformity	CE (low-voltage and EMC Directives)
Approvals	cULus (File No. E192450)
Safety Integrated	Safety Integrity Level 2 (SIL 2) to IEC 61508, control category 3 to EN 954-1 (for further information see the Safety Integrated section)

1) Note correlation between max. output frequency, pulse frequency and current derating, see System description.

2) The values are applicable to coolant (water) without the addition of anti-freeze or inhibitors. When anti-freeze or inhibitors are added, the specifications of the manufacturer regarding water quality must be observed. The proportion of anti-freeze must not exceed a minimum concentration, otherwise the coolant has a marked corrosive effect. In the case of Antifrogen N, the recommended range of the ratio of Antifrogen N to water lies between 20/80 and 45/55 Vol. %

3) The hardness of the coolant, especially the concentration of calcium compounds should be kept to a minimum to prevent the build-up of damaging calcium deposits (lime scale). A hardness < 1.5 mmol/l is recommended.

4) The number of microbes should generally be as low as possible to prevent damage as a result of slime-producing, iron-depositing, corroding bacteria. In closed coolant circuits, the accumulation of microbes can be prevented, for example, by adding anti-freeze. The concentration of anti-freeze must only reach a minimum level to prevent corrosion, see Footnote 2).

Technical specifications (continued)

Line voltage 380 ... 480 V 3 AC		Liquid-cooled Power Modules in chassis format 6SL3315-1TE32-1AA0	6SL3315-1TE32-6AA0	6SL3315-1TE33-1AA0	6SL3315-1TE35-0AA0
Output current					
• Rated current I_{rated}	A	210	260	310	490
• Base-load current I_L	A	205	250	302	477
• Base-load current I_H	A	178	233	277	438
• For S6 duty (40 %) I_{S6}	A	230	285	340	540
• I_{max}	A	307	375	453	715
Type rating[1]					
• Based on I_{rated}	kW (HP)	110 (150)	132 (200)	160 (250)	250 (400)
• Based on I_H	kW (HP)	90 (150)	110 (150)	132 (200)	200 (350)
Rated pulse frequency	kHz	2	2	2	2
Power loss					
• Total, approx.	kW	2.51	3.16	3.50	5.36
• Lost to ambient air, approx.	kW	0.06	0.07	0.09	0.14
Rated volumetric flow for water with 70 kPa pressure drop	dm^3/min (l/min)	9	9	12	12
Cooling circuit connection Inlet and return		Pipe thread ISO 228 – G ¾ B (external thread ¾", flat-sealing)	Pipe thread ISO 228 – G ¾ B (external thread ¾", flat-sealing)	Pipe thread ISO 228 – G ¾ B (external thread ¾", flat-sealing)	Pipe thread ISO 228 – G ¾ B (external thread ¾", flat-sealing)
Volume of liquid for integrated heat exchanger	dm^3 (l)	0.52	0.52	0.88	0.88
Sound pressure level L_{pA} (1 m (3.28 ft)) at 50/60 Hz	dB	52	52	52	52
Rated input current	A	230	285	338	537
Current requirement with 24 V DC, max.	A	1.5	1.5	1.8	1.8
Line connection U1, V1, W1		Flat connector for M12 screw	Flat connector for M12 screw	Flat connector for M12 screw	Flat connector for M12 screw
• Conductor cross-section, max.	mm^2	2 × 185	2 × 185	2 × 240	2 × 240
DC link connection DCP, DCN		Flat connector for M12 screw	Flat connector for M12 screw	Flat connector for M12 screw	Flat connector for M12 screw
• Conductor cross-section, max.	mm^2	2 × 185	2 × 185	2 × 240	2 × 240
Motor connection U2, V2, W2		Flat connector for M12 screw	Flat connector for M12 screw	Flat connector for M12 screw	Flat connector for M12 screw
• Conductor cross-section, max.	mm^2	2 × 185	2 × 185	2 × 240	2 × 240
PE connection		Flat connector for M12 screw	Flat connector for M12 screw	Flat connector for M12 screw	Flat connector for M12 screw
• Conductor cross-section, max.	mm^2	2 × 185	2 × 185	2 × 240	2 × 240
Motor cable length, max.					
• Shielded	m (ft)	300 (984)	300 (984)	300 (984)	300 (984)
• Unshielded	m (ft)	450 (1476)	450 (1476)	450 (1476)	450 (1476)
Degree of protection		IP00	IP00	IP00	IP00
Dimensions					
• Width	mm (in)	265 (10.43)	265 (10.43)	265 (10.43)	265 (10.43)
• Height	mm (in)	835.5 (32.89)	835.5 (32.89)	983 (38.70)	983 (38.70)
• Depth	mm (in)	549 (21.61)	549 (21.61)	549 (21.61)	549 (21.61)
Frame size		FL	FL	GL	GL
Weight, approx.	kg (lb)	78 (172)	78 (172)	105 (232)	105 (232)

[1] Rated power of a typical standard asynchronous motor at 400 V 3 AC.

Liquid-cooled Power Modules in chassis format

Selection and ordering data

Rated output current	Type rating	Liquid-cooled Power Modules in chassis format
A	kW (HP)	Order No.
Line voltage 380 ... 480 V 3 AC		
210	110 (150)	**6SL3315-1TE32-1AA0**
260	132 (200)	**6SL3315-1TE32-6AA0**
310	160 (250)	**6SL3315-1TE33-1AA0**
490	250 (400)	**6SL3315-1TE35-0AA0**

Accessories

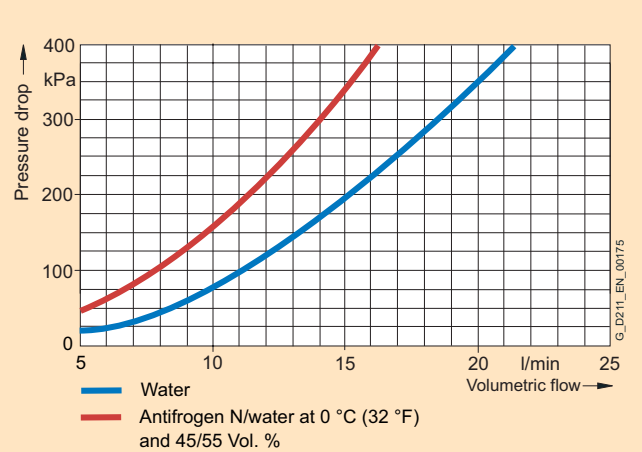
For line reactors and line-side components, see "Power Modules in chassis format".

Description	Order No.
3-way valve DN15 ¾" connection [1]	**VXP45.15-2.5**
Actuator for 3-way valve [1]	
• 230 V 1 AC	**SSC31**
• 24 V 1 AC	**SSC81**
Warning signs in foreign languages This label set can be glued over the standard German or English labels to provide warnings in other languages. One set of labels is supplied with the devices. The following languages are available in each label set: Chinese Simplified, Danish, Dutch, Finnish, French, Greek, Italian, Japanese, Korean, Polish, Portuguese/Brazilian, Russian, Swedish, Spanish, Czech, Turkish	**6SL3166-3AB00-0AA0**

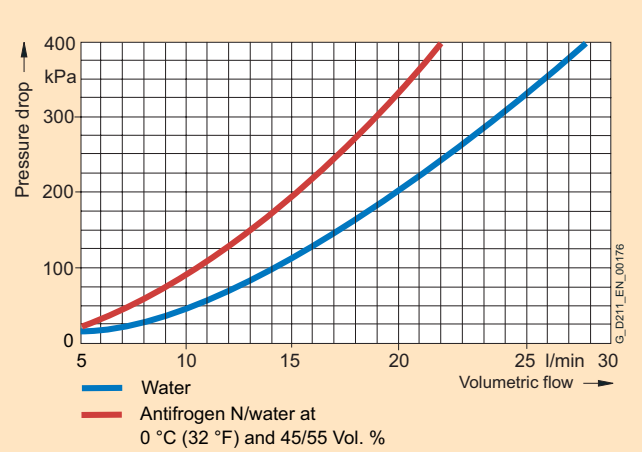
[1] Recommended components for installing a flow control as condensation protection; manufacturer: Siemens SBT
For further information, see Manual.

Characteristics

Pressure drop



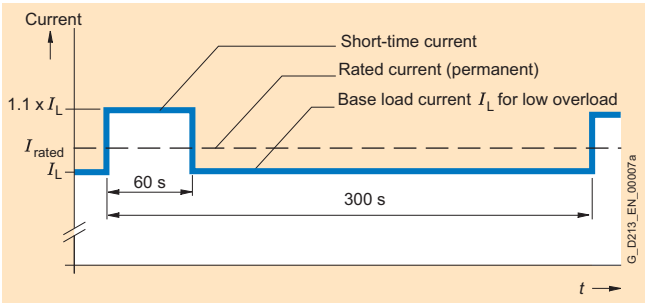
Pressure drop with frame size FL



Pressure drop with frame size GL

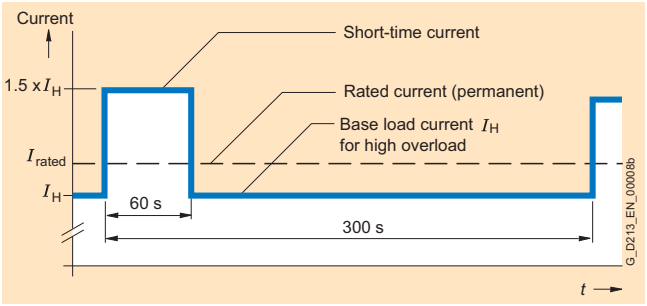
Overload capability

The base-load current I_L is based on a load cycle of 110 % for 60 s or 150 % for 10 s with a load cycle period of 300 s.

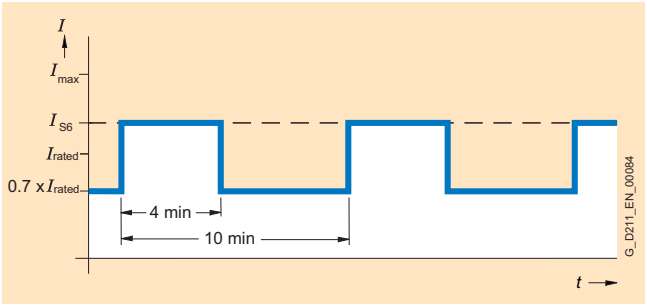


Low overload

The base load current I_H is based on a load cycle of 150 % for 60 s or 160 % for 10 s with a load cycle period of 300 s.



High overload



S6 load cycle with initial load with a load cycle period of 600 s

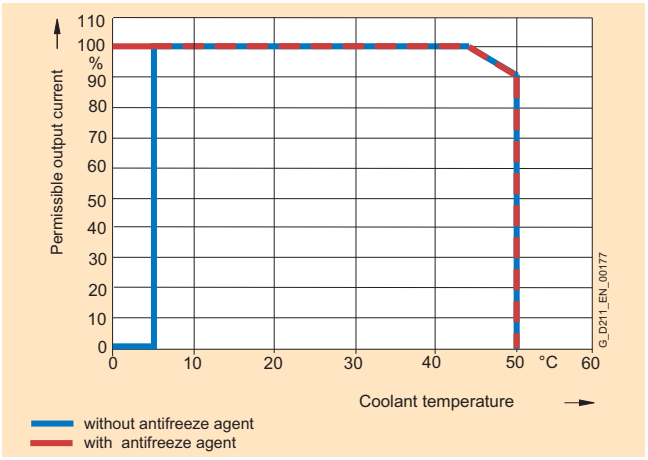
3

Characteristics (continued)

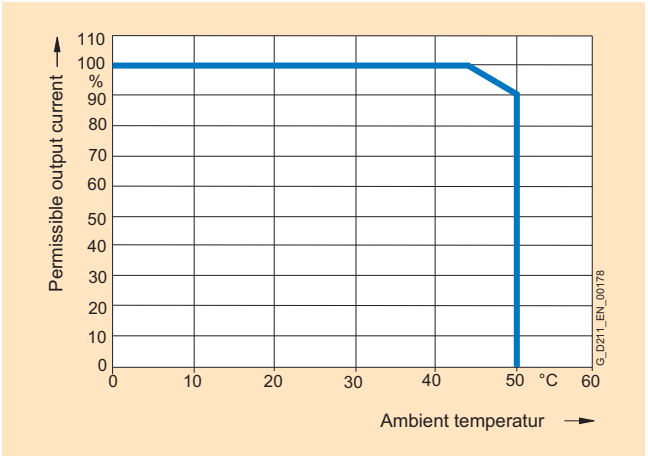
Derating factors

Output current dependent on pulse frequency

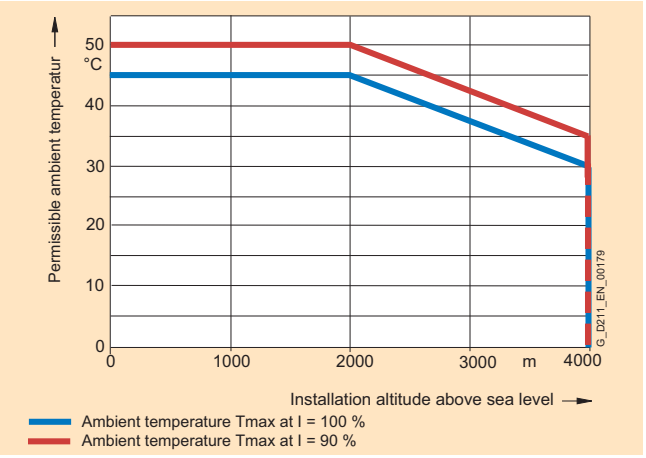
Liquid-cooled Power Modules in chassis format	Rated output current	**Derating factor**	
Type	A	for a pulse frequency of 2.5 kHz	for a pulse frequency of 4 kHz
6SL3315-1TE32-1AA0	210	0.95	0.82
6SL3315-1TE32-6AA0	260	0.95	0.83
6SL3315-1TE33-1AA0	310	0.97	0.88
6SL3315-1TE35-0AA0	490	0.94	0.78



Current derating dependent on temperature of the cooling liquid

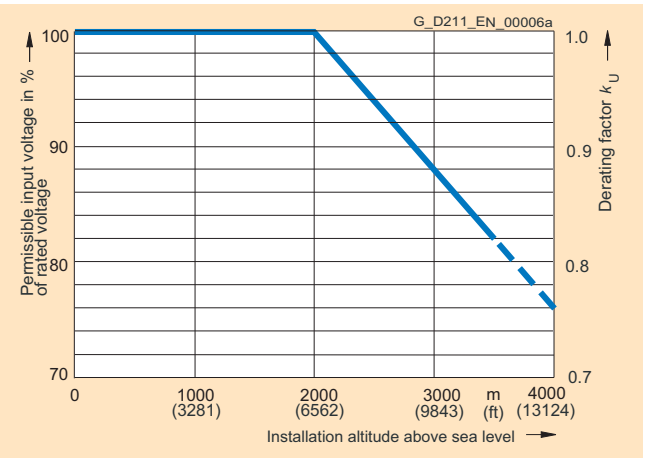


Current derating dependent on ambient temperature



Current derating dependent on installation altitude

Note: For installation altitudes over 2000 m (6562 ft), current derating is required due to the power losses internally transferred to the ambient air. Current derating is not necessary when an additional external fan is used for ventilation.



Voltage derating dependent on installation altitude

Overview

Basic Line Modules in booksize format

A Basic Line Module converts an AC source into an unregulated DC voltage equal to 1.35 x the line voltage. Basic Line Modules are used for applications in which no energy is returned to the supply or where the energy exchange between motoring and generating axes takes place in the DC link. Basic Line Modules can only feed energy from the supply system into the DC link, energy cannot be fed back into the supply system. Basic Line Modules are designed for connection to grounded-neutral (TN, TT) and non-grounded (IT) supply systems. The connected Motor Modules are pre-charged over the integrated pre-charging resistors (20 kW and 40 kW) or through activation of the thyristors (100 kW).

The 20 kW and 40 kW Basic Line Modules are equipped with an integrated brake chopper. With the addition of an external braking resistor, they can be used for applications with intermittent regenerative operation such as stopping.
A Braking Module is required with a 100 kW Basic Line Module in addition to an external braking resistor for regenerative operation.

Design

The Basic Line Modules in booksize format feature the following connections and interfaces as standard:

- 1 line connection
- 1 connection for the 24 V DC electronic power supply
- 1 DC link connection
- 3 DRIVE-CLiQ sockets
- 1 connection for braking resistor
  (20 kW and 40 kW Basic Line Modules only)
- 1 temperature sensor input

The status of the Basic Line Modules is indicated via two multi-color LEDs.

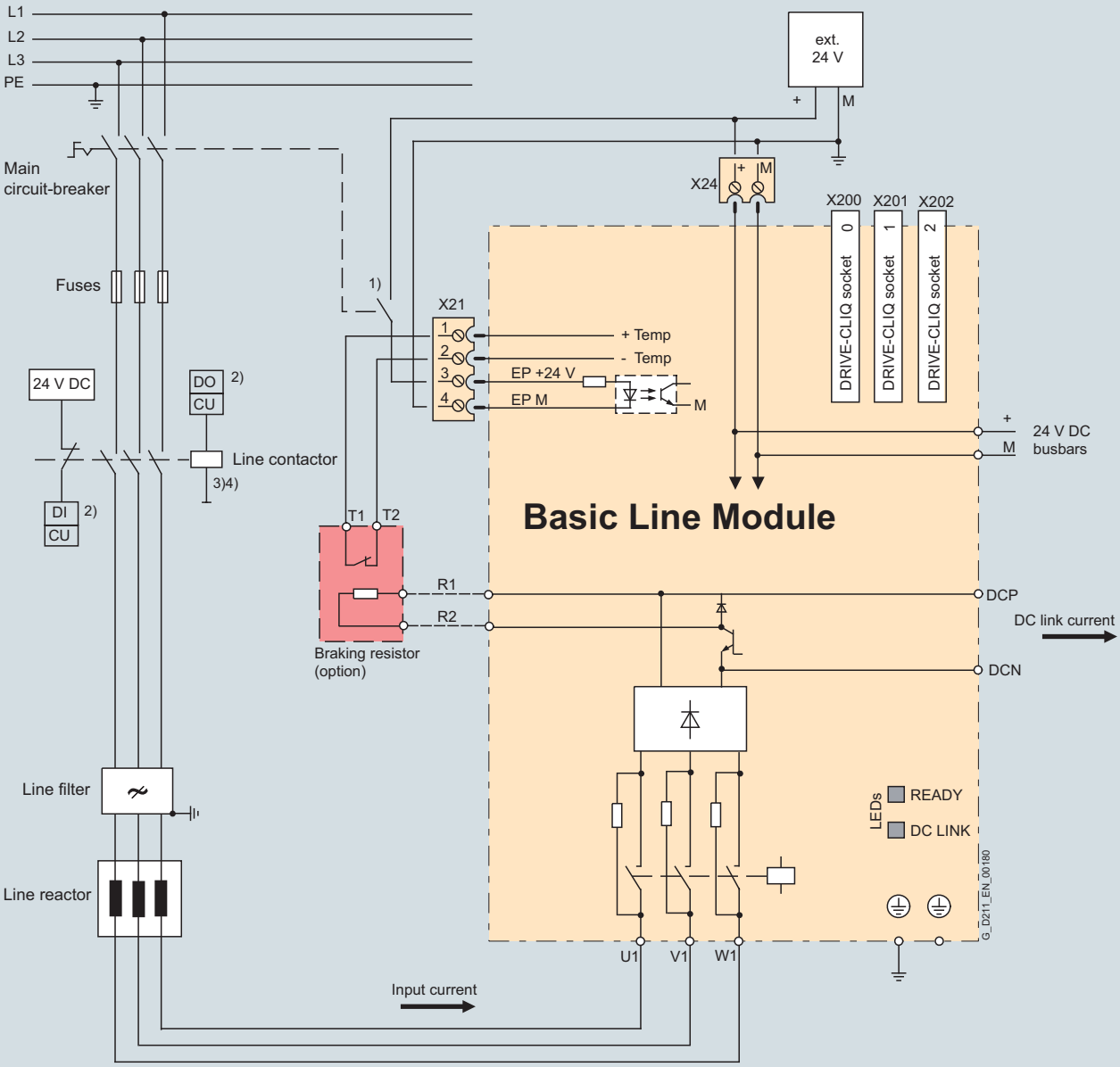
The scope of supply of the Basic Line Modules includes:

- DRIVE-CLiQ cable for connection to the Control Unit when mounted on the immediate left
- DRIVE-CLiQ cable (length depends on module width) to connect Basic Line Module to adjacent Motor Module
- Jumper for connecting the 24 V DC busbar to the adjacent Motor Module
- 24 V terminal adapter (X24)
- Connector X21
- 2 blanking plugs for sealing unused DRIVE-CLiQ sockets
- 1 set of warning signs in foreign languages
- 1 heat conducting foil
  (for Basic Line Modules with cold plate cooling only)

Basic Line Modules in booksize format

Integration

The Basic Line Module communicates with a CU320 or SIMOTION D4x5 Control Unit via DRIVE-CLiQ. A CompactFlash Card with firmware version 2.5 and higher is required for operation of a Basic Line Module.

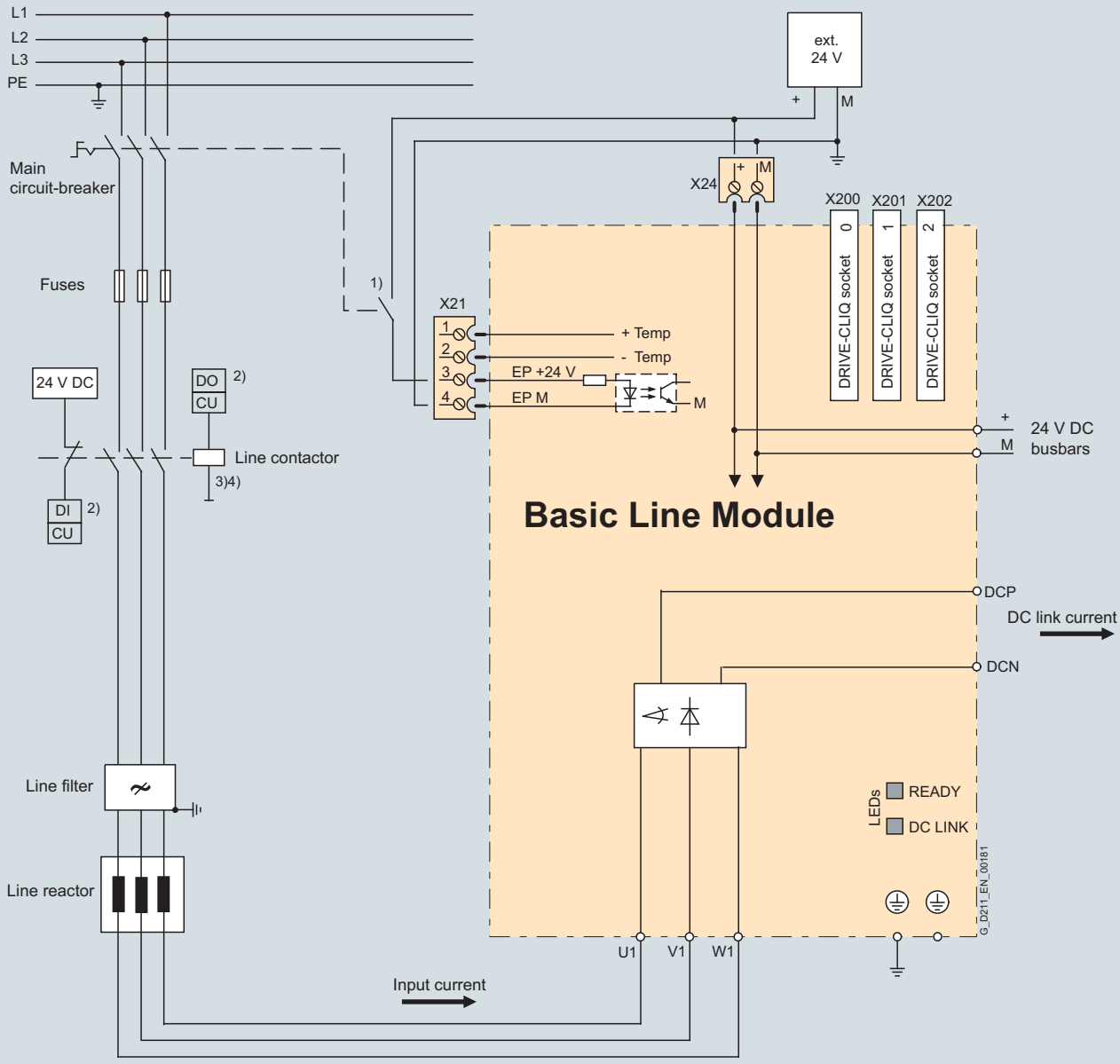


1) For operation, a 24 V DC voltage must be applied between terminals “EP +24 V” and “EP M”
2) Digital input (DI) or digital output (DO), controlled by the Control Unit.
3) No additional load permitted downstream of the line contactor.
4) The current carrying capacity of the digital output (DO) must be taken into account; an output interface element may have to be used.

Typical connection for 20 kW and 40 kW Basic Line Modules in booksize format

Note: The thermostatic switch built into the braking resistor must be looped into the shutdown chain of the drive to prevent thermal overloading of the system in the event of a fault. If a braking resistor is not connected, a jumper must be connected between X21.1 and X21.2.

Integration (continued)



1) For operation, a 24 V DC voltage must be applied between terminals “EP +24 V” and “EP M”
2) Digital input (DI) or digital output (DO), controlled via Control Unit.
3) No additional load permitted downstream of the line contactor.
4) The current carrying capacity of the digital output (DO) must be taken into account; an output interface element may have to be used.

Connection example of 100 kW Basic Line Module in booksize format

Basic Line Modules in booksize format

Technical specifications

General technical specifications	
Electrical data	
Line connection voltage (up to 2000 m (6562 ft) above sea level)	380 ... 480 V 3 AC ±10 % (-15 % < 1 min) [1]
Line frequency	47 … 63 Hz
Line Power factor at rated power	
• Fundamental Power Factor (cos φ_1)	> 0.96
• Total (λ)	0.75 … 0.93
Overvoltage category to EN 60664-1	Class III
DC link voltage, approx.	1.35 x line voltage [2]
Electronic power supply	24 V DC, -15 %/+20 %
Radio Interference suppression	
• Standard	
- 20 kW and 40 kW Basic Line Modules	No interference suppression
- 100 kW Basic Line Module	Category C3 according to EN 61800-3 up to 350 m (1148 ft) total cable length (shielded)
• With line filter	Category C2 according to EN 61800-3 up to 350 m (1148 ft) total cable length (shielded)
Ambient conditions	
Type of cooling	- Internal air cooling, power units with forced air cooling through a built-in fan - Cold plate cooling
Permissible ambient and coolant temperature (air) during operation for line-side components, Line Modules and Motor Modules	0 … 40 °C (32 … 104 °F) without derating, > 40 … 55 °C (104 … 131 °F) see derating characteristics
Site altitude	Up to 1000 m (3281 ft) above sea level without derating, > 1000 ... 4000 m (3281 ... 13124 ft) above sea level see derating characteristics
Certificates	
Conformity	CE (low-voltage and EMC Directives)
Approvals	cULus (File No. E192450)

1) Can also be operated on supply systems with 200 ... 240 V 3 AC ±10 % with appropriate parameterization and reduced power rating.

2) The DC link voltage is unregulated and load-dependent. For further information see System description.

Technical specifications (continued)

Line voltage 380 ... 480 V 3 AC Internal air cooling Cold plate cooling		Basic Line Modules in booksize format 6SL3130-1TE22-0AA0 6SL3136-1TE22-0AA0	 6SL3130-1TE24-0AA0 6SL3136-1TE24-0AA0	 6SL3130-1TE31-0AA0 6SL3136-1TE31-0AA0
Rated power				
• Rated power P_{rated}				
- With 380 V 3 AC	kW	20	40	100
- With 460 V 3 AC [2]	(HP)	(25)	(50)	(125)
• For S6 duty (40 %) P_{S6}	kW	26	52	130
• P_{max}	kW	60	120	175
Braking power with external braking resistor				
• $P_{Bmax.}$ (=2 × P_{rated})	kW	40	80	–
• Continuous braking power P_d (= 0.25 × P_n)	kW	5	10	–
DC link current				
• At 600 V DC	A	34	67	167
• For S6 duty (40 %)	A	43	87	217
• Maximum	A	100	200	292
Input current				
• Rated current at 380 V 3 AC	A	35	69	172
• Maximum	A	113	208	301
Activation threshold Braking module	V	774	774	–
Resistance value of the external braking resistor	Ω	≥ 14.8	≥ 7.4	–
Cable length to braking resistor, max.	m (ft)	15 (50)	15 (50)	–
Connection for braking resistor (X2)		Screw-type terminals	Screw-type terminals	–
• Conductor cross-section, max.	mm^2	0.5 … 4	0.5 … 10	
Current requirement 24 V DC electronic power supply, max.	A	1	1.4	2
Current carrying capacity				
• 24 V DC busbars	A	20	20	20
• DC link busbars	A	100	200	200
DC link capacitance				
• Basic Line Module	µF	940	1880	4100
• Drive line-up, max.	µF	20000	20000	50000
Internal air cooling				
• Power loss [1]	W	144	284	628
• Cooling air requirement	m^3/s (ft^3/s)	0.016 (0.6)	0.031 (1.1)	0.05 (1.8)
• Sound pressure level L_{pA} (1 m)	dB	< 60	< 65	< 65
Cold plate cooling				
• Power loss, int./ext. [1]	W	47/95	71/205	168/450
• Thermal resistance R_{th}	K/W	0.075	0.05	0.045
Line connection U1, V1, W1		Screw-type terminals	Screw-type terminals	M8 screw stud
• Conductor cross-section, max.	mm^2	0.5 … 16	10 … 50	1 × 35 … 120 or 2 × 50
Shield connection		Integrated into the power plug	see Accessories	see Accessories
PE connection		M5 screw	M6 screw	M6 screw
Cable length, max. (total of all motor cables and DC link)				
• Shielded/Unshielded	m (ft)	630 (2067)/850 (2789)	630 (2067)/850 (2789)	1000 (3281)/1500 (4922)
Degree of protection		IP20	IP20	IP20
Dimensions				
• Width	mm (in)	100 (3.94)	150 (5.91)	200 (7.87)
• Height	mm (in)	380 (14.96)	380 (14.96)	380 (14.96)
• Depth				
- With internal air cooling	mm (in)	270 (10.93)	270 (10.93)	270 (10.93)
- With cold plate cooling	mm (in)	226 (8.90)	226 (8.90)	226 (8.90)
Weight, approx.				
- With internal air cooling	kg (lb)	6.8 (15.0)	11.3 (24.9)	15.8 (34.8)
- With cold plate cooling	kg (lb)	6.4 (14.1)	10.9 (24.0)	16.4 (36.2)

[1] Power loss of Basic Line Module at rated output including losses of 24 V DC electronics power supply.

[2] Nominal HP ratings are provided for ease of assigning components only. The Line Module outputs are dependent on the Motor Module loading and are to be dimensioned accordingly.

Basic Line Modules in booksize format

Selection and ordering data

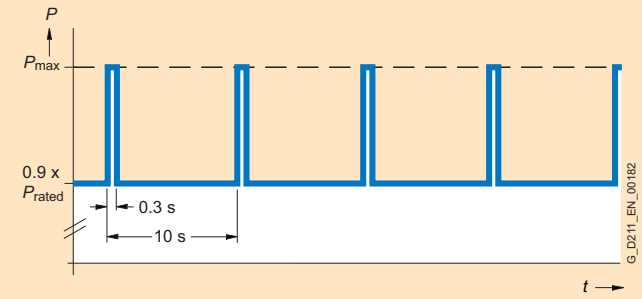
Rated infeed power	Basic Line Modules in booksize format	
	Internal air cooling	Cold plate cooling
kW (HP)	Order No.	Order No.
Line voltage 380 ... 480 V 3 AC		
20 (25)	**6SL3130-1TE22-0AA0**	**6SL3136-1TE22-0AA0**
40 (50)	**6SL3130-1TE24-0AA0**	**6SL3136-1TE24-0AA0**
100 (125)	**6SL3130-1TE31-0AA0**	**6SL3136-1TE31-0AA0**

Accessories

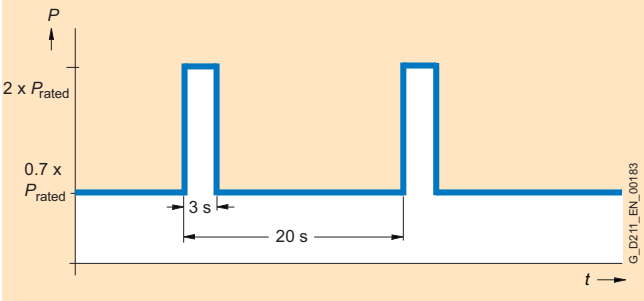
Description	Order No.
Shield connection kit for Line/Motor Modules in booksize format	
• 150 mm (5.91 in) wide for internal air cooling	**6SL3162-1AF00-0AA1**
• 150 mm (5.91 in) wide for cold plate cooling	**6SL3162-1AF00-0BA1**
• 200 mm (7.87 in) wide for internal air cooling	**6SL3162-1AH01-0AA0**
• 200 mm (7.87 in) wide for cold plate cooling	**6SL3162-1AH01-0BA0**
DC link rectifier adapter for direct infeed of DC link voltage	
• Screw-type terminals 0.5 to 10 mm^2 for Line Modules and Motor Modules in booksize format with a width of 50 mm (1.97 in) or 100 mm (3.94 in)	**6SL3162-2BD00-0AA0**
• Screw-type terminals 35 to 95 mm^2 for Line Modules and Motor Modules in booksize format with a width of 150 mm, 200 mm and 300 mm (5.91 in, 7.87 in and 11.81 in)	**6SL3162-2BM00-0AA0**
DC link adapters (2 units) for multi-tier configuration Screw-type terminals 35 to 95 mm^2 for all Line Modules and Motor Modules in booksize format	**6SL3162-2BM01-0AA0**
24 V terminal adapter for all Line Modules and Motor Modules in booksize format	**6SL3162-2AA00-0AA0**
24 V jumper for connection of the 24 V busbars (for booksize format)	**6SL3162-2AA01-0AA0**
Warning signs in foreign languages This set of foreign language warning signs can be placed on top of the German or English signs. One set of labels is supplied with the devices. The following languages are available in each label set: Chinese Simplified, Danish, Dutch, Finnish, French, Greek, Italian, Japanese, Korean, Polish, Portuguese/Brazilian, Russian, Swedish, Spanish, Czech, Turkish	**6SL3166-3AB00-0AA0**

Characteristics

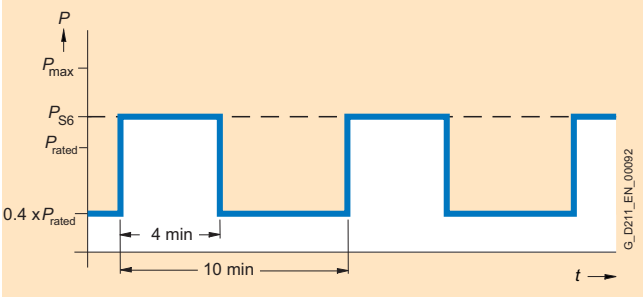
Overload capability



Load cycle with previous load

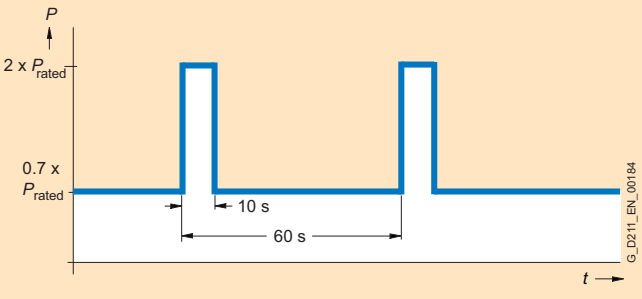


Load cycle with previous load



S6 load cycle with previous load

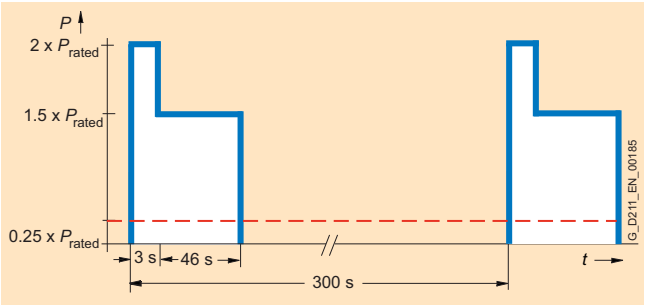
20 kW and 40 kW Basic Line Modules only



Load cycle with previous load

Braking power with external brake resistance

The following load cycles are defined for the braking modules of the 20 kW and 40 kW Basic Line Modules:



The maximum possible braking power P_{max} is calculated using the following formula:

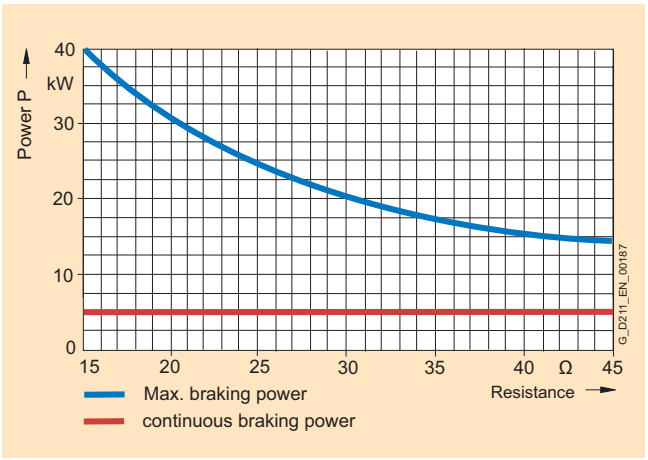
$P_{max} = V^2/R$

V = Activation threshold

R = Resistance value of the external braking resistor

The maximum braking power is achieved with the smallest permissible resistance value. The maximum possible braking power falls at larger resistance values.

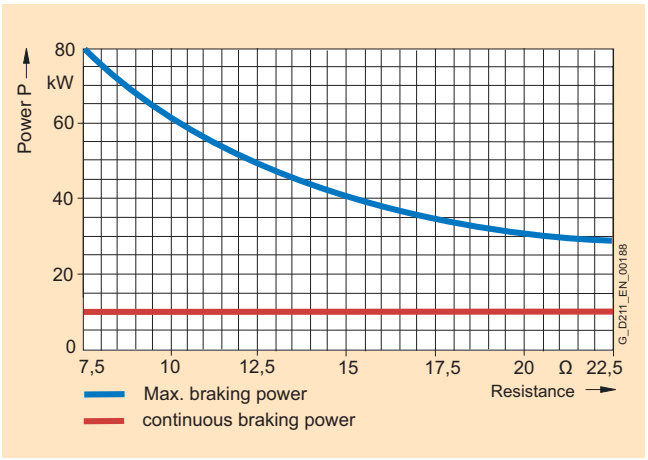
Characteristics (continued)



Braking power of the 20 kW Basic Line Modules depending on the connected braking resistor

When the recommended braking resistor is used, the following values result for the maximum braking power or continuous braking power:

Braking resistor 6SE7023-2ES87-2DC0
Resistance value = 20 Ω → max. braking power = 30 kW; continuous braking power = 5 kW

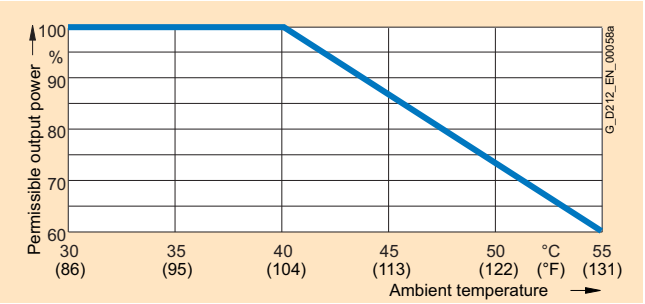


Braking power of the 40 kW Basic Line Modules depending on the connected braking resistor

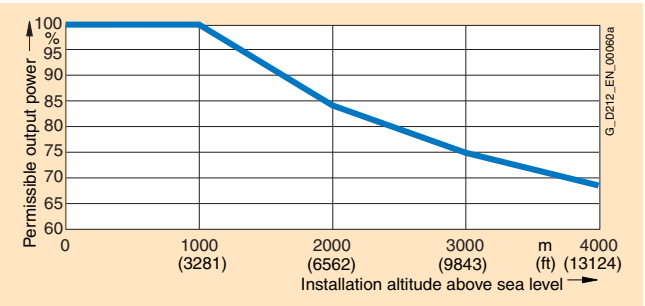
When the recommended braking resistor is used, the following values result for the maximum braking power or continuous braking power:

Braking resistor 6SE7028-0ES87-2DC0
Resistance value = 8 Ω → max. braking power = 75 kW; continuous braking power = 10 kW (limited by braking module)

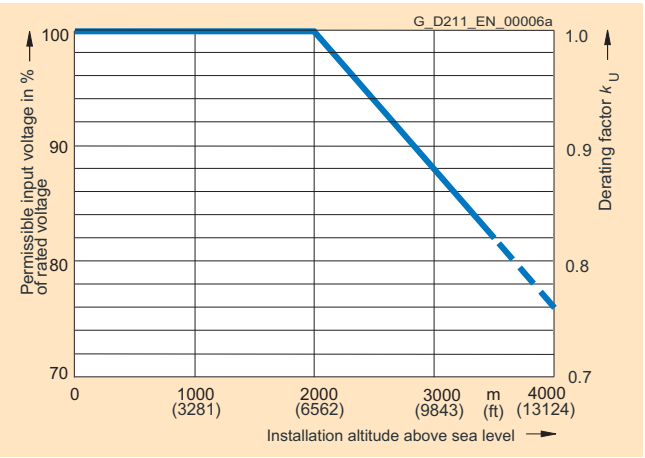
Derating characteristics



Output power dependent on ambient temperature



Output power dependent on installation altitude



Voltage derating dependent on installation altitude

Overview

20 kW and 100 kW line reactors

Line reactors limit the low-frequency harmonic effects and reduce the load on the rectifiers of the Basic Line Module.

Selection and ordering data

Rated power of the Basic Line Module	Suitable for Basic Line Module in booksize format	**Line reactor**
kW (HP)		Order No.
Line voltage 380 ... 480 V 3 AC		
20 (25)	6SL3130-1TE22-0AA0 6SL3136-1TE22-0AA0	**6SL3000-0CE22-0AA0**
40 (50)	6SL3130-1TE24-0AA0 6SL3136-1TE24-0AA0	**6SL3000-0CE24-0AA0**
100 (125)	6SL3130-1TE31-0AA0 6SL3136-1TE31-0AA0	**6SL3000-0CE31-0AA0**

Technical specifications

Line voltage 380 ... 480 V 3 AC		**Line reactor 6SL3000-0CE22-0AA0**	**6SL3000-0CE24-0AA0**	**6SL3000-0CE31-0AA0**
Rated current	A	37	74	185
Power loss at 50/60 Hz	W	130/154	270/320	480/565
Line/load connection		Screw-type terminals	Screw-type terminals	Flat connector for M8 screw
• Conductor cross-section	mm^2	0.5 … 16	2.5 … 35	–
Degree of protection		IP20	IP20	IP00
Dimensions				
• Width	mm (in)	178 (7.01)	210 (8.27)	261 (10.28)
• Height	mm (in)	165 (6.50)	245 (9.65)	228 (8.98)
• Depth	mm (in)	100 (3.94)	93 (3.66)	137 (5.39)
Weight, approx.	kg (lb)	5.2 (11.5)	11.2 (25)	21.7 (50)
Approvals		cURus	cURus	cURus
Suitable for Basic Line Module in booksize format	Type	6SL3130-1TE22-0AA0 6SL3136-1TE22-0AA0	6SL3130-1TE24-0AA0 6SL3136-1TE24-0AA0	6SL3130-1TE31-0AA0 6SL3136-1TE31-0AA0
• Rated power of the Basic Line Module	kW (HP)	20 (25)	40 (50)	100 (125)

Basic Line Modules in booksize format
Line filters

Overview

In plants with strict EMC requirements, line filters work together with line reactors to restrict the conducted interference emanating from the Power Modules to the limit values of Class A1 as defined in EN 55011 and Category C2 as defined in EN 61800-3. Line filters are suited only for direct connection to TN (grounded) systems.

Selection and ordering data

Rated power of the Basic Line Module	Suitable for Basic Line Module in booksize format	**Line filter**
kW (HP)		Order No.
Line voltage 380 ... 480 V 3 AC		
20 (25)	6SL3130-1TE22-0AA0 6SL3136-1TE22-0AA0	**6SL3000-0BE21-6DA0**
40 (50)	6SL3130-1TE24-0AA0 6SL3136-1TE24-0AA0	**6SL3000-0BE23-6DA1**
100 (125)	6SL3130-1TE31-0AA0 6SL3136-1TE31-0AA0	**6SL3000-0BE31-2DA0**

Technical specifications

Line voltage 380 ... 480 V 3 AC		**Line filter 6SL3000-0BE21-6DA0**	**6SL3000-0BE23-6DA1**	**6SL3000-0BE31-2DA0**
Rated current	A	36	74	192
Power loss	W	6	20	90
Line/load connection L1, L2, L3 / U, V, W		Screw-type terminals	Screw-type terminals	Screw-type terminals
• Conductor cross-section	mm^2	10	35	95
PE connection		M6 screw stud	M6 screw stud	M10 screw stud
Degree of protection		IP20	IP20	IP20
Dimensions				
• Width	mm (in)	50 (1.97)	75 (2.95)	150 (5.91)
• Height	mm (in)	429 (16.89)	433 (17.05)	479 (18.86)
• Depth	mm (in)	226 (8.90)	226 (8.90)	226 (8.90)
Weight, approx.	kg (lb)	5 (11.0)	7.5 (16.5)	18.8 (41.5)
Approvals		cURus	cURus available soon	cURus available soon
Suitable for Basic Line Module in booksize format	Type	6SL3130-1TE22-0AA0 6SL3136-1TE22-0AA0	6SL3130-1TE24-0AA0 6SL3136-1TE24-0AA0	6SL3130-1TE31-0AA0 6SL3136-1TE31-0AA0
• Rated power of the Basic Line Module	kW (HP)	20 (25)	40 (50)	100 (125)

Overview

Suitable line-side power components are assigned depending on the power rating of the Basic Line Module.

The tables below list recommended components.

Further information about the line contactors, switch disconnectors, fuses and circuit-breakers specified in the tables can be found in Catalogs LV 1, LV 1T and ET B1.

Assignment of line-side power components to Basic Line Modules in booksize format

Rated infeed power	Assignment to Basic Line Module in booksize format	**Line contactor**	**Output coupling device for line contactor**	**Main switch**
kW (HP)	Types 6SL3130- and 6SL3136-	Type	Order No.	Order No.
Line voltage 380 ... 480 V 3 AC				
20 (25)	1TE22-0AA0	**3RT1035-...**	**3TX7004-1LB00**	**3LD2504-0TK51**
40 (50)	1TE24-0AA0	**3RT1045-...**	**3TX7004-1LB00**	**3LD2704-0TK51**
100 (125)	1TE31-0AA0	**3RT1056-...**	**3TX7004-1LB00**	**3KA5530-1EE01**

Rated infeed power	Assignment to Basic Line Module in booksize format	**Circuit-breaker IEC 60947**	**Circuit-breaker UL489/CSA C22.2 No. 5-02**	**Fuse switch disconnector**
kW (HP)	Types 6SL3130- and 6SL3136-	Order No.	Order No.	Order No.
Line voltage 380 ... 480 V 3 AC				
20 (25)	1TE22-0AA0	**3RV1042-4MA10**	**–**	**3NP4010-0CH01**
40 (50)	1TE24-0AA0	**3VL1710-1DD33-0AA0**	**3VL2110-3KN30-0AA0**	**3NP4010-0CH01**
100 (125)	1TE31-0AA0	**3RV3725-1DC36-0AA0**	**3VL3125-3KN30-0AA0**	**3NP4270-0CA01**

Rated infeed power	Assignment to Basic Line Module in booksize format	**Switch disconnector with fuse holders**	**LV HRC fuse (gL/gG)**			**UL/CSA fuse, Class J** [1] **Available from: Ferraz Shawmut http://www.ferrazshawmut.com**		
kW (HP)	Types 6SL3130- and 6SL3136-	Order No.	Order No.	Rated current	Size	Reference No.	Rated current	Size
Line voltage 380 ... 480 V 3 AC								
20 (25)	1TE22-0AA0	**3KL5230-1EB01**	**3NA3824**	80 A	000	AJT80	80 A	29 × 117
40 (50)	1TE24-0AA0	**3KL5230-1EB01**	**3NA3830**	100 A	000	AJT100	100 A	29 × 117
100 (125)	1TE31-0AA0	**3KL5530-1EB01**	**3NA3144**	250 A	1	AJT250	250 A	54 × 181

[1] Not for use in 3NP and 3KL disconnectors.

Basic Line Modules in chassis format

Overview

A Basic Line Module converts an AC source into an unregulated DC supply. Basic Line Modules are used for applications in which no energy is returned to the supply or where the energy exchange between motoring and generating axes takes place in the DC link. The connected Motor Modules are precharged via the thyristor gate control. The thyristors are always fired at a delay angle of 0° in operation. Basic Line Modules are designed for connection to grounded-neutral (TN, TT) and non-grounded (IT) supply systems.

In a Basic Line Module in chassis format, a Braking Module of the corresponding frame size can be installed to support generating mode of the drive system in combination with an external braking resistor.

Design

The Basic Line Modules in chassis format feature the following connections as standard:

- 1 power connection
- 1 connection for the 24 V DC electronic power supply
- 1 DC link connection (DCP, DCN) for supplying the connected Motor Modules
- 1 DC link connection (DCPA, DCNA) for connecting a Braking Module
- 3 DRIVE-CLiQ sockets

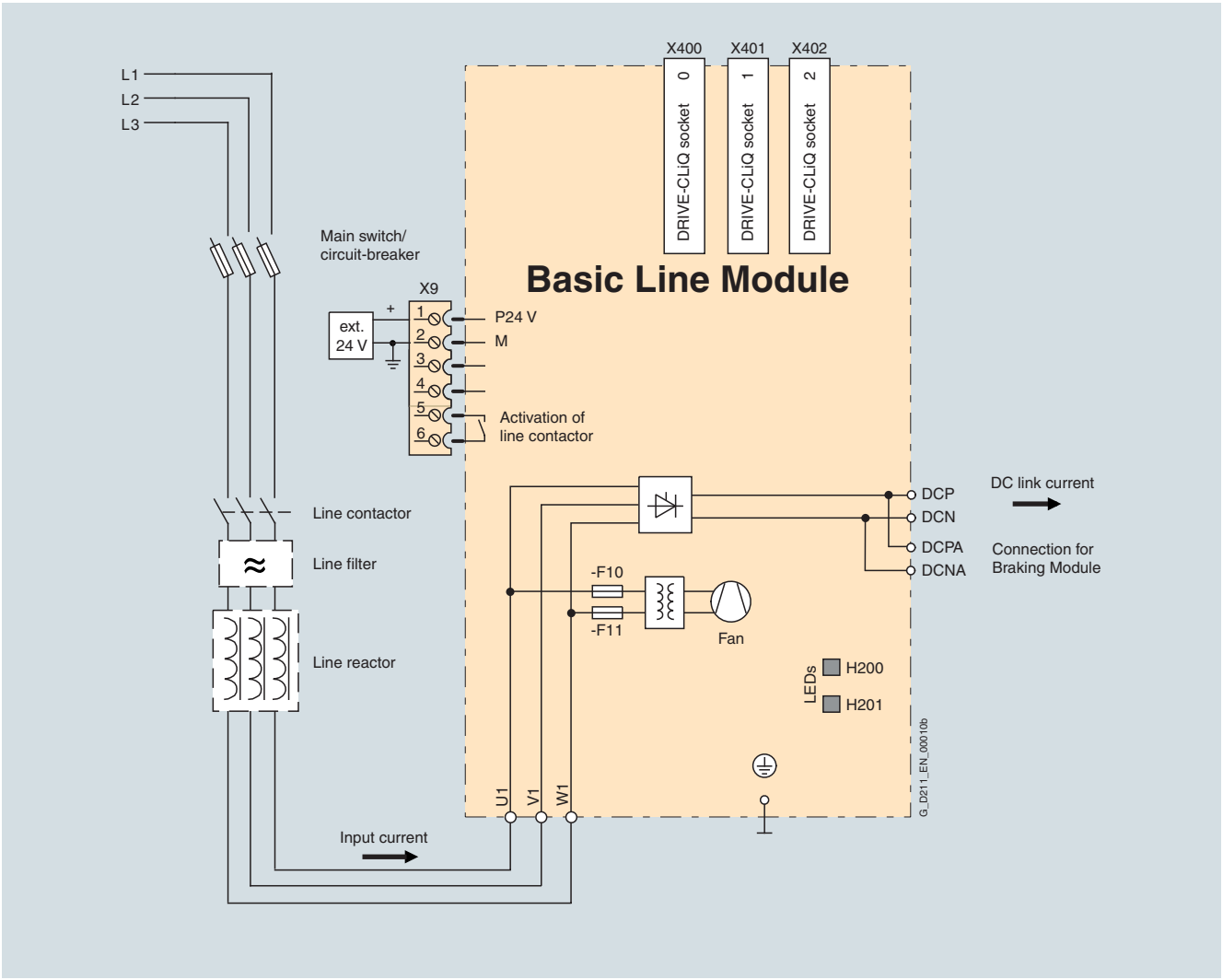
The status of the Basic Line Modules is indicated via two multi-color LEDs.

The scope of supply of the Basic Line Modules includes:

- 0.6 m (1.97 ft) DRIVE-CLiQ cable for connection to a CU320 or SIMOTION D4x5 Control Unit
- 1.45 m (4.76 ft) DRIVE-CLiQ cable for connection between the Control Unit and first Motor Module

Integration

The Basic Line Module communicates with a CU320 or SIMOTION D4x5 Control Unit via DRIVE-CLiQ.



Connection example of Basic Line Module in chassis format

Basic Line Modules in chassis format

Technical specifications

General technical specifications	
Electrical data	
Line connection voltage (up to 2000 m (6562 ft) above sea level)	380 V ... 480 V 3 AC ± 10 % (-15 % < 1 min) or 500 V ... 690 V 3 AC ± 10 % (-15 % < 1 min)
Line frequency	47 … 63 Hz
Line Power factor at rated power	
• Fundamental Power factor (cos φ_1)	> 0.96
• Total (λ)	0.75 … 0.93
Overvoltage category to EN 60664-1	Class III
DC link voltage, approx.	1.35 x line voltage [1)]
Electronics power supply	24 V DC, -15 %/+20 %
Line contactor control	
• Terminal strip X9/5-6	240 V AC/max. 8 A 30 V DC/max. 1 A
Radio Interference suppression	
• Standard	Category C3 to EN 61800-3 up to 300 m (984 ft) total cable length
• With line filter	Category C2 to EN 61800-3
Ambient conditions	
Type of cooling	Internal air cooling, power units with forced air cooling through a built-in fan
Permissible ambient and coolant temperature (air) during operation for line-side components, Line Modules and Motor Modules	0 … 40 °C (32 … 104 °F) without derating, > 40 … 55 °C (104 … 131 °F), see derating characteristics
Site altitude	Up to 2000 m (6562 ft) above sea level without derating, > 2000 ... 4000 m (6562 ... 13124 ft) above sea level see derating characteristics
Certificates	
Conformity	CE (low-voltage and EMC Directives)
Approvals	cULus (File No.: E192450) only for devices on line voltages 380 ... 480 V 3 AC and 500 ... 600 V 3 AC

1) The DC link voltage is unregulated and load-dependent. For further information see System description.

Technical specifications (continued)

Line voltage 380 ... 480 V 3 AC		Basic Line Modules in chassis format 6SL3330-1TE34-2AA0	6SL3330-1TE35-3AA0	6SL3330-1TE38-2AA0	6SL3330-1TE41-2AA0	6SL3330-1TE41-5AA0
Infeed power						
• Rated power P_{rated} - With 400 V 3 AC - With 460 V 3 AC [1]	kW (HP)	200 (300)	250 (400)	400 (600)	560 (800)	710 (1000)
• P_{max}	kW (HP)	300 (402)	375 (503)	600 (805)	840 (1126)	1065 (1428)
DC link current						
• Rated current I_{rated_DC}	A	420	530	820	1200	1500
• Base-load current I_{H_DC}	A	328	413	640	936	1170
• I_{max_DC}	A	630	795	1230	1800	2250
Input current						
• At V_{line} = 400 V	A	365	460	710	1010	1265
• Maximum	A	547	690	1065	1515	1897
Current requirement 24 V DC electronics power supply, max.	A	1.1	1.1	1.1	1.1	1.1
DC link capacitance						
• Basic Line Module	µF	7200	9600	14600	23200	29000
• Drive line-up, max.	µF	57600	76800	116800	185600	232000
Power loss, max.	kW	1.9	2.1	3.2	4.6	5.5
Cooling air requirement	m^3/s (ft^3/s)	0.17 (6.0)	0.17 (6.0)	0.17 (6.0)	0.36 (12.7)	0.36 (12.7)
Sound pressure level L_{pA} (1 m) at 50/60 Hz	dB	66/68	66/68	66/68	71/73	71/73
Line connection U1, V1, W1		Flat connector for M10 screw	Flat connector for M10 screw	Flat connector for M10 screw	Flat connector for M12 screw	Flat connector for M12 screw
• Conductor cross-section, max.	mm^2	2 × 240	2 × 240	2 × 240	6 × 185	6 × 185
DC link connection DCP, DCN		Flat connector for M10 screw	Flat connector for M10 screw	Flat connector for M10 screw	Flat connector for M12 screw	Flat connector for M12 screw
• Conductor cross-section, max.	mm^2	2 × 240	2 × 240	2 × 240	6 × 185	6 × 185
PE connection		M10 screw	M10 screw	M10 screw	M10 screw	M10 screw
• Conductor cross-section, max.	mm^2	2 × 240	2 × 240	2 × 240	4 × 240	4 × 240
Cable length, max. (total of all motor cables and DC link)						
• Shielded	m (ft)	2600 (8531)	2600 (8531)	2600 (8531)	4000 (13124)	4000 (13124)
• Unshielded	m (ft)	3900 (12796)	3900 (12796)	3900 (12796)	6000 (19686)	6000 (19686)
Degree of protection		IP00	IP00	IP00	IP00	IP00
Dimensions						
• Width	mm (in)	310 (12.20)	310 (12.20)	310 (12.20)	310 (12.20)	310 (12.20)
• Height	mm (in)	1164 (45.83)	1164 (45.83)	1164 (45.83)	1653 (65.08)	1653 (65.08)
• Depth	mm (in)	352 (13.86)	352 (13.86)	352 (13.86)	550 (21.65)	550 (21.65)
Frame size		FB	FB	FB	GB	GB
Weight, approx.	kg (lb)	96 (212)	96 (212)	96 (212)	214 (472)	214 (472)

[1] Nominal HP ratings are provided for ease of assigning components only. The Line Module outputs are dependent on the Motor Module loading and are to be dimensioned accordingly.

Technical specifications (continued)

Line voltage 500 ... 690 V 3 AC		Basic Line Modules in chassis format 6SL3330-1TH33-0AA0	6SL3330-1TH34-3AA0	6SL3330-1TH36-8AA0	6SL3330-1TH41-1AA0	6SL3330-1TH41-4AA0
Infeed power						
• Rated power P_{rated} with 690 V 3 AC [1]	kW	**250**	**355**	**560**	**900**	**1100**
• At 500 V 3 AC	kW	180	250	400	650	800
• P_{max} with 690 V 3 AC [1]	kW	375	532.5	840	1350	1650
DC link current						
• Rated current I_{rated_DC}	A	300	430	680	1100	1400
• I_{H_DC}	A	234	335	530	858	1092
• I_{max_DC}	A	450	645	1020	1650	2100
Input current						
• At V_{line} = 690 V	A	260	375	575	925	1180
• Maximum	A	390	562.5	862.5	1387.5	1770
Current requirement 24 V DC electronics power supply, max.	A	1.1	1.1	1.1	1.1	1.1
DC link capacitance						
• Basic Line Module	µF	3200	4800	7300	11600	15470
• Drive line-up, max.	µF	25600	38400	58400	92800	123760
Power loss	kW	1.5	2.1	3.0	5.4	5.8
Cooling air requirement	m^3/s (ft^3/s)	0.17 (6.0)	0.17 (6.0)	0.17 (6.0)	0.36 (12.7)	0.36 (12.7)
Sound pressure level L_{pA} (1 m) at 50/60 Hz	dB(A)	66/68	66/68	66/68	71/73	71/73
Line connection U1, V1, W1		Flat connector for M10 screw	Flat connector for M10 screw	Flat connector for M10 screw	Flat connector for M12 screw	Flat connector for M12 screw
• Conductor cross-section, max.	mm^2	2 × 240	2 × 240	2 × 240	6 × 185	6 × 185
DC link connection DCP, DCN		Flat connector for M10 screw	Flat connector for M10 screw	Flat connector for M10 screw	Flat connector for M12 screw	Flat connector for M12 screw
• Conductor cross-section, max.	mm^2	2 × 240	2 × 240	2 × 240	6 × 185	6 × 185
PE connection		M10 screw	M10 screw	M10 screw	M12 screw	M12 screw
• Conductor cross-section, max.	mm^2	2 × 240	2 × 240	2 × 240	4 × 240	4 × 240
Cable length, max. (total of all motor cables and DC link)						
• Shielded	m (ft)	1500 (4922)	1500 (4922)	1500 (4922)	2250 (7382)	2250 (7382)
• Unshielded	m (ft)	2250 (7382)	2250 (7382)	2250 (7382)	3375 (11073)	3375 (11073)
Degree of protection		IP00	IP00	IP00	IP00	IP00
Dimensions						
• Width	mm (in)	310 (12.20)	310 (12.20)	310 (12.20)	310 (12.20)	310 (12.20)
• Height	mm (in)	1164 (45.83)	1164 (45.83)	1164 (45.83)	1653 (65.08)	1653 (65.08)
• Depth	mm (in)	352 (13.86)	352 (13.86)	352 (13.86)	550 (21.65)	550 (21.65)
Frame size		FB	FB	FB	GB	GB
Weight, approx.	kg (lb)	96 (212)	96 (212)	96 (212)	214 (472)	214 (472)

[1] The infeed power is proportional to the line voltage. With 500 V 3 AC, the power is reduced by a factor of 690/500 = 1.38.

Selection and ordering data

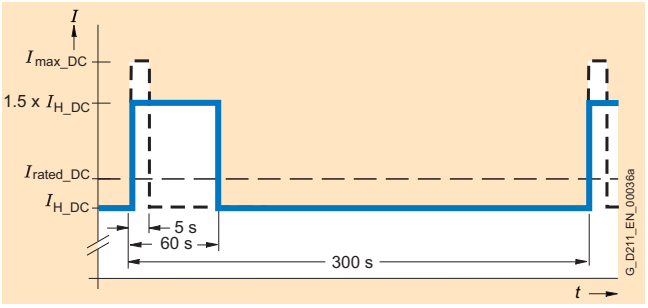
Rated power kW (HP)	Basic Line Module in chassis format Order No.
Line voltage 380 ... 480 V 3 AC	
200 (300)	**6SL3330-1TE34-2AA0**
250 (400)	**6SL3330-1TE35-3AA0**
400 (600)	**6SL3330-1TE38-2AA0**
560 (800)	**6SL3330-1TE41-2AA0**
710 (1000)	**6SL3330-1TE41-5AA0**
Line voltage 500 ... 690 V 3 AC	
250	**6SL3330-1TH33-0AA0**
355	**6SL3330-1TH34-3AA0**
560	**6SL3330-1TH36-8AA0**
900	**6SL3330-1TH41-1AA0**
1100	**6SL3330-1TH41-4AA0**

Accessories

Description	Order No.
Warning signs in foreign languages This set of foreign language warning signs can be placed on top of the German or English sings. One set of labels is supplied with the devices. The following languages are available in each label set: Chinese Simplified, Danish, Dutch, Finnish, French, Greek, Italian, Japanese Korean, Polish, Portuguese/ Brazilian, Russian, Swedish, Spanish, Czech, Turkish	**6SL3166-3AB00-0AA0**

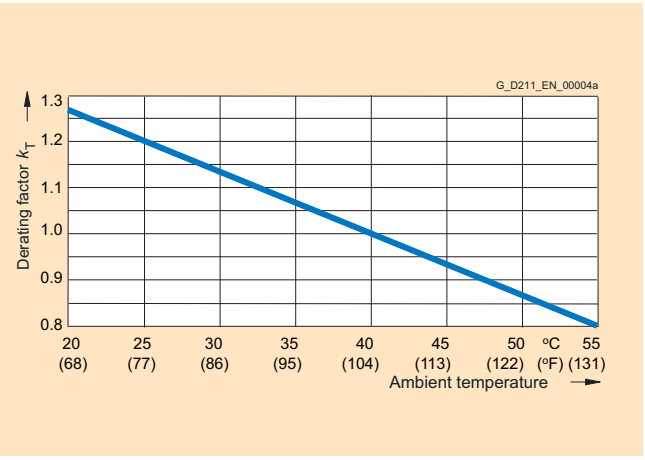
Characteristics

Overload capability



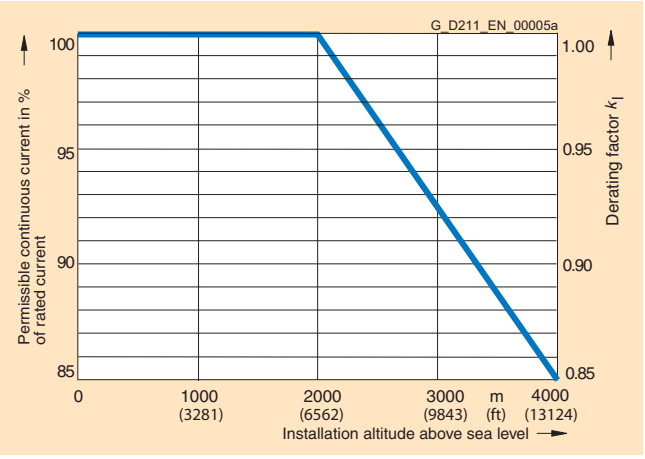
Overload capability

Derating characteristics

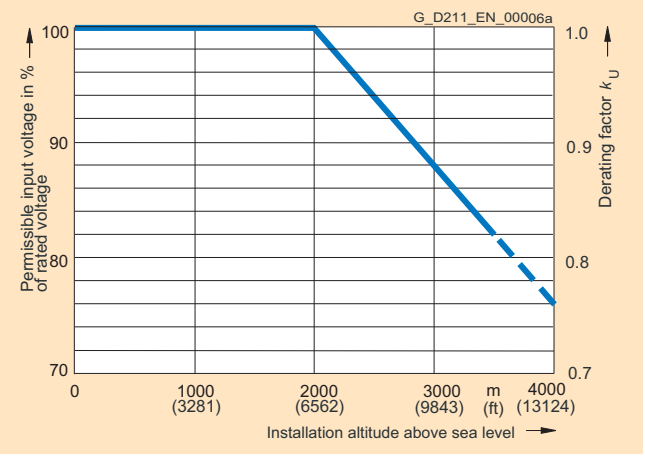


Current derating dependent on ambient temperature

Note: A derating factor k_T > 1.0 is to be taken into account only in conjunction with "current derating dependent on installation altitude". See also System description.



Current derating dependent on installation altitude



Voltage derating dependent on installation altitude

Basic Line Modules in chassis format
Line reactors

Overview

Line reactors reduce harmonic currents on the supply system and limit commutating dips in the Basic Line Module. For this reason, line reactors should always be used.

Selection and ordering data

Infeed power of the Basic Line Module	Suitable for Basic Line Module in chassis format	**Line reactor**
kW (HP)		Order No.
Line voltage 380 ... 480 V 3 AC		
200 (300)	6SL3330-1TE34-2AA0	**6SL3000-0CE35-1AA0**
250 (400)	6SL3330-1TE35-3AA0	
400 (600)	6SL3330-1TE38-2AA0	**6SL3000-0CE37-7AA0**
560 (800)	6SL3330-1TE41-2AA0	**6SL3000-0CE41-0AA0**
710 (1000)	6SL3330-1TE41-5AA0	**6SL3000-0CE41-5AA0**
Line voltage 500 ... 690 V 3 AC		
250	6SL3330-1TH33-0AA0	**6SL3000-0CH32-7AA0**
355	6SL3330-1TH34-3AA0	**6SL3000-0CH34-8AA0**
560	6SL3330-1TH36-8AA0	**6SL3000-0CH36-0AA0**
900	6SL3330-1TH41-1AA0	**6SL3000-0CH41-2AA0**
1100	6SL3330-1TH41-4AA0	

Technical specifications

Line voltage 380 ... 480 V 3 AC		Line reactor 6SL3000-0CE35-1AA0		6SL3000-0CE37-7AA0	6SL3000-0CE41-0AA0	6SL3000-0CE41-5AA0
Thermal current $I_{th\ max}$	A	508	508	773	1022	1485
Power loss at 50/60 Hz	kW	0.292/0.328	0.323/0.365	0.310/0.351	0.441/0.498	0.687/0.776
Line/load connection		Flat connector for M12 screw	Flat connector for M12 screw	Flat connector for M12 screw	Flat connector for M12 screw	Flat connector for M12 screw
Degree of protection		IP00	IP00	IP00	IP00	IP00
Dimensions						
• Width	mm (in)	300 (11.81)	300 (11.81)	300 (11.81)	350 (13.78)	460 (18.11)
• Height	mm (in)	269 (10.59)	269 (10.59)	269 (10.59)	321 (12.64)	435 (17.13)
• Depth	mm (in)	212.5 (8.37)	212.5 (8.37)	212.5 (8.37)	211.5 (8.33)	235 (9.25)
Weight, approx.	kg (lb)	38.0 (84)	38.0 (84)	51.3 (113)	69.6 (153)	118 (260)
Approvals		cURus	cURus	cURus	cURus	cURus
Suitable for Basic Line Module in chassis format	Type	6SL3330-1TE34-2AA0	6SL3330-1TE35-3AA0	6SL3330-1TE38-2AA0	6SL3330-1TE41-2AA0	6SL3330-1TE41-5AA0
• Rated power of the Basic Line Module	kW (HP)	200 (300)	250 (400)	400 (600)	560 (800)	710 (1000)

Line voltage 500 ... 690 V 3 AC		Line reactor 6SL3000-0CH32-7AA0	6SL3000-0CH34-8AA0	6SL3000-0CH36-0AA0	6SL3000-0CH41-2AA0	
Thermal current $I_{th\ max}$	A	270	482	597	1167	1167
Power loss at 50/60 Hz	kW	0.245/0.277	0.424/0.478	0.430/0.485	0.620/0.697	0.693/0.783
Line/load connection		Flat connector for M10 screw	Flat connector for M12 screw	Flat connector for M12 screw	Flat connector for M12 screw	Flat connector for M12 screw
Degree of protection		IP00	IP00	IP00	IP00	IP00
Dimensions						
• Width	mm (in)	270 (10.63)	350 (13.78)	350 (13.78)	460 (18.11)	460 (18.11)
• Height	mm (in)	248 (9.76)	321 (12.64)	321 (12.64)	435 (17.13)	435 (17.13)
• Depth	mm (in)	200 (7.87)	232.5 (9.15)	232.5 (9.15)	235 (9.25)	235 (9.25)
Weight, approx.	kg (lb)	27.9 (62)	55.6 (123)	63.8 (141)	147 (324)	147 (324)
Approvals [1]		cURus	cURus	cURus	cURus	cURus
Suitable for Basic Line Module in chassis format	Type	6SL3330-1TH33-0AA0	6SL3330-1TH34-3AA0	6SL3330-1TH36-8AA0	6SL3330-1TH41-1AA0	6SL3330-1TH41-4AA0
• Rated power of the Basic Line Module	kW	250	355	560	900	1100

[1] For line voltages up to 600 V 3 AC.

Basic Line Modules in chassis format
Line filters

Overview

In plants with strict EMC requirements, line filters work together with line reactors to restrict the conducted interference emanating from the Power Modules to the limit values of Category C2 as defined in EN 61800-3. Line filters are suited only for direct connection to TN (grounded) systems.

Selection and ordering data

Infeed power of the Basic Line Module kW (HP)	Suitable for Basic Line Module in chassis format	**Line filter** Order No.
Line voltage 380 ... 480 V 3 AC		
200 (300)	6SL3330-1TE34-2AA0	**6SL3000-0BE34-4AA0**
250 (400)	6SL3330-1TE35-3AA0	**6SL3000-0BE36-0AA0**
400 (600)	6SL3330-1TE38-2AA0	**6SL3000-0BE41-2AA0**
560 (800)	6SL3330-1TE41-2AA0	
710 (1000)	6SL3330-1TE41-5AA0	**6SL3000-0BE41-6AA0**
Line voltage 500 ... 690 V 3 AC		
250	6SL3330-1TH33-0AA0	**6SL3000-0BG34-4AA0**
355	6SL3330-1TH34-3AA0	
560	6SL3330-1TH36-8AA0	**6SL3000-0BG36-0AA0**
900	6SL3330-1TH41-1AA0	**6SL3000-0BG41-2AA0**
1100	6SL3330-1TH41-4AA0	

Technical specifications

Line voltage 380 ... 480 V 3 AC		Line filter 6SL3000-0BE34-4AA0	6SL3000-0BE36-0AA0	6SL3000-0BE41-2AA0	6SL3000-0BE41-6AA0
Rated current	A	440	600	1200	1600
Power loss	kW	0.049	0.055	0.137	0.182
Line/load connection L1, L2, L3 / L1', L2', L3'		Flat connector for M10 screw	Flat connector for M10 screw	Flat connector for M12 screw	Flat connector for M12 screw
PE connection		M8 screw stud	M10 screw stud	M10 screw stud	M10 screw stud
Degree of protection		IP00	IP00	IP00	IP00
Dimensions					
• Width	mm (in)	360 (14.17)	400 (15.75)	425 (16.73)	505 (19.88)
• Height	mm (in)	240 (9.45)	265 (10.43)	265 (10.43)	265 (10.43)
• Depth	mm (in)	116 (4.57)	140 (5.51)	145 (5.71)	145 (5.71)
Weight, approx.	kg (lb)	12.3 (27)	19.0 (42)	25.2 (56)	28.8 (64)
Approvals		cURus	cURus	cURus	cURus
Suitable for Basic Line Module in chassis format	Type (rated output)	6SL3330-1TE34-2AA0 (200 kW (300 HP))	6SL3330-1TE35-3AA0 (250 kW (400 HP))	6SL3330-1TE38-2AA0 (400 kW (600 HP)) 6SL3330-1TE41-2AA0 (560 kW (800 HP))	6SL3330-1TE41-5AA0 (710 kW (1000 HP))

Line voltage 500 ... 690 V 3 AC		Line filter 6SL3000-0BG34-4AA0	6SL3000-0BG36-0AA0	6SL3000-0BG41-2AA0
Rated current	A	440	600	1200
Power loss	kW	0.049	0.055	0.137
Line/load connection L1, L2, L3 / L1', L2', L3'		Flat connector for M10 screw	Flat connector for M10 screw	Flat connector for M12 screw
PE connection		M8 screw stud	M10 screw stud	M10 screw stud
Degree of protection		IP00	IP00	IP00
Dimensions				
• Width	mm (in)	360 (14.17)	360 (14.17)	425 (16.23)
• Height	mm (in)	240 (9.45)	240 (9.45)	265 (10.43)
• Depth	mm (in)	116 (4.57)	116 (4.57)	145 (5.71)
Weight, approx.	kg (lb)	12.3 (27)	19.0 (42)	25.2 (56)
Approvals		cURus	cURus	cURus
Suitable for Basic Line Module in chassis format	Type (rated output)	6SL3330-1TH33-0AA0 (250 kW) 6SL3330-1TH34-3AA0 (355 kW)	6SL3330-1TH36-8AA0 (560 kW)	6SL3330-1TH41-1AA0 (900 kW) 6SL3330-1TH41-4AA0 (1100 kW)

Basic Line Modules in chassis format
Recommended line-side components

Overview

Suitable line-side power components are assigned depending on the power rating of the Basic Line Module.

The tables below list recommended components.

Further information about the line contactors, switch disconnectors, fuses and circuit-breakers specified on the tables can be found in Catalogs LV 1, LV 1T and ET B1.

Assignment of line-side power components to Basic Line Modules in chassis format

Infeed power	Input current	Suitable for Basic Line Module	**Line contactor**	**Fixed-mounted circuit-breaker**	**Switch disconnector without handle and shaft**	**Switch disconnector with handle and shaft**
kW (HP)	A	Type 6SL3330-	Type	Order No.	Order No.	Order No.
Line voltage 380 ... 480 V 3 AC						
200 (300)	365	1TE34-2AA0	**3RT1075-...**	–	**3KL6130-1AB02**	**3KL6130-1EB02**
250 (400)	460	1TE35-3AA0	**3RT1076-...**	–	**3KL6130-1AB02**	**3KL6130-1EB02**
400 (600)	710	1TE38-2AA0	**3RT1066-...** (x 3 units)	–	**3KL6230-1AB02**	**3KL6230-1EB02**
560 (800)	1010	1TE41-2AA0	–	**3WL1112-2BB34-4AN2-Z C22**	–	–
710 (1000)	1265	1TE41-5AA0	–	**3WL1116-2BB34-4AN2-Z C22**	–	–
Line voltage 500 ... 690 V 3 AC						
250	260	1TH33-0AA0	**3RT1066-...**	–	**3KL5730-1AB01**	**3KL5730-1EB01**
355	375	1TH34-3AA0	**3RT1476-6AP36**	–	**3KL6130-1AB02**	**3KL6130-1EB02**
560	575	1TH36-8AA0	**3RT1476-6AP36**	–	**3KL6130-1AB02**	**3KL6130-1EB02**
900	925	1TH41-1AA0	–	**3WL1210-4BB34-4AN2-Z C22**	–	–
1100	1180	1TH41-4AA0	–	**3WL1212-4BB34-4AN2-Z C22**	–	–

Infeed power	Input current	Suitable for Basic Line Module	**Circuit-breaker IEC 60947**	**Circuit-breaker UL489/CSA C22.2 No. 5-02**	**Cable protection fuse**		**Cable protection fuse incl. semiconductor protection**	
kW (HP)	A	Type 6SL3330-	Order No.	Order No.	Order No.	Rated current	Order No.	Rated current
Line voltage 380 ... 480 V 3 AC								
200 (300)	365	1TE34-2AA0	**3VL4740-1DC36-0AA0**	**3VL4140-3KN30-0AA0**	**3NA3260**	400 A	**3NE1333-2**	450 A
250 (400)	460	1TE35-3AA0	**3VL5750-1DC36-0AA0**	**3VL4550-3KN30-0AA0**	**3NA3365**	500 A	**3NE1334-2**	500 A
400 (600)	710	1TE38-2AA0	–	–	**3NA3475**	800 A	**3NE1448-2** *)	800 A
560 (800)	1010	1TE41-2AA0	–	–	**3NA3482**	1250 A	**3NE1435-2** (2 units)	2 × 560 A
710 (1000)	1265	1TE41-5AA0	–	–	**3NA3475** (2 units)	2 × 800 A	**3NE1437-2** (2 units)	2 × 710 A
Line voltage 500 ... 690 V 3 AC								
250	260	1TH33-0AA0	**3VL4731-1DC36-0AA0**	**3VL4130-3KN30-0AA0**	**3NA3252-6**	315 A	**3NE1230-2**	315 A
355	375	1TH34-3AA0	–	–	**3NA3365-6**	500 A	**3NE1333-2** *)	450 A
560	575	1TH36-8AA0	–	–	**3NA3252-6** (2 units)	2 × 315 A	**3NE1436-2** *)	630 A
900	925	1TH41-1AA0	–	–	**3NA3365-6** (2 units)	2 × 500 A	**3NE1334-2** (2 units)	2 × 500 A
1100	1180	1TH41-4AA0	–	–	**3NA3365-6** (3 units)	3 × 500 A	**3NE1436-2** *) (2 units)	2 × 630 A

*) No semiconductor protection.

Overview

Smart Line Modules are non-regulated feed/feedback units (diode bridge for incoming supply; line-commutated feedback via IGBTs) with 100 % regenerative feedback power. The regenerative capability of the modules can be deactivated by means of parameterization. Smart Line Modules are designed for connection to grounded-neutral (TN, TT) and non-grounded (IT) supply systems.

The DC link is pre-charged via integrated precharging resistors.

The associated line reactor is absolutely essential for operating a Smart Line Module.

Design

Smart Line Modules in booksize compact format feature the following connections and interfaces as standard:

- 1 line connection via screw-type terminals
- 1 connection for the 24 V DC electronic power supply via the 24 V terminal adapter included in the scope of supply
- 1 DC link connection via integrated DC link busbars
- 2 PE (protective earth) connections
- 3 DRIVE-CLiQ sockets

The status of the Smart Line Modules is indicated via two multi-color LEDs.

The signal cable shield can be connected to the Line Module by means of a shield connection terminal, e.g. Weidmüller type KLBÜ 3-8 SC.

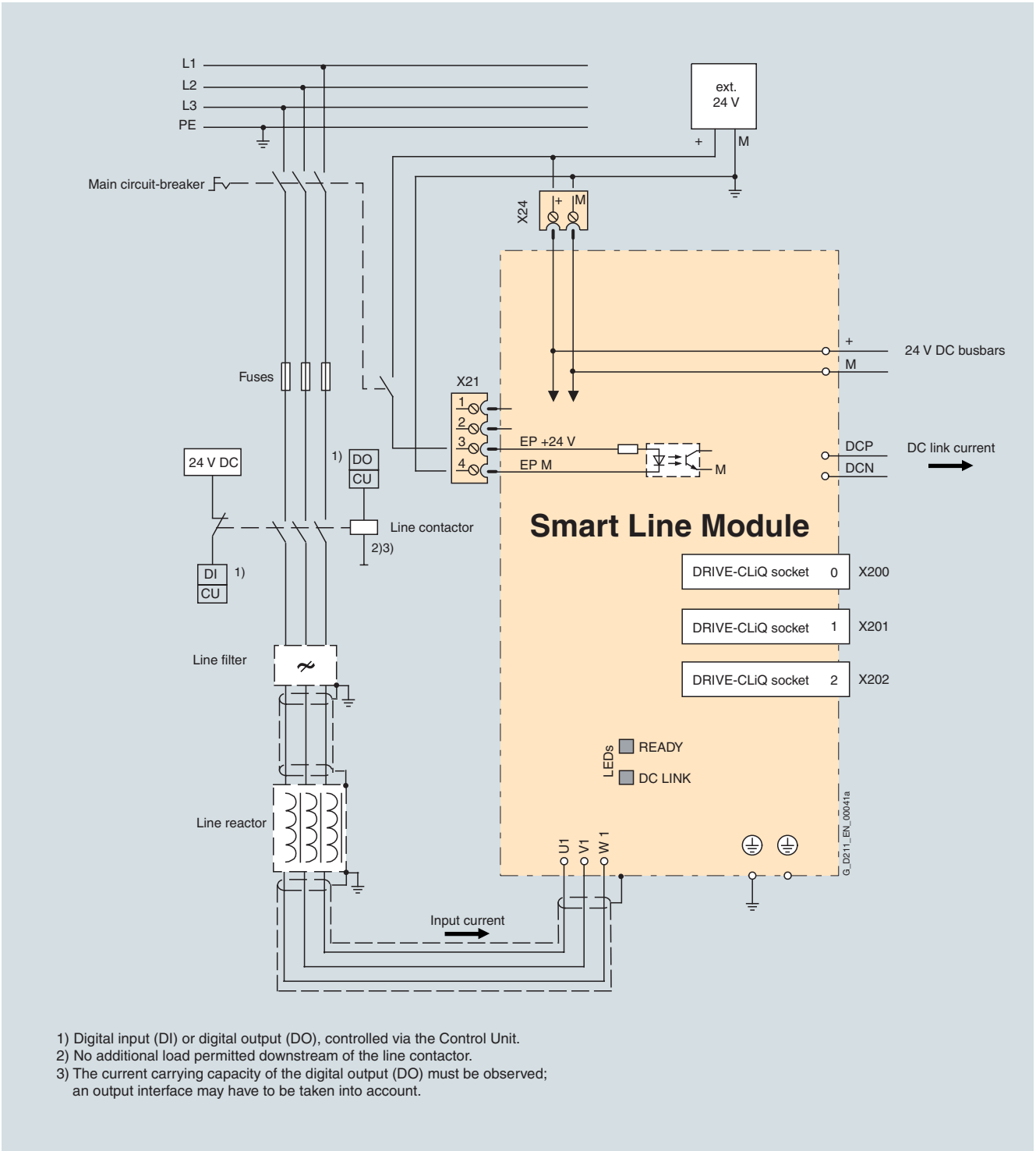
The scope of supply of the Smart Line Modules includes:

- DRIVE-CLiQ cable for connection to the Control Unit when mounted on the immediate left
- 2 blanking plugs for sealing unused DRIVE-CLiQ sockets
- DRIVE-CLiQ cable (length depends on module width) to connect Smart Line Modules to adjacent Motor Module
- Jumper for connecting the 24 V DC busbar to the adjacent Motor Module
- 24 V terminal adapter (X24)
- Connector X21 for digital inputs and outputs
- 1 set of warning signs in foreign languages
- 1 heat conducting foil

Smart Line Modules in booksize compact format

Integration

The Smart Line Module communicates with a CU320 or SIMOTION D4x5 Control Unit via DRIVE-CLiQ.



1) Digital input (DI) or digital output (DO), controlled via the Control Unit.
2) No additional load permitted downstream of the line contactor.
3) The current carrying capacity of the digital output (DO) must be observed; an output interface may have to be taken into account.

Connection example of a Smart Line Modules in booksize compact format

Technical specifications

General technical specifications	
Electrical data	
Line connection voltage (up to 2000 m (6562 ft) above sea level)	380 ... 480 V 3 AC ±10 % (-15 % < 1 min) [1]
Line frequency	47 … 63 Hz
Line Power factor at rated power	
• Fundamental Power factor (cos φ_1)	> 0.96
• Total (λ)	0.65 … 0.90
Overvoltage category to EN 60664-1	Class III
DC link voltage, approx.	1.35 x line voltage [2]
Electronic power supply	24 V DC, -15 %/+20 %
Radio Interference suppression	
• Standard	No interference suppression
• With line filter	Category C2 to EN 61800-3 up to 350 m (1148 ft) total cable length (shielded)
Ambient conditions	
Type of cooling	The devices are designed so that - internal air cooling (power units with forced air cooling through a built-in fan) or - cold plate cooling is possible
Permissible ambient and coolant temperature (air) during operation for line-side components, Line Modules and Motor Modules	0 … 40 °C (32 … 104 °F) without derating, > 40 … 55 °C (104 … 131 °F), see derating characteristics
Site altitude	Up to 1000 m (3281 ft) above sea level without derating, > 1000 ... 4000 m (3281 ... 13124 ft) above sea level see derating characteristics
Certificates	
Conformity	CE (low-voltage and EMC Directives)
Approvals	cULus

1) Can also be operated on supply systems with 200 ... 240 V 3 AC ±10 % with appropriate parameterization and reduced power rating.

2) The DC link voltage is regulated to the mean rectified line voltage value. For further information see System description.

Smart Line Modules in booksize compact format

Technical specifications (continued)

Line voltage 380 ... 480 V 3 AC	Smart Line Modules in booksize compact format
Internal air cooling/ cold plate cooling	**6SL3430-6TE21-6AA0**
Feed/feedback power	
• Rated power P_{rated} - With 380 V 3 AC - With 460 V 3 AC [3]	16 kW (18 HP)
• For S6 duty (40 %) P_{S6}	21 kW
• P_{max}	35 kW
DC link current	
• At 600 V DC	27 A
• For S6 duty (40 %)	35 A
• Maximum	59 A
Input current	
• Rated current at 380 V 3 AC	26 A
• For S6 duty (40 %)	35 A
• Maximum	59 A
Current requirement 24 V DC electronics power supply, max.	1.1 A
Current carrying capacity	
• 24 V DC busbars	20 A
• DC link busbars	100 A
DC link capacitance	
• Smart Line Module	705 µF
• Drive line-up, max.	6000 µF
Power loss [1]	
• With internal air cooling	0.19 kW
• With cold plate cooling, int./ext.	0.06/0.13 kW
• Thermal resistance R_{th}	0.1 K/W
Cooling air requirement	0.016 m^3/s (0.6 ft^3/s))
Sound pressure level L_{pA} (1 m)	< 60 dB
Line connection U1, V1, W1	Screw-type terminals (X1)
• Conductor cross-section, max.	2.5 … 10 mm^2
Shield connection	Shield connection plate integrated into the connector
PE connection	M5 screw
Cable length, max. (total of all motor cables and DC link) [2]	
• Shielded	350 (1148) m (ft)
• Unshielded	560 (1837) m (ft)
Degree of protection	IP20
Dimensions	
• Width	100 (3.94) mm (in)
• Height	270 (10.6) mm (in)
• Depth	226 (8.90) mm (in)
Weight, approx.	5.3 kg (12 lb)

[1] Power loss of Smart Line Module at rated output including losses of 24 V DC electronic power supply.

[2] Max. cable lengths in conjunction with Voltage Clamping Module, see "Derating characteristics".

[3] Nominal HP ratings are provided for ease of assigning components only. The Line Module outputs are dependent on the Motor Module loading and are to be dimensioned accordingly.

Selection and ordering data

Rated power	Smart Line Module in booksize compact format Internal air cooling
kW (HP)	Order No.
Line voltage 380 ... 480 V 3 AC	
16 (18)	**6SL3430-6TE21-6AA0**

Accessories

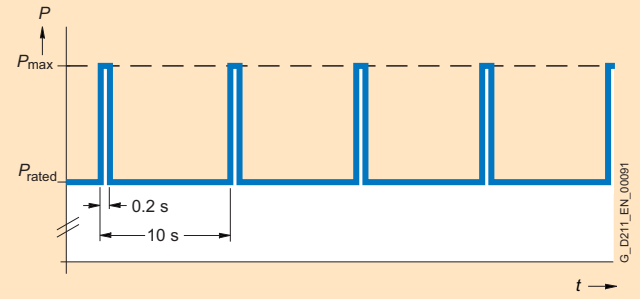
Description	Order No.
DC link rectifier adapter for direct infeed of DC link voltage	
• Screw-type terminals 0.5 to 10 mm^2 for Line Modules and Motor Modules in booksize format with a width of 50 mm (1.97 in) or 100 mm (3.94 in)	**6SL3162-2BD00-0AA0**
DC link adapters (2 units) for multi-tier configuration Screw-type terminals 35 to 95 mm^2 for all Line Modules and Motor Modules in booksize format	**6SL3162-2BM01-0AA0**
24 V terminal adapter for all Line Modules and Motor Modules in booksize format	**6SL3162-2AA00-0AA0**
24 V jumper for connection of the 24 V busbars (for booksize format)	**6SL3162-2AA01-0AA0**
Warning signs in foreign languages	**6SL3166-3AB00-0AA0**

This set of foreign language warning signs can be placed on top of the standard German or English signs.
One set of labels is supplied with the devices. The following languages are available in each label set:

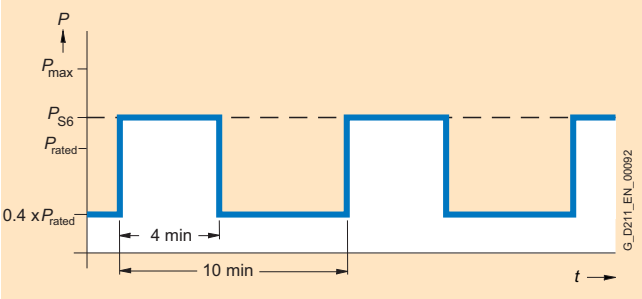
Chinese Simplified	Polish
Danish	Portuguese/
Dutch	Brazilian
Finnish	Russian
French	Swedish
Greek	Spanish
Italian	Czech
Japanese	Turkish
Korean	

Characteristics

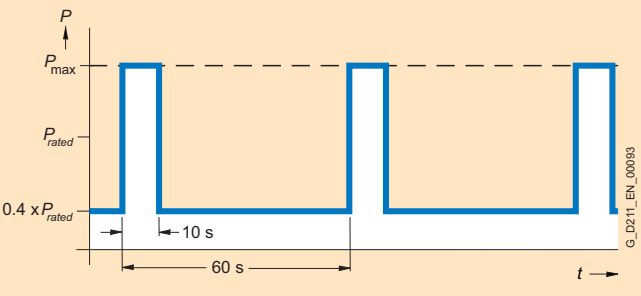
Overload capability



Load cycle with initial load

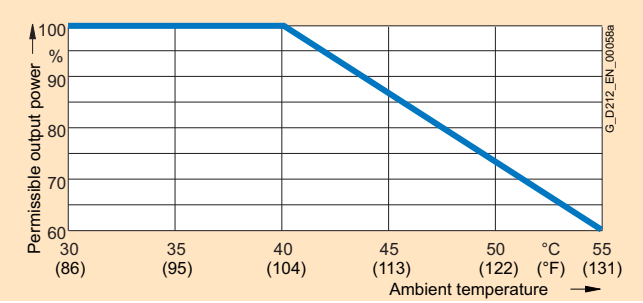


S6 load cycle with initial load

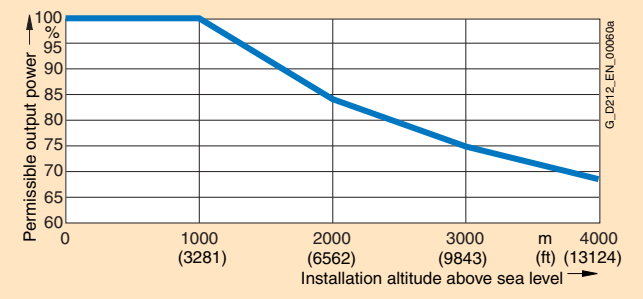


S6 load cycle with initial load

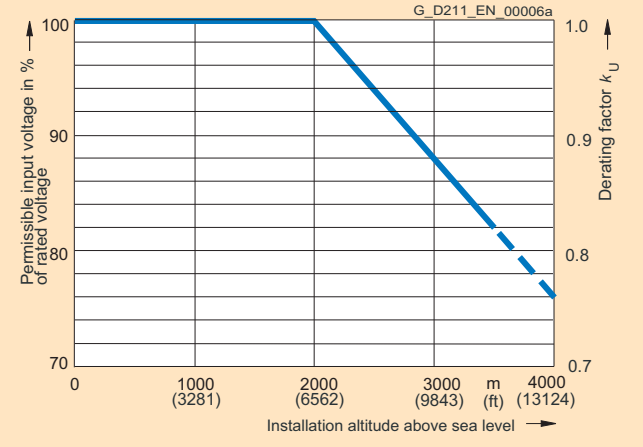
Derating characteristics



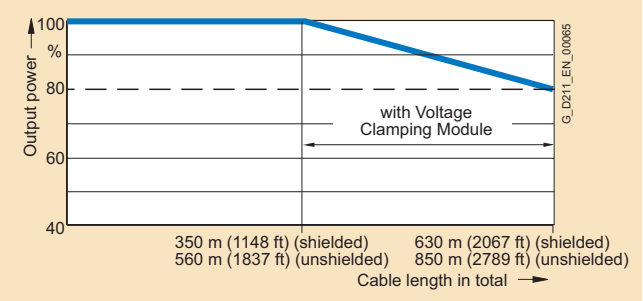
Output power dependent on ambient temperature



Output power dependent on installation altitude



Voltage derating dependent on installation altitude



Output power dependent on total cable length

Smart Line Modules in booksize format

Overview

Smart Line Modules are non-regulated feed/feedback units (diode bridge for incoming supply; line-commutated feedback via IGBTs) with 100 % regenerative feedback power. The regenerative feedback capability of the modules can be deactivated by means of a digital input (Smart Line Modules 5 kW and 10 kW) or by parameterizing. Smart Line Modules are designed for connection to grounded-neutral (TN, TT) and non-grounded (IT) supply systems.

The DC link is pre-charged via integrated precharging resistors.

The associated line reactor is absolutely essential for operating a Smart Line Module.

Design

Smart Line Modules in booksize format feature the following connections and interfaces as standard:

- 1 line connection via screw-type terminals
- 1 connection for the 24 V DC electronic power supply via the 24 V terminal adapter included in the scope of supply
- 1 DC link connection via integrated DC link busbars
- 2 PE (protective earth) connections
- 2 digital inputs
  (only on 5 kW and 10 kW Smart Line Modules)
- 1 digital output
  (only on 5 kW and 10 kW Smart Line Modules)
- 3 DRIVE-CLiQ sockets
  (only on 16 kW and 36 kW Smart Line Modules)

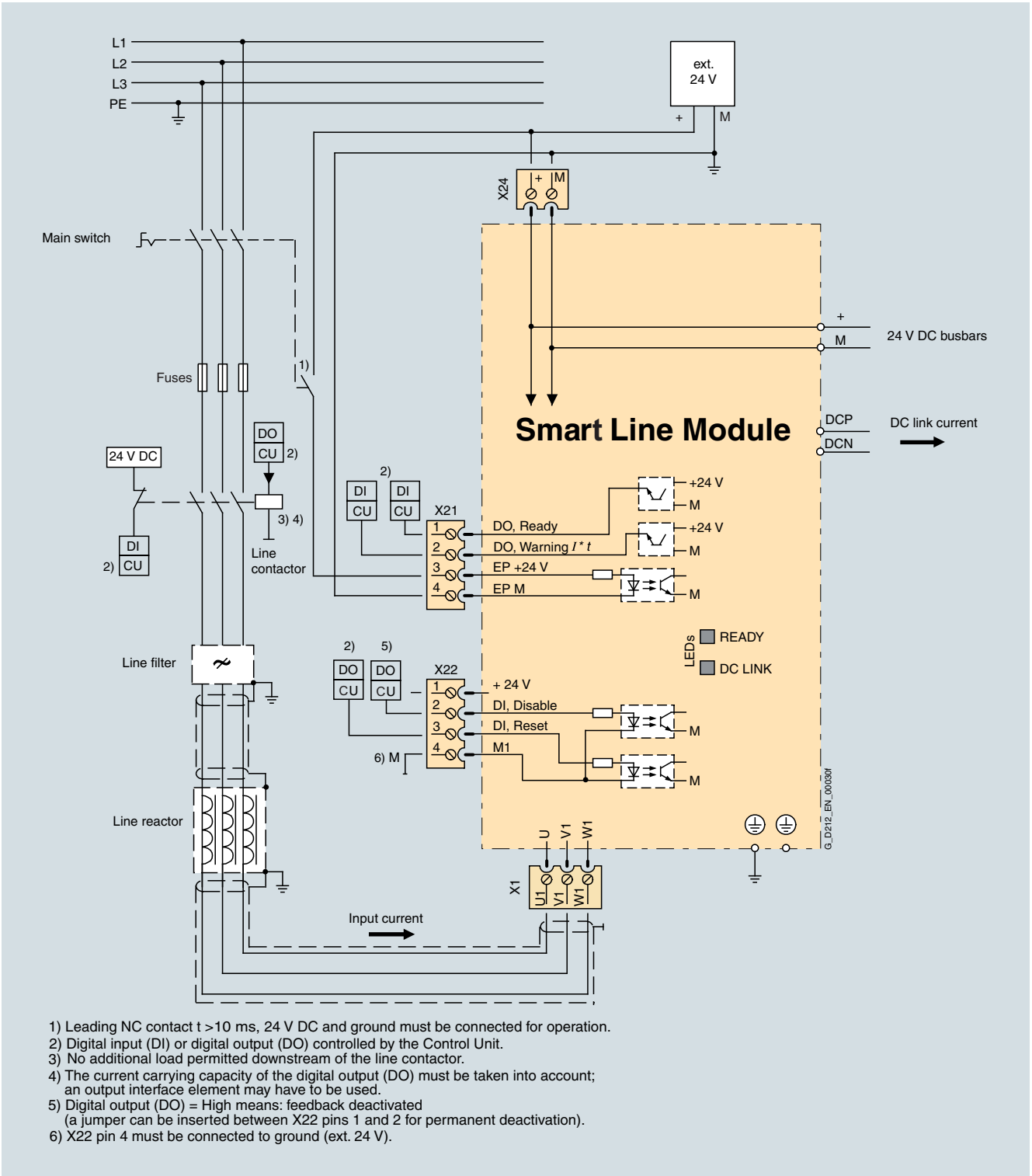
The status of the Smart Line Modules is indicated via two multi-color LEDs.

The signal cable shield can be connected to the Line Module by means of a shield connection terminal, e.g. Weidmüller type KLBÜ 3-8 SC.

The scope of supply of the Smart Line Modules includes:

- DRIVE-CLiQ cable for connection to the Control Unit when mounted on the immediate left
  (on 16 kW and 36 kW Smart Line Modules only)
- 2 blanking plugs for sealing unused DRIVE-CLiQ sockets
  (on 16 kW and 36 kW Smart Line Modules only)
- DRIVE-CLiQ cable (length depends on module width) to connect Smart Line Modules to adjacent Motor Module
- Jumper for connecting the 24 V DC busbar to the adjacent Motor Module
- 24 V terminal adapter (X24)
- Connector X21 for digital inputs and outputs
- Connector X22 for digital inputs and outputs
  (on 5 kW and 10 kW Smart Line Modules only)
- Connector X1 for line connection
  (on 5 kW and 10 kW Smart Line Modules only)
- 1 set of warning signs in foreign languages
- 1 heat conducting foil
  (for Smart Line Modules with cold plate cooling only)

Integration

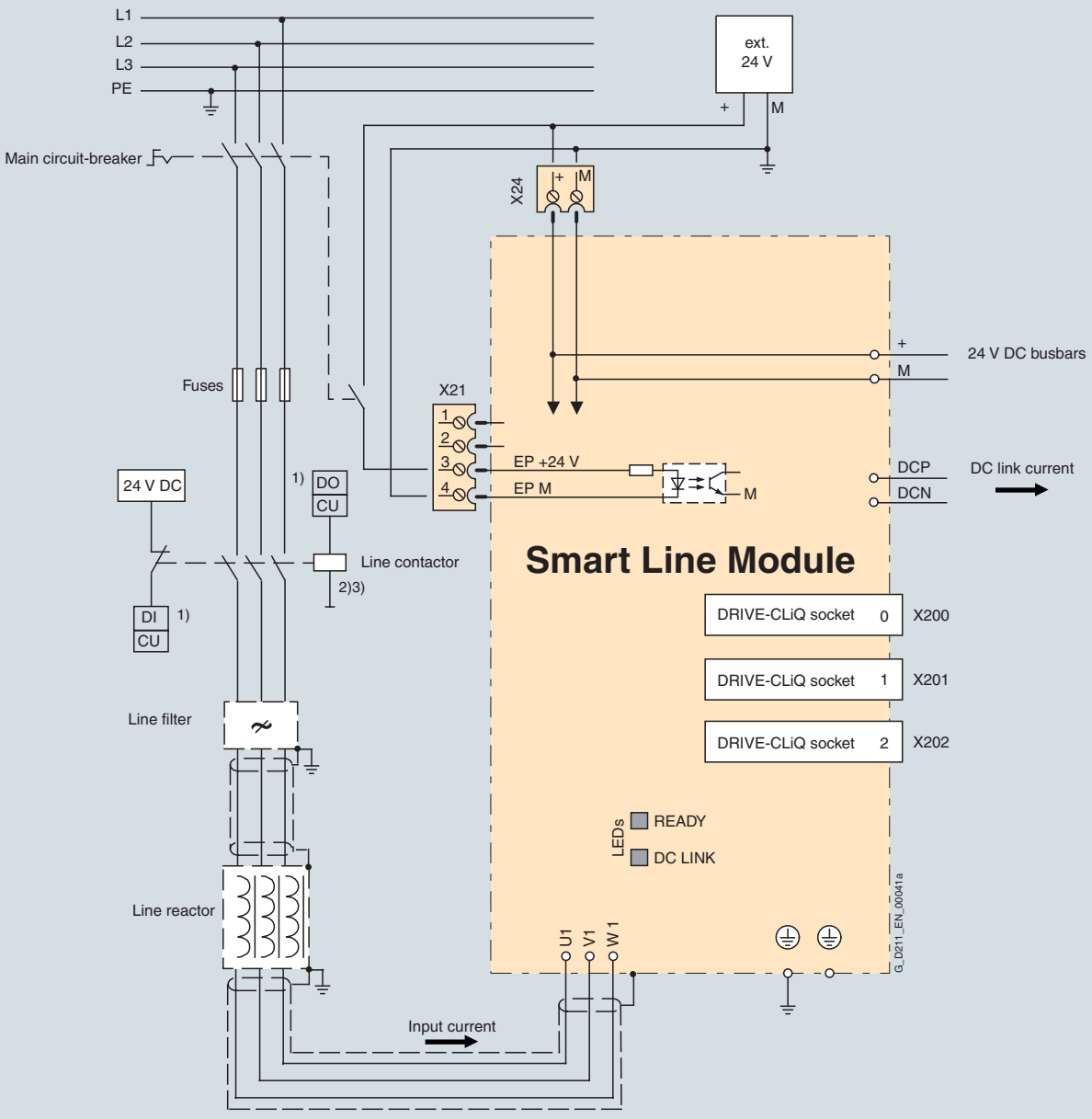


1) Leading NC contact t >10 ms, 24 V DC and ground must be connected for operation.
2) Digital input (DI) or digital output (DO) controlled by the Control Unit.
3) No additional load permitted downstream of the line contactor.
4) The current carrying capacity of the digital output (DO) must be taken into account; an output interface element may have to be used.
5) Digital output (DO) = High means: feedback deactivated (a jumper can be inserted between X22 pins 1 and 2 for permanent deactivation).
6) X22 pin 4 must be connected to ground (ext. 24 V).

Connection example of 5 kW (5 HP) and 10 kW (10 HP) Smart Line Modules in booksize format

3

Integration (continued)



1) Digital input (DI) or digital output (DO), controlled via the Control Unit.
2) No additional load permitted downstream of the line contactor.
3) The current carrying capacity of the digital output (DO) must be observed; an output interface may have to be taken into account.

Connection example of 16 kW and 36 kW Smart Line Modules in booksize format

Technical specifications

General technical specifications	
Electrical data	
Line connection voltage (up to 2000 m (6562 ft) above sea level)	380 ... 480 V 3 AC ±10 % (-15 % < 1 min) [1]
Line frequency	47 … 63 Hz
Line Power factor at rated power	
• Fundamental Power factor (cos φ_1)	> 0.96
• Total (λ)	0.65 … 0.90
Overvoltage category to EN 60664-1	Class III
DC link voltage, approx.	1.35 x line voltage [2]
Electronic power supply	24 V DC, -15 %/+20 %
Radio Interference suppression	
• Standard	No interference suppression
• With line filter	Category C2 to EN 61800-3 up to 350 m (1148 ft) total cable length (shielded)
Ambient conditions	
Type of cooling	- Internal air cooling, power units with forced air cooling through a built-in fan - Cold-plate cooling (5 kW and 10 kW)
Permissible ambient and coolant temperature (air) during operation for line-side components, Line Modules and Motor Modules	0 … 40 °C (32 … 104 °F) without derating, > 40 … 55 °C (104 … 131 °F) see derating characteristics
Site altitude	Up to 1000 m (3281 ft) above sea level without derating, > 1000 ... 4000 m (3281 ... 13124 ft) above sea level see derating characteristics
Certificates	
Conformity	CE (low-voltage and EMC Directives)
Approvals	cULus (File No.: E192450)

[1] Smart Line Modules 16 kW and 36 kW in booksize format with firmware version V2.5 or higher with appropriate parameterization and reduced power rating are also operable on networks with 200 ... 240 V 3 AC ±10 %.

[2] The DC link voltage is regulated to the mean rectified line voltage value. For further information see System description.

3

Technical specifications (continued)

Line voltage 380 ... 480 V 3 AC		Smart Line Modules in booksize format			
Internal air cooling		**6SL3130-6AE15-0AB0**	**6SL3130-6AE21-0AB0**	**6SL3130-6TE21-6AA3**	**6SL3130-6TE23-6AA3**
External air cooling		**6SL3131-6AE15-0AA0**	**6SL3131-6AE21-0AA0**	**–**	**–**
Cold plate cooling		**6SL3136-6AE15-0AA0**	**6SL3136-6AE21-0AA0**	**–**	**–**
Feed/feedback power					
• Rated power P_{rated}					
- With 380 V 3 AC	kW	5	10	16	36
- With 460 V 3 AC [3]	(HP)	(5)	(10)	(18)	(40)
• For S6 duty (40 %) P_{S6}	kW	6.5	13	21	47
• P_{max}	kW	10	20	35	70
DC link current					
• At 600 V DC	A	8.3	16.6	27	60
• For S6 duty (40 %)	A	11	22	35	79
• Maximum	A	16.6	33.2	59	117
Input current					
• Rated current at 380 V 3 AC	A	12	24	26	58
• For S6 duty (40 %)	A	15.6	31.2	35	79
• Maximum	A	22	44	59	117
Current requirement 24 V DC electronics power supply, max.	A	1.0	1.3	1.1	1.5
Current carrying capacity					
• 24 V DC busbars	A	20	20	20	20
• DC link busbars	A	100	100	100	200
DC link capacitance					
• Smart Line Module	µF	220	330	710	1410
• Drive line-up, max.	µF	6000	6000	20000	20000
Internal/external air cooling					
• Power loss [1]					
- Internal air cooling	kW	0.11	0.2	0.19	0.41
- External air cooling int./ext.	kW	0.06/0.05	0.1/0.1	–	–
• Cooling air requirement	m^3/s (ft^3/s)	0.008 (0.3)	0.008 (0.3)	0.016 (0.6)	0.031 (1.1)
• Sound pressure level L_{pA} (1 m)	dB	< 60	< 60	< 60	< 60
Cold plate cooling					
• Power loss, int./ext. [1]	kW	0.05/0.05	0.08/0.11	–	–
• Thermal resistance R_{th}	K/W	0.175	0.175	–	–
Line connection U1, V1, W1		Screw-type terminals (X1)	Screw-type terminals (X1)	Screw-type terminals (X1)	M6 screw studs (X1)
• Conductor cross-section	mm^2	2.5 … 6	2.5 … 6	2.5 … 10	2.5 … 50
Shield connection		Cable shield connection plate integrated into the connector	Cable shield connection plate integrated into the connector	Cable shield connection plate integrated into the connector	See Accessories
PE connection		M5 screw	M5 screw	M5 screw	M6 screw
Cable length, max. (total of all motor cables and DC link) [2]					
• Shielded	m (ft)	350 (1148)	350 (1148)	350 (1148)	350 (1148)
• Unshielded	m (ft)	560 (1837)	560 (1837)	560 (1837)	560 (1837)
Degree of protection		IP20	IP20	IP20	IP20
Dimensions					
• Width	mm (in)	50 (1.97)	50 (1.97)	100 (3.94)	150 (5.91)
• Height	mm (in)	380 (14.96)	380 (14.96)	380 (14.96)	380 (14.96)
• Depth					
- With internal air cooling	mm (in)	270 (10.63)	270 (10.63)	270 (10.63)	270 (10.63)
- With external air cooling on/behind mounting surface	mm (in)	226/66.5 (8.90/2.62)	226/66.5 (8.90/2.62)	–	–
- With cold plate cooling	mm (in)	226 (8.90)	226 (8.90)	–	–
Weight, approx.					
• With internal air cooling	kg (lb)	4.7 (10.4)	4.8 (10.6)	7 (15.4)	10.3 (22.7)
• With external air cooling	kg (lb)	5.3 (11.7)	5.4 (11.9)	–	–
• With cold plate cooling	kg (lb)	4 (8.82)	4 (8.82)	–	–

[1] Power loss of Smart Line Module at rated output including losses of 24 V DC electronics power supply.

[2] Max. cable lengths in conjunction with Voltage Clamping Module, see Derating characteristics.

[3] Nominal HP ratings are provided for ease of assigning components only. The Line Module outputs are dependent on the Motor Module loading and are to be dimensioned accordingly.

Selection and ordering data

Rated infeed power	Smart Line Module in booksize format		
	Internal air cooling	External air cooling	Cold plate cooling
kW (HP)	Order No.	Order No.	Order No.
Line voltage 380 ... 480 V 3 AC			
5 (5)	**6SL3130-6AE15-0AB0**	**6SL3131-6AE15-0AA0**	**6SL3136-6AE15-0AA0**
10 (10)	**6SL3130-6AE21-0AB0**	**6SL3131-6AE21-0AA0**	**6SL3136-6AE21-0AA0**
16 (18)	**6SL3130-6TE21-6AA3**	–	–
36 (40)	**6SL3130-6TE23-6AA3**	–	–

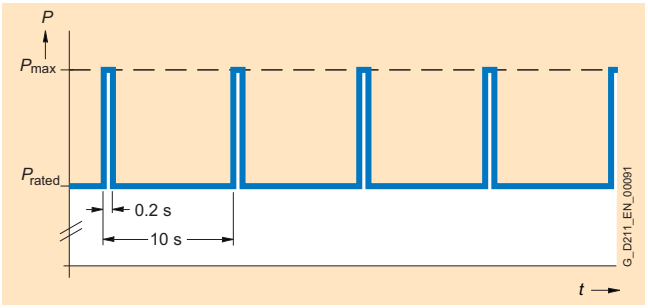
Accessories

Description	Order No.
Shield connection kit for Line/Motor Modules in booksize format with a width of 150 mm (5.91 in)	**6SL3162-1AF00-0AA1**
DC link rectifier adapter for direct infeed of DC link voltage	
• Screw-type terminals 0.5 to 10 mm^2 for Line Modules and Motor Modules in booksize format with a width of 50 mm (1.97 in) or 100 mm (3.94 in)	**6SL3162-2BD00-0AA0**
• Screw-type terminals 35 to 95 mm^2 for Line Modules and Motor Modules in booksize format with a width of 150 mm (5.91 in), 200 mm (7.87 in) and 300 mm (11.81 in)	**6SL3162-2BM00-0AA0**
DC link adapters (2 units) for multi-tier configuration Screw-type terminals 35 mm^2 to 95 mm^2 for all Line Modules and Motor Modules in booksize format	**6SL3162-2BM01-0AA0**
24 V terminal adapter for all Line Modules and Motor Modules in booksize format	**6SL3162-2AA00-0AA0**
24 V jumper for connection of the 24 V busbars (for booksize format)	**6SL3162-2AA01-0AA0**
Warning signs in foreign languages This set of foreign language warning signs can be placed on top of the standard German or English signs. One set of labels is supplied with the devices. The following languages are available in each label set: Chinese Simplified, Danish, Dutch, Finnish, French, Greek, Italian, Japanese, Korean, Polish, Portuguese/Brazilian, Russian, Swedish, Spanish, Czech, Turkish	**6SL3166-3AB00-0AA0**

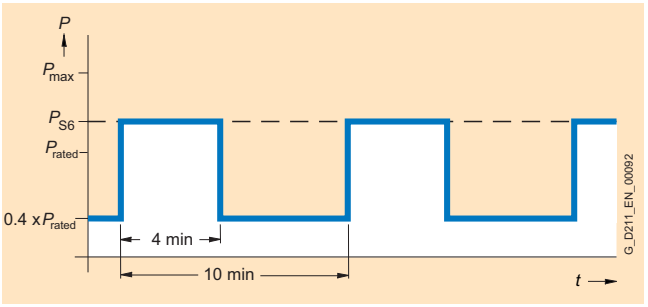
3

Characteristics

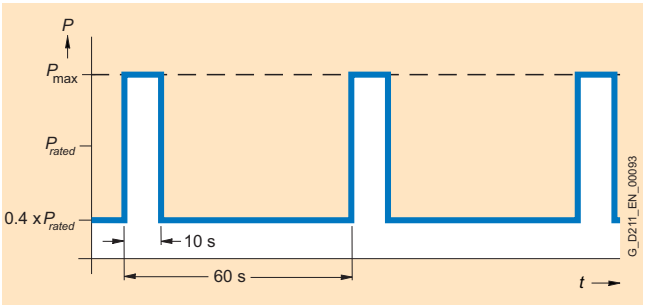
Overload capability



Load cycle with previous load

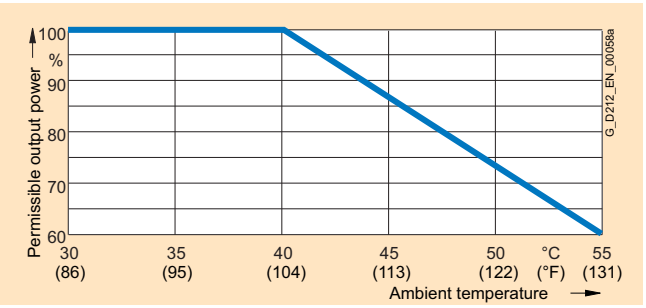


S6 load cycle with previous load

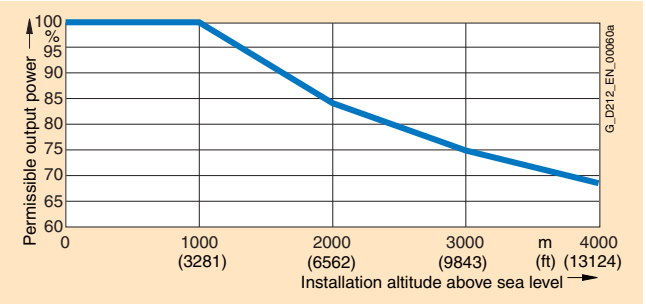


S6 load cycle with previous load

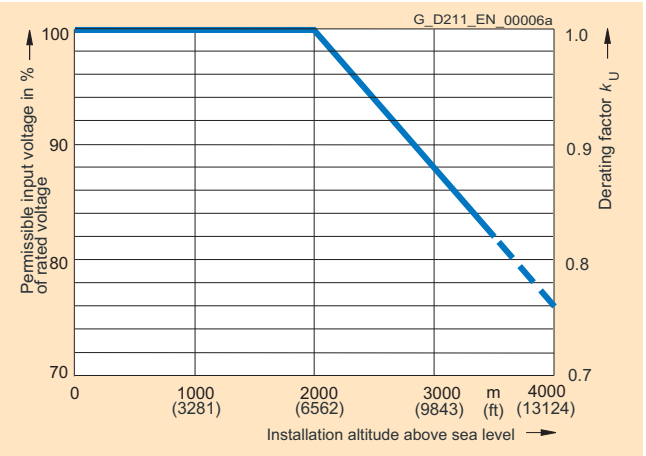
Derating characteristics



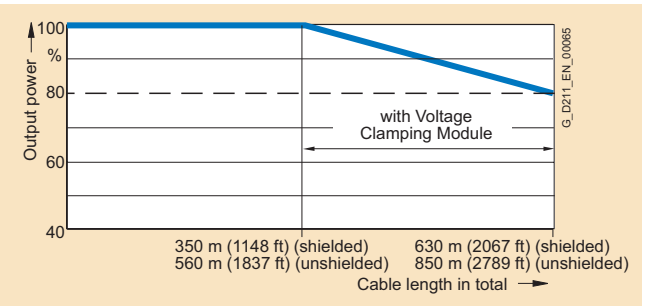
Output power dependent on ambient temperature



Output power dependent on installation altitude



Voltage derating dependent on installation altitude



Output power dependent on total cable length

Overview

Smart Line Modules are not warranted to operate without the specified line reactors. The use of other makes of line reactor can lead to malfunctions or irreparable damage to equipment.

Selection and ordering data

Rated power of the Smart Line Module kW (HP)	Suitable for Smart Line Module in booksize or booksize compact format	**Line reactor** Order No.
Line voltage 380 ... 480 V 3 AC		
5 (5)	6SL3130-6AE15-0AB0 6SL3131-6AE15-0AA0 6SL3136-6AE15-0AA0	**6SL3000-0CE15-0AA0**
10 (10)	6SL3130-6AE21-0AB0 6SL3131-6AE21-0AA0 6SL3136-6AE21-0AA0	**6SL3000-0CE21-0AA0**
16 (18)	6SL3130-6TE21-6AA3 6SL3430-6TE21-6AA0	**6SL3000-0CE21-6AA0**
36 (40)	6SL3130-6TE23-6AA3	**6SL3000-0CE23-6AA0**

Technical specifications

Line voltage **380 ... 480 V 3 AC**		**Line reactor** **6SL3000-0CE15-0AA0**	**6SL3000-0CE21-0AA0**	**6SL3000-0CE21-6AA0**	**6SL3000-0CE23-6AA0**
Rated current	A	14	28	35	69
Power loss	kW	0.062	0.116	0.11	0.17
Line/load connection 1U1, 1V1, 1W1 / 1U2, 1V2, 1W2		Screw-type terminals	Screw-type terminals	Screw-type terminals	Screw-type terminals
• Conductor cross-section	mm^2	4	10	10	16
PE connection		Screw-type terminals	Screw-type terminals	Screw-type terminals	Screw-type terminals
• Conductor cross-section	mm^2	4	10	10	16
Degree of protection		IP20	IP20	IP20	IP20
Dimensions					
• Width	mm (in)	150 (5.91)	177 (6.97)	219 (8.62)	228 (8.98)
• Height	mm (in)	175 (6.89)	196 (7.72)	180 (7.09)	235 (9.25)
• Depth	mm (in)	70 (2.76)	110 (4.33)	144 (5.67)	224 (8.82)
Weight, approx.	kg (lb)	3.7 (8)	7.5 (17)	9.5 (21)	17 (38)
Approvals		cURus	cURus	cURus	cURus
Suitable for Smart Line Module in booksize or booksize compact format	Type	6SL3130-6AE15-0AB0 6SL3131-6AE15-0AA0 6SL3136-6AE15-0AA0	6SL3130-6AE21-0AB0 6SL3131-6AE21-0AA0 6SL3136-6AE21-0AA0	6SL3130-6TE21-6AA3 6SL3430-6TE21-6AA0	6SL3130-6TE23-6AA3
• Rated infeed power of the Smart Line Module	kW	5	10	16	36

Smart Line Modules in booksize format
Line filters

Overview

In plants with strict EMC requirements, line filters work together with line reactors to restrict the conducted interference emanating from the Power Modules to the limit values of Class A1 as defined in EN 55011 and Category C2 as defined in EN 61800-3. Line filters are suited only for direct connection to TN (grounded) systems.

Selection and ordering data

Rated infeed power of the Smart Line Module kW (HP)	Suitable for Smart Line Module in booksize or booksize compact format	**Line filter** Order No.
Line voltage 380 ... 480 V 3 AC		
5 (5)	6SL3130-6AE15-0AB0 6SL3131-6AE15-0AA0 6SL3136-6AE15-0AA0	**6SL3000-0HE15-0AA0**
10 (10)	6SL3130-6AE21-0AB0 6SL3131-6AE21-0AA0 6SL3136-6AE21-0AA0	**6SL3000-0HE21-0AA0**
16 (18)	6SL3130-6TE21-6AA3 6SL3430-6TE21-6AA0	**6SL3000-0BE21-6DA0**
36 (40)	6SL3130-6TE23-6AA3	**6SL3000-0BE23-6DA0**

Technical specifications

Line voltage 380 ... 480 V 3 AC		**Line filter** **6SL3000-0HE15-0AA0**	**6SL3000-0HE21-0AA0**	**6SL3000-0BE21-6DA0**	**6SL3000-0BE23-6DA0**
Rated current	A	16	25	36	65
Power loss	W	20	20	6	10
Line/load connection L1, L2, L3 / U, V, W		Screw-type terminals	Screw-type terminals	Screw-type terminals	Screw-type terminals
• Conductor cross-section	mm^2	10	10	10	35
PE connection		M6 screw stud	M6 screw stud	M6 screw stud	M6 screw stud
Degree of protection		IP20	IP20	IP20	IP20
Dimensions					
• Width	mm (in)	60 (2.36)	60 (2.36)	50 (1.97)	75 (2.95)
• Height	mm (in)	285 (11.22)	285 (11.22)	420 (16.54)	420 (16.54)
• Depth	mm (in)	122 (4.80)	122 (4.80)	226 (8.90)	226 (8.90)
Weight, approx.	kg (lb)	3.8 (8)	5.7 (13)	5.0 (11)	6.5 (14)
Approvals		cURus (File No.: E70122)	cURus (File No.: E70122)	cURus (File No.: E70122)	cURus (File No.: E70122)
Suitable for Smart Line Module in booksize or booksize compact format	Type	6SL3130-6AE15-0AB0 6SL3131-6AE15-0AA0 6SL3136-6AE15-0AA0	6SL3130-6AE21-0AB0 6SL3131-6AE21-0AA0 6SL3136-6AE21-0AA0	6SL3130-6TE21-6AA3 6SL3430-6TE21-6AA0	6SL3130-6TE23-6AA3
• Rated infeed power of the Smart Line Module	kW	5	10	16	36

Overview

Suitable line-side power components are assigned depending on the power rating of the Smart Line Module.

The tables below list recommended components.

Further information about the line contactors, switch disconnectors, fuses and circuit-breakers specified in the tables can be found in Catalogs LV 1, LV 1T and ET B1.

Assignment of line-side power components to Smart Line Modules in booksize or booksize compact format

Rated power	Assignment to Smart Line Module in booksize or booksize compact format	**Line contactor**	**Circuit-breaker IEC 60947**	**Circuit-breaker UL489/CSA C22.2 No. 5-02**	**Main switch**
kW (HP)	Type	Type	Order No.	Order No.	Order No.
Line voltage 380 ... 480 V 3 AC					
5 (5)	6SL3130-6AE15-0AB0 6SL3131-6AE15-0AA0 6SL3136-6AE15-0AA0	**3RT1023-...**	**3RV1031-4BA10**	**–**	**3LD2003-0TK51**
10 (10)	6SL3130-6AE21-0AB0 6SL3131-6AE21-0AA0 6SL3136-6AE21-0AA0	**3RT1026-...**	**3RV1031-4FA10**	**–**	**3LD2203-0TK51**
16 (18)	6SL3130-6TE21-6AA3 6SL3430-6TE21-6AA0	**3RT1035-...**	**3RV1031-4FA10**	**–**	**3LD2504-0TK51**
36 (40)	6SL3130-6TE23-6AA3	**3RT1045-...**	**3RV1041-4LA10**	**3VL2108-3KN30-0AA0**	**3LD2704-0TK51**

Rated power	Assignment to Smart Line Module in booksize or booksize compact format	**Fuse switch disconnector**	**Switch disconnector with fuse holders**	**LV HRC fuse(gL/gG)**			**UL/CSA fuse, Class J** [1] **Available from: Ferraz Shawmut http://www.ferrazshawmut.com**		
kW (HP)	Type	Order No.	Order No.	Order No.	Rated current	Size	Reference No.	Rated current	Size
Line voltage 380 ... 480 V 3 AC									
5 (5)	6SL3130-6AE15-0AB0 6SL3131-6AE15-0AA0 6SL3136-6AE15-0AA0	**3NP4010-0CH01**	**3KL5030-1EB01**	**3NA3805**	16 A	000	AJT17-1/2	17.5 A	21 × 57
10 (10)	6SL3130-6AE21-0AB0 6SL3131-6AE21-0AA0 6SL3136-6AE21-0AA0	**3NP4010-0CH01**	**3KL5030-1EB01**	**3NA3814**	35 A	000	AJT35	35 A	27 × 60
16 (18)	6SL3130-6TE21-6AA3 6SL3430-6TE21-6AA0	**3NP4010-0CH01**	**3KL5030-1EB01**	**3NA3814**	35 A	000	AJT35	35 A	27 × 60
36 (40)	6SL3130-6TE23-6AA3	**3NP4010-0CH01**	**3KL5230-1EB01**	**3NA3824**	80 A	000	AJT80	80 A	29 × 117

[1] Not for use in 3NP and 3KL disconnectors.

Smart Line Modules in chassis format

Overview

Smart Line Modules are non-regulated feed/feedback units (diode bridge for incoming supply; line-commutated feedback via IGBTs) with 100 % regenerative feedback power. The regenerative feedback capability of the modules can be deactivated by parameterizing. Smart Line Modules are designed for connection to grounded-neutral (TN, TT) and non-grounded (IT) supply systems.

The DC link is pre-charged via integrated precharging resistors. The associated line reactor is absolutely essential for operating a Smart Line Module.

Design

Smart Line Modules in chassis format feature the following connections and interfaces as standard:

- 1 line connection
- 1 connection for the 24 V DC electronics power supply
- 1 DC link connection
- 3 DRIVE-CLiQ sockets

The status of the Smart Line Modules is indicated via two multicolor LEDs.

The scope of supply of the Smart Line Modules includes:

- DRIVE-CLiQ cable for connection to a CU320 or SIMOTION D4x5 Control Unit
- DRIVE-CLiQ cable for connection between the Control Unit and first Motor Module (type dependent)

Selection and ordering data

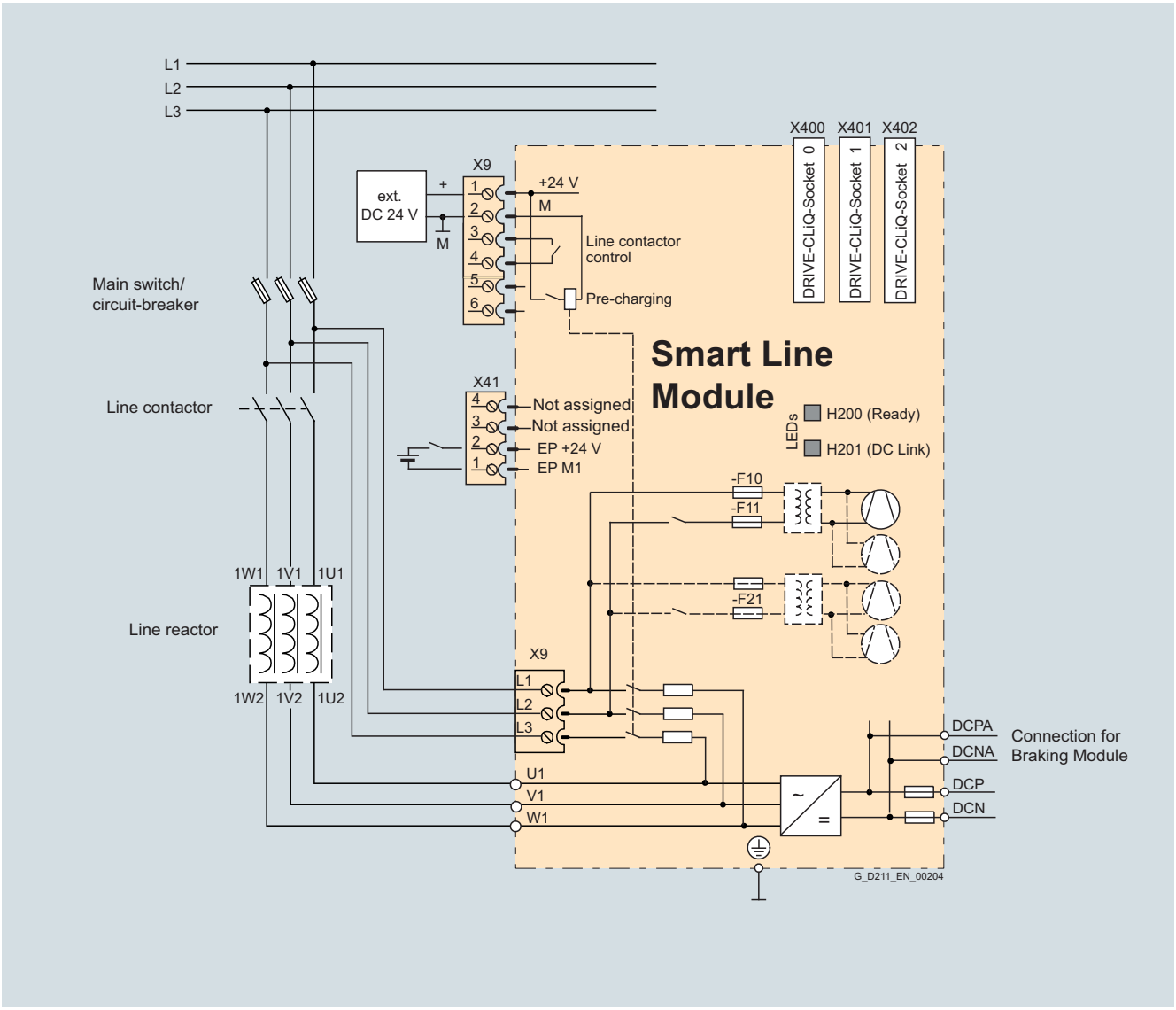
Rated power kW (HP)	**Smart Line Modules in chassis format** Order No.
Line voltage 380 ... 480 V 3 AC	
250 (400)	**6SL3330-6TE35-5AA0**
355 (500)	**6SL3330-6TE37-3AA0**
500 (700)	**6SL3330-6TE41-1AA0**
630 (800)	**6SL3330-6TE41-3AA0**
800 (1000)	**6SL3330-6TE41-7AA0**
Line voltage 500 ... 690 V 3 AC	
450	**6SL3330-6TG35-5AA0**
710	**6SL3330-6TG38-8AA0**
1000	**6SL3330-6TG41-2AA0**
1400	**6SL3330-6TG41-7AA0**

Accessories

Description	Order No.
Warning signs in foreign languages This set of foreign language warning signs can be placed on top of the standard German or English signs. One set of labels is supplied with the devices.The following languages are available in each label set: Chinese Simplified, Danish, Dutch, Finnish, French, Greek, Italian, Japanese, Korean, Polish, Portuguese/Brazilian, Russian, Swedish, Spanish, Czech, Turkish	**6SL3166-3AB00-0AA0**

Integration

The Smart Line Module communicates with a CU320 or SIMOTION D4x5 Control Unit via DRIVE-CLiQ.



Connection example of a Smart Line Module in chassis format

Smart Line Modules in chassis format

Technical specifications

General technical specifications	
Electrical data	
Line connection voltage (up to 2000 m (6562 ft) above sea level)	380 V ... 480 V 3 AC ± 10 % (-15 % < 1 min) or 500 V ... 690 V 3 AC ± 10 % (-15 % < 1 min)
Line frequency	47 … 63 Hz
Line Power factor at rated output	
• Fundamental Power factor (cos φ_1)	> 0.96
• Total (λ)	0.75 … 0.93
Overvoltage category to EN 60664-1	Class III
DC link voltage U_d	1.35 x line voltage [1]
Electronics power supply	24 V DC, -15 %/+20 %
Line contactor control	
• Terminal strip X9/5-6	240 V AC/max. 8 A 30 V DC/max. 1 A
Radio Interference suppression	
Standard	No radio interference suppression (Category C3 to EN 61800-3 up to 300 m (984 ft) total cable length)
Ambient conditions	
Type of cooling	Internal air cooling, power units with forced air cooling through a built-in fan
Permissible ambient and coolant temperature (air) during operation for line-side components, Line Modules and Motor Modules	0 … 40 °C (32 … 104 °F) without derating, > 40 … 55 °C (104 … 131 °F) see derating characteristics
Site altitude	Up to 2000 m (6562 ft) above sea level without derating, > 2000 ... 4000 m (6562 ... 13124 ft) above sea level see derating characteristics
Certificates	
Conformity	CE (low-voltage and EMC Directives)
Approvals	cULus (File No.: E192450)

[1] The DC link voltage is unregulated and load-dependent. For further information see System description.

Technical specifications (continued)

Line voltage 380 ... 480 V 3 AC		Smart Line Modules in chassis format 6SL3330- 6TE35-5AA0	 6SL3330- 6TE37-3AA0	 6SL3330- 6TE41-1AA0	 6SL3330- 6TE41-3AA0	 6SL3330- 6TE41-7AA0
Infeed power						
• Rated power P_{rated} - With 400 V 3 AC - With 460 V 3 AC [1]	 kW (HP)	 250 (400)	 355 (500)	 500 (700)	 630 (800)	 800 (1000)
• For S6 duty (40 %) P_{S6}	kW	On request	On request	On request	On request	On request
• P_{max}	kW	375	532.5	750	945	1200
DC link current						
• Rated current I_{rated_DC}	A	550	730	1050	1300	1700
• I_{H_DC}	A	490	650	934	1157	1513
• Base-load current I_{max_DC}	A	825	1095	1575	1950	2550
Input current						
• Rated current at 400 V 3 AC	A	463	614	883	1093	1430
• Maximum	A	694.5	921	1324.5	1639.5	2145
Current requirement						
• 24 V DC electronic power supply, max.	A	1.35	1.35	1.4	1.5	1.7
• Fan supply with 400 V 2 AC, 50/60 Hz, max.	A	1.6/2.4	1.6/2.4	3.53/5.3	5.2/7.8	5.2/7.8
DC link capacitance						
• Smart Line Module	µF	8400	12000	16800	18900	28800
• Drive line-up, max. (charge limit)	µF	33600	48000	67200	75600	115200
Efficiency η		0.99	0.99	0.99	0.99	0.99
Power loss, max.	kW	3.7	4.7	7.1	11	11.5
Cooling air requirement	m^3/s (ft^3/s)	0.36 (12.7)	0.36 (12.7)	0.78 (27.5)	1.08 (38.1)	1.08 (38.1)
Sound pressure level L_{pA} (1 m) at 50/60 Hz	dB	69/73	69/73	70/73	70/73	70/73
Line connection U1, V1, W1		Flat connector for M10 screw	Flat connector for M10 screw	Flat connector for M12 screw	Flat connector for M12 screw	Flat connector for M12 screw
• Conductor cross-section, max.	mm^2	2 × 240	2 × 240	4 × 240	4 × 240	6 × 240
DC link connection DCP, DCN		Flat connector for M10 screw	Flat connector for M10 screw	Flat connector for M12 screw	Flat connector for M12 screw	Flat connector for M12 screw
• Conductor cross-section, max.	mm^2	2 × 240	2 × 240	Busbar	Busbar	Busbar
PE connection		M10 screw	M10 screw	M12 screw	M12 screw	M12 screw
• Conductor cross-section, max.		2 × 240	2 × 240	3 × 240	4 × 240	4 × 240
Cable length, max. (total of all motor cables and DC link)						
• Shielded	m (ft)	4000 (13124)	4000 (13124)	4800 (15749)	4800 (15749)	4800 (15749)
• Unshielded	m (ft)	6000 (19686)	6000 (19686)	7200 (23623)	7200 (23623)	7200 (23623)
Degree of protection		IP00	IP00	IP00	IP00	IP00
Dimensions						
• Width	mm (in)	310 (12.20)	310 (12.20)	503 (19.80)	704 (27.72)	704 (27.72)
• Height	mm (in)	1400 (55.12)	1400 (55.12)	1400 (55.12)	1400 (55.12)	1400 (55.12)
• Depth	mm (in)	550 (21.65)	550 (21.65)	550 (21.65)	550 (21.65)	550 (21.65)
Frame Size		G	G	H	J	J
Weight, approx.	kg (lb)	150 (331)	150 (331)	294 (648)	458 (1010)	458 (1010)

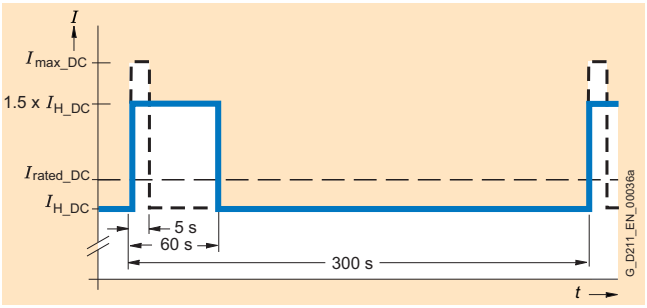
1) Nominal HP ratings are provided for ease of assigning components only. The Line Module outputs are dependent on the Motor Module loading and are to be dimensioned accordingly.

Technical specifications (continued)

Line voltage 500 ... 690 V 3 AC		Smart Line Modules in chassis format 6SL3330-6TG35-5AA0	6SL3330-6TG38-8AA0	6SL3330-6TG41-2AA0	6SL3330-6TG41-7AA0
Infeed power					
• Rated power P_{rated} with 690 V 3 AC	kW	450	710	1000	1400
• For S6 duty (40 %) P_{S6}	kW	On request	On request	On request	On request
• P_{max}	kW	675	1065	1500	2100
DC link current					
• Rated current I_{rated_DC}	A	550	900	1200	1700
• I_{H_DC}	A	490	800	1068	1513
• Base-load current I_{max_DC}	A	825	1350	1800	2550
Input current					
• Rated current at 690 V 3 AC	A	463	757	1009	1430
• Maximum	A	694.5	1135.5	1513.5	2145
Current requirement					
• 24 V DC electronic power supply, max.	A	1.35	1.4	1.5	1.7
• Fan supply with 690 V 2 AC, 50/60 Hz, max.	A	0.94/1.4	2.1/3.2	3.1/4.7	3.1/4.7
DC link capacitance					
• Smart Line Module	µF	5600	7400	11100	14400
• Drive line-up, max. (charge limit)	µF	22400	29600	44400	57600
Efficiency η		0.99	0.99	0.99	0.99
Power loss, max.	kW	4.3	6.5	12	13.8
Cooling air requirement	m^3/s (ft^3/s)	0.36 (12.7)	0.78 (27.5)	1.08 (38.1)	1.08 (38.1)
Sound pressure level L_{pA} (1 m) at 50/60 Hz	dB	69/73	70/73	70/73	70/73
Line connection U1, V1, W1		Flat connector for M10 screw	Flat connector for M12 screw	Flat connector for M12 screw	Flat connector for M12 screw
• Conductor cross-section, max.	mm^2	2 × 240	4 × 240	6 × 240	6 × 240
DC link connection DCP, DCN		Flat connector for M10 screw	Flat connector for M10 screw	Flat connector for M10 screw	Flat connector for M10 screw
• Conductor cross-section, max.	mm^2	2 × 240	Busbar	Busbar	Busbar
PE connection		M10 screw	M12 screw	M12 screw	M12 screw
• Conductor cross-section, max.		2 × 240	3 × 240	4 × 240	4 × 240
Cable length, max. (total of all motor cables and DC link)					
• Shielded	m (ft)	2250 (7382)	2750 (9023)	2750 (9023)	2750 (9023)
• Unshielded	m (ft)	3375 (11073)	4125 (13534)	4125 (13534)	4125 (13534)
Degree of protection		IP00	IP00	IP00	IP00
Dimensions					
• Width	mm (in)	310 (12.20)	503 (19.80)	704 (27.72)	704 (27.72)
• Height	mm (in)	1400 (55.12)	1400 (55.12)	1400 (55.12)	1400 (55.12)
• Depth	mm (in)	550 (21.65)	550 (21.65)	550 (21.65)	550 (21.65)
Frame Size		G	H	J	J
Weight, approx.	kg (lb)	150 (331)	294 (648)	458 (1010)	458 (1010)

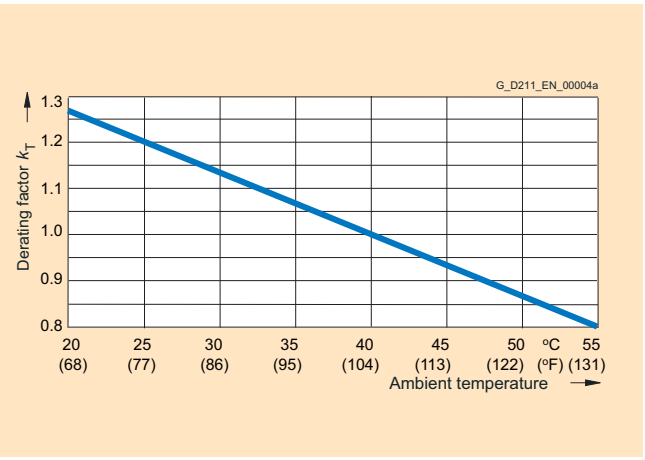
Characteristics

Overload capability



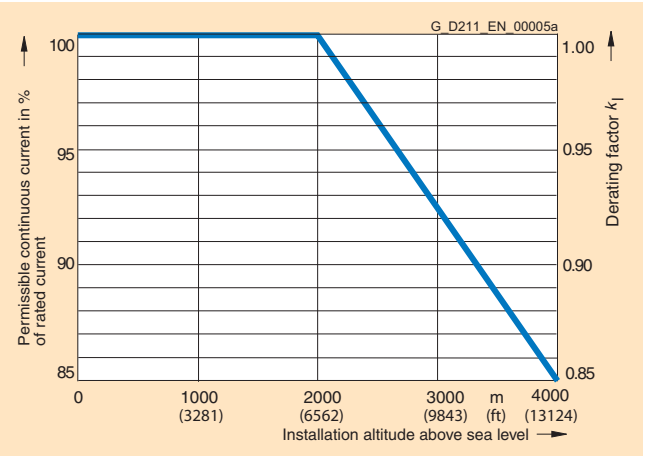
Overload capability

Derating characteristics

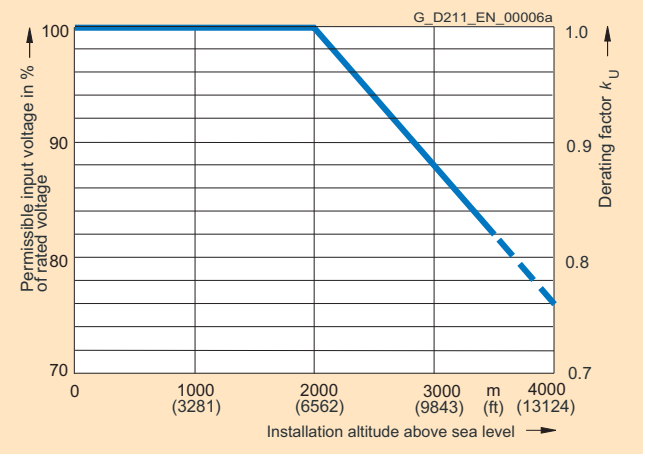


Current derating dependent on ambient temperature

Note: A derating factor k_T > 1.0 is to be taken into account only in conjunction with "current derating dependent on installation altitude". See also System description.



Current derating dependent on installation altitude



Voltage derating dependent on installation altitude

Overview

Line reactors reduce harmonic currents on the supply system and limit commutating dips in Smart Line Modules. The associated line reactor is required for operating Smart Line Modules.

Selection and ordering data

Infeed power of the Smart Line Module kW (HP)	Suitable for Smart Line Module in chassis format	**Line reactor** Order No.
Line voltage 380 ... 480 V 3 AC		
250 (400)	6SL3330-6TE35-5AA0	**6SL3000-0EE36-2AA0**
355 (500)	6SL3330-6TE37-3AA0	**6SL3000-0EE36-2AA0**
500 (700)	6SL3330-6TE41-1AA0	**6SL3000-0EE38-8AA0**
630 (800)	6SL3330-6TE41-3AA0	**6SL3000-0EE41-4AA0**
800 (1000)	6SL3330-6TE41-7AA0	**6SL3000-0EE41-4AA0**
Line voltage 500 ... 690 V 3 AC		
450	6SL3330-6TG35-5AA0	**6SL3000-0EH34-7AA0**
710	6SL3330-6TG38-8AA0	**6SL3000-0EH37-6AA0**
1000	6SL3330-6TG41-2AA0	**6SL3000-0EH41-4AA0**
1400	6SL3330-6TG41-7AA0	**6SL3000-0EH41-4AA0**

Technical specifications

Line voltage 380 ... 480 V 3 AC		Line reactor 6SL3000-0EE36-2AA0	6SL3000-0EE38-8AA0	6SL3000-0EE41-4AA0
Thermal current $I_{th\ max}$	A	615	885	1430
Power loss at 50/60 Hz	kW	0.5/0.56	0.725/0.81	0.925/1.08
Line/load connection		Flat connector for M10 screw	Flat connector for M10 screw	Flat connector for M10 screw
Degree of protection		IP00	IP00	IP00
Dimensions				
• Width	mm (in)	280 (11.02)	368 (14.49)	544 (21.42)
• Height	mm (in)	264 (10.39)	370 (14.57)	386 (15.20)
• Depth	mm (in)	203 (7.99)	254 (10.00)	232 (9.13)
Weight, approx.	kg (lb)	57 (126)	85.5 (189)	220 (485)
Approvals		On request	On request	On request
Suitable for Smart Line Module in chassis format	Type (rated infeed power)	6SL3330-6TE35-5AA0 (250 kW) 6SL3330-6TE37-3AA0 (355 kW)	6SL3330-6TE41-1AA0 (500 kW)	6SL3330-6TE41-3AA0 (630 kW) 6SL3330-6TE41-7AA0 (800 kW)

Line voltage 500 ... 690 V 3 AC		Line reactor 6SL3000-0EH34-7AA0	6SL3000-0EH37-6AA0	6SL3000-0EH41-4AA0
Thermal current $I_{th\ max}$	A	465	760	1430
Power loss at 50/60 Hz	kW	0.72/0.82	0.84/0.95	1.68/1.85
Line/load connection		Flat connector for M10 screw	Flat connector for M10 screw	Flat connector for M10 screw
Degree of protection		IP00	IP00	IP00
Dimensions				
• Width	mm (in)	330 (12.99)	370 (14.57)	655 (25.79)
• Height	mm (in)	318 (12.52)	376 (14.80)	383 (15.08)
• Depth	mm (in)	200 (7.87)	281 (11.06)	288 (11.34)
Weight, approx.	kg (lb)	58 (128)	145 (320)	239 (527.00)
Approvals [1]		cULus available soon	cULus available soon	cULus available soon
Suitable for Smart Line Module in chassis format	Type (rated infeed power)	6SL3330-6TG35-5AA0 (450 kW)	6SL3330-6TG38-8AA0 (710 kW)	6SL3330-6TG41-2AA0 (1000 kW) 6SL3330-6TG41-7AA0 (1400 kW)

[1] For line voltages up to 600 V 3 AC.

Smart Line Modules in chassis format
Recommended line-side components

Overview

Suitable line-side power components are assigned depending on the power rating of the Smart Line Module.

The tables below list recommended components.

Further information about the line contactors, switch disconnectors, fuses and circuit-breakers specified in the tables can be found in the Catalogs LV 1, LV 1T and ET B1.

Assignment of line-side power components to Smart Line Modules in chassis format

Infeed power	Input current	**Assignment to Smart Line Module**	**Line contactor**	**Fixed-mounted circuit-breaker**
kW (HP)	A	Type 6SL3330-	Order No.	Order No.
Line voltage 380 ... 480 V 3 AC				
250 (400)	463	6TE35-5AA0	**3RT1476-6AP36**	–
355 (500)	614	6TE37-3AA0	**3RT1476-6AP36**	–
500 (700)	883	6TE41-1AA0	–	**3WL1210-4CB34-4AN2-Z C22**
630 (800)	1093	6TE41-3AA0	–	**3WL1212-4CB34-4AN2-Z C22**
800 (1000)	1430	6TE41-7AA0	–	**3WL1216-4CB34-4AN2-Z C22**
Line voltage 500 ... 690 V 3 AC				
450	463	6TG35-5AA0	**3RT1466-6AP36**	–
710	757	6TG38-8AA0	**3RT1466-6AP36** (3 units)	–
1000	1009	6TG41-2AA0	–	**3WL1212-4CB34-4AN2-Z C22**
1400	1430	6TG41-7AA0	–	**3WL1216-4CB34-4AN2-Z C22**

Infeed power	Input current	**Assignment to Smart Line Module**	**Switch disconnector without handle and shaft**	**Switch disconnector with handle and shaft**	**Cable protection fuse**		**Cable protection fuse incl. semiconductor protection**	
kW (HP)	A	Type 6SL3330-	Order No.	Order No.	Order No.	Rated current	Order No.	Rated current
Line voltage 380 ... 480 V 3 AC								
250 (400)	463	6TE35-5AA0	**3KL6130-1AB02**	**3KL6130-1EB02**	**3NA3365**	500 A	**3NE1435-2**	560 A
355 (500)	614	6TE37-3AA0	**3KL6230-1AB02**	**3KL6230-1EB02**	**3NA3372**	630 A	**3NE1437-2**	710 A
500 (700)	883	6TE41-1AA0	–	–	**3NA3480**	1000 A	**3NE1334-2** (2 units)	2 × 500 A
630 (800)	1093	6TE41-3AA0	–	–	**3NA3482**	1250 A	**3NE1436-2** (2 units)	2 × 630 A
800 (1000)	1430	6TE41-7AA0	–	–	**3NA3475** (2 units)	2 × 800 A	**3NE1448-2** (2 units)	2 × 850 A
Line voltage 500 ... 690 V 3 AC								
450	463	6TG35-5AA0	**3KL6130-1AB02**	**3KL6130-1EB02**	**3NA3365-6**	500 A	**3NE1435-2**	560 A
710	757	6TG38-8AA0	**3KL6230-1AB02**	**3KL6230-1EB02**	**3NA3360-6** (2 units)	2 × 400 A	**3NE1448-2**	850 A
1000	1009	6TG41-2AA0	–	–	**3NA3354-6** (3 units)	3 × 355 A	**3NE1435-2** (2 units)	2 × 560 A
1400	1430	6TG41-7AA0	–	–	**3NA3365-6** (3 units)	3 × 500 A	**3NE1448-2** (2 units)	2 × 850 A

Overview

The self-commutated feed/feedback units (with IGBTs in infeed and regenerative feedback directions) generate a regulated DC link voltage. This means that the connected Motor Modules are decoupled from the line voltage. Line voltage fluctuations within the permissible supply tolerances have no effect on the motor voltage. Active Line Modules are designed for connection to grounded-neutral (TN, TT) and non-grounded (IT) supply systems.

The DC link is pre-charged via integrated precharging resistors.

In order to operate an Active Line Module, it is absolutely essential to use the appropriate Active Interface Module or matching line reactor.

Design

The Active Line Modules in booksize format feature the following connections and interfaces as standard:

- 1 line connection via screw-type terminals
- 1 connection for the 24 V DC electronic power supply via the 24 V terminal adapter included in the scope of supply
- 1 DC link connection via integrated DC link busbars
- 3 DRIVE-CLiQ sockets
- 2 PE (protective earth) connections

The status of the Active Line Modules is indicated via two multi-color LEDs.

On the 100 mm (3.94 in) wide Active Line Module, the shield for the power supply cable can be connected to the integrated shield connection plate via shield connection element or tube clip, e.g. Weidmüller type KLBÜ CO 4. The shield connection terminal must not be used for strain relief. Shield connection kits are available for the 150 mm (5.91 in), 200 mm (7.87 in) and 300 mm (11.81 in) wide modules.

The signal cable shield can be connected to the Line Module by means of a shield connection terminal, e.g. type KLBÜ 3-8 SC by Weidmüller.

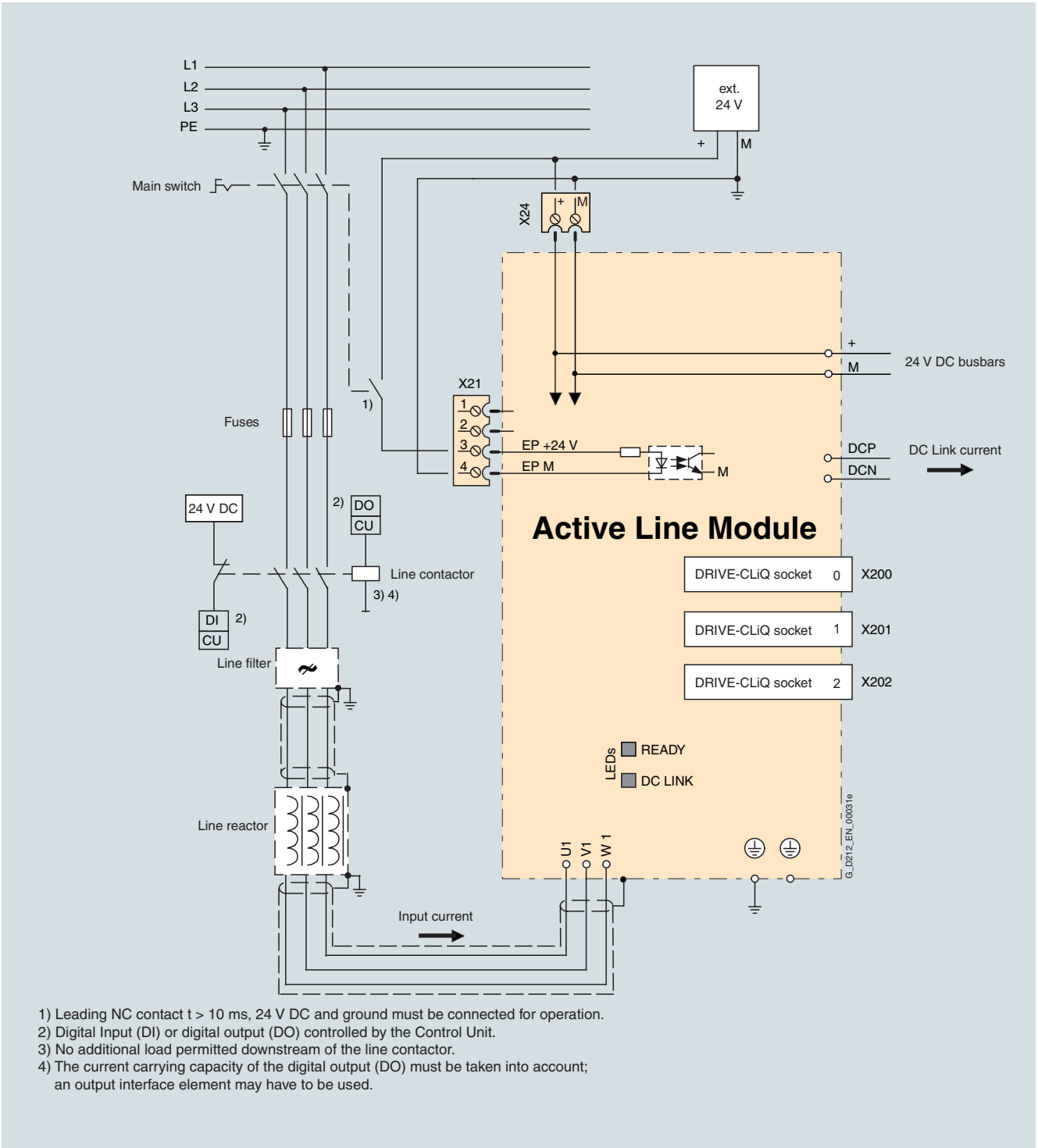
The scope of supply of the Active Line Modules includes:

- DRIVE-CLiQ cable for connection to the Control Unit mounted on the immediate left
- DRIVE-CLiQ cable (length depends on module width) to connect Active Line Module to adjacent Motor Module
- 2 blanking plugs for sealing unused DRIVE-CLiQ sockets
- Jumper for connecting the 24 V DC busbar to the adjacent Motor Module
- 24 V terminal adapter (X24)
- Connector X21 for digital inputs
- Fan insert for Active Line Modules of 80 kW and 120 kW (the supply voltage for the fan unit is supplied by the Active Line Module)
- 1 set of warning signs in foreign languages
- 1 heat conducting foil
  (for Active Line Modules with cold plate cooling only)

Active Line Modules in booksize format

Integration

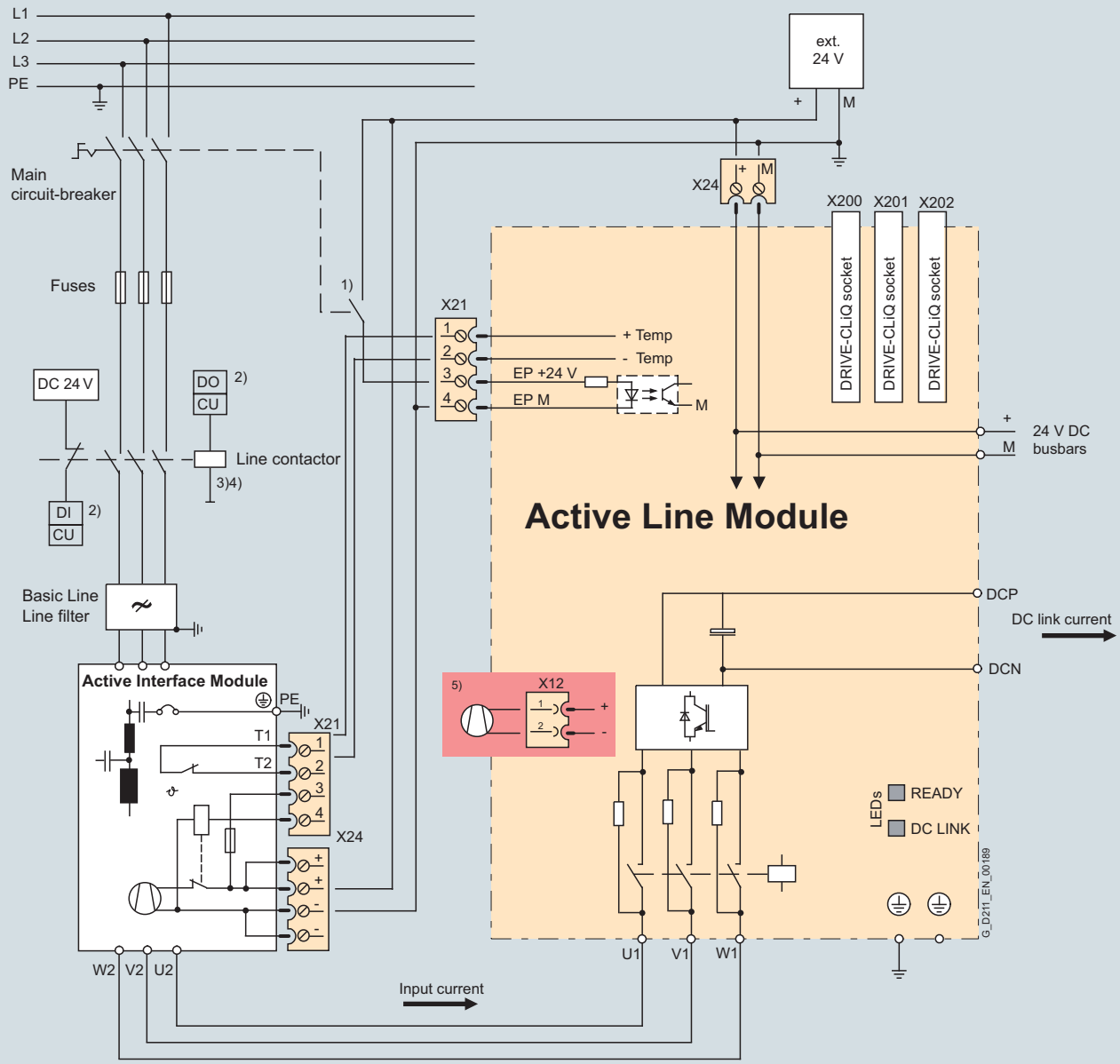
The Active Line Module communicates with the CU320 or SIMOTION D Control Unit via DRIVE-CLiQ.



1) Leading NC contact t > 10 ms, 24 V DC and ground must be connected for operation.
2) Digital Input (DI) or digital output (DO) controlled by the Control Unit.
3) No additional load permitted downstream of the line contactor.
4) The current carrying capacity of the digital output (DO) must be taken into account; an output interface element may have to be used.

Connection example of 16 kW and 36 kW Active Line Modules in booksize format

Integration (continued)



1) Leading NC contact t > 10 ms, 24 V DC and ground must be connected for operation.
2) Digital input (DI) or digital output (DO), controlled by the Control Unit.
3) No additional load permitted downstream of the line contactor.
4) The current carrying capacity of the digital output (DO) must be taken into account; an output interface element may have to be used.
5) Fan insert for Active Line Module 80 kW and 120 kW. The fan insert is supplied with the Active Line Module.

Connection example of 55 kW to 120 kW Active Line Modules in booksize format

Active Line Modules in booksize format

Technical specifications

General technical specifications	
Electrical data	
Line connection voltage (up to 2000 m (6562 ft) above sea level)	380 ... 480 V 3 AC ±10 % (-15 % < 1 min) [1]
Line frequency	47 … 63 Hz
Line Power factor	
• Active mode	
- Fundamental Power factor (cos ϕ_1)	1.0 (factory setting), can be altered by input of a reactive current setpoint
- Total (λ)	1.0 (factory setting)
• Smart Mode	
- Fundamental mode	> 0.96
- Overall	0.65 … 0.90
Overvoltage category to EN 60664-1	Class III
DC link voltage V_d	In "Active Mode" the DC link voltage is regulated and can be adjusted as a voltage decoupled from the line voltage. In "Smart Mode" the DC link voltage is in proportion to the line voltage to the mean rectified line voltage value. Factory setting for DC link voltage: 380 … 400 V 3 AC: 600 V (Active Mode) 400 … 415 V 3 AC: 625 V (Active Mode) 416 … 480 V 3 AC: 1.35 x line voltage (Smart Mode)
Electronic power supply	24 V DC, -15 %/+20 %
Radio Interference suppression	
• Active Line Module 16 kW and 36 kW	
- Standard (Active Line Module + line reactor)	No interference suppression
- With line filter package	Category C2 to EN 61800-3
• Active Line Module 55 kW, 80 kW and 120 kW	
- Standard (Active Line Module + Active Interface Module)	Category C3 to EN 61800-3 up to 350 m (1148 ft) total cable length
- With Basic Line Filter	Category C2 to EN 61800-3 up to 350 m (1148 ft) total cable length Category C3 to EN 61800-3 from 350 m to 1000 m (1148 ... 3281 ft) total cable length
Ambient conditions	
Type of cooling	- Internal air cooling, external air cooling Power units with forced air cooling through a built-in fan - Cold plate cooling
Permissible ambient and coolant temperature (air) during operation for line-side components, Line Modules and Motor Modules	0 … 40 °C (32 … 104 °F) without derating, > 40 … 55 °C (104 … 131 °F) see derating characteristics
Site altitude	Up to 1000 m (3281 ft) above sea level without derating, > 1000 ... 4000 m (3281 ... 13124 ft) above sea level see derating characteristics
Certificates	
Conformity	CE (low-voltage and EMC Directives)
Approvals	cULus (File No.: E192450)

[1] Active Line Modules 16 kW to 55 kW as of firmware version V2.5 with appropriate parameterization and reduced power rating also operable on networks with 200 ... 240 V 3 AC ±10 %.

Technical specifications (continued)

Line voltage 380 ... 480 V 3 AC		Active Line Modules in booksize format				
Internal air cooling	**6SL3130-**	**7TE21-6AA3**	**7TE23-6AA3**	**7TE25-5AA3**	**7TE28-0AA3**	**7TE31-2AA3**
External air cooling	**6SL3131-**	**7TE21-6AA3**	**7TE23-6AA3**	**7TE25-5AA3**	**7TE28-0AA3**	**7TE31-2AA3**
Cold plate cooling	**6SL3136-**	**7TE21-6AA3**	**7TE23-6AA3**	**7TE25-5AA3**	**7TE28-0AA3**	**7TE31-2AA3**
Feed/feedback power						
• Rated power P_{rated}						
- With 380 V 3 AC	kW	16	36	55	80 (64 [4])	120 (84 [4])
- With 460 V 3 AC [5]	(HP)	(18)	(40)	(60)	(100) (75 [4])	(150) (100 [4])
• For S6 duty (40 %) P_{S6}	kW	21	47	71	106	158
• P_{max}	kW	35	70	91	131	175
DC link current						
• At 600 V DC	A	27	60	92	134	200
• For S6 duty (40 %)	A	35	79	121	176	244
• Max.	A	59	117	152	218	292
Input current						
• Rated current at 380 V 3 AC	A	26	58	88	128	192
• For S6 duty (40 %)	A	35	79	121	176	244
• Maximum	A	59	117	152	195	292
Current requirement 24 V DC electronic power supply, max.	A	1.1	1.5	1.9	2.0	2.5
Current carrying capacity						
• 24 V DC busbars	A	20	20	20	20	20
• DC link busbars	A	100	200	200	200	200
DC link capacitance						
• Active Line Module	µF	710	1410	1880	2820	3995
• Drive line-up, max.	µF	20000	20000	20000	20000	20000
Internal/external air cooling						
• Power loss [1]						
- With internal air cooling	kW	0.29	0.67	0.95	1.39	2.26
- With external air cooling, int./ext.	kW	0.09/0.2	0.17/0.5	0.25/0.7	0.34/1.05	0.55/1.71
• Cooling air requirement	m^3/s (ft^3/s)	0.016 (0.6)	0.031 (1.1)	0.044 (1.6)	0.144 (5.1)	0.144 (5.1)
• Sound pressure level L_{pA} (1 m)	dB	< 60	< 65	< 60	< 75	< 75
Cold plate cooling						
• Power loss, int./ext. [1]	kW	0.07/0.21	0.13/0.52	0.19/0.74	0.3/1.1	0.46/1.8
• Thermal resistance R_{th}	K/W	0.075	0.055	0.05	0.028	0.028
Line connection U1, V1, W1		Screw-type terminals (X1)	M6 screw studs (X1)	M8 screw studs (X1)	M8 screw studs (X1)	M8 screw studs (X1)
• Conductor cross-section, max.	mm^2	2.5 … 10	2.5 … 50	2.5 … 95, 2 × 35	2.5 … 120, 2 × 50	2.5 … 120, 2 × 50
Shield connection		Integrated in the connector	see Accessories	see Accessories	see Accessories	see Accessories
PE connection		M5 screw	M6 screw	M6 screw	M8 screw	M8 screw
Cable length, max. (total of all motor power cables and DC link)						
• Shielded	m (ft)	350 [2] (1148)	350 [2] (1148)	1000 (3281)	1000 (3281)	1000 (3281)
• Unshielded	m (ft)	560 [2] (1837)	560 [2] (1837)	1500 (4922)	1500 (4922)	1500 (4922)
Degree of protection		IP20	IP20	IP20	IP20	IP20
Dimensions						
• Width	mm (in)	100 (3.94)	150 (5.91)	200 (7.87)	300 (11.81)	300 (11.81)
• Height	mm (in)	380 (14.96)	380 (14.96)	380 (14.96)	380 (14.96)	380 (14.96)
- With fan [3]	mm (in)	–	–	–	629 (24.76)	629 (24.76)
• Depth						
- With internal air cooling	mm (in)	270 (10.63)	270 (10.63)	270 (10.63)	270 (10.63)	270 (10.63)
- With external air cooling on/behind mounting surface	mm (in)	226/66.5 (8.90/2.62)	226/71 (8.90/2.80)	226/92 (8.90/3.62)	226/82 (8.90/3.23)	226/82 (8.90/3.23)
- With cold plate cooling	mm (in)	226 (8.90)	226 (8.90)	226 (8.90)	226 (8.90)	226 (8.90)
Weight, approx.						
- With internal air cooling	kg (lb)	7 (15.4)	10.3 (22.7)	17 (37.5)	23 (50.7)	23 (50.7)
- With external air cooling	kg (lb)	8.8 (19.4)	13.8 (30.4)	18.5 (40.8)	27.7 (61.1)	30.7 (67.7)
- With cold plate cooling	kg (lb)	6.1 (13.5)	10.2 (22.5)	13.8 (30.4)	20.3 (44.8)	20.4 (45.0)

1) Power loss of Active Line Module at rated output including losses of 24 V DC electronic power supply.

2) Max. cable lengths in conjunction with Voltage Clamping Module, see "Derating characteristics".

3) The fan is supplied with the Active Line Module and must be installed before the Active Line Module is commissioned.

4) In the case of cold plate cooling, derating is necessary due to heat transfer to the external heat sink (see the System description section).

5) Nominal HP ratings are provided for ease of assigning components only. The Line Module outputs are dependent on the Motor Module loading and are to be dimensioned accordingly.

Active Line Modules in booksize format

Selection and ordering data

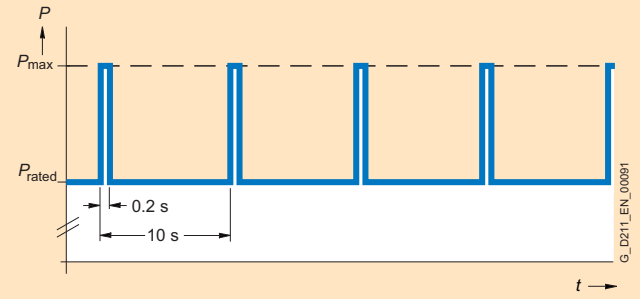
Rated power	Active Line Module in booksize format		
	Internal air cooling	External air cooling	Cold plate cooling
kW (HP)	Order No.	Order No.	Order No.
Line voltage 380 ... 480 V 3 AC			
16 (18)	**6SL3130-7TE21-6AA3**	**6SL3131-7TE21-6AA3**	**6SL3136-7TE21-6AA3**
36 (40)	**6SL3130-7TE23-6AA3**	**6SL3131-7TE23-6AA3**	**6SL3136-7TE23-6AA3**
55 (60)	**6SL3130-7TE25-5AA3**	**6SL3131-7TE25-5AA3**	**6SL3136-7TE25-5AA3**
80 (100)	**6SL3130-7TE28-0AA3**	**6SL3131-7TE28-0AA3**	**6SL3136-7TE28-0AA3**
120 (150)	**6SL3130-7TE31-2AA3**	**6SL3131-7TE31-2AA3**	**6SL3136-7TE31-2AA3**

Accessories

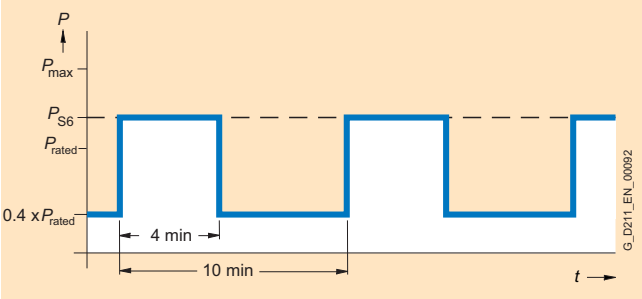
Description	Order No.
Shield connection kit for Line/Motor Modules in booksize format	
• 150 mm (5.91 in) wide for internal air cooling	**6SL3162-1AF00-0AA1**
• 150 mm (5.91 in) wide for external air cooling and cold plate cooling	**6SL3162-1AF00-0BA1**
• 200 mm (7.87 in) wide for internal air cooling	**6SL3162-1AH01-0AA0**
• 200 mm (7.87 in) wide for external air cooling and cold plate cooling	**6SL3162-1AH01-0BA0**
• 300 mm (11.81 in) wide for all cooling types	**6SL3162-1AH00-0AA0**
DC link rectifier adapter for direct infeed of DC link voltage	
• Screw-type terminals 0.5 to 10 mm^2 for Line Modules and Motor Modules in booksize format with a width of 50 mm (1.97 in) or 100 mm (3.94 in)	**6SL3162-2BD00-0AA0**
• Screw-type terminals 35 to 95 mm^2 for Line Modules and Motor Modules in booksize format with a width of 150 mm (5.91 in), 200 mm (7.87 in) and 300 mm (11.81 in)	**6SL3162-2BM00-0AA0**
DC link adapters (2 units) for multitier configuration Screw-type terminals 35 to 95 mm^2 for all Line Modules and Motor Modules in booksize format	**6SL3162-2BM01-0AA0**
24 V terminal adapter for all Line Modules and Motor Modules in booksize format	**6SL3162-2AA00-0AA0**
24 V jumper for connection of the 24 V busbars (for booksize format)	**6SL3162-2AA01-0AA0**
Warning signs in foreign languages This set of foreign language warning signs can be placed on top of the standard German or English signs. One set of labels is supplied with the devices. The following languages are available in each label set: Chinese Simplified, Danish, Dutch, Finnish, French, Greek, Italian, Japanese, Korean, Polish, Portuguese/Brazilian, Russian, Swedish, Spanish, Czech, Turkish	**6SL3166-3AB00-0AA0**

Characteristics

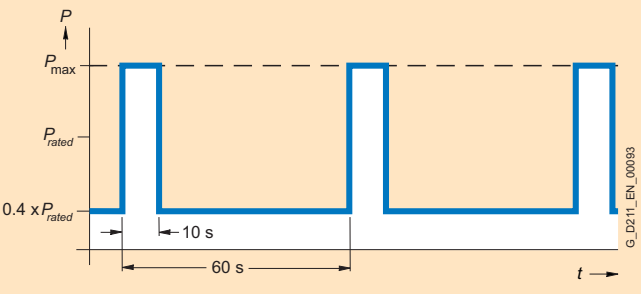
Overload capability



Load cycle with previous load

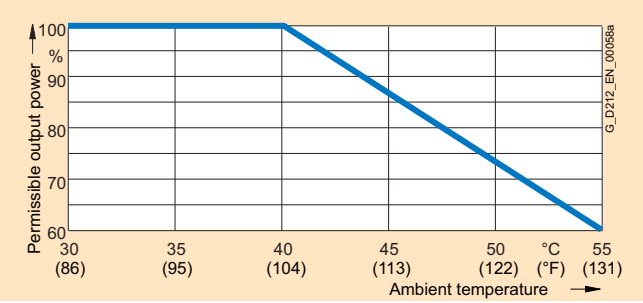


S6 load cycle with previous load

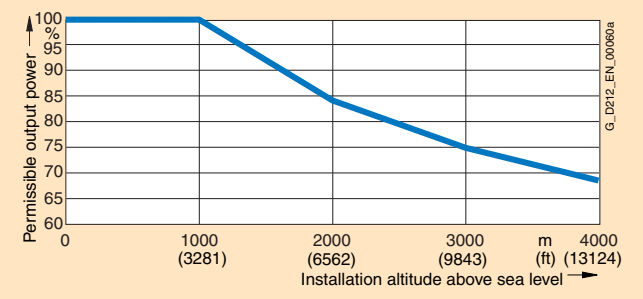


S6 load cycle with previous load

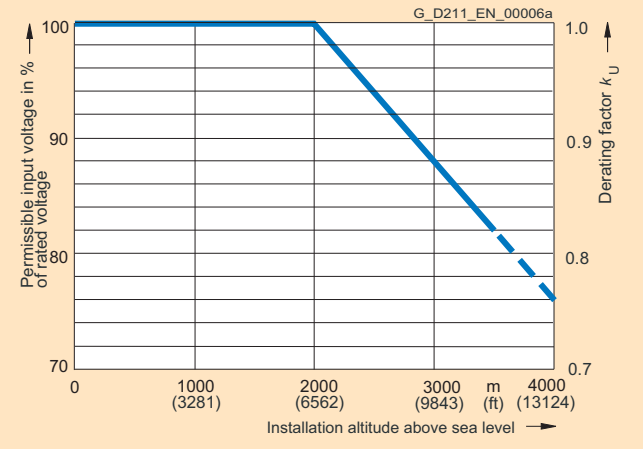
Derating characteristics



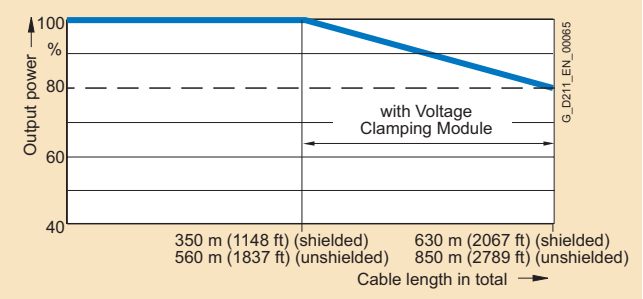
Output power dependent on ambient temperature



Output power dependent on installation altitude



Voltage derating dependent on installation altitude



Output power with 16 kW and 36 kW Active Line Modules is dependent on total cable length

Active Line Modules in booksize format
Active Interface Modules

Overview

The Active Interface Modules combined with the Active Line Modules form a highly functional unit and are essential for operation of the associated Active Line Module. The Active Interface Modules contain an ALM reactor, clean power filter and basic interference suppression to ensure compliance with Category C3 in accordance with EN 61800-3 regarding emitted interference.

The Clean Power Filter protects the line connection connection from switching-frequency harmonics. The drive system therefore draws a sinusoidal current from the supply and causes almost no harmonics.

The Active Line Modules in combination with the Active Interface Module can also be operated with supply systems with an isolated star point (IT systems).

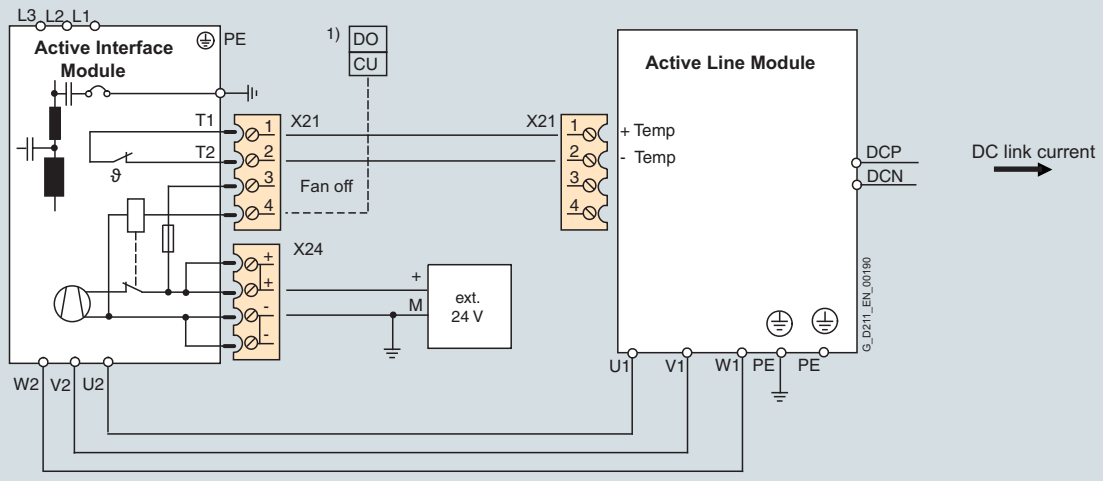
Design

The scope of supply of the Active Interface Modules includes:

- Connector X21 for temperature evaluation and fan control
- Connector X24 for connecting the 24 V supply for the integrated fan
- DRIVE-CLiQ cable (0.31 m for 55 kW Active Interface Module or 0.41 m for 80 kW and 120 kW Active Interface Module)
- 1 set of warning signs in foreign languages

3

Integration



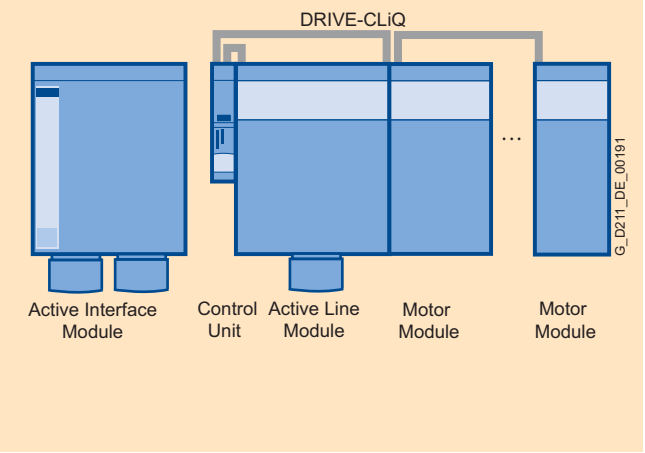
Connection example for Active Interface Module

The Active Interface Module requires a 24 V DC supply for operation of the integral fan.
The fan rotates after the 24 V DC supply is applied and can, if necessary (service life, noise), be shut off from the Control Unit over the "Fan off" input. It is only permitted to switch off the fan when the infeed of the drive system is not operating, otherwise the Active Interface Module will overheat.

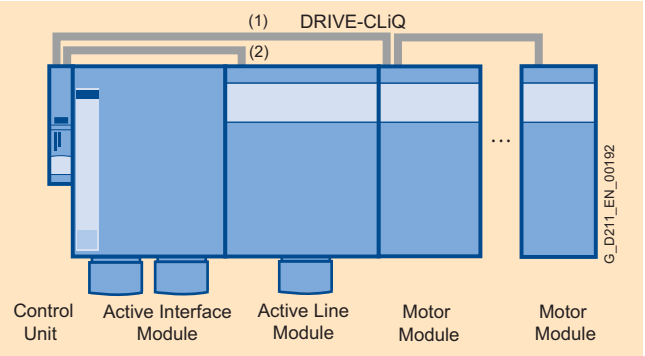
The thermostatic switch installed in the Active Interface Module is evaluated over the connected Active Line Module.

The power cables between the Active Interface Module and Active Line Module must be shielded if limit values for interference suppression are to be complied with. The cable shield can be routed over the shield connection set (option) to the Active Interface Module or Active Line Module.

Depending on the position of the Active Interface Module in the drive system, additional DRIVE-CLiQ cables may be required. If it is separately installed next to the left side of the Control Unit and Active Line Module, no additional DRIVE-CLiQ cables are required. If the Active Interface Module is placed between the Control Unit and Active Line Module, the DRIVE-CLiQ cables supplied with the Active Line Modules are suitable for setting up a line topology, i.e. Active Line Module and all Motor Modules in series on one DRIVE-CLiQ line. If the Active Line Module is connected over a separate DRIVE-CLiQ line, the DRIVE-CLiQ cable marked with (1) must be ordered. A DRIVE-CLiQ cable suitable for connection (2) is included in the scope of supply of the Active Line Module. For DRIVE-CLiQ cables for different configurations, see the section "Connection system".



Separate Active Interface Module



Active Interface Module integrated in the drive line-up

Active Line Modules in booksize format
Active Interface Modules

Technical specifications

Line voltage 380 ... 480 V 3 AC		Active Interface Module		
Internal air cooling		**6SL3100-0BE25-5AB0**	**6SL3100-0BE28-0AB0**	**6SL3100-0BE31-2AB0**
Rated current	A	85	132	200
Current requirement 24 V DC electronic power supply, max.	A	0.6	1.2	1.2
Internal resistance of the "Fan off" digital input (X21/Pin 4)	Ω	1440 ±10 %	1440 ±10 %	1440 ±10 %
Power loss	W	450	575	800
Cooling air requirement	m^3/s (ft^3/s)	0.075 (2.6)	0.15 (5.3)	0.15 (5.3)
Sound pressure level L_{pA} (1 m)	dB	66	68	68
Line/load connection L1, L2, L3/U2, V2, W2		M8 screw stud	M8 screw stud	M8 screw stud
• Conductor cross-section	mm^2	2.5 … 95 or 2 × 35	2.5 … 120 or 2 × 50	2.5 … 120 or 2 × 50
Thermostatic switch (NC contact)				
• Switching capacity		250 V AC/1.6 A 60 V DC/0.75 A	250 V AC/1.6 A 60 V DC/0.75 A	250 V AC/1.6 A 60 V DC/0.75 A
PE connection		M6 screw	M8 screw	M8 screw
Degree of protection		IP20	IP20	IP20
Dimensions				
• Width	mm (in)	200 (7.87)	300 (11.81)	300 (11.81)
• Height	mm (in)	380 (14.96)	380 (14.96)	380 (14.96)
• Depth	mm (in)	270 (10.63)	270 (10.63)	270 (10.63)
Weight, approx.	kg (lb)	21 (46.3)	29 (64)	36 (79.3)
Approvals		cURus available soon	cURus available soon	cURus available soon
Suitable for Active Line Module in booksize format	Type	6SL3130-7TE25-5AA3 6SL3131-7TE25-5AA3 6SL3136-7TE25-5AA3	6SL3130-7TE28-0AA3 6SL3131-7TE28-0AA3 6SL3136-7TE28-0AA3	6SL3130-7TE31-2AA3 6SL3131-7TE31-2AA3 6SL3136-7TE31-2AA3
• Rated power of the Active Line Module	kW	55	80	120

Selection and ordering data

Rated power of the Active Line Module	Suitable for Active Line Module in booksize format	**Active Interface Module**
kW (HP)		Order No.
Line voltage 380 ... 480 V 3 AC		
55 (60)	6SL3130-7TE25-5AA3 6SL3131-7TE25-5AA3 6SL3136-7TE25-5AA3	**6SL3100-0BE25-5AB0**
80 (100)	6SL3130-7TE28-0AA3 6SL3131-7TE28-0AA3 6SL3136-7TE28-0AA3	**6SL3100-0BE28-0AB0**
120 (150)	6SL3130-7TE31-2AA3 6SL3131-7TE31-2AA3 6SL3136-7TE31-2AA3	**6SL3100-0BE31-2AB0**

Accessories

Description	Order No.
Shield connection kit	
• For Active Interface Module 55 kW	**6SL3163-1AH00-0AA0**
• For Active Interface Module 80 kW and 120 kW	**6SL3163-1AM00-0AA0**
DRIVE-CLiQ cable, pre-assembled Degree of protection of connector IP20/IP20	
• Length 0.6 m (1.97 ft)	**6SL3060-4AU00-0AA0**
• Length 0.95 m (3.12 ft)	**6SL3060-4AA10-0AA0**

Characteristics

Refer to Active Line Modules in booksize format (page 3/113).

Overview

The 16 kW and 36 kW Active Line Modules cannot operate without the specified line reactors. The use of other makes of line reactor can lead to malfunctions or irreparable damage to equipment.

Selection and ordering data

Rated power of the Active Line Module	Suitable for Active Line Module in booksize format	**Line reactor**
kW (HP)		Order No.
Line voltage 380 ... 480 V 3 AC		
16 (18)	6SL3130-7TE21-6AA3 6SL3131-7TE21-6AA3	**6SN1111-0AA00-0BA1**
36 (40)	6SL3130-7TE23-6AA3 6SL3131-7TE23-6AA3	**6SN1111-0AA00-0CA1**

Technical specifications

Line voltage 380 ... 480 V 3 AC		**Line reactor 6SN1111-0AA00-0BA1**	**6SN1111-0AA00-0CA1**
Rated current	A	30	67
Power loss	kW	0.17	0.25
Line/load connection 1U1, 1V1, 1W1 / 1U2, 1V2, 1W2		Screw-type terminals	Screw-type terminals
• Conductor cross-section	mm^2	16	35
PE connection		Screw-type terminals	Screw-type terminals
• Conductor cross-section	mm^2	16	35
Degree of protection		IP20	IP20
Dimensions			
• Width	mm (in)	150 (5.91)	150 (5.91)
• Height	mm (in)	330 (12.99)	330 (12.99)
• Depth	mm (in)	145 (5.71)	230 (9.06)
Weight, approx.	kg (lb)	8.5 (19)	13 (29)
Approvals		cURus	cURus
Suitable for Active Line Module in booksize format	Type	6SL3130-7TE21-6AA3 6SL3131-7TE21-6AA3	6SL3130-7TE23-6AA3 6SL3131-7TE23-6AA3
• Rated power of the Active Line Module	kW	16	36

Active Line Modules in booksize format
Line filters

Overview

In plants which have strict EMC requirements, line filters work together with line reactors to restrict the conducted interference emanating from the Power Modules to the limit values of Category C2 as defined in EN 61800-3. Line filters are suited only for direct connection to TN (grounded) systems.

Optional line filter ranges that are coordinated with the power range are available for the SINAMICS S120 drive system:

- Wideband Line Filters
- Basic Line Filters

These line filters differ with regard to the frequency range in which they reduce the conducted emissions.

Note: According to product standard IEC 61800-3 RI suppression commensurate with the relevant operating conditions must be provided and is a legal requirement in the EU (EMC Directive). Line filters and line reactors are required for this purpose. The use of filters of other makes can lead to limit value violations, resonance, overvoltages and irreparable damage to motors or other equipment. The machine manufacturer must provide verification that the machinery to be operated with the drive products and the installed suppression elements, e.g. line filters, are CE/EMC-compliant before the machines are approved for delivery.

Active Line Modules in booksize format
Wideband Line Filter (in line filter package)

Overview

The damping characteristics of Wideband Line Filters for 16 kW and 36 kW Active Line Modules not only conform with the requirements of EMC standards for the frequency range of 150 kHz to 30 MHz but also include low frequencies of 2 kHz and above. As a result, these line filters have an extended functional range, allowing a certain independence with respect to the machine installation location in cases where the line properties are generally unknown (e.g., line impedance).

Selection and ordering data

Line filters for Active Line Modules in booksize format are available only in combination with the relevant line reactor as a line filter package. The order number for the line filter package includes the Wideband Line Filter and the line reactor.

Rated power of the Active Line Module	Suitable for Active Line Module in booksize format	**Line filter package (Wideband Line Filter and line reactor)**
kW (HP)		Order No.
Line voltage 380 ... 480 V 3 AC		
16 (18)	6SL3130-7TE21-6AA3 6SL3131-7TE21-6AA3	**6SL3000-0FE21-6AA0**
36 (40)	6SL3130-7TE23-6AA3 6SL3131-7TE23-6AA3	**6SL3000-0FE23-6AA0**

Technical specifications

Line voltage 380 ... 480 V 3 AC		Wideband Line Filter (included in each line filter package)	
Rated current	A	30	67
Power loss	kW	0.07	0.09
Line/load connection L1, L2, L3 / U, V, W		Screw-type terminals	Screw-type terminals
• Conductor cross-section	mm^2	10	50
PE connection		M5 screw stud	M8 screw stud
Degree of protection		IP20	IP20
Dimensions			
• Width	mm (in)	130 (5.12)	130 (5.12)
• Height	mm (in)	480 (18.90)	480 (18.90)
• Depth	mm (in)	150 (5.91)	245 (9.65)
Weight, approx.	kg (lb)	9 (20)	16 (35)
Approvals		cURus	cURus
Suitable for Active Line Module in booksize format	Type	6SL3130-7TE21-6AA3 6SL3131-7TE21-6AA3	6SL3130-7TE23-6AA3 6SL3131-7TE23-6AA3
• Rated power of the Active Line Module	kW	16	36

Accessories

Line filter package for Active Line Module 16 kW assembled with an adapter set

The adapter sets for units in booksize format are designed for very compact mounting. They enable line filters and line reactors to be installed compactly one above the other in the control cabinet.

Rated power of the Active Line Module	Suitable for Line filter package	**Adapter set**
kW (HP)		Order No.
16 (18)	6SL3000-0FE21-6AA0	**6SL3060-1FE21-6AA0**
36 (40)	6SL3000-0FE23-6AA0	**6SN1162-0GA00-0CA0**

Active Line Modules in booksize format
Basic Line Filters

Overview

Basic Line Filters are used on machines on which conducted interference emissions in the frequency range between 150 kHz and 30 MHz need to be damped in accordance with the requirements of CE-EMC legislation.

Selection and ordering data

Rated power of the Active Line Module kW (HP)	Suitable for Active Line Module in booksize format	**Basic Line Filters** Order No.
Line voltage 380 ... 480 V 3 AC		
16 (18)	6SL3130-7TE21-6AA3 6SL3131-7TE21-6AA3	**6SL3000-0BE21-6DA0**
36 (40)	6SL3130-7TE23-6AA3 6SL3131-7TE23-6AA3	**6SL3000-0BE23-6DA0**
55 (60)	6SL3130-7TE25-5AA3 6SL3131-7TE25-5AA3	**6SL3000-0BE25-5DA0**
80 (100)	6SL3130-7TE28-0AA3 6SL3131-7TE28-0AA3	**6SL3000-0BE28-0DA0**
120 (150)	6SL3130-7TE31-2AA3 6SL3131-7TE31-2AA3	**6SL3000-0BE31-2DA0**

More information

You must follow the instructions in the Equipment Manual when using Basic Line Filters in conjunction with 16 kW and 36 kW Active Line Modules in your machine: SINAMICS S120 booksize power units.

Technical specifications

Line voltage **380 ... 480 V 3 AC**		**Basic Line Filters** **6SL3000-0BE21-6DA0**	**6SL3000-0BE23-6DA0**	**6SL3000-0BE25-5DA0**	**6SL3000-0BE28-0DA0**	**6SL3000-0BE31-2DA0**
Rated current	A	36	65	105	132	192
Power loss	kW	0.006	0.010	0.015	0.05	0.09
Line/load connection L1, L2, L3 / U, V, W		Screw-type terminals	Screw-type terminals	Screw-type terminals	Screw-type terminals	Screw-type terminals
• Conductor cross-section	mm^2	10	35	50	95	95
PE connection		M6 screw stud	M6 screw stud	M8 screw stud	M10 screw stud	M10 screw stud
Degree of protection		IP20	IP20	IP20	IP20	IP20
Dimensions						
• Width	mm (in)	50 (1.97)	75 (2.95)	100 (3.94)	150 (5.91)	150 (5.91)
• Height	mm (in)	420 (16.54)	420 (16.54)	420 (16.54)	479 (18.86)	479 (18.86)
• Depth	mm (in)	226 (8.90)	226 (8.90)	226 (8.90)	226 (8.90)	226 (8.90)
Weight, approx.	kg (lb)	5 (11.0)	6.5 (14)	11.5 (25)	18.2 (40)	18.8 (42)
Approvals		cURus	cURus	cURus	cURus available soon	cURus available soon
Suitable for Active Line Module in booksize format	Type	6SL3130-7TE21-6AA3 6SL3131-7TE21-6AA3	6SL3130-7TE23-6AA3 6SL3131-7TE23-6AA3	6SL3130-7TE25-5AA3 6SL3131-7TE25-5AA3	6SL3130-7TE28-0AA3 6SL3131-7TE28-0AA3	6SL3130-7TE31-2AA3 6SL3131-7TE31-2AA3
• Rated power of the Active Line Module	kW	16	36	55	80	120

Overview

Suitable line-side power components are assigned depending on the power rating of the Active Line Modules.

The tables below list recommended components.

Further information about the line contactors, switch disconnectors, fuses and circuit-breakers specified in the tables can be found in the Catalogs LV 1, LV 1T and ET B1.

Assignment of line-side power components to Active Line Modules in booksize format

Rated power	Assignment to Active Line Module in booksize format	**Line contactor**	**Output coupling device for line contactor**	**Main switch**	**Leading auxiliary circuit switch for main switch**
kW (HP)	Type 6SL3130-6SL3131-	Type	Order No.	Order No.	Order No.
Line voltage 380 ... 480 V 3 AC					
16 (18)	7TE21-6AA3	**3RT1035-…**	**3TX7004-1LB00**	**3LD2504-0TK51**	**3LD9200-5B**
36 (40)	7TE23-6AA3	**3RT1045-…**	**3TX7004-1LB00**	**3LD2704-0TK51**	**3LD9200-5B**
55 (60)	7TE25-5AA3	**3RT1054-…**	**3TX7004-1LB00**	**3KA5330-1EE01**	**3KX3552-3EA01**
80 (100)	7TE28-0AA3	**3RT1056-…**	**3TX7004-1LB00**	**3KA5330-1EE01**	**3KX3552-3EA01**
120 (150)	7TE31-2AA3	**3RT1065-…**	**3TX7004-1LB00**	**3KA5730-1EE01**	**3KX3552-3EA01**

Rated power	Assignment to Active Line Module in booksize format	**Circuit-breaker IEC 60947**	**Circuit-breaker UL489/CSA C22.2 No. 5-02**	**Fuse switch disconnector**	**Switch disconnector with fuse holders**	**Leading auxiliary switch for switch disconnector with fuse holders**
kW (HP)	Type 6SL3130-6SL3131-	Order No.	Order No.	Order No.	Order No.	Order No.
Line voltage 380 ... 480 V 3 AC						
16 (18)	7TE21-6AA3	**3RV1031-4FA10**	**–**	**3NP4010-0CH01**	**3KL5030-1EB01**	**3KX3552-3EA01**
36 (40)	7TE23-6AA3	**3RV1041-4LA10**	**3VL2108-3KN30-0AA0**	**3NP4010-0CH01**	**3KL5230-1EB01**	**3KX3552-3EA01**
55 (60)	7TE25-5AA3	**3VL2712-1DC33-0AA0**	**3VL2112-3KN30-0AA0**	**3NP4270-0CA01**	**3KL5530-1EB01**	**3KX3552-3EA01**
80 (100)	7TE28-0AA3	**3VL3720-1DC33-0AA0**	**3VL3117-3KN30-0AA0**	**3NP4270-0CA01**	**3KL5530-1EB01**	**3KX3552-3EA01**
120 (150)	7TE31-2AA3	**3VL3725-1DC36-0AA0**	**3VL3125-3KN30-0AA0**	**3NP5360-0CA00**	**3KL5730-1EB01**	**3KX3552-3EA01**

Rated power	Assignment to Active Line Module in booksize format	**NEOZED fuse (gL/gG)**			**DIAZED fuse (gL/gG)**			**LV HRC fuse (gL/gG)**			**UL/CSA fuse, Class J** [1] **Available from: Ferraz Shawmut http://www.ferrazshawmut.com**		
kW (HP)	Type 6SL3130-6SL3131-	Order No.	Rated current	Size	Order No.	Rated current	Size	Order No.	Rated current	Size	Reference No.	Rated current	Size
Line voltage 380 ... 480 V 3 AC													
16 (18)	7TE21-6AA3	**5SE2335**	35 A	D02	**5SB411**	35 A	DIII	**3NA3814**	35 A	000	AJT35	35 A	27 × 60
36 (40)	7TE23-6AA3	–	–	–	**5SC211**	80 A	DIVH	**3NA3824**	80 A	000	AJT80	80 A	29 × 117
55 (60)	7TE25-5AA3	–	–	–	–	–	–	**3NA3132**	125 A	1	AJT125	125 A	41 × 146
80 (100)	7TE28-0AA3	–	–	–	–	–	–	**3NA3136**	160 A	1	AJT175	175 A	41 × 146
120 (150)	7TE31-2AA3	–	–	–	–	–	–	**3NA3144**	250 A	1	AJT250	250 A	54 × 181

[1] Not for use with 3NP and 3KL disconnectors.

Active Line Modules in chassis format

Overview

The self-commutated feed/feedback units (with IGBTs in infeed and regenerative feedback directions) generate a regulated DC link voltage. This means that the connected Motor Modules are decoupled from the line voltage. Line voltage fluctuations within the permissible supply tolerances have no effect on the motor voltage.

If required, the Active Line Modules can also provide power factor correction with reactive power compensation.

Active Line Modules are designed for connection to grounded-neutral (TN, TT) and non-grounded (IT) supply systems.

Design

The Active Line Modules in chassis format feature the following connections and interfaces as standard:

- 1 line connection
- 1 connection for the 24 V DC electronic power supply
- 1 DC link connection (DCP, DCN) for supplying the connected Motor Modules
- 1 DC link connection (DCPA, DCNA) for connecting a Braking Module
- 3 DRIVE-CLiQ sockets
- 2 PE (protective earth) connections

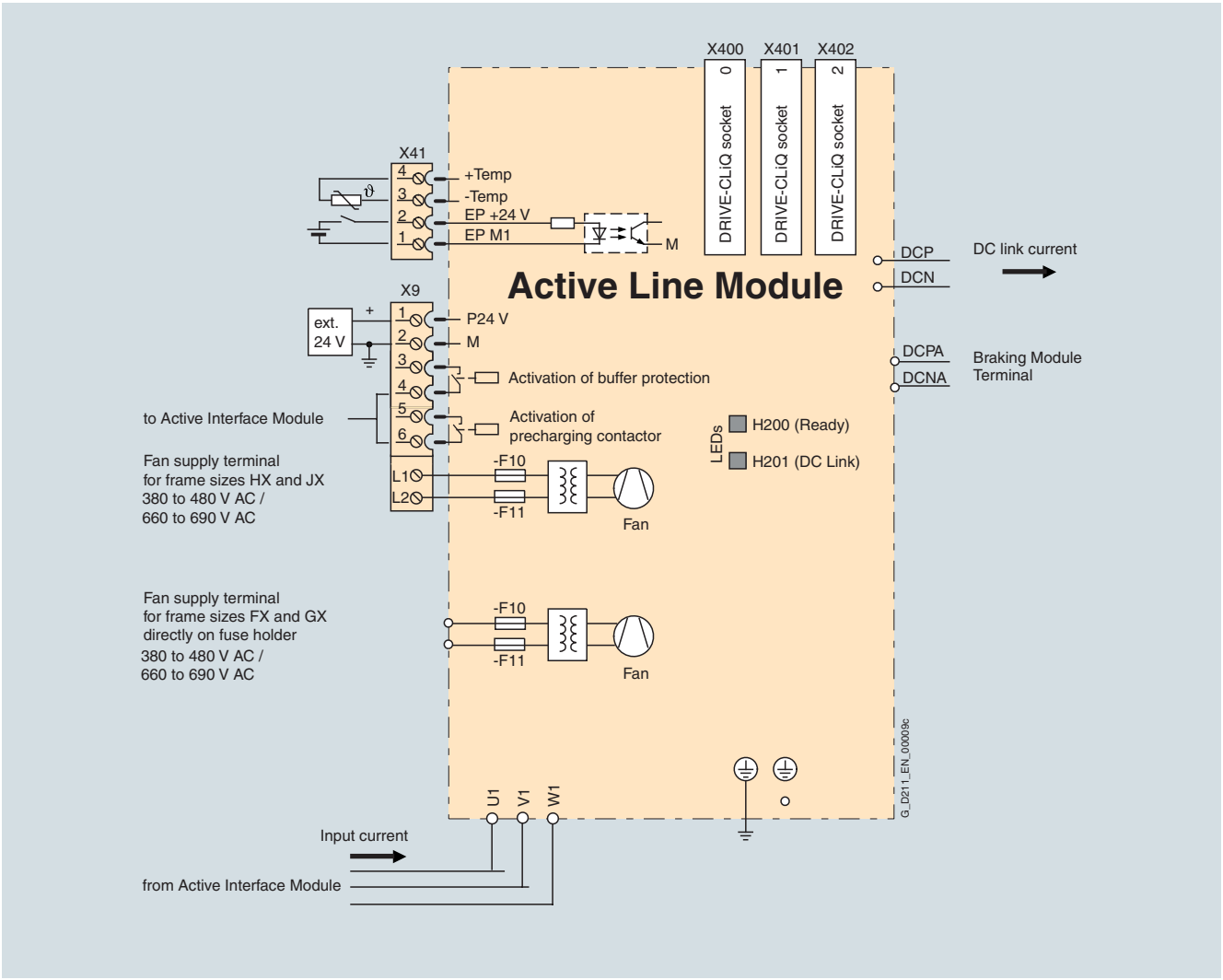
The status of the Active Line Modules is indicated via two multi-color LEDs.

The scope of supply of the Active Line Modules includes:

- Frame sizes FX and GX:
  - 0.60 m (1.97 ft) DRIVE-CLiQ cable for connection to the CU320 or SIMOTION D4x5 Control Unit
- Frame sizes HX and JX
  - 0.35 m (1.15 ft) DRIVE-CLiQ cable for connection to the CU320 or SIMOTION D4x5 Control Unit
  - 2.10 m (6.89 ft) DRIVE-CLiQ cable for connection to the first Motor Module

Integration

The Active Line Module communicates with the CU320 or SIMOTION D4x5 Control Unit via DRIVE-CLiQ.



Connection example of Active Line Module in chassis format

Active Line Modules in chassis format

Technical specifications

General technical specifications	
Electrical data	
Line connection voltage (up to 2000 m (6562 ft) above sea level)	380 V ... 480 V 3 AC ± 10 % (-15 % < 1 min) or 500 V ... 690 V 3 AC ± 10 % (-15 % < 1 min)
Line frequency	47 … 63 Hz
Line Power factor	
• Fundamental Power factor (cos ϕ_1)	1.0 (factory setting) can be altered by input of a reactive current setpoint
• Total (λ)	1.0 (factory setting)
Overvoltage category to EN 60664-1	Class III
DC link voltage V_d	The DC link voltage is regulated and can be adjusted as a voltage decoupled from the line voltage. Factory setting for DC link voltage: 1.5 x line voltage
Electronic power supply	24 V DC, -15 %/+20 %
Radio Interference suppression	
Standard (with Active Interface Module)	Category C3 to EN 61800-3
Ambient conditions	
Type of cooling	Forced air cooling through a built-in fan
Permissible ambient and coolant temperature (air) during operation for line-side components, Line Modules and Motor Modules	0 … 40 °C (32 … 104 °F) without derating, > 40 … 55 °C (104 … 131 °F) see derating characteristics
Site altitude	Up to 2000 m (6562 ft) above sea level without derating, > 2000 ... 4000 m (6562 ... 13124 ft) above sea level, see derating characteristics
Certificates	
Conformity	CE (low-voltage and EMC Directives)
Approvals	cULus (File No.: E192450) only for devices on line voltages 380 ... 480 V 3 AC and 500 ... 600 V 3 AC

Technical specifications (continued)

Line voltage 380 ... 480 V 3 AC		Active Line Modules in chassis format 6SL3330-7TE32-1AA0	6SL3330-7TE32-6AA0	6SL3330-7TE33-8AA0	6SL3330-7TE35-0AA0
Feed/feedback power					
• Rated power P_{rated}					
- With 400 V 3 AC	kW	**132**	**160**	**235**	**300**
- With 460 V 3 AC [2]	(HP)	**(200)**	**(225)**	**(350)**	**(450)**
• P_{max}	kW	198	240	352.5	450
DC link current					
• Rated current I_{rated_DC}	A	235	291	425	549
• I_{H_DC}	A	209	259	378	489
• I_{max_DC}	A	352	436	637	823
Input current					
• Rated current at 400 V 3 AC	A	210	260	380	490
• Maximum	A	315	390	570	735
Current requirement					
• 24 V DC electronics power supply, max.	A	1.1	1.1	1.35	1.35
• Fan supply with 400 V 2 AC, 50/60 Hz, max.	A	0.63/0.95	1.13/1.7	1.6/2.4	1.6/2.4
DC link capacitance	µF	4200	5200	7800	9600
Power loss, max.	kW	2.3	2.9	4.2	5.1
Cooling air requirement	m^3/s (ft^3/s)	0.17 (6.0)	0.23 (8.1)	0.36 (12.7)	0.36 (12.7)
Sound pressure level [1] L_{pA} (1 m) at 50/60 Hz	dB	74/76	75/77	76/78	76/78
Line connection U1, V1, W1		Flat connector for M10 screw	Flat connector for M10 screw	Flat connector for M10 screw	Flat connector for M10 screw
• Conductor cross-section, max.	mm^2	2 × 185	2 × 185	2 × 185	2 × 185
DC link connection DCP, DCN		Flat connector for M10 screw	Flat connector for M10 screw	Flat connector for M10 screw	Flat connector for M10 screw
• Conductor cross-section, max.	mm^2	2 × 185	2 × 185	2 × 185	2 × 185
PE connection		M10 screw	M10 screw	M10 screw	M10 screw
• Conductor cross-section, max.					
- PE1/GND	mm^2	1 × 185	1 × 185	1 × 185	1 × 185
- PE2/GND	mm^2	2 × 185	2 × 185	2 × 185	2 × 185
Cable length, max. (total of all motor cables and DC link)					
• Shielded	m (ft)	2700 (8859)	2700 (8859)	2700 (8859)	2700 (8859)
• Unshielded	m (ft)	4050 (13288)	4050 (13288)	4050 (13288)	4050 (13288)
Degree of protection		IP20	IP20	IP20	IP20
Dimensions					
• Width	mm (in)	326 (12.83)	326 (12.83)	326 (12.83)	326 (12.83)
• Height	mm (in)	1400 (55.12)	1400 (55.12)	1533 (60.35)	1533 (60.35)
• Depth	mm (in)	356 (14.02)	356 (14.02)	543 (21.38)	543 (21.38)
Frame size		FX	FX	GX	GX
Weight, approx.	kg (lb)	88 (194)	88 (194)	152 (335)	152 (335)

[1] Total sound pressure level of Active Interface Module and Active Line Module.

[2] Nominal HP ratings are provided for ease of assigning components only. The Line Module outputs are dependent on the Motor Module loading and are to be dimensioned accordingly.

Active Line Modules in chassis format

Technical specifications (continued)

Line voltage 380 ... 480 V 3 AC		Active Line Modules in chassis format 6SL3330-7TE36-1AA0	6SL3330-7TE38-4AA0	6SL3330-7TE41-0AA0	6SL3330-7TE41-4AA0
Feed/feedback power					
• Rated power P_{rated}					
- With 400 V 3 AC	kW	**380**	**500**	**630**	**900**
- With 460 V 3 AC [2]	(HP)	**(550)**	**(700)**	**(800)**	**(1150)**
• P_{max}	kW	570	750	945	1350
DC link current					
• Rated current I_{rated_DC}	A	678	940	1103	1574
• I_{H_DC}	A	603	837	982	1401
• I_{max_DC}	A	1017	1410	1654	2361
Input current					
• At 400 V 3 AC	A	605	840	985	1405
• Maximum	A	907	1260	1477	2107
Current requirement					
• 24 V DC electronic power supply, max.	A	1.4	1.4	1.5	1.7
• Fan supply with 400 V 2 AC, max.	A	5.2	5.2	7.8	7.8
DC link capacitance	µF	12600	16800	18900	28800
Power loss	kW	6.2	7.7	10.1	13.3
Cooling air requirement	m^3/s (ft^3/s)	0.78 (27.5)	0.78 (27.5)	1.08 (38.1)	1.08 (38.1)
Sound pressure level [1] L_{pA} (1 m) at 50/60 Hz	dB	78/80	78/80	78/80	78/80
Line connection U1, V1, W1		Flat connector for M12 screw	Flat connector for M12 screw	Flat connector for M12 screw	Flat connector for M12 screw
• Conductor cross-section, max.	mm^2	4 × 240	4 × 240	6 × 240	6 × 240
DC link connection DCP, DCN		Flat connector for busbar connection	Flat connector for busbar connection	Flat connector for busbar connection	Flat connector for busbar connection
PE connection		M12 screw	M12 screw	M12 screw	M12 screw
• Conductor cross-section, max.					
- PE1/GND	mm^2	1 × 240	1 × 240	1 × 240	1 × 240
- PE2/GND	mm^2	2 × 240	2 × 240	2 × 240	2 × 240
Cable length, max. (total of all motor cables and DC link)					
• Shielded	m (ft)	3900 (12796)	3900 (12796)	3900 (12796)	3900 (12796)
• Unshielded	m (ft)	5850 (19194)	5850 (19194)	5850 (19194)	5850 (19194)
Degree of protection		IP00	IP00	IP00	IP00
Dimensions					
• Width	mm (in)	503 (19.80)	503 (19.80)	704 (27.72)	704 (27.72)
• Height	mm (in)	1475 (58.07)	1475 (58.07)	1475 (58.07)	1475 (58.07)
• Depth	mm (in)	540 (21.26)	540 (21.26)	540 (21.26)	540 (21.26)
Frame size		HX	HX	JX	JX
Weight, approx.	kg (lb)	290 (639)	290 (639)	450 (992)	450 (992)

1) Total sound pressure level of Active Interface Module and Active Line Module.
2) Nominal HP ratings are provided for ease of assigning components only. The Line Module outputs are dependent on the Motor Module loading and are to be dimensioned accordingly.

Technical specifications (continued)

Line voltage 500 ... 690 V 3 AC		Active Line Modules in chassis format 6SL3330-7TG35-8AA0	6SL3330-7TG37-4AA0	6SL3330-7TG41-0AA0	6SL3330-7TG41-3AA0
Feed/feedback power					
• Rated power P_{rated} with 690 V 3 AC	kW	**560**	**800**	**1100**	**1400**
• With 500 V 3 AC [1]	kW	400	560	800	1000
• P_{max} with 690 V 3 AC [1]	kW	840	1200	1650	2100
DC link current					
• Rated current I_{rated_DC}	A	644	823	1148	1422
• I_{H_DC}	A	573	732	1022	1266
• I_{max_DC}	A	966	1234	1722	2133
Input current					
• At 690 V 3 AC	A	575	735	1025	1270
• Maximum	A	862	1102	1537	1905
Current requirement					
• 24 V DC electronics power supply, max.	A	1.4	1.5	1.7	1.7
• Fan supply with 690 V 2 AC, max.	A	3	4.5	4.5	4.5
DC link capacitance	µF	7400	11100	14400	19200
Power loss	kW	6.8	10.2	13.6	16.5
Cooling air requirement	m^3/s (ft^3/s)	0.78 (27.5)	1.1 (38.8)	1.1 (38.8)	1.1 (38.8)
Sound pressure level [2] L_{pA} (1 m) at 50/60 Hz	dB	78/80	78/80	78/80	78/80
Line connection U1, V1, W1		Flat connector for M12 screw	Flat connector for M12 screw	Flat connector for M12 screw	Flat connector for M12 screw
• Conductor cross-section, max.	mm^2	4 × 240	6 × 240	6 × 240	6 × 240
DC link connection DCP, DCN		Flat connector for busbar connection	Flat connector for busbar connection	Flat connector for busbar connection	Flat connector for busbar connection
PE connection		M12 screw	M12 screw	M12 screw	M12 screw
• Conductor cross-section, max.					
- PE1/GND	mm^2	1 × 240	1 × 240	1 × 240	1 × 240
- PE2/GND	mm^2	2 × 240	2 × 240	2 × 240	2 × 240
Cable length, max. (total of all motor cables and DC link)					
• Shielded	m (ft)	2250 (7382)	2250 (7382)	2250 (7382)	2250 (7382)
• Unshielded	m (ft)	3375 (11073)	3375 (11073)	3375 (11073)	3375 (11073)
Degree of protection		IP00	IP00	IP00	IP00
Dimensions					
• Width	mm (in)	503 (19.80)	704 (27.72)	704 (27.72)	704 (27.72)
• Height	mm (in)	1475 (58.07)	1475 (58.07)	1475 (58.07)	1475 (58.07)
• Depth	mm (in)	540 (21.26)	540 (21.26)	540 (21.26)	540 (21.26)
Frame size		HX	JX	JX	JX
Weight, approx.	kg (lb)	290 (639)	450 (992)	450 (992)	450 (992)

1) The infeed power is proportional to the line voltage. With 500 V 3 AC, the power is reduced by a factor of 690/500 = 1.38.

2) Total sound pressure level of Active Interface Module and Active Line Module.

Active Line Modules in chassis format

Selection and ordering data

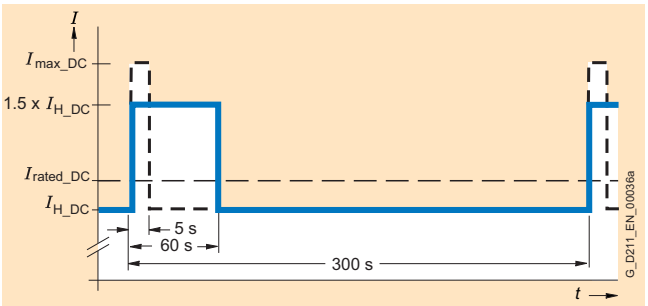
Rated power kW (HP)	Active Line Module in chassis format Order No.
Line voltage 380 ... 480 V 3 AC	
132 (200)	**6SL3330-7TE32-1AA0**
160 (225)	**6SL3330-7TE32-6AA0**
235 (350)	**6SL3330-7TE33-8AA0**
300 (450)	**6SL3330-7TE35-0AA0**
380 (550)	**6SL3330-7TE36-1AA0**
500 (700)	**6SL3330-7TE38-4AA0**
630 (800)	**6SL3330-7TE41-0AA0**
900 (1150)	**6SL3330-7TE41-4AA0**
Line voltage 500 ... 690 V 3 AC	
560	**6SL3330-7TG35-8AA0**
800	**6SL3330-7TG37-4AA0**
1100	**6SL3330-7TG41-0AA0**
1400	**6SL3330-7TG41-3AA0**

Accessories

Description	Order No.
Warning signs in foreign languages This set of foreign language warning signs can be placed on the top of the standard German or English signs. One set of labels is supplied with the devices. The following languages are available in each label set: Chinese Simplified, Danish, Dutch, Finnish, French, Greek, Italian, Japanese, Korean, Polish, Portuguese/Brazilian, Russian, Swedish, Spanish, Czech, Turkish	**6SL3166-3AB00-0AA0**

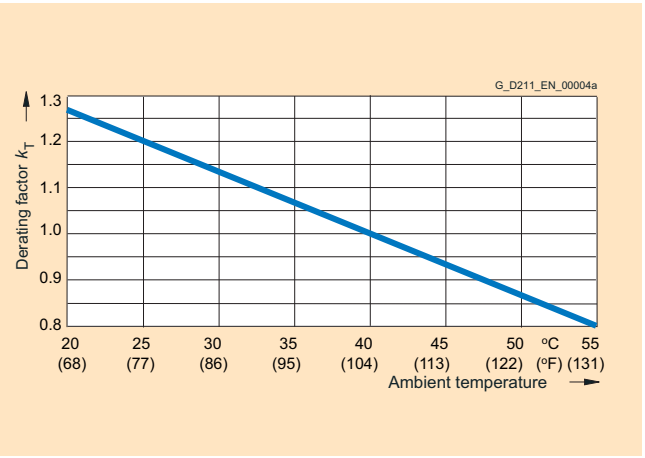
Characteristics

Overload capability



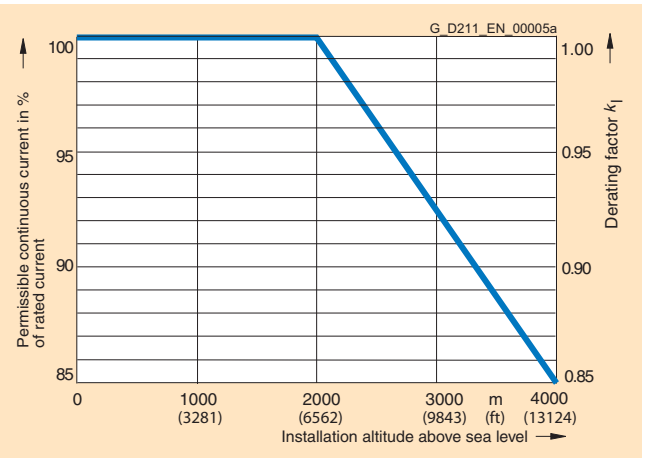
High overload

Derating characteristics

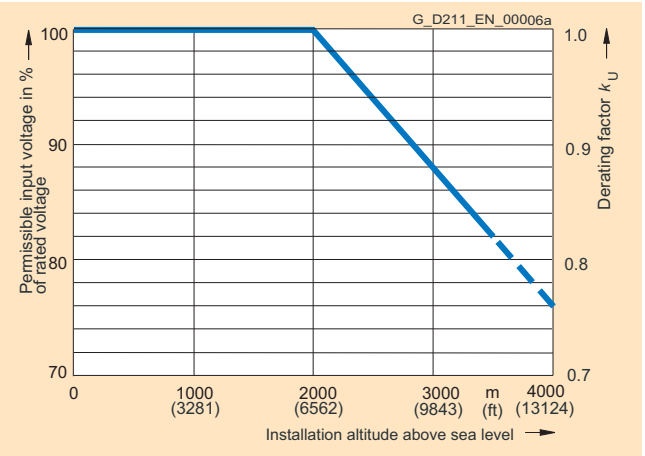


Current derating dependent on ambient temperature

Note: A derating factor k_T > 1.0 is only possible in connection with the "current derating dependent on installation altitude". See also System description.



Current derating dependent on installation altitude



Voltage derating dependent on installation altitude

Overview

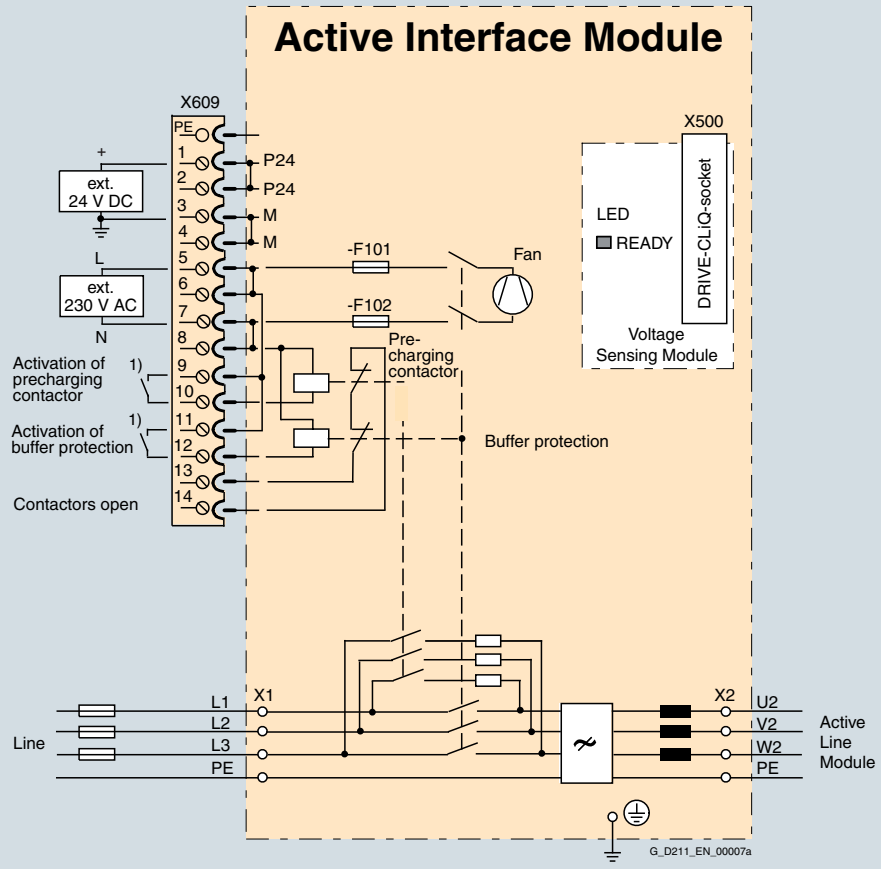
Active Interface Modules are used in combination with Active Line Modules in chassis format. Active Interface Modules contain a clean power filter with basic RI suppression, the pre-charging circuit for the Active Line Module, the line voltage sensing circuit and monitoring sensors. The bypass contactor is an integral component in frame sizes FI and GI, thereby making the module very compact. The bypass contactor must be provided separately for frame sizes HI and JI.

The vast majority of line harmonics are suppressed by the clean power filter.

The scope of supply of the Active Interface Modules includes:

- Frame size FI:
  - 0.60 m (1.97 ft) DRIVE-CLiQ cable for connection between Active Interface Module and Active Line Module
  - 1.45 m (4.76 ft) DRIVE-CLiQ cable for connection between the Control Unit and first Motor Module
- Frame size GI:
  - 0.95 m (3.12 ft) DRIVE-CLiQ cable for connection between Active Interface Module and Active Line Module
  - 1.45 m (4.76 ft) DRIVE-CLiQ cable for connection between the Control Unit and first Motor Module
- Frame sizes HI and JI:
  - 2.40 m (7.87 ft) DRIVE-CLiQ cable for connection between Active Interface Module and Active Line Module

Integration

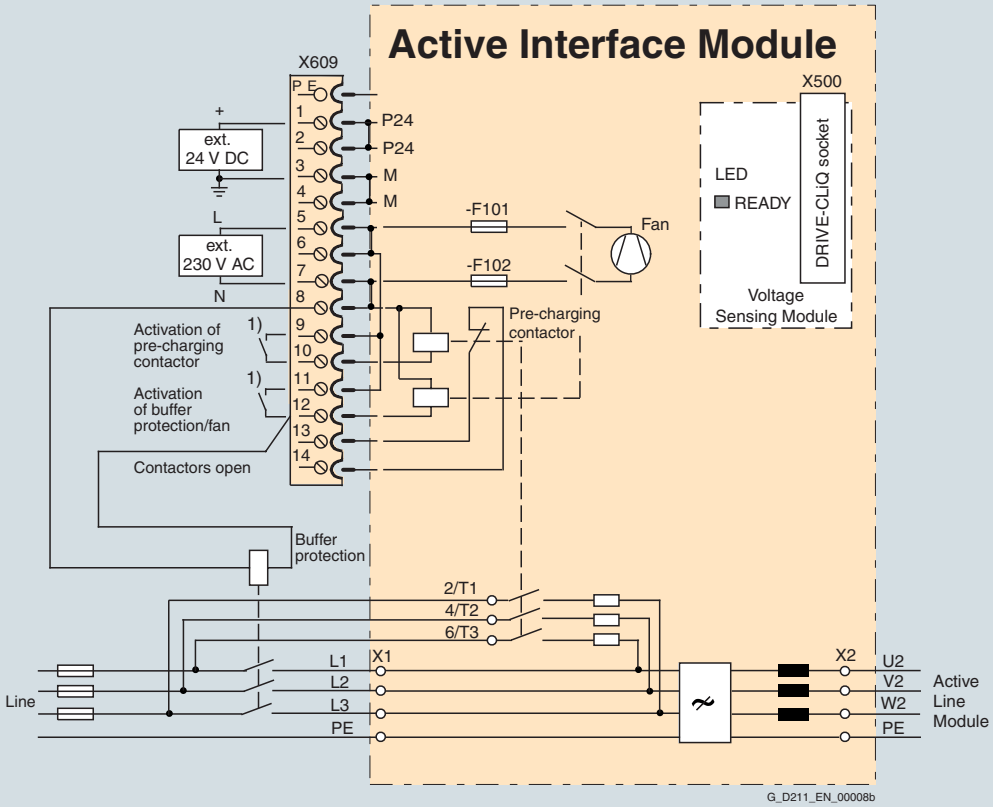


1) Activation by Active Line Module.

Typical connection of Active Interface Module in chassis format with integrated bypass connector (frame sizes FI and GI)

3

Integration (continued)



1) Activation by Active Line Module.

Connection example of Active Interface Module in chassis format with externally mounted bypass connector (frame sizes HI and JI)

Technical specifications

Line voltage 380 ... 480 V 3 AC		Active Interface Modules in chassis format 6SL3300-7TE32-6AA0		6SL3300-7TE33-8AA0	6SL3300-7TE35-0AA0
Rated current	A	210	260	380	490
Bypass contactor		included	included	included	included
DC link capacitance of the drive group, max.					
• At 50 Hz 400 V	µF	31200	31200	57600	57600
• At 60 Hz 480 V	µF	20800	20800	38400	38400
Current requirement					
• 24 V DC electronics power supply, max.	A	0.17	0.17	0.17	0.17
• Fan supply with 230 V 2 AC, 50/60 Hz, max.	A	0.45/0.6	0.45/0.6	0.9/1.2	0.9/1.2
Power loss	kW	2.1	2.2	3.0	3.9
Cooling air requirement	m^3/s (ft^3/s)	0.24 (8.5)	0.24 (8.5)	0.47 (16.6)	0.47 (16.6)
Sound pressure level [1] L_{pA} (1 m) at 50/60 Hz	dB	74/76	75/77	76/78	76/78
Line/load connection L1, L2, L3/U2, V2, W2		Flat connector for M10 screw	Flat connector for M10 screw	Flat connector for M10 screw	Flat connector for M10 screw
• Conductor cross-section, max.	mm^2	2 × 185	2 × 185	2 × 185	2 × 185
PE connection		M10 screw	M10 screw	M10 screw	M10 screw
• Conductor cross-section, max.	mm^2	2 × 185	2 × 185	2 × 185	2 × 185
Degree of protection		IP20	IP20	IP20	IP20
Dimensions					
• Width	mm (in)	325 (12.80)	325 (12.80)	325 (12.80)	325 (12.80)
• Height	mm (in)	1400 (55.12)	1400 (55.12)	1533 (60.35)	1533 (60.35)
• Depth	mm (in)	355 (13.98)	355 (13.98)	544 (21.42)	544 (21.42)
Frame size		FI	FI	GI	GI
Weight, approx.	kg (lb)	135 (298)	135 (298)	190 (419)	190 (419)
Approvals		cURus	cURus	cURus	cURus
Suitable for Active Line Module in chassis format	Type	6SL3330-7TE32-1AA0	6SL3330-7TE32-6AA0	6SL3330-7TE33-8AA0	6SL3330-7TE35-0AA0
• Rated power of the Active Line Module	kW (HP)	132 (200)	160 (225)	235 (350)	300 (450)

[1] Total sound pressure level of Active Interface Module and Active Line Module.

Technical specifications (continued)

Line voltage 380 ... 480 V 3 AC		Active Interface Modules in chassis format 6SL3300-7TE38-4AA0		6SL3300-7TE41-4AA0	
Rated current	A	605	840	985	1405
Bypass contactor		3RT1476-6AP36	3WL1110-2BB34-4AN2-Z C22	3WL1112-2BB34-4AN2-Z C22	3WL1116-2BB34-4AN2-Z C22
DC link capacitance of the drive group, max.					
• At 50 Hz 400 V	µF	100800	100800	172800	172800
• At 60 Hz 480 V	µF	67200	67200	115200	115200
Current requirement					
• 24 V DC electronics power supply, max.	A	0.17	0.17	0.17	0.17
• Fan supply with 230 V 2 AC, 50/60 Hz, max.	A	3.6/4.6	3.6/4.6	3.8/4.9	3.8/4.9
Power loss	kW	5.5	6.1	7.5	8.5
Cooling air requirement	m^3/s (ft^3/s)	0.4 (14.1)	0.4 (14.1)	0.4 (14.1)	0.4 (14.1)
Sound pressure level [1] L_{pA} (1 m) at 50/60 Hz	dB	78/80	78/80	78/80	78/80
Line/load connection L1, L2, L3/U2, V2, W2		Flat connector for M12 screw	Flat connector for M12 screw	Flat connector for M12 screw	Flat connector for M12 screw
• Conductor cross-section, max.	mm^2	4 × 240	4 × 240	4 × 240	4 × 240
PE connection		M12 screw	M12 screw	M12 screw	M12 screw
• Conductor cross-section, max.	mm^2	2 × 240	2 × 240	4 × 240	4 × 240
Degree of protection		IP00	IP00	IP00	IP00
Dimensions					
• Width	mm (in)	305 (12.01)	305 (12.01)	505 (19.88)	505 (19.88)
• Height	mm (in)	1750 (68.90)	1750 (68.90)	1750 (68.90)	1750 (68.90)
• Depth	mm (in)	545 (21.46)	545 (21.46)	545 (21.46)	545 (21.46)
Frame size		HI	HI	JI	JI
Weight, approx.	kg (lb)	390 (860)	390 (860)	620 (1367)	620 (1367)
Approvals		cURus	cURus	cURus	cURus
Suitable for Active Line Module in chassis format	Type	6SL3330-7TE36-1AA0	6SL3330-7TE38-4AA0	6SL3330-7TE41-0AA0	6SL3330-7TE41-4AA0
• Rated power of the Active Line Module	kW (HP)	380 (550)	500 (700)	630 (800)	900 (1150)

[1] Total sound pressure level of Active Interface Module and Active Line Module.

Technical specifications (continued)

Line voltage 500 ... 690 V 3 AC		Active Interface Modules in chassis format 6SL3300-7TG35-8AA0	6SL3300-7TG37-4AA0	6SL3300-7TG41-3AA0	
Rated current	A	575	735	1025	1270
Bypass contactor		3RT1476-6AP36	3WL1210-4BB34-4AN2 *)	3WL1212-4BB34-4AN2-Z C22	3WL1216-4BB34-4AN2-Z C22
DC link capacitance of the drive group, max.	µF	29600	76800	76800	76800
Current requirement					
• 24 V DC electronics power supply, max.	A	0.17	0.17	0.17	0.17
• 230 V AC, max.	A	4.6	4.9	4.9	4.9
Power loss	kW	6.8	9.0	9.6	9.6
Cooling air requirement	m^3/s (ft^3/s)	0.4 (14.1)	0.4 (14.1)	0.4 (14.1)	0.4 (14.1)
Sound pressure level 1) L_{pA} (1 m) at 50/60 Hz	dB	78/80	78/80	78/80	78/80
Line/load connection L1, L2, L3/U2, V2, W2		Flat connector for M12 screw	Flat connector for M12 screw	Flat connector for M12 screw	Flat connector for M12 screw
• Conductor cross-section, max.	mm^2	4 × 240 per connection	6 × 240 per connection	6 × 240 per connection	6 × 240 per connection
PE connection		M10 screw	M10 screw	M10 screw	M10 screw
• Conductor cross-section, max.	mm^2	2 × 240	4 × 240	4 × 240	4 × 240
Degree of protection		IP00	IP00	IP00	IP00
Dimensions					
• Width	mm (in)	305 (12.01)	505 (19.88)	505 (19.88)	505 (19.88)
• Height	mm (in)	1750 (68.90)	1750 (68.90)	1750 (68.90)	1750 (68.90)
• Depth	mm (in)	545 (21.46)	545 (21.46)	545 (21.46)	545 (21.46)
Frame size		HI	JI	JI	JI
Weight, approx.	kg (lb)	390 (860)	620 (1367)	620 (1367)	620 (1367)
Suitable for Active Line Module in chassis format	Type	6SL3330-7TG35-8AA0	6SL3330-7TG37-4AA0	6SL3330-7TG41-0AA0	6SL3330-7TG41-3AA0
• Rated power of the Active Line Module	kW	560	800	1100	1400

Selection and ordering data

Rated power of the Active Line Module	Suitable for Active Line Module in chassis format	**Active Interface Module** Order No.
kW (HP)		
Line voltage 380 ... 480 V 3 AC		
132 (200)	6SL3330-7TE32-1AA0	**6SL3300-7TE32-6AA0**
160 (225)	6SL3330-7TE32-6AA0	**6SL3300-7TE32-6AA0**
235 (350)	6SL3330-7TE33-8AA0	**6SL3300-7TE33-8AA0**
300 (450)	6SL3330-7TE35-0AA0	**6SL3300-7TE35-0AA0**
380 (550)	6SL3330-7TE36-1AA0	**6SL3300-7TE38-4AA0**
500 (700)	6SL3330-7TE38-4AA0	**6SL3300-7TE38-4AA0**
630 (800)	6SL3330-7TE41-0AA0	**6SL3300-7TE41-4AA0**
900 (1150)	6SL3330-7TE41-4AA0	**6SL3300-7TE41-4AA0**
Line voltage 500 ... 690 V 3 AC		
560	6SL3330-7TG35-8AA0	**6SL3300-7TG35-8AA0**
800	6SL3330-7TG37-4AA0	**6SL3300-7TG37-4AA0**
1100	6SL3330-7TG41-0AA0	**6SL3300-7TG41-3AA0**
1400	6SL3330-7TG41-3AA0	**6SL3300-7TG41-3AA0**

1) Total sound pressure level of Active Interface Module and Active Line Module.
*) Alternatively 3x 3RT1466-6AP36.

Active Line Modules in chassis format
Recommended line-side components

Overview

Suitable line-side power components are assigned depending on the power rating of the Active Line Modules.

The tables below list recommended components.

Further information about the line contactors, switch disconnectors, fuses and circuit-breakers specified in the tables can be found in the Catalogs LV 1, LV 1T and ET B1.

Assignment of line-side power components to Active Line Modules in chassis format

Rated power	Input current	Assignment to Active Interface Module	Assignment to Active Line Module	**Bypass contactor**	**Fixed-mounted circuit-breaker**
kW (HP)	A	Type 6SL3300-	Type 6SL3330-	Order No.	Order No.
Line voltage 380 ... 480 V 3 AC					
132 (200)	210	7TE32-6AA0	7TE32-1AA0	included in Active Interface Module	–
160 (225)	260	7TE32-6AA0	7TE32-6AA0	included in Active Interface Module	–
235 (350)	380	7TE33-8AA0	7TE33-8AA0	included in Active Interface Module	–
300 (450)	490	7TE35-0AA0	7TE35-0AA0	included in Active Interface Module	–
380 (550)	605	7TE38-4AA0	7TE36-1AA0	**3RT1476-6AP36**	–
500 (700)	840	7TE38-4AA0	7TE38-4AA0	**3WL1110-2BB34-4AN2**	**3WL1110-2BB34-4AN2-Z C22**
630 (800)	985	7TE41-4AA0	7TE41-0AA0	**3WL1112-2BB34-4AN2**	**3WL1112-2BB34-4AN2-Z C22**
900 (1150)	1405	7TE41-4AA0	7TE41-4AA0	**3WL1116-2BB34-4AN2**	**3WL1116-2BB34-4AN2-Z C22**
Line voltage 500 ... 690 V 3 AC					
560	575	7TG35-8AA0	7TG35-8AA0	**3RT1476-6AP36**	–
800	735	7TG37-4AA0	7TG37-4AA0	**3WL1210-4BB34-4AN2**	**3WL1210-4BB34-4AN2-Z C22**
1100	1025	7TG41-3AA0	7TG41-0AA0	**3WL1212-4BB34-4AN2**	**3WL1212-4BB34-4AN2-Z C22**
1400	1270	7TG41-3AA0	7TG41-3AA0	**3WL1216-4BB34-4AN2**	**3WL1216-4BB34-4AN2-Z C22**

Rated power	Input current	Assignment to Active Interface Module	**Switch disconnector without handle and shaft**	**Switch disconnector with handle and shaft**	**Cable protection fuse**		**Cable protection fuse incl. semiconductor protection**	
kW (HP)	A	Type 6SL3300-	Order No.	Order No.	Order No.	Rated current	Order No.	Rated current
Line voltage 380 ... 480 V 3 AC								
132 (200)	210	7TE32-6AA0	**3KL5530-1AB01**	**3KL5530-1EB01**	**3NA3144**	250 A	**3NE1230-2**	315 A
160 (225)	260	7TE32-6AA0	**3KL5730-1AB01**	**3KL5730-1EB01**	**3NA3252**	315 A	**3NE1331-2**	350 A
235 (350)	380	7TE33-8AA0	**3KL5730-1AB01**	**3KL5730-1EB01**	**3NA3365**	500 A	**3NE1334-2**	500 A
300 (450)	490	7TE35-0AA0	**3KL6130-1AB02**	**3KL6130-1EB02**	**3NA3372**	630 A	**3NE1436-2**	630 A
380 (550)	605	7TE38-4AA0	**3KL6230-1AB02**	**3KL6230-1EB02**	**3NA3372**	630 A	**3NE1437-2**	710 A
500 (700)	840	7TE38-4AA0	–	–	**3NA3362** (2 units)	2 × 425 A	**3NE1334-2** (2 units)	2 × 500 A
630 (800)	985	7TE41-4AA0	–	–	**3NA3365** (2 units)	2 × 500 A	**3NE1436-2** (2 units)	2 × 630 A
900 (1150)	1405	7TE41-4AA0	–	–	**3NA3365** (3 units)	3 × 500 A	**3NE1448-2** (3 units)	3 × 850 A
Line voltage 500 ... 690 V 3 AC								
560	575	7TG35-8AA0	**3KL6130-1AB02**	**3KL6130-1EB02**	**3NA3352-6** (2 units)	2 × 315 A	**3NE1447-2**	670 A
800	735	7TG37-4AA0	**3KL6230-1AB02**	**3KL6230-1EB02**	**3NA3360-6** (2 units)	2 × 400 A	**3NE1448-2**	850 A
1100	1025	7TG41-3AA0	–	–	**3NA3354-6** (3 units)	3 × 355 A	**3NE1436-2** (2 units)	2 × 630 A
1400	1270	7TG41-3AA0	–	–	**3NA3365-6** (3 units)	3 × 500 A	**3NE1438-2** (2 units)	2 × 800 A

Overview

In principle, all Single and Double Motor Modules can be operated on Basic Line Modules, Smart Line Modules or Active Line Modules for the appropriate voltage range.

A wide range of single-axis and two-axis Motor Modules with graded current/power ratings can be supplied:

- **Single Motor Modules**: Single-axis variant
  - Booksize compact format
    with rated output currents of 3 A to 18 A
  - Booksize format
    with rated output currents of 3 A to 200 A
  - Chassis format
    with rated output currents of 85 A to 1405 A
- **Double Motor Modules**: Two-axis variant
  - Booksize compact format
    with rated output currents of 1.7 A to 5 A
  - Booksize format
    with rated output currents of 3 A to 18 A

Examples for Motor Modules

Single Motor Module in booksize compact format

Double Motor Module in booksize compact format

Single Motor Module in booksize format
Internal cooling, external cooling, cold plate cooling

Double Motor Module in booksize format

Single Motor Module in chassis format
Frame sizes FX/GX and HX/JX

Single Motor Modules in booksize compact format

Design

The Single Motor Modules in booksize compact format feature the following connections and interfaces as standard:

- 2 DC link connections via integrated DC link busbars
- 1 electronics power supply connection via integrated 24 V DC bars
- 3 DRIVE-CLiQ sockets
- 1 motor connection via connector
- 1 safe standstill input (enable pulses)
- 1 safe motor brake control
- 1 temperature sensor input (KTY84-130 or PTC)
- 2 PE (protective earth) connections

The status of the Motor Modules is indicated via two multi-color LEDs.

The shield of the motor cable is routed over the connector to the motor connection.

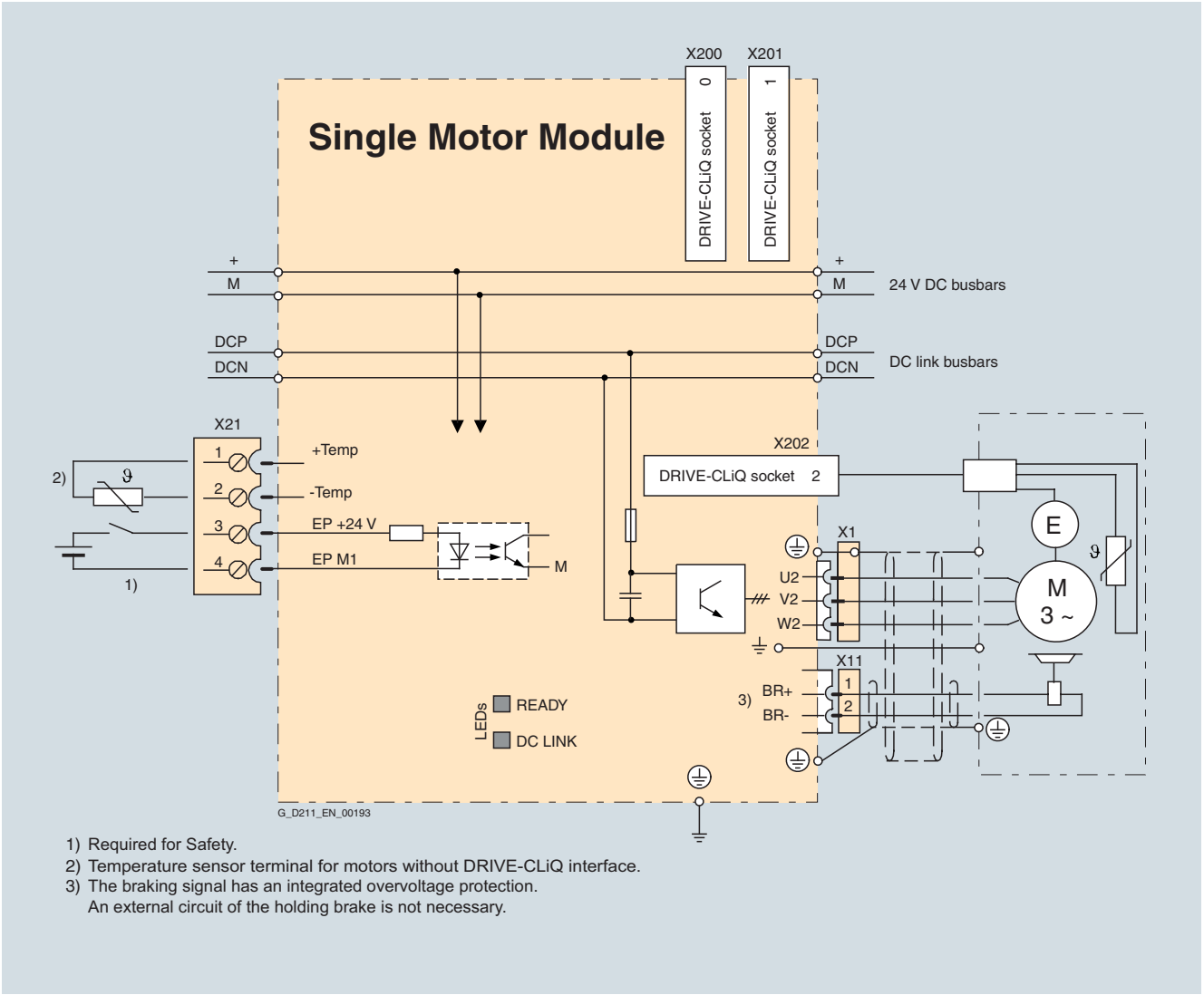
The signal cable shield can be connected to the Motor Module by means of a shield connection terminal, e.g. Weidmüller type KLBÜ 3-8 SC.

The scope of supply of the Motor Modules includes:

- DRIVE-CLiQ cable (length depends on module width) to connect Motor Module to adjacent module
- 2 blanking plugs for sealing unused DRIVE-CLiQ sockets
- Jumper for connecting the 24 V DC busbar to the adjacent Motor Module
- Connector X21
- Connector X11 for motor brake connection
- Connector X1 for motor connection
- 1 set of warning signs in foreign languages
- 1 heat conducting foil

Integration

Single Motor Modules communicate with the Control Unit via DRIVE-CLiQ.



1) Required for Safety.
2) Temperature sensor terminal for motors without DRIVE-CLiQ interface.
3) The braking signal has an integrated overvoltage protection.
An external circuit of the holding brake is not necessary.

Connection example of Single Motor Module in booksize compact format

Technical specifications

General technical specifications	
Electrical data	
DC link voltage (up to 2000 m (6562 ft) above sea level)	510 ... 720 V DC (line voltage 380 ... 480 V 3 AC) [1]
Output frequency	
• Control type Servo	0 … 650 Hz [2]
• Control type Vector	0 … 300 Hz [2]
• Control type *V/f*	0 … 600 Hz [2]
Electronics power supply	24 V DC -15 %/+20 %
Ambient conditions	
Type of cooling	The devices are designed so that - internal air cooling (power units with forced air cooling through a built-in fan) or - cold plate cooling is possible.
Permissible ambient and coolant temperature (air) during operation for line-side components, Line Modules and Motor Modules	0 … 40 °C (32 … 104 °F) without derating, > 40 … 55 °C (104 … 131 °F), see derating characteristics
Site altitude	Up to 1000 m (3281 ft) above sea level without derating, > 1000 ... 4000 m (3281 ... 13124 ft) above sea level see derating characteristics
Certificates	
Conformity	CE (low-voltage and EMC Directives)
Approvals	cULus
Safety Integrated	Safety Integrity Level 2 (SIL 2) to IEC 61508, control category 3 to EN 954-1 For further information, see the Safety Integrated section

1) With firmware version V2.5 and higher with appropriate parameterization and reduced power rating also operable on 200 ... 240 V 3 AC networks in accordance with a DC-link voltage of 270 ... 360 V DC.

2) Note correlation between max. output frequency, pulse frequency and current derating, see System description.

Technical specifications (continued)

DC link voltage 510 ... 720 V DC		Single Motor Modules in booksize compact format			
Internal air cooling/ cold plate cooling		**6SL3420-1TE13-0AA0**	**6SL3420-1TE15-0AA0**	**6SL3420-1TE21-0AA0**	**6SL3420-1TE21-8AA0**
Output current					
• Rated current I_{rated}	A	3	5	9	18
• Base-load current I_H	A	2.6	4.3	7.7	15.3
• For S6 duty (40 %) I_{S6}	A	3.5	6	10	24
• I_{max}	A	9	15	27	54
Type rating [1]					
• Based on I_{rated}	kW (HP)	1.6 (1.5)	2.7 (3)	4.8 (5)	9.7 (10)
• Based on I_H	kW (HP)	1.4 (1)	2.3 (2.5)	4.1 (5)	8.2 (10)
Rated pulse frequency	kHz	8	8	4	4
DC link current I_d [2]	A	3.6	6	11	22
Current carrying capacity					
• DC link busbars	A	100	100	100	100
• 24 V DC busbars	A	20	20	20	20
		If, due to a number of Line and Motor Modules being mounted side-by-side, the current carrying capacity exceeds 20 A, an additional 24 V DC connection using a 24-V terminal adapter is required (max. cross section 6 mm^2, max. fuse protection 20 A).			
DC link capacitance	µF	110	110	110	235
Current requirement with 24 V DC, max.	A	0.85	0.85	0.85	0.85
Power loss					
• With internal air cooling in control cabinet [3]	kW	0.07	0.1	0.1	0.18
• With cold plate cooling, int./ext.	kW	0.026/0.04	0.031/0.065	0.031/0.065	0.051/0.095
• Thermal resistance R_{th}	K/W	0.265	0.265	0.265	0.23
Cooling air requirement	m^3/s (ft^3/s)	0.008 (0.3)	0.008 (0.3)	0.008 (0.3)	0.008 (0.3)
Sound pressure level L_{pA} (1 m)	dB	< 60	< 60	< 60	< 60
Motor connection U2, V2, W2		Connector (X1) with screw-type terminals	Connector (X1) with screw-type terminals	Connector (X1) with screw-type terminals	Connector (X1) with screw-type terminals
• Conductor cross-section	mm^2	0.2 … 6	0.2 … 6	0.2 … 6	0.2 … 6
Shield connection		integrated in connector (X1)	integrated in connector (X1)	integrated in connector (X1)	integrated in connector (X1)
PE connection		M5 screw	M5 screw	M5 screw	M5 screw
Motor brake connection		Connector (X11), 24 V DC, 2 A	Connector (X11), 24 V DC, 2 A	Connector (X11), 24 V DC, 2 A	Connector (X11), 24 V DC, 2 A
Motor cable length, max.					
• Shielded	m (ft)	50 (164)	50 (164)	50 (164)	70 (230)
• Unshielded	m (ft)	75 (246)	75 (246)	75 (246)	100 (328)
Degree of protection		IP20	IP20	IP20	IP20
Dimensions					
• Width	mm (in)	50 (1.97)	50 (1.97)	50 (1.97)	75 (2.95)
• Height	mm (in)	270 (10.63)	270 (10.63)	270 (10.63)	270 (10.63)
• Depth	mm (in)	226 (8.90)	226 (8.90)	226 (8.90)	226 (8.90)
Weight, approx.	kg (lb)	2.7 (6)	2.7 (6)	2.7 (6)	3.4 (7.50)

1) Rated power of a standard asynchronous (induction) motor at 600 V DC link voltage.

2) Rated DC link current for dimensioning an external DC connection. For DC link current calculation for dimensioning the Line Module, see System description "Power Modules/Line Modules".

3) Power loss of Motor Module at rated output including losses of 24 V DC electronic power supply.

Single Motor Modules in booksize compact format

Selection and ordering data

Rated output current	Type rating	Single Motor Module in booksize compact format Internal air cooling
A	kW (HP) [1]	Order No.
DC link voltage 510 ... 720 V DC		
3	1.6 (1.5)	**6SL3420-1TE13-0AA0**
5	2.7 (3)	**6SL3420-1TE15-0AA0**
9	4.8 (5)	**6SL3420-1TE21-0AA0**
18	9.7 (10)	**6SL3420-1TE21-8AA0**

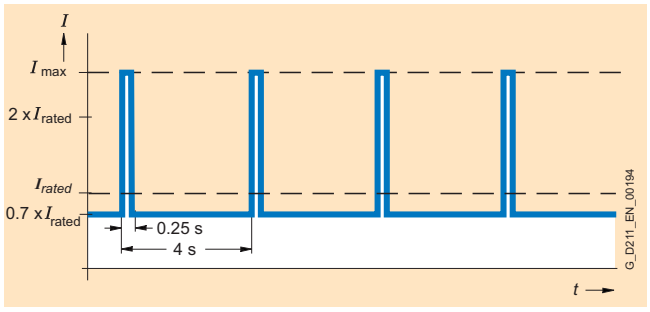
Accessories

Description	Order No.
DC link rectifier adapter for direct infeed of DC link voltage	
• Screw-type terminals 0.5 … 10 mm^2 for Line Modules and Motor Modules in booksize format with a width of 50 mm (1.97 in) or 100 mm (3.94 in)	**6SL3162-2BD00-0AA0**
DC link adapters (2 units) for multi-tier configuration Screw-type terminals 35 ... 95 mm^2 for all Line Modules/Motor Modules in booksize format	**6SL3162-2BM01-0AA0**
24 V terminal adapter for all Line Modules/Motor Modules in booksize format	**6SL3162-2AA00-0AA0**
24 V jumper for connection of the 24 V busbars (for booksize format)	**6SL3162-2AA01-0AA0**
Warning signs in foreign languages This set of foreign language warning signs can be placed on top of the standard German or English signs. One set of labels is supplied with the devices. The following languages are available in each label set: Chinese Simplified, Danish, Dutch, Finnish, French, Greek, Italian, Japanese, Korean, Polish, Portuguese/Brazilian, Russian, Swedish, Spanish, Czech, Turkish	**6SL3166-3AB00-0AA0**

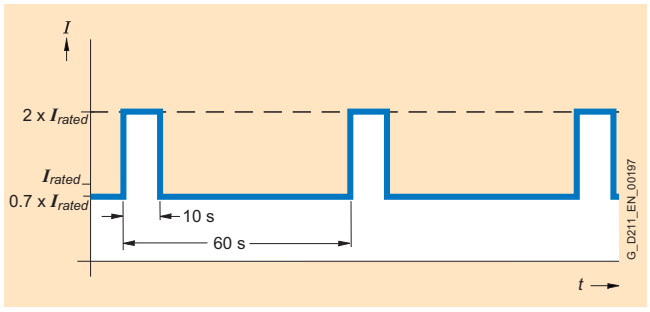
[1] Nominal HP based on Asynchronous motors (induction motors). Match the motor nameplate current for specific sizing.

Characteristics

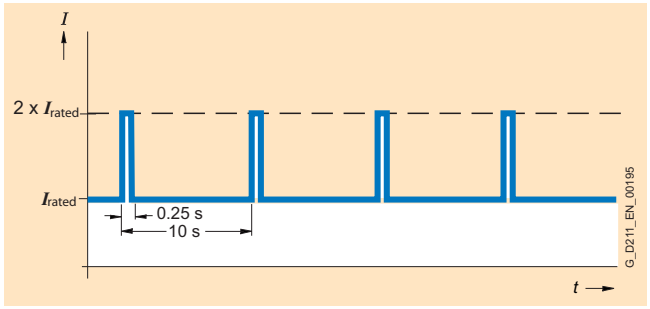
Overload capability



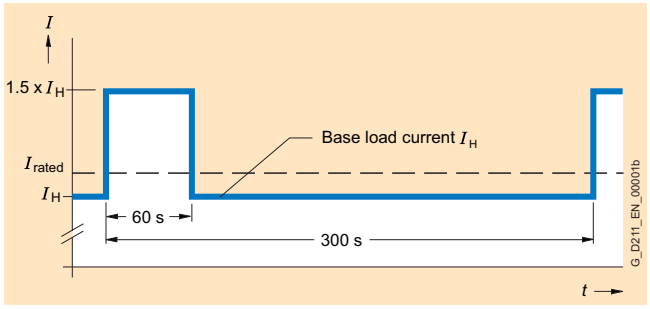
Maximum current load cycle with previous load



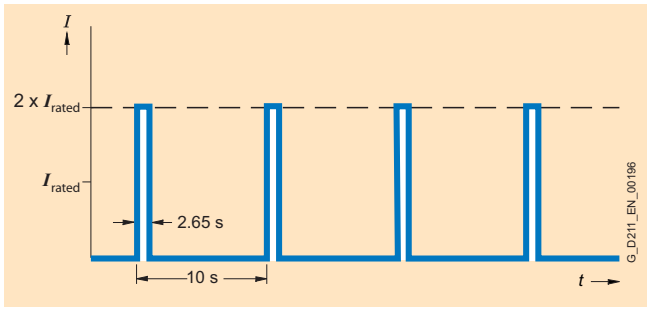
S6 load cycle with previous load with a load cycle period of 60 s



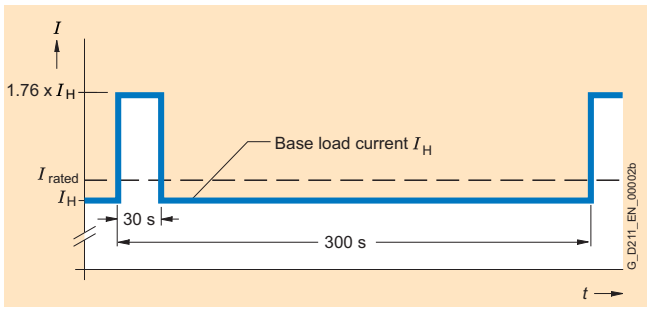
Load cycle with previous load



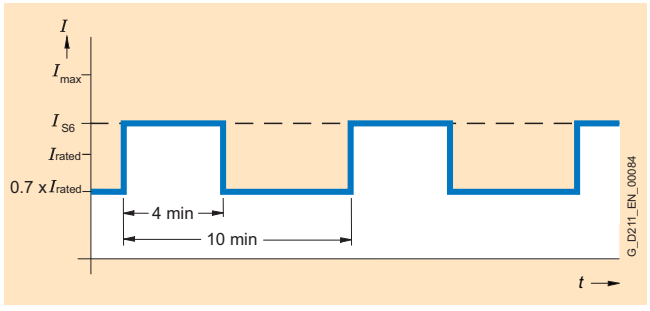
Load cycle with 60 s overload with a load cycle period of 300 s



Load cycle without previous load



Load cycle with 30 s overload with a load cycle period of 300 s



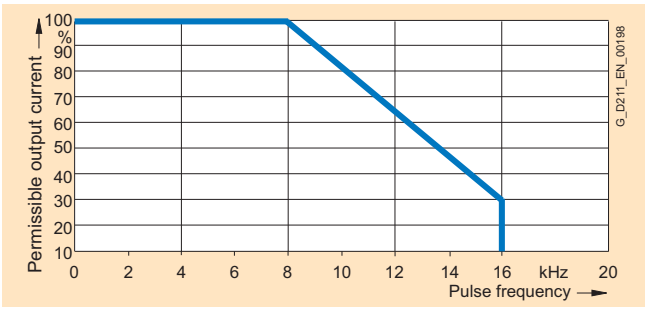
S6 load cycle with previous load with a load cycle period of 600 s

3

Characteristics (continued)

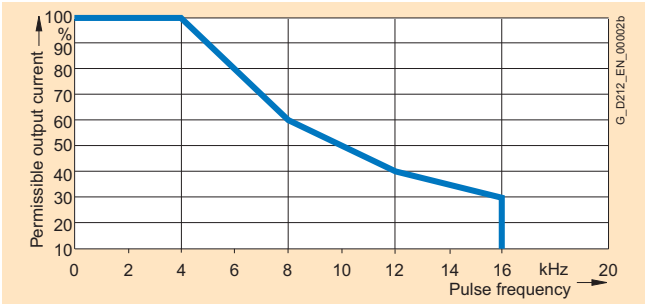
Derating characteristics

3 A and 5 A Single Motor Modules in booksize compact format

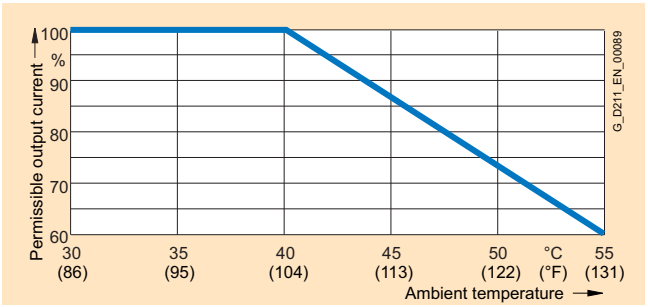


Output current dependent on pulse frequency

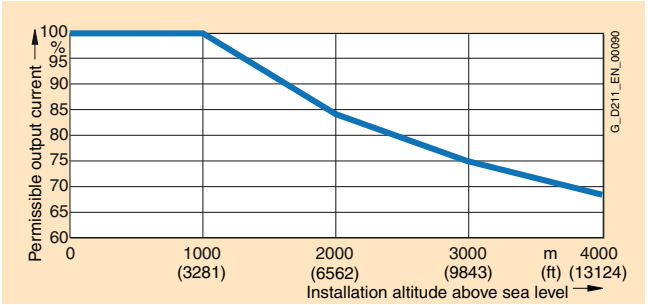
9 A and 18 A Single Motor Modules in booksize compact format



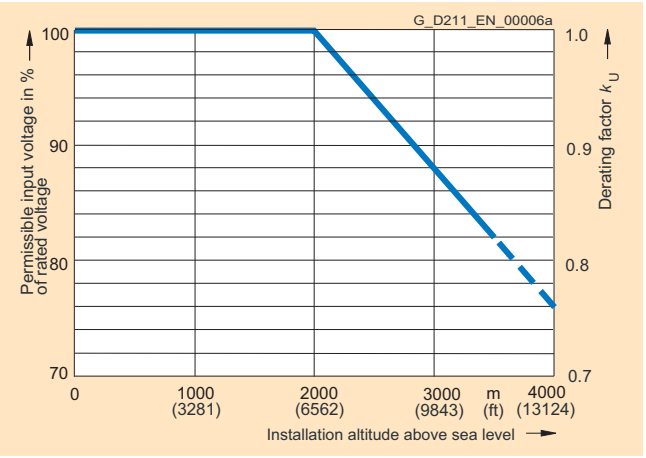
Output current dependent on pulse frequency



Output current dependent on ambient temperature



Output current dependent on installation altitude



Voltage derating dependent on installation altitude

Design

The Single Motor Modules in booksize format feature the following connections and interfaces as standard:

- 2 DC link connections via integrated DC link busbars
- 1 electronics power supply connection via integrated 24 V DC bars
- 3 DRIVE-CLiQ sockets
- 1 motor connection, plug-in (not included in scope of supply) or screw-stud depending on rated output current
- 1 safe standstill input (enable pulses)
- 1 safe motor brake control
- 1 temperature sensor input (KTY84-130 or PTC)
- 2 PE (protective earth) connections

The status of the Motor Modules is indicated via two multi-color LEDs.

The motor cable shield is inside the connector on 50 mm (1.97 in) and 100 mm (3.94 in) wide modules. A shield connection kit can be supplied for the 150 mm (5.91 in), 200 mm (7.87 in) and 300 mm (11.81 in) wide modules. On these modules, the motor cable shield can be connected using a tube clip.

The signal cable shield can be connected to the Motor Module by means of a shield connection terminal, e.g. Weidmüller type KLBÜ 3-8 SC.

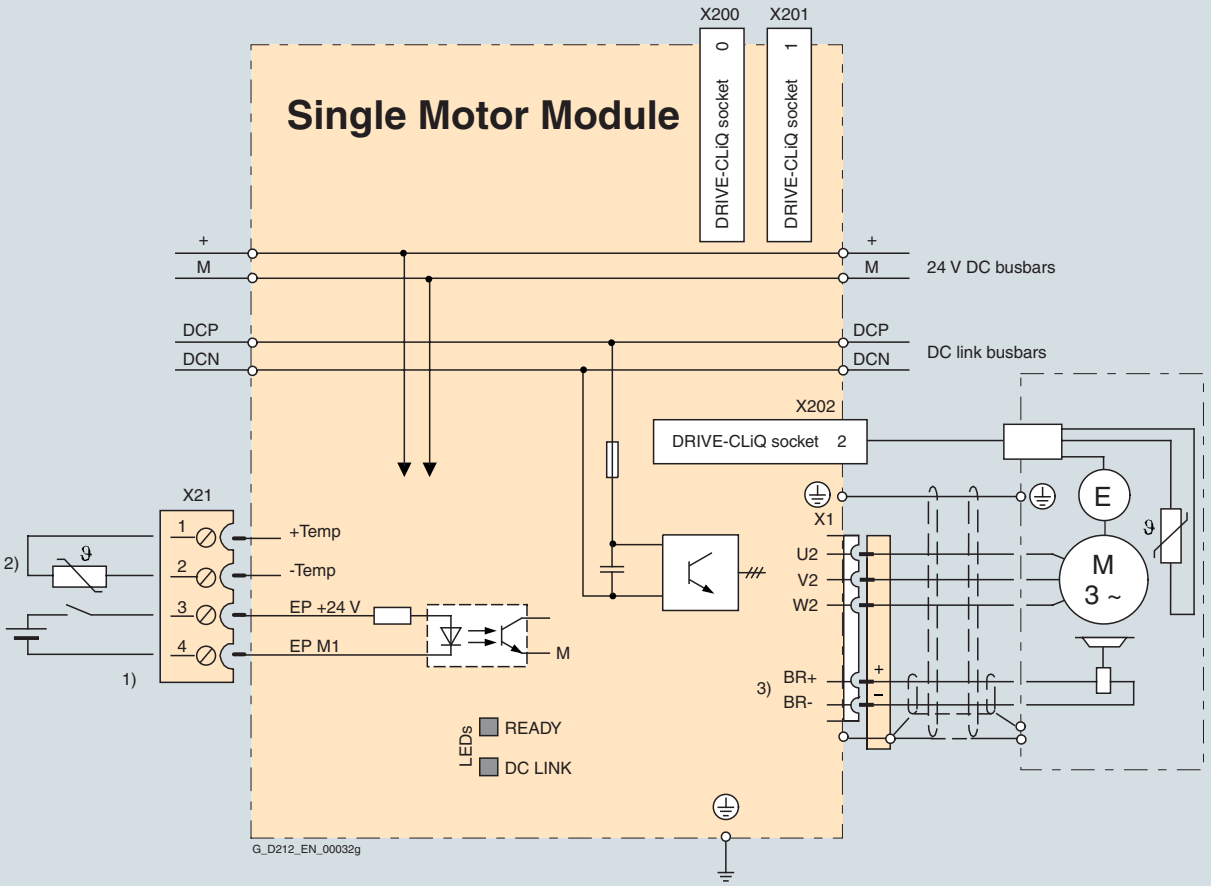
The scope of supply of the Motor Modules includes:

- DRIVE-CLiQ cable (length depends on module width) to connect Motor Module to adjacent module
- Jumper for connecting the 24 V DC busbar to the adjacent Motor Module
- Connector X21
- Connector X11 for the motor brake connection (for Motor Modules with a rated output current of 45 A to 200 A)
- 2 blanking plugs for sealing unused DRIVE-CLiQ sockets
- Fan insert for the 132 A and 200 A Motor Modules (the supply voltage for the fan insert is supplied by the Motor Module)
- 1 set of warning signs in foreign languages
- 1 heat conducting foil (for Motor Modules with cold plate cooling only)

Single Motor Modules in booksize format

Integration

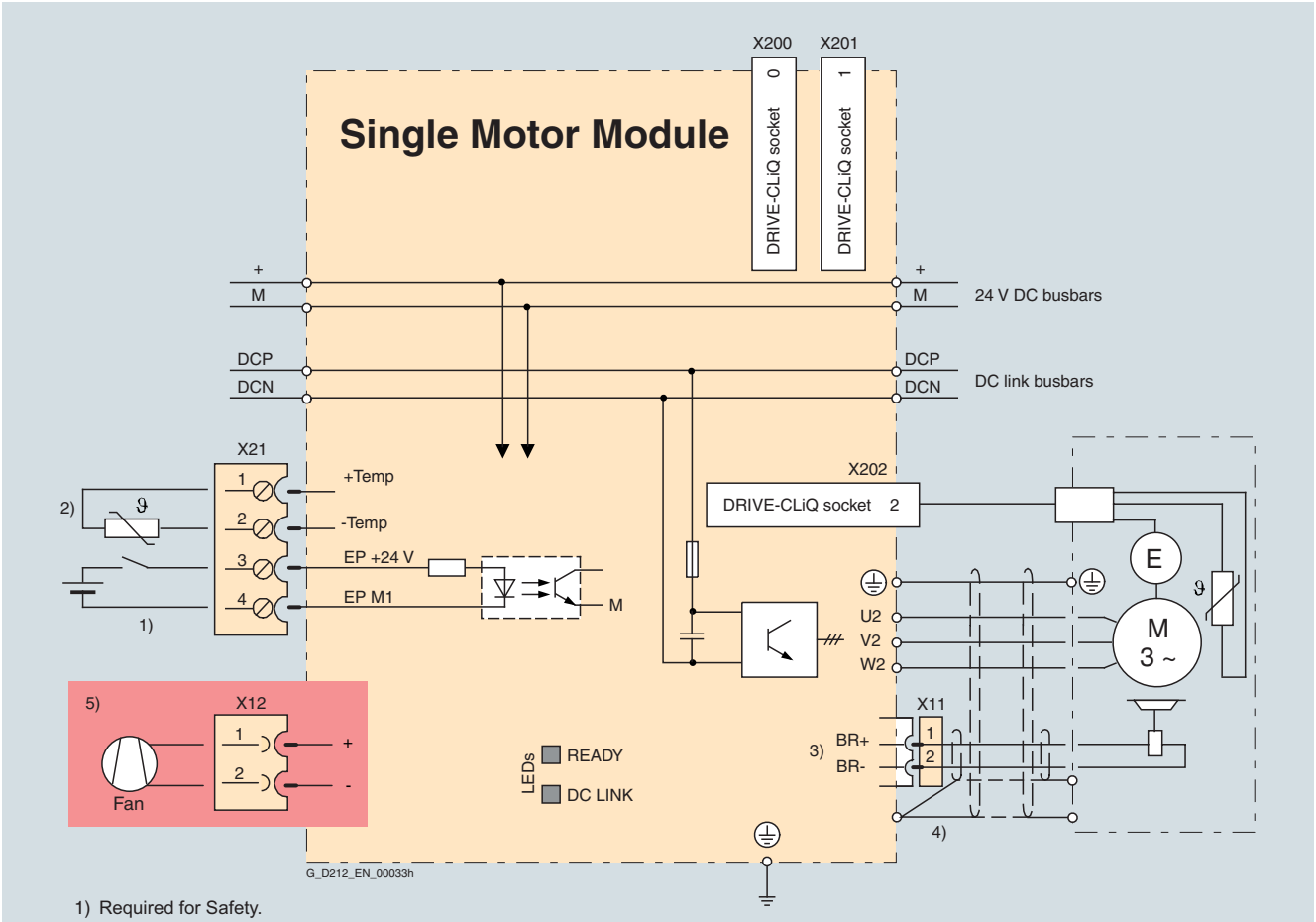
Single Motor Modules communicate with the Control Unit via DRIVE-CLiQ.



1) Required for Safety.
2) Temperature sensor terminal for motors without DRIVE-CLiQ interface.
3) The braking signal has an integrated overvoltage protection.
An external circuit of the holding brake is not necessary.

Connection example of Single Motor Modules in booksize format 3A to 30A

Integration (continued)



1) Required for Safety.
2) Temperature sensor terminal for motors without DRIVE-CLiQ interface.
3) The braking signal has an integrated overvoltage protection.
An external circuit of the holding brake is not necessary.
4) Contacting via shield plate.
5) Fan insert for 132 A and 200 A Single Motor Modules.
The fan insert is supplied with the Single Motor Module.

Typical connection of Single Motor Modules in booksize format 45 A to 200 A

Single Motor Modules in booksize format

Technical specifications

General technical specifications	
Electrical data	
DC link voltage (up to 2000 m (6562 ft) above sea level)	510 ... 720 V DC (line voltage 380 ... 480 V 3 AC) [1]
Output frequency	
• Control type Servo	0 … 650 Hz [2]
• Control type Vector	0 … 300 Hz [2]
• Control type *V/f*	0 … 600 Hz [2]
Electronic power supply	24 V DC -15 %/+20 %
Ambient conditions	
Type of cooling	- Internal air cooling, external air cooling Power units with forced air cooling through a built-in fan - Cold plate cooling
Permissible ambient and coolant temperature (air) during operation for line-side components, Line Modules and Motor Modules	0 … 40 °C (32 … 104 °F) without derating, > 40 … 55 °C (104 … 131 °F), see derating characteristics
Site altitude	Up to 1000 m (3281 ft) above sea level without derating, > 1000 ... 4000 m (3281 ... 13124 ft) above sea level, see derating characteristics
Certificates	
Conformity	CE (low-voltage and EMC Directives)
Approvals	cULus (File No.: E192450)
Safety Integrated	Safety Integrity Level 2 (SIL 2) to IEC 61508, control category 3 to EN 954-1 For further information, see the Safety Integrated section

1) 3 A ... 85 A Single Motor Modules with firmware version V2.5 and higher with appropriate parameterization and reduced power rating also operable on 200 ... 240 V 3 AC networks in accordance with a DC-link voltage of 270 ... 360 V DC.

2) Note correlation between max. output frequency, pulse frequency and current derating, see System description.

Technical specifications (continued)

DC link voltage 510 ... 720 V DC		Single Motor Modules in booksize format				
Internal air cooling	**6SL3120-**	**1TE13-0AA3**	**1TE15-0AA3**	**1TE21-0AA3**	**1TE21-8AA3**	**1TE23-0AA3**
External air cooling	**6SL3121-**	**1TE13-0AA3**	**1TE15-0AA3**	**1TE21-0AA3**	**1TE21-8AA3**	**1TE23-0AA3**
Cold plate cooling	**6SL3126-**	**1TE13-0AA3**	**1TE15-0AA3**	**1TE21-0AA3**	**1TE21-8AA3**	**1TE23-0AA3**
Output current						
• Rated current I_{rated}	A	3	5	9	18	30
• Base-load current I_H	A	2.6	4.3	7.7	15.3	25.5
• For S6 duty (40 %) I_{S6}	A	3.5	6	10	24	40
• I_{max}	A	6	10	18	36	56
Type rating [1]						
• Based on I_{rated}	kW (HP)	1.6 (1.5)	2.7 (3)	4.8 (5)	9.7 (10)	16.0 (20)
• Based on I_H	kW (HP)	1.4 (1)	2.3 (2.5)	4.1 (5)	8.2 (10)	13.7 (18)
Rated pulse frequency	kHz	4	4	4	4	4
DC link current I_d [2]	A	3.6	6	11	22	36
Current carrying capacity						
• DC link busbars	A	100	100	100	100	100
• 24 V DC busbars	A	20	20	20	20	20
		If, due to a number of Line and Motor Modules being mounted side-by-side, the current carrying capacity exceeds 20 A, an additional 24 V DC connection using a 24 V terminal adapter is required (max. cross section 6 mm^2, max. fuse protection 20 A).				
DC link capacitance	µF	110	110	110	220	705
Current requirement with 24 V DC, max.	A	0.85	0.85	0.85	0.85	0.9
Internal/external air cooling						
• Power loss [3]						
- With internal air cooling	kW	0.05	0.07	0.1	0.19	0.31
- With external air cooling, int./ext.	kW	0.035/0.015	0.04/0.03	0.055/0.045	0.1/0.09	0.1/0.21
• Cooling air requirement	m^3/s (ft^3/s)	0.008 (0.3)	0.008 (0.3)	0.008 (0.3)	0.008 (0.3)	0.016 (0.6)
• Sound pressure level L_{pA} (1 m)	dB	< 60	< 60	< 60	< 60	< 60
Cold plate cooling						
• Power loss, int./ext. [3]	kW	0.025/0.02	0.035/0.035	0.045/0.05	0.08/0.1	0.085/0.22
• Thermal resistance R_{th}	K/W	0.175	0.175	0.175	0.175	0.075
Motor connection U2, V2, W2		Connector (X1) [4], max. 30 A	Connector (X1) [4], max. 30 A	Connector (X1) [4], max. 30 A	Connector (X1) [4], max. 30 A	Connector (X1) [4], max. 30 A
Shield connection		integrated in connector (X1)	integrated in connector (X1)	integrated in connector (X1)	integrated in connector (X1)	integrated in connector (X1)
PE connection		M5 screw	M5 screw	M5 screw	M5 screw	M5 screw
Motor brake connection		Integrated into the plug-in motor connector (X1), 24 V DC, 2 A	Integrated into the plug-in motor connector (X1), 24 V DC, 2 A	Integrated into the plug-in motor connector (X1), 24 V DC, 2 A	Integrated into the plug-in motor connector (X1), 24 V DC, 2 A	Integrated into the plug-in motor connector (X1), 24 V DC, 2 A
Motor cable length, max.						
• Shielded	m (ft)	50 (164)	50 (164)	50 (164)	70 (230)	100 (328)
• Unshielded	m (ft)	75 (246)	75 (246)	75 (246)	100 (328)	150 (492)
Degree of protection		IP20	IP20	IP20	IP20	IP20
Dimensions						
• Width	mm (in)	50 (1.97)	50 (1.97)	50 (1.97)	50 (1.97)	100 (3.94)
• Height	mm (in)	380 (14.96)	380 (14.96)	380 (14.96)	380 (14.96)	380 (14.96)
• Depth						
- With internal air cooling	mm (in)	270 (10.63)	270 (10.63)	270 (10.63)	270 (10.63)	270 (10.63)
- With external air cooling, on/behind mounting surface	mm (in)	226/66.5 (8.90/2.62)	226/66.5 (8.90/2.62)	226/66.5 (8.90/2.62)	226/66.5 (8.90/2.62)	226/66.5 (8.90/2.62)
- With cold plate cooling	mm (in)	226 (8.90)	226 (8.90)	226 (8.90)	226 (8.90)	226 (8.90)
Weight, approx.						
• With internal air cooling	kg (lb)	5.0 (11.0)	5.0 (11.0)	5.0 (11.0)	5.0 (11.0)	6.9 (15.2)
• With external air cooling	kg (lb)	5.7 (12.6)	5.7 (12.6)	5.7 (12.6)	5.7 (12.6)	8.5 (18.7)
• With cold plate cooling	kg (lb)	4.2 (9.26)	4.2 (9.26)	4.5 (9.92)	4.5 (9.92)	6.1 (13.5)

1) Rated power of a standard asynchronous (induction) motor at 600 V DC link voltage.

2) Rated DC link current for dimensioning an external DC connection. For DC link current calculation for dimensioning the Line Module, see System description "Power Modules/Line Modules".

3) Power loss of Motor Module at rated output including losses of 24 V DC electronics power supply.

4) Connector not included in scope of supply, see Accessories.

3

Technical specifications (continued)

DC link voltage 510 ... 720 V DC		Single Motor Modules in booksize format				
Internal air cooling	**6SL3120-**	**1TE24-5AA3**	**1TE26-0AA3**	**1TE28-5AA3**	**1TE31-3AA3**	**1TE32-0AA3**
External air cooling	**6SL3121-**	**1TE24-5AA3**	**1TE26-0AA3**	**1TE28-5AA3**	**1TE31-3AA3**	**1TE32-0AA3**
Cold plate cooling	**6SL3126-**	**1TE24-5AA3**	**1TE26-0AA3**	**1TE28-5AA3**	**1TE31-3AA3**	**1TE32-0AA3**
Output current						
• Rated current I_{rated}	A	45	60	85	132 (105 5))	200 (140 5))
• Base-load current I_H	A	38	52	68	105	141
• For S6 duty (40 %) I_{S6}	A	60	80	110	150	230
• I_{max}	A	85	113	141	210	282
Rated pulse frequency	kHz	4	4	4	4	4
Type rating 1)						
• Based on I_{rated}	kW (HP)	24 (30)	32 (40)	46 (60)	71 (100)	107 (150)
• Based on I_H	kW (HP)	21 (25)	28 (40)	37 (50)	57 (75)	76 (100)
DC link current I_d 2)	A	54	72	102	158	200
Current carrying capacity						
• DC link busbars	A	200	200	200	200	200
• 24 V DC busbars	A	20	20	20	20	20
		If, due to a number of Line and Motor Modules being mounted side-by-side, the current carrying capacity exceeds 20 A, an additional 24 V DC connection using a 24 V terminal adapter is required (max. cross section 6 mm², max. fuse protection 20 A).				
DC link capacitance	µF	1175	1410	1880	2820	3995
Current requirement with 24 V DC, max.	A	1.2	1.2	1.5	1.5	1.5
Internal/external air cooling						
• Power loss 3)						
- With internal air cooling	kW	0.46	0.62	0.79	1.29	2.09
- With external air cooling, int./ext. 2)	kW	0.14/0.32	0.16/0.46	0.2/0.59	0.29/1.0	0.47/1.62
• Cooling air requirement	m³/s (ft³/s)	0.031 (1.1)	0.031 (1.1)	0.044 (1.6)	0.144 (5.1)	0.144 (5.1)
• Sound pressure level L_{pA} (1 m)	dB	< 65	< 65	< 60	< 73	< 73
Cold plate cooling						
• Power loss, int./ext. 3)	kW	0.11/0.34	0.13/0.48	0.15/0.62	0.24/1.05	0.39/1.7
• Thermal resistance R_{th}	K/W	0.055	0.055	0.05	0.028	0.028
Motor connection U2, V2, W2		M6 screw studs (X1)	M6 screw studs (X1)	M8 screw studs (X1)	M8 screw studs (X1)	M8 screw studs (X1)
• Conductor cross-section, max.	mm²	2.5 … 50	2.5 … 50	2.5 … 95, 2 × 35	2.5 … 120, 2 × 50	2.5 … 120, 2 × 50
Shield connection		see Accessories	see Accessories	see Accessories	see Accessories	see Accessories
PE connection		M6 screw	M6 screw	M6 screw	M8 screw	M8 screw
Motor brake connection		Plug-in connector (X11), 24 V DC, 2 A	Plug-in connector (X11), 24 V DC, 2 A	Plug-in connector (X11), 24 V DC, 2 A	Plug-in connector (X11), 24 V DC, 2 A	Plug-in connector (X11), 24 V DC, 2 A
Motor cable length, max.						
• Shielded	m (ft)	100 (328)	100 (328)	100 (328)	100 (328)	100 (328)
• Unshielded	m (ft)	150 (492)	150 (492)	150 (492)	150 (492)	150 (492)
Degree of protection		IP20	IP20	IP20	IP20	IP20
Dimensions						
• Width	mm (in)	150 (5.91)	150 (5.91)	200 (7.87)	300 (11.81)	300 (11.81)
• Height	mm (in)	380 (14.96)	380 (14.96)	380 (14.96)	380 (14.96)	380 (14.96)
- With fan 4)		–	–	–	629 (24.76)	629 (24.76)
• Depth						
- With internal air cooling	mm (in)	270 (10.63)	270 (10.63)	270 (10.63)	270 (10.63)	270 (10.63)
- With external air cooling, on/behind mounting surface	mm (in)	226/71 (8.90/2.80)	226/71 (8.90/2.80)	226/92 (8.90/3.62)	226/82 (8.90/3.23)	226/82 (8.90/3.23)
- With cold plate cooling	mm (in)	226 (8.90)	226 (8.90)	226 (8.90)	226 (8.90)	226 (8.90)
Weight, approx.						
• With internal air cooling	kg (lb)	9 (19.8)	9 (19.8)	15 (33.1)	21 (46.3)	21 (46.3)
• With external air cooling	kg (lb)	13.2 (29.1)	13.4 (29.5)	17.2 (37.9)	27.2 (60.0)	30 (66.2)
• With cold plate cooling	kg (lb)	9.1 (20.1)	9.1 (20.1)	12.5 (27.6)	18 (39.7)	18 (39.7)

1) Rated power of a standard asynchronous (induction) motor at 600 V DC link voltage.

2) Rated DC link current for dimensioning an external DC connection. For DC link current calculation for dimensioning the Line Module, see System description "Power Modules/Line Modules".

3) Power loss of Motor Module at rated output including losses of 24 V DC electronic power supply.

4) The fan is supplied with the Motor Module and must be installed before the Motor Module is commissioned.

5) In the case of cold-plate cooling, derating is necessary due to heat transfer to the external heat sink (see the System description section).

Selection and ordering data

Rated output current	Type rating	Single Motor Module in booksize format		
		Internal air cooling	External air cooling	Cold plate cooling
A	kW (HP) [1]	Order No.	Order No.	Order No.
DC link voltage 510 ... 720 V DC				
3	1.6 (1.5)	**6SL3120-1TE13-0AA3**	**6SL3121-1TE13-0AA3**	**6SL3126-1TE13-0AA3**
5	2.7 (3)	**6SL3120-1TE15-0AA3**	**6SL3121-1TE15-0AA3**	**6SL3126-1TE15-0AA3**
9	4.8 (5)	**6SL3120-1TE21-0AA3**	**6SL3121-1TE21-0AA3**	**6SL3126-1TE21-0AA3**
18	9.7 (10)	**6SL3120-1TE21-8AA3**	**6SL3121-1TE21-8AA3**	**6SL3126-1TE21-8AA3**
30	16 (20)	**6SL3120-1TE23-0AA3**	**6SL3121-1TE23-0AA3**	**6SL3126-1TE23-0AA3**
45	24 (30)	**6SL3120-1TE24-5AA3**	**6SL3121-1TE24-5AA3**	**6SL3126-1TE24-5AA3**
60	32 (40)	**6SL3120-1TE26-0AA3**	**6SL3121-1TE26-0AA3**	**6SL3126-1TE26-0AA3**
85	46 (60)	**6SL3120-1TE28-5AA3**	**6SL3121-1TE28-5AA3**	**6SL3126-1TE28-5AA3**
132	71 (100)	**6SL3120-1TE31-3AA3**	**6SL3121-1TE31-3AA3**	**6SL3126-1TE31-3AA3**
200	107 (150)	**6SL3120-1TE32-0AA3**	**6SL3121-1TE32-0AA3**	**6SL3126-1TE32-0AA3**

Accessories

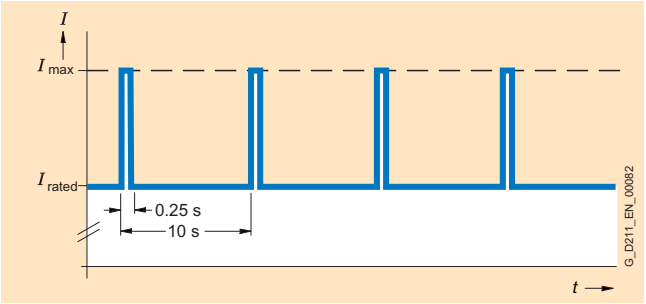
Description	Order No.
Power connector (X1) at Motor Module end, with screw-type terminals 1.5 ... 10 mm^2, for Motor Modules with a rated output current of 3 ... 30 A	**6SL3162-2MA00-0AA0**
Shield connection kit for Line/Motor Modules in booksize format	
• 150 mm (5.91 in) wide for internal air cooling	**6SL3162-1AF00-0AA1**
• 150 mm (7.87 in) wide for external air cooling and cold plate cooling	**6SL3162-1AF00-0BA1**
• 200 mm (7.87 in) wide for internal air cooling	**6SL3162-1AH01-0AA0**
• 200 mm (7.87 in) wide for external air cooling and cold plate cooling	**6SL3162-1AH01-0BA0**
• 300 mm (11.81 in) wide for all cooling types	**6SL3162-1AH00-0AA0**
DC link rectifier adapter for direct infeed of DC link voltage	
• Screw-type terminals 0.5 … 10 mm^2 for Line Modules and Motor Modules in booksize format with a width of 50 mm (1.97 in) or 100 mm (3.94 in)	**6SL3162-2BD00-0AA0**
• Screw-type terminals 35 … 95 mm^2 for Line Modules and Motor Modules in booksize format with a width of 150 mm, 200 mm and 300 mm (5.91 in, 7.87 in and 11.81 in)	**6SL3162-2BM00-0AA0**

Description	Order No.
DC link adapters (2 units) for multitier configuration Screw-type terminals 35 ... 95 mm^2 for all Line Modules/Motor Modules in booksize format	**6SL3162-2BM01-0AA0**
24 V terminal adapter for all Line Modules/Motor Modules in booksize format	**6SL3162-2AA00-0AA0**
24 V jumper for connection of the 24 V busbars (for booksize format)	**6SL3162-2AA01-0AA0**
DC link busbar kit (reinforced) for replacement of DC link busbars for 5 modules in booksize format	
• 50 mm (1.97 in) wide	**6SL3162-2DB00-0AA0**
• 100 mm (3.94 in) wide	**6SL3162-2DD00-0AA0**
Warning signs in foreign languages This set of foreign language warning signs can be placed on top of the standard German or English signs. One set of labels is supplied with the devices. The following languages are available in each label set: Chinese Simplified, Danish, Dutch, Finnish, French, Greek, Italian, Japanese, Korean, Polish, Portuguese/Brazilian, Russian, Swedish, Spanish, Czech, Turkish	**6SL3166-3AB00-0AA0**

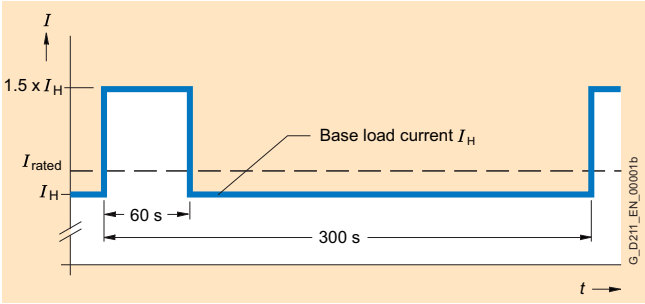
1) Nominal HP based on Asynchronous motors (induction motors). Match the motor nameplate current for specific sizing.

Characteristics

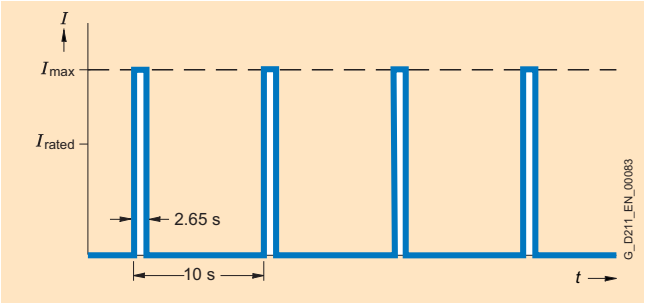
Overload capability



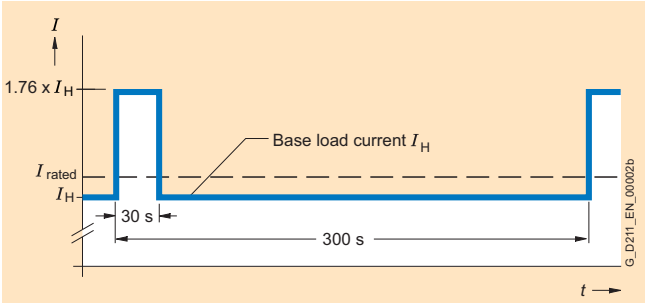
Load cycle with previous load



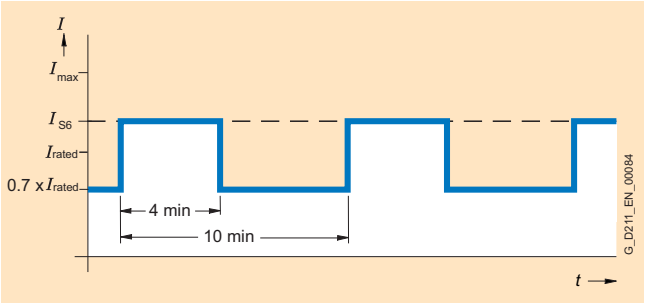
Load cycle with 60 s overlaod with a load cycle period of 300 s



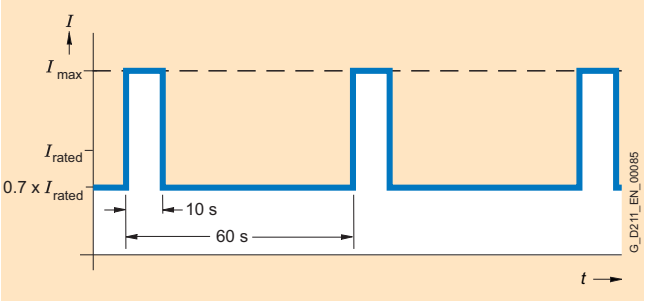
Load cycle without previous load



Load cycle with 30 s overlaod with a load cycle period of 300 s



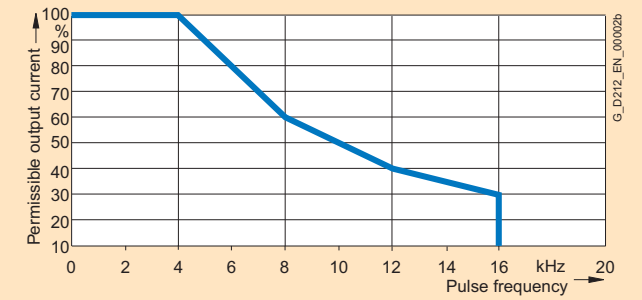
S6 load cycle with previous load with a load cycle period of 600 s



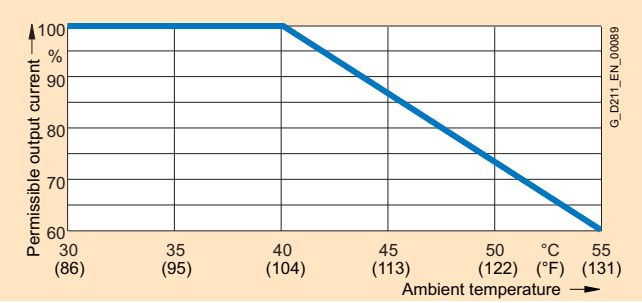
S6 load cycle with previous load with a load cycle period of 60 s

Characteristics (continued)

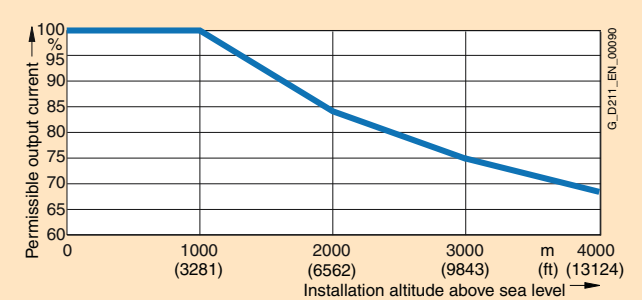
Derating characteristics



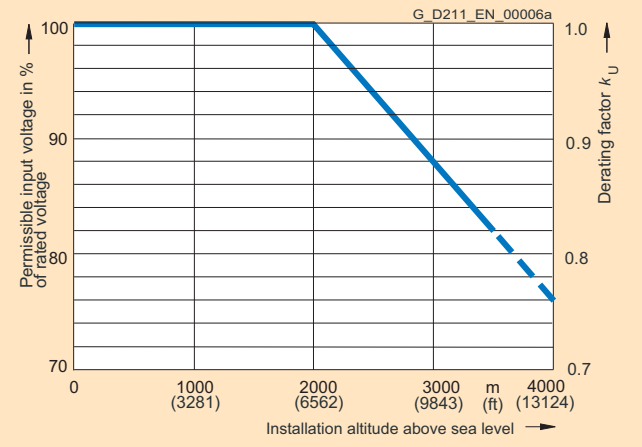
Output current dependent on pulse frequency



Output current dependent on ambient temperature



Output current dependent on installation altitude



Voltage derating dependent on installation altitude

Single Motor Modules in chassis format

Design

The Single Motor Modules in chassis format feature the following connections and interfaces as standard:

- 1 DC link connection (DCP, DCN) for connecting to the supply DC busbar
- 1 DC link connection (DCPA, DCNA) for connecting a Braking Module
- 1 electronic power supply connection
- 3 DRIVE-CLiQ sockets
- 1 motor connection
- 1 safe standstill input (enable pulses)
- 1 temperature sensor input (KTY84-130 or PTC)
- 1 PE (protective earth) connection

The status of the Motor Modules is indicated via two multi-color LEDs.

The scope of supply of the Motor Modules includes:

- Frame sizes FX and GX:
  - 0.60 m (1.97 ft) DRIVE-CLiQ cable for connection to the adjacent Motor Module
- Frame sizes HX and JX:
  - 0.35 m (1.15 ft) DRIVE-CLiQ cable for connection to the CU320 or SIMOTION D4x5 Control Unit
  - 2.10 m (6.89 ft) DRIVE-CLiQ cable for connection to the adjacent Motor Module

Selection and ordering data

Rated output current	Type rating	Single Motor Module in chassis format
A	kW (HP) [1]	Order No.
DC link voltage 510 ... 720 V DC		
210	110 (150)	**6SL3320-1TE32-1AA0**
260	132 (200)	**6SL3320-1TE32-6AA0**
310	160 (250)	**6SL3320-1TE33-1AA0**
380	200 (300)	**6SL3320-1TE33-8AA0**
490	250 (400)	**6SL3320-1TE35-0AA0**
605	315 (500)	**6SL3320-1TE36-1AA0**
745	400 (600)	**6SL3320-1TE37-5AA0**
840	450 (700)	**6SL3320-1TE38-4AA0**
985	560 (800)	**6SL3320-1TE41-0AA0**
1260	710 (1000)	**6SL3320-1TE41-2AA0**
1405	800 (1150)	**6SL3320-1TE41-4AA0**
DC link voltage 675 ... 1035 V DC		
85	75	**6SL3320-1TG28-5AA0**
100	90	**6SL3320-1TG31-0AA0**
120	110	**6SL3320-1TG31-2AA0**
150	132	**6SL3320-1TG31-5AA0**
175	160	**6SL3320-1TG31-8AA0**
215	200	**6SL3320-1TG32-2AA0**
260	250	**6SL3320-1TG32-6AA0**
330	315	**6SL3320-1TG33-3AA0**
410	400	**6SL3320-1TG34-1AA0**
465	450	**6SL3320-1TG34-7AA0**
575	560	**6SL3320-1TG35-8AA0**
735	710	**6SL3320-1TG37-4AA0**
810	800	**6SL3320-1TG38-1AA0**
910	900	**6SL3320-1TG38-8AA0**
1025	1000	**6SL3320-1TG41-0AA0**
1270	1200	**6SL3320-1TG41-3AA0**

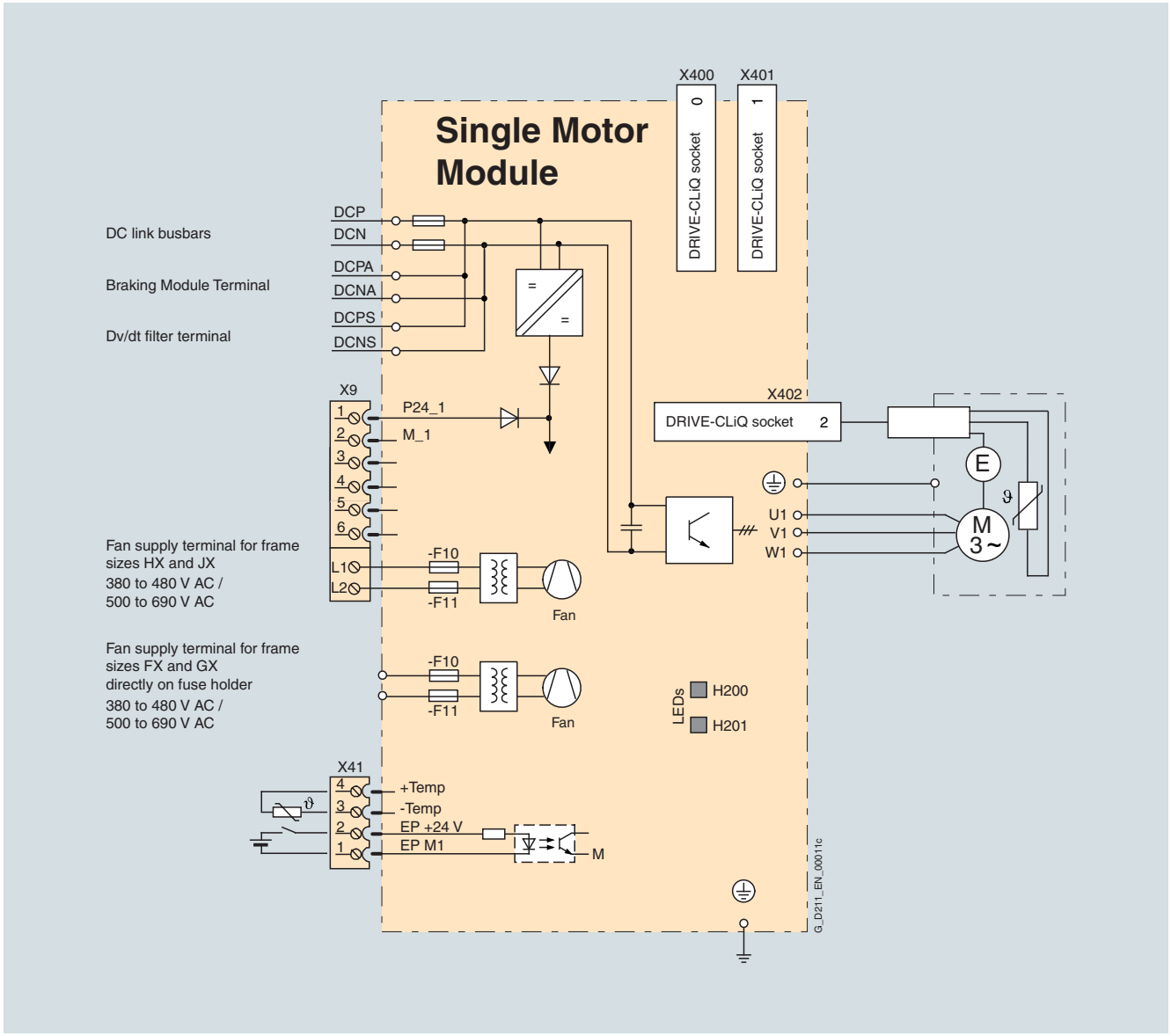
Accessories

Description	Order No.
Warning signs in foreign languages This set of foreign language warning sings can be placed on top of the standard German or English sings. One set of labels is supplied with the devices. The following languages are available in each label set: Chinese Simplified, Danish, Dutch, Finnish, French, Greek, Italian, Japanese, Korean, Polish, Portuguese/Brazilian, Russian, Swedish, Spanish, Czech, Turkish	**6SL3166-3AB00-0AA0**

1) Nominal HP based on Asynchronous motors (induction motors). Match the motor nameplate current for specific sizing.

Integration

The Single Motor Module communicates with the Control Unit via DRIVE-CLiQ.



Connection example of Single Motor Module in chassis format

Single Motor Modules in chassis format

Technical specifications

General technical specifications	
Electrical data	
DC link voltage (up to 2000 m (6562 ft) above sea level)	510 V … 720 V DC (line connection voltage 380 V … 480 V 3 AC) or 675 V … 1035 V DC (line connection voltage 500 V … 690 V 3 AC)
Output frequency	
• Control type Servo	0 … 650 Hz [1]
• Control type Vector	0 … 300 Hz [1]
• Control type *V/f*	0 … 300 Hz [1]
Electronic power supply	24 V DC -15 %/+20 %
Ambient conditions	
Type of cooling	Internal air cooling, power units with increased air cooling by built-in fans
Permissible ambient and coolant temperature (air) during operation for line-side components, Line Modules and Motor Modules	0 … 40 °C (32 … 104 °F) without derating, > 40 … 55 °C (104 … 131 °F) see derating characteristics
Site altitude	Up to 2000 m (6562 ft) above sea level without derating, > 2000 ... 4000 m (6562 ... 13124 ft) above sea level see derating characteristics
Certificates	
Conformity	CE (low-voltage and EMC Directives)
Approvals (510 ... 720 V DC Motor Modules only)	cULus (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 the Safety Integrated section

[1] Note correlation between max. output frequency, pulse frequency and current derating, see System description.

Technical specifications (continued)

DC link voltage 510 ... 720 V DC		Single Motor Modules in chassis format 6SL3320- 1TE32-1AA0	 6SL3320- 1TE32-6AA0	 6SL3320- 1TE33-1AA0	 6SL3320- 1TE33-8AA0	 6SL3320- 1TE35-0AA0
Output current						
• Rated current I_{rated}	A	210	260	310	380	490
• Base-load current I_L	A	205	250	302	370	477
• Base-load current I_H	A	178	233	277	340	438
• For S6 duty (40 %) I_{S6}	A	230	285	340	430	540
• I_{max}	A	307	375	453	555	715
Type rating [1]						
• Based on I_{rated}	kW (HP)	110 (150)	132 (200)	160 (250)	200 (300)	250 (400)
• Based on I_H	kW (HP)	90 (125)	110 (150)	132 (200)	160 (250)	200 (350)
Rated pulse frequency	kHz	2	2	2	2	2
Rated DC link current I_d [2] when supplied via						
• Basic/Smart Line Module	A	252	312	372	456	588
• Active Line Module	A	227	281	335	411	530
DC link capacitance	µF	4200	5200	6300	7800	9600
Current requirement						
• With 24 V DC, max.	A	0.9	0.9	1.2	1.2	1.2
• Fan supply with 400 V 2 AC, 50/60 Hz, max.	A	0.63/0.95	1.13/1.7	1.6/2.4	1.6/2.4	1.6/2.4
Power loss, max.	kW	1.94	2.6	3.1	3.8	4.5
Cooling air requirement	m^3/s (ft^3/s)	0.17 (6.0)	0.23 (8.1)	0.36 (12.7)	0.36 (12.7)	0.36 (12.7)
Sound pressure level L_{pA} (1 m) at 50/60 Hz	dB	< 67	< 69	< 69	< 69	< 69
DC link connection DCP, DCN		Flat connector for M10 screw	Flat connector for M10 screw	Flat connector for M10 screw	Flat connector for M10 screw	Flat connector for M10 screw
• Conductor cross-section, max.	mm^2	2 × 185	2 × 185	2 × 185	2 × 185	2 × 185
Motor connection U2, V2, W2		Flat connector for M10 screw	Flat connector for M10 screw	Flat connector for M10 screw	Flat connector for M10 screw	Flat connector for M10 screw
• Conductor cross-section, max.	mm^2	2 × 185	2 × 185	2 × 185	2 × 185	2 × 185
PE connection		M10 screw	M10 screw	M10 screw	M10 screw	M10 screw
• Conductor cross-section, max.	mm^2	2 × 185	2 × 185	2 × 185	2 × 185	2 × 185
Motor brake connection		–	–	–	–	–
Motor cable length, max. (without external options)	m (ft)					
• Shielded		300 (984)	300 (984)	300 (984)	300 (984)	300 (984)
• Unshielded		450 (1476)	450 (1476)	450 (1476)	450 (1476)	450 (1476)
Degree of protection		IP20	IP20	IP20	IP20	IP20
Dimensions						
• Width	mm (in)	326 (12.83)	326 (12.83)	326 (12.83)	326 (12.83)	326 (12.83)
• Height	mm (in)	1400 (55.12)	1400 (55.12)	1533 (60.35)	1533 (60.35)	1533 (60.35)
• Depth	mm (in)	356 (14.02)	356 (14.02)	545 (21.46)	545 (21.46)	545 (21.46)
Frame size		FX	FX	GX	GX	GX
Weight, approx.	kg (lb)	88 (194)	88 (194)	152 (335)	152 (335)	152 (335)

[1] Rated power of a standard asynchronous (induction) motor at 600 V DC link voltage.

[2] Rated DC link current for dimensioning an external DC connection. For DC link current calculation for dimensioning the Line Module, see System description "Power Modules/Line Modules".

3

Technical specifications (continued)

DC link voltage 510 ... 720 V DC		Single Motor Modules in chassis format 6SL3320-1TE36-1AA0	6SL3320-1TE37-5AA0	6SL3320-1TE38-4AA0
Output current				
• Rated current I_{rated}	A	605	745	840
• Base-load current I_L	A	590	725	820
• Base-load current I_H	A	460	570	700
• I_{max}	A	885	1087	1230
Type rating [1]				
• Based on I_{rated}	kW (HP)	315 (500)	400 (600)	450 (700)
• Based on I_H	kW (HP)	250 (350)	315 (450)	400 (500)
Rated pulse frequency	kHz	1.25	1.25	1.25
DC link current I_d [2]	A	726	894	1008
DC link capacitance	µF	12600	15600	16800
Current requirement				
• With 24 V DC, max.	A	1.0	1.0	1.0
• Fan supply with 400 V 2 AC, max.	A	3.2	3.2	3.2
Power loss	kW	5.84	6.68	7.15
Cooling air requirement	m^3/s (ft^3/s)	0.78 (27.5)	0.78 (27.5)	0.78 (27.5)
Sound pressure level L_{pA} (1 m)	dB	< 72	< 72	< 72
DC link connection DCP, DCN		Flat connector for busbar connection	Flat connector for busbar connection	Flat connector for busbar connection
Motor connection U2, V2, W2		Flat connector for M12 screw	Flat connector for M12 screw	Flat connector for M12 screw
• Conductor cross-section, max.	mm^2	4 × 240	4 × 240	4 × 240
PE connection		M12 screw	M12 screw	M12 screw
• Conductor cross-section, max.				
- PE1/GND	mm^2	1 × 240	1 × 240	1 × 240
- PE2/GND	mm^2	2 × 240	2 × 240	2 × 240
Motor brake connection		–	–	–
Motor cable length, max. (without external options)				
• Shielded	m (ft)	300 (984)	300 (984)	300 (984)
• Unshielded	m (ft)	450 (1476)	450 (1476)	450 (1476)
Degree of protection		IP00	IP00	IP00
Dimensions				
• Width	mm (in)	503 (19.80)	503 (19.80)	503 (19.80)
• Height	mm (in)	1475 (58.07)	1475 (58.07)	1475 (58.07)
• Depth	mm (in)	540 (21.26)	540 (21.26)	540 (21.26)
Frame size		HX	HX	HX
Weight, approx.	kg (lb)	290 (639)	290 (639)	290 (639)

1) Rated power of a standard asynchronous (induction) motor at 600 V DC link voltage.

2) Rated DC link current for dimensioning an external DC connection. For DC link current calculation for dimensioning the Line Module, see System description "Power Modules/Line Modules".

Technical specifications (continued)

DC link voltage 510 ... 720 V DC		Single Motor Modules in chassis format 6SL3320-1TE41-0AA0	6SL3320-1TE41-2AA0	6SL3320-1TE41-4AA0
Output current				
• Rated current I_{rated}	A	985	1260	1405
• Base-load current I_L	A	960	1230	1370
• Base-load current I_H	A	860	1127	1257
• I_{max}	A	1440	1845	2055
Type rating [1]				
• Based on I_{rated}	kW (HP)	560 (800)	710 (1000)	800 (1150)
• Based on I_H	kW (HP)	450 (700)	560 (900)	710 (1000)
Rated pulse frequency	kHz	1.25	1.25	1.25
DC link current I_d [2]	A	1182	1512	1686
DC link capacitance	µF	18900	26100	28800
Current requirement				
• With 24 V DC, max.	A	1.25	1.40	1.40
• Fan supply with 400 V 2 AC, max.	A	4.7	4.7	4.7
Power loss	kW	9.5	11.1	12.0
Cooling air requirement	m^3/s (ft^3/s)	1.1 (38.8)	1.1 (38.8)	1.1 (38.8)
Sound pressure level L_{pA} (1 m)	dB	< 72	< 72	< 72
DC link connection DCP, DCN		Flat connector for busbar connection	Flat connector for busbar connection	Flat connector for busbar connection
Motor connection U2, V2, W2		Flat connector for M12 screw	Flat connector for M12 screw	Flat connector for M12 screw
• Conductor cross-section, max.	mm^2	6 × 240	6 × 240	6 × 240
PE connection		M12 screw	M12 screw	M12 screw
• Conductor cross-section, max.				
- PE1/GND	mm^2	1 × 240	1 × 240	1 × 240
- PE2/GND	mm^2	2 × 240	2 × 240	2 × 240
Motor brake connection		–	–	–
Motor cable length, max. (without external options)				
• Shielded	m (ft)	300 (984)	300 (984)	300 (984)
• Unshielded	m (ft)	450 (1476)	450 (1476)	450 (1476)
Degree of protection		IP00	IP00	IP00
Dimensions				
• Width	mm (in)	704 (27.72)	704 (27.72)	704 (27.72)
• Height	mm (in)	1475 (58.07)	1475 (58.07)	1475 (58.07)
• Depth	mm (in)	540 (21.26)	540 (21.26)	540 (21.26)
Frame size		JX	JX	JX
Weight, approx.	kg (lb)	450 (992)	450 (992)	450 (992)

1) Rated power of a standard asynchronous (induction) motor at 600 V DC link voltage.

2) Rated DC link current for dimensioning an external DC connection. For DC link current calculation for dimensioning the Line Module, see System description "Power Modules/Line Modules".

3

Technical specifications (continued)

DC link voltage 675 ... 1035 V DC		Single Motor Modules in chassis format			
		6SL3320-1TG28-5AA0	6SL3320-1TG31-0AA0	6SL3320-1TG31-2AA0	6SL3320-1TG31-5AA0
Output current					
• Rated current I_{rated}	A	85	100	120	150
• Base-load current I_L	A	80	95	115	142
• Base-load current I_H	A	76	89	107	134
• I_{max}	A	120	142	172	213
Type rating [1]					
• Based on I_{rated}	kW	75	90	110	132
• Based on I_H	kW	55	75	90	110
Rated pulse frequency	kHz	1.25	1.25	1.25	1.25
Rated DC link current I_d [2] when supplied via					
• Basic/Smart Line Module	A	102	120	144	180
• Active Line Module	A	92	108	130	162
DC link capacitance	µF	1200	1200	1600	2800
Current requirement					
• With 24 V DC, max.	A	1	1	1	1
• Fan supply with 690 V 2 AC, 50/60 Hz, max.	A	0.4/0.5	0.4/0.5	0.4/0.5	0.4/0.5
Power loss	kW	1.17	1.43	1.89	1.80
Cooling air requirement	m^3/s (ft^3/s)	0.17 (6.0)	0.17 (6.0)	0.17 (6.0)	0.17 (6.0)
Sound pressure level L_{pA} (1 m) at 50/60 Hz	dB	< 67	< 67	< 67	< 67
DC link connection DCP, DCN		Flat connector for M10 screw	Flat connector for M10 screw	Flat connector for M10 screw	Flat connector for M10 screw
• Conductor cross-section, max.	mm^2	2 × 185	2 × 185	2 × 185	2 × 185
Motor connection U2, V2, W2		Flat connector for M10 screw	Flat connector for M10 screw	Flat connector for M10 screw	Flat connector for M10 screw
• Conductor cross-section, max.	mm^2	2 × 185	2 × 185	2 × 185	2 × 185
PE connection		M12 screw	M12 screw	M12 screw	M12 screw
• Conductor cross-section, max.					
- PE1/GND	mm^2	2 × 185	2 × 185	2 × 185	2 × 185
- PE2/GND	mm^2	2 × 185	2 × 185	2 × 185	2 × 185
Motor brake connection		–	–	–	–
Motor cable length, max. (without external options)					
• Shielded	m (ft)	300 (984)	300 (984)	300 (984)	300 (984)
• Unshielded	m (ft)	450 (1476)	450 (1476)	450 (1476)	450 (1476)
Degree of protection		IP20	IP20	IP20	IP20
Dimensions					
• Width	mm (in)	326 (12.83)	326 (12.83)	326 (12.83)	326 (12.83)
• Height	mm (in)	1400 (55.12)	1400 (55.12)	1400 (55.12)	1400 (55.12)
• Depth	mm (in)	356 (14.02)	356 (14.02)	356 (14.02)	356 (14.02)
Frame size		FX	FX	FX	FX
Weight, approx.	kg (lb)	88 (194)	88 (194)	88 (194)	88 (194)

1) Rated power of a standard asynchronous (induction) motor at 690 V 3 AC.

2) Rated DC link current for dimensioning an external DC connection. For DC link current calculation for dimensioning the Line Module, see System description "Power Modules/Line Modules".

Technical specifications (continued)

DC link voltage 675 ... 1035 V DC		Single Motor Modules in chassis format			
		6SL3320-1TG31-8AA0	6SL3320-1TG32-2AA0	6SL3320-1TG32-6AA0	6SL3320-1TG33-3AA0
Output current					
• Rated current I_{rated}	A	175	215	260	330
• Base-load current I_L	A	170	208	250	320
• Base-load current I_H	A	157	192	233	280
• I_{max}	A	255	312	375	480
Type rating [1]					
• Based on I_{rated}	kW	160	200	250	315
• Based on I_H	kW	132	160	200	250
Rated pulse frequency	kHz	1.25	1.25	1.25	1.25
Rated DC link current I_d [2] when supplied via					
• Basic/Smart Line Module	A	210	258	312	396
• Active Line Module	A	189	232	281	356
DC link capacitance	µF	2800	2800	3900	4200
Current requirement					
• With 24 V DC, max.	A	1.2	1.2	1.2	1.2
• Fan supply with 690 V 2 AC, 50/60 Hz, max.	A	0.94/1.4	0.94/1.4	0.94/1.4	0.94/1.4
Power loss	kW	2.67	3.09	3.62	4.34
Cooling air requirement	m^3/s (ft^3/s)	0.36 (12.7)	0.36 (12.7)	0.36 (12.7)	0.36 (12.7)
Sound pressure level L_{pA} (1 m) at 50/60 Hz	dB	< 69	< 69	< 69	< 69
DC link connection DCP, DCN		Flat connector for M10 screw	Flat connector for M10 screw	Flat connector for M10 screw	Flat connector for M10 screw
• Conductor cross-section, max.	mm^2	2 × 185	2 × 185	2 × 185	2 × 185
Motor connection U2, V2, W2		Flat connector for M10 screw	Flat connector for M10 screw	Flat connector for M10 screw	Flat connector for M10 screw
• Conductor cross-section, max.	mm^2	2 × 185	2 × 185	2 × 185	2 × 185
PE connection		M12 screw	M12 screw	M12 screw	M12 screw
• Conductor cross-section, max.					
- PE1/GND	mm^2	2 × 185	2 × 185	2 × 185	2 × 185
- PE2/GND	mm^2	2 × 185	2 × 185	2 × 185	2 × 185
Motor brake connection		–	–	–	–
Motor cable length, max. (without external options)					
• Shielded	m (ft)	300 (984)	300 (984)	300 (984)	300 (984)
• Unshielded	m (ft)	450 (1476)	450 (1476)	450 (1476)	450 (1476)
Degree of protection		IP20	IP20	IP20	IP20
Dimensions					
• Width	mm (in)	326 (12.83)	326 (12.83)	326 (12.83)	326 (12.83)
• Height	mm (in)	1533 (60.35)	1533 (60.35)	1533 (60.35)	1533 (60.35)
• Depth	mm (in)	545 (21.46)	545 (21.46)	545 (21.46)	545 (21.46)
Frame size		GX	GX	GX	GX
Weight, approx.	kg (lb)	152 (335)	152 (335)	152 (335)	152 (335)

1) Rated power of a standard asynchronous (induction) motor at 690 V 3 AC.

2) Rated DC link current for dimensioning an external DC connection. For DC link current calculation for dimensioning the Line Module, see System description "Power Modules/Line Modules".

3

Technical specifications (continued)

DC link voltage 675 ... 1035 V DC		Single Motor Modules in chassis format 6SL3320-1TG34-1AA0	6SL3320-1TG34-7AA0	6SL3320-1TG35-8AA0	6SL3320-1TG37-4AA0
Output current					
• Rated current I_{rated}	A	410	465	575	735
• Base-load current I_L	A	400	452	560	710
• Base-load current I_H	A	367	416	514	675
• I_{max}	A	600	678	840	1065
Type rating [1]					
• Based on I_{rated}	kW	400	450	560	710
• Based on I_H	kW	315	400	450	630
Rated pulse frequency	kHz	1.25	1.25	1.25	1.25
DC link current I_d [2]	A	492	558	690	882
DC link capacitance	µF	7400	7400	7400	11100
Current requirement					
• With 24 V DC, max.	A	1.0	1.0	1.0	1.25
• Fan supply with 690 V 2 AC, max.	A	1.84	1.84	2.74	2.74
Power loss	kW	6.13	6.80	10.3	10.9
Cooling air requirement	m^3/s (ft^3/s)	0.78 (27.5)	0.78 (27.5)	0.78 (27.5)	1.474 (52.1)
Sound pressure level L_{pA} (1 m)	dB	< 72	< 72	< 72	< 72
DC link connection DCP, DCN		Flat connector for busbar connection	Flat connector for busbar connection	Flat connector for busbar connection	Flat connector for busbar connection
Motor connection U2, V2, W2		Flat connector for M12 screw	Flat connector for M12 screw	Flat connector for M12 screw	Flat connector for M12 screw
• Conductor cross-section, max.	mm^2	4 × 240	4 × 240	4 × 240	4 × 240
PE connection		M12 screw	M12 screw	M12 screw	M12 screw
• Conductor cross-section, max.					
- PE1/GND	mm^2	1 × 240	1 × 240	1 × 240	1 × 240
- PE2/GND	mm^2	2 × 240	2 × 240	2 × 240	2 × 240
Motor brake connection		–	–	–	–
Motor cable length, max. (without external options)					
• Shielded	m (ft)	300 (984)	300 (984)	300 (984)	300 (984)
• Unshielded	m (ft)	450 (1476)	450 (1476)	450 (1476)	450 (1476)
Degree of protection		IP00	IP00	IP00	IP00
Dimensions					
• Width	mm (in)	503 (19.80)	503 (19.80)	503 (19.80)	704 (27.72)
• Height	mm (in)	1475 (58.07)	1475 (58.07)	1475 (58.07)	1475 (58.07)
• Depth	mm (in)	540 (21.26)	540 (21.26)	540 (21.26)	540 (21.26)
Frame size		HX	HX	HX	JX
Weight, approx.	kg (lb)	290 (639)	290 (639)	290 (639)	450 (992)

1) Rated power of a standard asynchronous (induction) motor at 690 V 3 AC.

2) Rated DC link current for dimensioning an external DC connection. For DC link current calculation for dimensioning the Line Module, see System description "Power Modules/Line Modules".

Technical specifications (continued)

DC link voltage 675 ... 1035 V DC		Single Motor Modules in chassis format 6SL3320-1TG38-1AA0	6SL3320-1TG38-8AA0	6SL3320-1TG41-0AA0	6SL3320-1TG41-3AA0
Output current					
• Rated current I_{rated}	A	810	910	1025	1270
• Base-load current I_L	A	790	880	1000	1230
• Base-load current I_H	A	724	814	917	1136
• I_{max}	A	1185	1320	1500	1845
Type rating [1]					
• Based on I_{rated}	kW	800	900	1000	1200
• Based on I_H	kW	710	800	900	1000
Rated pulse frequency	kHz	1.25	1.25	1.25	1.25
DC link current I_d [2]	A	972	1092	1230	1524
DC link capacitance	µF	11100	14400	14400	19200
Current requirement					
• With 24 V DC, max.	A	1.25	1.4	1.4	1.4
• Fan supply with 690 V 2 AC, max.	A	2.74	2.74	2.74	2.74
Power loss	kW	11.5	11.7	13.2	16.0
Cooling air requirement	m^3/s (ft^3/s)	1.474 (52.1)	1.474 (52.1)	1.474 (52.1)	1.474 (52.1)
Sound pressure level L_{pA} (1 m)	dB	< 72	< 72	< 72	< 72
DC link connection DCP, DCN		Flat connector for busbar connection	Flat connector for busbar connection	Flat connector for busbar connection	Flat connector for busbar connection
Motor connection U2, V2, W2		Flat connector for M12 screw	Flat connector for M12 screw	Flat connector for M12 screw	Flat connector for M12 screw
• Conductor cross-section, max.	mm^2	4 × 240	4 × 240	4 × 240	6 × 240
PE connection		M12 screw	M12 screw	M12 screw	M12 screw
• Conductor cross-section, max.					
- PE1/GND	mm^2	1 × 240	1 × 240	1 × 240	1 × 240
- PE2/GND	mm^2	2 × 240	2 × 240	2 × 240	2 × 240
Motor brake connection		–	–	–	–
Motor cable length, max. (without external options)					
• Shielded	m (ft)	300 (984)	300 (984)	300 (984)	300 (984)
• Unshielded	m (ft)	450 (1476)	450 (1476)	450 (1476)	450 (1476)
Degree of protection		IP00	IP00	IP00	IP00
Dimensions					
• Width	mm (in)	704 (27.72)	704 (27.72)	704 (27.72)	704 (27.72)
• Height	mm (in)	1475 (58.07)	1475 (58.07)	1475 (58.07)	1475 (58.07)
• Depth	mm (in)	540 (21.26)	540 (21.26)	540 (21.26)	540 (21.26)
Frame size		JX	JX	JX	JX
Weight, approx.	kg (lb)	450 (992)	450 (992)	450 (992)	450 (992)

1) Rated power of a standard asynchronous (induction) motor at 690 V 3 AC.

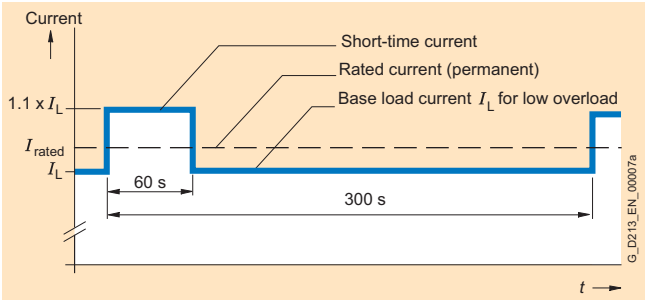
2) Rated DC link current for dimensioning an external DC connection. For DC link current calculation for dimensioning the Line Module, see System description "Power Modules/Line Modules".

Characteristics

Overload capability

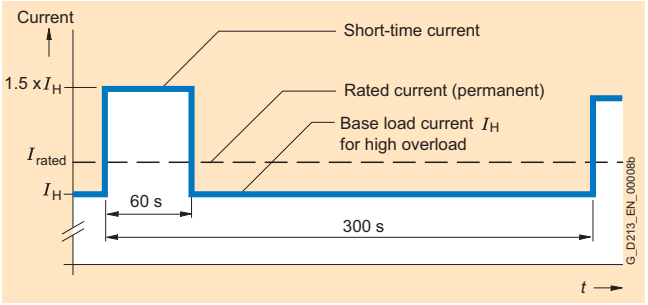
Load cycle data for Single Motor Modules in chassis format

The base load current I_L is based on a load cycle of 110 % for 60 s or 150 % for 10 s with a load cycle period of 300 s.



Low overload

The base load current I_H is based on a load cycle of 150 % for 60 s or 160 % for 10 s with a load cycle period of 300 s.



High overload

Derating factors

When the pulse frequency is increased, the derating factor of the output current must be taken into account.

This derating factor must be applied to the currents specified in the technical specifications.

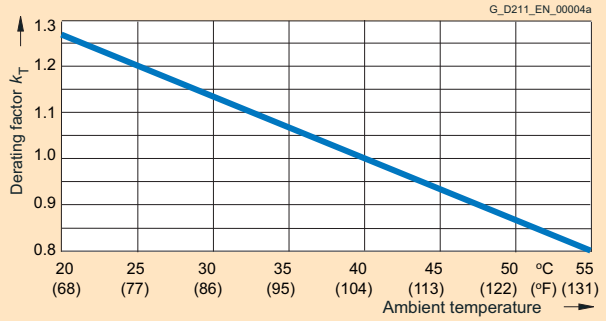
Derating factor of the output current as a function of the pulse frequency for devices with a rated pulse frequency of 2 kHz

Single Motor Module in chassis format	Type rating	Output current	Derating factor	
Type		for a pulse frequency of 2 kHz	for a pulse frequency of 2.5 kHz	for a pulse frequency of 4 kHz
6SL3320- ...	kW (HP)	A		
DC link voltage 510 ... 720 V DC				
1TE32-1AA0	110 (150)	210	0.95	0.82
1TE32-6AA0	132 (200)	260	0.95	0.83
1TE33-1AA0	160 (250)	310	0.97	0.88
1TE33-8AA0	200 (300)	380	0.96	0.87
1TE33-0AA0	250 (400)	490	0.94	0.78

Derating factor of the output current as a function of the pulse frequency for devices with a rated pulse frequency of 1.25 kHz

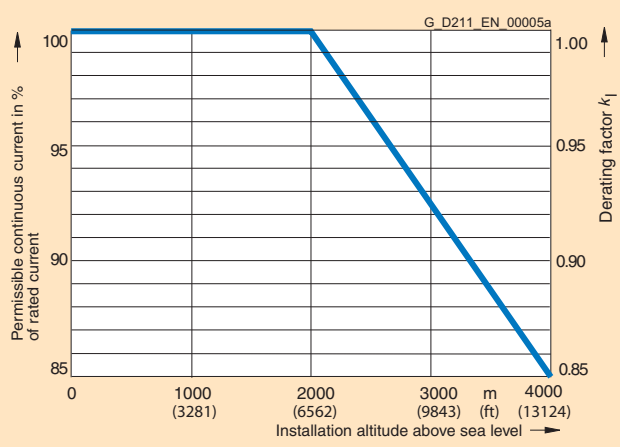
Single Motor Module in chassis format	Type rating	Output current	Derating factor
Type		for a pulse frequency of 1.25 kHz	for a pulse frequency of 2.5 kHz
6SL3320- ...	kW (HP)	A	
DC link voltage 510 ... 720 V DC			
1TE36-1AA0	315 (500)	605	0.72
1TE37-5AA0	400 (600)	745	0.72
1TE38-4AA0	450 (700)	840	0.79
1TE41-0AA0	560 (800)	985	0.87
1TE41-2AA0	710 (1000)	1260	0.87
1TE41-4AA0	800 (1150)	1405	0.95
DC link voltage 675 ... 1035 V DC			
1TG28-5AA0	75	85	0.89
1TG31-0AA0	90	100	0.88
1TG31-2AA0	110	120	0.88
1TG31-5AA0	132	150	0.84
1TG31-8AA0	160	175	0.87
1TG32-2AA0	200	215	0.87
1TG32-6AA0	250	260	0.88
1TG33-3AA0	315	330	0.82
1TG34-1AA0	400	410	0.82
1TG34-7AA0	450	465	0.87
1TG35-8AA0	560	575	0.85
1TG37-4AA0	710	735	0.79
1TG38-1AA0	800	810	0.95
1TG38-8AA0	900	910	0.87
1TG41-0AA0	1000	1025	0.86
1TG41-3AA0	1200	1270	0.79

Characteristics (continued)

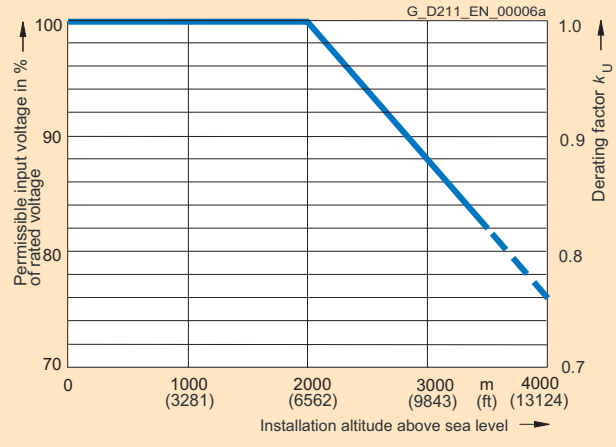


Current derating dependent on ambient temperature

Note: A derating factor k_T > 1.0 is to be taken into account only in conjunction with "current derating dependent on installation altitude". See also System description.



Current derating dependent on installation altitude



Voltage derating dependent on installation altitude

Double Motor Modules in booksize compact format

Design

Double Motor Modules feature the following connections and interfaces as standard:

- 2 DC link connections via integrated DC link busbars
- 2 electronic power supply connections via integrated 24 V DC busbars
- 4 DRIVE-CLiQ sockets
- 2 motor connections via connector
- 2 safe standstill inputs (1 input per axis)
- 2 safe motor brake controllers
- 2 temperature sensor inputs (KTY84-130 or PTC)
- 3 PE (protective earth) connections

The status of the Motor Modules is indicated via two multi-color LEDs.

The shield of the motor cables is routed over the connectors to the motor connection.

The signal cable shield can be connected to the Motor Module by means of a shield connection terminal, e.g. type KLBÜ 3-8 SC by Weidmüller.

The scope of supply of the Motor Modules includes:

- DRIVE-CLiQ cable (length depends on module width) to connect Motor Module to adjacent module
- 2 blanking plugs for sealing unused DRIVE-CLiQ sockets
- Jumper for connecting the 24 V DC busbar to the adjacent Motor Module
- Connectors X21 and X22
- Connectors X1 and X2 for motor connection
- 1 set of warning signs in foreign languages
- 1 heat conducting foil

Selection and ordering data

Rated output current	Type rating [1]	**Double Motor Module in booksize compact format** Internal air cooling Order No.
DC link voltage 510 ... 720 V DC		
2 × 1.7 A	2 x 0.9 kW (2 x 0.75 HP)	**6SL3420-2TE11-7AA0**
2 × 3 A	2 x 1.6 kW (2 x 1.5 HP)	**6SL3420-2TE13-0AA0**
2 × 5 A	2 x 2.7 kW (2 x 3 HP)	**6SL3420-2TE15-0AA0**

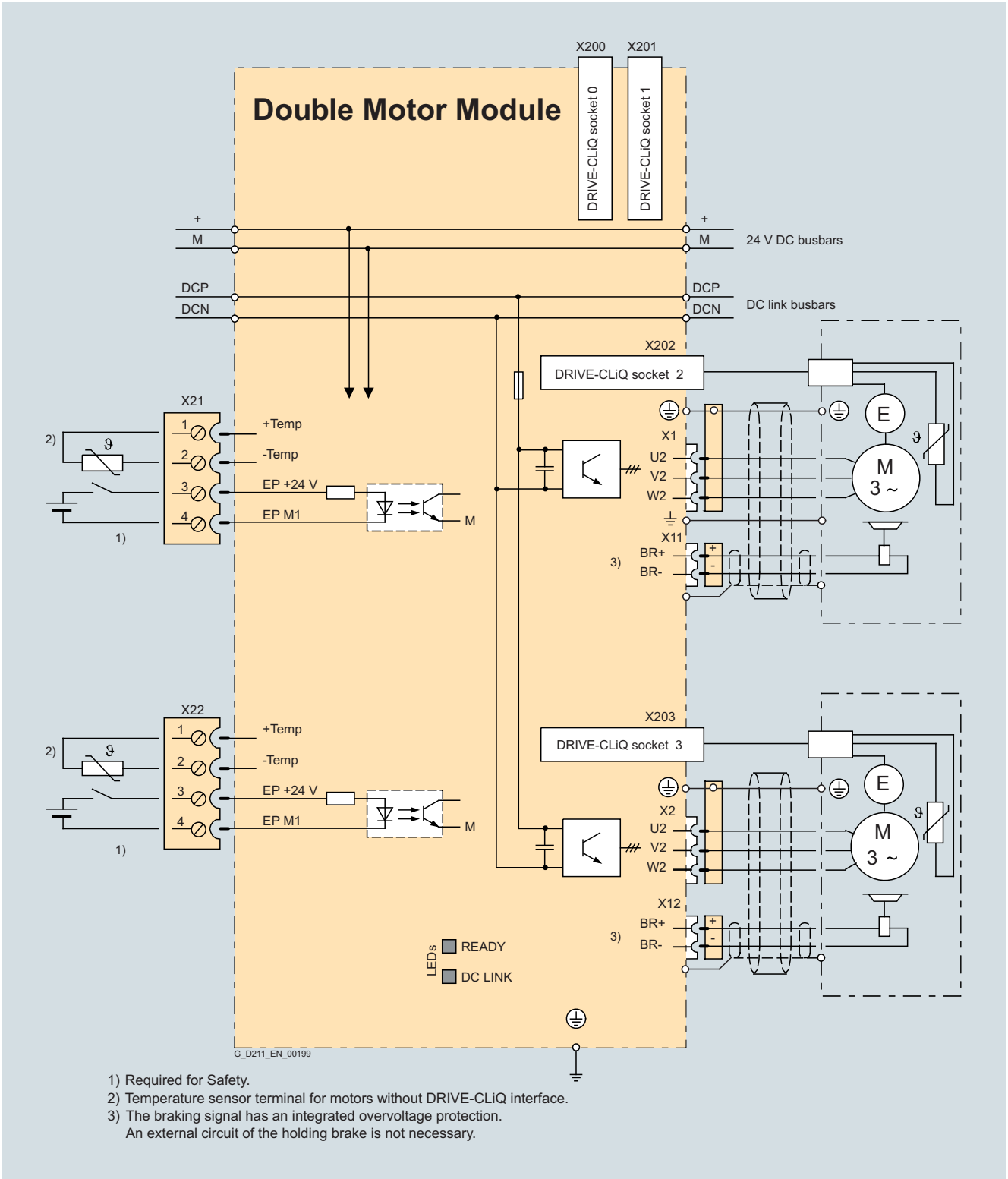
Accessories

Description	Order No.
DC link rectifier adapter for direct infeed of DC link voltage Screw-type terminals 0.5 … 10 mm^2 for booksize format Line Modules and Motor Modules with a width of 50 mm (1.97 in) or 100 mm (3.94 in)	**6SL3162-2BD00-0AA0**
DC link adapters (2 units) for multitier configuration Screw-type terminals 35 ... 95 mm^2 for all Line Modules and Motor Modules in booksize format	**6SL3162-2BM01-0AA0**
24 V terminal adapter for all Line Modules and Motor Modules in booksize format	**6SL3162-2AA00-0AA0**
24 V jumper for connection of the 24 V busbars (for booksize format)	**6SL3162-2AA01-0AA0**
Warning signs in foreign languages This set of foreign language warning signs can be placed on top of the standard German or English signs. One set of labels is supplied with the devices.The following languages are available in each label set: Chinese Simplified, Danish, Dutch, Finnish, French, Greek, Italian, Japanese, Korean, Polish, Portuguese/Brazilian, Russian, Swedish, Spanish, Czech, Turkish	**6SL3166-3AB00-0AA0**

[1] Nominal HP based on Asynchronous motors (induction motors). Match the motor nameplate current for specific sizing.

Integration

The Double Motor Module communicates with the Control Unit via DRIVE-CLiQ.



Connection example of Double Motor Modules in booksize compact format

Double Motor Modules in booksize compact format

Technical specifications

General technical specifications	
Electrical data	
DC link voltage (up to 2000 m (6562 ft) above sea level)	510 ... 720 V DC (line connection voltage 380 ... 480 V 3 AC) [1]
Output frequency	
• Control type Servo	0 … 650 Hz [2]
• Control type Vector	0 … 300 Hz [2]
• Control type *V/f*	0 … 600 Hz [2]
Electronic power supply	24 V DC -15 %/+20 %
Ambient conditions	
Type of cooling	The devices are designed so that - internal air cooling (power units with forced air cooling through a built-in fan) or - cold plate cooling is possible
Permissible ambient and coolant temperature (air) during operation for line-side components, Line Modules and Motor Modules	0 … 40 °C (32 … 104 °F) without derating, > 40 … 55 °C (104 … 131 °F), see derating characteristics
Site altitude	Up to 1000 m (3281 ft) above sea level without derating, > 1000 ... 4000 m (3281 ... 13124 ft) above sea level see derating characteristics
Certificates	
Conformity	CE (low-voltage and EMC Directives)
Approvals	cULus available soon
Safety Integrated	Safety Integrity Level 2 (SIL 2) to IEC 61508, control category 3 to EN 954-1 For further information, see the Safety Integrated section

[1] With firmware version V2.5 and higher with appropriate parameterization and reduced power rating also operable on 200 ... 240 V 3 AC networks in accordance with a DC-link voltage of 270 ... 360 V DC.

[2] Note correlation between max. output frequency, pulse frequency and current derating, see System description.

Technical specifications (continued)

DC link voltage 510 ... 720 V DC		Double Motor Module in booksize compact format		
Internal air cooling/ cold plate cooling		**6SL3420-2TE11-7AA0**	**6SL3420-2TE13-0AA0**	**6SL3420-2TE15-0AA0**
Output current				
• Rated current I_{rated}	A	2 × 1.7	2 × 3	2 × 5
• For S6 duty (40 %) I_{S6}	A	2 × 2	2 × 3.5	2 × 6
• Base-load current I_H	A	2 × 1.5	2 × 2.6	2 × 4.3
• I_{max}	A	2 × 5.1	2 × 9	2 × 15
Type rating [1]				
• Based on I_{rated}	kW (HP)	2 × 0.9 (0.75)	2 × 1.6 (1.5)	2 × 2.7 (3)
• Based on I_H	kW (HP)	2 × 0.8 (0.5)	2 × 1.4 (1)	2 × 2.3 (2.5)
Rated pulse frequency	kHz	8	8	8
DC link current I_d [2]	A	4.1	7.2	12
Current carrying capacity				
• DC link busbars	A	100	100	100
• 24 V DC busbars	A	20	20	20
		If, due to a number of Line and Motor Modules being mounted side-by-side, the current carrying capacity exceeds 20 A, an additional 24-V-DC connection using a 24-V terminal adapter is required (max. cross section 6 mm^2, max. fuse protection 20 A).		
DC link capacitance	µF	110	110	220
Current requirement with 24 V DC, max.	A	1	1	1
Power loss [3]				
• With internal air cooling in control cabinet	kW	0.11	0.13	0.19
• With cold plate cooling, int./ext.	kW	0.04/0.07	0.04/0.09	0.06/0.135
• Thermal resistance R_{th}	K/W	0.22	0.22	0.22
Cooling air requirement	m^3/s (ft^3/s)	0.008 (0.3)	0.008 (0.3)	0.008 (0.3)
Sound pressure level L_{pA} (1 m)	dB	< 60	< 60	< 60
Motor connection U2, V2, W2		2 connectors (X1, X2) with screw-type terminals	2 connectors (X1, X2) with screw-type terminals	2 connectors (X1, X2) with screw-type terminals
• Conductor cross-section	mm^2	0.2 … 6	0.2 … 6	0.2 … 6
Shield connection		integrated in connector (X1, X2)	integrated in connector (X1, X2)	integrated in connector (X1, X2)
PE connection		M5 screw	M5 screw	M5 screw
Motor brake connection		Connector (X11, X12), 24 V DC, 2 A	Connector (X11, X12), 24 V DC, 2 A	Connector (X11, X12), 24 V DC, 2 A
Motor cable length, max.				
• Shielded	m (ft)	50 (164)	50 (164)	50 (164)
• Unshielded	m (ft)	75 (246)	75 (246)	75 (246)
Degree of protection		IP20	IP20	IP20
Dimensions				
• Width	mm (in)	75 (2.95)	75 (2.95)	75 (2.95)
• Height	mm (in)	270 (10.63)	270 (10.63)	270 (10.63)
• Depth	mm (in)	226 (8.90)	226 (8.90)	226 (8.90)
Weight, approx.	kg (lb)	3.4 (7.50)	3.4 (7.50)	3.4 (7.50)

1) Rated power of a standard asynchronous (induction) motor at 600 V DC link voltage.

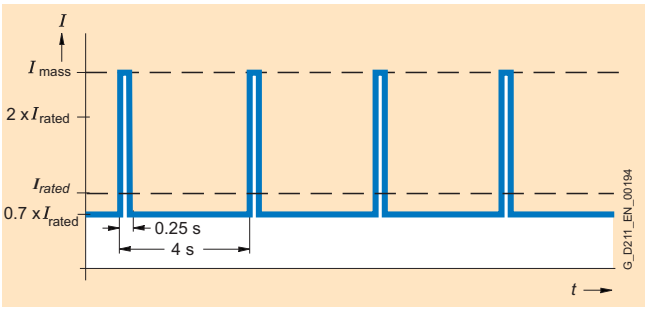
2) Rated DC link current for dimensioning an external DC connection. For DC link current calculation for dimensioning the Line Module, see System description "Power Modules/Line Modules".

3) Power loss of Motor Module at rated power including losses of 24 V DC electronic power supply.

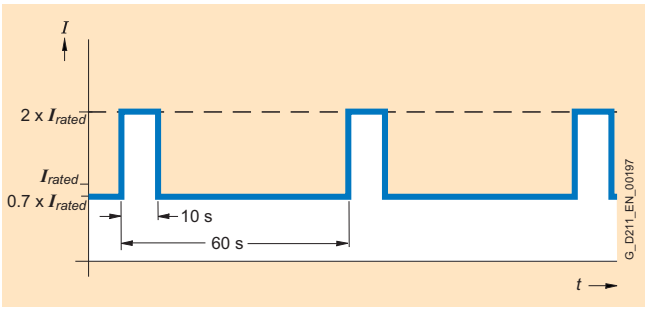
3

Characteristics

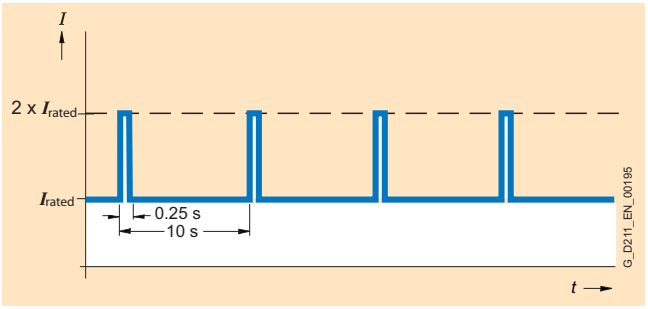
Overload capability



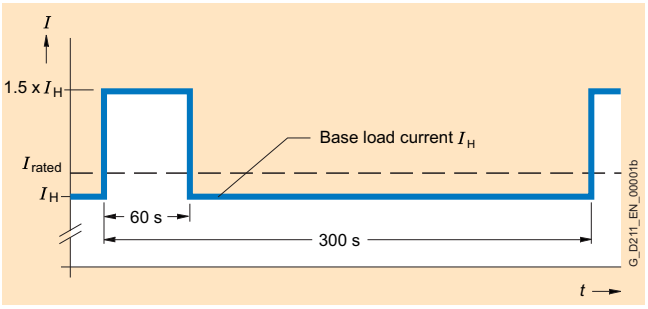
Maximum current load cycle with previous load



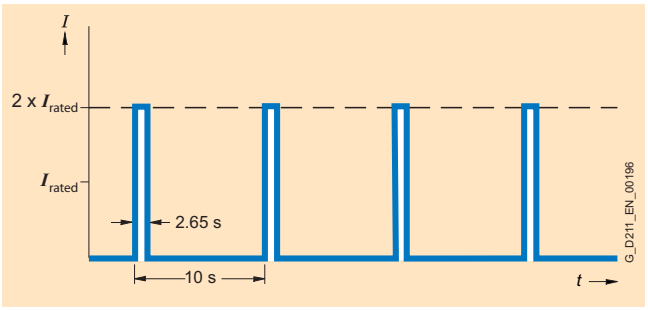
S6 load cycle with previous load with a load cycle period of 60 s



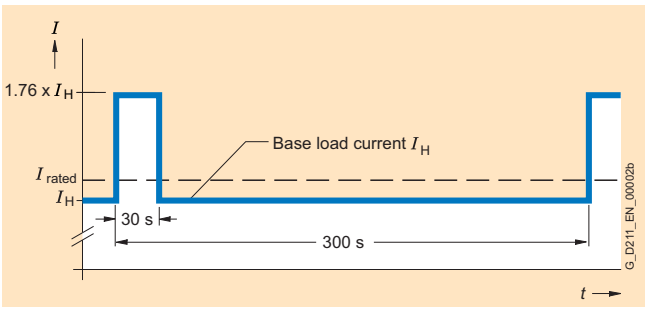
Load cycle with previous load



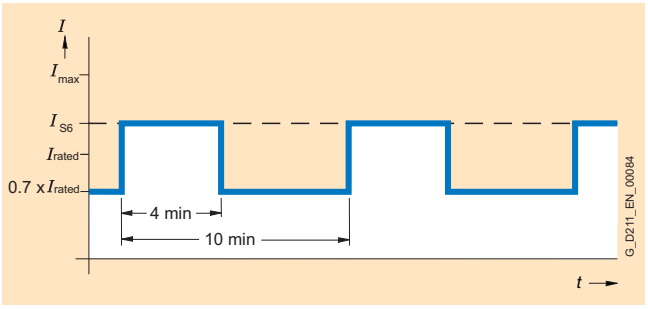
Load cycle with 60 s overload with a load cycle period of 300 s



Load cycle without previous load



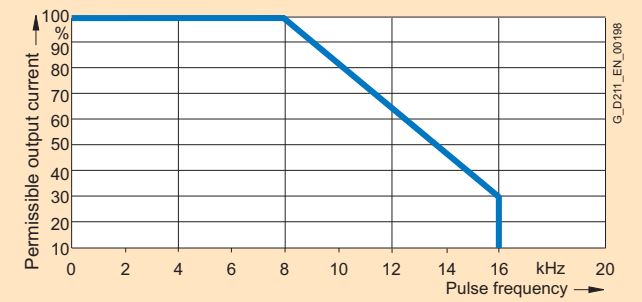
Load cycle with 30 s overload with a load cycle period of 300 s



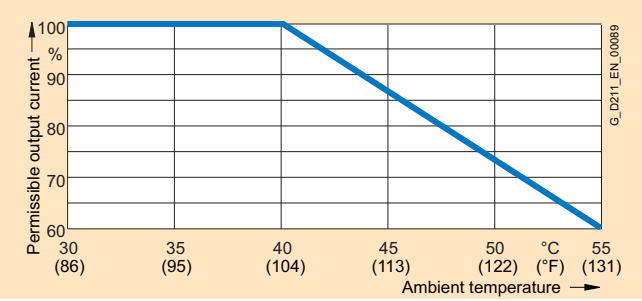
S6 load cycle with previous load with a load cycle period of 600 s

Characteristics (continued)

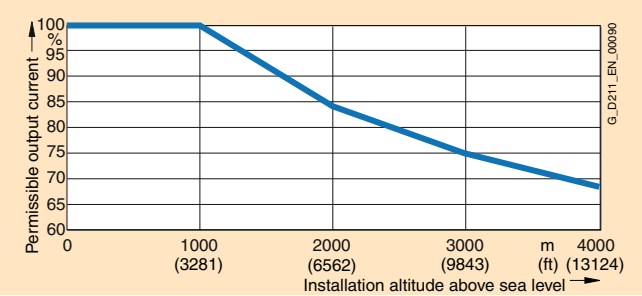
Derating characteristics



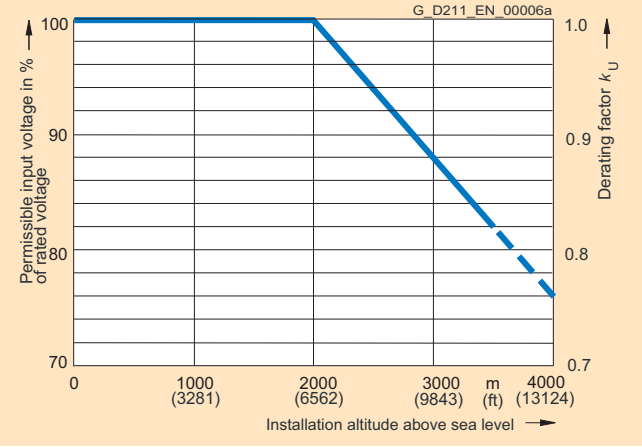
Output current dependent on pulse frequency



Output current dependent on ambient temperature



Output current dependent on installation altitude



Voltage derating dependent on installation altitude

Double Motor Modules in booksize format

Design

Double Motor Modules feature the following connections and interfaces as standard:

- 2 DC link connections via integrated DC link busbars
- 2 electronic power supply connections via integrated 24 V DC busbars
- 4 DRIVE-CLiQ sockets
- 2 plug-in motor connections (not included in scope of supply)
- 2 safe standstill inputs (1 input per axis)
- 2 safe motor brake control
- 2 temperature sensor inputs (KTY84-130 or PTC)
- 3 PE (protective earth) connections

The status of the Motor Modules is indicated via two multi-color LEDs.

On Double Motor Modules, the motor cable shield can be connected in the connector.

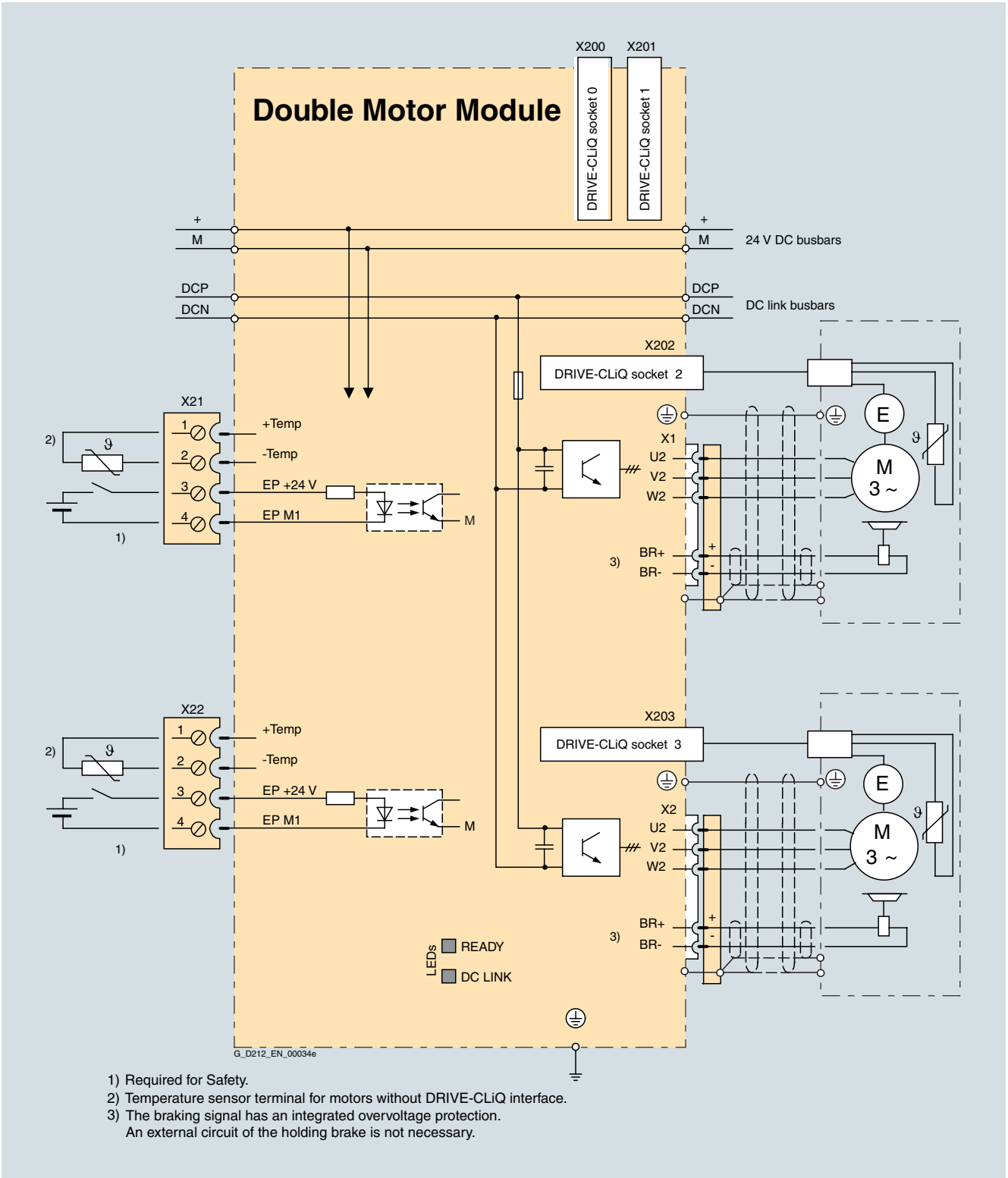
The signal cable shield can be connected to the Motor Module by means of a shield connection terminal, e.g. type KLBÜ 3-8 SC by Weidmüller.

The scope of supply of the Motor Modules includes:

- DRIVE-CLiQ cable (length depends on module width) to connect Motor Module to adjacent module
- 2 blanking plugs for sealing unused DRIVE-CLiQ sockets
- Jumper for connecting the 24 V DC busbar to the adjacent Motor Module
- Connectors X21 and X22
- 1 set of warning signs in foreign languages
- 1 heat conducting foil (for Double Motor Modules with cold plate cooling only)

Integration

The Double Motor Module communicates with the Control Unit via DRIVE-CLiQ.



1) Required for Safety.
2) Temperature sensor terminal for motors without DRIVE-CLiQ interface.
3) The braking signal has an integrated overvoltage protection.
An external circuit of the holding brake is not necessary.

Connection example of Double Motor Modules in booksize format 2 × 3 A to 2 × 18 A

Double Motor Modules in booksize format

Technical specifications

General technical specifications	
Electrical data	
DC link voltage (up to 2000 m (6562 ft) above sea level)	510 ... 720 V DC (line connection voltage 380 ... 480 V 3 AC) [1]
Output frequency	
• Control type Servo	0 … 650 Hz [2]
• Control type Vector	0 … 300 Hz [2]
• Control type *V/f*	0 … 600 Hz [2]
Electronic power supply	24 V DC -15 %/+20 %
Ambient conditions	
Type of cooling	- Internal air cooling, external air cooling, power units with forced air cooling through a built-in fan - Cold plate cooling
Permissible ambient and coolant temperature (air) during operation for line-side components, Line Modules and Motor Modules	0 … 40 °C (32 … 104 °F) without derating, > 40 … 55 °C (104 … 131 °F), see derating characteristics
Site altitude	Up to 1000 m (3281 ft) above sea level without derating, > 1000 ... 4000 m (3281 ... 13124 ft) above sea level see derating characteristics
Certificates	
Conformity	CE (low-voltage and EMC Directives)
Approvals	cULus (File No.: E192450)
Safety Integrated	Safety Integrity Level 2 (SIL 2) to IEC 61508, control category 3 to EN 954-1 For further information, see the Safety Integrated section

1) With firmware version V2.5 and higher with appropriate parameterization and reduced power rating also operable on 200 ... 240 V 3 AC networks in accordance with a DC-link voltage of 270 ... 360 V DC.

2) Note correlation between max. output frequency, pulse frequency and current derating, see System description.

Technical specifications (continued)

DC link voltage 510 ... 720 V DC		Double Motor Module in booksize format			
Internal air cooling		**6SL3120-2TE13-0AA3**	**6SL3120-2TE15-0AA3**	**6SL3120-2TE21-0AA3**	**6SL3120-2TE21-8AA3**
External air cooling		**6SL3121-2TE13-0AA3**	**6SL3121-2TE15-0AA3**	**6SL3121-2TE21-0AA3**	**6SL3121-2TE21-8AA3**
Cold plate cooling		**6SL3126-2TE13-0AA3**	**6SL3126-2TE15-0AA3**	**6SL3126-2TE21-0AA3**	**6SL3126-2TE21-8AA3**
Output current					
• Rated current I_{rated}	A	2 × 3	2 × 5	2 × 9	2 × 18
• For S6 duty (40 %) I_{S6}	A	2 × 3.5	2 × 6	2 × 10	2 × 24
• Base-load current I_H	A	2 × 2.6	2 × 4.3	2 × 7.7	2 × 15.3
• I_{max}	A	2 × 6	2 × 10	2 × 18	2 × 36
Type rating [1]					
• Based on I_{rated}	kW (HP)	2 × 1.6 (1.5)	2 × 2.7 (3)	2 × 4.8 (5)	2 × 9.7 (10)
• Based on I_H	kW (HP)	2 × 1.4 (1)	2 × 2.3 (2.5)	2 × 4.1 (5)	2 × 8.2 (10)
DC link current I_d [2]	A	7.2	12	22	43
Current carrying capacity					
• DC link busbars	A	100	100	100	100
• 24 V DC busbars	A	20	20	20	20
		If, due to a number of Line and Motor Modules being mounted side-by-side, the current carrying capacity exceeds 20 A, an additional 24-V-DC connection using a 24-V terminal adapter is required (max. cross section 6 mm^2, max. fuse protection 20 A).			
DC link capacitance	µF	110	220	220	705
Current requirement with 24 V DC, max.	A	1.0	1.0	1.0	1.0
Internal/external air cooling					
• Power loss [3]					
- With internal air cooling in control cabinet	kW	0.095	0.13	0.185	0.345
- With external air cooling int./ext.	kW	0.06/0.035	0.07/0.06	0.09/0.095	0.105/0.24
• Cooling air requirement	m^3/s (ft^3/s)	0.008 (0.3)	0.008 (0.3)	0.008 (0.3)	0.016 (0.6)
• Sound pressure level L_{pA} (1 m)	dB	< 60	< 60	< 60	< 60
Cold plate cooling					
• Power loss, int./ext. [3]	kW	0.055/0.035	0.06/0.065	0.08/0.1	0.095/0.25
• Thermal resistance R_{th}	K/W	0.185	0.185	0.185	0.075
Motor connection U2, V2, W2		2 x connectors (X1, X2) [4], max. 30 A	2 x connectors (X1, X2) [4], max. 30 A	2 x connectors (X1, X2) [4], max. 30 A	2 x connectors (X1, X2) [4], max. 30 A
Shield connection		integrated in connector (X1, X2)	integrated in connector (X1, X2)	integrated in connector (X1, X2)	integrated in connector (X1, X2)
PE connection		M5 screw	M5 screw	M5 screw	M5 screw
Motor brake connection		Integrated into the plug-in motor connector (X1, X2), 24 V DC, 2 A	Integrated into the plug-in motor connector (X1, X2), 24 V DC, 2 A	Integrated into the plug-in motor connector (X1, X2), 24 V DC, 2 A	Integrated into the plug-in motor connector (X1, X2), 24 V DC, 2 A
Motor cable length, max.					
• Shielded	m (ft)	50 (164)	50 (164)	50 (164)	70 (230)
• Unshielded	m (ft)	75 (246)	75 (246)	75 (246)	100 (328)
Degree of protection		IP20	IP20	IP20	IP20
Dimensions					
• Width	mm (in)	50 (1.97)	50 (1.97)	50 (1.97)	100 (3.94)
• Height	mm (in)	380 (14.96)	380 (14.96)	380 (14.96)	380 (14.96)
• Depth					
- With internal air cooling	mm (in)	270 (10.63)	270 (10.63)	270 (10.63)	270 (10.63)
- With external air cooling, on/behind mounting surface	mm (in)	226/66.5 (8.90/2.62)	226/66.5 (8.90/2.62)	226/66.5 (8.90/2.62)	226/66.5 (8.90/2.62)
- With cold plate cooling	mm (in)	226 (8.90)	226 (8.90)	226 (8.90)	226 (8.90)
Weight, approx.					
• With internal air cooling	kg (lb)	5.3 (11.7)	5.3 (11.7)	5.3 (11.7)	6.8 (15.0)
• With external air cooling	kg (lb)	5.8 (12.8)	5.8 (12.8)	5.8 (12.8)	8.6 (19.0)
• With cold plate cooling	kg (lb)	4.5 (9.92)	4.5 (9.92)	4.5 (9.92)	5.9 (13.0)

[1] Rated power of a standard asynchronous (induction) motor at 600 V DC link voltage.

[2] Rated DC link current for dimensioning an external DC connection. For DC link current calculation for dimensioning the Line Module, see System description "Power Modules/Line Modules".

[3] Power loss of Motor Module at rated output including losses of 24 V DC electronic power supply.

[4] Connector not included in scope of supply, see Accessories.

Double Motor Modules in booksize format

Selection and ordering data

Rated output current	Type rating [1]	Double Motor Module in booksize format		
		Internal air cooling Order No.	External air cooling Order No.	Cold plate cooling Order No.
DC link voltage 510 ... 720 V DC				
2 × 3 A	2 x 1.6 kW (2 x 1.5 HP)	**6SL3120-2TE13-0AA3**	**6SL3121-2TE13-0AA3**	**6SL3126-2TE13-0AA3**
2 × 5 A	2 x 2.7 kW (2 x 3 HP)	**6SL3120-2TE15-0AA3**	**6SL3121-2TE15-0AA3**	**6SL3126-2TE15-0AA3**
2 × 9 A	2 x 4.8 kW (2 x 5 HP)	**6SL3120-2TE21-0AA3**	**6SL3121-2TE21-0AA3**	**6SL3126-2TE21-0AA3**
2 × 18 A	2 x 9.7 kW (2 x 10 HP)	**6SL3120-2TE21-8AA3**	**6SL3121-2TE21-8AA3**	**6SL3126-2TE21-8AA3**

Accessories

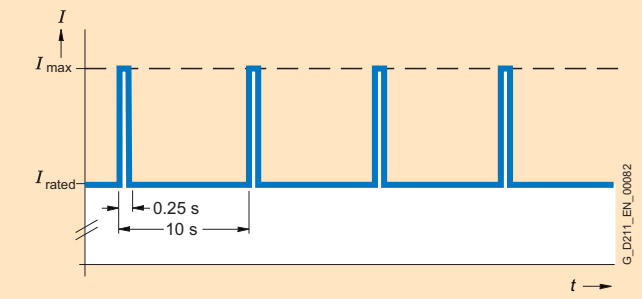
Description	Order No.
Power connector (X1/X2) at Motor Module end, with screw-type terminals 1.5 ... 10 mm^2, For Motor Modules with a rated output current of 3 ... 30 A	**6SL3162-2MA00-0AA0**
DC link rectifier adapter for direct infeed of DC link voltage Screw-type terminals 0.5 … 10 mm^2 for booksize format Line/Motor Modules with a width of 50 mm (1.97 in) or 100 mm (3.94 in)	**6SL3162-2BD00-0AA0**
DC link adapters (2 units) for multitier configuration Screw-type terminals 35 ... 95 mm^2 for all Line Modules/Motor Modules in booksize format	**6SL3162-2BM01-0AA0**
24 V terminal adapter for all Line Modules/Motor Modules in booksize format	**6SL3162-2AA00-0AA0**
24 V jumper for connection of the 24 V busbars (for booksize format)	**6SL3162-2AA01-0AA0**

Description	Order No.
DC link busbar kit (reinforced) for replacement of DC link busbars for 5 modules in booksize format	
• 50 mm (1.97 in) wide	**6SL3162-2DB00-0AA0**
• 100 mm (3.94 in) wide	**6SL3162-2DD00-0AA0**
Warning signs in foreign languages This set of foreign language warning signs can be placed on top of the standard German or English signs. One set of labels is supplied with the devices.The following languages are available in each label set: Chinese Simplified, Danish, Dutch, Finnish, French, Greek, Italian, Japanese, Korean, Polish, Portuguese/Brazilian, Russian, Swedish, Spanish, Czech, Turkish	**6SL3166-3AB00-0AA0**

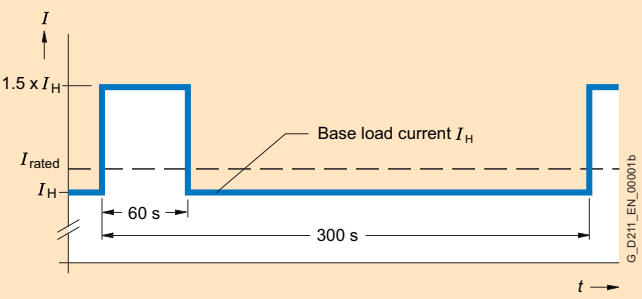
1) Nominal HP based on Asynchronous motors (induction motors). Match the motor nameplate current for specific sizing.

Characteristics

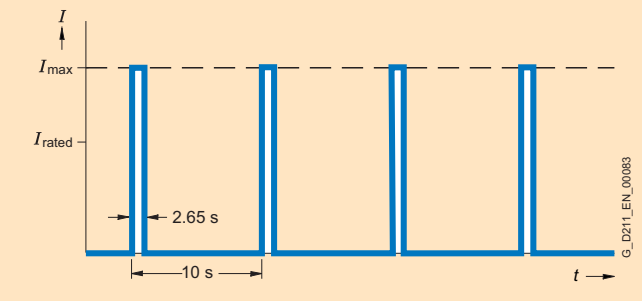
Overload capability



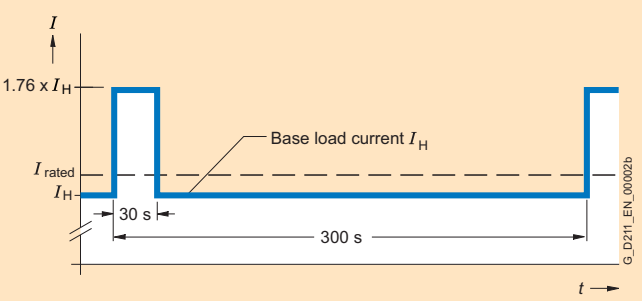
Load cycle with previous load



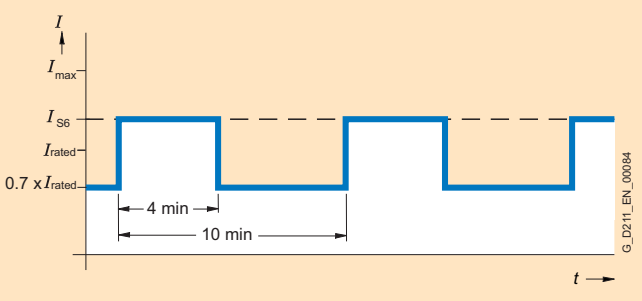
Load cycle with 60 s overload with a load cycle period of 300 s



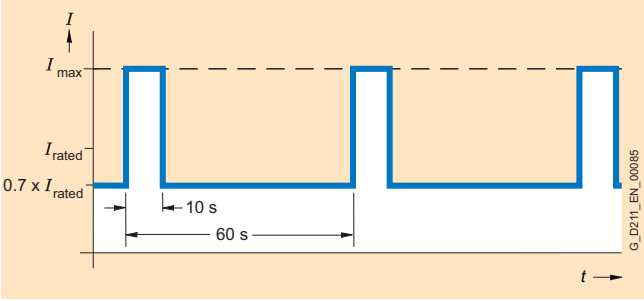
Load cycle without previous load



Load cycle with 30 s overload with a load cycle period of 300 s



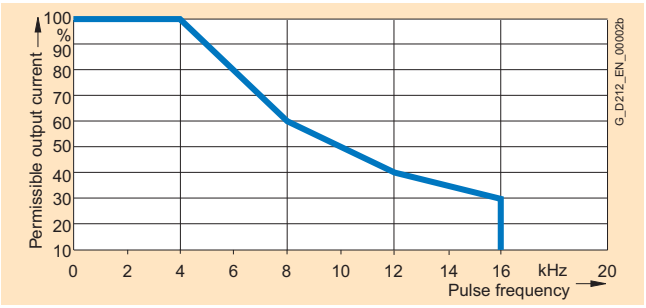
S6 load cycle with previous load with a load cycle period of 600 s



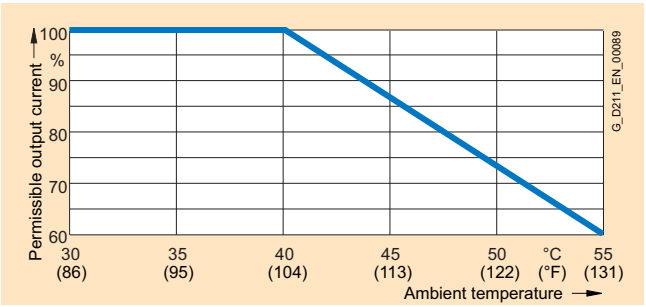
S6 load cycle with previous load with a load cycle period of 60 s

Characteristics (continued)

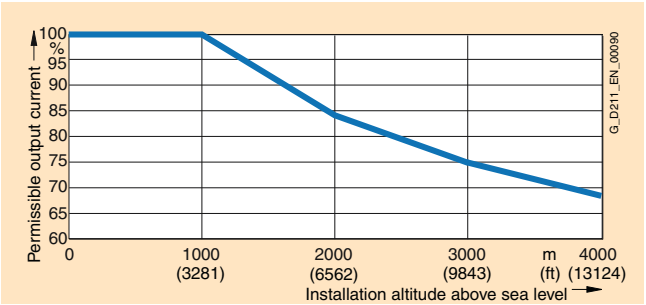
Derating characteristics



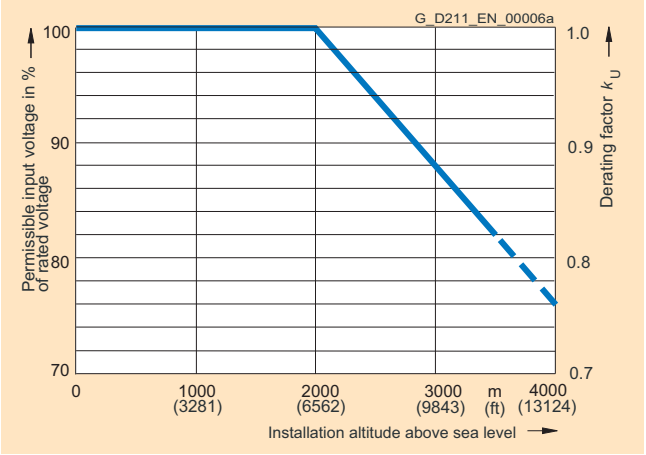
Output current dependent on pulse frequency



Output current dependent on ambient temperature



Output current dependent on installation altitude



Voltage derating dependent on installation altitude

Braking Modules in booksize format

Overview

A Braking Module and the matching external braking resistor are required to bring drives to a controlled standstill in the event of a power failure (e.g. emergency retraction or EMERGENCY OFF category 1) or limit the DC link voltage for brief periods of generator operation, e.g. when the regenerative feedback capability of the Line Module is deactivated. The Braking Module houses the power electronics and the associated control circuit. During operation, the DC link energy is converted to heat loss in an external braking resistor. Braking Modules function autonomously. A number of braking modules can be operated in parallel. In this case, each Braking Module must have its own braking resistor.

Braking Modules in booksize format can also be used for rapid discharge of the DC link.

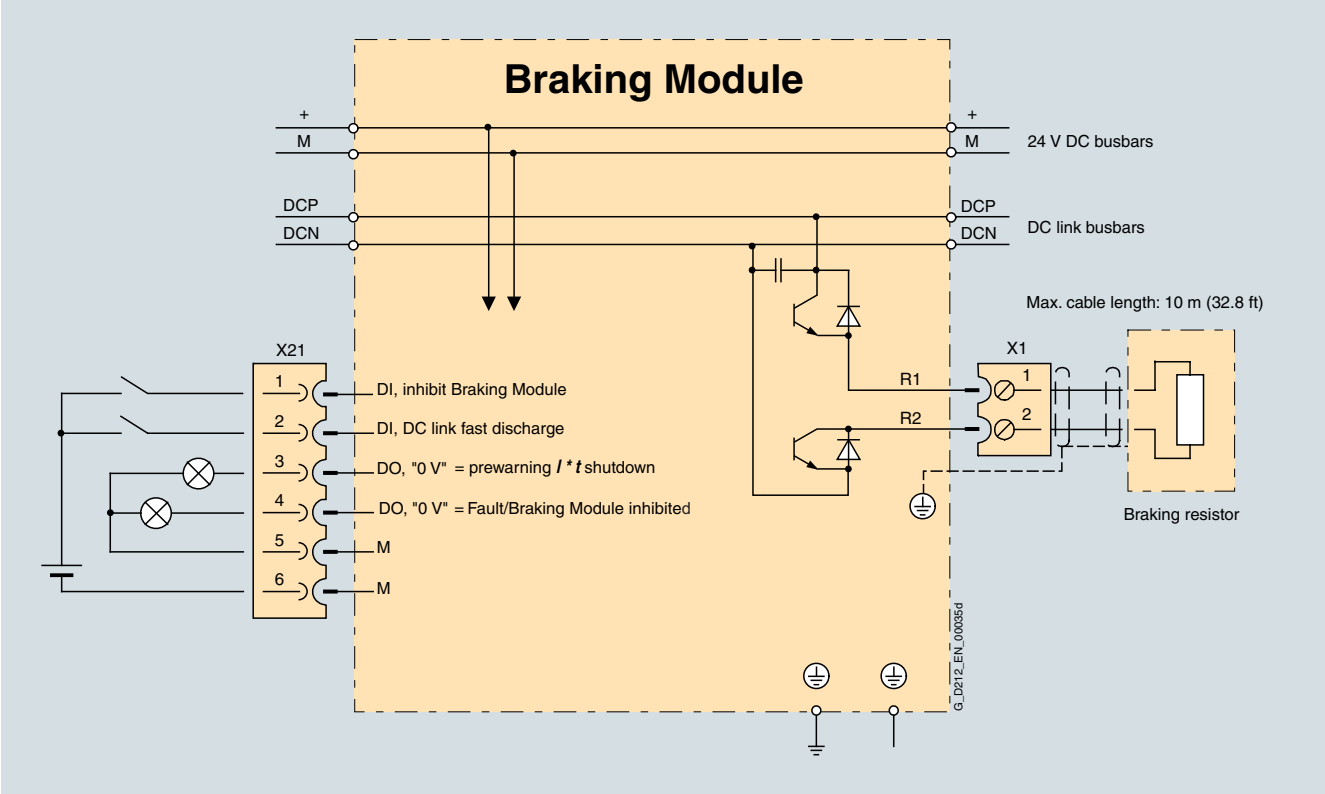
Design

The Braking Module in booksize format features the following connections and interfaces as standard:

- 2 DC link connections via integrated DC link busbars
- 2 electronics power supply connections via integrated 24 V DC bars
- Terminals for connecting the braking resistor
- 2 digital inputs (disable Braking Module/acknowledge faults and rapid discharge of DC link)
- 2 digital outputs (Braking Module disabled and prewarning – $I \times t$ monitoring)
- 2 PE (protective earth) connections

The status of the Braking Module is indicated via two 2-color LEDs.

Integration



Connection example of Braking Module in booksize format

Braking Modules in booksize format

Technical specifications

DC link voltage 510 ... 720 V DC	Braking Modules in booksize format
Internal air cooling	**6SL3100-1AE31-0AB0**
Rated power P_{DB}	1.5 kW
Peak power P_{max}	100 kW
Activation threshold	770 V
Cable length to braking resistor, max.	10 m (32.8 ft)
DC link capacitance	110 µF
Current requirement with 24 V DC, max.	0.5 A
Digital inputs	In accordance with IEC 61131-2 Type 1
• Voltage	-3 V … +30 V
• Low level (an open digital input is interpreted as "low")	-3 V … +5 V
• High level	15 … 30 V
• Current consumption at typ. 24 V DC	10 mA
• Conductor cross-section, max.	1.5 mm^2
Digital outputs (sustained-short-circuit-proof)	
• Voltage	24 V DC
• Load current per digital output, max.	100 mA
• Conductor cross-section, max.	1.5 mm^2
Current carrying capacity	
• 24 V DC busbars	20 A
• DC link busbars	100 A
PE connection	M5 screw
Dimensions	
• Width	50 mm (1.97 in)
• Height	380 mm (14.96 in)
• Depth, with spacer (included in scope of supply)	270 mm (10.63 in)
Weight, approx.	4.1 kg (9 lb)
Approvals	cURus (File No.: E192450)

Selection and ordering data

Description	Order No.
DC link voltage 510 ... 720 V DC	
Braking Modules in booksize format 1.5 kW/100 kW	**6SL3100-1AE31-0AB0**

Accessories

Description	Order No.
Warning signs in foreign languages This set of foreign language warning signs can be placed on top of the standard German or English signs. The following languages are available in each label set: Chinese Simplified, Danish, Dutch, Finnish, French, Greek, Italian, Japanese, Korean, Polish, Portuguese/Brazilian, Russian, Swedish, Spanish, Czech, Turkish	**6SL3166-3AB00-0AA0**

Overview

A Braking Module and the matching external braking resistor are required to bring drives to a controlled standstill in the event of a power failure (e.g. emergency retraction or EMERGENCY STOP category 1) or limit the DC link voltage for brief periods of generator operation, e.g. when the regenerative feedback capability of the Line Module is deactivated. The Braking Module houses the power electronics and the associated control circuit. During operation, the DC link energy is converted to power loss in an external braking resistor. Braking Modules function autonomously. A number of braking modules can be operated in parallel. In this case, each Braking Module must have its own braking resistor.

Braking Modules in chassis format are inserted in a mounting location inside the Motor Modules, Line Modules or Power Modules and are cooled by the fans on these modules. The supply voltage for the electronics is drawn from the DC link. The Braking Modules are connected to the DC link by means of the busbar sets and flexible cables, which are supplied as standard, and in the case of the Basic Line Modules of frame size GB, by means of a separate molded cable set (see accessories).

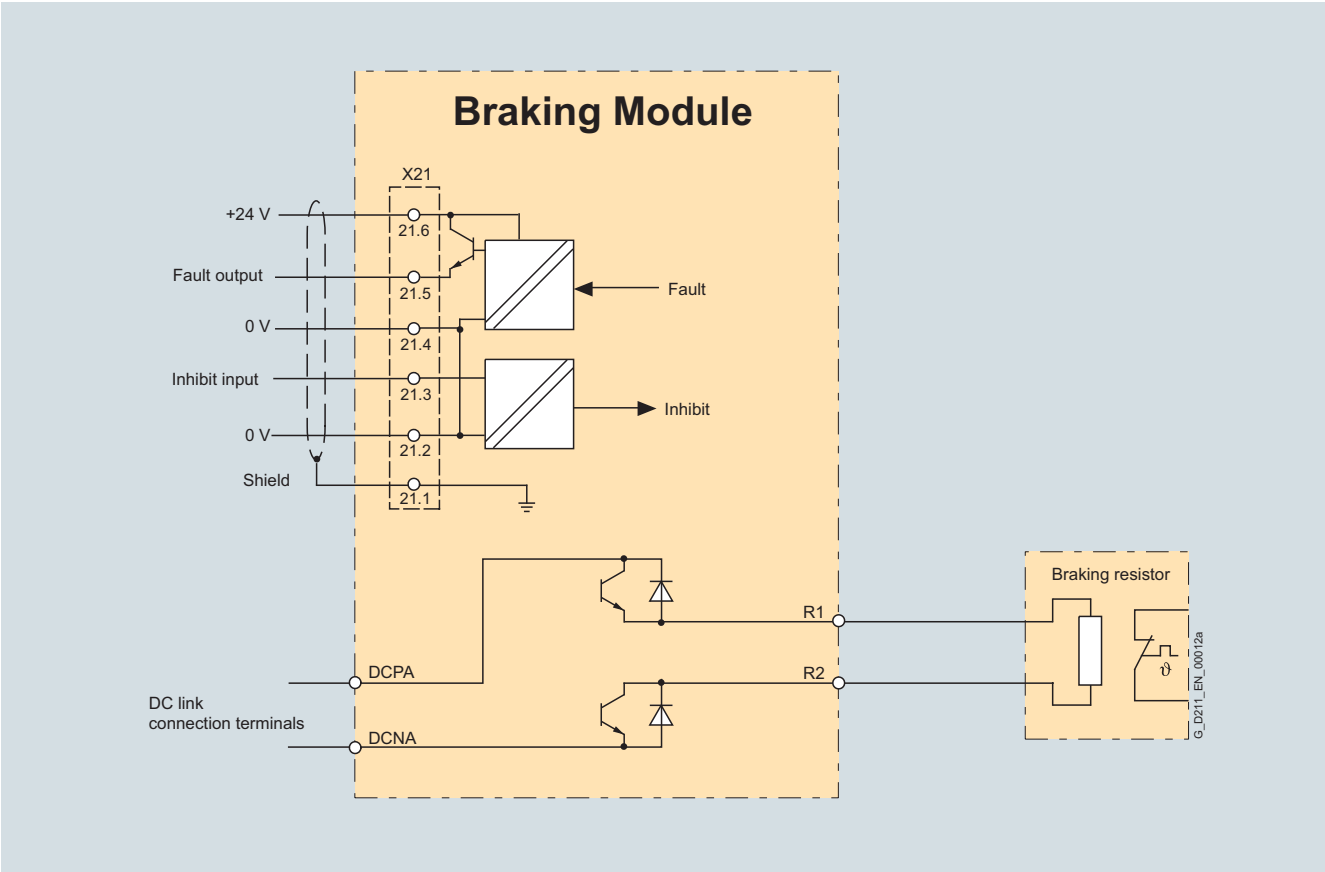
The activation threshold of the Braking Module can be adjusted by means of a DIP switch. The braking power values specified in the technical specifications apply to the upper activation threshold.

Design

The Braking Modules in chassis format feature the following connections and interfaces as standard:

- 1 DC link connection
- 1 braking resistor connection
- 1 digital input (inhibit Braking Module/acknowledge error)
- 1 digital output (Braking Module inhibited)
- 1 DIP switch for adjusting the application threshold

Integration



Connection example of Braking Module in chassis format

Braking Modules in chassis format

Technical specifications

DC link voltage 510 ... 720 V DC		Braking Module in chassis format 6SL3300-1AE31-3AA0	6SL3300-1AE32-5AA0	6SL3300-1AE32-5BA0
Power				
• Rated power P_{DB}	kW	25	50	50
• Peak power P_{15}	kW	125	250	250
• Power P_{20}	kW	100	200	200
• Power P_{40}	kW	50	100	100
Activation thresholds (adjustable via DIP switch)	V	774 (factory setting) or 673	774 (factory setting) or 673	774 (factory setting) or 673
Cable length to braking resistor, max.	m (ft)	50 (164)	50 (164)	50 (164)
Digital inputs In accordance with IEC 61131-2 Type 1				
• Voltage	V	-3 … +30	-3 … +30	-3 … +30
• Low level (an open digital input is interpreted as "low")	V	-3 … +5	-3 … +5	-3 … +5
• High level	V	15 … 30	15 … 30	15 … 30
• Current consumption typ. at 24 V DC	mA	10	10	10
• Conductor cross-section, max.	mm^2	1.5	1.5	1.5
Digital outputs (sustained-short-circuit-proof)				
• Voltage	V	DC 24	DC 24	DC 24
• Load current per digital output, max.	mA	500	500	500
• Conductor cross-section, max.	mm^2	1.5	1.5	1.5
Connection R1/R2		M8 screw	M8 screw	M8 screw
• Conductor cross-section, max.	mm^2	35	50	50
Weight, approx.	kg (lb)	3.6 (8)	7.3 (16)	7.5 (17)
Approvals		cURus (File No.: E192450)	cURus (File No.: E192450)	cURus (File No.: E192450)
Suitable for installation in a **Motor Module** **Power Module** **Active Line Module** **Basic Line Module**	Frame size	FX/FB	GX/GB [1)]	HX/JX

[1)] Cable harness set 6SL3366-2NG00-0AA0 is required to connect the Braking Module to a Basic Line Module of frame size GB.

Technical specifications (continued)

DC link voltage 675 ... 900 V DC		Braking Module in chassis format 6SL3300-1AF31-3AA0	6SL3300-1AF32-5AA0	6SL3300-1AF32-5BA0
Power				
• Rated power P_{DB}	kW	25	50	50
• Peak power P_{15}	kW	125	250	250
• Power P_{20}	kW	100	200	200
• Power P_{40}	kW	50	100	100
Activation thresholds (adjustable via DIP switch)	V	967 (factory setting) or 841	967 (factory setting) or 841	967 (factory setting) or 841
Cable length to braking resistor, max.	m (ft)	50 (164)	50 (164)	50 (164)
Digital inputs In accordance with IEC 61131-2 Type 1				
• Voltage	V	-3 … +30	-3 … +30	-3 … +30
• Low level (an open digital input is interpreted as "low")	V	-3 … +5	-3 … +5	-3 … +5
• High level	V	15 … 30	15 … 30	15 … 30
• Current consumption typ. at 24 V DC	mA	10	10	10
• Conductor cross-section, max.	mm^2	1.5	1.5	1.5
Digital outputs (sustained-short-circuit-proof)				
• Voltage	V	DC 24	DC 24	DC 24
• Load current per digital output, max.	mA	500	500	500
• Conductor cross-section, max.	mm^2	1.5	1.5	1.5
Connection R1/R2		M8 screw	M8 screw	M8 screw
• Conductor cross-section, max.	mm^2	35	50	50
Weight, approx.	kg (lb)	3.6 (8)	7.3 (16)	7.5 (17)
Approvals		cURus (File No.: E192450)	cURus (File No.: E192450)	cURus (File No.: E192450)
Suitable for installation in a **Motor Module** **Active Line Module** **Basic Line Module**	Frame size	FX/FB	GX/GB [1]	HX/JX

[1] Cable harness set 6SL3366-2NG00-0AA0 is required to connect the Braking Module to a Basic Line Module of frame size GB.

Braking Modules in chassis format

Technical specifications (continued)

DC link voltage 890 ... 1035 V DC		Braking Module in chassis format 6SL3300-1AH31-3AA0	6SL3300-1AH32-5AA0	6SL3300-1AH32-5BA0
Power				
• Rated power P_{DB}	kW	25	50	50
• Peak power P_{15}	kW	125	250	250
• Power P_{20}	kW	100	200	200
• Power P_{40}	kW	50	100	100
Activation thresholds (adjustable via DIP switch)	V	1153 (factory setting) or 1070	1153 (factory setting) or 1070	1153 (factory setting) or 1070
Cable length to braking resistor, max.	m (ft)	50 (164)	50 (164)	50 (164)
Digital inputs In accordance with IEC 61131-2 Type 1				
• Voltage	V	-3 … +30	-3 … +30	-3 … +30
• Low level (an open digital input is interpreted as "low")	V	-3 … +5	-3 … +5	-3 … +5
• High level	V	15 … 30	15 … 30	15 … 30
• Current consumption at 24 V DC, typ.	mA	10	10	10
• Conductor cross-section, max.	mm^2	1.5	1.5	1.5
Digital outputs (sustained-short-circuit-proof)				
• Voltage	V	DC 24	DC 24	DC 24
• Load current per digital output, max.	mA	500	500	500
• Conductor cross-section, max.	mm^2	1.5	1.5	1.5
Connection R1/R2		M8 screw	M8 screw	M8 screw
• Conductor cross-section, max.	mm^2	35	50	50
Weight, approx.	kg (lb)	3.6 (8)	7.3 (16)	7.5 (17)
Approvals		–	–	–
Suitable for installation in a **Motor Module** **Active Line Module** **Basic Line Module**	Frame size	FX/FB	GX/GB [1]	HX/JX

Selection and ordering data

Description	Order No.
DC link voltage 510 ... 720 V DC	
Braking Module in chassis format	
• Frame size FX, 25 kW/125 kW	**6SL3300-1AE31-3AA0**
• Frame size GX, 50 kW/250 kW	**6SL3300-1AE32-5AA0**
• Frame sizes HX and JX, 50 kW/250 kW	**6SL3300-1AE32-5BA0**
DC link voltage 675 ... 900 V DC	
Braking Module in chassis format	
• Frame size FX, 25 kW/125 kW	**6SL3300-1AF31-3AA0**
• Frame size GX, 50 kW/250 kW	**6SL3300-1AF32-5AA0**
• Frame sizes HX and JX, 50 kW/250 kW	**6SL3300-1AF32-5BA0**
DC link voltage 890 ... 1035 V DC	
Braking Module in chassis format	
• Frame size FX, 25 kW/125 kW	**6SL3300-1AH31-3AA0**
• Frame size GX, 50 kW/250 kW	**6SL3300-1AH32-5AA0**
• Frame sizes HX and JX, 50 kW/250 kW	**6SL3300-1AH32-5BA0**

Accessories

Description	Order No.
Cable harness set for mounting a Braking Module of frame size GX into a Basic Line Module of frame size GB	**6SL3366-2NG00-0AA0**
Warning signs in foreign languages This set of foreign language warning signs can be placed on top of the standard German or English signs. One set of labels is supplied with the devices. The following languages are available in each label set: Chinese Simplified, Danish, Dutch, Finnish, French, Greek, Italian, Japanese, Korean, Polish, Portuguese/Brazilian, Russian, Swedish, Spanish, Czech, Turkish	**6SL3166-3AB00-0AA0**

[1] Cable harness set 6SL3366-2NG00-0AA0 is required to connect the Braking Module to a Basic Line Module of frame size GB.

Overview

Braking resistor for blocksize format, frame sizes 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.

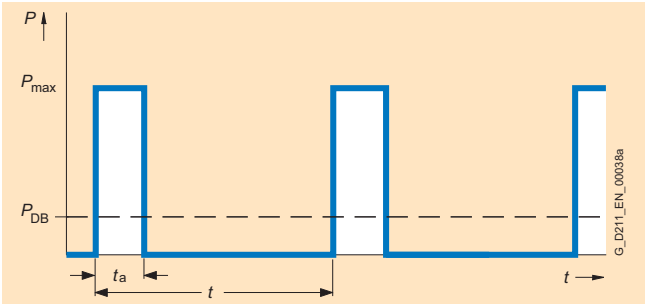
The braking resistors for the Power Modules of the FSC to FSF frame sizes should be placed outside the control cabinet or the switchgear room in order to direct the resulting heat loss away from the Power Modules, thereby allowing a corresponding reduction in the level of air conditioning required.

The braking resistors are designed with a temperature switch. The temperature switch must be evaluated to prevent consequential damage if the braking resistor overheats.

Selection and ordering data

Description	Suitable for Power Module, blocksize format	**Braking resistor** 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**

Characteristics



Load diagram for braking resistors in blocksize format

t_a = 12 s

t = 240 s

Braking resistors for blocksize format

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 lb)
Approvals	cURus
Suitable for Power Module blocksize format	FSA

DC link voltage 510 ... 720 V DC		Braking resistor 6SE6400-4BD11-0AA0	6SL3201-0BE12-0AA0	6SE6400-4BD16-5CA0	6SE6400-4BD21-2DA0	6SE6400-4BD22-2EA0	6SE6400-4BD24-0FA0
Resistor	Ω	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 (ft)	0.5 (1.64)	0.5 (1.64)	0.9 (2.95)	–	–	–
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 (in)	72 (2.83)	153 (6.02)	185 (7.28)	270 (10.63)	270 (10.63)	400 (15.75)
• Height	mm (in)	230 (9.06)	329 (12.95)	285 (11.22)	515 (20.98)	645 (25.39)	650 (25.59)
• Depth	mm (in)	43.5 (1.71)	43.5 (1.71)	150 (5.91)	175 (6.89)	175 (6.89)	315 (12.40)
Weight, approx.	kg (lb)	1.0 (2.2)	1.6 (3.53)	3.8 (8.38)	7.4 (16.3)	10.6 (23.4)	16.7 (37)
Approvals		cURus	cURus	cURus	cURus	cURus	cURus
Suitable for Power Module blocksize format		FSA	FSB	FSC	FSD	FSE	FSF

[1] With correctly connected load connection cable.

Overview

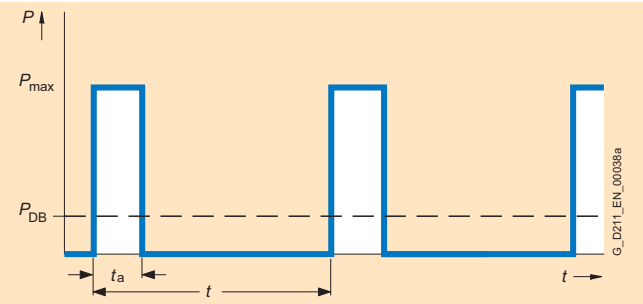
The excess energy of the DC link is dissipated via the braking resistor.

The corresponding braking resistor is connected to a Braking Module or Basic Line Module. The braking resistor is positioned outside the cabinet or switchgear room. This arrangement enables the resulting heat loss around the Line Modules / Motor Modules to be dissipated, thereby allowing a corresponding reduction in the level of air conditioning required.

Selection and ordering data

Description	Suitable for	**Braking resistor** Order No.
DC link voltage 510 ... 720 V DC		
Braking resistor		
• 0.3 kW/25 kW	Braking Module 6SL3100-1AE31-0AB0	**6SN1113-1AA00-0DA0**
• 1.5 kW/100 kW	Braking Module 6SL3100-1AE31-0AB0	**6SL3100-1BE31-0AA0**
• 5 kW/30 kW	Basic Line Module 20 kW 6SL3130-1TE22-0AA0	**6SE7023-2ES87-2DC0**
• 12.5 kW/75 kW	Basic Line Module 40 kW 6SL3130-1TE24-0AA0	**6SE7028-0ES87-2DC0**

Characteristics



Load diagram for Braking Module in booksize format and braking resistors for booksize format

Braking resistors for booksize format

Technical specifications

DC link voltage 510 ... 720 V DC		Braking resistors for Braking Modules in booksize format 6SN1113-1AA00-0DA0		6SL3100-1BE31-0AA0	
Resistor	Ω	17		5.7	
Rated power P_{DB}	kW	0.3		1.5	
Peak power P_{max}	kW	25		100	
Load duration for peak power t_a	s	0.1	0.4	1	2
Period duration of braking duty cycle t	s	11.5	210	68	460
Degree of protection		IP54 Braking resistor with connected 1.5 mm² cable (shielded), 3 m (9.84 ft) long		IP20	
Dimensions					
• Width	mm (in)	80 (3.15)		193 (7.60)	
• Height	mm (in)	210 (8.27)		410 (16.41)	
• Depth	mm (in)	53 (2.09)		240 (9.45)	
Weight, approx.	kg (lb)	3.4 (7.50)		5.6 (12.3)	
Approvals		cULus (File No.: E192450)		–	

DC link voltage 510 ... 720 V DC		Braking resistors 6SE7023-2ES87-2DC0	6SE7028-0ES87-2DC0
Resistor	Ω	20	8
Rated power P_{DB}	kW	5	12.5
Peak power P_{max}	kW	30	75
Load duration for peak power t_a	s	15	15
Period duration of braking duty cycle t	s	90	90
Degree of protection		IP20	IP20
Power connections		M6 screw stud	M6 screw stud
PE connection		M6 screw stud	M8 screw stud
Thermostatic switch (NC contact)		Screw-type terminals	Screw-type terminals
• Switching capacity		250 V AC/ max. 10 A 42 V DC/0.2 A	250 V AC/ max. 10 A 42 V DC/0.2 A
• Conductor cross-section	mm²	2.5	2.5
Dimensions			
• Width	mm (in)	430 (16.93)	740 (29.13)
• Height	mm (in)	485 (19.09)	485 (19.09)
• Depth	mm (in)	305 (12.01)	305 (12.01)
Weight, approx.	kg (lb)	14 (30.9)	22 (48.5)
Approvals		UL (File No.: E145153) CSA (File No.: LR21927-63R)	UL (File No.: E145153) CSA (File No.: LR21927-63R)
Suitable for Basic Line Module Booksize format		6SL3130-1TE22-0AA0	6SL3130-1TE24-0AA0

Overview

The excess energy of the DC link is dissipated via the braking resistor.

The braking resistor is connected to a Braking Module. The braking resistor is positioned outside the cabinet or switchgear room. This arrangement enables the resulting heat loss around the Line Modules / Motor Modules to be dissipated, thereby allowing a corresponding reduction in the level of air conditioning required.

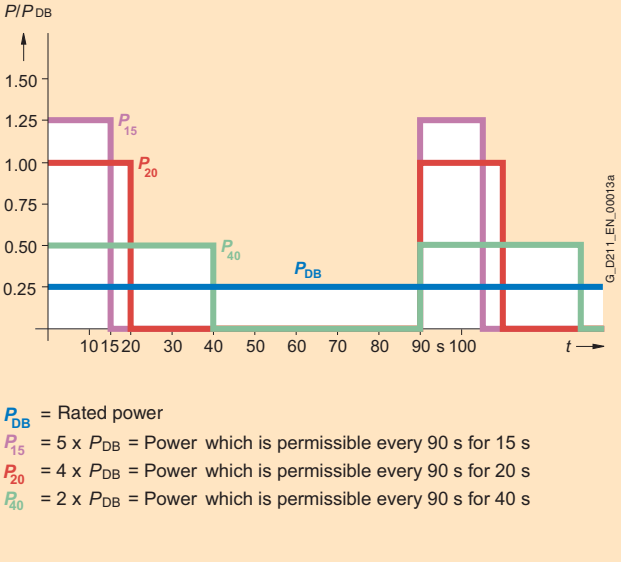
2 braking resistors with different rated and peak power values are available for chassis format units.

The braking resistor is monitored on the basis of the mark-space ratio. A temperature switch (NC contact) is also fitted. This responds when the maximum permissible temperature is exceeded and can be evaluated by a controller.

Selection and ordering data

Description	Suitable for Braking Module in chassis format	Braking resistor Order No.
DC link voltage 510 ... 720 V DC		
Braking resistor		
• 25 kW/125 kW	6SL3300-1AE31-3AA0	**6SL3000-1BE31-3AA0**
• 50 kW/250 kW	6SL3300-1AE32-5 . A0	**6SL3000-1BE32-5AA0**
DC link voltage 675 ... 900 V DC		
Braking resistor		
• 25 kW/125 kW	6SL3300-1AF31-3AA0	**6SL3000-1BF31-3AA0**
• 50 kW/250 kW	6SL3300-1AF32-5 . A0	**6SL3000-1BF32-5AA0**
DC link voltage 890 ... 1035 V DC		
Braking resistor		
• 25 kW/125 kW	6SL3300-1AH31-3AA0	**6SL3000-1BH31-3AA0**
• 50 kW/250 kW	6SL3300-1AH32-5 . A0	**6SL3000-1BH32-5AA0**

Characteristics



P_{DB} = Rated power
P_{15} = 5 x P_{DB} = Power which is permissible every 90 s for 15 s
P_{20} = 4 x P_{DB} = Power which is permissible every 90 s for 20 s
P_{40} = 2 x P_{DB} = Power which is permissible every 90 s for 40 s

Load diagram for Braking Module and braking resistor in chassis format

Braking resistors for chassis format

Technical specifications

DC link voltage 510 ... 720 V DC		Braking resistor 6SL3000-1BE31-3AA0	6SL3000-1BE32-5AA0
Resistor	Ω	4.4	2.2
Rated power P_{DB}	kW	25	50
Peak power P_{max}	kW	125	250
Load duration for peak power	s	15	15
Period duration of braking duty cycle	s	90	90
Current, max.	A	189	378
Cable entry		via M50 cable gland	via M50 cable gland
Power connection		via M10 stud terminal	via M10 stud terminal
• Conductor cross-section, max.	mm^2	50	70
Degree of protection		IP20	IP20
Dimensions			
• Width	mm (in)	740 (29.13)	810 (31.89)
• Height	mm (in)	605 (23.82)	1325 (52.17)
• Depth	mm (in)	485 (19.09)	485 (19.09)
Weight, approx.	kg (lb)	50 (110)	120 (265)
Approvals		cURus (File No.: E224314)	cURus (File No.: E224314)
Suitable for Braking Module in chassis format	Type	6SL3300-1AE31-3AA0	6SL3300-1AE32-5 . A0

DC link voltageC 675 ... 900 V D		Braking resistor 6SL3000-1BF31-3AA0	6SL3000-1BF32-5AA0
Resistor	Ω	6.8	3.4
Rated power P_{DB}	kW	25	50
Peak power P_{max}	kW	125	250
Load duration for peak power	s	15	15
Period duration of braking duty cycle	s	90	90
Current, max.	A	125	255
Cable entry		via M50 cable gland	via M50 cable gland
Power connection		via M10 stud terminal	via M10 stud terminal
• Conductor cross-section, max.	mm^2	50	70
Degree of protection		IP20	IP20
Dimensions			
• Width	mm (in)	740 (29.13)	810 (31.89)
• Height	mm (in)	605 (23.82)	1325 (52.17)
• Depth	mm (in)	485 (19.09)	485 (19.09)
Weight, approx.	kg (lb)	50 (110)	120 (265)
Approvals		cURus	cURus
Suitable for Braking Module in chassis format	Type	6SL3300-1AF31-3AA0	6SL3300-1AF32-5 . A0

Technical specifications (continued)

DC link voltage 890 ... 1035 V DC		Braking resistor 6SL3000-1BH31-3AA0	6SL3000-1BH32-5AA0
Resistor	Ω	9.8	4.9
Rated power P_{DB}	kW	25	50
Peak power P_{max}	kW	125	250
Load duration for peak power	s	15	15
Period duration of braking duty cycle	s	90	90
Current, max.	A	125	255
Cable entry		via M50 cable gland	via M50 cable gland
Power connection		via M10 stud terminal	via M10 stud terminal
• Conductor cross-section, max.	mm^2	50	70
Degree of protection		IP20	IP20
Dimensions			
• Width	mm (in)	740 (992)	810 (1086)
• Height	mm (in)	605 (811)	1325 (1777)
• Depth	mm (in)	485 (650)	485 (650)
Weight, approx.	kg (lb)	50 (110)	120 (265)
Approvals		–	–
Suitable for Braking Module in chassis format	Type	6SL3300-1AH31-3AA0	6SL3300-1AH32-5 **.** A0

Capacitor Modules in booksize format

Overview

Capacitor Modules are used to increase the DC link capacitance to bridge momentary power failures.

Capacitor Modules are connected to the DC link voltage via the integrated DC link busbars. Capacitor Modules function autonomously.

Several Capacitor Modules can be operated in parallel.

Design

Capacitor Modules feature the following connections and interfaces as standard:

- 2 DC link connections via integrated DC link busbars
- 2 PE (protective earth) connections

Technical specifications

DC link voltage 510 ... 720 V DC Internal air cooling	Capacitor Module 6SL3100-1CE14-0AA0
Capacitance	4000 µF
Current carrying capacity	
• 24 V DC busbars	20 A
• DC link busbars	100 A
PE connection	M5 screw
Dimensions	
• Width	100 mm (3.94 in)
• Height	380 mm (14.96 in)
• Depth, with spacer (included in scope of supply)	270 mm (10.63 in)
Weight, approx.	7.2 kg (16 lb)
Approvals	cULus (File No.: E214113)

Selection and ordering data

Description	Order No.
Capacitor Module	**6SL3100-1CE14-0AA0**

Accessories

Description	Order No.
Warning signs in foreign languages This set of foreign language warning signs can be placed on top of the standard German or English signs. The following languages are available in each label set: Chinese Simplified, Danish, Dutch, Finnish, French, Greek, Italian, Japanese, Korean, Polish, Portuguese/Brazilian, Russian, Swedish, Spanish, Czech, Turkish	**6SL3166-3AB00-0AA0**

Overview

The Control Supply Module in booksize format provides a 24 V DC power supply via the line or DC link. This makes it possible, for example, to make emergency retraction movements in the event of a supply failure, provided that the DC link voltage is available.

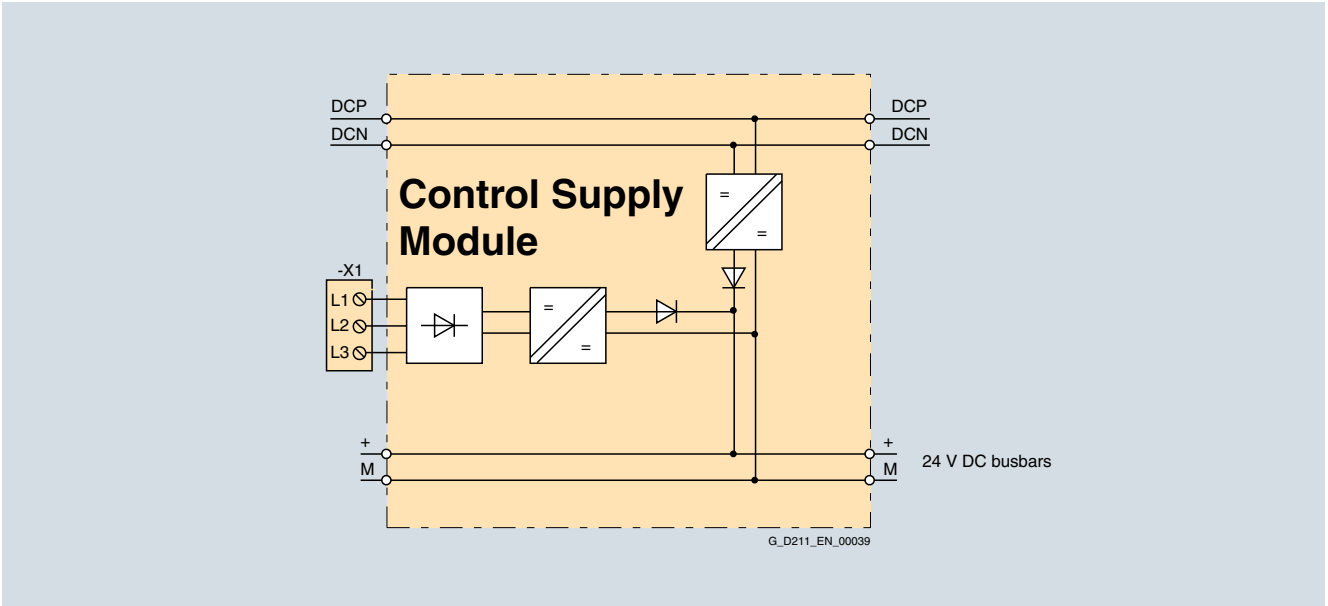
Design

Control Supply Modules feature the following connections and interfaces as standard:

- 1 line connection
- 2 DC link connections via integrated DC link busbars
- 2 electronics power supply connections via integrated 24 V DC bars
- 1 connection for the electronics power supply for Control Units, Terminal Modules, Sensor Modules, etc., via the 24 V terminal adapter provided in the scope of supply (max. cross-section 6 mm^2, max. fuse protection 20 A)
- 2 PE (protective earth) connections

The status of the Control Supply Modules is indicated via two multi-color LEDs.

Integration



Connection example of Control Supply Module

Control Supply Modules in booksize format

Technical specifications

DC link voltage 510 ... 720 V DC **Line voltage 380 ... 480 V 3 AC**	**Control Supply Modules in booksize format**
Internal air cooling	**6SL3100-1DE22-0AA0**
Rated input current	
• At 400 V 3 AC	2.2 A
• At 600 V DC	1.1 A
DC link voltage range	300 … 882 V DC (operation in 300 … 430 V DC range is permitted temporarily for < 1 min)
Radio Interference suppression (standard)	Category C2 to EN 61800-3
Rated output voltage	26 V DC
Rated output current [1]	20 A
Current carrying capacity	
• 24 V DC busbars [1]	20 A
• DC link busbars	100 A
Line connection L1, L2, L3 (X1)	Screw-type terminals
• Conductor cross-section	0.2 … 4.0 mm^2
PE connection	M5 screw
Dimensions	
• Width	50 mm (1.97 in)
• Height	380 mm (14.96 in)
• Depth, with spacer (included in scope of supply)	270 mm (10.63 in)
Weight, approx.	4.8 kg (10.6 lb)
Approvals	cULus (File No. E214113)

Selection and ordering data

Description	Order No.
Control Supply Module in booksize format	**6SL3100-1DE22-0AA0**

Accessories

Description	Order No.
Warning signs in foreign languages This set of foreign language warning signs can be placed on top of the standard German or English signs. The following languages are available in each label set: Chinese Simplified, Danish, Dutch, Finnish, French, Greek, Italian, Japanese, Korean, Polish, Portuguese/Brazilian, Russian, Swedish, Spanish, Czech, Turkish	**6SL3166-3AB00-0AA0**

[1] If the Control Supply Module is loaded with more than 10 A, it must be installed in the center of the drive line-up to ensure a current distribution as even as possible among the loads connected to the right and left of it. It is not permissible to connect Control Supply Modules in parallel.

Overview

DC link rectifier adapter

DC link rectifier adapter for 50–100 mm wide units

DC link rectifier adapter for 150–300 mm wide units

If the internal DC link busbars of the Motor Modules are not used, the DC link voltage must be supplied externally through a DC link rectifier adapter, e.g. when devices of booksize format are coupled with devices of chassis format over an external DC busbar. The DC link supply adapter is mounted on the DC link busbars of the Motor Module. The DC link cables are routed from above.

DC link adapter

Multi-tier DC link adapter for all unit widths

If a multi-tier Motor Module configuration is used, a DC link power supply adapter can be provided for linking the DC links of two drive groups. The DC link adapter is mounted sideways on the DC link busbars of the Motor Module. It can be mounted on the right or left side of the Motor Module; the identification of the poles (DCN and DCP) on the DC link adapter changes in accordance with the mounting position. The DC link cables are routed from behind. Multi-tier DC link adapters are supplied in sets of 2 units.

Technical specifications

		DC link rectifier adapter for booksize and booksize compact formats		DC link adapter for booksize and booksize compact formats
		6SL3162-2BD00-0AA0	6SL3162-2BM00-0AA0	6SL3162-2BM01-0AA0
Conductor cross-section (screw-type terminals)	mm^2	0.5 … 10	35 … 95	35 … 95
Current carrying capacity	A	43	240	240
Weight, approx.	kg (lb)	0.06 (0.13)	0.48 (1.06)	0.76 (1.68)
Approvals		cURus	cURus	cURus

Selection and ordering data

Description	Order No.
DC link rectifier adapter for direct infeed of DC link voltage for Line Modules and Motor Modules in booksize and booksize compact format	
• 50 mm (1.97 in), 75 mm (2.95 in) and 100 mm (3.94 in) wide	**6SL3162-2BD00-0AA0**
• 150 mm (5.91 in), 200 mm (7.87 in) and 300 mm (11.81 in) wide	**6SL3162-2BM00-0AA0**
DC link adapter set (2 units) for multi-tier configuration for all Line Modules and Motor Modules in booksize and booksize compact format	**6SL3162-2BM01-0AA0**

Voltage Clamping Module in booksize format

Overview

Undesirable oscillations to ground potential can occur in drive groupings with total cable lengths (sum of all motor and DC link cables) of > 350 m (1148 ft) (shielded) or 560 m (1837 ft) (unshielded). The Voltage Clamping Module damps these oscillations, thereby allowing the total permissible cables lengths in a booksize format drive grouping to increase to 630 m (2067 ft) (shielded) or 850 m (2789 ft) (unshielded), taking derating into account (see characteristics of corresponding Line Modules).

With total cable lengths of > 350 m (1148 ft), the limit values of Category C2 defined in EN 61800-3 can be exceeded.

VCM Voltage Clamping Modules may be operated only in networks with grounded neutral (TN system).

Where possible, the Voltage Clamping Module should be mounted next to the Line Module and connected to the voltage-source DC link via the integrated DC busbar.

Design

The Voltage Clamping Module features the following connections and interfaces as standard:

- 2 DC link connections via integrated DC link busbars
- 1 connection for functional ground
- 2 PE (protective earth) connections

The scope of supply of the Voltage Clamping Modules includes:

- Jumper for connecting the 24 V DC busbar to the adjacent Motor Module
- 1 set of warning signs in foreign languages

Technical specifications

DC link voltage 510 ... 720 V DC	**Voltage Clamping Module in booksize format**
Internal air cooling	**6SL3100-1VE00-0AA0**
Current carrying capacity	
• 24 V DC busbars	20 A
• DC link busbars	100 A
PE connection	M5 screw
Grounding	Screw-type terminal
• Conductor cross-section	4 … 16 mm^2
Power loss, approx.	50 W
Dimensions	
• Width	50 mm (1.97 in)
• Height	380 mm (14.96 in)
• Depth, with spacer (included in scope of supply)	270 mm (10.63 in)
Weight, approx.	3.1 kg (7 lb)
Approvals	cULus (File No.: E192450)

Selection and ordering data

Description	Order No.
Voltage Clamping Module in booksize format	**6SL3100-1VE00-0AA0**

Accessories

Description	Order No.
Warning signs in foreign languages This set of foreign language warning signs can be placed on top of the standard German or English signs. The following languages are available in each label set: Chinese Simplified, Danish, Dutch, Finnish, French, Greek, Italian, Japanese, Korean, Polish, Portuguese/Brazilian, Russian, Swedish, Spanish, Czech, Turkish	**6SL3166-3AB00-0AA0**

Overview

Motor reactors for blocksize format

Motor reactors reduce the voltage loading on the motor windings. At the same time, the capacitive charge/discharge currents that place an additional load on the power unit when long motor cables are used are reduced. The maximum permissible output frequency when a motor reactor is used is 150 Hz.

The motor reactors are designed for a pulse frequency of 4 kHz. Higher pulse frequencies are not permissible.

The motor reactor must be installed as close as possible to the Power Module.

Motor reactors are approved for use only in conjunction with "Vector" and "*V/f* control" modes.

Technical specifications

DC link voltage 510 ... 720 V DC or line voltage 380 ... 480 V 3 AC		**Motor reactor (for a 4 kHz pulse frequency)**		
		6SE6400-3TC00-4AD2	**6SL3202-0AE21-0CA0**	**6SL3202-0AJ23-2CA0**
Rated current	A	4.5	10	32
Power loss	kW	0.005	0.02	0.06
Connection to the Power Module		Cable 4 x AWG16 (1.5 mm^2)	Cable 4 x AWG14 (1.5 mm^2)	Cable 4 x 6 mm^2
• Length, approx.	m (ft)	0.3 (0.98)	0.4 (1.31)	0.35 (1.15)
Motor connection		Screw-type terminals	Screw-type terminals	Screw-type terminals
• Conductor cross-section	mm^2	6	6	6
PE connection		M5 screw stud	M5 screw stud	M5 screw stud
Cable length between motor reactor and motor, max.				
• Shielded	m (ft)	100 (328)	100 (328)	100 (328)
• Unshielded	m (ft)	150 (492)	150 (492)	150 (492)
Degree of protection [1]		IP20	IP20	IP20
Dimensions				
• Width	mm (in)	75.5 (2.97)	153 (6.02)	189 (7.44)
• Height	mm (in)	201 (7.91)	285 (11.22)	351 (13.82)
• Depth	mm (in)	110 (4.33)	70 (2.76)	80 (3.15)
Weight, approx.	kg (lb)	2 (4.5)	4.5 (10)	9 (20)
Approvals		cURus	cURus	cURus
Suitable for Power Module, blocksize format	Type (rated current)	6SL3210-1SE11-3UA0 (1.3 A) 6SL3210-1SE11-7UA0 (1.7 A) 6SL3210-1SE12-2UA0 (2.2 A) 6SL3210-1SE13-1UA0 (3.1 A) 6SL3210-1SE14-1UA0 (4.1 A)	6SL3210-1SE16-0 . A0 (5.9 A) 6SL3210-1SE17-7 . A0 (7.7 A) 6SL3210-1SE21-0 . A0 (10 A)	6SL3210-1SE21-8 . A0 (18 A) 6SL3210-1SE22-5 . A0 (25 A) 6SL3210-1SE23-2 . A0 (32 A)
• Frame size		FSA	FSB	FSC

[1] With correctly connected connection cable to the Power Module.

Technical specifications (continued)

DC link voltage 510 ... 720 V DC or line voltage 380 ... 480 V 3 AC		Motor reactor (for a 4 kHz pulse frequency)				
		6SE6400-3TC05-4DD0	6SE6400-3TC03-8DD0	6SE6400-3TC05-4DD0	6SE6400-3TC08-0ED0	6SE6400-3TC07-5ED0
Rated current	A	68	45	68	104	90
Power loss	kW	0.2	0.2	0.2	0.17	0.27
Connection to the Power Module		Flat terminator for M6 screw	Flat terminator for M6 screw	Flat terminator for M6 screw	Flat terminator for M6 screw	Flat terminator for M6 screw
Motor connection		Flat terminator for M6 screw	Flat terminator for M6 screw	Flat terminator for M6 screw	Flat terminator for M6 screw	Flat terminator for M6 screw
PE connection		M6 screw	M6 screw	M6 screw	M6 screw	M6 screw
Cable length between motor reactor and motor, max.						
• Shielded	m (ft)	200 (656)	200 (656)	200 (656)	200 (656)	200 (656)
• Unshielded	m (ft)	300 (984)	300 (984)	300 (984)	300 (984)	300 (984)
Degree of protection		IP00	IP00	IP00	IP00	IP00
Dimensions						
• Width	mm (in)	225 (8.86)	225 (8.86)	225 (8.86)	225 (8.86)	270 (10.63)
• Height	mm (in)	210 (8.27)	210 (8.27)	210 (8.27)	210 (8.27)	248 (9.76)
• Depth	mm (in)	140 (5.51)	140 (5.51)	140 (5.51)	140 (5.51)	189 (7.44)
Weight, approx.	kg (lb)	11.5 (25.4)	19 (42)	11.5 (25.4)	12 (26.5)	27 (59.5)
Approvals		cURus	cURus	cURus	cURus	cURus
Suitable for Power Module, blocksize format	Type (rated current)	6SL3210-1SE23-8 . A0 (38 A)	6SL3210-1SE24-5 . A0 (45 A)	6SL3210-1SE26-0 . A0 (60 A)	6SL3210-1SE27-5 . A0 (75 A)	6SL3210-1SE31-0 . A0 (90 A)
• Frame size		FSD	FSD	FSD	FSE	FSE

DC link voltage 510 ... 720 V DC or line voltage 380 ... 480 V 3 AC		Motor reactor (for a 4 kHz pulse frequency)		
		6SE6400-3TC14-5FD0	6SE6400-3TC15-4FD0	6SE6400-3TC14-5FD0
Rated current	A	178	178	178
Power loss	kW	0.47	0.25	0.47
Connection to the Power Module		Flat terminator for M8 screw	Flat terminator for M8 screw	Flat terminator for M8 screw
Motor connection		Flat terminator for M8 screw	Flat terminator for M8 screw	Flat terminator for M8 screw
PE connection		M8 screw	M8 screw	M8 screw
Cable length between motor reactor and motor, max.				
• Shielded	m (ft)	200 (656)	200 (656)	200 (656)
• Unshielded	m (ft)	300 (984)	300 (984)	300 (984)
Degree of protection		IP00	IP00	IP00
Dimensions				
• Width	mm (in)	357 (14.06)	270 (10.63)	357 (14.06)
• Height	mm (in)	321 (12.64)	248 (9.76)	321 (12.64)
• Depth	mm (in)	221 (8.70)	189 (7.44)	221 (8.70)
Weight, approx.	kg (lb)	57 (126)	24 (53)	57 (126)
Approvals		cURus	cURus	cURus
Suitable for Power Module, blocksize format	Type (rated current)	6SL3210-1SE31-1 . A0 (110 A)	6SL3210-1SE31-5 . A0 (145 A)	6SL3210-1SE31-8 . A0 (178 A)
• Frame size		FSF	FSF	FSF

Selection and ordering data

Rated output current	Type rating	Suitable for Power Module, blocksize format		**Motor reactor**
A	kW (HP)	Type	Frame Size	Order No.
Line voltage 380 ... 480 V 3 AC				
1.3	0.37 (0.50)	6SL3210-1SE11-3UA0	FSA	**6SE6400-3TC00-4AD2**
1.7	0.55 (0.75)	6SL3210-1SE11-7UA0		
2.2	0.75 (1)	6SL3210-1SE12-2UA0		
3.1	1.1 (1.5)	6SL3210-1SE13-1UA0		
4.1	1.5 (2)	6SL3210-1SE14-1UA0		
5.9	2.2 (3)	6SL3210-1SE16-0...	FSB	**6SL3202-0AE21-0CA0**
7.7	3 (5)	6SL3210-1SE17-7...		
10	4 (5)	6SL3210-1SE21-0...		
18	7.5 (10)	6SL3210-1SE21-8...	FSC	**6SL3202-0AJ23-2CA0**
25	11 (15)	6SL3210-1SE22-5...		
32	15 (20)	6SL3210-1SE23-2...		
38	18.5 (25)	6SL3210-1SE23-8...	FCD	**6SE6400-3TC05-4DD0**
45	22 (30)	6SL3210-1SE24-5...		**6SE6400-3TC03-8DD0**
60	30 (40)	6SL3210-1SE26-0...		**6SE6400-3TC05-4DD0**
75	37 (50)	6SL3210-1SE27-5...	FSE	**6SE6400-3TC08-0ED0**
90	45 (60)	6SL3210-1SE31-0...		**6SE6400-3TC07-5ED0**
110	55 (75)	6SL3210-1SE31-1...	FSF	**6SE6400-3TC14-5FD0**
145	75 (100)	6SL3210-1SE31-5...		**6SE6400-3TC15-4FD0**
178	90 (125)	6SL3210-1SE31-8...		**6SE6400-3TC14-5FD0**

Motor reactors for booksize format

Overview

Motor reactors reduce the voltage loading on the motor windings. At the same time, the capacitive charge/discharge currents that place an additional load on the power unit when long motor cables are used are reduced. The maximum permissible output frequency when a motor reactor is used is 120 Hz.

The motor reactors are designed for a pulse frequency of 4 kHz. Higher pulse frequencies are not permissible.

The motor reactor must be installed as close as possible to the Motor Module.

Motor reactors are approved for use only in conjunction with "Vector" and "*V/f* control" modes.

Selection and ordering data

Rated output current of Motor Module	Suitable for Motor Module in booksize format	**Motor reactor** Order No.
3 A and 2 × 3 A	6SL3120-1TE13-0AA3 6SL3121-1TE13-0AA3 6SL3120-2TE13-0AA3 6SL3121-2TE13-0AA3 6SL3126-2TE13-0AA3	**6SE7021-0ES87-1FE0**
5 A and 2 × 5 A	6SL3120-1TE15-0AA3 6SL3121-1TE15-0AA3 6SL3120-2TE15-0AA3 6SL3121-2TE15-0AA3 6SL3126-2TE15-0AA3	**6SE7021-0ES87-1FE0**
9 A and 2 × 9 A	6SL3120-1TE21-0AA3 6SL3121-1TE21-0AA3 6SL3120-2TE21-0AA3 6SL3121-2TE21-0AA3 6SL3126-2TE21-0AA3	**6SL3000-2BE21-0AA0**
18 A and 2 × 18 A	6SL3120-1TE21-8AA3 6SL3121-1TE21-8AA3 6SL3120-2TE21-8AA3 6SL3121-2TE21-8AA3 6SL3126-2TE21-8AA3	**6SE7022-6ES87-1FE0**
30 A	6SL3120-1TE23-0AA3 6SL3121-1TE23-0AA3 6SL3126-1TE23-0AA3	**6SE7024-7ES87-1FE0**
45 A	6SL3120-1TE24-5AA3 6SL3121-1TE24-5AA3 6SL3126-1TE24-5AA3	**6SE7027-2ES87-1FE0**
60 A	6SL3120-1TE26-0AA3 6SL3121-1TE26-0AA3 6SL3126-1TE26-0AA3	**6SL3000-2BE26-0AA0**
85 A	6SL3120-1TE28-5AA3 6SL3121-1TE28-5AA3 6SL3126-1TE28-5AA3	**6SE7031-5ES87-1FE0**
132 A	6SL3120-1TE31-3AA3 6SL3121-1TE31-3AA3 6SL3126-1TE31-3AA3	**6SE7031-8ES87-1FE0**
200 A	6SL3120-1TE32-0AA3 6SL3121-1TE32-0AA3 6SL3126-1TE32-0AA3	**6SE7032-6ES87-1FE0**

Technical specifications

DC link voltage 510 ... 720 V DC or line voltage 380 ... 480 V 3 AC		Motor reactor (for a 4 kHz pulse frequency)											
		6SE7021-0ES87-1FE0			6SL3000-2BE21-0AA0			6SE7022-6ES87-1FE0			6SE7024-7ES87-1FE0		
Rated current	A	9.2			9			23			42		
Power loss	kW	0.08			0.07			0.11			0.19		
Connection Motor Module/Motor		Screw-type terminals 4 mm²			Screw-type terminals 4 mm²			Screw-type terminals 10 mm²			Flat terminator for M8 screw		
PE connection		M6 screw stud			M6 screw stud			M6 screw stud			M6 screw		
Cable length between motor reactor and motor, max. (number of reactors in series)		(1)			(1)			(1)	(2)		(1)	(2)	
• Shielded	m (ft)	100 (328)			135 (443)			160 (525)	320 1050)		190 (623)	375 (1230)	
• Unshielded	m (ft)	150 (492)			200 (656)			240 (787)	480 1575)		280 (919)	560 (1837)	
Degree of protection		IP00			IP00			IP00			IP00		
Dimensions													
• Width	mm (in)	178 (7.01)			178 (7.01)			219 (8.62)			197 (7.76)		
• Height	mm (in)	97 (3.82)			159 (6.26)			180 (7.09)			220 (8.66)		
• Depth	mm (in)	88 (3.46)			111 (4.37)			132 (5.20)			121 (4.76)		
Weight, approx.	kg (lb)	6 (13.2)			5 (11.0)			9.5 (20.9)			20 (44.1)		
Approvals		cURus			cURus			cURus			cURus		
Suitable for Motor Module in booksize format	Type	6SL3120-1TE13-0AA3 6SL3121-1TE13-0AA3 6SL3120-2TE13-0AA3 6SL3121-2TE13-0AA3	6SL3120-1TE15-0AA3 6SL3121-1TE15-0AA3 6SL3120-2TE15-0AA3 6SL3121-2TE15-0AA3		6SL3120-1TE21-0AA3 6SL3121-1TE21-0AA3 6SL3120-2TE21-0AA3 6SL3121-2TE21-0AA3			6SL3120-1TE21-8AA3 6SL3121-1TE21-8AA3 6SL3120-2TE21-8AA3 6SL3121-2TE21-8AA3			6SL3120-1TE23-0AA3 6SL3121-1TE23-0AA3		
• Rated current of the Motor Module	A	3	5		9			18			30		

DC link voltage 510 ... 720 V DC or line voltage 380 ... 480 V 3 AC		Motor reactor (for a 4 kHz pulse frequency)														
		6SE7027-2ES87-1FE0			6SL3000-2BE26-0AA0			6SE7031-5ES87-1FE0			6SE7031-8ES87-1FE0			6SE7032-6ES87-1FE0		
Rated current	A	65			60			131			167			234		
Power loss	kW	0.2			0.1			0.22			0.29			0.29		
Connection Motor Module/Motor		Flat terminator for M8 screw			Flat terminator for M8 screw			Flat terminator for M8 screw			Flat terminator for M8 screw			Flat terminator for M8 screw		
PE connection		M6 screw stud			M6 screw stud			M6 screw			M6 screw			M6 screw		
Cable length between motor reactor and motor, max. (number of reactors in series)		(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
• Shielded	m (ft)	200 (656)	400 (1312)	600 (1969)	200 (656)	400 (1312)	600 (1969)	200 (656)	400 (1312)	600 (1969)	200 (656)	400 (1312)	600 (1969)	200 (656)	400 (1312)	600 (1969)
• Unshielded	m (ft)	300 (984)	600 (1969)	900 (2953)	300 (984)	600 (1969)	900 (2953)	300 (984)	600 (1969)	900 (2953)	300 (984)	600 (1969)	900 (2953)	300 (984)	600 (1969)	900 (2953)
Degree of protection		IP00			IP00			IP00			IP00			IP00		
Dimensions																
• Width	mm (in)	267 (10.51)			267 (10.51)			219 (8.62)			281 (11.06)			281 (11.06)		
• Height	mm (in)	221 (8.70)			220 (8.66)			220 (8.66)			250 (9.84)			250 (9.84)		
• Depth	mm (in)	131 (5.16)			126 (4.96)			145 (5.71)			171 (6.73)			184 (7.24)		
Weight, approx.	kg (lb)	11 (24.3)			10.5 (23.2)			25 (55.1)			30 (66.2)			30 (66.2)		
Approvals		cURus			cURus			cURus			cURus			cURus		
Suitable for Motor Module in booksize format	Type	6SL3120-1TE24-5AA3 6SL3121-1TE24-5AA3			6SL3120-1TE26-0AA3 6SL3121-1TE26-0AA3			6SL3120-1TE28-5AA3 6SL3121-1TE28-5AA3			6SL3120-1TE31-3AA3 6SL3121-1TE31-3AA3			6SL3120-1TE32-0AA3 6SL3121-1TE32-0AA3		
• Rated current of the Motor Module	A	45			60			85			132			200		

Motor reactors for chassis format

Overview

Motor reactors reduce the voltage loading on the motor windings. At the same time, the capacitive charge/discharge currents that place an additional load on the power unit when long motor cables are used are reduced. The maximum permissible output frequency when a motor reactor is used is 150 Hz.

The motor reactor must be installed as close as possible to the Motor Module or Power Module. Up to 2 motor reactors can be connected in series.

Motor reactors are approved for use only in conjunction with "Vector" and "*V/f* control" modes.

Technical specifications

DC link voltage 510 ... 720 V DC or line voltage 380 ... 480 V 3 AC		**Motor reactor (for pulse frequencies of 2 kHz to 4 kHz)**									
		6SL3000-2BE32-1AA0		**6SL3000-2BE32-6AA0**		**6SL3000-2BE33-2AA0**		**6SL3000-2BE33-8AA0**		**6SL3000-2BE35-0AA0**	
Rated current	A	210		260		310		380		490	
Power loss	kW	0.486		0.5		0.47		0.5		0.5	
Line/load connection		Flat terminator for M10 screw		Flat terminator for M10 screw		Flat terminator for M10 screw		Flat terminator for M10 screw		Flat terminator for M12 screw	
PE connection		M8 screw		M8 screw		M8 screw		M8 screw		M8 screw	
Cable length between motor reactor and motor, max. (number of reactors in series)		(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
• Shielded	m (ft)	300 (984)	525 (1723)	300 (984)	525 (1723)	300 (984)	525 (1723)	300 (984)	525 (1723)	300 (984)	525 (1723)
• Unshielded	m (ft)	450 (1476)	787 (2582)	450 (1476)	787 (2582)	450 (1476)	787 (2582)	450 (1476)	787 (2582)	450 (1476)	787 (2582)
Degree of protection		IP00		IP00		IP00		IP00		IP00	
Dimensions											
• Width	mm (in)	300 (11.81)		300 (11.81)		300 (11.81)		300 (11.81)		300 (11.81)	
• Height	mm (in)	285 (11.22)		315 (12.40)		285 (11.22)		285 (11.22)		365 (14.37)	
• Depth	mm (in)	257 (10.12)		277 (10.91)		257 (10.12)		277 (10.91)		277 (10.91)	
Weight, approx.	kg (lb)	66 (146)		66 (146)		66 (146)		73 (161)		100 (221)	
Approvals		cURus		cURus		cURus		cURus		cURus	
Suitable for Single Motor Module in chassis format	Type	6SL3320-1TE32-1AA0		6SL3320-1TE32-6AA0		6SL3320-1TE33-1AA0		6SL3320-1TE33-8AA0		6SL3320-1TE35-0AA0	
Suitable for Power Module in chassis format	Type	6SL3310-1TE32-1AA0		6SL3310-1TE32-6AA0		6SL3310-1TE33-1AA0		6SL3310-1TE33-8AA0		6SL3310-1TE35-0AA0	
• Rated current of Motor Module or Power Module	A	210		260		310		380		490	
• Type rating of Motor Module or Power Module	kW (HP)	110 (150)		132 (200)		160 (250)		200 (300)		250 (400)	

Technical specifications (continued)

DC link voltage 510 ... 720 V DC or line voltage 380 ... 480 V 3 AC		Motor reactor (for pulse frequencies of 1.25 kHz to 2.5 kHz)											
		6SL3000-2AE36-1AA0		6SL3000-2AE38-4AA0		6SL3000-2AE38-4AA0		6SL3000-2AE41-0AA0		6SL3000-2AE41-4AA0			
Rated current	A	605		840		840		985		1405		1405	
Power loss	kW	0.9		0.83		0.943		1.062		0.962		1.054	
Line/load connection		Flat connector for M12 screw		Flat connector for M12 screw		Flat connector for M12 screw		Flat connector for M12 screw		Flat connector for M12 screw (2×)		Flat connector for M12 screw (2×)	
PE connection		M8 screw		M10 screw		M10 screw		M10 screw		M10 screw		M10 screw	
Cable length between motor reactor and motor, max. (number of reactors in series)		(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
• Shielded	m (ft)	300 (984)	525 (1723)	300 (984)	525 (1723)	300 (984)	525 (1723)	300 (984)	525 (1723)	300 (984)	525 (1723)	300 (984)	525 (1723)
• Unshielded	m (ft)	450 (1476)	787 (2582)	450 (1476)	787 (2582)	450 (1476)	787 (2582)	450 (1476)	787 (2582)	450 (1476)	787 (2582)	450 (1476)	787 (2582)
Degree of protection		IP00		IP00		IP00		IP00		IP00		IP00	
Dimensions													
• Width	mm (in)	410 (16.14)		410 (16.14)		410 (16.14)		410 (16.14)		460 (18.11)		460 (18.11)	
• Height	mm (in)	392 (15.43)		392 (15.43)		392 (15.43)		392 (15.43)		392 (15.43)		392 (15.43)	
• Depth	mm (in)	292 (11.50)		292 (11.50)		292 (11.50)		302 (11.89)		326 (12.83)		326 (12.83)	
Weight, approx.	kg (lb)	130 (287)		140 (309)		140 (309)		146 (322)		179 (395)		179 (395)	
Approvals		cURus		cURus		cURus		cURus		cURus		cURus	
Suitable for Single Motor Module in chassis format	Type	6SL3320-1TE36-1AA0		6SL3320-1TE37-5AA0		6SL3320-1TE38-4AA0		6SL3320-1TE41-0AA0		6SL3320-1TE41-2AA0		6SL3320-1TE41-4AA0	
• Rated current of the Motor Module	A	605		745		840		985		1260		1405	
• Type rating of the Motor Module	kW (HP)	315 (500)		400 (600)		450 (700)		560 (800)		710 (1000)		800 (1150)	

DC link voltage 675 ... 1035 V DC or line voltage 500 ... 690 V 3 AC		Motor reactor (for pulse frequencies of 1.25 kHz to 2.5 kHz)											
		6SL3000-2AH31-0AA0				6SL3000-2AH31-5AA0				6SL3000-2AH31-8AA0		6SL3000-2AH32-4AA0	
Rated current	A	100		100		150		150		175		240	
Power loss	kW	0.257		0.3		0.318		0.335		0.4		0.425	
Line/load connection		Flat connector for M10 screw		Flat connector for M10 screw		Flat connector for M10 screw		Flat connector for M10 screw		Flat connector for M10 screw		Flat connector for M10 screw	
PE connection		M6 screw		M6 screw		M6 screw		M6 screw		M6 screw		M6 screw	
Cable length between motor reactor and motor, max. (number of reactors in series)		(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
• Shielded	m (ft)	300 (984)	525 (1723)	300 (984)	525 (1723)	300 (984)	525 (1723)	300 (984)	525 (1723)	300 (984)	525 (1723)	300 (984)	525 (1723)
• Unshielded	m (ft)	450 (1476)	787 (2582)	450 (1476)	787 (2582)	450 (1476)	787 (2582)	450 (1476)	787 (2582)	450 (1476)	787 (2582)	450 (1476)	787 (2582)
Degree of protection		IP00		IP00		IP00		IP00		IP00		IP00	
Dimensions													
• Width	mm (in)	270 (10.63)		270 (10.63)		270 (10.63)		270 (10.63)		300 (11.81)		300 (11.81)	
• Height	mm (in)	248 (9.76)		248 (9.76)		248 (9.76)		248 (9.76)		285 (11.22)		285 (11.22)	
• Depth	mm (in)	200 (7.87)		200 (7.87)		200 (7.87)		200 (7.87)		212 (8.35)		212 (8.35)	
Weight, approx.	kg (lb)	25 (55)		25 (55)		25.8 (57)		25.8 (57)		34 (75.0)		34 (75.0)	
Approvals		–		–		–		–		–		–	
Suitable for Single Motor Module in chassis format	Type	6SL3320-1TG28-5AA0		6SL3320-1TG31-0AA0		6SL3320-1TG31-2AA0		6SL3320-1TG31-5AA0		6SL3320-1TG31-8AA0		6SL3320-1TG32-2AA0	
• Rated current of the Motor Module	A	85		100		120		150		175		215	
• Type rating of the Motor Module	kW	75		90		110		132		160		200	

Motor reactors for chassis format

3

Technical specifications (continued)

DC link voltage 675 ... 1035 V DC or line voltage 500 ... 690 V 3 AC		Motor reactor (for pulse frequencies of 1.25 kHz to 2.5 kHz)											
		6SL3000-2AH32-6AA0		6SL3000-2AH33-6AA0		6SL3000-2AH34-5AA0		66SL3000-2AH34-7AA0		6SL3000-2AH35-8AA0		6SL3000-2AH38-1AA0	
Rated current	A	260		360		450		465		575		810	
Power loss	kW	0.44		0.45		0.545		0.72		0.8		0.96	
Line/load connection		Flat connector for M10 screw		Flat connector for M10 screw		Flat connector for M12 screw		Flat connector for M12 screw		Flat connector for M12 screw		Flat connector for M12 screw	
PE connection		M6 screw		M6 screw		M8 screw		M8 screw		M8 screw		M8 screw	
Cable length between motor reactor and motor, max. (number of reactors in series)		(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
• Shielded	m (ft)	300 (984)	525 (1723)	300 (984)	525 (1723)	300 (984)	525 (1723)	300 (984)	525 (1723)	300 (984)	525 (1723)	300 (984)	525 (1723)
• Unshielded	m (ft)	450 (1476)	787 (2582)	450 (1476)	787 (2582)	450 (1476)	787 (2582)	450 (1476)	787 (2582)	450 (1476)	787 (2582)	450 (1476)	787 (2582)
Degree of protection		IP00		IP00		IP00		IP00		IP00		IP00	
Dimensions													
• Width	mm (in)	300 (11.81)		300 (11.81)		350 (13.78)		410 (16.14)		410 (16.14)		410 (16.14)	
• Height	mm (in)	285 (11.22)		285 (11.22)		330 (12.99)		392 (15.43)		392 (15.43)		392 (15.43)	
• Depth	mm (in)	212 (8.35)		212 (8.35)		215 (8.46)		292 (11.50)		292 (11.50)		279 (10.98)	
Weight, approx.	kg (lb)	40 (88)		46 (101)		68 (150)		80 (176)		80 (176)		146 (322)	
Approvals		–		–		–		–		–		–	
Suitable for Single Motor Module in chassis format	Type	6SL3320-1TG32-6AA0		6SL3320-1TG33-3AA0		6SL3320-1TG34-1AA0		6SL3320-1TG34-7AA0		6SL3320-1TG35-8AA0		6SL3320-1TG37-4AA0	
• Rated current of the Motor Module	A	260		330		410		465		575		735	
• Type rating of the Motor Module	kW	250		315		400		450		560		710	

DC link voltage 675 ... 1035 V DC or line voltage 500 ... 690 V 3 AC		Motor reactor (for pulse frequencies of 1.25 kHz to 2.5 kHz)							
		6SL3000-2AH38-1AA0		6SL3000-2AH41-0AA0		6SL3000-2AH41-1AA0		6SL3000-2AH41-3AA0	
Rated current	A	810		910		1025		1270	
Power loss	kW	1.0		0.97		1.05		0.95	
Line/load connection		Flat connector for M12 screw		Flat connector for M12 screw		Flat connector for M12 screw		Flat connector for M12 screw	
PE connection		M8 screw		M8 screw		M8 screw		M8 screw	
Cable length between motor reactor and motor, max. (number of reactors in series)		(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
• Shielded	m (ft)	300 (984)	525 (1723)	300 (984)	525 (1723)	300 (984)	525 (1723)	300 (984)	525 (1723)
• Unshielded	m (ft)	450 (1476)	787 (2582)	450 (1476)	787 (2582)	450 (1476)	787 (2582)	450 (1476)	787 (2582)
Degree of protection		IP00		IP00		IP00		IP00	
Dimensions									
• Width	mm (in)	410 (16.14)		410 (16.14)		410 (16.14)		460 (18.11)	
• Height	mm (in)	392 (15.43)		392 (15.43)		392 (15.43)		392 (15.43)	
• Depth	mm (in)	279 (10.98)		279 (10.98)		317 (12.48)		296 (11.65)	
Weight, approx.	kg (lb)	146 (322)		150 (331)		163 (359)		153 (337)	
Approvals		–		–		–		–	
Suitable for Single Motor Module in chassis format	Type	6SL3320-1TG38-1AA0		6SL3320-1TG38-8AA0		6SL3320-1TG41-0AA0		6SL3320-1TG41-3AA0	
• Rated current of the Motor Module	A	810		910		1025		1270	
• Type rating of the Motor Module	kW	800		900		1000		1200	

Selection and ordering data

Rated current of the Motor Module or Power Module	Type rating of the Motor Module or Power Module	Suitable for Motor Module/ Power Module in chassis format	**Motor reactor**
A	kW (HP)	Type	Order No.
DC link voltage 510 ... 720 V DC (line voltage 380 ... 480 V 3 AC)			
210	110 (150)	6SL33 . 0-1TE32-1AA0	**6SL3000-2BE32-1AA0**
260	132 (200)	6SL33 . 0-1TE32-6AA0	**6SL3000-2BE32-6AA0**
310	160 (250)	6SL33 . 0-1TE33-1AA0	**6SL3000-2BE33-2AA0**
380	200 (300)	6SL33 . 0-1TE33-8AA0	**6SL3000-2BE33-8AA0**
490	250 (400)	6SL33 . 0-1TE35-0AA0	**6SL3000-2BE35-0AA0**
605	315 (500)	6SL3320-1TE36-1AA0	**6SL3000-2AE36-1AA0**
745	400 (600)	6SL3320-1TE37-5AA0	**6SL3000-2AE38-4AA0**
840	450 (700)	6SL3320-1TE38-4AA0	
985	560 (800)	6SL3320-1TE41-0AA0	**6SL3000-2AE41-0AA0**
1260	710 (1000)	6SL3320-1TE41-2AA0	**6SL3000-2AE41-4AA0**
1405	800 (1150)	6SL3320-1TE41-4AA0	
DC link voltage 675 ... 1035 V DC (line voltage 500 ... 690 V 3 AC)			
85	75	6SL3320-1TG28-5AA0	**6SL3000-2AH31-0AA0**
100	90	6SL3320-1TG31-0AA0	
120	110	6SL3320-1TG31-2AA0	**6SL3000-2AH31-5AA0**
150	132	6SL3320-1TG31-5AA0	
175	160	6SL3320-1TG31-8AA0	**6SL3000-2AH31-8AA0**
215	200	6SL3320-1TG32-2AA0	**6SL3000-2AH32-4AA0**
260	250	6SL3320-1TG32-6AA0	**6SL3000-2AH32-6AA0**
330	315	6SL3320-1TG33-3AA0	**6SL3000-2AH33-6AA0**
410	400	6SL3320-1TG34-1AA0	**6SL3000-2AH34-5AA0**
465	450	6SL3320-1TG34-7AA0	**6SL3000-2AH34-7AA0**
575	560	6SL3320-1TG35-8AA0	**6SL3000-2AH35-8AA0**
735	710	6SL3320-1TG37-4AA0	**6SL3000-2AH38-1AA0**
810	800	6SL3320-1TG38-1AA0	
910	900	6SL3320-1TG38-8AA0	**6SL3000-2AH41-0AA0**
1025	1000	6SL3320-1TG41-0AA0	
1270	1200	6SL3320-1TG41-3AA0	**6SL3000-2AH41-3AA0**

Sinusoidal filter for chassis format

Overview

If a sinusoidal filter is connected at the Motor Module output, the voltage between the motor terminals is virtually sinusoidal. This reduces the voltage load on the motor windings and prevents motor noise induced by the pulse frequency.

The pulse frequency of the Motor Modules must be set to 4 kHz for the sinusoidal filter.

With chassis format units, this reduces the maximum possible output current and the maximum achievable output voltage (see characteristics for Single Motor Modules in chassis format and System description). The voltage drops across the sinusoidal filter, a factor which must also be taken into account in the drive design (see System description).

The sinusoidal filter must be installed as close as possible to the Motor Module.

Technical specifications

DC link voltage 510 ... 720 V DC		**Sinusoidal filter 6SL3000-2CE32-3AA0**		**6SL3000-2CE32-8AA0**	**6SL3000-2CE33-3AA0**	**6SL3000-2CE34-1AA0**
Rated current	A	225	225	276	333	408
Power loss at 50/60 Hz	kW	0.35/0.6	0.35/0.6	0.4/0.69	0.245/0.53	0.38/0.7
Line connection		Flat connector for M10 screw	Flat connector for M10 screw	Flat connector for M10 screw	Flat connector for M10 screw	Flat connector for M10 screw
Load connection		Flat connector for M10 screw	Flat connector for M10 screw	Flat connector for M10 screw	Flat connector for M10 screw	Flat connector for M10 screw
Cable length between motor reactor and motor						
• Shielded	m (ft)	300 (984)	300 (984)	300 (984)	300 (984)	300 (984)
• Unshielded	m (ft)	450 (1476)	450 (1476)	450 (1476)	450 (1476)	450 (1476)
Degree of protection		IP00	IP00	IP00	IP00	IP00
Dimensions						
• Width	mm (in)	620 (24.41)	620 (24.41)	620 (24.41)	620 (24.41)	620 (24.41)
• Height	mm (in)	300 (11.81)	300 (11.81)	300 (11.81)	370 (14.57)	370 (14.57)
• Depth	mm (in)	320 (12.60)	320 (12.60)	320 (12.60)	360 (14.17)	360 (14.17)
Weight, approx.	kg (lb)	124 (273)	124 (273)	127 (280)	136 (300)	198 (437)
Approvals		cURus	cURus	cURus	cURus	cURus
Suitable for Single Motor Module in chassis format	Type	6SL3320-1TE32-1AA0	6SL3320-1TE32-6AA0	6SL3320-1TE33-1AA0	6SL3320-1TE33-8AA0	6SL3320-1TE35-0AA0
Suitable for Power Module in chassis format	Type	6SL3310-1TE32-1AA0	6SL3310-1TE32-6AA0	6SL3310-1TE33-1AA0	6SL3310-1TE33-8AA0	6SL3310-1TE35-0AA0
• Rated current of the Motor Module or Power Module at pulse frequency of 4 kHz	A	170	215	270	330	380
• Type rating of the Motor Module or Power Module at pulse frequency of 4 kHz	kW (HP)	90 (120)	110 (150)	132 (200)	160 (250)	200 (400)

Selection and ordering data

Rated output current of the Motor Module or Power Module	Type rating of the Motor Module or Power Module	Suitable for Motor Module/Power Module in chassis format	**Sinusoidal filter**
A	kW (HP)	Type	Order No.
DC link voltage 510 ... 720 V DC (line voltage 380 ... 480 V 3 AC)			
210	110 (150)	6SL33 . 0-1TE32-1AA0	**6SL3000-2CE32-3AA0**
260	132 (200)	6SL33 . 0-1TE32-6AA0	
310	160 (250)	6SL33 . 0-1TE33-1AA0	**6SL3000-2CE32-8AA0**
380	200 (300)	6SL33 . 0-1TE33-8AA0	**6SL3000-2CE33-3AA0**
490	250 (400)	6SL33 . 0-1TE35-0AA0	**6SL3000-2CE34-1AA0**

BOP20 Basic Operator Panel

Overview

BOP20 Basic Operator Panel

The BOP20 Basic Operator Panel can be inserted on any CU310 or CU320 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 of the BOP20 Basic Operator Panel is used for the power supply of the BOP20 Basic Operator Panel and the communication with the CU310 or CU320 Control Unit.

Integration

CU310 DP Control Unit with mounted BOP20 Basic Operator Panel

CU320 Control Unit with mounted BOP20 Basic Operator Panel

Selection and ordering data

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

Overview

The CBC10 Communication Board is used to interface the CU320 Control Unit and the drives to the CAN (Controller Area Network) protocol. The board's driver software fulfills the standards of the following CANopen specification of the CiA organization (CAN in Automation):

- Communication profiles in accordance with DS 301
- Drive profile in accordance with DSP 402 (in this case Profile Velocity Mode)
- EDS (Electronic Data Sheet) in accordance with DSP 306
- Operational status signaling in accordance with DSP 305

Design

The CBC10 Communication Board plugs into the option slot on the CU320 Control Unit. The CAN interface on the CBC10 has 2 SUB-D connections in each case of input and output.

Technical specifications

CBC10 Communication Board	
Power requirement, max. at 24 V DC via CU320 Control Unit, max.	0.05 A
Power loss	< 10 W
Weight, approx.	0.1 kg (0.22 lb)
Approvals	cULus (File No.: E164110)

Selection and ordering data

Description	Order No.
CBC10 Communication Board	**6SL3055-0AA00-2CA0**

Accessories

Description	Order No.
SUB-D connector, 9-pin, socket (3 units)	**6FC9341-2AE**
SUB-D connector, 9-pin, pin (3 units)	**6FC9341-2AF**

CBE20 Communication Board

Overview

The CBE20 Communication Board can be used to connect the SINAMICS S120 drive system to a PROFINET IO network via a CU320 Control Unit.

The SINAMICS S120 drive system then assumes the function of a PROFINET IO device and can perform the following functions:

- PROFINET IO device
- 100 Mbit/s full duplex
- Supports real-time classes of PROFINET IO:
  - RT (Real-Time)
  - IRT (Isochronous Real-Time), minimum send cycle 500 µs
- Connects to controls as PROFINET IO devices using PROFIdrive in accordance with Specification V4
- Standard TCP/IP communication for engineering processes using the STARTER commissioning tool
- Integrated 4-port switch with four RJ45 sockets based on the PROFINET ASIC ERTEC400. The optimum topology (line, star, tree) can therefore be configured without additional external switches.

Integration

The CBE20 Communication Board plugs into the option slot on the CU320 Control Unit.

Technical specifications

CBE20 Communication Board	
Current requirement at 24 V DC	0.16 A
Ambient temperature, permissible	
• Storage and transport	-40 … +70 °C (-40 … +158 °F)
• Operation	0 … 55 °C (32 … 131 °F)
Dimensions	130 mm × 78 mm (5.12 in × 3.07 in)
Weight, approx.	76 g (2.68 oz)
Approvals	cULus (File No.: E164110)

Selection and ordering data

Description	Order No.
CBE20 Communication Board	**6SL3055-0AA00-2EB0**

Accessories

The PROFINET cables and connectors listed below are recommended:

Description	Order No.
Industrial Ethernet FC	
• RJ45 Plug 145 (1 unit)	**6GK1901-1BB30-0AA0**
• RJ45 Plug 145 (10 units)	**6GK1901-1BB30-0AB0**
• Stripping tool	**6GK1901-1GA00**
• Standard Cable GP 2x2	**6XV1840-2AH10**
• Flexible Cable GP 2x2	**6XV1870-2B**
• Trailing Cable GP 2x2	**6XV1870-2D**
• Trailing Cable 2x2	**6XV1840-3AH10**
• Marine Cable 2x2	**6XV1840-4AH10**

For further information about connectors and cables, refer to Catalog IK PI.

Overview

The CUA31 Control Unit Adapter converts the PM-IF interface to a DRIVE-CLiQ interface. The CUA31 Control Unit Adapter allows Power Modules in blocksize format to operate on a CU320 or SIMOTION D Control Unit.

Design

The CUA31 Control Unit Adpater features the following connections and interfaces:

- 1 temperature sensor input (KTY84-130 or PTC)
- 3 DRIVE-CLiQ sockets
- 1 connection for the electronics power supply via the 24 V DC power supply connector
- 1 safe standstill input (enable pulses)

The status of the CUA31 Control Unit Adapter is indicated via multi-color LEDs.

Technical specifications

CUA31 Control Unit Adapter	
Power requirement at 24 V DC without DRIVE-CLiQ supply, max.	0.15 A for CUA31 + max. 0.5 A for PM340 Power Module
• Conductor cross-section, max.	2.5 mm^2
Power loss	< 4 W
PE connection	M5 screw
Dimensions	
• Width	73 mm (2.87 in)
• Height	165.8 mm (6.53 in)
• Depth	37.3 mm (1.47 in)
Weight, approx.	0.31 kg (0.68 lb)
Approvals	cULus (File No.: E164110)

Selection and ordering data

Description	Order No.
CUA31 Control Unit Adapter (without DRIVE-CLiQ cable)	**6SL3040-0PA00-0AA1**

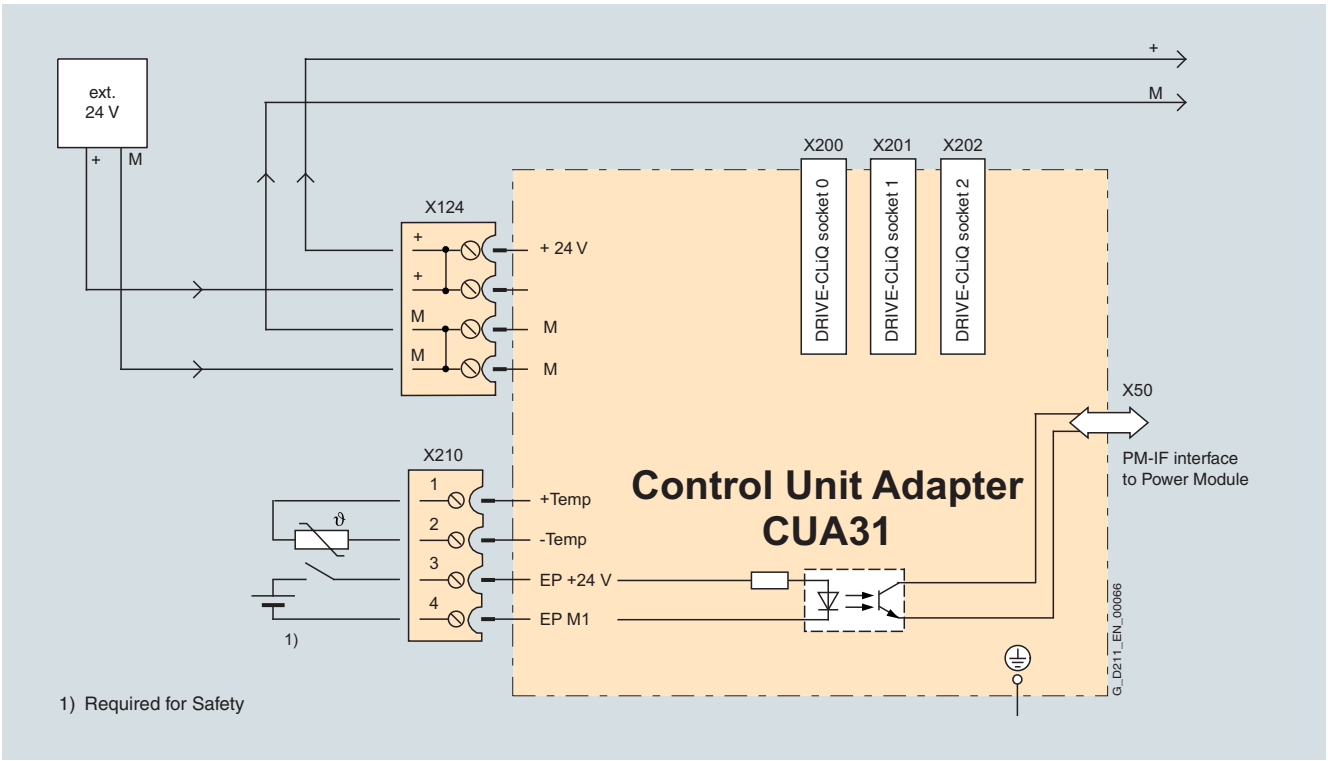
CUA31 Control Unit Adapter

Integration

The CUA31 Control Unit Adapter is snapped on the Power Module in blocksize format and communicates with a CU320 or a SIMOTION D Control Unit via a DRIVE-CLiQ link.

The CUA31 Control Unit Adapter's power is supplied by the Power Module via the PM-IF interface. If the CUA31 Control Unit Adapter needs to communicate when the Power Module is switched off, it must be supplied with 24 V DC from an external source.

Other DRIVE-CLiQ participants such as Sensor Modules or Terminal Modules can be connected to the CUA31 Control Unit Adapter.



Overview

The CUA32 Control Unit Adapter converts the PM-IF interface to a DRIVE-CLiQ interface. The CUA32 Control Unit Adapter is also equipped with integral HTL/TTL encoder evaluation.

The CUA32 Control Unit Adapter allows Power Modules in block-size format to operate on a CU320 or SIMOTION D Control Unit.

Design

The CUA32 Control Unit Adapter features the following connections and interfaces:

- 1 temperature sensor input (KTY84-130 or PTC)
- 3 DRIVE-CLiQ sockets
- 1 connection for the electronic power supply via the 24 V DC power supply connector
- 1 safe standstill input (enable pulses)
- 1 HTL/TTL encoder evaluation

The status of the CUA32 Control Unit Adapter is indicated via a multi-color LED.

Technical specifications

CUA32 Control Unit Adapter	
Power requirement at 24 V DC without DRIVE-CLiQ supply and encoder supply, max.	0.15 A for CUA32 + max. 0.5 A for PM340 Power Module
• Conductor cross-section, max.	2.5 mm^2
Encoder evaluation	TTL or HTL incremental encoders (parameterizable)
• Encoder supply	24 V DC/0.35 A or 5 V DC/0.35 A
• Limiting frequency	300 kHz
• Cable length with TTL incremental encoder, max. (only bipolar signals are permitted)	100 m (328 ft)
• Cable length with HTL incremental encoder, max.	
- For unipolar signals	100 m (328 ft)
- For bipolar signals	300 m (984 ft)
Power loss	< 4 W
PE connection	M5 screw
Dimensions	
• Width	73 mm (2.87 in)
• Height	165.8 mm (6.53 in)
• Depth	37.3 mm (1.47 in)
Weight, approx.	0.31 kg (0.68 lb)
Approvals	cULus available soon

Selection and ordering data

Description	Order No.
CUA32 Control Unit Adapter (without DRIVE-CLiQ cable)	**6SL3040-0PA01-0AA0**

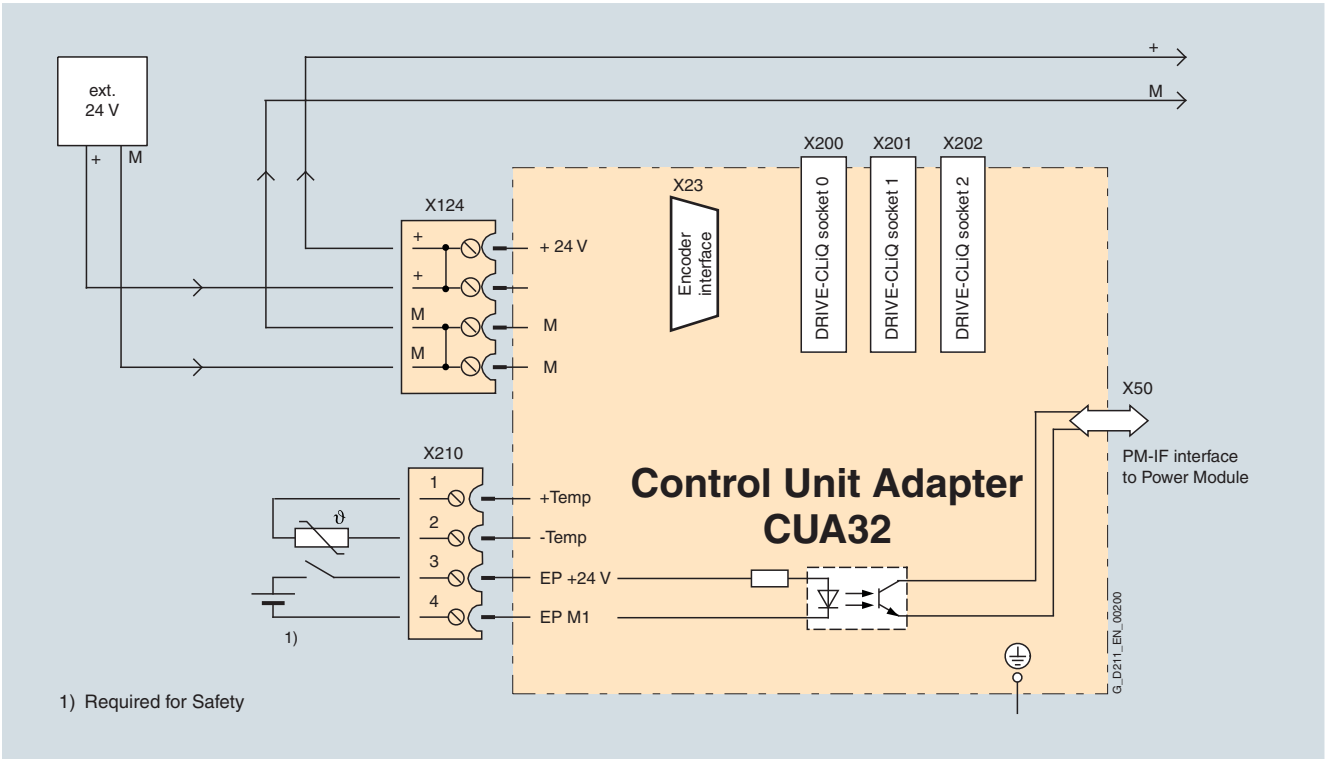
CUA32 Control Unit Adapter

Integration

The CUA32 Control Unit Adapter is snapped on the Power Module in blocksize format and communicates with a CU320 or a SIMOTION D Control Unit via a DRIVE-CLiQ link.

The CUA32 Control Unit Adapter's power is supplied by the Power Module via the PM-IF interface. If the CUA32 Control Unit Adapter needs to communicate when the Power Module is switched off, it must be supplied with 24 V DC from an external source.

Other DRIVE-CLiQ participants such as Sensor Modules or Terminal Modules can be connected to the CUA32 Control Unit Adapter.



1) Required for Safety

Overview

The DRIVE-CLiQ DMC20 Hub Module is used to implement star-shaped distribution of a DRIVE-CLiQ line. Two DRIVE-CLiQ DMC20 Hub Modules can be connected in series (cascaded).

Design

The following are located on the DRIVE-CLiQ DMC20 Hub Module:

- 6 DRIVE-CLiQ sockets for connecting 5 DRIVE-CLiQ participants
- 1 connection for the electronics power supply via the 24 V DC rectifier connector

The status of the DRIVE-CLiQ DMC20 Hub Module is indicated via a multi-color LED.

Technical specifications

DMC20 DRIVE-CLiQ Hub Module	
Power requirement at 24 V DC without DRIVE-CLiQ supply, max.	0.15 A
• Conductor cross-section, max.	2.5 mm^2
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)

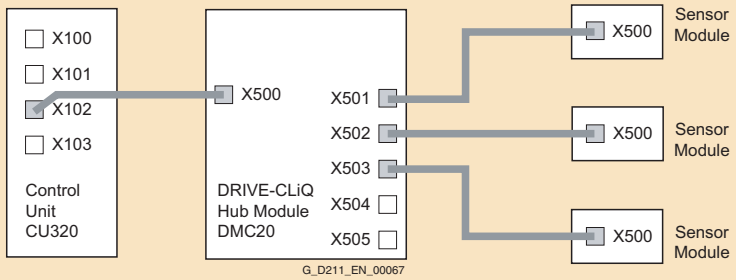
Selection and ordering data

Description	Order No.
DMC20 DRIVE-CLiQ Hub Module (without DRIVE-CLiQ cable)	**6SL3055-0AA00-6AA0**

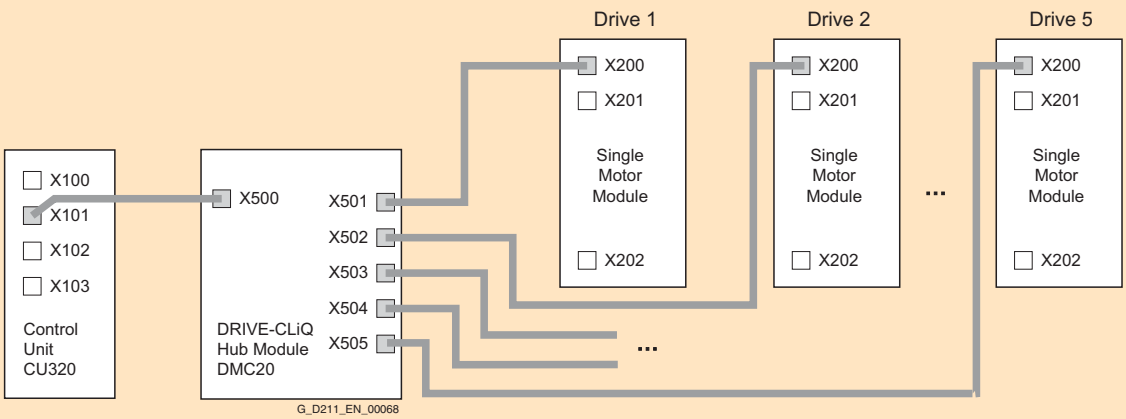
DMC20 DRIVE-CLiQ Hub Module

Integration

Signals from more than one encoder can be collected with the DRIVE-CLiQ DMC20 Hub Module and forwarded to the Control Unit through a single DRIVE-CLiQ cable.



A DRIVE-CLiQ DMC20 Hub Module allows individual DRIVE-CLiQ participants to be removed without interrupting the data exchange with the remaining participants in the DRIVE-CLiQ line.



Overview

The TB30 Terminal Board supports the addition of digital inputs/digital outputs and analog inputs/analog outputs to the CU320 and SIMOTION D4x5 Control Units.

Design

The following are located on the TB30 Terminal Board:

- Power supply for digital inputs/digital outputs
- 4 digital inputs
- 4 digital outputs
- 2 analog inputs
- 2 analog outputs

The TB30 Terminal Board plugs into the option slot on a Control Unit.

A shield connection for the signal cable shield is located on the Control Unit.

Selection and ordering data

Description	Order No.
TB30 Terminal Board	**6SL3055-0AA00-2TA0**

Technical specifications

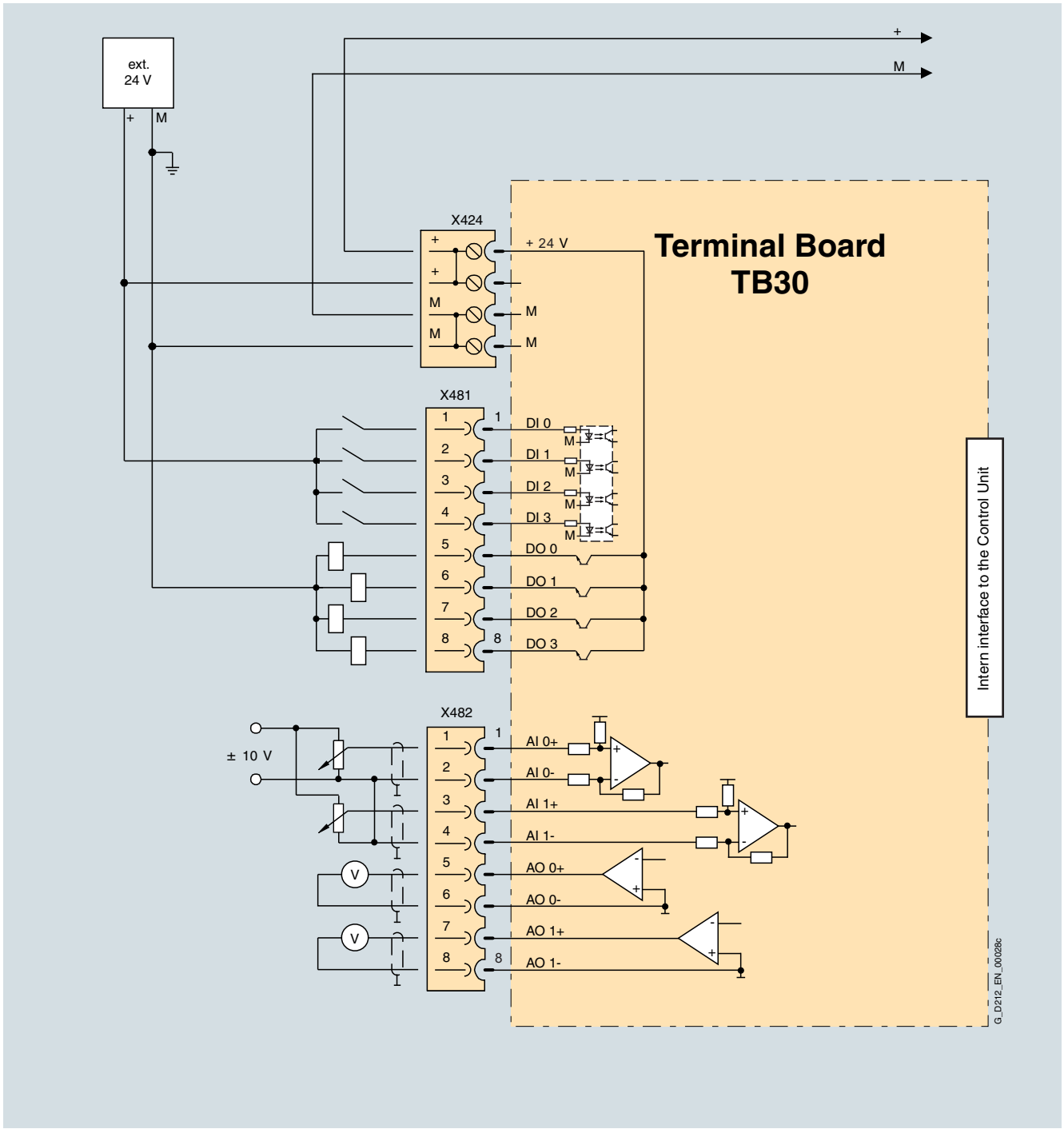
TB30 Terminal Board	
Power requirement at 24 V DC via CU320 Control Unit without taking account of digital outputs, max.	0.05 A
• Conductor cross-section, max.	2.5 mm^2
• Fuse protection, max.	20 A
Digital inputs In accordance with IEC 61131-2 Type 1	
• Voltage	-3 … +30 V
• Low level (an open digital input is interpreted as "low")	-3 … +5 V
• High level	15 … 30 V
• Current consumption at 24 V DC, typ.	10 mA
• Delay time of digital inputs [1], approx.	
- L → H	50 µs
- H → L	100 µs
• Conductor cross-section, max.	0.5 mm^2
Digital outputs (sustained-short-circuit proof)	
• Voltage	24 V DC
• Load current per digital output, max.	500 mA
• Delay time of digital outputs [1], approx.	150 µs
• Conductor cross-section, max.	0.5 mm^2
Analog inputs (difference)	
• Voltage range (an open analog input is interpreted as 0 V)	-10 … +10 V
• Internal resistance R_i	65 kΩ
• Resolution [2]	13 bit + sign
• Conductor cross-section, max.	0.5 mm^2
Analog outputs (sustained-short-circuit proof)	
• Voltage range	-10 … +10 V
• Load current, max.	-3 … +3 mA
• Resolution	11 bit + sign
• Settling time, approx.	200 µs
• Conductor cross-section, max.	0.5 mm^2
Power loss	< 3 W
Weight, approx.	0.1 kg (0.22 lb)
Approvals	cULus (File No.: E164110)

1) The specified delay times refer to the hardware. The actual reaction time depends on the time slot in which the digital input is processed.

2) If the analog input is to be operated in the signal processing sense with continuously variable input voltage, the sampling frequency $f_a = 1/t_{time\ slice}$ must be at least twice the value of the highest signal frequency f_{max}.

3

Integration



Connection example of TB30 Terminal Board

Overview

The number of available digital inputs and outputs within a drive system can be expanded with the TM15 Terminal Module.

Design

The following are located on the TM15 Terminal Module:

- 24 bidirectional digital inputs/outputs (isolation in 3 groups with 8 channels each)
- 24 green status LEDs for indicating the logical signal status of the relevant terminal
- 2 x DRIVE-CLiQ sockets
- 1 connection for the electronics power supply via the 24 V DC rectifier connector
- 1 PE (protective earth) connection

The TM15 Terminal Module can be snapped on a TH 35 top-hat rail in accordance with EN 60715 (IEC 60715).

The signal cable shield can be connected to the TM15 Terminal Module via a shield connection terminal, e.g. Phoenix Contact type SK8 or Weidmüller type KLBÜ CO 1. The shield connection terminal must not be used for strain relief.

The status of the TM15 Terminal Module is indicated via a multi-color LED.

Selection and ordering data

Description	Order No.
TM15 Terminal Module (without DRIVE-CLiQ cable)	**6SL3055-0AA00-3FA0**

Technical specifications

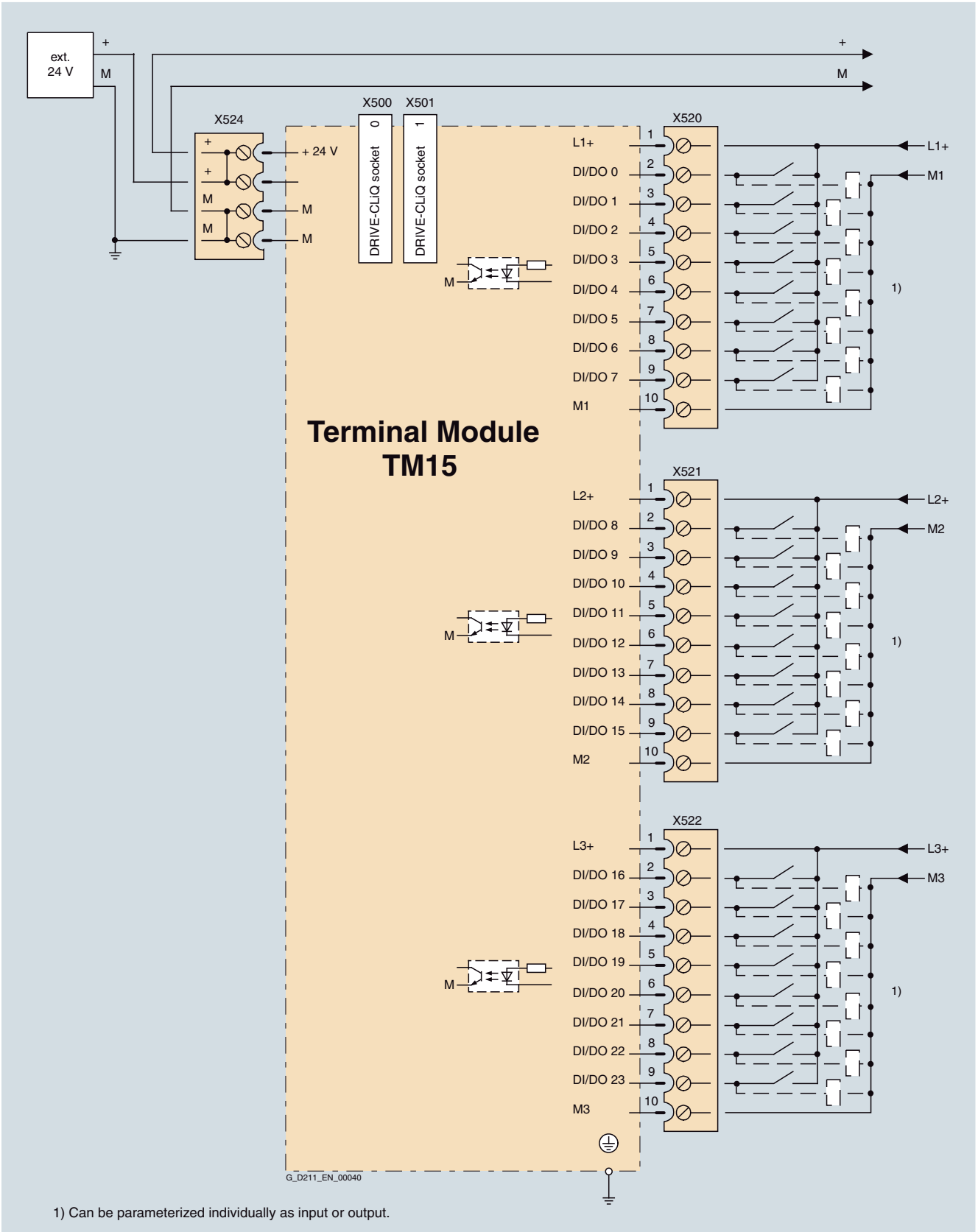
TM15 Terminal Module	
Power requirement with 24 V DC without load, max.	0.15 A
• Conductor cross-section, max.	2.5 mm^2
• Fuse protection, max.	20 A
Number of DRIVE-CLiQ sockets	2
I/O	
• Digital inputs/outputs	channelwise parameterizable as DI or DO
• Number of digital inputs/outputs	24
• Isolation	yes, in groups of 8
• Connection method	plug-in screw-type terminals
• Conductor cross-section, max.	1.5 mm^2
Digital inputs	
• Voltage	-30 … +30 V
• Low level (an open digital input is interpreted as "low")	-30 … +5 V
• High level	15 … 30 V
• Current consumption at 24 V DC	5 … 11 mA
• Delay times of digital inputs, typ.[1]	
- L → H	50 µs
- H → L	100 µs
Digital outputs (sustained-short-circuit proof)	
• Voltage	24 V DC
• Load current per digital output, max.	0.5 A
• Delay times (ohmic load) [1]	
- L → H, typ. L → H, max.	50 µs 100 µs
- H → L, typ. H → L, max.	150 µs 225 µs
• Aggregate current of outputs (per group), max.	
- Up to 60 °C (140 °F)	2 A
- Up to 50 °C (122 °F)	3 A
- Up to 40 °C (104 °F)	4 A
Power loss	< 3 W
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.	0.86 kg (2 lb)
Approvals	cULus (File No.: E164110)

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

TM15 Terminal Module

Integration

The TM15 Terminal Module communicates with a CU310, CU320 or SIMOTION D Control Unit via DRIVE-CLiQ.



1) Can be parameterized individually as input or output.

Connection example of TM15 Terminal Module

Overview

With the TM31 Terminal Module, the number of available digital inputs and outputs and the number of analog input and outputs within a drive system can be expanded.

The TM31 Terminal Module also features relay outputs with changeover contact and a temperature sensor input.

Design

The following are located on the TM31 Terminal Module:

- 8 digital inputs
- 4 bidirectional digital inputs/outputs
- 2 relay outputs with changeover contact
- 2 analog inputs
- 2 analog outputs
- 1 temperature sensor input (KTY84-130 or PTC)
- 2 DRIVE-CLiQ sockets
- 1 connection for the electronics power supply via the 24 V DC rectifier connector
- 1 PE (protective earth) connection

The TM31 Terminal Module can be snapped on a TH 35 top-hat rail in accordance with EN 60715 (IEC 60715).

The signal cable shield can be connected to the TM31 Terminal Module via a shield connection terminal, e.g. Phoenix Contact type SK8 or Weidmüller type KLBÜ CO 1. The shield connection terminal must not be used for strain relief.

The status of the TM31 Terminal Module is indicated via a multi-color LED.

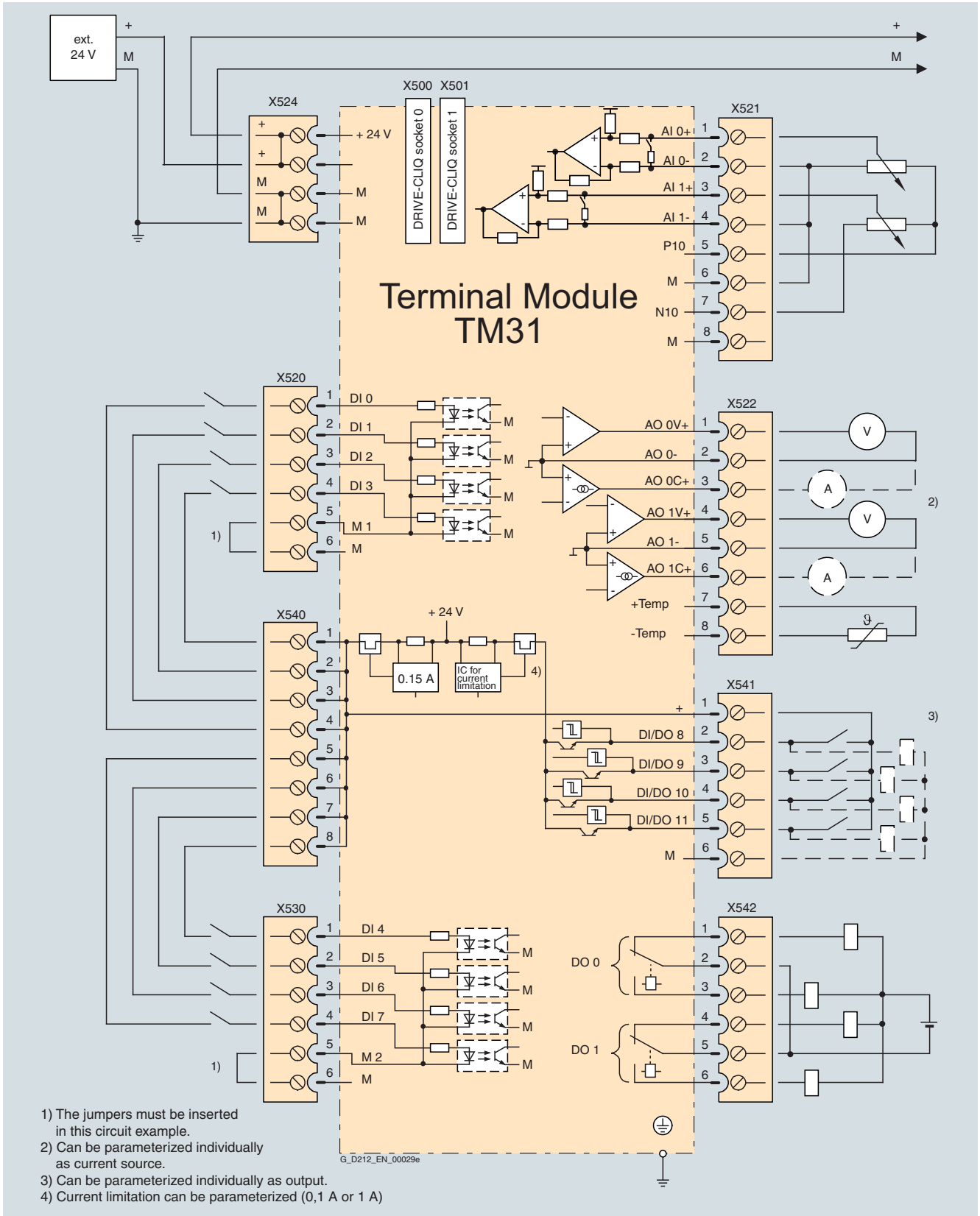
Selection and ordering data

Description	Order No.
TM31 Terminal Module (without DRIVE-CLiQ cable)	**6SL3055-0AA00-3AA0**

TM31 Terminal Module

Integration

The TM31 Terminal Module communicates with a CU310, CU320 or SIMOTION D Control Unit via DRIVE-CLiQ.



1) The jumpers must be inserted in this circuit example.
2) Can be parameterized individually as current source.
3) Can be parameterized individually as output.
4) Current limitation can be parameterized (0,1 A or 1 A)

Connection example of TM31 Terminal Module

Technical specifications

TM31 Terminal Module	
Power requirement at 24 V DC without taking account of digital outputs and DRIVE-CLiQ supply, max.	0.2 A
• Conductor cross-section, max.	2.5 mm^2
• Fuse protection, max.	20 A
Digital inputs in accordance with IEC 61131-2 Type 1	
• 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.	10 mA
• Delay times of digital inputs [1], approx.	
- L → H	50 µs
- H → L	100 µs
• Conductor cross-section, max.	1.5 mm^2
Digital outputs (sustained-short-circuit proof)	
• Voltage	24 V DC
• Load current per digital output, max.	100 mA
• Aggregate current of digital outputs, max.	400 mA
• Delay times of digital outputs [1]	
- Typ.	150 µs with 0.5 A ohmic load
- Max.	500 µs
• Conductor cross-section, max.	1.5 mm^2
Analog inputs (a switch is used for the changeover between voltage and current input)	
• As voltage input	
- Voltage range	-10 … +10 V
- Internal resistance R_i	100 kΩ
• As current input	
- Current range	4 … 20 mA, -20 … +20 mA, 0 … 20 mA
- Internal resistance R_i	250 Ω
- Resolution [2]	11 bit + sign
• Conductor cross-section, max.	1.5 mm^2

TM31 Terminal Module (continued)	
Analog outputs (sustained-short-circuit proof)	
• Voltage range	-10 … +10 V
• Load current, max.	-3 … +3 mA
• Current range	4 … 20 mA, -20 … +20 mA, 0 … 20 mA
• Load resistance, max.	500 Ω for outputs in the range -20 mA ... +20 mA
• Resolution	11 bit + sign
• Conductor cross-section, max.	1.5 mm^2
Relay outputs (changeover contacts)	
• Load current, max.	8 A
• Operational voltage, max.	250 V AC, 30 V DC
• Switching capacity, max.	
- At 250 V AC	2000 VA (cos φ = 1) 750 VA (cos φ = 1)
- At 30 V DC	240 W (resistive load)
• Required minimum current	100 mA
• Conductor cross-section, max.	2.5 mm^2
Power loss	< 10 W
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.	0.87 kg (2 lb)
Approvals	cULus (File No.: 164110)

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

[2] If the analog input is to be operated in the signal processing sense with continuously variable input voltage, the sampling frequency $f_a = 1/t_{time\ slice}$ must be at least twice the value of the highest signal frequency f_{max}.

TM41 Terminal Module

Overview

The TM41 Terminal Module supplies TTL signals which emulate an incremental encoder, e.g. to a higher-level control. The encoder interface (incremental encoder emulation) can be linked to an encoder signal from the Control Unit, e.g. incremental encoder sin/cos, by parameter assignment.

The TM41 Terminal Module increases the number of digital inputs/outputs and analog inputs that are available in the drive system.

Design

The following are located on the TM41 Terminal Module:

- 4 bidirectional digital inputs/outputs
- 4 digital inputs (with electrical isolation)
- 1 analog input
- 1 interface for simulation of TTL incremental encoder (RS422)
- 1 LED for signaling zero mark detection for encoder interface
- 2 DRIVE-CLiQ sockets
- 1 connection for the 24 V DC supply to digital outputs
- 1 connection for the electronics power supply via the 24 V DC power supply connector
- 1 PE (protective earth) connection

The TM41 Terminal Module can be snapped on a TH 35 top-hat rail in accordance with EN 60715 (IEC 60715).

The signal cable shield can be connected to the TM41 Terminal Module via a shield connection terminal, e.g. Phoenix Contact type SK8 or Weidmüller type KLBÜ CO 1. The shield connection terminal must not be used for strain relief.

The status of the TM41 Terminal Module is indicated via a multicolor LED.

A LED next to the interface for TTL pulse encoder emulation in accordance with is illuminated as soon as a zero mark is detected.

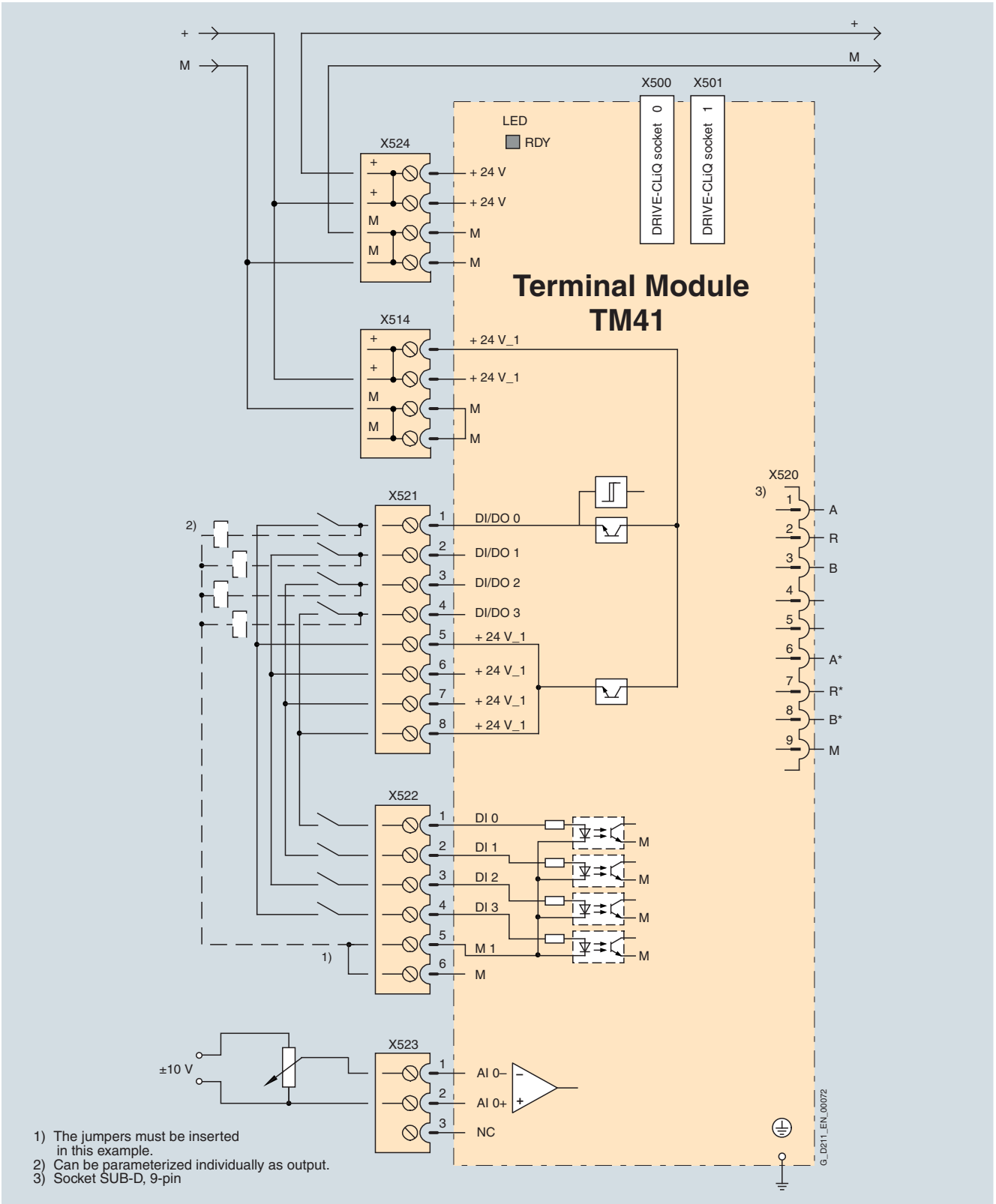
Selection and ordering data

Description	Order No.
TM41 Terminal Module (without DRIVE-CLiQ cable)	**6SL3055-0AA00-3PA0**

3

Integration

The TM41 Terminal Module communicates with a CU310, CU320 or SIMOTION D Control Unit via DRIVE-CLiQ.



Connection example of TM41 Terminal Module

TM41 Terminal Module

Technical specifications

TM41 Terminal Module	
Current requirement (X524 at 24 V DC) without DRIVE-CLiQ supply or digital outputs (X514)	0.2 A
• Conductor cross-section, max.	2.5 mm^2
• Fuse protection, max.	20 A
I/O	
• Digital inputs/outputs	Individually parameterizable as DI or DO
• Number of digital inputs/ outputs	4
• Number of digital input/ outputs (with isolation)	4
• Connection method	Plug-in screw-type terminals
• Conductor cross-section, max.	1.5 mm^2
Digital inputs	
• Voltage	
- Digital inputs without isolation	-3 V ... +30 V
- Digital inputs with isolation	-30 V ... +30 V
• Low level (an open digital input is interpreted as "low")	
- Digital inputs without isolation	-3 V ... +5 V
- Digital inputs with isolation	-30 V ... +5 V
• High level	15 … 30 V
• Current consumption at 24 V DC, typ.	< 9 mA
• Delay times of digital inputs, max. [1]	
- L → H	3 ms
- H → L	3 ms
Digital outputs (sustained-short-circuit proof)	
• Voltage	24 V DC
• Load current per digital output, max.	0.5 A
• Delay times (ohmic load) [1]	
- L → H, typ. L → H, max.	50 µs 100 µs
- H → L, typ. H → L, max.	75 µs 150 µs
Analog input (difference)	
• Voltage range	-10 … +10 V
• Internal resistance	≥ 40 kΩ
• Resolution [2]	13 bit + sign

TM41 Terminal Module (continued)	
Pulse encoder emulation	
• Level	TTL (RS422), A+, A-, B+, B-, zero track N+, N-
• Limit frequency $f_{max.}$	256 kHz
• Ratio Encoder pulses : encoder emulation	1 : 1 with incremental encoder sin/cos and TTL/HTL (evaluation for resolver available soon)
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.	0.85 kg (2 lb)
Approvals	cULus (File No.: E164110)

1) The specified delay times refer to the hardware. The actual reaction time depends on the time slot in which the digital input/output is processed.

2) If the analog input is to be operated in the signal processing sense with continuously variable input voltage, the sampling frequency $f_a = 1/t_{time\ slice}$ must be at least twice the value of the highest signal frequency f_{max}.

Overview

The TM54F Terminal Module is a dual-processor I/O interface with 4 fail-safe digital outputs and 10 fail-safe digital inputs for utilization of the Safety Integrated functions of the SINAMICS S120 drive system over external actuators and sensors.

The Safety Integrated basic functions (STO, SBC and SS1) can either be controlled over the existing terminals on the Motor Module and the CU320 or CU310 Control Unit or over the TM54F Terminal Module. The Safety Integrated extended functions (SS2, SOS, SLS and SSM) can only be controlled over the TM54F Terminal Module or PROFIsafe.

The fail-safe digital inputs and outputs are configured on two channels with internal, cross-over data comparison using the two processors. A fail-safe digital output consists of one current sourcing and one current sinking output as well as a digital input for reading back the switching state. A fail-safe digital input consists of two digital inputs.

Safety sensors can be connected via two switchable 24 V sensor supplies and can be evaluated over the fail-safe digital inputs. The switchable 24 V sensor supply ensures that the fail-safe digital inputs can be operated with dynamic response for error discovery (dynamic response serves for testing the switch-off signal paths). An unswitchable 24 V sensor supply is additionally provided by the TM54F Terminal Module for connecting safety sensors which cannot be operated dynamically.

A TM54F Terminal Module can be connected to a CU310 or CU320 Control Unit, a SIMOTION D or SIMOTION CX32 over DRIVE-CLiQ. Additional stations can be operated on the same DRIVE-CLiQ line, e.g. Terminal Modules, Sensor Modules and Motor Modules (but not an additional TM54F Terminal Module).

Design

The following are located on the TM54F Terminal Module:

- 4 fail-safe digital outputs
- 10 fail-safe digital inputs
- 4 LEDs, single color for indicating the status of the read back channel of the fail-safe digital outputs
- 4 LEDs, dual-color for indicating the status of the fail-safe digital outputs
- 20 LEDs, dual-color for indicating the status of the fail-safe digital inputs
- 3 LEDs, single color for indicating the status of the 24 V sensor supplies
- 2 DRIVE-CLiQ sockets
- 2 connections for 24 V sensor supply, switchable
- 1 connection for 24 V sensor supply, not switchable
- 1 connection for the electronic power supply via the 24 V DC rectifier connector
- 1 connection for the 24 V power supply to digital outputs and sensors
- 1 PE/ground conductor connection

The TM54F Terminal Module can be snapped on a TH 35 top-hat rail in accordance with EN 60715 (IEC 60715).

The signal cable shield can be connected to the TM54F Terminal Module via a terminal element, e.g. Phoenix Contact type SK8 or Weidmüller type KLBÜ CO 1. The terminal element must not be used for strain relief.

The status of the TM54F Terminal Module is indicated via a multi-color LED.

Pins for connector coding are supplied with the TM54F Terminal Module.

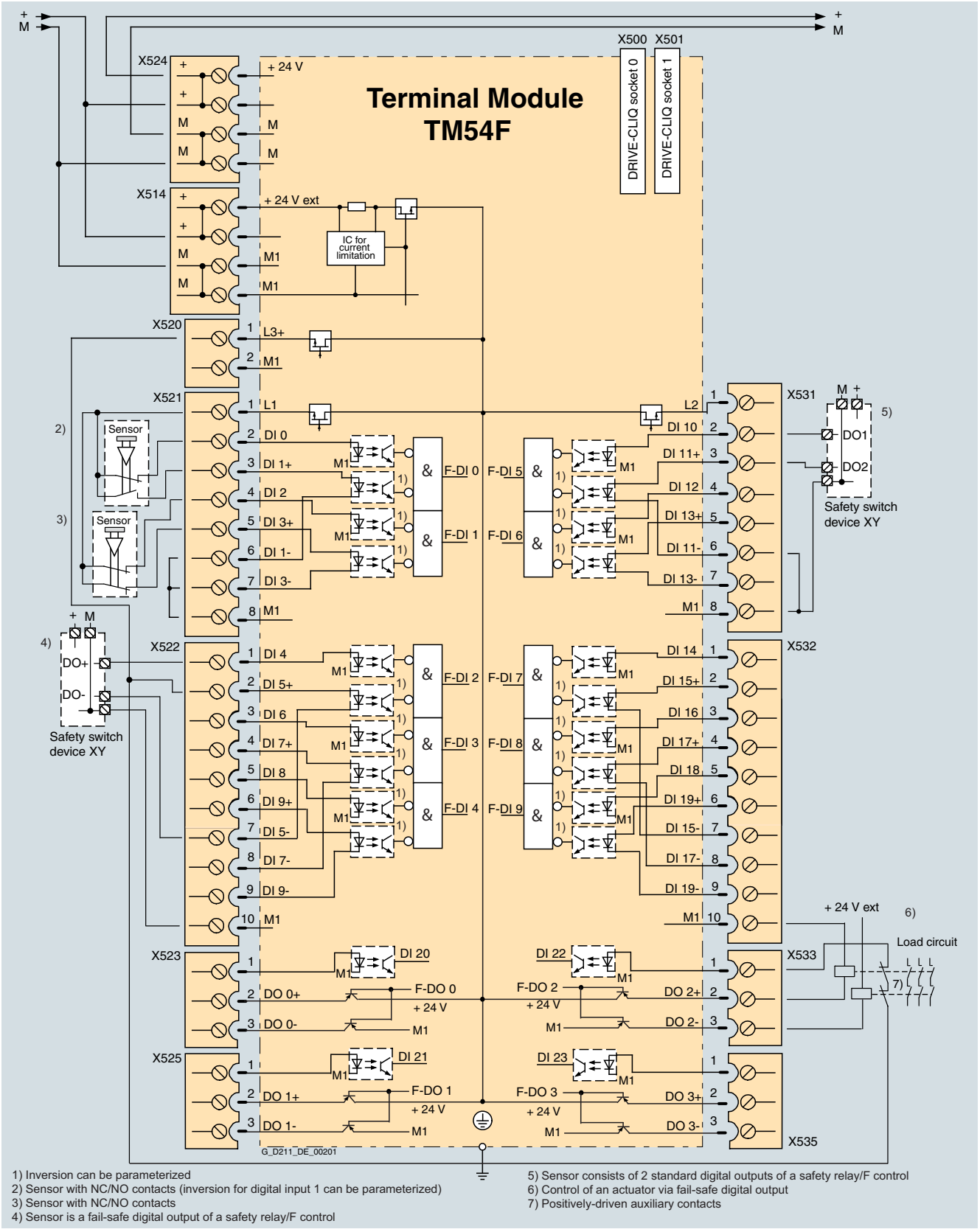
Selection and ordering data

Description	Order No.
TM54F Terminal Module (without DRIVE-CLiQ cable)	**6SL3055-0AA00-3BA0**

TM54F Terminal Module

Integration

The TM54F Terminal Module communicates with a CU310, CU320, SIMOTION D or SIMOTION CX32 Control Unit via DRIVE-CLiQ.



1) Inversion can be parameterized
2) Sensor with NC/NO contacts (inversion for digital input 1 can be parameterized)
3) Sensor with NC/NO contacts
4) Sensor is a fail-safe digital output of a safety relay/F control
5) Sensor consists of 2 standard digital outputs of a safety relay/F control
6) Control of an actuator via fail-safe digital output
7) Positively-driven auxiliary contacts

Connection example of TM54F Terminal Module

Technical specifications

TM54F Terminal Module	
Current requirement (X524 at 24 V DC) without DRIVE-CLiQ supply	0.2 A
• Conductor cross-section, max.	2.5 mm^2
• Fuse protection, max.	20 A
Max. current requirement ext. 24 V for supplying the digital outputs and 24 V sensor supply (X514 at 24 V DC)	4 A
• Conductor cross-section, max.	2.5 mm^2
• Fuse protection, max.	20 A
I/O	
• Number of fail-safe digital inputs	10
• Number of fail-safe digital outputs	4
• 24 V sensor supply	3 of which 2 can be temporarily shut down using a safety function for dynamic operation of fail-safe digital inputs, current carrying capacity 0.5 A each
• Connection method	Plug-in screw-type terminals
• Conductor cross-section, max.	1.5 mm^2
Digital inputs (with isolation)	
• Voltage	-30 … +30 V
• Low level (an open digital input is interpreted as "low")	-30 … +5 V
• High level	15 … 30 V
• Current consumption at 24 V DC, typ.	3.7 mA
• Delay time of digital inputs, approx. [1]	150 µs
• Safe state	Low level (for inputs that can be inverted: without inversion)
Digital outputs (sustained-short-circuit proof)	
• Voltage	24 V DC
• Load current per fail-safe digital output, max. [2]	0.5 A
• Delay times (ohmic load) [1]	150 µs
• Safe state	Output switched off
Scanning cycle t_{SI} for fail-safe digital inputs or fail-safe digital outputs	4 ... 25 ms (adjustable)
Response time	
• Fail-safe digital input → Motor Module	2 × t_{SI} + 1 ms + 3 × DRIVE-CLiQ cycle
• Motor Module → Fail-safe digital output	2 × t_{SI} + 3 × DRIVE-CLiQ cycle

TM54F Terminal Module (continued)	
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.	0.9 kg (2 lb)
Approvals	cULus (File No.: E164110)
Safety Integrated	Safety Integrity Level 2 (SIL2) in accordance with IEC 61508, control category 3 in accordance with EN 954-1

1) The specified delay times refer to the hardware. The actual reaction time depends on the time slot in which the digital input/output is processed.

2) The total current of all fail-safe digital outputs must not exceed 5.33 A.

VSM10 Voltage Sensing Module

Overview

The VSM10 Voltage Sensing Module can detect the exact line voltage characteristic and supports fault-free operation of Line Modules when power supply conditions are unfavorable, e.g. with severe voltage fluctuations or short-time interruptions.

The VSM10 Voltage Sensing Module is integrated in chassis format Active Interface Modules. It can be used optionally with all booksize format Active Line Modules and 16 kW or 36 kW Smart Line Modules.

Design

The VSM10 Voltage Sensing Module has the following interfaces:

- 1 connection for direct line voltage detection up to 690 V
- 1 connection for line voltage detection using voltage transformers, maximum voltage 100 V
- 2 analog inputs (reserved for resonance monitoring in Active Interface Modules in chassis format)
- 1 temperature sensor input (KTY84-130 or PTC)
- 1 DRIVE-CLiQ socket
- 1 connection for the electronics power supply via the 24 V DC power supply connector
- 1 PE (protective earth) connection

The VSM10 Voltage Sensing Module can be snapped onto a TH 35 top-hat rail to EN 60715 (IEC 60715).

The status of the VSM10 Voltage Sensing Module is indicated by a two-color LED.

Technical specifications

VSM10 Voltage Sensing Module	
Current requirement at 24 V DC, max.	0.15 A
• Connectable cross-section, max.	2.5 mm^2
Power loss, approx.	7.2 W
Line voltage detection	
• Input resistance	
- Terminal X521	> 362 kΩ/period
- Terminal X522	> 2.5 kΩ/period
Analog inputs (reserved for the monitoring of an Active Interface Module in chassis format)	
• Internal resistance (between the differential inputs)	ca. 100 kΩ
• Resolution	12 bit
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.	0.9 kg (2 lb)
Approvals	cULus (File No.: E164110)

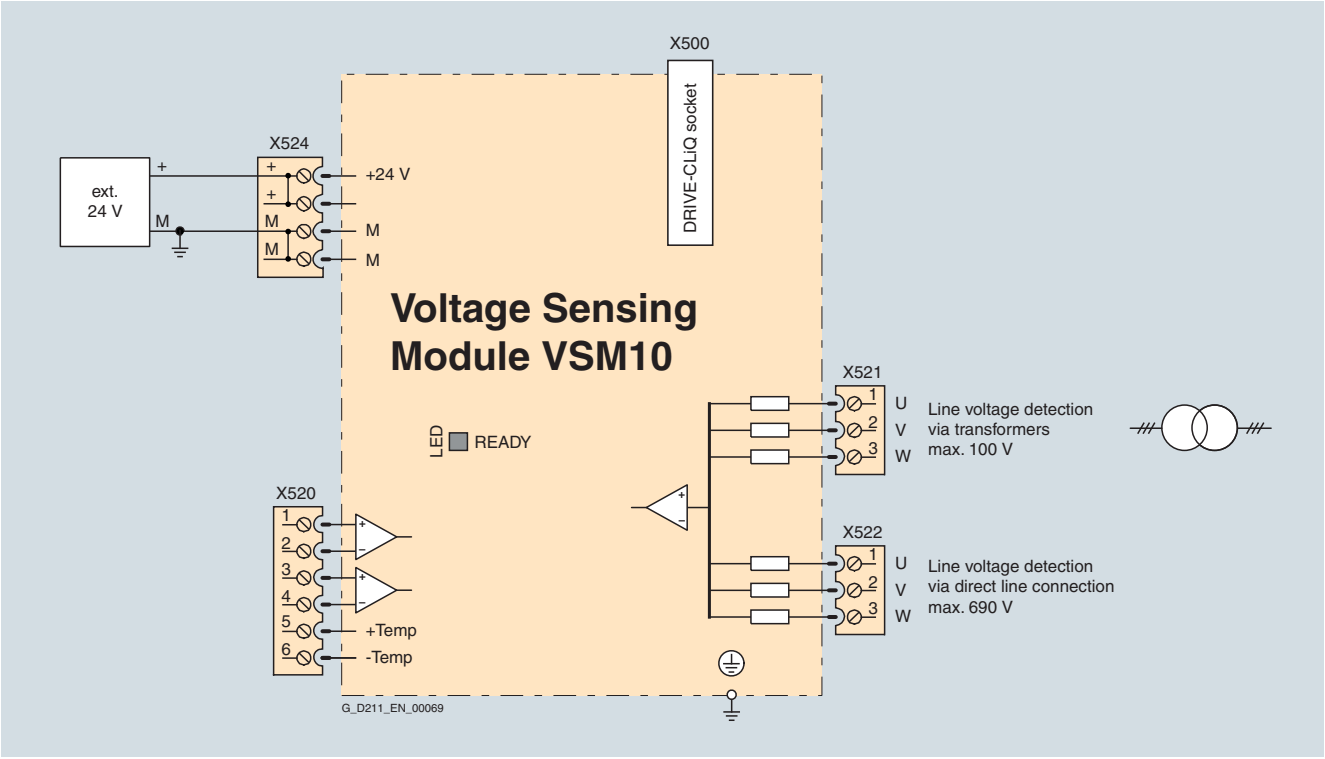
Selection and ordering data

Description	Order No.
VSM10 Voltage Sensing Module (without DRIVE-CLiQ cable)	**6SL3053-0AA00-3AA0**

3

Integration

The VSM10 Voltage Sensing Module communicates with the CU320 or SIMOTION D4x5 Control Unit via DRIVE-CLiQ.



Connection example of VSM10 Voltage Sensing Module

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.

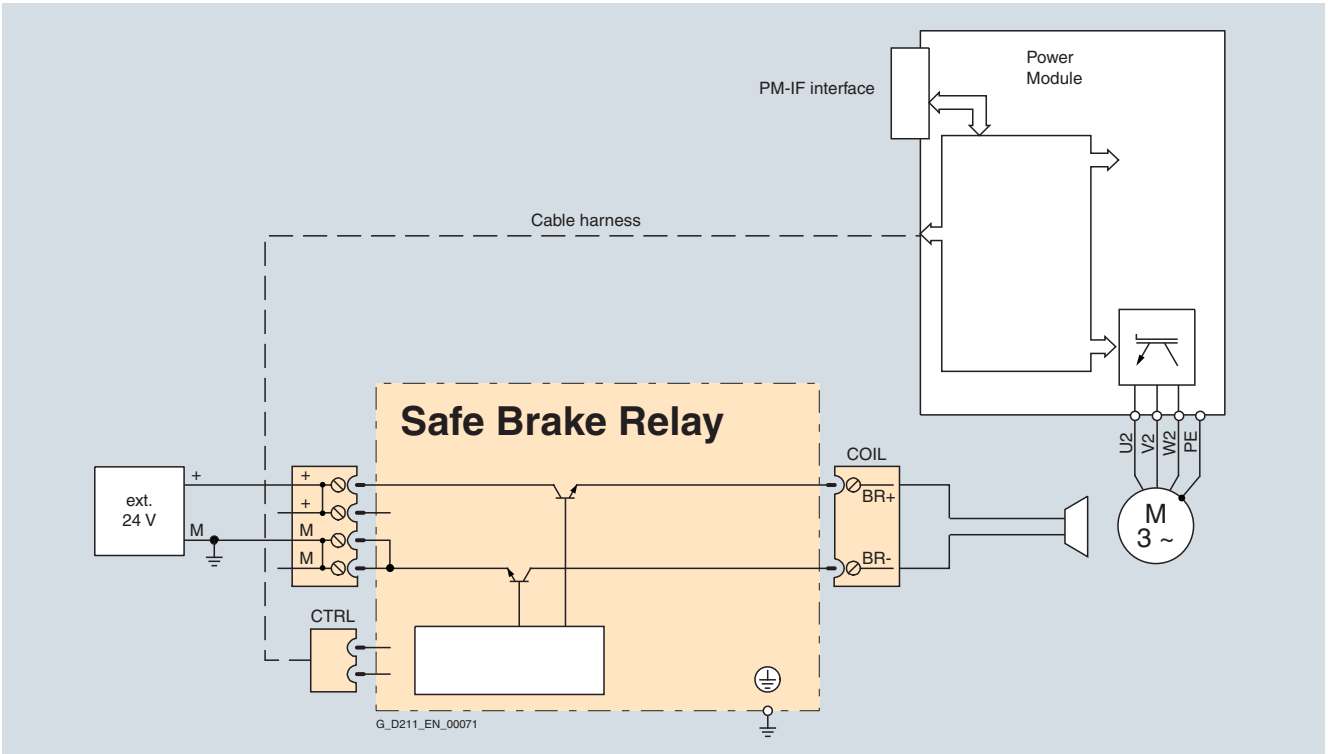
Technical specifications

	Safe Brake Relay
Switching capacity of the NO contact	–
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

Motors with DRIVE-CLiQ interface

DRIVE-CLiQ is the preferred method for connecting the encoder systems to SINAMICS S120.

Motors with DRIVE-CLiQ interface are available for this purpose, e.g.

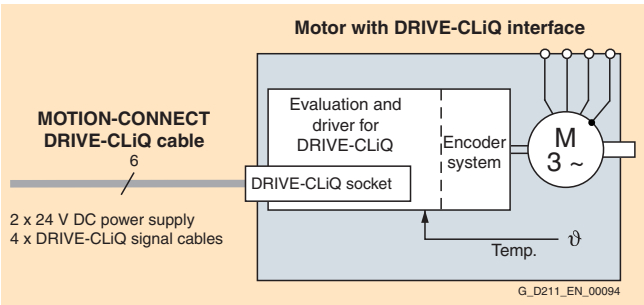
- 1FT6/1FT7/1FK7 synchronous motors
- 1FW3 torque motors
- 1PH7/1PL6/1PH4 asynchronous motors

Motors with DRIVE-CLiQ interface can be directly connected to the associated Motor Module via the available MOTION-CONNECT DRIVE-CLiQ cables. The connection of the MOTION-CONNECT DRIVE-CLiQ cable at the motor has degree of protection IP67.

The DRIVE-CLiQ interface supplies the motor encoder via the integrated 24 V DC supply and transfers the motor encoder and temperature signals and the electronic rating plate data, e.g. a unique identification number, rated data (voltage, current, torque) to the Control Unit.

This means that for the various encoder types - e.g. resolver or absolute encoder - different encoder cables with varying permissible lengths are now no longer required; just one cable type, MOTION-CONNECT DRIVE-CLiQ, can be used for all encoders.

These motors simplify commissioning and diagnostics, as the motor and encoder type are identified automatically.



Motors without DRIVE-CLiQ interface

The encoder and temperature signals of motors without DRIVE-CLiQ interface, as well as those of external encoders, must be connected via Sensor Modules. Sensor Modules Cabinet-Mounted are available in degree of protection IP20 for control cabinet installation, as well as Sensor Modules External-Mounted (degree of protection IP67).

Only one encoder system can be connected to each Sensor Module.

Technical specifications

Motors with DRIVE-CLiQ interface

Built-in encoder systems	• 22 bit incremental encoder (2048 S/R internal) • Absolute encoder single-turn + 12 bit multi-turn (traversing range 4096 revolutions) - 22 bit single-turn (2048 S/R internal) - 20 bit single-turn (512 S/R internal) - 16 bit single-turn (32 S/R internal) - 15 bit single-turn (16 S/R internal) • 15 bit resolver • 14 bit resolver
Power requirement at 24 V DC, max. (supplied over DRIVE-CLiQ MOTION-CONNECT cable)	190 mA
DRIVE-CLiQ cable length, max.	
• When using MOTION-CONNECT 500 DRIVE-CLiQ cables	100 m (328 ft)
• When using MOTION-CONNECT 800 DRIVE-CLiQ cables	50 m (164 ft)

SMC10 Sensor Module Cabinet-Mounted

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 Sensor Module Cabinet-Mounted 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 electronic 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 Sensor Module Cabinet-Mounted via a shield connection terminal, e.g. Phoenix Contact type SK8 or Weidmüller type KLBÜ CO 1.

Integration

SMC10 Sensor Modules Cabinet-Mounted communicate 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 resolver
• 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**

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} (firmware version 2.4 and later)

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

Design

The SMC20 Sensor Module Cabinet-Mounted 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 electronic power supply via the 24 V DC power supply connector
- 1 PE/ground conductor connection

The status of the SMC20 Sensor Module Cabinet-Mounted is indicated via a multi-color LED.

The SMC20 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 SMC20 Sensor Module Cabinet-Mounted via a shield connection terminal, e.g. Phoenix Contact type SK8 or Weidmüller type KLBÜ CO 1.

Integration

SMC20 Sensor Modules Cabinet-Mounted communicate 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} (firmware version 2.4 and later)
• 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	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.
SMC20 Sensor Module Cabinet-Mounted (without DRIVE-CLiQ cable)	**6SL3055-0AA00-5BA1**

SMC30 Sensor Module Cabinet-Mounted

Overview

The SMC30 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 SMC30.

The following encoder signals can be evaluated:

- Incremental encoders TTL/HTL with/without open-circuit detection (open-circuit detection is only available with bipolar signals)
- SSI encoder with TTL/HTL incremental signals
- SSI encoder without incremental signals

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

Design

The SMC30 Sensor Module Cabinet-Mounted 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 or terminals
- 1 connection for the electronics power supply via the 24 V DC power supply connector
- 1 PE (protective earth) connection

The status of the SMC30 Sensor Module Cabinet-Mounted is indicated via a multi-color LED.

The SMC30 Sensor Module Cabinet-Mounted can be snapped on a TH 35 top-hat rail in accordance with EN 60715 (IEC 60715).

The maximum encoder cable length between SMC30 modules and encoders is 100 m (328 ft). For HTL encoders, this length can be increased to 300 m (984 ft) if signals A+/A- and B+/B- are evaluated and the power supply cable has a minimum cross section of 0.5 mm^2.

The signal cable shield can be connected to the SMC30 Sensor Module Cabinet-Mounted via a shield connection terminal, e.g. Phoenix Contact type SK8 or Weidmüller type KLBÜ CO 1.

Integration

SMC30 Sensor Modules Cabinet-Mounted communicate with a Control Unit via DRIVE-CLiQ.

Technical specifications

SMC30 Sensor Module Cabinet-Mounted	
Power 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 TTL/HTL • SSI encoder with TTL/HTL incremental signals • SSI encoder without incremental signals
• Encoder supply	24 V DC/0.35 A or 5 V DC/0.35 A
• Encoder frequency, max.	300 kHz
• SSI baud rate	100 … 250 kBaud
• Limiting frequency	300 kHz
• Resolution absolute position SSI	30 bit
• Cable length, max.	
- TTL encoder	100 m (328 ft) (only bipolar signals permitted) [1]
- HTL encoder	100 m (328 ft) for unipolar signals 300 m (984 ft) for bipolar signals [1]
- SSI encoder	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 (1 lb)
Approvals	cULus (File No.: E164110)

Selection and ordering data

Description	Order No.
SMC30 Sensor Module Cabinet-Mounted (without DRIVE-CLiQ cable)	**6SL3055-0AA00-5CA2**

[1] Signal cables twisted in pairs and shielded.

Overview

SME20/SME25 Sensor Modules External are encoder evaluation units for machine encoders (direct measuring systems). The devices are designed with IP67 degree of protection. This means that the units can be installed outside the control cabinet near the machine encoder.

The following encoder signals can be evaluated:

- Incremental encoder sin/cos 1 V_{PP} without rotor position track (C/D track)
- Absolute encoder EnDat
- Absolute encoder SSI with incremental signals sin/cos 1 V_{pp} (firmware version 2.4 and later)

SME20/SME25 Sensor Modules External evaluate the encoder signals and convert the information obtained to DRIVE-CLiQ. Neither motor nor encoder data are saved in the SME20/SME25.

Design

SME20/SME25 Sensor Modules External feature the following interfaces as standard:

- 1 DRIVE-CLiQ interface
- 1 encoder connector (circular plug)
- 24 V DC electronics power supply via DRIVE-CLiQ link from the Control Unit/Motor Module
- 1 PE (protective earth) connection

Integration

SME20/SME25 Sensor Modules External communicate with a Control Unit via DRIVE-CLiQ.

Selection and ordering data

Description	Order No.
SME20 Sensor Module External for incremental measuring systems (without DRIVE-CLiQ cable)	**6SL3055-0AA00-5EA0**
SME25 Sensor Module External for absolute measuring systems (without DRIVE-CLiQ cable)	**6SL3055-0AA00-5HA0**

Technical specifications

		SME20 Sensor Module External	SME25 Sensor Module External
Encoder		• Incremental encoder sin/cos 1 V_{pp} with 5 V power supply	• Absolute encoder EnDat with 5 V power supply • Absolute encoder SSI with incremental signals sin/cos 1 V_{pp} with 5 V voltage supply
Signal subdivision (interpolation)		≤ 16384 times (14 bit)	≤ 16384 times (14 bit)
Measuring system interface		12-pin M23 circular connector	17-pin M23 circular connector
Outlet		IP67 DRIVE-CLiQ connector	IP67 DRIVE-CLiQ connector
Current requirement at 24 V DC, max. not taking encoder into account	A	0.11	0.11
• Conductor cross-section, max.		In accordance with connector contacts	In accordance with connector contacts
• Fuse protection, max.		Via DRIVE-CLiQ power supply source	Via DRIVE-CLiQ power supply source
Power loss	W	< 10	< 10
PE connection		M4 screw/1.8 Nm	M4 screw/1.8 Nm
Cable length, max.			
• to measuring system	m (ft)	3 (9.84)	3 (9.84)
• to automatic speed control	m (ft)	100 (328)	100 (328)
Degree of protection		IP67	IP67
Dimensions			
• Width	mm (in)	58 (2.28)	58 (2.28)
• Height	mm (in)	44 (1.73)	44 (1.73)
• Depth	mm (in)	112 (4.41)	112 (4.41)
Weight, approx.	kg (lb)	0.18 (0.40)	0.18 (0.40)
Approvals		cULus available soon	cULus available soon

SME120/SME125 Sensor Modules External

Overview

The SME120/SME125 Sensor Modules External are encoder evaluation units with degree of protection IP67, especially suitable for use in linear and torque motor applications. They can be installed close to the motor systems and encoders in the machine.

Sensor Modules External evaluate the encoder signals and motor temperature sensors specifically and convert the information obtained for DRIVE-CLiQ. The motor temperature signals are safely electrically separated.

A hall effect sensor box can be connected for the SME120 to determine the commutation position of a linear motor.

Neither motor nor encoder data are saved in the SME120/SME125.

The SME120 and SME125 can be operated on Control Units with firmware release V2.4 and later.

The following encoder signals can be evaluated depending on the type of Sensor Module:

- Incremental encoder sin/cos 1 V_{pp}
- Absolute encoder EnDat

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

Design

SME120/SME125 Sensor Modules External feature the following interfaces as standard:

- 1 DRIVE-CLiQ interface
- 1 encoder connection (circular connector)
- 1 temperature sensor connection (circular connector)
- 1 hall effect sensor connection (circular connector) (SME120 only)
- 24 V DC electronic power supply via DRIVE CLiQ link from the Control Unit or Motor Module
- 1 PE/ground conductor connection

Selection and ordering data

Description	Order No.
SME120 Sensor Module External for incremental measuring systems (without DRIVE-CLiQ cable)	**6SL3055-0AA00-5JA0**
SME125 Sensor Module External for absolute measuring systems (without DRIVE-CLiQ cable)	**6SL3055-0AA00-5KA0**

Technical specifications

		SME120 Sensor Module External	SME125 Sensor Module External
Encoder		• Incremental encoder sin/cos 1 V_{pp} with 5 V power supply	• Absolute encoder EnDat with 5 V power supply
Signal subdivision (interpolation)		≤ 16384 times (14 bit)	≤ 16384 times (14 bit)
Measuring system interface		12-pin M23 circular connector	17-pin M23 circular connector
Temperature sensor input		6-pin M17 circular connector	6-pin M17 circular connector
Hall effect sensor input		9-pin M23 circular connector	–
Outlet		IP67 DRIVE-CLiQ connector	IP67 DRIVE-CLiQ connector
Current requirement at 24 V DC, max. not taking encoder into account	A	0.16	0.16
• Current carrying capacity of the encoder supply, max. for measuring system (at 5 V DC) and, where applicable, including hall effect sensor box	A	0.35	0.35
• Conductor cross-section, max.		In accordance with connector contacts	In accordance with connector contacts
• Fuse protection, max.		Via DRIVE-CLiQ power supply source	Via DRIVE-CLiQ power supply source
Power loss	W	< 15	< 15
PE connection		M4 screw/1.8 Nm	M4 screw/1.8 Nm
Cable length, max.			
• to measuring system/temperature sensor	m (ft)	3 (9.84)	3 (9.84)
• to automatic speed control	m (ft)	100 (328)	100 (328)
Degree of protection		IP67	IP67
Dimensions			
• Width	mm (in)	117.6 (4.63)	117.6 (4.63)
• Height	mm (in)	44 (1.73)	44 (1.73)
• Depth	mm (in)	127 (5.00)	127 (5.00)
Weight, approx.	kg (lb)	0.4 (0.88)	0.4 (0.88)
Approvals		cULus (File No.: E164110)	cULus (File No.: E164110)

4 Synchronous motors

Overview

Type overview and rated data

	Motor type	Designation/ Principle of operation	Degree of protection	Cooling method
	**1FT6**	Servo motor – High Performance Permanent-magnet synchronous motor	IP64 (optional IP65, IP67, IP68)	Natural cooling Forced ventilation Water cooling
	**1FT7 Compact**	Servo motor – High Performance Permanent-magnet synchronous motor	IP64 (optional IP65, IP67)	Natural cooling
	**1FK7 Compact**	Compact servo motor Permanent-magnet synchronous motor	IP64 (optional IP65)	Natural cooling
	1FK7 High Dynamic	High Dynamic servo motor with extremely low moment of inertia	IP64 (optional IP65)	Natural cooling
	1FK7-DYA	Compact geared motor	IP64	Natural cooling
	1FK7	Servo geared motor	IP65	Natural cooling
	**1FS6**	Servo motor – explosion-protected Permanent-magnet synchronous motor in type of protection EEx de II C T3	IP64 (optional IP65)	Natural cooling
	**1FW3**	Torque motor Liquid cooled, permanent-magnet synchronous motor	IP54	Water cooling
	**1FU8**	SIEMOSYN motor Permanent-magnet synchronous motor	IP54 (2-pole) IP55 (4-/6-pole)	Natural cooling

Type overview and rated data

Shaft height	Output range in kW/HP	Torque range in Nm/lb_f-in	Selection and ordering
	0.01 … 0.1 … 1 … 10 … 100 … 1000		
28 … 132	0.2 (0.3) … 15.5 (21)	0.3 … 88 (2.7 … 779 lb_f-in)	4/16 … 4/27
80 … 160	6.9 (9.3) … 89 (119)	17 … 540 (151 … 4779 lb_f-in)	4/28 … 4/33
63 … 160	3.2 (4.3) … 118 (158)	10 … 690 (89 … 6107 lb_f-in)	4/34 … 4/37
36 … 100	0.9 (1.21) … 10.5 (14)	1.4 … 61 (12.4 … 540 lb_f-in)	4/40 … 4/51
20 … 160	0.05 (0.07) … 8.2 (11)	0.08 … 37 (0.7 … 327 lb_f-in)	4/54 … 4/55 4/58 … 4/59
36 … 80	0.6 (0.8) … 3.1 (4.2)	0.9 … 12 (8 … 106 lb_f-in)	4/56 … 4/59
36 … 80	0.4 (0.5) … 1.9 (2.6)	6.5 … 70 (57.5 … 619 lb_f-in)	4/82 … 4/83
36 … 100	0.3 (0.4) … 8.0 (10.7)	3.6 … 1740 (2.7 … 1283 lb_f-ft)	4/86 … 4/112
71 … 132	1.2 (1.6) … 12.4 (16.6)	1.9 … 68 (17 … 602 lb_f-in)	4/120 … 4/121
150 200 280	3.1 (4.2) … 177 (237)	100 … 7000 (73.8 … 5163 lb_f-ft)	4/124 … 4/135
71 … 160	0.31 (0.4) … 22.9 (31)	1.3 … 59.6 (11.5 … 528 lb_f-in)	See Catalog DA 48

Technical definitions

4

Regulations, standards and specifications

The motors comply with the appropriate standards and regulations, see table below.

As a result of the fact that in many countries the national regulations have been completely harmonized with the international IEC 60034-1 recommendation, there are no longer any differences with respect to coolant temperatures, temperature classes and temperature rise limits.

The motors listed below are UL-approved by "Underwriters Laboratories Inc.®" and also comply with Canadian URc standards: 1FK7, 1FT6, 1FT7, 1FW3, 1PH7 (without brake), 1PL6, PH4.

1FS6 EX motors are CSA - approved.

Title	DIN/VDE	DIN IEC
General specifications for rotating electrical machines	DIN VDE 0530 Part 1	DIN IEC 60034-1
Terminal designations and direction of rotation for electrical machines	DIN VDE 0530 Part 8	DIN IEC 60034-8
Types of rotating electrical machines	DIN VDE 0530 Part 7	DIN IEC 60034-7
Cooling methods of rotating electrical machines	DIN VDE 0530 Part 6	DIN IEC 60034-6
Degrees of protection of rotating electrical machines	DIN VDE 0530 Part 5	DIN IEC 60034-5
Vibration severity of rotating electrical machines	DIN VDE 0530 Part 14	DIN IEC 60034-14
Noise limit values for rotating electrical machines	DIN VDE 0530 Part 9	DIN IEC 60034-9
Cylindrical shaft extensions for electrical machines	DIN 748 Part 3	DIN IEC 60072

The most common degrees of protection for AC motors in accordance with IEC 60034-5

A suitable degree of protection must be selected to protect the machine against the following hazards depending on the relevant operating and environmental conditions:

- Ingress of water, dust and solid foreign objects;
- contact with or approach to rotating parts inside a motor and
- contact with or approach to live parts.

Degrees of protection of electric motors are specified by a code. This comprises of 2 letters, 2 digits and, if required, an additional letter.

IP (International Protection)
Code letter designating the degree of protection against contact and the ingress of solid foreign objects and water

0 to **6**
1st digit designating the degree of touch protection and protection against ingress of solid foreign objects

0 to **8**
2nd digit designating the degree of protection against ingress of water (no oil protection)

W, S and **M**
Additional code letters for special degrees of protection

Most motors are supplied with the following degrees of protection:

Motor	Degree of protection	1st digit Touch protection	Protection against foreign objects	2nd digit Protection against water
Internally cooled	**IP23**	Protection against finger contact	Protection against medium-sized, solid foreign above 12 mm (0.47 in) Ø	Protection against spray water up to 60° from the vertical
Surface-cooled	**IP54**	Complete protection against accidental contact	Protection against harmful dust deposits	Splash water from any direction
	IP55			Jet-water from any direction
	IP64	Complete protection against accidental contact	Protection against dust ingress	Splash water from any direction
	IP65 [1]			Jet-water from any direction
	IP67 [1]			Motor under specified pressure and time conditions under water
	IP68 [1]			Motor can be completely submersed in water under conditions which the manufacturer must specify

[1] DIN VDE 0530 Part 5 or EN 60034 Part 5 specifies that there are only 5 degrees of protection for the first digit code and 8 degrees of protection for the second digit code in relation to rotating electrical machinery. However, IP6 is included in DIN 40050 which generally applies to electrical equipment.

Radial eccentricity tolerance, shaft and flange accuracy (concentricity and axial eccentricity) in accordance with IEC 60072

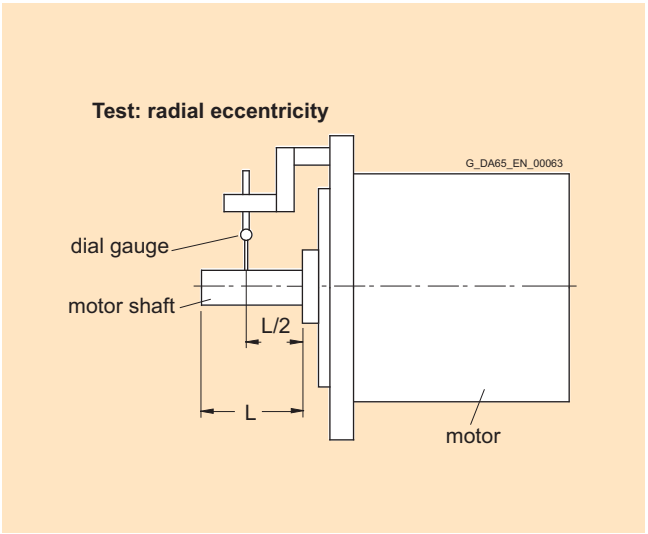
Radial eccentricity tolerance of shaft in relation to housing axis

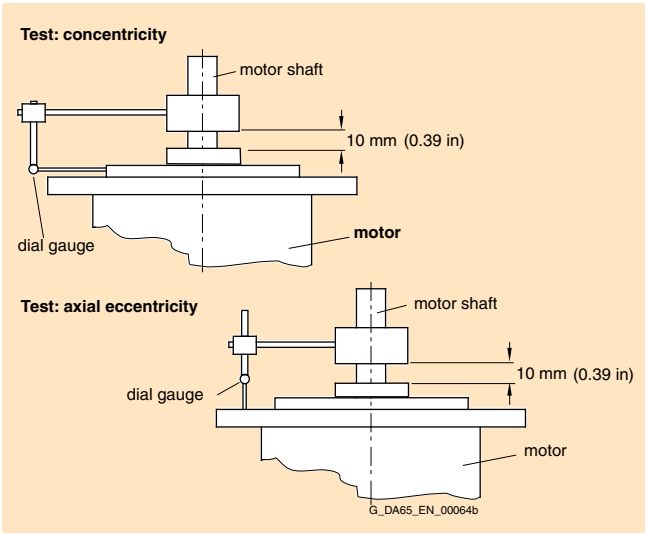
(refers to cylindrical shaft extensions)

Shaft height	Standard N mm (in)	Option R mm (in)
28, 36	0.035 (0.001)	0.018 (0.001)
48, 63, 71	0.04 (0.002)	0.021 (0.001)
80, 100, 132	0.05 (0.002)	0.025 (0.001)
160, 180, 225	0.06 (0.002)	0.03 (0.001)
280	0.07 (0.003)	0.035 (0.001)

Concentricity and axial eccentricity tolerance of the flange surface to the shaft axis (referred to the centering diameter of the mounting flange)

Shaft height	Standard N mm (in)	Option R mm (in)
28, 36, 48	0.08 (0.003)	0.04 (0.002)
63, 71, 80, 100	0.1 (0.004)	0.05 (0.002)
132, 160, 180, 225	0.125 (0.005)	0.063 (0.002)
280	0.16 (0.006)	0.08 (0.003)





Vibration severity and vibration magnitude Grade A according to DIN IEC 60034-14

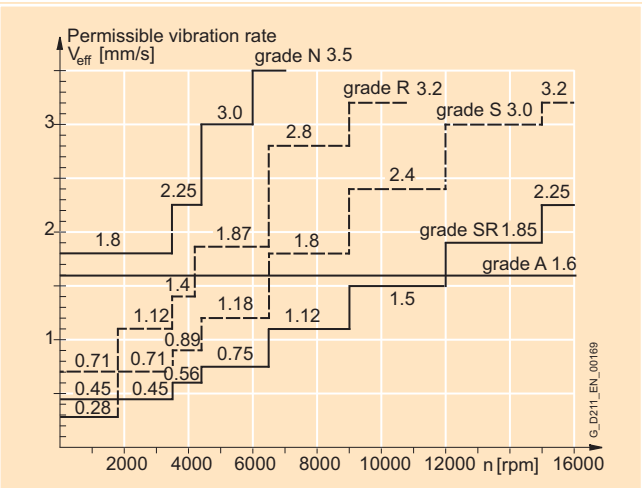
The vibration severity is the RMS value of the vibration velocity (frequency range from 10 to 1000 Hz). The vibration severity is measured using electrical measuring instruments in compliance with DIN 45666.

The values indicated refer only to the motor. These values can increase as a result of the overall system vibrational behavior due to installation.

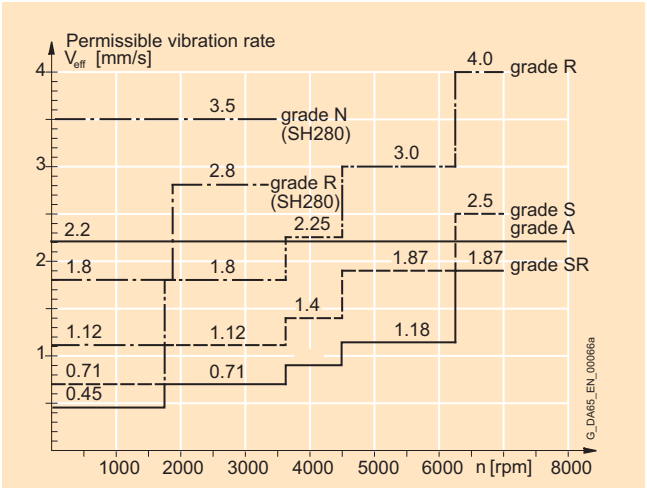
The speeds of 1800 rpm and 3600 rpm and the associated limit values are defined in accordance with IEC 60034-14. Speeds of 4500 rpm and 6000 rpm and the specified values are defined by the motor manufacturer.

Vibration magnitude Grade A

The motors maintain vibration magnitude Grade A up to rated speed.



Vibration severity limit values for shaft heights 20 to 132



Vibration severity limit values for shaft heights 160 to 280

Technical definitions

Balancing in accordance with DIN ISO 8821

Requirements placed on the process when balancing mounted components – especially belt pulleys

In addition to the balance quality of the motor, the vibration quality of motors with mounted belt pulleys and coupling is essentially determined by the balance quality of the mounted component.

If the motor and mounted component are separately balanced before they are assembled, then the process used to balance the belt pulley or coupling must be adapted to the motor balancing type. The following different balancing methods are used on motors of types 1PH4, 1PH7 and 1PL6:

- Half-key balancing
- Full-key balancing
- Plain shaft extension

The balancing method is encoded in the order designation for 1PH7 and 1PL6 motors. The letter "H" (half key) or "F" (full key) is printed on the shaft extension face to identify a half-key balanced or a full-key balanced motor.

1FK7, 1FT6 and 1FT7 motors with fitted key are always half-key balanced.

In general, motors with a plain shaft are recommended for systems with the most stringent vibrational quality requirements. For full-key balanced motors, we recommend belt pulleys with two opposite keyways, but only one fitted key in the shaft extension.

Vibration stress, immitted vibration values

The following maximum permissible vibration stress limits at full functionality apply only to 1FK7, 1FT6, 1FT7, 1FS6 and 1FW3 permanent-magnet synchronous motors.

Vibration stress (in accordance with DIN ISO 10816):

- 1 *g* (20 Hz to 2 kHz)

The following limits are valid for (immitted) vibration values introduced externally to all asynchronous motors of type 1PH7, 1PH4 and 1PL6:

Vibration frequency	Vibration values for	Shaft heights 100 to 160	180 to 280
<6.3 Hz	Vibration displacement *s*	≤ 0.16 mm (0.01 in)	≤ 0.25 mm (0.01 in)
6.3 ... 63 Hz	Vibration velocity V_{rms}	≤ 4.5 mm/s (0.18 in/s)	≤ 7.1 mm/s (0.28 in/s)
>63 Hz	Vibration acceleration *a*	≤ 2.55 m/s^2 (8.37 ft/s^2)	≤ 4.0 m/s^2 (13.12 ft/s^2)

The following limits are valid for (immitted) vibration values introduced externally to all torque motors of type 1FW3:

Vibration frequency	Vibration values for 1FW3	
<6.3 Hz	Vibration displacement *s*	≤ 0.26 mm (0.01 in)
6.3 ... 63 Hz	Vibration speed V_{am}	≤ 7.1 mm/s (0.28 in/s)
>63 Hz	Vibration acceleration *a*	≤ 4.0 m/s^2 (13.12 ft/s^2)

Coolant temperature (air) and installation altitude

Operation (unrestricted) CT = –15 °C to +40 °C (5 °F to 104 °F)

The rated power (rated torque) is applicable to continuous duty (S1) in accordance with EN 60034-1 at rated frequency, a coolant temperature (CT) of 40 °C (104 °F) and an installation altitude of 1000 m (3281 ft) above sea level.

All motors are in temperature class 155 (F) and utilized in accordance with temperature class 155 (F). For all other conditions, the factors given in the table on the right must be applied to determine the permissible output (torque).

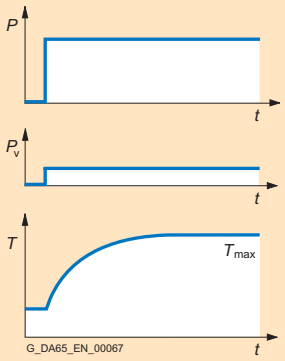
The coolant temperature and installation altitude are rounded to 5 °C (41 °F) and 500 m (1640 ft) respectively.

Note regarding the surface temperature: The surface of the motors can reach temperatures of over 100 °C (212 °F).

Installation altitude above sea level	Coolant temperature (CT) in °C (°F)			
in m (ft)	<30 (86)	30 to 40 (86 to104)	45 (113)	50 (122)
1000 (3281)	1.07	1.00	0.96	0.92
1500 (4922)	1.04	0.97	0.93	0.89
2000 (6562)	1.00	0.94	0.90	0.86
2500 (8203)	0.96	0.90	0.86	0.83
3000 (9843)	0.92	0.86	0.82	0.79
3500 (11484)	0.88	0.82	0.79	0.75
4000 (13124)	0.82	0.77	0.74	0.71

Duty types S1 and S6 in accordance with EN 0530

S1: Continuous operation duty-type

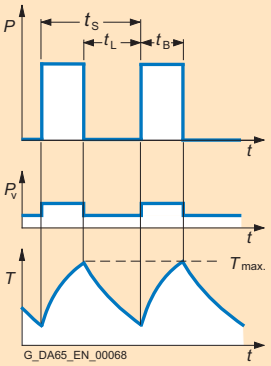


Duty cycle under constant load condition of sufficient duration to establish thermal equilibrium.

Designation: S1

Output specification (torque).

S6: Continuous operation duty-type



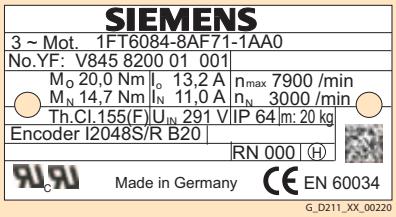
Duty cycle comprising a sequence of identical duty cycles, each of which consists of a period of constant load followed by an interval at no load. There are no de- energized intervals.

Designation:

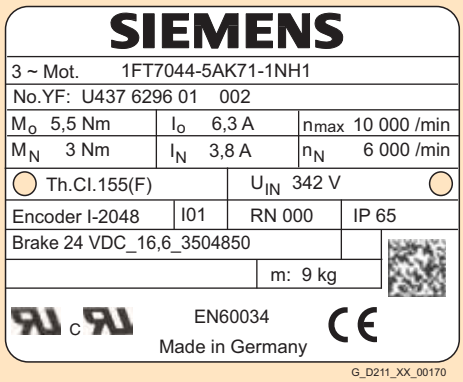
e.g.: S6 - 40 %, 85 kW. (114 HP).

$t_r = \frac{t_B}{t_B + t_L}, t_s = 10$ min

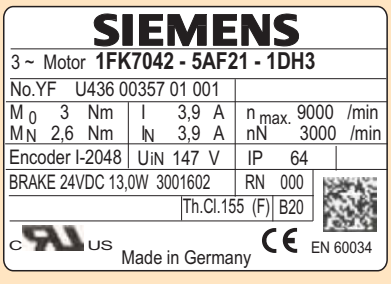
Rating plates



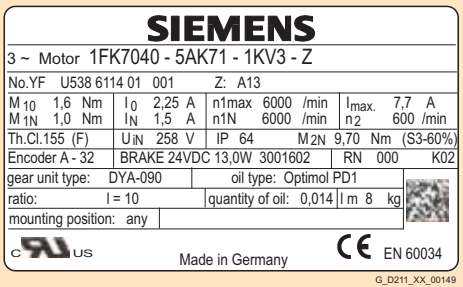
Example from the 1FT6 series (metal plate)



Example from the 1FT7 series (metal plate)



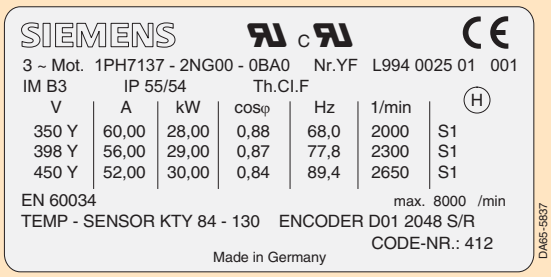
Example from the 1FK7 series with 300 V DC link voltage (adhesive plate)



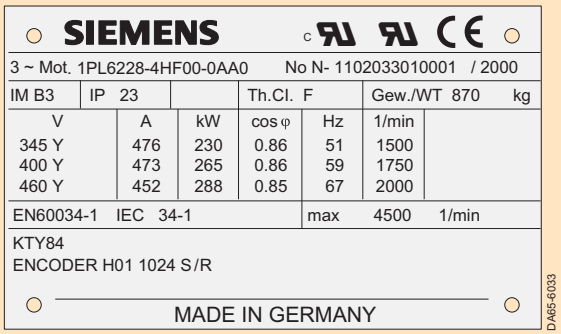
Example from the 1FK7-DYA series (adhesive plate)

Technical definitions

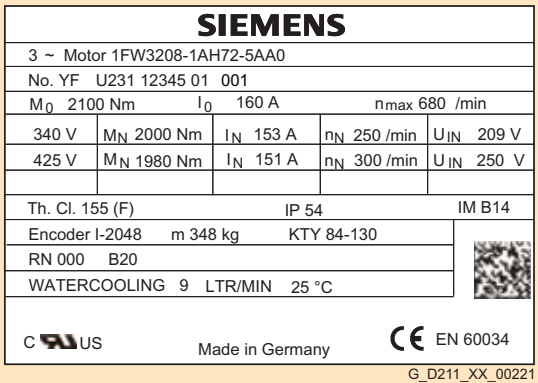
Rating plates



Example from the 1PH7 series, shaft heights 100 to 160 (adhesive plate)



Example from the 1PL6 series, shaft heights 180 to 280 (metal plate)



Example from the 1FW3 series (adhesive plate)

Rated torque

The torque supplied on the shaft is indicated in Nm/lb_f-in in the technical selection tables.

$$M_{rated} = P_{rated} \times \frac{9550}{n_{rated}}$$

P_{rated} Rated power in kW

n_{rated} Rated speed in rpm

M_{rated} Rated torque in Nm

$$M_{rated} = P_{rated} \times \frac{5250}{n_{rated}}$$

P_{rated} Rated power in HP

n_{rated} Rated speed in rpm

M_{rated} Rated torque in lb_f-ft

DURIGNIT IR 2000 insulation system

The DURIGNIT® IR 2000 insulating system consists of high-quality enamel wires and insulating sheeting in conjunction with a solvent-free resin impregnation.

This ensures that these motors will have a high mechanical and electrical strength, high service value and a long service life.

The insulation system protects the winding to a large degree against aggressive gases, vapors, dust, oil and increased air humidity. It can withstand the usual vibration stressing.

The motor insulation is tropicalized, i.e. suitable for air humidity levels of up to 100 %.

All motors are designed for temperature class 155 (F).

The utilization of these motors corresponds to temperature class 155 (F) at rated power/torque.

Motor protection

The KTY 84-130 temperature sensor is used to measure the motor temperature for converter-fed motor operation.

This sensor is a semi-conductor that changes its resistance depending on temperature in accordance with a defined curve.

Siemens converters determine the motor temperature using the resistance of the temperature sensor.

Their parameters can be set for specific alarm and shutdown temperatures.

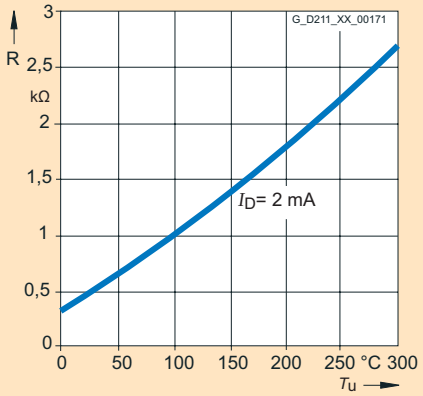
The KTY 84-130 temperature sensor is embedded in the winding overhang of the motor like a PTC thermistor.

The sensor is evaluated in the SINAMICS drive system as a standard function.

If the motors are operated on converters that do not feature a KTY 84 evaluation circuit, the temperature can be measured with the external 3RS10 temperature monitoring relay. For a detailed description, please refer to Catalog LV 10.

Example units:

- Control supply voltage: 24 V AC/DC
  Order No. 3RS1040-1GD50
- Control supply voltage: 24 to 240 V AC/DC
  Order No. 3RS1040-1GW50



Paint finish

The following paint finishes are available for the motors:

- Unpainted
  (coated with impregnating resin), e.g. 1FK7 or 1PH7
  (up to shaft height 160)
- Primed
  (for corrosion control), e.g. 1PH7, 1PL6 (shaft height 180 and above)
- Standard finish
  (e.g. RAL 7016), e.g. 1PH4, 1PH7, 1PL6, 1FK7, 1FS6, 1FW3
- Special finish
  (e.g. RAL 7016), e.g. 1FT6, 1FT7, 1PH7, 1PL6, 1FW3

All motors can be painted over with commercially available paint (up to 2 additional coats).

Version	Suitability of paint finish for climate group in accordance with DIN IEC 60721, Part 2 – 1		
Standard finish	**Moderate** (expanded) for indoor and outdoor installation with roof protection	Briefly: Continuous:	Up to 150 °C (302 °F) Up to 120 °C (248 °F)
Special finish	**Worldwide** (expanded) for outdoor installation	Briefly: Continuous:	Up to 150 °C (302 °F) Up to 120 °C (248 °F)
		Also:	For corrosive atmospheres up to 1% acid and alkali concentration or permanent dampness in sheltered rooms

Encoder systems/DRIVE-CLiQ interface

Motors with DRIVE-CLiQ interface

For motors with integrated DRIVE-CLiQ interface, the digital encoder resolution is specified in bits in the selection and ordering data. The encoder signal is converted to serial DRIVE-CLiQ protocol in the DRIVE-CLiQ interface. The motor-internal encoders are the same encoders that are used for motors without a DRIVE-CLiQ interface.

Explanation of the resolution of the encoder signal based on the example of the incremental encoder sin/cos 1 V_{pp} 2048 S/R

Motor without integral DRIVE-CLiQ interface

The analog encoder signal with 2048 increments is converted to a digital signal in the converter. The encoder signal is resolved within the converter to 2048 x 2048 = 4194304 signals.

In the selection and ordering data, the encoder is designated as "Incremental encoder sin/cos 1 V_{pp} 2048 S/R".

Motor with integrated DRIVE-CLiQ interface

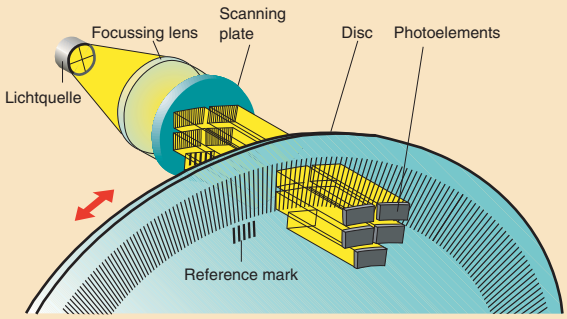
The analog encoder signal with 2048 increments is converted in the DRIVE-CLiQ interface to a digital signal with a resolution of 22 bits = 2^{22} = 4194304. There is no further conversion of the encoder signal in the converter.

The encoder is designated as "22 bit incremental encoder" in the selection and ordering data.

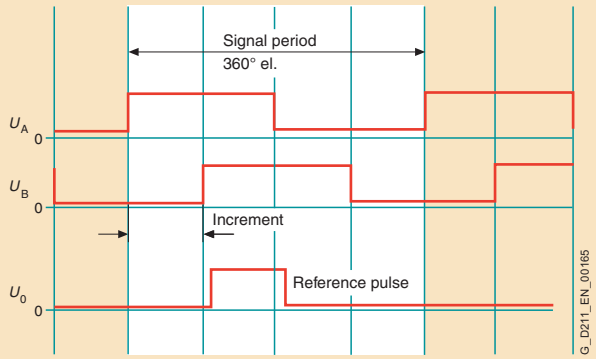
Encoder systems

HTL incremental encoder (1024 S/R or 2048 S/R)

Principle of operation: Photoelectric scanning



Output signals

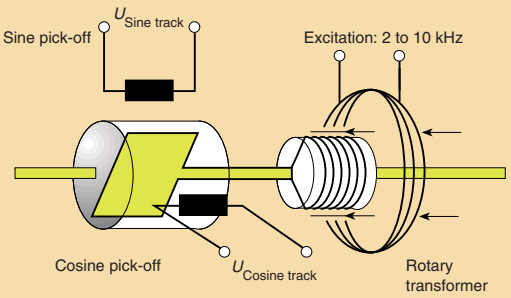


Technical specifications

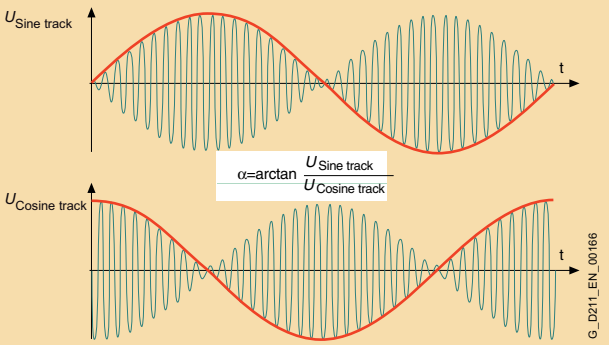
Supply voltage:	+10 ... 30 V
Output signals:	HTL Track A, track B Zero pulse and inverted signals
PPR count:	1024 (optional: 2048)
Accuracy:	±1'
Limit frequency (–3 dB):	160 kHz
Used for:	Asynchronous servomotors 1PH7, 1PL6, 1PH4
Max. possible connecting cable length	
- without transfer of inverted signals	150 m (492 ft)
- with transfer of inverted signals	300 m (984 ft)

Resolver, 2-pole/multi-pole [1)]

Principle of operation: Inductive scanning, sin/cos evaluation for rotor position



Output signals



Technical specifications

Operating voltage/frequency	+5 V/4 kHz
Output signals [2)]:	$U_{sine\ track} = r \times U_{excitation} \times \sin \alpha$ $U_{cosine\ track} = r \times U_{excitation} \times \cos \alpha$
Ratio:	$r = 0.5 \pm 5$ %
Angular error width:	< 5' (multi-pole) < 14' (2-pole) < 20' (2-pole in shaft heights 20/28)
Used for:	Synchronous servomotors 1FT6, 1FK7, 1FW3 Asynchronous servomotors 1PH7, 1PL6, 1PH4
Max. possible connecting cable length	150 m (492 ft) [3)]

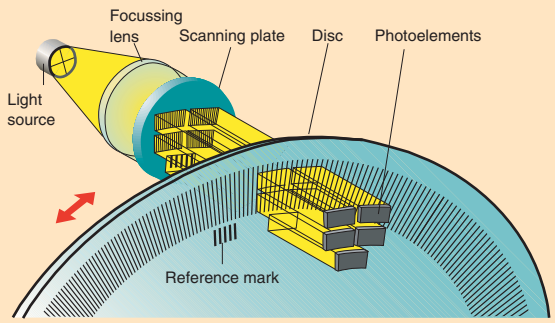
1) When a multi-pole resolver is used, the number of resolver poles matches the number of motor poles.

2) Output signals:
- 2-pole resolver:
  One sine/cos signal per revolution
- 4-pole resolver:
  Two sine/cos signals per revolution
- 6-pole resolver:
  Three sine/cos signals per revolution

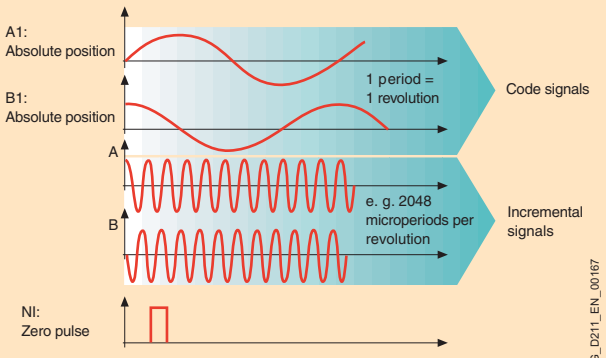
3) With DRIVE-CLiQ interface and MOTION-CONNECT 500: 100 m (328 ft)
With DRIVE-CLiQ interface and MOTION-CONNECT 800: 50 m (164 ft)

Incremental encoder sin/cos 1 V_{pp}

Principle of operation:Photoelectric scanning



Output signals

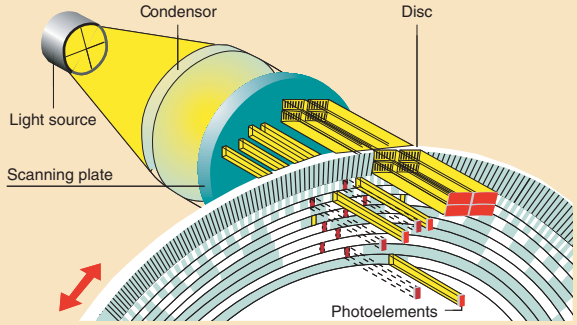


Technical specifications

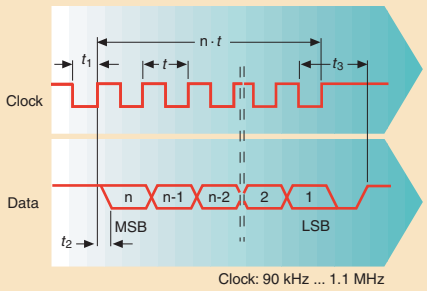
Supply voltage:	+5 V ±5 %
Incremental signals (sine-wave): • Voltage: • PPR count: • Accuracy:	 1 V_{pp} 2048 ±40"
Code signals: • Voltage: • Signal type (C and D track):	 1 V_{pp} 1 sine and 1 cosine signal/revolution
Used for:	Synchronous servomotors 1FT6, 1FT7, 1FK7, 1FS6, 1FW3 Asynchronous servomotors 1PH7, 1PL6, 1PH4
Max. possible connecting cable length	100 m (328 ft) [2]

EnDat absolute encoder

Principle of operation: photoelectric scanning



Output signals (serial interface)



Technical specifications

Supply voltage:	+5 V ±5 %
Incremental signals (sine-wave): • Voltage: • PPR count: • Accuracy:	 1 V_{pp} 2048 / 512 / 32 / 16 ±40" / ±80" / ±400" / ±480" [1]
Code signals:	Synchronous-serial EnDat interface Dual code 4096 encoded revolutions
Used for:	Synchronous servomotors 1FT6, 1FT7, 1FK7, 1FS6, 1FW3 Asynchronous servomotors 1PH7, 1PL6, 1PH4
Max. possible connecting cable length	100 m (328 ft) [2]

Note about principle of operation diagrams:
These principle of operation diagrams for incremental and absolute encoders have been reprinted with kind permission from the catalog of DR. JOHANNES HEIDENHAIN GmbH, Traunreut, Germany.

[1] EnDat absolute encoder with 2048 S/R for 1FT6, 1FT7, 1FK7, 1FS6 motors of shaft height 48 and higher, 1FW3 and all asynchronous motors.
- EnDat absolute encoder with 512 S/R for 1FT6 motors of shaft height 28 and 1FK7 of shaft heights 20, 28 and 36.
- EnDat absolute encoder with 32 S/R for 1FK7 motors of shaft height 48 and above.
- EnDat absolute encoder with 16 S/R for 1FK7 motors of shaft heights 20, 28 and 36.

[2] With DRIVE-CLiQ interface and MOTION-CONNECT 500: 100 m (328 ft)
With DRIVE-CLiQ interface and MOTION-CONNECT 800: 50 m (164 ft)

1FT6 motors

Overview

1FT6 motors are permanent-magnet synchronous motors with compact dimensions.

1FT6 motors with integrated encoders can be operated on the SINAMICS drive system.

The fully digital control of the SINAMICS S120 drive system and the encoder technology of the 1FT6 motors fulfill the highest demands in terms of dynamic performance, speed setting range, and rotational and positioning accuracy.

1FT6 motors are available with natural cooling, forced ventilation or also with water cooling. With the natural cooling method, heat is dissipated through the surface of the motor, whereas with the forced ventilation method, heat is forced out by means of built-on fans. Maximum power ratings, as well as a high degree of protection, can be achieved using water cooling.

Benefits

- Optimum surface quality at the workpiece thanks to highest smooth running characteristics degree of radial eccentricity (sinusoidal current injection)
- Minimized downtime due to high dynamic performance
- Power and signal connections for use in highly contaminative environments
- High resistance to cantilever force
- High thermal reserves for continuous or overload applications
- High overload capability (250 ms)
- Extremely high efficiency
- Extremely good drive dynamic response due to low rotor moments of inertia
- Low torque ripple (mean value 1 %)
- High degree of protection

Applications

- High-performance machine tools
- Machines with stringent requirements in terms of dynamic response, precision and flexibility, e.g. packaging machines, cross cutters, converting machines, material handling and printing machines.

Technical specifications

Type of motor	Permanent-magnet synchronous motor
Magnet material	Rare-earth magnet material
Insulation of the stator winding in accordance with EN 60034-1 (IEC 60034-1)	Temperature class 155 (F) for a winding temperature rise of ΔT = 100 K at an ambient temperature of +40 °C (104 °F) For water cooling max. inlet temperature 30 °C (86 °F) Avoid condensation.
Cooling	Natural cooling, forced ventilation and water cooling
Temperature monitoring	KTY84 temperature sensor in the stator winding
Type in accordance with EN 60034-7 (IEC 60034-7)	IM B5 (IM V1, IM V3) IM B14 (IM V18, IM V19) IM B35 for 1FT613/1FT616
Degree of protection in accordance with EN 60034-5 (IEC 60034-5)	IP64 standard type, IP65 core type
Shaft extension on the drive end in accordance with DIN 748-3 (IEC 60072-1)	Plain shaft
Shaft and flange accuracy [1] **in accordance with DIN 42955 (IEC 60072-1)**	Tolerance N
Vibration magnitude in accordance with EN 60034-14 (IEC 60034-14)	Level A (maintained up to rated speed)
Max. sound pressure level L_{pA} (1 m (3.28 ft)) in accordance with EN ISO 1680	
• Motors with natural/ water cooling	
- 1FT602 to 1FT604	55 dB
- 1FT606 to 1FT616	70 dB
• Motors with forced ventilation	
- 1FT608/1FT610	70 dB
- 1FT613/1FT616	74 dB

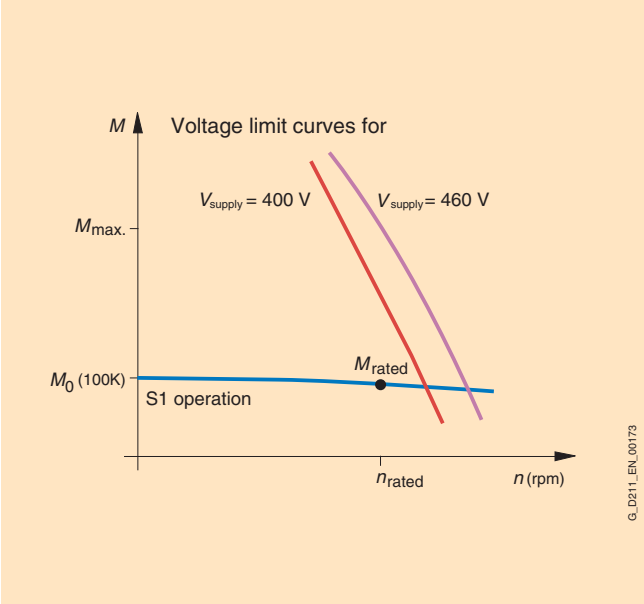
Built-in encoder systems for motors without DRIVE-CLiQ interface	• Incremental encoder sin/cos 1 V_{pp} 2048 S/R • Absolute encoder, multi-turn (traversing range 4096 revolutions) with EnDat interface: - 2048 S/R for 1FT603 to 1FT616 - 512 S/R for 1FT602 • Multi-pole resolver (number of poles corresponds 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: - 22 bit single-turn (2048 S/R internal) +12 bit multi-turn (traversing range 4096 revolutions) for 1FT603 to 1FT616 - 20 bit single-turn (512 S/R internal) +12 bit multi-turn (traversing range 4096 revolutions) for 1FT602 • 15 bit resolver • 14 bit resolver
Connection	Connectors for signals and power for 1FT602 to 1FT613 Terminal boxes for 1FT616
Paint finish	Anthracite RAL 7016
2nd rating plate	Enclosed separately
Options	• Shaft extension on the drive end with fitted key and keyway (half-key balancing) • Vibration magnitude Grade R • Built-in holding brake • Degree of protection IP67, IP68 M5 sealing air connection present (except with forced ventilation) • Terminal boxes for power connections for 1FT610 to 1FT613 • Planetary gearboxes, built-on (requirement: Plain shaft extension, shaft and flange accuracy tolerance N, vibration magnitude grade A, and IP65 degree of protection) for 1FT602 to 1FT613

S/R = signals/revolution

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

1FT6 motors

Characteristics



Speed-torque characteristic

More information

Core types can be supplied for certain motor types. These core types can be express delivered as replacement motors in the event of plant outages and offer the advantage of a quicker spare parts supply. For this reason, core types should be used for configuration wherever possible.

The selection and ordering data for Motor Modules are based on the Booksize format by way of example. The formats Booksize Compact, Blocksize or Chassis are also possible.
Detailed engineering is performed with the SIZER engineering tool.

Options

Order code	Option description	1FT6 Natural cooling	Forced ventilation	Water cooling
K09	Terminal box on right-hand side	–	■ (SH 160)	■ (SH 132 and SH 160)
K10	Terminal box on left-hand side	–	■ (SH 160)	■ (SH 132 and SH 160)
L68	Full-key balancing	–	■ (SH 132 and SH 160)	■ (SH 132 and SH 160)
M03	Version for Zone 2 hazardous areas (according to IEC EN 60079-15)	■ (up to SH 100)	–	■ (SH 63 to SH 100)
M39	Version for Zone 22 hazardous areas (according to EN 50281)	■ (up to SH 100)	–	■ (SH 63 to SH 100)
N05	Non-standard shaft extension (dimensions as for 1FT5 motors)	■ (SH 36 to SH 100)	–	–
N40	Food grade design	■ (SH 63 to SH 100)	–	■ (SH 63 to SH 100)
X01	Jet black finish RAL 9005	■	■	■
X02	Cream finish RAL 9001	■	■	■
X03	Reseda green finish RAL 6011	■	■	■
X04	Pebble gray finish RAL 7032	■	■	■
X05	Sky blue finish RAL 5015	■	■	■
X06	Light ivory finish RAL 1015	■	■	■

■ Option available
– Not available

Options

M03
Version for Zone 2 hazardous areas (according to IEC EN 60079-15)

Combustible or explosive gases or vapors occur only rarely or briefly in Zone 2 areas. The type of protection designation is EEx nA II ("non sparking").

The special conditions for operating 1FT6 motors in Zone 2 areas, in particular the reduction in permissible operating speeds, are described in detail in Appendix 610.40061.01 to the EC Declaration of Conformity 664.20023.21.

M39
Version for Zone 22 hazardous areas (according to IEC EN 61241-1)

Combustible or potentially explosive dust (non-conductive dust) occurs only rarely or briefly in Zone 22 areas The type of protection designation is Ex 3D T 150 °C (302 °F).

The special conditions for operating 1FT6 motors in Zone 22 areas are described in detail in Appendix 610.40070.01 to the EC Declaration of Conformity 664.20030.21.

Note regarding M03 and M39 options:

When used in Zone 2 or Zone 22, 1FT6 motors are only designed for encoder connection through connectors. A version with a DRIVE-CLiQ interface on the motor is not possible. Connection to SINAMICS S120 is only possible via SMC (Sensor Module Cabinet-Mounted).

N05
Non-standard shaft extension (dimensions as for 1FT5 motors)

1FT6 motors are shipped with the following shaft dimensions that are compatible with 1FT5 motors:

- SH 36: 11 x 23 mm (0.43 x 0.91 in)
- SH 48: 14 x 30 mm (0.55 x 1.18 in)
- SH 63: 19 x 40 mm (0.75 x 1.57 in)
- SH 80: 24 x 50 mm (0.94 x 1.97 in)
- SH 100: 32 x 58 mm (1.26 x 2.28 in)

Note:

1FT6 motors with SH 63 with option N05 do not have a compatible flange with 1FT5 motors with SH 63.

N40
Food industry design

With this option, 1FT6 motors feature the following:

- Stainless steel shaft, fitted key and screws
- Bearing sealed with special grease (suitable for food industry) and shaft seal with stainless steel spring
- Degree of protection IP68
- Must be connected by plug (nickel plated), terminal box connection is not possible
- Paint finish: Primer plus light top coat (white aluminum RAL 9006)

1FT6 motors, core type
Natural cooling

Selection and ordering data

Rated speed	Shaft height	Rated power	Static torque	Rated torque [1]	Rated current	1FT6 synchronous motors 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	Order No. **Core type**		J	m
rpm		kW (HP)	Nm (lb_f-ft)	Nm (lb_f-ft)	A			10^{-4} kgm^2 (10^{-3} lb_f-in-s^2)	kg (lb)
2000	100	4.8 (6.44)	27 (19.9)	23 (17)	11	**1FT6102-1AC71-■■■1**	4	99 (87.6)	27.5 (60.6)
		8.0 (10.7)	50 (36.9)	38 (28)	17.6	**1FT6105-1AC71-■■■1**	4	168 (148)	39.5 (87.1)
3000	48	1.4 (1.88)	5 (3.7)	4.3 (3.2)	2.9	**1FT6044-1AF71-■■■1**	2	5.1 (4.51)	8.3 (18.3)
	63	1.5 (2.01)	6 (4.4)	4.7 (3.5)	3.4	**1FT6062-1AF71-■■■1**	3	8.5 (7.52)	9.5 (20.9)
		2.2 (2.95)	9.5 (7)	7.0 (5.2)	4.9	**1FT6064-1AF71-■■■1**	3	13 (11.5)	12.5 (27.6)
	80	3.2 (4.29)	13 (9.6)	10.3 (7.6)	8.7	**1FT6082-1AF71-■■■1**	4	30 (26.5)	15 (33.1)
		4.6 (6.17)	20 (14.7)	14.7 (10.8)	11	**1FT6084-1AF71-■■■1**	4	48 (42.4)	20.5 (45.2)
		5.8 (7.78)	27 (19.9)	18.5 (13.6)	13	**1FT6086-1AF71-■■■1**	4	66.5 (58.8)	25.5 (56.2)
4500	63	1.7 (2.28)	6 (4.4)	3.6 (2.7)	3.9	**1FT6062-1AH71-■■■1**	3	8.5 (7.52)	9.5 (20.9)
		2.3 (3.08)	9.5 (7)	4.8 (3.5)	5.5	**1FT6064-1AH71-■■■1**	3	13 (11.5)	12.5 (27.6)
	80	4.9 (6.57)	20 (14.7)	10.5 (7.7)	12.5	**1FT6084-1AH71-■■■1**	4	48 (42.4)	20.5 (45.2)
		5.7 (7.64)	27 (19.9)	12 (8.8)	12.6	**1FT6086-1AH71-■■■1**	4	66.5 (58.8)	25.5 (56.2)
6000	36	0.88 (1.18)	2 (1.5)	1.4 (1)	2.1	**1FT6034-1AK71-■■■1**	2	1.1 (0.97)	4.4 (9.7)
	80	4.1 (5.50)	20 (14.7)	6.5 (4.8)	9.2	**1FT6084-1AK71-■■■1**	4	48 (42.4)	20.5 (45.2)

Type:	IM B5		**1**
Connector outlet direction:	Transverse right (not for 1FT603/1FT604/1FT606) Transverse left (not for 1FT603/1FT604/1FT606) Axial NDE Axial DE		**1** **2** **3** **4**
Encoder systems for motors without DRIVE-CLiQ interface:	Incremental encoder sin/cos 1 V_{pp} 2048 S/R Absolute encoder EnDat 2048 S/R [1]		**A** **E**
Encoder systems for motors with DRIVE-CLiQ interface:	22 bit incremental encoder Absolute encoder, 22 bit single-turn +12 bit multi-turn [1]		**D** **F**
Shaft extension: Plain shaft Plain shaft	**Shaft and flange accuracy:** Tolerance N Tolerance N	**Holding brake:** without with	**G** **H**

Selection and ordering data

Motor type (continued)	Static current	Calculated power P_{calc} [4]	SINAMICS S120 Motor Module		Power cable with complete shield		
			Rated output current [3]	Booksize format	Motor connection (and brake connection) via power connector		
	I_0 at M_0 ΔT=100 K	P_{calc} for M_0 ΔT=100 K	I_{rated}	Order No.	Power connector	Cable cross-section [2]	Order No. Pre-assembled cable
	A	kW (HP)	A		Size	mm²	
1FT6102-1AC7...	12.1	5.7 (7.6)	18	**6SL312■-■TE21-8AA3**	1.5	4 x 1.5	**6FX■002-5■S21-....**
1FT6105-1AC7...	21.4	10.5 (14.8)	30	**6SL312■-1TE23-0AA3**	1.5	4 x 4	**6FX■002-5■S41-....**
1FT6044-1AF7...	3	1.6 (2.2)	3	**6SL312■-■TE13-0AA3**	1	4 x 1.5	**6FX■002-5■S01-....**
1FT6062-1AF7...	4.1	1.9 (2.6)	5	**6SL312■-■TE15-0AA3**	1	4 x 1.5	**6FX■002-5■S01-....**
1FT6064-1AF7...	6.1	3.0 (4.0)	9	**6SL312■-■TE21-0AA3**	1	4 x 1.5	**6FX■002-5■S01-....**
1FT6082-1AF7...	9.6	4.1 (5.5)	18	**6SL312■-■TE21-8AA3**	1.5	4 x 1.5	**6FX■002-5■S21-....**
1FT6084-1AF7...	13.2	6.3 (8.5)	18	**6SL312■-■TE21-8AA3**	1.5	4 x 1.5	**6FX■002-5■S21-....**
1FT6086-1AF7...	16.4	8.5 (11.4)	18	**6SL312■-■TE21-8AA3**	1.5	4 x 2.5	**6FX■002-5■S31-....**
1FT6062-1AH7...	5.7	2.8 (3.8)	9	**6SL312■-■TE21-0AA3**	1	4 x 1.5	**6FX■002-5■S01-....**
1FT6064-1AH7...	9.0	4.5 (6.0)	9	**6SL312■-■TE21-0AA3**	1	4 x 1.5	**6FX■002-5■S01-....**
1FT6084-1AH7...	19.8	9.4 (12.6)	18	**6SL312■-■TE21-8AA3**	1.5	4 x 4	**6FX■002-5■S41-....**
1FT6086-1AH7...	23.3	12.7 (17.0)	30	**6SL312■-1TE23-0AA3**	1.5	4 x 4	**6FX■002-5■S41-....**
1FT6034-1AK7...	2.6	1.3 (1.7)	3	**6SL312■-■TE13-0AA3**	1	4 x 1.5	**6FX■002-5■S01-....**
1FT6084-1AK7...	24.1	12.6 (16.9)	30	**6SL312■-1TE23-0AA3**	1.5	4 x 4	**6FX■002-5■S41-....**

Cooling:	
Internal air cooling	**0**
External air cooling	**1**
Motor Module:	
Single Motor Module	**1**
Double Motor Module	**2**
Type of power cable:	
MOTION-CONNECT 800	**8**
MOTION-CONNECT 500	**5**
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] 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)

[3] With default setting of the pulse frequency.

[4] $P_{calc}\,[kW] = \frac{M_0\,[Nm] \times n_{rated}}{9550}$ $\quad P_{calc}\,[HP] = \frac{M_0\,[lb_f\text{-}in] \times n_{rated}}{63000}$

1FT6 motors, standard type
Natural cooling

Selection and ordering data

Rated speed	Shaft height	Rated power	Static torque	Rated torque [1]	Rated current	1FT6 synchronous motors 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	Order No. **Standard type**		J	m
rpm		kW (HP)	Nm (lb_f-ft)	Nm (lb_f-ft)	A			10^{-4} kgm^2 (10^{-3} lb_f-in-s^2)	kg (lb)
1500	100	3.8 (5.1)	27 (19.9)	24.5 (18.1)	8.4	**1FT6102-8AB7■-■■■■**	4	99 (87.6)	27.5 (60.6)
		6.4 (8.6)	50 (36.9)	41 (30.2)	14.5	**1FT6105-8AB7■-■■■■**	4	168 (148)	39.5 (87.1)
		9.6 (12.9)	70 (51.6)	61 (45)	20.5	**1FT6108-8AB7■-■■■■**	4	260 (230)	55.5 (122)
	132	9.7 (13.0)	75 (55.3)	62 (45.7)	19	**1FT6132-6AB71-■■■■**	3	430 (380)	85 (187)
		11.8 (15.8)	95 (70)	75 (55.3)	24	**1FT6134-6AB71-■■■■**	3	547 (484)	100 (220)
		13.8 (18.5)	115 (84.8)	88 (64.9)	27	**1FT6136-6AB71-■■■■**	3	664 (587)	117 (258)

Type:	IM B5 IM B14 [2] (not for 1FT613)	1 2
Connector outlet direction:	Transverse right Transverse left Axial NDE (not for 1FT613) Axial DE	1 2 3 4
Terminal box/ Cable entry:	Transverse/from right Transverse/from left Axial/from NDE Axial/from DE	5 6 7 8
Encoder systems for motors without DRIVE-CLiQ interface:	Incremental encoder sin/cos 1 V_{pp} 2048 S/R Absolute encoder EnDat 2048 S/R [1] Multi-pole resolver 2-pole resolver	A E S T
Encoder systems for motors with DRIVE-CLiQ interface:	22 bit incremental encoder Absolute encoder, 22 bit single-turn +12 bit multi-turn [1] 15 bit resolver 14 bit resolver	D F U 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
Fitted key and keyway	Tolerance R	without	D
Fitted key and keyway	Tolerance R	with	E
Plain shaft	Tolerance N	without	G
Plain shaft	Tolerance N	with	H
Plain shaft	Tolerance R	without	K
Plain shaft	Tolerance R	with	L

Vibration magnitude:	**Degree of protection:**	
Grade A	IP64	0
Grade A	IP65	1
Grade A	IP67	2
Grade A	IP68	6
Grade R	IP64	3
Grade R	IP65	4
Grade R	IP67	5
Grade R	IP68	7

To select the degree of protection and type, see the selection guide.

Selection and ordering data

Motor type (continued)	Static current	Calculated power P_{calc} [5]	SINAMICS S120 Motor Module		Power cable with complete shield		
			Rated output current [4]	Booksize format	Motor connection (and brake connection) via power connector		
	I_0 at M_0 ΔT=100 K	P_{calc} for M_0 ΔT=100 K	I_{rated}	Order No.	Power connector	Cable cross-section [3]	Order No. Pre-assembled cable
	A	kW (HP)	A		Size	mm²	
1FT6102-8AB7...	8.7	4.2 (5.6)	9	**6SL312■ - ■TE21 - 0AA3**	1.5	4 x 1.5	**6FX■002-5■S21-....**
1FT6105-8AB7...	16.0	7.9 (10.6)	18	**6SL312■ - ■TE21-8AA3**	1.5	4 x 2.5	**6FX■002-5■S31-....**
1FT6108-8AB7...	22.3	11.0 (14.8)	30	**6SL312■ - 1TE23-0AA3**	1.5	4 x 4	**6FX■002-5■S41-....**
1FT6132-6AB7...	21.6	11.8 (15.8)	30	**6SL312■ - 1TE23-0AA3**	1.5	4 x 4	**6FX■002-5■S41-....**
1FT6134-6AB7...	27.0	14.9 (20.0)	30	**6SL312■ - 1TE23-0AA3**	1.5	4 x 4	**6FX■002-5■S41-....**
1FT6136-6AB7...	34	18.1 (24.3)	45	**6SL312■ - 1TE24-5AA3**	1.5	4 x 10	**6FX■002-5■S64-....**

Cooling:							
Internal air cooling	**0**						
External air cooling	**1**						
Motor Module:							
Single Motor Module		**1**					
Double Motor Module		**2**					
Type of power cable:							
MOTION-CONNECT 800					**8**		
MOTION-CONNECT 500					**5**		
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) Same flange as for IM B5 type, but with metric threaded insert in the four mounting holes.

3) 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).

4) With default setting of the pulse frequency.

5) $P_{calc}\,[kW] = \frac{M_0\,[Nm] \times n_{rated}}{9550}$ $\quad P_{calc}\,[HP] = \frac{M_0\,[lb_f\text{-}in] \times n_{rated}}{63000}$

1FT6 motors, standard type
Natural cooling

Selection and ordering data

Rated speed	Shaft height	Rated power	Static torque	Rated torque [1]	Rated current	1FT6 synchronous motors 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	Order No. **Standard type**		J	m
rpm		kW (HP)	Nm (lb_f-ft)	Nm (lb_f-ft)	A			10^{-4} kgm^2 (10^{-3} lb_f-in-s^2)	kg (lb)
2000	63	0.8 (1.1)	4.0 (2.9)	3.7 (2.7)	1.9	**1FT6061-6AC7■-■■■■**	3	6.0 (5.31)	8.0 (7.6)
		1.1 (1.5)	6.0 (4.4)	5.2 (3.8)	2.6	**1FT6062-6AC7■-■■■■**	3	8.5 (7.52)	9.5 (20.9)
		1.7 (2.3)	9.5 (7)	8.0 (5.9)	3.8	**1FT6064-6AC7■-■■■■**	3	13 (11.5)	12.5 (27.6)
	80	1.6 (2.2)	8.0 (5.9)	7.5 (5.5)	4.1	**1FT6081-8AC7■-■■■■**	4	21 (18.5)	12.5 (27.6)
		2.4 (3.2)	13 (9.6)	11.4 (8.4)	6.6	**1FT6082-8AC7■-■■■■**	4	30 (26.5)	15.0 (33.1)
		3.5 (4.7)	20 (14.7)	16.9 (12.5)	8.3	**1FT6084-8AC7■-■■■■**	4	48 (42.4)	20.5 (45.2)
		4.7 (6.3)	27 (19.9)	22.5 (16.6)	10.9	**1FT6086-8AC7■-■■■■**	4	66.5 (58.8)	25.5 (56.2)
	100	4.8 (6.4)	27 (19.9)	23 (17)	11	**1FT6102-8AC7■-■■■■**	4	99 (87.6)	27.5 (60.6)
		8.0 (10.7)	50 (36.9)	38 (28)	17.6	**1FT6105-8AC7■-■■■■**	4	168 (148)	39.5 (87.1)
		11.5 (15.4)	70 (51.6)	55 (40.5)	24.5	**1FT6108-8AC7■-■■■■**	4	260 (230)	55.5 (122)
	132	11.5 (15.4)	75 (55.3)	55 (40.5)	23	**1FT6132-6AC71-■■■■**	3	430 (380)	85.0 (187)
		13.6 (18.2)	95 (70)	65 (47.9)	27	**1FT6134-6AC71-■■■■**	3	547 (484)	100 (220)
		15.5 (20.8)	115 (84.8)	74 (54.5)	30	**1FT6136-6AC71-■■■■**	3	664 (587)	117 (258)

Type:	IM B5 IM B14 [2] (not for 1FT613)	**1** **2**
Connector outlet direction:	Transverse right (not for 1FT606) Transverse left (not for 1FT606) Axial NDE (not for 1FT613) Axial DE	**1** **2** **3** **4**
Terminal box/ cable entry: (only for 1FT61)	Transverse/from right Transverse/from left Axial/from NDE Axial/from DE	**5** **6** **7** **8**
Encoder systems for motors without DRIVE-CLiQ interface:	Incremental encoder sin/cos 1 V_{pp} 2048 S/R Absolute encoder EnDat 2048 S/R [1] Multi-pole resolver 2-pole resolver	**A** **E** **S** **T**
Encoder systems for motors with DRIVE-CLiQ interface:	22 bit incremental encoder Absolute encoder, 22 bit single-turn +12 bit multi-turn [1] 15 bit resolver 14 bit resolver	**D** **F** **U** **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**
Fitted key and keyway	Tolerance R	without	**D**
Fitted key and keyway	Tolerance R	with	**E**
Plain shaft	Tolerance N	without	**G**
Plain shaft	Tolerance N	with	**H**
Plain shaft	Tolerance R	without	**K**
Plain shaft	Tolerance R	with	**L**

Vibration magnitude:	**Degree of protection:**	
Grade A	IP64	**0**
Grade A	IP65	**1**
Grade A	IP67	**2**
Grade A	IP68	**6**
Grade R	IP64	**3**
Grade R	IP65	**4**
Grade R	IP67	**5**
Grade R	IP68	**7**

To select the degree of protection and type, see the selection guide.

Selection and ordering data

Motor type (continued)	Static current	Calculated power P_{calc} [5]	SINAMICS S120 Motor Module		Power cable with complete shield		
			Rated output current [4]	Booksize format	Motor connection (and brake connection) via power connector		
	I_0 at M_0 ΔT=100 K	P_{calc} for M_0 ΔT=100 K	I_{rated}	Order No.	Power connector	Cable cross-section [3]	Order No. Pre-assembled cable
	A	kW (HP)	A		Size	mm²	
1FT6061-6AC7...	1.9	0.84 (1.1)	3	**6SL312■ - ■TE13-0AA3**	1	4 x 1.5	**6FX■002-5■S01-....**
1FT6062-6AC7...	2.7	1.3 (1.7)	3	**6SL312■ - ■TE13-0AA3**	1	4 x 1.5	**6FX■002-5■S01-....**
1FT6064-6AC7...	4.2	2.0 (2.7)	5	**6SL312■ - ■TE15-0AA3**	1	4 x 1.5	**6FX■002-5■S01-....**
1FT6081-8AC7...	3.9	1.7 (2.3)	5	**6SL312■ - ■TE15-0AA3**	1.5	4 x 1.5	**6FX■002-5■S21-....**
1FT6082-8AC7...	6.6	2.7 (3.6)	9	**6SL312■ - ■TE21-0AA3**	1.5	4 x 1.5	**6FX■002-5■S21-....**
1FT6084-8AC7...	8.8	4.2 (5.6)	9	**6SL312■ - ■TE21-0AA3**	1.5	4 x 1.5	**6FX■002-5■S21-....**
1FT6086-8AC7...	11.3	5.7 (7.6)	18	**6SL312■ - ■TE21-8AA3**	1.5	4 x 1.5	**6FX■002-5■S21-....**
1FT6102-8AC7...	12.1	5.7 (7.6)	18	**6SL312■ - ■TE21-8AA3**	1.5	4 x 1.5	**6FX■002-5■S21-....**
1FT6105-8AC7...	21.4	10.5 (14.8)	30	**6SL312■ - 1TE23-0AA3**	1.5	4 x 4	**6FX■002-5■S41-....**
1FT6108-8AC7...	29	14.7 (19.7)	30	**6SL312■ - 1TE23-0AA3**	1.5	4 x 6	**6FX■002-5■S51-....**
1FT6132-6AC7 ...	29	15.7 (21.1)	30	**6SL312■ - 1TE23-0AA3**	1.5	4 x 6	**6FX■002-5■S51-....**
1FT6134-6AC7 ...	36	19.9 (26.7)	45	**6SL312■ - 1TE24-5AA3**	1.5	4 x 10	**6FX■002-5■S64-....**
1FT6136-6AC7...	42	24.1 (32.3)	45	**6SL312■ - 1TE24-5AA3**	3	4 x 16	**6FX■002-5■S14-....**

Cooling:	
Internal air cooling	**0**
External air cooling	**1**
Motor Module:	
Single Motor Module	**1**
Double Motor Module	**2**
Type of power cable:	
MOTION-CONNECT 800	**8**
MOTION-CONNECT 500	**5**
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) Same flange as for IM B5 type, but with metric threaded insert in the four mounting holes.

3) 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)

4) With default setting of the pulse frequency.

5) $P_{calc}\,[kW] = \frac{M_0\,[Nm] \times n_{rated}}{9550}$ $\quad P_{calc}\,[HP] = \frac{M_0\,[lb_f\text{-}in] \times n_{rated}}{63000}$

1FT6 motors, standard type
Natural cooling

Selection and ordering data

Rated speed	Shaft height	Rated power	Static torque	Rated torque [1]	Rated current	1FT6 synchronous motors 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	Order No. **Standard type**		J	m
rpm		kW (HP)	Nm (lb_f-ft)	Nm (lb_f-ft)	A			10^{-4} kgm^2 (10^{-3} lb_f-in-s^2)	kg (lb)
3000	48	0.7 (0.9)	2.6 (1.9)	2.15 (1.6)	1.7	**1FT6041-4AF71 -** ■ ■ ■ ■	2	2.9 (2.57)	6.6 (14.6)
		1.4 (1.9)	5.0 (3.7)	4.3 (3.2)	2.9	**1FT6044-4AF71 -** ■ ■ ■ ■	2	5.1 (4.51)	8.3 (18.3)
	63	1.1 (1.5)	4.0 (2.9)	3.5 (2.6)	2.6	**1FT6061-6AF7**■ **-** ■ ■ ■ ■	3	6.0 (5.31)	8.0 (17.6)
		1.5 (2.0)	6.0 (4.4)	4.7 (3.5)	3.4	**1FT6062-6AF7**■ **-** ■ ■ ■ ■	3	8.5 (7.52)	9.5 (20.9)
		2.2 (3.0)	9.5 (7)	7.0 (5.2)	4.9	**1FT6064-6AF7**■ **-** ■ ■ ■ ■	3	13.0 (11.5)	12.5 (27.6)
	80	2.2 (3.0)	8.0 (5.9)	6.9 (5.1)	5.6	**1FT6081-8AF7**■ **-** ■ ■ ■ ■	4	21.0 (18.5)	12.5 (27.6)
		3.2 (4.3)	13 (9.6)	10.3 (7.6)	8.7	**1FT6082-8AF7**■ **-** ■ ■ ■ ■	4	30.0 (26.5)	15.0 (33.1)
		4.6 (6.2)	20 (14.7)	14.7 (10.8)	11	**1FT6084-8AF7**■ **-** ■ ■ ■ ■	4	48.0 (42.4)	20.5 (45.2)
		5.8 (7.8)	27 (19.9)	18.5 (13.6)	13	**1FT6086-8AF7**■ **-** ■ ■ ■ ■	4	66.5 (58.8)	25.5 (56.2)
	100	6.1 (8.2)	27 (19.9)	19.5 (14.4)	13.2	**1FT6102-8AF7**■ **-** ■ ■ ■ ■	4	99.0 (87.6)	27.5 (60.6)
		9.7 (13.0)	50 (36.9)	31 (22.8)	22.5	**1FT6105-8AF7**■ **-** ■ ■ ■ ■	4	168 (148)	39.5 (87.1)
		11.6 (15.6)	70 (51.6)	37 (27.3)	25	**1FT6108-8AF7**■ **-** ■ ■ ■ ■	4	260 (230)	55.5 (122.4)
	132	11.3 (15.2)	75 (55.3)	36 (26.5)	23	**1FT6132-6AF71 -** ■ ■ ■ ■	3	430 (380)	85.0 (187.4)

Type:	IM B5 IM B14 [2] (not for 1FT604/1FT613)	1 2
Connector outlet direction:	Transverse right (not for 1FT604/1FT606) Transverse left (not for 1FT604/1FT606) Axial NDE (not for 1FT613 and not for 1FT6 with DRIVE-CLiQ and power connector size 3) Axial DE	1 2 3 4
Terminal box/ cable entry: (only for 1FT61)	Transverse/from right Transverse/from left Axial/from NDE Axial/from DE	5 6 7 8
Encoder systems for motors without DRIVE-CLiQ interface:	Incremental encoder sin/cos 1 V_{pp} 2048 S/R Absolute encoder EnDat 2048 S/R [1] Multi-pole resolver 2-pole resolver	A E S T
Encoder systems for motors with DRIVE-CLiQ interface:	22 bit incremental encoder Absolute encoder, 22 bit single-turn +12 bit multi-turn [1] 15 bit resolver 14 bit resolver	D F U 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
Fitted key and keyway	Tolerance R	without	D
Fitted key and keyway	Tolerance R	with	E
Plain shaft	Tolerance N	without	G
Plain shaft	Tolerance N	with	H
Plain shaft	Tolerance R	without	K
Plain shaft	Tolerance R	with	L

Vibration magnitude:	**Degree of protection:**	
Grade A	IP64	0
Grade A	IP65	1
Grade A	IP67	2
Grade A	IP68	6
Grade R	IP64	3
Grade R	IP65	4
Grade R	IP67	5
Grade R	IP68	7

To select the degree of protection and type, see the selection guide.

Selection and ordering data

Motor type (continued)	Static current	Calculated power P_{calc} 6)	SINAMICS S120 Motor Module		Power cable with complete shield		
			Rated output current 5)	Booksize format	Motor connection (and brake connection) via power connector		
	I_0 at M_0 ΔT=100 K	P_{calc} for M_0 ΔT=100 K	I_{rated}	Order No.	Power connector	Cable cross-section 4)	Order No. Pre-assembled cable
	A	kW (HP)	A		Size	mm^2	
1FT6041-4AF7 ...	1.9	0.8 (1.1)	3	**6SL312■ - ■TE13-0AA3**	1	4 x 1.5	**6FX■002-5■S01-....**
1FT6044-4AF7 ...	3.0	1.6 (2.2)	3	**6SL312■ - ■TE13-0AA3**	1	4 x 1.5	**6FX■002-5■S01-....**
1FT6061-6AF7 ...	2.7	1.3 (1.7)	3	**6SL312■ - ■TE13-0AA3**	1	4 x 1.5	**6FX■002-5■S01-....**
1FT6062-6AF7 ...	4.1	1.9 (2.6)	5	**6SL312■ - ■TE15-0AA3**	1	4 x 1.5	**6FX■002-5■S01-....**
1FT6064-6AF7 ...	6.1	3.0 (4.0)	9	**6SL312■ - ■TE21-0AA3**	1	4 x 1.5	**6FX■002-5■S01-....**
1FT6081-8AF7 ...	5.8	2.5 (3.4)	9	**6SL312■ - ■TE21-0AA3**	1.5	4 x 1.5	**6FX■002-5■S21-....**
1FT6082-8AF7 ...	9.6	4.1 (5.5)	18	**6SL312■ - ■TE21-8AA3**	1.5	4 x 1.5	**6FX■002-5■S21-....**
1FT6084-8AF7 ...	13.2	6.3 (8.5)	18	**6SL312■ - ■TE21-8AA3**	1.5	4 x 1.5	**6FX■002-5■S21-....**
1FT6086-8AF7 ...	16.4	8.5 (11.4)	18	**6SL312■ - ■TE21-8AA3**	1.5	4 x 2.5	**6FX■002-5■S31-....**
1FT6102-8AF7 ...	16.9	8.5 (11.4)	18	**6SL312■ - ■TE21-8AA3**	1.5	4 x 2.5	**6FX■002-5■S31-....**
1FT6105-8AF7 ...	32	15.7 (21.1)	30 3)	**6SL312■ - 1TE23-0AA3**	1.5	4 x 10	**6FX■002-5■S61-....**
1FT6108-8AF7 ...	41	22.0 (29.5)	45	**6SL312■ - 1TE24-5AA3**	3	4 x 10	**6FX■002-5■S14-....**
1FT6132-6AF7 ...	43	23.6 (31.7)	45	**6SL312■ - 1TE24-5AA3**	3	4 x 10	**6FX■002-5■S14-....**

Cooling: Internal air cooling External air cooling	**0** **1**						
Motor Module: Single Motor Module Double Motor Module		**1** **2**					
Type of power cable: MOTION-CONNECT 800 MOTION-CONNECT 500					**8** **5**		
Without brake cores With brake cores						**C** **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) Same flange as for IM B5 type, but with metric threaded insert in the four mounting holes.

3) With the specified Motor Module, the motor cannot be fully utilized with M_0 at ΔT = 100 K winding temperature rise.
If a Motor Module with a higher rating is used, you must check whether the specified power cable can be connected to it.

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) With default setting of the pulse frequency.

6) $P_{calc}\ [kW] = \frac{M_0\ [Nm] \times n_{rated}}{9550}$ $\quad P_{calc}\ [HP] = \frac{M_0\ [lb_f\text{-in}] \times n_{rated}}{63000}$

1FT6 motors, standard type
Natural cooling

Selection and ordering data

Rated speed	Shaft height	Rated power	Static torque	Rated torque [1]	Rated current	1FT6 synchronous motors 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	Order No. **Standard type**		J	m
rpm		kW (HP)	Nm (lb_f-ft)	Nm (lb_f-ft)	A			10^{-4} kgm^2 (10^{-3} lb_f-in-s^2)	kg (lb)
4500	63	1.4 (1.9)	4.0 (2.9)	2.9 (2.1)	3.4	**1FT6061-6AH7■-■■■■**	3	6.0 (5.31)	8.0 (17.6)
		1.7 (2.3)	6.0 (4.4)	3.6 (2.7)	3.9	**1FT6062-6AH7■-■■■■**	3	8.5 (7.52)	9.5 (20.9)
		2.3 (3.1)	9.5 (7.0)	4.8 (3.5)	5.5	**1FT6064-6AH7■-■■■■**	3	13.0 (11.5)	12.5 (27.6)
	80	2.7 (3.6)	8.0 (5.9)	5.8 (4.3)	7.3	**1FT6081-8AH7■-■■■■**	4	21.0 (18.5)	12.5 (27.6)
		4.0 (5.4)	13.0 (9.6)	8.5 (6.3)	11.0	**1FT6082-8AH7■-■■■■**	4	30.0 (26.5)	15.0 (33.1)
		4.9 (6.6)	20.0 (14.7)	10.5 (7.7)	12.5	**1FT6084-8AH7■-■■■■**	4	48.0 (42.4)	20.5 (45.2)
		5.7 (7.6)	27.0 (19.9)	12.0 (8.8)	12.6	**1FT6086-8AH7■-■■■■**	4	66.5 (58.8)	25.5 (56.2)
	100	5.7 (7.6)	27.0 (19.9)	12.0 (8.8)	12.0	**1FT6102-8AH7■-■■■■**	4	99.0 (87.6)	27.5 (60.6)

Type:	IM B5 IM B14 [2]	1 2							
Connector outlet direction:	Transverse right (not for 1FT606) Transverse left (not for 1FT606) Axial NDE Axial DE	1 2 3 4							
Terminal box/ cable entry: (only for 1FT61)	Transverse/from right Transverse/from left Axial/from NDE Axial/from DE	5 6 7 8							
Encoder systems for motors without DRIVE-CLiQ interface:	Incremental encoder sin/cos 1 V_{pp} 2048 S/R Absolute encoder EnDat 2048 S/R [1] Multi-pole resolver 2-pole resolver		A E S T						
Encoder systems for motors with DRIVE-CLiQ interface:	22 bit incremental encoder Absolute encoder, 22 bit single-turn +12 bit multi-turn [1] 15 bit resolver 14 bit resolver		D F U 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						
Fitted key and keyway	Tolerance R	without	D						
Fitted key and keyway	Tolerance R	with	E						
Plain shaft	Tolerance N	without	G						
Plain shaft	Tolerance N	with	H						
Plain shaft	Tolerance R	without	K						
Plain shaft	Tolerance R	with	L						
Vibration magnitude:	**Degree of protection:**								
Grade A	IP64			0					
Grade A	IP65			1					
Grade A	IP67			2					
Grade A	IP68			6					
Grade R	IP64			3					
Grade R	IP65			4					
Grade R	IP67			5					
Grade R	IP68			7					

To select the degree of protection and type, see the selection guide.

Selection and ordering data

Motor type (continued)	Static current	Calculated power P_{calc} [6]	SINAMICS S120 Motor Module		Power cable with complete shield		
			Rated output current [5]	Booksize format	Motor connection (and brake connection) via power connector		
	I_0 at M_0 ΔT=100 K	P_{calc} for M_0 ΔT=100 K	I_{rated}	Order No.	Power connector	Cable cross-section [4]	Order No. Pre-assembled cable
	A	kW (HP)	A		Size	mm²	
1FT6061-6AH7...	4	1.9 (2.6)	5	**6SL312■ - ■TE15-0AA3**	1	4 x 1.5	**6FX■002-5■S01-....**
1FT6062-6AH7...	5.7	2.8 (3.8)	9	**6SL312■ - ■TE21-0AA3**	1	4 x 1.5	**6FX■002-5■S01-....**
1FT6064-6AH7...	9.0	4.5 (6.0)	9	**6SL312■ - ■TE21-0AA3**	1	4 x 1.5	**6FX■002-5■S01-....**
1FT6081-8AH7...	8.6	3.8 (5.1)	9	**6SL312■ - ■TE21-0AA3**	1.5	4 x 1.5	**6FX■002-5■S21-....**
1FT6082-8AH7...	14.8	6.1 (8.2)	18	**6SL312■ - ■TE21-8AA3**	1.5	4 x 1.5	**6FX■002-5■S21-....**
1FT6084-8AH7...	19.8	9.4 (12.6)	18 [3]	**6SL312■ - ■TE21-8AA3**	1.5	4 x 4	**6FX■002-5■S41-....**
1FT6086-8AH7...	23.3	12.7 (17.0)	30	**6SL312■ - 1TE23-0AA3**	1.5	4 x 4	**6FX■002-5■S41-....**
1FT6102-8AH7...	24.1	12.7 (17.0)	30	**6SL312■ - 1TE23-0AA3**	1.5	4 x 4	**6FX■002-5■S41-....**

Cooling:							
Internal air cooling	**0**						
External air cooling	**1**						
Motor Module:							
Single Motor Module		**1**					
Double Motor Module		**2**					
Type of power cable:							
MOTION-CONNECT 800					**8**		
MOTION-CONNECT 500					**5**		
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) Same flange as for IM B5 type, but with metric threaded insert in the four mounting holes.

3) With the specified Motor Module, the motor cannot be fully utilized with M_0 at ΔT = 100 K winding temperature rise.

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) With default setting of the pulse frequency.

6) $P_{calc}\,[kW] = \frac{M_0\,[Nm] \times n_{rated}}{9550}$ $\quad P_{calc}\,[HP] = \frac{M_0\,[lb_f\text{-}in] \times n_{rated}}{63000}$

1FT6 motors, standard type
Natural cooling

Selection and ordering data

Rated speed	Shaft height	Rated power	Static torque	Rated torque [1]	Rated current	1FT6 synchronous motors 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	Order No. **Standard type**		J	m
rpm		kW (HP)	Nm (lb_f-ft)	Nm (lb_f-ft)	A			10^{-4} kgm^2 (10^{-3} lb_f-in-s^2)	kg (lb)
6000	28	0.19 (0.3)	0.4 (0.3)	0.3 (0.2)	1.1	**1FT6021-6AK71 -** ■ ■ ■ ■	3	0.21 (0.19)	1.2 (2.6)
		0.31 (0.4)	0.8 (0.6)	0.5 (0.4)	0.9	**1FT6024-6AK71 -** ■ ■ ■ ■	3	0.34 (0.30)	2.1 (4.6)
	36	0.47 (0.6)	1.0 (0.7)	0.75 (0.6)	1.2	**1FT6031-4AK71 -** ■ ■ ■ ■	2	0.65 (0.58)	3.1 (6.8)
		0.88 (1.2)	2.0 (1.5)	1.4 (1.0)	2.1	**1FT6034-4AK71 -** ■ ■ ■ ■	2	1.1 (0.97)	4.4 (9.7)
	48	1.1 (1.5)	2.6 (1.9)	1.7 (1.3)	2.4	**1FT6041-4AK71 -** ■ ■ ■ ■	2	2.9 (2.57)	6.6 (14.6)
		1.9 (2.6)	5.0 (3.7)	3.0 (2.2)	4.1	**1FT6044-4AK71 -** ■ ■ ■ ■	2	5.1 (4.51)	8.3 (18.3)
	63	1.3 (1.7)	4.0 (2.9)	2.1 (1.5)	3.1	**1FT6061-6AK7**■ **-** ■ ■ ■ ■	3	6.0 (5.31)	8.0 (17.6)
		1.3 (1.7)	6.0 (4.4)	2.1 (1.5)	3.2	**1FT6062-6AK7**■ **-** ■ ■ ■ ■	3	8.5 (7.52)	9.5 (20.9)
		1.3 (1.7)	9.5 (7.0)	2.1 (1.5)	3.5	**1FT6064-6AK7**■ **-** ■ ■ ■ ■	3	13.0 (11.5)	12.5 (27.6)
	80	2.9 (4.0)	8.0 (5.9)	4.6 (3.4)	7.7	**1FT6081-8AK7**■ **-** ■ ■ ■ ■	4	21.0 (18.5)	12.5 (27.6)
		3.5 (4.7)	13.0 (9.6)	5.5 (4.1)	9.1	**1FT6082-8AK7**■ **-** ■ ■ ■ ■	4	30.0 (26.5)	15.0 (33.1)
		4.1 (5.5)	20.0 (14.7)	6.5 (4.8)	9.2	**1FT6084-8AK7**■ **-** ■ ■ ■ ■	4	48.0 (42.4)	20.5 (45.2)

Type:	IM B5 IM B14 [2] (not for 1FT602/1FT603/1FT604)	1 2
Connector outlet direction:	Transverse right (not for 1FT603/1FT604/1FT606) Transverse left (not for 1FT603/1FT604/1FT606) Axial NDE Axial DE	1 2 3 4
Encoder systems for motors without DRIVE-CLiQ interface:	Incremental encoder sin/cos 1 V_{pp} 2048 S/R Absolute encoder EnDat 2048 S/R [1] (not for 1FT602) Absolute encoder EnDat 512 S/R [1] (only for 1FT602) Multi-pole resolver 2-pole resolver	A E H S T
Encoder systems for motors with DRIVE-CLiQ interface:	22 bit incremental encoder Absolute enc. 22 bit single-turn +12 bit multi-turn [1] (not for 1FT602) Absolute enc. 20 bit single-turn +12 bit multi-turn (only for 1FT602) 15 bit resolver 14 bit resolver	D F L U 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
Fitted key and keyway	Tolerance R	without	D
Fitted key and keyway	Tolerance R	with	E
Plain shaft	Tolerance N	without	G
Plain shaft	Tolerance N	with	H
Plain shaft	Tolerance R	without	K
Plain shaft	Tolerance R	with	L

Vibration magnitude:	**Degree of protection:**	
Grade A	IP64	0
Grade A	IP65 (not for 1FT602)	1
Grade A	IP67	2
Grade A	IP68 (not for 1FT602)	6
Grade R	IP64	3
Grade R	IP65 (not for 1FT602)	4
Grade R	IP67	5
Grade R	IP68 (not for 1FT602)	7

To select the degree of protection and type, see the selection guide.

Selection and ordering data

Motor type (continued)	Static current	Calculated power P_{calc} 5)	SINAMICS S120 Motor Module		Power cable with complete shield		
			Rated output current 4)	Booksize format	Motor connection (and brake connection) via power connector		
	I_0 at M_0 ΔT=100 K	P_{calc} for M_0 ΔT=100 K	I_{rated}	Order No.	Power connector	Cable cross-section 3)	Order No. Pre-assembled cable
	A	kW (HP)	A		Size	mm^2	
1FT6021-6AK7 ...	1.25	0.3 (0.4)	3	**6SL312■ - ■TE13-0AA3**	1	4 x 1.5	**6FX■002-5■S01-....**
1FT6024-6AK7 ...	1.25	0.5 (0.7)	3	**6SL312■ - ■TE13-0AA3**	1	4 x 1.5	**6FX■002-5■S01-....**
1FT6031-4AK7 ...	1.4	0.6 (0.8)	3	**6SL312■ - ■TE13-0AA3**	1	4 x 1.5	**6FX■002-5■S01-....**
1FT6034-4AK7 ...	2.6	1.3 (1.7)	3	**6SL312■ - ■TE13-0AA3**	1	4 x 1.5	**6FX■002-5■S01-....**
1FT6041-4AK7 ...	3.0	1.6 (2.2)	3	**6SL312■ - ■TE13-0AA3**	1	4 x 1.5	**6FX■002-5■S01-....**
1FT6044-4AK7 ...	5.9	3.1 (4.2)	9	**6SL312■ - ■TE21-0AA3**	1	4 x 1.5	**6FX■002-5■S01-....**
1FT6061-6AK7...	5.0	2.5 (3.4)	5	**6SL312■ - ■TE15-0AA3**	1	4 x 1.5	**6FX■002-5■S01-....**
1FT6062-6AK7...	7.6	3.8 (5.1)	9	**6SL312■ - ■TE21-0AA3**	1	4 x 1.5	**6FX■002-5■S01-....**
1FT6064-6AK7...	12.0	4.0 (5.4)	18	**6SL312■ - ■TE21-8AA3**	1	4 x 1.5	**6FX■002-5■S01-....**
1FT6081-8AK7...	11.1	5.0 (6.7)	18	**6SL312■ - ■TE21-8AA3**	1.5	4 x 1.5	**6FX■002-5■S21-....**
1FT6082-8AK7...	17.3	8.2 (11.0)	18	**6SL312■ - ■TE21-8AA3**	1.5	4 x 2.5	**6FX■002-5■S31-....**
1FT6084-8AK7...	24.1	12.6 (16.9)	30	**6SL312■ - 1TE23-0AA3**	1.5	4 x 4	**6FX■002-5■S41-....**

Cooling:								
Internal air cooling	**0**							
External air cooling	**1**							
Motor Module:								
Single Motor Module		**1**						
Double Motor Module		**2**						
Type of power cable:								
MOTION-CONNECT 800						**8**		
MOTION-CONNECT 500						**5**		
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) Same flange as for IM B5 type, but with metric threaded insert in the four mounting holes.

3) 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)

4) With default setting of the pulse frequency.

5) $P_{calc}\ [kW] = \frac{M_0\ [Nm] \times n_{rated}}{9550}$ $\quad P_{calc}\ [HP] = \frac{M_0\ [lb_f\text{-in}] \times n_{rated}}{63000}$

1FT6 motors, standard type
Forced ventilation

Selection and ordering data

Rated speed	Shaft height	Rated power	Static torque	Rated torque [1]	Rated current	1FT6 synchronous motors Forced ventilation [2]	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	Order No. **Standard type**		J	m
rpm		kW (HP)	Nm (lb_f-ft)	Nm (lb_f-ft)	A			10^{-4} kgm^2 (10^{-3} lb_f-in-s^2)	kg (lb)
1500	100	9.3 (12.5)	65.0 (47.9)	59.0 (43.5)	21.7	**1FT6105-8SB7■ - ■■■■**	4	168 (148)	45.5 (100)
		13.0 (17.4)	90.0 (66.3)	83.0 (61.2)	31	**1FT6108-8SB7■ - ■■■■**	4	260 (230)	61.5 (135)
	132	16.0 (21.5)	110 (81.1)	102 (75.5)	36	**1FT6132-6SB71 - ■■■■**	3	430 (380)	91.0 (200)
		20.4 (27.4)	140 (103)	130 (95.8)	45	**1FT6134-6SB71 - ■■■■**	3	547 (484)	106 (233)
		25.1 (33.7)	175 (129)	160 (117)	55	**1FT6136-6SB71 - ■■■■**	3	664 (587)	123 (271)
2000	100	11.7 (15.7)	65.0 (47.9)	56.0 (41.3)	28	**1FT6105-8SC7■ - ■■■■**	4	168 (148)	45.5 (100)
		16.8 (22.5)	90.0 (66.3)	80.0 (59)	40	**1FT6108-8SC7■ - ■■■■**	4	260 (230)	61.5 (135)
	132	20.5 (27.5)	110 (81.1)	98.0 (72.2)	46	**1FT6132-6SC71 - ■■■■**	3	430 (380)	91.0 (200)
		26.2 (35.1)	140 (103)	125 (92.1)	57	**1FT6134-6SC71 - ■■■■**	3	547 (484)	106 (233)
		32.5 (43.6)	175 (129)	155 (114)	72	**1FT6136-6SC71 - ■■■■**	3	664 (587)	123 (271)

Type:	IM B5	**1**
	IM B14 [3] (not for 1FT613.)	**2**
Connector outlet direction:	Transverse right	**1**
	Transverse left	**2**
	Axial NDE (not for 1FT613 and not for 1FT6 with DRIVE-CLiQ and power connector size 3)	**3**
	Axial DE	**4**
Terminal box/ Cable entry:	Transverse/from right	**5**
	Transverse/from left	**6**
	Axial/from NDE	**7**
	Axial/from DE	**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]	**E**
	Multi-pole resolver	**S**
	2-pole resolver	**T**
Encoder systems for motors with DRIVE-CLiQ interface:	22 bit incremental encoder	**D**
	Absolute encoder, 22 bit single-turn +12 bit multi-turn [1]	**F**
	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**
Fitted key and keyway	Tolerance R	without	**D**
Fitted key and keyway	Tolerance R	with	**E**
Plain shaft	Tolerance N	without	**G**
Plain shaft	Tolerance N	with	**H**
Plain shaft	Tolerance R	without	**K**
Plain shaft	Tolerance R	with	**L**

Vibration magnitude:	Degree of protection: [4]	
Grade A	IP64	**0**
Grade A	IP65	**1**
Grade R	IP64	**3**
Grade R	IP65	**4**

To select the degree of protection and type, see the selection guide.

Selection and ordering data

Motor type (continued)	Static current	Calculated power P_{calc} 7)	SINAMICS S120 Motor Module		Power cable with complete shield		
			Rated output current 6)	Booksize format	Motor connection (and brake connection) via power connector		
	I_0 at M_0 ΔT=100 K	P_{calc} for M_0 ΔT=100 K	I_{rated}	Order No.	Power connector	Cable cross-section 5)	Order No. Pre-assembled cable
	A	kW (HP)	A		Size	mm²	
1FT6105-8SB7...	21.9	10.2 (13.7)	30	**6SL312■ -1TE23-0AA3**	1.5	4 x 4	**6FX■002-5■S41-....**
1FT6108-8SB7...	30	14.1 (18.9)	30	**6SL312■ -1TE23-0AA3**	1.5	4 x 6	**6FX■002-5■S51-....**
1FT6132-6SB7...	36	17.3 (23.2)	45	**6SL312■ -1TE24-5AA3**	3	4 x 10	**6FX■002-5■S14-....**
1FT6134-6SB7...	44	22.0 (29.5)	60	**6SL312■ -1TE26-0AA3**	3	4 x 10	**6FX■002-5■S14-....**
1FT6136-6SB7...	55	27.5 (36.9)	60	**6SL312■ -1TE26-0AA3**	3	4 x 16	**6FX■002-5■S23-....**
1FT6105-8SC7...	30	13.6 (18.2)	30	**6SL312■ -1TE23-0AA3**	1.5	4 x 6	**6FX■002-5■S51-....**
1FT6108-8SC7...	41	18.8 (25.2)	45	**6SL312■ -1TE24-5AA3**	3	4 x 10	**6FX■002-5■S14-....**
1FT6132-6SC7...	47	23.0 (30.8)	60	**6SL312■ -1TE26-0AA3**	3	4 x 10	**6FX■002-5■S14-....**
1FT6134-6SC7...	58	29.3 (39.3)	60	**6SL312■ -1TE26-0AA3**	3	4 x 16	**6FX■002-5■S23-....**
1FT6136-6SC7...	77	36.6 (49.1)	85	**6SL312■ -1TE28-5AA3**	3	4 x 25	**6FX■002-5DS33-....**

Cooling: Internal air cooling / External air cooling	**0** / **1**							
Motor Module: Single Motor Module		**1**						
Type of power cable: MOTION-CONNECT 800 / MOTION-CONNECT 500							**8** / **5**	
Without brake cores / With brake cores								**C** / **D**
For length code as well as power and signal cables, see MOTION-CONNECT connection system.								**....**

Notes on blower motor for forced ventilation:

	Shaft heights 80 and 100	Shaft height 132
Direction of air flow	From NDE to DE	From DE to NDE
Connection system	Connector size 1	Terminal box
Type of connecting cable	6FX.002-5CA01-....	6FX.008-1BB11-....
Pin and terminal assignments	Pin 1: L1, Pin 2: N	U1/L1: V2/L2: W3/L3
Supply voltage	1-phase 220/260 V AC, 50/60 Hz	3-phase 400/460 V AC, 50/60 Hz
Max. fan current	0.3 A	0.4 A
Weight of the fan module, approx.	4.8 kg (10.6 lb)	5.6 kg (12.3 lb)
Sound pressure level L_{pA} (1 m)	70 dB	74 dB

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

2) Not for use in environments containing electrically conductive dust. Forced ventilation cannot be used in the presence of flammable, corrosive, electrically conductive or explosive dust.

3) Same flange as for IM B5 type, but with metric threaded insert in the four mounting holes.

4) The degree of protection refers to the motor. The built-on fan meets the requirements of degree of protection IP54.

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)

6) With default setting of the pulse frequency.

7) $P_{calc}\,[kW] = \frac{M_0\,[Nm] \times n_{rated}}{9550}$ $\quad P_{calc}\,[HP] = \frac{M_0\,[lb_f\text{-}in] \times n_{rated}}{63000}$

1FT6 motors, standard type
Forced ventilation

Selection and ordering data

Rated speed	Shaft height	Rated power	Static torque	Rated torque [1]	Rated current	1FT6 synchronous motors Forced ventilation [2]	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	Order No. **Standard type**		J	m
rpm		kW (HP)	Nm (lb_f-ft)	Nm (lb_f-ft)	A			10^{-4}kgm^2 (10^{-3} lb_f-in-s^2)	kg (lb)
3000	80	6.9 (9.3)	26.0 (19.2)	22.0 (16.2)	17	**1FT6084-8SF7■ - ■■■■**	4	48.0 (42.4)	25.0 (55.1)
		9.7 (13.0)	35.0 (25.8)	31.0 (22.8)	24.5	**1FT6086-8SF7■ - ■■■■**	4	66.5 (58.8)	30.0 (66.2)
	100	15.7 (21.1)	65.0 (47.9)	50.0 (36.9)	35	**1FT6105-8SF7■ - ■■■■**	4	168 (148)	45.5 (100)
		22 (29.5)	90.0 (66.3)	70.0 (51.6)	53	**1FT6108-8SF7■ - ■■■■**	4	260 (230)	61.5 (135)
	132	28.3 (38.0)	110 (81.1)	90.0 (66.3)	62	**1FT6132-6SF71 - ■■■■**	3	430 (380)	91.0 (200)
		34.6 (46.4)	140 (103)	110 (81.1)	72	**1FT6134-6SF71 - ■■■■**	3	547 (484)	106 (233)
		45.5 (61.0)	175 (129)	145 (106)	104	**1FT6136-6SF71 - ■■■■**	3	664 (587)	123 (271)
4500	80	9.4 (12.6)	26.0 (19.2)	20.0 (14.7)	24.5	**1FT6084-8SH7■ - ■■■■**	4	48.0 (42.4)	25.0 (55.1)
		12.7 (17.0)	35.0 (25.8)	27.0 (19.9)	31.5	**1FT6086-8SH7■ - ■■■■**	4	66.5 (58.8)	30.0 (66.2)
	100	18.8 (25.2)	65.0 (47.9)	40.0 (29.9)	41	**1FT6105-8SH7■ - ■■■■**	4	168 (148)	45.5 (100)
6000	80	10.7 (14.4)	26.0 (19.2)	17.0 (12.5)	25.5	**1FT6084-8SK7■ - ■■■■**	4	48.0 (42.4)	25.0 (55.1)
		13.8 (18.5)	35.0 (25.8)	22.0 (16.2)	29	**1FT6086-8SK7■ - ■■■■**	4	66.5 (58.8)	30.0 (66.2)

Type:	IM B5 IM B14 [3] (not for 1FT613.)	1 2
Connector outlet direction (not for 1FT6136-6SF71):	Transverse right Transverse left Axial NDE (not for 1FT613 and not for 1FT6 with DRIVE-CLiQ and power connector size 3) Axial DE	1 2 3 4
Terminal box/ cable entry: (only for 1FT61)	Transverse/from right Transverse/from left Axial/from NDE Axial/from DE	5 6 7 8
Encoder systems for motors without DRIVE-CLiQ interface:	Incremental encoder sin/cos 1 V_{pp} 2048 S/R Absolute encoder EnDat 2048 S/R [1] Multi-pole resolver 2-pole resolver	A E S T
Encoder systems for motors with DRIVE-CLiQ interface:	22 bit incremental encoder Absolute encoder, 22 bit single-turn +12 bit multi-turn [1] 15 bit resolver 14 bit resolver	D F U 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
Fitted key and keyway	Tolerance R	without	D
Fitted key and keyway	Tolerance R	with	E
Plain shaft	Tolerance N	without	G
Plain shaft	Tolerance N	with	H
Plain shaft	Tolerance R	without	K
Plain shaft	Tolerance R	with	L

Vibration magnitude:	**Degree of protection:** [4]	
Grade A	IP64	0
Grade A	IP65	1
Grade R	IP64	3
Grade R	IP65	4

To select the degree of protection and type, see the selection guide.

Selection and ordering data

Motor type (continued)	Static current	Calculated power P_{calc} 8)	SINAMICS S120 Motor Module		Power cable with complete shield		
			Rated output current 7)	Booksize format	Motor connection (and brake connection) via power connector		
	I_0 at M_0 ΔT=100 K	P_{calc} for M_0 ΔT=100 K	I_{rated}	Order No.	Power connector	Cable cross-section 6)	Order No. Pre-assembled cable
	A	kW (HP)	A		Size	mm²	
1FT6084-8SF7...	18.2	8.2 (11.0)	18 5)	**6SL312■ - ■TE21-8AA3**	1.5	4 x 2.5	**6FX■002-5■S31-....**
1FT6086-8SF7...	25	11.0 (14.8)	30	**6SL312■ - 1TE23-0AA3**	1.5	4 x 4	**6FX■002-5■S41-....**
1FT6105-8SF7...	42	20.4 (27.4)	45	**6SL312■ - 1TE24-5AA3**	3	4 x 10	**6FX■002-5■S14-....**
1FT6108-8SF7...	62	28.3 (37.9)	60 5)	**6SL312■ - 1TE26-0AA3**	3	4 x 16	**6FX■002-5■S23-....**
1FT6132-6SF7...	69	34.6 (46.4)	85	**6SL312■ - 1TE28-5AA3**	3	4 x 25	**6FX■002-5DS33-....**
1FT6134-6SF7...	83	44.0 (59.0)	85	**6SL312■ - 1TE28-5AA3**	3	4 x 25	**6FX■002-5DS33-....**
1FT6136-6SF7...	110	55.0 (73.8)	132	**6SL312■ - 1TE31-3AA3**	Terminal box (max. 4 x 35)		
1FT6084-8SH7...	26	12.3 (16.5)	30	**6SL312■ - 1TE23-0AA3**	1.5	4 x 4	**6FX■002-5■S41-....**
1FT6086-8SH7...	38	16.5 (22.1)	45	**6SL312■ - 1TE24-5AA3**	3	4 x 10	**6FX■002-5■S14-....**
1FT6105-8SH7...	59	30.6 (41.0)	85	**6SL312■ - 1TE28-5AA3**	3	4 x 16	**6FX■002-5■S23-....**
1FT6084-8SK7...	35	16.3 (21.9)	45	**6SL312■ - 1TE24-5AA3**	1.5	4 x 10	**6FX■002-5■S64-....**
1FT6086-8SK7...	44	22.0 (29.5)	45	**6SL312■ - 1TE24-5AA3**	3	4 x 10	**6FX■002-5■S14-....**

Cooling:												
Internal air cooling	**0**											
External air cooling	**1**											
Motor Module:												
Single Motor Module		**1**										
Double Motor Module		**2**										
Type of power cable:												
MOTION-CONNECT 800									**8**			
MOTION-CONNECT 500									**5**			
Without brake cores										**C**		
With brake cores										**D**		
For length code as well as power and signal cables, see MOTION-CONNECT connection system.												**....**

Notes on blower motor for forced ventilation:

	Shaft heights 80 and 100	Shaft height 132
Direction of air flow	From NDE to DE	From DE to NDE
Connection system	Connector size 1	Terminal box
Type of connecting cable	6FX.002-5CA01-....	6FX.008-1BB11-....
Pin and terminal assignments	Pin 1: L1, Pin 2: N	U1/L1: V2/L2: W3/L3
Supply voltage	1-phase 220/260 V AC, 50/60 Hz	3-phase 400/460 V AC, 50/60 Hz
Max. fan current	0.3 A	0.4 A
Weight of the fan module, approx.	4.8 kg (10.6 lb)	5.6 kg (12.3 lb)
Sound pressure level L_{pA} (1 m)	70 dB	74 dB

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

2) Not for use in environments containing electrically conductive dust. Forced ventilation cannot be used in the presence of flammable, corrosive, electrically conductive or explosive dust.

3) Same flange as for IM B5 type, but with metric threaded insert in the four mounting holes.

4) The degree of protection refers to the motor. The built-on fan meets the requirements of degree of protection IP54.

5) With the specified Motor Module, the motor cannot be fully utilized with M_0 at ΔT = 100 K winding temperature rise.

6) 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).

7) With default setting of the pulse frequency.

8) $P_{calc}\ [kW] = \frac{M_0\ [Nm] \times n_{rated}}{9550}$ $\quad P_{calc}\ [HP] = \frac{M_0\ [lb_f\text{-in}] \times n_{rated}}{63000}$

1FT6 Big Servo motors
Forced ventilation

Selection and ordering data

Rated speed	Shaft height	Rated power	Static torque	Rated torque	Rated current	1FT6 synchronous motors Big Servo Forced ventilation [1]	Number of pole pairs	Rotor moment of inertia (without brake)	Weight (without brake)
n_{rated}		P_{rated} at ΔT=100 K	M_0 at ΔT=100 K	M_{rated} at ΔT=100 K	I_{rated} at ΔT=100 K	Order No.		J	
rpm	SH	kW (HP)	Nm (lb_f-ft)	Nm (lb_f-ft)	A			10^{-4} kgm^2 (10^{-3} lb_f-in-s^2)	kg (lb)
1500	160	60.5 (81.1)	425 (313)	385 (283)	136	**1FT6163-8SB7 6 -** ■■■■	4	2300 (2035)	170 (374)
		85 (114)	600 (442)	540 (398)	174	**1FT6168-8SB7 6 -** ■■■■	4	3100 (2743)	210 (463)
2500	160	89 (119)	425 (313)	340 (250)	185	**1FT6163-8SD7 6 -** ■■■■	4	2300 (2035)	170 (374)

Type [3]:	IM B35		**6**	
Terminal box at top, cable entry:	Transverse right Transverse left Axial NDE Axial DE		**5** **6** **7** **8**	
Encoder systems for motors without DRIVE-CLiQ interface	Incremental encoder sin/cos 1 V_{pp} 2048 S/R Absolute encoder EnDat 2048 S/R Multi-pole resolver 2-pole resolver		**A** **E** **S** **T**	
Encoder systems for motors with DRIVE-CLiQ interface:	22 bit incremental encoder Absolute encoder, 22 bit single-turn +12 bit multi-turn 15 bit resolver 14 bit resolver		**D** **F** **U** **P**	
Shaft extension:	**Shaft and flange accuracy:**	**Holding brake:**	**A** **D** **G** **K**	
With fitted key and keyway	Tolerance N	without		
With fitted key and keyway	Tolerance R	without		
Plain shaft	Tolerance N	without		
Plain shaft	Tolerance R	without		
Vibration magnitude:		**Degree of protection:** [2]		
Grade A		IP64	**0**	
Grade A		IP65	**1**	
Grade R		IP64	**3**	
Grade R		IP65	**4**	

To select the degree of protection and type, see the selection guide.

Selection and ordering data

Motor type (continued)	Static current	Calculated power	SINAMICS S120 Motor Module		Power cable with complete shield		
		P_{calc} [7]	Rated output current [5]	Booksize format	Motor connection via terminal box		
	I_0 at ΔT=100 K	P_{calc} for M_0 ΔT=100 K	I_{rated} [4]	Order No.	Cable entry terminal box [6]	Max. connectable cable cross-section	Order No. Power cable/ By the meter
	A	kW (HP)	A			mm^2	
1FT6163-8SB76-....	151	66.8 (89.6)	200	**6SL312■-1TE32-0AA3**	2 x M50 x 1.5	2 x 4 x 50	**6FX■008-1BB50-....**
1FT6168-8SB76-....	194	94.2 (126)	200	**6SL312■-1TE32-0AA3**	2 x M50 x 1.5	2 x 4 x 50	**6FX■008-1BB50-....**
1FT6163-8SD76-....	226	111 (148)	200	**6SL312■-1TE32-0AA3**	2 x M50 x 1.5	2 x 4 x 50	**6FX■008-1BB50-....**

Cooling:	
Internal air cooling	**0**
External air cooling	**1**
Motor Module:	
Single Motor Module	**1**
Type of power cable:	
MOTION-CONNECT 800	**8**
MOTION-CONNECT 500	**5**
For length code as well as power and signal cables, see MOTION-CONNECT connection system.	**....**

Notes on blower motor for forced ventilation:

	Shaft height 160
Direction of air flow	From DE to NDE
Connection system	Terminal box
Type of connecting cable	6FX.008-1BB11-....
Pin and terminal assignments	U1/L1: V2/L2: W3/L3
Supply voltage	400/480 V 3 AC 50/60 Hz
Max. fan current	0.8 A
Sound pressure level L_{pA} (1 m)	74 dB

1) Not for use in environments containing electrically conductive dust. Forced ventilation cannot be used in the presence of flammable, corrosive, electrically conductive or explosive dust.

2) The degree of protection refers to the motor. The built-on fan meets the requirements of degree of protection IP54.

3) 1FT616 Big Servo motors of construction type IM B35 can be mounted on the flange only.

4) Motor Modules are assigned according to the motor rated current.

5) With default setting of the pulse frequency.

6) Terminal box type gk 630.

7) $P_{calc}\,[kW] = \frac{M_0\,[Nm] \times n_{rated}}{9550}$ $\quad P_{calc}\,[HP] = \frac{M_0\,[lb_f\text{-}in] \times n_{rated}}{63000}$

1FT6 motors, standard type
Water cooling

Selection and ordering data

Rated speed	Shaft height	Rated power	Static torque	Rated torque	Rated current	**1FT6 synchronous motors Water cooling** [1) 2)]	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	Order No. **Standard type**		J	m
rpm		kW (HP)	Nm (lb_f-ft)	Nm (lb_f-ft)	A			10^{-4} kgm^2 (10^{-3} lb_f-in-s^2)	kg (lb)
1500	100	18.2 (24.4)	119 (87.7)	116 (85.5)	43	**1FT6108-8WB7■ - ■■■■**	4	260 (230)	61.5 (135)
2000	100	17.2 (23.1)	85.0 (62.6)	82.0 (60.4)	60	**1FT6105-8WC7■ - ■■■■**	4	168 (148)	45.5 (100)
		24.1 (32.3)	119 (87.7)	115 (84.8)	57	**1FT6108-8WC7■ - ■■■■**	4	260 (230)	61.5 (135)
3000	63	3.2 (4.3)	10.2 (7.5)	10.0 (7.4)	6.9	**1FT6062-6WF7■ - ■■■■**	3	8.5 (7.52)	9.5 (20.9)
		5.1 (6.8)	16.2 (11.9)	16.0 (11.8)	10.3	**1FT6064-6WF7■ - ■■■■**	3	13.0 (11.5)	12.5 (27.6)
	80	11.0 (14.8)	35.0 (25.8)	35.0 (25.8)	27	**1FT6084-8WF7■ - ■■■■**	4	48.0 (42.4)	21.0 (46.3)
		14.5 (19.4)	47.0 (34.6)	46.0 (33.9)	37	**1FT6086-8WF7■ - ■■■■**	4	66.5 (58.8)	26.0 (57.3)
	100	24.5 (32.9)	85.0 (62.6)	78.0 (57.5)	82	**1FT6105-8WF7■ - ■■■■**	4	168 (148)	45.5 (100)
		34.2 (45.9)	119 (87.7)	109 (80.3)	81	**1FT6108-8WF7■ - ■■■■**	4	260 (230)	61.5 (135)
4500	63	4.7 (6.3)	10.2 (7.5)	10.0 (7.4)	9.6	**1FT6062-6WH7■ - ■■■■**	3	8.5 (7.52)	9.5 (20.9)
		7.5 (10.1)	16.2 (11.9)	16.0 (11.8)	15.2	**1FT6064-6WH7■ - ■■■■**	3	13.0 (11.5)	12.5 (27.6)
	80	16.5 (22.1)	35.0 (25.8)	35.0 (25.8)	39	**1FT6084-8WH7■ - ■■■■**	4	48.0 (42.4)	21.0 (46.3)
		21.2 (28.4)	47.0 (34.6)	45.0 (33.2)	53	**1FT6086-8WH7■ - ■■■■**	4	66.5 (58.8)	26.0 (57.3)
6000	63	6.2 (8.3)	10.2 (7.5)	9.8 (7.2)	12.7	**1FT6062-6WK7■ - ■■■■**	3	8.5 (7.52)	9.5 (20.9)
		9.9 (13.3)	16.2 (11.9)	15.8 (11.6)	20	**1FT6064-6WK7■ - ■■■■**	3	13.0 (11.5)	12.5 (27.6)
	80	21.4 (28.7)	35.0 (25.8)	34.0 (25.1)	51	**1FT6084-8WK7■ - ■■■■**	4	48.0 (42.4)	21.0 (46.3)
		27.7 (37.2)	47.0 (34.6)	44.0 (32.4)	58	**1FT6086-8WK7■ - ■■■■**	4	66.5 (58.8)	26.0 (57.3)

Type:	IM B5 IM B14 [3)] (not for 1FT613)	1 2
Connector outlet direction:	Transverse right (not for 1FT606) Transverse left (not for 1FT606) Axial NDE (not for 1FT6 with DRIVE-CLiQ and power connec. size 3) Axial DE (1FT6062 only with water connec. on side or below) [2)]	1 2 3 4
Terminal box/cable entry: (only for 1FT61)	Transverse/from right Transverse/from left Axial/from NDE Axial/from DE	5 6 7 8
Encoder systems for motors without DRIVE-CLiQ interface:	Incremental encoder sin/cos 1 V_{pp} 2048 S/R Absolute encoder EnDat 2048 S/R Multi-pole resolver 2-pole resolver	A E S T
Encoder systems for motors with DRIVE-CLiQ interface:	22 bit incremental encoder Absolute encoder, 22 bit single-turn +12 bit multi-turn 15 bit resolver 14 bit resolver	D F U 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
Fitted key and keyway	Tolerance R	without	D
Fitted key and keyway	Tolerance R	with	E
Plain shaft	Tolerance N	without	G
Plain shaft	Tolerance N	with	H
Plain shaft	Tolerance R	without	K
Plain shaft	Tolerance R	with	L

Vibration magnitude:	**Degree of protection:**	
Grade A	IP64	0
Grade A	IP65	1
Grade A	IP67	2
Grade A	IP68	6
Grade R	IP64	3
Grade R	IP65	4
Grade R	IP67	5
Grade R	IP68	7

To select the degree of protection and type, see the selection guide.

Selection and ordering data

Motor type (continued)	Static current I_0 at M_0 ΔT=100K	Calculated power P_{calc} [7] P_{calc} for M_0 ΔT=100 K	SINAMICS S120 Motor Module: Rated output current [6] I_{rated}	SINAMICS S120 Motor Module: Booksize format Order No.	Power cable with complete shield – Motor connection (and brake connection) via power connector: Power connector	Cable cross-section [5]	Order No. Pre-assembled cable
	A	kW (HP)	A		Size	mm²	
1FT6108-8WB7...	43	18.7 (25.1)	45	**6SL312■- 1TE24-5AA3**	3	4 x 10	**6FX■002-5■S14-....**
1FT6105-8WC7...	58	17.8 (23.9)	60	**6SL312■- 1TE26-0AA3**	3	4 x 16	**6FX■002-5■S23-....**
1FT6108-8WC7...	57	24.9 (33.4)	60	**6SL312■- 1TE26-0AA3**	3	4 x 16	**6FX■002-5■S23-....**
1FT6062-6WF7...	6.9	3.2 (4.3)	9	**6SL312■- ■TE21-0AA3**	1	4 x 1.5	**6FX■002-5■S01-....**
1FT6064-6WF7...	10.3	5.1 (6.8)	18	**6SL312■- ■TE21-8AA3**	1	4 x 1.5	**6FX■002-5■S01-....**
1FT6084-8WF7...	24.5	11.0 (14.8)	30	**6SL312■- 1TE23-0AA3**	1.5	4 x 4	**6FX■002-5■S41-....**
1FT6086-8WF7...	34	14.8 (19.9)	45	**6SL312■- 1TE24-5AA3**	1.5	4 x 10	**6FX■002-5■S64-....**
1FT6105-8WF7...	83	26.7 (35.8)	85	**6SL312■- 1TE28-5AA3**	3	4 x 25	**6FX5 002-5DS33-....**
1FT6108-8WF7...	86	37.4 (50.2)	85 [4]	**6SL312■- 1TE28-5AA3**	3	4 x 35	**6FX5 002-5DS43-....**
1FT6062-6WH7...	9.7	4.8 (6.4)	18	**6SL312■- ■TE21-8AA3**	1	4 x 1.5	**6FX■002-5■S01-....**
1FT6064-6WH7...	15.4	7.6 (10.2)	18	**6SL312■- ■TE21-8AA3**	1	4 x 2.5	**6FX■002-5■S11-....**
1FT6084-8WH7...	37	16.5 (22.1)	45	**6SL312■- 1TE24-5AA3**	1.5	4 x 10	**6FX■002-5■S64-....**
1FT6086-8WH7...	52	22.1 (29.6)	60	**6SL312■- 1TE26-0AA3**	3	4 x 16	**6FX■002-5■S23-....**
1FT6062-6WK7...	12.9	6.4 (8.6)	18	**6SL312■- ■TE21-8AA3**	1	4 x 1.5	**6FX■002-5■S01-....**
1FT6064-6WK7...	20.5	10.2 (13.7)	30	**6SL312■- 1TE23-0AA3**	1	4 x 2.5	**6FX■002-5■S11-....**
1FT6084-8WK7...	47	22.0 (29.5)	60	**6SL312■- 1TE26-0AA3**	3	4 x 10	**6FX■002-5■S14-....**
1FT6086-8WK7...	59	29.5 (39.6)	60	**6SL312■- 1TE26-0AA3**	3	4 x 16	**6FX■002-5DS23-....**

Option	Code
Cooling:	
Internal air cooling	**0**
External air cooling	**1**
Motor Module:	
Single Motor Module	**1**
Double Motor Module	**2**
Type of power cable:	
MOTION-CONNECT 800	**8**
MOTION-CONNECT 500	**5**
Without brake cores	**C**
With brake cores	**D**
For length code as well as power and signal cables, see MOTION-CONNECT connection system.	**....**

Notes on water cooling:

- Inlet temperature of cooling water: max. 30 °C (86 °F)
- Cooling water throughput: at least 5 l/min (1.32 US gallons)
- Pressure ahead of motor: p_{max} = 3 bar (43.5 psi)
- Cooling water connection: G 3/8"
- Coolant: water with up to 25 % corrosion protection (recommendation: Tyfocor)
- Loss of pressure between inlet and outlet <0.1 bar (1.45 psi)

1) Delivered as standard with water connection "at top".

2) Water connection on right side: Add **-Z** + order code **Q20 to order number**
Water connection on left side: Add **-Z** + order code **Q21 to order number**
Water connection below: Add **-Z** + order code **Q22 to order number**.

3) Same flange as for IM B5 type, but with metric threaded insert in the four mounting holes.

4) With the specified Motor Module, the motor cannot be fully utilized with M_0 at ΔT = 100 K winding temperature rise. If a Motor Module with a higher rating is used, you must check whether the specified power cable can be connected to it.

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).

6) With default setting of the pulse frequency.

7) $P_{calc}\ [\text{kW}] = \dfrac{M_0\ [\text{Nm}] \times n_{rated}}{9550}$ $\qquad P_{calc}\ [\text{HP}] = \dfrac{M_0\ [\text{lb}_f\text{-in}] \times n_{rated}}{63000}$

1FT6 Big Servo motors
Water cooling

Selection and ordering data

Rated speed	Shaft height	Rated power	Static torque	Rated torque	Rated current	1FT6 synchronous motors Big Servo Water 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	Order No.		J	m
rpm		kW (HP)	Nm (lb_f-ft)	Nm (lb_f-ft)	A			10^{-4} kgm^2 (10^{-3} lb_f-in-s^2)	kg (lb)
1500	132	23.6 (31.7)	155 (114)	150 (110)	58	**1FT6132-6WB76 -** ■■■■	3	430 (380)	90.0 (198)
		29.1 (39.0)	200 (147)	185 (136)	67	**1FT6134-6WB76 -** ■■■■	3	547 (484)	103 (227)
		36.1 (48.4)	240 (176)	230 (169)	90	**1FT6136-6WB76 -** ■■■■	3	665 (588)	120 (264)
		45.5 (61.0)	300 (221)	290 (213)	112	**1FT6138-6WB76 -** ■■■■	3	845 (747)	137 (302)
	160	70.7 (94.8)	450 (331)	450 (331)	160	**1FT6163-8WB76 -** ■■■■	4	2300 (2035)	170 (374)
		108.4 (145.4)	700 (515)	690 (508)	221	**1FT6168-8WB76 -** ■■■■	4	3100 (2743)	210 (463)
2500	132	35.3 (47.3)	155 (114)	135 (99.5)	82	**1FT6132-6WD76 -** ■■■■	3	430 (380)	90.0 (198)
		48.4 (64.9)	200 (147)	185 (136)	115	**1FT6134-6WD76 -** ■■■■	3	547 (484)	103 (227)
		57.6 (77.2)	240 (176)	220 (162)	149	**1FT6136-6WD76 -** ■■■■	3	665 (588)	120 (264)
		72.0 (96.6)	300 (221)	275 (202)	162	**1FT6138-6WD76 -** ■■■■	3	845 (747)	137 (302)
	160	117.8 (158.0)	450 (331)	450 (331)	240	**1FT6163-8WD76 -** ■■■■	4	2300 (2035)	170 (374)

Type [1]**:**	IM B35							**6**
Terminal box/ Cable entry:	Transverse/from right Transverse/from left Axial/from NDE Axial/from DE							**5** **6** **7** **8**
Encoder systems for motors without DRIVE-CLiQ interface:	Incremental encoder sin/cos 1 V_{pp} 2048 S/R Absolute encoder EnDat 2048 S/R Multi-pole resolver 2-pole resolver							**A** **E** **S** **T**
Encoder systems for motors with DRIVE-CLiQ interface:	22 bit incremental encoder Absolute encoder, 22 bit single-turn +12 bit multi-turn 15 bit resolver 14 bit resolver							**D** **F** **U** **P**
Shaft extension:	**Shaft and flange accuracy:**	**Holding brake:**						**A** **D** **G** **K**
Fitted key and keyway	Tolerance N	without						
Fitted key and keyway	Tolerance R	without						
Plain shaft	Tolerance N	without						
Plain shaft	Tolerance R	without						
Vibration magnitude:	**Degree of protection:**							
Grade A	IP64							**0**
Grade A	IP65							**1**
Grade R	IP64							**3**
Grade R	IP65							**4**

To select the degree of protection, see selection guide.

Selection and ordering data

Motor type (continued)	Static current	Calculated power P_{calc} 4)	SINAMICS S120 Motor Module		Power cable with complete shield		
			Rated output current 2)	Booksize format	Motor connection via terminal box		
	I_0 at M_0 ΔT=100 K	P_{calc} for M_0 ΔT=100 K	I_{rated}	Order No.	Cable cross-section terminal box type 3)	Max. connectable cable cross-section	Order No. Power cable By the meter
	A	kW (HP)	A			mm²	
1FT6132-6WB76-...	58	24.3 (23.6)	60	**6SL312■ -1TE 26-0AA3**	2 x M32 x 1.5	2 x 4 x 16	**6FX■008-1BB61-....**
1FT6134-6WB76-...	73	31.4 (42.1)	85	**6SL312■ -1TE 28-5AA3**	2 x M40 x 1.5	2 x 4 x 35	**6FX■008-1BB35-....**
1FT6136-6WB76-...	92	37.7 (50.6)	132	**6SL312■ -1TE 31-3AA3**	2 x M50 x 1.5	2 x 4 x 50	**6FX■008-1BB50-....**
1FT6138-6WB76-...	112	47.1 (63.2)	132	**6SL312■ -1TE 31-3AA3**	2 x M50 x 1.5	2 x 4 x 50	**6FX■008-1BB50-....**
1FT6163-8WB76-...	160	70.7 (94.8)	200	**6SL312■ -1TE 32-0AA3**	2 x M50 x 1.5	2 x 4 x 50	**6FX■008-1BB50-....**
1FT6168-8WB76-...	225	110 (147)	260	**6SL3320 -1TE 32-6AA3**	2 x M50 x 1.5	2 x 4 x 50	**6FX■008-1BB50-....**
1FT6132-6WD76-...	92	40.6 (54.4)	85	**6SL312■ -1TE 28-5AA3**	2 x M40 x 1.5	2 x 4 x 35	**6FX■008-1BB35-....**
1FT6134-6WD76-...	122	52.4 (70.3)	132	**6SL312■ -1TE 31-3AA3**	2 x M50 x 1.5	2 x 4 x 50	**6FX■008-1BB50-....**
1FT6136-6WD76-...	158	62.8 (84.2)	200	**6SL312■ -1TE 32-0AA3**	2 x M50 x 1.5	2 x 4 x 50	**6FX■008-1BB50-....**
1FT6138-6WD76-...	167	78.5 (105)	200	**6SL312■ -1TE 32-0AA3**	2 x M50 x 1.5	2 x 4 x 50	**6FX■008-1BB50-....**
1FT6163-8WD76-...	240	118 (158)	260	**6SL3320 -1TE 32-6AA3**	2 x M50 x 1.5	2 x 4 x 50	**6FX■008-1BB50-....**

Cooling:					
Internal air cooling	**0**				
External air cooling	**1**				
Motor Module:					
Single Motor Module		**1**			
Type of power cable:					
MOTION-CONNECT 800				**8**	
MOTION-CONNECT 500				**5**	
For length code as well as power and signal cables, see MOTION-CONNECT connection system.					**....**

Notes on water cooling:

- Inlet temperature of cooling water: max. 30 °C (86 °F)
- Cooling water throughput:
  1FT613: at least 8 l/min (2.11 US gallons)
  1FT616: at least 10 l/min (2.64 US gallons)
- Pressure ahead of motor: p_{max} = 6 bar (87 psi)
- Cooling water connection:
  1FT613: G 3/8".
  1FT616: G 1/2".
- Coolant: water with up to 25 % corrosion protection (recommendation: Tyfocor)
- Loss of pressure between inlet and outlet <0.1 bar (1.45 psi)

1) 1FT616 Big Servo motors of construction type IM B35 can be mounted on the flange only.

2) With default setting of the pulse frequency.

3) Terminal box type gk 630.

4) $P_{calc}\,[kW] = \frac{M_0\,[Nm] \times n_{rated}}{9550}$ $\quad P_{calc}\,[HP] = \frac{M_0\,[lb_f\text{-in}] \times n_{rated}}{63000}$

1FT7 Compact motors

Overview

The new 1FT7 Compact motors are permanent-magnet synchronous motors with very compact dimensions and an optically attractive design. Quick and easy mounting of the motors is possible due to the well proven cross-profile and quick release cable connectors.

The 1FT7 Compact motors fulfill the highest demands on dynamic response, speed setting range including field weakening, shaft and flange accuracy. They are equipped with state-of-the-art encoder technology and optimized for the use with our fully digital control and drive systems.

Benefits

- High shaft and flange accuracy
- Low torque ripple (average value <1 %)
- Highest dynamic response for minimized acceleration and deceleration times due to reduced moment of inertia (up to 30 % less than 1FT6)
- High overload capability (up to 4 x M_0)
- Compact design (up to 30 % shorter than 1FT6)
- High degree of protection
- Rugged, vibration-isolated encoder mounting
- Easy encoder replacement on site without alignment
- Quick and easy mounting due to cross-profile
- Rotatable quick release connectors
- New flange design with recessed flange surface, especially suitable for toothed-belt output and vertical assembly (IM V1). The previous flange design, compatible with the 1FT6 motors, can be ordered optionally.

Applications

- High-performance machine tools
- Machines with stringent requirements in terms of dynamic response, precision and limited space conditions, such as packaging machines, foil stretching machines, printing machines and material handling equipment

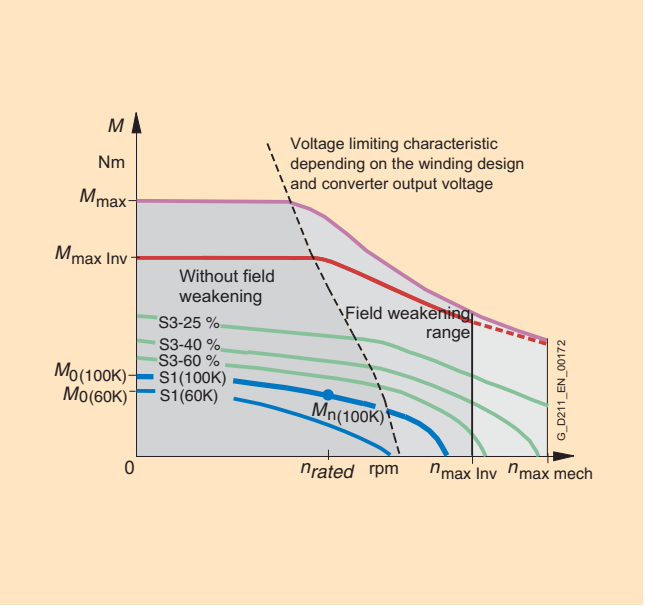
Technical specifications

Type of motor	Permanent-magnet synchronous motor
Magnet material	Rare-earth magnet material
Cooling	Natural cooling (SH 36 to SH 100)
Temperature monitoring	KTY 84 temperature sensor in 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 ΔT = 100 K at an ambient temperature of +40 °C (104 °F)
Type in accordance with EN 60034-7 (IEC 60034-7)	IM B5 (IM V1, IM V3) with flange 0
Degree of protection in accordance with EN 60034-5 (IEC 60034-5)	IP65
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) [1]	Tolerance N
Vibration magnitude in accordance with EN 60034-14 (IEC 60034-14)	Grade A (maintained up to rated speed)
Max. sound pressure level L_{pA} (1 m (3.28 ft)) in accordance with EN ISO 1680 Tolerance +3dB	
• 1FT703 to 1FT706	65 dB
• 1FT708 to 1FT710	70 dB
Built-in encoder systems for motors without DRIVE-CLiQ interface	• Incremental encoder sin/cos 1 V_{pp} 2048 S/R • Absolute encoder, multi-turn 2048 S/R (traversing range 4096 revolutions) with EnDat interface
Built-in encoder systems for motors with DRIVE-CLiQ interface	• 22 bit incremental encoder (2048 S/R internal) • 22 bit absolute encoder single-turn (2048 S/R internal) +12 bit multi-turn (traversing range 4096 revolutions)
Connection	Connectors for signals and power can be rotated
Paint finish	Pearl dark grey RAL 9023
2nd rating plate	Enclosed separately
Options	• Type IM B5 (IM V1, IM V3) with flange 1 (compatible with 1FT6) • Shaft extension on the drive end with fitted key and keyway (half-key balancing) • Built-in holding brake • Degree of protection IP64, IP67 • Vibration magnitude Grade R • Shaft and flange accuracy Tolerance R • Paint finish with other colors • Planetary gearbox, built-on

S/R = signals/revolution

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

Characteristics



Torque characteristic of a synchronous motor operating on a converter with field weakening (example characteristic)

More information

Core types can be supplied for certain motor types. These core types can be express delivered as replacement motors in the event of plant outages and offer the advantage of a quicker spare parts supply. For this reason, core types should be used for configuration wherever possible.

The selection and ordering data are based on the Booksize format by way of example. The formats Booksize Compact, Blocksize or Chassis are also possible.
Detailed engineering is performed with the SIZER engineering tool.

Options

Order code	Option description	1FT7 Compact
X01	Jet black finish RAL 9005	■
X02	Cream finish RAL 9001	■
X03	Reseda green finish RAL 6011	■
X04	Pebble gray finish RAL 7032	■
X05	Sky blue finish RAL 5015	■
X06	Light ivory finish RAL 1015	■
X09	Anthracite finish RAL 7016	■

■ Option available

1FT7 Compact motors, core type
Natural cooling

Selection and ordering data

Rated speed	Shaft height	Rated power	Static torque	Rated torque	Rated current	**1FT7 Compact synchronous motors 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	Order No. **Core type**		J	m
rpm		kW (HP)	Nm (lb_f-ft)	Nm (lb_f-ft)	A			10^{-4} kgm^2 (10^{-3} lb_f-in-s^2)	kg (lb)
2000	100	5.03 (6.75)	30 (22.1)	24 (17.7)	10	**1FT7102 - 1AC7■ - 1■ ■ 1**	5	91.4 (80.9)	26.1 (57.5)
		7.96 (10.7)	50 (36.9)	38 (28)	15	**1FT7105 - 1AC7■ - 1■ ■ 1**	5	178 (157)	44.2 (97.5)
3000	48	1.35 (1.81)	5.0 (3.7)	4.3 (3.2)	2.6	**1FT7044 - 1AF7■ - 1■ ■ 1**	3	5.43 (4.81)	7.2 (15.9)
	63	1.7 (2.28)	6.0 (4.4)	5.4 (4.0)	3.9	**1FT7062 - 1AF7■ - 1■ ■ 1**	5	7.36 (6.51)	7.1 (15.7)
		2.39 (3.20)	9.0 (6.6)	7.6 (5.6)	5.2	**1FT7064 - 1AF7■ - 1■ ■ 1**	5	11.9 (10.5)	9.7 (21.4)
	80	3.24 (4.34)	13 (9.6)	10.5 (7.7)	6.6	**1FT7082 - 1AF7■ - 1■ ■ 1**	5	26.5 (23.4)	14 (30.9)
		4.55 (6.10)	20 (14.8)	14.5 (10.7)	8.5	**1FT7084 - 1AF7■ - 1■ ■ 1**	5	45.1 (39.9)	20.8 (45.9)
		5.65 (7.58)	28 (20.7)	18 (13.3)	11	**1FT7086 - 1AF7■ - 1■ ■ 1**	5	63.6 (56.2)	27.5 (60.6)
4500	80	4.82 (6.46) [3]	20 (14.8)	11.5 (8.5) [3]	10.1 [3]	**1FT7084 - 1AH7■ - 1■ ■ 1**	5	45.1 (39.9)	20.8 (45.9)
		4.71 (6.32)	28 (20.7)	10 (7.4)	10	**1FT7086 - 1AH7■ - 1■ ■ 1**	5	63.6 (56.2)	27.5 (60.6)
6000	36	0.88 (1.18)	2.0 (1.5)	1.4 (1.0)	2.1	**1FT7034 - 1AK7■ - 1■ ■ 1**	3	0.85 (0.75)	3.8 (8.38)
	63	2.13 (2.86) [1]	6.0 (4.4)	3.7 (2.7) [1]	5.9 [1]	**1FT7062 - 1AK7■ - 1■ ■ 1**	5	7.36 (6.51)	7.1 (15.7)
		2.59 (3.47) [2]	9.0 (6.6)	5.5 (4.1) [2]	6.1 [2]	**1FT7064 - 1AK7■ - 1■ ■ 1**	5	11.9 (10.5)	9.7 (21.4)

Type IM B5:	Flange 0 Flange 1 (compatible with 1FT6)		**0** **1**
Encoder systems for motors without DRIVE-CLiQ interface:	Incremental encoder sin/cos 1 V_{pp} 2048 S/R Absolute encoder EnDat 2048 S/R		**N** **M**
Encoder systems for motors with DRIVE-CLiQ interface:	22 bit incremental encoder Absolute encoder, 22 bit single-turn + 12 bit multi-turn		**D** **F**
Shaft extension: Plain shaft Plain shaft	**Shaft and flange accuracy:** Tolerance N Tolerance N	**Holding brake:** without with	**G** **H**
Vibration magnitude: Grade A	**Degree of protection:** IP65		**1**

To select the degree of protection and type, see selection guides.

Selection and ordering data

Motor type (continued)	Static current	Calculated power P_{calc} 6)	SINAMICS S120 Motor Module		Power cable with complete shield Motor connection (and brake connection) via power connector		
			Rated output current 5)	Booksize format			
	I_0 at M_0 ΔT=100 K	P_{calc} for M_0 ΔT=100 K	I_{rated}	Order No.	Power connector	Cable cross-section 4)	Order No. Pre-assembled cable
	A	kW (HP)	A		Size	mm^2	
1FT7102-1AC7...	12.5	6.28 (8.42)	18	**6SL312■ - ■TE21 - 8AA3**	1.5	4 x 1.5	**6FX■ 002 - 5■S21 - ....**
1FT7105-1AC7...	18	10.47 (14.0)	18	**6SL312■ - ■TE21 - 8AA3**	1.5	4 x 2.5	**6FX■ 002 - 5■S31 - ....**
1FT7044-1AF7...	2.8	1.57 (2.11)	3	**6SL312■ - ■TE13 - 0AA3**	1	4 x 1.5	**6FX■ 002 - 5■S01 - ....**
1FT7062-1AF7...	3.9	1.88 (2.52)	5	**6SL312■ - ■TE15 - 0AA3**	1	4 x 1.5	**6FX■ 002 - 5■S01 - ....**
1FT7064-1AF7...	5.7	2.83 (3.80)	9	**6SL312■ - ■TE21 - 0AA3**	1	4 x 1.5	**6FX■ 002 - 5■S01 - ....**
1FT7082-1AF7...	7.6	4.08 (5.47)	9	**6SL312■ - ■TE21 - 0AA3**	1	4 x 1.5	**6FX■ 002 - 5■S01 - ....**
1FT7084-1AF7...	11	6.28 (8.42)	18	**6SL312■ - ■TE21 - 8AA3**	1	4 x 1.5	**6FX■ 002 - 5■S01 - ....**
1FT7086-1AF7...	15.5	8.80 (11.8)	18	**6SL312■ - ■TE21 - 8AA3**	1.5	4 x 2.5	**6FX■ 002 - 5■S31 - ....**
1FT7084-1AH7...	15.6	9.42 (12.6)	18	**6SL312■ - ■TE21 - 8AA3**	1.5	4 x 2.5	**6FX■ 002 - 5■S31 - ....**
1FT7086-1AH7...	22.4	13.19 (17.7)	30	**6SL312■ - 1 TE23 - 0AA3**	1.5	4 x 4	**6FX■ 002 - 5■S41 - ....**
1FT7034-1AK7...	2.7	1.26 (1.69)	3	**6SL312■ - ■TE13 - 0AA3**	1	4 x 1.5	**6FX■ 002 - 5■S01 - ....**
1FT7062-1AK7...	8.4	3.77 (5.06)	9	**6SL312■ - ■TE21 - 0AA3**	1	4 x 1.5	**6FX■ 002 - 5■S01 - ....**
1FT7064-1AK7...	9	5.65 (7.58)	9	**6SL312■ - ■TE21 - 0AA3**	1	4 x 1.5	**6FX■ 002 - 5■S01 - ....**

Cooling: Internal air cooling External air cooling	**0** **1**						
Motor Module: Single Motor Module Double Motor Module		**1** **2**					
Type of power cable: MOTION-CONNECT 800 MOTION-CONNECT 500			**8** **5**				
Without brake cores With brake cores				**C** **D**			
For length code as well as power and signal cables, see MOTION-CONNECT connection system.					**....**		

1) These values refer to n = 5500 rpm.

2) These values refer to n = 4500 rpm.

3) These values refer to n = 4000 rpm.

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) With default setting of the pulse frequency.

6) $P_{calc}\,[kW] = \frac{M_0\,[Nm] \times n_{rated}}{9550}$ $\quad P_{calc}\,[HP] = \frac{M_0\,[lb_f\text{-}in] \times n_{rated}}{63000}$

1FT7 Compact motors, standard type Natural cooling

Selection and ordering data

Rated speed	Shaft height	Rated power	Static torque	Rated torque	Rated current	1FT7 Compact synchronous motors 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	Order No. **Standard type**		J	m
rpm		kW (HP)	Nm (lb_f-ft)	Nm (lb_f-ft)	A			10^{-4} kgm^2 (10^{-3} lb_f-in-s^2)	kg (lb)
1500	100	4.08 (5.47)	30 (22.1)	26 (19.2)	8	**1FT7102 - 5AB7■ - 1 ■ ■ ■**	5	91.4 (80.9)	26.1 (57.5)
		6.60 (8.85)	50 (36.9)	42 (31.0)	13	**1FT7105 - 5AB7■ - 1 ■ ■ ■**	5	178 (157)	44.2 (97.5)
		9.58 (12.8)	70 (51.6)	61 (45.0)	16	**1FT7108 - 5AB7■ - 1 ■ ■ ■**	5	248 (219)	59.0 (130)

Type IM B5:	Flange 0 Flange 1 (compatible with 1FT6)	**0** **1**
Encoder systems for motors without DRIVE-CLiQ interface:	Incremental encoder sin/cos 1 V_{pp} 2048 S/R Absolute encoder EnDat 2048 S/R	**N** **M**
Encoder systems for motors with DRIVE-CLiQ interface:	22 bit incremental encoder Absolute encoder, 22 bit single-turn +12 bit multi-turn	**D** **F**

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

Vibration magnitude:	Degree of protection:	
Grade A	IP64	**0**
Grade A	IP65	**1**
Grade A	IP67	**2**
Grade R	IP64	**3**
Grade R	IP65	**4**
Grade R	IP67	**5**

To select the degree of protection and type, see selection guides.

Selection and ordering data

Motor type (continued)	Static current	Calculated power P_{calc} 3)	SINAMICS S120 Motor Module		Power cable with complete shield Motor connection (and brake connection) via power connector		
			Rated output current 2)	Booksize format			
	I_0 at M_0 ΔT=100 K	P_{calc} for M_0 ΔT=100 K	I_{rated}	Order No.	Power connector	Cable cross-section 1)	Order No. Pre-assembled cable
	A	kW (HP)	A		Size	mm²	
1FT7102-5AB7...	9	4.71 (6.32)	9	**6SL312■ - ■TE21 - 0AA3**	1.5	4 x 1.5	**6FX■ 002 - 5■S21 - ....**
1FT7105-5AB7...	15	7.85 (10.5)	18	**6SL312■ - ■TE21 - 8AA3**	1.5	4 x 1.5	**6FX■ 002 - 5■S21 - ....**
1FT7108-5AB7...	18	10.99 (14.7)	18	**6SL312■ - ■TE21 - 8AA3**	1.5	4 x 2.5	**6FX■ 002 - 5■S31 - ....**

Cooling:	
Internal air cooling	**0**
External air cooling	**1**
Motor Module:	
Single Motor Module	**1**
Double Motor Module	**2**
Type of power cable:	
MOTION-CONNECT 800	**8**
MOTION-CONNECT 500	**5**
Without brake cores	**C**
With brake cores	**D**
For length code as well as power and signal cables, see MOTION-CONNECT connection system.	**....**

1) 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)

2) With default setting of the pulse frequency.

3) $P_{calc}\,[kW] = \frac{M_0\,[Nm] \times n_{rated}}{9550}$ $\quad P_{calc}\,[HP] = \frac{M_0\,[lb_f\text{-}in] \times n_{rated}}{63000}$

1FT7 Compact motors, standard type
Natural cooling

Selection and ordering data

Rated speed	Shaft height	Rated power	Static torque	Rated torque	Rated current	1FT7 Compact synchronous motors 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	Order No. **Standard type**		J	m
rpm		kW (HP)	Nm (lb_f-ft)	Nm (lb_f-ft)	A			10^{-4} kgm^2 (10^{-3} lb_f-in-s^2)	kg (lb)
2000	80	2.39 (3.20)	13 (9.6)	11.4 (8.4)	4.9	**1FT7082 - 5AC7■ - 1 ■ ■ ■**	5	26.5 (23.5)	14 (30.9)
		3.54 (4.75)	20 (14.8)	16.9 (12.5)	8.4	**1FT7084 - 5AC7■ - 1 ■ ■ ■**	5	45.1 (39.9)	20.8 (45.9)
		4.71 (6.32)	28 (20.7)	22.5 (16.6)	9.2	**1FT7086 - 5AC7■ - 1 ■ ■ ■**	5	63.6 (56.3)	27.5 (60.6)
	100	5.03 (6.75)	30 (22.1)	24.0 (17.7)	10	**1FT7102 - 5AC7■ - 1 ■ ■ ■**	5	91.4 (80.9)	26.1 (57.5)
		7.96 (10.7)	50 (36.9)	38.0 (28.0)	15	**1FT7105 - 5AC7■ - 1 ■ ■ ■**	5	178 (157)	44.2 (97.5)
		10.5 (14.1)	70 (51.6)	50.0 (36.9)	18	**1FT7108 - 5AC7■ - 1 ■ ■ ■**	5	248 (219)	59 (130)

Type IM B5:	Flange 0 Flange 1 (compatible with 1FT6)	**0** **1**
Encoder systems for motors without DRIVE-CLiQ interface:	Incremental encoder sin/cos 1 V_{pp} 2048 S/R Absolute encoder EnDat 2048 S/R	**N** **M**
Encoder systems for motors with DRIVE-CLiQ interface:	22 bit incremental encoder Absolute encoder, 22 bit single-turn +12 bit multi-turn	**D** **F**

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

Vibration magnitude:	Degree of protection:	
Grade A	IP64	**0**
Grade A	IP65	**1**
Grade A	IP67	**2**
Grade R	IP64	**3**
Grade R	IP65	**4**
Grade R	IP67	**5**

To select the degree of protection and type, see selection guides.

Selection and ordering data

Motor type (continued)	Static current	Calculated power P_{calc} 3)	SINAMICS S120 Motor Module		Power cable with complete shield Motor connection (and brake connection) via power connector		
			Rated output current 2)	Booksize format			
	I_0 at M_0 ΔT=100 K	P_{calc} for M_0 ΔT=100 K	I_{rated}	Order No.	Power connector	Cable cross-section 1)	Order No. Pre-assembled cable
	A	kW (HP)	A		Size	mm^2	
1FT7082-5AC7...	5	2.72 (3.65)	5	**6SL312■ - ■TE15 - 0AA3**	1	4 x 1.5	**6FX■ 002 - 5■S01 - ....**
1FT7084-5AC7...	9	4.19 (5.62)	9	**6SL312■ - ■TE21 - 0AA3**	1	4 x 1.5	**6FX■ 002 - 5■S01 - ....**
1FT7086-5AC7...	10.6	5.86 (7.86)	18	**6SL312■ - ■TE21 - 8AA3**	1	4 x 1.5	**6FX■ 002 - 5■S01 - ....**
1FT7102-5AC7...	12.5	6.28 (8.42)	18	**6SL312■ - ■TE21 - 8AA3**	1.5	4 x 1.5	**6FX■ 002 - 5■S21 - ....**
1FT7105-5AC7...	18	10.47 (14.0)	18	**6SL312■ - ■TE21 - 8AA3**	1.5	4 x 2.5	**6FX■ 002 - 5■S31 - ....**
1FT7108-5AC7...	25	14.66 (19.7)	30	**6SL312■ - 1TE23 - 1AA3**	1.5	4 x 4	**6FX■ 002 - 5■S41 - ....**

Cooling:	
Internal air cooling	**0**
External air cooling	**1**
Motor Module:	
Single Motor Module	**1**
Double Motor Module	**2**
Type of power cable:	
MOTION-CONNECT 800	**8**
MOTION-CONNECT 500	**5**
Without brake cores	**C**
With brake cores	**D**
For length code as well as power and signal cables, see MOTION-CONNECT connection system.	**....**

1) 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).

2) With default setting of the pulse frequency.

3) $P_{calc}\,[kW] = \frac{M_0\,[Nm] \times n_{rated}}{9550}$ $\quad P_{calc}\,[HP] = \frac{M_0\,[lb_f\text{-}in] \times n_{rated}}{63000}$

1FT7 Compact motors, standard type
Natural cooling

Selection and ordering data

Rated speed	Shaft height	Rated power	Static torque	Rated torque	Rated current	**1FT7 Compact synchronous motors 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	Order No. **Standard type**		J	m
rpm		kW (HP)	Nm (lb_f-ft)	Nm (lb_f-ft)	A			10^{-4} kgm^2 (10^{-3} lb_f-in-s^2)	kg (lb)
3000	48	0.85 (1.14)	3.0 (2.2)	2.7 (2.0)	2.1	**1FT7042 - 5AF7■ - 1■■■**	3	2.81 (2.49)	4.6 (10.1)
		1.35 (1.81)	5.0 (3.7)	4.3 (3.2)	2.6	**1FT7044 - 5AF7■ - 1■■■**	3	5.43 (4.81)	7.2 (15.9)
		1.76 (2.36)	7.0 (5.2)	5.6 (4.1)	3.5	**1FT7046 - 5AF7■ - 1■■■**	3	7.52 (6.66)	9.3 (20.5)
	63	1.70 (2.28)	6.0 (4.4)	5.4 (4.0)	3.9	**1FT7062 - 5AF7■ - 1■■■**	5	7.36 (6.51)	7.1 (15.7)
		2.39 (3.20)	9.0 (6.6)	7.6 (5.6)	5.2	**1FT7064 - 5AF7■ - 1■■■**	5	11.9 (10.5)	9.7 (21.4)
		2.92 (3.92)	12.0 (8.9)	9.3 (6.9)	7.2	**1FT7066 - 5AF7■ - 1■■■**	5	16.4 (14.5)	12.3 (27.1)
		3.42 (4.59)	15.0 (11.1)	10.9 (8.0)	6.7	**1FT7068 - 5AF7■ - 1■■■**	5	23.2 (20.5)	16.3 (35.9)
	80	3.24 (4.34)	13.0 (9.6)	10.3 (7.6)	6.6	**1FT7082 - 5AF7■ - 1■■■**	5	26.5 (23.5)	14.0 (30.9)
		4.55 (6.10)	20.0 (14.8)	14.5 (10.7)	8.5	**1FT7084 - 5AF7■ - 1■■■**	5	45.1 (39.9)	20.8 (45.9)
		5.62 (7.54)	28.0 (20.7)	18 (13.3)	11	**1FT7086 - 5AF7■ - 1■■■**	5	63.6 (56.3)	27.5 (60.6)
	100	6.28 (8.42)	30.0 (22.1)	20 (14.8)	12	**1FT7102 - 5AF7■ - 1■■■**	5	91.4 (80.9)	26.1 (57.5)
		8.80 (11.8)	50.0 (36.9)	28 (20.7)	15	**1FT7105 - 5AF7■ - 1■■■**	5	178 (157)	44.2 (97.5)
		8.17 (11.0)	70.0 (51.6)	20 (14.8)	12	**1FT7108 - 5AF7■ - 1■■■**	5	248 (220)	59.0 (130)

Type IM B5:	Flange 0 Flange 1 (compatible with 1FT6)	**0** **1**
Encoder systems for motors without DRIVE-CLiQ interface:	Incremental encoder sin/cos 1 V_{pp} 2048 S/R Absolute encoder EnDat 2048 S/R	**N** **M**
Encoder systems for motors with DRIVE-CLiQ interface:	22 bit incremental encoder Absolute encoder, 22 bit single-turn +12 bit multi-turn	**D** **F**

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

Vibration magnitude:	**Degree of protection:**	
Grade A	IP64	**0**
Grade A	IP65	**1**
Grade A	IP67	**2**
Grade R	IP64	**3**
Grade R	IP65	**4**
Grade R	IP67	**5**

To select the degree of protection and type, see selection guides.

Selection and ordering data

Motor type (continued)	Static current	Calculated power P_{calc} [3]	SINAMICS S120 Motor Module		Power cable with complete shield Motor connection (and brake connection) via power connector		
			Rated output current [2]	Booksize format			
	I_0 at M_0 ΔT=100 K	P_{calc} for M_0 ΔT=100 K	I_{rated}	Order No.	Power connector	Cable cross-section [1]	Order No. Pre-assembled cable
	A	kW (HP)	A		Size	mm²	
1FT7042-5AF7...	2.1	0.94 (1.26)	3	**6SL312■ - ■TE13 - 0AA3**	1	4 x 1.5	**6FX■ 002 - 5■S01 - ....**
1FT7044-5AF7...	2.8	1.57 (2.11)	3	**6SL312■ - ■TE13 - 0AA3**	1	4 x 1.5	**6FX■ 002 - 5■S01 - ....**
1FT7046-5AF7...	4	2.20 (2.95)	5	**6SL312■ - ■TE15 - 0AA3**	1	4 x 1.5	**6FX■ 002 - 5■S01 - ....**
1FT7062-5AF7...	3.9	1.88 (2.52)	5	**6SL312■ - ■TE15 - 0AA3**	1	4 x 1.5	**6FX■ 002 - 5■S01 - ....**
1FT7064-5AF7...	5.7	2.83 (3.80)	9	**6SL312■ - ■TE21 - 0AA3**	1	4 x 1.5	**6FX■ 002 - 5■S01 - ....**
1FT7066-5AF7...	8.4	3.77 (5.06)	9	**6SL312■ - ■TE21 - 0AA3**	1	4 x 1.5	**6FX■ 002 - 5■S01 - ....**
1FT7068-5AF7...	8.3	4.71 (6.32)	9	**6SL312■ - ■TE21 - 0AA3**	1	4 x 1.5	**6FX■ 002 - 5■S01 - ....**
1FT7082-5AF7...	7.6	4.08 (5.47)	9	**6SL312■ - ■TE21 - 0AA3**	1	4 x 1.5	**6FX■ 002 - 5■S01 - ....**
1FT7084-5AF7...	11	6.28 (8.42)	18	**6SL312■ - ■TE21 - 8AA3**	1	4 x 1.5	**6FX■ 002 - 5■S01 - ....**
1FT7086-5AF7...	15.5	8.80 (11.8)	18	**6SL312■ - ■TE21 - 8AA3**	1.5	4 x 2.5	**6FX■ 002 - 5■S31 - ....**
1FT7102-5AF7...	18	9.42 (12.6)	18	**6SL312■ - ■TE21 - 8AA3**	1.5	4 x 2.5	**6FX■ 002 - 5■S31 - ....**
1FT7105-5AF7...	26	15.71 (21.0)	30	**6SL312■ - 1TE23 - 1AA3**	1.5	4 x 4	**6FX■ 002 - 5■S41 - ....**
1FT7108-5AF7...	36	21.99 (29.5)	45	**6SL312■ - 1TE24 - 5AA3**	1.5	4 x 6	**6FX■ 002 - 5■S51 - ....**

Cooling: Internal air cooling External air cooling	**0** **1**
Motor Module: Single Motor Module Double Motor Module	**1** **2**
Type of power cable: MOTION-CONNECT 800 MOTION-CONNECT 500	**8** **5**
Without brake cores With brake cores	**C** **D**
For length code as well as power and signal cables, see MOTION-CONNECT connection system.	**....**

[1] 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).

[2] With default setting of the pulse frequency.

[3] $P_{calc}\,[kW] = \frac{M_0\,[Nm] \times n_{rated}}{9550}$ $\quad P_{calc}\,[HP] = \frac{M_0\,[lb_f\text{-}in] \times n_{rated}}{63000}$

1FT7 Compact motors, standard type
Natural cooling

Selection and ordering data

Rated speed	Shaft height	Rated power	Static torque	Rated torque	Rated current	1FT7 Compact synchronous motors 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	Order No. **Standard type**		J	m
rpm		kW (HP)	Nm (lb_f-ft)	Nm (lb_f-ft)	A			10^{-4} kgm^2 (10^{-3} lb_f-in-s^2)	kg (lb)
4500	48	1.32 (1.77) [1]	7.0 (5.2)	3.6 (2.7) [1]	4.7 [1]	**1FT7046 - 5AH7■ - 1■■■**	3	7.52 (6.66)	9.3 (20.5)
	63	2.55 (3.42) [2]	12 (8.9)	6.1 (4.5) [2]	7.5 [2]	**1FT7066 - 5AH7■ - 1■■■**	5	16.4 (14.5)	12.3 (27.1)
	80	3.77 (5.06)	13 (9.6)	8.0 (5.9)	8.4	**1FT7082 - 5AH7■ - 1■■■**	5	26.5 (23.5)	14.0 (30.9)
		4.82 (6.46) [2]	20 (14.8)	11.5 (8.5) [2]	10.1 [2]	**1FT7084 - 5AH7■ - 1■■■**	5	45.1 (39.9)	20.8 (45.9)
		4.71 (6.32)	28 (20.7)	10 (7.4)	10	**1FT7086 - 5AH7■ - 1■■■**	5	63.6 (56.3)	27.5 (60.6)

Type IM B5:	Flange 0	**0**
	Flange 1 (compatible with 1FT6)	**1**
Encoder systems for motors without DRIVE-CLiQ interface:	Incremental encoder sin/cos 1 V_{pp} 2048 S/R	**N**
	Absolute encoder EnDat 2048 S/R	**M**
Encoder systems for motors with DRIVE-CLiQ interface:	22 bit incremental encoder	**D**
	Absolute encoder, 22 bit single-turn +12 bit multi-turn	**F**

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

Vibration magnitude:	Degree of protection:	
Grade A	IP64	**0**
Grade A	IP65	**1**
Grade A	IP67	**2**
Grade R	IP64	**3**
Grade R	IP65	**4**
Grade R	IP67	**5**

To select the degree of protection and type, see selection guides.

Selection and ordering data

Motor type (continued)	Static current	Calculated power P_{calc} 5)	SINAMICS S120 Motor Module		Power cable with complete shield Motor connection (and brake connection) via power connector		
			Rated output current 4)	Booksize format			
	I_0 at M_0 ΔT=100 K	P_{calc} for M_0 ΔT=100 K	I_{rated}	Order No.	Power connector	Cable cross-section 3)	Order No. Pre-assembled cable
	A	kW (HP)	A		Size	mm²	
1FT7046-5AH7...	8.1	3.30 (4.43)	9	**6SL312■ - ■TE21 - 0AA3**	1	4 x 1.5	**6FX■ 002 - 5■S01 - ....**
1FT7066-5AH7...	13.6	5.65 (7.58)	18	**6SL312■ - ■TE21 - 8AA3**	1	4 x 1.5	**6FX■ 002 - 5■S01 - ....**
1FT7082-5AH7...	12.3	6.13 (8.22)	18	**6SL312■ - ■TE21 - 8AA3**	1	4 x 1.5	**6FX■ 002 - 5■S01 - ....**
1FT7084-5AH7...	15.6	9.42 (12.6)	18	**6SL312■ - ■TE21 - 8AA3**	1.5	4 x 2.5	**6FX■ 002 - 5■S31 - ....**
1FT7086-5AH7...	22.4	13.19 (17.7)	30	**6SL312■ - 1 TE23 - 0AA3**	1.5	4 x 4	**6FX■ 002 - 5■S41 - ....**

Cooling: Internal air cooling External air cooling	**0** **1**
Motor Module: Single Motor Module Double Motor Module	**1** **2**
Type of power cable: MOTION-CONNECT 800 MOTION-CONNECT 500	**8** **5**
Without brake cores With brake cores	**C** **D**
For length code as well as power and signal cables, see MOTION-CONNECT connection system.	**....**

1) These values refer to n = 3500 rpm.

2) These values refer to n = 4000 rpm.

3) 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).

4) With default setting of the pulse frequency.

5) $P_{calc}\,[kW] = \frac{M_0\,[Nm] \times n_{rated}}{9550}$ $\quad P_{calc}\,[HP] = \frac{M_0\,[lb_f\text{-}in] \times n_{rated}}{63000}$

1FT7 Compact motors, standard type
Natural cooling

Selection and ordering data

Rated speed	Shaft height	Rated power	Static torque	Rated torque	Rated current	1FT7 Compact synchronous motors 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	Order No. **Standard type**		J	m
rpm		kW (HP)	Nm (lb_f-ft)	Nm (lb_f-ft)	A			10^{-4} kgm^2 (10^{-3} lb_f-in-s^2)	kg (lb)
6000	36	0.88 (1.18)	2.0 (1.5)	1.4 (1.0)	2.1	**1FT7034 - 5AK7■ - 1■■■**	3	0.85 (0.75)	3.8 (8.38)
		1.07 (1.43)	3.0 (2.2)	1.7 (1.3)	2.4	**1FT7036 - 5AK7■ - 1■■■**	3	1.33 (1.18)	5.0 (11.0)
	48	1.26 (1.69)	3.0 (2.2)	2.0 (1.5)	3	**1FT7042 - 5AK7■ - 1■■■**	3	2.81 (2.49)	4.6 (10.1)
		1.41 (1.89) [1]	5.0 (3.7)	3.0 (2.2) [1]	3.6 [1]	**1FT7044 - 5AK7■ - 1■■■**	3	5.43 (4.81)	7.2 (15.9)
	63	2.13 (2.86) [2]	6.0 (4.4)	3.7 (2.7) [2]	5.9 [2]	**1FT7062 - 5AK7■ - 1■■■**	5	7.36 (6.51)	7.1 (15.7)
		2.59 (3.47) [1]	9.0 (6.6)	5.5 (4.1) [1]	6.1 [1]	**1FT7064 - 5AK7■ - 1■■■**	5	11.9 (10.5)	9.7 (21.4)

Type IM B5:	Flange 0 Flange 1 (compatible with 1FT6)	**0** **1**
Encoder systems for motors without DRIVE-CLiQ interface:	Incremental encoder sin/cos 1 V_{pp} 2048 S/R Absolute encoder EnDat 2048 S/R	**N** **M**
Encoder systems for motors with DRIVE-CLiQ interface:	22 bit incremental encoder Absolute encoder, 22 bit single-turn +12 bit multi-turn	**D** **F**

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

Vibration magnitude:	**Degree of protection:**	
Grade A	IP64	**0**
Grade A	IP65	**1**
Grade A	IP67	**2**
Grade R	IP64	**3**
Grade R	IP65	**4**
Grade R	IP67	**5**

To select the degree of protection and type, see selection guides.

Selection and ordering data

Motor type (continued)	Static current	Calculated power P_{calc} 5)	SINAMICS S120 Motor Module		Power cable with complete shield Motor connection (and brake connection) via power connector		
			Rated output current 4)	Booksize format			
	I_0 at M_0 ΔT=100 K	P_{calc} for M_0 ΔT=100 K	I_{rated}	Order No.	Power connector	Cable cross-section 3)	Order No. Pre-assembled cable
	A	kW (HP)	A		Size	mm²	
1FT7034-5AK7...	2.7	1.26 (1.69)	3	**6SL312■ - ■TE13 - 0AA3**	1	4 x 1.5	**6FX■ 002 - 5■S01 - ....**
1FT7036-5AK7...	4.0	1.88 (2.52)	5	**6SL312■ - ■TE15 - 0AA3**	1	4 x 1.5	**6FX■ 002 - 5■S01 - ....**
1FT7042-5AK7...	3.9	1.89 (2.53)	5	**6SL312■ - ■TE15 - 0AA3**	1	4 x 1.5	**6FX■ 002 - 5■S01 - ....**
1FT7044-5AK7...	5.7	3.15 (4.22)	9	**6SL312■ - ■TE21 - 0AA3**	1	4 x 1.5	**6FX■ 002 - 5■S01 - ....**
1FT7062-5AK7...	8.4	3.78 (5.07)	9	**6SL312■ - ■TE21 - 0AA3**	1	4 x 1.5	**6FX■ 002 - 5■S01 - ....**
1FT7064-5AK7...	9	5.67 (7.60)	9	**6SL312■ - ■TE21 - 0AA3**	1	4 x 1.5	**6FX■ 002 - 5■S01 - ....**

Cooling:	
Internal air cooling	**0**
External air cooling	**1**
Motor Module:	
Single Motor Module	**1**
Double Motor Module	**2**
Type of power cable:	
MOTION-CONNECT 800	**8**
MOTION-CONNECT 500	**5**
Without brake cores	**C**
With brake cores	**D**
For length code as well as power and signal cables, see MOTION-CONNECT connection system.	**....**

1) These values refer to n = 4500 rpm.

2) These values refer to n = 5500 rpm.

3) 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).

4) With default setting of the pulse frequency.

5) $P_{calc}\,[kW] = \frac{M_0\,[Nm] \times n_{rated}}{9550}$ $\quad P_{calc}\,[HP] = \frac{M_0\,[lb_f\text{-}in] \times n_{rated}}{63000}$

1FK7 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 S120 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

Applications

- Machine tools
- Robots and manipulators
- Wood, glass, ceramics and stone working
- Packaging, plastics and textile machines
- Auxiliary axes

Technical specifications

Type of motor	Perm.-magnet syn. motor
Magnet material	Rare-earth magnet material
Insulation of the stator winding in accordance with EN 60034-1 (IEC 60034-1)	Temperature class 155 (F) for a winding temperature rise of ΔT = 100 K at an ambient temperature of 40 °C (104 °F)
Cooling	Natural cooling
Temperature monitoring	KTY84 temperature sensor in the stator winding
Type in accordance with EN 60034-7 (IEC 60034-7)	IM B5 (IM V1, IM V3)
Degree of protection [1] **in accord. with EN 60034-5 (IEC 60034-5)**	IP64
Shaft extension on the drive end in accordance with DIN 748-3 (IEC 60072-1)	Plain shaft
Shaft and flange accuracy [2] **in accordance with DIN 42955 (IEC 60072-1)**	Tolerance N
Vibration magnitude in accord. with EN 60034-14 (IEC 60034-14)	Grade A (maintained up to rated speed)
Max. sound pressure level L_{pA} (1 m (3.28 ft)) in accord. with DIN EN ISO 1680	
• 1FK701 to 1FK704 • 1FK706 • 1FK708 to 1FK710	55 dB 65 dB 70 dB
Built-in encoder systems for motors without DRIVE-CLiQ interface	• Incremental encoder sin/cos 1 V_{pp} 2048 S/R • Absolute encoder, multi-turn, [3] with EnDat interface: - 2048 S/R for 1FK704 to 1FK710 - 512 S/R for 1FK701 to 1FK703 - 32 S/R for 1FK704 to 1FK710 - 16 S/R for 1FK701 to 1FK703 • Multi-pole resolver (number of poles corresp. 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: - 22 bit single-turn (2048 S/R internal) +12 bit multi-turn [3] for 1FK704 to 1FK710 - 20 bit single-turn (512 S/R internal) +12 bit multi-turn [3] for 1FK702 to 1FK703 - 16 bit single-turn (32 S/R internal) +12 bit multi-turn [3] for 1FK704 to 1FK710 - 15 bit single-turn (16 S/R internal) +12 bit multi-turn [3] for 1FK702 to 1FK703 • 15 bit resolver • 14 bit resolver
Connection	Connectors for signals and power can be rotated (270°)
Paint finish [1]	Unpainted
2nd rating plate [1] **3rd rating plate**	Attached in the NDE cover Enclosed separately
Options [1]	• Shaft ext. at the drive end with fitted key and keyway (half-key balancing) • Built-in holding brake • Degree of protection IP65, drive end flange IP67 • Planetary gearbox, assembled (requirement: plain shaft extension, degree of protection IP64 for LP+ and IP65 for SP+) • Anthracite finish RAL 7016

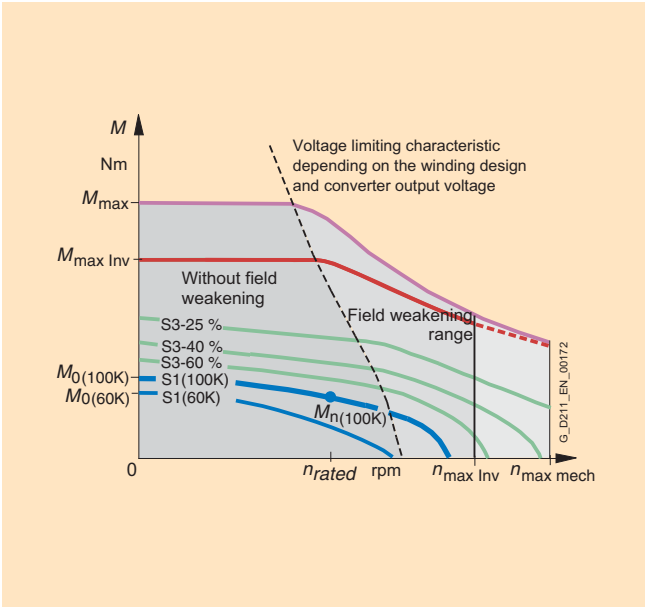
S/R = signals/revolution

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

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

3) Traversing range 4096 revolutions

Characteristics



Torque characteristic of a synchronous motor operating on a converter with field weakening (example characteristic)

Options

Order code	Option description	1FK7 Compact	1FK7 High Dynamic
M03	Version for Zone 2 hazardous areas (in accordance with EN 50021/IEC 60079-15)	■	■
M39	Version for Zone 22 hazardous areas (in accordance with EN 50281/IEC 61241)	■	■
N05	Non-standard shaft extension (dimensions as for 1FT5 motors)	■	■
N25	Permanent magnet brake instead of spring-operated brake	–	■
K23	Special finish for "Worldwide" climate comprising primer and paint finish (anthracite RAL 7016 paint finish or selectable with Option X0.)	■	■
K24	Primed (unpainted)	■	■
X01	Jet black finish RAL 9005	■	■
X02	Cream finish RAL 9001	■	■
X03	Reseda green finish RAL 6011	■	■
X04	Pebble gray finish RAL 7032	■	■
X05	Sky blue finish RAL 5015	■	■
X06	Light ivory finish RAL 1015	■	■
X08	White aluminum RAL 9006, suitable for food grade applications	■	■
X27	Pearl dark grey RAL 9023 paint finish	■	■

■ Option available

M03
Version for Zone 2 hazardous areas (according to IEC EN 60079-15)

Combustible or explosive gases or vapors occur only rarely or briefly in Zone 2 areas The type of protection designation is EEx nA II ("non sparking").

The special conditions for operating 1FK7 motors in Zone 2 areas, in particular the reduction in permissible operating speeds, are described in detail in Appendix 610.40063.01 to the EC Declaration of Conformity 664.20025.21.

M39
Version for Zone 22 hazardous areas (according to IEC EN 61241-1)

Combustible or potentially explosive dust (non-conductive dust) occurs only rarely or briefly in Zone 22 areas The type of protection designation is Ex 3D T 150 °C.

The special conditions for operating 1FK7 motors in Zone 22 areas are described in detail in Appendix 610.40071.01 to the EC Declaration of Conformity 664.20031.21.

Note regarding M03 and M39 options:

When used in Zone 2 or Zone 22, 1FK7 motors are only designed for encoder connection through connectors. A version with a DRIVE-CLiQ interface on the motor is not possible. Connection to SINAMICS S120 is only possible via SMC (Sensor Module Cabinet-Mounted).

N05
Non-standard shaft extension (dimensions as for 1FT5 motors)

1FK7 motors are shipped with the following shaft dimensions that are compatible with 1FT5 motors:

- SH 36: 11 x 23 mm (0.43 x 0.91 in)
- SH 48: 14 x 30 mm (0.55 x 1.18 in)
- SH 63: 19 x 40 mm (0.75 x 1.57 in)
- SH 80: 24 x 50 mm (0.94 x 1.97 in)
- SH 100: 32 x 58 mm (1.26 x 2.28 in)

Note:

1FK7 motors of SH 63 with option N05 do not have a compatible flange with 1FT5 motors of SH 63.

Q90
Food-grade gear oil

Only for 1FK7 Compact with helical and bevel gears

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	Order No.		J	m
rpm		kW (HP)	Nm (lb_f-ft)	Nm (lb_f-ft)	A			10^{-4} kgm^2 (10^{-3} lb_f-in-s^2)	kg (lb)
2000	100	4.29 (5.75)	27 (19.9)	20.5 (15.1)	9.6	**1FK7101-5AC71-1■■■**	4	79.9 (70.7)	21 (46.3)
		5.23 (7.01)	36 (26.6)	25 (18.4)	11.5	**1FK7103-5AC71-1■■■**	4	105 (92.9)	29 (63.9)
		7.75 (10.4)	48 (35.4)	37 (27.3)	16	**1FK7105-5AC71-1■■■**	4	156 (138)	39 (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 (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 (22.1)
		3.3 (4.4)	16 (11.8)	10.5 (7.7)	7.4	**1FK7083-5AF71-1■■■**	4	27.3 (24.1)	14 (30.9)
	100	3.77 (5.1)	18 (13.3)	12.0 (8.8)	8.0	**1FK7100-5AF71-1■■■**	4	55.3 (48.9)	19 (41.9)
		4.87 (6.5)	27 (19.9)	15.5 (11.4)	11.8	**1FK7101-5AF71-1■■■**	4	79.9 (70.7)	21 (46.3)
		5.37 (7.2) [2]	36 (26.6)	20.5 (15.1) [2]	16.5 [2]	**1FK7103-5AF71-1■■■**	4	105 (92.9)	29 (63.9)
		8.17 (11.0)	48 (35.4)	26.0 (19.2)	18	**1FK7105-5AF71-1■■■**	4	156 (138)	39 (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 (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 (22.1)
		3.04 (4.1) [4]	16 (11.8)	8.3 (6.1) [4]	9 [4]	**1FK7083-5AH71-1■■■**	4	27.3 (24.1)	14 (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 [8]:	22 bit incremental encoder (not for 1FK701)	D
	22 bit absolute encoder, single-turn +12 bit multi-turn [1] (not for 1FK701 to 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 to 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
	IP65 and DE flange IP67, anthracite paint finish and metal rating plate on motor (not for 1FK701)	8

To select the degree of protection and type, see selection guides.

Selection and ordering data

Motor type (continued)	Static current	Calculated power P_{calc} [10]	SINAMICS S120 Motor Module		Power cable with complete shield		
			Rated output current [9]	Booksize format	Motor connection (and brake connection) via power connector		
	I_0 at M_0 ΔT=100 K	P_{calc} for M_0 ΔT=100 K	I_{rated}	Order No.	Power connector	Cable cross-section [7]	Order No. Pre-assembled cable
	A	kW (HP)	A		Size	mm^2	
1FK7101-5AC71...	12.3	5.7 (7.64)	18	6SL312■-■TE21-8AA3	1.5	4 x 1.5	6FX■002-5■S01-....
1FK7103-5AC71...	14.7	7.5 (10.0)	18	6SL312■-■TE21-8AA3	1.5	4 x 1.5	6FX■002-5■S01-....
1FK7105-5AC71...	20	10 (13.4)	30	6SL312■-■TE23-0AA3	1.5	4 x 2.5	6FX■002-5■S31-....
1FK7042-5AF71...	2.2	0.9 (1.2)	3	6SL312■-■TE13-0AA3	1	4 x 1.5	6FX■002-5■S01-....
1FK7060-5AF71...	4.5	1.9 (2.6)	5	6SL312■-■TE15-0AA3	1	4 x 1.5	6FX■002-5■S01-....
1FK7063-5AF71...	8	3.5 (4.7)	9	6SL312■-■TE21-0AA3	1	4 x 1.5	6FX■002-5■S01-....
1FK7080-5AF71...	4.8	2.5 (3.4)	5	6SL312■-■TE15-0AA3	1	4 x 1.5	6FX■002-5■S01-....
1FK7083-5AF71...	10.4	5.0 (6.7)	9 [6]	6SL312■-■TE21-0AA3	1	4 x 1.5	6FX■002-5■S01-....
1FK7100-5AF71...	11.2	5.7 (7.6)	18	6SL312■-■TE21-8AA3	1	4 x 1.5	6FX■002-5■S01-....
1FK7101-5AF71...	19	8.5 (11.4)	18 [6]	6SL312■-■TE21-8AA3	1.5	4 x 2.5	6FX■002-5■S31-....
1FK7103-5AF71...	27.5	11.3 (15.2)	30	6SL312■-1TE23-0AA3	1.5	4 x 4	6FX■002-5■S41-....
1FK7105-5AF71...	31	15 (20.1)	30 [6]	6SL312■-1TE23-0AA3	1.5	4 x 10	6FX■002-5■S61-....
1FK7060-5AH71...	6.2	2.8 (3.8)	9	6SL312■-■TE21-0AA3	1	4 x 1.5	6FX■002-5■S01-....
1FK7063-5AH71...	12	5.2 (7.0)	18	6SL312■-■TE21-8AA3	1	4 x 1.5	6FX■002-5■S01-....
1FK7080-5AH71...	7.4	3.8 (5.1)	9	6SL312■-■TE21-0AA3	1	4 x 1.5	6FX■002-5■S01-....
1FK7083-5AH71...	15	7.5 (10.1)	18	6SL312■-■TE21-8AA3	1	4 x 1.5	6FX■002-5■S01-....
1FK7011-5AK71...	1.5	0.11 (0.2)	3	6SL312■-■TE13-0AA3	0.5	4 x 1.5	6FX5002-5DA20-....
1FK7015-5AK71...	1.5	0.22 (0.3)	3	6SL312■-■TE13-0AA3	0.5	4 x 1.5	6FX5002-5DA20-....
1FK7022-5AK71...	1.8	0.5 (0.7)	3	6SL312■-■TE13-0AA3	1	4 x 1.5	6FX■002-5■S01-....
1FK7032-5AK71...	1.7	0.7 (0.9)	3	6SL312■-■TE13-0AA3	1	4 x 1.5	6FX■002-5■S01-....
1FK7034-5AK71...	1.9	1.0 (1.3)	3	6SL312■-■TE13-0AA3	1	4 x 1.5	6FX■002-5■S01-....
1FK7040-5AK71...	2.25	1.0 (1.3)	3	6SL312■-■TE13-0AA3	1	4 x 1.5	6FX■002-5■S01-....
1FK7042-5AK71...	4.4	1.9 (2.6)	5	6SL312■-■TE15-0AA3	1	4 x 1.5	6FX■002-5■S01-....

Cooling:							
Internal air cooling	0						
External air cooling	1						
Motor Module:							
Single Motor Module		1					
Double Motor Module		2					
Type of power cable:							
MOTION-CONNECT 800					8		
MOTION-CONNECT 500					5		
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) With the specified Motor Module, the motor cannot be fully utilized with M_0 at ΔT = 100 K winding temperature rise. If a Motor Module with a higher rating is used, you must check whether the specified power cable can be connected to it.

7) 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)

8) 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).

9) With default setting of the pulse frequency.

10) $P_{calc}\,[kW] = \frac{M_0\,[Nm] \times n_{rated}}{9550}$ $\quad P_{calc}\,[HP] = \frac{M_0\,[lb_f\text{-}in] \times n_{rated}}{63000}$

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 ΔT=100 K	M_0 at ΔT=100 K	M_{rated} at ΔT=100 K	I_{rated} at ΔT=100 K	Order No.		J	m
rpm		kW (HP)	Nm (lb_f-ft)	Nm (lb_f-ft)	A			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 (22.1)
		2.51 (3.37)	12 (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 (16.2)	12 (8.8) [2]	12.5 [2]	**1FK7085-7AF71-1■■■**	4	23 (20.3)	23.5 (51.8)
		3.77 (5.06) [3]	28 (20.6)	18 (13.3) [3]	14.5 [3]	**1FK7086-7AF71-1■■■**	4	23 (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 (22.1)
		2.36 (3.16)	12 (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 for 1FK703)	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
	IP65 and DE flange IP67, anthracite paint finish and metal rating plate on motor	8

To select the degree of protection and type, see selection guides.

Selection and ordering data

Motor type (continued)	Static current	Calculated power P_{calc} [6]	SINAMICS S120 Motor Module		Power cable with complete shield		
			Rated output current [5]	Booksize format	Motor connection (and brake connection) via power connector		
	I_0 at M_0 ΔT=100 K	P_{calc} for M_0 ΔT=100 K	I_{rated}	Order No.	Power connector	Cable cross-section [4]	Order No. Pre-assembled cable
	A	kW (HP)	A		Size	mm^2	
1FK7044-7AF71...	4.5	1.3 (1.7)	5	**6SL312■-■TE15-0AA3**	1	4 x 1.5	**6FX■002-5■S01-....**
1FK7061-7AF71...	6.1	2.0 (2.7)	9	**6SL312■-■TE21-0AA3**	1	4 x 1.5	**6FX■002-5■S01-....**
1FK7064-7AF71...	11	3.8 (5.1)	18	**6SL312■-■TE21-8AA3**	1	4 x 1.5	**6FX■002-5■S01-....**
1FK7085-7AF71...	22.5	6.9 (9.3)	30	**6SL312■-1TE23-0AA3**	1.5	4 x 4	**6FX■002-5■S41-....**
1FK7086-7AF71...	21	8.8 (11.8)	30	**6SL312■-1TE23-0AA3**	1.5	4 x 4	**6FX■002-5■S41-....**
1FK7043-7AH71...	4.5	1.5 (2.0)	5	**6SL312■-■TE15-0AA3**	1	4 x 1.5	**6FX■002-5■S01-....**
1FK7044-7AH71...	6.3	1.9 (2.6)	9	**6SL312■-■TE21-0AA3**	1	4 x 1.5	**6FX■002-5■S01-....**
1FK7061-7AH71...	8	3.0 (4.0)	9	**6SL312■-■TE21-0AA3**	1	4 x 1.5	**6FX■002-5■S01-....**
1FK7064-7AH71...	15	5.7 (7.6)	18	**6SL312■-■TE21-8AA3**	1	4 x 1.5	**6FX■002-5■S01-....**
1FK7033-7AK71...	2.2	0.8 (1.1)	3	**6SL312■-■TE13-0AA3**	1	4 x 1.5	**6FX■002-5■S01-....**
1FK7043-7AK71...	6.4	1.9 (2.6)	9	**6SL312■-■TE21-0AA3**	1	4 x 1.5	**6FX■002-5■S01-....**

Cooling:		
Internal air cooling	**0**	
External air cooling	**1**	
Motor Module:		
Single Motor Module		**1**
Double Motor Module		**2**
Type of power cable:		
MOTION-CONNECT 800		**8**
MOTION-CONNECT 500		**5**
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) The current carrying capacity of the power cables complies with EN 60204-1 for installation type C, for continuous duty at an ambient

5) With default setting of the pulse frequency.

6) $P_{calc}\,[kW] = \frac{M_0\,[Nm] \times n_{rated}}{9550}$ $\quad P_{calc}\,[HP] = \frac{M_0\,[lb_f\text{-}in] \times n_{rated}}{63000}$

1FK7 Compact/1FK7 High Dynamic motors
Natural cooling for Power Modules

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	Order No.		J	m
rpm		kW (HP)	Nm (lb_f-ft)	Nm (lb_f-ft)	A			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)

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 [4]:	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 single-turn absolute encoder +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**
	IP65 and DE flange IP67, anthracite paint finish and metal rating plate on motor (not for 1FK701)	**8**

To select the degree of protection and type, see selection guides.

Selection and ordering data

Motor type (continued)	Static current	Calculated power	SINAMICS S120 Power Module		Power cable with complete shield		
			Rated output current [5]	**Booksize format without line filter**	Motor connection (and brake connection) via power connector		
	I_0 at M_0 ΔT=100 K	P_{calc} [6] for M_0 ΔT=100 K	I_{rated} at M_0 ΔT=100 K	Order No.	Power connector	Cable cross-section [3]	Order No. Pre-assembled cable
	A	kW (HP)	A		Size	mm^2	
1FK7032-5AF21...	1.7	0.36 (0.5)	2.3	**6SL3210 - 1SB12-3UA3**	1	4 x 1.5	**6FX■002-5■G01-....**
1FK7033-7AF21...	2.2	0.41 (0.6)	2.3	**6SL3210 - 1SB12-3UA3**	1	4 x 1.5	**6FX■002-5■G01-....**
1FK7034-5AF21...	1.9	0.50 (0.7)	2.3	**6SL3210 - 1SB12-3UA3**	1	4 x 1.5	**6FX■002-5■G01-....**
1FK7042-5AF21...	3.9	0.94 (1.3)	3.9	**6SL3210 - 1SB14-0UA3**	1	4 x 1.5	**6FX■002-5■G01-....**
1FK7043-7AF21...	3.9	0.85 (1.1)	3.9	**6SL3210 - 1SB14-0UA3**	1	4 x 1.5	**6FX■002-5■G01-....**
1FK7011-5AK21...	0.85	0.11 (0.2)	0.9	**6SL3210 - 1SB11-0UA3**	0.5	4 x 1.5	**6FX5002-5DA30-....** [2]
1FK7015-5AK21...	0.85	0.22 (0.3)	0.9	**6SL3210 - 1SB11-0UA3**	0.5	4 x 1.5	**6FX5002-5DA30-....** [2]
1FK7022-5AK21...	1.8	0.53 (0.7)	2.3	**6SL3210 - 1SB12-3UA3**	1	4 x 1.5	**6FX■002-5■G01-....**

Cooling: Internal air cooling	**0**								
Motor Module: Single Motor Module		**1**							
Type of power cable: MOTION-CONNECT 800 MOTION-CONNECT 500							**8 5**		
Without brake cores With brake cores								**C 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) 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).

3) 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).

4) 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).

5) With default setting of the pulse frequency.

6) $P_{calc}\,[kW] = \frac{M_0\,[Nm] \times n_{rated}}{9550}$ $\quad P_{calc}\,[HP] = \frac{M_0\,[lb_f\text{-}in] \times n_{rated}}{63000}$

Selection guides
Built-in holding brakes

Built-in holding brakes for 1FT6, 1FT7 and 1FK7 motors

Many drives need a holding brake with an emergency stop function for safety reasons or to meet process requirements.

The permanent-magnet or spring-loaded, single-face brakes used for these motor series function according to the closed-circuit current principle. The magnetic field of the permanent magnet exerts a tension on the brake anchor plate, i.e. in a condition of zero current, the brake is closed and the motor shaft thereby stopped. When the rated voltage of 24 V DC is applied to the brake, current flows through the coil and produces a counterfield that cancels the pull of the permanent magnet, causing the brake to release.

The spring-loaded, single-face brake operates by the force of pressure exerted by the spring instead of a permanent magnet.

In the event of an emergency stop or power outage, approximately 2000 braking operations can be performed with the maximum switched energy without causing excessive wear on the holding brake (condition: maximum external moment of inertia = moment of inertia of motor and n_{max} type-specific).

The holding brake is not an operational brake.

In order to avoid switching overvoltages and any related effects on the plant environment, the brake cables must be connected

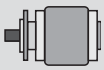
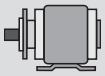
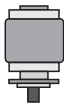
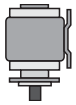
Technical specifications for built-in holding brakes (brake supply voltage 24 V DC ±10 %)

Frame size	Motor type	Brake type	Holding torque [1]	Direct current	Opening time with varistor	Closing time with varistor	Moment of inertia	Maximum switched energy per brake operation from n = 3000 rpm
			Nm (lb_f-ft)	A	ms	ms	10^{-4} kgm^2 (10^{-3} lb_f-in-s^2)	J
for 1FT6 motors								
28	**1FT602.**	**EBD 0.11 B**	1.0 (0.7)	0.3	20	10	0.07 (0.06)	9
36	**1FT603.**	**EBD 0.15 B**	2.0 (1.5)	0.4	30	15	0.12 (0.11)	27
48	**1FT604.**	**EBD 0.4 BA**	5.0 (3.7)	0.8	50	20	1.06 (0.94)	125
63	**1FT606.**	**EBD 1.5 B**	15.0 (11.1)	0.8	130	30	3.2 (2.83)	320
80	**1FT6081/082**	**EBD 1.2 B**	15.0 (11.1)	0.8	150	35	3.2 (2.83)	750
80	**1FT6084/086**	**EBD 3.5 BN**	28.0 (20.7)	0.9	180	35	13.5 (11.9)	1600
100	**1FT610.**	**EBD 4 B**	70.0 (51.6)	1.4	220	50	32 (28.3)	2100
132	**1FT613.** [2]	**EBD 8 B**	140 (103)	1.7	300	90	76 (67.2)	9800
for 1FT7 Compact motors								
36	**1FT703.**	**HT04P01**	3.0 (2.2)	0.3	60	25	0.12 (0.11)	30
48	**1FT704.**	**HT07P01**	8.0 (5.9)	0.6	90	30	0.87 (0.77)	270
63	**1FT706.**	**HT09P01**	18 (13.3)	0.8	150	50	2.84 (2.51)	880
80	**1FT708.**	**HT11P01**	48 (35.4)	1.0	220	65	15.4 (13.6)	1900
100	**1FT710.**	**HT14P01**	85 (62.7)	1.6	250	70	27.6 (24.4)	5300
for 1FK7 Compact motors								
20	**1FK701.**	**HT03P**	0.4 (0.3)	0.3	30	20	0.019 (0.02)	2
28	**1FK7022**	**EBD 0.11 BN**	1.1 (0.8)	0.3	30	20	0.07 (0.06)	8
36	**1FK7032**	**EBD 0.13 BN**	1.3 (1.0)	0.4	50	30	0.08 (0.07)	17
48	**1FK704.**	**EBD 0.3 BV**	3.2 (2.4)	0.6	70	30	0.72 (0.64)	74
63	**1FK706.**	**EBD 0.8 BK**	13 (9.6)	0.8	100	50	2.25 (1.99)	400
80	**1FK7080**	**EBD 1.5 BN**	10 (7.4)	0.7	100	50	3.1 (2.74)	400
80	**1FK7083**	**EBD 2 BY**	22 (16.2)	0.9	200	60	8.6 (7.61)	1400
100	**1FK7100**	**EBD 2 BY**	22 (16.2)	0.9	200	60	8.6 (7.61)	1400
100	**1FK7101/103/105**	**EBD 3.5 BV**	41 (30.2)	1.0	300	70	13.5 (11.9)	3000
for 1FK7 High Dynamic motors								
36	**1FK703.**	**1EB 14-30**	1.3 (1.0)	0.45	100	40	0.12 (0.11)	14
48	**1FK704.**	**1EB 20-40**	4.0 (3.0)	0.6	150	50	0.13 (0.12)	96
63	**1FK706.**	**1EB 28-60**	12 (8.9)	0.8	150	50	0.34 (0.30)	230
80	**1FK708.**	**1EB 35-80**	22 (16.2)	1.2	200	60	2.0 (1.77)	700

[1] Minimum torque of brake in static state (stationary motor)

[2] Holding brake is not available for version with water cooling

Types/mounting position

Type/ mounting position	Desig-nation	Type/ mounting position	Desig-nation	Type/ mounting position	Desig-nation
	IM B3		IM B5 IM B14		IM B35
	IM V5		IM V1 IM V18		IM V15
	IM V6		IM V3 IM V19		IM V35

Degree of protection

The degree of protection designation in accordance with EN 60034-5 and IEC 60034-5 consists of letters "IP" and two digits (e.g. IP64). The second digit in the degree of protection designation represents protection against water, the first digit protection against touch and protection against ingress of solid foreign objects.

Since coolants are used for machine tools and transfer lines that contain oil, are able to creep, and may also be corrosive, protection against water alone is insufficient. The IP rating should only be considered here as a guideline. Our sealing systems are based on many years of practical experience, exceed the IEC specifications by far, and are appropriate to the requirements of machine tools.

The table can serve as a decision aid for selecting the proper degree of protection for motors. With the IM V3/IM V19 types, permanent liquid on the flange is only permissible with IP67/IP68.

Liquids / **Effect**	**General workshop environment**	**Water General cooling lubricant (95 % water, 5 % oil) Oil**	**Penetrating oil; petroleum; aggressive cooling lubricants**
Dry	IP64	–	
Water-enriched environment/ increased humidity	–	IP64	IP67 [1]
Mist		IP65	IP67
Spray	–	IP65	IP68
Jet	–	IP67	IP68
Splash, brief immersion; constant inundation	–	IP67	IP68

[1] IP64 with dry run at shaft exit.

Series SP+ planetary gearbox for 1FT6 motors

Overview

1FT6 motors can be combined with planetary gearboxes to compact coaxial drive units. The gearboxes are flanged directly to the drive end of the motors.

When selecting the gearbox, ensure that its maximum permissible input speed is not exceeded by the maximum speed of the motor. In the case of high operating frequencies, allowance must be made for the factor f_2 (see Configuration Manual, "Synchronous motors"). The frictional losses of the gearbox must always be taken into account.

The gearboxes are only available in non-balanced design.

Benefits

- High efficiency
  Single-stage: > 97 %
  2-stage: > 94 %
- Minimum torsional backlash
  Single-stage: ≤ 4 arcmin
  2-stage: ≤ 6 arcmin
- Power transmission from the central sun wheel via planet wheels
- No shaft deflections in the planet wheel set due to symmetrical force distribution
- Very low moment of inertia and thus short acceleration times of the motors
- Output shaft bearings dimensioned for high cantilever and axial loads with preloaded tapered-roller bearings
- The gearboxes are connected to the motor shaft via an integrated clamping hub. A plain motor shaft extension is necessary for this purpose. Shaft and flange accuracy tolerance N in accordance with DIN 42955 and vibration magnitude grade A in accordance with EN 60034-14 are sufficient. The motor flange is adapted by means of adapter plates.
- Output shaft of gearbox exactly coaxial with the motor
- The gearboxes are enclosed (seal between gearbox and motor) and filled with oil at the factory. They are lubricated and sealed for their service life.
  The gearboxes are suitable for all mounting positions.
- Degree of protection of gearbox: IP65
- Small dimensions
- Low weight

1FT6 synchronous motor with mounted planetary gearbox series SP+

Integration

1FT602 to 1FT613 motors can be supplied ex factory (Siemens AG) complete with flange-mounted planetary gearbox.

The gearboxes assigned to the individual motors and gear ratios *i* available for these motor/gearbox combinations are listed in the selection table below. When making a selection, note the maximum permissible input speed of the gearbox, which should be equal or higher to the maximum motor speed.

The motor/gearbox combinations listed in the selection tables are mainly intended for cycle operation S3-60 % (ON time ≤ 60 % and ≤ 20 min). Reduced maximum motor speeds and output torques apply for use in S1 continuous duty (ON time > 60 % or > 20 min). The gearbox temperature must not exceed 90 °C (194 °F).

Follow the instructions contained in the Configuration Manual for synchronous motors when assigning gearboxes to the motor.

1FT6 motors must be designed with plain motor shaft extension, shaft and flange accuracy tolerance N and vibration magnitude grade A/degree of protection IP65 (for 1FT602: IP64) for mounting onto the gearbox.

Selection and ordering data

Motor	Planetary gearbox single-stage			Available gear ratio i =				Motor speed, max. S3-60 %	Output torque, max. S3-60 %	Radial output shaft loading, max. [1]	Axial output shaft loading, max. [1]
Type	Type	Torsional backlash	Gearbox weight, approx.	4	5	7	10	n_{G1} (n_1)	M_{G2} (T_{2B})	F_r (F_{2Rmax})	F_a (F_{2Amax})
		arcmin	kg (lb)					rpm	Nm (lb$_f$-ft)	N(lb$_f$)	N (lb$_f$)
1FT6021	SP 060S-MF1	≤ 4	1.9 (4.2)	–	–	–	✔	6000	40 (29.5)	2700 (606)	2400 (540)
1FT6024				✔	✔	✔	✔		(32 for i = 10)		
1FT6031				✔	✔	✔	✔				
1FT6034				✔	✔	✔	–				
1FT6034	SP 075S-MF1	≤ 4	3.9 (8.6)	–	–	–	✔	6000	110 (81.1)	4000 (899)	3350 (753)
1FT6041				✔	✔	✔	✔		(90 for i = 10)		
1FT6044				✔	✔	✔	✔				
1FT6061	SP 100S-MF1	≤ 3	7.7 (17.0)	✔	✔	✔	✔	4500	300 (221)	6300 (1416)	5650 (1270)
1FT6062				✔	✔	✔	✔		(225 for i = 10)		
1FT6064				✔	✔	✔	✔				
1FT6081	SP 140S-MF1	≤ 3	17.2 (37.9)	✔	✔	✔	✔	4000	600 (442)	9450 (2124)	9870 (2218)
1FT6082				✔	✔	✔	✔		(480 for i = 10)		
1FT6084				✔	✔	✔	✔				
1FT6086				✔	✔	✔	–				
1FT6086	SP 180S-MF1	≤ 3	34 (75.0)	–	–	–	✔	3500	1100 (810)	14700 (3304)	14150 (3181)
1FT6102				✔	✔	✔	✔		(880 for i = 10)		
1FT6105				✔	✔	✔	–				
1FT6108				✔	✔	✔	–				
1FT6105	SP 210S-MF1	≤ 3	56 (123)	–	–	–	✔	2500	2500 (1844)	21000 (4721)	30000 (6744)
1FT6108				–	–	–	✔		(2400 for i = 7 1900 for i = 10)		
1FT6132				✔	✔	✔	✔				
1FT6134				✔	✔	✔	–				
1FT6136				✔	✔	✔	–				
1FT6134	SP 240S-MF1	≤ 3	83 (183)	–	–	–	✔	2200	4500 (3319)	30000 (6744)	33000 (7418)
1FT6136				–	–	–	✔		(4300 for i = 7 3400 for i = 10)		
Order codes • Gear shaft with fitted key • Gear shaft without fitted key				**J02** **J22**	**J03** **J23**	**J05** **J25**	**J09** **J29**				

Ordering data **1FT6 … - … 7 1 - .. ■ 1 - Z**
J ■ ■

G without holding brake
H with holding brake

Order No. of the motor with identifier "**-Z**" and order code for mounting the planetary gearbox assigned to the motor
Preconditions for mounting planetary gearbox SP+:
Plain motor shaft extension/shaft and flange accuracy tolerance N and vibration magnitude grade A/IP65 degree of protection [2]

✔ Possible
– Not possible

1) In reference to the output shaft center.

2) IP64 degree of protection with 1FT602.: **1FT602.-6AK71-.. ■ 0-Z J..**
G
H

Series SP+ planetary gearbox, single-stage for 1FT6 motors

Technical specifications

Planetary gearbox with 1FT6 motor

Single-stage Type	Gear ratio	Motor speed	Output torque	Moments of inertia of gearbox (referred to the drive)						
		Continuous duty S1 [1]		1FT602.	1FT603.	1FT604.	1FT606.	1FT608.	1FT610.	1FT613.
		n_{N1} rpm	M_{N2} (T_{2N}) Nm (lb_f-ft)	J_1 kgcm^2 (lb_f-in^2)	J_1 kgcm^2 (lb_f-in^2)	J_1 kgcm^2 (lb_f-in^2)	J_1 kgcm^2 (lb_f-in^2)	J_1 kgcm^2 (lb_f-in^2)	J_1 kgcm^2 (lb_f-in^2)	J_1 kgcm^2 (lb_f-in^2)
SP 060S-MF1	4	3300	26 (19.2)	0.15 (0.05)	0.22 (0.08)	–	–	–	–	–
	5	3300	26 (19.2)	0.12 (0.04)	0.20 (0.07)	–	–	–	–	–
	7	4000	26 (19.2)	0.10 (0.03)	0.18 (0.06)	–	–	–	–	–
	10	4000	17 (12.5)	0.09 (0.03)	0.17 (0.06)	–	–	–	–	–
SP 075S-MF1	4	2900	75 (55.3)	–	–	0.78 (0.27)	–	–	–	–
	5	2900	75 (55.3)	–	–	0.68 (0.23)	–	–	–	–
	7	3100	75 (55.3)	–	–	0.59 (0.20)	–	–	–	–
	10	3100	52 (38.3)	–	0.38 (0.13)	0.54 (0.19)	–	–	–	–
SP 100S-MF1	4	2500	180 (132)	–	–	–	3.04 (1.04)	–	–	–
	5	2500	175 (129)	–	–	–	2.61 (0.89)	–	–	–
	7	2800	170 (125)	–	–	–	2.29 (0.78)	–	–	–
	10	2800	120 (88.5)	–	–	–	2.07 (0.71)	–	–	–
SP 140S-MF1	4	2100	360 (266)	–	–	–	–	11.0 (3.76)	–	–
	5	2100	360 (266)	–	–	–	–	9.95 (3.40)	–	–
	7	2600	360 (266)	–	–	–	–	9.01 (3.08)	–	–
	10	2600	220 (162)	–	–	–	–	8.44 (2.88)	–	–
SP 180S-MF1	4	1500	750 (553)	–	–	–	–	–	33.9 (11.6)	–
	5	1500	750 (553)	–	–	–	–	–	27.9 (9.53)	–
	7	2300	750 (553)	–	–	–	–	–	22.2 (7.59)	–
	10	2300	750 (553)	–	–	–	–	19.2 (6.56)	19.2 (6.56)	–
SP 210S-MF1	4	1200	1500 (1106)	–	–	–	–	–	–	94.3 (32.2)
	5	1500	1500 (1106)	–	–	–	–	–	–	76.9 (26.3)
	7	1700	1400 (1033)	–	–	–	–	–	–	61.5 (21.0)
	10	2000	1000 (738)	–	–	–	–	–	53.1 (18.1)	53.1 (18.1)
SP 240S-MF1	10	1700	1300 (959)	–	–	–	–	–	–	70.8 (24.2)

[1] The limit values in the table apply for S1 continuous duty (ON time > 60 % or > 20 min) for a maximum gearbox temperature of 90 °C (194 °F).

Selection and ordering data

Motor	Planetary gearbox two-stage			Available gear ratio i =					Motor speed, max. S3-60 %	Output torque, max. S3-60 %	Radial output shaft loading, max. [1]	Axial output shaft loading, max. [1]
Type	Type	Torsional backlash	Gearbox weight, approx.	16	20	28	40	50	n_{G1} (n_1)	M_{G2} (T_{2B})	F_r (F_{2Rmax})	F_a (F_{2Amax})
		arcmin	kg (lb)						rpm	Nm (lb_f-ft)	N (lb_f)	N (lb_f)
1FT6021	SP 060S-MF2	≤ 6	2.0 (4.4)	✔	✔	✔	✔	✔	6000	40 (29.5)	2700 (607)	2400 (540)
1FT6024				✔	✔	✔	✔	–				
1FT6031				✔	✔	✔	–	–				
1FT6024	SP 075S-MF2	≤ 6	3.6 (7.9)	–	–	–	–	✔	6000	110 (81.1)	4000 (899)	3350 (753)
1FT6031				–	–	–	✔	✔				
1FT6034				✔	✔	✔	–	–				
1FT6041				✔	✔	–	–	–				
1FT6034	SP 100S-MF2	≤ 5	7.9 (17.4)	–	–	–	✔	✔	4500	300 (221)	6300 (1416)	5650 (1270)
1FT6041				–	–	✔	✔	✔				
1FT6044				✔	✔	✔	–	–				
1FT6061				✔	✔	✔	✔	–				
1FT6062				✔	✔	✔	–	–				
1FT6064				✔	–	–	–	–				
1FT6044	SP 140S-MF2	≤ 5	17 (37.5)	–	–	–	✔	✔	4000	600 (442)	9450 (2124)	9870 (2219)
1FT6061				–	–	–	–	✔				
1FT6062				–	–	–	✔	✔				
1FT6064				–	✔	✔	–	–				
1FT6081				✔	✔	✔	✔	–				
1FT6082				✔	✔	–	–	–				
1FT6084				✔	–	–	–	–				
1FT6064	SP 180S-MF2	≤ 5	36.4 (80.3)	–	–	–	✔	✔	4000	1100 (811)	14700 (3305)	14150 (3181)
1FT6081				–	–	–	–	✔				
1FT6082				–	–	✔	✔	–				
1FT6084				–	✔	✔	–	–				
1FT6086				✔	✔	–	–	–				
1FT6102				✔	✔	–	–	–				
1FT6082	SP 210S-MF2	≤ 5	55.0 (121)	–	–	–	–	✔	3500	2400 (1770) (2500 for i = 20)	21000 (4721)	30000 (6744)
1FT6105				✔	–	–	–	–				
1FT6084	SP 240S-MF2	≤ 5	80.6 (178)	–	–	–	✔	✔	3500	4500 (3319) (4000 for i = 40 4300 for i = 50)	30000 (6744)	30000 (6744)
1FT6086				–	–	✔	✔	✔				
1FT6102				–	–	✔	✔	✔				
1FT6105				–	✔	✔	–	–				
1FT6108				✔	✔	–	–	–				
1FT6132				✔	✔	–	–	–				
1FT6134				✔	–	–	–	–				
1FT6136				✔	–	–	–	–				
Order codes • Gear shaft with fitted key • Gear shaft without fitted key				**J12 J32**	**J13 J33**	**J15 J35**	**J16 J36**	**J17 J37**				

Ordering data **1FT6...-...71-..■1-Z J■■**

G without holding brake
H with holding brake

Order No. of the motor with identifier "**-Z**" and order code for mounting the planetary gearbox assigned to the motor
Preconditions for mounting planetary gearbox SP+:
Plain motor shaft extension/shaft and flange accuracy tolerance N and vibration magnitude grade A/IP65 degree of protection [2]

[1] In reference to the output shaft center.

[2] IP64 degree of protection with 1FT602.: **1FT602.-6AK71-..■0-Z J.. G H**

Series SP+ planetary gearbox, two-stage for 1FT6 motors

Technical specifications

Planetary gearbox with 1FT6 motor

Two-stage Type	Gear ratio	Motor speed	Output torque	Moments of inertia of gearbox (referred to the drive)						
		Continuous duty S1 [1]		1FT602.	1FT603.	1FT604.	1FT606.	1FT608.	1FT610.	1FT613.
		n_{N1} rpm	M_{N2} (T_{2N}) Nm (lb$_f$-ft)	J_1 kgcm^2 (lb$_f$-in^2)	J_1 kgcm^2 (lb$_f$-in^2)	J_1 kgcm^2 (lb$_f$-in^2)	J_1 kgcm^2 (lb$_f$-in^2)	J_1 kgcm^2 (lb$_f$-in^2)	J_1 kgcm^2 (lb$_f$-in^2)	J_1 kgcm^2 (lb$_f$-in^2)
SP 060S-MF2	16	4400	26 (19.2)	0.08 (0.03)	0.17 (0.06)	–	–	–	–	–
	20	4400	26 (19.2)	0.07 (0.02)	0.16 (0.06)	–	–	–	–	–
	28	4400	26 (19.2)	0.06 (0.02)	0.16 (0.06)	–	–	–	–	–
	40	4400	26 (19.2)	0.06 (0.02)	–	–	–	–	–	–
	50	4800	26 (19.2)	0.06 (0.02)	–	–	–	–	–	–
SP 075S-MF2	16	3500	75 (55.3)	–	0.23 (0.08)	0.55 (0.19)	–	–	–	–
	20	3500	75 (55.3)	–	0.20 (0.07)	0.53 (0.18)	–	–	–	–
	28	3500	75 (55.3)	–	0.18 (0.06)	0.50 (0.17)	–	–	–	–
	40	3500	75 (55.3)	–	0.17 (0.06)	–	–	–	–	–
	50	3800	75 (55.3)	0.10 (0.03)	0.16 (0.06)	–	–	–	–	–
SP 100S-MF2	16	3100	180 (133)	–	–	0.81 (0.28)	2.18 (0.75)	–	–	–
	20	3100	180 (133)	–	–	0.70 (0.24)	2.07 (0.71)	–	–	–
	28	3100	180 (133)	–	–	0.60 (0.21)	1.97 (0.67)	–	–	–
	40	3100	180 (133)	–	0.38 (0.13)	0.55 (0.19)	1.92 (0.66)	–	–	–
	50	3500	175 (129)	–	0.38 (0.13)	0.54 (0.19)	–	–	–	–
SP 140S-MF2	16	2900	360 (265)	–	–	–	–	10.3 (3.52)	–	–
	20	2900	360 (265)	–	–	–	2.71 (0.93)	9.77 (3.34)	–	–
	28	2900	360 (265)	–	–	–	2.34 (0.80)	9.41 (3.22)	–	–
	40	2900	360 (265)	–	–	1.40 (0.48)	2.10 (0.72)	9.16 (3.13)	–	–
	50	3200	360 (265)	–	–	1.39 (0.48)	2.08 (0.71)	–	–	–
SP 180S-MF2	16	2700	750 (553)	–	–	–	–	12.4 (4.24)	13.5 (4.61)	–
	20	2700	750 (553)	–	–	–	–	10.9 (3.73)	12.0 (4.10)	–
	28	2700	750 (553)	–	–	–	–	9.48 (3.24)	–	–
	40	2700	750 (553)	–	–	–	5.51 (1.88)	8.67 (2.96)	–	–
	50	2900	750 (553)	–	–	–	5.45 (1.86)	8.61 (2.94)	–	–
SP 210S-MF2	16	2500	1500 (1106)	–	–	–	–	–	34.5 (11.8)	–
	50	2500	1500 (1106)	–	–	–	–	28.3 (9.67)	–	–
SP 240S-MF2	16	2300	2500 (1844)	–	–	–	–	–	39.2 (13.4)	39.2 (13.4)
	20	2500	2500 (1844)	–	–	–	–	–	34.6 (11.8)	34.6 (11.8)
	28	2500	2500 (1844)	–	–	–	–	30.5 (10.4)	30.5 (10.4)	–
	40	2500	2500 (1844)	–	–	–	–	28.2 (9.64)	28.2 (9.64)	–
	50	2500	2500 (1844)	–	–	–	–	27.9 (9.53)	27.9 (9.53)	–

[1] The limit values in the table apply for S1 continuous duty (ON time > 60 % or > 20 min) for a maximum gearbox temperature of 90 °C (194 °F).

Series SP+ planetary gearbox for 1FT7 motors

Overview

1FT7 motors can be combined with planetary gearboxes to form compact coaxial drive units. The gearboxes are flanged directly to the drive end of the motors.

When selecting the gearbox, ensure that its maximum permissible input speed is not exceeded by the maximum speed of the motor. In the case of high operating frequencies, allowance must be made for the factor f_2 (see Configuration Manual, "Synchronous motors"). The frictional losses of the gearbox must always be taken into account.

The gearboxes are only available in non-balanced design.

Benefits

- High efficiency
  Single-stage: > 97 %
  2-stage: > 94 %
- Minimum torsional backlash
  Single-stage: ≤ 4 arcmin,
  two-stage: ≤ 6 arcmin
- Power transmission from the central sun wheel via planet wheels
- No shaft deflections in the planet wheel set due to symmetrical force distribution
- Very low moment of inertia and thus short acceleration times of the motors
- Output shaft bearings dimensioned for high cantilever and axial loads with preloaded tapered-roller bearings
- The gearboxes are connected to the motor shaft via an integrated clamping hub. A plain motor shaft extension is necessary for this purpose. Shaft and flange accuracy tolerance N in accordance with DIN42955 and vibration magnitude grade A in accordance with EN 60034-14 are sufficient. The motor flange is adapted by means of adapter plates.
- Output shaft of gearbox exactly coaxial with the motor
- The gearboxes are enclosed (seal between gearbox and motor) and filled with oil at the factory. They are lubricated and sealed for their service life.
  The gearboxes are suitable for all mounting positions.
- Degree of protection of gearbox: IP65
- Small dimensions
- Low weight

More information

Dimension drawings for 1FT7 synchronous motors with built-on planetary gearboxes of series SP+ are provided by CAD CREATOR.
http://www.siemens.com/cad-creator

1FT7 synchronous motor with mounted planetary gearbox series SP+

Integration

1FT703 to 1FT710 naturally-cooled motors can be supplied ex factory (Siemens AG) complete with flange-mounted planetary gear unit.

The gearboxes assigned to the individual motors and gear ratios *i* available for these motor/gearbox combinations are listed in the selection table below. When making a selection, note the maximum permissible input speed of the gearbox, which should be equal or higher to the maximum motor speed.

The motor/gearbox combinations listed in the selection tables are mainly intended for cycle operation S3-60 % (ON time ≤ 60 % and ≤ 20 min). Reduced maximum motor speeds and output torques apply for use in S1 continuous duty (ON time > 60 % or > 20 min). It is not permissible to exceed a gearbox temperature of +90 °C (194 °F).

Follow the instructions contained in the section for synchronous motors in the Configuration Manual when assigning gearboxes to the motor.

1FT7 motors must be designed with flange type "1", with plain motor shaft extension, shaft and flange accuracy tolerance N and vibration magnitude grade A/degree of protection IP65, for mounting onto the gearbox.

Series SP+ planetary gearbox, single-stage for 1FT7 motors

Selection and ordering data

Motor Natural cooling	**Planetary gearbox single-stage**			**Available gear ratio *i* =**				Motor speed, max. S3-60 %	Output torque, max. S3-60 %	Radial output shaft loading, max. [1]	Axial output shaft loading, max. [1]
Type	Type	Torsional backlash	Gearbox weight, approx.	**4**	**5**	**7**	**10**	n_{G1} (n_1)	M_{G2} (T_{2B})	F_r (F_{2Rmax})	F_a (F_{2Amax})
		arcmin	kg (lb)					rpm	Nm (lb_f-ft)	N (lb_f)	N (lb_f)
1FT7034	SP 060S-MF1	≤ 4	1.9 (4.2)	✔	✔	✔	–	6000	40 (295)	2700 (607)	2400 (540)
1FT7034	SP 075S-MF1	≤ 4	3.9 (8.6)	–	–	–	✔	6000	110 (81.1)	4000 (899)	3350 (753)
1FT7036				✔	✔	✔	✔		(90 for *i* = 10)		
1FT7042				✔	✔	✔	✔				
1FT7044				✔	✔	✔	✔				
1FT7046				✔	✔	✔	–				
1FT7046	SP 100S-MF1	≤ 3	7.7 (17.0)	–	–	–	✔	4500	300 (221)	6300 (1416)	5650 (1270)
1FT7062				✔	✔	✔	✔		(225 for *i* = 10)		
1FT7064				✔	✔	✔	✔				
1FT7066				✔	✔	✔	✔				
1FT7068				✔	✔	✔	–				
1FT7068	SP 140S-MF1	≤ 3	17.2 (37.9)	–	–	–	✔	4000	600 (442)	9450 (2124)	9870 (2219)
1FT7082				✔	✔	✔	✔		(480 for *i* = 10)		
1FT7084				✔	✔	✔	✔				
1FT7086				✔	✔	✔	–				
1FT7086	SP 180S-MF1	≤ 3	34 (75.0)	–	–	–	✔	3500	1100 (810)	14700 (3305)	14150 (3181)
1FT7102				✔	✔	✔	✔		(880 for *i* = 10)		
1FT7105				✔	✔	✔	–				
1FT7108				✔	✔	✔	–				
1FT7105	SP 210S-MF1	≤ 3	56 (123)	–	–	–	✔	2500	2500 (1844) (2400 for *i* = 7 1900 for *i* = 10)	21000 (4721)	30000 (6744)
1FT7108				–	–	–	✔				
Order codes • Gear shaft with fitted key • Gear shaft without fitted key				**J02 J22**	**J03 J23**	**J05 J25**	**J09 J29**				

Ordering data **1FT7...-...71-..■1-Z J■■**

G without holding brake
H with holding brake

Order No. of the motor with identifier "**-Z**" and order code for mounting the planetary gearbox assigned to the motor
Preconditions for mounting planetary gearbox SP+:
Plain motor shaft extension/shaft and flange accuracy tolerance N and vibration magnitude grade A/IP65 degree of protection

✔ Possible
– Not possible
[1] In reference to the output shaft center.

Technical specifications

Planetary gearbox with 1FT7 motor

Single-stage Type	Gear ratio	Motor speed	Output torque	Moments of inertia of gearbox (referred to the drive)				
		Continuous duty S1 [1]		1FT703.	1FT704.	1FT706.	1FT708.	1FT710.
		n_{N1} rpm	M_{N2} (T_{2N}) Nm (lb_f-ft)	J_1 kgcm^2 (lb_f-in^2)	J_1 kgcm^2 (lb_f-in^2)	J_1 kgcm^2 (lb_f-in^2)	J_1 kgcm^2 (lb_f-in^2)	J_1 kgcm^2 (lb_f-in^2)
SP 060S-MF1	4	3300	26 (19.2)	0.22 (0.08)	–	–	–	
	5	3300	26 (19.2)	0.20 (0.07)	–	–	–	
	7	4000	26 (19.2)	0.18 (0.06)	–	–	–	
SP 075S-MF1	4	2900	75 (55.3)	0.61 (0.21)	0.78 (0.27)	–	–	
	5	2900	75 (55.3)	0.51 (0.17)	0.68 (0.23)	–	–	
	7	3100	75 (55.3)	0.42 (0.14)	0.59 (0.20)	–	–	
	10	3100	52 (38.4)	0.38 (0.13)	0.54 (0.19)	–	–	
SP 100S-MF1	4	2500	180 (133)	–	–	3.04 (1.04)	–	
	5	2500	175 (129)	–	–	2.61 (0.89)	–	
	7	2800	170 (125)	–	–	2.29 (0.78)	–	
	10	2800	120 (88.5)	–	1.38 (0.47)	2.07 (0.71)	–	
SP 140S-MF1	4	2100	360 (266)	–	–	–	11.0 (3.76)	
	5	2100	360 (266)	–	–	–	9.95 (3.40)	
	7	2600	360 (266)	–	–	–	9.01 (3.08)	
	10	2600	220 (162)	–	–	5.28 (1.80)	8.44 (2.88)	
SP 180S-MF1	4	1500	750 (553)	–	–	–	–	33.9 (11.6)
	5	1500	750 (553)	–	–	–	–	27.9 (9.53)
	7	2300	750 (553)	–	–	–	–	22.2 (7.59)
	10	2300	750 (553)	–	–	–	19.2 (6.56)	19.2 (6.56)
SP 210S-MF1	10	2000	1000 (738)	–	–	–	–	53.1 (18.1)

[1] The limit values in the table apply for S1 continuous duty (ON time > 60 % or > 20 min) for a maximum gearbox temperature of 90 °C (194 °F).

Series SP+ planetary gearbox, 2-stage for 1FT7 motors

Selection and ordering data

Motor Natural cooling	**Planetary gearbox two-stage**			**Available gear ratio *i* =**					Motor speed, max. S3-60 %	Output torque, max. S3-60 %	Radial output shaft loading, max. 1)	Axial output shaft loading, max. 1)
Type	Type	Torsional backlash	Gearbox weight, approx.	16	20	28	40	50	n_{G1} (n_1)	M_{G2} (T_{2B})	F_r (F_{2Rmax})	F_a (F_{2Amax})
		arcmin	kg (lb)						rpm	Nm (lb$_f$-ft)	N (lb$_f$)	N (lb$_f$)
1FT7034	SP 075S-MF2	≤ 6	3.6 (7.9)	✔	✔	✔	–	–	6000	110 (81.1)	4000 (899)	3350 (753)
1FT7036				✔	–	–	–	–				
1FT7042				✔	–	–	–	–				
1FT7034	SP 100S-MF2	≤ 5	7.9 (17.4)	–	–	–	✔	✔	4500	300 (221)	6300 (1416)	5650 (1270)
1FT7036				–	✔	✔	✔	✔				
1FT7042				–	✔	✔	✔	✔				
1FT7044				✔	✔	✔	–	–				
1FT7046				✔	✔	–	–	–				
1FT7062				✔	✔	–	–	–				
1FT7064				✔	–	–	–	–				
1FT7044	SP 140S-MF2	≤ 5	17 (37.5)	–	–	–	✔	✔	4000	600 (442)	9450 (2124)	9870 (2219)
1FT7046				–	–	✔	✔	✔				
1FT7062				–	–	✔	✔	✔				
1FT7064				–	✔	–	–	–				
1FT7066				✔	✔	–	–	–				
1FT7068				✔	✔	–	–	–				
1FT7082				✔	✔	–	–	–				
1FT7084				✔	–	–	–	–				
1FT7064	SP 180S-MF2	≤ 5	36.4 (80.3)	–	–	–	✔	✔	4000	1100 (811)	14700 (3305)	14150 (3181)
1FT7066				–	–	✔	✔	✔				
1FT7068				–	–	✔	✔	✔				
1FT7082				–	–	✔	✔	✔				
1FT7084				–	✔	✔	–	–				
1FT7086				✔	✔	–	–	–				
1FT7102				✔	✔	–	–	–				
1FT7084	SP 210S-MF2	≤ 5	55 (121)	–	–	–	✔	✔	3500	2400 (1770) (2500 for *i* = 40)	21000 (4721)	30000 (6744)
1FT7086				–	–	✔	✔	–				
1FT7102				–	–	✔	–	–				
1FT7105				✔	✔	–	–	–				
1FT7108				✔	–	–	–	–				
1FT7086	SP 240S-MF2	≤ 5	80.6 (178)	–	–	–	–	✔	3500	4500 (3319) (4000 for *i* = 40 4300 for *i* = 50)	30000 (6744)	33000 (7419)
1FT7102				–	–	–	✔	✔				
1FT7105				–	–	✔	✔	–				
1FT7108				–	✔	✔	–	–				
Order codes • Gear shaft with fitted key • Gear shaft without fitted key				**J12 J32**	**J13 J33**	**J15 J35**	**J16 J36**	**J17 J37**				

Ordering data **1FT7...-...71-..■1-Z J■■**

G without holding brake
H with holding brake

Order No. of the motor with identifier "**-Z**" and order code for mounting the planetary gearbox assigned to the motor
Preconditions for mounting planetary gearbox SP+:
Plain motor shaft extension/shaft and flange accuracy tolerance N and vibration magnitude grade A/IP65 degree of protection

1) In reference to the output shaft center.

Technical specifications

Planetary gearbox with 1FT7 motor

Two-stage Type	Gear ratio	Motor speed	Output torque	Moments of inertia of gearbox (referred to the drive)				
		Continuous duty S1 [1]		1FT703 .	1FT704.	1FT706.	1FT708.	1FT710.
		n_{N1} rpm	M_{N2} (T_{2N}) Nm (lb$_f$-ft)	J_1 kgcm^2 (lb$_f$-in^2)	J_1 kgcm^2 (lb$_f$-in^2)	J_1 kgcm^2 (lb$_f$-in^2)	J_1 kgcm^2 (lb$_f$-in^2)	J_1 kgcm^2 (lb$_f$-in^2)
SP 075S-MF2	16	3500	75 (55.3)	0.23 (0.08)	0.55 (0.19)	–	–	–
	20	3500	75 (55.3)	0.20 (0.07)	–	–	–	–
	28	3500	75 (55.3)	0.18 (0.06)	–	–	–	–
SP 100S-MF2	16	3100	180 (133)	–	0.81 (0.28)	2.18 (0.75)	–	–
	20	3100	180 (133)	0.54 (0.19)	0.70 (0.24)	2.07 (0.71)	–	–
	28	3100	180 (133)	0.43 (0.15)	0.60 (0.21)	–	–	–
	40	3100	180 (133)	0.38 (0.13)	0.55 (0.19)	–	–	–
	50	3500	175 (129)	0.38 (0.13)	0.54 (0.19)	–	–	–
SP 140S-MF2	16	2900	360 (265)	–	–	3.19 (1.09)	10.3 (3.52)	–
	20	2900	360 (265)	–	–	2.71 (0.93)	9.77 (3.34)	–
	28	2900	360 (265)	–	1.65 (0.56)	2.34 (0.80)	–	–
	40	2900	360 (265)	–	1.40 (0.48)	2.10 (0.72)	–	–
	50	3200	360 (265)	–	1.39 (0.48)	2.08 (0.71)	–	–
SP 180S-MF2	16	2700	750 (553)	–	–	–	12.4 (4.24)	13.5 (4.61)
	20	2700	750 (553)	–	–	–	10.9 (3.73)	12.0 (4.10)
	28	2700	750 (553)	–	–	6.32 (2.16)	9.48 (3.24)	–
	40	2700	750 (553)	–	–	5.51 (1.88)	8.67 (2.96)	–
	50	2900	750 (553v	–	–	5.45 (1.86)	8.61 (2.94)	–
SP 210S-MF2	16	2500	1500 (1106)	–	–	–	–	34.5 (11.8)
	20	2500	1500 (1106)	–	–	–	–	31.5 (10.8)
	28	2500	1500 (1106)	–	–	–	30.0 (10.3)	30.0 (10.3)
	40	2500	1500 (1106)	–	–	–	28.5 (9.74)	–
	50	2500	1500 (1106)	–	–	–	28.3 (9.67)	–
SP 240S-MF2	20	2500	2500 (1844)	–	–	–	–	34.6 (11.8)
	28	2500	2500 (1844)	–	–	–	–	30.5 (10.4)
	40	2500	2500 (1844)	–	–	–	–	28.2 (9.64)
	50	2500	2500 (1844)	–	–	–	27.9 (9.53)	27.9 (9.53)

[1] The limit values in the table apply for S1 continuous duty (ON time > 60 % or > 20 min) for a maximum gearbox temperature of 90 °C (194 °F).

Series SP+ planetary gearbox for 1FK7 motors

Overview

1FK7 motors can be combined with planetary gearboxes to form compact coaxial drive units. The gearboxes are flanged directly to the drive end of the motors.

When selecting the gearbox, ensure that its maximum permissible input speed is not exceeded by the maximum speed of the motor. In the case of high operating frequencies, allowance must be made for the factor f_2 (see Configuration Manual, "1FK7 synchronous motors"). The frictional losses of the gearbox must always be taken into account.

The gearboxes are only available in non-balanced design and with fitted key.

Benefits

- High efficiency
  Single-stage: > 97 %
  2-stage: > 94 %
- Minimum torsional backlash
  Single-stage: ≤ 4 arcmin,
  2-stage: ≤ 6 arcmin
- Power transmission from the central sun wheel via planet wheels
- No shaft deflections in the planet wheel set due to symmetrical force distribution
- Very low moment of inertia and thus short acceleration times of the motors
- Output shaft bearings dimensioned for high cantilever and axial loads with preloaded tapered-roller bearings
- The gearboxes are connected to the motor shaft via an integrated clamping hub. A plain motor shaft extension is necessary for this purpose. Shaft and flange accuracy tolerance N in accordance with DIN42955 and vibration magnitude grade A in accordance with EN 60034-14 are sufficient. The motor flange is adapted by means of adapter plates.
- Output shaft of gearbox exactly coaxial with the motor
- The gearboxes are enclosed (seal between gearbox and motor) and filled with oil at the factory. They are lubricated and sealed for their service life.
  The gearboxes are suitable for all mounting positions.
- Degree of protection of gearbox: IP65
- Small dimensions
- Low weight

1FK7 synchronous motor with built-in planetary gearbox series SP+

Integration

1FK702 to 1FK710 motors can be supplied ex factory (Siemens AG) complete with flange-mounted planetary gearbox.

The gearboxes assigned to the individual motors and gear ratios *i* available for these motor/gearbox combinations are listed in the selection table below. When making a selection, note the maximum permissible input speed of the gearbox, which should be equal or higher to the maximum motor speed.

The motor/gearbox combinations listed in the selection table are mainly intended for cycle operation S3-60 % (ON time ≤ 60 % and ≤ 20 min). Reduced maximum motor speeds and output torques apply for use in S1 continuous duty (ON time > 60 % or > 20 min). The gearbox temperature may not exceed 90 °C (194 °F).

Follow the instructions contained in the Configuration Manual for 1FK7 synchronous motors when assigning gearboxes to the motor.

1FK7 motors must be designed with plain motor shaft extension/shaft and flange accuracy tolerance N, degree of protection IP65 and anthracite paint finish for mounting onto the gearbox.

4

Selection and ordering data

Motor Natural cooling	**Planetary gearbox single-stage**			**Available gear ratio *i* =**				Motor speed, max. S3-60 %	Output torque, max. S3-60 %	Radial output shaft loading, max. [1]	Axial output shaft loading, max. [1]
Type	Type	Torsional backlash	Gearbox weight, approx.	**4**	**5**	**7**	**10**	n_{G1} (n_1)	M_{G2} (T_{2B})	F_r (F_{2Rmax})	F_a (F_{2Amax})
		arcmin	kg (lb)					rpm	Nm (lb$_f$-ft)	N (lb$_f$)	N (lb$_f$)
1FK7022	SP 060S-MF1	≤ 4	1.9 (4.2)	✔	✔	✔	✔	6000	40 (29.5)	2700 (607)	2400 (540)
1FK7032				✔	✔	✔	✔		(32 for i = 10)		
1FK7033				✔	✔	✔	✔				
1FK7034				✔	✔	✔	✔				
1FK7040	SP 075S-MF1	≤ 4	3.9 (7.9)	✔	✔	✔	✔	6000	110 (81.1)	4000 (899)	3350 (753)
1FK7042				✔	✔	✔	✔		(90 for i = 10)		
1FK7043				✔	✔	✔	✔				
1FK7044				✔	✔	✔	✔				
1FK7060	SP 100S-MF1	≤ 3	7.7 (17.0)	✔	✔	✔	✔	4500	300 (221)	6300 (1416)	5650 (1270)
1FK7061				✔	✔	✔	✔		(225 for i = 10)		
1FK7063				✔	✔	✔	✔				
1FK7064				✔	✔	✔	✔				
1FK7080	SP 140S-MF1	≤ 3	17.2 (37.9)	✔	✔	✔	✔	4000	600 (442)	9450 (2124)	9870 (2219)
1FK7083				✔	✔	✔	✔		(480 for i = 10)		
1FK7085				✔	✔	✔	✔				
1FK7086				✔	✔	✔	✔				
1FK7100	SP 180S-MF1	≤ 3	34 (75.0)	✔	✔	✔	✔	3500	1100 (811)	14700 (3305)	14150 (3181)
1FK7101				✔	✔	✔	✔				
1FK7103				✔	✔	✔	✔				
1FK7105				✔	✔	✔	–				
1FK7105	SP 210S-MF1	≤ 3	56 (123)	–	–	–	✔	2500	2500 (1844) (2400 for i = 7 1900 for i = 10)	21000 (4721)	30000 (6744)
Order codes • Gear shaft with fitted key • Gear shaft without fitted key				**J02** **J22**	**J03** **J23**	**J05** **J25**	**J09** **J29**				

Ordering data **1FK7...-.A..1-..■5-Z**
J■■

G without holding brake
H with holding brake

Order No. of the motor with identifier "**-Z**" and order code for mounting the planetary gearbox assigned to the motor
Preconditions for mounting planetary gearbox SP+:
Plain motor shaft extension and IP65 degree of protection, anthracite paint finish

✔ Possible
– Not possible
[1] In reference to the output shaft center.

Series SP+ planetary gearbox, single-stage for 1FK7 motors

Technical specifications

Planetary gearbox with 1FK7 motor

Single-stage Type	Gear ratio	Motor speed	Output torque	Moments of inertia of gearbox (referred to the drive)					
		Continuous duty S1 [1]		1FK702	1FK703.	1FK704.	1FK706.	1FK708.	1FK710.
		n_{N1} rpm	M_{N2} (T_{2N}) Nm (lb$_f$-ft)	J_1 kgcm^2 (lb$_f$-in^2)	J_1 kgcm^2 (lb$_f$-in^2)	J_1 kgcm^2 (lb$_f$-in^2)	J_1 kgcm^2 (lb$_f$-in^2)	J_1 kgcm^2 (lb$_f$-in^2)	J_1 kgcm^2 (lb$_f$-in^2)
SP 060S-MF1	4	3300	26 (19.2)	0.15 (0.05)	0.22 (0.08)	–	–	–	–
	5	3300	26 (19.2)	0.12 (0.04)	0.20 (0.07)	–	–	–	–
	7	4000	26 (19.2)	0.10 (0.03)	0.18 (0.06)	–	–	–	–
	10	4000	17 (12.5)	0.09 (0.03)	0.17 (0.06)	–	–	–	–
SP 075S-MF1	4	2900	75 (55.3)	–	–	0.78 (0.27)	–	–	–
	5	2900	75 (55.3)	–	–	0.68 (0.23)	–	–	–
	7	3100	75 (55.3)	–	–	0.59 (0.20)	–	–	–
	10	3100	52 (38.4)	–	–	0.54 (0.19)	–	–	–
SP 100S-MF1	4	2500	180 (133)	–	–	–	3.04 (1.04)	–	–
	5	2500	175 (129)	–	–	–	2.61 (0.89)	–	–
	7	2800	170 (125)	–	–	–	2.29 (0.78)	–	–
	10	2800	120 (88.5)	–	–	–	2.07 (0.71)	–	–
SP 140S-MF1	4	2100	360 (265)	–	–	–	–	11.0 (3.76)	–
	5	2100	360 (265)	–	–	–	–	9.95 (3.40)	–
	7	2600	360 (265)	–	–	–	–	9.01 (3.08)	–
	10	2600	220 (162)	–	–	–	–	8.44 (2.88)	–
SP 180S-MF1	4	1500	750 (553)	–	–	–	–	–	33.9 (11.6)
	5	1500	750 (553)	–	–	–	–	–	27.9 (9.53)
	7	2300	750 (553)	–	–	–	–	–	22.2 (7.59)
	10	2300	750 (553)	–	–	–	–	–	19.2 (6.56)
SP 210S-MF1	10	2000	1000 (738)	–	–	–	–	–	53.1 (18.1)

[1] The limit values in the table apply for S1 continuous duty (ON time > 60 % or > 20 min) for a maximum gearbox temperature of 90 °C (194 °F).

Selection and ordering data

Motor Natural cooling	**Planetary gearbox two-stage**			**Available gear ratio *i* =**					Motor speed, max. S3-60 %	Output torque, max. S3-60 %	Radial output shaft loading, max. 1)	Axial output shaft loading, max. 1)
Type	Type	Torsional backlash	Gearbox weight, approx.	**16**	**20**	**28**	**40**	**50**	n_{G1} (n_1)	M_{G2} (T_{2B})	F_r (F_{2Rmax})	F_a (F_{2Amax})
		arcmin	kg (lb)						rpm	Nm (lb_f-ft)	N (lb_f)	N (lb_f)
1FK7022	SP 060S-MF2	≤ 6	2.0 (4.4)	✔	✔	✔	–	–	6000	40 (295)	2700 (607)	2400 (540)
1FK7032				✔	✔	–	–	–				
1FK7033				✔	✔	–	–	–				
1FK7022	SP 075S-MF2	≤ 6	3.6 (7.9)	–	–	–	✔	✔	6000	110 (81.1)	4000 (899)	3350 (753)
1FK7032				–	–	✔	✔	✔				
1FK7033				–	–	✔	✔	✔				
1FK7034				✔	✔	✔	–	–				
1FK7040				✔	✔	✔	–	–				
1FK7042				✔	✔	–	–	–				
1FK7043				✔	–	–	–	–				
1FK7034	SP 100S-MF2	≤ 5	7.9 (17.4)	–	–	–	✔	✔	4500	300 (221)	6300 (1416)	2400 (1270)
1FK7040				–	–	–	✔	✔				
1FK7042				–	–	✔	✔	✔				
1FK7043				–	✔	✔	✔	✔				
1FK7044				✔	✔	✔	✔	–				
1FK7060				✔	✔	✔	–	–				
1FK7061				✔	✔	–	–	–				
1FK7044	SP 140S-MF2	≤ 5	17 (37.5)	–	–	–	–	✔	4000	600 (442)	9450 (2124)	9870 (2219)
1FK7060				–	–	–	✔	✔				
1FK7061				–	–	✔	✔	✔				
1FK7063				✔	✔	✔	–	–				
1FK7064				✔	✔	✔	–	–				
1FK7080				✔	✔	✔	✔	–				
1FK7083				✔	✔	–	–	–				
Order codes • Gear shaft with fitted key				**J12**	**J13**	**J15**	**J16**	**J17**				
• Gear shaft without fitted key				**J32**	**J33**	**J35**	**J36**	**J37**				

Ordering data **1FK7...-.A..1-..■5-Z**
J■■

G without holding brake
H with holding brake

Order No. of the motor with identifier "**-Z**" and
order code for mounting the planetary gearbox assigned to the motor
Preconditions for mounting planetary gearbox SP+: Plain motor shaft extension and IP65 degree of protection, anthracite paint finish

✔ Possible
– Not possible
1) Referred to the center of the output shaft at 100 rpm.

Series SP+ planetary gearbox, two-stage for 1FK7 motors

Selection and ordering data

Motor Natural cooling	**Planetary gearbox two-stage**			**Available gear ratio *i* =**					Motor speed, max. S3-60 %	Output torque, max. S3-60 %	Radial output shaft loading, max. [1]	Axial output shaft loading, max. [1]
Type	Type	Torsional backlash	Gearbox weight, approx.	**16**	**20**	**28**	**40**	**50**	n_{G1} (n_1)	M_{G2} (T_{2B})	F_r (F_{2Rmax})	F_a (F_{2Amax})
		arcmin	kg (lb)						rpm	Nm (lb_f-ft)	N (lb_f)	N (lb_f)
1FK7063	SP 180S-MF2	≤ 5	36.4 (80.3)	–	–	–	✔	✔	4000	1100 (811)	14700 (3305)	14150 (3181)
1FK7064				–	–	–	✔	✔				
1FK7080				–	–	–	–	✔				
1FK7083				–	–	✔	–	–				
1FK7085				✔	✔	–	–	–				
1FK7086				✔	✔	–	–	–				
1FK7100				✔	✔	✔	–	–				
1FK7101				✔	✔	–	–	–				
1FK7103				✔	–	–	–	–				
1FK7083	SP 210S-MF2	≤ 6	55 (121)	–	–	–	✔	✔	3500	2400 (1770) (2500 for *i* = 20)	21000 (4721)	30000 (6744)
1FK7085				–	–	✔	✔	–				
1FK7086				–	–	✔	–	–				
1FK7100				–	–	–	✔	✔				
1FK7101				–	–	✔	–	–				
1FK7103				–	✔	–	–	–				
1FK7105				✔	✔	–	–	–				
1FK7101	SP 240S-MF2	≤ 6	80.6 (178)	–	–	–	✔	✔	3500	4500 (3319) (4000 for *i* = 40 4300 for *i* = 50)	30000 (6744)	33000 (7419)
1FK7103				–	–	✔	✔	–				
1FK7105				–	–	✔	–	–				
Order codes • Gear shaft with fitted key • Gear shaft without fitted key				**J12 J32**	**J13 J33**	**J15 J35**	**J16 J36**	**J17 J37**				

Ordering data **1FK7...-.A..1-..■5-Z J■■**

G	without holding brake
H	with holding brake

Order No. of the motor with identifier "**-Z**" and order code for mounting the planetary gearbox assigned to the motor
Preconditions for mounting planetary gearbox SP+: Plain motor shaft extension and IP65 degree of protection, anthracite paint finish

[1] In reference to the output shaft center.

Technical specifications

Planetary gearbox with 1FK7 motor

Two-stage Type	Gear ratio	Motor speed	Output torque	Moments of inertia of gearbox (referred to the drive)					
		Continuous duty S1 [1]		1FK702.	1FK703.	1FK704.	1FK706.	1FK708.	1FK710.
		n_{N1} rpm	M_{N2} (T_{2N}) Nm (lb$_f$-ft)	J_1 kgcm^2 (lb$_f$-in^2)	J_1 kgcm^2 (lb$_f$-in^2)	J_1 kgcm^2 (lb$_f$-in^2)	J_1 kgcm^2 (lb$_f$-in^2)	J_1 kgcm^2 (lb$_f$-in^2)	J_1 kgcm^2 (lb$_f$-in^2)
SP 060S-MF2	16	4400	26 (19.2)	0.08 (0.03)	0.17 (0.06)	–	–	–	–
	20	4400	26 (19.2)	0.07 (0.02)	0.16 (0.06)	–	–	–	–
	28	4400	26 (19.2)	0.06 (0.02)	–	–	–	–	–
SP 075S-MF2	16	3500	75 (55.3)	–	0.23 (0.08)	0.55 (0.19)	–	–	–
	20	3500	75 (55.3)	–	0.20 (0.07)	0.53 (0.19)	–	–	–
	28	3500	75 (55.3)	–	0.18 (0.06)	0.50 (0.17)	–	–	–
	40	3500	75 (55.3)	0.10 (0.03)	0.17 (0.06)	–	–	–	–
	50	3800	75 (55.3)	0.10 (0.03)	0.16 (0.06)	–	–	–	–
SP 100S-MF2	16	3100	180 (132)	–	–	0.81 (0.28)	2.18 (0.75)	–	–
	20	3100	180 (132)	–	–	0.70 (0.24)	2.07 (0.71)	–	–
	28	3100	180 (132)	–	–	0.60 (0.20)	1.97 (0.67)	–	–
	40	3100	180 (132)	–	0.38 (0.13)	0.55 (0.19)	–	–	–
	50	3500	175 (129)	–	0.38 (0.13)	0.54 (0.19)	–	–	–
SP 140S-MF2	16	2900	360 (266)	–	–	–	3.19 (1.09)	10.3 (3.52)	–
	20	2900	360 (266)	–	–	–	2.71 (0.93)	9.77 (3.34)	–
	28	2900	360 (266)	–	–	–	2.34 (0.80)	9.41 (3.22)	–
	40	2900	360 (266)	–	–	–	2.10 (0.72)	9.16 (3.13)	–
	50	3200	360 (266)	–	–	1.39 (0.48)	2.08 (0.71)	–	–
SP 180S-MF2	16	2700	750 (553)	–	–	–	–	12.4 (4.24)	13.5 (4.61)
	20	2700	750 (553)	–	–	–	–	10.9 (3.73)	12.0 (4.10)
	28	2700	750 (553)	–	–	–	–	9.48 (3.24)	10.6 (3.62)
	40	2700	750 (553)	–	–	–	5.51 (1.88)	8.67 (2.96)	–
	50	2900	750 (553)	–	–	–	5.45 (1.86)	8.61 (2.94)	–
SP 210S-MF2	16	2500	1500 (1106)	–	–	–	–	–	34.5 (11.8)
	20	2500	1500 (1106)	–	–	–	–	–	31.5 (10.8)
	28	2500	1500 (1106)	–	–	–	–	30.0 (10.3)	30.0 (10.3)
	40	2500	1500 (1106)	–	–	–	–	28.5 (9.74)	28.5 (9.74)
	50	2500	1500 (1106)	–	–	–	–	28.3 (9.67)	28.3 (9.67)
SP 240S-MF2	28	2500	2500 (1844)	–	–	–	–	–	30.5 (10.4)
	40	2500	2500 (1844)	–	–	–	–	–	28.2 (9.64)
	50	2500	2500 (1844)	–	–	–	–	–	27.9 (9.53)

[1] The limit values in the table apply for S1 continuous duty (ON time > 60 % or > 20 min) for a maximum gearbox temperature of 90 °C (194 °F).

Series LP+ planetary gearbox for 1FK7 motors

Overview

1FK7 motors can be combined with planetary gearboxes to form compact coaxial drive units. The gearboxes are flanged directly to the drive end of the motors.

When selecting the gearbox, ensure that its maximum permissible input speed is not exceeded by the maximum speed of the motor. In the case of high operating frequencies, allowance must be made for the factor f_2 (see Configuration Manual, "1FK7 synchronous motors"). The frictional losses of the gearbox must always be taken into account.

The gearboxes are only available in non-balanced design and with fitted key.

Benefits

- High efficiency, single-stage: > 97 %
- Minimum torsional backlash
  Single-stage: ≤ 4 arcmin
- Power transmission from the central sun wheel via planet wheels
- No shaft deflections in the planet wheel set due to symmetrical force distribution
- The gearboxes are connected to the motor shaft via an integrated clamping hub. A plain motor shaft extension is necessary for this purpose. Shaft and flange accuracy tolerance N in accordance with DIN 42955 and vibration magnitude grade A in accordance with EN 60034-14 are sufficient. The motor flange is adapted by means of adapter plates.
- Output shaft of gearbox exactly coaxial with the motor
- The gearboxes are suitable for all mounting positions.
- The gearboxes are sealed (seal between gearbox and motor) and filled with grease in the factory.
  They are lubricated and sealed for their service life.
- Degree of protection of gearbox: IP64
- Small dimensions
- Low weight

1FK7 synchronous motor with mounted planetary gearbox series LP+

Integration

1FK702 to 1FK710 motors can be supplied ex factory (Siemens AG) complete with flange-mounted planetary gearbox.

The gearboxes assigned to the individual motors and gear ratios *i* available for these motor/gearbox combinations are listed in the selection table below. When making a selection, note the maximum permissible input speed of the gearbox, which should be equal or higher to the maximum motor speed.

The motor/gearbox combinations listed in the selection table are mainly intended for cycle operation S3-60 % (ON time ≤ 60 % and ≤ 20 min). Reduced maximum motor speeds and output torques apply for use in S1 continuous duty (ON time > 60 % or > 20 min). The gearbox temperature may not exceed 90 °C (194 °F).

Follow the instructions contained in the Configuration Manual for 1FK7 synchronous motors when assigning gearboxes to the motor.

1FK7 motors must be designed with plain motor shaft extension/shaft and flange accuracy tolerance N, degree of protection IP64 and anthracite paint finish for mounting onto the gearbox.

Selection and ordering data

Motor Natural cooling	**Planetary gearbox single-stage** Torsion. backlash ≤ 12 arcmin		**Available gear ratio *i* =**		Input speed, max. S3-60 %	Output torque, max. S3-60 %		Output shaft radial force, max. [1]	Gearbox moment of inertia
Type	Type	Gearbox weight, approx. kg (lb)	5	10	n_{G1} rpm	M_{G2} at i = 5 Nm (lb_f-ft)	M_{G2} at i = 10 Nm (lb_f-ft)	F_r N (lb_f)	J_G at i = 5/10 10^{-4}kgm^2 (10^{-3} lb_f-in-s^2)
1FK7022	LP 050-M01	0.75 (1.65)	✔	–	8000	12 (8.9)	11 (8.1)	650 (146)	0.055 (0.05)
1FK7022	LP 070-M01	2.0 (4.41	–	✔	6000	35 (25.8)	32 (23.6)	1450 (326)	0.28 (0.25)
1FK7032			✔	✔					
1FK7033			✔	✔					
1FK7034			✔	✔					
1FK7040	LP 090-M01	4.0 (8.82)	✔	✔	6000	90 (66.4)	80 (59.0)	1900 (427)	1.77 (1.57)
1FK7042			✔	✔					
1FK7043			✔	✔					
1FK7044			✔	✔					
1FK7060	LP 120-M01	8.6 (19.0)	✔	✔	4800	220 (162)	200 (148)	4000 (899)	5.42 (4.80)
1FK7061			✔	✔					
1FK7063			✔	✔					
1FK7064			✔	–					
1FK7080	LP 155-M01	17 (37.5)	✔	✔	3600	450 (332)	350 (258)	6000 (1349)	25.7 (22.8)
1FK7082			✔	✔					
1FK7083			✔	✔					
1FK7085			✔	✔					
1FK7086			✔	✔					
1FK7100			✔	✔					
1FK7101			✔	–					
1FK7103			✔	–					
1FK7105			✔	–					
Order codes • Gear shaft with fitted key			**V40**	**V42**					
Ordering data	**1FK7...-.A..1-..■3-Z** **V■■**		**G** without holding brake **H** with holding brake						

Order No. of the motor with identifier "**-Z**" and order code for mounting the planetary gearbox assigned to the motor
Preconditions for mounting LP+ planetary gearboxes:
Plain motor shaft extension and IP64 degree of protection, anthracite paint finish

Continuous duty

Continuous duty is permissible at the rated speed and rated torque. The gearbox temperature may not exceed 90 °C (194 °F).

Planetary gearbox single-stage Torsional backlash ≤ 12 arcmin	Rated input speed	Rated output torque	
Type	n_{G1} rpm	M_{G2} at i = 5 Nm (lb_f-ft)	M_{G2} at i = 10 Nm (lb_f-ft)
LP 050-M01	4000	5.7 (4.2)	–
LP 070-M01	3700	18 (13.3)	16.5 (12.2)
LP 090-M01	3400	45 (33.2)	40 (29.5)
LP 120-M01	2600	110 (81.1)	100 (73.8)
LP 155-M01	2000	320 (236)	190 (140)

✔ Possible
– Not possible
[1] Referred to the center of the output shaft at 100 rpm.

1FK7-DYA compact geared motors

Overview

The 1FK7-DYA compact geared motor combines electrical and mechanical components in the smallest space possible. This mechatronic unit consists of a permanent-magnet 1FK7 synchronous motor and a directly mounted single-stage planetary gearbox.

The 1FK7-DYA compact geared motors with degree of protection IP64 are designed for operation without external cooling as the heat is dissipated over the motor surface. The integrated planetary gearboxes have high maximum torques and permit high radial and axial forces at the shaft extension.

Benefits

- Space-saving installation due to the high power density of the motor and integration of the planetary gearbox directly into the motor end shield. Mounting to the machine is greatly simplified by this and the logistics are reduced to a minimum.
- Mounting in construction types IM B5 and IM B14 is possible.
- Highly dynamic due to lower motor moment of inertia; this means shorter cycle times.
- Maintenance-free
- Suitable for S1 continuous duty
- High positioning accuracy thanks to low mechanical torsional backlash of < 8 arcmin
- Mechanical compatibility with regard to IM B14 flange and shaft extension for the LP+ planetary gearbox
- Power connection via plug, signal connection via plug or DRIVE-CLiQ for SINAMICS S120

Applications

In general mechanical engineering, any place where coaxial drive units are used, e.g. in

- Packaging machines
- Wood, glass and ceramic processing machines
- Plastic, injection molding and foil stretching machines
- Handling systems
- Machine tools
- All kinds of auxiliary axes

Integration

1FK7-DYA compact geared motors can be combined with the SINAMICS S120 drive system to create a powerful system with high functionality.

The integrated encoder system for speed and position control can be selected depending on the application.

Technical specifications

Type of motor	Permanent-magnet synchronous motor
Magnet material	Rare-earth magnet material
Insulation of the stator winding in accordance with EN 60034-1 (IEC 60034-1)	Temperature class 155 (F) for a winding temperature rise of ΔT = 100 K at an ambient temperature of 40 °C (104 °F)
Cooling	Natural cooling
Temperature monitoring	KTY 84 temperature sensor in stator winding
Type in accordance with EN 60034-7 (IEC 60034-7)	IM B5 (IM V1, IM V3) IM B14
Degree of protection in accordance with EN 60034-5 (IEC 60034-5)	IP64
Shaft extension on the drive end in accordance with DIN 748-3 (IEC 60072-1)	with fitted key
Shaft and flange accuracy in accordance with DIN 42955 (IEC 60072-1) [1]	Tolerance N
Vibration magnitude in accordance with EN 60034-14 (IEC 60034-14)	Grade A (maintained up to rated speed)
Max. sound pressure level L_{pA} (1 m (3.28 ft)) in accordance with DIN EN ISO 1680	
• 1FK703	72 dB
• 1FK704	75 dB
• 1FK706	80 dB
• 1FK708	82 dB

Built-in encoder systems for motors without DRIVE-CLiQ interface	• Incremental encoder sin/cos 1 V_{pp} 2048 S/R • Absolute encoder, multi-turn (traversing range 4096 revolutions) with EnDat interface - 2048 S/R for 1FK704 to 1FK708 - 512 S/R for 1FK703 - 32 S/R for 1FK704 to 1FK708 - 16 S/R for 1FK703 • 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) • 22 bit absolute encoder: - 22 bit single-turn (2048 S/R internal) +12 bit multi-turn (traversing range 4096 revolutions) for 1FK704 to 1FK708 - 20 bit single-turn (512 S/R internal) +12 bit multi-turn (traversing range 4096 revolutions) for 1FK703 - 16 bit single-turn (32 S/R internal) +12 bit multi-turn (traversing range 4096 revolutions) for 1FK704 to 1FK708 - 15 bit single-turn (16 S/R internal) +12 bit multi-turn (traversing range 4096 revolutions) for 1FK703 • 15 bit resolver • 14 bit resolver
Connection	Connectors for signals and power can be rotated (270°)
Paint finish	Anthracite RAL 7016
2nd rating plate **3rd rating plate**	Attached in the NDE cover Enclosed separately
Options	Built-in holding brake

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

1FK7-DYA compact geared motors

Selection and ordering data

Rated speed	Rated power	Maxi-mum speed	Maximum torque	Static torque	Rated torque	Avai-lable gear ratio	1FK7-DYA Compact geared motors		Num-ber of pole pairs	Rotor moment of inertia [2] (with-out brake)	(with brake)
$n_{2\ rated}$	P_2	n_{2max}	M_{2max}	M_{20}	$M_{2\ rated}$ [1]	i	Order No.	Order code		J	J
rpm	kW (HP)	rpm	Nm (lb_f-ft)	Nm (lb_f-ft)	Nm (lb_f-ft)					10^{-4} kgm^2 (10^{-3} lb_f-in-s^2)	10^{-4} kgm^2 (10^{-3} lb_f-in-s^2)
370	0.37 (0.50)	600	32 (23.6)	11 (8.1)	9.5 (7.0)	10	**1FK7032-5AK71-1 ■■ 3-Z**	**A03**	3	0.75 (0.66)	0.83 (0.73)
740	0.5 (0.67)	1200	32 (23.6)	7.5 (5.5)	6.5 (4.8)	5	**1FK7034-5AK71-1 ■■ 3-Z**	**A00**	3	1.04 (0.92)	1.12 (0.99)
340	0.45 (0.60)	600	49 (36.1)	15 (11.1)	12.5 (9.2)	10	**1FK7040-5AK71-1 ■■ 3-Z**	**A13**	4	2.3 (2.04)	3.0 (2.66)
680	0.71 (0.95)	1200	51 (37.6)	13 (9.6)	10 (7.4)	5	**1FK7042-5AK71-1 ■■ 3-Z**	**A10**	4	3.6 (3.19)	4.3 (3.81)
260	1.25 (1.68)	480	175 (129)	57 (42)	46 (33.9)	10	**1FK7060-5AH71-1 ■■ 3-Z**	**A73**	4	10.3 (9.12)	12.5 (11.1)
520	1.74 (2.33)	960	170 (125)	51 (37.6)	32 (23.6)	5	**1FK7063-5AH71-1 ■■ 3-Z**	**A70**	4	17.4 (15.4)	19.6 (17.4)
200	1.47 (1.97)	360	242 (179)	76 (56.1)	70 (51.6)	10	**1FK7080-5AH71-1 ■■ 3-Z**	**A83**	4	28.7 (25.4)	31.8 (28.2)
400	1.88 (2.52)	720	233 (172)	68 (50.2)	45 (33.2)	5	**1FK7083-5AH71-1 ■■ 3-Z**	**A80**	4	41 (36.3)	49.6 (43.9)

Encoder systems for motors without DRIVE-CLiQ interface:	Incremental encoder sin/cos 1 V_{pp} 2048 S/R Absolute encoder EnDat 2048 S/R [1] (not for 1FK703) Absolute encoder EnDat 512 S/R [1] (only for 1FK703) Absolute encoder EnDat 32 S/R [1] (not for 1FK703) Absolute encoder EnDat 16 S/R [1] (only for 1FK703) Multi-pole resolver 2-pole resolver		**A** **E** **H** **G** **J** **S** **T**
Encoder systems for motors with DRIVE-CLiQ interface:	22 bit incremental encoder 22 bit absolute encoder, single-turn +12 bit multi-turn [1] (not for 1FK703) 20 bit absolute encoder, single-turn +12 bit multi-turn [1] (only for 1FK703) 16 bit absolute encoder, single-turn +12 bit multi-turn [1] (not for 1FK703) 15 bit absolute encoder, single-turn +12 bit multi-turn [1] (only for 1FK703) 15 bit resolver 14 bit resolver		**D** **F** **L** **K** **V** **U** **P**
Shaft extension: Fitted key and keyway Fitted key and keyway	**Shaft and flange accuracy:** Tolerance N Tolerance N	**Holding brake:** Without with	**U** **V**
Degree of protection:	IP64, anthracite finish RAL 7016		**3**

4

Selection and ordering data

Motor type (continued)	Weight (without brake)	Weight (with brake)	Static current	Maximum current	SINAMICS S120 Motor Module Booksize format		Power cable with complete shield, Motor terminal (and brake terminal) via power connector		
					Rated output current [4]	Order No.	Power connector	Cable cross-section [3]	Order No. Pre-assembled cable
	m kg (lb)	m kg (lb)	I_0 at M_0 ΔT=100 K A	I_{max} A	I_{rated} A		Size	mm^2	
1FK7032-5AK71-...	4.11 (9.06)	4.47 (9.86)	1.7	5	3	**6SL312■-■TE13-0AA3**	1	4 x 1.5	**6FX■002-5■S01-....**
1FK7034-5AK71-...	5.01 (11.1)	5.37 (11.8)	1.9	7.9	3	**6SL312■-■TE13-0AA3**	1	4 x 1.5	**6FX■002-5■S01-....**
1FK7040-5AK71-...	6.60 (14.6)	7.61 (16.8)	2.3	7.4	3	**6SL312■-■TE13-0AA3**	1	4 x 1.5	**6FX■002-5■S01-....**
1FK7042-5AK71-...	7.91 (17.4)	8.62 (19.0)	4.4	14.9	5	**6SL312■-■TE15-0AA3**	1	4 x 1.5	**6FX■002-5■S01-....**
1FK7060-5AH71-...	13.9 (30.7)	15 (33.1)	6.2	19	9	**6SL312■-■TE21-0AA3**	1	4 x 1.5	**6FX■002-5■S01-....**
1FK7063-5AH71-...	17.6 (38.8)	19 (41.9)	12	41	18	**6SL312■-■TE21-8AA3**	1	4 x 1.5	**6FX■002-5■S01-....**
1FK7080-5AH71-...	23.4 (51.6)	24.6 (54.2)	7.4	24	9	**6SL312■-■TE21-0AA3**	1	4 x 1.5	**6FX■002-5■S01-....**
1FK7083-5AH71-...	28.6 (63.1)	31.2 (68.8)	15	48	18	**6SL312■-■TE21-8AA3**	1	4 x 1.5	**6FX■002-5■S01-....**

Cooling: Internal air cooling External air cooling	**0** **1**
Motor Module: Single Motor Module Double Motor Module	**1** **2**
Type of power cable: MOTION-CONNECT 800 MOTION-CONNECT 500	**8** **5**
Without brake cores With brake cores	**C** **D**
For length code as well as power and signal cables, see MOTION-CONNECT connection system.	**....**

1) If the absolute encoder is used, $M_{2\ rated}$ is reduced by 10 %.

2) In reference to the motor shaft.

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

4) With default setting of the pulse frequency.

1FK7 geared servomotors

Overview

1FK7 geared servomotors with bevel-, offset-shaft-, worm- and helical gear (from left to right)

The 1FK7 geared servomotors comprise the 1FK7 synchronous motors described above and the directly mounted helical and angled gears.

The 1FK7 geared servomotors are pre-assembled as a complete unit and supplied with a gearbox filled with oil.
The type range comprises helical geared motors with 9 gearbox sizes, offset-shaft geared motors with 5 gearbox sizes, bevel geared motors with 8 gearbox sizes and worm geared motors with 5 gearbox sizes. A wide range of mechanical mounting methods can be realized with the numerous options.

1FK7 geared servomotors are designed for operation without external cooling and the heat is dissipated through the motor surface and the gearbox mounting surface.

1FK7 geared servomotors can be combined with the SINAMICS S120 drive system to create a powerful system with high functionality. Integrated encoder systems for speed and position control can be selected depending on the application just as for 1FK7 synchronous motors.

Benefits

- Extremely compact design as a result of the direct mounting (because there is no coupling and motor adapter between the motor and gearbox)
- Maintenance-free and lubricated for life (exception worm gearing)
- High efficiency
- Low torsional backlash
- Low running noise due to the helical gearing
- Service-life maintenance-free gearing (exception worm gearing)
- Suitable for cyclic operation with alternating load and continuous duty
- Low-cost solution when compared to planetary geared motors

Applications

1FK7 geared servomotors are ideally suited for applications in general machine construction for basic positioning tasks and auxiliary drives with servo quality that continually operate, for example in:

- Packaging machines
- High-bay racking units
- Wood, glass and ceramic processing machines
- Beverage filling plants
- Conveyor belts

Technical specifications

Helical geared motor	
Nominal ratio i_{nom}	3.8 ... 70
Rated output torque M_2	3.6 ... 1737 Nm (2.7 ... 1281 lb_f-ft)
Acceleration torque M_{2max}	19 ... 4140 Nm (14 ... 3054 lb_f-ft)
Torsional backlash	10 ... 20 arcmin
Efficiency	94 ... 96 %
Mechanical options	Solid shaft with fitted key, flange, mounting feet, tapped hole group
Offset-shaft geared motor	
Nominal ratio i_{nom}	4.3 ... 35
Rated output torque M_2	4 ... 587 Nm (3 ... 433 lb_f-ft)
Acceleration torque M_{2max}	24 ... 1100 Nm (2.7 ... 811 lb_f-ft)
Torsional backlash	10 ... 11 arcmin
Efficiency	94 % ... 96 %
Mechanical options	Solid shaft, hollow shaft with fitted key, hollow shaft with shrink disk, flange, mounting feet, tapped hole group
Bevel geared motor	
Nominal ratio i_{nom}	4 ... 76
Rated output torque M_2	3.8 ... 1626 Nm (2.8 ... 1199 lb_f-ft)
Acceleration torque M_{2max}	22 ... 4650 Nm (16 ... 3430 lb_f-ft)
Torsional backlash	10 ... 12 arcmin
Efficiency	94 ... 96 %
Mechanical options	Solid shaft, hollow shaft with fitted key, hollow shaft with shrink disk, flange, mounting feet, tapped hole group, torque bracket
Worm geared motor	
Nominal ratio i_{nom}	9.2 ... 70
Rated output torque M_2	8.5 ... 399 Nm (6.3 ... 294 lb_f-ft)
Acceleration torque M_{2max}	43 ... 791 Nm (32 ... 583 lb_f-ft)
Torsional backlash	Depending on the gearbox size and gear ratio
Mechanical options	Solid shaft, hollow shaft with fitted key, hollow shaft with shrink disk, flange, mounting feet, tapped hole group, torque bracket

The "CAD CREATOR" tool can be used to configure the geared servomotors and as a guide for selection and ordering. This tool contains the relevant data and all dimension drawings.

The Order No. for the CD-ROM is **6SL3075-0AA00-0AG0**

On the Internet, the CAD CREATOR can be found at:
http://www.siemens.com/cad-creator

Other Siemens geared motors can be found at:
http://www.siemens.com/sgmdesigner

Selection and ordering data

Explanation of the designations in the selection tables

P_2	kW (HP)	Mechanical power output at the gear shaft (in S3 duty)
n_2	rpm	Gear unit output speed referred to the input speed of the motor of n_1 = 3000 rpm for a horizontal gear shaft output
M_2	Nm (lb_f-ft)	Rated gear unit output torque in S3 duty
M_{2max}	Nm (lb_f-ft)	Max. permissible acceleration torque of the gear unit
i_{nom}		Nominal gear ratio (approximate value as decimal number)
i_{exact}		Exact gear ratio (specified as a fraction for parameter entry in the drive converter)
$F_{rpermiss}$	N (lb_f)	Max. perm. cantilever force on gear shaft extension
f_B		Gear unit overload factor (quotient between the max. permissible acceleration torque and static torque of the motor and ratio)
Gearbox size	C... F... K... S...	Identifier for gear unit type and size
SH	(shaft height)	Motor frame size (1FK7 geared servomotors are available in frame sizes 36, 48, 63, 80 and 100)
Order codes		The order codes define the gear unit type, size, gear ratio and mechanical design
Weight	kg (lb)	Total weight of the geared motor

Selection and ordering data

Output (S3 60%) P_2 kW (HP)	Output speed n_2 rpm	Rated output torque M_2 Nm (lb_f-ft)	Max. permissible acceleration torque M_{2max} Nm (lb_f-ft)	Nominal ratio i_{nom}	Exact ratio i_{exact}	Cantilever force gear shaft extension $F_{rpermiss}$ N (lb_f)	Overload factor f_B
0.30 (0.40)	782	3.63 (2.70)	19 (14.0)	3.8	441/115	560 (126)	4.2
	476	5.96 (4.40)	29 (21.4)	6.3	2035/323	660 (148	3.9
	291	9.74 (7.20)	51 (37.6)	10.5	1421/138	778 (175)	4.2
	192	14.8 (10.9)	72 (53.1)	15.5	1595/102	894 (201)	3.9
	129	22 (16.2)	65 (47.9)	23	325/14	1020 (229)	2.4
	86	33.1 (24.4)	65 (47.9)	35	1261/36	1170 (263)	1.6
	64	44.3 (32.7)	65 (47.9)	47	7865/168	1289 (290)	1.2
	43	66.6 (49.1)	138 (102)	70	775/11	2099 (472)	1.7
0.41 (0.55)	782	5.02 (3.70)	36 (26.6)	3.8	441/115	560 (126)	6.0
	476	8.25 (6.10)	55 (40.6)	6.3	2035/323	660 (148)	5.6
	291	13.5 (10.0)	72 (53.1)	10.5	1421/138	778 (175)	4.5
	192	20.5 (15.1)	72 (53.1)	15.5	1595/102	894 (201)	3.0
	128	30.8 (22.7)	138 (102)	24	1035/44	1456 (327)	3.8
	129	30.4 (22.4)	65 (47.9)	23	325/14	1020 (229)	1.8
	86	45.9 (33.9)	138 (102)	35	2700/77	1663 (374)	2.5
	86	45.9 (33.9)	65 (47.9)	35	1261/36	1170 (263)	1.2
	64	61.4 (45.3)	138 (102)	47	516/11	1833 (412)	1.9
0.79 (1.06)	782	9.67 (7.10)	36 (26.6)	3.8	441/115	560 (126)	3.2
	476	15.9 (11.7)	55 (40.6)	6.3	2035/323	660 (148)	3.0
	291	26 (19.2)	72 (53.1)	10.5	1421/138	778 (175)	2.4
	191	39.6 (29.2)	138 (102	15.5	377/24	1273 (286)	3.0
	192	39.4 (29.1)	72 (53.1)	15.5	1595/102	894 (201)	1.6
	128	59.3 (43.7)	138 (102	24	1035/44	1456 (327)	2.0
	86	88.4 (65.2)	138 (102)	35	2700/77	1663 (374)	1.4
	64	118 (87.0)	138 (102)	47	516/11	1833 (412)	1.0
1.43 (1.92)	782	17.5 (12.9)	50 (36.9)	3.8	441/115	560 (126)	2.2
	476	28.7 (21.2)	59 (43.5)	6.3	2035/323	660 (148)	1.6
	511	26.8 (19.8)	102 (75.2)	5.9	47/8	917 (206)	3.0
	291	46.9 (34.6)	72 (53.1)	10.5	1421/138	778 (175)	1.2
	289	47.3 (34.9)	138 (102)	10.5	841/81	1109 (249)	2.3
	191	71.6 (52.8)	138 (102)	15.5	377/24	1273 (286)	1.5
	196	69.7 (51.4)	230 (170)	15.5	703/46	1775 (399)	2.6
	128	107 (78.9)	138 (102)	25	1035/44	1456 (327)	1.0
	128	107 (78.9)	350 (258)	24	845/36	3045 (685)	2.6

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Gearbox size	Motor frame size (shaft height) SH	Helical geared motors Order No.	Order codes Gearbox type	Type	Type Mount. position	Total weight, approx. kg (lb)
C002	36	1FK7032-5AK71-1■■5-Z	D01	G■■	H■■	8.6 (19.0)
C002	36	1FK7032-5AK71-1■■5-Z	D02	G■■	H■■	8.6 (19.0)
C002	36	1FK7032-5AK71-1■■5-Z	D03	G■■	H■■	8.6 (19.0)
C002	36	1FK7032-5AK71-1■■5-Z	D04	G■■	H■■	8.6 (19.0)
C002	36	1FK7032-5AK71-1■■5-Z	D05	G■■	H■■	8.6 (19.0)
C002	36	1FK7032-5AK71-1■■5-Z	D06	G■■	H■■	8.6 (19.0)
C002	36	1FK7032-5AK71-1■■5-Z	D07	G■■	H■■	8.6 (19.0)
C102	36	1FK7032-5AK71-1■■5-Z	D18	G■■	H■■	13.5 (29.8)
C002	48	1FK7040-5AK71-1■■5-Z	D01	G■■	H■■	9.4 (20.7)
C002	48	1FK7040-5AK71-1■■5-Z	D02	G■■	H■■	9.4 (20.7)
C002	48	1FK7040-5AK71-1■■5-Z	D03	G■■	H■■	9.4 (20.7)
C002	48	1FK7040-5AK71-1■■5-Z	D04	G■■	H■■	9.4 (20.7)
C102	48	1FK7040-5AK71-1■■5-Z	D15	G■■	H■■	14.3 (31.5)
C002	48	1FK7040-5AK71-1■■5-Z	D05	G■■	H■■	9.4 (20.7)
C102	48	1FK7040-5AK71-1■■5-Z	D16	G■■	H■■	14.3 (31.5)
C002	48	1FK7040-5AK71-1■■5-Z	D06	G■■	H■■	9.4 (20.7)
C102	48	1FK7040-5AK71-1■■5-Z	D17	G■■	H■■	14.3 (31.5)
C002	48	1FK7042-5AF71-1■■5-Z	D01	G■■	H■■	10.7 (23.6)
C002	48	1FK7042-5AF71-1■■5-Z	D02	G■■	H■■	10.7 (23.6)
C002	48	1FK7042-5AF71-1■■5-Z	D03	G■■	H■■	10.7 (23.6)
C102	48	1FK7042-5AF71-1■■5-Z	D14	G■■	H■■	15.6 (34.4)
C002	48	1FK7042-5AF71-1■■5-Z	D04	G■■	H■■	10.7 (23.6)
C102	48	1FK7042-5AF71-1■■5-Z	D15	G■■	H■■	15.6 (34.4)
C102	48	1FK7042-5AF71-1■■5-Z	D16	G■■	H■■	15.6 (34.4)
C102	48	1FK7042-5AF71-1■■5-Z	D17	G■■	H■■	15.6 (34.4)
C002	63	1FK7060-5AF71-1■■5-Z	D01	G■■	H■■	13.4 (29.6)
C002	63	1FK7060-5AF71-1■■5-Z	D02	G■■	H■■	13.4 (29.6)
C102	63	1FK7060-5AF71-1■■5-Z	D12	G■■	H■■	18.3 (40.4)
C002	63	1FK7060-5AF71-1■■5-Z	D03	G■■	H■■	13.4 (29.6)
C102	63	1FK7060-5AF71-1■■5-Z	D13	G■■	H■■	18.3 (40.4)
C102	63	1FK7060-5AF71-1■■5-Z	D14	G■■	H■■	18.3 (40.4)
C202	63	1FK7060-5AF71-1■■5-Z	D24	G■■	H■■	22.3 (49.2)
C102	63	1FK7060-5AF71-1■■5-Z	D15	G■■	H■■	18.3 (40.4)
C302	63	1FK7060-5AF71-1■■5-Z	D35	G■■	H■■	27.4 (60.4)

Encoder systems for motors without DRIVE-CLiQ interface:	Incremental encoder sin/cos 1 V_{pp}	A
	Absolute encoder EnDat 2048 S/R (shaft height 48 and higher)	E
	Absolute encoder EnDat 512 S/R (only shaft height 36)	H
	Absolute encoder EnDat 32 S/R (shaft height 48 and higher)	G
	Absolute encoder EnDat 16 S/R (shaft height 36)	J
	Resolver, multi-pole (pole number = pole number for motor)	S
	Resolver, 2-pole	T
Encoder systems for motors with DRIVE-CLiQ interface:	22 bit incremental encoder	D
	22 bit absolute encoder, single-turn +12 bit multi-turn (shaft height 48 and higher)	F
	20 bit absolute encoder, single-turn +12 bit multi-turn (only shaft height 36)	L
	16 bit absolute encoder, single-turn +12 bit multi-turn (shaft height 48 and higher)	K
	15 bit absolute encoder, single-turn +12 bit multi-turn (only shaft height 36)	V
	15 bit resolver (no. of poles = no. of motor poles)	U
	14 bit resolver	P
Holding brake:	Motor **without** holding brake	U
	Motor **with** holding brake	V

Order codes for type, type of construction and mounting position, refer to page 4/110

1FK7 geared servomotors
Helical geared motors

Selection and ordering data

Output (S3 60 %) P_2 kW (HP)	Output speed n_2 rpm	Rated output torque M_2 Nm (lb_f-ft)	Max. permissible acceleration torque M_{2max} Nm (lb_f-ft)	Nominal ratio i_{nom}	Exact ratio i_{exact}	Cantilever force gear shaft extension $F_{rpermiss}$ N (lb_f)	Overload factor f_B
1.42 (1.90)	85	160 (118)	230 (170)	35	1372/39	2343 (527)	1.1
1.43 (1.92)	86 60	159 (117) 227 (167)	550 (406) 400 (295)	35 50	975/28 2736/55	5961 (1340) 3911 (879)	2.7 1.4
1.44 (1.93)	60 43	229 (169) 319 (235)	600 (443) 550 (406)	50 70	1305/26 559/8	6734 (1514) 7519 (1690)	2.1 1.4
	43	319 (235)	850 (627)	70	10075/144	9229 (2075)	2.1
2.23 (2.99)	782 511	27.2 (20.1) 41.6 (30.7)	50 (36.9) 102 (75.2)	3.8 5.9	441/115 47/8	560 (126) 917 (206)	1.2 1.6
2.22 (2.98)	289 196	73.5 (54.2) 108 (79.7)	138 (102) 230 (170)	10.5 15.5	841/81 703/46	1109 (249) 1775 (399)	1.2 1.4
	128 86	166 (122) 247 (182)	350 (258) 550 (406)	23 35	845/36 975/28	3045 (685) 5961 (1340)	1.4 1.5
2.23 (2.99)	60 43	355 (262) 495 (365)	600 (443) 850 (627)	50 70	1305/26 10075/144	6734 (1514) 9229 (2075)	1.1 1.1
2.07 (2.78)	773	25.6 (18.9)	101 (74.5)	3.9	1363/351	799 (180)	3.3
2.08 (2.79)	511	38.8 (28.6)	115 (84.8)	5.9	47/8	917 (206)	2.5
2.07 (2.78)	289 196	68.5 (50.5) 101 (74.5)	138 (102) 230 (170)	10.5 15.5	847/81 703/46	1109 (249) 1775 (399)	1.7 1.9
2.08 (2.79)	191 128	104 (76.7) 155 (114)	138 (102) 350 (258)	15.5 23	377/24 845/36	1273 (286) 3045 (685)	1.1 1.9
2.07 (2.78)	127 86	156 (115) 230 (170)	230 (170) 550 (406)	24 35	637/27 975/28	2051 (461) 5961 (1340)	1.3 2.0
2.08 (2.79)	86	231 (170)	350 (258)	35	1261/36	3479 (782)	1.3
2.07 (2.78)	60	329 (243)	920 (679)	50	1943/39	8241 (1853)	2.4
2.09 (2.80)	44	454 (335)	1380 (1018)	69	620/9	12344 (2775)	2.6
3.20 (4.29)	773 772	39.5 (29.1) 39.6 (29.2)	101 (74.5) 154 (114)	3.9 3.9	1363/351 486/125	799 (180) 1125 (253)	1.7 2.5
	511 518	59.8 (44.1) 59.0 (43.5)	115 (84.8) 176 (130)	5.9 5.8	47/8 666/115	917 (206) 1284 (289)	1.3 2.0
	320 322	95.6 (70.5) 94.8 (69.9)	230 (170) 350 (258)	9.4 9.3	2450/261 3575/384	1509 (339) 2237 (503)	1.6 2.4
3.19 (4.28)	193	158 (117)	400 (295)	15.5	544/35	2654 (597)	1.7
3.18 (4.26)	190	160 (118)	600 (443)	16	63/4	4576 (1029)	2.5
3.19 (4.28)	128 128	238 (176) 238 (176)	550 (406) 850 (627)	23 23	1495/64 1495/64	5219 (1173) 6402 (1439)	1.5 2.3
3.20 (4.29)	86 86	355 (262) 355 (262)	550 (406) 1380 (1018)	35 35	975/28 1360/39	5961 (1340) 9838 (2212)	1.0 2.6
3.19 (4.28)	60	507 (374)	920 (679)	50	1943/39	2265 (509)	1.2
3.20 (4.29)	64	477 (352)	1971 (1454)	47	515/11	14923 (3355)	2.7
3.23 (4.33)	44	702 (518)	1380 (1018)	69	620/9	12344 (2775)	1.3
3.19 (4.28)	43	708 (522)	2300 (1697)	70	765/11	17027 (3828)	2.1

Gearbox size	Motor frame size (shaft height) SH	Helical geared motors Order No.	Order codes Gearbox type	Type	Type Mounting posit.	Total weight, approx. kg (lb)
C202	63	1FK7060-5AF71-1 ■■ 5 - Z	D26	G■■	H■■	22.3 (49.2)
C402 C302	63 63	1FK7060-5AF71-1 ■■ 5 - Z 1FK7060-5AF71-1 ■■ 5 - Z	D46 D37	G■■ G■■	H■■ H■■	37.6 (82.9) 27.4 (60.4)
C402 C402	63 63	1FK7060-5AF71-1 ■■ 5 - Z 1FK7060-5AF71-1 ■■ 5 - Z	D47 D48	G■■ G■■	H■■ H■■	37.6 (82.9) 37.6 (82.9)
C502	63	1FK7060-5AF71-1 ■■ 5 - Z	D58	G■■	H■■	49.2 (108)
C002 C102	63 63	1FK7063-5AF71-1 ■■ 5 - Z 1FK7063-5AF71-1 ■■ 5 - Z	D01 D12	G■■ G■■	H■■ H■■	17.1 (37.7) 22.0 (48.5)
C102 C202	63 63	1FK7063-5AF71-1 ■■ 5 - Z 1FK7063-5AF71-1 ■■ 5 - Z	D13 D24	G■■ G■■	H■■ H■■	22.0 (48.5) 26.0 (57.3)
C302 C402	63 63	1FK7063-5AF71-1 ■■ 5 - Z 1FK7063-5AF71-1 ■■ 5 - Z	D35 D46	G■■ G■■	H■■ H■■	31.1 (68.6) 41.3 (91.1)
C402 C502	63 63	1FK7063-5AF71-1 ■■ 5 - Z 1FK7063-5AF71-1 ■■ 5 - Z	D47 D58	G■■ G■■	H■■ H■■	41.3 (91.1) 52.9 (117)
C102	80	1FK7080-5AF71-1 ■■ 5 - Z	D11	G■■	H■■	21.7 (47.9)
C102	80	1FK7080-5AF71-1 ■■ 5 - Z	D12	G■■	H■■	21.7 (47.9)
C102 C202	80 80	1FK7080-5AF71-1 ■■ 5 - Z 1FK7080-5AF71-1 ■■ 5 - Z	D13 D24	G■■ G■■	H■■ H■■	21.7 (47.9) 25.7 (56.7)
C102 C302	80 80	1FK7080-5AF71-1 ■■ 5 - Z 1FK7080-5AF71-1 ■■ 5 - Z	D14 D35	G■■ G■■	H■■ H■■	21.7 (47.9) 30.8 (67.9)
C202 C402	80 80	1FK7080-5AF71-1 ■■ 5 - Z 1FK7080-5AF71-1 ■■ 5 - Z	D25 D46	G■■ G■■	H■■ H■■	25.7 (56.7) 41.0 (90.4)
C302	80	1FK7080-5AF71-1 ■■ 5 - Z	D36	G■■	H■■	30.8 (67.9)
C502	80	1FK7080-5AF71-1 ■■ 5 - Z	D57	G■■	H■■	52.6 (116)
C612	80	1FK7080-5AF71-1 ■■ 5 - Z	D68	G■■	H■■	67.9 (150)
C102 C202	80 80	1FK7083-5AF71-1 ■■ 5 - Z 1FK7083-5AF71-1 ■■ 5 - Z	D11 D21	G■■ G■■	H■■ H■■	26.9 (59.3) 30.9 (68.1)
C102 C202	80 80	1FK7083-5AF71-1 ■■ 5 - Z 1FK7083-5AF71-1 ■■ 5 - Z	D12 D22	G■■ G■■	H■■ H■■	26.9 (59.3) 30.9 (68.1)
C202 C302	80 80	1FK7083-5AF71-1 ■■ 5 - Z 1FK7083-5AF71-1 ■■ 5 - Z	D23 D33	G■■ G■■	H■■ H■■	30.9 (68.1) 36.0 (79.4)
C302	80	1FK7083-5AF71-1 ■■ 5 - Z	D34	G■■	H■■	36.0 (79.4)
C402	80	1FK7083-5AF71-1 ■■ 5 - Z	D44	G■■	H■■	46.2 (102)
C402 C502	80 80	1FK7083-5AF71-1 ■■ 5 - Z 1FK7083-5AF71-1 ■■ 5 - Z	D45 D55	G■■ G■■	H■■ H■■	46.2 (102) 57.8 (127)
C402 C612	80 80	1FK7083-5AF71-1 ■■ 5 - Z 1FK7083-5AF71-1 ■■ 5 - Z	D46 D66	G■■ G■■	H■■ H■■	46.2 (102) 73.1 (161)
C502	80	1FK7083-5AF71-1 ■■ 5 - Z	D57	G■■	H■■	57.8 (127)
C712	80	1FK7083-5AF71-1 ■■ 5 - Z	D77	G■■	H■■	108.4 (239)
C612	80	1FK7083-5AF71-1 ■■ 5 - Z	D68	G■■	H■■	73.1 (161)
C712	80	1FK7083-5AF71-1 ■■ 5 - Z	D78	G■■	H■■	108.4 (239)

Encoder systems for motors without DRIVE-CLiQ interface:	Incremental encoder sin/cos 1 V_{pp}	A	.	.
	Absolute encoder EnDat 2048 S/R (shaft height 48 and higher)	E		
	Absolute encoder EnDat 32 S/R (shaft height 48 and higher)	G		
	Resol., multi. (pole num. = pole num. for mot.)	S		
	Resolver, 2-pole	T		
Encoder systems for motors with DRIVE-CLiQ interface:	22 bit incremental encoder	D	.	.
	22 bit absolute encoder, single-turn +12 bit multi-turn (shaft height 48 and higher)	F		
	16 bit absolute encoder, single-turn +12 bit multi-turn (shaft height 48 and higher)	K		
	15 bit resol. (num. of poles = num. of mot. pol.)	U		
	14 bit resolver	P		
Holding brake:	Motor **without** holding brake	U		
	Motor **with** holding brake	V		
Order codes for type, type of construction and mounting position, refer to page 4/110			.	.

1FK7 geared servomotors
Helical geared motors

Selection and ordering data

Output (S3 60 %) P_2 kW (HP)	Output speed n_2 rpm	Rated output torque M_2 Nm (lb_f-ft)	Max. permissible acceleration torque M_{2max} Nm (lb_f-ft)	Nominal ratio i_{nom}	Exact ratio i_{exact}	Cantilever force gear shaft extension $F_{rpermiss}$ N (lb_f)	Overload factor f_B
3.66 (4.91)	774 512	45.1 (33.3) 68.2 (50.3)	251 (185) 288 (212)	3.9 5.9	190/49 2584/441	1671 (376) 1917 (431)	3.7 2.8
3.64 (4.88)	322	108 (79.7)	350 (258)	9.3	3575/384	2237 (503)	2.2
3.66 (4.91)	193	181 (134)	400 (295)	15.5	544/35	2654 (597)	1.5
3.64 (4.88)	190	183 (135)	600 (443)	16	63/4	4576 (1029)	2.2
3.65 (4.89)	128 128	272 (201) 272 (201)	850 (627) 550 (406)	23 23	1495/64 1495/64	6402 (1439) 5219 (1173)	2.1 1.3
3.66 (4.91)	86	406 (300)	1380 (1018)	35	1360/39	9838 (2212)	2.3
3.65 (4.89)	66 64	528 (390) 545 (402)	1380 (1018) 2300 (1697)	45 47	136/3 515/11	1852 (416) 14923 (3355)	1.7 2.8
3.70 (4.96)	44	802 (592)	4140 (3054)	69	620/9	23146 (5203)	3.4
4.73 (6.34)	774	58.3 (43.0)	251 (185)	3.9	190/49	1671 (376)	2.5
4.72 (6.33)	512 324	88.1 (65.1) 139 (103)	288 (212) 550 (406)	5.9 9.3	2584/441 3445/372	1917 (431) 3834 (862)	1.9 2.3
	322 191	140 (103) 236 (174)	350 (258) 920 (679)	9.3 15.5	3575/384 377/24	2237 (503) 5609 (1261)	1.4 2.2
	190	237 (175)	600 (443)	16	63/4	4576 (1029)	1.5
4.70 (6.30)	128	351 (259)	850 (627)	23	1495/64	6402 (1439)	1.4
4.71 (6.32)	120	375 (277)	1650 (1217)	25	5185/208	8797 (1978)	2.5
4.75 (6.37)	86	527 (389)	2300 (1697)	35	2700/77	13552 (3047)	2.5
4.71 (6.32)	66	682 (503)	1380 (1018)	45	136/3	10737 (2414)	1.2
4.72 (6.33)	64	704 (519)	2300 (1697)	47	515/11	14923 (3355)	1.9
4.77 (6.40)	44	1036 (764)	4140 (3054)	69	620/9	23146 (5203)	2.3

4

Gearbox size	Motor frame size (shaft height) SH	Helical geared motors Order No.	Order codes Gearbox type	Type	Type Mounting posit.	Total weight, approx. kg (lb)
C302 C302	100 100	**1FK7100-5AF71-1 ■■ 5 - Z** **1FK7100-5AF71-1 ■■ 5 - Z**	**D31** **D32**	**G■■** **G■■**	**H■■** **H■■**	38.2 (84.2) 38.2 (84.2)
C302	100	**1FK7100-5AF71-1 ■■ 5 - Z**	**D33**	**G■■**	**H■■**	38.2 (84.2)
C302	100	**1FK7100-5AF71-1 ■■ 5 - Z**	**D34**	**G■■**	**H■■**	38.2 (84.2)
C402	100	**1FK7100-5AF71-1 ■■ 5 - Z**	**D44**	**G■■**	**H■■**	48.4 (107)
C502 C402	100 100	**1FK7100-5AF71-1 ■■ 5 - Z** **1FK7100-5AF71-1 ■■ 5 - Z**	**D55** **D45**	**G■■** **G■■**	**H■■** **H■■**	60.0 (132) 48.4 (107)
C612	100	**1FK7100-5AF71-1 ■■ 5 - Z**	**D66**	**G■■**	**H■■**	75.3 (166)
C612 C712	100 100	**1FK7100-5AF71-1 ■■ 5 - Z** **1FK7100-5AF71-1 ■■ 5 - Z**	**D67** **D77**	**G■■** **G■■**	**H■■** **H■■**	75.3 (166) 110.6 (244)
C812	100	**1FK7100-5AF71-1 ■■ 5 - Z**	**D88**	**G■■**	**H■■**	170.2 (375)
C302	100	**1FK7101-5AF71-1 ■■ 5 - Z**	**D31**	**G■■**	**H■■**	43.8 (96.6)
C302 C402	100 100	**1FK7101-5AF71-1 ■■ 5 - Z** **1FK7101-5AF71-1 ■■ 5 - Z**	**D32** **D43**	**G■■** **G■■**	**H■■** **H■■**	43.8 (96.6) 43.8 (96.6)
C302 C502	100 100	**1FK7101-5AF71-1 ■■ 5 - Z** **1FK7101-5AF71-1 ■■ 5 - Z**	**D33** **D54**	**G■■** **G■■**	**H■■** **H■■**	54.0 (119) 65.6 (145)
C402	100	**1FK7101-5AF71-1 ■■ 5 - Z**	**D44**	**G■■**	**H■■**	54.0 (119)
C502	100	**1FK7101-5AF71-1 ■■ 5 - Z**	**D55**	**G■■**	**H■■**	65.6 (145)
C612	100	**1FK7101-5AF71-1 ■■ 5 - Z**	**D65**	**G■■**	**H■■**	80.9 (178)
C712	100	**1FK7101-5AF71-1 ■■ 5 - Z**	**D76**	**G■■**	**H■■**	116.2 (256)
C612	100	**1FK7101-5AF71-1 ■■ 5 - Z**	**D67**	**G■■**	**H■■**	80.9 (178)
C712	100	**1FK7101-5AF71-1 ■■ 5 - Z**	**D77**	**G■■**	**H■■**	116.2 (256)
C812	100	**1FK7101-5AF71-1 ■■ 5 - Z**	**D88**	**G■■**	**H■■**	175.8 (388)

Encoder systems for motors without DRIVE-CLiQ interface:	Incremental encoder sin/cos 1 V_{pp}	**A**		
	Absolute encoder EnDat 2048 S/R (shaft height 48 and higher)	**E**		
	Absolute encoder EnDat 32 S/R (shaft height 48 and higher)	**G**		
	Resolver, multipole (pole number = pole number for motor)	**S**		
	Resolver, 2-pole	**T**		
Encoder systems for motors with DRIVE-CLiQ interface:	22 bit incremental encoder	**D**		
	22 bit absolute encoder, single-turn +12 bit multi-turn (shaft height 48 and higher)	**F**		
	16 bit absolute encoder, single-turn +12 bit multi-turn (shaft height 48 and higher)	**K**		
	15 bit resolver (number of poles = number of motor poles)	**U**		
	14 bit resolver	**P**		
Holding brake:	Motor **without** holding brake		**U**	
	Motor **with** holding brake		**V**	
Order codes for type, type of construction and mounting position, refer to page 4/110				. . . .

Selection and ordering data

Output (S3 60 %) P_2 kW (HP)	Output speed n_2 rpm	Rated output torque M_2 Nm (lb_f-ft)	Max. permissible acceleration torque M_{2max} Nm (lb_f-ft)	Nominal ratio i_{nom}	Exact ratio i_{exact}	Cantilever force gear shaft extension $F_{rpermiss}$ N (lb_f)	Overload factor f_B
5.19 (6.96)	644	77 (56.8)	251 (185)	3.9	190/49	1671 (376)	1.9
5.18 (6.95)	423	117 (86.3)	288 (212)	5.9	2584/441	1917 (431)	2.0
5.19 (6.96)	424	117 (86.3)	420 (310)	5.9	377/64	3297 (741)	1.4
5.18 (6.95)	269	184 (136)	350 (258)	9.3	3575/384	2237 (503)	2.5
5.20 (6.97)	241	206 (152)	920 (679)	10.5	841/81	4886 (1098)	1.1
5.21 (6.99)	159	313 (231)	600 (443)	16	63/4	4576 (1029)	1.1
5.19 (6.96)	154	322 (238)	1650 (1217)	16	1037/64	7620 (1713)	2.9
5.20 (6.97)	107	464 (342)	850 (627)	23	1495/64	6402 (1439)	1.9
5.19 (6.96)	100	496 (366)	1650 (1217)	25	5185/208	8797 (1978)	1.1
5.23 (7.01)	72 71	694 (512) 703 (519)	1380 (1018) 4140 (3054)	35 35	1360/39 106/3	9838 (2212) 18528 (4165)	3.4 1.1
5.17 (6.93)	53	931 (687)	2300 (1697)	47	515/11	14923 (3355)	2.2
5.18 (6.95)	46	1076 (794)	4140 (3054)	54	704/13	21362 (4802)	1.2
5.16 (6.92)	36	1370 (1011)	4140 (3054)	69	620/9	23146 (5203)	1.1
7.92 (10.6)	770	98.2 (72.4)	366 (270)	3.9	841/216	2872 (646)	2.0
7.93 (10.6)	774	97.8 (72.1)	251 (185)	3.9	190/49	1671 (377)	1.4
7.95 (10.7)	513	148 (109)	650 (479)	5.9	117/20	4036 (907)	2.4
7.93 (10.6)	512	148 (109)	288 (212)	5.9	2584/441	1917 (431)	1.1
7.94 (10.7)	324 324	234 (173) 234 (173)	850 (627) 550 (406)	9.3 9.3	3445/372 3445/372	4703 (1057) 3834 (862)	2.0 1.3
7.92 (10.6)	191 185	396 (292) 409 (302)	920 (679) 1650 (1217)	16 16	377/24 1037/64	5609 (1261) 7620 (1713)	1.3 2.2
7.90 (10.6)	129 120	585 (432) 629 (464)	2300 (1697) 1650 (1217)	23 25	255/11 5185/208	11806 (2654) 8797 (1978)	2.1 1.4
7.93 (10.6)	85	891 (657)	4140 (3054)	36	106/3	18528 (4165)	2.5
7.96 (10.7)	86	884 (652)	2300 (1697)	35	2700/77	13552 (3047)	1.4
7.93 (10.6)	66	1148 (847)	4140 (3054)	46	592/13	20163 (4533)	2.0
7.91 (10.6)	64	1181 (871)	2300 (1697)	47	515/11	14923 (3355)	1.1
8.00 (10.7)	44	1737 (1281)	4140 (3054)	69	620/9	23146 (5203)	1.3

4

Gearbox size	Motor frame size (shaft height) SH	Helical geared motors Order No.	Order codes Gearbox type	Type	Type Mounting posit.	Total weight, approx. kg (lb)
C302	100	1FK7103-5AF71-1 ■■ 5 - Z	D31	G■■	H■■	50.4 (111)
C302	100	1FK7103-5AF71-1 ■■ 5 - Z	D32	G■■	H■■	50.4 (111)
C402	100	1FK7103-5AF71-1 ■■ 5 - Z	D42	G■■	H■■	60.6 (134)
C302	100	1FK7103-5AF71-1 ■■ 5 - Z	D33	G■■	H■■	50.4 (111)
C502	100	1FK7103-5AF71-1 ■■ 5 - Z	D53	G■■	H■■	72.2 (159)
C402	100	1FK7103-5AF71-1 ■■ 5 - Z	D44	G■■	H■■	60.6 (134)
C612	100	1FK7103-5AF71-1 ■■ 5 - Z	D64	G■■	H■■	87.5 (193)
C502	100	1FK7103-5AF71-1 ■■ 5 - Z	D55	G■■	H■■	72.2 (159)
C612	100	1FK7103-5AF71-1 ■■ 5 - Z	D65	G■■	H■■	87.5 (193)
C612	100	1FK7103-5AF71-1 ■■ 5 - Z	D66	G■■	H■■	87.5 (193)
C812	100	1FK7103-5AF71-1 ■■ 5 - Z	D86	G■■	H■■	182.4 (402)
C712	100	1FK7103-5AF71-1 ■■ 5 - Z	D77	G■■	H■■	122.8 (271)
C812	100	1FK7103-5AF71-1 ■■ 5 - Z	D87	G■■	H■■	182.4 (402)
C812	100	1FK7103-5AF71-1 ■■ 5 - Z	D88	G■■	H■■	182.4 (402)
C402	100	1FK7105-5AF71-1 ■■ 5 - Z	D41	G■■	H■■	70.6 (156)
C302	100	1FK7105-5AF71-1 ■■ 5 - Z	D31	G■■	H■■	60.4 (133)
C502	100	1FK7105-5AF71-1 ■■ 5 - Z	D52	G■■	H■■	82.2 (181)
C302	100	1FK7105-5AF71-1 ■■ 5 - Z	D32	G■■	H■■	60.4 (133)
C502	100	1FK7105-5AF71-1 ■■ 5 - Z	D53	G■■	H■■	82.2 (181)
C402	100	1FK7105-5AF71-1 ■■ 5 - Z	D43	G■■	H■■	70.6 (156)
C502	100	1FK7105-5AF71-1 ■■ 5 - Z	D54	G■■	H■■	82.2 (181)
C612	100	1FK7105-5AF71-1 ■■ 5 - Z	D64	G■■	H■■	97.5 (215)
C712	100	1FK7105-5AF71-1 ■■ 5 - Z	D75	G■■	H■■	132.8 (293)
C612	100	1FK7105-5AF71-1 ■■ 5 - Z	D65	G■■	H■■	97.5 (215)
C812	100	1FK7105-5AF71-1 ■■ 5 - Z	D86	G■■	H■■	192.4 (424)
C712	100	1FK7105-5AF71-1 ■■ 5 - Z	D76	G■■	H■■	132.8 (293)
C812	100	1FK7105-5AF71-1 ■■ 5 - Z	D87	G■■	H■■	192.4 (424)
C712	100	1FK7105-5AF71-1 ■■ 5 - Z	D77	G■■	H■■	132.8 (293)
C812	100	1FK7105-5AF71-1 ■■ 5 - Z	D88	G■■	H■■	192.4 (424)

Encoder systems for motors without DRIVE-CLiQ interface:	Incremental encoder sin/cos 1 V_{pp}	A			
	Absolute encoder EnDat 2048 S/R (shaft height 48 and higher)	E			
	Absolute encoder EnDat 32 S/R (shaft height 48 and higher)	G			
	Resolver, multipole (pole number = pole number for motor)	S			
	Resolver, 2-pole	T			
Encoder systems for motors with DRIVE-CLiQ interface:	22 bit incremental encoder	D			
	22 bit absolute encoder, single-turn +12 bit multi-turn (shaft height 48 and higher)	F			
	16 bit absolute encoder, single-turn +12 bit multi-turn (shaft height 48 and higher)	K			
	15 bit resolver(number of poles = number of motor poles)	U			
	14 bit resolver	P			
Holding brake:	Motor **without** holding brake		U		
	Motor **with** holding brake		V		
Order codes for type, type of construction and mounting position, refer to page 4/110				. .	. .

1FK7 geared servomotors
Offset-shaft geared motors

Selection and ordering data

Output (S3 60 %) P_2 kW (HP)	Output speed n_2 rpm	Rated output torque M_2 Nm (lb_f-ft)	Max. permissible acceleration torque M_{2max} Nm (lb_f-ft)	Nominal ratio i_{nom}	Exact ratio i_{exact}	Cantilever force gear shaft extension $F_{rpermiss}$ N (lb_f)	Overload factor f_B
0.30 (0.40)	696	4.07 (3.00)	24 (17.7)	4.3	56/13	1021 (230)	4.7
	464	6.11 (4.50)	33 (24.3)	6.5	84/13	1169 (263)	4.5
	275	10.3 (7.60)	52 (38.4)	11	273/25	1392 (313)	4.1
	221	12.9 (9.50)	62 (45.7)	13.5	231/17	1497 (337)	3.9
	130	21.8 (16.1)	114 (84.1)	23	3185/138	1786 (402)	4.2
	86	33.1 (24.4)	120 (88.5)	35	3575/102	2053 (462)	2.9
0.41 (0.55)	696	5.64 (4.20)	45 (33.2)	4.3	56/13	1021 (230)	6.7
	464	8.46 (6.20)	64 (47.2)	6.5	84/13	1169 (263)	6.3
	275	14.3 (10.5)	99 (73.0)	11	273/25	1392 (313)	5.8
	221	17.8 (13.1)	105 (77.4)	13.5	231/17	1497 (337)	5.0
	130	30.2 (22.3)	120 (88.5)	23	3185/138	1786 (402)	3.4
	86	45.9 (33.9)	120 (88.5)	35	3575/102	2053 (462)	2.2
0.79 (1.06)	696	10.9 (8.00)	45 (33.2)	4.3	56/13	1021 (230)	3.6
	464	16.3 (12.0)	64 (47.2)	6.5	84/13	1169 (263)	3.4
	275	27.5 (20.3)	99 (73.0)	11	273/25	1392 (313)	3.1
	221	34.3 (25.3)	105 (77.4)	13.5	231/17	1497 (337)	2.7
	130	58.2 (42.9)	120 (88.5)	23	3185/138	1786 (402)	1.8
	128	59.1 (43.6)	233 (172)	23	2320/99	2308 (519)	3.4
	86	88.4 (65.2)	120 (88.5)	35	3575/102	2053 (462)	1.2
	85	89.4 (65.9)	270 (199)	35	390/11	2650 (596)	2.6
1.43 (1.92)	696	19.6 (14.5)	80 (59.0)	4.3	56/13	1021 (230)	3.2
	464	29.5 (21.8)	91 (67.1)	6.5	84/13	1169 (263)	2.4
	275	49.8 (36.7)	105 (77.4)	11	273/25	1392 (313)	1.7
	278	49.3 (36.4)	196 (145)	11	7303/676	1783 (402)	3.1
	221	61.9 (45.7)	105 (77.4)	13.5	231/17	1497 (337)	1.3
	220	62.1 (45.8)	210 (155)	13.5	109/8	1927 (433)	2.6
	128	107 (78.9)	270 (199)	23	2320/99	2308 (519)	2.0
	85	162 (120)	270 (199)	35	390/11	2650 (596)	1.3
	86	160 (118)	450 (332)	35	7252/207	3666 (824)	2.2
2.22 (2.98)	696	30.5 (22.5)	80 (59.0)	4.3	56/13	1021 (230)	1.7
	464	45.8 (33.8)	91 (67.1)	6.5	84/13	1169 (263)	1.3
	540	39.3 (29.0)	112 (82.6)	5.6	5341/962	1428 (321)	1.9
	278	76.5 (56.4)	196 (145)	11	7303/676	1783 (401)	1.7
	220	96.5 (71.2)	210 (155)	13.5	109/8	1927 (433)	1.4
	128	166 (122)	270 (199)	23	2320/99	2308 (519)	1.1
	86	248 (183)	450 (332)	35	7252/207	3666 (824)	1.2

4

Gearbox size	Motor frame size (shaft height) SH	Offset-shaft geared motors Order No.	Order codes Gearbox type	Type	Type Mounting posit.	Total weight, approx. kg (lb)
F102	36	**1FK7032-5AK71-1■■5-Z**	**C11**	**G■■**	**H■■**	13.8 (30.4)
F102	36	**1FK7032-5AK71-1■■5-Z**	**C12**	**G■■**	**H■■**	13.8 (30.4)
F102	36	**1FK7032-5AK71-1■■5-Z**	**C13**	**G■■**	**H■■**	13.8 (30.4)
F102	36	**1FK7032-5AK71-1■■5-Z**	**C14**	**G■■**	**H■■**	13.8 (30.4)
F102	36	**1FK7032-5AK71-1■■5-Z**	**C15**	**G■■**	**H■■**	13.8 (30.4)
F102	36	**1FK7032-5AK71-1■■5-Z**	**C16**	**G■■**	**H■■**	13.8 (30.4)
F102	48	**1FK7040-5AK71-1■■5-Z**	**C11**	**G■■**	**H■■**	14.6 (32.2)
F102	48	**1FK7040-5AK71-1■■5-Z**	**C12**	**G■■**	**H■■**	14.6 (32.2)
F102	48	**1FK7040-5AK71-1■■5-Z**	**C13**	**G■■**	**H■■**	14.6 (32.2)
F102	48	**1FK7040-5AK71-1■■5-Z**	**C14**	**G■■**	**H■■**	14.6 (32.2)
F102	48	**1FK7040-5AK71-1■■5-Z**	**C15**	**G■■**	**H■■**	14.6 (32.2)
F102	48	**1FK7040-5AK71-1■■5-Z**	**C16**	**G■■**	**H■■**	14.6 (32.2)
F102	48	**1FK7042-5AF71-1■■5-Z**	**C11**	**G■■**	**H■■**	15.9 (35.1)
F102	48	**1FK7042-5AF71-1■■5-Z**	**C12**	**G■■**	**H■■**	15.9 (35.1)
F102	48	**1FK7042-5AF71-1■■5-Z**	**C13**	**G■■**	**H■■**	15.9 (35.1)
F102	48	**1FK7042-5AF71-1■■5-Z**	**C14**	**G■■**	**H■■**	15.9 (35.1)
F102	48	**1FK7042-5AF71-1■■5-Z**	**C15**	**G■■**	**H■■**	15.9 (35.1)
F202	48	**1FK7042-5AF71-1■■5-Z**	**C25**	**G■■**	**H■■**	24.1 (53.1)
F102	48	**1FK7042-5AF71-1■■5-Z**	**C16**	**G■■**	**H■■**	15.9 (35.1)
F202	48	**1FK7042-5AF71-1■■5-Z**	**C26**	**G■■**	**H■■**	24.1 (53.1)
F102	63	**1FK7060-5AF71-1■■5-Z**	**C11**	**G■■**	**H■■**	18.6 (41.0)
F102	63	**1FK7060-5AF71-1■■5-Z**	**C12**	**G■■**	**H■■**	18.6 (41.0)
F102	63	**1FK7060-5AF71-1■■5-Z**	**C13**	**G■■**	**H■■**	18.6 (41.0)
F202	63	**1FK7060-5AF71-1■■5-Z**	**C23**	**G■■**	**H■■**	26.8 (59.1)
F102	63	**1FK7060-5AF71-1■■5-Z**	**C14**	**G■■**	**H■■**	18.6 (41.0)
F202	63	**1FK7060-5AF71-1■■5-Z**	**C24**	**G■■**	**H■■**	26.8 (59.1)
F202	63	**1FK7060-5AF71-1■■5-Z**	**C25**	**G■■**	**H■■**	26.8 (59.1)
F202	63	**1FK7060-5AF71-1■■5-Z**	**C26**	**G■■**	**H■■**	26.8 (59.1)
F302	63	**1FK7060-5AF71-1■■5-Z**	**C36**	**G■■**	**H■■**	34.4 (75.9)
F102	63	**1FK7063-5AF71-1■■5-Z**	**C11**	**G■■**	**H■■**	22.3 (49.2)
F102	63	**1FK7063-5AF71-1■■5-Z**	**C12**	**G■■**	**H■■**	22.3 (49.2)
F202	63	**1FK7063-5AF71-1■■5-Z**	**C22**	**G■■**	**H■■**	30.5 (67.3)
F202	63	**1FK7063-5AF71-1■■5-Z**	**C23**	**G■■**	**H■■**	30.5 (67.3)
F202	63	**1FK7063-5AF71-1■■5-Z**	**C24**	**G■■**	**H■■**	30.5 (67.3)
F202	63	**1FK7063-5AF71-1■■5-Z**	**C25**	**G■■**	**H■■**	30.5 (67.3)
F302	63	**1FK7063-5AF71-1■■5-Z**	**C36**	**G■■**	**H■■**	38.1 (84.0)

Encoder systems for motors without DRIVE-CLiQ interface:	Incremental encoder sin/cos 1 V_{pp}	**A**
	Absolute encoder EnDat 2048 S/R (shaft height 48 and higher)	**E**
	Absolute encoder EnDat 512 S/R (only shaft height 36)	**H**
	Absolute encoder EnDat 32 S/R (shaft height 48 and higher)	**G**
	Absolute encoder EnDat 16 S/R (only shaft height 36)	**J**
	Resolver, multi-pole (pole number = pole number for motor)	**S**
	Resolver, 2-pole	**T**
Encoder systems for motors with DRIVE-CLiQ interface:	22 bit incremental encoder	**D**
	22 bit absolute encoder, single-turn +12 bit multi-turn (shaft height 48 and higher)	**F**
	20 bit absolute encoder, single-turn +12 bit multi-turn (only shaft height 36)	**L**
	16 bit absolute encoder, single-turn +12 bit multi-turn (shaft height 48 and higher)	**K**
	15 bit absolute encoder, single-turn +12 bit multi-turn (only shaft height 36)	**V**
	15 bit resolver (number of poles = number of motor poles)	**U**
	14 bit resolver	**P**
Holding brake:	Motor **without** holding brake	**U**
	Motor **with** holding brake	**V**

Order codes for type, type of construction and mounting position, refer to page 4/110

1FK7 geared servomotors
Offset-shaft geared motors

Selection and ordering data

Output (S3 60 %) P_2 kW (HP)	Output speed n_2 rpm	Rated output torque M_2 Nm (lb_f-ft)	Max. permissible acceleration torque M_{2max} Nm (lb_f-ft)	Nominal ratio i_{nom}	Exact ratio i_{exact}	Cantilever force gear shaft extension $F_{rpermiss}$ N (lb_f)	Overload factor f_B
2.08 (2.79)	540	36.6 (27.0)	173 (128)	5.6	5341/962	1428 (321)	4.0
	278	71.3 (52.6)	210 (155)	11	7303/676	1783 (401)	2.5
	220	89.9 (66.3)	210 (155)	13.5	109/8	1927 (433)	2.0
	128	155 (114)	270 (199)	23	2320/99	2308 (519)	1.5
	128	155 (114)	450 (332)	24	588/25	3210 (722)	2.5
	86	231 (170)	450 (332)	35	7252/207	3666 (824)	1.7
	86	231 (170)	700 (516)	35	2210/63	4523 (1017)	2.6
3.20 (4.29)	540	56.5 (41.7)	173 (128)	5.6	5341/962	1428 (321)	2.0
	278	110 (81.1)	210 (155)	11	7303/676	1783 (401)	1.3
	278	110 (81.1)	350 (258)	11	1456/135	2475 (556)	2.1
	224	136 (100)	350 (258)	13.5	7696/575	2660 (598)	1.7
	221	138 (102)	550 (406)	13.5	5984/441	3296 (741)	2.6
	128	240 (177)	450 (332)	24	588/25	3210 (722)	1.2
	129	236 (174)	700 (516)	23	325/14	3942 (886)	1.9
	86	357 (263)	700 (516)	35	2210/63	4523 (1017)	1.3
	85	359 (265)	1100 (811)	35	845/24	6120 (1376)	2.0
3.66 (4.91)	516	67.7 (49.9)	482 (356)	5.8	3784/651	2484 (558)	4.8
	277	126 (92.9)	550 (406)	11	682/63	3057 (687)	2.9
	221	158 (117)	550 (406)	13.5	5984/441	3296 (741)	2.3
	129	270 (199)	700 (516)	23	325/14	3942 (886)	1.7
	129	271 (200)	1100 (811)	23	1885/81	5331 (1198)	2.7
	86	408 (301)	700 (516)	35	2210/63	4523 (1017)	1.1
4.72 (6.33)	516	87.4 (64.5)	482 (356)	5.8	3784/651	2484 (558)	3.2
	277	163 (120)	550 (406)	11	682/63	3057 (687)	1.9
	221	204 (151)	550 (406)	13.5	5984/441	3296 (741)	1.5
	220	205 (151)	1000 (738)	13.5	871/64	4458 (1002)	2.8
	129	349 (257)	700 (516)	23	325/14	3942 (886)	1.2
	85	529 (390)	1100 (811)	35	845/24	6120 (1376)	1.2
5.20 (6.97)	430	115 (84.8)	482 (356)	5.8	3784/651	2484 (558)	2.4
	231	215 (159)	550 (406)	11	682/63	3057 (687)	1.5
	231	215 (159)	991 (731)	11	2077/192	4130 (928)	2.6
	184	269 (198)	550 (406)	13.5	5984/441	3296 (741)	1.2
	183	270 (199)	1000 (738)	13.5	871/64	4458 (1002)	2.1
	108	460 (339)	1100 (811)	23	1885/81	5331 (1198)	1.4
7.93 (10.6)	529	143 (106)	766 (565)	5.7	1407/248	3330 (749)	2.9
	516	147 (108)	482 (356)	6.0	3784/651	2484 (558)	1.8
	277	273 (201)	991 (731)	11	2077/192	4130 (928)	2.0
	277	273 (201)	550 (406)	11	682/63	3057 (687)	1.1
	220	343 (253)	1000 (738)	13.6	871/64	4458 (1002)	1.6
	129	587 (433)	1100 (811)	24	1885/81	5331 (1198)	1.0

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Gearbox size	Motor frame size (shaft height) SH	Offset-shaft geared motors Order No.	Order codes Gearbox type	Type	Type Mounting posit.	Total weight, approx. kg (lb
F202	80	**1FK7080-5AF71-1 ■■ 5 - Z**	**C22**	**G■■**	**H■■**	30.2 (66.6)
F202	80	**1FK7080-5AF71-1 ■■ 5 - Z**	**C23**	**G■■**	**H■■**	30.2 (66.6)
F202	80	**1FK7080-5AF71-1 ■■ 5 - Z**	**C24**	**G■■**	**H■■**	30.2 (66.6)
F202	80	**1FK7080-5AF71-1 ■■ 5 - Z**	**C25**	**G■■**	**H■■**	30.2 (66.6)
F302	80	**1FK7080-5AF71-1 ■■ 5 - Z**	**C35**	**G■■**	**H■■**	37.8 (83.4)
F302	80	**1FK7080-5AF71-1 ■■ 5 - Z**	**C36**	**G■■**	**H■■**	37.8 (83.4)
F402	80	**1FK7080-5AF71-1 ■■ 5 - Z**	**C46**	**G■■**	**H■■**	46.1 (102)
F202	80	**1FK7083-5AF71-1 ■■ 5 - Z**	**C22**	**G■■**	**H■■**	35.4 (78.1)
F202	80	**1FK7083-5AF71-1 ■■ 5 - Z**	**C23**	**G■■**	**H■■**	35.4 (78.1)
F302	80	**1FK7083-5AF71-1 ■■ 5 - Z**	**C33**	**G■■**	**H■■**	43.0 (94.8)
F302	80	**1FK7083-5AF71-1 ■■ 5 - Z**	**C34**	**G■■**	**H■■**	43.0 (94.8)
F402	80	**1FK7083-5AF71-1 ■■ 5 - Z**	**C44**	**G■■**	**H■■**	51.3 (113)
F302	80	**1FK7083-5AF71-1 ■■ 5 - Z**	**C35**	**G■■**	**H■■**	43.0 (94.8)
F402	80	**1FK7083-5AF71-1 ■■ 5 - Z**	**C45**	**G■■**	**H■■**	51.3 (113)
F402	80	**1FK7083-5AF71-1 ■■ 5 - Z**	**C46**	**G■■**	**H■■**	51.3 (113)
F602	80	**1FK7083-5AF71-1 ■■ 5 - Z**	**C66**	**G■■**	**H■■**	78.3 (173)
F402	100	**1FK7100-5AF71-1 ■■ 5 - Z**	**C42**	**G■■**	**H■■**	53.5 (118)
F402	100	**1FK7100-5AF71-1 ■■ 5 - Z**	**C43**	**G■■**	**H■■**	53.3 (118)
F402	100	**1FK7100-5AF71-1 ■■ 5 - Z**	**C44**	**G■■**	**H■■**	53.5 (118)
F402	100	**1FK7100-5AF71-1 ■■ 5 - Z**	**C45**	**G■■**	**H■■**	53.3 (118)
F602	100	**1FK7100-5AF71-1 ■■ 5 - Z**	**C65**	**G■■**	**H■■**	80.5 (178)
F402	100	**1FK7100-5AF71-1 ■■ 5 - Z**	**C46**	**G■■**	**H■■**	53.3 (118)
F402	100	**1FK7101-5AF71-1 ■■ 5 - Z**	**C42**	**G■■**	**H■■**	59.1 (130)
F402	100	**1FK7101-5AF71-1 ■■ 5 - Z**	**C43**	**G■■**	**H■■**	59.1 (130)
F402	100	**1FK7101-5AF71-1 ■■ 5 - Z**	**C44**	**G■■**	**H■■**	59.1 (130)
F602	100	**1FK7101-5AF71-1 ■■ 5 - Z**	**C64**	**G■■**	**H■■**	86.1 (190)
F402	100	**1FK7101-5AF71-1 ■■ 5 - Z**	**C45**	**G■■**	**H■■**	59.1 (130)
F602	100	**1FK7101-5AF71-1 ■■ 5 - Z**	**C66**	**G■■**	**H■■**	86.1 (190)
F402	100	**1FK7103-5AF71-1 ■■ 5 - Z**	**C42**	**G■■**	**H■■**	65.7 (145)
F402	100	**1FK7103-5AF71-1 ■■ 5 - Z**	**C43**	**G■■**	**H■■**	65.7 (145)
F602	100	**1FK7103-5AF71-1 ■■ 5 - Z**	**C63**	**G■■**	**H■■**	92.7 (204)
F402	100	**1FK7103-5AF71-1 ■■ 5 - Z**	**C44**	**G■■**	**H■■**	65.7 (145)
F602	100	**1FK7103-5AF71-1 ■■ 5 - Z**	**C64**	**G■■**	**H■■**	2.7 (145)
F602	100	**1FK7103-5AF71-1 ■■ 5 - Z**	**C65**	**G■■**	**H■■**	92.7 (145)
F602	100	**1FK7105-5AF71-1 ■■ 5 - Z**	**C62**	**G■■**	**H■■**	103 (227)
F402	100	**1FK7105-5AF71-1 ■■ 5 - Z**	**C42**	**G■■**	**H■■**	75.7 (167)
F602	100	**1FK7105-5AF71-1 ■■ 5 - Z**	**C63**	**G■■**	**H■■**	103 (227)
F402	100	**1FK7105-5AF71-1 ■■ 5 - Z**	**C43**	**G■■**	**H■■**	75.7 (167)
F602	100	**1FK7105-5AF71-1 ■■ 5 - Z**	**C64**	**G■■**	**H■■**	103 (227)
F602	100	**1FK7105-5AF71-1 ■■ 5 - Z**	**C65**	**G■■**	**H■■**	103 (227)

Encoder systems for motors without DRIVE-CLiQ interface:	Incremental encoder sin/cos 1 V_{pp}	**A**				
	Absolute encoder EnDat 2048 S/R (shaft height 48 and higher)	**E**				
	Absolute encoder EnDat 32 S/R (shaft height 48 and higher)	**G**				
	Resolver, multipole (pole number = pole number for motor)	**S**				
	Resolver, 2-pole	**T**				
Encoder systems for motors with DRIVE-CLiQ interface:	22 bit incremental encoder	**D**				
	22 bit absolute encoder, single-turn +12 bit multi-turn (shaft height 48 and higher)	**F**				
	16 bit absolute encoder, single-turn +12 bit multi-turn (shaft height 48 and higher)	**K**				
	15 bit resolver(number of poles = number of motor poles)	**U**				
	14 bit resolver	**P**				
Holding brake:	Motor **without** holding brake		**U**			
	Motor **with** holding brake		**V**			
Order codes for type, type of construction and mounting position, refer to page 4/110				.	.	. .

1FK7 geared servomotors
Bevel geared motors

Selection and ordering data

Output (S3 60 %) P_2 kW (HP)	Output speed n_2 rpm	Rated output torque M_2 Nm (lb_f-ft)	Max. permissible acceleration torque M_{2max} Nm (lb_f-ft)	Nominal ratio i_{nom}	Exact ratio i_{exact}	Cantilever force gear shaft extension $F_{rpermiss}$ N (lb_f)	Overload factor f_B
0.30 (0.40)	750	3.78 (2.80)	22 (16.2)	4	4/1	1494 (336)	4.7
	500	5.68 (4.20)	31 (22.9)	6	6/1	1710 (384)	4.5
	296	9.59 (7.10)	48 (35.4)	10	507/50	2037 (458)	4.1
	179	15.8 (11.7)	73 (53.8)	16.5	117/7	2406 (541)	3.8
	129	22.0 (16.2)	102 (75.2)	23	1140/49	2686 (604)	3.8
	85	33.2 (24.5)	135 (99.6)	35	3686/105	3081 (693)	3.3
	65	43.7 (32.2)	185 (137)	46	1849/40	4053 (911)	3.4
	43	65.7 (48.5)	159 (117)	69	6665/96	4641 (1043)	2.0
0.41 (0.55)	750	5.24 (3.90)	42 (31.0)	4	4/1	1494 (336)	6.7
	500	7.86 (5.80)	59 (43.5)	6	6/1	1710 (384)	6.3
	296	13.3 (9.80)	92 (67.9)	10	507/50	2037 (458)	5.8
	179	21.9 (16.2)	122 (90.0)	16.5	117/7	2406 (541)	4.7
	129	30.5 (22.5)	135 (99.6)	23	1140/49	2686 (604)	3.7
	85	46.0 (33.9)	135 (99.6)	35	3686/105	3081 (693)	2.5
	65	60.5 (44.6)	220 (162)	46	1849/40	4053 (911)	3.1
0.79 (1.06)	750	10.1 (7.40)	42 (31.0)	4	4/1	1494 (336)	3.6
	500	15.1 (11.1)	59 (43.5)	6	6/1	1710 (384)	3.4
	296	25.6 (18.9)	92 (67.9)	10	507/50	2037 (458)	3.1
	179	42.2 (31.1)	122 (90.0)	16.5	117/7	2406 (541)	2.5
	129	58.7 (43.3)	135 (99.6)	23	1140/49	2686 (604)	2.0
	85	88.5 (65.3)	135 (99.6)	35	3686/105	3081 (693)	1.3
	87	87.1 (64.2)	220 (162)	35	1935/56	3678 (1043)	2.2
1.43 (1.92)	750	18.2 (13.4)	76 (56.1)	4	4/1	1494 (336)	3.3
	500	27.4 (20.2)	87 (64.2)	6	6/1	1710 (384)	2.5
	296	46.2 (34.1)	103 (76.0)	10	507/50	2037 (458)	1.8
	178	76.9 (56.7)	219 (162)	17	2967/176	2895 (651)	2.2
	129	106 (78.2)	220 (162)	23	2967/128	3220 (724)	1.6
	129	106 (78.2)	385 (284)	23	559/24	3762 (846)	2.8
	87	158 (117)	220 (162)	35	1935/56	3678 (1043)	1.1
	86	158 (117)	385 (284)	35	903/26	4298 (966)	1.9
	65	211 (156)	385 (284)	46	1849/40	4728 (1063)	1.4
	65	211 (156)	600 (443)	46	602/13	7570 (1702)	2.2
	46	290 (214)	1000 (738)	65	12586/195	10154 (2283)	2.7

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Gearbox size	Motor frame size (shaft height) SH	Bevel geared motors Order No.	Order codes Gearbox type	Type	Type Mounting posit.	Total weight, approx. kg (lb)
K102	36	1FK7032-5AK71-1■■5-Z	B11	G■■	H■■	12.3 (27.1)
K102	36	1FK7032-5AK71-1■■5-Z	B12	G■■	H■■	12.3 (27.1)
K102	36	1FK7032-5AK71-1■■5-Z	B13	G■■	H■■	12.3 (27.1)
K102	36	1FK7032-5AK71-1■■5-Z	B14	G■■	H■■	12.3 (27.1)
K102	36	1FK7032-5AK71-1■■5-Z	B15	G■■	H■■	12.3 (27.1)
K102	36	1FK7032-5AK71-1■■5-Z	B16	G■■	H■■	12.3 (27.1)
K202	36	1FK7032-5AK71-1■■5-Z	B27	G■■	H■■	19.8 (43.7)
K202	36	1FK7032-5AK71-1■■5-Z	B28	G■■	H■■	19.8 (43.7)
K102	48	1FK7040-5AK71-1■■5-Z	B11	G■■	H■■	13.1 (28.9)
K102	48	1FK7040-5AK71-1■■5-Z	B12	G■■	H■■	13.1 (28.9)
K102	48	1FK7040-5AK71-1■■5-Z	B13	G■■	H■■	13.1 (28.9)
K102	48	1FK7040-5AK71-1■■5-Z	B14	G■■	H■■	13.1 (28.9)
K102	48	1FK7040-5AK71-1■■5-Z	B15	G■■	H■■	13.1 (28.9)
K102	48	1FK7040-5AK71-1■■5-Z	B16	G■■	H■■	13.1 (28.9)
K202	48	1FK7040-5AK71-1■■5-Z	B27	G■■	H■■	20.6 (45.4)
K102	48	1FK7042-5AF71-1■■5-Z	B11	G■■	H■■	14.4 (31.8)
K102	48	1FK7042-5AF71-1■■5-Z	B12	G■■	H■■	14.4 (31.8)
K102	48	1FK7042-5AF71-1■■5-Z	B13	G■■	H■■	14.4 (31.8)
K102	48	1FK7042-5AF71-1■■5-Z	B14	G■■	H■■	14.4 (31.8)
K102	48	1FK7042-5AF71-1■■5-Z	B15	G■■	H■■	14.4 (31.8)
K102	48	1FK7042-5AF71-1■■5-Z	B16	G■■	H■■	14.4 (31.8)
K202	48	1FK7042-5AF71-1■■5-Z	B26	G■■	H■■	21.9 (48.3)
K102	63	1FK7060-5AF71-1■■5-Z	B11	G■■	H■■	17.1 (37.7)
K102	63	1FK7060-5AF71-1■■5-Z	B12	G■■	H■■	17.1 (37.7)
K102	63	1FK7060-5AF71-1■■5-Z	B13	G■■	H■■	17.1 (37.7)
K202	63	1FK7060-5AF71-1■■5-Z	B24	G■■	H■■	24.6 (54.2)
K202	63	1FK7060-5AF71-1■■5-Z	B25	G■■	H■■	24.6 (54.2)
K302	63	1FK7060-5AF71-1■■5-Z	B35	G■■	H■■	29.6 (65.3)
K202	63	1FK7060-5AF71-1■■5-Z	B26	G■■	H■■	24.6 (54.2)
K302	63	1FK7060-5AF71-1■■5-Z	B36	G■■	H■■	29.6 (65.3)
K302	63	1FK7060-5AF71-1■■5-Z	B37	G■■	H■■	29.6 (65.3)
K402	63	1FK7060-5AF71-1■■5-Z	B47	G■■	H■■	43.1 (95.0)
K513	63	1FK7060-5AF71-1■■5-Z	B58	G■■	H■■	48.9 (108)

Encoder systems for motors without DRIVE-CLiQ interface:	Incremental encoder sin/cos 1 V_{pp}	A
	Absolute encoder EnDat 2048 S/R (shaft height 48 and higher)	E
	Absolute encoder EnDat 512 S/R (only shaft height 36)	H
	Absolute encoder EnDat 32 S/R (shaft height 48 and higher)	G
	Absolute encoder EnDat 16 S/R (only shaft height 36)	J
	Resolver, multi-pole (pole number = pole number for motor)	S
	Resolver, 2-pole	T
Encoder systems for motors with DRIVE-CLiQ interface:	22 bit incremental encoder	D
	22 bit absolute encoder, single-turn +12 bit multi-turn (shaft height 48 and higher)	F
	20 bit absolute encoder, single-turn +12 bit multi-turn (only shaft height 36)	L
	16 bit absolute encoder, single-turn +12 bit multi-turn (shaft height 48 and higher)	K
	15 bit absolute encoder, single-turn +12 bit multi-turn (only shaft height 36)	V
	15 bit resolver (number of poles = number of motor poles)	U
	14 bit resolver	P
Holding brake:	Motor **without** holding brake	U
	Motor **with** holding brake	V

Order codes for type, type of construction and mounting position, refer to page 4/110

1FK7 geared servomotors
Bevel geared motors

Selection and ordering data

Output (S3 60 %) P_2 kW (HP)	Output speed n_2 rpm	Rated output torque M_2 Nm (lb_f-ft)	Max. permissible acceleration torque M_{2max} Nm (lb_f-ft)	Nominal ratio i_{nom}	Exact ratio i_{exact}	Cantilever force gear shaft extension $F_{rpermiss}$ N (lb_f)	Overload factor f_B
2.22 (2.98)	750	28.3 (20.9)	76 (56.1)	4	4/1	1494 (336)	1.8
	750	28.3 (20.9)	83 (61.2)	4	4/1	1793 (403)	2.0
	500	42.5 (31.3)	87 (64.2)	6	6/1	1710 (384)	1.4
	500	42.5 (31.3)	128 (94.4)	6	6/1	2394 (538)	2.0
	324	65.6 (48.4)	186 (137)	9.3	1075/116	2767 (622)	1.9
	178	119 (87.8)	219 (162)	17	2967/176	2895 (651)	1.2
	129	165 (122)	385 (284)	23	559/24	3762 (846)	1.5
	86	246 (181)	385 (284)	35	903/26	4298 (966)	1.0
	65	328 (242)	600 (443)	46	602/13	7570 (1702)	1.2
2.17 (2.91)	46	450 (332)	1000 (738)	65	12586/195	10154 (2283)	1.5
2.07 (2.78)	750	26.4 (19.5)	135 (99.6)	4	4/1	1793 (403)	4.4
	500	39.6 (29.2)	155 (114)	6	6/1	2052 (461)	3.3
	298	66.4 (49.0)	184 (136)	10	2881/286	2439 (548)	2.4
	177	112 (82.6)	384 (283)	17	559/33	3383 (761)	2.9
	129	153 (113)	220 (162)	23	2967/128	3220 (724)	1.2
	129	154 (114)	385 (284)	23	559/24	3762 (846)	2.1
	86	229 (169)	600 (443)	35	4171/120	6879 (1546)	2.2
2.03 (2.72)	62	313 (231)	1000 (738)	48	2697/56	9210 (2071)	2.7
	39	495 (365)	1600 (1180)	76	126697/1664	12763 (2869)	2.7
3.20 (4.29)	750	40.7 (30.0)	135 (99.6)	4	4/1	1793 (403)	2.2
	500	61.1 (45.1)	155 (114)	6	6/1	2052 (461)	1.7
	500	61.1 (45.1)	271 (200)	6	6/1	2394 (538)	2.9
	298	103 (76.0)	184 (136)	10	2881/286	2439 (548)	1.2
	324	94.4 (69.6)	314 (232)	9.3	1075/116	2767 (622)	2.2
	177	173 (128)	384 (283)	17	559/33	3383 (761)	1.5
	177	173 (128)	575 (424)	17	559/33	5414 (1217)	2.2
	129	237 (175)	385 (284)	23	559/24	3762 (846)	1.1
3.14 (4.21)	123	244 (180)	1000 (738)	24	11687/480	7337 (1649)	2.7
	93	324 (239)	1000 (738)	32	20677/640	8062 (1812)	2.0
	62	483 (356)	1000 (738)	48	2697/56	9210 (2071)	1.4
	63	479 (353)	1600 (1180)	48	39711/832	10923 (2456)	2.2
	46	648 (478)	1000 (738)	65	12586/195	10154 (2283)	1.0
	46	651 (480)	2574 (1899)	65	33201/512	16635 (3740)	2.6
3.19 (4.28)	86	354 (261)	600 (443)	35	4171/120	6879 (1546)	1.1
3.66 (4.91)	750	46.6 (34.4)	356 (263)	4	4/1	3346 (752)	5.1
	500	69.8 (51.5)	407 (300)	6	6/1	3830 (861)	3.9
	297	118 (87.0)	484 (357)	10	1333/132	4556 (1024)	2.7
	177	197 (145)	575 (424)	17	559/33	5414 (1217)	1.9
	129	271 (200)	600 (443)	23	559/24	6020 (1353)	1.5
3.60 (4.83)	123	279 (206)	1000 (738)	24	11687/480	7337 (1649)	2.4
	93	371 (274)	1000 (738)	32	20677/640	8062 (1812)	1.8
	87	397 (293)	1600 (1180)	35	35441/1024	9813 (2206)	2.7
	60	572 (422)	2600 (1918)	50	166005/3328	15242 (3427)	3.0
	46	744 (549)	2600 (1918)	65	33201/512	16635 (3740)	2.3

4

Gearbox size	Motor frame size (shaft height) SH	Bevel geared motors Order No.	Order codes Gearbox type	Type	Type Mounting posit.	Total weight, approx. kg (lb)
K102	63	1FK7063-5AF71-1 ■■ 5 - Z	B11	G■■	H■■	20.8 (45.9)
K202	63	1FK7063-5AF71-1 ■■ 5 - Z	B21	G■■	H■■	28.3 (62.4)
K102	63	1FK7063-5AF71-1 ■■ 5 - Z	B12	G■■	H■■	20.8 (45.9)
K302	63	1FK7063-5AF71-1 ■■ 5 - Z	B32	G■■	H■■	33.3 (73.4)
K302	63	1FK7063-5AF71-1 ■■ 5 - Z	B33	G■■	H■■	33.3 (73.4)
K202	63	1FK7063-5AF71-1 ■■ 5 - Z	B24	G■■	H■■	28.3 (62.4)
K302	63	1FK7063-5AF71-1 ■■ 5 - Z	B35	G■■	H■■	33.3 (73.4)
K302	63	1FK7063-5AF71-1 ■■ 5 - Z	B36	G■■	H■■	33.3 (73.4)
K402	63	1FK7063-5AF71-1 ■■ 5 - Z	B47	G■■	H■■	46.8 (103)
K513	63	1FK7063-5AF71-1 ■■ 5 - Z	B58	G■■	H■■	52.6 (116)
K202	80	1FK7080-5AF71-1 ■■ 5 - Z	B21	G■■	H■■	28.0 (61.7)
K202	80	1FK7080-5AF71-1 ■■ 5 - Z	B22	G■■	H■■	28.0 (61.7)
K202	80	1FK7080-5AF71-1 ■■ 5 - Z	B23	G■■	H■■	28.0 (61.7)
K302	80	1FK7080-5AF71-1 ■■ 5 - Z	B34	G■■	H■■	33.0 (72.8)
K202	80	1FK7080-5AF71-1 ■■ 5 - Z	B25	G■■	H■■	28.0 (61.7)
K302	80	1FK7080-5AF71-1 ■■ 5 - Z	B35	G■■	H■■	33.0 (72.8)
K402	80	1FK7080-5AF71-1 ■■ 5 - Z	B46	G■■	H■■	46.5 (103)
K513	80	1FK7080-5AF71-1 ■■ 5 - Z	B57	G■■	H■■	52.3 (115)
K613	80	1FK7080-5AF71-1 ■■ 5 - Z	B68	G■■	H■■	73.8 (163)
K202	80	1FK7083-5AF71-1 ■■ 5 - Z	B21	G■■	H■■	33.2 (73.2)
K202	80	1FK7083-5AF71-1 ■■ 5 - Z	B22	G■■	H■■	33.2 (73.2)
K302	80	1FK7083-5AF71-1 ■■ 5 - Z	B32	G■■	H■■	38.2 (84.2)
K202	80	1FK7083-5AF71-1 ■■ 5 - Z	B23	G■■	H■■	33.2 (73.2)
K302	80	1FK7083-5AF71-1 ■■ 5 - Z	B33	G■■	H■■	38.2 (84.2)
K302	80	1FK7083-5AF71-1 ■■ 5 - Z	B34	G■■	H■■	38.2 (84.2)
K402	80	1FK7083-5AF71-1 ■■ 5 - Z	B44	G■■	H■■	51.7 (114)
K302	80	1FK7083-5AF71-1 ■■ 5 - Z	B35	G■■	H■■	38.2 (84.2)
K513	80	1FK7083-5AF71-1 ■■ 5 - Z	B55	G■■	H■■	57.5 (127)
K513	80	1FK7083-5AF71-1 ■■ 5 - Z	B56	G■■	H■■	57.5 (127)
K513	80	1FK7083-5AF71-1 ■■ 5 - Z	B57	G■■	H■■	57.5 (127)
K613	80	1FK7083-5AF71-1 ■■ 5 - Z	B67	G■■	H■■	79.0 (174)
K513	80	1FK7083-5AF71-1 ■■ 5 - Z	B58	G■■	H■■	57.5 (127)
K713	80	1FK7083-5AF71-1 ■■ 5 - Z	B78	G■■	H■■	107.3 (237)
K402	80	1FK7083-5AF71-1 ■■ 5 - Z	B46	G■■	H■■	51.7 (114)
K402	100	1FK7100-5AF71-1 ■■ 5 - Z	B41	G■■	H■■	53.9 (119)
K402	100	1FK7100-5AF71-1 ■■ 5 - Z	B42	G■■	H■■	53.9 (119)
K402	100	1FK7100-5AF71-1 ■■ 5 - Z	B43	G■■	H■■	53.9 (119)
K402	100	1FK7100-5AF71-1 ■■ 5 - Z	B44	G■■	H■■	53.9 (119)
K402	100	1FK7100-5AF71-1 ■■ 5 - Z	B45	G■■	H■■	53.9 (119)
K513	100	1FK7100-5AF71-1 ■■ 5 - Z	B55	G■■	H■■	59.7 (132)
K513	100	1FK7100-5AF71-1 ■■ 5 - Z	B56	G■■	H■■	59.7 (132)
K613	100	1FK7100-5AF71-1 ■■ 5 - Z	B66	G■■	H■■	81.2 (179)
K713	100	1FK7100-5AF71-1 ■■ 5 - Z	B77	G■■	H■■	109.5 (241)
K713	100	1FK7100-5AF71-1 ■■ 5 - Z	B78	G■■	H■■	109.5 (241)

Encoder systems for motors without DRIVE-CLiQ interface:	Incremental encoder sin/cos 1 V_{pp}	A
	Absolute encoder EnDat 2048 S/R (shaft height 48 and higher)	E
	Absolute encoder EnDat 32 S/R (shaft height 48 and higher)	G
	Resol., multipol.(pole no. = pole no. for motor)	S
	Resolver, 2-pole	T
Encoder systems for motors with DRIVE-CLiQ interface:	22 bit incremental encoder	D
	22 bit absolute encoder, single-turn +12 bit multi-turn (shaft height 48 and higher)	F
	16 bit absolute encoder, single-turn +12 bit multi-turn (shaft height 48 and higher)	K
	15 bit resolver (no. of poles = no. of motor poles)	U
	14 bit resolver	P
Holding brake:	Motor **without** holding brake	U
	Motor **with** holding brake	V

Order codes for type, type of construction and mounting position, refer to page 4/110

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1FK7 geared servomotors
Bevel geared motors

Selection and ordering data

Output (S3 60 %) P_2 kW (HP)	Output speed n_2 rpm	Rated output torque M_2 Nm (lb_f-ft)	Max. permissible acceleration torque M_{2max} Nm (lb_f-ft)	Nominal ratio i_{nom}	Exact ratio i_{exact}	Cantilever force gear shaft extension $F_{rpermiss}$ N (lb_f)	Overload factor f_B
4.72 (6.33)	750 500	60.1 (44.3) 90.2 (66.5)	356 (263) 407 (300)	4 6	4/1 6/1	3346 (752) 3830 (861)	3.4 2.6
	297 177	152 (112) 255 (188)	484 (357 575 (424)	10 17	1333/132 559/33	4556 (1024) 5414 (1217)	1.8 1.3
4.66 (6.25)	186 123	238 (176) 361 (266)	1000 (738) 1000 (738)	16 24	26071/1620 11687/480	6391 (1437) 7337 (1649)	2.4 1.6
	125 87 85	356 (263) 513 (378) 525 (387)	1584 (1168) 1600 (1180) 2600 (1918)	24 35 35	24583/1024 35441/1024 567/16	8687 (1953) 9813 (2206) 13600 (3057)	2.6 1.8 2.8
4.64 (6.22)	60	739 (545)	2600 (1918)	50	166005/3328	15242 (3427)	2.0
4.63 (6.21)	46	961 (709)	2600 (1918)	65	33201/512	16635 (3740)	1.6
4.67 (6.26)	46	969 (714)	4650 (3430)	65	188387/2880	21991 (4944)	2.8
5.17 (6.93)	625	79 (58.3)	356 (263)	4	4/1	3346 (752)	2.5
5.20 (6.97)	417	119 (87.8)	407 (300)	6	6/1	3830 (861)	1.9
5.19 (6.96)	248	200 (148)	484 (357)	10	1333/132	4556 (1024)	1.4
5.13 (6.88)	246 155	199 (147) 315 (232)	900 (664) 1000 (738)	10 16	203/20 26071/1620	5481 (1232) 6391 (1437)	2.6 1.8
	158 103	310 (229) 477 (352)	1380 (1018) 1000 (738)	16 24	54839/3456 11687/480	7567 (1701) 7337 (1649)	2.5 1.2
	104 72	470 (347) 678 (500)	1584 (1168) 1600 (1180)	24 35	24583/1024 35441/1024	8687 (1953) 9813 (2206)	1.9 1.3
5.16 (6.92)	71	694 (512)	2600 (1918)	35	567/16	13600 (3057)	2.1
5.12 (6.87)	50	978 (721)	2600 (1918)	50	166005/3328	15242 (3427)	1.5
5.13 (6.88)	51	960 (708)	4650 (3430)	49	5487/112	19971 (4490)	2.8
5.19 (6.96)	39	1271 (938)	2600 (1918)	65	33201/512	16635 (3740)	1.2
5.09 (6.83)	38	1280 (944)	4650 (3430)	65	188387/2880	21991 (4944)	2.1
7.93 (10.6)	750 500	101 (74.5) 151 (111)	356 (263) 407 (300)	4 6	4/1 6/1	3346 (752) 3830 (861)	1.9 1.5
7.81 (10.5)	296	252 (186)	900 (664)	10	203/20	5481 (1232)	1.9
7.93 (10.6)	297	255 (188)	484 (357)	10	1333/132	4556 (1024)	1.0
7.80 (10.5)	189 186	394 (291) 400 (295)	1380 (1018) 1000 (738)	16 16	54839/3456 26071/1620	7567 (1701) 6391 (1437)	1.9 1.4
	125 119	597 (440) 626 (462)	1584 (1168) 2600 (1918)	24 25	24583/1024 64449/2560	8687 (1953) 12135 (2728)	1.4 2.3
7.84 (10.5)	85	881 (650)	2600 (1918)	35	567/16	3276 (736)	1.6
7.80 (10.5)	83 61 60	898 (662) 1218 (898) 1240 (915)	4255 (3139) 4650 (3430) 2600 (1918)	36 49 50	2891/80 5487/112 166005/3328	18045 (4057) 19971 (4490) 15242 (3427)	2.6 2.1 1.1
7.83 (10.5)	46	1626 (1199)	4650 (3430)	65	188387/2880	21991 (4944)	1.5

4

Gearbox size	Motor frame size (shaft height) SH	Bevel geared motors Order No.	Order codes Gearbox type	Type	Type Mounting posit.	Total weight, approx. kg (lb)
K402	100	**1FK7101-5AF71-1 ■■ 5 - Z**	**B41**	**G■■**	**H■■**	59.5 (131)
K402	100	**1FK7101-5AF71-1 ■■ 5 - Z**	**B42**	**G■■**	**H■■**	59.5 (131)
K402	100	**1FK7101-5AF71-1 ■■ 5 - Z**	**B43**	**G■■**	**H■■**	59.5 (131)
K402	100	**1FK7101-5AF71-1 ■■ 5 - Z**	**B44**	**G■■**	**H■■**	59.5 (131)
K513	100	**1FK7101-5AF71-1 ■■ 5 - Z**	**B54**	**G■■**	**H■■**	65.3 (144)
K513	100	**1FK7101-5AF71-1 ■■ 5 - Z**	**B55**	**G■■**	**H■■**	65.3 (144)
K613	100	**1FK7101-5AF71-1 ■■ 5 - Z**	**B65**	**G■■**	**H■■**	86.8 (191)
K613	100	**1FK7101-5AF71-1 ■■ 5 - Z**	**B66**	**G■■**	**H■■**	86.8 (191)
K713	100	**1FK7101-5AF71-1 ■■ 5 - Z**	**B76**	**G■■**	**H■■**	115.1 (254)
K713	100	**1FK7101-5AF71-1 ■■ 5 - Z**	**B77**	**G■■**	**H■■**	115.1 (254)
K713	100	**1FK7101-5AF71-1 ■■ 5 - Z**	**B78**	**G■■**	**H■■**	115.1 (254)
K813	100	**1FK7101-5AF71-1 ■■ 5 - Z**	**B88**	**G■■**	**H■■**	168.5 (372)
K402	100	**1FK7103-5AF71-1 ■■ 5 - Z**	**B41**	**G■■**	**H■■**	66.1 (146)
K402	100	**1FK7103-5AF71-1 ■■ 5 - Z**	**B42**	**G■■**	**H■■**	66.1 (146)
K402	100	**1FK7103-5AF71-1 ■■ 5 - Z**	**B43**	**G■■**	**H■■**	66.1 (146)
K513	100	**1FK7103-5AF71-1 ■■ 5 - Z**	**B53**	**G■■**	**H■■**	71.9 (159)
K513	100	**1FK7103-5AF71-1 ■■ 5 - Z**	**B54**	**G■■**	**H■■**	71.9 (159)
K613	100	**1FK7103-5AF71-1 ■■ 5 - Z**	**B64**	**G■■**	**H■■**	93.4 (206)
K513	100	**1FK7103-5AF71-1 ■■ 5 - Z**	**B55**	**G■■**	**H■■**	71.9 (159)
K613	100	**1FK7103-5AF71-1 ■■ 5 - Z**	**B65**	**G■■**	**H■■**	93.4 (206)
K613	100	**1FK7103-5AF71-1 ■■ 5 - Z**	**B66**	**G■■**	**H■■**	93.4 (206)
K713	100	**1FK7103-5AF71-1 ■■ 5 - Z**	**B76**	**G■■**	**H■■**	121.7 (268)
K713	100	**1FK7103-5AF71-1 ■■ 5 - Z**	**B77**	**G■■**	**H■■**	121.7 (268)
K813	100	**1FK7103-5AF71-1 ■■ 5 - Z**	**B87**	**G■■**	**H■■**	175.1 (386)
K713	100	**1FK7103-5AF71-1 ■■ 5 - Z**	**B78**	**G■■**	**H■■**	121.7 (268)
K813	100	**1FK7103-5AF71-1 ■■ 5 - Z**	**B88**	**G■■**	**H■■**	175.1 (386)
K402	100	**1FK7105-5AF71-1 ■■ 5 - Z**	**B41**	**G■■**	**H■■**	76.1 (168)
K402	100	**1FK7105-5AF71-1 ■■ 5 - Z**	**B42**	**G■■**	**H■■**	76.1 (168)
K513	100	**1FK7105-5AF71-1 ■■ 5 - Z**	**B53**	**G■■**	**H■■**	82.0 (181)
K402	100	**1FK7105-5AF71-1 ■■ 5 - Z**	**B43**	**G■■**	**H■■**	76.1 (168)
K613	100	**1FK7105-5AF71-1 ■■ 5 - Z**	**B64**	**G■■**	**H■■**	103 (227)
K513	100	**1FK7105-5AF71-1 ■■ 5 - Z**	**B54**	**G■■**	**H■■**	82.0 (181)
K613	100	**1FK7105-5AF71-1 ■■ 5 - Z**	**B65**	**G■■**	**H■■**	103 (227)
K713	100	**1FK7105-5AF71-1 ■■ 5 - Z**	**B75**	**G■■**	**H■■**	132 (291)
K713	100	**1FK7105-5AF71-1 ■■ 5 - Z**	**B76**	**G■■**	**H■■**	132 (291)
K813	100	**1FK7105-5AF71-1 ■■ 5 - Z**	**B86**	**G■■**	**H■■**	185 (408)
K813	100	**1FK7105-5AF71-1 ■■ 5 - Z**	**B87**	**G■■**	**H■■**	185 (408)
K713	100	**1FK7105-5AF71-1 ■■ 5 - Z**	**B77**	**G■■**	**H■■**	132 (291)
K813	100	**1FK7105-5AF71-1 ■■ 5 - Z**	**B88**	**G■■**	**H■■**	185 (408)

Encoder systems for motors without DRIVE-CLiQ interface:	Incremental encoder sin/cos 1 V_{pp}	**A**		
	Absolute encoder EnDat 2048 S/R (shaft height 48 and higher)	**E**		
	Absolute encoder EnDat 32 S/R (shaft height 48 and higher)	**G**		
	Resolver, multipole (pole number = pole number for motor)	**S**		
	Resolver, 2-pole	**T**		
Encoder systems for motors with DRIVE-CLiQ interface:	22 bit incremental encoder	**D**		
	22 bit absolute encoder, single-turn +12 bit multi-turn (shaft height 48 and higher)	**F**		
	16 bit absolute encoder, single-turn +12 bit multi-turn (shaft height 48 and higher)	**K**		
	15 bit resolver(number of poles = number of motor poles)	**U**		
	14 bit resolver	**P**		
Holding brake:	Motor **without** holding brake		**U**	
	Motor **with** holding brake		**V**	
Order codes for type, type of construction and mounting position, refer to page 4/110			. .	. .

1FK7 geared servomotors
Worm geared motors

Selection and ordering data

Output (S3 60 %) P_2 kW (HP)	Output speed n_2 rpm	Rated output torque M_2 Nm (lb_f-ft)	Max. permissible acceleration torque M_{2max} Nm (lb_f-ft)	Nominal ratio i_{nom}	Exact ratio i_{exact}	Cantilever force gear shaft extension $F_{rpermiss}$ N (lb_f)	Overload factor f_B
0.28 (0.38)	312 172	8.5 (6.3) 15.3 (11.3)	43 (31.7) 73 (53.8)	9.6 17.5	1107/115 297/17	1689 (380) 1938 (436)	4.1 3.9
0.27 (0.36)	128 86	20.2 (14.9) 30.0 (22.1)	82 (60.5) 125 (92.2)	23 35	117/5 873/25	2271 (511) 2441 (549)	3.3 3.4
0.24 (0.32)	51 52	45.6 (33.6) 45.8 (33.8)	88 (64.9) 172 (126.9)	59 58	117/2 405/7	3082 (693) 2889 (649)	1.6 3.1
	40 43	57.7 (42.6) 54.8 (40.4)	96 (70.8) 184 (136)	75 70	747/10 279/4	3343 (752) 3075 (691)	1.4 2.7
0.38 (0.51)	172 86	21.2 (15.6) 41.6 (30.7)	110 (81.1) 150 (111)	17.5 35	297/17 873/25	1938 (436) 2441 (549)	4.4 3.0
0.35 (0.47)	52 43	63.4 (46.8) 75.9 (56.0)	172 (127) 184 (136)	58 70	405/7 279/4	2889 (649) 3075 (691)	2.3 2.0
0.73 (0.98)	172 130	40.8 (30.1) 53.6 (39.5)	110 (81.1) 132 (97.4)	17.5 23	297/17 162/7	1938 (436) 2128 (478)	2.3 2.1
0.72 (0.97)	86 86	80.1 (59.1) 79.9 (58.9)	150 (111) 252 (186)	35 35	873/25 243/7	2441 (549) 3411 (767)	1.6 2.7
0.66 (0.89)	52	122 (90.0)	172 (127)	58	405/7	2889 (649)	1.2
0.69 (0.93)	52	126 (92.9)	302 (223)	58	1863/32	4053 (911)	2.1
0.66 (0.89)	43	146 (108)	184 (136)	70	279/4	3075 (691)	1.1
0.68 (0.91)	43	151 (111)	324 (239)	70	351/5	4314 (970)	1.9
1.35 (1.81)	326	39.5 (29.1)	74 (54.6)	9.2	46/5	1565 (352)	1.5
1.33 (1.78)	172 171	73.7 (54.4) 74.4 (54.9)	110 (81.1) 217 (160)	17.5 17.5	297/17 351/20	1938 (436) 2717 (611)	1.2 2.3
1.31 (1.76)	129 86 86	97.9 (72.2) 144 (106) 146 (108)	259 (191) 310 (229) 498 (367)	23 35 35	1863/80 243/7 2268/65	2986 (671) 3411 (767) 4881 (1097)	2.1 1.7 2.7
1.24 (1.66)	52 51	227 (167) 232 (171)	302 (233) 561 (414)	58 59	1863/32 117/2	4053 (911) 5799 (1304)	1.0 1.9
	43 43	275 (203) 277 (204)	609 (449) 791 (583)	70 70	2241/32 279/4	6157 (1384) 7994 (1797)	1.7 2.2

4

Gearbox size	Motor frame size (shaft height) SH	Worm geared motors Order No.	Order codes Gearbox type	Type	Type Mounting position	Total weight, approx. kg (lb)
S002 S102	36 36	1FK7032-5AK71-1 ■■ 5 - Z 1FK7032-5AK71-1 ■■ 5 - Z	E03 E14	G■■ G■■	H■■ H■■	6.6 (14.6) 12.9 (28.4)
S002 S102	36 36	1FK7032-5AK71-1 ■■ 5 - Z 1FK7032-5AK71-1 ■■ 5 - Z	E05 E16	G■■ G■■	H■■ H■■	6.6 (14.6) 12.9 (28.4)
S002 S102	36 36	1FK7032-5AK71-1 ■■ 5 - Z 1FK7032-5AK71-1 ■■ 5 - Z	E07 E17	G■■ G■■	H■■ H■■	6.6 (14.6) 12.9 (28.4)
S002 S102	36 36	1FK7032-5AK71-1 ■■ 5 - Z 1FK7032-5AK71-1 ■■ 5 - Z	E08 E18	G■■ G■■	H■■ H■■	6.6 (14.6) 12.9 (28.4)
S102 S102	48 48	1FK7040-5AK71-1 ■■ 5 - Z 1FK7040-5AK71-1 ■■ 5 - Z	E14 E16	G■■ G■■	H■■ H■■	13.7 (30.2) 13.7 (30.2)
S102 S102	48 48	1FK7040-5AK71-1 ■■ 5 - Z 1FK7040-5AK71-1 ■■ 5 - Z	E17 E18	G■■ G■■	H■■ H■■	13.7 (30.2) 13.7 (30.2)
S102 S102	48 48	1FK7042-5AF71-1 ■■ 5 - Z 1FK7042-5AF71-1 ■■ 5 - Z	E14 E15	G■■ G■■	H■■ H■■	15.0 (33.1) 15.0 (33.1)
S102 S202	48 48	1FK7042-5AF71-1 ■■ 5 - Z 1FK7042-5AF71-1 ■■ 5 - Z	E16 E26	G■■ G■■	H■■ H■■	15.0 (33.1) 22.5 (49.6)
S102	48	1FK7042-5AF71-1 ■■ 5 - Z	E17	G■■	H■■	15.0 (33.1)
S202	48	1FK7042-5AF71-1 ■■ 5 - Z	E27	G■■	H■■	22.5 (49.6)
S102	48	1FK7042-5AF71-1 ■■ 5 - Z	E18	G■■	H■■	15.0 (33.1)
S202	48	1FK7042-5AF71-1 ■■ 5 - Z	E28	G■■	H■■	22.5 (49.6)
S102	63	1FK7060-5AF71-1 ■■ 5 - Z	E13	G■■	H■■	17.7 (39.0)
S102 S202	63 63	1FK7060-5AF71-1 ■■ 5 - Z 1FK7060-5AF71-1 ■■ 5 - Z	E14 E24	G■■ G■■	H■■ H■■	17.7 (39.0) 25.2 (55.6)
S202 S202 S302	63 63 63	1FK7060-5AF71-1 ■■ 5 - Z 1FK7060-5AF71-1 ■■ 5 - Z 1FK7060-5AF71-1 ■■ 5 - Z	E25 E26 E36	G■■ G■■ G■■	H■■ H■■ H■■	25.2 (55.6) 25.2 (55.6) 34.4 (75.9)
S202 S302	63 63	1FK7060-5AF71-1 ■■ 5 - Z 1FK7060-5AF71-1 ■■ 5 - Z	E27 E37	G■■ G■■	H■■ H■■	25.2 (55.6) 34.4 (75.9)
S302 S402	63 63	1FK7060-5AF71-1 ■■ 5 - Z 1FK7060-5AF71-1 ■■ 5 - Z	E38 E48	G■■ G■■	H■■ H■■	34.4 (75.9) 43.6 (96.1)

Encoder systems for motors without DRIVE-CLiQ interface:	Incremental encoder sin/cos 1 V_{pp}	A				
	Absolute encoder EnDat 2048 S/R (shaft height 48 and higher)	E				
	Absolute encoder EnDat 512 S/R (only shaft height 36)	H				
	Absolute encoder EnDat 32 S/R (shaft height 48 and higher)	G				
	Absolute encoder EnDat 16 S/R (only shaft height 36)	J				
	Resolver, multi-pole (pole number = pole number for motor)	S				
	Resolver, 2-pole	T				
Encoder systems for motors with DRIVE-CLiQ interface:	22 bit incremental encoder	D				
	22 bit absolute encoder, single-turn +12 bit multi-turn (shaft height 48 and higher)	F				
	20 bit absolute encoder, single-turn +12 bit multi-turn (only shaft height 36)	L				
	16 bit absolute encoder, single-turn +12 bit multi-turn (shaft height 48 and higher)	K				
	15 bit absolute encoder, single-turn +12 bit multi-turn (only shaft height 36)	V				
	15 bit resolver (number of poles = number of motor poles)	U				
	14 bit resolver	P				
Holding brake:	Motor **without** holding brake		U			
	Motor **with** holding brake		V			
Order codes for type, type of construction and mounting position, refer to page 4/110				.	.	. .

1FK7 geared servomotors
Worm geared motors

Selection and ordering data

Output (S3 60 %) P_2 kW (HP)	Output speed n_2 rpm	Rated output torque M_2 Nm (lb_f-ft)	Max. permissible acceleration torque M_{2max} Nm (lb_f-ft)	Nominal ratio i_{nom}	Exact ratio i_{exact}	Cantilever force gear shaft extension $F_{rpermiss}$ N (lb_f)	Overload factor f_B
2.11 (2.83)	325	61.9 (45.7)	126 (92.9)	9.2	1431/155	2194 (493)	1.4
2.08 (2.79)	171	116 (85.6)	217 (160)	17.5	351/20	2717 (611)	1.2
2.05 (2.75)	129 86	152 (112) 227 (167)	259 (191) 498 (367)	23 35	1863/80 2268/65	2986 (671) 4881 (1097)	1.1 1.5
1.92 (2.57)	51	360 (266)	561 (414)	59	117/2	5799 (1304)	1.0
1.94 (2.60)	43	430 (317)	791 (583)	70	279/4	7994 (1797)	1.2
1.93 (2.59)	171	108 (79.7)	217 (160)	17.5	351/20	2717 (611)	1.7
	173 129	107 (78.9) 142 (105)	373 (275) 259 (191)	17.5 23	1998/115 1863/80	3869 (870) 2986 (671)	3.0 1.6
	128 86	144 (106) 213 (157)	458 (338) 720 (531)	23 35	117/5 873/25	4273 (961) 6347 (1427)	2.7 2.9
1.79 (2.40)	51 43	335 (247) 399 (294)	561 (414) 609 (449)	59 70	117/2 2241/32	5799 (1304) 6157 (1384)	1.4 1.3
3.05 (4.09)	322	90.5 (66.8)	216 (159)	9.3	270/29	3143 (707)	1.6
3.01 (4.04)	173	166 (122)	373 (275)	17.5	1998/115	3869 (870)	1.5
3.03 (4.06)	172	168 (124)	557 (411)	17.5	612/35	5040 (1133)	2.2
2.98 (4.00)	128 128	222 (164) 222 (164)	458 (338) 685 (505)	23 23	117/5 117/5	4273 (961) 5554 (1249)	1.4 2.0
2.95 (3.96)	86	328 (242)	720 (531)	35	873/25	6347 (1427)	1.4
3.47 (4.65)	259	128 (94.4)	371 (274)	11.5	81/7	4392 (987)	1.9
3.44 (4.61)	172	191 (141)	557 (411)	17.5	612/35	5040 (1133)	1.9
4.50 (6.03)	259	166 (122)	371 (274)	11.5	81/7	4392 (987)	1.3
4.45 (5.97)	172	247 (182)	557 (411)	17.5	612/35	5040 (1133)	1.3

4

Gearbox size	Motor frame size (shaft height) SH	Worm geared motors Order No.	Order codes Gearbox type	Type	Type Mounting posit.	Total weight, approx. kg (lb)
S202	63	**1FK7063-5AF71-1 ■■ 5 - Z**	**E23**	**G■■**	**H■■**	28.9 (63.7)
S202	63	**1FK7063-5AF71-1 ■■ 5 - Z**	**E24**	**G■■**	**H■■**	28.9 (63.7)
S202	63	**1FK7063-5AF71-1 ■■ 5 - Z**	**E25**	**G■■**	**H■■**	28.9 (63.7)
S302	63	**1FK7063-5AF71-1 ■■ 5 - Z**	**E36**	**G■■**	**H■■**	38.1 (84.0)
S302	63	**1FK7063-5AF71-1 ■■ 5 - Z**	**E37**	**G■■**	**H■■**	38.1 (84.0)
S402	63	**1FK7063-5AF71-1 ■■ 5 - Z**	**E48**	**G■■**	**H■■**	47.3 (104)
S202	80	**1FK7080-5AF71-1 ■■ 5 - Z**	**E24**	**G■■**	**H■■**	28.6 (63.1)
S302	80	**1FK7080-5AF71-1 ■■ 5 - Z**	**E34**	**G■■**	**H■■**	37.8 (83.4)
S202	80	**1FK7080-5AF71-1 ■■ 5 - Z**	**E25**	**G■■**	**H■■**	28.6 (63.1)
S302	80	**1FK7080-5AF71-1 ■■ 5 - Z**	**E35**	**G■■**	**H■■**	37.8 (83.4)
S402	80	**1FK7080-5AF71-1 ■■ 5 - Z**	**E46**	**G■■**	**H■■**	47 (104)
S302	80	**1FK7080-5AF71-1 ■■ 5 - Z**	**E37**	**G■■**	**H■■**	37.8 (83.4)
S302	80	**1FK7080-5AF71-1 ■■ 5 - Z**	**E38**	**G■■**	**H■■**	37.8 (83.4)
S302	80	**1FK7083-5AF71-1 ■■ 5 - Z**	**E33**	**G■■**	**H■■**	43 (94.8)
S302	80	**1FK7083-5AF71-1 ■■ 5 - Z**	**E34**	**G■■**	**H■■**	43 (94.8)
S402	80	**1FK7083-5AF71-1 ■■ 5 - Z**	**E44**	**G■■**	**H■■**	52.2 (115)
S302	80	**1FK7083-5AF71-1 ■■ 5 - Z**	**E35**	**G■■**	**H■■**	43 (94.8)
S402	80	**1FK7083-5AF71-1 ■■ 5 - Z**	**E45**	**G■■**	**H■■**	52.2 (115)
S402	80	**1FK7083-5AF71-1 ■■ 5 - Z**	**E46**	**G■■**	**H■■**	52.2 (115)
S402	100	**1FK7100-5AF71-1 ■■ 5 - Z**	**E43**	**G■■**	**H■■**	54.4 (120)
S402	100	**1FK7100-5AF71-1 ■■ 5 - Z**	**E44**	**G■■**	**H■■**	54.4 (120)
S402	100	**1FK7101-5AF71-1 ■■ 5 - Z**	**E43**	**G■■**	**H■■**	60 (132)
S402	100	**1FK7101-5AF71-1 ■■ 5 - Z**	**E44**	**G■■**	**H■■**	60 (132)

Encoder systems for motors without DRIVE-CLiQ interface:	Incremental encoder sin/cos 1 V_{pp}	**A**		
	Absolute encoder EnDat 2048 S/R (shaft height 48 and higher)	**E**		
	Absolute encoder EnDat 32 S/R (shaft height 48 and higher)	**G**		
	Resolver, multipole (pole number = pole number for motor)	**S**		
	Resolver, 2-pole	**T**		
Encoder systems for motors with DRIVE-CLiQ interface:	22 bit incremental encoder	**D**		
	22 bit absolute encoder, single-turn +12 bit multi-turn (shaft height 48 and higher)	**F**		
	16 bit absolute encoder, single-turn +12 bit multi-turn (shaft height 48 and higher)	**K**		
	15 bit resolver(number of poles = number of motor poles)	**U**		
	14 bit resolver	**P**		
Holding brake:	Motor **without** holding brake		**U**	
	Motor **with** holding brake		**V**	
Order codes for type, type of construction and mounting position, refer to page 4/110				. . . .

1FK7 geared servomotors

Selection and ordering data

Order codes for 1FK7 geared servomotors

Order No. geared motor + Order codes

1FK7 . . . - . 5A . 71 - 1 . . 5 - Z ■ ■ ■ **G** ■ ■ **H** ■ ■

1st order code, gearbox type

• Bevel gear unit K 102 to K 813	**B**
• Offset-shaft gear unit F 202 to F 602	**C**
• Helical gear unit C 002 to C 812	**D**
• Worm gear unit S 002 to S 402	**E**

For complete order code for gear type, see selection and ordering data on pages 3/80 to 3/101

2nd order code, 1st and 2nd positions: Type

• Foot-mounted	**G 1**
• Tapped hole group	**G 2**
• Flange (round)	**G 3**
• Foot-mounted and flange (round)	**G 5**
• Foot-mounted and tapped hole group	**G 6**

2nd order code, 3rd position: Gear shaft extension

Helical gear unit:	Offset-shaft gear unit:	For bevel and worm gear units:	
• Solid shaft with fitted key	• Solid shaft with fitted key, gearbox side 5	• Solid shaft with fitted key, gearbox side 4	**1**
	• Hollow shaft with keyway, insertion side 5	• Hollow shaft with keyway, insertion side 4	**3**
	• Hollow shaft with shrink disk, shrink disk side 6, insertion side 5	• Hollow shaft with shrink disk, shrink disk side 4, insertion side 3	**4**
		• Solid shaft with fitted key, gearbox side 3	**5**
		• Hollow shaft with keyway, insertion side 3	**7**
		• Hollow shaft with shrink disk, shrink disk side 3, insertion side 4	**8**

3rd order code, 1st and 2nd positions: Type/mounting position

Type for Helical gear unit:	Mounting position for Offset shaft, bevel and worm gear units:	
• IM B3 / IM B5 / IM B14 / IM B34 / IM B35	• EL 1	**H 1**
• IM B7	• EL 2	**H 2**
• IM B8	• EL 3	**H 3**
• IM B6	• EL 4	**H 4**
• IM V1	• EL 5	**H 5**
• IM V3 / IM V6 / IM V19	• EL 6	**H 6**
• IM V5	–	**H 7**
• IM V18	–	**H 8**

3rd order code, 3rd position: Connector mounting position

• Connector position on gearbox side 2	**1**
• Connector position on gearbox side 4	**2**
• Connector position on gearbox side 1	**3**
• Connector position on gearbox side 3	**4**

4

Selection and ordering data

Order codes for 1FK7 geared servomotors

Order No. geared motor + Order codes

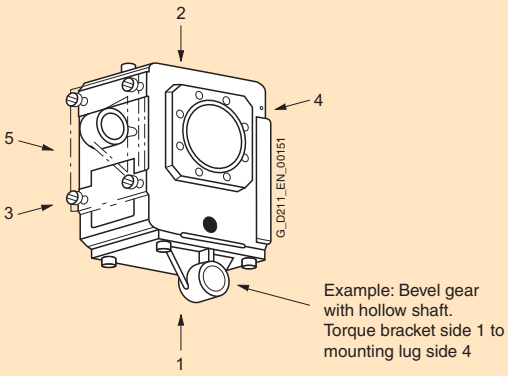
			Q ■ ■	and G 2	or ■ [1]	G 2 ■ [1]
4th order code, torque bracket for bevel (K) and worm gear units (S)						
Torque bracket position		**Gear unit type and size**				
Torque bracket	Side 1, eye side 4	K 102, S 102	Q 1 2	G 2	3	G 2 8
	Side 1, eye side 3	K 102, S 102	Q 1 3	G 2	7	G 2 4
	Side 5, eye side 4	K 102, S 102	Q 1 4	G 2	3	G 2 8
	Side 5, eye side 3	K 102, S 102	Q 1 5	G 2	7	G 2 4
	Side 2, eye side 4	K 102	Q 1 6	G 2	3	G 2 8
	Side 2, eye side 3	K 102	Q 1 7	G 2	7	G 2 4
Torque bracket	Side 1, eye side 4	K 202, S 202	Q 2 2	G 2	3	G 2 8
	Side 1, eye side 3	K 202, S 202	Q 2 3	G 2	7	G 2 4
	Side 5, eye side 4	K 202, S 202	Q 2 4	G 2	3	G 2 8
	Side 5, eye side 3	K 202, S 202	Q 2 5	G 2	7	G 2 4
Torque bracket	Side 1, eye side 4	K 302, S 302	Q 3 2	G 2	3	G 2 8
	Side 1, eye side 3	K 302, S 302	Q 3 3	G 2	7	G 2 4
	Side 5, eye side 4	K 302, S 302	Q 3 4	G 2	3	G 2 8
	Side 5, eye side 3	K 302, S 302	Q 3 5	G 2	7	G 2 4
Torque bracket	Side 1, eye side 4	K 402, S 402	Q 4 2	G 2	3	G 2 8
	Side 1, eye side 3	K 402, S 402	Q 4 3	G 2	7	G 2 4
	Side 5, eye side 4	K 402, S 402	Q 4 4	G 2	3	G 2 8
	Side 5, eye side 3	K 402, S 402	Q 4 5	G 2	7	G 2 4
Torque bracket	Side 1, eye side 4	K 513	Q 5 2	G 2	3	G 2 8
	Side 1, eye side 3	K 513	Q 5 3	G 2	7	G 2 4
	Side 5, eye side 4	K 513	Q 5 4	G 2	3	G 2 8
	Side 5, eye side 3	K 513	Q 5 5	G 2	7	G 2 4
Torque bracket	Side 1, eye side 4	K 613	Q 6 2	G 2	3	G 2 8
	Side 1, eye side 3	K 613	Q 6 3	G 2	7	G 2 4
	Side 5, eye side 4	K 613	Q 6 4	G 2	3	G 2 8
	Side 5, eye side 3	K 613	Q 6 5	G 2	7	G 2 4
Torque bracket	Side 1, eye side 4	K 713	Q 7 2	G 2	3	G 2 8
	Side 1, eye side 3	K 713	Q 7 3	G 2	7	G 2 4
	Side 5, eye side 4	K 713	Q 7 4	G 2	3	G 2 8
	Side 5, eye side 3	K 713	Q 7 5	G 2	7	G 2 4
Torque bracket	Side 1, eye side 4	K 813	Q 8 2	G 2	3	G 2 8
	Side 1, eye side 3	K 813	Q 8 3	G 2	7	G 2 4
	Side 5, eye side 4	K 813	Q 8 4	G 2	3	G 2 8
	Side 5, eye side 3	K 813	Q 8 5	G 2	7	G 2 4

[1] Options **Q12** to **Q85** can be combined only with the following order codes:
B.. or **E..** with **G23** or **G24** or **G27** or **G28**

1FK7 geared servomotors

Selection and ordering data

5. order code, other options			
Paint finish, jet black RAL 9005	X	0	1
Paint finish, cream RAL 9001	X	0	2
Paint finish, reseda green RAL 6011	X	0	3
Paint finish, pebble gray RAL 7032	X	0	4
Paint finish, sky blue RAL 5015	X	0	5
Paint finish, light ivory RAL 1015	X	0	6
Paint finish, ash gray RAL 7000	X	0	7
Paint finish, white aluminum RAL 9006	X	0	8
Paint finish, gentian blue RAL 5010	X	1	2
Paint finish, pure orange RAL 2004	X	1	9
Food-grade gear oil (1FK7... - 5A.71 - 1...**7** - Z)	Q	9	0



View of gear sides with location of torque bracket and position of mounting lug

Overview of possible combinations of option Gxx with Hxx and Qxx

		Gear type				Permissible H options		
		Helical	Offset shaft	Bevel	Worm	Permissible H option for helical gear	Permissible H option for offset shaft	Permissible H option for bevel and worm
Description of options		**Order code for option Gxx**				**Order code for option Hxx**		
G11	Foot-mounted, solid shaft with fitted key	✔				**H1x to H4x, H6x, H7x**		
G13	Footed-mounted, hollow shaft with keyway (insertion gearbox side 4)							
G14	Footed-mounted, hollow shaft with shrink disk (insertion gearbox side 4)							
G15	Foot-mounted, solid shaft with fitted key (gearbox side 3)							
G17	Footed-mounted, hollow shaft with keyway (insertion gearbox side 3)							
G18	Footed-mounted, hollow shaft with shrink disk (gearbox side 3)							
G21	Tapped hole group, solid shaft with keyway (gearbox side 4 for bevel and worm)	✔		✔	✔ [1]	**H1x, H6x, H8x**		**H1x to H6x**
G23	Tapped hole group, solid shaft with keyway (insertion gearbox side 5 for offset shaft, insertion gearbox side 4 for bevel and worm)		✔	✔	✔ [1]		**H1x to H6x**	**H1x to H6x, Qxx**
G24	Tapped hole group, hollow shaft with shrink disk (shrink disk on gearbox side 6 and insertion side 5 for offset-shaft gear unit; shrink disk on gearbox side 4 and insertion side 3 for bevel and worm)		✔	✔	✔ [1]			
G25	Tapped hole group, solid shaft with fitted key (gearbox side 3)			✔	✔ [1]			**H1x to H6x**
G27	Tapped hole group, hollow shaft with fitted key (insertion gearbox side 3)			✔	✔ [1]			**H1x to H6x, Qxx**
G28	Tapped hole group, hollow shaft with shrink disk (shrink disk on gearbox side 3 and insertion side 4 for bevel and worm)			✔	✔ [1]			
G31	Flange (round), solid shaft with fitted key (gearbox side 5 for offset-shaft gear unit; side 4 for bevel and worm)	✔	✔	✔	✔ [1]	**H1x, H5x, H6x**	**H1x to H6x**	**H1x to H6x**
G33	Flange (round), hollow shaft with keyway (insertion gearbox side 4)		✔	✔	✔ [1]			
G34	Flange (round), hollow shaft with shrink disk, shrink disk on gearbox side 6 and insertion side 5 for offset-shaft gear unit; shrink disk on gearbox side 4 and insertion side 3 for bevel and worm)		✔	✔	✔ [1]			
G35	Flange (round), solid shaft with fitted key (gearbox side 3)			✔	✔ [1]			
G37	Flange (round), hollow shaft with keyway (insertion gearbox side 3)			✔	✔ [1]			
G38	Flange (round), hollow shaft with shrink disk (shrink disk on gearbox side 3 and insertion side 4 for bevel and worm)			✔	✔			

Qxx: New options, torque bracket
H2x: construction type IM B7 for helical gear units

[1] Not for worm gear size S002 (E0x).

1FK7 geared servomotors

Overview of possible combinations of option Gxx with Hxx and Qxx

		Gear type				Permissible H options		
		Helical	Parallel shaft	Bevel	Worm	Permissible H option for helical gear	Permissible H option for offset-shaft	Permissible H option for bevel and worm
Description of options		**Order code for option Gxx**				**Order code for option Hxx**		
G51	Foot-mounted and flange (round), solid shaft with fitted key (gearbox side 4 for bevel and worm)	✔ 1)		✔ 2)	✔	**H1x, H2x**		**H1x to H6x**
G53	Foot-mounted and flange (round), hollow shaft with keyway (insertion gearbox side 4)			✔ 2)	✔			
G54	Foot-mounted and flange (round), hollow shaft with shrink disk (shrink disk on gearbox side 4 and insertion side 4 for bevel and worm)			✔ 2)	✔			
G55	Foot-mounted and flange (round), solid shaft with fitted key (gearbox side 3)			✔ 2)	✔			
G57	Foot-mounted and flange (round), hollow shaft with keyway (insertion gearbox side 3)			✔ 2)	✔			
G58	Foot-mounted and flange (round), hollow shaft with shrink disk (shrink disk on gearbox side 3 and insertion side 4 for bevel and worm)			✔ 2)	✔			
G61	Foot-mounted and tapped hole group, solid shaft with fitted key (gearbox side 4 for bevel and worm)	✔		✔	✔	**H1x, H2x**		**H1x to H6x**
G63	Foot-mounted and tapped hole group, hollow shaft with keyway (insertion gearbox side 4)			✔	✔			
G64	Foot-mounted and tapped hole group, hollow shaft with shrink disk (shrink disk on gearbox side 4 and insertion side 4 for bevel and worm)			✔	✔			
G65	Foot-mounted and tapped hole group, solid shaft with fitted key (gearbox side 3)			✔	✔			
G67	Foot-mounted and tapped hole group, hollow shaft with keyway (insertion gearbox side 3)			✔	✔			
G68	Foot-mounted and tapped hole group, hollow shaft with shrink disk (shrink disk on gearbox side 3 and insertion side 4 for bevel and worm)			✔	✔			

Qxx: New options, torque bracket
H2x: construction type IM B7 for helical gear units

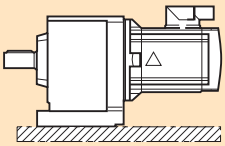
1) The flange diameter for helical gear units with foot mounting and flange is one diameter grade smaller in each case than the diameter for helical units with flange only (without foot mounting).

2) Only for 1FK706. to 1FK10. with gear size K 513 to K 813 (B5x to B8x).

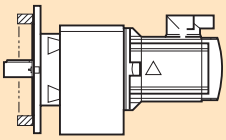
Selection and ordering data

Helical geared motors – Types

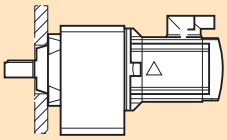
IM B3



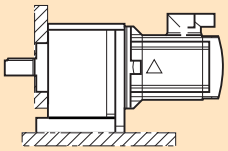
IM B5



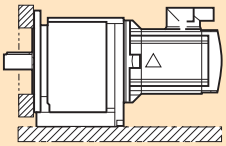
IM B14



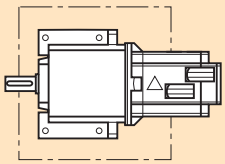
IM B34



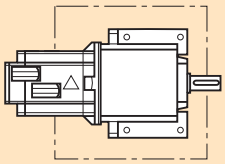
IM B35



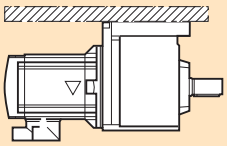
IM B6



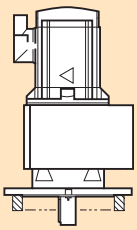
IM B7



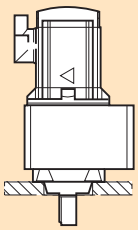
IM B8



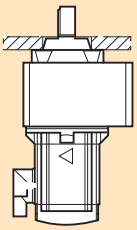
IM V1



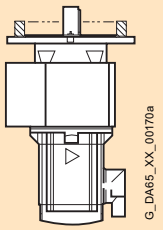
IM V18



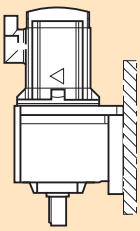
IM V19



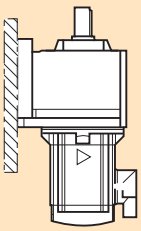
IM V3



IM V5



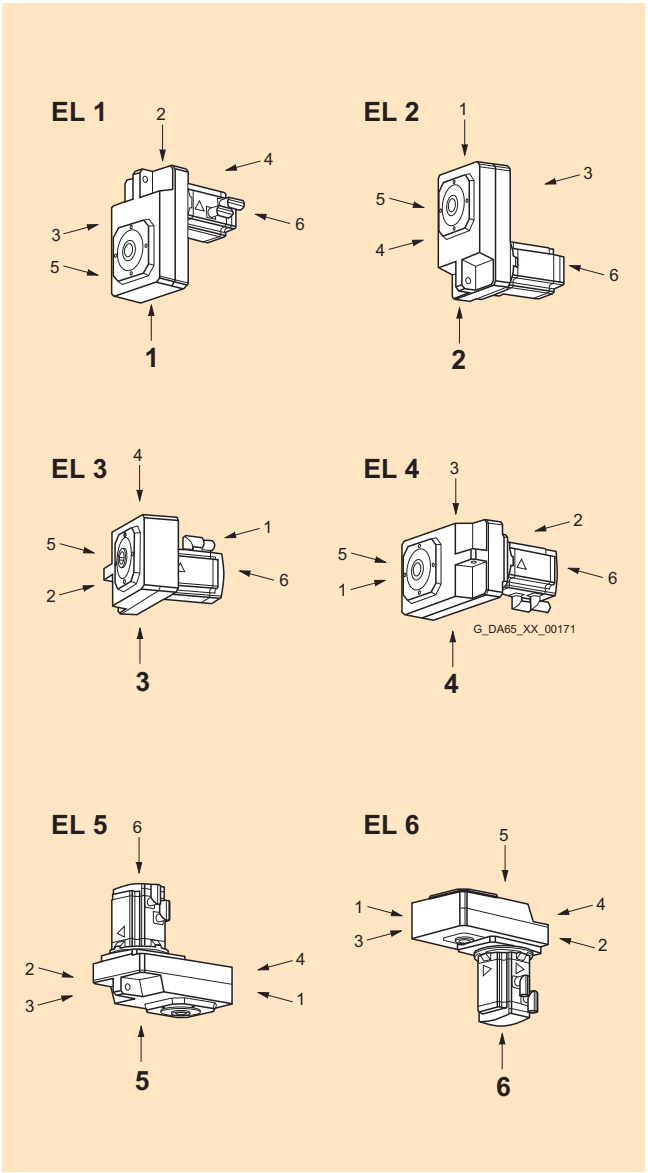
IM V6



4

Selection and ordering data

Offset-shaft geared motors – Mounting positions EL 1 to EL 6

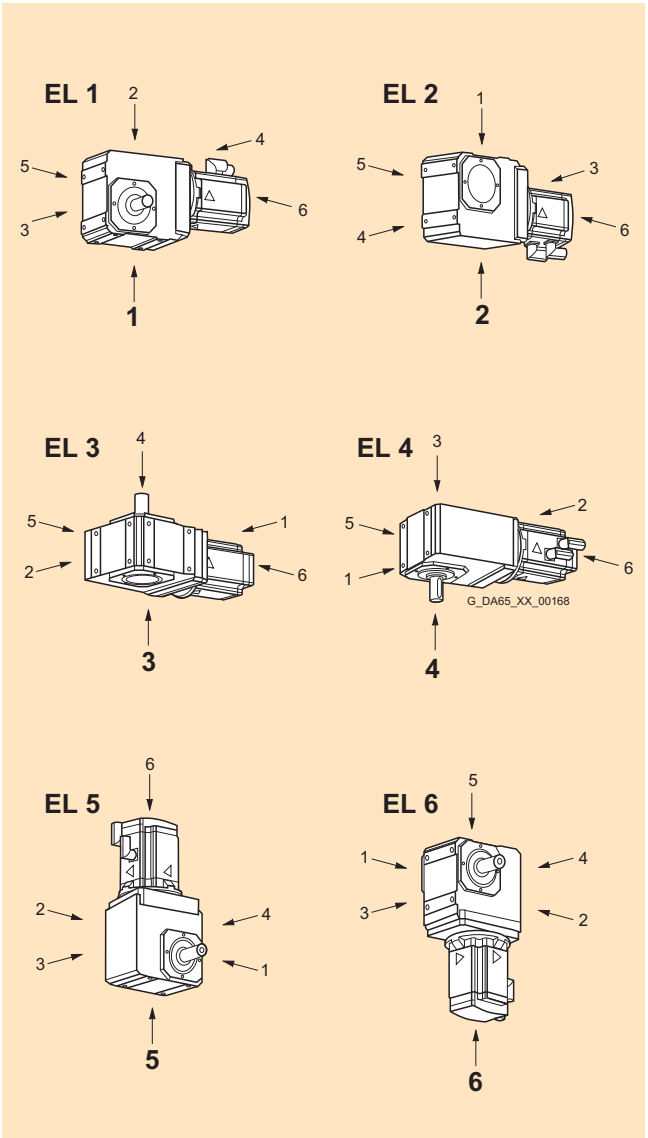


4

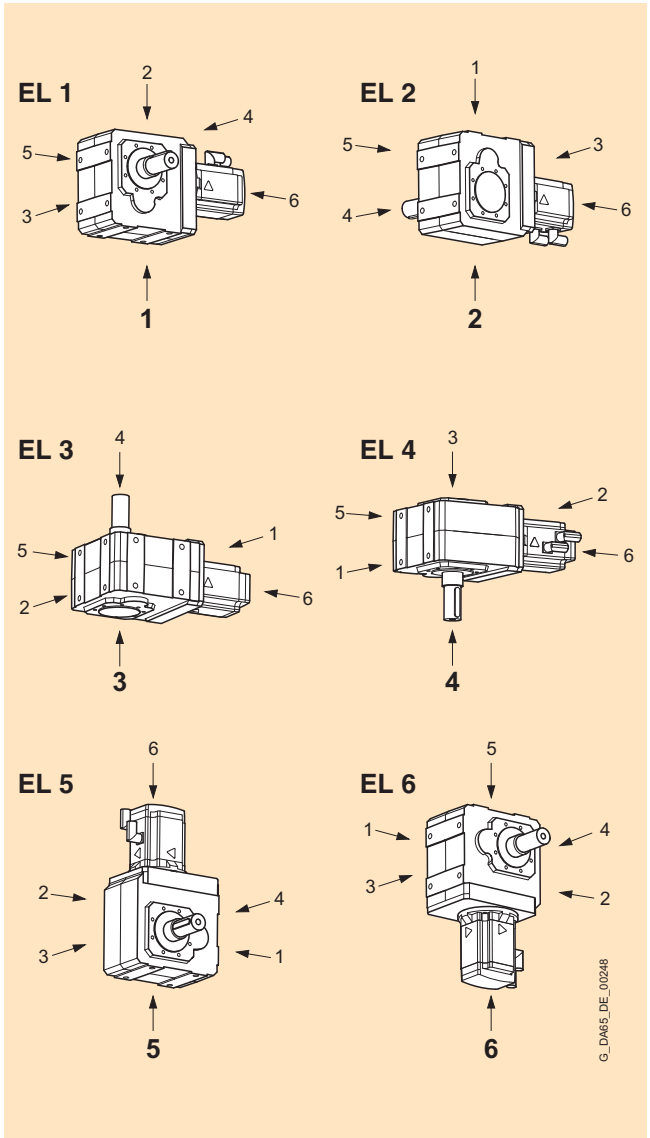
Selection and ordering data

Bevel geared motors – Mounting positions EL 1 to EL 6

Gearbox sizes K1 to K4



Gearbox sizes K5 to K8

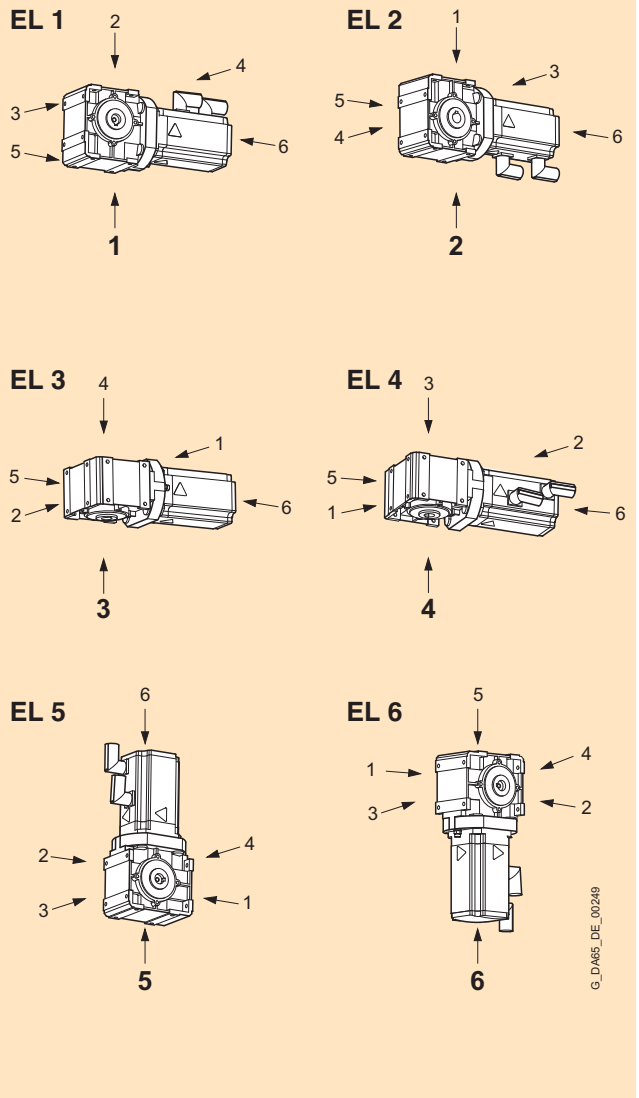


1FK7 geared servomotors

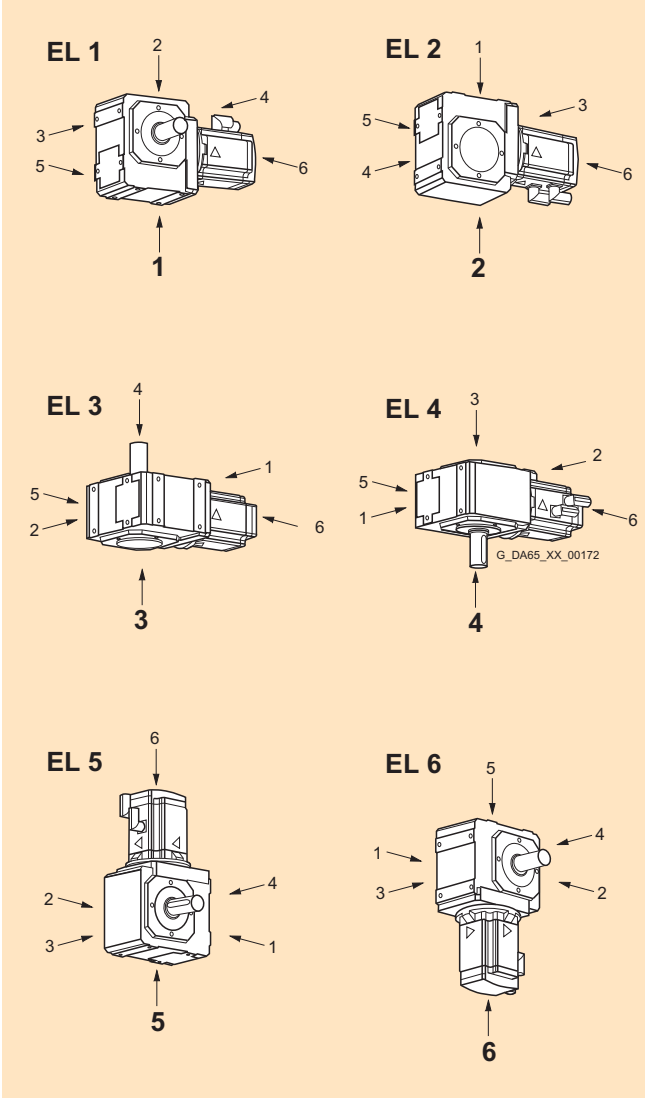
Selection and ordering data

Worm geared motors – Mounting positions EL 1 to EL 6

Gearbox size S0

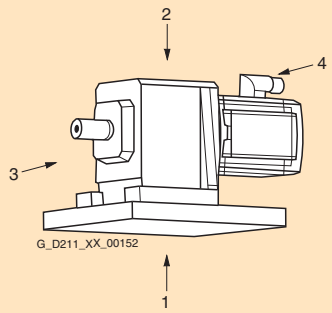


Gearbox sizes S1 to S4



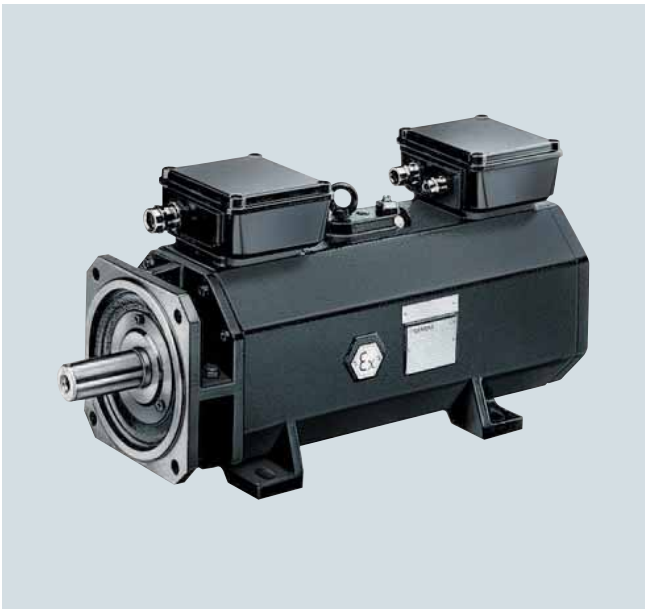
Selection and ordering data

Connector mounting position



1FS6 motors, explosion-protected Natural cooling

Overview



1FS6 explosion-protected synchronous servomotors

1FS6 motors are permanent-magnet synchronous motors for use in Zone 1 hazardous areas.

They are designed in compliance with the EEx de IIC T3 type of protection, certified according to ATEX guidelines 94/9/EG, and also have CSA approval for Class 1, Zone 1, Temperature Class T3 (CAN/CSA-79-1-95 "Flameproof enclosure")

In addition to compliance with the ATEX guidelines, the motors also comply with the applicable standards and regulations for hazardous environments:

- IEC EN 60079-0
  General Conditions for Electrical Equipment for Potentially Explosive Atmospheres
- IEC EN 60079-1
  Standard referring to EEx d type of protection
- IEC EN 60079-7
  Standard referring to EEx e type of protection
- IEC EN 60079-15
  Standard referring to Ex nA type of protection

1FS6 motors can be combined with the SINAMICS S120 drive system to create a powerful, high-performance system. 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.

Benefits

- Winding insulation for temperature class 180 (H)
- High cantilever load
- Naturally cooled motors with terminal box for power connection
- Additional terminal box for connection of encoder system and temperature sensors
- Monitoring of motor temperature with KTY 84-130 and PTC thermistor (triggering device must be certified according to test mark PTB 3x PTC-01 ATEX 3218, e.g. SIMIREL 3RN10 thermistor motor protection)

Applications

1FS6 motors with explosion protection are suitable for operation in Zone 1 hazardous areas in any industrial sector or machine type, including, for example in:

- Flexographic printing and platen-printing machines
- Filling plants with potentially explosive vapors
- Film coating plants

Technical specifications

Type of motor	AC servomotor (permanent-magnet synchronous motor)
Magnet material	Rare-earth magnet material
Insulation of the stator winding in accordance with EN 60034-1 (IEC 60034-1)	Temperature class 180 (H) for a winding temperature rise of ΔT = 100 K at an ambient temperature of 40 °C (104 °F).
Cooling	Natural cooling
Temperature monitoring	3 x PTC thermistors + KTY 84 temperature sensor in stator winding
Type according to EN 60034-7 (IEC 60034-7)	IM B5 (1FS6074 and 1FS6096) IM B35 (1FS6115 and 1FS6134)
Degree of protection according to EN 60034-5 (IEC 60034-5)	IP64
Shaft extension on the drive end according to DIN 748-3 (IEC 60072-1)	Plain shaft
Shaft and flange accuracy according to DIN 42955 (IEC 60072-1) [1]	Tolerance N (normal)
Vibration magnitude in accordance with EN 60034-14 (IEC 60034-14)	Grade N (normal)
Bearings	Permanently lubricated deep-groove ball bearings
Built-in encoder systems	• Incremental encoder sin/cos 1 V_{pp} 2048 S/R • Absolute encoder EnDat 2048 S/R [2]
Connection	2 terminal boxes
Paint finish	Anthracite RAL 7016
Options	• Shaft extension with fitted key and keyway (half-key balancing) • Shaft and flange accuracy Tolerance R • IP65 degree of protection with radial shaft seal

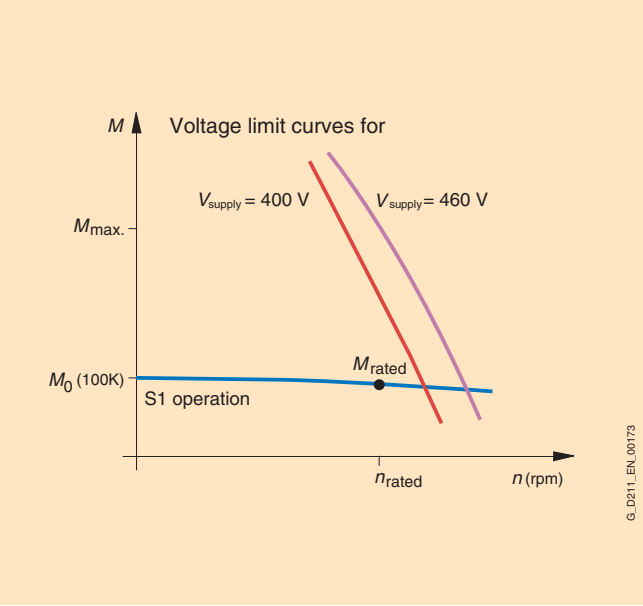
S/R = signals/revolution

Notice

A PTC thermistor triggering device, such as SIMIREL 3RN10 thermistor motor protection, is mandatory for operating these machines in potentially explosive environments.
The connection cables must be able to withstand temperatures of at least +100 °C (+212 °F).

The motors can be connected to the SINAMICS S120 drive system only by way of a terminal box. It is not permissible to use connector plugs in Zone 1 areas. Encoders must be connected by means of an SMC20 Sensor Module Cabinet-Mounted.

Characteristics



Speed/torque characteristic

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

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

1FS6 motors, explosion-protected Natural cooling

Selection and ordering data

Rated speed n_{rated} rpm	Shaft height SH	Rated power P_{rated} at ΔT=100 K kW (HP)	Rated torque [1] M_{rated} at ΔT=100 K Nm (lb_f-ft)	Rated current I_{rated} at ΔT=100 K A	Static torque M_0 at ΔT=100 K Nm (lb_f-ft)	**1FS6 synchronous motors Explosion-protected Natural cooling** Order No.	Number of pole pairs	Rotor moment of inertia (without brake) J 10^{-4} kgm^2 (10^{-3} lb_f-in-s^2)	Weight (without brake) kg (lb)
1500	112	5.8 (7.78)	37 (27.3)	13	40 (29.5)	**1FS6115-8AB73-■■■■**	4	168 (149)	87 (192)
	132	10.7 (14.4)	68 (50.2)	22	76 (56.1)	**1FS6134-6AB73-■■■■**	3	547 (484)	149 (329)
2000	71	1.5 (2.01)	7.2 (5.30)	3.4	7.6 (5.61)	**1FS6074-6AC71-■■■■**	3	13 (11.5)	29 (64.0)
	90	4.2 (5.63)	20 (14.8)	9.8	22 (16.2)	**1FS6096-8AC71-■■■■**	4	66.5 (58.9)	55 (121)
	112	7.1 (9.52)	34 (25.1)	16	40 (29.5)	**1FS6115-8AC73-■■■■**	4	168 (149)	87 (192)
	132	12.4 (16.6)	59 (43.5)	24	76 (56.1)	**1FS6134-6AC73-■■■■**	3	547 (484)	149 (329)
3000	71	2.0 (2.68)	6.3 (4.60)	4.4	7.6 (5.61)	**1FS6074-6AF71-■■■■**	3	13 (11.5)	29 (64.0)
	90	5.3 (7.11)	17 (12.5)	12	22 (16.2)	**1FS6096-8AF71-■■■■**	4	66.5 (58.9)	55 (121)
	112	8.8 (11.8)	28 (20.7)	20	40 (29.5)	**1FS6115-8AF73-■■■■**	4	168 (149)	87 (192)
4500	71	2.1 (2.82)	4.5 (3.30)	5.0	7.6 (5.61)	**1FS6074-6AH71-■■■■**	3	13 (11.5)	29 (64.0)
	90	5.2 (6.97)	11 (8.10)	11.5	22 (16.2)	**1FS6096-8AH71-■■■■**	4	66.5 (58.9)	55 (121)
6000	71	1.2 (1.61)	1.9 (1.40)	3.2	7.6 (5.61)	**1FS6074-6AK71-■■■■**	3	13 (11.5)	29 (64.0)

Type:	IM B5 (only for 1FS607 and 1FS609) IM B35 (only for 1FS611 and 1FS613)	**1** **3**
Terminal box for power and encoder connection:	Cable entry transverse right Cable entry transverse left Cable entry axial NDE Cable entry axial DE	**5** **6** **7** **8**
Encoder system without DRIVE-CLiQ interface:	Incremental encoder sin/cos 1 V_{pp}, 2048 S/R Absolute encoder EnDat 2048 S/R [1]	**A** **E**
Shaft extension: Plain shaft Fitted key and keyway Plain shaft Fitted key and keyway	**Shaft and flange accuracy:** Tolerance N Tolerance N Tolerance R Tolerance R	**G** **A** **K** **D**
Vibration magnitude: Grade N Grade N	**Degree of protection:** IP64 IP65 with radial shaft seal	**0** **1**

Selection and ordering data

Motor type (continued)	Static current	SINAMICS S120 Motor Module		Power cable with complete shield	
		Rated current	Booksize format	Motor connection via terminal box	
	I_0 at ΔT=100 K	I_{rated}	Order No.	Cable cross-section [2]	Order No. Pre-assembled cable without connector, prepared wire end
	A	A		mm^2	
1FS6115-8AB73-....	13	18	**6SL312■-■TE21-8AA3**	4 x 1.5	**6FX5002-5XA00-....**
1FS6134-6AB73-....	22	30	**6SL312■-1TE23-0AA3**	4 x 4	**6FX5002-5XA20-....**
1FS6074-6AC71-....	3.4	5	**6SL312■-■TE15-0AA3**	4 x 1.5	**6FX5002-5XA00-....**
1FS6096-8AC71-....	9.2	18	**6SL312■-■TE21-8AA3**	4 x 1.5	**6FX5002-5XA00-....**
1FS6115-8AC73-....	18	18	**6SL312■-■TE21-8AA3**	4 x 2.5	**6FX5002-5XA10-....**
1FS6134-6AC73-....	29	30	**6SL312■-1TE23-0AA3**	4 x 4	**6FX5002-5XA20-....**
1FS6074-6AF71-....	4.8	5	**6SL312■-■TE15-0AA3**	4 x 1.5	**6FX5002-5XA00-....**
1FS6096-8AF71-....	14	18	**6SL312■-■TE21-8AA3**	4 x 1.5	**6FX5002-5XA00-....**
1FS6115-8AF73-....	26	30	**6SL312■-1TE23-0AA3**	4 x 4	**6FX5002-5XA20-....**
1FS6074-6AH71-....	7.2	5	**6SL312■-■TE15-0AA3**	4 x 1.5	**6FX5002-5XA00-....**
1FS6096-8AH71-....	19	18	**6SL312■-■TE21-8AA3**	4 x 1.5	**6FX5002-5XA00-....**
1FS6074-6AK71-....	9.6	5	**6SL312■-■TE15-0AA3**	4 x 1.5	**6FX5002-5XA00-....**

Cooling: Internal air cooling External air cooling	**0** **1**		
Motor Module: Single Motor Module Double Motor Module		**1** **2**	
For length code as well as power and signal cables, see MOTION-CONNECT connection system.			**....**

Ordering data for signal cables

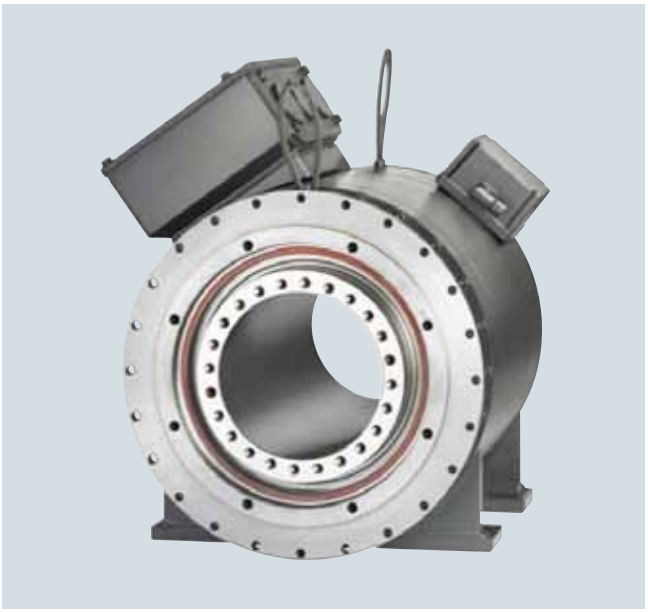
Description	Order No.
Pre-assembled signal cable with complete shield	
• Incremental encoder sin/cos 1 V_{pp}	**6FX5002-2XA00-....**
• EnDat absolute encoder	**6FX5002-2XQ10-....**
• PTC thermistor (for connection to 3RN10 triggering device)	**6FX5002-1XA04-....**

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

2) 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).

1FW3 torque motors
Water cooling

Overview



1FW3 torque motors

1FW3 torque motors are liquid-cooled, high-pole (slow running) permanent-magnet synchronous motors with hollow-shaft. The operating characteristics can be essentially compared to those of regular synchronous motors.

1FW3 torque motors are supplied as fully assembled units. The range includes 3 shaft heights with various lengths. For shaft heights 150 and 200, the stator and rotor have a flange with centering rings and tapped holes at the drive end according to type IM B14. In shaft height 280, the flange is designed with centering ring and through-holes as for construction type IM B35.

1FW3 torque motors can be combined with the SINAMICS S120 drive system to create a powerful, high-performance system. The integrated encoder systems for speed and position control can be selected depending on the application.

Benefits

- Highest torque in the most compact design
- High overload capability
- No elasticity in the drive train
- No torsional backlash
- High availability, since there are no mechanical transmission elements subject to wear in the drive train
- Low moment of inertia
- Direct coupling to the machine using flanges
- Hollow-shaft rotor design allows flexible installation concepts
- Energy savings due to reduction in mechanical losses

Applications

The 1FW3 series was developed as a direct drive. This direct drive is a compact drive unit where the mechanical motor power is transferred directly to the driven machine without any mechanical transmission elements.

- Extruder main drives
- Screw drives for injection molding machines
- Pull-roll drives for foil-stretching machines
- Stretch, calender and chill rolls
- Dynamic positioning tasks, e.g. rotary tables, cyclic conveyor belts
- Substitute for hydraulic motors
- Roller drives in paper machines
- Cross-cutter drives for continuous material webs, e.g. paper, textiles, metal sheet
- Wire-drawing machines
- Choppers

Technical specifications

Type of motor	Permanent-magnet synchronous motor
Magnet material	Rare-earth magnet material
Insulation of the stator winding in accordance with EN 60034-1 (IEC 60034-1)	Temperature class 155 (F) for a winding temperature rise of ΔT = 100 K at a coolant (water) inlet temperature of +25 °C (104 °F)
Cooling according to EN 60034-6 (IEC 60034-6)	Water cooling
Thermal motor protection according to EN 60034-11 (IEC 60034-11)	KTY 84 temperature sensor in stator winding
Type according to EN 60034-7 (IEC 60034-7)	
• Shaft height 150	IM B14, IM V18, IM V19
• Shaft height 200	IM B14, IM V18, IM V19
• Shaft height 280	IM B35
Degree of protection according to EN 60034-5 (IEC 60034-5)	IP54
Shaft extension according to DIN 748-3 (IEC 60072-1)	Hollow shaft Inside diameter for SH 150: d_i=152 mm Inside diameter for SH 200: d_i=152 mm Inside diameter for SH 280: d_i =250 mm
Shaft and flange accuracy according to DIN 42955 (IEC 60072-1) [1]	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 Tolerance + 3 dB	70 dB at 4 kHz nominal pulse frequency 73 dB at 2 kHz nominal pulse frequency
Flange accuracy	Grade N (normal)
Shock load	Maximum permissible radial acceleration 50 m/s^2 (not in operational state)
Bearings	Roller bearings with permanent grease lubrication (lubrication over the bearing lifetime = 20000 h)

Encoder systems for motors without DRIVE-CLiQ interface	• Multi-pole resolver, belt-mounted • Incremental encoder sin/cos 1 V_{pp}, 2048 S/R, belt-mounted • Absolute encoder - Multi-turn with EnDat interface 2048 S/R, belt-mounted or coaxial mounted at NDE - Single-turn with EnDat interface, 2048 S/R, coaxial mounted at NDE
Encoder systems for motors with DRIVE-CLiQ interface	• 15 bit resolver belt-mounted • 22 bit incremental encoder (2048 S/R internal) belt-mounted • Absolute encoder: - 22 bit single-turn (2048 S/R internal) +12 bit multi-turn (traversing range 4096 revolutions) belt-mounted or coaxial mounted at NDE - 22 bit single-turn (2048 S/R internal) coaxial mounted at NDE
Connection	Terminal box for power cable Connector for encoder signals and KTY 84
Paint finish	Anthracite RAL 7016
2nd rating plate	Enclosed separately
Options	• Motor protection through PTC thermistor with 3 integrated temperature sensors for tripping • Shaft cover at NDE • Relubrication device • Non-standard paint finish • Non-standard rated speeds (enquiry necessary)

S/R = signals/revolution

Options

Order code	Option description
A11	Motor protection by PTC thermistors
X01	Jet black finish RAL 9005
X02	Cream finish RAL 9001
X03	Reseda green finish RAL 6011
X04	Pebble gray finish RAL 7032
X05	Sky blue finish RAL 5015
X06	Light ivory finish RAL 1015
K40	Re-lubrication devices at DE and NDE
T20	Shaft cover at NDE (not required with coaxial mounted encoder)

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

1FW3 torque motors Water cooling

Selection and ordering data

Rated speed	Shaft height	Rated power	Rated torque	Rated current	Static torque	1FW3 torque motors Water cooling	Number of pole pairs	Rotor moment of inertia	Weight approx.
n_{rated}	SH	P_{rated} at ΔT=100 K	M_{rated} at ΔT=100 K	I_{rated} at ΔT=100 K	M_0 at ΔT=100 K	Order No.		J	m
rpm		kW (HP)	Nm (lb_f-ft)	A	Nm (lb_f-ft)			kgm^2 (lb_f-in-s^2)	kg (lb)
Line voltage 400 V 3 AC Smart Line Module/Basic Line Module/Power Module									
140	200	4.4 (5.90)	300 (221)	13	315 (232)	**1FW3201-1■E■2-■AA0**	14	0.22 (1.95)	127 (280)
		7.3 (9.79)	500 (369)	21	525 (387)	**1FW3202-1■E■2-■AA0**	14	0.36 (3.19)	156 (344)
		11.0 (14.8)	750 (553)	30	790 (583)	**1FW3203-1■E■2-■AA0**	14	0.49 (4.34)	182 (401)
		14.7 (19.7)	1000 (738)	40	1050 (775)	**1FW3204-1■E■2-■AA0**	14	0.70 (6.20)	223 (492)
		22.0 (29.5)	1500 (1106)	65	1575 (1162)	**1FW3206-1■E■2-■AA0**	14	0.97 (8.59)	279 (615)
		29.3 (39.3)	2000 (1475)	84	2100 (1549)	**1FW3208-1■E■2-■AA0**	14	1.31 (11.6)	348 (767)
	280	36.6 (49.1)	2500 (1844)	108	2625 (1936)	**1FW3281-1■E■3-■AA0**	17	4.10 (36.3)	628 (1385)
		51.3 (68.8)	3500 (2582)	150	3675 (2711)	**1FW3283-1■E■3-■AA0**	17	5.10 (45.1)	731 (1612)
		73.3 (98.3)	5000 (3688)	207	5250 (3872)	**1FW3285-1■E■3-■AA0**	17	6.60 (58.4)	885 (1951)
		102.6 (138)	7000 (5163)	292	7350 (5421)	**1FW3288-1■E■3-■AA0**	17	8.60 (76.1)	1087 (2397)

Encoder systems for motors without DRIVE-CLiQ interface:	Incremental encoder sin/cos 1 V_{pp}	Belt-mounted	**A**	**7**
	Absolute encod., multi. EnDat 2048 S/R	Coaxial mounted	**E**	**6**
	Absolute encod., multi. EnDat 2048 S/R	Belt-mounted	**E**	**7**
	Multi-pole resolver	Belt-mounted	**S**	**7**
	Absolute encod., single. EnDat 2048 S/R	Coaxial mounted	**N**	**6**
Encoder systems for motors with DRIVE-CLiQ interface:	22 bit incremental encoder	Belt-mounted	**D**	**7**
	22 bit absolute encoder, single-turn +12 bit multi-turn	Coaxial mounted	**F**	**6**
	22 bit absolute encoder, single-turn +12 bit multi-turn	Belt-mounted	**F**	**7**
	15 bit resolver	Belt-mounted	**U**	**7**
	22 bit absolute encoder, single-turn	Coaxial mounted	**P**	**6**
Type:	IM B14 (for shaft height 150 and 200)		**2**	
	IM B35 (for shaft height 280)		**3**	
Terminal box top:	Cable outlet transverse right			**5**
	Cable outlet transverse left			**6**
	Cable outlet NDE			**7**
	Cable outlet DE			**8**

Further rated speeds on request.

Selection and ordering data

Motor type (continued)	Static current I_0 at ΔT=100 K	SINAMICS S120 Motor Module: Rated output current I_{rated}	SINAMICS S120 Motor Module: Order No.	Power cable with complete shield, Motor connection via terminal box: Terminal box type, Cable entry	Cable cross-section [1], Max. possible cross-section	Order No. Power cable, By the meter
	A	A			mm²	
Line voltage 400 V 3 AC Smart Line Module/Basic Line Module/Power Module						
1FW3201-1 . E . 2-....	13	18	**6SL3 1 2 ■ - ■ T E 2 1 -8AA3**	gk 230 2 x M32 x 1.5	**4 x 1.5** 2 x 4 x 16	**6FX■008-1BB11-....** **6FX■008-1BB61-....**
1FW3202-1 . E . 2-....	22	30	**6SL3 1 2 ■ - 1 T E 2 3 -0AA3**	gk 230 2 x M32 x 1.5	**4 x 2.5** 2 x 4 x 16	**6FX■008-1BB21-....** **6FX■008-1BB61-....**
1FW3203-1 . E . 2-....	32	30	**6SL3 1 2 ■ - 1 T E 2 3 -0AA3**	gk 230 2 x M32 x 1.5	**4 x 6** 2 x 4 x 16	**6FX■008-1BB41-....** **6FX 5 008-1BB61-....**
1FW3204-1 . E . 2-....	42	45	**6SL3 1 2 ■ - 1 T E 2 4 -5AA3**	gk 230 1 x M32 x 1.5	**4 x 10** 2 x 4 x 16	**6FX■008-1BB51-....** **6FX■008-1BB61-....**
1FW3206-1 . E . 2-....	68	85	**6SL3 1 2 ■ - 1 T E 2 8 -5AA3**	gk 420 2 x M40 x 1.5	**4 x 16** 2 x 4 x 35	**6FX■008-1BB61-....** **6FX■008-1BB35-....**
1FW3208-1 . E . 2-....	88	85	**6SL3 1 2 ■ - 1 T E 2 8 -5AA3**	gk 420 2 x M40 x 1.5	**4 x 25** 2 x 4 x 35	**6FX■008-1BB25-....** **6FX■008-1BB35-....**
1FW3281-1 . E . 2-....	113	132	**6SL3 1 2 ■ - 1 T E 3 1 -3AA3**	1XB7 700 3 x M75 x 1.5	**4 x 50** 3 x 4 x 120	**6FX■008-1BB50-....** **6FX■008-1BB12-....**
1FW3283-1 . E . 2-....	158	200	**6SL3 1 2 ■ - 1 T E 3 2 -0AA3**	1XB7 700 3 x M75 x 1.5	**4 x 70** 3 x 4 x 120	**6FX■008-1BB70-....** **6FX■008-1BB12-....**
1FW3285-1 . E . 2-....	217	210	**6SL3 3 2 0 - 1 T E 3 2 -1AA0**	1XB7 700 3 x M75 x 1.5	**4 x 120** 3 x 4 x 120	**6FX■008-1BB12-....** **6FX■008-1BB12-....**
1FW3288-1 . E . 2-....	306	310	**6SL3 3 2 0 - 1 T E 3 3 -1AA0**	1XB7 700 3 x M75 x 1.5	**2 x 4 x 95** 3 x 4 x 120	**6FX■008-1BB05-....** **6FX■008-1BB12-....**

Option	Code
Format:	
Booksize	**1**
Chassis	**3**
Cooling:	
Internal air cooling	**0**
External air cooling	**1**
Motor Module:	
Single Motor Module	**1**
Double Motor Module	**2**
Type of power cable:	
MOTION-CONNECT 800	**5**
MOTION-CONNECT 500	**8**
For length code for power and signal cables, see MOTION-CONNECT connection system.	**....**

[1] 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).
In the second line, the maximum connectable cable cross-sections are specified when other ambient conditions or installation types exist.
Differing ambient conditions can be configured with SIZER.

1FW3 torque motors Water cooling

Selection and ordering data

Rated speed	Shaft height	Rated power	Rated torque	Rated current	Static torque	1FW3 torque motors Water cooling	Number of pole pairs	Rotor moment of inertia	Weight approx.
n_{rated}	SH	P_{rated} at ΔT=100 K	M_{rated} at ΔT=100 K	I_{rated} at ΔT=100 K	M_0 at ΔT=100 K	Order No.		J	m
rpm		kW (HP)	Nm (lb_f-ft)	A	Nm (lb_f-ft)			kgm^2 (lb_f-in-s^2)	kg (lb)
Line voltage 400 V 3 AC Smart Line Module/Basic Line Module/Power Module									
220	280	55.3 (74.2)	2400 (1770)	153	2652 (1956)	**1FW3281-1■G■3-■AA0**	17	4.10 (36.3)	628 (1385)
		78.3 (105)	3400 (2508)	222	3675 (2711)	**1FW3283-1■G■3-■AA0**	17	5.10 (45.1)	731 (1612)
		92.1 (124)	4000 (2950)	255	5250 (3872)	**1FW3285-1■G■3-■AA0**	17	6.60 (58.4)	885 (1951)
		112.8 (151)	4900 (3614)	318	7350 (5421)	**1FW3288-1■G■3-■AA0**	17	8.60 (76.1)	1087 (2397)
270	150	2.8 (3.75)	100 (73.8)	7.2	105 (77.4)	**1FW3150-1■H■2-■AA0**	7	0.12 (1.06)	87 (192)
		5.7 (7.64)	200 (148)	14	210 (155)	**1FW3152-1■H■2-■AA0**	7	0.16 (1.42)	108 (238)
		8.5 (11.4)	300 (221)	20.5	315 (232)	**1FW3154-1■H■2-■AA0**	7	0.20 (1.77)	129 (284)
		11.3 (15.2)	400 (295)	28	420 (310)	**1FW3155-1■H■2-■AA0**	7	0.24 (2.12)	150 (331)
		14.1 (18.9)	500 (369)	34	525 (387)	**1FW3156-1■H■2-■AA0**	7	0.28 (2.48)	171 (377)
	200	8.5 (11.4)	300 (221)	23	315 (232)	**1FW3201-1■H■2-■AA0**	14	0.22 (1.95)	127 (280)
		14.1 (18.9)	500 (369)	37	525 (387)	**1FW3202-1■H■2-■AA0**	14	0.36 (3.19)	156 (344)
		21.2 (28.4)	750 (553)	59	790 (583)	**1FW3203-1■H■2-■AA0**	14	0.49 (4.34)	182 (401)
		28.3 (38.0)	1000 (738)	74	1050 (775)	**1FW3204-1■H■2-■AA0**	14	0.70 (6.20)	223 (492)
		42.4 (56.9)	1500 (1106)	118	1575 (1162)	**1FW3206-1■H■2-■AA0**	14	0.97 (8.59)	279 (615)
		56.5 (75.8)	2000 (1475)	153	2100 (1549)	**1FW3208-1■H■2-■AA0**	14	1.31 (11.6)	348 (767)

Encoder systems for motors without DRIVE-CLiQ interface:	Incremental encoder sin/cos 1 V_{pp}	Belt-mounted	**A**	**7**
	Absolute encod., multi. EnDat 2048 S/R	Coaxial mounted	**E**	**6**
	Absolute encod., multi. EnDat 2048 S/R	Belt-mounted	**E**	**7**
	Multi-pole resolver	Belt-mounted	**S**	**7**
	Absolute encod., single. EnDat 2048 S/R	Coaxial mounted	**N**	**6**
Encoder systems for motors with DRIVE-CLiQ interface:	22 bit incremental encoder	Belt-mounted	**D**	**7**
	22 bit absolute encoder, single-turn +12 bit multi-turn	Coaxial mounted	**F**	**6**
	22 bit absolute encoder, single-turn +12 bit multi-turn	Belt-mounted	**F**	**7**
	15 bit resolver	Belt-mounted	**U**	**7**
	22 bit absolute encoder, single-turn	Coaxial mounted	**P**	**6**
Type:	IM B14 (for shaft height 150 and 200) IM B35 (for shaft height 280)			**2** **3**
Terminal box top:	Cable outlet transverse right			**5**
	Cable outlet transverse left			**6**
	Cable outlet NDE			**7**
	Cable outlet DE			**8**

Further rated speeds on request.

Selection and ordering data

Motor type (continued)	Static current	SINAMICS S120 Motor Module		Power cable with complete shield		
		Rated output current		Motor connection via terminal box		
	I_0 at ΔT=100 K	I_{rated}	Order No.	Terminal box type Cable entry	Cable cross-section [1] Max. possible cross-section	Order No. Power cable By the meter
	A	A			mm^2	
Line voltage 400 V 3 AC Smart Line Module/Basic Line Module/Power Module						
1FW3281-1 . G. 3-....	167	200	**6SL3 1 2 ■ - 1 T E 3 2 -0AA3**	1XB7700 3 x M75 x 1.5	**4 x 95** 3 x 4 x 120	**6FX ■ 008-1BB05-....** **6FX ■ 008-1BB12-....**
1FW3283-1 . G. 3-....	239	260	**6SL3 3 2 0 - 1 T E 3 2 -6AA0**	1XB7700 3 x M75 x 1.5	**4 x 120** 3 x 4 x 120	**6FX ■ 008-1BB12-....** **6FX ■ 008-1BB12-....**
1FW3285-1 . G. 3-....	332	310	**6SL3 3 2 0 - 1 T E 3 3 -1AA0**	1XB7700 3 x M75 x 1.5	**2 x 4 x 95** 3 x 4 x 120	**6FX ■ 008-1BB05-....** **6FX ■ 008-1BB12-....**
1FW3288-1 . G. 3-....	474	490	**6SL3 3 2 0 - 1 T E 3 5 -0AA0**	1XB7700 3 x M75 x 1.5	**3 x 4 x 120** 3 x 4 x 120	**6FX ■ 008-1BB12-....** **6FX ■ 008-1BB12-....**
1FW3150-1 . H. 2-....	7.3	9	**6SL3 1 2 ■ - ■ T E 2 1 -0AA3**	gk 230 2 x M32 x 1.5	**4 x 1.5** 2 x 4 x 16	**6FX ■ 008-1BB11-....** **6FX ■ 008-1BB61-....**
1FW3152-1 . H. 2-....	15	18	**6SL3 1 2 ■ - ■ T E 2 1 -8AA3**	gk 230 2 x M32 x 1.5	**4 x 1.5** 2 x 4 x 16	**6FX ■ 008-1BB11-....** **6FX ■ 008-1BB61-....**
1FW3154-1 . H. 2-....	21.5	30	**6SL3 1 2 ■ - 1 T E 2 3 -0AA3**	gk 230 2 x M32 x 1.5	**4 x 4** 2 x 4 x 16	**6FX ■ 008-1BB31-....** **6FX ■ 008-1BB61-....**
1FW3155-1 . H. 2-....	29	30	**6SL3 1 2 ■ - 1 T E 2 3 -0AA3**	gk 230 2 x M32 x 1.5	**4 x 6** 2 x 4 x 16	**6FX ■ 008-1BB41-....** **6FX ■ 008-1BB61-....**
1FW3156-1 . H. 2-....	35	45	**6SL3 1 2 ■ - 1 T E 2 4 -5AA3**	gk 230 2 x M32 x 1.5	**4 x 6** 2 x 4 x 16	**6FX ■ 008-1BB41-....** **6FX ■ 008-1BB61-....**
1FW3201-1 . H. 2-....	24	30	**6SL3 1 2 ■ - 1 T E 2 3 -0AA3**	gk 230 2 x M32 x 1.5	**4 x 4** 2 x 4 x 16	**6FX ■ 008-1BB31-....** **6FX ■ 008-1BB61-....**
1FW3202-1 . H. 2-....	39	45	**6SL3 1 2 ■ - 1 T E 2 4 -5AA3**	gk 230 2 x M32 x 1.5	**4 x 10** 2 x 4 x 16	**6FX ■ 008-1BB51-....** **6FX ■ 008-1BB61-....**
1FW3203-1 . H. 2-....	62	60	**6SL3 1 2 ■ - 1 T E 2 6 -0AA3**	gk 420 2 x M40 x 1.5	**4 x 16** 2 x 4 x 35	**6FX ■ 008-1BB61-....** **6FX ■ 008-1BB35-....**
1FW3204-1 . H. 2-....	77	85	**6SL3 1 2 ■ - 1 T E 2 8 -5AA3**	gk 420 2 x M40 x 1.5	**4 x 25** 2 x 4 x 35	**6FX ■ 008-1BB25-....** **6FX ■ 008-1BB35-....**
1FW3206-1 . H. 2-....	121	132	**6SL3 1 2 ■ - 1 T E 3 1 -3AA3**	gk 630 2 x M50 x 1.5	**4 x 50** 2 x 4 x 50	**6FX ■ 008-1BB50-....** **6FX ■ 008-1BB50-....**
1FW3208-1 . H. 2-....	160	200	**6SL3 1 2 ■ - 1 T E 3 2 -0AA3**	gk 630 2 x M50 x 1.5	**2 x 4 x 35** 2 x 4 x 50	**6FX ■ 008-1BB35-....** **6FX ■ 008-1BB50-....**

Format: Booksize Chassis	**1** **3**							
Cooling: Internal air cooling External air cooling		**0** **1**						
Motor Module: Single Motor Module Double Motor Module			**1** **2**					
Type of power cable: MOTION-CONNECT 800 MOTION-CONNECT 500						**5** **8**		
For length code for power and signal cables, see MOTION-CONNECT connection system.								**....**

[1] 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).
In the second line, the maximum connectable cable cross-sections are specified when other ambient conditions or installation types exist.
Differing ambient conditions can be configured with SIZER.

1FW3 torque motors Water cooling

Selection and ordering data

Rated speed	Shaft height	Rated power	Rated torque	Rated current	Static torque	1FW3 torque motors Water cooling	Number of pole pairs	Rotor moment of inertia	Weight approx.
n_{rated}	SH	P_{rated} at ΔT=100 K	M_{rated} at ΔT=100 K	I_{rated} at ΔT=100 K	M_0 at ΔT=100 K	Order No.		J	m
rpm		kW (HP)	Nm (lb_f-ft)	A	Nm (lb_f-ft)			kgm^2 (lb_f-in-s^2)	kg (lb)
Line voltage 400 V 3 AC Smart Line Module/Basic Line Module/Power Module									
450	150	4.7 (6.30)	100 (73.8)	11.0	105 (77.4)	**1FW3150-1 ■ L ■ 2 - ■ A A 0**	7	0.12 (1.06)	87 (192)
		9.4 (12.6)	200 (148)	22.0	210 (155)	**1FW3152-1 ■ L ■ 2 - ■ A A 0**	7	0.16 (1.42)	108 (238)
		14.1 (18.9)	300 (221)	32.0	315 (232)	**1FW3154-1 ■ L ■ 2 - ■ A A 0**	7	0.20 (1.77)	129 (284)
		18.8 (25.2)	400 (295)	43.0	420 (310)	**1FW3155-1 ■ L ■ 2 - ■ A A 0**	7	0.24 (2.12)	150 (331)
		23.6 (31.7)	500 (369)	53.0	525 (387)	**1FW3156-1 ■ L ■ 2 - ■ A A 0**	7	0.28 (2.48)	171 (377)
	200	14.1 (18.9)	300 (221)	37.0	315 (232)	**1FW3201-1 ■ L ■ 2 - ■ A A 0**	14	0.22 (1.95)	127 (280)
		23.6 (31.7)	500 (369)	59.0	525 (387)	**1FW3202-1 ■ L ■ 2 - ■ A A 0**	14	0.36 (3.19)	156 (344)
		35.3 (47.3)	750 (553)	92.0	790 (583)	**1FW3203-1 ■ L ■ 2 - ■ A A 0**	14	0.49 (4.34)	182 (401)
		47.1 (63.2)	1000 (738)	118.0	1050 (775)	**1FW3204-1 ■ L ■ 2 - ■ A A 0**	14	0.70 (6.20)	223 (492)
		65.9 (88.4)	1400 (1033)	169.0	1575 (1162)	**1FW3206-1 ■ L ■ 2 - ■ A A 0**	14	0.97 (8.59)	279 (615)
		87.1 (117)	1850 (1365)	226.0	2100 (1549)	**1FW3208-1 ■ L ■ 2 - ■ A A 0**	14	1.31 (11.6)	348 (767)
670	150	7.0 (9.39)	100 (73.8)	17.0	105 (77.4)	**1FW3150-1 ■ P ■ 2 - ■ A A 0**	7	0.12 (1.06)	87 (192)
		14.0 (18.8)	200 (148)	32.5	210 (155)	**1FW3152-1 ■ P ■ 2 - ■ A A 0**	7	0.16 (1.42)	108 (238)
		21.0 (28.2)	300 (221)	47.5	315 (232)	**1FW3154-1 ■ P ■ 2 - ■ A A 0**	7	0.20 (1.77)	129 (284)
		28.1 (37.7)	400 (295)	64.0	420 (310)	**1FW3155-1 ■ P ■ 2 - ■ A A 0**	7	0.24 (2.12)	150 (331)
		35.1 (47.1)	500 (369)	76.0	525 (387)	**1FW3156-1 ■ P ■ 2 - ■ A A 0**	7	0.28 (2.48)	171 (377)

Encoder systems for motors without DRIVE-CLiQ interface:	Incremental encoder sin/cos 1 V_{pp}	Belt-mounted	**A**	**7**
	Absolute encod., multi. EnDat 2048 S/R	Coaxial mounted	**E**	**6**
	Absolute encod., multi. EnDat 2048 S/R	Belt-mounted	**E**	**7**
	Multi-pole resolver	Belt-mounted	**S**	**7**
	Absolute encod., single. EnDat 2048 S/R	Coaxial mounted	**N**	**6**
Encoder systems for motors with DRIVE-CLiQ interface:	22 bit incremental encoder	Belt-mounted	**D**	**7**
	22 bit absolute encoder, single-turn +12 bit multi-turn	Coaxial mounted	**F**	**6**
	22 bit absolute encoder, single-turn +12 bit multi-turn	Belt-mounted	**F**	**7**
	15 bit resolver	Belt-mounted	**U**	**7**
	22 bit absolute encoder, single-turn	Coaxial mounted	**P**	**6**
Type:	IM B14 (for shaft heights 150 and 200)		**2**	
Terminal box top:	Cable outlet transverse right			**5**
	Cable outlet transverse left			**6**
	Cable outlet NDE			**7**
	Cable outlet DE			**8**

Further rated speeds on request.

Selection and ordering data

Motor type (continued)	Static current I_0 at ΔT=100 K A	SINAMICS S120 Motor Module Rated output current I_{rated} A	SINAMICS S120 Motor Module Order No.	Power cable with complete shield – Motor connection via terminal box: Terminal box type Cable entry	Cable cross-section 1) Max. possible cross-section mm²	Order No. Power cable By the meter
Line voltage 400 V 3 AC Smart Line Module/Basic Line Module/Power Module						
1FW3150-1.L.2-....	11.5	18	**6SL3 12■-■TE21-8AA3**	gk 230 2 x M32 x 1.5	**4 x 1.5** 2 x 4 x 16	**6FX■008-1BB11-....** **6FX■008-1BB61-....**
1FW3152-1.L.2-....	22.5	30	**6SL3 12■-1TE23-0AA3**	gk 230 2 x M32 x 1.5	**4 x 4** 2 x 4 x 16	**6FX■008-1BB31-....** **6FX■008-1BB61-....**
1FW3154-1.L.2-....	33	45	**6SL3 12■-1TE24-5AA3**	gk 230 2 x M32 x 1.5	**4 x 6** 2 x 4 x 16	**6FX■008-1BB41-....** **6FX■008-1BB61-....**
1FW3155-1.L.2-....	45	60	**6SL3 12■-1TE26-0AA3**	gk 230 2 x M32 x 1.5	**4 x 10** 2 x 4 x 16	**6FX■008-1BB51-....** **6FX■008-1BB61-....**
1FW3156-1.L.2-....	55	60	**6SL3 12■-1TE26-0AA3**	gk 420 2 x M40 x 1.5	**4 x 16** 2 x 4 x 35	**6FX■008-1BB61-....** **6FX■008-1BB35-....**
1FW3201-1.L.2-....	38	45	**6SL3 12■-1TE24-5AA3**	gk 230 2 x M32 x 1.5	**4 x 10** 2 x 4 x 16	**6FX■008-1BB51-....** **6FX■008-1BB35-....**
1FW3202-1.L.2-....	62	60	**6SL3 12■-1TE26-0AA3**	gk 420 2 x M40 x 1.5	**4 x 16** 2 x 4 x 35	**6FX■008-1BB61-....** **6FX■008-1BB35-....**
1FW3203-1.L.2-....	100	132	**6SL3 12■-1TE31-3AA3**	gk 420 2 x M40 x 1.5	**4 x 35** 2 x 4 x 35	**6FX■008-1BB35-....** **6FX■008-1BB35-....**
1FW3204-1.L.2-....	129	132	**6SL3 12■-1TE31-3AA3**	gk 630 2 x M50 x 1.5	**2 x 4 x 50** 2 x 4 x 50	**6FX■008-1BB50-....** **6FX■008-1BB50-....**
1FW3206-1.L.2-....	189	200	**6SL3 12■-1TE32-0AA3**	gk 630 2 x M50 x 1.5	**2 x 4 x 35** 2 x 4 x 50	**6FX■008-1BB35-....** **6FX■008-1BB50-....**
1FW3208-1.L.2-....	256	260	**6SL3 320-1TE32-6AA0**	gk 630 2 x M50 x 1.5	**2 x 4 x 50** 2 x 4 x 50	**6FX■008-1BB50-....** **6FX■008-1BB50-....**
1FW3150-1.P.2-....	17.5	18	**6SL3 12■-■TE21-8AA3**	gk 230 2 x M32 x 1.5	**4 x 2.5** 2 x 4 x 16	**6FX■008-1BB25-....** **6FX■008-1BB61-....**
1FW3152-1.P.2-....	33.5	45	**6SL3 12■-1TE24-5AA3**	gk 230 2 x M32 x 1.5	**4 x 6** 2 x 4 x 16	**6FX■008-1BB41-....** **6FX■008-1BB61-....**
1FW3154-1.P.2-....	49	60	**6SL3 12■-1TE26-0AA3**	gk 230 2 x M32 x 1.5	**4 x 10** 2 x 4 x 16	**6FX■008-1BB51-....** **6FX■008-1BB61-....**
1FW3155-1.P.2-....	67	85	**6SL3 12■-1TE28-5AA3**	gk 420 2 x M40 x 1.5	**4 x 25** 2 x 4 x 3	**6FX■008-1BB25-....** **6FX■008-1BB35-....**
1FW3156-1.P.2-....	80	85	**6SL3 12■-1TE28-5AA3**	gk 420 2 x M40 x 1.5	**4 x 25** 2 x 4 x 35	**6FX■008-1BB25-....** **6FX■008-1BB35-....**

Format:	
Booksize	**1**
Chassis	**3**
Cooling:	
Internal air cooling	**0**
External air cooling	**1**
Motor Module:	
Single Motor Module	**1**
Double Motor Module	**2**
Type of power cable:	
MOTION-CONNECT 800	**5**
MOTION-CONNECT 500	**8**
For length code for power and signal cables, see MOTION-CONNECT connection system.	**....**

1) 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).
In the second line, the maximum connectable cable cross-sections are specified when other ambient conditions or installation types exist.
Differing ambient conditions can be configured with SIZER.

1FW3 torque motors Water cooling

Selection and ordering data

Rated speed	Shaft height	Rated power	Rated torque	Rated current	Static torque	1FW3 torque motors Water cooling	Number of pole pairs	Rotor moment of inertia	Weight approx.
n_{rated}	SH	P_{rated} at ΔT=100 K	M_{rated} at ΔT=100 K	I_{rated} at ΔT=100 K	M_0 at ΔT=100 K	Order No.		J	m
rpm		kW (HP)	Nm (lb_f-ft)	A	Nm (lb_f-ft)			kgm^2 (lb_f-in-s^2)	kg (lb)
Line voltage 400 V 3 AC Active Line Module									
150	200	4.7 (6.30)	300 (221)	13	315 (232)	**1FW3201-1■E■2-■AA0**	14	0.22 (1.95)	127 (280)
		7.9 (10.6)	500 (369)	21	525 (387)	**1FW3202-1■E■2-■AA0**	14	0.36 (3.19)	156 (344)
		11.8 (15.8)	750 (553)	30	790 (583)	**1FW3203-1■E■2-■AA0**	14	0.49 (4.34)	182 (401)
		15.7 (21.1)	1000 (738)	40	1050 (775)	**1FW3204-1■E■2-■AA0**	14	0.70 (6.20)	223 (492)
		23.6 (31.7)	1500 (1106)	65	1575 (1162)	**1FW3206-1■E■2-■AA0**	14	0.97 (8.59)	279 (615)
		31.4 (42.1)	2000 (1475)	84	2100 (1549)	**1FW3208-1■E■2-■AA0**	14	1.31 (11.6)	348 (767)
	280	39.3 (52.7)	2500 (1844)	108	2625 (1936)	**1FW3281-1■E■3-■AA0**	17	4.10 (36.3)	628 (1385)
		55.0 (73.8)	3500 (2582)	150	3675 (2711)	**1FW3283-1■E■3-■AA0**	17	5.10 (45.1)	731 (1612)
		78.5 (105)	5000 (3688)	207	5250 (3872)	**1FW3285-1■E■3-■AA0**	17	6.60 (58.4)	885 (1951)
		109.9 (147)	7000 (5163)	292	7350 (5421)	**1FW3288-1■E■3-■AA0**	17	8.60 (76.1)	1087 (2397)

Encoder systems for motors without DRIVE-CLiQ interface:	Incremental encoder sin/cos 1 V_{pp}	Belt-mounted	**A**	**7**
	Absolute encod., multi. EnDat 2048 S/R	Coaxial mounted	**E**	**6**
	Absolute encod., multi. EnDat 2048 S/R	Belt-mounted	**E**	**7**
	Multi-pole resolver	Belt-mounted	**S**	**7**
	Absolute encod., single. EnDat 2048 S/R	Coaxial mounted	**N**	**6**
Encoder systems for motors with DRIVE-CLiQ interface:	22 bit incremental encoder	Belt-mounted	**D**	**7**
	22 bit absolute encoder, single-turn +12 bit multi-turn	Coaxial mounted	**F**	**6**
	22 bit absolute encoder, single-turn +12 bit multi-turn	Belt-mounted	**F**	**7**
	15 bit resolver	Belt-mounted	**U**	**7**
	22 bit absolute encoder, single-turn	Coaxial mounted	**P**	**6**
Type:	IM B14 (for shaft height 150 and 200)			**2**
	IM B35 (for shaft height 280)			**3**
Terminal box top:	Cable outlet transverse right			**5**
	Cable outlet transverse left			**6**
	Cable outlet NDE			**7**
	Cable outlet DE			**8**

Further rated speeds on request.

Selection and ordering data

Motor type (continued)	Static current I_0 at ΔT=100 K A	SINAMICS S120 Motor Module Rated output current I_{rated} A	SINAMICS S120 Motor Module Order No.	Power cable with complete shield Motor connection via terminal box Terminal box type Cable entry	Cable cross-section [1)] Max. possible cross-section mm²	Order No. Power cable By the meter
Line voltage 400 V 3 AC Active Line Module						
1FW3201-1.E.2-....	13	18	**6SL3 12■-■TE21-8AA3**	gk 230 2 x M32 x 1.5	**4 x 1.5** 2 x 4 x 16	**6FX■008-1BB11-....** **6FX■008-1BB61-....**
1FW3202-1.E.2-....	22	30	**6SL3 12■-1TE23-0AA3**	gk 230 2 x M32 x 1.5	**4 x 2.5** 2 x 4 x 16	**6FX■008-1BB21-....** **6FX■008-1BB61-....**
1FW3203-1.E.2-....	32	30	**6SL3 12■-1TE23-0AA3**	gk 230 2 x M32 x 1.5	**4 x 6** 2 x 4 x 16	**6FX■008-1BB41-....** **6FX 5 008-1BB61-....**
1FW3204-1.E.2-....	42	45	**6SL3 12■-1TE24-5AA3**	gk 230 1 x M32 x 1.5	**4 x 10** 2 x 4 x 16	**6FX■008-1BB51-....** **6FX■008-1BB61-....**
1FW3206-1.E.2-....	68	85	**6SL3 12■-1TE28-5AA3**	gk 420 2 x M40 x 1.5	**4 x 16** 2 x 4 x 35	**6FX■008-1BB61-....** **6FX■008-1BB35-....**
1FW3208-1.E.2-....	88	85	**6SL3 12■-1TE28-5AA3**	gk 420 2 x M40 x 1.5	**4 x 25** 2 x 4 x 35	**6FX■008-1BB25-....** **6FX■008-1BB35-....**
1FW3281-1.E.2-....	113	132	**6SL3 12■-1TE31-3AA3**	1XB7700 3 x M75 x 1.5	**4 x 50** 3 x 4 x 120	**6FX■008-1BB50-....** **6FX■008-1BB12-....**
1FW3283-1.E.2-....	158	200	**6SL3 12■-1TE32-0AA3**	1XB7700 3 x M75 x 1.5	**4 x 70** 3 x 4 x 120	**6FX■008-1BB70-....** **6FX■008-1BB12-....**
1FW3285-1.E.2-....	217	210	**6SL3 320-1TE32-1AA0**	1XB7700 3 x M75 x 1.5	**4 x 120** 3 x 4 x 120	**6FX■008-1BB12-....** **6FX■008-1BB12-....**
1FW3288-1.E.2-....	306	310	**6SL3 320-1TE33-1AA0**	1XB7700 3 x M75 x 1.5	**2 x 4 x 95** 3 x 4 x 120	**6FX■008-1BB05-....** **6FX■008-1BB12-....**

Format:
Booksize **1**
Chassis **3**

Cooling:
Internal air cooling **0**
External air cooling **1**

Motor Module:
Single Motor Module **1**
Double Motor Module **2**

Type of power cable:
MOTION-CONNECT 800 **5**
MOTION-CONNECT 500 **8**

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

1) 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).
In the second line, the maximum connectable cable cross-sections are specified when other ambient conditions or installation types exist.
Differing ambient conditions can be configured with SIZER.

1FW3 torque motors Water cooling

Selection and ordering data

Rated speed n_{rated} rpm	Shaft height SH	Rated power P_{rated} at ΔT=100 K kW (HP)	Rated torque M_{rated} at ΔT=100 K Nm (lb_f-ft)	Rated current I_{rated} at ΔT=100 K A	Static torque M_0 at ΔT=100 K Nm (lb_f-ft)	**1FW3 torque motors Water cooling** Order No.	Number of pole pairs	Rotor moment of inertia J kgm^2 (lb_f-in-s^2)	Weight approx. m kg (lb)
Line voltage 400 V 3 AC Active Line Module									
250	280	62.8 (84.2)	2400 (1770)	153	2652 (1956)	**1FW3281-1 ■G■ 3-■AA0**	17	4.10 (36.3)	628 (1385)
		89.0 (119)	3400 (2508)	222	3675 (2711)	**1FW3283-1 ■G■ 3-■AA0**	17	5.10 (45.1)	731 (1612)
		104.7 (140)	4000 (2950)	255	5250 (3872)	**1FW3285-1 ■G■ 3-■AA0**	17	6.60 (58.4)	885 (1951)
		128.2 (172)	4900 (3614)	318	7350 (5421)	**1FW3288-1 ■G■ 3-■AA0**	17	8.60 (76.1)	1087 (2397)
300	150	3.1 (4.16)	100 (73.8)	7.2	105 (77.4)	**1FW3150-1 ■H■ 2-■AA0**	7	0.12 (1.06)	87 (192)
		6.3 (8.45)	200 (148)	14	210 (155)	**1FW3152-1 ■H■ 2-■AA0**	7	0.16 (1.42)	108 (238)
		9.4 (12.6)	300 (221)	20.5	315 (232)	**1FW3154-1 ■H■ 2-■AA0**	7	0.20 (1.77)	129 (284)
		12.6 (16.9)	400 (295)	28	420 (310)	**1FW3155-1 ■H■ 2-■AA0**	7	0.24 (2.12)	150 (331)
		15.7 (21.1)	500 (369)	34	525 (387)	**1FW3156-1 ■H■ 2-■AA0**	7	0.28 (2.48)	171 (377)
	200	9.4 (12.6)	300 (221)	23	315 (232)	**1FW3201-1 ■H■ 2-■AA0**	14	0.22 (1.95)	127 (280)
		15.7 (21.1)	500 (369)	37	525 (387)	**1FW3202-1 ■H■ 2-■AA0**	14	0.36 (3.19)	156 (344)
		23.6 (31.7)	750 (553)	59	790 (583)	**1FW3203-1 ■H■ 2-■AA0**	14	0.49 (4.34)	182 (401)
		31.4 (42.1)	1000 (738)	74	1050 (775)	**1FW3204-1 ■H■ 2-■AA0**	14	0.70 (6.20)	223 (492)
		47.1 (63.2)	1500 (1106)	118	1575 (1162)	**1FW3206-1 ■H■ 2-■AA0**	14	0.97 (8.59)	279 (615)
		62.8 (84.2)	2000 (1475)	153	2100 (1549)	**1FW3208-1 ■H■ 2-■AA0**	14	1.31 (11.6)	348 (767)

Encoder systems for motors without DRIVE-CLiQ interface:	Incremental encoder sin/cos 1 V_{pp}	Belt-mounted	**A**	**7**
	Absolute encod., multi. EnDat 2048 S/R	Coaxial mounted	**E**	**6**
	Absolute encoder, multi. EnDat 2048 S/R	Belt-mounted	**E**	**7**
	Multi-pole resolver	Belt-mounted	**S**	**7**
	Absolute encod., single. EnDat 2048 S/R	Coaxial mounted	**N**	**6**
Encoder systems for motors with DRIVE-CLiQ interface:	22 bit incremental encoder	Belt-mounted	**D**	**7**
	22 bit absolute encoder, single-turn +12 bit multi-turn	Coaxial mounted	**F**	**6**
	22 bit absolute encoder, single-turn +12 bit multi-turn	Belt-mounted	**F**	**7**
	15 bit resolver	Belt-mounted	**U**	**7**
	22 bit absolute encoder, single-turn	Coaxial mounted	**P**	**6**
Type:	IM B14 (for shaft height 150 and 200)			**2**
	IM B35 (for shaft height 280)			**3**
Terminal box top:	Cable outlet transverse right			**5**
	Cable outlet transverse left			**6**
	Cable outlet NDE			**7**
	Cable outlet DE			**8**

Further rated speeds on request.

Selection and ordering data

Motor type (continued)	Static current	SINAMICS S120 Motor Module		Power cable with complete shield		
		Rated output current		Motor connection via terminal box		
	I_0 at ΔT=100 K	I_{rated}	Order No.	Terminal box type Cable entry	Cable cross-section [1] Max. possible cross-section	Order No. Power cable By the meter
	A	A			mm²	
Line voltage 400 V 3 AC Active Line Module						
1FW3281-1.G.3-....	167	200	**6SL3 1 2 ■-1 T E 3 2-0AA3**	1XB7700 3 x M75 x 1.5	**4 x 95** 3 x 4 x 120	**6FX ■ 008-1BB05-....** **6FX ■ 008-1BB12-....**
1FW3283-1.G.3-....	239	260	**6SL3 3 2 0-1 T E 3 2-6AA0**	1XB7700 3 x M75 x 1.5	**4 x 120** 3 x 4 x 120	**6FX ■ 008-1BB12-....** **6FX ■ 008-1BB12-....**
1FW3285-1.G.3-....	332	310	**6SL3 3 2 0-1 T E 3 3-1AA0**	1XB7700 3 x M75 x 1.5	**2 x 4 x 95** 3 x 4 x 120	**6FX ■ 008-1BB05-....** **6FX ■ 008-1BB12-....**
1FW3288-1.G.3-....	474	490	**6SL3 3 2 0-1 T E 3 5-0AA0**	1XB7700 3 x M75 x 1.5	**3 x 4 x 120** 3 x 4 x 120	**6FX ■ 008-1BB12-....** **6FX ■ 008-1BB12-....**
1FW3150-1.H.2-....	7.3	9	**6SL3 1 2 ■-■ T E 2 1-0AA3**	gk 230 2 x M32 x 1.5	**4 x 1.5** 2 x 4 x 16	**6FX ■ 008-1BB11-....** **6FX ■ 008-1BB61-....**
1FW3152-1.H.2-....	15	18	**6SL3 1 2 ■-■ T E 2 1-8AA3**	gk 230 2 x M32 x 1.5	**4 x 1.5** 2 x 4 x 16	**6FX ■ 008-1BB11-....** **6FX ■ 008-1BB61-....**
1FW3154-1.H.2-....	21.5	30	**6SL3 1 2 ■-1 T E 2 3-0AA3**	gk 230 2 x M32 x 1.5	**4 x 4** 2 x 4 x 16	**6FX ■ 008-1BB31-....** **6FX ■ 008-1BB61-....**
1FW3155-1.H.2-....	29	30	**6SL3 1 2 ■-1 T E 2 3-0AA3**	gk 230 2 x M32 x 1.5	**4 x 6** 2 x 4 x 16	**6FX ■ 008-1BB41-....** **6FX ■ 008-1BB61-....**
1FW3156-1.H.2-....	35	45	**6SL3 1 2 ■-1 T E 2 4-5AA3**	gk 230 2 x M32 x 1.5	**4 x 6** 2 x 4 x 16	**6FX ■ 008-1BB41-....** **6FX ■ 008-1BB61-....**
1FW3201-1.H.2-....	24	30	**6SL3 1 2 ■-1 T E 2 3-0AA3**	gk 230 2 x M32 x 1.5	**4 x 4** 2 x 4 x 16	**6FX ■ 008-1BB31-....** **6FX ■ 008-1BB61-....**
1FW3202-1.H.2-....	39	45	**6SL3 1 2 ■-1 T E 2 4-5AA3**	gk 230 2 x M32 x 1.5	**4 x 10** 2 x 4 x 16	**6FX ■ 008-1BB51-....** **6FX ■ 008-1BB61-....**
1FW3203-1.H.2-....	62	60	**6SL3 1 2 ■-1 T E 2 6-0AA3**	gk 420 2 x M40 x 1.5	**4 x 16** 2 x 4 x 35	**6FX ■ 008-1BB61-....** **6FX ■ 008-1BB35-....**
1FW3204-1.H.2-....	77	85	**6SL3 1 2 ■-1 T E 2 8-5AA3**	gk 420 2 x M40 x 1.5	**4 x 25** 2 x 4 x 35	**6FX ■ 008-1BB25-....** **6FX ■ 008-1BB35-....**
1FW3206-1.H.2-....	121	132	**6SL3 1 2 ■-1 T E 3 1-3AA3**	gk 630 2 x M50 x 1.5	**4 x 50** 2 x 4 x 50	**6FX ■ 008-1BB50-....** **6FX ■ 008-1BB50-....**
1FW3208-1.H.2-....	160	200	**6SL3 1 2 ■-1 T E 3 2-0AA3**	gk 630 2 x M50 x 1.5	**2 x 4 x 35** 2 x 4 x 50	**6FX ■ 008-1BB35-....** **6FX ■ 008-1BB50-....**

Format: Booksize Chassis	**1** **3**										
Cooling: Internal air cooling External air cooling		**0** **1**									
Motor Module: Single Motor Module Double Motor Module			**1** **2**								
Type of power cable: MOTION-CONNECT 800 MOTION-CONNECT 500								**5** **8**			
For length code for power and signal cables, see MOTION-CONNECT connection system.											**....**

[1] 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).
In the second line, the maximum connectable cable cross-sections are specified when other ambient conditions or installation types exist.
Differing ambient conditions can be configured with SIZER.

1FW3 torque motors Water cooling

Selection and ordering data

Rated speed	Shaft height	Rated power	Rated torque	Rated current	Static torque	1FW3 torque motors Water cooling	Number of pole pairs	Rotor moment of inertia	Weight approx.
n_{rated}	SH	P_{rated} at ΔT=100 K	M_{rated} at ΔT=100 K	I_{rated} at ΔT=100 K	M_0 at ΔT=100 K	Order No.		J	m
rpm		kW (HP)	Nm (lb_f-ft)	A	Nm (lb_f-ft)			kgm^2 (lb_f-in-s^2)	kg (lb)
Line voltage 400 V 3 AC Active Line Module									
500	150	5.2 (6.97)	100 (73.8)	11.0	105 (77.4)	**1FW3150-1 ■ L ■ 2 - ■ A A 0**	7	0.12 (1.06)	87 (192)
		10.5 (14.1)	200 (148)	22.0	210 (155)	**1FW3152-1 ■ L ■ 2 - ■ A A 0**	7	0.16 (1.42)	108 (238)
		15.7 (21.1)	300 (221)	32.0	315 (232)	**1FW3154-1 ■ L ■ 2 - ■ A A 0**	7	0.20 (1.77)	129 (284)
		20.9 (28.0)	400 (295)	43.0	420 (310)	**1FW3155-1 ■ L ■ 2 - ■ A A 0**	7	0.24 (2.12)	150 (331)
		26.2 (35.1)	500 (369)	53.0	525 (387)	**1FW3156-1 ■ L ■ 2 - ■ A A 0**	7	0.28 (2.48)	171 (377)
	200	15.7 (21.1)	300 (221)	37.0	315 (232)	**1FW3201-1 ■ L ■ 2 - ■ A A 0**	14	0.22 (1.95)	127 (280)
		26.2 (35.1)	500 (369)	59.0	525 (387)	**1FW3202-1 ■ L ■ 2 - ■ A A 0**	14	0.36 (3.19)	156 (344)
		39.3 (52.7)	750 (553)	92.0	790 (583)	**1FW3203-1 ■ L ■ 2 - ■ A A 0**	14	0.49 (4.34)	182 (401)
		52.3 (70.1)	1000 (738)	118.0	1050 (775)	**1FW3204-1 ■ L ■ 2 - ■ A A 0**	14	0.70 (6.20)	223 (492)
		73.3 (98.3)	1400 (1033)	169.0	1575 (1162)	**1FW3206-1 ■ L ■ 2 - ■ A A 0**	14	0.97 (8.59)	279 (615)
		96.8 (130)	1850 (1365)	226.0	2100 (1549)	**1FW3208-1 ■ L ■ 2 - ■ A A 0**	14	1.31 (11.6)	348 (767)
750	150	7.9 (10.6)	100 (73.8)	17.0	105 (77.4)	**1FW3150-1 ■ P ■ 2 - ■ A A 0**	7	0.12 (1.06)	87 (192)
		15.7 (21.1)	200 (148)	32.5	210 (155)	**1FW3152-1 ■ P ■ 2 - ■ A A 0**	7	0.16 (1.42)	108 (238)
		23.6 (31.7)	300 (221)	47.5	315 (232)	**1FW3154-1 ■ P ■ 2 - ■ A A 0**	7	0.20 (1.77)	129 (284)
		31.5 (42.2)	400 (295)	64.0	420 (310)	**1FW3155-1 ■ P ■ 2 - ■ A A 0**	7	0.24 (2.12)	150 (331)
		39.3 (52.7)	500 (369)	76.0	525 (387)	**1FW3156-1 ■ P ■ 2 - ■ A A 0**	7	0.28 (2.48)	171 (377)

Encoder systems for motors without DRIVE-CLiQ interface:	Incremental encoder sin/cos 1 V_{pp}	Belt-mounted	**A**	**7**
	Absolute encod., multi. EnDat 2048 S/R	Coaxial mounted	**E**	**6**
	Absolute encod., multi. EnDat 2048 S/R	Belt-mounted	**E**	**7**
	Multi-pole resolver	Belt-mounted	**S**	**7**
	Absolute encod., single. EnDat 2048 S/R	Coaxial mounted	**N**	**6**
Encoder systems for motors with DRIVE-CLiQ interface:	22 bit incremental encoder	Belt-mounted	**D**	**7**
	22 bit absolute encoder, single-turn +12 bit multi-turn	Coaxial mounted	**F**	**6**
	22 bit absolute encoder, single-turn +12 bit multi-turn	Belt-mounted	**F**	**7**
	15 bit resolver	Belt-mounted	**U**	**7**
	22 bit absolute encoder, single-turn	Coaxial mounted	**P**	**6**
Type:	IM B14 (for shaft heights 150 and 200)			**2**
Terminal box top:	Cable outlet transverse right			**5**
	Cable outlet transverse left			**6**
	Cable outlet NDE			**7**
	Cable outlet DE			**8**

Further rated speeds on request.

Selection and ordering data

Motor type (continued)	Static current	SINAMICS S120 Motor Module		Power cable with complete shield Motor connection via terminal box		
		Rated output current				
	I_0 at ΔT=100 K	I_{rated}	Order No.	Terminal box type Cable entry	Cable cross-section [1] Max. possible cross-section	Order No. Power cable By the meter
	A	A			mm²	
Line voltage 400 V 3 AC Active Line Module						
1FW3150-1 . L. 2-....	11.5	18	**6SL3 1 2 ■-■ T E 2 1 -8AA3**	gk 230 2 x M32 x 1.5	**4 x 1.5** 2 x 4 x 16	**6FX ■ 008-1BB11-....** **6FX ■ 008-1BB61-....**
1FW3152-1 . L. 2-....	22.5	30	**6SL3 1 2 ■- 1 T E 2 3 -0AA3**	gk 230 2 x M32 x 1.5	**4 x 4** 2 x 4 x 16	**6FX ■ 008-1BB31-....** **6FX ■ 008-1BB61-....**
1FW3154-1 . L. 2-....	33	45	**6SL3 1 2 ■- 1 T E 2 4 -5AA3**	gk 230 2 x M32 x 1.5	**4 x 6** 2 x 4 x 16	**6FX ■ 008-1BB41-....** **6FX ■ 008-1BB61-....**
1FW3155-1 . L. 2-....	45	60	**6SL3 1 2 ■- 1 T E 2 6 -0AA3**	gk 230 2 x M32 x 1.5	**4 x 10** 2 x 4 x 16	**6FX ■ 008-1BB51-....** **6FX ■ 008-1BB61-....**
1FW3156-1 . L. 2-....	55	60	**6SL3 1 2 ■- 1 T E 2 6 -0AA3**	gk 420 2 x M40 x 1.5	**4 x 16** 2 x 4 x 35	**6FX ■ 008-1BB61-....** **6FX ■ 008-1BB35-....**
1FW3201-1 . L. 2-....	38	45	**6SL3 1 2 ■- 1 T E 2 4 -5AA3**	gk 230 2 x M32 x 1.5	**4 x 10** 2 x 4 x 16	**6FX ■ 008-1BB51-....** **6FX ■ 008-1BB35-....**
1FW3202-1 . L. 2-....	62	60	**6SL3 1 2 ■- 1 T E 2 6 -0AA3**	gk 420 2 x M40 x 1.5	**4 x 16** 2 x 4 x 35	**6FX ■ 008-1BB61-....** **6FX ■ 008-1BB35-....**
1FW3203-1 . L. 2-....	100	132	**6SL3 1 2 ■- 1 T E 3 1 -3AA3**	gk 420 2 x M40 x 1.5	**4 x 35** 2 x 4 x 35	**6FX ■ 008-1BB35-....** **6FX ■ 008-1BB35-....**
1FW3204-1 . L. 2-....	129	132	**6SL3 1 2 ■- 1 T E 3 1 -3AA3**	gk 630 2 x M50 x 1.5	**2 x 4 x 50** 2 x 4 x 50	**6FX ■ 008-1BB50-....** **6FX ■ 008-1BB50-....**
1FW3206-1 . L. 2-....	189	200	**6SL3 1 2 ■- 1 T E 3 2 -0AA3**	gk 630 2 x M50 x 1.5	**2 x 4 x 35** 2 x 4 x 50	**6FX ■ 008-1BB35-....** **6FX ■ 008-1BB50-....**
1FW3208-1 . L. 2-....	256	260	**6SL3 3 2 0 - 1 T E 3 2 -6AA0**	gk 630 2 x M50 x 1.5	**2 x 4 x 50** 2 x 4 x 50	**6FX ■ 008-1BB50-....** **6FX ■ 008-1BB50-....**
1FW3150-1 . P. 2-....	17.5	18	**6SL3 1 2 ■-■ T E 2 1 -8AA3**	gk 230 2 x M32 x 1.5	**4 x 2.5** 2 x 4 x 16	**6FX ■ 008-1BB25-....** **6FX ■ 008-1BB61-....**
1FW3152-1 . P. 2-....	33.5	45	**6SL3 1 2 ■- 1 T E 2 4 -5AA3**	gk 230 2 x M32 x 1.5	**4 x 6** 2 x 4 x 16	**6FX ■ 008-1BB41-....** **6FX ■ 008-1BB61-....**
1FW3154-1 . P. 2-....	49	60	**6SL3 1 2 ■- 1 T E 2 6 -0AA3**	gk 230 2 x M32 x 1.5	**4 x 10** 2 x 4 x 16	**6FX ■ 008-1BB51-....** **6FX ■ 008-1BB61-....**
1FW3155-1 . P. 2-....	67	85	**6SL3 1 2 ■- 1 T E 2 8 -5AA3**	gk 420 2 x M40 x 1.5	**4 x 25** 2 x 4 x 3	**6FX ■ 008-1BB25-....** **6FX ■ 008-1BB35-....**
1FW3156-1 . P. 2-....	80	85	**6SL3 1 2 ■- 1 T E 2 8 -5AA3**	gk 420 2 x M40 x 1.5	**4 x 25** 2 x 4 x 35	**6FX ■ 008-1BB25-....** **6FX ■ 008-1BB35-....**

Format: Booksize Chassis	**1** **3**										
Cooling: Internal air cooling External air cooling		**0** **1**									
Motor Module: Single Motor Module Double Motor Module			**1** **2**								
Type of power cable: MOTION-CONNECT 800 MOTION-CONNECT 500								**5** **8**			
For length code for power and signal cables, see MOTION-CONNECT connection system.											**....**

[1] 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).
In the second line, the maximum connectable cable cross-sections are specified when other ambient conditions or installation types exist.
Differing ambient conditions can be configured with SIZER.

Dimension drawings

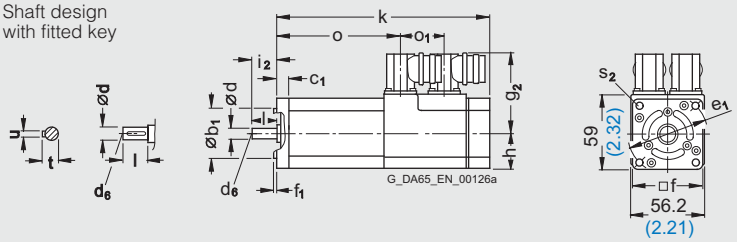
1FT6 motors with/without DRIVE-CLiQ
Natural cooling

For motor			Dimensions in mm (in)																
									Without DRIVE-CLiQ	With DRIVE-CLiQ					Encoder system: Resolver			
															without brake		with brake	
Shaft height	Type	DIN IEC	a_1 P	b_1 N	c_1 LA	e_1 M	f AB	f_1 T	g_2 –	g_2 –	h H	i_2 –	s_2 S	o_1	k LB	o –	k LB	o –
1FT6, type IM B5, natural cooling, with connector, with/without brake																		
28	**1FT6021**		–	40 (1.57)	9.8 (0.39)	63 (2.48)	55 (2.17)	2.5 (0.10)	64 (2.52)	73.5 (2.89)	28 (1.10)	20 (0.79)	5.8 (0.23)	34.5 (1.36)	193 (7.60)	122 (4.80)	218 (8.58)	147 (5.79)
	1FT6024														233 (9.17)	162 (6.38)	258 (10.16)	187 (7.36)
36	**1FT6031**		92 (3.62)	60 (2.36)	8 (0.31)	75 (2.95)	72 (2.83)	3 (0.12)	76 (2.99)	86 (3.39)	36 (1.42)	30 (1.18)	5.5 (0.22)	–	180 (7.09)	151 (5.94)	200 (7.87)	171 (6.73)
	1FT6034														220 (8.66)	191 (7.52)	240 (9.45)	211 (8.31)

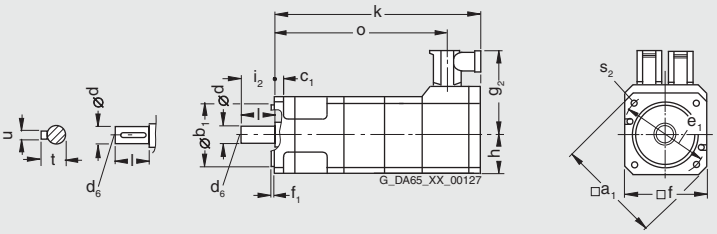
			Encoder system: Incremental encoder Absolute encoder				DE shaft extension				
			without brake		with brake						
Shaft height	Type	DIN IEC	k LB	o –	k LB	o –	**d** **D**	d_6 –	l E	t GA	u F
28	**1FT6021**		193 (7.60)	122 (4.80)	218 (8.58)	147 (5.79)	**9** **(0.35)**	M3	20 (0.79)	10.2 (0.40)	3 (0.12)
	1FT6024		233 (9.17)	162 (6.38)	258 (10.16)	187 (7.36)					
36	**1FT6031**		220 (8.66)	151 (5.94)	240 (9.45)	171 (6.73)	**14** **(0.55)**	M5	30 (1.18)	16 (0.63)	5 (0.20)
	1FT6034		260 (10.24)	191 (7.52)	280 (11.02)	211 (8.31)					

1FT602

Shaft design with fitted key



1FT603

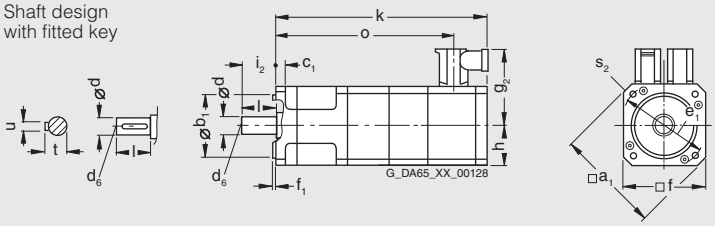


For motor			Dimensions in mm (in)						Without DRIVE-CLiQ	With DRIVE-CLiQ					Encoder system: Resolver			
															without brake		with brake	
Shaft height	Type	DIN IEC	a_1 P	b_1 N	c_1 LA	e_1 M	f AB	f_1 T	g_2 –	g_2 –	h H	i_2 –	s_2 [1] S	s_2 [2] S	k LB	o –	k LB	o –
1FT6, type IM B5, natural cooling, with connector, with/without brake																		
48	**1FT6041**		120 (4.72)	80 (3.15)	10 (0.39)	100 (3.94)	96 (3.78)	3 (0.12)	80 (3.15)	90 (3.54)	48 (1.89)	40 (1.57)	7 (0.28)	M6	185 (7.28)	159 (6.26)	220 (8.66)	194 (7.64)
	1FT6044														235 (9.25)	209 (8.23)	270 (10.63)	244 (9.61)
63	**1FT6061**		146 (5.75)	110 (4.33)	10 (0.39)	130 (5.12)	116 (4.57)	3.5 (0.14)	90 (3.54)	100 (3.94)	58 (2.28)	50 (1.97)	9 (0.35)	M8	198 (7.80)	172 (6.77)	228 (8.98)	202 (7.95)
	1FT6062														223 (8.78)	197 (7.76)	253 (9.96)	227 (8.94)
	1FT6064														273 (10.75)	247 (9.72)	303 (11.93)	277 (10.91)

			Encoder system: Incremental encoder Absolute encoder				DE shaft extension				
			without brake		with brake						
Shaft height	Type	DIN IEC	k LB	o –	k LB	o –	**d** **D**	d_6 –	l E	t GA	u F
48	**1FT6041**		228 (8.98)	157 (6.18)	263 (10.35)	192 (7.56)	**19** **(0.75)**	M6	40 (1.57)	21.5 (0.85)	6 (0.24)
	1FT6044		278 (10.94)	207 (8.15)	313 (12.32)	242 (9.53)					
63	**1FT6061**		228 (8.98)	172 (6.77)	258 (10.16)	202 (7.95)	**24** **(0.94)**	M8	50 (1.97)	27 (1.06)	8 (0.31)
	1FT6062		253 (9.96)	197 (7.76)	283 (11.14)	227 (8.94)					
	1FT6064		303 (11.93)	247 (9.72)	333 (13.11)	277 (10.91)					

1FT604
1FT606

Shaft design with fitted key



[1] IM B5
[2] IM B14

Dimension drawings

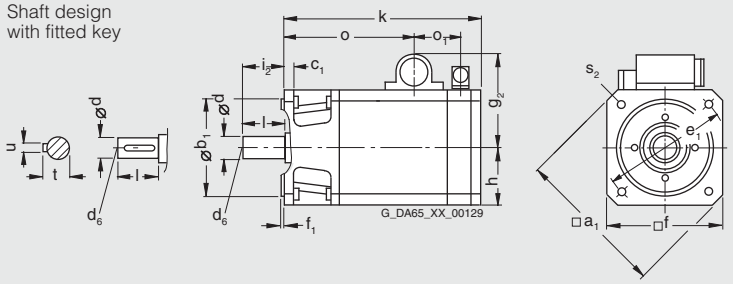
1FT6 motors with/without DRIVE-CLiQ
Natural cooling

For motor		Dimensions in mm (in)												Encoder system: Resolver			
														without brake		with brake	
Shaft height	Type	DIN IEC	a_1 P	b_1 N	c_1 LA	e_1 M	f AB	f_1 T	g_2 –	h H	i_2 –	s_2 [1] S	s_2 [2] S	o_1 –	k LB	o –	k LB	o –
1FT6, type IM B5, natural cooling, with connector, with/without brake																	
80	**1FT6081**		194 (7.64)	130 (5.12)	12 (0.47)	165 (6.50)	155 (6.10)	3.5 (0.14)	127.5 (5.02)	77.5 (3.05)	58 (2.28)	11 (0.43)	M10	76 (2.99)	221 (8.70)	113 (4.45)	248 (9.76)	140 (5.51)
	1FT6082														246 (9.69)	138 (5.43)	273 (10.75)	165 (6.50)
	1FT6084														296 (11.65)	188 (7.40)	342 (13.46)	234 (9.21)
	1FT6086														346 (13.62)	238 (9.37)	392 (15.43)	284 (11.18)

			Encoder system: Incremental encoder Absolute encoder				DE shaft extension				
			without brake		with brake						
Shaft height	Type	DIN IEC	k LB	o –	k LB	o –	**d D**	d_6 –	l E	t GA	u F
80	**1FT6081**		221 (8.70)	113 (4.45)	248 (9.76)	140 (5.51)	**32 (1.26)**	M12	58 (2.28)	35 (1.38)	10 (0.39)
	1FT6082		246 (9.69)	138 (5.43)	273 (10.75)	165 (6.50)					
	1FT6084		296 (11.65)	188 (7.40)	342 (13.46)	234 (9.21)					
	1FT6086		346 (13.62)	238 (9.37)	392 (15.43)	284 (11.18)					

1FT608

Shaft design with fitted key



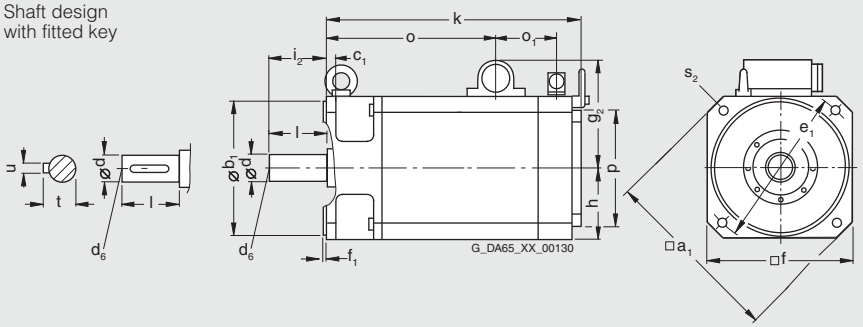
[1] IM B5
[2] IM B14

For motor		Dimensions in mm (in)														
									Connector Size							
									1.5	3						
Shaft height	Type	DIN IEC	a_1 P	b_1 N	c_1 LA	e_1 M	f AB	f_1 T	g_2 –	g_2 –	h H	i_2 –	p HD	s_2 [1] S	s_2 [2] S	o_1 –
1FT6, type IM B5, natural cooling, with connector, with/without brake																
100	**1FT6102** **1FT6105** **1FT6108**		240 (9.45)	180 (7.09)	13 (0.51)	215 (8.46)	192 (7.56)	4 (0.16)	146 (5.75)	172 (6.77)	96 (3.78)	80 (3.15)	155 (6.10)	14 (0.55)	M12	76 (2.99)
132	**1FT6132** **1FT6134** **1FT6136**		–	250 (9.84)	18 (0.71)	300 (11.81)	260 (10.24)	5 (0.20)	172.5 (6.79)	198.5 (7.81)	132 (5.20)	82 (3.23)	245 (9.65)	18 (0.71)	–	66 (2.60)

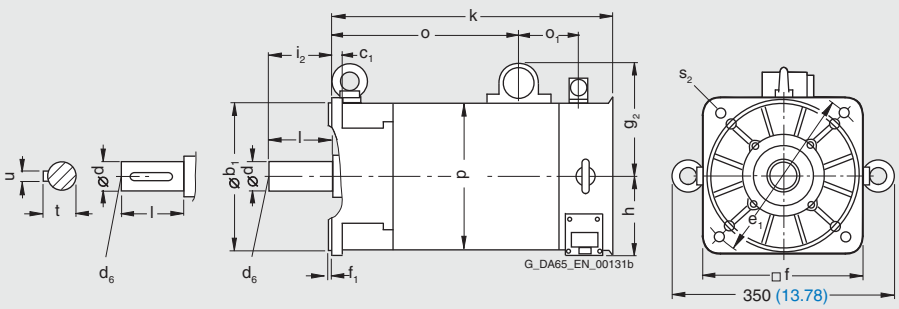
			Encoder system: Resolver				Incremental encoder Absolute encoder				DE shaft extension				
			without brake		with brake		without brake		with brake						
Shaft height	Type	DIN IEC	k LB	o –	k LB	o –	k LB	o –	k LB	o –	**d** **D**	d_6 –	l E	t GA	u F
100	**1FT6102**		295 (11.61)	186 (7.32)	341 (13.43)	232 (9.13)	295 (11.61)	186 (7.32)	341 (13.43)	232 (9.13)	**38** **(1.50)**	M12	80 (3.15)	41 (1.61)	10 (0.39)
	1FT6105		370 (14.57)	261 (10.28)	416 (16.38)	307 (12.09)	370 (14.57)	261 (10.28)	416 (16.38)	307 (12.09)					
	1FT6108		470 (18.50)	361 (14.21)	516 (20.31)	407 (16.02)	470 (18.50)	361 (14.21)	516 (20.31)	407 (16.02)					
132	**1FT6132**		423 (16.65)	288 (11.34)	473 (18.62)	338 (13.31)	423 (16.65)	288 (11.34)	473 (18.62)	338 (13.31)	**48** **(1.89)**	M16	82 (3.23)	52.5 (2.07)	14 (0.55)
	1FT6134		473 (18.62)	338 (13.31)	523 (20.59)	388 (15.28)	473 (18.62)	338 (13.31)	523 (20.59)	388 (15.28)					
	1FT6136		523 (20.59)	388 (15.28)	573 (22.56)	438 (17.24)	523 (20.59)	388 (15.28)	573 (22.56)	438 (17.24)					

1FT610

Shaft design with fitted key



1FT613



[1] IM B5
[2] IM B14

Dimension drawings

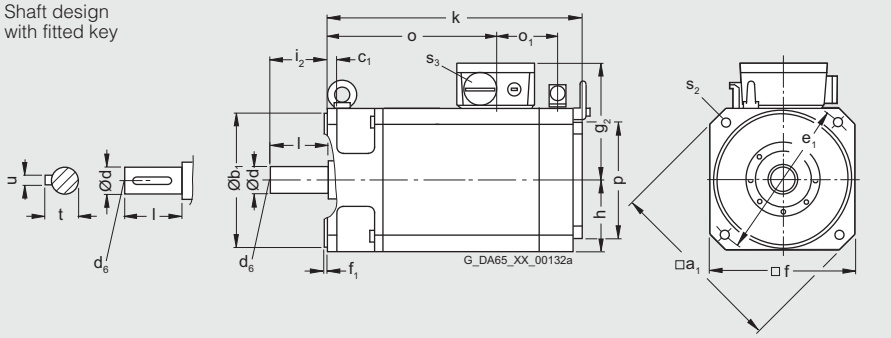
1FT6 motors with/without DRIVE-CLiQ
Natural cooling

For motor		Dimensions in mm (in)															
									Terminal box								
									gk 130	gk 230							
Shaft height	Type	DIN IEC	a_1 P	b_1 N	c_1 LA	e_1 M	f AB	f_1 T	g_2 –	g_2 –	h H	i_2 –	p HD	s_2 [1] S	s_2 [2] S	s_3 –	o_1 –
1FT6, type IM B5, natural cooling, with terminal box, with/without brake																	
100	**1FT6102** **1FT6105** **1FT6108**		240 (9.45)	180 (7.09)	13 (0.51)	215 (8.46)	192 (7.56)	4 (0.16)	155 (6.10)	160 (6.30)	96 (3.78)	80 (3.15)	155 (6.10)	14 (0.55)	M12	PG29	76 (2.99)
132	**1FT6132** **1FT6134** **1FT6136**		–	250 (9.84)	18 (0.71)	300 (11.81)	260 (10.24)	5 (0.20)	–	194 (7.64)	132 (5.20)	82 (3.23)	245 (9.65)	18 (0.71)	–	PG29/ PG36	–

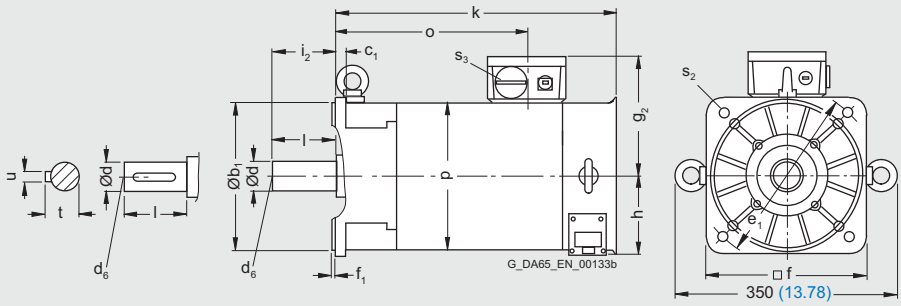
			Encoder system: Resolver				Incremental encoder Absolute encoder				DE shaft extension				
			without brake		with brake		without brake		with brake						
Shaft height	Type	DIN IEC	k LB	o –	k LB	o –	k LB	o –	k LB	o –	**d** **D**	d_6 –	l E	t GA	u F
100	**1FT6102**		295 (11.61)	186 (7.32)	341 (13.43)	232 (9.13)	295 (11.61)	186 (7.32)	341 (13.43)	232 (9.13)	**38** **(1.50)**	M12	80 (3.15)	41 (1.61)	10 (0.39)
	1FT6105		370 (14.57)	261 (10.28)	416 (16.38)	307 (12.09)	370 (14.57)	261 (10.28)	416 (16.38)	307 (12.09)					
	1FT6108		470 (18.50)	361 (14.21)	516 (20.31)	407 (16.02)	470 (18.50)	361 (14.21)	516 (20.31)	407 (16.02)					
132	**1FT6132**		423 (16.65)	288 (11.34)	473 (18.62)	338 (13.31)	423 (16.65)	288 (11.34)	473 (18.62)	338 (13.31)	**48** **(1.89)**	M16	82 (3.23)	51.5 (2.03)	14 (0.55)
	1FT6134		473 (18.62)	338 (13.31)	523 (20.59)	388 (15.28)	473 (18.62)	338 (13.31)	523 (20.59)	388 (15.28)					
	1FT6136		523 (20.59)	388 (15.28)	573 (22.56)	438 (17.24)	523 (20.59)	388 (15.28)	573 (22.56)	438 (17.24)					

1FT610

Shaft design with fitted key



1FT613



[1] IM B5
[2] IM B14

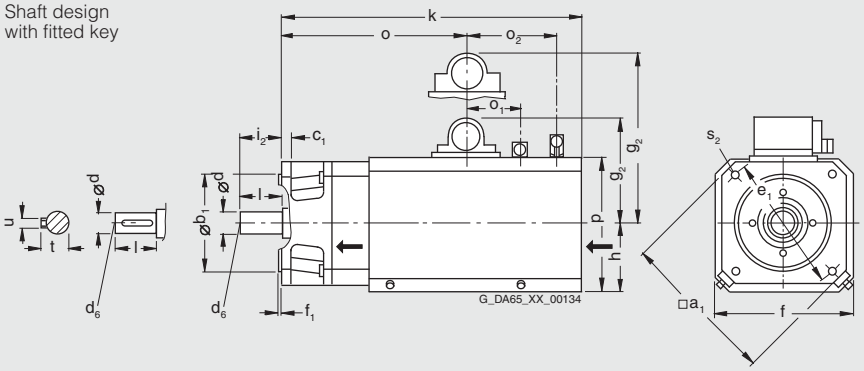
For motor — Dimensions in mm (in)

Shaft height	Type	DIN IEC	a_1 P	b_1 N	c_1 LA	e_1 M	f AB	f_1 T	Connector Size 1.5 g_2 –	Connector Size 3 g_2 –	h H	i_2 –	p HD	s_2 [1] S	s_2 [2] S	o_1 –	o_2 –
1FT6, type IM B5, forced ventilation, with connector, with/without brake																	
80	**1FT6084** **1FT6086**		194 (7.64)	130 (5.12)	12 (0.47)	165 (6.50)	185 (7.28)	3.5 (0.14)	140 (5.51)	154 (6.06)	93 (3.66)	58 (2.28)	175 (6.89)	11 (0.43)	M10	76 (2.99)	169 (6.65)
100	**1FT6105** **1FT6108**		240 (9.45)	180 (7.09)	13 (0.51)	215 (8.46)	221 (8.70)	4 (0.16)	158 (6.22)	172 (6.77)	111 (4.37)	80 (3.15)	212 (8.35)	14 (0.55)	M12	76 (2.99)	170 (6.69)

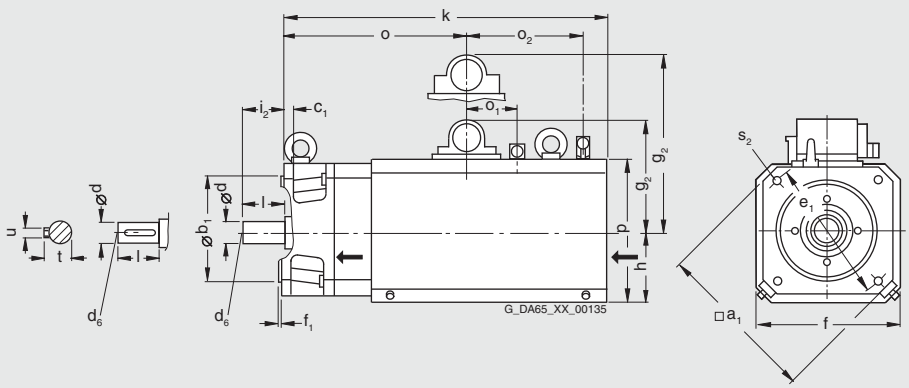
Shaft height	Type	DIN IEC	Encoder system: Resolver / Incremental encoder / Absolute encoder — without brake k LB	without brake o –	with brake k LB	with brake o –	DE shaft extension d D	d_6 –	l E	t GA	u F
80	**1FT6084**		399 (15.71)	188 (7.40)	445 (17.52)	234 (9.21)	**32** **(1.26)**	M12	58 (2.28)	35 (1.38)	10 (0.39)
	1FT6086		449 (17.68)	238 (9.37)	495 (19.49)	284 (11.18)					
100	**1FT6105**		473 (18.62)	261 (10.28)	519 (20.43)	307 (12.09)	**38** **(1.50)**	M12	80 (3.15)	41 (1.61)	10 (0.39)
	1FT6108		573 (22.56)	361 (14.21)	619 (24.37)	407 (16.02)					

1FT608

Shaft design with fitted key



1FT610



1) IM B5
2) IM B14

Dimension drawings

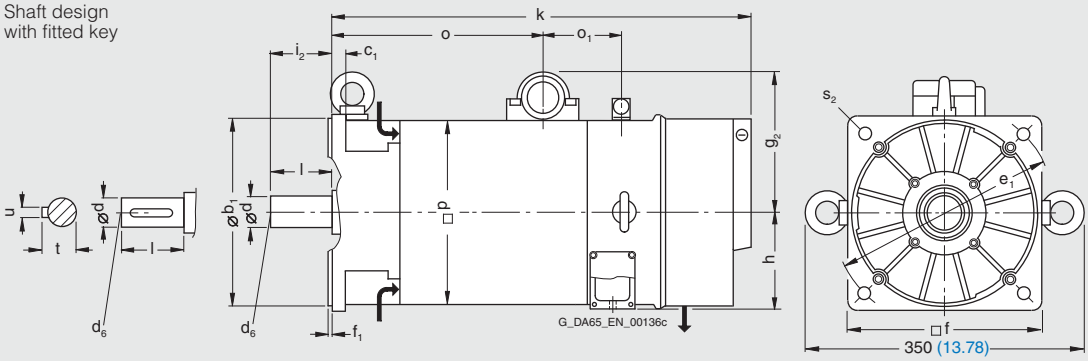
1FT6 motors with/without DRIVE-CLiQ
Forced ventilation

For motor		Dimensions in mm (in)								Connector Size 3							
Shaft height	Type	DIN IEC	a_1 P	b_1 N	c_1 LA	e_1 M	f AB	f_1 T	g_2 –	h H	i_2 –	p HD	s_2 [1] S	s_2 [2] S	o_1 –	o_2 –
1FT6, type IM B5, forced ventilation, with connector, with/without brake																
132	**1FT6132** **1FT6134** **1FT6136**		–	250 (9.84)	18 (0.71)	300 (11.81)	260 (10.24)	5 (0.20)	198.5 (7.81)	132 (5.20)	82 (3.23)	245 (9.65)	18 (0.71)	–	66 (2.60)	–

			Encoder system: Resolver / Incremental encoder / Absolute encoder				DE shaft extension				
			without brake		with brake						
Shaft height	Type	DIN IEC	k LB	o –	k LB	o –	**d** **D**	d_6 –	l E	t GA	u F
132	**1FT6132**		541 (21.30)	288 (11.34)	591 (23.27)	338 (13.31)	**48** **(1.89)**	M16	82 (3.23)	51.5 (2.03)	14 (0.55)
	1FT6134		591 (23.27)	338 (13.31)	641 (25.24)	388 (15.28)					
	1FT6136		641 (25.24)	388 (15.28)	691 (27.20)	438 (17.24)					

1FT613

Shaft design with fitted key



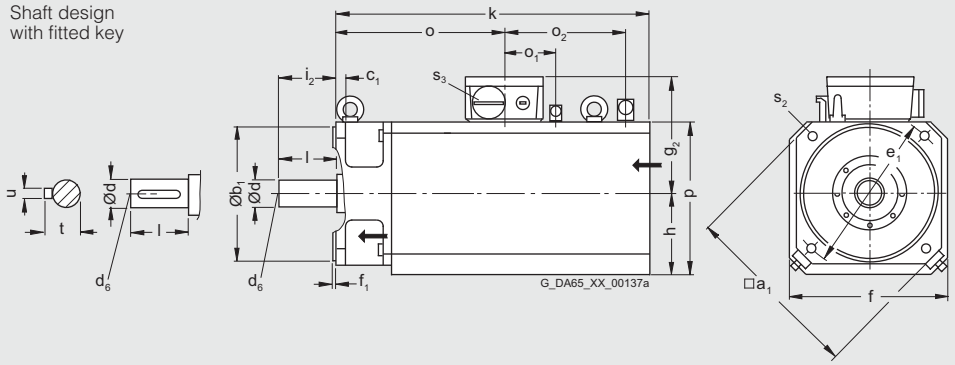
[1] IM B5
[2] IM B14

For motor		Dimensions in mm (in)							Terminal box								
									gk 130	gk 230	gk 420						
Shaft height	Type	DIN IEC	a_1 P	b_1 N	c_1 LA	e_1 M	f AB	f_1 T	g_2 –	g_2 –	g_2 –	h H	i_2 –	p HD	s_2 [1] S	s_2 [2] S	s_3 –
1FT6, type IM B5, forced ventilation, with terminal box, with/without brake																	
100	**1FT6105** **1FT6108**		240 (9.45)	180 (7.09)	13 (0.51)	215 (8.46)	221 (8.70)	4 (0.16)	167 (6.57)	172 (6.77)	–	111 (4.37)	80 (3.15)	212 (8.35)	14 (0.55)	M12	PG29
132	**1FT6132** **1FT6134** **1FT6136**		–	250 (9.84)	18 (0.71)	300 (11.81)	260 (10.24)	5 (0.20)	–	186.5 (7.34)	202 (7.95)	132 (5.20)	82 (3.23)	245 (9.65)	18 (0.71)	–	PG29/ PG36

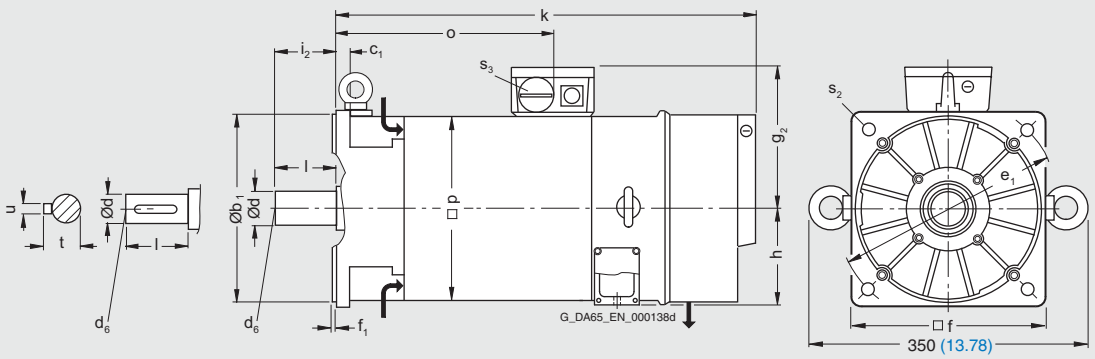
					Encoder system: Resolver / Incremental encoder / Absolute encoder				DE shaft extension				
					without brake		with brake						
Shaft height	Type	DIN IEC	o_1 –	o_2 –	k LB	o –	k LB	o –	**d** **D**	d_6 –	l E	t GA	u F
100	**1FT6105**		76 (2.99)	170 (6.69)	473 (18.62)	261 (10.28)	519 (20.43)	307 (12.09)	**38** **(1.50)**	M12	80 (3.15)	41 (1.61)	10 (0.39)
	1FT6108				573 (22.56)	361 (14.21)	619 (24.37)	407 (16.02)					
132	**1FT6132**		–	–	541 (21.30)	288 (11.34)	591 (23.27)	338 (13.31)	**48** **(1.89)**	M16	82 (3.23)	51.5 (2.03)	14 (0.55)
	1FT6134				591 (23.27)	338 (13.31)	641 (25.24)	388 (15.28)					
	1FT6136				641 (25.24)	388 (15.28)	691 (27.20)	438 (17.24)					

1FT610

Shaft design with fitted key



1FT613



[1] IM B5
[2] IM B14

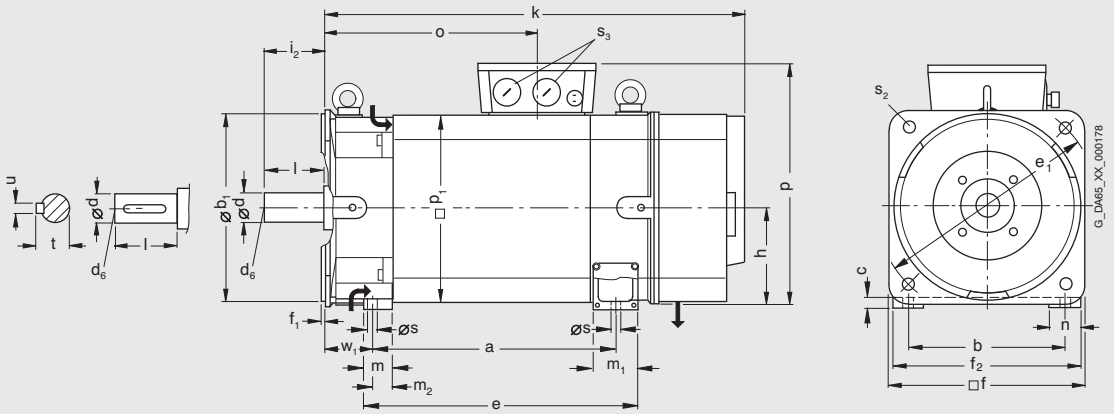
Dimension drawings

1FT6 Big Servo motors with/without DRIVE-CLiQ
Forced ventilation

For motor		Dimensions in mm (in)															
Shaft height	Type	DIN IEC	a B	b A	b_1 N	c LA	e BB	e_1 M	f AB	f_1 T	f_2 AB	h H	i_2 –	k LB	m BA	m_1 –	m_2 S
1FT6 Big Servo, type IM B35, forced ventilation, with terminal box																	
160	**1FT6163**		444 (17.48)	254 (10)	300 (11.81)	17 (0.67)	493 (19.41)	350 (13.78)	314 (12.36)	5 (0.2)	286 (11.26)	160 (6.3)	110 (4.33)	707 (27.83)	31 (1.22)	65 (2.56)	16 (0.63)
	1FT6168		544 (21.42)				593 (23.35)							807 (31.77)			

											DE shaft extension					
Shaft height	Type	DIN IEC	n AA	o -	p HD	p_1 AC	s K	s_2 S	s_3 -	w_1 C	**d D**	d_6 –	l E	t GA	u F
160	**1FT6163**		52 (2.05)	391.5 (15.41)	403.5 (15.89)	294 (11.57)	14 (0.55)	18 (0.71)	M50 x 1.5	70 (2.76)	**55 (2.17)**	M20	110 (4.33)	59 (2.32)	16 (0.63)
	1FT6168			491.5 (19.35)											

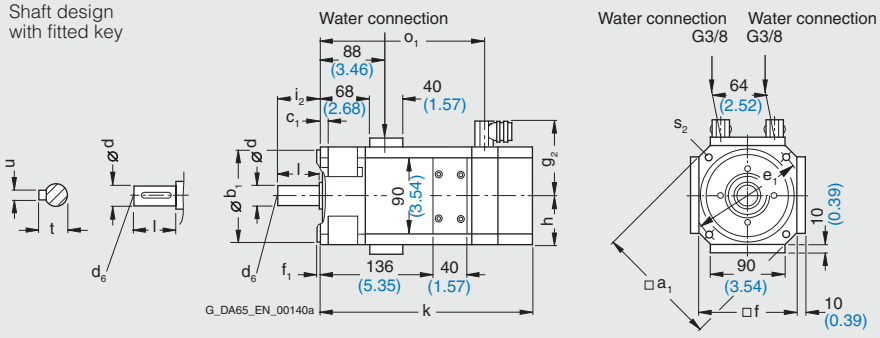
1FT616



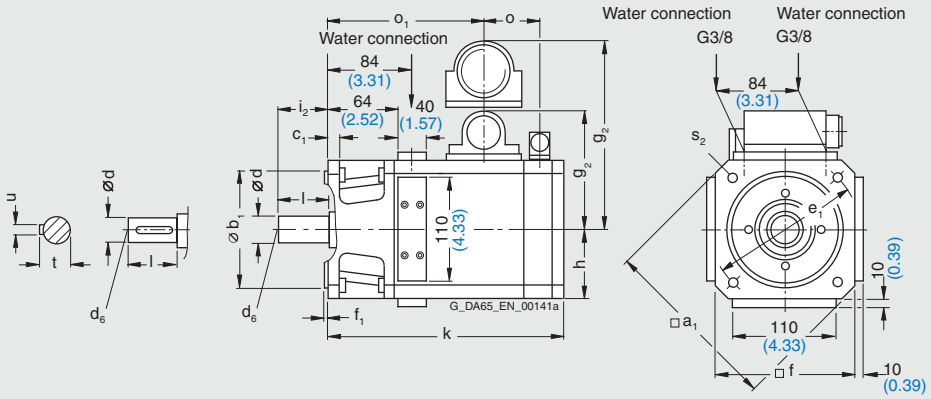
For motor		Dimensions in mm (in)							Connector size									
									With DRIVE-CLiQ	Without DRIVE-CLiQ								
									1	1	1.5	3						
Shaft height	Type	DIN IEC	a_1 P	b_1 N	c_1 LA	e_1 M	f AB	f_1 T	g_2 –	g_2 –	g_2 –	g_2 –	h H	i_2 –	p HD	s_2 S 1)	s_2 S 2)
1FT6, type IM B5, water cooling, with connector, with/without brake																	
63	**1FT6062** **1FT6064**		146 (5.75)	110 (4.33)	10 (0.39)	130 (5.12)	116 (4.57)	3.5 (0.14)	100 (3.94)	99 (3.90)	–	–	58 (2.28)	50 (1.97)	–	9 (0.35)	M8
80	**1FT6084** **1FT6086**		194 (7.64)	130 (5.12)	12 (0.47)	165 (6.50)	155 (6.10)	3.5 (0.14)	–	–	139.5 (5.49)	153.5 (6.04)	77.5 (3.05)	58 (2.28)	–	11 (0.43)	M10

				Encoder system: Resolver Incremental encoder Absolute encoder				Resolver		Incremental encoder Absolute encoder		DE shaft extension				
				without brake		with brake		with/without brake		with/without brake						
Shaft height	Type	DIN IEC	o –	k LB	o_1 –	k LB	o_1 –	k LB	o_1 –	k LB	o_1 –	**d** D	d_6 –	l E	t GA	u F
63	**1FT6062**		–	–	–	–	–	253 (9.96)	227 (8.94)	283 (11.14)	227 (8.94)	**24 (0.94)**	M8	50 (1.97)	27 (1.06)	8 (0.31)
	1FT6064							303 (11.93)	277 (10.91)	333 (13.11)	277 (10.91)					
80	**1FT6084**		76 (2.99)	296 (11.65)	188 (7.40)	342 (13.46)	234 (9.21)	–	–	–	–	**32 (1.26)**	M12	58 (2.28)	35 (1.38)	10 (0.39)
	1FT6086			346 (13.62)	238 (9.37)	392 (15.43)	284 (11.18)	–	–	–	–					

1FT606



1FT608



1) IM B5
2) IM B14

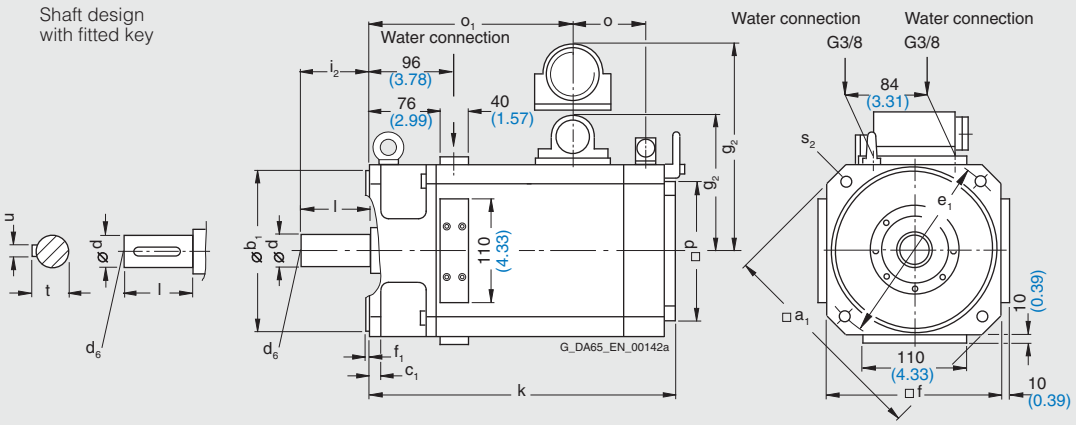
Dimension drawings

1FT6 motors with/without DRIVE-CLiQ
Water cooling

For motor		Dimensions in mm (in)															
									Connector								
									1.5	3							
Shaft height	Type	**DIN IEC**	a_1 P	b_1 N	c_1 LA	e_1 M	f AB	f_1 T	g_2 –	g_2 –	h H	i_2 –	p HD	s_2 [1] S	s_2 [2] S	o –
1FT6, type IM B5, water cooling, with connector, with/without brake																
100	**1FT6105** **1FT6108**		240 (9.45)	180 (7.09)	13 (0.51)	215 (8.46)	192 (7.56)	4 (0.16)	158 (6.22)	172 (6.77)	96 (3.78)	80 (3.15)	155 (6.10)	14 (0.55)	M12	76 (2.99)

			Encoder system: Resolver Incremental encoder Absolute encoder				DE shaft extension				
			without brake		with brake						
Shaft height	Type	**DIN IEC**	k LB	o_1 –	k LB	o_1 –	**d D**	d_6 –	l E	t GA	u F
100	**1FT6105**		370 (14.57)	261 (10.28)	416 (16.38)	307 (12.09)	**38 (1.50)**	M12	80 (3.15)	41 (1.61)	10 (0.39)
	1FT6108		470 (18.50)	361 (14.21)	516 (20.31)	407 (16.02)					

1FT610



[1] IM B5
[2] IM B14

4

For motor — Dimensions in mm (in)

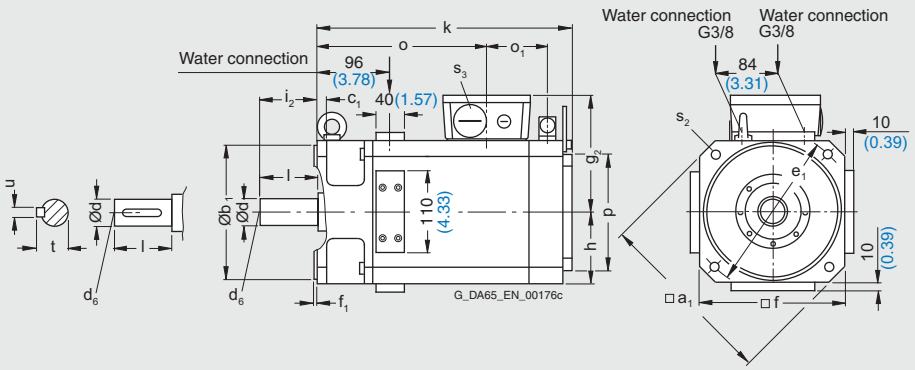
Encoder system: Resolver / Incremental encoder / Absolute encoder

Shaft height	Type	DIN IEC	a_1 P	b_1 N	c_1 LA	e_1 M	f AB	f_1 T	g_2 –	h H	i_2 –	k LB (without brake)	o – (without brake)	k LB (with brake)	o – (with brake)	o_1 –	p HD	s_2 S	s_3 -
1FT6, type IM B5, water cooling, with terminal box gk 230 for $n_{rated} \leq 2{,}000$ rpm, with/without brake																			
100	**1FT6105**		240 (9.45)	180 (7.09)	13 (0.51)	215 (8.46)	192 (7.56)	4 (0.16)	161 (6.34)	96 (3.78)	80 (3.15)	370 (14.57)	261 (10.28)	416 (16.38)	307 (12.09)	76 (2.99)	155 (6.10)	14 (0.55)	PG29
	1FT6108											470 (18.50)	361 (14.21)	516 (20.31)	407 (16.02)				
1FT6, type IM B5, water cooling, with terminal box gk 420 for $n_{rated} = 3{,}000$ rpm, with/without brake																			
	1FT6105		240 (9.45)	180 (7.09)	13 (0.51)	215 (8.46)	192 (7.56)	4 (0.16)	176 (6.93)	96 (3.78)	80 (3.15)	370 (14.57)	261 (10.28)	416 (16.38)	307 (12.09)	–	155 (6.10)	14 (0.55)	PG36
	1FT6108											470 (18.50)	361 (14.21)	516 (20.31)	407 (16.02)				

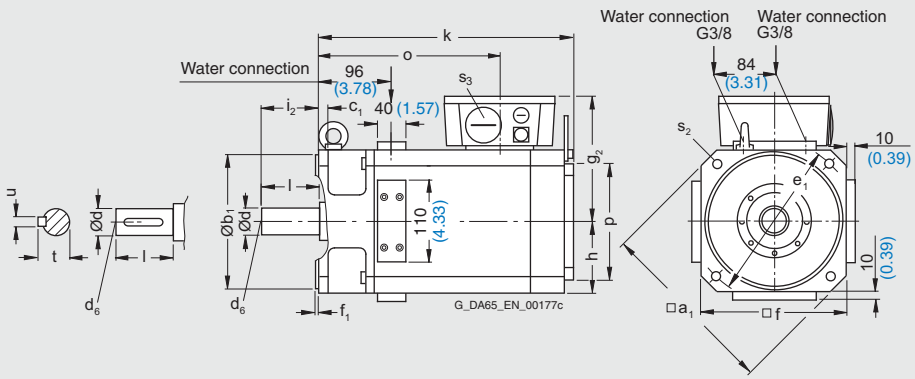
DE shaft extension

Shaft height	Type	DIN IEC	d D	d_6 –	l E	t GA	u F
100	**1FT6105** **1FT6108**		**38 (1.50)**	M12	80 (3.15)	41 (1.61)	10 (0.39)
	1FT6105 **1FT6108**		**38 (1.50)**	M12	80 (3.15)	41 (1.61)	10 (0.39)

1FT610 With terminal box gk 320



1FT610 With terminal box gk 420



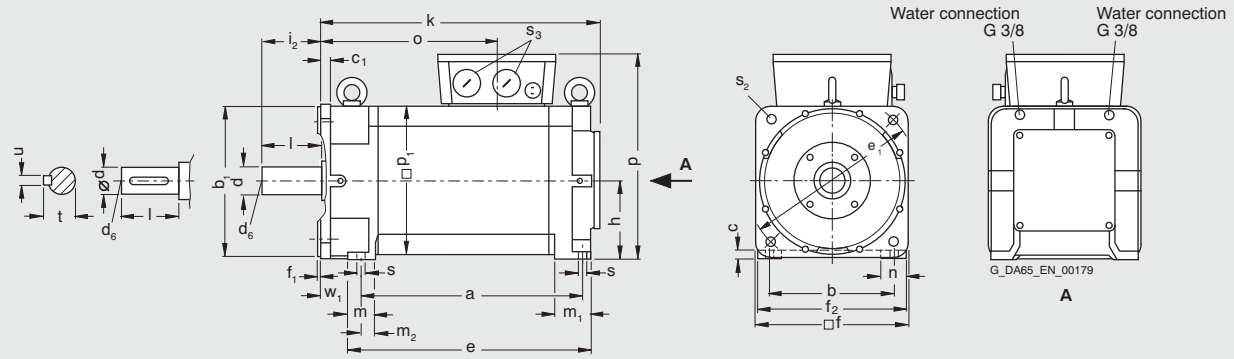
Dimension drawings

1FT6 Big Servo motors with/without DRIVE-CLiQ
Water cooling

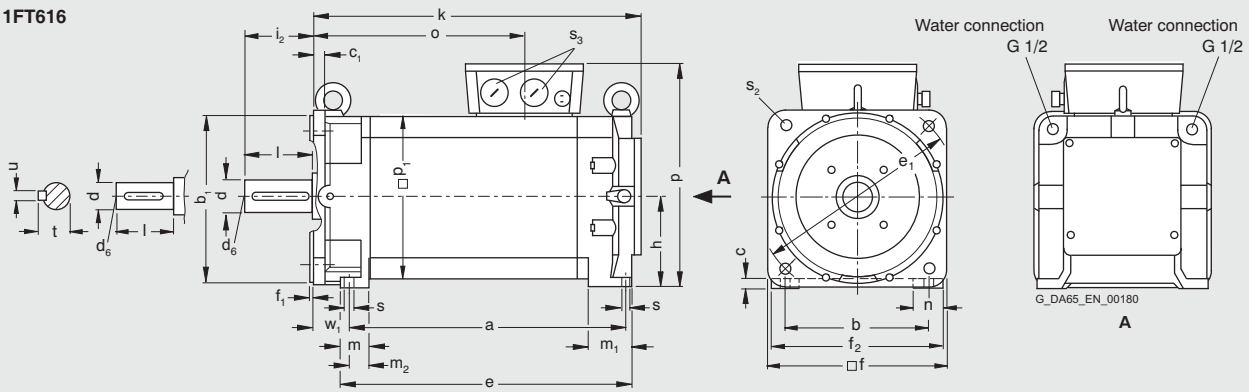
For motor		Dimensions in mm (in)																
Shaft height	Type	DIN IEC	a B	b A	b_1 N	c LA	c_1 –	e BB	e_1 M	f AB	f_1 T	f_2 –	h H	i_2 –	k LB	m BA	m_1 –	m_2 –
1FT6 Big Servo, type IM B35, water cooling, with terminal box																		
132	**1FT6132**		342 (13.46)	216 (8.5)	250 (9.84)	14 (0.55)	16 (0.63)	366 (14.41)	300 (11.81)	260 (10.24)	5 (0.2)	245 (9.65)	132 (5.2)	82 (3.23)	423 (16.65)	36 (1.42)	53 (2.09)	23 (0.91)
	1FT6134		392 (15.43)					416 (16.38)							473 (18.62)			
	1FT6136		442 (17.4)					466 (18.35)							523 (20.59)			
	1FT6138		517 (20.35)					541 (21.3)							598 (23.54)			
160	**1FT6163**		507 (19.96)	254 (10)	300 (11.81)	17 (0.67)	17.5 (0.69)	532 (20.94)	350 (13.78)	314 (12.36)	5 (0.2)	294 (11.57)	160 (6.3)	110 (4.33)	590 (23.23)	44 (1.73)	77 (3.03)	30.5 (1.2)
	1FT6168		607 (23.9)					632 (24.88)							690 (27.17)			

Shaft height	Type	DIN IEC	n AA	o –	p HD	p_1 AC	s K	s_2 K	n_{rated}=1500 rpm s_3 –	n_{rated}=2500 rpm s_3 –	w_1 C	DE shaft extension d D	d_6 –	l E	t GA	u F
132	**1FT6132**		14 (0.55)	255.5 (10.06)	350.5 (13.8)	245 (9.65)	12 (0.47)	18 (0.71)	M32 x 1.5	M40 x 1.5	53 (2.09)	**48 (1.89)**	M16	82 (3.23)	51.5 (2.03)	14 (0.55)
	1FT6134			305.5 (12.03)					M40 x 1.5	M50 x 1.5						
	1FT6136			355.5 (14)					M50 x 1.5	M50 x 1.5						
	1FT6138			430.5 (16.95)					M50 x 1.5	M50 x 1.5						
160	**1FT6163**		17 (0.67)	391.5 (15.41)	403.5 (15.89)	294 (11.57)	14 (0.55)	18 (0.71)	M50 x 1.5	M50 x 1.5	56 (2.2)	**55 (2.17)**	M20	110 (4.33)	59 (2.32)	16 (0.63)
	1FT6168			491.5 (19.35)												

1FT613



1FT616



1FT7 Compact motors with/without DRIVE-CLiQ
Natural cooling

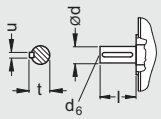
For motor — Dimensions in mm (in)

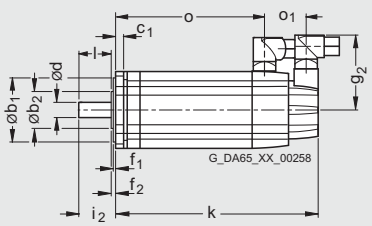
Shaft height	Type	DIN / IEC	a_1 P	b_1 N	c_1 LA	e_1 M	f AB	f_1 T	g_2 –	o_1 –	s_2 S	i_2 –	Flange 1 (1FT6-compatible) without brake k LB	without brake o –	with brake k LB	with brake o –
1FT7 Compact, type IM B5, natural cooling, with connector, with/without brake																
36	**1FT7034**		90 (3.54)	60 (2.36)	8 (0.31)	75 (2.95)	72 (2.83)	3 (0.12)	80 (3.15)	48 (1.89)	6.5 (0.26)	30 (1.18)	195 (7.68)	133 (5.24)	222 (8.74)	160 (6.30)
	1FT7036												243 (9.57)	181 (7.13)	270 (10.63)	208 (8.19)
48	**1FT7042**		120 (4.72)	80 (3.15)	10 (0.39)	100 (3.94)	96 (3.78)	3 (0.12)	93 (3.66)	53 (2.09)	6.5 (0.26)	40 (1.57)	169 (6.65)	102 (4.02)	201 (7.91)	134 (5.28)
	1FT7044												219 (8.62)	152 (5.98)	251 (9.88)	184 (7.24)
	1FT7046												259 (10.20)	192 (7.56)	291 (11.46)	224 (8.82)
63	**1FT7062**		155 (6.10)	110 (4.33)	10 (0.39)	130 (5.12)	126 (4.96)	3.5 (0.14)	104 (4.09)	53 (2.09)	9 (0.35)	50 (1.97)	173 (6.81)	106 (4.17)	208 (8.19)	141 (5.55)
	1FT7064												205 (8.07)	137 (5.39)	240 (9.45)	173 (6.81)
	1FT7066												236 (9.29)	169 (6.65)	272 (10.71)	204 (8.03)
	1FT7068												284 (11.18)	216 (8.50)	319 (12.56)	252 (9.92)

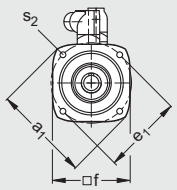
Shaft height	Type	DIN / IEC	Flange 0 b_2 –	i_2 –	f_2 –	without brake k LB	without brake o –	with brake k LB	with brake o –	DE shaft extension **d** D	d_6 –	l E	t GA	u F
36	**1FT7034**		36 (1.42)	36.5 (1.44)	5.5 (0.22)	189 (7.44)	127 (5.00)	216 (8.50)	154 (6.06)	**14 (0.55)**	M5	30 (1.18)	16 (0.63)	5 (0.20)
	1FT7036					237 (9.33)	175 (6.89)	264 (10.39)	202 (7.95)					
48	**1FT7042**		46 (1.81)	46 (1.81)	5.5 (0.22)	163 (6.42)	96 (3.78)	195 (7.68)	128 (5.04)	**19 (0.75)**	M6	40 (1.57)	21.5 (0.85)	6 (0.24)
	1FT7044					213 (8.39)	146 (5.75)	245 (9.65)	178 (7.01)					
	1FT7046					253 (9.96)	186 (7.32)	285 (11.22)	218 (8.58)					
63	**1FT7062**		51 (2.01)	56.5 (2.22)	6 (0.24)	167 (6.57)	99 (3.90)	202 (7.95)	135 (5.31)	**24 (0.94)**	M8	50 (1.97)	27 (1.06)	8 (0.31)
	1FT7064					198 (7.80)	131 (5.16)	233 (9.17)	166 (6.54)					
	1FT7066					230 (9.06)	162 (6.38)	265 (10.43)	198 (7.80)					
	1FT7068					277 (10.91)	210 (8.27)	312 (12.28)	245 (9.65)					

Flange 0
1FT703
1FT704
1FT706

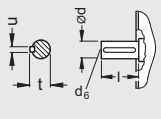
Shaft design
with fitted key

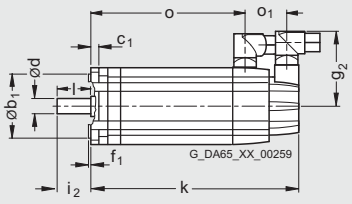


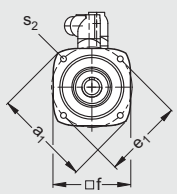




Flange 1
(1FT6-compatible)
1FT703
1FT704
1FT706







Dimension drawings

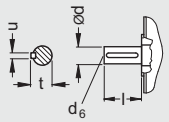
1FT7 Compact motors with/without DRIVE-CLiQ
Natural cooling

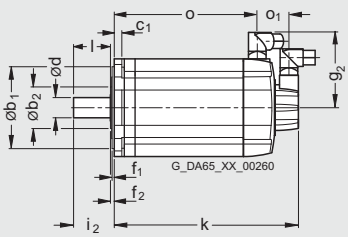
For motor		Dimensions in mm (in)														
													Flange 1 (1FT6-compatible)			
													without brake		with brake	
Shaft height	Type	DIN IEC	a_1 P	b_1 N	c_1 LA	e_1 M	f AB	f_1 T	g_2 –	o_1 –	s_2 S	i_2 –	k LB	o –	k LB	o –
1FT7 Compact, type IM B5, natural cooling, with connector, with/without brake																
80	**1FT7082**		195 (7.68)	130 (5.12)	11.5 (0.45)	165 (6.50)	155 (6.10)	3.5 (0.14)	141 (5.55)	51 (2.01)	11 (0.43)	58 (2.28)	196 (7.72)	130 (5.12)	248 (9.76)	183 (7.20)
	1FT7084												247 (9.72)	182 (7.17)	299 (11.77)	234 (9.21)
	1FT7086												299 (11.77)	234 (9.21)	351 (13.82)	286 (11.26)
100	**1FT7102**		245 (9.65)	180 (7.09)	13 (0.51)	215 (8.46)	196 (7.72)	4 (0.16)	161 (6.34)	56 (2.20)	14 (0.55)	80 (3.15)	221 (8.70)	151 (5.94)	273 (10.75)	203 (7.99)
	1FT7105												307 (12.09)	238 (9.37)	360 (14.17)	290 (11.42)
	1FT7108												377 (14.84)	307 (12.09)	429 (16.89)	359 (14.13)

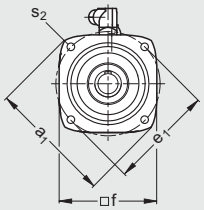
			Flange 0							DE shaft extension				
						without brake		with brake						
Shaft height	Type	DIN IEC	b_2 –	i_2 –	f_2 –	k LB	o –	k LB	o –	**d D**	d_6 –	l E	t GA	u F
80	**1FT7082**		66 (2.60)	64.5 (2.54)	6 (0.24)	189 (7.44)	124 (4.88)	241 (9.49)	176 (6.93)	**32 (1.26)**	M12	58 (2.28)	35 (1.38)	10 (0.39)
	1FT7084					241 (9.49)	175 (6.89)	293 (11.54)	228 (8.98)					
	1FT7086					292 (11.50)	227 (8.94)	345 (13.58)	279 (10.98)					
100	**1FT7102**		81 (3.19)	87 (3.43)	6.5 (0.26)	214 (8.43)	144 (5.67)	266 (10.47)	196 (7.72)	**38 (1.50)**	M12	80 (3.15)	41 (1.61)	10 (0.39)
	1FT7105					301 (11.85)	231 (9.09)	353 (13.90)	283 (11.14)					
	1FT7108					370 (14.57)	300 (11.81)	422 (16.61)	352 (13.86)					

Flange 0
1FT708
1FT710

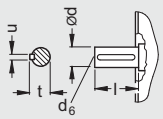
Shaft design
with fitted key

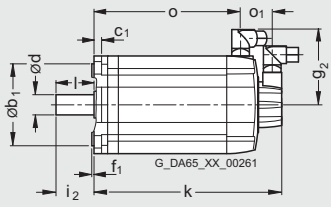


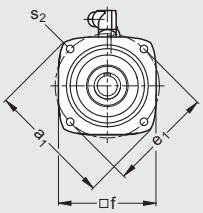




Flange 1
(1FT6-compatible)
1FT708
1FT710







For motor — Dimensions in mm (in)

Encoder system:
Resolver
Absolute encoder EnDat 16 S/R
15 bit absolute encoder (16 S/R)

Shaft height	Type	DIN IEC	a_1 P	b_1 N	c_1 LA	e_1 M	f AB	f_1 T	g_2 –	h H	i_2 –	s_2 S	without brake k LB	without brake o_1 –	without brake o_2 –	with brake k LB	with brake o_1 –	with brake o_2 –
1FK7 Compact, type IM B5, natural cooling, with connector, with/without brake																		
20	**1FK7011-5**		–	30 (1.18)	7 (0.28)	46 (1.81)	40 (1.57)	2.5 (0.10)	65.5 (2.58)	20 (0.79)	18 (0.71)	4.5 (0.18)	140 (5.51)	89 (3.50)	118 (4.65)	140 (5.51)	89 (3.50)	118 (4.65)
	1FK7015-5												165 (6.50)	114 (4.49)	143 (5.63)	165 (6.50)	114 (4.49)	143 (5.63)
28	**1FK7022-5**		–	40 (1.57)	10 (0.39)	63 (2.48)	55 (2.17)	2.5 (0.10)	75 (2.95)	27.5 (1.08)	20 (0.79)	5.4 (0.21)	153 (6.02)	95 (3.74)	128 (5.04)	175 (6.89)	95 (3.74)	150 (5.91)
36	**1FK7032-5**	92 (3.62)	60 (2.36)	8 (0.31)	75 (2.95)	72 (2.83)	3 (0.12)	81 (3.19)	36 (1.42)	30 (1.18)	6.5 (0.26)	150 (5.91)	90 (3.54)	125 (4.92)	175 (6.89)	90 (3.54)	149 (5.87)	
	1FK7034-5												175 (6.89)	115 (4.53)	150 (5.91)	200 (7.87)	115 (4.53)	174 (6.85)
48	**1FK7040-5**	120 (4.72)	80 (3.15)	10 (0.39)	100 (3.94)	96 (3.78)	3 (0.12)	90 (3.54)	48 (1.89)	40 (1.57)	7 (0.28)	134 (5.28)	73 (2.87)	106 (4.17)	163 (6.42)	73 (2.87)	135 (5.31)	
	1FK7042-5												162 (6.38)	101 (3.98)	134 (5.28)	191 (7.52)	101 (3.98)	163 (6.42)
63	**1FK7060-5**	155 (6.10)	110 (4.33)	10 (0.39)	130 (5.12)	126 (4.96)	3.5 (0.14)	105 (4.13)	63 (2.48)	50 (1.97)	9 (0.35)	157 (6.18)	94 (3.70)	126 (4.96)	200 (7.87)	94 (3.70)	169 (6.65)	
	1FK7063-5												202 (7.95)	139 (5.47)	171 (6.73)	245 (9.65)	139 (5.47)	214 (8.43)

Encoder system:
Incremental encoder sin/cos1 V_{pp}
22 bit incremental encoder (2048 S/R)
Absolute encoder EnDat 32 S/R
16 bit absolute encoder (32 S/R)

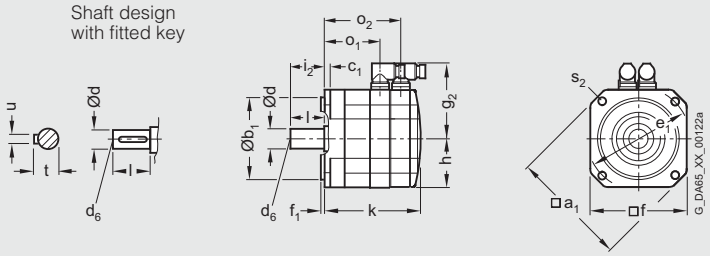
Absolute encoder EnDat 2048 S/R
22 bit absolute encoder (2048 S/R)
Absolute encoder EnDat 512 S/R
20 bit absolute encoder (512 S/R)

DE shaft extension

Shaft height	Type	without brake k LB	without brake o_1 –	without brake o_2 –	with brake k LB	with brake o_1 –	with brake o_2 –	without brake k LB	without brake o_1 –	without brake o_2 –	with brake k LB	with brake o_1 –	with brake o_2 –	d D	d_6 –	l E	t GA	u F
20	**1FK7011-5**	155 (6.10)	89 (3.50)	118 (4.65)	155 (6.10)	89 (3.50)	118 (4.65)	155 (6.10)	89 (3.50)	118 (4.65)	155 (6.10)	89 (3.50)	118 (4.65)	**8 (0.31)**	–	18 (0.71)	8.8 (0.35)	2 (0.08)
	1FK7015-5	180 (7.09)	114 (4.49)	143 (5.63)	180 (7.09)	114 (4.49)	143 (5.63)	180 (7.09)	114 (4.49)	143 (5.63)	180 (7.09)	114 (4.49)	143 (5.63)					
28	**1FK7022-5**	178 (7.01)	95 (3.74)	128 (5.04)	200 (7.87)	95 (3.74)	150 (5.91)	178 (7.01)	95 (3.74)	128 (5.04)	200 (7.87)	95 (3.74)	150 (5.91)	**9 (0.35)**	M3	20 (0.79)	10.2 (0.40)	3 (0.12)
36	**1FK7032-5**	175 (6.89)	90 (3.54)	125 (4.92)	200 (7.87)	90 (3.54)	149 (5.87)	175 (6.89)	90 (3.54)	125 (4.92)	200 (7.87)	90 (3.54)	149 (5.87)	**14 (0.55)**	M5	30 (1.18)	16 (0.63)	5 (0.20)
	1FK7034-5	200 (7.87)	115 (4.53)	150 (5.91)	225 (8.86)	115 (4.53)	174 (6.85)	200 (7.87)	115 (4.53)	150 (5.91)	225 (8.86)	115 (4.53)	174 (6.85)					
48	**1FK7040-5**	155 (6.10)	73 (2.87)	106 (4.17)	184 (7.24)	73 (2.87)	135 (5.31)	163 (6.42)	73 (2.87)	106 (4.17)	192 (7.56)	73 (2.87)	135 (5.31)	**19 (0.75)**	M6	40 (1.57)	21.5 (0.85)	6 (0.24)
	1FK7042-5	182 (7.17)	101 (3.98)	134 (5.28)	211 (8.31)	101 (3.98)	163 (6.42)	191 (7.52)	101 (3.98)	134 (5.28)	220 (8.66)	101 (3.98)	163 (6.42)					
63	**1FK7060-5**	180 (7.09)	94 (3.70)	126 (4.96)	223 (8.78)	94 (3.70)	169 (6.65)	188 (7.40)	94 (3.70)	126 (4.96)	231 (9.09)	94 (3.70)	169 (6.65)	**24 (0.94)**	M8	50 (1.97)	27 (1.06)	8 (0.31)
	1FK7063-5	225 (8.86)	139 (5.47)	171 (6.73)	268 (10.55)	139 (5.47)	214 (8.43)	233 (9.17)	139 (5.47)	171 (6.73)	276 (10.87)	139 (5.47)	214 (8.43)					

1FK701.-5
1FK702.-5
1FK703.-5
1FK704.-5
1FK706.-5

Shaft design
with fitted key



Dimension drawings

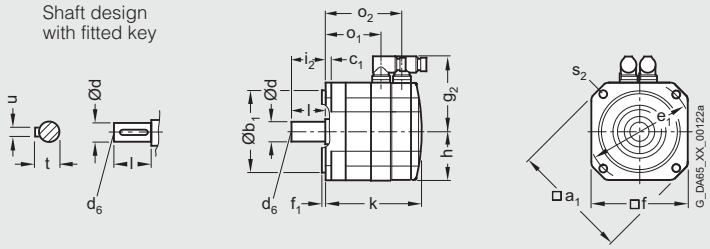
1FK7 Compact motors with/without DRIVE-CLiQ
Natural cooling

For motor		Dimensions in mm (in)											Encoder system: Resolver					
													without brake			with brake		
Shaft height	Type	DIN IEC	a_1 P	b_1 N	c_1 LA	e_1 M	f AB	f_1 T	g_2 –	h H	i_2 –	s_2 S	k LB	o_1 –	o_2 –	k LB	o_1 –	o_2 –
1FK7 Compact, type IM B5, natural cooling, with connector, with/without brake																		
80	**1FK7080-5**		186 (7.32)	130 (5.12)	13 (0.51)	165 (6.50)	155 (6.10)	3.5 (0.14)	119.5 (4.70)	77.5 (3.05)	58 (2.28)	11 (0.43)	156 (6.14)	91 (3.58)	124 (4.88)	184 (7.24)	91 (3.58)	151 (5.94)
	1FK7083-5												194 (7.64)	129 (5.08)	162 (6.38)	245 (9.65)	129 (5.08)	207 (8.15)
100	**1FK7100-5**		240 (9.45)	180 (7.09)	13 (0.51)	215 (8.46)	192 (7.56)	4 (0.16)	138 (5.43)	96 (3.78)	80 (3.15)	14 (0.55)	185 (7.28)	113 (4.45)	153 (6.02)	204 (8.03)	113 (4.45)	172 (6.77)
	1FK7101-5												211 (8.31)	139 (5.47)	179 (7.05)	240 (9.45)	139 (5.47)	208 (8.19)
	1FK7103-5												237 (9.33)	165 (6.50)	205 (8.07)	266 (10.47)	165 (6.50)	234 (9.21)
	1FK7105-5												289 (11.38)	217 (8.54)	257 (10.12)	318 (12.52)	217 (8.54)	286 (11.26)

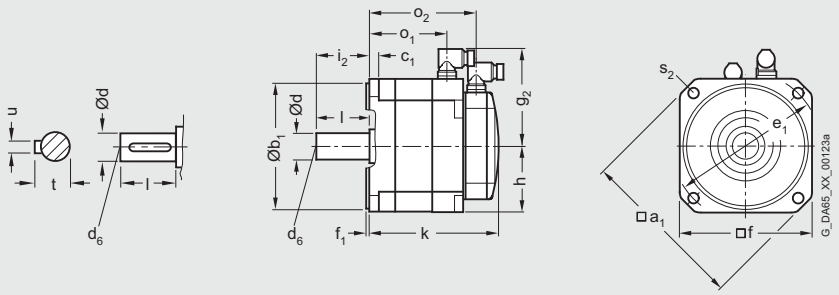
		Encoder system: Incremental encoder sin/cos1 V_{pp} 22 bit incremental encoder (2048 S/R) Absolute encoder EnDat 32 S/R 16 bit absolute encoder (32 S/R)						Absolute encoder EnDat 2048 S/R 22 bit absolute encoder (2048 S/R)						DE shaft extension				
		without brake			with brake			without brake			with brake							
Shaft height	**Type**	k LB	o_1 –	o_2 –	k LB	o_1 –	o_2 –	k LB	o_1 –	o_2 –	k LB	o_1 –	o_2 –	**d D**	d_6 –	l E	t GA	u F
80	**1FK7080-5**	179 (7.05)	91 (3.58)	124 (4.88)	206 (8.11)	91 (3.58)	151 (5.94)	187 (7.36)	91 (3.58)	124 (4.88)	215 (8.46)	91 (3.58)	151 (5.94)	**32 (1.26)**	M12	58 (2.28)	35 (1.38)	10 (0.39)
	1FK7083-5	217 (8.54)	129 (5.08)	162 (6.38)	268 (10.55)	153 (6.02)	213 (8.39)	225 (8.86)	129 (5.08)	162 (6.38)	276 (10.87)	129 (5.08)	207 (8.15)					
100	**1FK7100-5**	208 (8.19)	113 (4.45)	153 (6.02)	227 (8.94)	113 (4.45)	172 (6.77)	216 (8.50)	113 (4.45)	153 (6.02)	235 (9.25)	113 (4.45)	172 (6.77)	**38 (1.50)**	M12	80 (3.15)	41 (1.61)	10 (0.39)
	1FK7101-5	234 (9.21)	139 (5.47)	179 (7.05)	263 (10.35)	139 (5.47)	208 (8.19)	242 (9.53)	139 (5.47)	179 (7.05)	271 (10.67)	139 (5.47)	208 (8.19)					
	1FK7103-5	260 (10.24)	165 (6.50)	205 (8.07)	289 (11.38)	165 (6.50)	234 (9.21)	268 (10.55)	165 (6.50)	205 (8.07)	297 (11.69)	165 (6.50)	234 (9.21)					
	1FK7105-5	312 (12.28)	217 (8.54)	257 (10.12)	341 (13.43)	217 (8.54)	286 (11.26)	320 (12.60)	217 (8.54)	257 (10.12)	349 (13.74)	217 (8.54)	286 (11.26)					

1FK708 .-5

Shaft design with fitted key



1FK7100-5
1FK7101-5
1FK7103-5
1FK7105-5



1FK7 High Dynamic motors with/without DRIVE-CLiQ
Natural cooling

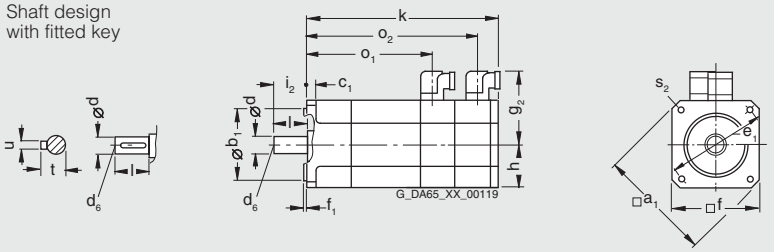
For motor — Dimensions in mm (in)

Shaft height	Type	DIN IEC	a_1 P	b_1 N	c_1 LA	e_1 M	f AB	f_1 T	g_2 –	h H	i_2 –	s_2 S	Encoder system: Resolver, Absolute encoder EnDat 16 S/R, 15 bit absolute encoder (16 S/R) with/without brake: k LB	o_1 –	o_2 –
1FK7 High Dynamic, type IM B5, natural cooling, with connector, with/without brake															
36	**1FK7033-7**		92 (3.62)	60 (2.36)	8 (0.31)	75 (2.95)	72 (2.83)	3 (0.12)	78 (3.07)	36 (1.42)	30 (1.18)	6.5 (0.26)	170/195 (6.69/7.68)	108/108 (4.25/4.25)	145/170 (5.71/6.69)
48	**1FK7043-7**		120 (4.72)	80 (3.15)	10 (0.39)	100 (3.94)	96 (3.78)	3 (0.12)	90 (3.54)	48 (1.89)	40 (1.57)	7 (0.28)	191/220 (7.52/8.66)	130/130 (5.12/5.12)	163/192 (6.42/7.56)
	1FK7044-7												216/245 (8.51/9.65)	155/155 (6.10/6.10)	188/217 (7.40/8.54)
63	**1FK7061-7**		155 (6.10)	110 (4.33)	10 (0.39)	130 (5.12)	126 (4.96)	3.5 (0.14)	105 (4.13)	63 (2.48)	50 (1.97)	9 (0.35)	185/228 (7.28/8.98)	121/121 (4.76/4.76)	153/196 (6.02/7.72)
	1FK7064-7												249/292 (9.80/11.50)	185/185 (7.28/7.28)	217/260 (8.54/10.24)
80	**1FK7085-7**		186 (7.32)	130 (5.12)	13 (0.51)	165 (6.50)	155 (6.10)	3.5 (0.14)	141.5 (5.57)	77.5 (3.05)	60 (2.36)	11 (0.43)	261/303 (10.28/11.93)	192/192 (7.56/7.56)	229/272 (9.02/10.71)
	1FK7086-7								140.5 (5.53)						

Shaft height	Type	DIN IEC	Encoder system: Incremental encoder sin/cos1 V_{pp}, 22 bit incremental encoder (2048 S/R), Absolute encoder EnDat 32 S/R, 16 bit absolute encoder (32 S/R) with/without brake: k LB	o_1 –	o_2 –	Absolute encoder EnDat 2048 S/R, 22 bit absolute encoder (2048 S/R), Absolute encoder EnDat 512 S/R, 20 bit absolute encoder (512 S/R) with/without brake: k LB	o_1 –	o_2 –	DE shaft extension: **d** D	d_6 –	l E	t GA	u F
36	**1FK7033-7**		194/219 (7.64/8.62)	109/109 (4.29/4.29)	144/168 (5.67/6.61)	194/219 (7.64/8.62)	109/109 (4.29/4.29)	144/168 (5.67/6.61)	**14 (0.55)**	M5	30 (1.18)	16 (0.63)	5 (0.20)
48	**1FK7043-7**		212/241 (8.35/9.49)	130/130 (5.12/5.12)	163/192 (6.42/7.56)	220/249 (8.66/9.80)	130/130 (5.12/5.12)	163/192 (6.42/7.56)	**19 (0.75)**	M6	40 (1.57)	21.5 (0.85)	6 (0.24)
	1FK7044-7		237/266 (9.33/10.47)	155/155 (6.10/6.10)	188/217 (7.40/8.54)	245/274 (9.65/10.79)	155/155 (6.10/6.10)	188/217 (7.40/8.54)					
63	**1FK7061-7**		208/251 (8.19/9.88)	121/121 (4.76/4.76)	154/197 (6.06/7.76)	217/260 (8.54/10.24)	121/121 (4.76/4.76)	154/197 (6.06/7.76)	**24 (0.94)**	M8	50 (1.97)	27 (1.06)	8 (0.31)
	1FK7064-7		272/315 (10.71/12.40)	185/185 (7.28/7.28)	218/261 (8.58/10.28)	281/324 (11.06/12.76)	185/185 (7.28/7.28)	218/261 (8.58/10.28)					
80	**1FK7085-7**		283/326 (11.14/12.83)	192/192 (7.56/7.56)	229/272 (9.02/10.71)	292/334 (11.50/13.15)	192/192 (7.56/7.56)	229/272 (9.02/10.71)	**32 (1.26)**	M12	58 (2.28)	35 (1.38)	10 (0.39)
	1FK7086-7												

1FK703.-7
1FK704.-7
1FK706.-7
1FK708.-7

Shaft design with fitted key

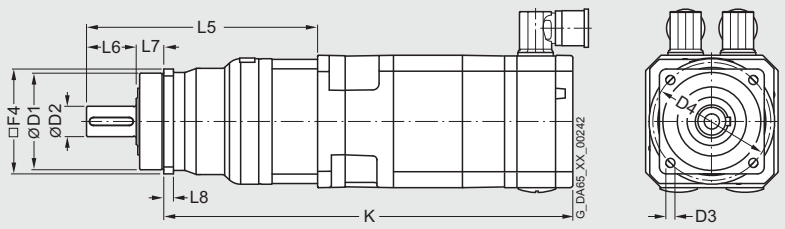


Dimension drawings

1FT6 motors with/without DRIVE-CLiQ with SP+ planetary gearbox, single-stage

For motors				Dimensions in mm (in)								Encoder system: Resolver		Increm. encoder Absolute encoder	
			Planetary gearbox									without brake	with brake	without brake	with brake
Shaft height	Type	F4	Type	D1	D2	D3	D4	L5	L6	L7	L8	K	K	K	K
1FT6 with SP+ planetary gearbox, single-stage, type IM B5, natural cooling, with connector, with/without brake															
28	**1FT6021**	62 (2.44)	**SP060S-MF1**	60 (2.36)	16 (0.63)	5.5 (0.22)	68 (2.68)	138 (5.43)	28 (1.10)	20 (0.79)	6 (0.24)	283 (11.14)	308 (12.13)	283 (11.14)	308 (12.13)
	1FT6024											323 (12.72)	348 (13.70)	323 (12.72)	348 (13.70)
36	**1FT6031**	62 (2.44)	**SP060S-MF1**	60 (2.36)	16 (0.63)	5.5 (0.22)	68 (2.68)	142 (5.59)	28 (1.10)	20 (0.79)	6 (0.24)	274 (10.79)	294 (11.57)	314 (12.36)	334 (13.15)
	1FT6034											314 (12.36)	334 (13.15)	354 (13.94)	374 (14.72)
	1FT6034	76 (2.99)	**SP075S-MF1**	70 (2.76)	22 (0.87)	6.6 (0.26)	85 (3.35)	164 (6.46)	36 (1.42)	20 (0.79)	7 (0.28)	328 (12.91)	348 (13.70)	368 (14.49)	388 (15.28)
48	**1FT6041**	76 (2.99)	**SP075S-MF1**	70 (2.76)	22 (0.87)	6.6 (0.26)	85 (3.35)	168 (6.61)	36 (1.42)	20 (0.79)	7 (0.28)	297 (11.69)	332 (13.07)	340 (13.39)	375 (14.76)
	1FT6044											347 (13.66)	382 (15.04)	390 (15.35)	425 (16.73)
63	**1FT6061**	101 (3.98)	**SP100S-MF1**	90 (3.54)	32 (1.26)	9 (0.35)	120 (4.72)	217 (8.54)	58 (2.28)	30 (1.18)	10 (0.39)	327 (12.87)	357 (14.06)	357 (14.06)	387 (15.24)
	1FT6062											352 (13.86)	382 (15.04)	382 (15.04)	412 (16.22)
	1FT6064											402 (15.83)	432 (17.01)	432 (17.01)	462 (18.19)
80	**1FT6081**	141 (5.55)	**SP140S-MF1**	130 (5.12)	40 (1.57)	11 (0.43)	165 (6.50)	283 (11.14)	82 (3.23)	30 (1.18)	12 (0.47)	392 (15.43)	419 (16.50)	392 (15.43)	419 (16.50)
	1FT6082											417 (16.42)	444 (17.48)	417 (16.42)	444 (17.48)
	1FT6084											467 (18.39)	513 (20.20)	467 (18.39)	513 (20.20)
	1FT6086											517 (20.35)	563 (22.17)	517 (20.35)	563 (22.17)
	1FT6086	182 (7.17)	**SP180S-MF1**	160 (6.30)	55 (2.17)	13.5 (0.53)	215 (8.46)	310 (12.20)	82 (3.23)	30 (1.18)	15 (0.59)	544 (21.42)	590 (23.23)	544 (21.42)	590 (23.23)

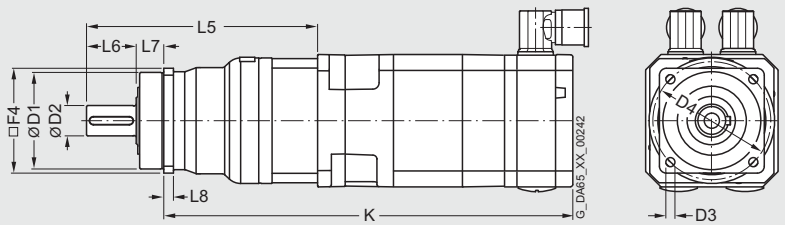
1FT602
1FT603
1FT604
1FT606
1FT608



1FT6 motors with/without DRIVE-CLiQ with SP+ planetary gearbox, single-stage

For motor				Dimensions in mm (in)								Encoder system: Resolver		Increm. encoder Absolute encoder	
			Planetary gearbox									without brake	with brake	without brake	with brake
Shaft height	Type	F4	Type	D1	D2	D3	D4	L5	L6	L7	L8	K	K	K	K
1FT6 with SP+ planetary gearbox, single-stage, type IM B5, natural cooling, with connector, with/without brake															
100	**1FT6102**	182 (7.17)	**SP180S-MF1**	160 (6.30)	55 (2.17)	13.5 (0.53)	215 (8.46)	310 (12.20)	82 (3.23)	30 (1.18)	15 (0.59)	493 (19.41)	539 (21.22)	493 (19.41)	539 (21.22)
	1FT6105											568 (22.36)	614 (24.17)	568 (22.36)	614 (24.17)
	1FT6105	215 (8.46)	**SP210S-MF1**	180 (7.09)	75 (2.95)	17 (0.67)	250 (9.84)	385 (15.16)	105 (4.13)	38 (1.50)	17 (0.67)	612 (24.09)	658 (25.91)	612 (24.09)	658 (25.91)
	1FT6108	182 (7.17)	**SP180S-MF1**	160 (6.30)	55 (2.17)	13.5 (0.53)	215 (8.46)	310 (12.20)	82 (3.23)	30 (1.18)	15 (0.59)	668 (26.30)	714 (28.11)	668 (26.30)	714 (28.11)
		215 (8.46)	**SP210S-MF1**	180 (7.09)	75 (2.95)	17 (0.67)	250 (9.84)	385 (15.16)	105 (4.13)	38 (1.50)	17 (0.67)	712 (28.03)	758 (29.84)	712 (28.03)	758 (29.84)
132	**1FT6132**	215 (8.46)	**SP210S-MF1**	180 (7.09)	75 (2.95)	17 (0.67)	250 (9.84)	385 (15.16)	105 (4.13)	38 (1.50)	17 (0.67)	665 (26.18)	715 (28.15)	665 (26.18)	715 (28.15)
	1FT6134											715 (28.15)	765 (30.12)	715 (28.15)	765 (30.12)
	1FT6134	242 (9.53)	**SP240S-MF1**	200 (7.87)	85 (3.35)	17 (0.67)	290 (11.42)	443 (17.44)	130 (5.12)	40 (1.57)	20 (0.79)	746 (29.37)	796 (31.34)	746 (29.37)	796 (31.34)
	1FT6136	215 (8.46)	**SP210S-MF1**	180 (7.09)	75 (2.95)	17 (0.67)	250 (9.84)	385 (15.16)	105 (4.13)	38 (1.50)	17 (0.67)	765 (30.12)	815 (32.09)	765 (30.12)	815 (32.09)
		242 (9.53)	**SP240S-MF1**	200 (7.87)	85 (3.35)	17 (0.67)	290 (11.42)	443 (17.44)	130 (5.12)	40 (1.57)	20 (0.79)	796 (31.34)	846 (33.31)	796 (31.34)	846 (33.31)

1FT610
1FT613

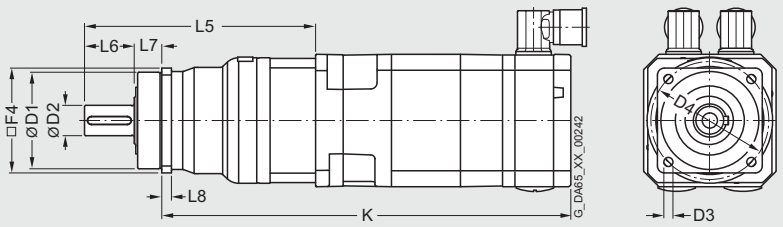


Dimension drawings

1FT6 motors with/without DRIVE-CLiQ with SP+ planetary gearbox, two-stage

For motor				Dimensions in mm (in)								Encoder system: Resolver		Increm. encoder Absolute encoder	
			Planetary gearbox									without brake	with brake	without brake	with brake
Shaft height	Type	F4	Type	D1	D2	D3	D4	L5	L6	L7	L8	K	K	K	K
1FT6 with SP+ planetary gearbox, two-stage, type IM B5, natural cooling, with connector, with/without brake															
28	**1FT6021**	62 (2.44)	**SP060S-MF2**	60 (2.36)	16 (0.63)	5.5 (0.22)	68 (2.68)	156 (6.14)	28 (1.10)	20 (0.79)	6 (0.24)	301 (11.85)	326 (12.83)	301 (11.85)	326 (12.83)
		76 (2.99)	**SP075S-MF2**	70 (2.76)	22 (0.87)	6.6 (0.26)	85 (3.35)	175 (6.89)	36 (1.42)	20 (0.79)	7 (0.28)	312 (12.28)	337 (13.27)	312 (12.28)	337 (13.27)
	1FT6024	62 (2.44)	**SP060S-MF2**	60 (2.36)	16 (0.63)	5.5 (0.22)	68 (2.68)	156 (6.14)	28 (1.10)	20 (0.79)	6 (0.24)	341 (13.43)	366 (14.41)	341 (13.43)	366 (14.41)
		76 (2.99)	**SP075S-MF2**	70 (2.76)	22 (0.87)	6.6 (0.26)	85 (3.35)	175 (6.89)	36 (1.42)	20 (0.79)	7 (0.28)	352 (13.86)	377 (14.84)	352 (13.86)	377 (14.84)
		101 (3.98)	**SP100S-MF2**	90 (3.54)	32 (1.26)	9 (0.35)	120 (4.72)	230 (9.06)	58 (2.28)	30 (1.18)	10 (0.39)	375 (14.76)	400 (15.75)	375 (14.76)	400 (15.75)
36	**1FT6031**	62 (2.44)	**SP060S-MF2**	60 (2.36)	16 (0.63)	5.5 (0.22)	68 (2.68)	164 (6.46)	28 (1.10)	20 (0.79)	6 (0.24)	296 (11.65)	316 (12.44)	336 (13.23)	356 (14.02)
		76 (2.99)	**SP075S-MF2**	70 (2.76)	22 (0.87)	6.6 (0.26)	85 (3.35)	179 (7.05)	36 (1.42)	20 (0.79)	7 (0.28)	303 (11.93)	323 (12.72)	343 (13.50)	363 (14.29)
		101 (3.98)	**SP100S-MF2**	90 (3.54)	32 (1.26)	9 (0.35)	120 (4.72)	230 (9.06)	58 (2.28)	30 (1.18)	10 (0.39)	322 (12.68)	342 (13.46)	362 (14.25)	382 (15.04)
	1FT6034	76 (2.99)	**SP075S-MF2**	70 (2.76)	22 (0.87)	6.6 (0.26)	85 (3.35)	179 (7.05)	36 (1.42)	20 (0.79)	7 (0.28)	343 (13.50)	363 (14.29)	383 (15.08)	403 (15.87)
		101 (3.98)	**SP100S-MF2**	90 (3.54)	32 (1.26)	9 (0.35)	120 (4.72)	230 (9.06)	58 (2.28)	30 (1.18)	10 (0.39)	362 (14.25)	382 (15.04)	402 (15.83)	422 (16.61)
		141 (5.56)	**SP140S-MF2**	130 (5.12)	40 (1.57)	11 (0.43)	165 (6.50)	298 (11.73)	82 (3.23)	30 (1.18)	12 (0.47)	406 (15.98)	426 (16.77)	446 (17.56)	466 (18.35)
48	**1FT6041**	76 (2.99)	**SP075S-MF2**	70 (2.76)	22 (0.87)	6.6 (0.26)	85 (3.35)	192 (7.56)	36 (1.42)	20 (0.79)	7 (0.28)	321 (12.64)	356 (14.02)	364 (14.33)	399 (15.71)
		101 (3.98)	**SP100S-MF2**	90 (3.54)	32 (1.26)	9 (0.35)	120 (4.72)	234 (9.21)	58 (2.28)	30 (1.18)	10 (0.39)	331 (13.03)	366 (14.41)	374 (14.72)	409 (16.10)
		141 (5.55)	**SP140S-MF2**	130 (5.12)	40 (1.57)	11 (0.43)	165 (6.50)	298 (11.73)	82 (3.23)	30 (1.18)	12 (0.47)	371 (14.61)	406 (15.98)	414 (16.30)	449 (17.68)
	1FT6044	101 (3.98)	**SP100S-MF2**	90 (3.54)	32 (1.26)	9 (0.35)	120 (4.72)	234 (9.21)	58 (2.28)	30 (1.18)	10 (0.39)	381 (15.00)	416 (16.38)	424 (16.69)	459 (18.07)
		141 (5.55)	**SP140S-MF2**	130 (5.12)	40 (1.57)	11 (0.43)	165 (6.50)	298 (11.73)	82 (3.23)	30 (1.18)	12 (0.47)	421 (16.57)	456 (17.95)	464 (18.27)	499 (19.65)
		182 (7.17)	**SP180S-MF2**	160 (6.30)	55 (2.17)	13.5 (0.53)	215 (8.46)	346 (13.62)	82 (3.23)	30 (1.18)	15 (0.59)	469 (18.46)	504 (19.84)	512 (20.16)	547 (21.54)

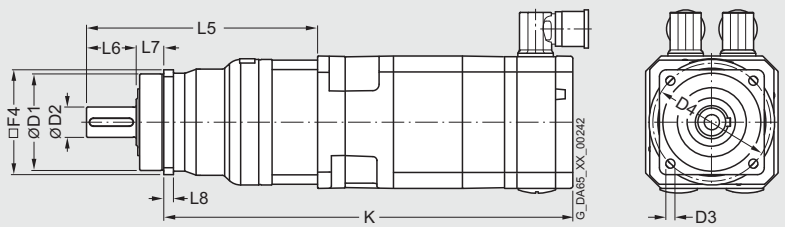
1FT602
1FT603
1FT604



1FT6 motors with/without DRIVE-CLiQ with SP+ planetary gearbox, two-stage

For motor				Dimensions in mm (in)								Encoder system: Resolver		Increm. encoder Absolute encoder	
			Planetary gearbox									without brake	with brake	without brake	with brake
Shaft height	Type	F4	Type	D1	D2	D3	D4	L5	L6	L7	L8	K	K	K	K
1FT6 with SP+ planetary gearbox, two-stage, type IM B5, natural cooling, with connector, with/without brake															
63	**1FT6061**	101 (3.98)	**SP100S-MF2**	90 (3.54)	32 (1.26)	9 (0.35)	120 (4.72)	252 (9.92)	58 (2.28)	30 (1.18)	10 (0.39)	362 (14.25)	392 (15.43)	392 (15.43)	422 (16.61)
		141 (5.55)	**SP140S-MF2**	130 (5.12)	40 (1.57)	11 (0.43)	165 (6.50)	305 (12.01)	82 (3.23)	30 (1.18)	12 (0.47)	391 (15.39)	421 (16.57)	421 (16.57)	451 (17.76)
		182 (7.17)	**SP180S-MF2**	160 (6.30)	55 (2.17)	13.5 (0.53)	215 (8.46)	346 (13.62)	82 (3.23)	30 (1.18)	15 (0.59)	432 (17.01)	462 (18.19)	462 (18.19)	492 (19.37)
	1FT6062	101 (3.98)	**SP100S-MF2**	90 (3.54)	32 (1.26)	9 (0.35)	120 (4.72)	252 (9.92)	58 (2.28)	30 (1.18)	10 (0.39)	387 (15.24)	417 (16.42)	417 (16.42)	447 (17.60)
		141 (5.55)	**SP140S-MF2**	130 (5.12)	40 (1.57)	11 (0.43)	165 (6.50)	305 (12.01)	82 (3.23)	30 (1.18)	12 (0.47)	416 (16.38)	446 (17.56)	446 (17.56)	476 (18.74)
	1FT6064	101 (3.98)	**SP100S-MF2**	90 (3.54)	32 (1.26)	9 (0.35)	120 (4.72)	252 (9.92)	58 (2.28)	30 (1.18)	10 (0.39)	437 (17.20)	467 (18.39)	467 (18.39)	497 (19.57)
		141 (5.55)	**SP140S-MF2**	130 (5.12)	40 (1.57)	11 (0.43)	165 (6.50)	305 (12.01)	82 (3.23)	30 (1.18)	12 (0.47)	466 (18.35)	496 (19.53)	496 (19.53)	526 (20.71)
		182 (7.17)	**SP180S-MF2**	160 (6.30)	55 (2.17)	13.5 (0.53)	215 (8.46)	346 (13.62)	82 (3.23)	30 (1.18)	15 (0.59)	507 (19.96)	537 (21.14)	537 (21.14)	567 (22.32)
80	**1FT6081**	141 (5.55)	**SP140S-MF2**	130 (5.12)	40 (1.57)	11 (0.43)	165 (6.50)	332 (13.07)	82 (3.23)	30 (1.18)	12 (0.47)	441 (17.36)	468 (18.43)	441 (17.36)	468 (18.43)
		182 (7.17)	**SP180S-MF2**	160 (6.30)	55 (2.17)	13.5 (0.53)	215 (8.46)	355 (13.98)	82 (3.23)	30 (1.18)	15 (0.59)	464 (18.27)	491 (19.33)	464 (18.27)	491 (19.33)
		215 (8.46)	**SP210S-MF2**	180 (7.09)	75 (2.95)	17 (0.67)	250 (9.84)	415 (16.34)	105 (4.13)	38 (1.50)	17 (0.67)	493 (19.41)	520 (20.47)	493 (19.41)	520 (20.47)
	1FT6082	141 (5.55)	**SP140S-MF2**	130 (5.12)	40 (1.57)	11 (0.43)	165 (6.50)	332 (13.07)	82 (3.23)	30 (1.18)	12 (0.47)	466 (18.35)	493 (19.41)	466 (18.35)	493 (19.41)
		182 (7.17)	**SP180S-MF2**	160 (6.30)	55 (2.17)	13.5 (0.53)	215 (8.46)	355 (13.98)	82 (3.23)	30 (1.18)	15 (0.59)	489 (19.25)	516 (20.31)	489 (19.25)	516 (20.31)
		215 (8.46)	**SP210S-MF2**	180 (7.09)	75 (2.95)	17 (0.67)	250 (9.84)	415 (16.34)	105 (4.13)	38 (1.50)	17 (0.67)	518 (20.39)	545 (21.46)	518 (20.39)	545 (21.46)
	1FT6084	141 (5.55)	**SP140S-MF2**	130 (5.12)	40 (1.57)	11 (0.43)	165 (6.50)	332 (13.07)	82 (3.23)	30 (1.18)	12 (0.47)	516 (20.31)	562 (22.13)	516 (20.31)	562 (22.13)
		182 (7.17)	**SP180S-MF2**	160 (6.30)	55 (2.17)	13.5 (0.53)	215 (8.46)	355 (13.98)	82 (3.23)	30 (1.18)	15 (0.59)	539 (21.22)	585 (23.03)	539 (21.22)	585 (23.03)
		245 (9.65)	**SP240S-MF2**	200 (7.87)	85 (3.35)	17 (0.67)	290 (11.42)	467.5 (18.41)	130 (5.12)	40 (1.57)	20 (0.79)	594 (23.39)	640 (25.20)	594 (23.39)	640 (25.20)
	1FT6086	182 (7.17)	**SP180S-MF2**	160 (6.30)	55 (2.17)	13.5 (0.53)	215 (8.46)	355 (13.98)	82 (3.23)	30 (1.18)	15 (0.59)	589 (23.19)	635 (25.00)	589 (23.19)	635 (25.00)
		245 (9.65)	**SP240S-MF2**	200 (7.87)	85 (3.55)	17 (0.67)	290 (11.42)	467.5 (18.41)	130 (5.12)	40 (1.57)	20 (0.79)	644 (25.35)	690 (27.17)	644 (25.35)	690 (27.17)

1FT606
1FT608

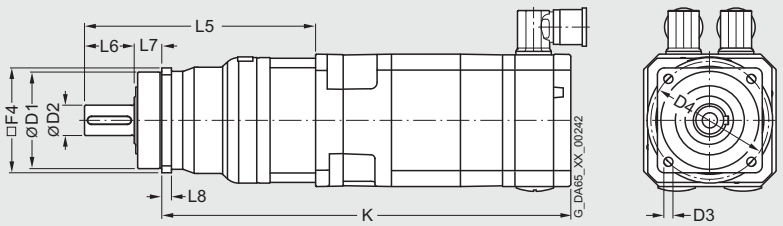


Dimension drawings

1FT6 motors with/without DRIVE-CLiQ with SP+ planetary gearbox, two-stage

For motor				Dimensions in mm (in)								Encoder system: Resolver		Increm. encoder Absolute encoder	
			Planetary gearbox									without brake	with brake	without brake	with brake
Shaft height	Type	F4	Type	D1	D2	D3	D4	L5	L6	L7	L8	K	K	K	K
1FT6 with SP+ planetary gearbox, two-stage, type IM B5, natural cooling, with connector, with/without brake															
100	**1FT6102**	182 (7.17)	**SP180S-MF2**	160 (6.30)	55 (2.17)	13.5 (0.53)	215 (8.46)	355 (13.98)	82 (3.23)	30 (1.18)	15 (0.59)	538 (21.18)	584 (22.99)	538 (21.18)	584 (22.99)
		245 (9.65)	**SP240S-MF2**	200 (7.87)	85 (3.35)	17 (0.67)	290 (11.42)	467.5 (18.41)	130 (5.17)	40 (1.57)	20 (0.79)	593 (23.35)	639 (25.16)	593 (23.35)	639 (25.16)
	1FT6105	215 (8.46)	**SP210S-MF2**	180 (7.09)	75 (2.95)	17 (0.67)	250 (9.84)	415 (16.34)	105 (4.13)	38 (1.50)	17 (0.67)	642 (25.28)	688 (27.09)	642 (25.28)	688 (27.09)
		245 (9.65)	**SP240S-MF2**	200 (7.87)	85 (3.35)	17 (0.67)	290 (11.42)	467.5 (18.41)	130 (5.12)	40 (1.57)	20 (0.79)	668 (26.30)	714 (28.11)	668 (26.30)	714 (28.11)
	1FT6108	245 (9.65)	**SP240S-MF2**	200 (7.87)	85 (3.35)	17 (0.67)	290 (11.42)	467.5 (18.41)	130 (5.12)	40 (1.57)	20 (0.79)	768 (30.24)	814 (32.05)	768 (30.24)	814 (32.05)
132	**1FT6132**	245 (9.65)	**SP240S-MF2**	200 (7.87)	85 (3.35)	17 (0.67)	290 (11.42)	467.5 (18.41)	130 (5.12)	40 (1.57)	20 (0.79)	721 (28.39)	771 (30.35)	721 (28.39)	771 (30.35)
	1FT6134											771 (30.35)	821 (32.32)	771 (30.35)	821 (32.32)
	1FT6136											821 (32.32)	871 (34.29)	821 (32.32)	871 (34.29)

1FT610
1FT613



1FK7 Compact motors with/without DRIVE-CLiQ with SP+ planetary gearbox, single-stage

For motor				Dimensions in mm (in)								Encoder system: Resolver; Absolute encoder EnDat 16 S/R, 15 bit absolute encoder (16 S/R)		Increm. encoder sin/cos 1 V_{pp}, 22 bit increm. encoder (2048 S/R), Absolute encoder EnDat 32 S/R, 16 bit absolute encoder (32 S/R)		Absolute encoder EnDat 2048 S/R, 22 bit absolute encoder (2048 S/R), Absolute encoder EnDat 512 S/R, 20 bit absolute encoder (512 S/R)	
			Planetary gearbox									without brake	with brake	without brake	with brake	without brake	with brake
Shaft height	Type	F4	Type	D1	D2	D3	D4	L5	L6	L7	L8	K	K	K	K	K	K
1FK7 Compact with SP+ planetary gearbox, single-stage, type IM B5, natural cooling, with connector, with/without brake																	
28	**1FK7022-5**	62 (2.44)	**SP060S-MF1**	60 (2.36)	16 (0.63)	5.5 (0.22)	68 (2.68)	137 (5.39)	28 (1.10)	20 (0.79)	6 (0.24)	242 (9.53)	264 (10.39)	267 (10.51)	289 (11.38)	267 (10.51)	289 (11.38)
36	**1FK7032-5**	62 (2.44)	**SP060S-MF1**	60 (2.36)	16 (0.63)	5.5 (0.22)	68 (2.68)	142 (5.59)	28 (1.10)	20 (0.79)	6 (0.24)	244 (9.61)	269 (10.59)	269 (10.59)	294 (11.57)	269 (10.59)	294 (11.57)
	1FK7034-5											269 (10.59)	294 (11.57)	294 (11.57)	319 (12.56)	294 (11.57)	319 (12.56)
48	**1FK7040-5**	76 (2.99)	**SP075S-MF1**	70 (2.76)	22 (0.87)	6.6 (0.26)	85 (3.35)	168 (6.61)	36 (1.42)	20 (0.79)	7 (0.28)	246 (9.69)	275 (10.83)	267 (10.51)	296 (11.65)	275 (10.83)	304 (11.97)
	1FK7042-5											274 (10.79)	303 (11.93)	294 (11.57)	323 (12.72)	303 (11.93)	332 (13.07)
63	**1FK7060-5**	101 (3.98)	**SP100S-MF1**	90 (3.54)	32 (1.26)	9 (0.35)	120 (4.72)	217 (8.54)	58 (2.28)	30 (1.18)	10 (0.39)	286 (11.26)	329 (12.95)	309 (12.17)	352 (13.86)	317 (12.48)	360 (14.17)
	1FK7063-5											331 (13.03)	374 (14.72)	354 (13.94)	397 (15.63)	362 (14.25)	405 (15.94)
80	**1FK7080-5**	141 (5.55)	**SP140S-MF1**	130 (5.12)	40 (1.58)	11 (0.43)	165 (6.50)	283 (11.14)	82 (3.23)	30 (1.18)	12 (0.47)	327 (12.87)	355 (13.98)	350 (13.78)	377 (14.84)	358 (14.09)	386 (15.20)
	1FK7083-5											365 (14.37)	416 (16.38)	388 (15.28)	439 (17.28)	396 (15.59)	447 (17.60)
100	**1FK7100-5**	182 (7.17)	**SP180S-MF1**	160 (6.30)	55 (2.17)	13.5 (0.53)	215 (8.47)	310 (12.20)	82 (3.23)	30 (1.18)	15 (0.59)	383 (15.08)	402 (15.83)	406 (15.98)	425 (16.73)	414 (16.30)	433 (17.05)
	1FK7101-5											409 (16.10)	438 (17.24)	432 (17.01)	461 (18.15)	440 (17.32)	469 (18.46)
	1FK7103-5											435 (17.13)	464 (18.27)	458 (18.03)	487 (19.17)	466 (18.35)	495 (19.49)
	1FK7105-5	182 (7.17)	**SP180S-MF1**	160 (6.30)	55 (2.17)	13.5 (0.55)	215 (8.47)	310 (12.20)	82 (3.23)	30 (1.18)	15 (0.59)	487 (19.17)	516 (20.31)	510 (20.08)	539 (21.22)	518 (20.39)	547 (21.54)
	1FK7105-5	215 (8.46)	**SP210S-MF1**	180 (7.09)	75 (2.95)	17 (0.67)	250 (9.84)	385 (15.16)	105 (4.13)	38 (1.50)	17 (0.67)	531 (20.91)	560 (22.05)	554 (21.81)	583 (22.95)	562 (22.13)	591 (23.27)

1FK702.-5
1FK703.-5
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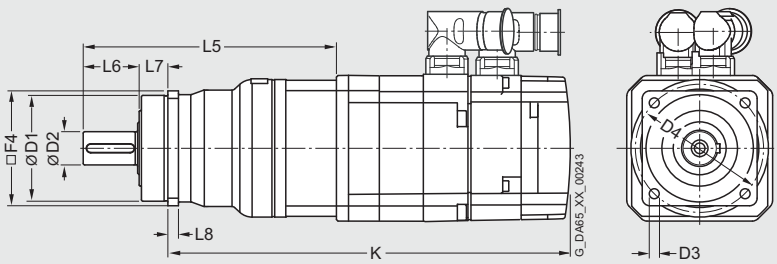
1FK706.-5
1FK708.-5
1FK710.-5

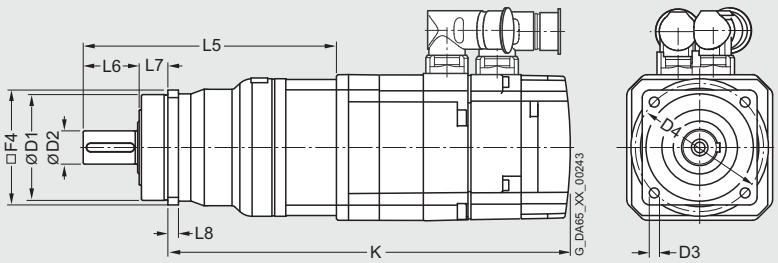


Dimension drawings

1FK7 High Dynamic motors with/without DRIVE-CLiQ with SP+ planetary gearbox, single-stage

For motor				Dimensions in mm (in)								Encoder system: Resolver Absolute encoder EnDat 16 S/R 15 bit absolute encoder (16 S/R)		Increm. encoder sin/cos 1 V_{pp} 22 bit increm. encoder (2048 S/R) Absolute encoder EnDat 32 S/R 16 bit absolute encoder (32 S/R)		Absolute encoder EnDat 2048 S/R 22 bit absolute encoder (2048 S/R) Absolute encoder EnDat 512 S/R 20 bit absolute encoder (512 S/R)	
			Planetary gearbox									without brake	with brake	without brake	with brake	without brake	with brake
Shaft height	Type	F4	Type	D1	D2	D3	D4	L5	L6	L7	L8	K	K	K	K	K	K
1FK7 High Dynamic with SP+ planetary gearbox, single-stage, type IM B5, natural cooling, with connector, with/without brake																	
36	**1FK7033-7**	62 (2.44)	**SP060S-MF1**	60 (2.36)	16 (0.63)	5.5 (0.22)	68 (2.68)	142 (5.59)	28 (1.10)	20 (0.79)	6 (0.24)	263 (10.35)	288 (11.34)	288 (11.34)	313 (12.32)	288 (11.34)	313 (12.32)
48	**1FK7043-7**	76 (2.99)	**SP075S-MF1**	70 (2.76)	22 (0.87)	6.6 (0.26)	85 (3.35)	168 (6.61)	36 (1.42)	20 (0.79)	7 (0.28)	303 (11.93)	332 (13.07)	324 (12.76)	353 (13.90)	332 (13.07)	361 (14.21)
	1FK7044-7											328 (12.91)	357 (14.06)	349 (13.74)	378 (14.88)	357 (14.06)	386 (15.20)
63	**1FK7061-7**	101 (3.98)	**SP100S-MF1**	90 (3.54)	32 (1.26)	9 (0.35)	120 (4.72)	217 (8.54)	58 (2.28)	30 (1.18)	10 (0.39)	314 (12.36)	357 (14.06)	337 (13.27)	380 (14.96)	346 (13.62)	389 (15.31)
	1FK7064-7											378 (14.88)	421 (16.57)	401 (15.79)	444 (17.48)	410 (16.14)	453 (17.83)
80	**1FK7085-7** **1FK7086-7**	141 (5.55)	**SP140S-MF1**	130 (5.12)	40 (1.57)	11 (0.43)	165 (6.50)	283 (11.14)	82 (3.23)	30 (1.18)	12 (0.47)	432 (17.01)	474 (18.66)	454 (17.87)	497 (19.57)	463 (18.23)	505 (19.88)

1FK703.-7
1FK704.-7
1FK706.-7
1FK708.-7



1FK7 Compact motors with/without DRIVE-CLiQ with SP+ planetary gearbox, two-stage

For motor				Dimensions in mm (in)								Encoder system: Resolver Absolute encoder EnDat 16 S/R 15 bit absolute encoder (16 S/R)		Increm. encoder sin/cos 1 V_{pp} 22 bit increm. encoder (2048 S/R) Absolute encoder EnDat 32 S/R 16 bit absolute encoder (32 S/R)		Absolute encoder EnDat 2048 S/R 22 bit absolute encoder (2048 S/R) Absolute encoder EnDat 512 S/R 20 bit absolute encoder (512 S/R)	
			Planetary gearbox									without brake	with brake	without brake	with brake	without brake	with brake
Shaft height	Type	F4	Type	D1	D2	D3	D4	L5	L6	L7	L8	K	K	K	K	K	K
1FK7 Compact with SP+ planetary gearbox, two-stage, type IM B5, natural cooling, with connector, with/without brake																	
28	**1FK7022-5**	62 (2.44)	**SP060S-MF2**	60 (2.36)	16 (0.63)	5.5 (0.22)	68 (2.68)	156 (6.14)	28 (1.10)	20 (0.79)	6 (0.24)	261 (10.28)	283 (11.14)	286 (11.26)	308 (12.13)	286 (11.26)	308 (12.13)
		76 (2.99)	**SP075S-MF2**	70 (2.76)	22 (0.87)	6.6 (0.26)	85 (3.35)	175 (6.89)	36 (1.42)	20 (0.79)	7 (0.28)	272 (10.71)	294 (11.57)	297 (11.69)	319 (12.56)	297 (11.69)	319 (12.56)
		101 (3.98)	**SP100S-MF2**	90 (3.54)	32 (1.26)	9 (0.35)	120 (4.72)	230 (9.06)	58 (2.28)	30 (1.18)	10 (0.39)	295 (11.61)	317 (12.48)	320 (12.60)	342 (13.46)	320 (12.60)	342 (13.46)
36	**1FK7032-5**	62 (2.44)	**SP060S-MF2**	60 (2.36)	16 (0.63)	5.5 (0.22)	68 (2.68)	164 (6.46)	28 (1.10)	20 (0.79)	6 (0.24)	266 (10.47)	291 (11.46)	291 (11.46)	316 (12.44)	291 (11.46)	316 (12.44)
		76 (2.99)	**SP075S-MF2**	70 (2.76)	22 (0.87)	6.6 (0.26)	85 (3.35)	179 (7.05)	36 (1.42)	20 (0.79)	7 (0.28)	273 (10.75)	298 (11.73)	298 (11.73)	323 (12.72)	298 (11.73)	323 (12.72)
		101 (3.98)	**SP100S-MF2**	90 (3.54)	32 (1.26)	9 (0.35)	120 (4.72)	230 (9.06)	58 (2.28)	30 (1.18)	10 (0.39)	292 (11.50)	317 (12.48)	317 (12.48)	342 (13.46)	317 (12.48)	342 (13.46)
	1FK7034-5	76 (2.99)	**SP075S-MF2**	70 (2.76)	22 (0.87)	6.6 (0.26)	85 (3.35)	179 (7.05)	36 (1.42)	20 (0.79)	7 (0.28)	298 (11.73)	323 (12.72)	323 (12.72)	348 (13.70)	323 (12.72)	348 (13.70)
		101 (3.98)	**SP100S-MF2**	90 (3.54)	32 (1.26)	9 (0.35)	120 (4.72)	230 (9.06)	58 (2.28)	30 (1.18)	10 (0.39)	317 (12.48)	342 (13.46)	342 (13.46)	367 (14.45)	342 (13.46)	367 (14.45)
48	**1FK7040-5**	76 (2.99)	**SP075S-MF2**	70 (2.76)	22 (0.87)	6.6 (0.26)	85 (3.35)	192 (7.56)	36 (1.42)	20 (0.79)	7 (0.28)	270 (10.63)	299 (11.77)	291 (11.46)	320 (12.60)	299 (11.77)	328 (12.91)
		101 (3.98)	**SP100S-MF2**	90 (3.54)	32 (1.26)	9 (0.35)	120 (4.72)	234 (9.21)	58 (2.28)	30 (1.18)	10 (0.39)	280 (11.02)	309 (12.17)	301 (11.85)	330 (12.99)	309 (12.17)	338 (13.31)
		141 (5.55)	**SP140S-MF2**	130 (5.12)	40 (1.57)	11 (0.43)	165 (6.50)	298 (11.73)	82 (3.23)	30 (1.18)	12 (0.47)	320 (12.60)	349 (13.74)	341 (13.43)	370 (14.57)	349 (13.74)	378 (14.88)
	1FK7042-5	76 (2.99)	**SP075S-MF2**	70 (2.76)	22 (0.87)	6.6 (0.26)	85 (3.35)	192 (7.56)	36 (1.42)	20 (0.79)	7 (0.28)	298 (11.73)	327 (12.87)	298 (11.73)	347 (13.66)	327 (12.87)	356 (14.02)
		101 (3.98)	**SP100S-MF2**	90 (3.54)	32 (1.26)	9 (0.35)	120 (4.72)	234 (9.21)	58 (2.28)	30 (1.18)	10 (0.39)	308 (12.13)	337 (13.27)	308 (12.13)	357 (14.06)	337 (13.27)	366 (14.41)
		141 (5.55)	**SP140S-MF2**	130 (5.12)	40 (1.57)	11 (0.43)	165 (6.50)	298 (11.73)	82 (3.23)	30 (1.18)	12 (0.47)	348 (13.71)	377 (14.84)	368 (14.49)	397 (15.63)	377 (14.84)	406 (15.98)
63	**1FK7060-5**	101 (3.98)	**SP100S-MF2**	90 (3.54)	32 (1.26)	9 (0.35)	120 (4.72)	252 (9.92)	58 (2.28)	30 (1.18)	10 (0.39)	321 (12.64)	364 (14.33)	344 (13.54)	387 (15.24)	352 (13.86)	395 (15.55)
		141 (5.55)	**SP140S-MF2**	130 (5.12)	40 (1.57)	11 (0.43)	165 (6.50)	305 (12.01)	82 (3.23)	30 (1.18)	12 (0.47)	350 (13.78)	393 (15.47)	373 (14.69)	416 (16.38)	381 (15.00)	424 (16.69)
	1FK7063-5	141 (5.55)	**SP140S-MF2**	130 (5.12)	40 (1.57)	11 (0.43)	165 (6.50)	305 (12.01)	82 (3.23)	30 (1.18)	12 (0.47)	395 (15.55)	438 (17.24)	418 (16.46)	461 (18.15)	426 (16.77)	469 (18.46)
		182 (7.17)	**SP180S-MF2**	160 (6.30)	55 (2.17)	13.5 (0.53)	215 (8.46)	346 (13.62)	82 (3.23)	30 (1.18)	15 (0.59)	436 (17.17)	479 (18.86)	459 (18.07)	502 (19.76)	467 (18.39)	510 (20.08)

1FK702.-5
1FK703.-5
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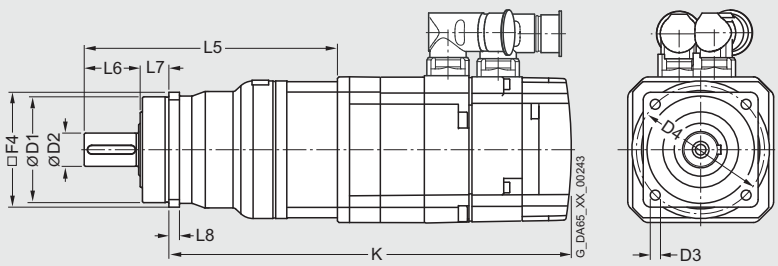
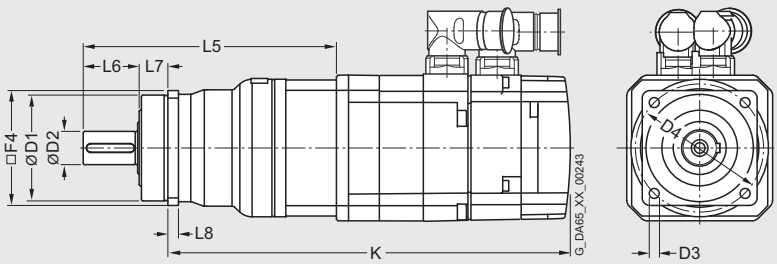


Dimension drawings

1FK7 Compact motors with/without DRIVE-CLiQ with SP+ planetary gearbox, two-stage

For motor				Dimensions in mm (in)								Encoder system: Resolver		Increm. encoder sin/cos 1 V_{pp} 22 bit increm. encoder (2048 S/R) Absolute encoder EnDat 32 S/R 16 bit absolute encoder (32 S/R)		Absolute encoder EnDat 2048 S/R 22 bit absolute encoder (2048 S/R)	
			Planetary gearbox									without brake	with brake	without brake	with brake	without brake	with brake
Shaft height	Type	F4	Type	D1	D2	D3	D4	L5	L6	L7	L8	K	K	K	K	K	K
1FK7 Compact with SP+ planetary gearbox, two-stage, type IM B5, natural cooling, with connector, with/without brake																	
80	**1FK7080-5**	141 (5.55)	**SP140S-MF2**	130 (5.12)	40 (1.57)	11 (0.43)	165 (6.50)	332 (13.07)	82 (3.23)	30 (1.18)	12 (0.47)	376 (14.80)	404 (15.91)	399 (15.71)	426 (16.77)	407 (16.02)	435 (17.13)
		182 (7.17)	**SP180S-MF2**	160 (6.30)	55 (2.17)	13.5 (0.53)	215 (8.46)	355 (13.98)	82 (3.23)	30 (1.18)	15 (0.59)	399 (15.71)	427 (16.81)	422 (16.61)	449 (17.68)	430 (16.93)	458 (18.03)
		215 (8.46)	**SP210S-MF2**	180 (7.09)	75 (2.95)	17 (0.67)	250 (9.84)	415 (16.34)	105 (4.13)	38 (1.50)	17 (0.67)	428 (16.85)	456 (17.95)	451 (17.76)	478 (18.82)	459 (18.07)	487 (19.17)
	1FK7083-5	141 (5.55)	**SP140S-MF2**	130 (5.12)	40 (1.57)	11 (0.43)	165 (6.50)	332 (13.07)	82 (3.23)	30 (1.18)	12 (0.47)	414 (16.30)	465 (18.31)	437 (17.20)	488 (19.21)	445 (17.52)	496 (19.53)
		182 (7.17)	**SP180S-MF2**	160 (6.30)	55 (2.17)	13.5 (0.53)	215 (8.46)	355 (13.98)	82 (3.23)	30 (1.18)	15 (0.59)	437 (17.20)	488 (19.21)	460 (18.11)	511 (20.12)	468 (18.43)	519 (20.43)
		215 (8.46)	**SP210S-MF2**	180 (7.09)	75 (2.95)	17 (0.67)	250 (9.84)	415 (16.34)	105 (4.13)	38 (1.50)	17 (0.67)	466 (18.35)	517 (20.35)	489 (19.25)	540 (21.26)	497 (19.57)	548 (21.57)
100	**1FK7100-5**	182 (7.17)	**SP180S-MF2**	160 (6.30)	55 (2.17)	13.5 (0.53)	215 (8.46)	310 (12.20)	82 (3.23)	30 (1.18)	15 (0.59)	383 (15.08)	402 (15.83)	406 (15.98)	425 (16.73)	414 (16.30)	433 (17.05)
		215 (8.46)	**SP210S-MF2**	180 (7.09)	75 (2.95)	17 (0.67)	250 (9.84)	415 (16.34)	105 (4.13)	38 (1.50)	17 (0.67)	457 (17.99)	476 (18.74)	480 (18.90)	499 (19.65)	488 (19.21)	507 (19.96)
	1FK7101-5	182 (7.17)	**SP180S-MF2**	160 (6.30)	55 (2.17)	13.5 (0.53)	215 (8.46)	310 (12.20)	82 (3.23)	30 (1.18)	15 (0.59)	409 (16.10)	438 (17.24)	432 (17.01)	461 (18.15)	440 (17.32)	469 (18.46)
		215 (8.46)	**SP210S-MF2**	180 (7.09)	75 (2.95)	17 (0.67)	250 (9.84)	415 (16.34)	105 (4.13)	38 (1.50)	17 (0.67)	483 (19.02)	512 (20.16)	506 (19.92)	535 (21.06)	514 (20.24)	543 (21.38)
		245 (9.65)	**SP240S-MF2**	200 (7.87)	85 (3.35)	17 (0.67)	290 (11.42)	467.5 (18.41)	130 (5.12)	40 (1.57)	20 (0.79)	509 (20.04)	538 (21.18)	531 (20.91)	561 (22.09)	539 (21.22)	569 (22.40)
	1FK7103-5	182 (7.17)	**SP180S-MF2**	160 (6.30)	55 (2.17)	13.5 (0.53)	215 (8.46)	310 (12.20)	82 (3.23)	30 (1.18)	15 (0.59)	435 (17.13)	464 (18.27)	458 (18.03)	487 (19.19)	466 (18.35)	495 (19.49)
		215 (8.46)	**SP210S-MF2**	180 (7.09)	75 (2.95)	17 (0.67)	250 (9.84)	415 (16.34)	105 (4.13)	38 (1.50)	17 (0.67)	509 (20.04)	538 (21.18)	532 (20.94)	561 (22.09)	540 (21.26)	569 (22.40)
		245 (9.56)	**SP240S-MF2**	200 (7.87)	85 (3.35)	17 (0.67)	290 (11.42)	467.5 (18.41)	130 (5.12)	40 (1.57)	20 (0.79)	535 (21.06)	564 (22.20)	557 (21.93)	587 (23.11)	565 (22.24)	595 (23.43)
	1FK7105-5	215 (8.46)	**SP210S-MF2**	180 (7.09)	75 (2.95)	17 (0.67)	250 (9.84)	415 (16.34)	105 (4.13)	38 (1.50)	17 (0.67)	561 (22.09)	590 (23.23)	584 (22.99)	613 (24.13)	592 (23.31)	621 (24.45)
		245 (9.65)	**SP240S-MF2**	200 (7.87)	85 (3.35)	17 (0.67)	290 (11.42)	467.5 (18.41)	130 (5.12)	40 (1.57)	20 (0.79)	587 (23.11)	616 (24.25)	610 (24.02)	639 (25.16)	618 (24.33)	647 (25.47)

1FK708.-5
1FK710.-5



1FK7 High Dynamic motors with/without DRIVE-CLiQ with SP+ planetary gearbox, two-stage

For motor				Dimensions in mm (in)								Encoder system: Resolver; Absolute encoder EnDat 16 S/R, 15 bit absolute encoder (16 S/R)		Increm. encoder sin/cos 1 V_{pp}, 22 bit increm. encoder (2048 S/R); Absolute encoder EnDat 32 S/R, 16 bit absolute encoder (32 S/R)		Absolute encoder EnDat 2048 S/R, 22 bit absolute encoder (2048 S/R); Absolute encoder EnDat 512 S/R, 20 bit absolute encoder (512 S/R)	
			Planetary gearbox									without brake	with brake	without brake	with brake	without brake	with brake
Shaft height	Type	F4	Type	D1	D2	D3	D4	L5	L6	L7	L8	K	K	K	K	K	K
1FK7 High Dynamic with SP+ planetary gearbox, two-stage, type IM B5, natural cooling, with connector, with/without brake																	
36	**1FK7033-7**	62 (2.44)	**SP060S-MF2**	60 (2.36)	16 (0.63)	5.5 (0.22)	68 (2.68)	164 (6.46)	28 (1.10)	20 (0.79)	6 (0.24)	285 (11.22)	310 (12.20)	310 (12.20)	335 (13.19)	310 (12.20)	335 (13.19)
		76 (2.99)	**SP075S-MF2**	70 (2.76)	22 (0.87)	6.6 (0.26)	85 (3.35)	179 (7.05)	36 (1.42)	20 (0.79)	7 (0.28)	292 (11.50)	317 (12.48)	317 (12.48)	342 (13.46)	317 (12.48)	342 (13.46)
		101 (3.98)	**SP100S-MF2**	90 (3.54)	32 (1.26)	9 (0.35)	120 (4.72)	230 (9.06)	58 (2.28)	30 (1.18)	10 (0.39)	311 (12.24)	336 (13.23)	336 (13.23)	361 (14.21)	336 (13.23)	361 (14.21)
48	**1FK7043-7**	76 (2.99)	**SP075S-MF2**	70 (2.76)	22 (0.87)	6.6 (0.26)	85 (3.35)	192 (7.56)	36 (1.42)	20 (0.79)	7 (0.28)	327 (12.87)	356 (14.02)	348 (13.70)	377 (14.84)	356 (14.02)	385 (15.16)
		101 (3.98)	**SP100S-MF2**	90 (3.54)	32 (1.26)	9 (0.35)	120 (4.72)	234 (9.21)	58 (2.28)	30 (1.18)	10 (0.39)	337 (13.27)	366 (14.41)	358 (14.09)	387 (15.24)	366 (14.41)	395 (15.55)
		141 (5.55)	**SP140S-MF2**	130 (5.12)	40 (1.57)	11 (0.43)	165 (6.50)	298 (11.74)	82 (3.23)	30 (1.18)	12 (0.47)	377 (14.84)	406 (15.98)	398 (15.67)	427 (16.81)	406 (15.98)	435 (17.13)
	1FK7044-7	101 (3.98)	**SP100S-MF2**	90 (3.54)	32 (1.26)	9 (0.35)	120 (4.72)	234 (9.21)	58 (2.28)	30 (1.18)	10 (0.39)	362 (14.25)	391 (15.39)	383 (15.08)	412 (16.22)	391 (15.39)	420 (16.54)
		141 (5.55)	**SP140S-MF2**	130 (5.12)	40 (1.57)	11 (0.43)	165 (6.50)	298 (11.73)	82 (3.23)	30 (1.18)	12 (0.47)	402 (15.83)	431 (16.97)	432 (17.01)	452 (17.80)	431 (16.97)	460 (18.11)
63	**1FK7061-7**	101 (3.98)	**SP100S-MF2**	90 (3.54)	32 (1.26)	9 (0.35)	120 (4.72)	252 (9.92)	58 (2.28)	30 (1.18)	10 (0.39)	349 (13.74)	392 (15.43)	372 (14.65)	415 (16.34)	381 (15.00)	424 (16.69)
	1FK7061-7	141 (5.55)	**SP140S-MF2**	130 (5.12)	40 (1.57)	11 (0.43)	165 (6.50)	305 (12.01)	82 (3.23)	30 (1.18)	12 (0.47)	378 (14.88)	421 (16.57)	401 (15.79)	444 (17.48)	410 (16.14)	453 (17.83)
	1FK7064-7											442 (17.40)	485 (19.09)	465 (18.31)	508 (20.00)	474 (18.66)	517 (20.35)
	1FK7064-7	182 (7.17)	**SP180S-MF2**	160 (6.30)	55 (2.17)	14 (0.55)	215 (8.46)	346 (13.62)	82 (3.23)	30 (1.18)	15 (0.59)	483 (19.02)	526 (20.71)	506 (19.92)	549 (21.61)	515 (20.28)	558 (21.97)
80	**1FK7085-7**	182 (7.17)	**SP180S-MF2**	160 (6.30)	55 (2.17)	13.5 (0.53)	215 (8.46)	355 (13.98)	82 (3.23)	30 (1.18)	15 (0.59)	504 (19.84)	546 (21.50)	526 (20.71)	569 (22.40)	535 (21.06)	577 (22.72)
		215 (8.46)	**SP210S-MF2**	180 (7.09)	75 (2.95)	17 (0.67)	250 (9.84)	415 (16.34)	105 (4.13)	38 (1.50)	17 (0.67)	533 (20.98)	575 (22.64)	555 (21.85)	598 (23.54)	564 (22.20)	606 (23.86)
	1FK7086-7	182 (7.17)	**SP180S-MF2**	160 (6.30)	55 (2.17)	13.5 (0.53)	215 (8.46)	355 (13.98)	82 (3.23)	30 (1.18)	15 (0.59)	504 (19.84)	546 (21.50)	526 (20.71)	569 (22.40)	535 (21.06)	577 (22.72)
		215 (8.46)	**SP210S-MF2**	180 (7.09)	75 (2.95)	17 (0.67)	250 (9.84)	415 (16.34)	105 (4.13)	38 (1.50)	17 (0.67)	533 (20.98)	575 (22.64)	555 (21.85)	598 (23.54)	564 (22.20)	606 (23.86)

1FK703.-7
1FK704.-7
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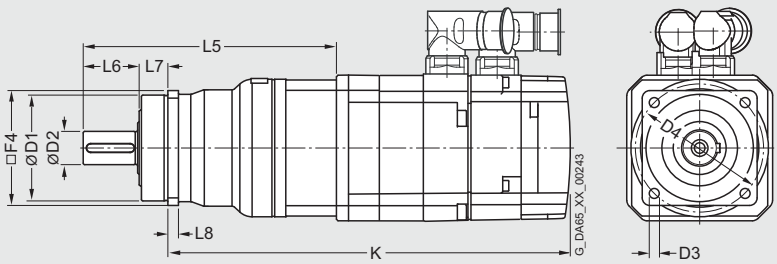


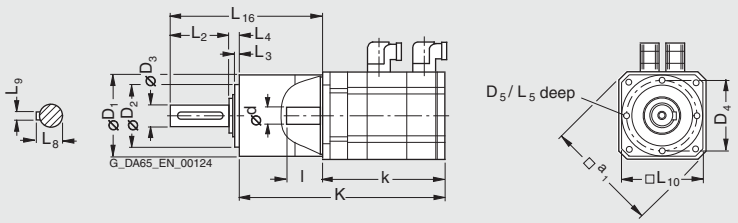
Dimension drawings

1FK7 Compact motors with/without DRIVE-CLiQ with LP+ planetary gearbox, single-stage

For motor		Dimensions in mm (in)													
		Planetary gearbox													
Shaft height	Type	Type	D_1 –	D_2 –	D_3 –	D_4 –	D_5 –	L_2 –	L_3 –	L_4 –	L_5 –	L_8 –	L_9 –	L_{10} –	L_{16} –
28	**1FK7022-5**	**LP050-M01**	50 (1.97)	35 (1.38)	12 (0.47)	44 (1.73)	M4	18 (0.71)	4 (0.16)	7 (0.28)	8 (0.31)	14 (0.55)	4 (0.16)	50 (1.97)	88 (3.46)
	1FK7022-5	**LP070-M01**	70 (2.76)	52 (2.05)	16 (0.63)	62 (2.44)	M5	28 (1.10)	5 (0.20)	8 (0.31)	10 (0.39)	18 (0.71)	5 (0.20)	70 (2.76)	119 (4.69)
36	**1FK7032-5**	**LP070-M01**	70 (2.76)	52 (2.05)	16 (0.63)	62 (2.44)	M5	28 (1.10)	5 (0.20)	8 (0.31)	10 (0.39)	18 (0.71)	5 (0.20)	70 (2.76)	126 (4.96)
	1FK7034-5														
48	**1FK7040-5**	**LP090-M01**	90 (3.54)	68 (2.68)	22 (0.87)	80 (3.15)	M6	36 (1.42)	5 (0.20)	10 (0.39)	12 (0.47)	25 (0.98)	6 (0.24)	90 (3.54)	158 (6.22)
	1FK7042-5														
63	**1FK7060-5**	**LP120-M01**	120 (4.72)	90 (3.54)	32 (1.26)	108 (4.25)	M8	58 (2.28)	6 (0.24)	12 (0.47)	16 (0.63)	35 (1.38)	10 (0.39)	120 (4.72)	210 (8.27)
	1FK7063-5														
80	**1FK7080-5**	**LP155-M01**	155 (6.10)	120 (4.72)	40 (1.57)	140 (5.51)	M10	82 (3.23)	8 (0.31)	15 (0.59)	20 (0.79)	43 (1.69)	12 (0.47)	150 (5.91)	266 (10.47)
	1FK7083-5														

			Encoder system: Resolver, Absolute encoder EnDat 16 S/R, 15 bit absolute encoder (16 S/R)				Incremental encoder sin/cos 1 V_{pp}, 22 bit increm. encoder (2048 S/R), Absolute encoder EnDat 32 S/R, 16 bit absolute encoder (32 S/R)				Absolute encoder EnDat 2048 S/R, 22 bit absolute encoder (2048 S/R), Absolute encoder EnDat 512 S/R, 20 bit absolute encoder (512 S/R)						
			without brake		with brake		without brake		with brake		without brake		with brake				
Shaft height	Type	DIN IEC	k LB	K –	k LB	K –	k LB	K –	k LB	K –	k LB	K –	k LB	K –	l E	d D	a_1 P
1FK7 Compact with LP+ planetary gearbox, single-stage, type IM B5, natural cooling, with connector, with/without brake																	
28	**1FK7022-5**		153 (6.02)	216 (8.50)	175 (6.89)	238 (9.37)	178 (7.01)	241 (9.49)	200 (7.87)	263 (10.35)	178 (7.01)	241 (9.49)	200 (7.87)	263 (10.35)	20 (0.79)	9 (0.35)	-
	1FK7022-5			236 (9.29)		258 (10.16)		261 (10.28)		283 (11.14)		261 (10.28)		283 (11.14)			
36	**1FK7032-5**		150 (5.91)	240 (9.45)	175 (6.89)	265 (10.43)	175 (6.89)	265 (10.43)	200 (7.87)	290 (11.42)	175 (6.89)	265 (10.43)	200 (7.87)	290 (11.42)	30 (1.18)	14 (0.55)	92 (3.62)
	1FK7034-5		175 (6.89)	265 (10.43)	200 (7.87)	290 (11.42)	200 (7.87)	290 (11.42)	225 (8.86)	315 (12.40)	200 (7.87)	290 (11.42)	225 (8.86)	315 (12.40)			
48	**1FK7040-5**		135 (5.31)	247 (9.72)	164 (6.46)	276 (10.87)	155 (6.10)	267 (10.51)	184 (7.24)	296 (11.65)	164 (6.46)	276 (10.87)	193 (7.60)	305 (12.01)	40 (1.57)	19 (0.75)	120 (4.72)
	1FK7042-5		162 (6.38)	274 (10.79)	191 (7.52)	303 (11.93)	183 (7.20)	295 (11.61)	212 (8.35)	324 (12.76)	191 (7.52)	303 (11.93)	220 (8.66)	332 (13.07)			
63	**1FK7060-5**		157 (6.18)	297 (11.69)	200 (7.87)	340 (13.39)	180 (7.09)	320 (12.60)	223 (8.78)	363 (14.29)	188 (7.40)	328 (12.91)	231 (9.09)	371 (14.61)	50 (1.97)	24 (0.94)	155 (6.10)
	1FK7063-5		202 (7.95)	342 (13.46)	245 (9.65)	385 (15.16)	225 (8.86)	365 (14.37)	268 (10.55)	408 (16.06)	233 (9.17)	373 (14.69)	276 (10.87)	416 (16.38)			
80	**1FK7080-5**		156 (6.14)	325 (12.80)	184 (7.24)	353 (13.90)	179 (7.05)	347 (13.66)	206 (8.11)	375 (14.76)	187 (7.36)	355 (13.98)	215 (8.46)	384 (15.12)	58 (2.28)	32 (1.26)	186 (7.32)
	1FK7083-5		194 (7.64)	363 (14.29)	245 (9.65)	414 (16.30)	217 (8.54)	385 (15.16)	268 (10.55)	436 (17.17)	225 (8.86)	393 (15.47)	276 (10.87)	444 (17.48)			

1FK702.-5
1FK703.-5
1FK704.-5
1FK706.-5
1FK708.-5

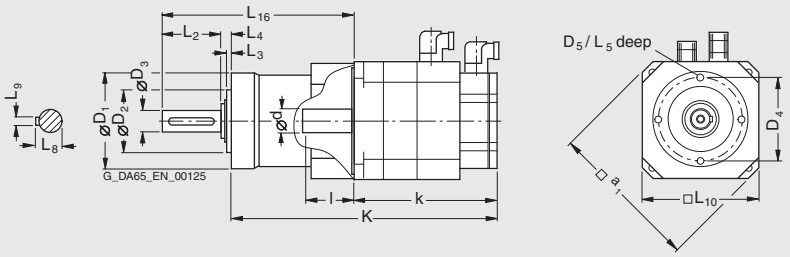


1FK7 Compact motors with/without DRIVE-CLiQ with LP+ planetary gearbox, single-stage

For motor		Dimensions in mm (in)														
		Planetary gearbox														
Shaft height	Type	Type	D_1 –	D_2 –	D_3 –	D_4 –	D_5 –	L_2 –	L_3 –	L_4 –	L_5 –	L_8 –	L_9 –	L_{10} –	L_{16} –	
100	**1FK710.-5**	**LP155-M01**	155 (6.10)	120 (4.72)	40 (1.57)	140 (5.51)	M10	82 (3.23)	8 (0.31)	15 (0.59)	20 (0.79)	43 (1.69)	12 (0.47)	150 (5.91)	286 (11.26)	

			Encoder system: Resolver				Incremental encoder sin/cos 1 V_{pp} 22 bit increm. encoder (2048 S/R) Absolute encoder EnDat 32 S/R 16 bit absolute encoder (32 S/R)				Absolute encoder EnDat 2048 S/R 22 bit absolute encoder (2048 S/R)						
			without brake		with brake		without brake		with brake		without brake		with brake				
Shaft height	Type	**DIN IEC**	k LB	K –	k LB	K –	k LB	K –	k LB	K –	k LB	K –	k LB	K –	l E	d D	a_1 P
1FK7 Compact with LP+ planetary gearbox, single-stage, type IM B5, natural cooling, with connector, with/without brake																	
100	**1FK7100-5**		185 (7.28)	374 (14.72)	204 (8.03)	393 (15.47)	208 (8.19)	396 (15.59)	227 (8.94)	415 (16.34)	216 (8.50)	404 (15.91)	235 (9.25)	423 (16.65)	80 (3.15)	38 (1.50)	240 (9.45)
	1FK7101-5		211 (8.31)	400 (15.75)	240 (9.45)	429 (16.89)	234 (9.21)	422 (16.61)	263 (10.35)	452 (17.80)	242 (9.53)	430 (16.93)	271 (10.67)	460 (18.11)			
	1FK7103-5		237 (9.33)	426 (16.77)	266 (10.47)	455 (17.91)	260 (10.24)	448 (17.64)	289 (11.38)	478 (18.82)	268 (10.55)	456 (17.95)	297 (11.69)	486 (19.13)			
	1FK7105-5		289 (11.38)	478 (18.82)	318 (12.52)	507 (19.96)	312 (12.28)	500 (19.69)	341 (13.43)	530 (20.87)	320 (12.60)	508 (20.00)	349 (13.74)	538 (21.18)			

1FK710.-5



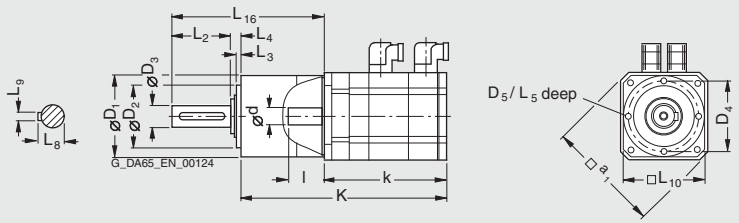
Dimension drawings

1FK7 High Dynamic motors with/without DRIVE-CLiQ with LP+ planetary gearbox, single-stage

For motor		Dimensions in mm (in)													
		Planetary gearbox													
Shaft height	Type	Type	D_1 –	D_2 –	D_3 –	D_4 –	D_5 –	L_2 –	L_3 –	L_4 –	L_5 –	L_8 –	L_9 –	L_{10} –	L_{16} –
36	**1FK7033-7**	**LP070-M01**	70 (2.76)	52 (2.05)	16 (0.63)	62 (2.44)	M5	28 (1.10)	5 (0.20)	8 (0.31)	10 (0.39)	18 (0.71)	5 (0.20)	70 (2.76)	126 (4.96)
48	**1FK7043-7** **1FK7044-7**	**LP090-M01**	90 (3.54)	68 (2.68)	22 (0.87)	80 (3.15)	M6	36 (1.42)	5 (0.20)	10 (0.39)	12 (0.47)	25 (0.98)	6 (0.24)	90 (3.54)	158 (6.22)
63	**1FK7061-7** **1FK7064-7**	**LP120-M01**	120 (4.72)	90 (3.54)	32 (1.26)	108 (4.25)	M8	58 (2.28)	6 (0.24)	12 (0.47)	16 (0.63)	35 (1.38)	10 (0.39)	120 (4.72)	210 (8.27)
80	**1FK7085-7** **1FK7086-7**	**LP155-M01**	155 (6.10)	120 (4.72)	40 (1.57)	140 (5.51)	M10	82 (3.23)	8 (0.31)	15 (0.59)	20 (0.79)	43 (1.69)	12 (0.47)	150 (5.91)	266 (10.47)

			Encoder system: Resolver, Absolute encoder EnDat 16 S/R, 15 bit absolute encoder (16 S/R)				Incremental encoder sin/cos 1 V_{pp}, 22 bit increm. encoder (2048 S/R), Absolute encoder EnDat 32 S/R, 16 bit absolute encoder (32 S/R)				Absolute encoder EnDat 2048 S/R, 22 bit absolute encoder (2048 S/R), Absolute encoder EnDat 512 S/R, 20 bit absolute encoder (512 S/R)						
			without brake		with brake		without brake		with brake		without brake		with brake				
Shaft height	Type	DIN IEC	k LB	K –	k LB	K –	k LB	K –	k LB	K –	k LB	K –	k LB	K –	l E	d D	a_1 P
1FK7 High Dynamic with LP+ planetary gearbox, single-stage, type IM B5, natural cooling, with connector, with/without brake																	
36	**1FK7033-7**		170 (6.69)	260 (10.24)	195 (7.68)	285 (11.22)	195 (7.68)	285 (11.22)	220 (8.66)	310 (12.20)	195 (7.68)	285 (11.22)	220 (8.66)	310 (12.20)	30 (1.18)	14 (0.55)	92 (3.62)
48	**1FK7043-7**		191 (7.52)	303 (11.93)	220 (8.66)	332 (13.07)	212 (8.35)	324 (12.76)	240 (9.45)	352 (13.86)	220 (8.66)	332 (13.07)	249 (9.80)	361 (14.21)	40 (1.57)	19 (0.75)	120 (4.72)
	1FK7044-7		216 (8.50)	328 (12.91)	245 (9.65)	357 (14.06)	237 (9.33)	349 (13.74)	265 (10.43)	377 (14.84)	245 (9.65)	357 (14.06)	274 (10.79)	386 (15.20)			
63	**1FK7061-7**		185 (7.28)	325 (12.80)	228 (8.98)	368 (14.49)	208 (8.19)	348 (13.70)	251 (9.88)	391 (15.39)	217 (8.54)	357 (14.06)	260 (10.24)	400 (15.75)	50 (1.97)	24 (0.94)	155 (6.10)
	1FK7064-7		249 (9.80)	389 (15.31)	292 (11.50)	432 (17.01)	272 (10.71)	412 (16.22)	315 (12.40)	455 (17.91)	281 (11.06)	421 (16.57)	324 (12.76)	464 (18.27)			
80	**1FK7085-7** **1FK7086-7**		261 (10.28)	430 (16.93)	304 (11.97)	473 (18.62)	284 (11.18)	453 (17.83)	326 (12.83)	495 (19.49)	292 (11.50)	461 (18.15)	335 (13.19)	504 (19.84)	58 (2.28)	32 (1.26)	186 (7.32)

1FK7033-7
1FK704.-7
1FK706.-7
1FK708.-7

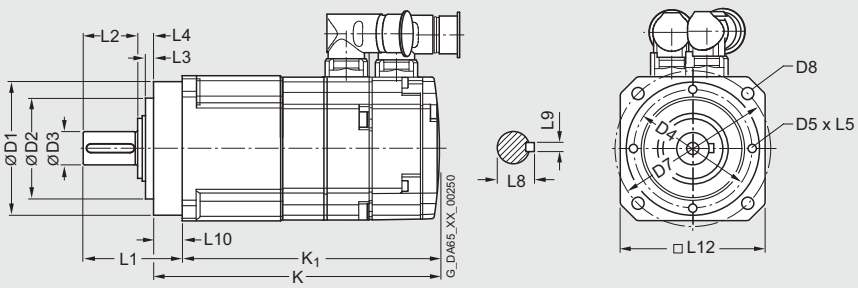


1FK7-DYA motors with/without DRIVE-CLiQ with planetary gearbox, single-stage

For motor		Dimensions in mm (in) Planetary gearbox																
Shaft height	Type	Type	D1	D2	D3	D4	D5	D7	D8	L1	L2	L3	L4	L5	L8	L9	L10	L12
36	**1FK7032-5**	**DYA70-10**	70 (2.76)	52 (2.05)	16 (0.63)	62 (2.44)	M5	82 (3.23)	5.5 (0.22)	56 (2.20)	28 (1.10)	5 (0.20)	8 (0.31)	10 (0.39)	18 (0.71)	5 (0.20)	20 (0.79)	76 (2.99)
	1FK7034-5	**DYA70-5**																
48	**1FK7040-5**	**DYA90-10**	90 (3.54)	68 (2.68)	22 (0.87)	80 (3.15)	M6	105 (4.13)	7 (0.28)	66 (2.60)	36 (1.42)	5 (0.20)	10 (0.39)	12 (0.47)	24.5 (0.96)	6 (0.24)	20 (0.79)	101 (3.98)
	1FK7042-5	**DYA90-5**																
63	**1FK7060-5**	**DYA120-10**	120 (4.72)	90 (3.54)	32 (1.26)	108 (4.25)	M8	140 (5.51)	9 (0.35)	95 (3.74)	58 (2.28)	6 (0.24)	12 (0.47)	16 (0.63)	35 (1.38)	10 (0.39)	25 (0.98)	128 (5.04)
	1FK7063-5	**DYA120-5**																
80	**1FK7080-5**	**DYA155-10**	155 (6.10)	120 (4.72)	40 (1.57)	140 (5.51)	M10	170 (6.69)	11 (0.43)	127 (5.00)	82 (3.23)	8 (0.31)	15 (0.59)	20 (0.79)	43 (1.69)	12 (0.47)	30 (1.18)	161 (6.34)
	1FK7083-5	**DYA155-5**																

		Encoder system: Resolver Absolute encoder EnDat 16 S/R 15 bit absolute encoder (16 S/R)				Incremental encoder sin/cos 1 V_{pp} 22 bit incremental encoder (2048 S/R) Absolute encoder EnDat 32 S/R 16 bit absolute encoder (32 S/R)				Absolute encoder EnDat 2048 S/R 22 bit absolute encoder (2048 S/R) Absolute encoder EnDat 512 S/R 20 bit absolute encoder (512 S/R)			
		without brake		with brake		without brake		with brake		without brake		with brake	
Shaft height	Type	K	K1	K	K1	K	K1	K	K1	K	K1	K	K1
1FK7-DYA with planetary gearbox, single-stage, type IM B5, natural cooling, with connector, with/without brake													
36	**1FK7032-5**	197 (7.76)	177 (6.97)	222 (8.74)	202 (7.95)	222 (8.74)	202 (7.95)	247 (9.72)	227 (8.94)	222 (8.74)	202 (7.95)	247 (9.72)	227 (8.94)
	1FK7034-5	222 (8.74)	202 (7.95)	247 (9.72)	227 (8.94)	247 (9.72)	227 (8.94)	272 (10.71)	252 (9.92)	247 (9.72)	227 (8.94)	272 (10.71)	252 (9.92)
48	**1FK7040-5**	194 (7.64)	174 (6.85)	223 (8.78)	203 (7.99)	214 (8.43)	194 (7.64)	243 (9.57)	223 (8.78)	223 (8.78)	203 (7.99)	252 (9.92)	232 (9.13)
	1FK7042-5	221 (8.70)	201 (7.91)	250 (9.84)	230 (9.06)	242 (9.53)	222 (8.74)	271 (10.67)	251 (9.88)	250 (9.84)	230 (9.06)	279 (10.98)	259 (10.20)
63	**1FK7060-5**	233 (9.17)	208 (8.19)	261 (10.28)	236 (9.29)	256 (10.08)	231 (9.09)	284 (11.18)	259 (10.20)	264 (10.39)	239 (9.41)	292 (11.50)	267 (10.51)
	1FK7063-5	278 (10.94)	253 (9.96)	306 (12.05)	281 (11.06)	301 (11.85)	276 (10.87)	329 (12.95)	304 (11.97)	309 (12.17)	284 (11.18)	337 (13.27)	312 (12.28)
80	**1FK7080-5**	250 (9.84)	220 (8.66)	278 (10.94)	248 (9.76)	273 (10.75)	243 (9.57)	300 (11.81)	270 (10.63)	281 (11.06)	251 (9.88)	309 (12.17)	279 (10.98)
	1FK7083-5	288 (11.34)	258 (10.16)	339 (13.35)	309 (12.17)	311 (12.24)	281 (11.06)	362 (14.25)	332 (13.07)	319 (12.56)	289 (11.38)	370 (14.57)	340 (13.39)

1FK703.-5
1FK704.-5
1FK706.-5
1FK708.-5

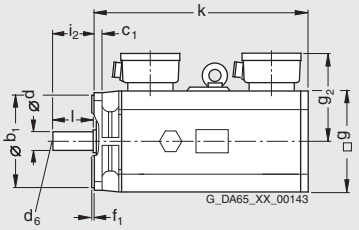


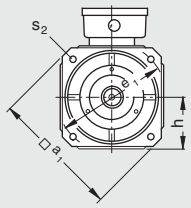
Dimension drawings

1FS6 motors
Natural cooling

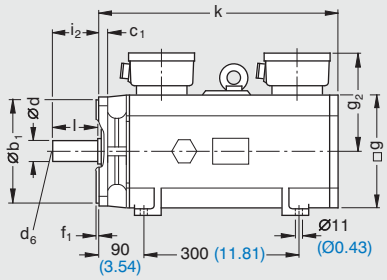
For motor		Dimensions in mm (in)													DE shaft extension		
Shaft height	Type	**DIN** **IEC**	a_1 P	b_1 N	c_1 LA	e_1 M	f AB	f_1 T	g AC	g_2 –	h H	i_2 LE	k LB	s_2 S	**d** **D**	d_6 DB	l E
1FS6, type IM B5 (shaft heights 71, 90) IM B35 (shaft heights 112, 132), natural cooling, with terminal box																	
71	**1FS6074**		146 (5.75)	110 (4.33)	12 (0.47)	130 (5.12)	–	3.5 (0.14)	128 (5.04)	147.5 (5.81)	64 (2.52)	50 (1.97)	414 (16.3)	9 (0.35)	**24** **(0.94)**	M8	50 (1.97)
90	**1FS6096**		194 (7.64)	130 (5.12)	12 (0.47)	165 (6.5)	–	3.5 (0.14)	166 (6.54)	168 (6.61)	83 (3.27)	58 (2.28)	476 (18.74)	11 (0.343)	**32** **(1.26)**	M12	58 (2.28)
112	**1FS6115**		240 (9.45)	180 (7.09)	14 (0.55)	215 (8.46)	235 (9.25)	4 (0.16)	200 (7.87)	184 (7.24)	112 (4.441)	80 (3.15)	515 (20.28)	14 (0.55)	**38** **(1.5)**	M12	80 (3.15)
132	**1FS6134**		–	250 (9.84)	18 (0.71)	300 (11.81)	260 (10.24)	5 (0.2)	256 (10.08)	209 (8.23)	132 (5.2)	82 (3.23)	559 (22.01)	18 (0.71)	**48** **(1.89)**	M16	82 (3.23)

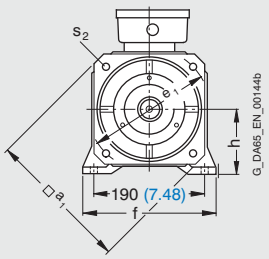
1FS6074
1FS6096



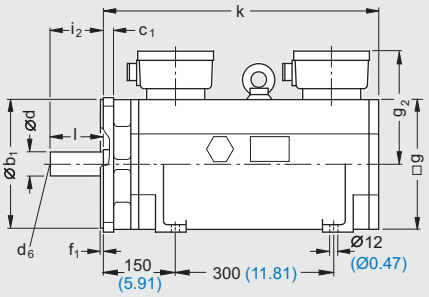


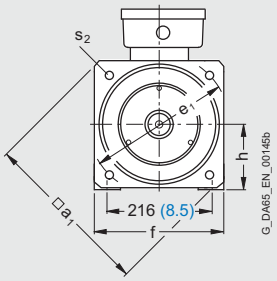
1FS6115





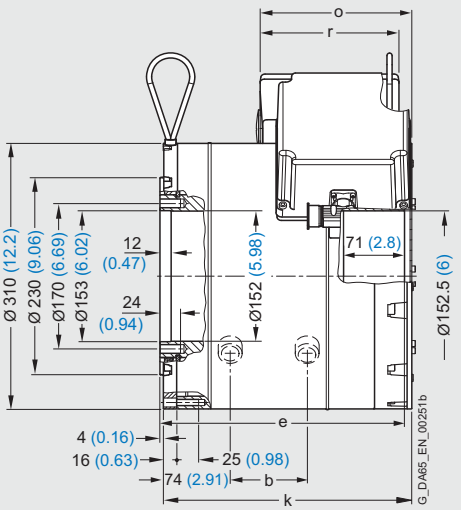
1FS6134

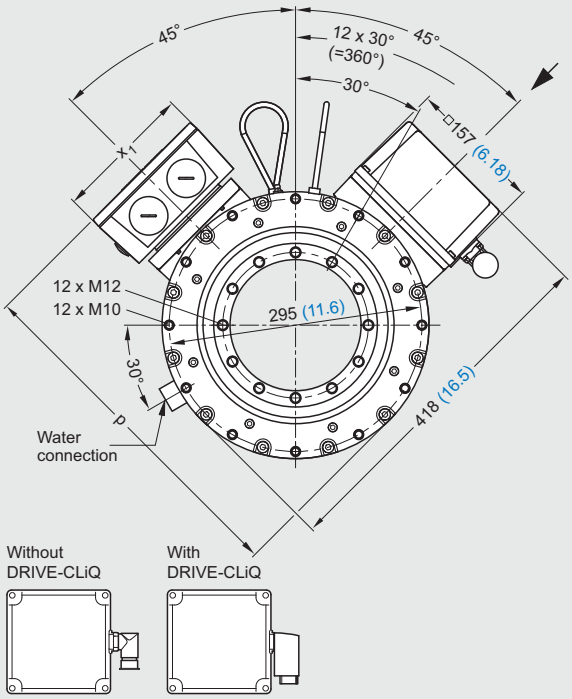




1FW3 torque motors with/without DRIVE-CLiQ
Water cooling

For motor		Dimensions in mm (in)																
						Terminal box gk 230				Terminal box gk 420				Terminal box gk 630				
Shaft height	Type	DIN IEC	b –	e –	k L	o –	p HD	r LL	x_1 AG	o –	p HD	r LL	x_1 AG	o –	p HD	r LL	x_1 AG
1FW3, type IM B14, water cooling, with terminal box, belt-mounted encoder																		
150	**1FW3150**		68 (2.68)	256 (10.08)	260.5 (10.26)	159.5 (6.28)	393 (15.47)	122 (4.8)	117 (4.61)	177 (6.97)	409 (16.81)	162 (6.38)	162 (6.38)	201 (7.91)	427 (16.81)	210 (8.27)	210 (8.27)
	1FW3152		125 (4.92)	313 (12.32)	317.5 (12.5)												
	1FW3154		174 (6.85)	362 (14.25)	366.5 (14.43)												
	1FW3155		226 (8.9)	414 (16.3)	418.5 (16.48)												
	1FW3156		279 (10.98)	467 (18.39)	471.5 (18.56)												

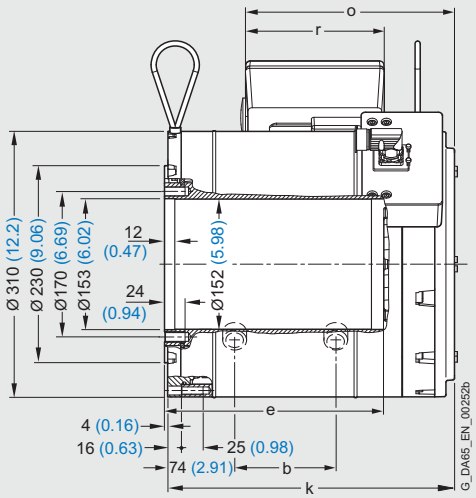


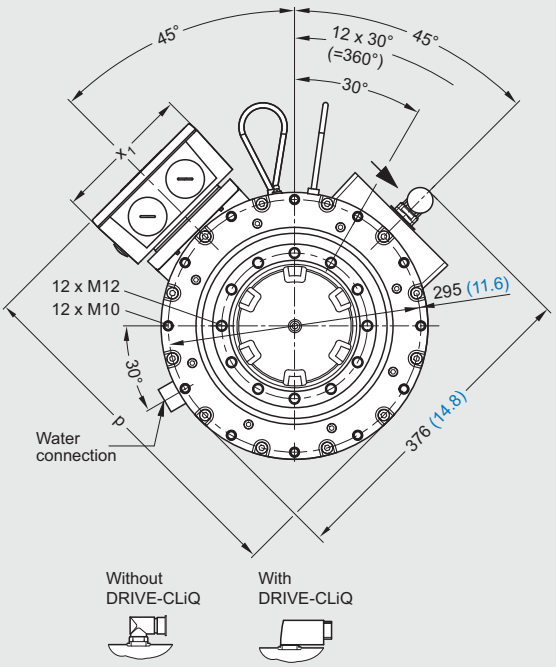


Dimension drawings

1FW3 torque motors with/without DRIVE-CLiQ Water cooling

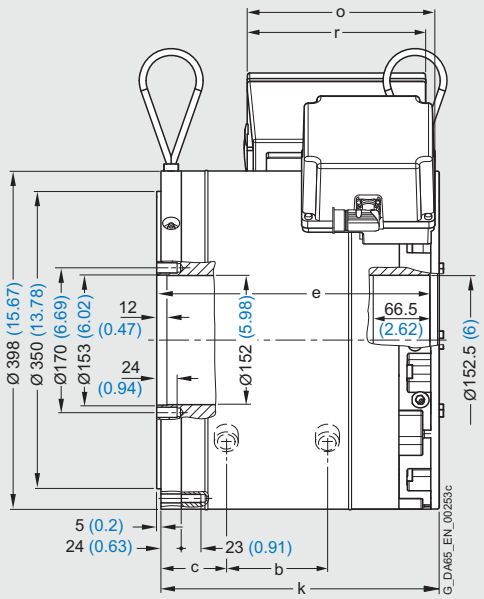
For motor		Dimensions in mm (in)																
						Terminal box gk 230				Terminal box gk 420				Terminal box gk 630				
Shaft height	Type	DIN IEC	b –	e –	k L	o –	p HD	r LL	x_1 AG	o –	p HD	r LL	x_1 AG	o –	p HD	r LL	x_1 AG
1FW3, type IM B14, water cooling, with terminal box, coaxial mounted encoder																		
150	**1FW3150**		68 (2.68)	199 (7.83)	277.5 (10.93)	174 (6.85)	393 (15.47)	122 (4.8)	117 (4.61)	194 (7.64)	410 (16.14)	162 (6.38)	162 (6.38)	218 (8.58)	427 (16.81)	210 (8.27)	210 (8.27)
	1FW3152		125 (4.92)	256 (10.08)	334.5 (13.17)												
	1FW3154		174 (6.85)	305 (12.01)	383.5 (15.1)												
	1FW3155		226 (8.9)	357 (14.06)	435.5 (17.15)												
	1FW3156		279 (10.98)	410 (16.14)	488.5 (19.23)												

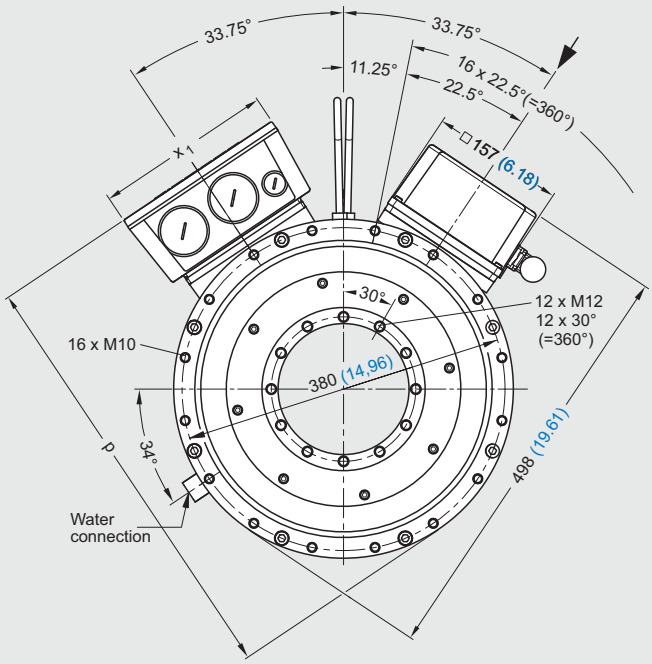


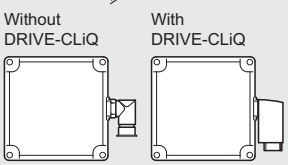


1FW3 torque motors with/without DRIVE-CLiQ
Water cooling

For motor		Dimensions in mm (in)															
						Terminal box gk 230				Terminal box gk 420				Terminal box gk 630			
Shaft height	Type	DIN / IEC b –	c C	e –	k L	o –	p HD	r LL	x_1 AG	o –	p HD	r LL	x_1 AG	o –	p HD	r LL	x_1 AG
1FW3, type IM B14, water cooling, with terminal box, belt-mounted encoder																	
200	**1FW3201**	48.5 (1.91)	67.5 (2.66)	229 (9.02)	235.5 (9.27)	158 (6.22)	474 (18.66)	122 (4.8)	117 (4.61)	175 (6.89)	490 (19.29)	162 (6.38)	162 (6.38)	226 (8.9)	508 (20)	210 (8.27)	210 (8.27)
	1FW3202	94.5 (3.72)	67.5 (2.66)	275 (10.83)	281.5 (11.08)												
	1FW3203	137 (5.39)	69.5 (2.74)	321.5 (12.66)	328 (12.91)												
	1FW3204	206 (8.11)	69.5 (2.74)	390.5 (15.37)	397 (15.63)												
	1FW3206	298.5 (11.75)	69.5 (2.74)	483 (19.02)	489.5 (19.27)												
	1FW3208	413.5 (16.28)	69.5 (2.74)	598 (23.54)	604.5 (23.8)												



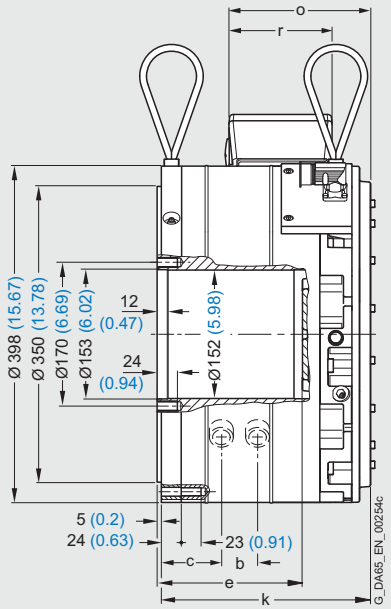


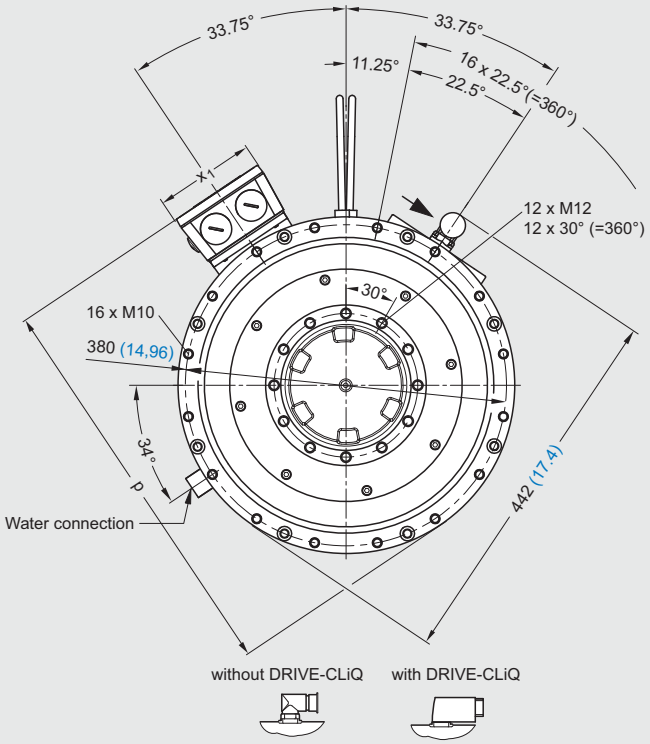


Dimension drawings

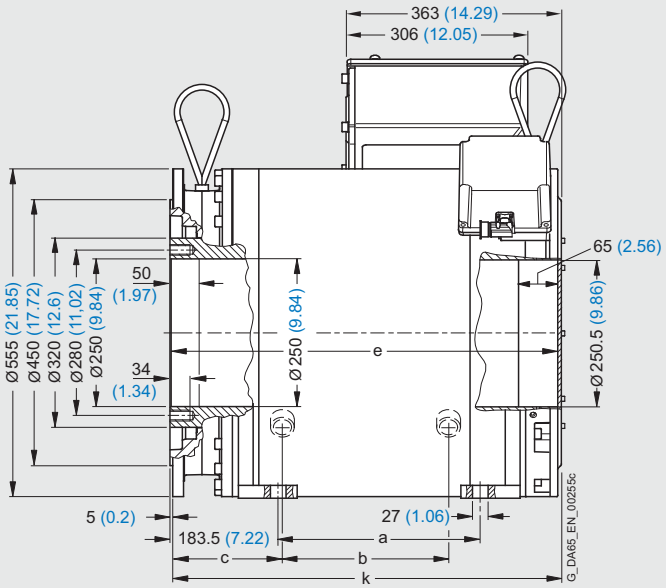
1FW3 torque motors with/without DRIVE-CLiQ Water cooling

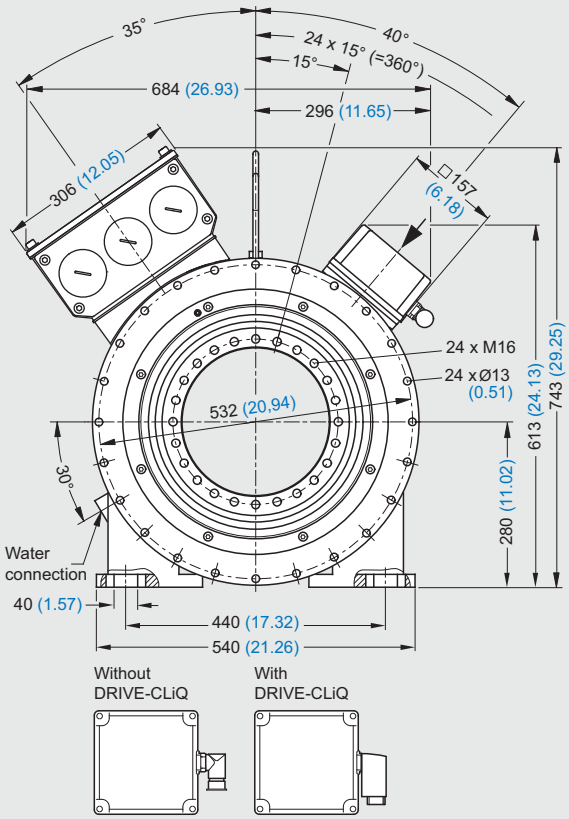
For motor		Dimensions in mm (in)															
						Terminal box gk 230				Terminal box gk 420				Terminal box gk 630			
Shaft height	Type	DIN / IEC b –	c C	e –	k L	o –	p HD	r LL	x_1 AG	o –	p HD	r LL	x_1 AG	o –	p HD	r LL	x_1 AG
1FW3, type IM B14, water cooling, with terminal box, coaxial mounted encoder																	
200	**1FW3201**	48.5 (1.91)	67.5 (2.66)	172 (6.77)	247.5 (9.74)	167 (6.57)	474 (18.66)	122 (4.8)	117 (4.61)	188 (7.4)	490 (19.29)	162 (6.38)	162 (6.38)	239 (9.41)	508 (20)	210 (8.27)	210 (8.27)
	1FW3202	94.5 (3.72)	67.5 (2.66)	218 (8.58)	293.5 (11.56)												
	1FW3203	137 (5.39)	69.5 (2.74)	264.5 (10.41)	340 (13.39)												
	1FW3204	206 (8.11)	69.5 (2.74)	333.5 (13.13)	409 (16.1)												
	1FW3206	298.5 (11.75)	69.5 (2.74)	426 (16.77)	501.5 (19.74)												
	1FW3208	413.5 (16.28)	69.5 (2.74)	541 (21.3)	616.5 (24.27)												





For motor		Dimensions in mm (in)					
Shaft height	Type	**DIN** **IEC**	a B	b –	c C	e –	k L
1FW3, type IM B35, water cooling, with terminal box, belt-mounted encoder							
280	**1FW3281**		258 (10.16)	217 (8.54)	174 (6.85)	571 (22.48)	574 (22.6)
	1FW3283		342.5 (13.48)	301.5 (11.87)		655.5 (25.81)	658.5 (25.93)
	1FW3285		468.5 (18.44)	427.5 (16.83)		781.5 (30.77)	784.5 (30.89)
	1FW3288		637 (25.08)	596 (23.46)		950 (37.4)	953 (37.52)

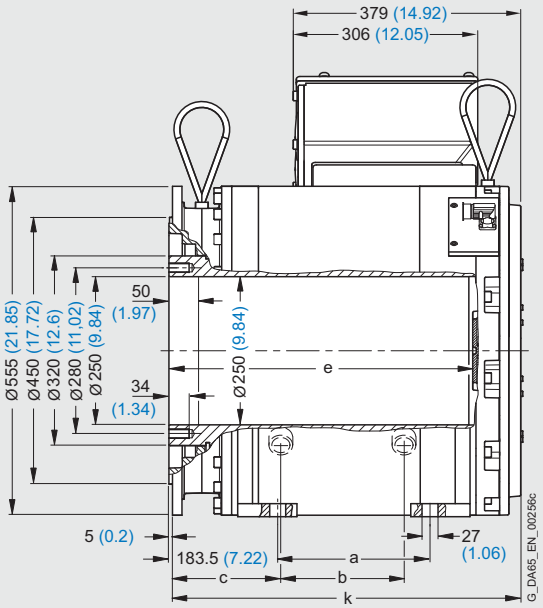


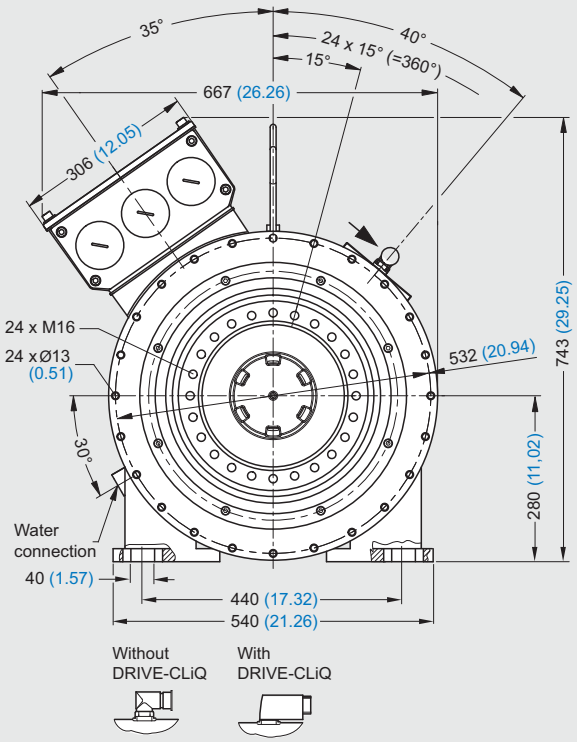


Dimension drawings

1FW3 torque motors with/without DRIVE-CLiQ Water cooling

For motor		Dimensions in mm (in)					
Shaft height	Type	**DIN** **IEC**	a B	b –	c C	e –	k L
1FW3, type IM B35, water cooling, with terminal box, coaxial mounted encoder							
280	**1FW3281**		258 (10.16)	217 (8.54)	174 (6.85)	514 (20.24)	589.5 (23.56)
	1FW3283		342.5 (13.48)	301.5 (11.87)		598.5 (23.56)	674 (26.54)
	1FW3285		468.5 (18.44)	427.5 (16.83)		724.5 (28.52)	800 (31.50)
	1FW3288		637 (25.08)	596 (23.46)		893 (35.16)	968.5 (38.13)



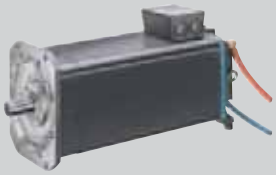


Asynchronous motors

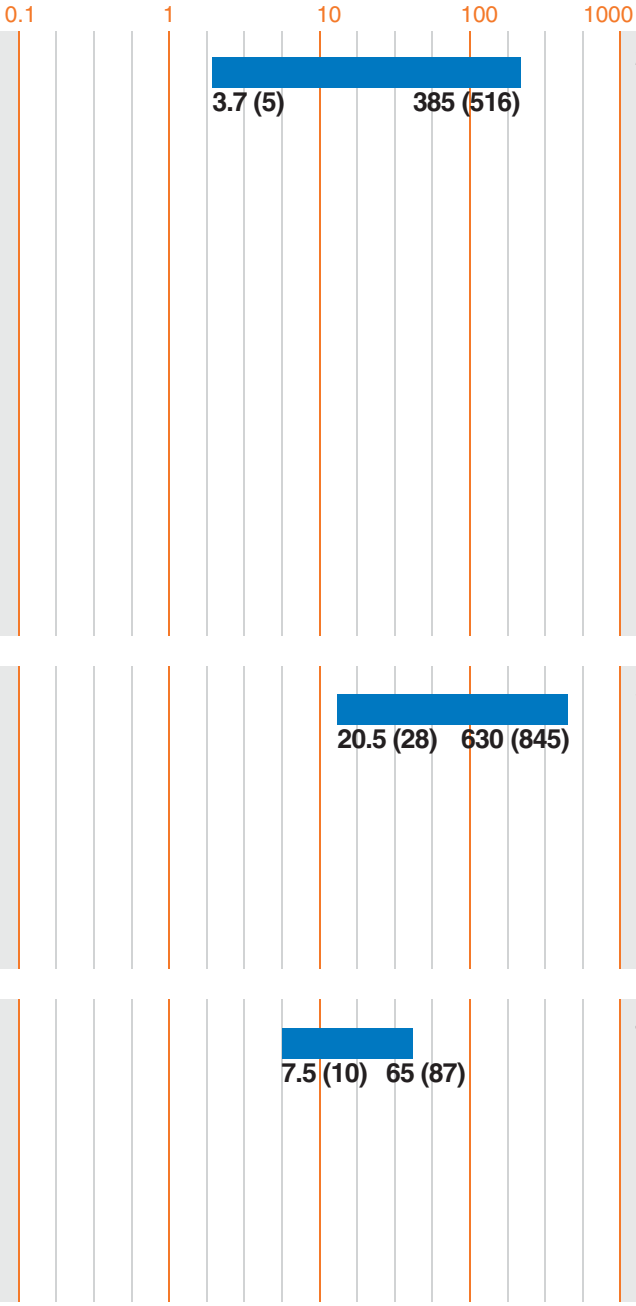
5

Overview

Type overview and rated data

Motor types	Designation/ Operating principle	Degree of protection	Cooling method
1PH7  	Asynchronous servo motor Three-phase squirrel-cage motor without casing	IP55	Forced ventilation Surface cooling
1PL6 	Asynchronous servo motor Three-phase squirrel-cage motor without casing	IP23	Forced ventilation Open-circuit cooling
1PH4 	Asynchronous servo motor Liquid-cooled three-phase squirrel-cage motor	IP65	Water cooling

Shaft height	Power range in kW (HP)	Torque range in Nm (lb_f-ft)	Selection and ordering data on pages
100 ... 280	3.7 (5) ... 385 (516)	22 ... 2480 (18 ... 1829)	5/8 ... 5/33
180 ... 280	20.5 (28) ... 630 (845)	370 ... 3600 (373 ... 2655)	5/36 ... 5/51
100 ... 160	7.5 (10) ... 65 (87)	45 ... 333 (33 ... 246)	5/64 ... 5/69



Overview

Technical definitions

Encoder systems

1PH7 motors
Forced ventilation

Overview

1PH7 AC motors, shaft heights 100 to 160

1PH7 AC motors, shaft heights 180 and 225

1PH7 AC motors, shaft height 280

The 1PH7 AC motors are compact, force-ventilated squirrel-cage asynchronous 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
- Bearings 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 the power cable
- 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)

Applications

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 such as coiler and winder drives.

1PH7 motors
Forced ventilation

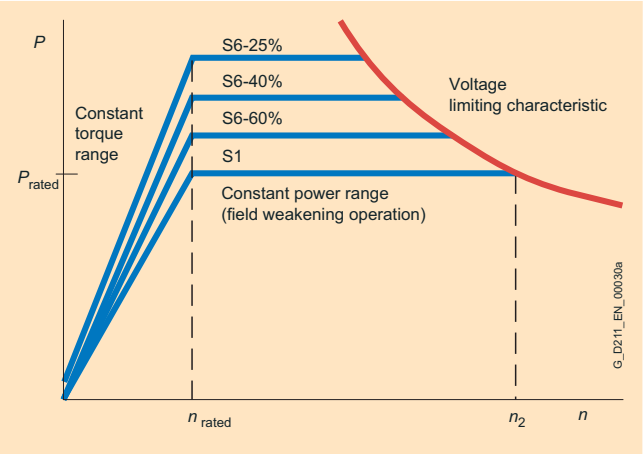
Technical specifications

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 SH 100 to SH 225: Fan mounted axially at NDE SH 280: Fan mounted radially at NDE
Temperature monitoring	KTY84 temperature sensor in the stator winding for SH 280: Additional KTY 84 as reserve
Motor fan ratings (see selection guides for technical specifications)	400 V 3 AC, 50/60 Hz 480 V 3 AC, 60 Hz
Type 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, plain shaft
Shaft and flange accuracy in accordance with DIN 42955 (IEC 60072-1) [1]	SH 100 to SH 160: Tolerance R (reduced) SH 180 to SH 280: Tolerance N (normal)
Vibration magnitude in accordance with EN 60034-14 (IEC 60034-14)	SH 100 to SH 225: Grade R (reduced) SH 280: Grade N (normal)
Sound pressure level in accordance with EN ISO 1680 Tolerance +3 dB	Sound pressure level as a function of air-flow direction See selection guides
Bearing versions and maximum speeds	See selection guides
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 • 2-pole resolver
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 • 14 bit resolver
Connection	Connector for signals (mating connector not supplied) Terminal box for power SH 160 to SH 225: Terminal box at top SH 280: Terminal box NDE right
Paint finish	SH 100 to SH 160: Without finish, Standard finish anthracite RAL 7016 SH 180 to SH 280: Primed, standard finish anthracite RAL 7016
Options	Refer to Options and Selection and ordering data

S/R = signals/revolution

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

Characteristics



Power/speed characteristic

Options

Order code	Option description	For use with 1PH7 asynchronous motors with shaft height		
		SH 100 to 160	SH 180 SH 225	SH 280
	Standard finish in another color, RAL ...	● [1]	■ [2]	■ [2]
	Special finish in another color, RAL ...	●	■ [3]	■ [3]
C30	Winding version 690 V	–	–	■
G14	Fan unit with air filter	–	■	■
G80	POG10 pulse encoder, mounting prepared	–	–	■
K08	Encoder connector mounted opposite	–	–	■
K16	Second standard shaft extension (only possible without encoder)	–	–	■
K31	2nd Rating plate supplied separately in terminal box	✔	■	■
K40	Re-lubrication devices, DE and NDE	–	■ [4]	✔
K45	230 V standstill heating	–	–	■
K55	Cable entry plate, terminal box, customer-specific (plain text is required)	–	■	■
K83	Terminal box rotated through +90 degrees	–	–	■
K84	Terminal box rotated through -90 degrees	–	–	■
K85	Terminal box rotated through 180 degrees	–	–	■
L27	NDE bearing, insulated version	–	■ [5]	✔
M03 [6]	Version for Zone 2 hazardous areas (in accordance with IEC EN 60079-15)	■	–	–
M39 [6]	Version for Zone 22 hazardous areas (in accordance with EN 50281)	■	■	■
M83	Additional thread for a setting screw on motor feet	–	–	■
Y55	Non-standard shaft extension DE	●	●	●
Y80	Different rating plate data (plain text is required)	●	●	●
Y82	Additional rating plate with customer data	●	●	●

■ Option available
● On request
– Not available
✔ Standard

1) Order using a code (without plain text). e.g.:
X01: Jet black finish RAL 9005
X02: Cream finish RAL 9001
X03: Reseda green finish RAL 6011
X04: Pebble gray finish RAL 7032
X05: Sky blue finish RAL 5015
X06: Light ivory finish RAL 1015

2) Order with order code **R1Y**
(the RAL color must be specified in plain text).

3) Order with order code **R2Y**
(the RAL color must be specified in plain text).

4) Not possible with bearings for increased maximum speed.

5) Only for SH 180 (for SH 225 standard)

6) The general conditions and information in the declarations of conformity must be taken into account. Declarations of conformity are available on request from your local Siemens sales office.

More information

The selection and ordering data is based on the booksize type by way of example. The types booksize compact, blocksize and chassis are also possible.
Detailed configuration is performed using the SIZER configuration tool.

1PH7 motors
Forced ventilation

Selection and ordering data

Rated speed n_{rated} rpm	Shaft height SH	Rated power P_{rated} kW (HP)	Rated torque M_{rated} Nm (lb_f-ft)	Rated current I_{rated} A	Rated voltage V_{rated} V	Speed during field weakening [1] n_2 rpm	Continuous speed, max. [2] n_{S1} rpm	Speed, max. [3] n_{max} rpm	1PH7 asynchronous motor Order No.
400 V 3 AC line voltage, Servo Control									
400	160	9.5 (12.74)	227 (167)	30	274	1940	3700 [9]	6500 [9]	**1PH7163-■■B■■-■...**
		13 (17.43)	310 (229)	37	294	1540	3700 [9]	6500 [9]	**1PH7167-■■B■■-■...**
1000	100	3.7 (4.96)	35 (25.8)	10	343	2250	5500 [9]	9000 [9]	**1PH7103-■■D■■-■...**
		6.3 (8.45)	60 (44.3)	17.5	319	3560	5500 [9]	9000 [9]	**1PH7107-■■D■■-■...**
	132	12 (16.1)	115 (84.8)	30	336	2500	4500	8000 [9]	**1PH7133-■■D■■-■...**
		17 (22.8)	162 (119.5)	43	322	3390	4500	8000 [9]	**1PH7137-■■D■■-■...**
	160	22 (29.5)	210 (155)	55	315	2750	3700	6500 [9]	**1PH7163-■■D■■-■...**
		28 (37.55)	267 (197)	71	312	4090	3700	6500 [9]	**1PH7167-■■D■■-■...**
1500	100	3.7 (4.96)	24 (17.7)	10	350	5360	5500	9000 [9]	**1PH7101-■■F■■-■...**
		5.5 (7.38)	35 (25.8)	13	350	3000	5500	9000 [9]	**1PH7103-■■F■■-■...**
		7.0 (9.39)	45 (33.2)	17.5	346	5110	5500	9000 [9]	**1PH7105-■■F■■-■...**
		9.0 (12.1)	57 (42)	23.5	336	3500	5500	9000 [9]	**1PH7107-■■F■■-■...**
	132	11 (14.75)	70 (51.6)	24	350	4310	4500	8000 [9]	**1PH7131-■■F■■-■...**
		15 (20.12)	96 (70.8)	34	346	4400	4500	8000 [9]	**1PH7133-■■F■■-■...**
		18.5 (24.81)	118 (87)	42	350	4920	4500	8000 [9]	**1PH7135-■■F■■-■...**
		22 (29.5)	140 (103)	57	308	3750	4500	8000 [9]	**1PH7137-■■F■■-■...**
	160	30 (40.23)	191 (141)	72	319	4000	3700	6500	**1PH7163-■■F■■-■...**
		37 (49.62)	236 (174)	82	350	2750	3700	6500	**1PH7167-■■F■■-■...**
2000	100	7 (9.39)	33 (24.3)	17.5	343	4630	5500	9000	**1PH7103-■■G■■-■...**
		10.5 (14.18)	50 (36.9)	26	350	4000	5500	9000	**1PH7107-■■G■■-■...**
	132	20 (26.82)	96 (70.8)	45	350	4000	4500	8000	**1PH7133-■■G■■-■...**
		28 (37.55)	134 (98.8)	60	350	3750	4500	8000	**1PH7137-■■G■■-■...**
	160	36 (48.28)	172 (127)	85	333	3000	3700	6500	**1PH7163-■■G■■-■...**
		41 (54.98)	196 (145)	89	350	2750	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**
	2-pole resolver		**R**
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**
	14 bit resolver		**P**
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 [4]:	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**

Selection and ordering data

Power factor	Magnetizing current	Efficiency	Rated frequency	Moment of inertia	Weight, approx.	1PH7 asynchronous motor	SINAMICS S120 Motor Module	
							Rated output current	
cos φ	I_μ A	η_{rated}	f_{rated} Hz	J kgm² (lb_f-in-s²)	kg (lb)	Order No.	I_{rated} A	Order No.
400 V 3 AC line voltage, Servo Control								
0.88	11.5	0.809	14.3	0.185 (1.64)	175 (386)	**1PH7163-. . B . .-. ■■■**	30	**6SL3120- 1 TE23-0AA3**
0.88	14.0	0.814	14.3	0.228 (2.02)	210 (463)	**1PH7167-. . B . .-. ■■■**	45	**6SL3120- 1 TE24-5AA3**
0.82	4.8	0.794	35.6	0.017 (0.15)	40 (88.2)	**1PH7103-. . D . .-. ■■■**	9 [8]	**6SL3120-■TE21-0AA3**
0.81	9	0.822	35.3	0.029 (0.26)	65 (143)	**1PH7107-. . D . .-. ■■■**	18	**6SL3120-■TE21-8AA3**
0.86	13	0.865	34.8	0.076 (0.67)	90 (198)	**1PH7133-. . D . .-. ■■■**	30	**6SL3120- 1 TE23-0AA3**
0.86	19	0.878	34.6	0.109 (0.96)	150 (331)	**1PH7137-. . D . .-. ■■■**	45	**6SL3120- 1 TE24-5AA3**
0.85	24	0.899	34.2	0.185 (1.64)	175 (386)	**1PH7163-. . D . .-. ■■■**	60	**6SL3120- 1 TE26-0AA3**
0.84	33	0.903	34.2	0.228 (2.02)	210 (463)	**1PH7167-. . D . .-. ■■■**	85	**6SL3120- 1 TE28-5AA3**
0.74	5.9	0.847	51.6	0.017 (0.15)	40 (88.2)	**1PH7101-. . F . .-. ■■■**	9 [8]	**6SL3120-■TE21-0AA3**
0.84	5.4	0.832	52.7	0.017 (0.15)	40 (88.2)	**1PH7103-. . F . .-. ■■■**	18	**6SL3120-■TE21-8AA3**
0.78	9.4	0.866	51.7	0.029 (0.26)	65 (143)	**1PH7105-. . F . .-. ■■■**	18	**6SL3120-■TE21-8AA3**
0.80	11.0	0.859	52.0	0.029 (0.26)	65 (143)	**1PH7107-. . F . .-. ■■■**	30	**6SL3120- 1 TE23-0AA3**
0.88	8.4	0.896	51.3	0.076 (0.67)	90 (198)	**1PH7131-. . F . .-. ■■■**	30	**6SL3120- 1 TE23-0AA3**
0.85	14	0.895	51.3	0.076 (0.67)	90 (198)	**1PH7133-. . F . .-. ■■■**	45	**6SL3120- 1 TE24-5AA3**
0.85	17	0.902	51.1	0.109 (0.96)	150 (331)	**1PH7135-. . F . .-. ■■■**	45	**6SL3120- 1 TE24-5AA3**
0.85	23	0.900	51.2	0.109 (0.96)	150 (331)	**1PH7137-. . F . .-. ■■■**	60	**6SL3120- 1 TE26-0AA3**
0.85	30	0.912	50.9	0.185 (1.64)	175 (386)	**1PH7163-. . F . .-. ■■■**	85	**6SL3120- 1 TE28-5AA3**
0.86	32	0.916	50.8	0.228 (2.02)	210 (463)	**1PH7167-. . F . .-. ■■■**	85	**6SL3120- 1 TE28-5AA3**
0.80	8.3	0.857	68.9	0.017 (0.15)	40 (88.2)	**1PH7103-. . G . .-. ■■■**	18	**6SL3120-■TE21-8AA3**
0.80	12	0.869	68.6	0.029 (0.26)	65 (143)	**1PH7107-. . G . .-. ■■■**	30	**6SL3120- 1 TE23-0AA3**
0.86	18	0.898	68.0	0.076 (0.67)	90 (198)	**1PH7133-. . G . .-. ■■■**	45	**6SL3120- 1 TE24-5AA3**
0.88	21	0.903	68.0	0.109 (0.96)	150 (331)	**1PH7137-. . G . .-. ■■■**	60	**6SL3120- 1 TE26-0AA3**
0.84	37	0.906	67.5	0.185 (1.64)	175 (386)	**1PH7163-. . G . .-. ■■■**	85	**6SL3120- 1 TE28-5AA3**
0.84	40	0.907	67.4	0.228 (2.02)	210 (463)	**1PH7167-. . G . .-. ■■■**	85 [8]	**6SL3120- 1 TE28-5AA3**

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 [5]	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 [6]	None		**2**
–	Anthracite RAL 7016, standard paint finish		**3**
Flange/shaft seal ring [6]	Anthracite RAL 7016, standard paint finish		**5**
–	Anthracite RAL 7016, special paint finish		**6**
Flange/shaft seal ring [6]	Anthracite RAL 7016, special paint finish		**8**
Special version:	Specify supplem. order code and plain text if applic. (see Options).		**–Z**
Motor Module:	Single Motor Module		**1**
	Double Motor Module		**2**

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) Version with brake possible if: 12th Position "2" or "3", 14th position "K", 15th position "A", "B", "J" or "K", 16th position "0", "3" or "6".

5) Max. possible speed (see also selection guides): 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").

6) 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.

7) Preferred air-flow direction in polluted environment.

8) The rated output current of the Motor Module is lower than the motor rated current.

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

1PH7 motors
Forced ventilation

Selection and ordering data

Rated speed n_{rated} rpm	Shaft height SH	Rated power P_{rated} kW (HP)	Rated torque M_{rated} Nm (lb_f-ft)	Rated current I_{rated} A	Rated voltage V_{rated} V	Speed during field weakening [1] n_2 rpm	Continuous speed, max. [2] n_{S1} rpm	Speed, max. [3] n_{max} rpm	1PH7 asynchronous motor Order No.
400 V 3 AC line voltage, Servo Control									
400	180	16.3 (21.9)	390 (288)	51	271	2100 [10]	3500 [4][10]	5000 [10]	**1PH7184-■■B■■-■...**
		21.2 (28.4)	505 (373)	67	268	2400 [10]	3500 [4][10]	5000 [10]	**1PH7186-■■B■■-■...**
	225	30.4 (40.8)	725 (535)	88	268	1900	3100 [4][10]	4500 [10]	**1PH7224-■■B■■-■...**
		39.2 (52.6)	935 (690)	114	264	2200 [10]	3100 [4][10]	4500 [10]	**1PH7226-■■B■■-■...**
		48 (64.4)	1145 (845)	136	272	2200 [10]	3100 [4][10]	4500 [4][10]	**1PH7228-■■B■■-■...**
1000	180	39 (52.3)	372 (274)	90	335	3300	3500 [4]	5000	**1PH7184-■■D■■-■...**
		51 (68.4)	485 (358)	116	340	3700	3500 [4]	5000	**1PH7186-■■D■■-■...**
	225	71 (95.2)	678 (500)	161	335	2900	3100 [4]	4500	**1PH7224-■■D■■-■...**
		92 (123)	880 (649)	198	340	2900	3100 [4]	4500	**1PH7226-■■D■■-■...**
		113 (152)	1080 (797)	240	340	2900	3100 [4]	4500 [4]	**1PH7228-■■D■■-■...**
1500	180	51 (68.4)	325 (240)	120	335	5000	3500 [4]	5000	**1PH7184-■■F■■-■...**
		74 (99.2)	471 (347)	170	330	5000	3500 [4]	5000	**1PH7186-■■F■■-■...**
	225	95 (127)	605 (446)	204	340	2900	3100 [4]	4500	**1PH7224-■■U■■-■...**
		130 (174)	828 (611)	278	340	2900	3100 [4]	4500	**1PH7226-■■F■■-■...**
		160 (215)	1019 (752)	350	340	2900	3100 [4]	4500 [4]	**1PH7228-■■F■■-■...**
2500	180	78 (10.5)	298 (220)	171	340	5000	3500 [4]	5000	**1PH7184-■■L■■-■...**
		106 (142)	405 (299)	235	335	5000	3500 [4]	5000	**1PH7186-■■L■■-■...**
	225	142 (190)	542 (400)	298	340	3500	3100 [4]	4500	**1PH7224-■■L■■-■...**
		168 (225)	642 (438)	362	335	3500	3100 [4]	4500	**1PH7226-■■L■■-■...**
		205 (275)	783 (578)	433	340	3500	3100 [4]	4500 [4]	**1PH7228-■■L■■-■...**

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**
	2-pole resolver		**R**
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**
	14 bit resolver		**P**
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 concept for other types (IM 6, IM B7, IM B8, IM V5, IM V6)	**1**
	IM B35 (only for 1PH7184 with flange A 400/1PH7186 with flange A 450/1PH7 with flange A 550)		**3**
	IM B35 (only for 1PH7184 with flange A 450)		**4**
	IM B35 (only for 1PH7184 with flange A 450/1PH7186 with flange A 450/1PH7 with flange A 550)	Hoisting concept for other types (IM V15, IM V35)	**5**
	IM B35 (only for 1PH7184 with flange A 450)	Hoisting concept for other types (IM V15, IM V35)	**6**
Holding brake with emergency stop function (suitable for coupling output in type IM B3) [5]:	Without brake		**0**
	With brake (includes emergency release screws and microswitch)		**2**
	With brake (includes manual release and microswitch)		**4**

Selection and ordering data

Power factor	Magnetizing current	Efficiency	Rated frequency	Moment of inertia	Weight, approx.	1PH7 asynchronous motor	SINAMICS S120 Motor Module	
							Rated output current	
cos φ	I_μ A	η_{rated}	f_{rated} Hz	J kgm² (lb_f-in-s²)	kg (lb)	Order No.	I_{rated} A	Order No.
400 V 3 AC line voltage, Servo Control								
0.84	26	0.830	14.2	0.503 (4.45)	370 (816)	**1PH7184- . . B . .-. ■■■**	60	**6SL3120- 1 TE26-0AA3**
0.81	38.5	0.845	14.0	0.666 (5.89)	440 (970)	**1PH7186- . . B . .-. ■■■**	85	**6SL3120- 1 TE28-5AA3**
0.87	36.5	0.864	14.0	1.479 (13.1)	630 (1389)	**1PH7224- . . B . .-. ■■■**	85 [9]	**6SL3120- 1 TE28-5AA3**
0.86	49	0.880	14.0	1.930 (17.1)	750 (1654)	**1PH7226- . . B . .-. ■■■**	132	**6SL3120- 1 TE31-3AA3**
0.85	60.5	0.888	13.9	2.326 (20.6)	860 (1896)	**1PH7228- . . B . .-. ■■■**	132 [9]	**6SL3120- 1 TE31-3AA3**
0.83	44	0.913	34.2	0.503 (4.45)	370 (816)	**1PH7184- . . D . .-. ■■■**	85 [9]	**6SL3120- 1 TE28-5AA3**
0.81	58	0.918	34.1	0.666 (5.89)	440 (970)	**1PH7186- . . D . .-. ■■■**	132	**6SL3120- 1 TE31-3AA3**
0.81	78.5	0.934	33.9	1.479 (13.1)	630 (1389)	**1PH7224- . . D . .-. ■■■**	200	**6SL3120- 1 TE32-0AA3**
0.84	87.5	0.935	33.9	1.930 (17.1)	750 (1654)	**1PH7226- . . D . .-. ■■■**	200	**6SL3120- 1 TE32-0AA3**
0.85	98	0.938	33.9	2.326 (20.6)	860 (1896)	**1PH7228- . . D . .-. ■■■**	260	**6SL3320- 1 TE32-6AA0**
0.78	64	0.930	50.7	0.503 (4.45)	370 (816)	**1PH7184- . . F . .-. ■■■**	132	**6SL3120- 1 TE31-3AA3**
0.81	84	0.937	50.7	0.666 (5.89)	440 (970)	**1PH7186- . . F . .-. ■■■**	200	**6SL3120- 1 TE32-0AA3**
0.84	88.5	0.944	50.6	1.479 (13.1)	630 (1398)	**1PH7224- . . U . .-. ■■■**	200 [9]	**6SL3120- 1 TE32-0AA3**
0.84	120	0.945	50.6	1.930 (17.1)	750 (1654)	**1PH7226- . . F . .-. ■■■**	310	**6SL3320- 1 TE33-1AA0**
0.82	169	0.949	50.5	2.326 (20.6)	860 (1896)	**1PH7228- . . F . .-. ■■■**	380	**6SL3320- 1 TE33-8AA0**
0.82	77	0.937	84.1	0.503 (4.45)	370 (816)	**1PH7184- . . L . .-. ■■■**	200	**6SL3120- 1 TE32-0AA3**
0.82	108	0.942	84.1	0.666 (5.89)	440 (970)	**1PH7186- . . L . .-. ■■■**	260	**6SL3320- 1 TE32-6AA0**
0.84	115	0.948	84.0	1.479 (13.1)	630 (1389)	**1PH7224- . . L . .-. ■■■**	310	**6SL3320- 1 TE33-1AA0**
0.84	154	0.950	84.0	1.930 (17.1)	750 (1654)	**1PH7226- . . L . .-. ■■■**	380	**6SL3320- 1 TE33-8AA0**
0.84	185	0.950	83.9	2.326 (20.6)	860 (1896)	**1PH7228- . . L . .-. ■■■**	490	**6SL3320- 1 TE35-0AA0**

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 [6]	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 [7]	Primed	**2**
–	Anthracite RAL 7016, standard paint finish	**3**
Flange/shaft seal ring [7]	Anthracite RAL 7016, standard paint finish	**5**
–	Anthracite RAL 7016, special paint finish	**6**
Flange/shaft seal ring [7]	Anthracite RAL 7016, special paint finish	**8**

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

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 reduced for increased cantilever forces, see selection guides.

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

6) For shaft height 180 n_{max} = 7000 rpm, 1PH7224: n_{max} = 5500 rpm only coupling drive possible and 16th data position "0", "3" or "6").

7) 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 with belt drive or increased cantilever forces.

8) Preferred direction of air flow in a polluted environment.

9) The rated output current of the Motor Module is lower than the motor rated current.

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

1PH7 motors
Forced ventilation

Selection and ordering data

Rated speed n_{rated} rpm	Shaft height SH	Rated power P_{rated} kW (HP)	Rated torque M_{rated} Nm (lb_f-ft)	Rated current I_{rated} A	Rated voltage V_{rated} V	Speed during field weakening [1)9)] n_2 rpm	Continuous speed, max. [2)] n_{S1} rpm	Speed, max. [3)] n_{max} rpm	1PH7 asynchronous motor Order No.
400 V 3 AC line voltage, Vector Control									
400	160	9.5 (12.7)	227 (167)	30	274	2630 [9)]	3700 [9)]	6500 [9)]	**1PH7163-■■B■■-■...**
		13.0 (17.4)	310 (229)	37	294	2140 [9)]	3700 [9)]	6500 [9)]	**1PH7167-■■B■■-■...**
1150	100	4.3 (5.8)	36 (26.6)	10	391	2400	5500	9000 [9)]	**1PH7103-■■D■■-■...**
		7.2 (9.7)	60 (44.3)	17.5	360	4170	5500	9000 [9)]	**1PH7107-■■D■■-■...**
	132	13.5 (18.1)	112 (82.6)	29	381	3000	4500	8000 [9)]	**1PH7133-■■D■■-■...**
		19.5 (26.2)	162 (119)	43	367	3930	4500	8000 [9)]	**1PH7137-■■D■■-■...**
	160	25 (33.5)	208 (153)	55	364	3500	3700	6500 [9)]	**1PH7163-■■D■■-■...**
		31 (41.6)	257 (190)	70	357	4840	3700	6500 [9)]	**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**
	2-pole resolver									**R**
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**
	14 bit resolver									**P**
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 [4)]:	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**

Selection and ordering data

Power factor	Magnetizing current	Efficiency	Rated frequency	Moment of inertia	Weight, approx.	1PH7 asynchronous motor	SINAMICS S120 Motor Module	
							Rated output current	
	I_μ	η_{rated}	f_{rated}	J			I_{rated}	
cos φ	A		Hz	kgm² (lb$_f$-in-s²)	kg (lb)	Order No.	A	Order No.
400 V 3 AC line voltage, Vector Control								
0.88	11.5	0.809	14.3	0.185 (1.64)	175 (386)	**1PH7163- . . B . . - . ■■■**	30	**6SL3120- 1 TE23-0AA3**
0.88	14.0	0.814	14.3	0.228 (2.02)	210 (463)	**1PH7167- . . B . . - . ■■■**	45	**6SL3120- 1 TE24-5AA3**
0.81	5.0	0.813	40.6	0.017 (0.15)	40 (88.2)	**1PH7103- . . D . . - . ■■■**	9 [8]	**6SL3120- ■ TE21-0AA3**
0.81	8.8	0.838	40.3	0.029 (0.26)	65 (143)	**1PH7107- . . D . . - . ■■■**	18	**6SL3120- ■ TE21-8AA3**
0.85	13	0.877	39.7	0.076 (0.67)	90 (198)	**1PH7133- . . D . . - . ■■■**	30	**6SL3120- 1 TE23-0AA3**
0.86	19	0.887	39.6	0.109 (0.96)	150 (331)	**1PH7137- . . D . . - . ■■■**	45	**6SL3120- 1 TE24-5AA3**
0.84	25	0.904	39.2	0.185 (1.64)	175 (386)	**1PH7163- . . D . . - . ■■■**	60	**6SL3120- 1 TE26-0AA3**
0.83	34	0.909	39.1	0.228 (2.02)	210 (463)	**1PH7167- . . D . . - . ■■■**	85	**6SL3120- 1 TE28-5AA3**

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

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

Motor Module:	Single Motor Module	**1**
	Double Motor Module	**2**

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) 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".

5) 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").

6) 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.

7) Preferred direction of air flow in a polluted environment.

8) The rated output current of the Motor Module is lower than the motor rated current.

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

1PH7 motors
Forced ventilation

Selection and ordering data

Rated speed n_{rated} rpm	Shaft height SH	Rated power P_{rated} kW (HP)	Rated torque M_{rated} Nm (lb_f-ft)	Rated current I_{rated} A	Rated voltage V_{rated} V	Speed during field weakening [1] n_2 rpm	Continuous speed, max. [2] n_{S1} rpm	Speed, max. [3] n_{max} rpm	1PH7 asynchronous motor Order No.
400 V 3 AC line voltage, Vector Control									
1750	100	4.3 (5.77)	24 (17.7)	10	398	6130	5500	9000 [9]	**1PH7101-■■F■■-■...**
		6.3 (8.45)	34 (25.1)	13	398	3500	5500	9000 [9]	**1PH7103-■■F■■-■...**
		8 (10.7)	44 (32.5)	17.5	398	5940	5500	9000 [9]	**1PH7105-■■F■■-■...**
		10 (13.4)	55 (40.6)	23	381	4500	5500	8750	**1PH7107-■■F■■-■...**
	132	13 (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 (33.5)	136 (100)	56	357	4000	4500	8000	**1PH7137-■■F■■-■...**
	160	34 (45.6)	186 (137)	72	364	4000	3700	6500	**1PH7163-■■F■■-■...**
		41 (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 (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 (38.9)	120 (88.5)	56	398	4000	4500	8000	**1PH7137-■■G■■-■...**
	160	38 (51)	158 (117)	82	398	3000	3700	6500	**1PH7163-■■G■■-■...**
		44 (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**
	2-pole resolver		**R**
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**
	14 bit resolver		**P**
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 [4]:	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**

Selection and ordering data

Power factor	Magnetizing current	Efficiency	Rated frequency	Moment of inertia	Weight, approx.	1PH7 asynchronous motor	SINAMICS S120 Motor Module	
							Rated output current	
	I_μ	η_{rated}	f_{rated}	J			I_{rated}	
cos φ	A		Hz	kgm² (lb$_f$-in-s²)	kg (lb)	Order No.	A	Order No.
400 V 3 AC line voltage, Vector Control								
0.75	5.7	0.855	60.0	0.017 (0.15)	40 (88.2)	**1PH7101-. . F . .-. ■■■**	9 [8]	**6SL3120-■TE21-0AA3**
0.84	5.3	0.849	61.0	0.017 (0.15)	40 (88.2)	**1PH7103-. . F . .-. ■■■**	18	**6SL3120-■TE21-8AA3**
0.77	9.3	0.875	60.0	0.029 (0.26)	65 (143)	**1PH7105-. . F . .-. ■■■**	18	**6SL3120-■TE21-8AA3**
0.80	10.6	0.870	60.3	0.029 (0.26)	65 (143)	**1PH7107-. . F . .-. ■■■**	30	**6SL3120-1TE23-0AA3**
0.88	8.1	0.902	59.7	0.076 (0.67)	90 (198)	**1PH7131-. . F . .-. ■■■**	30	**6SL3120-1TE23-0AA3**
0.85	14	0.900	59.7	0.076 (0.67)	90 (198)	**1PH7133-. . F . .-. ■■■**	45	**6SL3120-1TE24-5AA3**
0.86	16	0.906	59.5	0.109 (0.96)	150 (331)	**1PH7135-. . F . .-. ■■■**	45	**6SL3120-1TE24-5AA3**
0.85	23	0.902	59.5	0.109 (0.96)	150 (331)	**1PH7137-. . F . .-. ■■■**	60	**6SL3120-1TE26-0AA3**
0.86	28	0.915	59.2	0.185 (1.64)	175 (386)	**1PH7163-. . F . .-. ■■■**	85	**6SL3120-1TE28-5AA3**
0.86	30	0.920	59.2	0.228 (2.02)	210 (463)	**1PH7167-. . F . .-. ■■■**	85	**6SL3120-1TE28-5AA3**
0.79	8.2	0.866	78.8	0.017 (0.15)	40 (88.2)	**1PH7103-. . G . .-. ■■■**	18	**6SL3120-■TE21-8AA3**
0.80	12	0.878	78.7	0.029 (0.26)	65 (143)	**1PH7107-. . G . .-. ■■■**	30	**6SL3120-1TE23-0AA3**
0.86	17	0.900	78.0	0.076 (0.67)	90 (198)	**1PH7133-. . G . .-. ■■■**	45	**6SL3120-1TE24-5AA3**
0.87	21	0.903	77.8	0.109 (0.96)	150 (331)	**1PH7137-. . G . .-. ■■■**	60	**6SL3120-1TE26-0AA3**
0.83	43	0.900	77.3	0.185 (1.64)	175 (386)	**1PH7163-. . G . .-. ■■■**	85	**6SL3120-1TE28-5AA3**
0.84	40	0.911	77.4	0.228 (2.02)	210 (463)	**1PH7167-. . G . .-. ■■■**	85	**6SL3120-1TE28-5AA3**

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 [5]	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 [6]	None		**2**
–	Anthracite RAL 7016, standard paint finish		**3**
Flange/shaft seal ring [6]	Anthracite RAL 7016, standard paint finish		**5**
–	Anthracite RAL 7016, special paint finish		**6**
Flange/shaft seal ring [6]	Anthracite RAL 7016, special paint finish		**8**
Special versions:	Specify supplementary order code and plain text if applicable (see Options).		**–Z**
Motor Module:	Single Motor Module		**1**
	Double Motor Module		**2**

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) 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".

5) 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").

6) 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.

7) Preferred direction of air flow in a polluted environment.

8) The rated output current of the Motor Module is lower than the motor rated current.

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

1PH7 motors
Forced ventilation

Selection and ordering data

Rated speed n_{rated} rpm	Shaft height SH	Rated power P_{rated} kW (HP)	Rated torque M_{rated} Nm (lb_f-ft)	Rated current I_{rated} A	Rated voltage V_{rated} V	Speed during field weakening [1] n_2 rpm	Continuous speed, max. [2] n_{S1} rpm	Speed, max. [3] n_{max} rpm	1PH7 asynchronous motor Order No.
400 V 3 AC line voltage, Vector Control									
400	180	16.3 (21.9)	390 (288)	51	271	2900 [10]	3500 [4)10]	5000 [10]	**1PH7184-■■B■■-■...**
		21.2 (28.4)	505 (373)	67	268	3300 [10]	3500 [4)10]	5000 [10]	**1PH7186-■■B■■-■...**
	225	30.4 (40.8)	725 (535)	88	268	2700 [10]	3100 [4)10]	4500 [10]	**1PH7224-■■B■■-■...**
		39.2 (52.6)	935 (690)	114	264	2900 [10]	3100 [4)10]	4500 [10]	**1PH7226-■■B■■-■...**
		48 (64.4)	1145 (845)	136	272	2900 [10]	3100 [4)10]	4500 [4)10]	**1PH7228-■■B■■-■...**
1150	180	44 (59)	366 (270)	89	383	4200	3500 [4]	5000	**1PH7184-■■D■■-■...**
		58 (77.8)	482 (356)	116	390	4400	3500 [4]	5000	**1PH7186-■■D■■-■...**
	225	81 (109)	670 (494)	160	385	2900	3100 [4]	4500	**1PH7224-■■D■■-■...**
		105 (141)	870 (642)	197	390	2900	3100 [4]	4500	**1PH7226-■■D■■-■...**
		129 (173)	1070 (789)	238	390	2900	3100 [4]	4500 [4]	**1PH7228-■■D■■-■...**

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**
	2-pole resolver		**R**
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**
	14 bit resolver		**P**
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) [5]:	Without brake		**0**
	With brake (includes emergency release screws and microswitch)		**2**
	With brake (includes manual release and microswitch)		**4**

Selection and ordering data

Power factor	Magnetizing current	Efficiency	Rated frequency	Moment of inertia	Weight, approx.	1PH7 asynchronous motor	SINAMICS S120 Motor Module	
							Rated output current	
	I_μ	η_{rated}	f_{rated}	J			I_{rated}	
cos φ	A		Hz	kgm² (lb$_f$-in-s²)	kg (lb)	Order No.	A	Order No.
400 V 3 AC line voltage, Vector Control								
0.84	26	0.830	14.2	0.503 (4.45)	370 (816)	**1PH7184- . . B . .-. ■■■**	60	**6SL3120-1TE26-0AA3**
0.81	38.5	0.845	14.0	0.666 (5.89)	440 (970)	**1PH7186- . . B . .-. ■■■**	85	**6SL3120-1TE28-5AA3**
0.87	36.5	0.864	14.0	1.479 (13.1)	630 (1389)	**1PH7224- . . B . .-. ■■■**	85 [9]	**6SL3120-1TE28-5AA3**
0.86	49	0.880	14.0	1.930 (17.1)	750 (1654)	**1PH7226- . . B . .-. ■■■**	132	**6SL3120-1TE31-3AA3**
0.85	60.5	0.888	13.9	2.326 (20.6)	860 (1896)	**1PH7228- . . B . .-. ■■■**	132 [9]	**6SL3120-1TE31-3AA3**
0.82	42	0.920	39.2	0.503 (4.45)	370 (816)	**1PH7184- . . D . .-. ■■■**	85 [9]	**6SL3120-1TE28-5AA3**
0.81	58	0.925	39.1	0.666 (5.89)	440 (970)	**1PH7186- . . D . .-. ■■■**	132	**6SL3120-1TE31-3AA3**
0.81	79	0.938	38.9	1.479 (13.1)	630 (1389)	**1PH7224- . . D . .-. ■■■**	200	**6SL3120-1TE32-0AA3**
0.84	87.5	0.941	38.9	1.930 (17.1)	750 (1654)	**1PH7226- . . D . .-. ■■■**	200	**6SL3120-1TE32-0AA3**
0.85	98	0.943	38.9	2.326 (20.6)	860 (1896)	**1PH7228- . . D . .-. ■■■**	260	**6SL3320-1TE32-6AA0**

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 [6]	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 [7]	Primed	**2**
–	Anthracite RAL 7016, standard paint finish	**3**
Flange/shaft seal ring [7]	Anthracite RAL 7016, standard paint finish	**5**
–	Anthracite RAL 7016, special paint finish	**6**
Flange/shaft seal ring [7]	Anthracite RAL 7016, special paint finish	**8**

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

[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 reduced for increased cantilever forces, see selection guides.

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

[6] 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".

[7] 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.

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

[9] The rated output current of the Motor Module is lower than the motor rated current.

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

1PH7 motors
Forced ventilation

Selection and ordering data

Rated speed n_{rated} rpm	Shaft height SH	Rated power P_{rated} kW (HP)	Rated torque M_{rated} Nm (lb_f-ft)	Rated current I_{rated} A	Rated voltage V_{rated} V	Speed during field weakening [1] n_2 rpm	Continuous speed, max. [2] n_{S1} rpm	Speed, max. [3] n_{max} rpm	1PH7 asynchronous motor Order No.
400 V 3 AC line voltage, Vector Control									
1750	180	60 (80.5)	327 (241)	120	388	5000	3500 [4]	5000	**1PH7184-■■ F ■■-■ . . .**
		85 (114)	465 (343)	169	385	5000	3500 [4]	5000	**1PH7186-■■ F ■■-■ . . .**
	225	110 (148)	600 (443)	203	395	2900	3100 [4]	4500	**1PH7224-■■ U ■■-■ . . .**
		135 (181)	737 (544)	254	395	2900	3100 [4]	4500	**1PH7226-■■ F ■■-■ . . .**
		179 (240)	975 (719)	342	395	2900	3100 [4]	4500 [4]	**1PH7228-■■ F ■■-■ . . .**
2900	180	81 (109)	265 (196)	158	395	5000	3500 [4]	5000	**1PH7184-■■ L ■■-■ . . .**
		101 (135)	333 (246)	206	385	5000	3500 [4]	5000	**1PH7186-■■ L ■■-■ . . .**
	225	149 (200)	490 (361)	274	395	3500	3100 [4]	4500	**1PH7224-■■ L ■■-■ . . .**
		185 (248)	610 (450)	348	390	3500	3100 [4]	4500	**1PH7226-■■ L ■■-■ . . .**
		215 (288)	708 (522)	402	395	3500	3100 [4]	4500 [4]	**1PH7228-■■ 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**
	2-pole resolver	**R**
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**
	14 bit resolver	**P**
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) [5]:	Without brake	**0**
	With brake (includes emergency release screws and microswitch)	**2**
	With brake (includes manual release and microswitch)	**4**

Selection and ordering data

Power factor	Magnetizing current	Efficiency	Rated frequency	Moment of inertia	Weight, approx.	1PH7 asynchronous motor	SINAMICS S120 Motor Module	
							Rated output current	
	I_μ	η_{rated}	f_{rated}	J			I_{rated}	
cos φ	A		Hz	kgm² (lb$_f$-in-s²)	kg (lb)	Order No.	A	Order No.
400 V 3 AC line voltage, Vector Control								
0.78	64	0.934	59.0	0.503 (4.45)	370 (816)	**1PH7184- . . F . . -. ■■■**	132	**6SL3120-1TE31-3AA3**
0.80	84	0.940	59.0	0.666 (5.89)	440 (970)	**1PH7186- . . F . . -. ■■■**	200	**6SL3120-1TE32-0AA3**
0.84	88	0.944	58.9	1.479 (13.1)	630 (1389)	**1PH7224- . . U . . -. ■■■**	200 [9]	**6SL3120-1TE32-0AA3**
0.82	120	0.947	58.9	1.930 (17.1)	750 (1654)	**1PH7226- . . F . . -. ■■■**	260	**6SL3320-1TE32-6AA0**
0.81	169	0.948	58.8	2.326 (20.6)	860 (1896)	**1PH7228- . . F . . -. ■■■**	380	**6SL3320-1TE33-8AA0**
0.80	77	0.934	97.4	0.503 (4.45)	370 (816)	**1PH7184- . . L . . -. ■■■**	200	**6SL3120-1TE32-0AA3**
0.78	107	0.936	97.3	0.666 (5.89)	440 (970)	**1PH7186- . . L . . -. ■■■**	200 [9]	**6SL3120-1TE32-0AA3**
0.84	115	0.946	97.3	1.479 (13.1)	630 (1389)	**1PH7224- . . L . . -. ■■■**	310	**6SL3320-1TE33-1AA0**
0.83	154	0.946	97.2	1.930 (17.1)	750 (1654)	**1PH7226- . . L . . -. ■■■**	380	**6SL3320-1TE33-8AA0**
0.82	186	0.946	97.2	2.326 (20.6)	860 (1896)	**1PH7228- . . L . . -. ■■■**	490	**6SL3320-1TE35-0AA0**

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 [6]	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 [7]	Primed	**2**
–	Anthracite RAL 7016, standard paint finish	**3**
Flange/shaft seal ring [7]	Anthracite RAL 7016, standard paint finish	**5**
–	Anthracite RAL 7016, special paint finish	**6**
Flange/shaft seal ring [7]	Anthracite RAL 7016, special paint finish	**8**

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

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 reduced for increased cantilever forces, see selection guides.

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

6) 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".

7) 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.

8) Preferred direction of air flow in a polluted environment.

9) The rated output current of the Motor Module is lower than the motor rated current.

1PH7 motors
Forced ventilation

Selection and ordering data

Rated speed n_{rated} rpm	Shaft height SH	Rated power P_{rated} kW (HP)	Rated torque M_{rated} Nm (lb_f-ft)	Rated current I_{rated} A	Rated voltage V_{rated} V	Speed during field weakening [1] n_2 rpm	Continuous speed, max. [2] n_{S1} rpm	Speed, max. [3] n_{max} rpm	1PH7 asynchronous motor Order No.
400 V 3 AC line voltage, Vector Control									
500	280	80 (107)	1529 (1128)	144	400	1700	2200	3300 [6]	**1PH7 284-■■B■■-0 . . .**
		100 (134)	1909 (1408)	180	400	1800	2200	3300 [6]	**1PH7 286-■■B■■-0 . . .**
		130 (174)	2481 (1830)	233	400	1800	2200	3300 [6]	**1PH7 288-■■B■■-0 . . .**
800	280	125 (168)	1492 (1101)	220	400	2200	2200	3300	**1PH7 284-■■C■■-0 . . .**
		155 (208)	1850 (1365)	285	385	2200	2200	3300	**1PH7 286-■■C■■-0 . . .**
		190 (255)	2268 (1673)	365	370	2200	2200	3300	**1PH7 288-■■C■■-0 . . .**
1150	280	170 (228)	1414 (1043)	314	400	2200	2200	3300	**1PH7 284-■■D■■-0 . . .**
		210 (282)	1745 (1287)	414	380	2200	2200	3300	**1PH7 286-■■D■■-0 . . .**
		260 (349)	2160 (1593)	497	385	2200	2200	3300	**1PH7 288-■■D■■-0 . . .**
1750	280	225 (302)	1228 (906)	393	400	2200	2200	3300	**1PH7 284-■■F■■-0 . . .**
		270 (362)	1474 (1087)	466	400	2200	2200	3300	**1PH7 286-■■F■■-0 . . .**
		340 (456)	1856 (1369)	586	400	2200	2200	3300	**1PH7 288-■■F■■-0 . . .**

Fans [4]**:**	External fan unit, NDE at top, air-flow direction NDE to DE	**0**
	External fan unit, NDE on right, air-flow direction NDE to DE	**1**
	External fan unit, NDE on left, air-flow direction NDE to DE	**2**
	External fan unit, DE at top, air-flow direction DE to NDE	**3**
	External fan unit, DE on right, air-flow direction DE to NDE	**4**
	External fan unit, DE on left, air-flow direction DE to NDE	**5**
	Without external fan unit, for single pipe connection at NDE on right	**6**
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**
	2-pole resolver	**R**
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**
	14 bit resolver	**P**
Terminal box/ cable entry (view DE) [4]**:**	NDE right/from below/encoder connector DE	**0**
	NDE left/from below/encoder connector DE	**1**
	NDE top/from right/encoder connector DE	**2**
	DE top/from right/encoder connector NDE	**5**
Type [4]**:**	IM B3	**0**
	IM V5 (can be subsequently modified to IM V6)	**1**
	IM B35 (with flange A 660)	**3**
	IM V15 (with flange A 660; can be subsequently modified to IM V35)	**5**

Selection and ordering data

Power factor	Magnetizing current	Efficiency	Rated frequency	Moment of inertia	Weight, approx.	1PH7 asynchronous motor	SINAMICS S120 Motor Module	
							Rated output current	
	I_μ	η_{rated}	f_{rated}	J			I_{rated}	
cos φ	A		Hz	kgm² (lb$_f$-in-s²)	kg (lb)	Order No.	A	Order No.
400 V 3 AC line voltage, Vector Control								
0.87	60	0.922	17	4.2 (37.2)	1300 (2867)	**1PH7284-. . B . .-0■■■**	200	**6SL3120-1TE32-0AA3**
0.86	78	0.930	17	5.2 (46)	1500 (3308)	**1PH7286-. . B . .-0■■■**	200	**6SL3120-1TE32-0AA3**
0.87	100	0.933	17	6.3 (55.8)	1700 (3749)	**1PH7288-. . B . .-0■■■**	260	**6SL3320-1TE32-6AA0**
0.86	95	0.944	27	4.2 (37.2)	1300 (2867)	**1PH7284-. . C . .-0■■■**	260	**6SL3320-1TE32-6AA0**
0.85	135	0.948	27	5.2 (46)	1500 (3308)	**1PH7286-. . C . .-0■■■**	310	**6SL3320-1TE33-1AA0**
0.84	170	0.951	27	6.3 (55.8)	1700 (3749)	**1PH7288-. . C . .-0■■■**	380	**6SL3320-1TE33-8AA0**
0.82	158	0.956	38.6	4.2 (37.2)	1300 (2867)	**1PH7284-. . D . .-0■■■**	310 [5]	**6SL3320-1TE33-1AA0**
0.81	218	0.958	38.6	5.2 (46)	1500 (3308)	**1PH7286-. . D . .-0■■■**	490	**6SL3320-1TE35-0AA0**
0.82	252	0.960	38.6	6.3 (55.8)	1700 (3749)	**1PH7288-. . D . .-0■■■**	490 [5]	**6SL3320-1TE35-0AA0**
0.86	163	0.962	58.7	4.2 (37.2)	1300 (2867)	**1PH7284-. . F . .-0■■■**	490	**6SL3320-1TE35-0AA0**
0.87	184	0.963	58.7	5.2 (46)	1500 (3308)	**1PH7286-. . F . .-0■■■**	490	**6SL3320-1TE35-0AA0**
0.87	234	0.965	58.7	6.3 (55.8)	1700 (3749)	**1PH7288-. . F . .-0■■■**	605	**6SL3320-1TE36-1AA0**

Output type [4]**:**	**Vibrat. magnitude:**	**Shaft and flange accuracy:**	
Coupling	Grade N	Tolerance N	**A**
Coupling	Grade R	Tolerance R	**B**
Belt/increased cantilever forces	Grade N	Tolerance N	**E**
Belt/increased cantilever forces	Grade R	Tolerance R	**F**
Shaft extension (DE):	**Balancing:**		
Fitted key	Half-key		**A**
Fitted key	Full-key		**C**
Plain shaft	–		**J**
Paint finish:			
Primed			**0**
Anthracite RAL 7016, standard paint finish			**3**
Anthracite RAL 7016, special paint finish			**6**
Special versions:	Specify supplementary order code and plain text if applicable (see Options).		**–Z**

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) See table "Permissible combinations of mechanical designs", page 5/33.

5) The rated output current of the Motor Module is lower than the motor rated current.

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

1PH7 motors
Forced ventilation

Selection and ordering data

Rated speed n_{rated} rpm	Shaft height SH	Rated power P_{rated} kW (HP)	Rated torque M_{rated} Nm (lb_f-ft)	Rated current I_{rated} A	Rated voltage V_{rated} V	Speed during field weakening [1] n_2 rpm	Continuous speed, max. [2] n_{S1} rpm	Speed, max. [3] n_{max} rpm	1PH7 asynchronous motor Order No.
480 V 3 AC line voltage, Servo/Vector Control									
500	160	12 (16.1)	230 (170)	30	340	2840 [8]	3700 [8]	6500 [8]	**1PH7163-■■B■■-■...**
		16 (21.5)	306 (221)	35	350	2380 [8]	3700 [8]	6500 [8]	**1PH7167-■■B■■-■...**
1350	100	4.7 (6.30)	33 (24.3)	9.5	433	3500	5500	9000 [8]	**1PH7103-■■D■■-■...**
		8 (10.7)	57 (42.0)	17	405	5160	5500	9000 [8]	**1PH7107-■■D■■-■...**
	132	15 (20.1)	106 (78.2)	30	433	3500	4500	8000 [8]	**1PH7133-■■D■■-■...**
		22 (29.5)	156 (115)	42	416	4750	4500	8000 [8]	**1PH7137-■■D■■-■...**
	160	28 (37.6)	198 (146)	53	413	4000	3700	6500	**1PH7163-■■D■■-■...**
		34 (45.6)	241 (178)	67	400	5900	3700	6500	**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**
	2-pole resolver						**R**
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**
	14 bit resolver						**P**
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 [4]:	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**

Selection and ordering data

Power factor	Magnetizing current	Efficiency	Rated frequency	Moment of inertia	Weight, approx.	1PH7 asynchronous motor	SINAMICS S120 Motor Module	
							Rated output current	
	I_μ	η_{rated}	f_{rated}	J			I_{rated}	
cos φ	A		Hz	kgm² (lb$_f$-in-s²)	kg (lb)	Order No.	A	Order No.
480 V 3 AC line voltage, Servo/Vector Control								
0.86	13	0.841	17.6	0.185 (1.64)	175 (386)	**1PH7163-. . B . .-. ■■■**	30	**6SL3120-1TE23-0AA3**
0.89	13	0.836	17.7	0.228 (2.02)	210 (463)	**1PH7167-. . B . .-. ■■■**	45	**6SL3120-1TE24-5AA3**
0.81	4.5	0.830	47.1	0.017 (0.15)	40 (88.2)	**1PH7103-. . D . .-. ■■■**	18	**6SL3120-■TE21-8AA3**
0.80	8.1	0.853	47.0	0.029 (0.26)	65 (143)	**1PH7107-. . D . .-. ■■■**	18	**6SL3120-■TE21-8AA3**
0.84	12	0.887	46.4	0.076 (0.67)	90 (198)	**1PH7133-. . D . .-. ■■■**	30	**6SL3120-1TE23-0AA3**
0.85	17	0.895	46.3	0.109 (0.96)	150 (331)	**1PH7137-. . D . .-. ■■■**	45	**6SL3120-1TE24-5AA3**
0.83	24	0.911	45.8	0.185 (1.64)	175 (386)	**1PH7163-. . D . .-. ■■■**	60	**6SL3120-1TE26-0AA3**
0.83	34	0.910	45.8	0.228 (2.02)	210 (463)	**1PH7167-. . D . .-. ■■■**	85	**6SL3120-1TE28-5AA3**

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 [5]	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 [6]	None		**2**
–	Anthracite RAL 7016, standard paint finish		**3**
Flange/shaft seal ring [6]	Anthracite RAL 7016, standard paint finish		**5**
–	Anthracite RAL 7016, special paint finish		**6**
Flange/shaft seal ring [6]	Anthracite RAL 7016, special paint finish		**8**
Special versions:	Specify supplementary order code and plain text if applicable (see Options).		**–Z**
Motor Module:	Single Motor Module		**1**
	Double Motor Module		**2**

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) 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".

5) 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").

6) 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.

7) Preferred direction of air flow in a polluted environment.

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

1PH7 motors
Forced ventilation

Selection and ordering data

Rated speed n_{rated} rpm	Shaft height SH	Rated power P_{rated} kW (HP)	Rated torque M_{rated} Nm (lb_f-ft)	Rated current I_{rated} A	Rated voltage V_{rated} V	Speed during field weakening [1] n_2 rpm	Continuous speed, max. [2] n_{S1} rpm	Speed, max. [3] n_{max} rpm	1PH7 asynchronous motor Order No.
480 V 3 AC line voltage, Servo/Vector Control									
2000	100	4.7 (6.3)	22 (16.2)	10	459	7580	5500	9000	**1PH7101-■■F■■-■...**
		7 (9.39)	33 (24.3)	13	459	4100	5500	9000	**1PH7103-■■F■■-■...**
		9 (12.7)	43 (31.7)	17.5	450	7160	5500	9000	**1PH7105-■■F■■-■...**
		11 (14.8)	53 (39.1)	23	433	5500	5500	9000	**1PH7107-■■F■■-■...**
	132	15 (20.1)	72 (53.1)	25	459	5660	4500	8000	**1PH7131-■■F■■-■...**
		20 (26.8)	96 (70.8)	34	459	5910	4500	8000	**1PH7133-■■F■■-■...**
		24 (32.2)	115 (84.8)	42	459	6730	4500	8000	**1PH7135-■■F■■-■...**
		28 (37.6)	134 (98.8)	55	402	4000	4500	8000	**1PH7137-■■F■■-■...**
	160	37 (49.6)	177 (131)	70	412	4000	3700	6500	**1PH7163-■■F■■-■...**
		45 (60.4)	215 (159)	76	459	3250	3700	6500	**1PH7167-■■F■■-■...**
2650	100	8 (10.7)	29 (21.4)	16.5	440	7500	5500	9000	**1PH7103-■■G■■-■...**
		13 (17.4)	47 (34.7)	24.5	459	7500	5500	9000	**1PH7107-■■G■■-■...**
	132	24 (32.2)	87 (64.2)	42	450	4000	4500	8000	**1PH7133-■■G■■-■...**
		30 (40.2)	108 (79.7)	52	450	4250	4500	8000	**1PH7137-■■G■■-■...**
	160	40 (53.6)	144 (106)	76	433	3500	3700	6500	**1PH7163-■■G■■-■...**
		44 (59.0)	159 (117)	77	459	3250	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**
	2-pole resolver		**R**
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**
	14 bit resolver		**P**
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 [4]:	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**

Selection and ordering data

Power factor	Magnetizing current	Efficiency	Rated frequency	Moment of inertia	Weight, approx.	1PH7 asynchronous motor	SINAMICS S120 Motor Module	
							Rated output current	
	I_μ	η_{rated}	f_{rated}	J			I_{rated}	
cos φ	A		Hz	kgm² (lb$_f$-in-s²)	kg (lb)	Order No.	A	Order No.
480 V 3 AC line voltage, Servo/Vector Control								
0.72	6.0	0.862	68.2	0.017 (0.15)	40 (88.2)	**1PH7101-. . F . .-. ■■■**	18	**6SL3120-■TE21-8AA3**
0.82	5.6	0.860	69.1	0.017 (0.15)	40 (88.2)	**1PH7103-. . F . .-. ■■■**	18	**6SL3120-■TE21-8AA3**
0.78	9.3	0.878	68.3	0.029 (0.26)	65 (143)	**1PH7105-. . F . .-. ■■■**	18	**6SL3120-■TE21-8AA3**
0.79	10.8	0.876	68.6	0.029 (0.26)	65 (143)	**1PH7107-. . F . .-. ■■■**	30	**6SL3120-1TE23-0AA3**
0.88	8.5	0.903	68.0	0.076 (0.67)	90 (198)	**1PH7131-. . F . .-. ■■■**	30	**6SL3120-1TE23-0AA3**
0.84	15	0.900	68.0	0.076 (0.67)	90 (198)	**1PH7133-. . F . .-. ■■■**	45	**6SL3120-1TE24-5AA3**
0.85	17	0.905	67.8	0.109 (0.96)	150 (331)	**1PH7135-. . F . .-. ■■■**	45	**6SL3120-1TE24-5AA3**
0.85	23	0.900	67.9	0.109 (0.96)	150 (331)	**1PH7137-. . F . .-. ■■■**	60	**6SL3120-1TE26-0AA3**
0.85	29	0.912	67.5	0.185 (1.64)	175 (386)	**1PH7163-. . F . .-. ■■■**	85	**6SL3120-1TE28-5AA3**
0.84	32	0.916	67.4	0.228 (2.02)	210 (463)	**1PH7167-. . F . .-. ■■■**	85	**6SL3120-1TE28-5AA3**
0.78	8.2	0.871	90.3	0.017 (0.15)	40 (88.2)	**1PH7103-. . G . .-. ■■■**	18	**6SL3120-■TE21-8AA3**
0.78	12	0.887	90.2	0.029 (0.26)	65 (143)	**1PH7107-. . G . .-. ■■■**	30	**6SL3120-1TE23-0AA3**
0.85	17	0.898	89.6	0.076 (0.67)	90 (198)	**1PH7133-. . G . .-. ■■■**	45	**6SL3120-1TE24-5AA3**
0.84	21	0.894	89.4	0.109 (0.96)	150 (331)	**1PH7137-. . G . .-. ■■■**	60	**6SL3120-1TE26-0AA3**
0.82	37	0.895	89.0	0.185 (1.64)	175 (386)	**1PH7163-. . G . .-. ■■■**	85	**6SL3120-1TE28-5AA3**
0.80	40	0.911	89.0	0.228 (2.02)	210 (463)	**1PH7167-. . G . .-. ■■■**	85	**6SL3120-1TE28-5AA3**

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 [5]	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 [6]	None		**2**
–	Anthracite RAL 7016, standard paint finish		**3**
Flange/shaft seal ring [6]	Anthracite RAL 7016, standard paint finish		**5**
–	Anthracite RAL 7016, special paint finish		**6**
Flange/shaft seal ring [6]	Anthracite RAL 7016, special paint finish		**8**
Special versions:	Specify supplementary order code and plain text if applicable (see Options).		**–Z**
Motor Module:	Single Motor Module		**1**
	Double Motor Module		**2**

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) 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".

5) Max. possible speed (see also selection guides):
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").

6) 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.

7) Preferred direction of air flow in a polluted environment.

1PH7 motors
Forced ventilation

Selection and ordering data

Rated speed n_{rated} rpm	Shaft height SH	Rated power P_{rated} kW (HP)	Rated torque M_{rated} Nm (lb_f-ft)	Rated current I_{rated} A	Rated voltage V_{rated} V	Speed during field weakening [1] n_2 rpm	Continuous speed, max. [2] n_{S1} rpm	Speed, max. [3] n_{max} rpm	1PH7 asynchronous motor Order No.
480 V 3 AC line voltage, Servo/Vector Control									
500	180	20.5 (27.5)	392 (289)	51	335	3200 [10]	3500 [4][10]	5000 [10]	**1PH7184-■■B■■-■...**
		26.5 (35.5)	506 (373)	67	335	3600 [10]	3500 [4][10]	5000 [10]	**1PH7186-■■B■■-■...**
	225	38 (51.0)	725 (535)	86	335	2900 [10]	3100 [4][10]	4500 [10]	**1PH7224-■■B■■-■...**
		49 (65.7)	935 (690)	112	330	3200 [10]	3100 [4][10]	4500 [10]	**1PH7226-■■B■■-■...**
		60 (80.5)	1145 (845)	135	340	3200 [10]	3100 [4][10]	4500 [4][10]	**1PH7228-■■B■■-■...**
1350	180	50 (67.1)	355 (262)	86	450	5000	3500 [4]	5000	**1PH7184-■■D■■-■...**
		67 (89.9)	475 (350)	114	460	5000	3500 [4]	5000	**1PH7186-■■D■■-■...**
	225	92 (123)	650 (479)	156	450	2900	3100 [4]	4500	**1PH7224-■■D■■-■...**
		120 (161)	847 (625)	193	460	2900	3100 [4]	4500	**1PH7226-■■D■■-■...**
		147 (197)	1043 (769)	232	460	2900	3100 [4]	4500 [4]	**1PH7228-■■D■■-■...**
2000	180	68 (91.2)	325 (240)	120	450	5000	3500 [4]	5000	**1PH7184-■■F■■-■...**
		94 (126)	450 (332)	165	445	5000	3500 [4]	5000	**1PH7186-■■F■■-■...**
	225	124 (166)	590 (435)	200	460	2900	3100 [4]	4500	**1PH7224-■■U■■-■...**
		153 (205)	730 (538)	254	450	2900	3100 [4]	4500	**1PH7226-■■F■■-■...**
		196 (263)	936 (690)	332	450	3000	3100 [4]	4500 [4]	**1PH7228-■■F■■-■...**
2900	180	81 (109)	267 (197)	158	395	5000	3500 [4]	5000	**1PH7184-■■L■■-■...**
		101 (135)	333 (246)	206	385	5000	3500 [4]	5000	**1PH7186-■■L■■-■...**
	225	149 (200)	490 (361)	274	395	3500	3100 [4]	4500	**1PH7224-■■L■■-■...**
		185 (248)	610 (450)	348	390	3500	3100 [4]	4500	**1PH7226-■■L■■-■...**
		215 (288)	708 (522)	402	395	3500	3100 [4]	4500 [4]	**1PH7228-■■L■■-■...**

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**
	2-pole resolver		**R**
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**
	14 bit resolver		**P**
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) [5]:	Without brake		**0**
	With brake (includes emergency release screws and microswitch)		**2**
	With brake (includes manual release and microswitch)		**4**

Selection and ordering data

Power factor	Magnetizing current	Efficiency	Rated frequency	Moment of inertia	Weight, approx.	1PH7 asynchronous motor	SINAMICS S120 Motor Module	
							Rated output current	
	I_μ	η_{rated}	f_{rated}	J			I_{rated}	
cos φ	A		Hz	kgm² (lb$_f$-in-s²)	kg (lb)	Order No.	A	Order No.
480 V 3 AC line voltage, Servo/Vector Control								
0.83	26	0.858	17.5	0.503 (4.45)	370 (816)	**1PH7184- . . B . .-. ■■■**	60	**6SL3120-1 TE26-0AA3**
0.79	39.5	0.870	17.3	0.666 (5.89)	440 (970)	**1PH7186- . . B . .-. ■■■**	85	**6SL3120-1 TE28-5AA3**
0.85	37.5	0.888	17.3	1.479 (13.9)	630 (1389)	**1PH7224- . . B . .-. ■■■**	85 [9]	**6SL3120-1 TE28-5AA3**
0.85	50	0.900	17.3	1.930 (17.1)	750 (1654)	**1PH7226- . . B . .-. ■■■**	132	**6SL3120-1 TE31-3AA3**
0.84	61.5	0.907	17.2	2.326 (20.6)	860 (1896)	**1PH7228- . . B . .-. ■■■**	132 [9]	**6SL3120-1 TE31-3AA3**
0.81	42	0.928	45.8	0.503 (4.45)	370 (816)	**1PH7184- . . D . .-. ■■■**	85 [9]	**6SL3120-1 TE28-5AA3**
0.79	59.5	0.930	45.7	0.666 (5.89)	440 (970)	**1PH7186- . . D . .-. ■■■**	132	**6SL3120-1 TE31-3AA3**
0.80	78.5	0.942	45.6	1.479 (13.1)	630 (1389)	**1PH7224- . . D . .-. ■■■**	200	**6SL3120-1 TE32-0AA3**
0.82	88.5	0.945	45.6	1.930 (17.1)	750 (1654)	**1PH7226- . . D . .-. ■■■**	200	**6SL3120-1 TE32-0AA3**
0.84	99.5	0.947	45.6	2.326 (20.6)	860 (1896)	**1PH7228- . . D . .-. ■■■**	260	**6SL3320-1 TE32-6AA0**
0.78	66	0.935	67.3	0.503 (4.45)	370 (816)	**1PH7184- . . F . .-. ■■■**	132	**6SL3120-1 TE31-3AA3**
0.78	87	0.941	67.3	0.666 (5.89)	440 (970)	**1PH7186- . . F . .-. ■■■**	200	**6SL3120-1 TE32-0AA3**
0.82	91	0.944	67.2	1.479 (13.1)	630 (1389)	**1PH7224- . . U . .-. ■■■**	200	**6SL3120-1 TE32-0AA3**
0.82	119	0.948	67.2	1.930 (17.1)	750 (1654)	**1PH7226- . . F . .-. ■■■**	260	**6SL3320-1 TE32-6AA0**
0.79	168	0.950	67.1	2.326 (20.6)	860 (1896)	**1PH7228- . . F . .-. ■■■**	380	**6SL3320-1 TE33-8AA0**
0.80	77	0.934	97.4	0.503 (4.45)	370 (816)	**1PH7184- . . L . .-. ■■■**	200	**6SL3120-1 TE32-0AA3**
0.78	107	0.936	97.3	0.666 (5.89)	440 (970)	**1PH7186- . . L . .-. ■■■**	210	**6SL3320-1 TE32-1AA0**
0.84	115	0.946	97.3	1.479 (13.1)	630 (1389)	**1PH7224- . . L . .-. ■■■**	310	**6SL3320-1 TE33-1AA0**
0.83	154	0.946	97.2	1.930 (17.1)	750 (1654)	**1PH7226- . . L . .-. ■■■**	380	**6SL3320-1 TE33-8AA0**
0.82	188	0.954	97.2	2.326 (20.6)	860 (1896)	**1PH7228- . . L . .-. ■■■**	490	**6SL3320-1 TE35-0AA0**

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 [6]	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 [7]	Primed	**2**
–	Anthracite RAL 7016, standard paint finish	**3**
Flange/shaft seal ring [7]	Anthracite RAL 7016, standard paint finish	**5**
–	Anthracite RAL 7016, special paint finish	**6**
Flange/shaft seal ring [7]	Anthracite RAL 7016, special paint finish	**8**

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

[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 reduced for increased cantilever forces, see selection guides.

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

[6] 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".

[7] 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.

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

[9] The rated output current of the Motor Module is lower than the motor rated current.

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

1PH7 motors
Forced ventilation

Selection and ordering data

Rated speed n_{rated} rpm	Shaft height SH	Rated power P_{rated} kW (HP)	Rated torque M_{rated} Nm (lb_f-ft)	Rated current I_{rated} A	Rated voltage V_{rated} V	Speed during field weakening [1] n_2 rpm	Continuous speed, max. [2] n_{S1} rpm	Speed, max. [3] n_{max} rpm	1PH7 asynchronous motor Order No.
480 V 3 AC line voltage, Servo/Vector Control									
600	280	95 (127)	1519 (1120)	144	480	2200	2200	3300 [6]	**1PH7284-■■B■■-0...**
		120 (161)	1916 (1413)	180	480	2200	2200	3300 [6]	**1PH7286-■■B■■-0...**
		155 (208)	2467 (1820)	233	480	2200	2200	3300 [6]	**1PH7288-■■B■■-0...**
1000	280	150 (201)	1433 (1057)	220	480	2200	2200	3300	**1PH7284-■■C■■-0...**
		185 (248)	1767 (1303)	285	480	2200	2200	3300	**1PH7286-■■C■■-0...**
		230 (308)	2197 (1621)	365	460	2200	2200	3300	**1PH7288-■■C■■-0...**
1350	280	200 (268)	1416 (1044)	314	470	2200	2200	3300	**1PH7284-■■D■■-0...**
		245 (329)	1733 (1278)	414	445	2200	2200	3300	**1PH7286-■■D■■-0...**
		305 (409)	2158 (1592)	497	450	2200	2200	3300	**1PH7288-■■D■■-0...**
2000	280	255 (342)	1218 (898)	393	455	2200	2200	3300	**1PH7284-■■F■■-0...**
		310 (416)	1481 (1092)	466	455	2200	2200	3300	**1PH7286-■■F■■-0...**
		385 (516)	1838 (1356)	586	455	2200	2200	3300	**1PH7288-■■F■■-0...**

Fans [4]**:**	External fan unit, NDE at top, air-flow direction NDE to DE	**0**
	External fan unit, NDE on right, air-flow direction NDE to DE	**1**
	External fan unit, NDE on left, air-flow direction NDE to DE	**2**
	External fan unit, DE at top, air-flow direction DE to NDE	**3**
	External fan unit, DE on right, air-flow direction DE to NDE	**4**
	External fan unit, DE on left, air-flow direction DE to NDE	**5**
	Without external fan unit, for single pipe connection at NDE on right	**6**
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**
	2-pole resolver	**R**
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**
	14 bit resolver	**P**
Terminal box/ cable entry (view DE) [4]**:**	NDE right/from below/encoder connector DE	**0**
	NDE left/from below/encoder connector DE	**1**
	NDE top/from right/encoder connector DE	**2**
	DE top/from right/encoder connector NDE	**5**
Type [4]**:**	IM B3	**0**
	IM V5 (can be subsequently modified to IM V6)	**1**
	IM B35 (with flange A 660)	**3**
	IM V15 (with flange A 660; can be subsequently modified to IM V35)	**5**

Selection and ordering data

Power factor	Magnetizing current	Efficiency	Rated frequency	Moment of inertia	Weight, approx.	1PH7 asynchronous motor	SINAMICS S120 Motor Module	
							Rated output current	
	I_μ	η_{rated}	f_{rated}	J			I_{rated}	
cos φ	A		Hz	kgm² (lb$_f$-in-s²)	kg (lb)	Order No.	A	Order No.
480 V 3 AC line voltage, Servo/Vector Control								
0.86	61	0.932	20.3	4.2 (37.2)	1300 (2867)	**1PH7284- . . B . . -0 ■ ■ ■**	200	**6SL3120-1TE32-0AA3**
0.86	80	0.939	20.3	5.2 (46.0)	1500 (3308)	**1PH7286- . . B . . -0 ■ ■ ■**	200	**6SL3120-1TE32-0AA3**
0.86	102	0.941	20.3	6.3 (55.8)	1700 (3749)	**1PH7288- . . B . . -0 ■ ■ ■**	260	**6SL3320-1TE32-6AA0**
0.86	90	0.950	34	4.2 (37.2)	1300 (2867)	**1PH7284- . . C . . -0 ■ ■ ■**	260	**6SL3320-1TE32-6AA0**
0.84	135	0.954	34	5.2 (46.0)	1500 (3308)	**1PH7286- . . C . . -0 ■ ■ ■**	310	**6SL3320-1TE33-1AA0**
0.84	170	0.956	34	6.3 (55.8)	1700 (3749)	**1PH7288- . . C . . -0 ■ ■ ■**	380	**6SL3320-1TE33-8AA0**
0.82	159	0.958	45.3	4.2 (37.2)	1300 (2867)	**1PH7284- . . D . . -0 ■ ■ ■**	310 [5]	**6SL3320-1TE33-1AA0**
0.80	217	0.960	45.3	5.2 (46.0)	1500 (3308)	**1PH7286- . . D . . -0 ■ ■ ■**	490	**6SL3320-1TE35-0AA0**
0.82	250	0.962	45.3	6.3 (55.8)	1700 (3749)	**1PH7288- . . D . . -0 ■ ■ ■**	490 [5]	**6SL3320-1TE35-0AA0**
0.86	162	0.962	67	4.2 (37.2)	1300 (2867)	**1PH7284- . . F . . -0 ■ ■ ■**	490	**6SL3320-1TE35-0AA0**
0.87	182	0.964	67	5.2 (46.0)	1500 (3308)	**1PH7286- . . F . . -0 ■ ■ ■**	490	**6SL3320-1TE35-0AA0**
0.87	232	0.965	67	6.3 (55.8)	1700 (3749)	**1PH7288- . . F . . -0 ■ ■ ■**	605	**6SL3320-1TE36-1AA0**

Output type [4]**:**	**Vibrat. magnitude:**	**Shaft and flange accuracy:**	
Coupling	Grade N	Tolerance N	**A**
Coupling	Grade R	Tolerance R	**B**
Belt/increased cantilever forces	Grade N	Tolerance N	**E**
Belt/increased cantilever forces	Grade R	Tolerance R	**F**
Shaft extension (DE):	**Balancing:**		
Fitted key	Half-key		**A**
Fitted key	Full-key		**C**
Plain shaft	–		**J**
Paint finish:			
Primed			**0**
Anthracite RAL 7016, standard paint finish			**3**
Anthracite RAL 7016, special paint finish			**6**
Special versions:	Specify supplementary order code and plain text if applicable (see Options).		**–Z**

[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] See table "Permissible combinations of mechanical designs", page 5/33.

[5] The rated output current of the Motor Module is lower than the motor rated current.

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

1PH7 motors
Forced ventilation

Selection and ordering data

Rated speed n_{rated} rpm	Shaft height SH	Rated power P_{rated} kW (HP)	Rated torque M_{rated} Nm (lb_f-ft)	Rated current I_{rated} A	Rated voltage V_{rated} V	Speed during field weakening [1] n_2 rpm	Continuous speed, max. [2] n_{S1} rpm	Speed, max. [3] n_{max} rpm	1PH7 asynchronous motor Order No.
690 V 3 AC line voltage, Servo/Vector Control									
500	280	77 (103)	1471 (1085)	80	690	1700	2200	3300 [6]	**1PH7284-■■B■■-0...**
		96 (128)	1834 (1353)	101	690	1800	2200	3300 [6]	**1PH7286-■■B■■-0...**
		125 (168)	2388 (1761)	130	690	1900	2200	3300 [6]	**1PH7288-■■B■■-0...**
800	280	115 (154)	1373 (1013)	120	690	2200	2200	3300	**1PH7284-■■C■■-0...**
		145 (194)	1731 (1277)	160	665	2200	2200	3300	**1PH7286-■■C■■-0...**
		185 (248)	2208 (1629)	210	640	2200	2200	3300	**1PH7288-■■C■■-0...**
1150	280	164 (220)	1362 (1005)	176	690	2200	2200	3300	**1PH7284-■■D■■-0...**
		203 (272)	1686 (1244)	233	655	2200	2200	3300	**1PH7286-■■D■■-0...**
		251 (337)	2084 (1537)	280	665	2200	2200	3300	**1PH7288-■■D■■-0...**
1750	280	217 (291)	1184 (873)	221	690	2200	2200	3300	**1PH7284-■■F■■-0...**
		261 (350)	1424 (1050)	262	690	2200	2200	3300	**1PH7286-■■F■■-0...**
		329 (441)	1795 (1324)	330	690	2200	2200	3300	**1PH7288-■■F■■-0...**

Fans [4]**:**	External fan unit, NDE at top, air-flow direction NDE to DE	**0**
	External fan unit, NDE on right, air-flow direction NDE to DE	**1**
	External fan unit, NDE on left, air-flow direction NDE to DE	**2**
	External fan unit, DE at top, air-flow direction DE to NDE	**3**
	External fan unit, DE on right, air-flow direction DE to NDE	**4**
	External fan unit, DE on left, air-flow direction DE to NDE	**5**
	Without external fan unit, for single pipe connection at NDE on right	**6**
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**
	2-pole resolver	**R**
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**
	14 bit resolver	**P**
Terminal box/ cable entry (view DE) [4]**:**	NDE on right/from below/encoder connector DE	**0**
	NDE on left/from below/encoder connector DE	**1**
	NDE at top/from right/encoder connector DE	**2**
	DE at top/from right/encoder connector NDE	**5**
Type [4]**:**	IM B3	**0**
	IM V5 (can be subsequently modified to IM V6)	**1**
	IM B35 (with flange A 660)	**3**
	IM V15 (with flange A 660; can be subsequently modified to IM V35)	**5**

Selection and ordering data

Power factor	Magnetizing current	Efficiency	Rated frequency	Moment of inertia	Weight, approx.	1PH7 asynchronous motor	SINAMICS S120 Motor Module	
							Rated output current	
	I_μ	η_{rated}	f_{rated}	J			I_{rated}	
cos φ	A		Hz	kgm² (lb$_f$-in-s²)	kg (lb)	Order No.	A	Order No.
690 V 3 AC line voltage, Servo/Vector Control								
0.87	34	0.923	17	4.2 (37.2)	1300 (2867)	**1PH7284-. . B . . -0 ■ ■ ■**	85	**6SL3320-1TG28-5AA0**
0.86	45	0.927	17	5.2 (46.0)	1500 (3308)	**1PH7286-. . B . . -0 ■ ■ ■**	100 [5]	**6SL3320-1TG31-0AA0**
0.86	57	0.930	17	6.3 (55.8)	1700 (3749)	**1PH7288-. . B . . -0 ■ ■ ■**	150	**6SL3320-1TG31-5AA0**
0.85	55	0.943	27	4.2 (37.2)	1300 (2867)	**1PH7284-. . C . . -0 ■ ■ ■**	120	**6SL3320-1TG31-2AA0**
0.84	80	0.947	27	5.2 (46.0)	1500 (3308)	**1PH7286-. . C . . -0 ■ ■ ■**	175	**6SL3320-1TG31-8AA0**
0.84	100	0.950	27	6.3 (55.8)	1700 (3749)	**1PH7288-. . C . . -0 ■ ■ ■**	215	**6SL3320-1TG32-2AA0**
0.81	91	0.955	38.6	4.2 (37.2)	1300 (2867)	**1PH7284-. . D . . -0 ■ ■ ■**	175 [5]	**6SL3320-1TG31-8AA0**
0.80	125	0.957	38.6	5.2 (46.0)	1500 (3308)	**1PH7286-. . D . . -0 ■ ■ ■**	260	**6SL3320-1TG32-6AA0**
0.81	145	0.959	38.6	6.3 (55.8)	1700 (3749)	**1PH7288-. . D . . -0 ■ ■ ■**	330	**6SL3320-1TG33-3AA0**
0.86	94	0.961	58.7	4.2 (37.2)	1300 (2867)	**1PH7284-. . F . . -0 ■ ■ ■**	260	**6SL3320-1TG32-6AA0**
0.87	105	0.963	58.7	5.2 (46.0)	1500 (3308)	**1PH7286-. . F . . -0 ■ ■ ■**	260 [5]	**6SL3320-1TG32-6AA0**
0.86	134	0.964	58.7	6.3 (55.8)	1700 (3749)	**1PH7288-. . F . . -0 ■ ■ ■**	330	**6SL3320-1TG33-3AA0**

Output type [4]**:**	**Vibrat. magnitude:**	**Shaft and flange accuracy:**	
Coupling	Grade N	Tolerance N	**A**
Coupling	Grade R	Tolerance R	**B**
Belt/increased cantilever forces	Grade N	Tolerance N	**E**
Belt/increased cantilever forces	Grade R	Tolerance R	**F**
Shaft extension:	**Balancing:**		
Fitted key	Half-key		**A**
Fitted key	Full-key		**C**
Plain shaft	–		**J**
Paint finish:			
Primed			**0**
Anthracite RAL 7016, standard paint finish			**3**
Anthracite RAL 7016, special paint finish			**6**
Special versions:	Specify additional short code and, if necessary, plain text (see options). **C30** absolutely essential		**–Z**

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) See table "Permissible combinations of mechanical designs", page 5/33.

5) The rated output current is lower than the motor rated current.

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

Permissible combinations of mechanical designs for 1PH7 motors, shaft height 280

Selection and ordering data – supplements

Permissible combinations of mechanical designs

1PH728 . motors
Shaft height 280
Position in Order No. 8. 9. 10. 11. 12. 13. 14. 15. 16.
1PH728 . - ■ . . ■■ - . ■ . .

Permissible combinations of mechanical designs

External fan unit
8th position in Order No.
1PH728 . - ■ . . . . - . . . .

Order No. supplement

	0	1	2	3	4	5	6
	NDE **at top** NDE → DE	NDE **on right** NDE → DE	NDE **on left** NDE → DE	DE **at top** DE → NDE	DE **on right** DE → NDE	DE **on left** DE → NDE	**Single pipe connection NDE on right** (can be modified subseq. to NDE left)
1PH728 . - . . . . 0 - . . . . Type IM B3							
1PH728 . - . . . . 1 - . . . . Type IM V5 (can be modified subsequently to IM V6)							
1PH728 . - . . . . 3 - . . . . Type IM B35							
1PH728 . - . . . . 5 - . . . . Type IM V15 (can be modified subsequently to IM V35)							
Order codes for options							
R1Y Standard finish RAL ...							
R2Y Special finish RAL ...							
G14 With air filter							
K08 Encoder connector mounted opposite							
K55 Cable entry plate, terminal box, customer-specific [1]							
K83 Terminal box rotated through +90 degrees							
K84 Terminal box rotated through -90 degrees							
K85 Terminal box rotated through 180 degrees							
K16 Second standard shaft extension (only possible without encoder)							
K31 Second rating plate							
K45 230 V standstill heating							
C30 690 V version							
Y55 Non-standard shaft extension DE							
Y80 Different rating plate data [1]							
Y82 Extra rating plate with customer data [1]							
M83 Additional thread for a setting screw on motor feet							

Standard design

Released supplementary versions

[1] Plain text required

Permissible combinations of mechanical designs for 1PH7 motors, shaft height 280

Terminal box 11th position in Order No. **1PH728 . - . . . ■ . - . . . .** **Order No. supplement**				**Type** 12th position in Order No. **1PH728 . - . . . . ■ - . . . .** **Order No. supplement**				**Drive type** 14th position in Order No. **1PH728 . - . . . . . - . ■ . .** **Order No. supplement**			
0	**1**	**2**	**5**	**0**	**1**	**3**	**5**	**A**	**B**	**E**	**F**
NDE **on right** Cable entry at bottom, encoder connector DE	NDE **on left** Cable entry at bottom, encoder connector DE	NDE **at top** Cable entry on right, encoder connector DE	DE **at top** Cable entry on right, encoder connector NDE	Type **IM B3**	Type **IM V5** (IM V6)	Type **IM B35**	Type **IM V15** (IM V35)	**Coupling N/N**	**Coupling R/R**	**Belt/ increa-sed canti-lever forces N/N**	**Belt/ increa-sed canti-lever forces R/R**

1PL6 motors
Forced ventilation

Overview

1PL6 AC motors, shaft heights 180 to 225

1PL6 AC motors, shaft height 280

The 1PL6 AC motors are compact, force-ventilated or enclosed-ventilated squirrel-cage asynchronous motors with degree of protection IP23. 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.

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.

The motors comply with DIN standards and have degree of protection IP23 in accordance with EN 60034-5 (or IEC 60034-5). With this degree of protection, the motors are not suitable for operation in corrosive atmospheres or for installation outdoors.

Benefits

- Extremely high power density with compact dimensions (50 to 60% higher output as compared to 1PH7 in degree of protection IP55)
- 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 the 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)

Applications

Installation in dry inside areas (no corrosive atmosphere).

Crane systems:
- Hoisting and closing gears for cranes

Printing industry:
- Main drives for printing machines

Manufacture of rubber, plastic and wire:
- Drives for extruders, calenders, rubber injection machines, foil machines, fleece plants
- Wire-drawing machines, cable-stranding machines, etc.

General applications such as coiler and winder drives.

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)	SH 180 and SH 225: Forced and enclosed ventilation Fan mounted axially at NDE, air-flow direction from NDE to DE SH 225 and SH 280 Forced ventilation, fan is mounted radially at NDE, air-flow direction from NDE to DE
Temperature monitoring	KTY 84 temperature sensor in the stator winding SH 280: Additional KTY 84 as reserve
Motor fan ratings (see selection guides for data)	400 V 3 AC 50/60 Hz 480 V 3 AC 60 Hz
Type in accordance with EN 60034-7 (IEC 60034-7)	IM B3, IM B35
Degree of protection in accordance with EN 60034-5 (IEC 60034-5)	IP23
Shaft extension on 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]	Tolerance N (normal)
Vibration magnitude in accordance with EN 60034-14 (IEC 60034-14)	SH 180 and SH 225: Grade R (reduced) SH 280: Grade N (normal)
Sound pressure level in acc. with EN ISO 1680 Tolerance +3 dB	Sound pressure level in accordance with the direction of ventilation See selection guides
Bearing versions and maximum speeds	See selection guides
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 • 2-pole resolver
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 • 14 bit resolver
Connection	Connector for signals (mating connector not supplied) Terminal box for power SH 180 / SH 225: Terminal box at top SH 280: Terminal box NDE right
Paint finish	Primed, Standard paint finish, anthracite RAL 7016
Options	Refer to Options and Selection and ordering data

S/R = signals/revolution

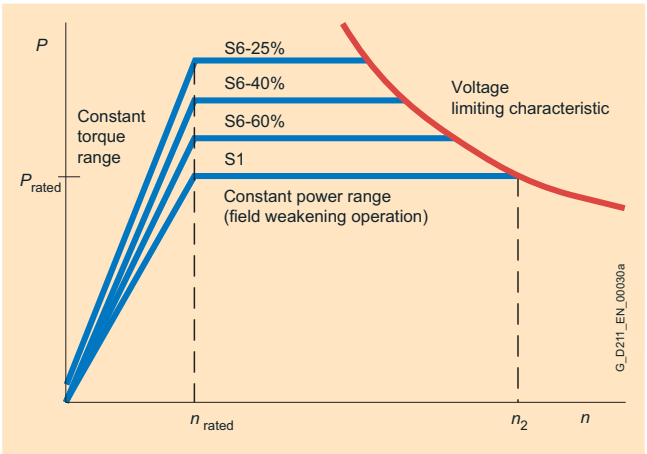
[1] Shaft extension run-out, concentricity of centering ring and shaft and perpendicularity of flange to shaft.

Options

Order code	Option description	For use with 1PL6 asynchronous motors with shaft height		
		SH 180 SH 225 Axial ventilation	SH 225 Radial ventilation	SH 280
R1Y	Normal paint finish in another color, RAL ... (plain text description required)	■	■	■
R2Y	Special paint finish in another color, RAL ... (plain text description required)	■	■	■
C30	Winding version 690 V	–	–	■
G14	Fan unit with air filter	■	■	■
G00	External fan unit, radial NDE left	–	■	See pages 5/50 and 5/51
G02	External fan unit, radial NDE right	–	■	See pages 5/50 and 5/51
G04	External fan unit, radial NDE top	–	■	See pages 5/50 and 5/51
G80	POG10 pulse encoder, mounting prepared	–	■	■
K08	Encoder connector mounted opposite	–	■	■
K09	Terminal box arrangement, NDE right	–	■	See pages 5/50 and 5/51
K10	Terminal box arrangement, NDE left	–	■	See pages 5/50 and 5/51
K11	Terminal box arrangement, NDE top	–	■	See pages 5/50 and 5/51
K16	Second standard shaft extension (possible only for encoderless systems)	–	●	■
K31	2nd Rating plate supplied separately in terminal box	■	■	■
K40	Re-lubrication devices, DE and NDE	■	■	✔
K45	230 V standstill heating	–	●	■
K55	Cable entry plate, terminal box, customer-specific (plain text is required)	■	■	■
K83	Rotation of terminal box through +90 °	–	■	■
K84	Rotation of terminal box through –90 °	–	■	■
K85	Rotation of terminal box through 180 °	–	■	■
L27	NDE bearing, insulated version	■ [1]	✔	✔
M83	Additional thread for a setting screw on motor feet	–	–	■
Y55	Non-standard shaft extension DE	●	●	●
Y80	Different rating plate data (plain text is required)	●	●	●
Y82	Additional rating plate with customer data	●	●	●

■ Option possible – Not available
● On request ✔ Standard

Characteristics



Power/speed characteristic

[1] Only for SH 180 (for SH 225 standard).

1PL6 motors
Forced ventilation

Selection and ordering data

Rated speed n_{rated} rpm	Shaft height SH	Rated power P_{rated} kW (HP)	Rated torque M_{rated} Nm (lb_f-ft)	Rated current I_{rated} A	Rated voltage V_{rated} V	Speed during field weakening [1] n_2 rpm	Continuous speed, max. [2] n_{S1} rpm	Speed, max. [3] n_{max} rpm	1PL6 asynchronous motor Order No.
400 V 3 AC line voltage, Servo Control									
400	180	20.5 (27.5)	489 (361)	58	290	1500	3500 [4)5)]	5000 [5)]	**1PL6184-■■B■■-0 . . .**
		30.5 (40.9)	728 (537)	87	290	1600	3500 [4)5)]	5000 [5)]	**1PL6186-■■B■■-0 . . .**
	225	40 (53.6)	955 (704)	105	296	1400	3100 [4)5)]	4500 [5)]	**1PL6224-■■B■■-0 . . .**
		57 (76.4)	1361 (1004)	145	305	1400	3100 [4)5)]	4500 [5)]	**1PL6226-■■B■■-0 . . .**
		72 (96.6)	1719 (1268)	181	305	1300	3100 [4)5)]	4500 [4)5)]	**1PL6228-■■B■■-0 . . .**
1000	180	57 (76.4)	544 (401)	122	345	2100	3500 [4)]	5000	**1PL6184-■■D■■-0 . . .**
		74 (99.2)	707 (522)	157	345	2400	3500 [4)]	5000	**1PL6186-■■D■■-0 . . .**
	225	105 (141)	1003 (740)	220	345	2500	3100 [4)]	4500	**1PL6224-■■D■■-0 . . .**
		135 (181)	1289 (951)	278	345	2200	3100 [4)]	4500	**1PL6226-■■D■■-0 . . .**
		165 (221)	1576 (1163)	331	348	2200	3100 [4)]	4500 [4)]	**1PL6228-■■D■■-0 . . .**
1500	180	76 (102)	484 (357)	165	345	4000	3500 [4)]	5000	**1PL6184-■■F■■-0 . . .**
		108 (145)	688 (508)	233	340	4000	3500 [4)]	5000	**1PL6186-■■F■■-0 . . .**
	225	142 (190)	904 (667)	292	345	2900	3100 [4)]	4500	**1PL6224-■■F■■-0 . . .**
		175 (235)	1114 (822)	356	345	2900	3100 [4)]	4500	**1PL6226-■■F■■-0 . . .**
		230 (308)	1465 (1081)	468	345	2900	3100 [4)]	4500 [4)]	**1PL6228-■■F■■-0 . . .**
2500	180	100 (134)	382 (282)	208	345	5000	3500 [4)]	5000	**1PL6184-■■L■■-0 . . .**
		130 (174)	497 (367)	275	340	5000	3500 [4)]	5000	**1PL6186-■■L■■-0 . . .**
	225	178 (239)	680 (502)	358	345	3500	3100 [4)]	4500	**1PL6224-■■L■■-0 . . .**
		235 (315)	698 (515)	476	340	3500	3100 [4)]	4500	**1PL6226-■■L■■-0 . . .**
		265 (355)	1013 (747)	535	345	3500	3100 [4)]	4500 [4)]	**1PL6228-■■L■■-0 . . .**

Fans:	External fan unit, heavy-gauge threaded cable entry in terminal box		**4**
	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**
	2-pole resolver		**R**
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**
	14 bit resolver		**P**
Terminal box/ cable entry (view DE):	Top/from right		**0**
	Top/from DE		**1**
	Top/from NDE		**2**
	Top/from left		**3**
	Radial ventilation for SH 225 [6)]		**5**
Type:	IM B3		**0**
	IM B3	Hoisting system for different types (IM B6, IM B7, IM B8, IM V5, IM V6)	**1**
	IM B35 (SH 180: with flange A 450, SH 225: with flange A 550)		**3**
	IM B35 (SH 180: with flange A 450, SH 225: with flange A 550)	Hoisting system for different types (IM V15, IM V35)	**5**

Selection and ordering data

Power factor	Magnetizing current	Efficiency	Rated frequency	Moment of inertia	Weight, approx.	1PL6 asynchronous motor	SINAMICS S120 Motor Module	
							Rated output current	
	I_μ	η_{rated}	f_{rated}	J			I_{rated}	
cos φ	A		Hz	kgm² (lb$_f$-in-s²)	kg (lb)	Order No.	A	Order No.
400 V 3 AC line voltage, Servo Control								
0.84	33.4	0.820	14.2	0.503 (4.45)	370 (816)	**1PL6184-..B..-0■■■**	60	**6SL3120-1TE26-0AA3**
0.84	48.6	0.828	14.1	0.666 (5.89)	440 (970)	**1PL6186-..B..-0■■■**	85 [7]	**6SL3120-1TE28-5AA3**
0.86	45.8	0.864	14	1.479 (13.1)	630 (1389)	**1PL6224-..B..-0■■■**	132	**6SL3120-1TE31-3AA3**
0.85	67	0.868	14	1.930 (17.1)	750 (1654)	**1PL6226-..B..-0■■■**	200	**6SL3120-1TE32-0AA3**
0.86	77	0.871	14.1	2.326 (20.6)	860 (1896)	**1PL6228-..B..-0■■■**	200	**6SL3120-1TE32-0AA3**
0.87	45	0.897	34.4	0.503 (4.45)	370 (816)	**1PL6184-..D..-0■■■**	132	**6SL3120-1TE31-3AA3**
0.86	61	0.907	34.3	0.666 (5.89)	440 (970)	**1PL6186-..D..-0■■■**	200	**6SL3120-1TE32-0AA3**
0.86	86	0.927	34.5	1.479 (13.1)	630 (1389)	**1PL6224-..D..-0■■■**	210 [7]	**6SL3320-1TE32-1AA0**
0.88	90	0.927	31.1	1.930 (17.1)	750 (1654)	**1PL6226-..D..-0■■■**	310	**6SL3320-1TE33-1AA0**
0.89	103	0.928	34.2	2.326 (20.6)	860 (1896)	**1PL6228-..D..-0■■■**	380	**6SL3320-1TE33-8AA0**
0.84	70	0.924	50.9	0.503 (4.45)	370 (816)	**1PL6184-..F..-0■■■**	200	**6SL3120-1TE32-0AA3**
0.85	91	0.930	50.9	0.666 (5.89)	440 (970)	**1PL6186-..F..-0■■■**	260	**6SL3320-1TE32-1AA0**
0.87	91	0.940	50.9	1.479 (13.1)	630 (1389)	**1PL6224-..F..-0■■■**	310	**6SL3320-1TE33-1AA0**
0.87	125	0.944	50.7	1.930 (17.1)	750 (1654)	**1PL6226-..F..-0■■■**	380	**6SL3320-1TE33-8AA0**
0.86	177	0.947	50.7	2.326 (20.6)	860 (1896)	**1PL6228-..F..-0■■■**	490	**6SL3320-1TE35-0AA0**
0.86	80	0.936	84.2	0.503 (4.45)	370 (816)	**1PL6184-..L..-0■■■**	210	**6SL3320-1TE32-1AA0**
0.85	113	0.943	84.1	0.666 (5.89)	440 (970)	**1PL6186-..L..-0■■■**	310	**6SL3320-1TE33-1AA0**
0.87	119	0.950	84.1	1.479 (13.1)	630 (1389)	**1PL6224-..L..-0■■■**	380	**6SL3320-1TE33-8AA0**
0.88	157	0.953	84	1.930 (17.1)	750 (1654)	**1PL6226-..L..-0■■■**	490	**6SL3320-1TE35-0AA0**
0.87	189	0.952	84	2.326 (20.6)	860 (1896)	**1PL6228-..L..-0■■■**	605	**6SL3320-1TE36-1AA0**

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 cantilever forces	Grade R	Tolerance N	**G**
Increased cantilever forces	Grade R	Tolerance R	**H**

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**

Paint finish:	
Primed	**0**
Anthracite RAL 7016, standard paint finish	**3**
Anthracite RAL 7016, special paint finish	**6**

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

[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 needs to be reduced for increased cantilever forces, see selection guides.

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

[6] Digit "5" for SH 225: Radial ventilation, for possible versions see table "Permissible combinations of mechanical designs", page 5/48.

[7] The rated output current of the Motor Module is lower than the motor rated current.

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

1PL6 motors
Forced ventilation

Selection and ordering data

Rated speed n_{rated} rpm	Shaft height SH	Rated power P_{rated} kW (HP)	Rated torque M_{rated} Nm (lb_f-ft)	Rated current I_{rated} A	Rated voltage V_{rated} V	Speed during field weakening [1] n_2 rpm	Continuous speed, max. [2] n_{S1} rpm	Speed, max. [3] n_{max} rpm	1PL6 asynchronous motor Order No.
400 V 3 AC line voltage, Vector Control									
400	180	24.5 (32.9)	585 (432)	69	300	1700	3500 [4)5)]	5000 [5)]	**1PL6184-■■B■■-0...**
		31.5 (42.2)	752 (555)	90	290	1900	3500 [4)5)]	5000 [5)]	**1PL6186-■■B■■-0...**
	225	45 (60.4)	1074 (792)	117	300	1600	3100 [4)5)]	4500 [5)]	**1PL6224-■■B■■-0...**
		57 (76.4)	1361 (1004)	145	305	1800	3100 [4)5)]	4500 [5)]	**1PL6226-■■B■■-0...**
		72 (96.6)	1719 (1268)	181	305	1800	3100 [4)5)]	4500 [4)5)]	**1PL6228-■■B■■-0...**
1150	180	65 (87.2)	540 (398)	121	400	2500	3500 [4)]	5000	**1PL6184-■■D■■-0...**
		85 (114)	706 (521)	158	400	2700	3500 [4)]	5000	**1PL6186-■■D■■-0...**
	225	120 (161)	997 (735)	218	400	2800	3100 [4)]	4500	**1PL6224-■■D■■-0...**
		155 (208)	1287 (949)	275	400	2600	3100 [4)]	4500	**1PL6226-■■D■■-0...**
		190 (255)	1578 (1164)	334	400	2500	3100 [4)]	4500 [4)]	**1PL6228-■■D■■-0...**
1750	180	89 (119)	486 (359)	166	400	4500	3500 [4)]	5000	**1PL6184-■■F■■-0...**
		125 (168)	682 (503)	231	400	4500	3500 [4)]	5000	**1PL6186-■■F■■-0...**
	225	165 (221)	900 (664)	292	400	2900	3100 [4)]	4500	**1PL6224-■■F■■-0...**
		200 (268)	1091 (805)	350	400	2900	3100 [4)]	4500	**1PL6226-■■F■■-0...**
		265 (355)	1446 (1067)	470	400	2900	3100 [4)]	4500 [4)]	**1PL6228-■■F■■-0...**
2900	180	113 (152)	372 (274)	209	400	5000	3500 [4)]	5000	**1PL6184-■■L■■-0...**
		150 (201)	494 (364)	280	390	5000	3500 [4)]	5000	**1PL6186-■■L■■-0...**
	225	205 (275)	675 (498)	365	400	3500	3100 [4)]	4500	**1PL6224-■■L■■-0...**
		270 (362)	889 (656)	470	400	3500	3100 [4)]	4500	**1PL6226-■■L■■-0...**
		300 (402)	988 (729)	530	400	3500	3100 [4)]	4500 [4)]	**1PL6228-■■L■■-0...**

Fans:	External fan unit, heavy-gauge threaded cable entry in terminal box			**4**	
	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**
	2-pole resolver				**R**
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**
	14 bit resolver				**P**
Terminal box/ cable entry (view DE):	Top/from right				**0**
	Top/from DE				**1**
	Top/from NDE				**2**
	Top/from left				**3**
	Radial ventilation for SH 225 [6)]				**5**
Type:	IM B3				**0**
	IM B3	Hoisting system for different types (IM B6, IM B7, IM B8, IM V5, IM V6)			**1**
	IM B35 (SH 180: with flange A 450, SH 225: with flange A 550)				**3**
	IM B35 (SH 180: with flange A 450, SH 225: with flange A 550)	Hoisting system for different types (IM V15, IM V35)			**5**

Selection and ordering data

Power factor	Magnetizing current	Efficiency	Rated frequency	Moment of inertia	Weight, approx.	1PL6 asynchronous motor	SINAMICS S120 Motor Module	
							Rated output current	
	I_μ	η_{rated}	f_{rated}	J			I_{rated}	
cos φ	A		Hz	kgm² (lb$_f$-in-s²)	kg (lb)	Order No.	A	Order No.
400 V 3 AC line voltage, Vector Control								
0.86	33	0.800	14.4	0.503 (4.45)	370 (816)	**1PL6184- . . B . . - 0 ■ ■ ■**	85	**6SL3120-1TE28-5AA3**
0.85	47	0.814	14.3	0.666 (5.89)	440 (970)	**1PL6186- . . B . . - 0 ■ ■ ■**	85 [7]	**6SL3120-1TE28-5AA3**
0.87	45	0.844	14.2	1.479 (13.1)	630 (1389)	**1PL6224- . . B . . - 0 ■ ■ ■**	132	**6SL3120-1TE31-3AA3**
0.85	67	0.868	14.0	1.930 (17.1)	750 (1654)	**1PL6226- . . B . . - 0 ■ ■ ■**	200	**6SL3120-1TE32-0AA3**
0.86	77	0.871	14.0	2.326 (20.6)	860 (1896)	**1PL6228- . . B . . - 0 ■ ■ ■**	200	**6SL3120-1TE32-0AA3**
0.86	46	0.906	39.4	0.503 (4.45)	370 (816)	**1PL6184- . . D . . - 0 ■ ■ ■**	132	**6SL3120-1TE31-3AA3**
0.86	62	0.910	39.4	0.666 (5.89)	440 (970)	**1PL6186- . . D . . - 0 ■ ■ ■**	200	**6SL3120-1TE32-0AA3**
0.85	86	0.930	39.1	1.479 (13.1)	630 (1389)	**1PL6224- . . D . . - 0 ■ ■ ■**	260	**6SL3320-1TE32-6AA0**
0.87	92	0.930	39.2	1.930 (17.1)	750 (1654)	**1PL6226- . . D . . - 0 ■ ■ ■**	310	**6SL3320-1TE33-1AA0**
0.88	102	0.931	39.2	2.326 (20.6)	860 (1896)	**1PL6228- . . D . . - 0 ■ ■ ■**	380	**6SL3320-1TE33-8AA0**
0.84	68	0.921	59.3	0.503 (4.45)	370 (816)	**1PL6184- . . F . . - 0 ■ ■ ■**	200	**6SL3120-1TE32-0AA3**
0.84	92	0.935	59.3	0.666 (5.89)	440 (970)	**1PL6186- . . F . . - 0 ■ ■ ■**	260	**6SL3320-1TE32-6AA0**
0.87	90	0.942	59.2	1.479 (13.1)	630 (1389)	**1PL6224- . . F . . - 0 ■ ■ ■**	310	**6SL3320-1TE33-1AA0**
0.87	122	0.942	59.1	1.930 (17.1)	750 (1654)	**1PL6226- . . F . . - 0 ■ ■ ■**	380	**6SL3320-1TE33-8AA0**
0.86	174	0.948	59.0	2.326 (20.6)	860 (1896)	**1PL6228- . . F . . - 0 ■ ■ ■**	490	**6SL3320-1TE35-0AA0**
0.85	79	0.938	97.6	0.503 (4.45)	370 (816)	**1PL6184- . . L . . - 0 ■ ■ ■**	210	**6SL3320-1TE32-1AA0**
0.84	110	0.943	97.5	0.666 (5.89)	440 (970)	**1PL6186- . . L . . - 0 ■ ■ ■**	310	**6SL3320-1TE33-1AA0**
0.86	118	0.950	97.5	1.479 (13.1)	630 (1389)	**1PL6224- . . L . . - 0 ■ ■ ■**	380	**6SL3320-1TE33-8AA0**
0.87	160	0.952	97.4	1.930 (17.1)	750 (1654)	**1PL6226- . . L . . - 0 ■ ■ ■**	490	**6SL3320-1TE35-0AA0**
0.86	188	0.952	97.3	2.326 (20.6)	860 (1896)	**1PL6228- . . L . . - 0 ■ ■ ■**	605	**6SL3320-1TE36-1AA0**

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 cantilever forces	Grade R	Tolerance N	**G**
Increased cantilever forces	Grade R	Tolerance R	**H**

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**

Paint finish:	
Primed	**0**
Anthracite RAL 7016, standard paint finish	**3**
Anthracite RAL 7016, special paint finish	**6**

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

[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 reduced for increased cantilever forces, see selection guides.

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

[6] Digit "5" for SH 225: Radial ventilation, for possible versions see table "Permissible combinations of mechanical designs", page 5/48.

[7] The rated output current of the Motor Module is lower than the motor rated current.

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

1PL6 motors
Forced ventilation

Selection and ordering data

Rated speed n_{rated} rpm	Shaft height SH	Rated power P_{rated} kW (HP)	Rated torque M_{rated} Nm (lb_f-ft)	Rated current I_{rated} A	Rated voltage V_{rated} V	Speed during field weakening [1] n_2 rpm	Continuous speed, max. [2] n_{S1} rpm	Speed, max. [3] n_{max} rpm	1PL6 asynchronous motor Order No.
400 V 3 AC line voltage, Vector Control									
800	280	195 (262)	2328 (1717)	335	400	1700	2200	3300	**1PL6284-■■C■■-0...**
		250 (335)	2984 (2201)	440	385	1900	2200	3300	**1PL6286-■■C■■-0...**
		310 (416)	3701 (2730)	570	370	2200	2200	3300	**1PL6288-■■C■■-0...**
1150	280	280 (375)	2325 (1715)	478	400	2200	2200	3300	**1PL6284-■■D■■-0...**
		355 (476)	2944 (2172)	637	380	2200	2200	3300	**1PL6286-■■D■■-0...**
		435 (583)	3607 (2688)	765	385	2200	2200	3300	**1PL6288-■■D■■-0...**
1750	280	370 (496)	2019 (1489)	616	400	2200	2200	3300	**1PL6284-■■F■■-0...**
		445 (597)	2429 (1792)	736	400	2200	2200	3300	**1PL6286-■■F■■-0...**
		560 (751)	3055 (2253)	924	400	2200	2200	3300	**1PL6288-■■F■■-0...**

Fans [4]:	External fan unit, NDE at top, air-flow direction NDE to DE	**0**
	External fan unit, NDE on right, air-flow direction NDE to DE	**1**
	External fan unit, NDE on left, air-flow direction NDE to DE	**2**
	External fan unit, DE at top, air-flow direction DE to NDE	**3**
	External fan unit, DE on right, air-flow direction DE to NDE	**4**
	External fan unit, DE on left, air-flow direction DE to NDE	**5**
	Without external fan unit, for single pipe connection at NDE on right	**6**
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**
	2-pole resolver	**R**
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**
	14 bit resolver	**P**
Terminal box/ cable entry (view DE) [4]:	NDE on right/from below/encoder connector DE	**0**
	NDE on left/from below/encoder connector DE	**1**
	NDE at top/from right/encoder connector DE	**2**
	DE at top/from right/encoder connector NDE	**5**
Type [4]:	IM B3	**0**
	IM V5 (can be subsequently modified to IM V6)	**1**
	IM B35 (with flange A 660)	**3**
	IM V15 (with flange A 660; can be subsequently modified to IM V35)	**5**

Selection and ordering data

Power factor	Magnetizing current	Efficiency	Rated frequency	Moment of inertia	Weight, approx.	1PL6 asynchronous motor	SINAMICS S120 Motor Module	
							Rated output current	
	I_μ	η_{rated}	f_{rated}	J			I_{rated}	
cos φ	A		Hz	kgm² (lb$_f$-in-s²)	kg (lb)	Order No.	A	Order No.
400 V 3 AC line voltage, Vector Control								
0.90	95	0.929	27.3	4.2 (37.2)	1300 (2867)	**1PL6284- . . C . . - 0 ■ ■ ■**	380	**6SL3320-1TE33-8AA0**
0.90	135	0.934	27.3	5.2 (46.0)	1500 (3308)	**1PL6286- . . C . . - 0 ■ ■ ■**	490	**6SL3320-1TE35-0AA0**
0.90	170	0.939	27.3	6.3 (55.8)	1700 (3749)	**1PL6288- . . C . . - 0 ■ ■ ■**	605	**6SL3320-1TE36-1AA0**
0.89	156	0.950	38.9	4.2 (37.2)	1300 (2867)	**1PL6284- . . D . . - 0 ■ ■ ■**	490	**6SL3320-1TE35-0AA0**
0.89	214	0.953	38.9	5.2 (46.0)	1500 (3308)	**1PL6286- . . D . . - 0 ■ ■ ■**	745	**6SL3320-1TE37-5AA0**
0.89	248	0.955	38.9	6.3 (55.8)	1700 (3749)	**1PL6288- . . D . . - 0 ■ ■ ■**	840	**6SL3320-1TE38-4AA0**
0.90	162	0.959	59.0	4.2 (37.2)	1300 (2867)	**1PL6284- . . F . . - 0 ■ ■ ■**	605 [5]	**6SL3320-1TE36-1AA0**
0.91	182	0.960	59.0	5.2 (46.0)	1500 (3308)	**1PL6286- . . F . . - 0 ■ ■ ■**	745	**6SL3320-1TE37-5AA0**
0.91	232	0.962	59.0	6.3 (55.8)	1700 (3749)	**1PL6288- . . F . . - 0 ■ ■ ■**	985	**6SL3320-1TE41-0AA0**

Output type [4]**:**	**Vibrat. magnitude:**	**Shaft and flange accuracy:**	
Coupling	Grade N	Tolerance N	**A**
Coupling	Grade R	Tolerance R	**B**
Belt/increased cantilever forces	Grade N	Tolerance N	**E**
Belt/increased cantilever forces	Grade R	Tolerance R	**F**
Shaft extension (DE):	**Balancing:**		
Fitted key	Half-key		**A**
Fitted key	Full-key		**C**
Plain shaft	–		**J**
Paint finish:			
Primed			**0**
Anthracite RAL 7016, standard paint finish			**3**
Anthracite RAL 7016, special paint finish			**6**
Special versions:	Specify supplementary order code and plain text if applicable (see Options).		**–Z**

[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] See table "Permissible combinations of mechanical designs", page 5/48.

[5] The rated output current of the Motor Module is lower than the motor rated current.

1PL6 motors
Forced ventilation

Selection and ordering data

Rated speed n_{rated} rpm	Shaft height SH	Rated power P_{rated} kW (HP)	Rated torque M_{rated} Nm (lb$_f$-ft)	Rated current I_{rated} A	Rated voltage V_{rated} V	Speed during field weakening [1] n_2 rpm	Continuous speed, max. [2] n_{S1} rpm	Speed, max. [3] n_{max} rpm	1PL6 asynchronous motor Order No.
480 V 3 AC line voltage, Servo/Vector Control									
500	180	30 (40.2)	573 (423)	66	370	1900	3500 [4)5)]	5000 [5)]	**1PL6184-■■B■7-0...**
		40 (53.6)	764 (564)	91	355	2000	3500 [4)5)]	5000 [5)]	**1PL6186-■■B■■-0...**
	225	55 (73.8)	1050 (774)	114	370	1800	3100 [4)5)]	4500 [5)]	**1PL6224-■■B■■-0...**
		72 (96.6)	1375 (1014)	147	375	2000	3100 [4)5)]	4500 [5)]	**1PL6226-■■B■■-0...**
		90 (121)	1719 (1268)	180	380	1900	3100 [4)5)]	4500 [4)5)]	**1PL6228-■■B■■-0...**
1350	180	74 (99.2)	523 (386)	119	460	3000	3500 [4)]	5000	**1PL6184-■■D■■-0...**
		98 (131)	693 (511)	156	460	3100	3500 [4)]	5000	**1PL6186-■■D■■-0...**
	225	137 (184)	969 (715)	215	460	2900	3100 [4)]	4500	**1PL6224-■■D■■-0...**
		172 (231)	1217 (898)	265	460	2900	3100 [4)]	4500	**1PL6226-■■D■■-0...**
		218 (292)	1542 (1137)	332	460	2900	3100 [4)]	4500 [4)]	**1PL6228-■■D■■-0...**
2000	180	98 (131)	468 (345)	161	460	5000	3500 [4)]	5000	**1PL6184-■■F■■-0...**
		135 (181)	645 (476)	220	460	5000	3500 [4)]	5000	**1PL6186-■■F■■-0...**
	225	178 (239)	850 (627)	275	460	2900	3100 [4)]	4500	**1PL6224-■■F■■-0...**
		220 (295)	1050 (774)	342	460	2900	3100 [4)]	4500	**1PL6226-■■F■■-0...**
		288 (386)	1375 (1014)	450	460	2900	3100 [4)]	4500 [4)]	**1PL6228-■■F■■-0...**
2900	180	113 (152)	372 (274)	209	400	5000	3500 [4)]	5000	**1PL6184-■■L■■-0...**
		150 (201)	494 (364)	280	390	5000	3500 [4)]	5000	**1PL6186-■■L■■-0...**
	225	205 (275)	675 (498)	365	400	3500	3100 [4)]	4500	**1PL6224-■■L■■-0...**
		270 (362)	889 (656)	470	395	3500	3100 [4)]	4500	**1PL6226-■■L■■-0...**
		300 (402)	988 (729)	530	400	3500	3100 [4)]	4500 [4)]	**1PL6228-■■L■■-0...**

Fans:	External fan unit, heavy-gauge threaded cable entry in terminal box			**4**		
	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**	
	2-pole resolver				**R**	
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**	
	14 bit resolver				**P**	
Terminal box/ cable entry (view DE):	Top/from right					**0**
	Top/from DE					**1**
	Top/from NDE					**2**
	Top/from left					**3**
	Radial ventilation for SH 225 [6)]					**5**
Type:	IM B3					**0**
	IM B3	Hoisting system for different types (IM B6, IM B7, IM B8, IM V5, IM V6)				**1**
	IM B35 (SH 180: with flange A 450, SH 225: with flange A 550)					**3**
	IM B35 (SH 180: with flange A 450, SH 225: with flange A 550)	Hoisting system for different types (IM V15, IM V35)				**5**

Selection and ordering data

Power factor	Magnetizing current	Efficiency	Rated frequency	Moment of inertia	Weight, approx.	1PL6 asynchronous motor	SINAMICS S120 Motor Module	
							Rated output current	
	I_μ	η_{rated}	f_{rated}	J			I_{rated}	
cos φ	A		Hz	kgm² (lb$_f$-in-s²)	kg (lb)	Order No.	A	Order No.
480 V 3 AC line voltage, Servo/Vector Control								
0.84	34	0.844	17.6	0.503 (4.45)	370 (816)	**1PL6184-. . B . . -0 ■ ■ ■**	85	**6SL3120-1TE28-5AA3**
0.84	46	0.845	17.6	0.666 (5.89)	440 (970)	**1PL6186-. . B . . -0 ■ ■ ■**	132	**6SL3120-1TE31-3AA3**
0.86	46	0.875	17.5	1.479 (13.1)	630 (1389)	**1PL6224-. . B . . -0 ■ ■ ■**	132	**6SL3120-1TE31-3AA3**
0.85	66	0.887	17.4	1.930 (17.1)	750 (1654)	**1PL6226-. . B . . -0 ■ ■ ■**	200	**6SL3120-1TE32-0AA3**
0.85	79	0.894	17.4	2.326 (20.6)	860 (1896)	**1PL6228-. . B . . -0 ■ ■ ■**	200	**6SL3120-1TE32-0AA3**
0.86	44	0.918	46.1	0.503 (4.45)	370 (816)	**1PL6184-. . D . . -0 ■ ■ ■**	132	**6SL3120-1TE31-3AA3**
0.85	60	0.920	46.0	0.666 (5.89)	440 (970)	**1PL6186-. . D . . -0 ■ ■ ■**	200	**6SL3120-1TE32-0AA3**
0.85	82	0.940	45.8	1.479 (13.1)	630 (1389)	**1PL6224-. . D . . -0 ■ ■ ■**	210 [7]	**6SL3320-1TE32-1AA0**
0.87	88	0.940	45.8	1.930 (17.1)	750 (1654)	**1PL6226-. . D . . -0 ■ ■ ■**	260 [7]	**6SL3320-1TE32-6AA0**
0.88	100	0.938	45.8	2.326 (20.6)	860 (1896)	**1PL6228-. . D . . -0 ■ ■ ■**	380	**6SL3320-1TE33-8AA0**
0.83	70	0.934	67.5	0.503 (4.45)	370 (816)	**1PL6184-. . F . . -0 ■ ■ ■**	200	**6SL3120-1TE32-0AA3**
0.83	94	0.940	67.5	0.666 (5.89)	440 (970)	**1PL6186-. . F . . -0 ■ ■ ■**	260	**6SL3320-1TE32-6AA0**
0.86	91	0.944	67.5	1.479 (13.1)	630 (1389)	**1PL6224-. . F . . -0 ■ ■ ■**	310	**6SL3320-1TE33-1AA0**
0.86	124	0.948	67.5	1.930 (17.1)	750 (1654)	**1PL6226-. . F . . -0 ■ ■ ■**	380	**6SL3320-1TE33-8AA0**
0.85	176	0.948	67.3	2.326 (20.6)	860 (1896)	**1PL6228-. . F . . -0 ■ ■ ■**	490	**6SL3320-1TE35-0AA0**
0.85	79	0.938	97.6	0.503 (4.45)	370 (816)	**1PL6184-. . L . . -0 ■ ■ ■**	210	**6SL3320-1TE32-1AA0**
0.84	110	0.943	97.5	0.666 (5.89)	440 (970)	**1PL6186-. . L . . -0 ■ ■ ■**	310	**6SL3320-1TE33-1AA0**
0.86	118	0.950	97.5	1.479 (13.1)	630 (1389)	**1PL6224-. . L . . -0 ■ ■ ■**	380	**6SL3320-1TE33-8AA0**
0.87	160	0.952	97.4	1.930 (17.1)	750 (1654)	**1PL6226-. . L . . -0 ■ ■ ■**	490	**6SL3320-1TE35-0AA0**
0.86	188	0.952	97.3	2.326 (20.6)	860 (1896)	**1PL6228-. . L . . -0 ■ ■ ■**	605	**6SL3320-1TE36-1AA0**

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 cantilever forces	Grade R	Tolerance N	**G**
Increased cantilever forces	Grade R	Tolerance R	**H**

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**

Paint finish:	
Primed	**0**
Anthracite RAL 7016, standard paint finish	**3**
Anthracite RAL 7016, special paint finish	**6**

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

[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 reduced for increased cantilever forces, see selection guides.

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

[6] Digit "5" for SH 225: Radial ventilation, for possible versions see table "Permissible combinations of mechanical designs", page 5/48.

[7] The rated output current of the Motor Module is lower than the motor rated current.

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

1PL6 motors
Forced ventilation

Selection and ordering data

Rated speed n_{rated} rpm	Shaft height SH	Rated power P_{rated} kW (HP)	Rated torque M_{rated} Nm (lb_f-ft)	Rated current I_{rated} A	Rated voltage V_{rated} V	Speed during field weakening [1] n_2 rpm	Continuous speed, max. [2] n_{S1} rpm	Speed, max. [3] n_{max} rpm	1PL6 asynchronous motor Order No.
480 V 3 AC line voltage, Servo/Vector Control									
1000	280	235 (315)	2244 (1655)	335	480	2200	2200	3300	**1PL6284-■■C■■-0 . . .**
		310 (416)	2961 (2184)	440	480	2200	2200	3300	**1PL6286-■■C■■-0 . . .**
		385 (516)	3677 (2712)	570	460	2200	2200	3300	**1PL6288-■■C■■-0 . . .**
1350	280	325 (436)	2299 (1696)	478	470	2200	2200	3300	**1PL6284-■■D■■-0 . . .**
		410 (550)	2901 (2140)	637	445	2200	2200	3300	**1PL6286-■■D■■-0 . . .**
		505 (677)	3573 (2635)	765	450	2200	2200	3300	**1PL6288-■■D■■-0 . . .**
2000	280	415 (557)	1981 (1461)	616	455	2200	2200	3300	**1PL6284-■■F■■-0 . . .**
		500 (671)	2387 (1761)	736	455	2200	2200	3300	**1PL6286-■■F■■-0 . . .**
		630 (845)	3009 (2219)	924	455	2200	2200	3300	**1PL6288-■■F■■-0 . . .**

Fans [4]**:**	External fan unit, NDE at top, air-flow direction NDE to DE	**0**
	External fan unit, NDE on right, air-flow direction NDE to DE	**1**
	External fan unit, NDE on left, air-flow direction NDE to DE	**2**
	External fan unit, DE at top, air-flow direction DE to NDE	**3**
	External fan unit, DE on right, air-flow direction DE to NDE	**4**
	External fan unit, DE on left, air-flow direction DE to NDE	**5**
	Without external fan unit, for single pipe connection at NDE on right	**6**
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**
	2-pole resolver	**R**
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**
	14 bit resolver	**P**
Terminal box/ cable entry (view DE) [4]**:**	NDE on right/from below/encoder connector DE	**0**
	NDE on left/from below/encoder connector DE	**1**
	NDE at top/from right/encoder connector DE	**2**
	DE at top/from right/encoder connector NDE	**5**
Type [4]**:**	IM B3	**0**
	IM V5 (can be subsequently modified to IM V6)	**1**
	IM B35 (with flange A 660)	**3**
	IM V15 (with flange A 660; can be subsequently modified to IM V35)	**5**

Selection and ordering data

Power factor	Magnetizing current	Efficiency	Rated frequency	Moment of inertia	Weight, approx.	1PL6 asynchronous motor	SINAMICS S120 Motor Module	
							Rated output current	
	I_μ	η_{rated}	f_{rated}	J			I_{rated}	
cos φ	A		Hz	kgm² (lb$_f$-in-s²)	kg (lb)	Order No.	A	Order No.
480 V 3 AC line voltage, Servo/Vector Control								
0.90	90	0.939	34.0	4.2 (37.2)	1300 (2867)	**1PL6284- . . C . . - 0 ■ ■ ■**	380	**6SL3320-1TE33-8AA0**
0.90	135	0.945	34.0	5.2 (46.0)	1500 (3308)	**1PL6286- . . C . . - 0 ■ ■ ■**	490	**6SL3320-1TE35-0AA0**
0.90	170	0.948	34.0	6.3 (55.8)	1700 (3749)	**1PL6288- . . C . . - 0 ■ ■ ■**	605	**6SL3320-1TE36-1AA0**
0.89	157	0.955	45.5	4.2 (37.2)	1300 (2867)	**1PL6284- . . D . . - 0 ■ ■ ■**	490	**6SL3320-1TE35-0AA0**
0.89	215	0.957	45.5	5.2 (46.0)	1500 (3308)	**1PL6286- . . D . . - 0 ■ ■ ■**	745	**6SL3320-1TE37-5AA0**
0.89	248	0.959	45.5	6.3 (55.8)	1700 (3749)	**1PL6288- . . D . . - 0 ■ ■ ■**	840	**6SL3320-1TE38-4AA0**
0.90	161	0.961	67.3	4.2 (37.2)	1300 (2867)	**1PL6284- . . F . . - 0 ■ ■ ■**	745	**6SL3320-1TE37-5AA0**
0.91	181	0.963	67.3	5.2 (46.0)	1500 (3308)	**1PL6286- . . F . . - 0 ■ ■ ■**	745	**6SL3320-1TE37-5AA0**
0.91	231	0.965	67.3	6.3 (55.8)	1700 (3749)	**1PL6288- . . F . . - 0 ■ ■ ■**	985	**6SL3320-1TE41-0AA0**

Output type [4]**:**	**Vibrat. magnitude:**	**Shaft and flange accuracy:**	
Coupling	Grade N	Tolerance N	**A**
Coupling	Grade R	Tolerance R	**B**
Belt/increased cantilever forces	Grade N	Tolerance N	**E**
Belt/increased cantilever forces	Grade R	Tolerance R	**F**
Shaft extension (DE):	**Balancing:**		
Fitted key	Half-key		**A**
Fitted key	Full-key		**C**
Plain shaft	–		**J**
Paint finish:			
Primed			**0**
Anthracite RAL 7016, standard paint finish			**3**
Anthracite RAL 7016, special paint finish			**6**
Special versions:	Specify supplementary order code and plain text if applicable (see Options).		**–Z**

[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] See table "Permissible combinations of mechanical designs", page 5/51.

1PL6 motors
Forced ventilation

Selection and ordering data

Rated speed n_{rated} rpm	Shaft height SH	Rated power P_{rated} kW (HP)	Rated torque M_{rated} Nm (lb_f-ft)	Rated current I_{rated} A	Rated voltage V_{rated} V	Speed during field weakening [1] n_2 rpm	Continuous speed, max. [2] n_{S1} rpm	Speed, max. [3] n_{max} rpm	1PL6 asynchronous motor Order No.
690 V 3 AC line voltage, Servo/Vector Control									
800	280	185 (248)	2208 (1629)	185	690	2000	2200	3300	**1PL6284-■■C■■-0 . . .**
		240 (322)	2865 (2113)	250	665	2100	2200	3300	**1PL6286-■■C■■-0 . . .**
		300 (402)	3581 (2641)	320	640	2200	2200	3300	**1PL6288-■■C■■-0 . . .**
1150	280	272 (365)	2259 (1666)	270	690	2200	2200	3300	**1PL6284-■■D■■-0 . . .**
		344 (461)	2857 (2107)	359	655	2200	2200	3300	**1PL6286-■■D■■-0 . . .**
		422 (566)	3504 (2585)	431	665	2200	2200	3300	**1PL6288-■■D■■-0 . . .**
1750	280	359 (481)	1959 (1445)	347	690	2200	2200	3300	**1PL6284-■■F■■-0 . . .**
		432 (579)	2357 (1739)	415	690	2200	2200	3300	**1PL6286-■■F■■-0 . . .**
		543 (728)	2963 (2186)	520	690	2200	2200	3300	**1PL6288-■■F■■-0 . . .**

Fans [4]**:**	External fan unit, NDE top, air-flow direction NDE to DE	**0**
	External fan unit, NDE right, air-flow direction NDE to DE	**1**
	External fan unit, NDE left, air-flow direction NDE to DE	**2**
	External fan unit, DE top, air-flow direction DE to NDE	**3**
	External fan unit, DE right, air-flow direction DE to NDE	**4**
	External fan unit, DE left, air-flow direction DE to NDE	**5**
	Without external fan unit, for single pipe connection at NDE right	**6**
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**
	2-pole resolver	**R**
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**
	14 bit resolver	**P**
Terminal box/ cable entry (view DE) [4]**:**	NDE right/from below/encoder connector DE	**0**
	NDE left/from below/encoder connector DE	**1**
	NDE top/from right/encoder connector DE	**2**
	DE top/from right/encoder connector NDE	**5**
Type [4]**:**	IM B3	**0**
	IM V5 (can be subsequently modified to IM V6)	**1**
	IM B35 (with flange A 660)	**3**
	IM V15 (with flange A 660, can be subsequently modified to IM V35)	**5**

Selection and ordering data

Power factor	Magnetizing current	Efficiency	Rated frequency	Moment of inertia	Weight, approx.	1PL6 asynchronous motor	SINAMICS S120 Motor Module	
							Rated output current	
	I_μ	η_{rated}	f_{rated}	J			I_{rated}	
cos φ	A		Hz	kgm² (lb$_f$-in-s²)	kg (lb)	Order No.	A	Order No.
690 V 3 AC line voltage, Servo/Vector Control								
0.90	55	0.928	27	4.2 (37.2)	1300 (2867)	**1PL6284- . . C . . - 0 ■ ■ ■**	215	**6SL3320-1TG32-2AA0**
0.90	80	0.934	27	5.2 (46.0)	1500 (3308)	**1PL6286- . . C . . - 0 ■ ■ ■**	260	**6SL3320-1TG32-6AA0**
0.90	100	0.938	27	6.3 (55.8)	1700 (3749)	**1PL6288- . . C . . - 0 ■ ■ ■**	330	**6SL3320-1TG33-3AA0**
0.89	89	0.949	38.9	4.2 (37.2)	1300 (2867)	**1PL6284- . . D . . - 0 ■ ■ ■**	330	**6SL3320-1TG33-3AA0**
0.89	123	0.953	38.9	5.2 (46.0)	1500 (3308)	**1PL6286- . . D . . - 0 ■ ■ ■**	410	**6SL3320-1TG34-1AA0**
0.89	143	0.955	38.9	6.3 (55.8)	1700 (3749)	**1PL6288- . . D . . - 0 ■ ■ ■**	465	**6SL3320-1TG34-7AA0**
0.90	93	0.958	59	4.2 (37.2)	1300 (2867)	**1PL6284- . . F . . - 0 ■ ■ ■**	410	**6SL3320-1TG34-1AA0**
0.91	105	0.960	59	5.2 (46.0)	1500 (3308)	**1PL6286- . . F . . - 0 ■ ■ ■**	410 [5]	**6SL3320-1TG34-1AA0**
0.91	133	0.962	59	6.3 (55.8)	1700 (3749)	**1PL6288- . . F . . - 0 ■ ■ ■**	575	**6SL3320-1TG35-8AA0**

Output type [4]**:**	**Vibrat. magnitude:**	**Shaft and flange accuracy:**	
Coupling	Grade N	Tolerance N	**A**
Coupling	Grade R	Tolerance R	**B**
Belt/increased cantilever forces	Grade N	Tolerance N	**E**
Belt/increased cantilever forces	Grade R	Tolerance R	**F**
Shaft extension (DE):	**Balancing:**		
Fitted key	Half-key		**A**
Fitted key	Full-key		**C**
Plain shaft	–		**J**
Paint finish:			
Primed			**0**
Anthracite RAL 7016, standard paint finish			**3**
Anthracite RAL 7016, special paint finish			**6**
Special versions:	Specify supplementary order code and plain text if applicable (see Options). **C30** absolutely essential		**–Z**

[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] See table "Permissible combinations of mechanical designs", page 5/51.

[5] The rated output current of the Motor Module is lower than the motor rated current.

Permissible combinations of mechanical designs for 1PL6 motors, shaft height 225

Selection and ordering data – supplements

Permissible combinations of mechanical designs, radial ventilation

1PL6 2. . motors Shaft height 225													External fan unit, radially mounted -Z			
Position in Order No. 1PL6224 1PL6226 1PL6228	-	8. ■ External fan unit	9.	10.	11. ■ Radial ventilation [2]	12. ■ Type (IM B3 and IM B35)	-	13. ■	14.	15. ■ Direction of air flow NDE → DE, shaft ext.	16.		G04 NDE **top**, air inlet from NDE, dir. of air flow NDE → DE	G02 NDE **right**, air inlet from NDE, dir. of air flow NDE → DE	G00 NDE **left**, air inlet from NDE, dir. of air flow NDE → DE	
With external fan unit	-	**4** **7**	.	.	**5**	**0** **3**	-		.	**B** **D** **K**	.					
Without external fan unit, for pipe conn.	-	**6** **8**	.	.	**5**	**0** **3**	-		.	**B** **D** **K**	.					
Order codes for options																
R1Y Standard finish RAL ...																
R2Y Special finish RAL ...																
G14 With air filter																
G80 Prepared for POG10 pulse encoder mounting (encoder is supplied)																
K55 Cable entry plate, terminal box, customer-specific [1]																
K16 Second standard shaft extension (possible only for encoderless systems)													On request			
K31 Second rating plate																
Y55 Non-standard shaft extension DE																
K40 230 V standstill heating													On request			
Y80 Different rating plate data [1]													On request			
Y82 Extra rating plate with customer data													On request			

Standard design

Released supplementary versions

[1] Plain text required

[2] Direction of cable entry for **K09**: Power DE, encoder connector on top
Direction of cable entry for **K10**: Power DE, encoder connector on top
Direction of cable entry for **K11**: Cable entry on right, encoder connector DE

Permissible combinations of mechanical designs for 1PL6 motors, shaft height 225

	Terminal box arrangement -Z			Cable entries -Z			
	K09	K10	K11	K08	K83	K84	K85
	NDE **right** (view DE)	NDE **left** (view DE)	NDE **top** (view DE)	Encoder connector mounted opposite	Rotation of terminal box through +90°	Rotation of terminal box through -90°	Rotation of terminal box through 180°

Permissible combinations of mechanical designs for 1PL6 motors, shaft height 280

Selection and ordering data – supplements

Permissible combinations of mechanical designs

5

1PL6 28 . motors **Shaft height 280** Position in Order No. 8. 9. 10. 11. 12. 13. 14. 15. 16. **1PL628 . - ■ . . ■■ - . ■ . .**	**Permissible combinations of mechanical designs** **External fan unit** 8th position in Order No. **1PL628 . - ■ . . . . - . . . .** **Order No. supplement**						
	0	**1**	**2**	**3**	**4**	**5**	**6**
	NDE **top** NDE → DE	NDE **right** NDE → DE	NDE **left** NDE → DE	DE **top** DE → NDE	DE **right** DE → NDE	DE **left** DE → NDE	**Single pipe connection NDE right** (can be modified subseq. to NDE left)
1PL628 . - . . . . 0 - . . . . Type IM B3							
1PL628 . - . . . . 1 - . . . . Type IM V5 (can be modified subsequently to IM V6)							
1PL628 . - . . . . 3 - . . . . Type IM B35							
1PL628 . - . . . . 5 - . . . . Type IM V15 (can be modified subsequently to IM V35)							
Order codes for options							
R1Y Standard finish RAL ...							
R2Y Special finish RAL ...							
G14 With air filter							
K08 Encoder connector mounted opposite							
K55 Cable entry plate, terminal box, customer-specific [1]							
K83 Terminal box rotated through +90 degrees							
K84 Terminal box rotated through -90 degrees							
K85 Terminal box rotated through 180 degrees							
K16 Second standard shaft extension (only possible without encoder)							
K31 Second rating plate							
K45 230 V standstill heating							
C30 690 V version							
Y55 Non-standard shaft extension DE							
Y80 Different rating plate data [1]							
Y82 Extra rating plate with customer data [1]							
M83 Additional thread for a setting screw on motor feet							

Standard design

Released supplementary versions

[1] Plain text is necessary

Permissible combinations of mechanical designs for 1PL6 motors, shaft height 280

Terminal box 11th position in Order No. **1PL628 . - . . . ■ . - . . . .** **Order No. supplement**				**Type** 12th position in Order No. **1PL628 . - . . . . ■ - . . . .** **Order No. supplement**				**Drive type** 14th position in Order No. **1PL628 . - . . . . . - . ■ . .** **Order No. supplement**			
0	**1**	**2**	**5**	**0**	**1**	**3**	**5**	**A**	**B**	**E**	**F**
NDE **right** Cable entry at bottom, encoder connector DE	NDE **left** Cable entry at bottom, encoder connector DE	NDE **top** Cable entry on right, encoder connector DE	DE **top** Cable entry on right, encoder connector NDE	Type **IM B3**	Type **IM V5** (IM V6)	Type **IM B35**	Type **IM V15** (IM V35)	**Coupling N/N**	**Coupling R/R**	**Belt/ increased cantilever forces N/N**	**Belt/ increased cantilever forces R/R**

Selection guides for 1PH7 and 1PL6 motors
Ventilation data and sound pressure level

Ventilation data and sound pressure level

Shaft height SH	Fan motor: Current consumption at			Direction of air flow	Sound pressure level L_{pA} (1 m)	Air flow rate at
	400 V/50 Hz (±10 %)	400 V/60 Hz (±10 %)	480 V/60 Hz (+5 %, –10 %)		Motor + external fan unit Rated load, 50 Hz Tolerance +3 dB Rated pulse frequency 4 kHz/2.5 kHz	50 Hz approx.
	A	A	A		dB	m^3/s
1PH7 motors						
100	0.19	0.13	0.18	NDE → DE	70	0.04
	0.20	0.13	0.20	DE → NDE	70	0.04
132	0.35	0.24	0.32	NDE → DE	70	0.10
	0.37	0.24	0.33	DE → NDE	70	0.10
160	0.29	0.31	0.33	NDE → DE	72	0.15
	0.3	0.33	0.34	DE → NDE	75	0.15
180	0.8	1.1	1.1	NDE → DE, DE → NDE	73	0.19
225	1.9	2.2	2.2	NDE → DE	74	0.36
	2.8	2.8	2.8	DE → NDE	76 [1]	0.36
280	2.55	2.6	2.6	NDE → DE, DE → NDE	74	0.42
1PL6 motors						
180	0.8	1.1	1.1	NDE → DE, DE → NDE	73 [2]	0.27
225	1.9	2.2	2.2	NDE → DE	74 [2]	0.38
	2.8	2.8	2.8	DE → NDE	76 [1] [2]	0.38
280	2.55	2.6	2.6	NDE → DE, DE → NDE	74 [2]	0.52

[1] The sound pressure level can be reduced when the air flow is from the drive end to the non-drive end with option G15 (sound attenuator).

[2] Speed range 0 to 2000 rpm.

Bearing version/drive type and maximum speeds

Shaft height/ Motor type	Bearing type/ Drive type	Bearing arrangement		Max. continuous speed for S1 duty		Max. speed limit [1]	
		Motor end	Bearing designation	n_{s1} rpm	n_{s1} [2] rpm	$n_{max.}$ rpm	$n_{max.}$ [2] rpm
100	Deep-groove ball bearings for coupling or belt output	DE NDE	6308 C4 6208 C4	5500	10000	9000	12000
132	Deep-groove ball bearings for coupling or belt output	DE NDE	6310 C4 6210 C4	4500	8500	8000	10000
160	Deep-groove ball bearings for coupling or belt output	DE NDE	6312 C4 6212 C4	3700	7000	6500	8000
180	Deep-groove ball bearings for coupling output	DE NDE	6214 C3 6214 C3	3500	4500	5000	7000
	Cylindrical roller bearings for belt output	DE NDE	NU22 14E 6214 C3	3500	–	5000	–
	Cylindrical roller bearings for increased cantilever forces	DE NDE	NU22 14E 6214 C3	3000	–	5000	–
225	Deep-groove ball bearings for coupling output	DE NDE	6216 C3 6216 C3	3100	3600 (for 1PH7224)	4500	5500 (for 1PH7224)
	Cylindrical roller bearings for belt output	DE NDE	NU22 16E 6216 C3	3100	–	4500	–
Type 224, 226	Cylindrical roller bearings for increased cantilever forces	DE NDE	NU22 16E 6216 C3	2700	–	4500	–
Type 228	Cylindrical roller bearings for increased cantilever forces	DE NDE	NU22 16E 6216 C3	2500	–	4000	–
280	Deep-groove ball bearings for coupling output	DE NDE	6220 C3 6220 C3	2200	–	3300	–
	Cylindrical roller bearings for belt output	DE NDE	NU22 0E 6220 C3	2200	–	3300	–

Bearing service life

The bearing lifetime is limited by material fatigue (fatigue service life) or lubrication failure (grease service life).

The fatigue service life (static bearing service life L_{10h}) is primarily dependent on the mechanical load. This correlation can be seen in the cantilever force/axial force diagrams. The values are determined in accordance with DIN/ISO 281.

The bearing lifetime is mainly dependent on the bearing size, speed, temperature as well as the vibration load.

The bearing lifetime can be extended by especially favorable operating conditions (low average speed, low bearing temperature, cantilever force or vibration load).

A reduced bearing lifetime can be expected for difficult operating conditions and when motors are mounted vertically.

Further information can be found in the Configuration Manuals.

Lifetime lubrication

At motors equipped with lifetime lubrication, the grease lifetime is harmonized with bearing service life.

In the basic version, motors up to and including shaft height 225 have lubrication for entire service life.

Regreasing

For motors which can be regreased at defined regreasing intervals, the bearing service life can be extended and/or unfavorable factors such as mounting conditions, speed, bearing size and mechanical load compensated.

A lubricating nipple for regreasing is provided as standard on motors with SH 280.

A lubricating nipple for regreasing can be ordered as an optional extra for motors with SH 180 and 225, order code **K40**.

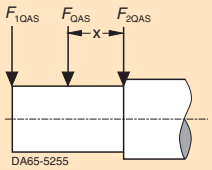
[1] For continuous duty (with 30 % n_{max}, 60 % $^2/_3$ n_{max}, 10 % standstill) for a duty cycle time of 10 min.

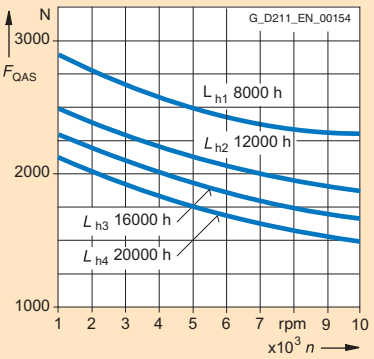
[1] Version for increased maximum speed, see selection and ordering data for 1PH7.

Selection guides for 1PH7 and 1PL6 motors
Cantilever force diagrams

Cantilever force diagrams

Permissible cantilever forces 1PH7 motors Shaft height 100

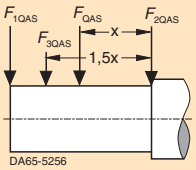


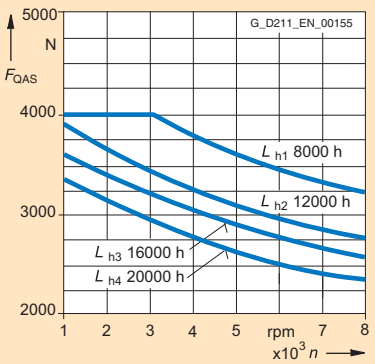


x = 40 mm
F_{1QAS} = 0.9 F_{QAS}
F_{2QAS} = 1.1 F_{QAS}
L_{h1}, L_{h2}, L_{h3}, L_{h4} = lifetime estimate for variable operating conditions (F_{QAS}; n)
q = period of efficiency [%] under constant conditions

$$L_{10hges} = \frac{100}{\frac{q_1}{L_{h1}} + \frac{q_2}{L_{h2}} + \frac{q_3}{L_{h3}} + \frac{q_4}{L_{h4}}}$$

Permissible cantilever forces 1PH7 motors Shaft height 132

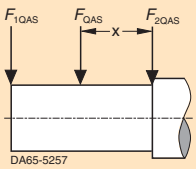


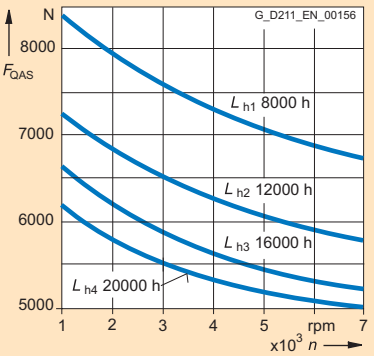


x = 55 mm
F_{1QAS} = max. 2000 N
F_{2QAS} = 1.1 F_{QAS}
F_{3QAS} = max. 2500 N
L_{h1}, L_{h2}, L_{h3}, L_{h4} = lifetime estimate for variable operating conditions (F_{QAS}; n)
q = period of efficiency [%] under constant conditions

$$L_{10hges} = \frac{100}{\frac{q_1}{L_{h1}} + \frac{q_2}{L_{h2}} + \frac{q_3}{L_{h3}} + \frac{q_4}{L_{h4}}}$$

Permissible cantilever forces 1PH7 motors Shaft height 160

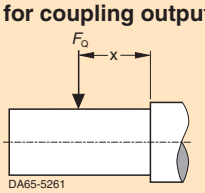


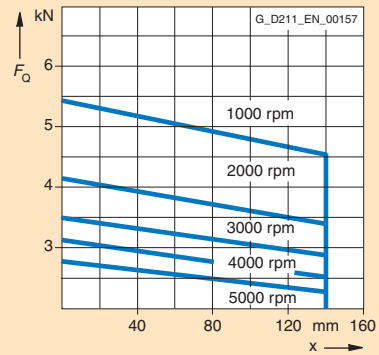


x = 55 mm
F_{1QAS} = 0.9 F_{QAS}
F_{2QAS} = 1.1 F_{QAS}
L_{h1}, L_{h2}, L_{h3}, L_{h4} = lifetime estimate for variable operating conditions (F_{QAS}; n)
q = period of efficiency [%] under constant conditions

$$L_{10hges} = \frac{100}{\frac{q_1}{L_{h1}} + \frac{q_2}{L_{h2}} + \frac{q_3}{L_{h3}} + \frac{q_4}{L_{h4}}}$$

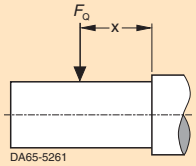
Permissible cantilever forces 1PH718 and 1PL618 motors Shaft height 180 for coupling output

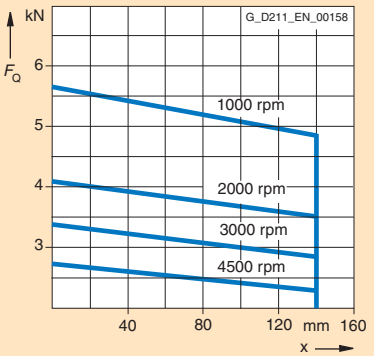




L_{10h} = 20000 h

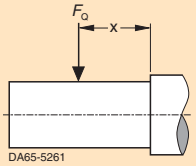
Permissible cantilever forces 1PH722 and 1PL622 motors Shaft height 225 for coupling output



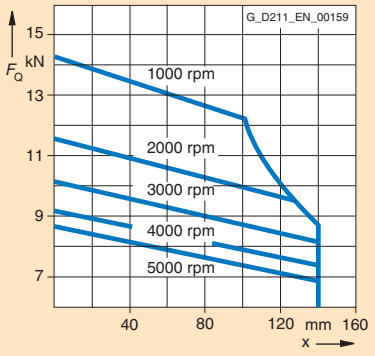


L_{10h} = 20000 h

Permissible cantilever forces 1PH718 and 1PL618 motors Shaft height 180 for belt output



Minimum cantilever force 3 kN

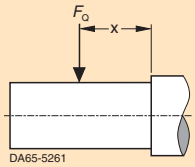


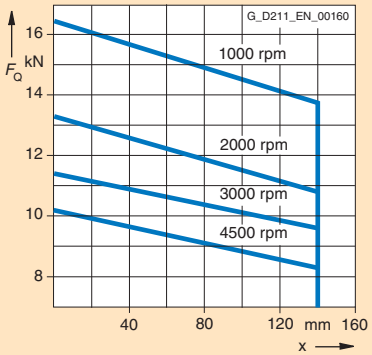
L_{10h} = 12000 h

The roller bearings used here could sustain damage if they are operated under no load.
Observe the specified minimum cantilever forces!

Cantilever force diagrams

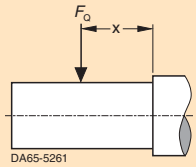
Permissible cantilever forces 1PH722 and 1PL622 motors Shaft height 225 for belt output

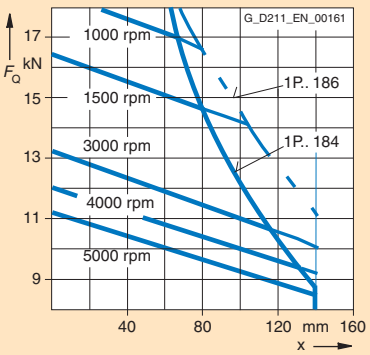




Minimum cantilever force 4 kN L_{10h} = 12000 h

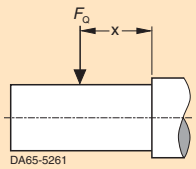
Permissible cantilever forces 1PH718 and 1PL618 motors Shaft height 180 for belt output with increased cantilever force

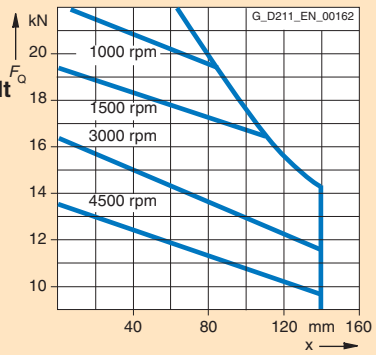




Minimum cantilever force 4 kN L_{10h} = 12000 h

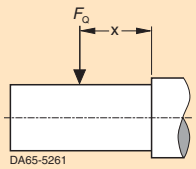
Permissible cantilever forces 1PH722 and 1PL622 motors Shaft height 225 for belt output with increased cantilever force

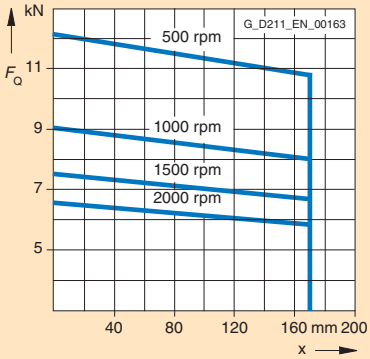




Minimum cantilever force 5 kN L_{10h} = 12000 h

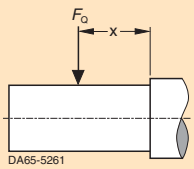
Permissible cantilever forces 1PH728 and 1PL628 motors Shaft height 280 for coupling output

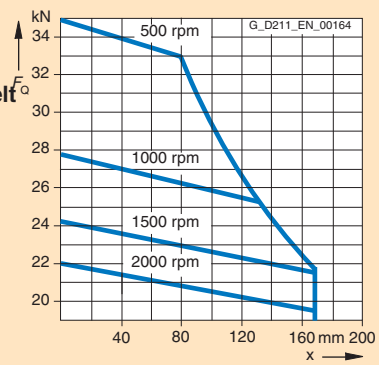




L_{10h} > 20000 h when regreased

Permissible cantilever forces 1PH728 and 1PL628 motors Shaft height 280 for belt output with increased cantilever force





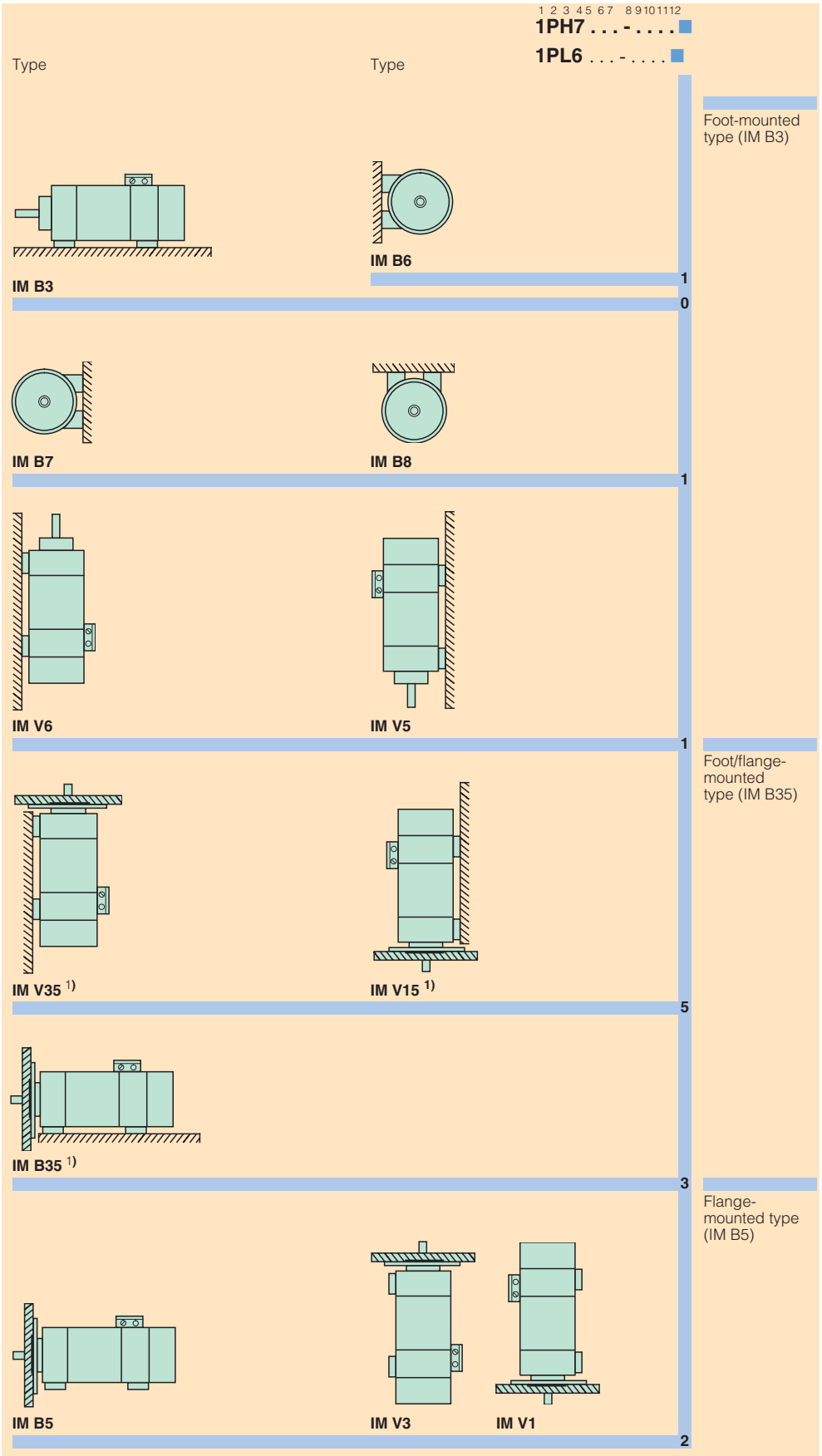
Minimum cantilever force 9 kN L_{10h} > 12000 h when regreased

The roller bearings used here could sustain damage if they are operated under no load.
Observe the specified minimum cantilever forces!

Selection guides for 1PH7 and 1PL6 motors
Mounting position

1PH7 and 1PL6 motors are available in types IM B3 (standard version), IM B5 and IM B35. Other types (IM V15, IM V35, IM B6, IM B7, IM B8 etc.) can also be supplied. Depending on the intended motor mounting position, the motor order (shaft heights 180 and 225) must clearly indicate where the lifting lugs need to be fitted before the motor leaves the factory (12th position in motor order number). In the case of motors of shaft heights 100 to 160, the lifting lug screw fittings can be repositioned later for other hoisting methods.

Note: There are no condensate drain holes in the motors.



1) Flange and foot mounting required.

Terminal box assignment, max. connectable cable cross-sections

Shaft height SH	Motor type	Terminal box type	Cable entry	Max. outer cable diameter	Cable entry	Max. outer cable diameter [2]	Number of main terminals	Max. cross-section per terminal	Max. current per terminal [1]
			Valid for the 8th position of order no. "2", "4" or "6" [3]		Valid for the 8th position of order no. "7" or "8"				
				mm (in)		mm (in)		mm^2	A
1PH7 motors									
100	1PH710.-...	Integrated	PG29	28 (1.10)	M32 x 1.5	21 (0.83)	6 x M5	25	84
132	1PH713.-...	Integrated	PG36	34 (1.34)	M40 x 1.5	28 (1.10)	6 x M6	35	104
160	1PH716.-...	Integrated	PG42	40 (1.57)	M50 x 1.5	38 (1.50)	6 x M6	50	123
180	1PH7184-...	1XB7322	2 x PG42	40 (1.57)	2 x M50 x 1.5	38 (1.50)	3 x M12	2 x 50	191
	1PH7186-..B	1XB7322	2 x PG42	40 (1.57)	2 x M50 x 1.5	38 (1.50)	3 x M12	2 x 50	191
	1PH7186-..D	1XB7322	2 x PG42	40 (1.57)	2 x M50 x 1.5	38 (1.50)	3 x M12	2 x 50	191
	1PH7186-..F	1XB7422	2 x M72 x 2	56 (2.20)	2 x M63 x 1.5	53 (2.09)	3 x M12	2 x 70	242
	1PH7186-..L	1XB7422	2 x M72 x 2	56 (2.20)	2 x M63 x 1.5	53 (2.09)	3 x M12	2 x 70	242
225	1PH7224-..B	1XB7322	2 x PG42	40 (1.57)	2 x M50 x 1.5	38 (1.50)	3 x M12	2 x 50	191
	1PH7224-..D	1XB7322	2 x PG42	40 (1.57)	2 x M50 x 1.5	38 (1.50)	3 x M12	2 x 50	191
	1PH7224-..U	1XB7422	2 x M72 x 2	56 (2.20)	2 x M63 x 1.5	53 (2.09)	3 x M12	2 x 70	242
	1PH7224-..L	1XB7700	3 x M72 x 2	56 (2.20)	3 x M75 x 1.5	68 (2.68)	3 x 2 x M12	3 x 150	583
	1PH7226-..B	1XB7322	2 x PG42	40 (1.57)	2 x M50 x 1.5	38 (1.50)	3 x M12	2 x 50	191
	1PH7226-..D	1XB7422	2 x M72 x 2	56 (2.20)	2 x M63 x 1.5	53 (2.09)	3 x M12	2 x 70	242
	1PH7226-..F	1XB7700	3 x M72 x 2	56 (2.20)	3 x M75 x 1.5	68 (2.68)	3 x 2 x M12	3 x 150	583
	1PH7226-..L	1XB7700	3 x M72 x 2	56 (2.20)	3 x M75 x 1.5	68 (2.68)	3 x 2 x M12	3 x 150	583
	1PH7228-..B	1XB7322	2 x PG42	40 (1.57)	2 x M50 x 1.5	38 (1.50)	3 x M12	2 x 50	191
	1PH7228-..D	1XB7700	3 x M72 x 2	56 (2.20)	3 x M75 x 1.5	68 (2.68)	3 x 2 x M12	3 x 150	583
	1PH7228-..F	1XB7700	3 x M72 x 2	56 (2.20)	3 x M75 x 1.5	68 (2.68)	3 x 2 x M12	3 x 150	583
	1PH7228-..L	1XB7700	3 x M72 x 2	56 (2.20)	3 x M75 x 1.5	68 (2.68)	3 x 2 x M12	3 x 150	583
280	1PH728.-..B	1XB7712	3 x M63 x 1.5	53 (2.09)	–	–	(3+1)[4] x 3 x M16	3 x 95	450
	1PH7284-..C								
	1PH7284-..D								
	1PH7286-..C	1XB7712	3 x M75 x 1.5	68 (2.68)	–	–	(3+1)[4] x 3 x M16	3 x 185	710
	1PH7286-..D								
	1PH7288-..C								
	1PH7288-..D								
	1PH728.-..F								

[1] Current carrying capacity similar to EN 60204-1, installation type C.

[2] Dependent on the version of the metric cable entry gland.

[3] Not for shaft height 280.

[4] Including ground terminal.

Selection guides for 1PH7 motors
Mounted holding brakes

Mounted holding brakes for 1PH7 motors

A brake can be mounted on the drive end of 1PH7 motors with shaft heights 100, 132, 160, 180 and 225.

These brakes are electro-magnetic units for dry-running operation. An electro-magnetic field is used to release the brake which is applied using spring force. It operates according to the closed-circuit principle. When de-energized, the spring-operated brake is applied and holds the drive. When current is flowing, the brake opens and the drive can turn.

When the power fails or an "emergency stop" is issued, the drive is braked from its current speed down to standstill. The holding torques and number of emergency stop operations are shown in the table on page 5/59.

The brakes are intended for connection to alternating voltage 230 V AC, 50 to 60 Hz or to direct voltage 24 V DC (only up to frame size 160), which must be provided by the customer.

The rectifier is built into the terminal box of the brake. The degree of protection is IP55.

In the basic version, the brake has three emergency release screws (only for shaft heights 180 and 225); these are axially accessible from the front. The integrated or built-on microswitch can be incorporated in a higher-level control system as either an NC or an NO contact. The fast switching rectifier is used to overexcite the coil to release the brake and to achieve short release times (release current = 2 x holding current).

All technical specifications such as holding torque, permissible speeds, number of emergency brakes and brake currents are included in the table on page 5/59.

The operating instructions for the mounted holding brake are supplied together with the motor-brake unit.

Ordering example: 1PH7 186-2HF0**0-2**AA3
Type IM B3, holding brake contains microswitch and emergency ventilation screw (for further ordering possibilities, see the order number key on page 5/59).

Mounted holding brake for 1PH7 motors Shaft heights 100 to 160

The holding brakes for motors in shaft heights 100, 132, and 160 are brake modules (manufactured by Binder) with their own bearings, flange and shaft extension. The brake module's flange and shaft extension dimensions are identical to those of the motor. If a motor is to be fitted with a brake, the motor is made in flange-design and with a plain shaft (without a fitted key). The brake module's shaft is then fitted onto the motor shaft by heat shrinking. It can be removed by using an oil-hydraulic interference fit. The brake module is then screwed onto the motor flange. The brake module's shaft extension contains a fitted key (with half-key balancing).

The output can be implemented with either a coupling or belt pulley. The permissible cantilever forces can be found in the appropriate cantilever force diagrams.

1PH7 motors (shaft heights 100, 132) are available with type IM B5; further, motors in shaft heights 100, 132 and 160 are also available with type IM B35 (it is also possible to provide motors with a foot mounting type IM B3).

If required, a manual release can be mounted on the brake, so that the brake can be released manually in the event of a voltage failure or motor shutdown. When the manual release lever is released, it automatically returns to the braking state. It is also possible to install a microswitch, which can then be integrated into a higher-level control system as either an NC or NO contact. The microswitch is connected via a separate cable.

The brake control module has degree of protection IP55. Motors with mounted brake control modules are only available in the vibration severity grade N, and with the shaft and flange accuracy N.

All technical specifications such as holding torque, max. braking force, permissible speeds, cantilever forces and braking currents are included in the table on page 5/59.

Ordering example: 1PH7 137-2HF0**2-3K**B3
Type IM B5, holding brake with manual ventilation (for further ordering options, see the order number key on page 5/59).

Mounted holding brake for 1PH7 motors Shaft heights 180 and 225

For these motors, the brake (manufactured by Stromag) is mounted on the DE bearing end shield. The motor shaft is extended using a shrunk-on stub shaft. The torque is transmitted through a fitted key in accordance with DIN 6885/1.
In addition, the stub shaft can be axially secured using a thrust washer and a central screw (M20). The holding brake does not have its own bearings; the output forces are therefore absorbed by the motor bearings. Due to limitations of space and their high transverse forces, belt pulleys cannot be attached. When selecting the coupling to couple to the motor-brake combination, it should be carefully noted that the shaft extension diameter is larger than the diameter of the motor shaft end. REVOLEX bolt-type couplings 2LF6337 for shaft height 180 and 2LF6338 for shaft height 225 can be used if preferred.

For ordering data and dimensions, see Catalog D 81.1.

Mounted holding brakes for 1PH7 motors (continued)

Technical specifications for the mounted holding brakes with emergency stop function (brake terminal voltage 230 V AC, 50 to 60 Hz/24 V DC +5 % –10 %)

Shaft height	Motor type	Brake type	Holding torque (tolerance ±20 %)	Speed $n_{max.}$	Perm. single switching energy W_E	Service life switching energy $W_{max.}$	No. emergency stops before lining change from $n_{max.}$ at J z		Coil current AC	Coil current DC	Flange dimension DIN 42948	Shaft extension dimension DIN 748 Ø length		Perm. cantilever force (3000 rpm, $x_{max.}$)	Moment of inertia of brake	Weight of brake	Opening time	Closing time
			Nm (lb_f-ft)	rpm	kJ	MJ	–	kgm^2 (lb_f-in-s^2)	A	A		mm (in)	mm (in)	N (lb_f)	kgm^2 (lb_f-in-s^2)	kg (lb)	ms	ms
For 1PH7 motors with brake supply voltage 230 V AC, 50 to 60 Hz																		
100	**1PH710.**	**Size 19**	60 ... 150 (44 ...111)	5500	25	90	8700	0.062 (0.55)	1.0	4.7	A 250	38 (1.50)	80 (3.15)	2300 (517.06)	0.005 (0.04)	21 (46.3)	255	60
132	**1PH713.**	**Size 24**	140 ... 310 (103 ...229)	4500	40	226	9400	0.208 (1.84)	1.3	6.3	A 350	42 (1.65)	110 (4.33)	2000 (449.62)	0.015 (0.13)	46 (101)	330	95
160	**1PH716.**	**Size 29**	280 ... 500 (207...369)	3700	60	401	11900	0.448 (3.97)	1.35	6.7	A 400	55 (2.17)	110 (4.33)	6800 (1528.71)	0.028 (0.25)	66 (146)	350	450
180	**1PH7184** **1PH7186**	**NFE 60** **NFE 60/80**	600 (443) 800 (590)	3500	69 91	154 56	2230 620	1.02 (9.03) 1.36 (12.04)	0.9	–	–	90 (3.54)	90 (3.54)	2800 (629.47)	0.027 (0.24) 0.026 (0.23)	55 (121)	400	160
225	**1PH7224** **1PH7226** **1PH7228**	**NFE 100** **NFE 100** **NFE 100/140**	1000 (738) 1000 (738) 1400 (1033)	3100	158 206 248	153 109 32	970 530 130	3.0 (26.55) 3.9 (34.52) 4.7 (41.60)	1.3	–	–	100 (3.94)	100 (3.94)	2800 (629.47)	0.041 (0.36) 0.041 (0.36) 0.041 (0.36)	75 (165)	460	200

Holding torque in Nm: For motors in shaft heights 100 to 160, the holding torque can be continuously set in the specified value range using a setting ring. The dynamic braking torque is approximately 0.7 to 0.8 x holding torque.

Speed $n_{max.}$: Max. permissible speed at which emergency stops are possible.

Perm. single switching energy W_E in kJ: Perm. switching energy during an emergency stop, $W_E = J_{total} \times n^2/182.5 \times 10^{-3}$ (J in kgm^2, n in rpm)

Service life switching energy $W_{max.}$ in MJ: Max. possible switching energy of the brake (for emergency stop) until the brake linings must be replaced, $W_{max.} = W_E \times z$.

Number of emergency stops z: The specified number of emergency stops refers to the following conditions: Braking from speed $n_{max.}$, $J_{total} = 2 \times J_{mot.}$

A conversion can be made for operation under different conditions: Number of emergency stops $z = W_{max.}/W_E$

Coil current in A: Current in order to maintain the brake in a released condition. The following applies for NFE brakes: Release current = 2 x holding current.

Perm. cantilever force in N: For motors in shaft heights 100 to 160, coupling and belt outputs are possible; for shaft heights 180 and 225, only coupling outputs are permissible.

Opening (release) time in ms: Separating time until the brake opens (the specified values refer to the max. braking torque).

Closing time in ms: Interlocking time until the brake closes (the values refer to the max. braking torque).

Order No. code for 1PH7 shaft heights 100, 132 and 160 for a mounted holding brake with emergency stop function

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16
1PH7 . . . - . . . . . - K . .

No brake	**0**
Brake supply voltage: 230 V AC, 50 to 60 Hz	
With brake (brake supply voltage: 230 V AC, 50 to 60 Hz)	**1**
With brake (brake has microswitch)	**2**
With brake (brake has manual release)	**3**
With brake (brake has a microswitch and manual release)	**4**
Brake supply voltage: 24 V DC	
With brake (brake supply voltage: 24 V DC)	**5**
With brake (brake has microswitch)	**6**
With brake (brake has manual release)	**7**
With brake (brake has a microswitch and manual release)	**8**

Brake versions are only possible in the following combination:
- Vibration magnitude grade N, shaft and flange accuracy tolerance N ("**K**" in 14th position)
- Shaft extension on the brake module with fitted key and half-key balancing ("**A**" or "**B**" at the 15th position) or plain shaft extension ("**J**" or "**K**" at the 15th position)
- Type IM B5 (only for sizes 100 and 132, "**2**" at the 12th position) or IM B35 ("**3**" at the 12th position, can be mounted/installed with foot type IM B3)
- and "**0**", "**3**" or "**6**" at the 16th position.

Order No. code for 1PH7 shaft heights 180 and 225 for a mounted holding brake with emergency stop function

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16
1PH7 . . . - . . . . 0 - AA .

No brake	**0**
With brake (brake has microswitch and emergency release screw)	**2**
With brake (brake has microswitch and manual release)	**4**

Versions 2 and 4 are only available as type IM B3, i.e.:
- at the 12th position, only "**0**"
- at the 14th position, only "**A**"
- at the 15th position, only "**A**"
- and at the 16th position only "**0**", "**3**" or "**6**".

Selection guides for 1PL6 motors
Terminal box assignment/cable cross-sections

Terminal box assignment, max. connectable cable cross-sections

Shaft height SH	Motor type	Terminal box type	Cable entry	Max. outer cable diameter	Cable entry	Max. outer cable diameter [2]	Number of main terminals	Max. cross-section per terminal	Max. current per terminal [1]
			Valid for the 8th position of order no. "2", "4" or "6" [3]		Valid for the 8th position of order no. "7" or "8"				
				mm (in)		mm (in)		mm^2	A
1PL6 motors									
180	1PL6184-..B	1XB7322	2 x PG 42	40 (1.57)	2 x M50 x 1.5	38 (1.50)	3 x M12	2 x 50	191
	1PL6184-..D	1XB7322	2 x PG 42	40 (1.57)	2 x M50 x 1.5	38 (1.50)	3 x M12	2 x 50	191
	1PL6184-..F	1XB7322	2 x PG 42	40 (1.57)	2 x M50 x 1.5	38 (1.50)	3 x M12	2 x 50	191
	1PL6184-..L	1XB7422	2 x M72 x 2	56 (2.20)	2 x M63 x 1.5	53 (2.09)	3 x M12	2 x 70	242
	1PL6186-..B	1XB7322	2 x PG 42	40 (1.57)	2 x M50 x 1.5	38 (1.50)	3 x M12	2 x 50	191
	1PL6186-..D	1XB7322	2 x PG 42	40 (1.57)	2 x M50 x 1.5	38 (1.50)	3 x M12	2 x 50	191
	1PL6186-..F	1XB7422	2 x M72 x 2	56 (2.20)	2 x M63 x 1.5	53 (2.09)	3 x M12	2 x 70	242
	1PL6186-..L	1XB7700	3 x M72 x 2	56 (2.20)	3 x M75 x 1.5	68 (2.68)	3 x 2 x M12	3 x 150	583
225	1PL6224-..B	1XB7322	2 x PG 42	40 (1.57)	2 x M50 x 1.5	38 (1.50)	3 x M12	2 x 50	191
	1PL6224-..D	1XB7422	2 x M72 x 2	56 (2.20)	2 x M63 x 1.5	53 (2.09)	3 x M12	2 x 70	242
	1PL6224-..F	1XB7700	3 x M72 x 2	56 (2.20)	3 x M75 x 1.5	68 (2.68)	3 x 2 x M12	3 x 150	583
	1PL6224-..L	1XB7700	3 x M72 x 2	56 (2.20)	3 x M75 x 1.5	68 (2.68)	3 x 2 x M12	3 x 150	583
	1PL6226-..B	1XB7322	2 x PG 42	40 (1.57)	2 x M50 x 1.5	38 (1.50)	3 x M12	2 x 50	191
	1PL6226-..D	1XB7700	3 x M72 x 2	56 (2.20)	3 x M75 x 1.5	68 (2.68)	3 x 2 x M12	3 x 150	583
	1PL6226-..F	1XB7700	3 x M72 x 2	56 (2.20)	3 x M75 x 1.5	68 (2.68)	3 x 2 x M12	3 x 150	583
	1PL6226-..L	1XB7700	3 x M72 x 2	56 (2.20)	3 x M75 x 1.5	68 (2.68)	3 x 2 x M12	3 x 150	583
	1PL6228-..B	1XB7322	2 x PG 42	40 (1.57)	2 x M50 x 1.5	38 (1.50)	3 x M12	2 x 50	191
	1PL6228-..D	1XB7700	3 x M72 x 2	56 (2.20)	3 x M75 x 1.5	68 (2.68)	3 x 2 x M12	3 x 150	583
	1PL6228-..F	1XB7700	3 x M72 x 2	56 (2.20)	3 x M75 x 1.5	68 (2.68)	3 x 2 x M12	3 x 150	583
	1PL6228-..L	1XB7700	3 x M72 x 2	56 (2.20)	3 x M75 x 1.5	68 (2.68)	3 x 2 x M12	3 x 150	583
280	1PL628.	1XB7712	4 x M75 x 1.5	68 (2.68)	–	–	(3+1)[4] x 4 x M16	4 x 185	925

[1] Current carrying capacity similar to EN 60204-1, installation type C.

[2] Dependent on the version of the metric cable entry gland.

[3] Not for shaft height 280.

[4] Including ground terminal.

1PH4 motors
Water cooling

Overview

1PH4 AC motors, shaft heights 100 to 160

The AC motors in the 1PH4 series are compact, water-cooled squirrel-cage asynchronous motors with a high degree of protection.

They have been designed specifically for use in conjunction with the SINAMICS S120 drive system, allowing power losses and noise levels to be reduced to a minimum. 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 IP65 (shaft exit IP55)
- Speed down to zero without reducing the torque
- Low noise level
- Bearings for high cantilever load
- Ruggedness
- Essentially maintenance-free
- High rotational accuracy
- Integrated encoder system to sense the motor speed, connected using a connector
- Terminal box to connect the power cables
- Motor temperature monitoring with KTY 84
- Maximum permissible water pressure 6 bar

Applications

- All applications in which extreme ambient conditions, such as dust, dirt, or a corrosive atmosphere, do not permit air cooling
- In processes in which the environment must not be heated
- On special machines, when cooling water is an inherent process element

1PH4 motors
Water cooling

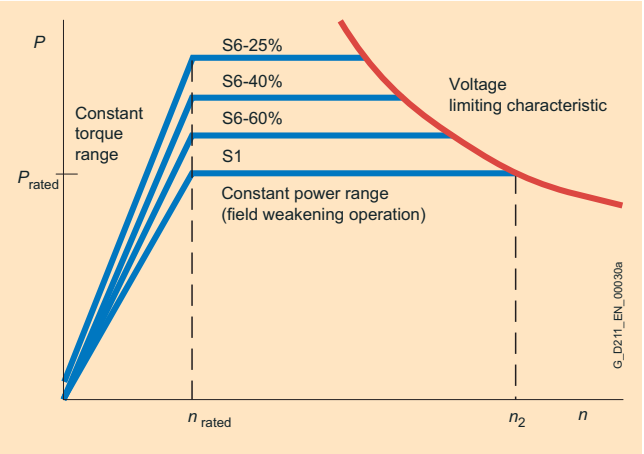
Technical specifications

Insulation of the stator winding in accordance with EN 60034-1 (IEC 60034-1)	Temperature class 155 (F) for a coolant inlet temperature of up to +30 °C (77 °F)
Cooling according to EN 60034-6 (IEC 60034-6)	Water cooling Due to the possible formation of condensation, we recommend a coolant inlet temperature of approximately +30 °C (86 °F) (depending on ambient conditions). Max. cooling water pressure at inlet: 6 bar Cooling water quantity/connecting thread at NDE: 1PH410: 6 l/min/G ¼ 1PH413: 8l/min/G 3/8 1PH416:10l/min/G ½
Temperature monitoring	KTY 84 temperature sensor in stator winding
Type according to EN 60034-7 (IEC 60034-7)	IM B35 (IM V15, IM V35)
Degree of protection according to EN 60034-5 (IEC 60034-5)	IP65 (IP55 on shaft exit)
Shaft extension on the drive end to DIN 748-3 (IEC 60072-1)	With fitted key, full-key balancing
Shaft and flange accuracy in accordance with DIN 42955 (IEC 60072-1) [1]	Tolerance N (normal)
Vibration magnitude in accordance with EN 60034-14 (IEC 60034-14)	Grade R (reduced)
Sound pressure level L_{pA} (1 m) in accordance with DIN EN ISO 1680 Tolerance +3 dB	1PH410: 69 dB 1PH413: 69 dB 1PH416: 71 dB
Bearing versions	Duplex bearing at DE for belt output (minimum cantilever force required)
Built-in encoder system for motors without DRIVE-CLiQ interface	• Incremental encoder HTL 1024 S/R • Incremental encoder HTL 2048 S/R • Incremental encoder sin/cos 1 V_{PP} with C and D track • Incremental encoder sin/cos 1 V_{PP} without C and D track • Absolute encoder EnDat 2048 S/R
Built-in encoder systems 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 (can be rotated 4 x 90°)
Paint finish	Anthracite RAL 7016
Options	Refer to Options and Selection and ordering data

S/R = Signals/Revolution

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

Characteristics



Speed/power characteristic

Options

Order code	Option description
K00	**Bearing version** (view DE) (default = duplex bearing) • Single bearing - for coupling [1] - for planetary gearbox, e.g. ZF gearbox 2LG43..., type IM B35, IM V15 [1)2)] - for low to moderate cantilever forces
	Vibration magnitude in accordance with EN 60034-14 (IEC 60034-14) (standard = vibration magnitude grade R, duplex bearing)
K05	- Grade S with duplex bearing arrangement [3]
K02	- Grade S with single bearing arrangement [3]
K03	- Grade SR with single bearing [3]
K04	**Shaft and flange accuracy** in accordance with DIN 42955 (IEC 60072-1) (standard = tolerance N) - Tolerance R [4]
	Shaft extension (DE) (standard = full-key balancing with keyway)
K42	- Plain shaft
L69	- Half-key balancing
	Shaft seal (DE) [5]
K18	- Rotary shaft seal, oil-tight, IP65
	Brake [1]
G46	- With holding brake mounted on DE
	Terminal box arrangement (view DE) (standard = top)
K09	- Right-hand side
K10	- Left-hand side
	Terminal box rotation
K83	- By 90°, cable entry from drive end
K84	- By 90°, cable entry from non-drive end
K85	- By 180°
	Speed [6]
L37	- Increased maximum speed and half-key balancing
	Rating plate
K31	- Second rating plate, separately packed
	Encoder system
H30	- Without encoder

[1] Options mutually exclude each other.

[2] Vibration magnitude grades S/SR are not available for models with mounted gearboxes. For ZF gearbox 2LG42... the order code **K00 + G97** must be used (for gearbox selection, see "Gearboxes").

[3] Automatically includes version **K04**.

[4] Increased shaft accuracy.

[5] Only recommended if the sealing ring is occasionally lubricated with oil spray or mist.

[6] Version for increased maximum speed includes vibration magnitude grade SR and half-key balancing. The following options are not possible:

- Prepared for ZF gearbox mounting
- Shaft seal

1PH4 motors
Water cooling

Selection and ordering data

Rated speed n_{rated} rpm	Shaft height SH	Rated power P_{rated} kW (HP)	Rated torque M_{rated} Nm (lb_f-ft)	Rated current I_{rated} A	Rated voltage V_{rated} V	Speed during field weakening [1] n_2 rpm	Continuous speed, max. [2] n_{S1} rpm	Speed, max. [3] n_{max} rpm	**1PH4 asynchronous motor** [4] Order No.
400 V 3 AC line voltage, Servo Control									
1500	100	7.5 (10.1)	48 (35.4)	20.5	350	3200	5600	7500 [6]	**1PH4103-4 ■ F 5 6**
		11 (14.8)	70 (51.6)	28	350	2900	5600	7500 [6]	**1PH4105-4 ■ F 5 6**
		14 (18.8)	89 (65.6)	35.5	350	3150	5600	7500 [6]	**1PH4107-4 ■ F 5 6**
	132	15 (20.1)	95 (70.1)	35	350	2200	5200	6700	**1PH4133-4 ■ F 5 6**
		22 (29.5)	140 (103)	52	350	2600	5200	6700	**1PH4135-4 ■ F 5 6**
		27 (36.2)	172 (127)	62	350	2450	5200	6700	**1PH4137-4 ■ F 5 6**
	160	37 (49.6)	236 (174)	89	350	3000	4000	5300	**1PH4163-4 ■ F 5 6**
		46 (61.7)	293 (216)	107	350	2850	4000	5300	**1PH4167-4 ■ F 5 6**
		52 (69.7)	331 (224)	117	350	2700	4000	5300	**1PH4168-4 ■ F 5 6**

Encoder systems for motors without DRIVE-CLiQ interface:	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**

Selection and ordering data

Power factor	Magnetizing current	Efficiency	Rated frequency	Moment of inertia	Weight, approx.	1PH4 asynchronous motor [4]	SINAMICS S120 Motor Module	
							Rated output current	
$\cos \varphi$	I_μ A	η_{rated}	f_{rated} Hz	J kgm^2 (lb$_f$-in-s^2)	kg (lb)	Order No.	I_{rated} A	Order No.
400 V 3 AC line voltage, Servo Control								
0.74	12	0.820	52.8	0.017 (0.15)	52 (115)	**1PH4103-4 . F5 6**	18 [5]	**6SL3120-■T E21-8AA3**
0.78	13.5	0.836	52.9	0.024 (0.21)	67 (148)	**1PH4105-4 . F5 6**	30	**6SL3120-1 T E23-0AA3**
0.77	18.5	0.851	52.5	0.031 (0.27)	80 (176)	**1PH4107-4 . F5 6**	45	**6SL3120-1 T E24-5AA3**
0.81	13	0.877	51.8	0.046 (0.41)	90 (198)	**1PH4133-4 . F5 6**	45	**6SL3120-1 T E24-5AA3**
0.79	24	0.890	51.4	0.071 (0.63)	112 (247)	**1PH4135-4 . F5 6**	60	**6SL3120-1 T E26-0AA3**
0.81	24	0.895	51.5	0.085 (0.75)	130 (287)	**1PH4137-4 . F5 6**	60 [5]	**6SL3120-1 T E26-0AA3**
0.77	45	0.905	50.9	0.170 (1.5)	175 (386)	**1PH4163-4 . F5 6**	85 [5]	**6SL3120-1 T E28-5AA3**
0.79	48	0.910	51.0	0.206 (1.82)	210 (463)	**1PH4167-4 . F5 6**	132	**6SL3120-1 T E31-3AA3**
0.81	48	0.913	51.0	0.220 (1.95)	240 (529)	**1PH4168-4 . F5 6**	132	**6SL3120-1 T E31-3AA3**

Special versions:	Specify supplementary order code and plain text if applicable (see options).	**–Z**
Motor Module:	Single Motor Module Double Motor Module	**1** **2**

[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] Standard version with duplex bearing.

[5] The rated output current of the Motor Module is lower than the motor rated current.

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

1PH4 motors
Water cooling

Selection and ordering data

Rated speed n_{rated} rpm	Shaft height SH	Rated power P_{rated} kW (HP)	Rated torque M_{rated} Nm (lb_f-ft)	Rated current I_{rated} A	Rated voltage V_{rated} V	Speed during field weakening [1] n_2 rpm	Continuous speed, max. [2] n_{S1} rpm	Speed, max. [3] n_{max} rpm	**1PH4 asynchronous motor** [4] Order No.
400 V 3 AC line voltage, Vector Control									
1750	100	8.8 (11.8)	48 (35.4)	20.5	400	3750	5600	7500 [6]	**1PH4103-4 ■ F 5 6**
		12.8 (17.2)	70 (51.6)	28	400	3450	5600	7500 [6]	**1PH4105-4 ■ F 5 6**
		16.3 (21.9)	89 (65.6)	35.5	400	3700	5600	7500 [6]	**1PH4107-4 ■ F 5 6**
	132	17.5 (23.5)	96 (70.8)	35.5	400	2550	5200	6700	**1PH4133-4 ■ F 5 6**
		25.5 (34.2)	139 (103)	52	400	3000	5200	6700	**1PH4135-4 ■ F 5 6**
		31.5 (42.2)	172 (127)	63	400	2800	5200	6700	**1PH4137-4 ■ F 5 6**
	160	43 (57.7)	235 (173)	88	400	3400	4000	5300	**1PH4163-4 ■ F 5 6**
		54 (72.4)	295 (218)	107	400	3200	4000	5300	**1PH4167-4 ■ F 5 6**
		61 (81.8)	333 (246)	117	400	3050	4000	5300	**1PH4168-4 ■ F 5 6**

Encoder systems for motors without DRIVE-CLiQ interface:	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**

Selection and ordering data

Power factor	Magnetizing current	Efficiency	Rated frequency	Moment of inertia	Weight, approx.	1PH4 asynchronous motor [4]	SINAMICS S120 Motor Module	
							Rated output current	
cos φ	I_μ A	η_{rated}	f_{rated} Hz	J kgm² (lb_f-in-s²)	kg (lb)	Order No.	I_{rated} A	Order No.
400 V 3 AC line voltage, Vector Control								
0.75	11.5	0.841	61.2	0.017 (0.15)	52 (115)	**1PH4103-4 . F 5 6**	18 [5]	**6SL3120-■TE21-8AA3**
0.78	13.5	0.854	61.3	0.024 (0.21)	67 (148)	**1PH4105-4 . F 5 6**	30	**6SL3120-1TE23-0AA3**
0.78	18	0.867	61.0	0.031 (0.27)	80 (176)	**1PH4107-4 . F 5 6**	45	**6SL3120-1TE24-5AA3**
0.82	12	0.887	60.2	0.046 (0.41)	90 (198)	**1PH4133-4 . F 5 6**	45	**6SL3120-1TE24-5AA3**
0.79	22	0.901	59.8	0.071 (0.63)	112 (247)	**1PH4135-4 . F 5 6**	60	**6SL3120-1TE26-0AA3**
0.81	23	0.905	59.9	0.085 (0.75)	130 (287)	**1PH4137-4 . F 5 6**	60 [5]	**6SL3120-1TE26-0AA3**
0.78	42	0.914	59.3	0.170 (1.5)	175 (386)	**1PH4163-4 . F 5 6**	85 [5]	**6SL3120-1TE28-5AA3**
0.80	44	0.920	59.4	0.206 (1.82)	210 (463)	**1PH4167-4 . F 5 6**	132	**6SL3120-1TE31-3AA3**
0.82	43	0.921	59.4	0.220 (1.95)	240 (529)	**1PH4168-4 . F 5 6**	132	**6SL3120-1TE31-3AA3**

Special versions:	Specify supplementary order code and plain text if applicable (see options).	**–Z**
Motor Module:	Single Motor Module Double Motor Module	**1** **2**

[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] Standard version with duplex bearing.

[5] The rated output current of the Motor Module is lower than the motor rated current.

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

1PH4 motors
Water cooling

Selection and ordering data

Rated speed n_{rated} rpm	Shaft height SH	Rated power P_{rated} kW (HP)	Rated torque M_{rated} Nm (lb_f-ft)	Rated current I_{rated} A	Rated voltage V_{rated} V	Speed during field weakening [1] n_2 rpm	Continuous speed, max. [2] n_{S1} rpm	Speed, max. [3] n_{max} rpm	1PH4 asynchronous motor [4] Order No.
480 V 3 AC line voltage, Servo/Vector Control									
2000	100	9.5 (12.7)	45 (32.2)	19.5	450	4850	5600	7500 [6]	**1PH4103- 4 ■ F 5 6**
		14 (18.8)	67 (49.4)	26.5	450	4450	5600	7500 [6]	**1PH4105- 4 ■ F 5 6**
		18 (24.1)	86 (63.4)	34.5	450	4700	5600	7500 [6]	**1PH4107- 4 ■ F 5 6**
	132	19 (25.5)	91 (67.1)	33.5	450	3300	5200	6700	**1PH4133- 4 ■ F 5 6**
		28 (37.6)	134 (98.8)	50	450	3720	5200	6700	**1PH4135- 4 ■ F 5 6**
		34 (45.6)	162 (120)	59	450	3600	5200	6700	**1PH4137- 4 ■ F 5 6**
	160	47 (63.0)	224 (165)	84	450	4300	4000	5300	**1PH4163- 4 ■ F 5 6**
		58 (77.8)	277 (204)	101	450	3980	4000	5300	**1PH4167- 4 ■ F 5 6**
		65 (87.2)	310 (289)	110	450	3750	4000	5300	**1PH4168- 4 ■ F 5 6**

Encoder systems for motors without DRIVE-CLiQ interface:	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**

Selection and ordering data

Power factor	Magnetizing current	Efficiency	Rated frequency	Moment of inertia	Weight, approx.	1PH4 asynchronous motor [4]	SINAMICS S120 Motor Module	
							Rated output current	
$\cos \varphi$	I_μ A	η_{rated}	f_{rated} Hz	J kgm^2 (lb$_f$-in-s^2)	kg (lb)	Order No.	I_{rated} A	Order No.
480 V 3 AC line voltage, Servo/Vector Control								
0.74	11.2	0.856	69.3	0.017 (0.15)	52 (115)	**1PH4 103- 4 . F 5 6**	18 [5]	**6SL3120-■TE21-8AA3**
0.79	12.9	0.870	69.4	0.024 (0.21)	67 (148)	**1PH4 105- 4 . F 5 6**	30	**6SL3120-1TE23-0AA3**
0.78	17.1	0.879	69.1	0.031 (0.27)	80 (176)	**1PH4 107- 4 . F 5 6**	45	**6SL3120-1TE24-5AA3**
0.83	11.9	0.899	68.4	0.046 (0.41)	90 (198)	**1PH4 133- 4 . F 5 6**	45	**6SL3120-1TE24-5AA3**
0.80	21.5	0.909	68.1	0.071 (0.63)	112 (247)	**1PH4 135- 4 . F 5 6**	60	**6SL3120-1TE26-0AA3**
0.83	22.1	0.914	68.1	0.085 (0.75)	130 (287)	**1PH4 137- 4 . F 5 6**	60	**6SL3120-1TE26-0AA3**
0.79	39.7	0.923	67.6	0.170 (1.5)	175 (386)	**1PH4 163- 4 . F 5 6**	85	**6SL3120-1TE28-5AA3**
0.81	42.6	0.926	67.6	0.206 (1.82)	210 (463)	**1PH4 167- 4 . F 5 6**	132	**6SL3120-1TE31-3AA3**
0.83	41	0.928	67.6	0.220 (1.95)	240 (529)	**1PH4 168- 4 . F 5 6**	132	**6SL3120-1TE31-3AA3**

Special versions:	Specify supplementary order code and plain text if applicable (see options).	**–Z**
Motor Module:	Single Motor Module Double Motor Module	**1** **2**

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) Standard version with duplex bearing.

5) The rated output current of the Motor Module is lower than the motor rated current.

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

Dimension drawings

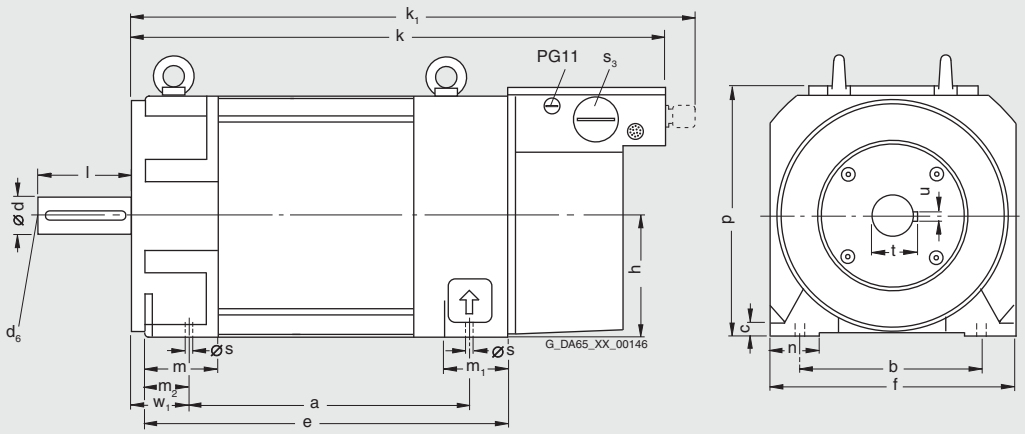
1PH7 motors
Forced ventilation

For motor		Dimensions in mm (in)																
Shaft height	Type	**DIN IEC**	a B	b A	c LA	e M	f AB	h H	k LB	k_1 –	m BA	m_1 –	m_2 –	n AA	p HD	s K	s_3 –	w_1 C
1PH7, type IM B3, forced ventilation																		
100	**1PH7101 1PH7103**		202.5 (7.97)	160 (6.3)	11 (0.43)	263 (10.35)	196 (7.72)	100 (3.94)	411 (16.18)	434 (17.09)	52 (2.05)	64 (2.52)	27 (1.06)	39 (1.54)	220 (8.66)	12 (0.47)	PG29	40 (1.57)
	1PH7105 1PH7107		297.5 (11.71)			358 (14.09)			506 (19.92)	529 (20.83)								
132	**1PH7131 1PH7133**		265.5 (10.45)	216 (8.5)	14 (0.55)	341 (13.43)	260 (10.24)	132 (5.2)	538 (21.18)	561 (22.09)	63 (2.48)	75 (2.95)	33 (1.3)	52 (2.05)	275 (10.83)	12 (0.47)	PG36	50 (1.97)
	1PH7135 1PH7137		350.5 (13.8)			426 (16.77)			623 (24.53)	646 (25.43)								
160	**1PH7163**		346.5 (13.64)	254 (10)	17 (0.67)	438 (17.24)	314 (12.36)	160 (6.3)	640 (25.2)	663 (26.1)	78 (3.07)	81 (3.19)	42 (1.65)	62 (2.44)	330 (12.99)	14 (0.55)	PG42	64 (2.52)
	1PH7167		406.5 (16)			498 (19.61)			700 (27.56)	723 (28.46)								

		DE shaft extension					
Shaft height	Type	**DIN IEC**	**d D**	d_6 –	l E	t GA	u F
100	**1PH7101 1PH7103 1PH7105 1PH7107**		**38 (1.5)**	M12	80 (3.15)	41 (1.61)	10 (0.39)
132	**1PH7131 1PH7133 1PH7135 1PH7137**		**42 (1.65)**	M16	110 (4.33)	45 (1.77)	12 (0.47)
160	**1PH7163 1PH7167**		**55 (2.17)**	M20	110 (4.33)	59 (2.32)	16 (0.63)

For deviating and additional dimensions for 1PH7 motors with DRIVE-CLiQ, see 1PH7 motors with DRIVE-CLiQ.

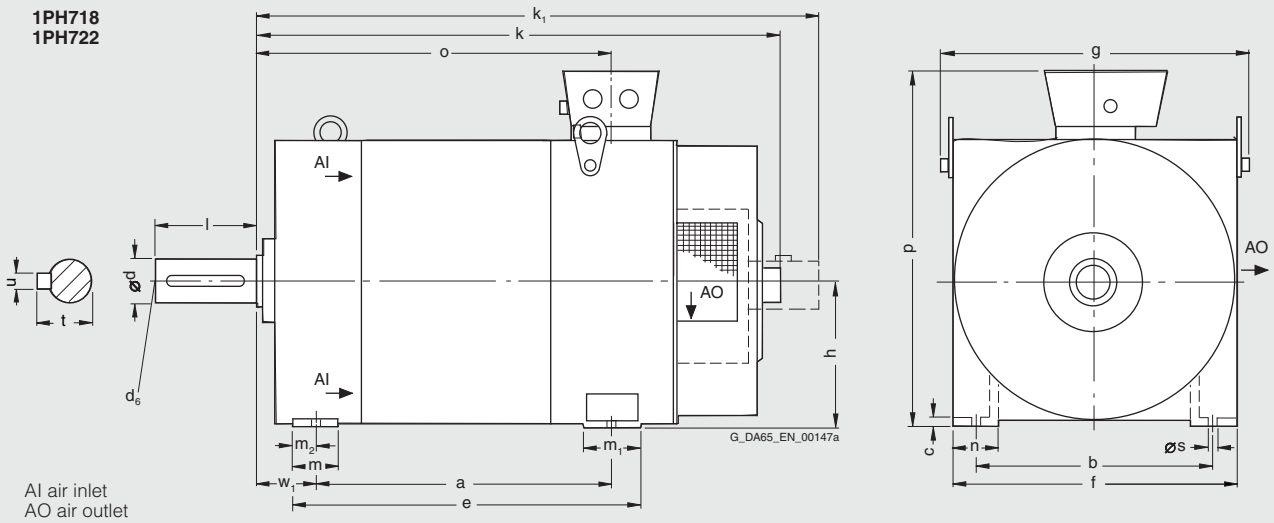
1PH710
1PH713
1PH716



For motor		Dimensions in mm (in)															Terminal box type 1XB7...		
																	...322	...422	...700
Shaft height	Type	DIN IEC	a B	b A	c LA	e M	f AB	g AC	h H	k LB	k_1 –	m BA	m_1 –	m_2 –	n AA	o –	p [1] HD	p [1] HD	p [1] HD
1PH7, type IM B3, forced ventilation, direction of air flow DE → NDE																			
180	**1PH7184**		430 (16.93)	279 (10.98)	14 (0.55)	510 (20.08)	360 (14.17)	408 (16.09)	180 (7.09)	835 (32.87)	–	60 (2.36)	120 (4.72)	35 (1.38)	65 (2.56)	541 (21.3)	495 (19.49)	–	–
	1PH7186		520 (20.47)			600 (23.62)				925 (36.42)						631 (24.84)		545 (21.46)	–
225	**1PH7224**		445 (17.52)	356 (14.02)	18 (0.71)	530 (20.87)	450 (17.72)	498 (19.61)	225 (8.86)	–	1100 (43.31)	60 (2.36)	120 (4.72)	40 (1.57)	85 (3.35)	629 (24.76)	595 (23.43)	645 (25.39)	680 (26.77)
	1PH7226		545 (21.45)			630 (24.8)					1200 (47.24)					729 (28.7)			
	1PH7228		635 (25)			720 (28.35)					1290 (50.78)					819 (32.24)		–	

		DE shaft extension						
Shaft height	Type	DIN IEC	s K	w_1 C	**d D**	d_6 –	l E	t GA	u F
180	**1PH7184**		14.5 (0.57)	121 (4.76)	**60 (2.36)**	M20	140 (5.51)	64 (2.52)	18 (0.72)
	1PH7186				**65 (2.56)**			69 (2.72)	
225	**1PH7224 1PH7226 1PH7228**		18.5 (0.73)	149 (5.87)	**75 (2.95)**	M20	140 (5.51)	79.5 (3.13)	20 (0.79)

1PH718
1PH722



AI air inlet
AO air outlet

[1] Maximum dimensions, depending on electrical version (terminal box type).

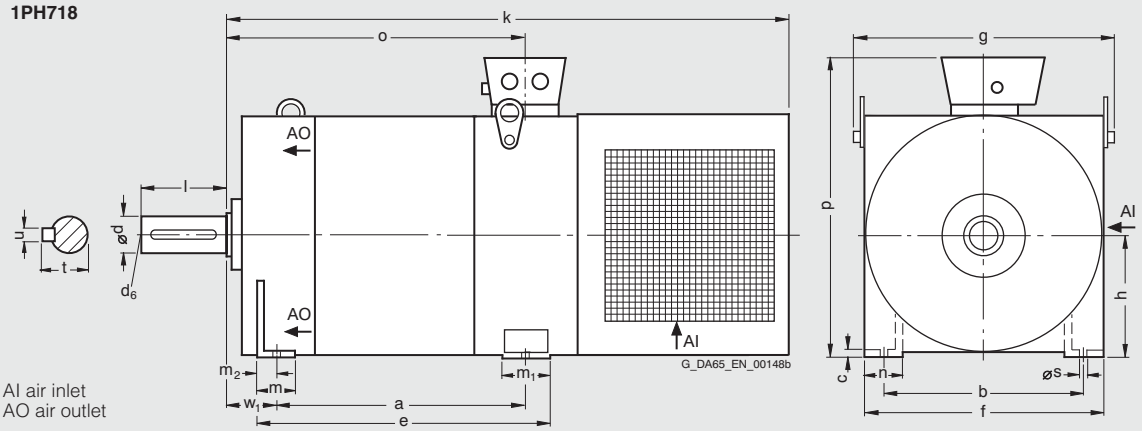
Dimension drawings

1PH7 motors
Forced ventilation

For motor			Dimensions in mm (in)														Terminal box type 1XB7...		
																	...322	...422	...700
Shaft height	Type	DIN IEC	a B	b A	c LA	e M	f AB	g AC	h H	k LB	m BA	m_1 –	m_2 –	n AA	o –	p [1] HD	p [1] HD	p [1] HD	p [1] HD
1PH7, type IM B3, forced ventilation, direction of air flow NDE → DE																			
180	**1PH7184**		430 (16.93)	279 (10.98)	14 (0.55)	510 (20.08)	360 (14.17)	405 (15.94)	180 (7.09)	1010 (39.76)	60 (2.36)	120 (4.72)	35 (1.38)	65 (2.56)	541 (21.3)	495 (19.49)	–	–	
	1PH7186		520 (20.47)			600 (23.62)				1100 (43.31)					631 (24.84)		560 (22.05)	–	
225	**1PH7224**		445 (17.52)	356 (14.02)	18 (0.71)	530 (20.87)	450 (17.72)	498 (19.61)	225 (8.86)	1090 (42.91)	60 (2.36)	120 (4.72)	40 (1.57)	85 (3.35)	629 (24.76)	595 (23.43)	645 (25.39)	680 (26.77)	
	1PH7226		545 (21.46)			630 (24.8)				1190 (46.85)					729 (28.7)				
	1PH7228		635 (25)			720 (28.35)				1280 (50.39)					819 (32.24)		–		

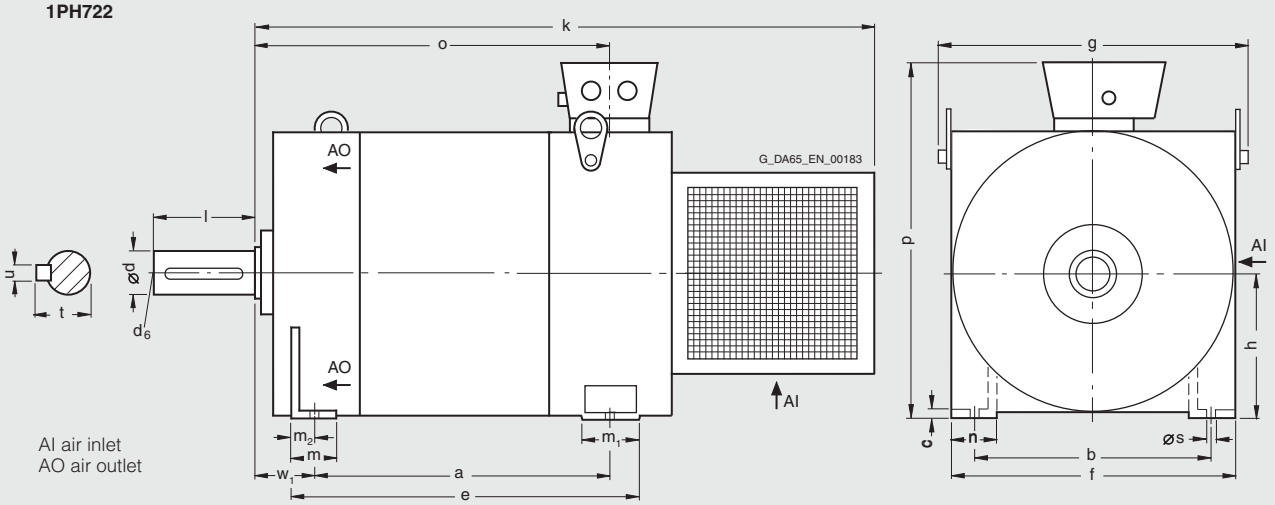
For motor			DE shaft extension						
Shaft height	Type	DIN IEC	s K	w_1 C	**d** D	d_6 –	l E	t GA	u F
180	**1PH7184**		14.5 (0.57)	121 (4.76)	**60 (2.36)**	M20	140 (5.51)	64 (2.52)	18 (0.71)
	1PH7186				**65 (2.56)**			69 (2.72)	
225	**1PH7224 1PH7226 1PH7228**		18.5 (0.73)	149 (5.87)	**75 (2.95)**	M20	140 (5.51)	79.5 (3.13)	20 (0.79)

1PH718



AI air inlet
AO air outlet

1PH722



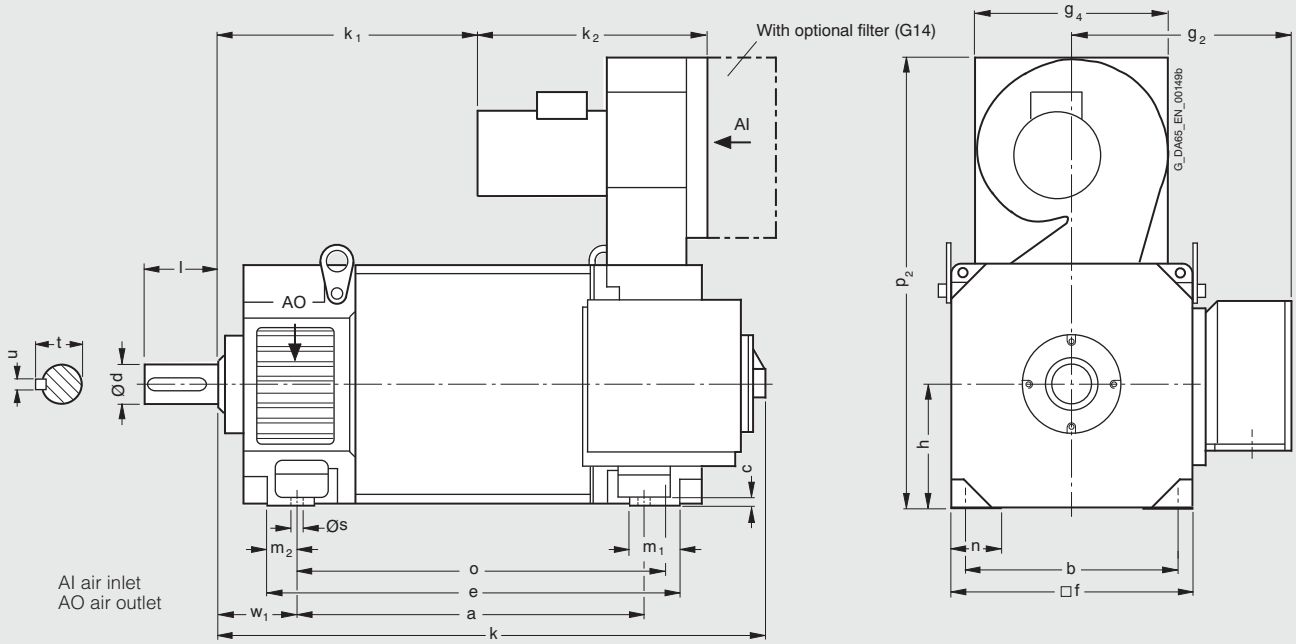
AI air inlet
AO air outlet

[1] Maximum dimensions, depending on electrical version (terminal box type).

For motor		Dimensions in mm (in)																	
Shaft height	Type	**DIN IEC** a B	b A	c HA	e BB	f AB	g_2 AD	g_4 –	h H	k LB	k_1 –	k_2 –	m_1 –	m_2 –	n AA	o –	p_2 –	s K
1PH7, type IM B3, forced ventilation, direction of air flow NDE → DE																		
280	**1PH7284**	684 (26.9)	457 (17.99)	22 (0.87)	840 (33.07)	560 (22.05)	518 (20.39)	449 (17.68)	280 (11.02)	1146 (45.12)	489 (19.25)	546 (21.5)	108 (4.25)	78 (3.07)	100 (3.94)	731 (28.78)	1042 (41.02)	24 (0.94)
	1PH7286	794 (31.26)			950 (37.4)					1256 (49.45)	599 (23.58)					841 (33.11)		
	1PH7288	924 (36.38)			1080 (42.52)					1386 (54.57)	729 (28.7)					971 (38.23)		

		DE shaft extension				
Shaft height	Type	**DIN IEC** w_1 C	**d D**	l E	t GA	u FA
280	**1PH7284 1PH7286 1PH7288**	190 (7.48)	**95 (3.74)**	170 (6.69)	100 (3.94)	25 (0.98)

1PH728



Dimension drawings

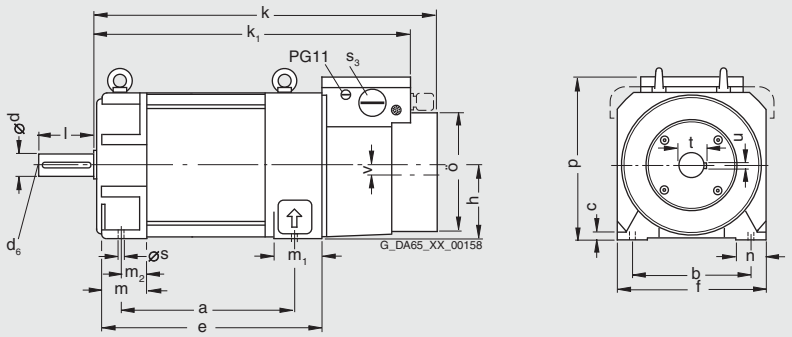
1PH7 motors
Forced ventilation

For motor			Dimensions in mm (in)													
Shaft height	Type	**DIN** **IEC**	a B	b A	c LA	e M	f AB	h H	k LB	k_1 –	m BA	m_1 –	m_2 –	n AA	ö –	p HD
1PH7, type IM B3, forced ventilation, with pipe connection, NDE																
100	**1PH7101** **1PH7103**		202.5 (7.97)	160 (6.3)	11 (0.43)	263 (10.35)	196 (7.72)	100 (3.94)	441 (17.36)	411 (16.18)	52 (2.05)	64 (2.52)	25 (0.98)	39 (1.54)	161 (6.34)	220 (8.66)
	1PH7105 **1PH7107**		297.5 (11.71)			358 (14.09)			536 (21.1)	506 (19.92)						
132	**1PH7131** **1PH7133**		265.5 (10.45)	216 (8.5)	14 (0.55)	341 (13.43)	260 (10.24)	132 (5.2)	573 (22.56)	538 (21.18)	63 (2.48)	75 (2.95)	30 (1.18)	52 (2.05)	211.5 (8.33)	275 (10.83)
	1PH7135 **1PH7137**		350.5 (13.8)			426 (16.77)			658 (25.91)	623 (24.53)						
160	**1PH7163**		346.5 (13.64)	254 (10)	17 (0.67)	438 (17.24)	314 (12.36)	160 (6.3)	674 (26.54)	640 (25.2)	78 (3.07)	81 (3.19)	36 (1.42)	62 (2.44)	253 (9.96)	330 (12.99)
	1PH7167		406.5 (16)			498 (19.61)			734 (28.9)	700 (27.56)						

			DE shaft extension								
Shaft height	Type	**DIN** **IEC**	s K	s_3 –	v –	w_1 C	**d** **D**	d_6 –	l E	t GA	u F
100	**1PH710.**		12 (0.47)	PG29	10.5 (0.41)	40 (1.57)	**38** **(1.5)**	M12	80 (3.15)	41.3 (1.63)	10 (0.39)
132	**1PH713.**		12 (0.47)	PG36	17 (0.67)	50 (1.97)	**42** **(1.65)**	M16	110 (4.33)	45.3 (1.78)	12 (0.47)
160	**1PH716.**		14 (0.55)	PG42	17 (0.67)	64 (2.52)	**55** **(2.17)**	M20	110 (4.33)	56.3 (2.22)	16 (0.63)

For deviating and additional dimensions for 1PH7 motors with DRIVE-CLiQ, see 1PH7 motors with DRIVE-CLiQ.

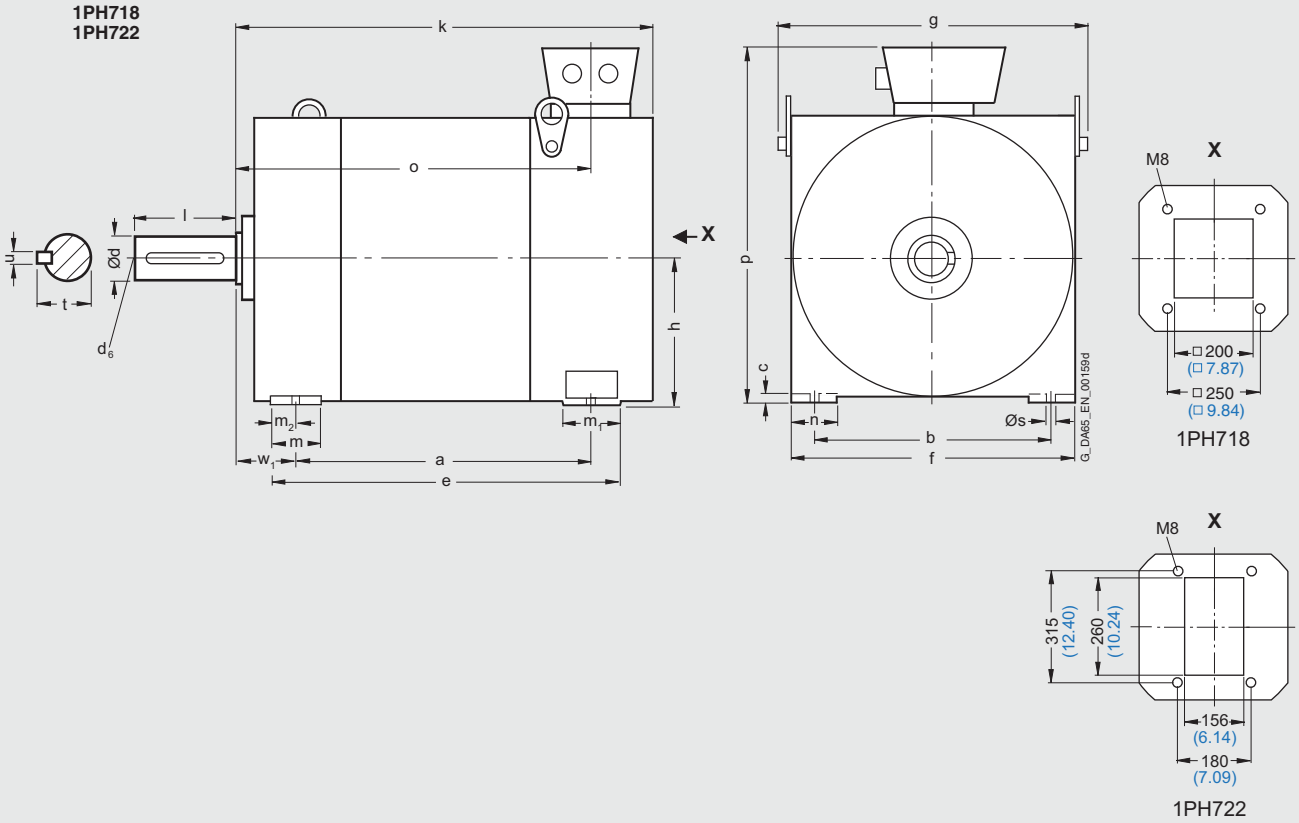
1PH710
1PH713
1PH716



For motor		Dimensions in mm (in)														Terminal box type 1XB7...		
																...322	...422	...700
Shaft height	Type	DIN IEC	a B	b A	c LA	e M	f AB	g AC	h H	k LB	m BA	m_1 –	m_2 –	n AA	o –	p [1] HD	p [1] HD	p [1] HD
1PH7, type IM B3, forced ventilation, with pipe connection, NDE																		
180	**1PH7184**		430 (16.93)	279 (10.98)	14 (0.55)	510 (20.08)	360 (14.17)	408 (16.06)	180 (7.09)	830 (32.68)	60 (2.36)	120 (4.72)	35 (1.38)	65 (2.56)	541 (21.3)	495 (19.49)	–	–
	1PH7186		520 (20.47)			600 (23.62)				920 (36.22)					631 (24.84)		560 (22.05)	–
225	**1PH7224**		445 (17.52)	356 (14.02)	18 (0.71)	530 (20.78)	450 (17.72)	498 (19.61)	225 (8.86)	950 (37.4)	60 (2.36)	120 (4.72)	40 (1.57)	80 (3.15)	629 (24.76)	595 (23.43)	645 (25.39)	680 (26.77)
	1PH7226		545 (21.46)			630 (24.8)				1050 (41.34)					729 (28.7)			
	1PH7228		635 (25)			720 (28.35)				1140 (44.88)					819 (32.24)		–	

			DE shaft extension						
Shaft height	Type	DIN IEC	s K	w_1 C	**d D**	d_6 –	l E	t GA	u F
180	**1PH7184**		14.5 (0.57)	121 (4.76)	**60 (2.36)**	M20	140 (5.51)	64 (2.52)	18 (0.71)
	1PH7186				**65 (2.56)**			69 (2.72)	
225	**1PH7224 1PH7226 1PH7228**		18.5 (0.73)	149 (5.87)	**75 (2.95)**	M20	140 (5.51)	79.5 (3.13)	20 (0.79)

1PH718
1PH722



[1] Maximum dimensions, depending on electrical version (terminal box type).

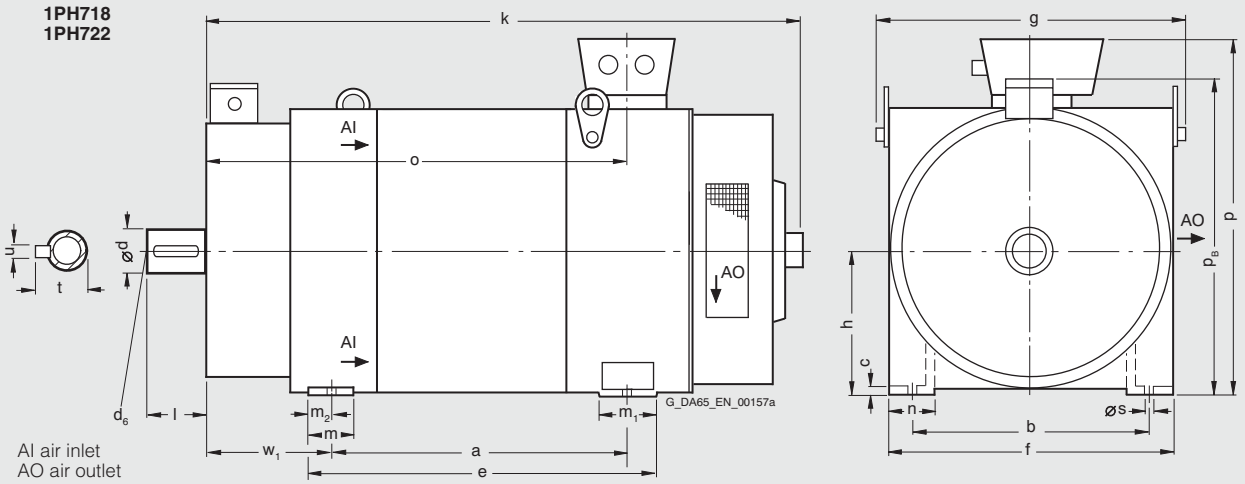
Dimension drawings

1PH7 motors
Forced ventilation

For motor		Dimensions in mm (in)														Terminal box type 1XB7...		
																...322	...422	...700
Shaft height	Type	DIN IEC	a B	b A	c LA	e M	f AB	g AC	h H	k LB	m BA	m_1 –	m_2 –	n AA	o –	p [1] HD	p [1] HD	p [1] HD
1PH7, type IM B3, forced ventilation, with brake control module, direction of air flow DE → NDE																		
180	**1PH7184**		430 (16.93)	279 (10.98)	14 (0.55)	510 (20.08)	360 (14.17)	408 (16.06)	180 (7.09)	945 (37.2)	60 (2.36)	120 (4.72)	35 (1.38)	65 (2.56)	644 (25.35)	495 (19.49)	–	–
	1PH7186		520 (20.47)			600 (23.62)				1035 (40.75)					734 (28.9)		560 (22.05)	–
225	**1PH7224**		445 (17.52)	356 (14.02)	18 (0.71)	530 (20.87)	450 (17.72)	498 (19.61)	225 (8.86)	1230 (48.43)	60 (2.36)	120 (4.72)	40 (1.57)	80 (3.15)	758 (29.84)	595 (23.43)	645 (25.39)	680 (26.77)
	1PH7226		545 (21.46)			630 (24.8)				1330 (52.36)					858 (33.78)			
	1PH7228		635 (25)			720 (28.35)				1420 (55.91)					948 (37.32)		–	

			DE shaft extension							
Shaft height	Type	DIN IEC	p_B –	s K	w_1 C	**d** **D**	d_6 –	l E	t GA	u F
180	**1PH7184** **1PH7186**		390 (15.4)	14.5 (0.57)	224 (8.82)	**90** **(3.54)**	M20	90 (3.54)	95 (3.74)	25 (0.98)
225	**1PH7224** **1PH7226** **1PH7228**		450 (17.7)	18.5 (0.73)	278 (10.9)	**100** **(3.94)**	M20	100 (3.94)	106 (4.17)	28 (1.1)

1PH718
1PH722



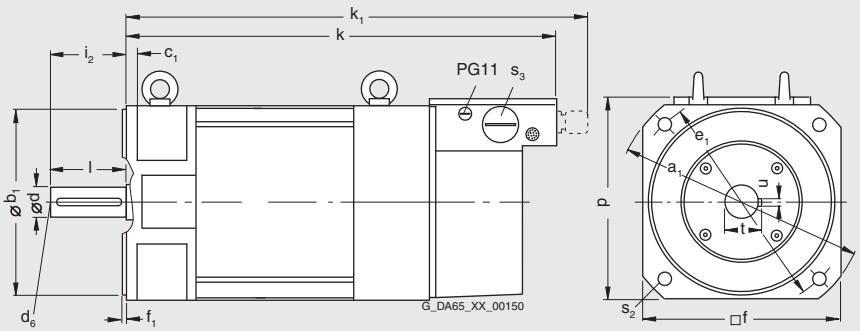
AI air inlet
AO air outlet

[1] Maximum dimensions, depending on electrical version (terminal box type).

For motor		Dimensions in mm (in)													DE shaft extension				
Shaft height	Type	DIN IEC	a_1 P	b_1 N	c_1 LA	e_1 M	f AB	f_1 T	i_2 –	k LB	k_1 –	p HD	s_2 S	s_3 –	**d** **D**	d_6 –	l E	t GA	u F
1PH7, type IM B5, forced ventilation																			
100	**1PH7101** **1PH7103**		250 (9.84)	180 (7.09)	10 (0.39)	215 (8.46)	196 (7.72)	4 (0.16)	80 (3.15)	411 (16.18)	434 (17.09)	218 (8.58)	14 (0.55)	PG29	**38** **(1.5)**	M12	80 (3.15)	41 (1.61)	10 (0.39)
	1PH7105 **1PH7107**									506 (19.92)	529 (20.83)								
132	**1PH7131** **1PH7133**		350 (13.78)	250 (9.84)	16 (0.63)	300 (11.81)	260 (10.24)	5 (0.2)	110 (4.33)	538 (21.18)	561 (22.09)	273 (10.75)	18 (0.71)	PG36	**42** **(1.65)**	M16	110 (4.33)	45 (1.77)	12 (0.47)
	1PH7135 **1PH7137**									623 (24.53)	646 (25.43)								

For deviating and additional dimensions for 1PH7 motors with DRIVE-CLiQ, see 1PH7 motors with DRIVE-CLiQ.

1PH710
1PH713



Dimension drawings

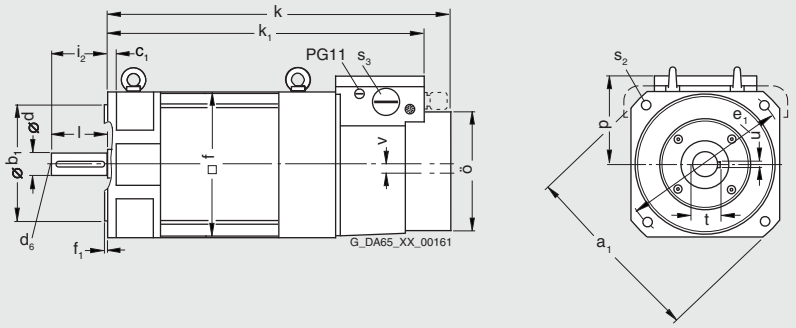
1PH7 motors
Forced ventilation

For motor		Dimensions in mm (in)															
Shaft height	Type	**DIN IEC**	a_1 P	b_1 N	c_1 LA	e_1 M	f AB	f_1 T	i_2 –	k LB	k_1 –	ö –	p HD	s_2 S	s_3 –	v –
1PH7, type IM B5, forced ventilation, with pipe connection, NDE																
100	**1PH7101 1PH7103**		250 (9.84)	180 (7.09)	10 (0.39)	215 (8.46)	196 (7.72)	4 (0.16)	80 (3.15)	441 (17.36)	411 (16.18)	161 (6.34)	120 (4.72)	14 (0.55)	PG29	10.5 (0.41)
	1PH7105 1PH7107									536 (21.1)	506 (19.92)					
132	**1PH7131 1PH7133**		350 (13.78)	250 (9.84)	16 (0.63)	300 (11.81)	260 (10.24)	5 (0.2)	110 (4.33)	573 (22.56)	538 (21.18)	211.5 (8.33)	143 (5.63)	18 (0.71)	PG36	17 (0.67)
	1PH7135 1PH7137									658 (25.91)	623 (24.53)					

		DE shaft extension				
Shaft height	Type	**DIN IEC**	**d D**	d_6 –	l E	t GA	u F
100	**1PH7101 1PH7103 1PH7105 1PH7107**		**38 (1.5)**	M12	80 (3.15)	41 (1.61)	10 (0.39)
132	**1PH7131 1PH7133 1PH7135 1PH7137**		**42 (1.65)**	M16	110 (4.33)	45 (1.77)	12 (0.47)

For deviating and additional dimensions for 1PH7 motors with DRIVE-CLiQ, see 1PH7 motors with DRIVE-CLiQ.

1PH710
1PH713

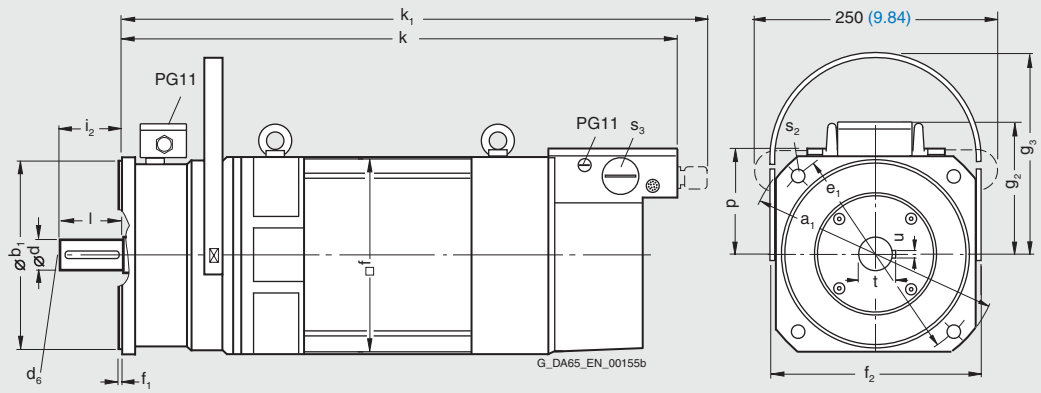


For motor		Dimensions in mm (in)															
Shaft height	Type	DIN IEC	a_1 P	b_1 N	c_1 LA	e_1 M	f AB	f_1 T	f_2 –	g_2 AB	g_3 T	i_2 –	k LB	k_1 –	p HD	s_2 S	s_3 S
1PH7, type IM B5, forced ventilation, with brake control module																	
100	**1PH7101 1PH7103**		250 (9.84)	180 (7.09)	13 (0.51)	215 (8.46)	196 (7.72)	4 (0.16)	220 (8.66)	149 (5.87)	224 (8.82)	80 (3.15)	541 (21.3)	564 (22.2)	120 (4.72)	14 (0.55)	PG29
	1PH7105 1PH7107												636 (25.04)	659 (25.94)			
132	**1PH7131 1PH7133**		–	250 (9.84)	18 (0.71)	300 (11.81)	260 (10.24)	5 (0.2)	278 (10.94)	174 (6.85)	269 (10.59)	110 (4.33)	700 (27.56)	723 (28.46)	143 (5.63)	18 (0.71)	PG36
	1PH7135 1PH7137												785 (30.91)	808 (31.81)			

		DE shaft extension					
Shaft height	Type	DIN IEC	**d** **D**	d_6 –	l E	t GA	u F
100	**1PH7101 1PH7103 1PH7105 1PH7107**		**38 (1.5)**	M12	80 (3.15)	41 (1.61)	10 (0.39)
132	**1PH7131 1PH7133 1PH7135 1PH7137**		**42 (1.65)**	M16	110 (4.33)	45 (1.77)	12 (0.47)

For deviating and additional dimensions for 1PH7 motors with DRIVE-CLiQ, see 1PH7 motors with DRIVE-CLiQ.

1PH710
1PH713



Dimension drawings

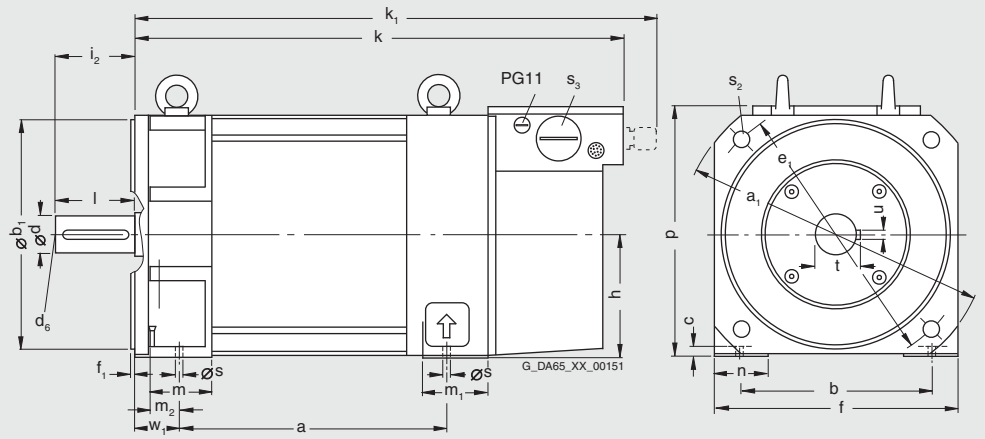
1PH7 motors
Forced ventilation

For motor		Dimensions in mm (in)																
Shaft height	Type	**DIN** **IEC** a B	a_1 P	b A	b_1 N	c LA	e_1 M	f AB	f_1 T	h H	i_2 –	k LB	k_1 –	m BA	m_1 –	m_2 –	n AA	p HD
1PH7, type IM B35, forced ventilation																		
100	**1PH7101** **1PH7103**	202.5 (7.97)	250 (9.84)	160 (6.3)	180 (7.09)	11 (0.43)	215 (8.46)	196 (7.72)	4 (0.16)	100 (3.94)	80 (3.15)	411 (16.18)	435 (17.13)	52 (2.05)	64 (2.52)	27 (1.06)	39 (1.54)	220 (8.66)
	1PH7105 **1PH7107**	297.5 (11.71)										506 (19.92)	529 (20.83)					
132	**1PH7131** **1PH7133**	265.5 (10.45)	350 (13.78)	216 (8.5)	250 (9.84)	14 (0.55)	300 (11.81)	260 (10.24)	5 (0.2)	132 (5.2)	110 (4.33)	538 (21.18)	561 (22.09)	63 (2.48)	75 (2.95)	33 (1.3)	52 (2.05)	275 (10.83)
	1PH7135 **1PH7137**	350.5 (13.8)										623 (24.53)	646 (25.43)					
160	**1PH7163**	346.5 (13.64)	400 (15.75)	254 (10)	300 (11.81)	17 (0.67)	350 (13.78)	314 (12.36)	5 (0.2)	160 (6.3)	110 (4.33)	640 (25.2)	663 (26.1)	78 (3.07)	81 (3.19)	42 (1.65)	62 (2.44)	330 (12.99)
	1PH7167	406.5 (16)										700 (27.56)	723 (28.46)					

		DE shaft extension								
Shaft height	Type	**DIN** **IEC** s K	s_2 S	s_3 –	w_1 C	**d** **D**	d_6 –	l E	t GA	u F
100	**1PH7101** **1PH7103** **1PH7105** **1PH7107**	12 (0.47)	14 (0.55)	PG29	40 (1.57)	**38** **(1.5)**	M12	80 (3.15)	41 (1.61)	10 (0.39)
132	**1PH7131** **1PH7133** **1PH7135** **1PH7137**	12 (0.47)	18 (0.71)	PG36	50 (1.97)	**42** **(1.65)**	M16	110 (4.33)	45 (1.77)	12 (0.47)
160	**1PH7163** **1PH7167**	14 (0.47)	18 (0.71)	PG42	64 (2.52)	**55** **(2.17)**	M20	110 (4.33)	59 (2.32)	16 (0.63)

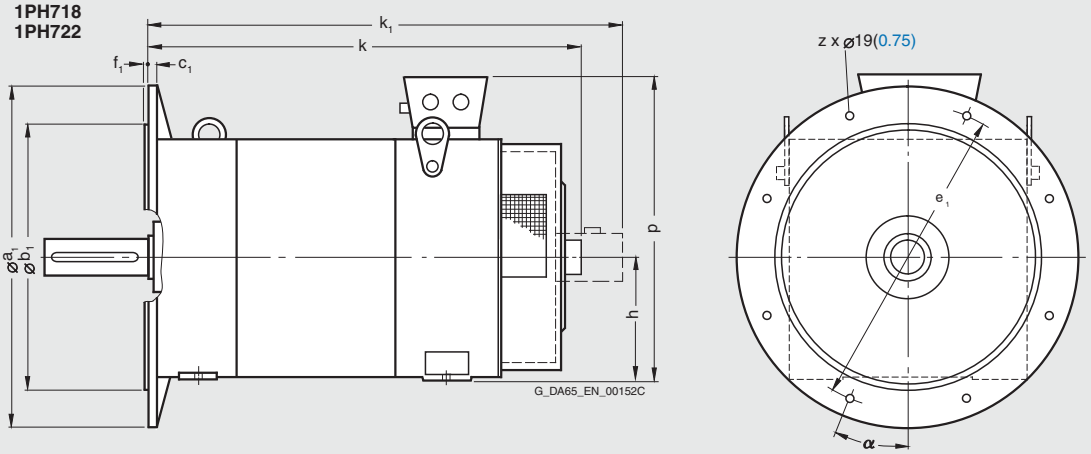
For deviating and additional dimensions for 1PH7 motors with DRIVE-CLiQ, see 1PH7 motors with DRIVE-CLiQ.

1PH710
1PH713
1PH716



For motor		Dimensions in mm (in)									For dimensions for foot mounting, shaft and terminal box, see dimension drawing of 1PH718 and 1PH722 motors, type IM B3. Terminal box type 1XB7...				
Shaft height	Type	DIN IEC	a_1 P	b_1 N	c_1 LA	e_1 M	f_1 T	h H	k LB	k_1 –	...322 p [1]	...422 p [1]	...700 p [1]	z –	α –
1PH7, type IM B35, forced ventilation, direction of air flow DE → NDE															
180	**1PH7184**		400 (15.75)	300 (11.81)	15 (0.59)	350 (13.78)	5 (0.2)	180 (7.09)	835 (32.87)	–	495 (19.49)	–	–	4	45°
	1PH7184		450 (17.72)	350 (13.78)	16 (0.63)	400 (15.75)			835 (32.87)			–	–	8	22.5°
	1PH7186								925 (36.42)			560 (22.05)	–		
225	**1PH7224**		550 (21.65)	450 (17.72)	18 (0.71)	500 (19.69)	5 (0.2)	225 (8.86)	–	1100 (43.31)	595 (23.43)	645 (25.39)	680 (26.77)	8	22.5°
	1PH7226									1200 (47.24)					
	1PH7228									1290 (50.79)		–			

1PH718
1PH722



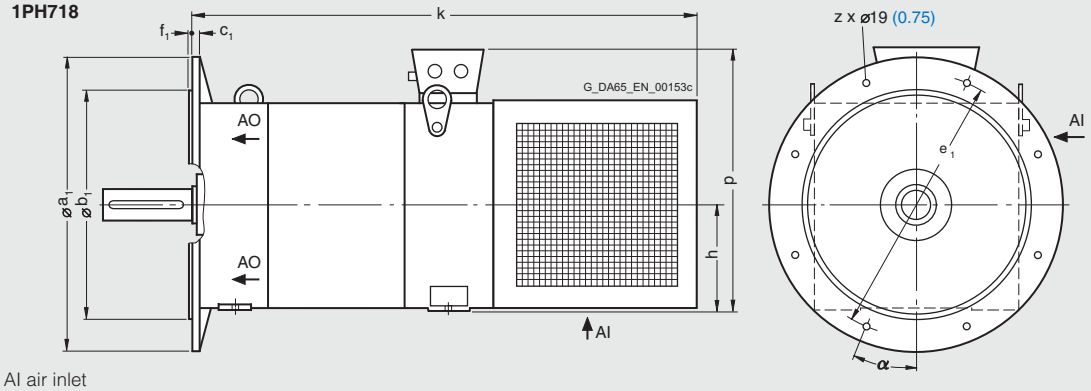
[1] Maximum dimensions, depending on electrical version (terminal box type).

Dimension drawings

1PH7 motors
Forced ventilation

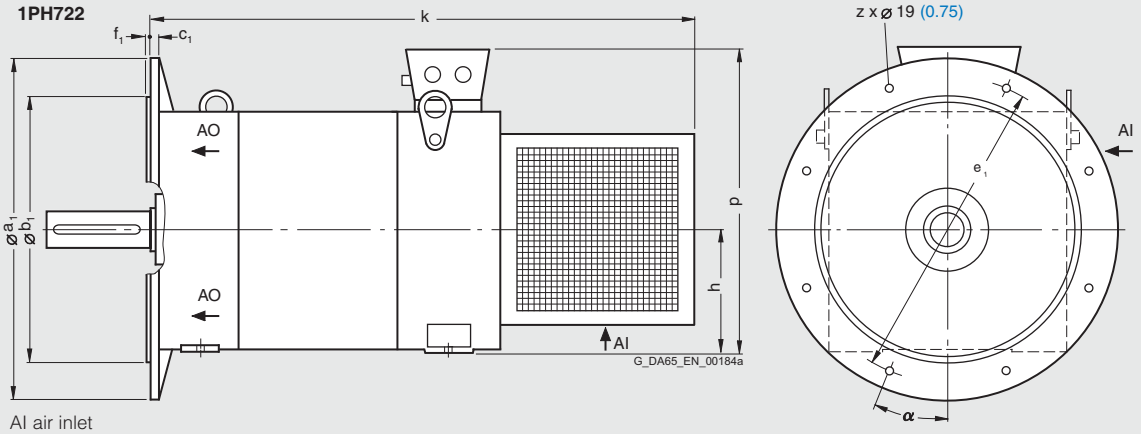
For motor		Dimensions in mm (in)								For dimensions of the shaft and terminal box foot installation, see dimension drawing of 1PH718 and 1PH722 motors, type IM B3. Terminal box type 1XB7...				
Shaft height	Type	DIN IEC	a_1 P	b_1 N	c_1 LA	e_1 M	f_1 T	h H	k LB	...322 p [1]	...422 p [1]	...700 p [1]	z –	α –
1PH7, type IM B35, forced ventilation, direction of air flow NDE → DE														
180	**1PH7184**		400 (15.75)	300 (11.81)	15 (0.59)	350 (13.78)	5 (0.2)	180 (7.09)	1010 (39.76)	495 (19.49)	–	–	4	45°
	1PH7184		450 (17.72)	350 (13.78)	16 (0.63)	400 (15.75)			1010 (39.76)		–	–	8	22.5°
	1PH7186								1100 (43.31)		560 (22.05)	–		
225	**1PH7224**		550 (21.65)	450 (17.72)	18 (0.71)	500 (19.69)	5 (0.2)	225 (8.86)	1090 (42.91)	595 (23.43)	645 (25.39)	680 (26.77)	8	22.5°
	1PH7226								1190 (46.85)					
	1PH7228								1280 (50.39)		–			

1PH718



AI air inlet
AO air outlet

1PH722

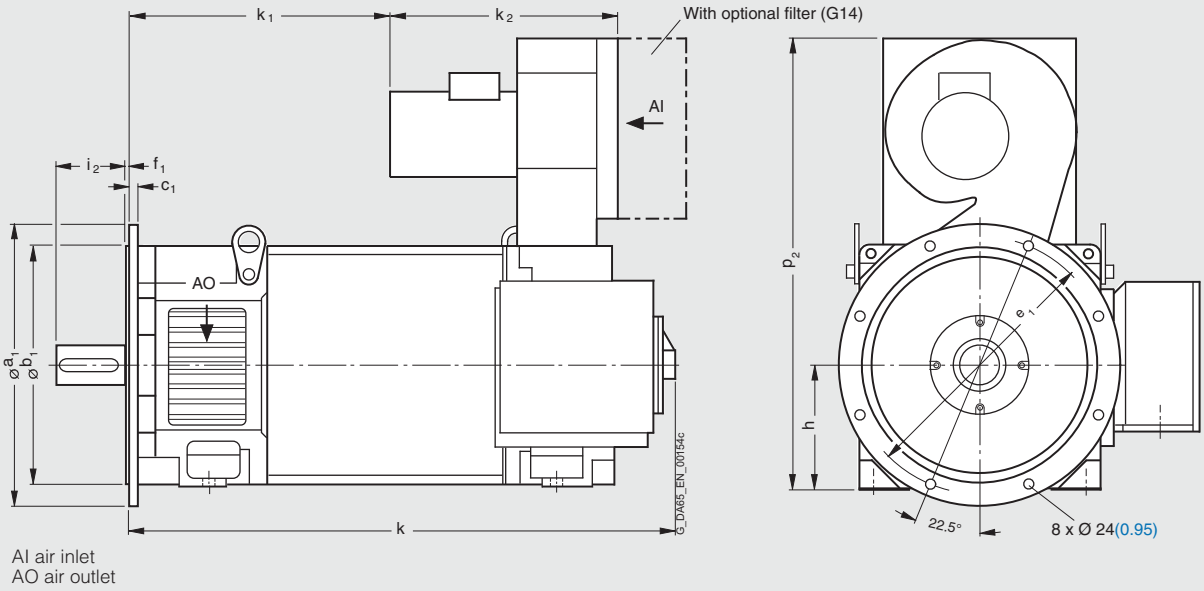


AI air inlet
AO air outlet

[1] Maximum dimensions, depending on electrical version (terminal box type).

For motor		Dimensions in mm (in)											For dimensions of the shaft and terminal box foot installation, see dimension drawing of 1PH728 motors of type IM B3.
Shaft height	Type	**DIN IEC**	a_1 P	b_1 N	c_1 LA	e_1 M	f_1 T	h H	i_2 –	k LB	k_1 –	k_2 –	p_2 –
1PH7, type IM B35, forced ventilation, direction of air flow NDE → DE													
280	**1PH7284**		660 (25.98)	550 (21.65)	24 (0.94)	600 (23.62)	6 (0.24)	280 (11.02)	170 (6.69)	1146 (45.12)	489 (19.25)	546 (21.5)	1042 (41.02)
	1PH7286									1256 (49.45)	599 (23.58)		
	1PH7288									1386 (54.57)	729 (28.7)		

1PH728



AI air inlet
AO air outlet

Dimension drawings

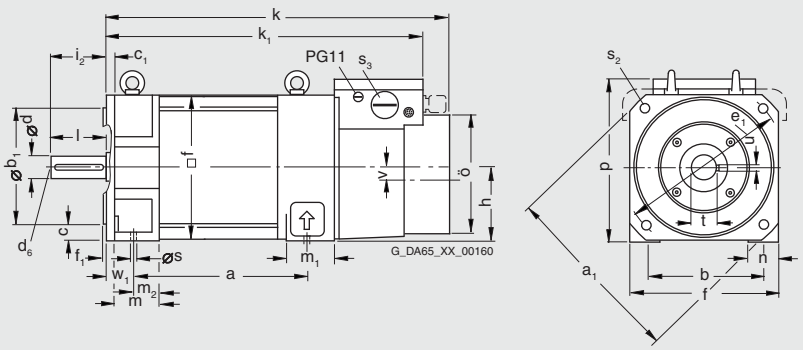
1PH7 motors
Forced ventilation

For motor			Dimensions in mm (in)														
Shaft height	Type	DIN IEC	a B	a_1 P	b A	b_1 N	c LA	c_1 –	e_1 –	f AB	f_1 T	h H	k LB	k_1 –	m BA	m_1 –	m_2 –
1PH7, type IM B35, forced ventilation, with pipe connection, NDE																	
100	**1PH7101** **1PH7103**		202.5 (7.97)	250 (9.84)	160 (6.3)	180 (7.09)	11 (0.43)	13 (0.51)	215 (8.46)	196 (7.72)	4 (0.16)	100 (3.94)	441 (17.36)	411 (16.18)	52 (2.05)	64 (2.52)	25 (0.98)
	1PH7105 **1PH7107**		297.5 (11.71)										536 (21.1)	506 (19.92)			
132	**1PH7131** **1PH7133**		265.5 (10.45)	350 (13.78)	216 (8.5)	250 (9.84)	14 (0.55)	17 (0.67)	300 (11.81)	260 (10.24)	5 (0.2)	132 (5.2)	573 (22.56)	538 (21.18)	63 (2.48)	75 (2.95)	30 (1.18)
	1PH7135 **1PH7137**		350.5 (13.8)										658 (25.91)	623 (24.53)			
160	**1PH7163**		346.5 (13.64)	400 (15.75)	254 (10)	300 (11.81)	17 (0.67)	22 (0.87)	350 (13.78)	314 (12.36)	5 (0.2)	160 (6.3)	674 (26.54)	640 (25.2)	78 (3.07)	81 (3.19)	36 (1.42)
	1PH7167		406.5 (16)										734 (28.9)	700 (27.56)			

											DE shaft extension					
Shaft height	Type	DIN IEC	n AA	ö –	p HD	s K	s_2 K	s_3 –	v –	w_1 C	**d** **D**	d_6 –	l E	t GA	u F	
100	**1PH710.**		39 (1.54)	161 (6.34)	220 (8.66)	12 (0.47)	14 (0.55)	PG29	10.5 (0.41)	40 (1.57)	**38** **(1.5)**	M12	80 (3.15)	41 (1.61)	10 (0.39)	
132	**1PH713.**		52 (2.05)	211.5 (8.33)	275 (10.83)	12 (0.47)	18 (0.71)	PG36	17 (0.67)	50 (1.97)	**42** **(1.65)**	M16	110 (4.33)	45 (1.77)	12 (0.47)	
160	**1PH716.**		62 (2.44)	253 (9.96)	330 (12.99)	14 (0.55)	18 (0.71)	PG42	17 (0.67)	64 (2.52)	**55** **(2.17)**	M20	110 (4.33)	59 (2.32)	16 (0.63)	

For deviating and additional dimensions for 1PH7 motors with DRIVE-CLiQ, see 1PH7 motors with DRIVE-CLiQ.

1PH710
1PH713
1PH716

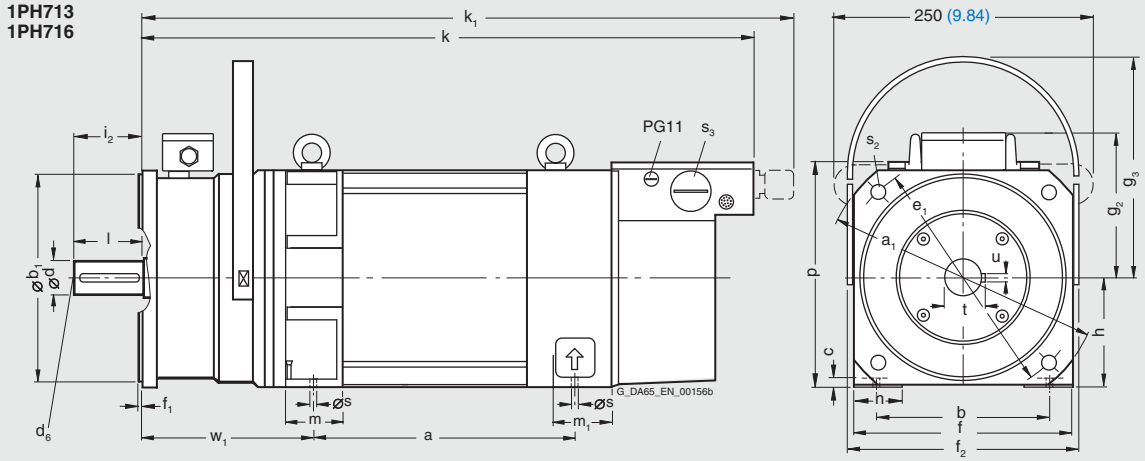


For motor		Dimensions in mm (in)															
Shaft height	Type	DIN IEC	a B	a_1 P	b A	b_1 N	c LA	e_1 M	f AB	f_1 T	f_2 –	g_2 –	g_3 –	h H	i_2 –	k LB	k_1 –
1PH7, type IM B35, forced ventilation, with brake control module																	
100	**1PH7101 1PH7103**		202.5 (7.97)	250 (9.84)	160 (6.30)	180 (7.09)	11 (0.43)	215 (8.46)	196 (7.72)	4 (0.16)	220 (8.66)	149 (5.87)	224 (8.82)	100 (3.94)	80 (3.15)	541 (21.3)	564 (22.2)
	1PH7105 1PH7107		297.5 (11.71)													636 (25.04)	659 (25.94)
132	**1PH7131 1PH7133**		265.5 (10.45)	–	216 (8.5)	250 (9.84)	14 (0.55)	300 (11.81)	260 (10.24)	5 (0.2)	278 (10.94)	174 (6.85)	269 (10.59)	132 (5.2)	110 (4.33)	700 (27.56)	723 (28.46)
	1PH7135 1PH7137		350.5 (13.8)													785 (30.91)	808 (31.81)
160	**1PH7163**		346.5 (13.64)	400 (15.75)	254 (10)	300 (11.81)	17 (0.67)	350 (13.78)	314 (12.36)	5 (0.2)	327 (12.87)	199 (7.83)	328 (12.91)	160 (6.3)	110 (4.33)	808 (31.81)	831 (32.72)
	1PH7167		406.5 (16)													868 (34.17)	891 (35.08)

											DE shaft extension					
Shaft height	Type	DIN IEC	m BA	m_1 –	m_2 –	n AA	p –	s K	s_2 –	s_3 –	w_1 C	**d** **D**	d_6 –	l E	t GA	u F
100	**1PH7101 1PH7103 1PH7105 1PH7107**		52 (2.05)	64 (2.52)	27 (1.06)	39 (1.54)	220 (8.66)	12 (0.47)	14 (0.55)	PG29	170 (6.69)	**38** **(1.5)**	M12	80 (3.15)	41 (1.61)	10 (0.39)
132	**1PH7131 1PH7133 1PH7135 1PH7137**		63 (2.48)	75 (2.95)	33 (1.3)	52 (2.05)	275 (10.83)	12 (0.47)	18 (0.71)	PG36	212 (8.35)	**42** **(1.65)**	M16	110 (4.33)	45 (1.77)	12 (0.47)
160	**1PH7163 1PH7167**		78 (3.07)	81 (3.19)	42 (1.65)	62 (2.44)	330 (12.99)	14 (0.55)	18 (0.71)	PG42	232 (9.13)	**55** **(2.17)**	M20	110 (4.33)	59 (2.32)	16 (0.63)

For deviating and additional dimensions for 1PH7 motors with DRIVE-CLiQ, see 1PH7 motors with DRIVE-CLiQ.

1PH710
1PH713
1PH716

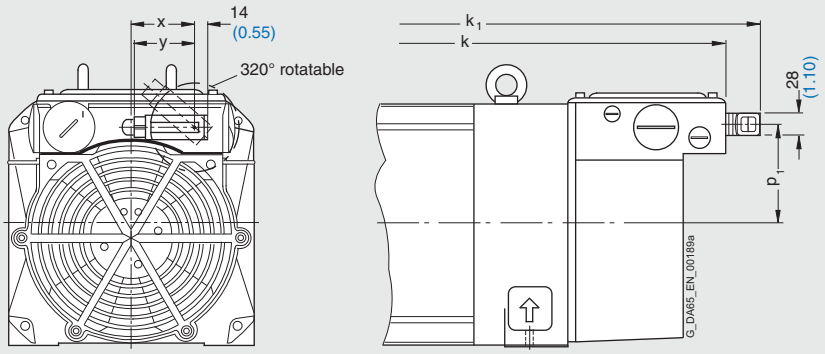


Dimension drawings

1PH7 motors with DRIVE-CLiQ
Forced ventilation

For motor		Dimensions in mm (in)						
Shaft height	Type	**DIN** **IEC**	k LB	k_1 –	p_1 –	x –	y –	
Deviating and additional dimensions for 1PH7 motors with DRIVE-CLiQ to those given in dimension tables 1PH7, forced ventilation								
100	**1PH7101** **1PH7103**		411 (16.18)	453 (17.83)	81 (3.19)	52.5 (2.07)	63.5 (2.5)	
	1PH7105 **1PH7107**		506 (19.92)	548 (21.57)				
132	**1PH7131** **1PH7133**		538 (21.18)	580 (22.83)	103.5 (4.07)	66 (2.6)	63.5 (2.5)	
	1PH7135 **1PH7137**		623 (24.53)	665 (26.18)				
160	**1PH7163**		640 (25.2)	682 (26.85)	127 (5)	75 (2.95)	63.5 (2.5)	
	1PH7167		700 (27.56)	742 (29.21)				

1PH710
1PH713
1PH716

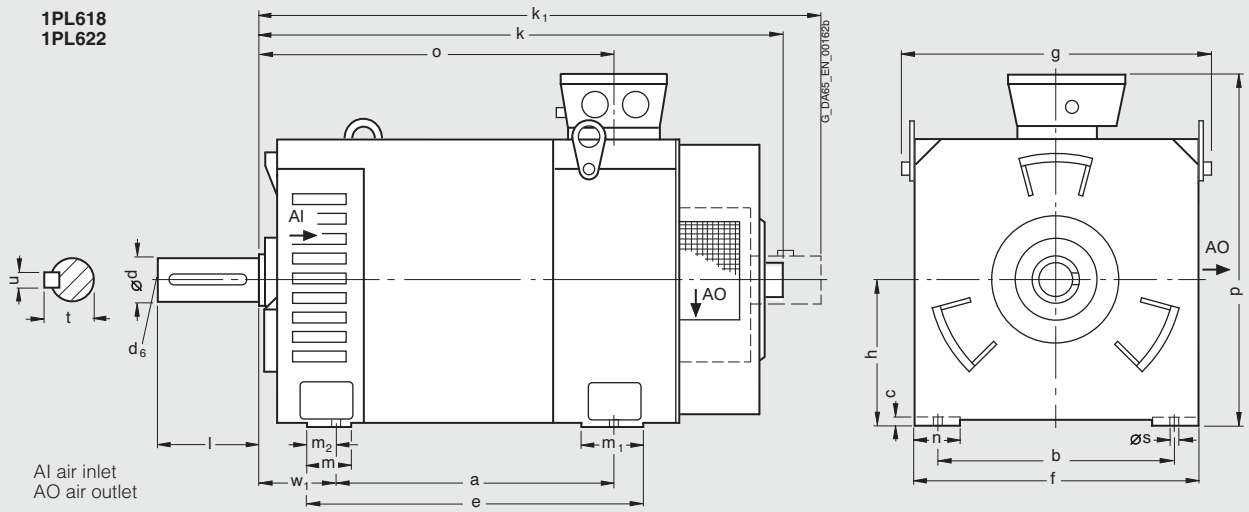


5

For motor		Dimensions in mm (in)														
Shaft height	Type	DIN / IEC	a B	b A	c LA	e M	f AB	g AC	h H	k LB	k_1 –	m BA	m_1 –	m_2 –	n AA	o –
1PL6, type IM B3, forced ventilation, direction of air flow DE → NDE																
180	**1PL6184**		430 (16.93)	279 (10.98)	14 (0.55)	525 (20.67)	360 (14.17)	405 (15.94)	180 (7.09)	835 (32.87)	–	78 (3.07)	120 (4.72)	50 (1.97)	65 (2.56)	541 (21.3)
	1PL6186		520 (20.47)			615 (24.21)				925 (36.42)						631 (24.84)
225	**1PL6224**		445 (17.52)	356 (14.02)	18 (0.71)	545 (21.46)	450 (17.72)	498 (19.61)	225 (8.86)	–	1100 (43.31)	80 (3.15)	120 (4.72)	60 (2.36)	85 (3.35)	629 (24.76)
	1PL6226		545 (21.46)			645 (25.39)					1200 (47.24)					729 (28.7)
	1PL6228		635 (25)			735 (28.94)					1290 (50.79)					819 (32.24)

			Terminal box type 1XB7...					DE shaft extension				
			...322	...422	...700							
Shaft height	Type	DIN / IEC	p [1] HD	p [1] HD	p [1] HD	s K	w_1 C	**d** **D**	d_6 –	l E	t GA	u F
180	**1PL6184**		495 (19.49)	560 (22.05)	–	14.5 (0.57)	121 (4.76)	**60 (2.36)**	M20	140 (5.51)	64 (2.52)	18 (0.71)
	1PL6186				580 (22.83)			**65 (2.56)**			69 (2.72)	
225	**1PL6224**		595 (23.43)	645 (25.39)	680 (26.77)	18.5 (0.73)	149 (5.87)	**75 (2.95)**	M20	140 (5.51)	79.5 (3.13)	20 (0.79)
	1PL6226			–								
	1PL6228			–								

1PL618
1PL622



AI air inlet
AO air outlet

[1] Maximum dimensions, depending on electrical version (terminal box type).

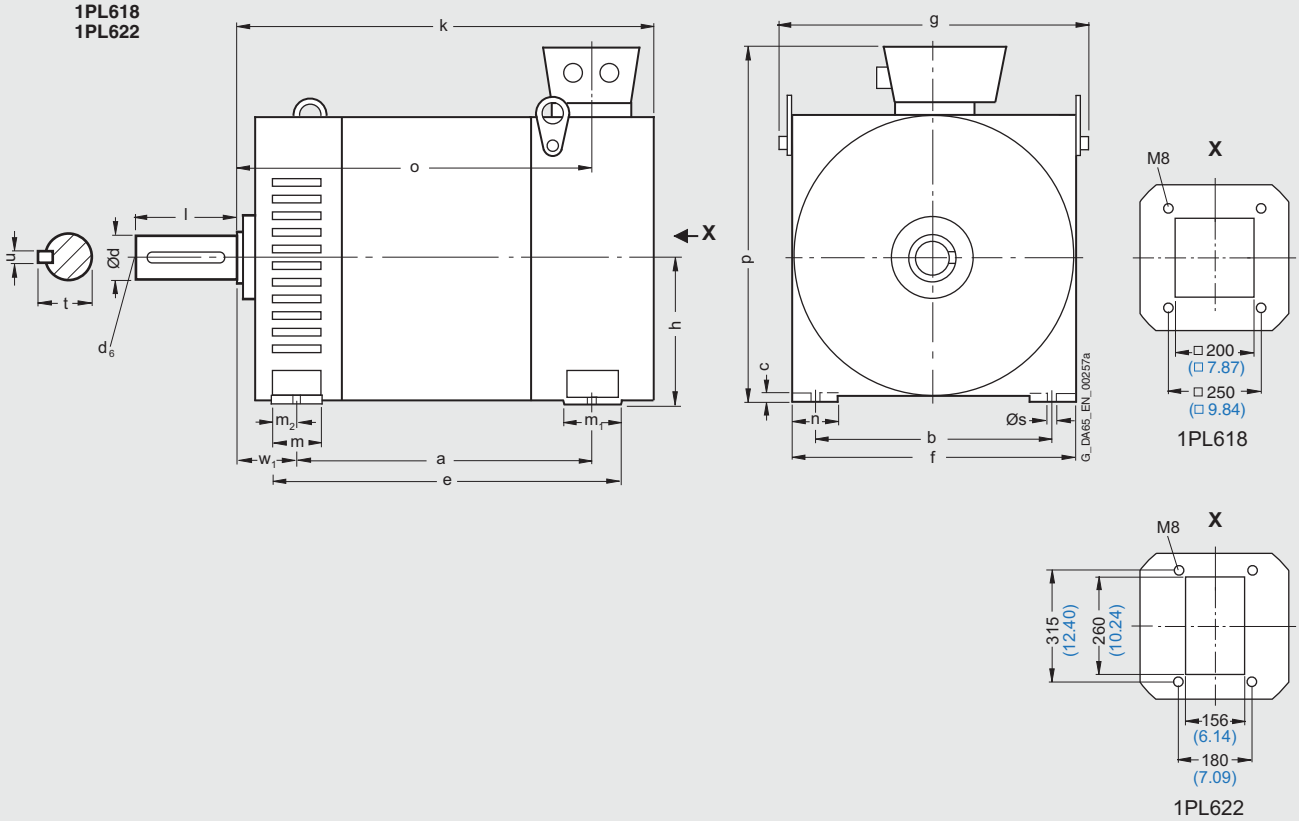
Dimension drawings

1PL6 motors
Forced ventilation

For motor		Dimensions in mm (in)														Terminal box type 1XB7...	
																...422	...700
Shaft height	Type	**DIN** **IEC** a B	b A	c LA	e M	f AB	g AC	h H	k LB	m BA	m_1 –	m_2 –	n AA	o –	p [1] HD	p [1] HD	
1PL6, type IM B3, forced ventilation, with pipe connection, NDE																	
180	**1PL6184**	430 (16.93)	279 (10.98)	14 (0.55)	510 (20.08)	360 (14.17)	408 (16.06)	180 (7.09)	630 (24.8)	60 (2.36)	120 (4.72)	35 (1.38)	65 (2.56)	541 (21.3)	560 (22.05)	–	
	1PL6186	520 (20.47)			600 (23.62)				720 (28.35)					631 (24.84)		680 (26.77)	
225	**1PL6224**	445 (17.52)	356 (14.02)	18 (0.71)	530 (20.78)	450 (17.72)	498 (19.61)	225 (8.86)	750 (29.53)	60 (2.36)	120 (4.72)	40 (1.57)	80 (3.15)	629 (24.76)	–	680 (26.77)	
	1PL6226	545 (21.46)			630 (24.8)				850 (33.46)					729 (28.7)			
	1PL6228	635 (25)			720 (28.35)				940 (37.01)					819 (32.24)			

		DE shaft extension						
Shaft height	Type	**DIN** **IEC** s K	w_1 C	**d** **D**	d_6 –	l E	t GA	u F
180	**1PL6184**	14.5 (0.57)	121 (4.76)	**60 (2.36)**	M20	140 (5.51)	64 (2.52)	18 (0.71)
	1PL6186			**65 (2.56)**			69 (2.72)	
225	**1PL6224** **1PL6226** **1PL6228**	18.5 (0.73)	149 (5.87)	**75 (2.95)**	M20	140 (5.51)	79.5 (3.13)	20 (0.79)

1PL618
1PL622

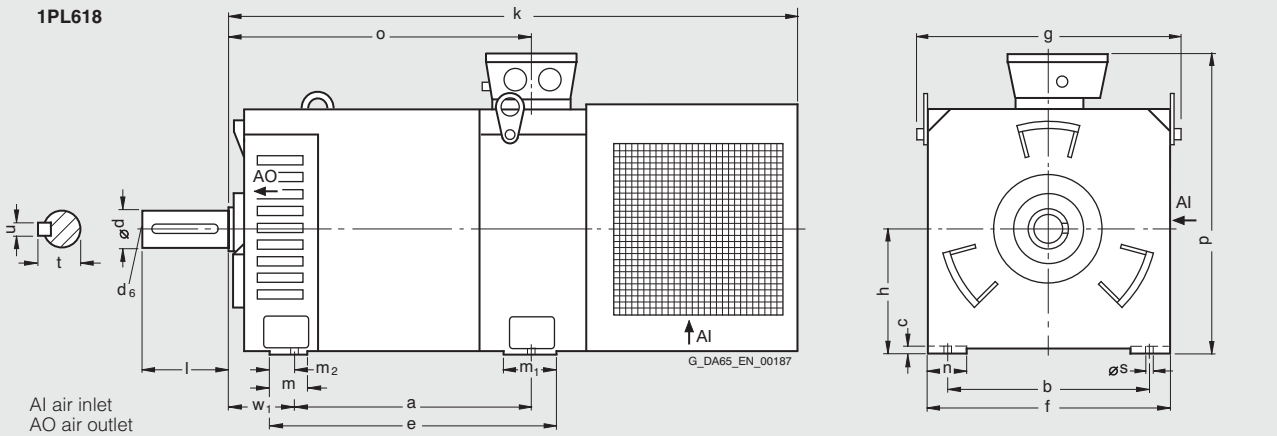


[1] Maximum dimensions, depending on electrical version (terminal box type).

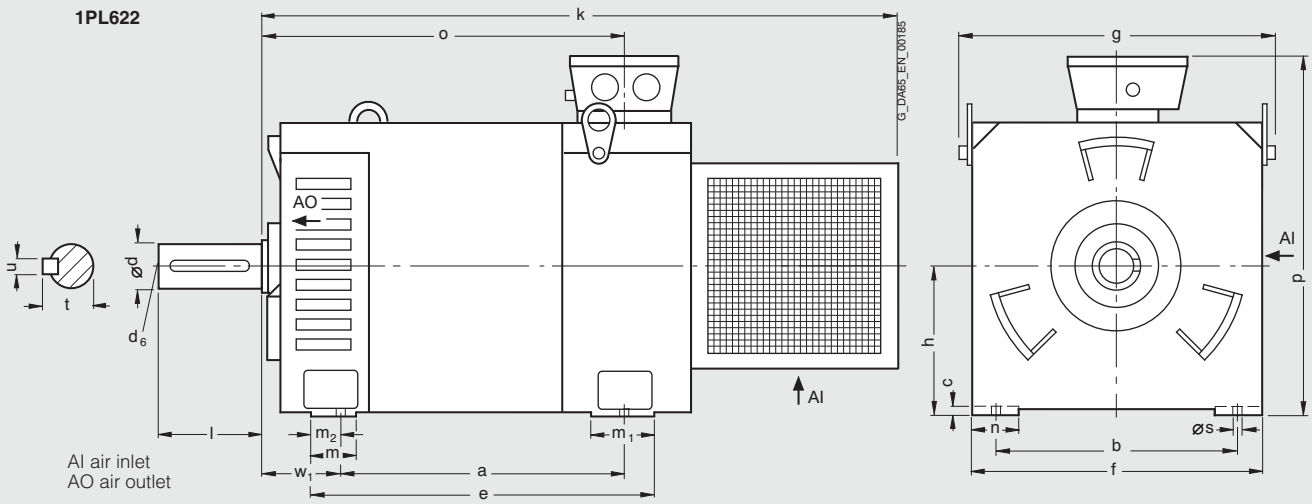
For motor		Dimensions in mm (in)														Terminal box type 1XB7...		
																...322	...422	...700
Shaft height	Type	DIN IEC	a B	b A	c LA	e M	f AB	g AC	h H	k LB	m BA	m_1 –	m_2 –	n AA	o –	p [1] HD	p [1] HD	p [1] HD
1PL6, type IM B3, forced ventilation, direction of air flow NDE → DE																		
180	**1PL6184**		430 (16.93)	279 (10.98)	14 (0.55)	525 (20.67)	360 (14.17)	405 (15.94)	180 (7.09)	1010 (39.76)	78 (3.07)	120 (4.72)	50 (1.97)	65 (2.56)	541 (21.3)	495 (19.49)	560 (22.05)	–
	1PL6186		520 (20.47)			615 (24.21)				1100 (43.31)					631 (24.84)			580 (22.83)
225	**1PL6224**		445 (17.52)	356 (14.02)	18 (0.71)	545 (21.46)	450 (17.72)	498 (19.61)	225 (8.86)	1090 (42.91)	80 (3.15)	120 (4.72)	60 (2.36)	85 (3.35)	629 (24.76)	595 (23.43)	645 (25.39)	680 (26.77)
	1PL6226		545 (21.46)			645 (25.39)				1190 (46.85)					729 (28.7)		–	
	1PL6228		635 (25)			735 (28.94)				1280 (50.39)					819 (32.24)		–	

For motor			DE shaft extension						
Shaft height	Type	DIN IEC	s K	w_1 C	**d** D	d_6 –	l E	t GA	u F
180	**1PL6184**		14.5 (0.57)	121 (4.76)	**60 (2.36)**	M20	140 (5.51)	64 (2.52)	18 (0.71)
	1PL6186				**65 (2.56)**			69 (2.72)	
225	**1PL6224 1PL6226 1PL6228**		18.5 (0.73)	149 (5.87)	**75 (2.95)**	M20	140 (5.51)	79.5 (3.13)	20 (0.79)

1PL618



1PL622



[1] Maximum dimensions, depending on electrical version (terminal box type).

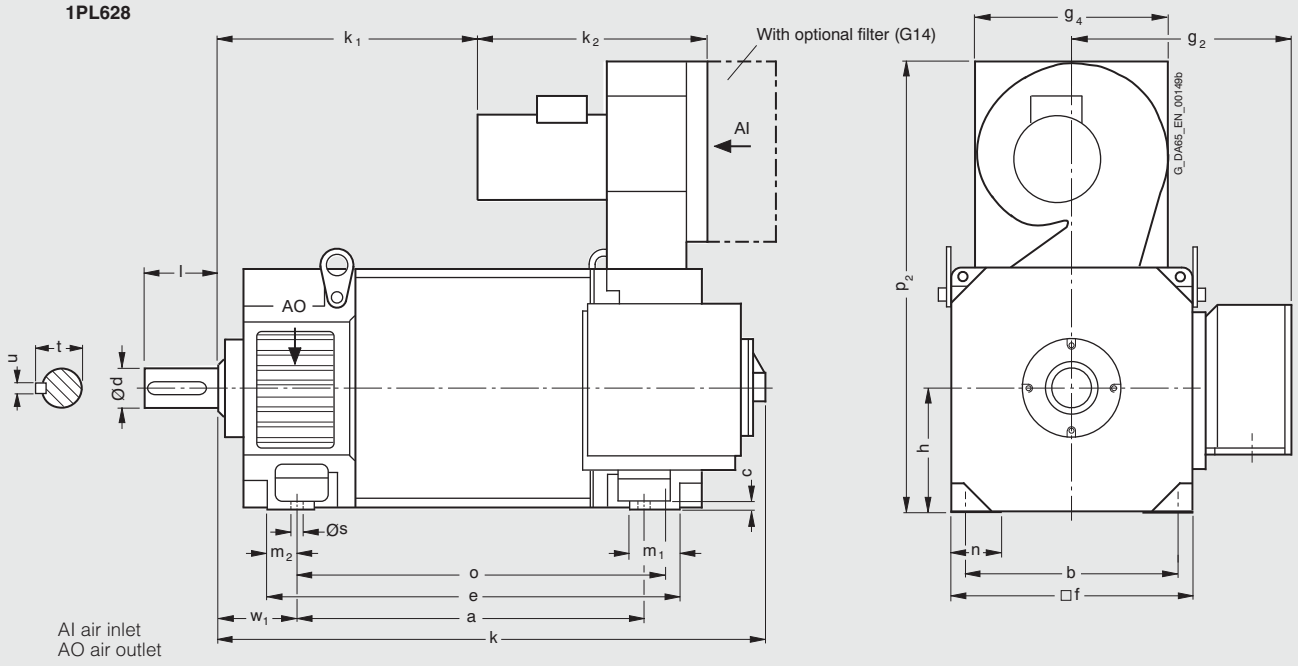
Dimension drawings

1PL6 motors
Forced ventilation

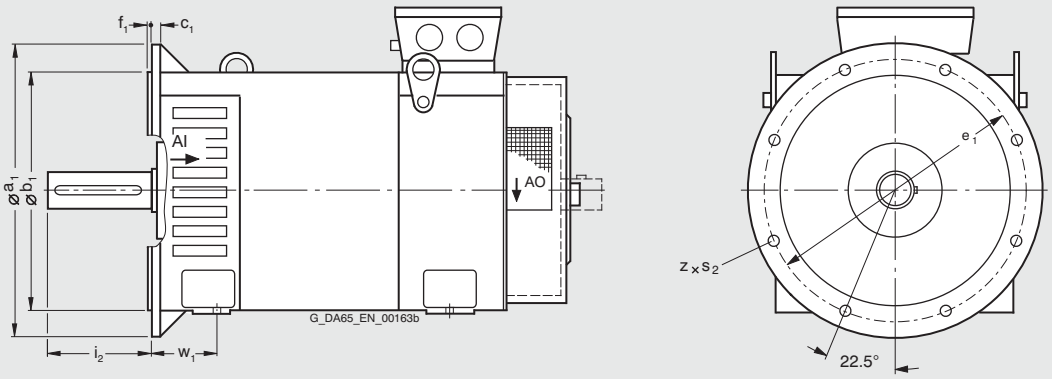
For motor			Dimensions in mm (in)													
Shaft height	Type	**DIN** **IEC**	a B	b A	c HA	e BB	f AB	g_2 AD	g_4 –	h H	k LB	k_1 –	k_2 –	m_1 –	m_2 –	n AA
1PL6, type IM B3, forced ventilation, direction of air flow NDE → DE																
280	**1PL6284**		684 (26.93)	457 (17.99)	22 (0.87)	840 (33.07)	560 (22.05)	518 (20.39)	449 (17.68)	280 (11.02)	1146 (45.12)	489 (19.25)	546 (21.5)	108 (4.25)	78 (3.07)	100 (3.94)
	1PL6286		794 (31.26)			950 (37.4)					1256 (49.45)	599 (23.58)				
	1PL6288		924 (36.38)			1080 (42.52)					1386 (54.57)	729 (28.7)				

			DE shaft extension							
Shaft height	Type	**DIN** **IEC**	o –	p_2 –	s K	w_1 C	**d** **D**	l E	t GA	u F
280	**1PL6284**		731 (28.78)	1042 (41.02)	24 (0.94)	190 (7.48)	**95** **(3.74)**	170 (6.69)	100 (3.94)	25 (0.98)
	1PL6286		841 (33.11)							
	1PL6288		971 (38.23)							

1PL628



For motor		Dimensions in mm (in)									For dimensions of the shaft and terminal box foot installation, see dimension drawing of 1PL618 and 1PL622 motors of type IM B3.
Shaft height	Type	**DIN** **IEC**	a_1 P	b_1 N	c_1 LA	e_1 M	f_1 T	i_2 –	s_2 S	z –	w_1 –
1PL6, type IM B35, forced ventilation, direction of air flow DE → NDE											
180	**1PL6184** **1PL6186**		450 (17.72)	350 (13.78)	16 (0.63)	400 (15.75)	5 (0.2)	140 (5.51)	19 (0.75)	8	121 (4.76)
225	**1PL6224** **1PL6226** **1PL6228**		550 (21.65)	450 (17.72)	18 (0.71)	500 (19.69)	5 (0.2)	140 (5.51)	19 (0.75)	8	149 (5.87)



AI air inlet
AO air outlet

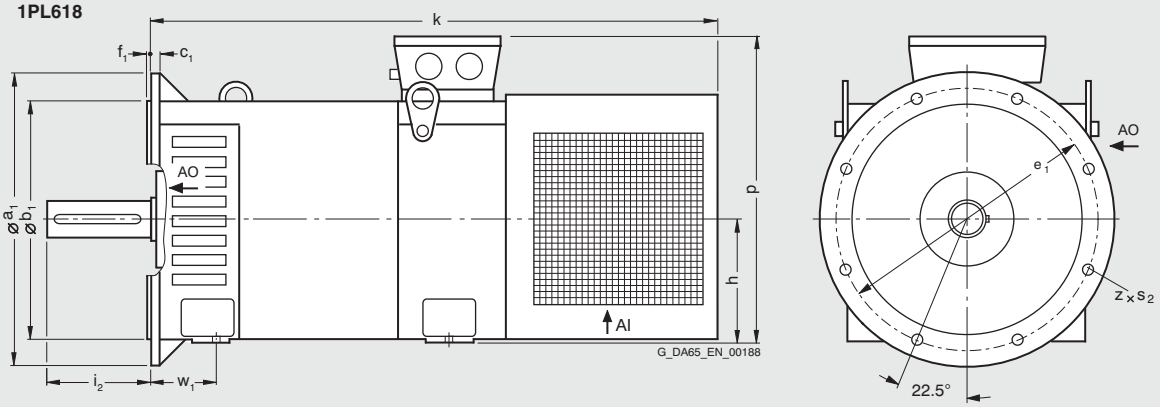
5

Dimension drawings

1PL6 motors
Forced ventilation

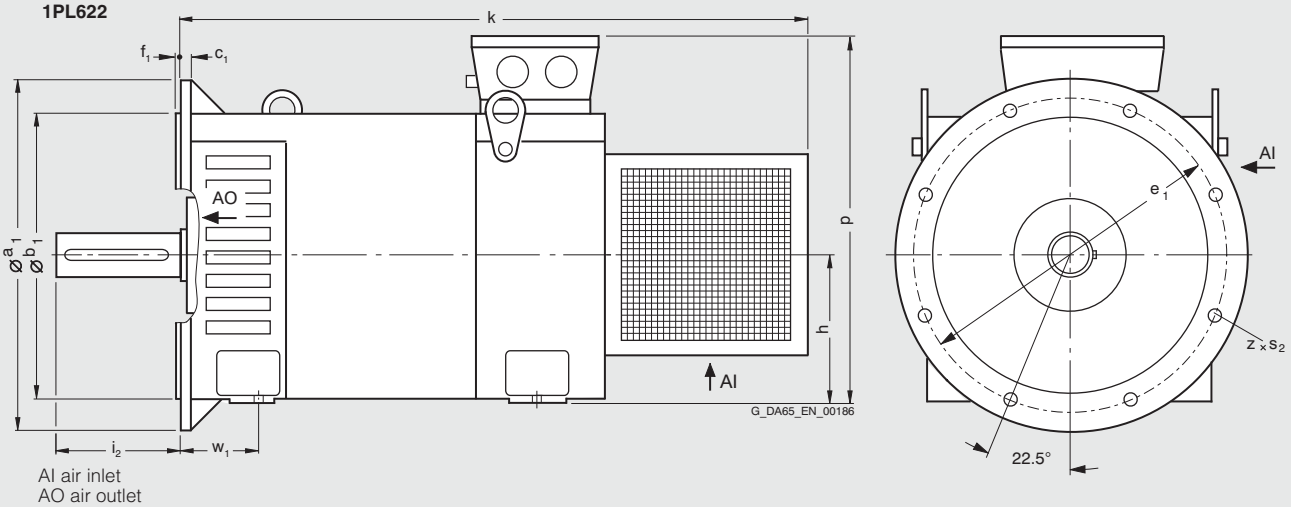
For motor		Dimensions in mm (in)									For dimensions of the shaft and terminal box foot installation, see dimension drawing of 1PL618 and 1PL622 motors of type IM B3.				
											Terminal box type 1XB7...				
											...322	...422	...700		
Shaft height	Type	DIN IEC	a_1 P	b_1 N	c_1 LA	e_1 M	f_1 T	h H	k LB		p [1] HD	p [1] HD	p [1] HD	s_2 S	z –
1PL6, type IM B35, forced ventilation, direction of air flow NDE → DE															
180	**1PL6184**		450 (17.72)	350 (13.78)	16 (0.63)	400 (15.75)	5 (0.2)	180 (7.09)	1010 (39.76)		495 (19.49)	560 (22.05)	–	19 (0.75)	8
	1PL6186								1100 (43.31)				580 (22.83)		
225	**1PL6224**		550 (21.65)	450 (17.72)	18 (0.71)	500 (19.69)	5 (0.2)	225 (8.86)	1090 (42.91)		595 (23.43)	645 (25.39)	680 (26.77)	19 (0.75)	8
	1PL6226								1190 (46.85)			–			
	1PL6228								1280 (50.39)			–			

1PL618



AI air inlet
AO air outlet

1PL622

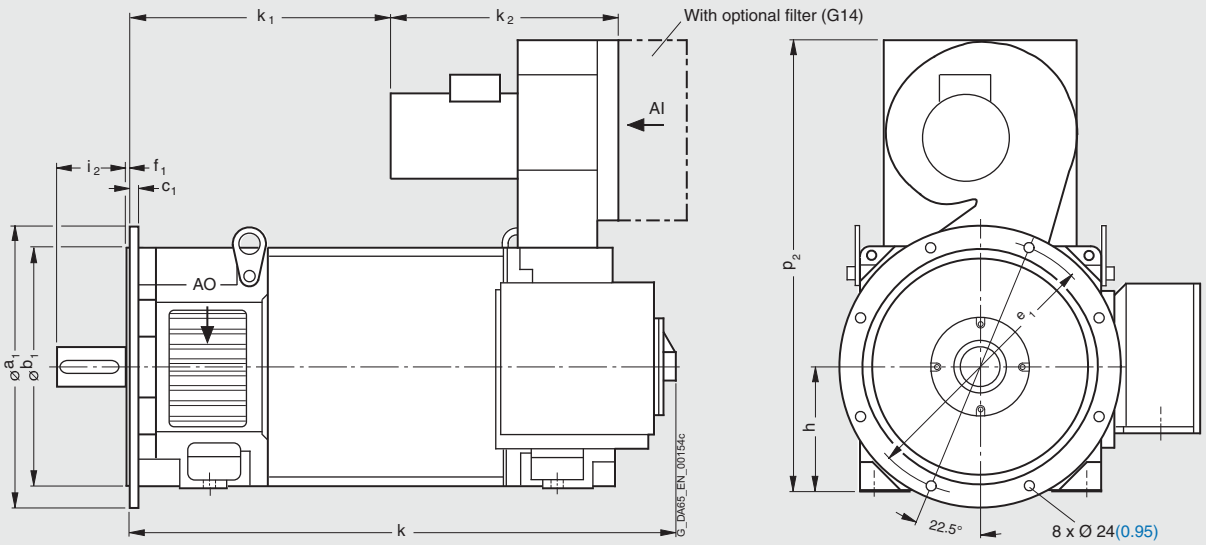


AI air inlet
AO air outlet

[1] Maximum dimensions, depending on electrical version (terminal box type).

For motor		Dimensions in mm (in)											For dimensions of the shaft and terminal box foot installation, see dimension drawing of 1PL628 motors of type IM B3.
Shaft height	Type	**DIN** **IEC**	a_1 P	b_1 N	c_1 LA	e_1 M	f_1 T	h H	i_2 –	k LB	k_1 –	k_2 –	p_2 –
1PL6, type IM B35, forced ventilation, direction of air flow NDE → DE													
280	**1PL6284**		660 (25.98)	550 (21.65)	24 (0.94)	600 (23.62)	6 (0.24)	280 (11.02)	170 (6.69)	1146 (45.12)	489 (19.25)	546 (21.5)	1042 (41.02)
	1PL6286									1256 (49.45)	599 (23.58)		
	1PL6288									1386 (54.57)	729 (28.7)		

1PL628



AI air inlet
AO air outlet

Dimension drawings

1PH4 motors
Water cooling

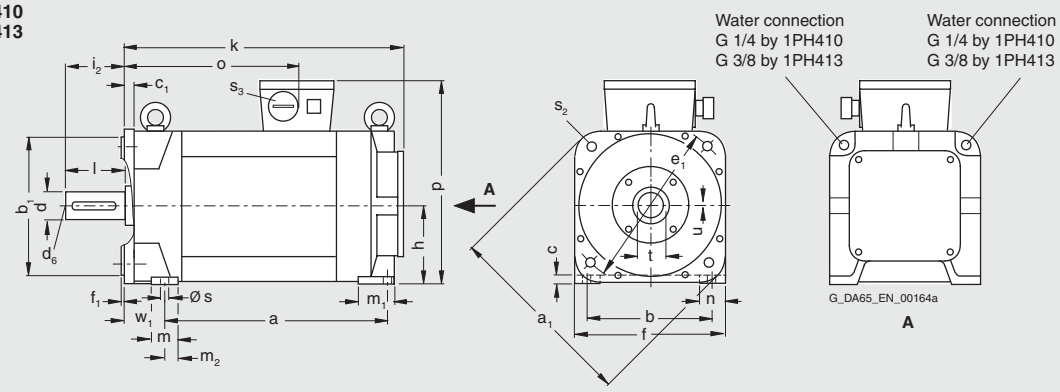
For motor — Dimensions in mm (in)

Shaft height	Type	DIN / IEC	a B	a_1 P	b A	b_1 N	c LA	c_1 –	e_1 –	f AB	f_1 T	h H	i_2 –	k LB	m BA	m_1 –	m_2 –	n AA
1PH4, type IM B35, water cooling																		
100	**1PH4103**		349 (13.74)	250 (9.84)	160 (6.3)	180 (7.09)	11 (0.43)	12 (0.47)	215 (8.46)	190 (7.48)	4 (0.16)	100 (3.94)	80 (3.15)	416 (16.38)	35 (1.38)	60 (2.36)	24 (0.94)	40 (1.57)
	1PH4105		409 (16.1)											476 (18.74)				
	1PH4107		474 (18.66)											541 (21.3)				
132	**1PH4133**		377 (14.84)	350 (13.8)	216 (8.5)	250 (9.84)	14 (0.55)	16 (0.63)	300 (11.81)	245 (9.65)	5 (0.2)	132 (5.2)	110 (4.33)	458 (18.03)	36 (1.42)	85 (3.35)	24 (0.94)	43 (1.69)
	1PH4135		447 (17.6)											528 (20.79)				
	1PH4137		497 (19.57)											578 (22.76)				

DE shaft extension

Shaft height	Type	DIN / IEC	o –	p HD	s K	s_2 K	s_3 –	w_1 C	**d** **D**	d_6 –	l E	t GA	u F
100	**1PH4103**		244 (9.61)	259 (10.20)	12 (0.47)	14 (0.55)	PG29	44 (1.73)	**38** **(1.5)**	M12	80 (3.15)	41 (1.61)	10 (0.39)
	1PH4105		304 (11.97)										
	1PH4107		369 (14.53)										
132	**1PH4133**		264 (10.39)	334.5 (13.17)	12 (0.47)	18 (0.71)	PG36	53 (2.09)	**42** **(1.77)**	M16	110 (4.33)	45 (1.77)	12 (0.47)
	1PH4135		334 (13.15)										
	1PH4137		384 (15.12)										

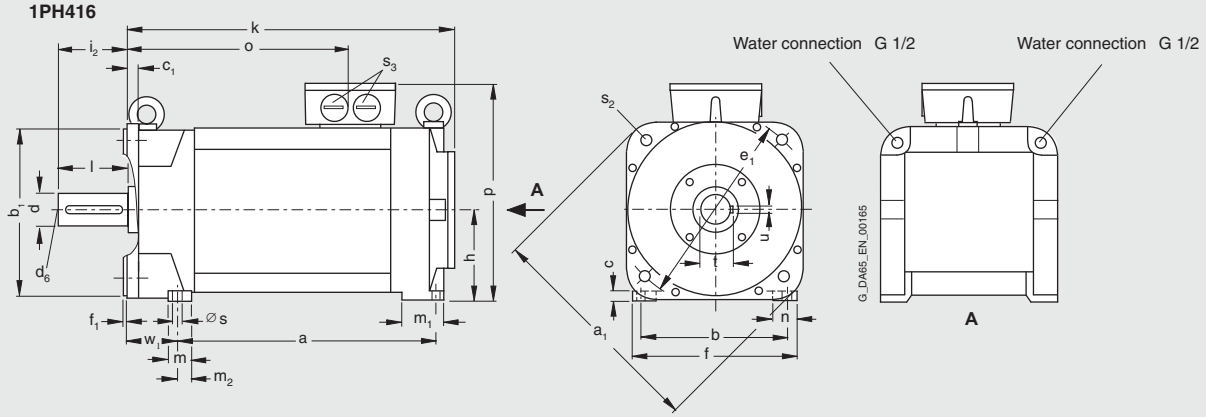
1PH410
1PH413



For motor		Dimensions in mm (in)																
Shaft height	Type	DIN IEC	a B	a_1 P	b A	b_1 N	c LA	c_1 –	e_1 –	f AB	f_1 T	h H	i_2 –	k LB	m BA	m_1 –	m_2 –	n AA
1PH4, type IM B35, water cooling																		
160	**1PH4163**		508 (20)	400 (15.75)	254 (10)	300 (11.81)	15 (0.59)	18 (0.71)	350 (13.78)	294 (11.57)	5 (0.2)	160 (6.3)	110 (4.33)	591 (23.27)	44 (1.73)	77 (3.03)	29 (1.14)	49 (1.93)
	1PH4167		563 (22.17)											646 (25.43)				
	1PH4168		608 (23.94)											691 (27.2)				

			DE shaft extension										
Shaft height	Type	DIN IEC	o –	p HD	s K	s_2 K	s_3 –	w_1 C	**d D**	d_6 –	l E	t GA	u F
160	**1PH4163**		407 (16.02)	388 (15.28)	14 (0.55)	18 (0.71)	PG36	56 (2.2)	**55 (2.17)**	M20	110 (4.33)	59 (2.32)	16 (0.63)
	1PH4167		462 (18.19)										
	1PH4168		507 (19.96)										

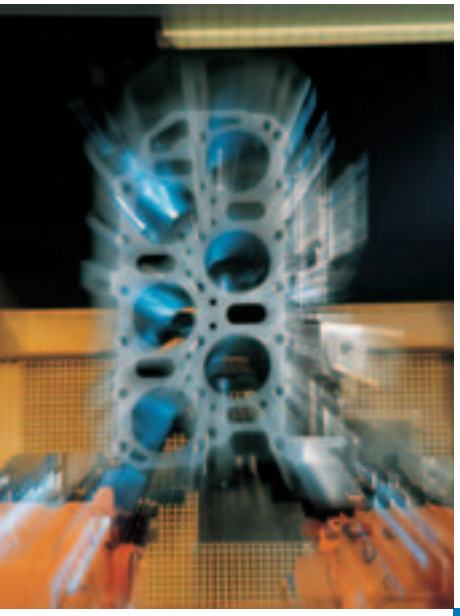
1PH416



Notes

Measuring systems

6



For products approved for Canada and U.S.A., see Appendix.

Introduction

Overview

SIMODRIVE sensors are built-on optoelectronic rotary encoders for the recording of paths, angles of rotation, or speeds of machines. They can be used in conjunction with numerical controllers, programmable logic controllers, drives and position displays, e.g. for:

- SINAMICS drive systems
- SIMOTION Motion Control systems
- SINUMERIK CNCs
- SIMATIC programmable logic controllers
- SIMODRIVE and SIMOVERT MASTERDRIVES drive systems

Application

A distinction is made between incremental and absolute measuring procedures:

- In the case of incremental encoders, the machine must travel to a reference point after each power-off state, as the position is not usually stored in the controller, and movements of the machine while the power is off are not recorded.
- Absolute encoders, on the other hand, also record these movements while the power is off and return the actual position with power On. Travel to a reference point is not necessary.

Design

All encoders are available in Synchro flange and supported flange joint versions. Encoders with a Synchro flange can be attached to the machine with 3 clamp straps or mounted with axial screws. The encoder is driven by means of a plug-in coupling or a spring disk coupling. Alternatively, pulleys can also be used.

The encoder supply voltage is 5 V DC or alternatively 10 V to 30 V DC. The 10 V to 30 V DC version supports longer cable lengths. Most control systems apply the supply voltage directly on the measuring circuit connector. With SINAMICS, the power supply for the measuring systems is provided via the Sensor Modules.

For rotary encoders with cables, the cable length including the connector is 1 m (3.28 ft).
The following bending radii for the cables at the encoder must be complied with:

- One-time bending: ≥ 20 mm (0.79 in)
- Continuous bending: ≥ 75 mm (2.95 in)

Incremental encoders

Function

Incremental encoders deliver a defined number of electrical pulses per rotation, which represent the measurement of the traveled distance or angle.

Incremental encoders operate on the principle of optoelectronic scanning of dividing disks with the transmitted light principle. The light source is a light emitting diode (LED). The light-dark modulation that is generated as the encoder shaft rotates is picked up by photoelectronic elements. With an appropriate arrangement of the line pattern on the dividing disk connected to the shaft and the fixed aperture, the photoelectronic elements provide two trace signals A and B at 90° to one another, as well as a reference signal R. The encoder electronics amplify these signals and convert them into different output levels.

The following output levels are available:

- RS 422 difference signals (TTL)
  In the case of RS 422 encoders (TTL), the resolution can be improved by a factor of four by means of edge evaluation.
- sin/cos 1 V_{pp} analog signals
  Even better resolution can be achieved for encoders with sinusoidal signals by interpolating them in the higher-level controller.
- HTL (High Voltage Transistor Logic)
  Encoders with HTL interfaces are designed for applications with digital inputs with 24 V levels.

Technical specifications

Product name	TTL (RS 422) incremental encoder	sin/cos 1 V_{pp} incremental encoder	HTL incremental encoder	TTL (RS 422) double-track incremental encoder
Operating voltage V_p on encoder	5 V DC ± 10 % or 10 … 30 V DC	5 V DC ± 10 %	10 ... 30 V DC	5 V DC ± 5 %
Limit frequency, typical	–	≥ 180 kHz (-3 dB) ≥ 450 kHz (-6 dB)	–	–
Scanning frequency, max.	300 kHz	–	300 kHz	Track 1: 160 kHz Track 2: 1 MHz
No-load current consumption, max.	150 mA	150 mA	150 mA	150 mA per track
Signal level	TTL (RS 422)	sinusoidal 1 V_{pp}	V_H ≥ 21 V at I_H = 20 mA at 24 V V_L ≤ 2.8 V at I_L = 20 mA at 24 V	TTL (RS 422)
Outputs protected against short-circuit to 0 V	Yes	Yes	Yes	Yes
Switching time (10 … 90 %) (1 m (3.28 ft) cable and recommended input circuit)	Rise/fall time t_+/t_- ≤ 50 ns	–	Rise/fall time t_+/t_- ≤ 200 ns	Rise/fall time t_+/t_- ≤ 100 ns
Phase angle, signal A to B	90°	90° ± 10°el.	90°	90°
Edge spacing, min. at				
• 1 MHz	–	–	–	Track 2: ≥ 0.125 µs
• 300 kHz	≥ 0.45 µs	–	≥ 0.45 µs	–
• 160 kHz	–	–	–	Track 1: ≥ 0.8 µs
Cable length to down-stream electronics[1], max.	100 m (328 ft)	150 m (492 ft)	300 m (984 ft)	Up to 500 kHz: 100 m (328 ft) Up to 1 MHz: 50 m (164 ft)
LED failure monitoring	High-resistance driver	–	High-resistance driver	–
Resolution, max.	5000 S/R	2500 S/R	2500 S/R	Track 1: 1024 S/R Track 2: 9000 S/R
Accuracy (in angular seconds)	± 18° mech. x 3600/ number of signals/revolution z	± 18° mech. x 3600/ number of signals/revolution z	± 18° mech. x 3600/ number of signals/revolution z	Track 1: ± 63 Track 2: ± 12
Speed, max.				
• Electrical	(18×10^6 rpm)/ number of signals/revolution	(27×10^6 rpm)/ number of signals/revolution (at -6 dB)	(18×10^6 rpm)/ number of signals/revolution	Track 1: 9000 rpm Track 2: 6500 rpm
• Mechanical	12000 rpm	12000 rpm	12000 rpm	12000 rpm
Friction torque (at 20 °C) (68 °F)	≤ 0.01 Nm (0.08 lb_f-in)	≤ 0.01 Nm (0.08 lb_f-in)	≤ 0.01 Nm (0.08 lb_f-in)	≤ 0.01 Nm (0.08 lb_f-in)
Starting torque (at 20 °C) (68 °F)	≤ 0.01 Nm (0.08 lb_f-in)	≤ 0.01 Nm (0.08 lb_f-in)	≤ 0.01 Nm (0.08 lb_f-in)	≤ 0.01 Nm (0.08 lb_f-in)
Shaft loading capacity				
• n > 6000 rpm				
- Axial	10 N (2.25 lb_f)	10 N (2.25 lb_f)	10 N (2.25 lb_f)	–
- Radial at shaft extension	20 N (4.50 lb_f)	20 N (4.50 lb_f)	20 N (4.50 lb_f)	–
• n ≤ 6000 rpm				
- Axial	40 N (8.99 lb_f)	40 N (8.99 lb_f)	40 N (8.99 lb_f)	10 N (2.25 lb_f)
- Radial at shaft extension	60 N (13.5 lb_f)	60 N (13.5 lb_f)	60 N (13.5 lb_f)	20 N (4.50 lb_f)
Angular acceleration, max.	10^5 rad/s^2	10^5 rad/s^2	10^5 rad/s^2	10^5 rad/s^2
Moment of inertia of rotor	1.45×10^{-6} kgm^2 (12.8×10^{-6} lb_f-in-s^2)	1.45×10^{-6} kgm^2 (12.8×10^{-6} lb_f-in-s^2)	1.45×10^{-6} kgm^2 (12.8×10^{-6} lb_f-in-s^2)	20×10^{-6} kgm^2 (177×10^{-6} lb_f-in-s^2)
Vibration (55 … 2000 Hz) to EN 60068-2-6	≤ 300 m/s^2 (984 ft/s^2)	≤ 300 m/s^2 (984 ft/s^2)	≤ 300 m/s^2 (984 ft/s^2)	≤ 100 m/s^2 (328 ft/s^2)
Shock to EN 60068-2-27				
• 2 ms	≤ 2000 m/s^2 (6562 ft/s^2)	≤ 2000 m/s^2 (6562 ft/s^2)	≤ 2000 m/s^2 (6562 ft/s^2)	–
• 6 ms	≤ 1000 m/s^2 (3281 ft/s^2)	≤ 1000 m/s^2 (3281 ft/s^2)	≤ 1000 m/s^2 (3281 ft/s^2)	≤ 1000 m/s^2 (3281 ft/s^2)

S/R = signals/revolution

1) With recommended cable and input circuitry of the downstream electronics, observe max. permissible cable length of module to be evaluated.

Technical specifications (continued)

Product name	TTL (RS 422) incremental encoder	sin/cos 1 V_{pp} incremental encoder	HTL incremental encoder	TTL (RS 422) double-track incremental encoder
Ambient temperature				
Operation				
• Flange outlet or fixed cable				
- At V_p = 5 V ± 10 %	-40 ... +100 °C (-40 ... +212 °F)	-40 ... +100 °C (-40 ... +212 °F)	-40 ... +100 °C (-40 ... +212 °F)	-10 ... +70 °C (+14 ... +158 °F)
- At V_p = 10 … 30 V	-40 ... +70 °C (-40 ... +158 °F)	–	–	–
• Flexible cable				
- At V_p = 5 V ± 10 %	-10 ... +100 °C (+14 ... +212 °F)	-10 ... +100 °C (+14 ... +212 °F)	-10 ... +100 °C (+14 ... +212 °F)	-10 ... +70 °C (+14 ... +158 °F)
- At V_p = 10 … 30 V	-10 ... +70 °C (+14 ... +158 °F)	–	–	–
Degree of protection to EN 60529 (IEC 60529)				
• Without shaft input	IP67	IP67	IP67	IP67
• With shaft input	IP64	IP64	IP64	IP64
EMC	Tested in accordance with the guidelines for electromagnetic compatibility 89/336/EEC and the regulations of the EMC guidelines (applicable basic standards)			
Weight, approx.	0.25 kg (0.55 lb)	0.25 kg (0.55 lb)	0.25 kg (0.55 lb)	0.7 kg (1.54 lb)
CE mark	Yes	Yes	Yes	Yes

Selection and ordering data

Designation	Order No.
TTL (RS 422) incremental encoder	
Synchro flange and 5 V DC supply voltage	
Connection:	
• Axial flange outlet	**6FX2001-2G■■■**
• Radial flange outlet	**6FX2001-2E■■■**
• Cable 1 m (3.28 ft) with connector [1]	**6FX2001-2C■■■**
Synchro flange and 10 ... 30 V DC supply voltage	
Connection:	
• Axial flange outlet	**6FX2001-2H■■■**
• Radial flange outlet	**6FX2001-2F■■■**
• Cable 1 m (3.28 ft) with connector [1]	**6FX2001-2D■■■**
Supported flange joint and 5 V DC supply voltage	
Connection:	
• Axial flange outlet	**6FX2001-2R■■■**
• Radial flange outlet	**6FX2001-2P■■■**
• Cable 1 m (3.28 ft) with connector [1]	**6FX2001-2M■■■**
Supported flange joint and 10 ... 30 V DC supply voltage	
Connection:	
• Axial flange outlet	**6FX2001-2S■■■**
• Radial flange outlet	**6FX2001-2Q■■■**
• Cable 1 m (3.28 ft) with connector [1]	**6FX2001-2N■■■**
Resolution	
500 S/R	**A 5 0**
1000 S/R	**B 0 0**
1024 S/R	**B 0 2**
1250 S/R	**B 2 5**
1500 S/R	**B 5 0**
2000 S/R	**C 0 0**
2048 S/R	**C 0 4**
2500 S/R	**C 5 0**
3600 S/R	**D 6 0**
5000 S/R	**F 0 0**

S/R = signals/revolution

Designation	Order No.
sin/cos 1 V_{pp} incremental encoder	
Synchro flange and 5 V DC supply voltage	
Connection:	
• Axial flange outlet	**6FX2001-3G■■■**
• Radial flange outlet	**6FX2001-3E■■■**
• Cable 1 m (3.28 ft) with connector [1]	**6FX2001-3C■■■**
Resolution	
1000 S/R	**B 0 0**
1024 S/R	**B 0 2**
2500 S/R	**C 5 0**
HTL incremental encoder	
Synchro flange and 10 ... 30 V DC supply voltage	
Connection:	
• Axial flange outlet	**6FX2001-4H■■0**
• Radial flange outlet	**6FX2001-4F■■0**
• Cable 1 m (3.28 ft) with connector [1]	**6FX2001-4D■■0**
Supported flange joint and 10 ... 30 V DC supply voltage	
Connection:	
• Axial flange outlet	**6FX2001-4S■■0**
• Radial flange outlet	**6FX2001-4Q■■0**
• Cable 1 m (3.28 ft) with connector [1]	**6FX2001-4N■■0**
Resolution	
100 S/R	**A 1**
500 S/R	**A 5**
1000 S/R	**B 0**
2500 S/R	**C 5**
TTL (RS 422) double-track incremental encoder	
Synchro flange and 5 V DC supply voltage	
Connection:	
• Cable 1 m (3.28 ft) with axial connector 2 types of resolution: 9000/1024 S/R	**6FX2001-2UK00**

[1] Universal integrated cable outlet for axial and radial outlet direction.

Absolute encoders

Function

Absolute encoders (absolute shaft encoders) are designed on the same scanning principle as incremental encoders, but have a greater number of tracks. For example, if there are 13 tracks, then 2^{13} = 8192 steps are coded in the case of single-turn encoders. The code used is a one-step code (gray code), which prevents any scanning errors from occurring.

After switching on the machine, the position value is transmitted immediately to the controller. There is no need to travel to a reference point.

SSI, DRIVE-CLiQ and EnDat absolute encoders are of advantage in time-critical applications.

In plants with a large number of encoders, PROFIBUS DP is more of an advantage due to the reduced wiring overhead. PROFIBUS DP encoders are programmable and support isochronous mode with internode communication.

Single-turn encoders divide one rotation (360° mechanical) into a specific number of steps, e.g. 8192. A unique code word is assigned to each position. After 360° the position values are repeated.

Multi-turn encoders also record the number of revolutions, in addition to the absolute position within one revolution. To do this, further code discs which are coupled via gear steps with the encoder shaft are scanned. When evaluating 12 additional tracks, this means that 2^{12} = 4096 revolutions can be coded.

Technical specifications

Product name	SSI absolute encoder	Absolute encoder with DRIVE-CLiQ	EnDat absolute encoder	PROFIBUS DP absolute encoder (EN 50170)
Operating voltage V_p on encoder	10 ... 30 V DC	24 V DC -15 % +20 %	5 V DC ± 5 %	10 ... 30 V DC
Power consumption, approx.				
• Single-turn	160 mA	245 mA	160 mA	300 ... 100 mA (2.5 W)
• Multi-turn	200 mA	325 mA	200 mA	300 ... 100 mA (2.5 W)
Interface	SSI	DRIVE-CLiQ	EnDat	PROFIBUS
Clock input	Differential cable receiver according to EIA standard RS 485	–	Differential cable receiver according to EIA standard RS 485	Differential cable receiver according to EIA standard RS 485
Data output	Differential cable driver according to EIA standard RS 485	DRIVE-CLiQ	Differential cable driver according to EIA standard RS 485	Differential cable driver according to EIA standard RS 485
Short-circuit strength	Yes	Yes	Yes	Yes
Data transfer rate	100 kHz ... 1 MHz	100 Mbit	100 kHz ... 2 MHz	12 Mbit/s
LED for diagnostics	–	–	–	Yes (green/red)
Speed, max.				
• Electrical	–	14000 rpm	–	–
- At ± 1 bit accuracy	5000 rpm	–	5000 rpm	5800 rpm
- At ± 100 bit accuracy	10000 rpm	–	10000 rpm	–
• Mechanical				
- Single-turn	12000 rpm	12000 rpm	12000 rpm	12000 rpm
- Multi-turn	10000 rpm	10000 rpm	10000 rpm	6000 rpm
Cable length to down-stream electronics [1], max.	Up to 1-MHz-cycle: 50 m (164 ft) Up to 300-kHz-cycle: 100 m (328 ft) Up to 100-kHz-cycle: 400 m (1312 ft)	100 m (328 ft)	Up to 1-MHz-cycle: 50 m (164 ft) Up to 300-kHz-cycle: 150 m (492 ft)	Up to 12 Mbit/s: 100 m (328 ft) Up to 1.5 Mbit/s: 200 m (656 ft) Up to 93.75 kbit/s: 1200 m (3937 ft)
Number of nodes	–	–	–	99
Connection	Flange outlet, axial/radial	DRIVE-CLiQ connector, radial	Flange outlet, axial/radial	Terminal block with address selector switch and bus terminating resistor in removable cover with 3 radial cable glands
Cable diameter	–	–	–	6.5 ... 9 mm (0.26 ... 0.35 in) Removal of cover possible without interrupting bus
Resolution				
• Single-turn	13 bit (8192 steps)	22 bit	13 bit (8192 steps)	13 bit (8192 steps)
• Multi-turn	25 bit (8192 × 4096 steps)	34 bit (22 bit Single-turn + 12 bit Multi-turn)	25 bit (8192 × 4096 steps)	27 bit (8192 × 16384 steps)
Message frame length				
• Single-turn	13 bit, without parity	–	According to EnDat specification	–
• Multi-turn	25 bit, without parity	–	According to EnDat specification	–
Incremental track	–	2048 S/R, 1 V_{pp} (encoder-internal only)	512 S/R, 1 V_{pp}	–
Code type				
• Sampling	Gray	Binary (encoder-internal only)	Gray	Gray
• Transfer	Gray, fir tree format	–	Binary	Binary

[1] Observe the maximum permissible cable length of the connected module.

Technical specifications (continued)

Product name	SSI absolute encoder	Absolute encoder with DRIVE-CLiQ	EnDat absolute encoder	PROFIBUS DP absolute encoder (EN 50170)
Parameterization capability				
• Resolution per revolution	–	–	–	Arbitrary 1 ... 8192
• Total resolution	–	–	–	Arbitrary 1 ... 16384
• Preset	Set to zero	–	–	Arbitrary
• Counting direction	Yes	Yes	–	Yes
• Speed signal	–	–	–	Yes
• Limit switches	–	–	–	Yes, 2
• Isochronous mode and internode communication acc. to DP V2	–	–	–	Yes
Online parameterization	–	–	–	Yes
Network load, approx.	–	–	–	20 µs per encoder at 12 Mbit/s
Cycle time	–	–	–	667 µs
Accuracy	± 60 angular seconds	± 36 angular seconds	± 60 angular seconds (incr. track)	± ½ LSB
EMC	Tested in accordance with EN 50081 and EN 50082	Tested in accordance with EN 50081 and EN 50082	Tested in accordance with EN 50081 and EN 50082	Tested in accordance with EN 50081 and EN 50082
Friction torque (at 20 °C) (68 °F)	≤ 0.01 Nm (0.08 lb_f-in)	≤ 0.01 Nm (0.08 lb_f-in)	≤ 0.01 Nm (0.08 lb_f-in)	≤ 0.01 Nm (0.08 lb_f-in)
Starting torque (at 20 °C) (68 °F)	≤ 0.01 Nm (0.08 lb_f-in)	≤ 0.01 Nm (0.08 lb_f-in)	≤ 0.01 Nm (0.08 lb_f-in)	≤ 0.01 Nm (0.08 lb_f-in)
Shaft loading capacity				
• n > 6000 rpm				
- Axial	10 N (2.25 lb_f)	10 N (2.25 lb_f)	10 N (2.25 lb_f)	10 N (2.25 lb_f)
- Radial at shaft extension	20 N (4.50 lb_f)	20 N (4.50 lb_f)	20 N (4.50 lb_f)	20 N (4.50 lb_f)
• n ≤ 6000 rpm				
- Axial	40 N (8.99 lb_f)	40 N (8.99 lb_f)	40 N (8.99 lb_f)	40 N (8.99 lb_f)
- Radial at shaft extension	60 N (13.5 lb_f)	60 N (13.5 lb_f)	60 N (13.5 lb_f)	110 N (24.7 lb_f)
Angular acceleration, max.	10^5 rad/s^2	10^5 rad/s^2	10^5 rad/s^2	10^5 rad/s^2
Moment of inertia of rotor				
• Solid shaft	1.45 x 10^{-6} kgm^2 (12.8 x 10^{-6} lb_f-in-s^2)	1.90 x 10^{-6} kgm^2 (16.8 x 10^{-6} lb_f-in-s^2)	1.45 x 10^{-6} kgm^2 (12.8 x 10^{-6} lb_f-in-s^2)	1,90 x 10^{-6} kgm^2 (16.8 x 10^{-6} lb_f-in-s^2)
• Hollow shaft	–	2.80 x 10^{-6} kgm^2 (24.8 x 10^{-6} lb_f-in-s^2)	–	2.80 x 10^{-6} kgm^2 (24.8 x 10^{-6} lb_f-in-s^2)
Vibration (55 … 2000 Hz) to EN 60068-2-6	≤ 300 m/s^2 (984 ft/s^2)	≤ 100 m/s^2 (328 ft/s^2)	≤ 300 m/s^2 (984 ft/s^2)	≤ 100 m/s^2 (328 ft/s^2)
Shock to EN 60068-2-27				
• 2 ms	≤ 2000 m/s^2 (6562 ft/s^2)	≤ 2000 m/s^2 (6562 ft/s^2)	≤ 2000 m/s^2 (6562 ft/s^2)	≤ 2000 m/s^2 (6562 ft/s^2)
• 6 ms	≤ 1000 m/s^2 (3281 ft/s^2)	≤ 1000 m/s^2 (3281 ft/s^2)	≤ 1000 m/s^2 (3281 ft/s^2)	≤ 1000 m/s^2 (3281 ft/s^2)
Ambient temperature				
• Operation	-40 ... +85 °C (-40 ... +185 °F)	-20 ... +100 °C (-4 ... +212 °F)	-40 ... +100 °C (-40 ... +212 °F)	-40 ... +85 °C (-40 ... +185 °F)
Degree of protection to EN 60529 (IEC 60529)				
• Without shaft input	IP67	IP67	IP67	IP67
• With shaft input	IP64	IP64	IP64	IP64
Weight, approx.				
• Single-turn	0.35 kg (0.77 lb)	0.40 kg (0.88 lb)	0.35 kg (0.77 lb)	0.5 kg (1.10 lb)
• Multi-turn	0.35 kg (0.77 lb)	0.44 kg (0.97 lb)	0.35 kg (0.77 lb)	0.7 kg (1.54 lb)
CE mark	Yes	Yes	Yes	Yes
PROFIBUS certificate	–	–	–	Yes
Supported profiles	–	–	–	Class 1, Class 2

Selection and ordering data

Designation	Order No.
SSI absolute encoder	
Synchro flange and 10 ... 30 V DC supply voltage	
Connection:	
• Axial flange outlet	**6FX2001-5HS■■**
• Radial flange outlet	**6FX2001-5FS■■**
Supported flange joint and 10 ... 30 V DC supply voltage	
Connection:	
• Axial flange outlet	**6FX2001-5SS■■**
• Radial flange outlet	**6FX2001-5QS■■**
Resolution	
• Single-turn 8192 steps/revolution (13 bit)	**1 2**
• Multi-turn 8192 steps/revolution, 4096 revolutions (25 bit)	**2 4**
Absolute encoder with DRIVE-CLiQ	
24 V DC supply voltage Radial connection	
• Synchro flange Solid shaft 6 mm (0.24 in)	**6FX2001-5FD■■-0AA0**
• Supported flange joint Solid shaft 10 mm (0.39 in)	**6FX2001-5QD■■-0AA0**
• Torque bracket Hollow shaft 10 mm (0.39 in)	**6FX2001-5VD■■-0AA0**
• Torque bracket Hollow shaft 12 mm (0.47 in)	**6FX2001-5WD■■-0AA0**
Resolution	
• Single-turn 22 bit	**1 3**
• Multi-turn 34 bit	**2 5**
EnDat absolute encoder	
Synchro flange and 5 V DC supply voltage	
Connection:	
• Axial flange outlet	**6FX2001-5HE■■**
• Radial flange outlet	**6FX2001-5FE■■**
Supported flange joint and 5 V DC supply voltage	
Connection:	
• Axial flange outlet	**6FX2001-5SE■■**
• Radial flange outlet	**6FX2001-5QE■■**
Resolution	
• Single-turn 8192 steps/revolution (13 bit)	**1 3**
• Multi-turn 8192 steps/revolution, 4096 revolutions (25 bit)	**2 5**

Designation	Order No.
PROFIBUS DP absolute encoder (EN 50170)	
10 ... 30 V DC supply voltage Radial connection	
• Synchro flange Solid shaft	**6FX2001-5FP■■**
• Supported flange joint Solid shaft	**6FX2001-5QP■■**
• Torque bracket Hollow shaft 8 mm/10 mm/12 mm/15 mm (0.31 in/0.39 in/0.47 in/0.59 in)	**6FX2001-5WP■■**
Resolution	
• Single-turn 8192 steps/revolution (13 bit)	**1 2**
• Multi-turn 8192 steps/revolution, 16384 revolutions (27 bit)	**2 4**
User Manual for start-up and parameterization of PROFIBUS encoders Language: English/German	**6SN1197-0AB10-0YP4**

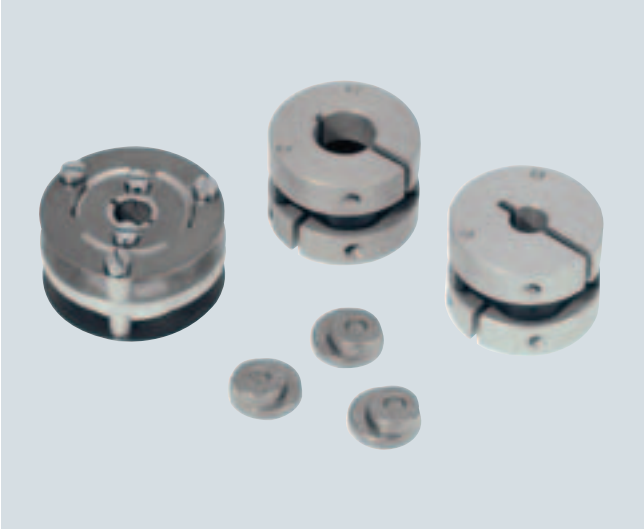
More information

Designation	Order No.
Decentralizing with PROFIBUS DP	**ISBN3-89578-074-X**

6

Mounting accessories

Overview



Clamp straps/couplings

Clamp straps and couplings are available as mounting accessories for the rotary encoders. The clamp straps are used to fix the encoders with a Synchro flange.

Mating connector

A mating connector is available for the encoder with flange outlet or with cable and encoder connector for cable diameters 5.5 mm (0.22 in) to 12 mm (0.47 in). Connectors with 12 contacts are suitable for all incremental encoders, as well as SSI absolute encoders. Connectors with 17 contacts are suitable for EnDat encoders.

Replacement connector

A replacement connector is available for encoders with cable.

Technical specifications

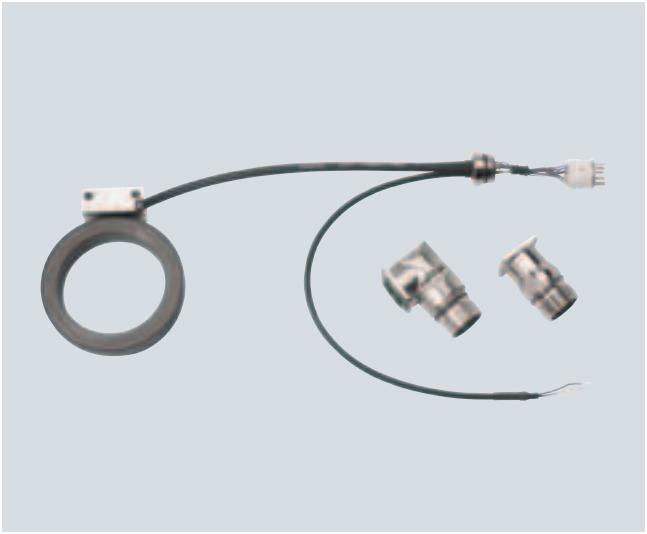
Product name	Spring disk coupling	Plug-in coupling
Transmission torque, max.	0.8 Nm (2.88 oz_f)	0.7 Nm (2.52 oz_f)
Shaft diameter	6 mm (0.24 in) both ends or d_1 = 6 mm (0.24 in), d_2 = 5 mm (0.20 in)	6 mm (0.24 in) both ends or 10 mm (0.39 in) both ends
Center offset of shafts, max.	0.4 mm (0.02 in)	0.5 mm (0.02 in)
Axial offset	± 0.4 mm (0.02 in)	± 0.5 mm (0.02 in)
Angular displacement of shafts, max.	3°	1°
Torsional rigidity	150 Nm/rad (539.51 oz_f/rad)	31 Nm/rad (111.5 oz_f/rad)
Lateral spring stiffness	6 N/mm (1.35 lb_f)	10 N/mm (2.25 lb_f)
Moment of inertia	19 gcm^2 (168 x 10^{-7} lb_f-in-s^2)	20 gcm^2 (177 x 10^{-7} lb_f-in-s^2)
Speed, max.	12000 rpm	12000 rpm
Ambient temperature		
• Operation	-40 ... +150 °C (-40 ... +302 °F)	-40 ... +80 °C (-40 ... +176 °F)
Weight, approx.	16 g (0.56 oz)	20 g (0.71 oz)

Selection and ordering data

Designation	Order No.
Clamp strap For double-track encoders and encoders with Synchro flange (3 units are required)	**6FX2001-7KP01**
Spring disk coupling Shaft diameter:	
• 6 mm/6 mm (0.24 in/0.24 in)	**6FX2001-7KF10**
• 6 mm/5 mm (0.24 in/0.20 in)	**6FX2001-7KF06**
Plug-in coupling Shaft diameter:	
• 6 mm/6 mm (0.24 in/0.24 in)	**6FX2001-7KS06**
• 10 mm/10 mm (0.39 in/0.39 in)	**6FX2001-7KS10**
Mating connector for flange outlet or encoder connector with cap nut (1 unit) Crimp version, socket contacts for cable diameters 5.5 … 12 mm (0.22 … 0.47 in)	
• 12-pin, insulator with 12 socket contacts (1 unit) for TTL, sin/cos 1 V_{pp}, HTL incremental encoders or for SSI absolute encoders	**6FX2003-0SU12**
• 17-pin, insulator with 17 socket contacts (1 unit) for EnDat absolute encoders	**6FX2003-0SU17**
Replacement connectors with external thread for encoders (1 unit)	**6FX2003-0SA12**
• 12-pin, insulator with 12 contact pins (1 unit) for RS 422, sin/cos 1 V_{pp}, HTL incremental encoders for SSI absolute encoders	

SIMAG H2 hollow-shaft measuring system

Application



SIMAG H2 is an incremental system for measuring angles of rotation and rotational speeds. The application range comprises hollow-shaft applications with direct drives, as well as autonomous spindle encoder applications.

The electrical signals and the flange outlet are compatible with existing motor measuring systems. SIMAG H2 can be operated with all commonly available controls as a motor measuring system or a direct measuring system.

Design

The SIMAG H2 measuring system consists of three components:

- Measuring wheel
- Scanning head with connecting lead
- Connection kit

The magnetic division on the measuring wheel is used as the unit of measurement. Different internal diameters are available for each external diameter. The internal diameter can be re-worked. The measuring wheel is attached with the shaft nut; alternatives are screw fitting to a shaft shoulder (not possible with all measuring wheel variants) or shrink fitting.

The non-contact sensor head scans the incremental and reference tracks on the measuring wheel and amplifies the signals.

It is connected via a cable attached to the scanning head. The end of the cable is pre-assembled with contacts and an insulation insert. For assembly, the insulation insert can be fixed into a straight or angular flange outlet. For confined spaces, the encoder can also be supplied with open wire ends.

Technical specifications

Product name	**SIMAG H2 hollow-shaft measuring system**
Output signals	2 voltage signals 1 V_{pp} in quadrate; 1 reference signal per encoder rotation
Operating voltage	5 V DC ± 5 %
Power consumption, typical	30 mA
Resolution	
(with external diameter D_a)	192 S/R (D_a = 60.72 mm/2.39 in)
	256 S/R (D_a = 81.14 mm/3.19 in)
	400 S/R (D_a = 126.92 mm/5.00 in)
	480 S/R (D_a = 152.39 mm/6.00 in)
	800 S/R (D_a = 254.25 mm/10.0 in)
Indexing accuracy of measuring wheel	
• Resolution = 192 S/R	± 96 angular seconds
• Resolution = 256 S/R	± 72 angular seconds
• Resolution = 400 S/R	± 46 angular seconds
• Resolution = 480 S/R	± 38 angular seconds
• Resolution = 800 S/R	± 23 angular seconds
Limit speed	
• Resolution = 192 S/R	≤ 33000 rpm
• Resolution = 256 S/R	≤ 25000 rpm
• Resolution = 400 S/R	≤ 16000 rpm
• Resolution = 480 S/R	≤ 13000 rpm
• Resolution = 800 S/R	≤ 8000 rpm
Distance between measuring wheel and scanning head	200 µm
Ambient temperature	
• Operation	-20 ... +120 °C (-4 ... +248 °F)
Shock resistance (11 ms)	1000 m/s² (3281 ft/s²)
Vibration (50 ... 2000 Hz)	200 m/s² (656 ft/s²)
Degree of protection to EN 60529 (IEC 60529)	
• when installed	IP67
Bending radius of connecting cable	
• One-time bending	≥ 25 mm (0.98 in)
• Repeated bending	≥ 60 mm (2.36 in)
Length of cable to converter, max.	50 m (164 ft)
Dimensions, approx. Scanning head (mounted)	
• Width	36 mm (1.42 in)
• Height	18 mm (0.71 in)
• Depth	15 mm (0.59 in)

S/R = signals/revolution

SIMAG H2 hollow-shaft measuring system

Technical specifications (continued)

Measuring wheels

Measuring wheel external diameter D_a = 60.72 mm (2.39 in)	
Internal diameter [1]	40^{H6} mm (1.57^{H6} in)
Thickness	15 mm (0.59 in)
Resolution	192 S/R
Moment of inertia, approx.	1.0×10^{-4} kgm^2 (8.85×10^{-4} lb$_f$-in-s^2)
Weight, approx.	0.20 kg (0.44 lb)

Measuring wheel external diameter D_a = 81.14 mm (3.19 in)				
Internal diameter [1]	45^{H6} mm (1.76^{H6} in)	55^{H6} mm (2.17^{H6} in)	60^{H6} mm (2.36^{H6} in)	65^{H6} mm (2.56^{H6} in)
Thickness	15 mm (0.59 in)	15 mm (0.59 in)	15 mm (0.59 in)	15 mm (0.59 in)
Resolution	256 S/R	256 S/R	256 S/R	256 S/R
Moment of inertia, approx.	3.8×10^{-4} kgm^2 (33.6×10^{-4} lb$_f$-in-s^2)	3.2×10^{-4} kgm^2 (28.3×10^{-4} lb$_f$-in-s^2)	2.8×10^{-4} kgm^2 (24.8×10^{-4} lb$_f$-in-s^2)	2.2×10^{-4} kgm^2 (19.5×10^{-4} lb$_f$-in-s^2)
Weight, approx.	0.35 kg (0.77 lb)	0.30 kg (0.66 lb)	0.25 kg (0.55 lb)	0.20 kg (0.44 lb)

Measuring wheel external diameter D_a = 126.92 mm (5.00 in)			
Internal diameter [1]	65^{H6} mm (2.56^{H6} in)	85^{H6} mm (3.35^{H6} in)	100^{H6} mm (3.94^{H6} in)
Thickness	15 mm (0.59 in)	15 mm (0.59 in)	15 mm (0.59 in)
Resolution	400 S/R	400 S/R	400 S/R
Moment of inertia, approx.	25×10^{-4} kgm^2 (221×10^{-4} lb$_f$-in-s^2)	21×10^{-4} kgm^2 (186×10^{-4} lb$_f$-in-s^2)	16×10^{-4} kgm^2 (142×10^{-4} lb$_f$-in-s^2)
Weight, approx.	1.0 kg (2.20 lb)	0.75 kg (1.65 lb)	0.5 kg (1.10 lb)

Measuring wheel external diameter D_a = 152.39 mm (6.00 in)		
Internal diameter [1]	80^{H6} mm (3.15^{H6} in)	110^{H6} mm (4.33^{H6} in)
Thickness	15 mm (0.59 in)	15 mm (0.59 in)
Resolution	480 S/R	480 S/R
Moment of inertia, approx.	54×10^{-4} kgm^2 (478×10^{-4} lb$_f$-in-s^2)	42×10^{-4} kgm^2 (372×10^{-4} lb$_f$-in-s^2)
Weight, approx.	1.5 kg (3.31 lb)	1.0 kg (2.20 lb)

Measuring wheel external diameter D_a = 254.25 mm (10.0 in)	
Internal diameter [1]	150^{H6} mm (5.91^{H6} in)
Thickness	15 mm (0.59 in)
Resolution	800 S/R
Moment of inertia, approx.	420×10^{-4} kgm^2 (3717×10^{-4} lb$_f$-in-s^2)
Weight, approx.	3.9 kg (8.60 lb)

[1] The measuring wheels can be re-worked (by increasing the inner diameter or by drilling holes/tapping threads). See Configuring/ Installation Guide.

Selection and ordering data

Designation	Order No.
Scanning head, incremental 1 mm (0.04 in) pole pitch, 1 V_{pp}	
• With plug insert and 0.3 m (11.8 in) temperature cable (2-core)	
- With 0.2 m (7.87 in) signal cable	**6FX2001-6AA12-1CA0**
- With 0.5 m (19.7 in) signal cable	**6FX2001-6AA12-1FA0**
- With 2.0 m (6.56 ft) signal cable	**6FX2001-6AA12-3AA0**
• With open wire ends	
- With 1.0 m (3.28 ft) signal cable	**6FX2001-6AA12-2AA5**
- With 1.5 m (4.92 ft) signal cable	**6FX2001-6AA12-2FA8**
- With 3.5 m (11.5 ft) signal cable	**6FX2001-6AA12-4FA0**
Measuring wheel D_a = 60.72 mm (2.39 in)	**6FX2001-6RB12-3EA0**
• Internal diameter 40^{H6} mm (1.57^{H6} in)	
Measuring wheel D_a = 81.14 mm (3.19 in)	
• Internal diameter 45^{H6} mm (1.77^{H6} in)	**6FX2001-6RB12-4EF0**
• Internal diameter 55^{H6} mm (2.17^{H6} in)	**6FX2001-6RB12-4FF8**
• Internal diameter 60^{H6} mm (2.36^{H6} in)	**6FX2001-6RB12-4GA0**
• Internal diameter 65^{H6} mm (2.56^{H6} in)	**6FX2001-6RB12-4GF0**
Measuring wheel D_a = 126.92 mm (5.00 in)	
• Internal diameter 65^{H6} mm (2.56^{H6} in)	**6FX2001-6RB12-5GF0**
• Internal diameter 85^{H6} mm (3.35^{H6} in)	**6FX2001-6RB12-5JF0**
• Internal diameter 100^{H6} mm (3.94^{H6} in)	**6FX2001-6RB12-5LA0**
Measuring wheel D_a = 152.39 mm (6.00 in)	
• Internal diameter 80^{H6} mm (3.15^{H6} in)	**6FX2001-6RB12-6JA0**
• Internal diameter 110^{H6} mm (4.33^{H6} in)	**6FX2001-6RB12-6MA0**
Measuring wheel D_a = 254.25 mm (10.0 in)	**6FX2001-6RB12-7SA0**
• Internal diameter 150^{H6} mm (5.91^{H6} in)	
Connection kit for insulation insert	
• Straight flange outlet	**6FX2001-6FA12-0GA0**
• Angular flange outlet	**6FX2001-6FA12-0WA0**
Extraction tool for insulation insert Of flange outlet, straight or angled	**6FX2001-6FK12-0AA0**

Connection system MOTION-CONNECT

7

For products approved for Canada and U.S.A., see Appendix.

General

Overview

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

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

The following MOTION-CONNECT cable designs are available:

- **MOTION-CONNECT 500** is the option for mainly fixed installation.
- **MOTION-CONNECT 500 PLUS** is designed to meet average mechanical requirements and is therefore particularly suitable for woodworking machines, printing machines and simple machine tools.
- **MOTION-CONNECT 700** is the ideal complement to linear motors and machines with high dynamic requirements. The cables are resistant to cutting oils.
- **MOTION-CONNECT 800** meets all high mechanical requirements for use in cable carriers for machine tools and production machines. The cables are resistant to cutting oils.

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

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.

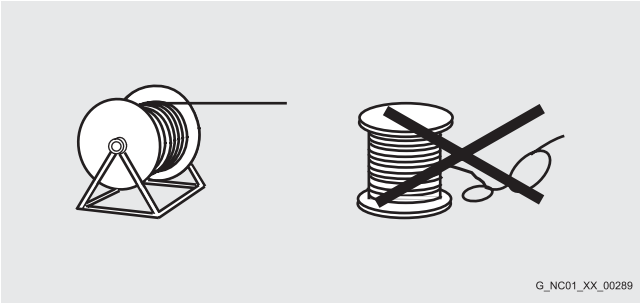
Siemens AG assumes no liability for correct transmission of signals or power in this case.

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.

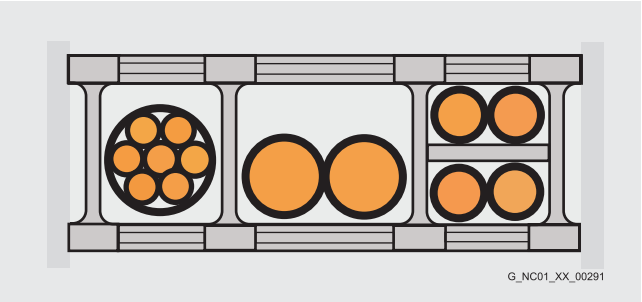
The cables are not suitable for outdoor use.

Operation on networks with 660 V to 690 V and earthed phase conductor is permissible only after taking a special precaution to reduce the overvoltage category by one grade,e.g. upstream connection of an isolating transformer.

Function



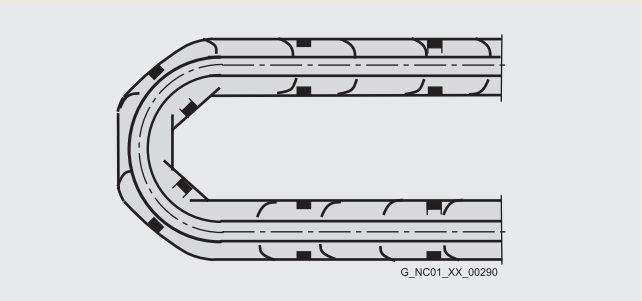
The cables must be removed from the drum without twisting, i.e., the cables must be unwound and must never be lifted over the drum flange in loops.



To maximize the service life of the cable carrier and cables, cables in the carrier made from different materials must be installed in the cable carrier with spacers. The spacers must be filled evenly to ensure that the position of the cables does not change during operation. The cables should be distributed as symmetrically as possible according to their weights and dimensions. Cables with very different outer diameters should be separated by spacers.

When inserting pre-assembled cables into the cable carrier, do **not** pull at the connector, as this may damage the strain relief or cable clamping.

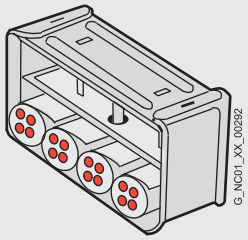
The cables must not be fixed in the cable carrier. They must be freely movable.



The cables must be able to be moved without applying force in particular in the bending radius of the carrier. The specified minimum bending radius must be adhered to.

The cable fixings must be attached at both ends at an appropriate distance away from the end points of the moving parts in a "dead" zone.

Function (continued)



MOTION-CONNECT cables are tested in a cable carrier. A cable strain relief is attached to the moving ends of the cable carrier. Strain relief is applied over a wide area of the sheath surface without squeezing the cable.

When routing the cables, always observe the installation instructions of the cable carrier manufacturer depending on the design of the plant.

Note:

If, for example, pre-assembled cables are installed in a cable carrier in such a way that the connector would inhibit assembly, pre-assembled cables without assembled connectors can also be supplied (power and signal cables [1]). In this case, the contacts of the cables are crimped and the connector housing is supplied separately. After routing the cables, the customer assembles the connector housing.

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

In case of vibration load and with horizontal or vertical cable entries, we recommend that the cable is additionally fixed if between the cable strain relief on the cable carrier and the terminal at the motor part of the cable is hanging loose or is not routed. To prevent machine vibrations being transmitted to the connectors, the cable should be fixed at the moving part where the motor is mounted.

Representation in connection overviews

Symbol	Explanation
▬——	Connector with pin contacts
)——	Connector with socket contacts
o——	Exposed core ends
– – – –	Cable not included in scope of supply

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; AC 50/60 Hz 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	
Power				IEC 60364-5-52
150	–	–	344	
185	–	–	392	
> 185	Values must be taken from the standard			

Derating factors for power and signal cables

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

[1] Not for DRIVE-CLiQ signal cables.

General
DRIVE-CLiQ signal cables

Technical specifications

DRIVE-CLiQ signal cables	DRIVE-CLiQ	DRIVE-CLiQ MOTION-CONNECT 500	DRIVE-CLiQ MOTION-CONNECT 800
Type	**6FX2...-1DC..-....**	**6FX5...-.DC..-....**	**6FX8...-.DC..-....**
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	UL STYLE 20236/CSA-N.210.2-M90
• UL-CSA File No. [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 ... +176 °F)	-20 … +80 °C (-4 ... +176 °F)	-20 … +80 °C (-4 ... +176 °F)
• Flexible installation	–	0 … 60 °C (+32 ... +140 °F)	-20 … +60 °C (-4 ... +140 °F)
Tensile load, max.			
• Fixed installation	45 N/mm^2 (6526 lb$_f$/in^2)	80 N/mm^2 (11600 lb$_f$/in^2)	50 N/mm^2 (7252 lb$_f$/in^2)
• Flexible installation	–	30 N/mm^2 (4350 lb$_f$/in^2)	20 N/mm^2 (2901 lb$_f$/in^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)
Torsional stress	–	Absolute 30°/m	Absolute 30°/m
Bending	–	100000	10 million
Traversing velocity	–	30 m/min (98.43 ft/min)	180 m/min (591 ft/min)
Acceleration	–	2 m/s^2 (6.56 ft/s^2)	5 m/s^2 (16.41 ft/s^2) (5 m (16.41 ft)); 10 m/s^2 (32.81 ft/s^2) (2.5 m (8.20 ft))
Insulation material incl. jacket	CFC/silicone-free	CFC/silicone-free	CFC/halogen/silicone-free IEC 60754-1/DIN VDE 0472-815
Oil resistance	EN 60811-2-1	EN 60811-2-1 (mineral oil only)	EN 60811-2-1
Outer jacket	PVC	PVC	PUR, HD22.10 S2 (VDE 0282, Part 10)
	Gray RAL 7032	DESINA color green RAL 6018	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

[1] The File Number is printed on the cable jacket.

Technical specifications (continued)

Signal cables	MOTION-CONNECT 500	MOTION-CONNECT 700	MOTION-CONNECT 800
Type	**6FX500.-....-....**	**6FX700.-....-....**	**6FX800.-.....-....**
Approvals			
• VDE	Yes	Yes	Yes
• cUL or UL/CSA	UL758-CSA-C22.2-N.210.2-M90	UL758-CSA-C22.2-N.210.2-M90	UL758-CSA-C22.2-N.210.2-M90
• UL-CSA File No.[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 … +176 °F)	-50 … +80 °C (-58 … +176 °F)	-50 … +80 °C (-58 … +176 °F)
• Flexible installation	0 … 60 °C (+32 … +140 °F)	-20 … +60 °C (-4 ... +140 °F)	-20 … +60 °C (-4 ... +140 °F)
Tensile load, max.			
• Fixed installation	50 N/mm^2 (7252 lb$_f$/in^2)	50 N/mm^2 (7252 lb$_f$/in^2)	50 N/mm^2 (7252 lb$_f$/in^2)
• Flexible installation	20 N/mm^2 (2901 lb$_f$/in^2)	20 N/mm^2 (2901 lb$_f$/in^2)	20 N/mm^2 (2901 lb$_f$/in^2)
Smallest bending radius			
• Fixed installation	60 mm (2.36 in)	60 mm (2.36 in)	60 mm (2.36 in)
• Flexible installation	100 mm (3.94 in)	95 mm (3.74 in)	100 mm (3.94 in)
Torsional stress	Absolute 30°/m	Absolute 30°/m	Absolute 30°/m
Bending	100000	10 million	10 million
Traversing velocity	180 m/min (591 ft/min)	200 m/min (656.2 ft/min)	180 m/min (591 ft/min)
Acceleration	5 m/s^2 (16.41 ft/s^2)	30 m/s^2 (98.43 ft/s^2)	5 m/s^2 (16.41 ft/s^2) (5 m (16.41 ft)); 10 m/s^2 (32.81 ft/s^2) (2.5 m (8.20 ft))
Insulation material incl. jacket	CFC/silicone-free	CFC/halogen/silicone-free IEC 60754-1/DIN VDE 0472-815	CFC/halogen/silicone-free IEC 60754-1/DIN VDE 0472-815
Oil resistance	EN 60811-2-1 (mineral oil only)	EN 60811-2-1	EN 60811-2-1
Outer jacket	PVC	PUR, HD22.10 S2 (VDE 0282, Part 10)	PUR, HD22.10 S2 (VDE 0282, Part 10)
	DESINA color green RAL 6018	DESINA color green RAL 6018	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

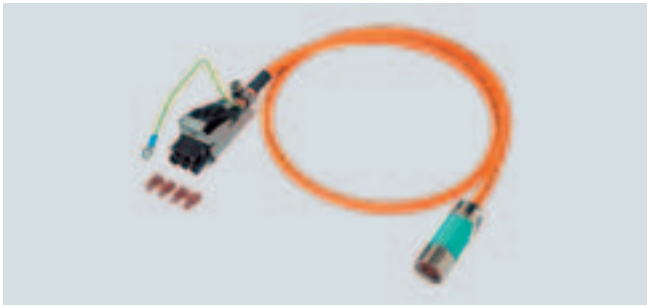
1) The File Number is printed on the cable jacket.

Technical specifications (continued)

Power cables	MOTION-CONNECT 500	MOTION-CONNECT 500 PLUS	MOTION-CONNECT 700	MOTION-CONNECT 800
Type	**6FX500.-....-....**	**6FX51..-....-....**	**6FX700.-....-....**	**6FX800.-.....-....**
Approvals				
• VDE [1]	Yes	Yes	Yes	Yes
• cUL or UL/CSA	UL758-CSA-C22.2-N.210.2-M90	UL758-CSA-C22.2-N210.2-M90	UL758-CSA-C22.2-N.210.2-M90	UL758-CSA-C22.2-N.210.2-M90
• UL-CSA File No. [2]	Yes	Yes	Yes	Yes
Rated voltage V_0/V in accordance with EN 50395				
• Power conductors	600 V/1000 V	600 V/1000 V	600 V/1000 V	600 V/1000 V
• Signal conductors	24 V (EN) 1000 V (UL/CSA)	24 V (EN) 1000 V (UL/CSA)	24 V (EN) 1000 V (UL/CSA)	24 V (EN) 1000 V (UL/CSA)
Test voltage, rms				
• Power conductors	4 kV	4 kV	4 kV	4 kV
• Signal conductors	2 kV	2 kV	2 kV	2 kV
Operating temperature on the surface				
• Fixed installation	-20 … +80 °C (-4 ... +176 °F)	-20 ... +80 °C (-4 ... +176 °F)	-50 … +80 °C (-58 ... +176 °F)	-50 … +80 °C (-58 ... +176 °F)
• Flexible installation	0 … +60 °C (+32 ... +140 °F)	0 ... +60 °C (+32 ... +140 °F)	-20 … +60 °C (-4 ... +140 °F)	-20 … +60 °C (-4 ... +140 °F)
Tensile load, max.				
• Fixed installation	50 N/mm^2 (7252 lb$_f$/in^2)	50 N/mm^2 (7252 lb$_f$/in^2)	50 N/mm^2 (7252 lb$_f$/in^2)	50 N/mm^2 (7252 lb$_f$/in^2)
• Flexible installation	20 N/mm^2 (2901 lb$_f$/in^2)	20 N/mm^2 (2901 lb$_f$/in^2)	20 N/mm^2 (2901 lb$_f$/in^2)	20 N/mm^2 (2901 lb$_f$/in^2)
Smallest bending radius				
• Fixed installation	5 × D_{max}	5 × D_{max}	4 × D_{max}	6 × D_{max}
• Flexible installation	See power cables	See power cables	See power cables	See power cables
Torsional stress	Absolute 30°/m	Absolute 30°/m	Absolute 30°/m	Absolute 30°/m
Bending	100000	2 million	10 million from 16 mm^2: 3 million	10 million from 10 mm^2: 3 million
Traversing velocity	30 m/min (98.43 ft/min)	180 m/min (591 ft/min)	200 m/min (656 ft/min) from 16 mm^2: 150 m/min (492 ft/min)	180 m/min (591 ft/min) from 10 mm^2: 100 m/min (328 ft/min)
Acceleration	2 m/s^2 (6.56 ft/s^2)	5 m/s^2 (16.41 ft/s^2)	30 m/s^2 (98.43 ft/s^2)	5 m/s^2 (16.41 ft/s^2) (5 m (16.41 ft)); 10 m/s^2 (32.81 ft/s^2) (2.5 m (8.20 ft))
Insulation material incl. jacket	CFC/silicone-free	CFC/silicone-free	CFC/halogen/silicone-free IEC 60754-1/ DIN VDE 0472-815	CFC/halogen/silicone-free IEC 60754-1/ DIN VDE 0472-815
Oil resistance	EN 60811-2-1 (mineral oil only)	EN 60811-2-1 (mineral oil only)	EN 60811-2-1	EN 60811-2-1
Outer jacket	PVC DESINA color orange RAL 2003	PVC DESINA color orange RAL 2003	PUR, HD22.10 S2 (VDE 0282, Part 10) DESINA color orange RAL 2003	PUR, HD22.10 S2 (VDE 0282, Part 10) DESINA color orange RAL 2003
Flame-retardant	EN 60332-1-1 to 1-3	EN 60332-1-1 to 1-3	EN 60332-1-1 to 1-3	EN 60332-1-1 to 1-3

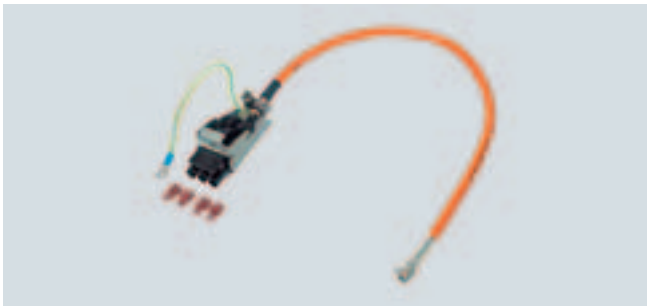
[1] The respective registration number is printed on the cable jacket (only valid for power cables).
[2] The File Number is printed on the cable jacket.

Overview



Motor Module plug with circular connector

Ring terminal end with circular connector



Motor Module plug with exposed core ends

Connection with circular connector for Power Module and Motor Module of the booksize compact format

The synchronous and asynchronous motors are connected to the Motor Modules or Power Modules by means of MOTION-CONNECT power cables.

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

Depending on the version, the MOTION-CONNECT power cables are pre-assembled at one end or both ends.

Note:
All **6FX.002-5....-....** power cables are also available as customized cables with crimped contacts and with the connector housing for the **module end** enclosed separately.
In this case, the 6th position of the Order No. must be changed from 0 to 1: 6FX.0**1**2-5....-....

Power cables for SINAMICS S120

Selection and ordering data

MOTION-CONNECT power cables without brake cores for motors connected to Motor Modules

Connection method, Motor Module end	Number of cores x cross-section	Connector size, motor end	Pre-assembled cable for 1FT/1FK motors	D_{max}		Cable sold by the meter [1] for motors with terminal box	Weight (without connector)		Smallest perm. bending radius [2]	
				6FX5	6FX8		6FX5	6FX8	6FX5	6FX8
	mm²		Order No.	mm (in)	mm (in)	Order No.	kg/m (lb/ft)	kg/m (lb/ft)	mm (in)	mm (in)
Connector [3]	4×1.5	1	6FX■002-5CS01-....	8.4 (0.33)	10.4 (0.41)	6FX■008-1BB11-....	0.12 (0.08)	0.16 (0.11)	155 (6.10)	100 (3.94)
		1.5	6FX■002-5CS21-....							
		e. c. [4]	6FX5002-5CS02-....							
	4×2.5	1	6FX■002-5CS11-....	10.0 (0.39)	12.1 (0.48)	6FX■008-1BB21-....	0.21 (0.14)	0.23 (0.16)	180 (7.09)	120 (4.72)
		1.5	6FX■002-5CS31-....							
		e. c. [4]	6FX5002-5CS12-....							
	4×4	1.5	6FX■002-5CS41-....	11.4 (0.45)	13.2 (0.52)	6FX■008-1BB31-....	0.27 (0.18)	0.31 (0.21)	210 (8.27)	130 (5.12)
		e. c. [4]	6FX5002-5CS42-....							
	4×6	1.5	6FX■002-5CS51-....	13.6 (0.54)	16.0 (0.63)	6FX■008-1BB41-....	0.37 (0.25)	0.42 (0.28)	245 (9.65)	170 (6.69)
		e. c. [4]	6FX5002-5CS52-....							
	4×10	1.5	6FX■002-5CS61-....	20.0 (0.79)	19.4 (0.76)	6FX■008-1BB51-....	0.73 (0.49)	0.63 (0.42)	360 (14.17)	210 (6.69)
		3	6FX■002-5CS13-....							
		e. c. [4]	6FX5002-5CS62-....							
Ring terminal ends	4×6	1.5	6FX■002-5CS54-....	13.6 (0.54)	16.0 (0.63)	6FX■008-1BB41-....	0.37 (0.25)	0.42 (0.28)	245 (9.65)	170 (6.69)
	4×10	1.5	6FX■002-5CS64-....	20.0 (0.79)	19.4 (0.76)	6FX■008-1BB51-....	0.73 (0.49)	0.63 (0.42)	360 (14.17)	210 (6.69)
		3	6FX■002-5CS14-....							
	4×16	1.5	6FX8002-5CS24-....	24.2 (0.95)	23.6 (0.93)	6FX■008-1BB61-....	1.10 (0.74)	0.95 (0.64)	440 (17.32)	260 (10.24)
		3	6FX■002-5CS23-....							
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)	–
	4×150	–	–	63.0 (2.48)	–	6FX5008-1BB15-....	8.21 (5.52)	–	1135 (44.68)	–
	4×185	–	–	66.2 (2.61)	–	6FX5008-1BB18-....	9.82 (6.60)	–	1195 (47.05)	–

MOTION-CONNECT 500	**5**			**5**	
MOTION-CONNECT 800	**8**			**8**	
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 drums.

[2] Valid for routing in cable carrier.

[3] For Motor Modules 3 A to 30 A in booksize format.

[4] e. c. = exposed core ends; suitable for motors with terminal box.

Selection and ordering data (continued)

MOTION-CONNECT power cables with brake cores for motors connected to Motor Modules

Connection method, Motor Module end	Number of cores x cross-section	Connector size, motor end	Pre-assembled cable for 1FT/1FK motors	D_{max}		Cable sold by the meter [1] for motors with terminal box	Weight (without connector)		Smallest perm. bending radius [2]	
				6FX5	6FX8		6FX5	6FX8	6FX5	6FX8
	mm²		Order No.	mm (in)	mm (in)	Order No.	kg/m (lb/ft)	kg/m (lb/ft)	mm (in)	mm (in)
Connector [3]	4x1.5+2x1.5	0.5	6FX 5002-5DA20-....	10.8 (0.43)	12.9 (0.51)	6FX■008-1BA11-....	0.22 (0.15)	0.25 (0.17)	195 (7.68)	125 (4.92)
		1	6FX■002-5DS01-....							
		1.5	6FX■002-5DS21-....							
	4x2.5+2x1.5	1	6FX■002-5DS11-....	12.4 (0.49)	14.2 (0.56)	6FX■008-1BA21-....	0.25 (0.17)	0.31 (0.21)	225 (8.86)	140 (4.92)
		1.5	6FX■002-5DS31-....							
	4x4+2x1.5	1.5	6FX■002-5DS41-....	14.0 (0.55)	15.3 (0.60)	6FX■008-1BA31-....	0.35 (0.24)	0.40 (0.27)	255 (10.04)	150 (5.91)
	4x6+2x1.5	1.5	6FX■002-5DS51-....	16.1 (0.63)	17.8 (0.70)	6FX■008-1BA41-....	0.49 (0.33)	0.53 (0.36)	290 (11.42)	195 (7.68)
	4x10+2x1.5	1.5	6FX■002-5DS61-....	21.7 (0.85)	20.8 (0.82)	6FX■008-1BA51-....	0.81 (0.54)	0.78 (0.52)	395 (15.55)	230 (9.06)
		3	6FX■002-5DS13-....							
Ring terminal ends	4x6+2x1.5	1.5	6FX■002-5DS54-....	16.1 (0.63)	17.8 (0.70)	6FX■008-1BA41-....	0.49 (0.33)	0.53 (0.36)	290 (11.42)	195 (7.68)
	4x10+2x1.5	1.5	6FX■002-5DS64-....	21.7 (0.85)	20.8 (0.82)	6FX■008-1BA51-....	0.81 (0.54)	0.78 (0.52)	395 (15.55)	230 (9.06)
		3	6FX■002-5DS14-....							
	4x16+2x1.5	3	6FX■002-5DS23-....	25.0 (0.98)	24.7 (0.97)	6FX■008-1BA61-....	1.12 (0.75)	1.05 (0.71)	450 (17.72)	275 (10.83)
Exposed core ends [4]	4x25+2x1.5	3	6FX■002-5DG33-....	29.4 (1.16)	27.9 (1.10)	6FX■008-1BA25-....	1.62 (1.09)	1.51 (1.01)	530 (20.87)	325 (12.80)
	4x35+2x1.5	3	6FX■002-5DG43-....	32.6 (1.28)	32.0 (1.26)	6FX■008-1BA35-....	2.06 (1.38)	2.00 (1.34)	590 (23.23)	380 (14.96)
	4x50+2x1.5	3	6FX■002-5DG53-....	38.0 (1.50)	35.8 (1.41)	6FX■008-1BA50-....	3.04 (2.04)	2.66 (1.79)	685 (27.97)	420 (16.54)
MOTION-CONNECT 500			**5**			**5**				
MOTION-CONNECT 800			**8**			**8**				
Length codes			**....**			**....**				

MOTION-CONNECT power cables without brake cores for motors connected to Power Modules AC/AC units and Motor Modules in booksize compact format

Connection method, Power Module end	Number of cores x cross-section	Connector size, motor end	Pre-assembled cable for 1FT/1FK motors	D_{max}		Cable sold by the meter [1]	Weight (without connector)		Smallest perm. bending radius [2]	
				6FX5	6FX8		6FX5	6FX8	6FX5	6FX8
	mm²		Order No.	mm (in)	mm (in)	Order No.	kg/m (lb/ft)	kg/m (lb/ft)	mm (in)	mm (in)
Exposed core ends	4x1.5	1	6FX■002-5CG01-....	8.4 (0.33)	10.4 (0.41)	6FX■008-1BB11-....	0.12 (0.08)	0.16 (0.11)	155 (6.10)	100 (3.94)
		1.5	6FX■002-5CG21-....							
	4x2.5	1	6FX■002-5CG11-....	10.0 (0.39)	12.1 (0.48)	6FX■008-1BB21-....	0.21 (0.14)	0.23 (0.15)	180 (7.09)	120 (4.72)
		1.5	6FX■002-5CG31-....							
	4x4	1.5	6FX■002-5CG41-....	11.4 (0.45)	13.2 (0.52)	6FX■008-1BB31-....	0.27 (0.18)	0.31 (0.21)	210 (8.27)	130 (5.12)
	4x6	1.5	6FX■002-5CG51-....	13.6 (0.54)	16.0 (0.63)	6FX■008-1BB41-....	0.37 (0.25)	0.42 (0.28)	245 (9.65)	170 (6.69)
	4x10	1.5	6FX■002-5CG61-....	20.0 (0.79)	19.4 (0.76)	6FX■008-1BB51-....	0.73 (0.49)	0.63 (0.42)	360 (14.17)	210 (8.27)
		3	6FX■002-5CG13-....							
	4x16	3	6FX■002-5CG23-....	24.2 (0.95)	23.6 (0.93)	6FX 5008-1BB61-....	1.10 (0.74)	0.95 (0.64)	440 (17.32)	260 (10.24)
MOTION-CONNECT 500			**5**			**5**				
MOTION-CONNECT 800			**8**			**8**				
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 drums.
[2] Valid for routing in cable carrier.
[3] For Motor Modules 3 A to 30 A in booksize format.
[4] Length of core ends: 300 mm (11.81 in). 4 M8 cable lugs, 1 M6 cable lug and 1 spring-loaded terminal are also included in the scope of supply of the cables.

Selection and ordering data (continued)

MOTION-CONNECT power cables with brake cores for motors connected to Power Modules AC/AC units and Motor Modules in booksize compact format

Connection method, Power Module end	Number of cores x cross-section	Connector size, motor end	Pre-assembled cable for 1FT/1FK motors	D_{max}		Cable sold by the meter [1]	Weight (without connector)		Smallest perm. bending radius [2]	
				6FX5	6FX8		6FX5	6FX8	6FX5	6FX8
	mm²		Order No.	mm (in)	mm (in)	Order No.	kg/m (lb/ft)	kg/m (lb/ft)	mm (in)	mm (in)
Exposed core ends	4x1.5+2x1.5	0.5	**6FX5002-5DA30-....**	10.8 (0.43)	–	**6FX5008-1BA11-....**	0.22 (0.15)	–	195 (7.68)	–
		1	**6FX■002-5DG01-....**	10.8 (0.43)	12.9 (0.51)	**6FX■008-1BA11-....**	0.22 (0.15)	0.25 (0.17)	195 (7.68)	125 (4.92)
		1.5	**6FX■002-5DG21-....**							
	4x2.5+2x1.5	1	**6FX■002-5DG11-....**	12.4 (0.49)	14.2 (0.56)	**6FX■008-1BA21-....**	0.25 (0.17)	0.31 (0.21)	225 (8.86)	140 (5.51)
		1.5	**6FX■002-5DG31-....**							
	4x4+2x1.5	1.5	**6FX■002-5DG41-....**	14.0 (0.55)	15.3 (0.60)	**6FX■008-1BA31-....**	0.35 (0.34)	0.40 (0.27)	255 (10.04)	150 (5.91)
	4x6+2x1.5	1.5	**6FX■002-5DG51-....**	16.1 (0.63)	17.8 (0.70)	**6FX■008-1BA41-....**	0.49 (0.33)	0.53 (0.36)	290 (11.42)	195 (7.68)
	4x10+2x1.5	1.5	**6FX■002-5DG61-....**	21.7 (0.85)	20.8 (0.82)	**6FX■008-1BA51-....**	0.81 (0.54)	0.78 (0.52)	395 (15.55)	230 (9.06)
		3	**6FX■002-5DG13-....**							
	4x16+2x1.5	3	**6FX■002-5DG23-....**	25.0 (0.98)	24.7 (0.60)	**6FX■008-1BA61-....**	1.12 (0.75)	1.05 (0.71)	450 (17.72)	275 (10.83)
	4x25+2x1.5	3	**6FX■002-5DG33-....**	29.4 (1.16)	27.9 (1.10)	**6FX■008-1BA25-....**	1.62 (1.09)	1.51 (1.01)	530 (20.87)	325 (12.80)
	4x35+2x1.5	3	**6FX■002-5DG43-....**	32.6 (1.28)	32.0 (1.26)	**6FX■008-1BA35-....**	2.06 (1.38)	2.00 (1.34)	590 (23.23)	380 (14.96)
	4x50+2x1.5	3	**6FX■002-5DG53-....**	38.0 (1.50)	35.8 (1.41)	**6FX■008-1BA50-....**	3.04 (2.04)	2.66 (1.79)	685 (26.97)	420 (16.54)

MOTION-CONNECT 500	**5**			**5**		
MOTION-CONNECT 800	**8**			**8**		
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 drums.

[2] Valid for routing in cable carrier.

Accessories

Power cable extensions for 1FT/1FK motors connected to Motor Modules

No. of cores x cross-section mm²	Connector size	Basic cable for 1FT/1FK motors Type	Extension Order No.
4x1.5	0.5	6FX5002-5DA20-....	**6FX5002-5ME05-....**
	1	6FX . 002-5 . S01-....	**6FX■002-5■A05-....**
	1.5	6FX . 002-5 . S21-....	**6FX■002-5■A28-....**
4x2.5	1	6FX . 002-5 . S11-....	**6FX■002-5■A15-....**
	1.5	6FX . 002-5 . S31-....	**6FX■002-5■A38-....**
4x4	1.5	6FX . 002-5 . S41-....	**6FX■002-5■A48-....**
4x6	1.5	6FX . 002-5 . S51-....	**6FX■002-5■A58-....**
4x10	1.5	6FX . 002-5 . S61-....	**6FX■002-5■A68-....**
	3	6FX . 002-5 . S13-....	**6FX■002-5■X18-....**
4x16	3	6FX . 002-5 . S23-....	**6FX■002-5■X28-....**
4x25	3	6FX . 002-5DG33-....	**6FX■002-5DX38-....**
4x35	3	6FX . 002-5DG43-....	**6FX■002-5DX48-....**
4x50	3	6FX . 002-5DG53-....	**6FX■002-5DX58-....**

MOTION-CONNECT 500			**5**
MOTION-CONNECT 800			**8**
Without brake cores		**C**	
With brake cores		**D**	
Length codes			**....**

Power cable extensions for 1FT/1FK motors connected to Power Modules AC/AC units and Motor Modules in booksize compact format

No. of cores x cross-section mm²	Connector size	Basic cable for 1FT/1FK motors Type	Extension Order No.
4x1.5	0.5	6FX5002-5DA30-....	**6FX5002-5ME05-....**
	1	6FX . 002-5 . G01-....	**6FX■002-5■A05-....**
	1.5	6FX . 002-5 . G21-....	**6FX■002-5■A28-....**
4x2.5	1	6FX . 002-5 . G11-....	**6FX■002-5■A15-....**
	1.5	6FX . 002-5 . G31-....	**6FX■002-5■A38-....**
4x4	1.5	6FX . 002-5 . G41-....	**6FX■002-5■A48-....**
4x6	1.5	6FX . 002-5 . G51-....	**6FX■002-5■A58-....**
4x10	1.5	6FX . 002-5 . G61-....	**6FX■002-5■A68-....**
	3	6FX . 002-5 . G13-....	**6FX■002-5■X18-....**
4x16	3	6FX . 002-5 . G23-....	**6FX■002-5■X28-....**
4x25	3	6FX . 002-5DG33-....	**6FX■002-5DX38-....**
4x35	3	6FX . 002-5DG43-....	**6FX■002-5DX48-....**
4x50	3	6FX . 002-5DG53-....	**6FX■002-5DX58-....**

MOTION-CONNECT 500			**5**
MOTION-CONNECT 800			**8**
Without brake cores		**C**	
With brake cores		**D**	
Length codes			**....**

The combinations of power cable extensions shown are only provided by way of example.

Note:
The maximum specified cable length (basic cable and extensions) must not be exceeded. The total maximum length is reduced by 2 m (6.56 ft) for each interruption point.

Power cables for SINAMICS S120

Selection and ordering data

Pre-assembled MOTION-CONNECT 500 power cables without brake cores for 1FS6 Ex motors connected to Motor Modules

Connection method, Motor Module end	Number of cores x cross-section	**Pre-assembled cable for 1FS6 motors (temperature-resistant up to 100 °C/212 °F)**	D_{max}	Weight (without connector)	Smallest perm. bending radius [1]
	mm^2	Order No.	mm (in)	kg/m (lb/ft)	mm (in)
Pin terminals	4×1.5	**6FX5002-5XA00-....**	10.4 (0.41)	0.160 (0.116)	190 (7.48)
	4×2.5	**6FX5002-5XA10-....**	12.1 (0.48)	0.235 (0.170)	220 (8.66)
	4×4	**6FX5002-5XA20-....**	13.2 (0.52)	0.300 (0.217)	240 (9.45)
	4×6	**6FX5002-5XA30-....**	15.3 (0.60)	0.400 (0.289)	280 (11.02)
Length codes		**....**			

7

[1] Valid for routing in cable carrier.

Overview

MOTION-CONNECT DRIVE-CLiQ cable

Signal cables are pre-assembled and are sold by the meter for the connection of a variety of components.

The following different types of cable are available:

- DRIVE-CLiQ cables
- MOTION-CONNECT DRIVE-CLiQ cables
- MOTION-CONNECT pre-assembled cables

Application

DRIVE-CLiQ cables

are used to connect components with DRIVE-CLiQ connections which have a separate or external 24 V DC power supply.

DRIVE-CLiQ cables for connecting Line/Motor Modules with a Control Unit are part of the scope of supply of the relevant Line/Motor Modules.

MOTION-CONNECT DRIVE-CLiQ cables

are used whenever components with DRIVE-CLiQ connections must meet high requirements such as mechanical stress and oil resistance, e.g. in the event of a connection outside the cabinet between

- Motor Modules and Sensor Modules
- Motor Modules and motors with DRIVE-CLiQ interface

MOTION-CONNECT DRIVE-CLiQ cables feature 24 V DC cores.

MOTION-CONNECT pre-assembled cables

are used whenever motor encoders on motors without DRIVE-CLiQ interface are connected to Sensor Modules.

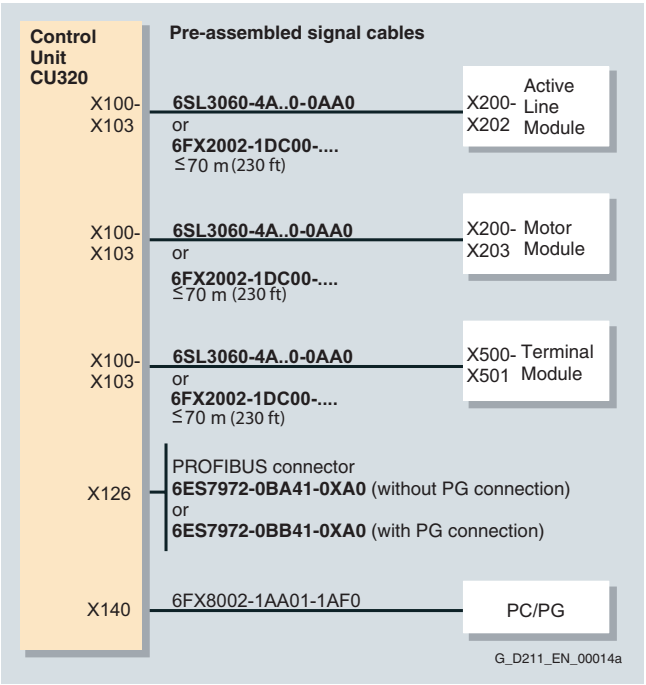
Note:
All **6FX.002-2C...-....** signal cables are also available customized with crimped contacts and with the connector housing supplied separately (not in the case of DRIVE-CLiQ signal cables).

- Signal cables with enclosed connector housing **for the motor side**: In this case, the 6th position of the Order No. must be changed from 0 to 4: 6FX.0**4**2-2C...-....
- Signal cables with enclosed connector housing **for the module side**: In this case, the 6th position of the Order No. must be changed from 0 to 1: 6FX.0**1**2-2C...-....

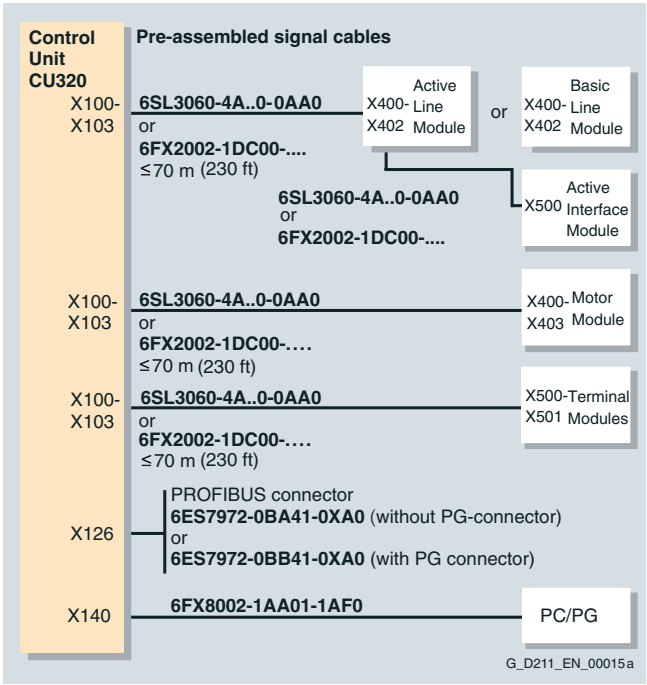
Integration

For the standard configuration, the required DRIVE-CLiQ cables of type 6SL3060-4A..0-0AA0 are already included in the scope of supply of the Line Modules and Motor Modules. In this case, the modules must be mounted directly adjacent to one another in a row.

Connection overview of Control Unit CU320 in booksize compact and booksize formats



Connection overview for Control Unit CU320 in chassis format

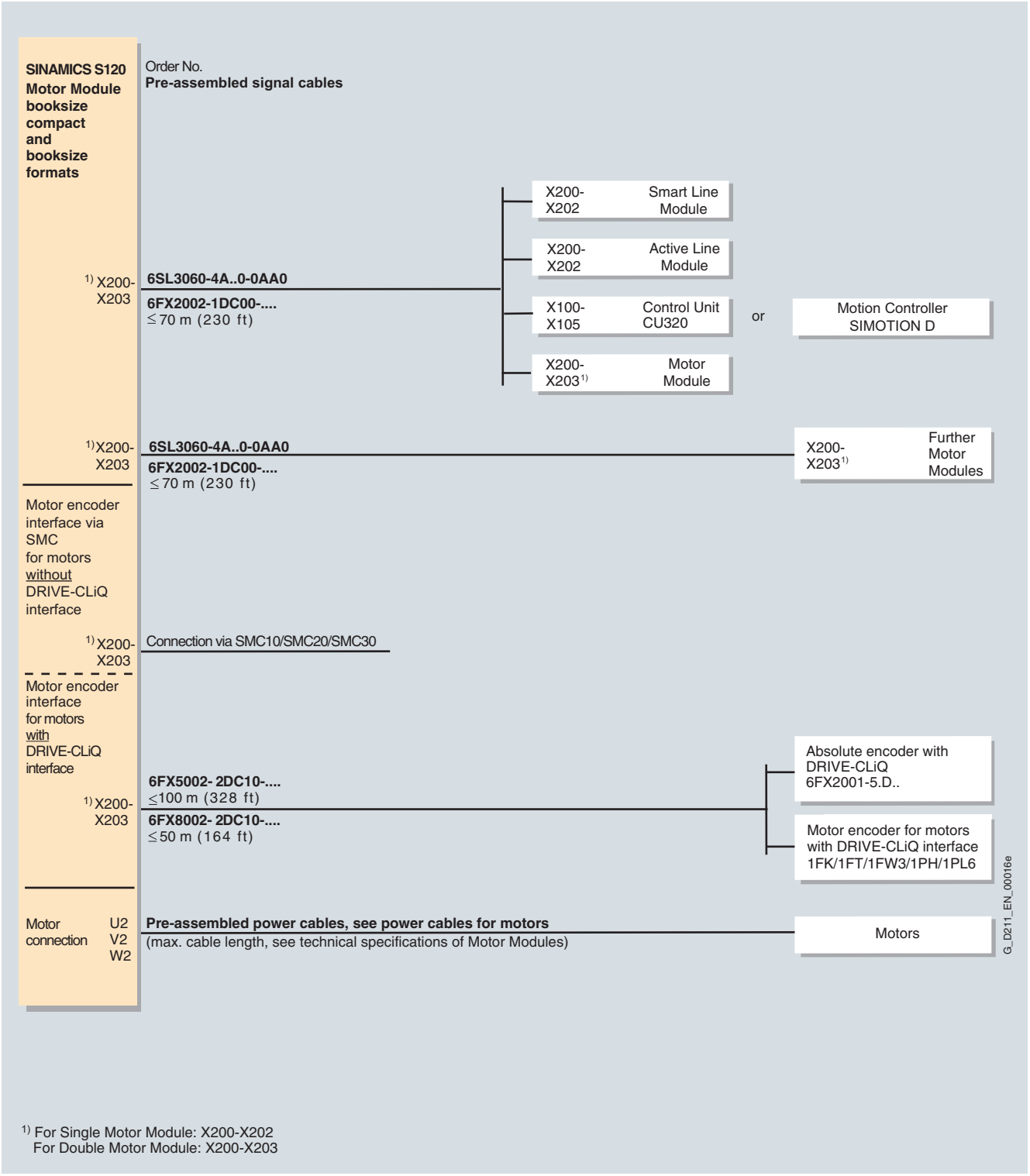


Signal cables for SINAMICS S120

Integration (continued)

Connection overview of Line Modules and Motor Modules in booksize compact and chassis formats

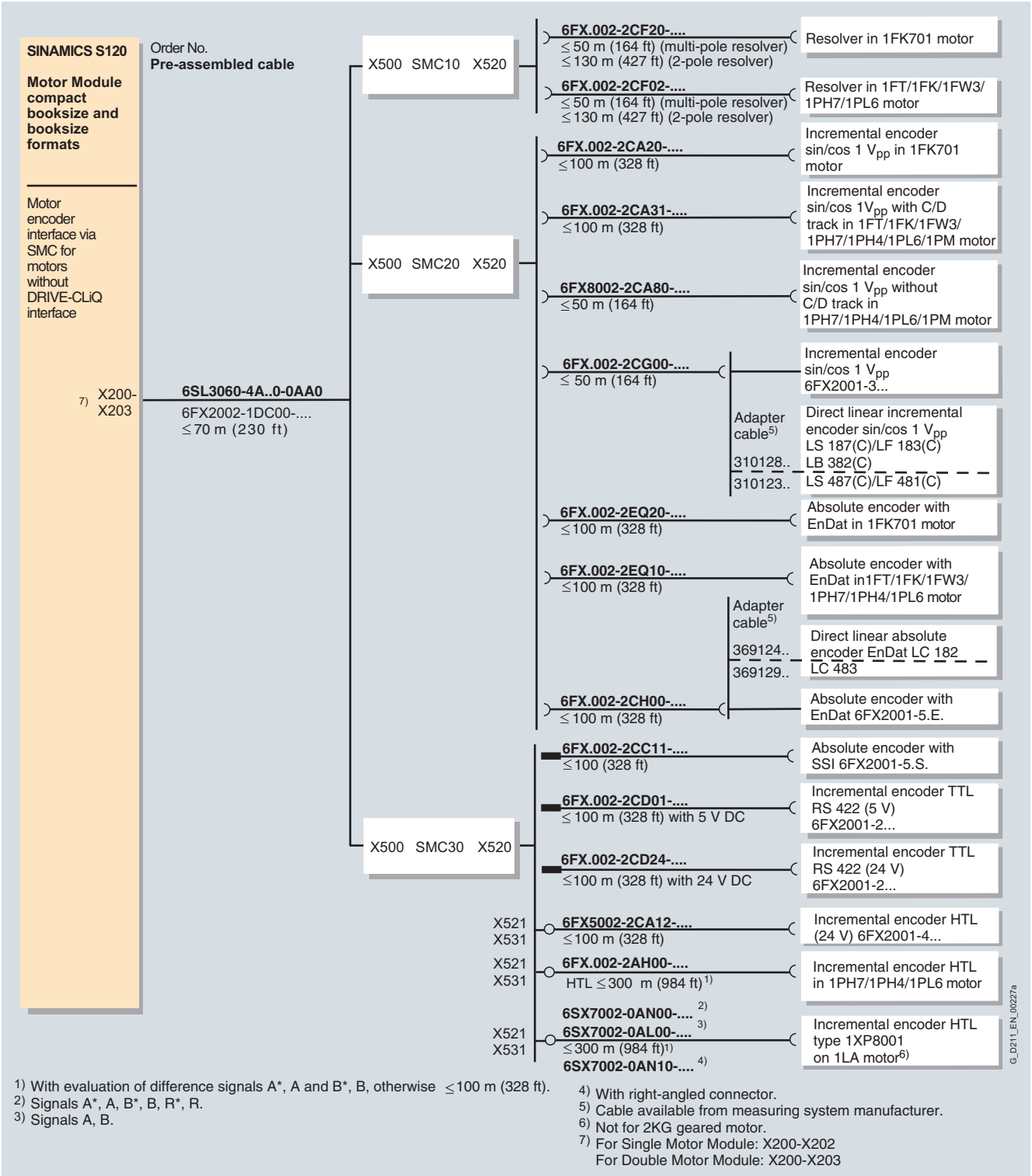
For the standard configuration, the required DRIVE-CLiQ cables of type 6SL3060-4A..0-0AA0 are already included in the scope of supply of the Line Modules and Motor Modules. In this case, the modules must be mounted directly adjacent to one another in a row.



1) For Single Motor Module: X200-X202
For Double Motor Module: X200-X203

Integration (continued)

Connection overview of Line Modules and Motor Modules in booksize compact and booksize formats (continued)



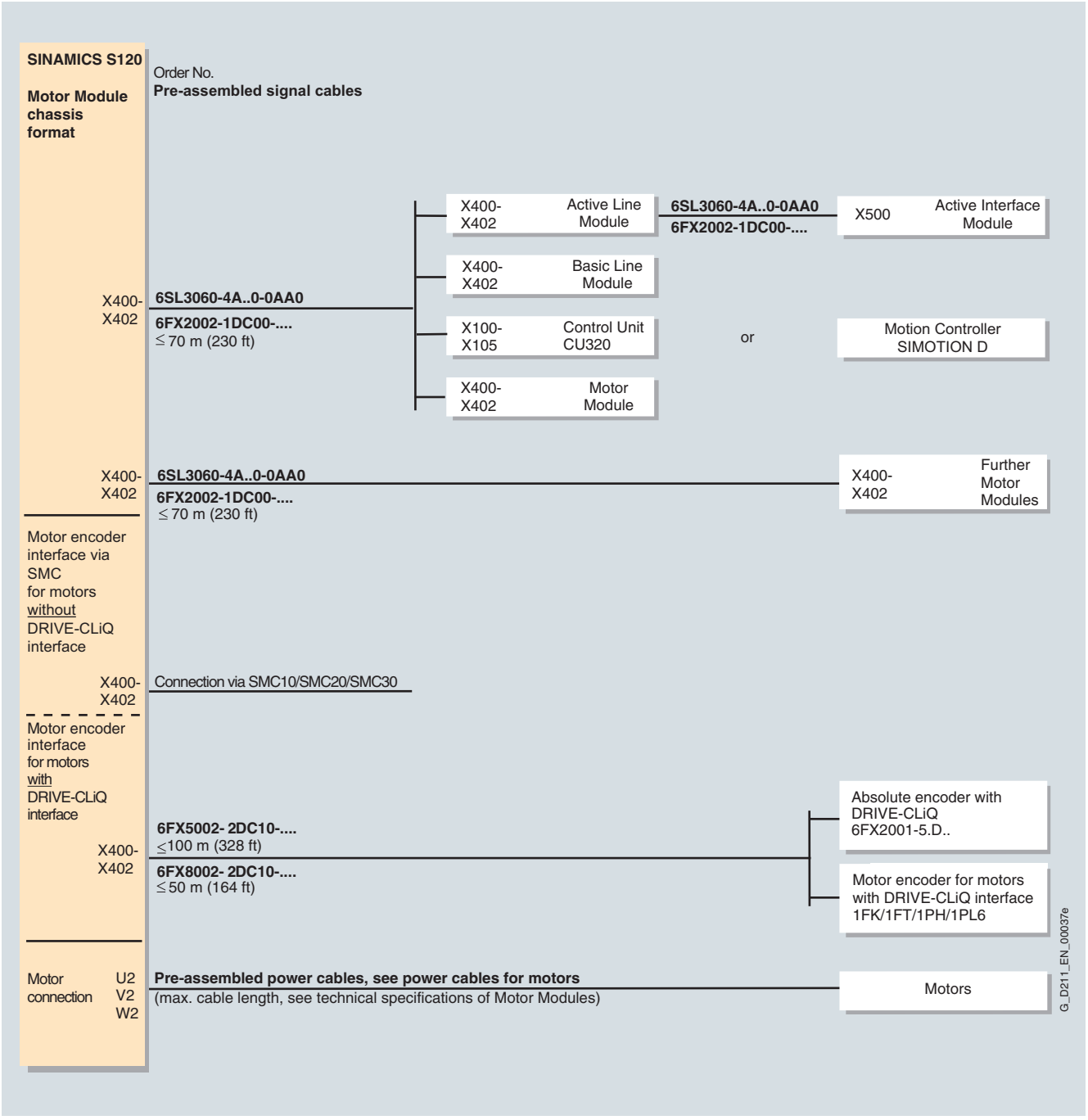
1) With evaluation of difference signals A*, A and B*, B, otherwise ≤ 100 m (328 ft).
2) Signals A*, A, B*, B, R*, R.
3) Signals A, B.
4) With right-angled connector.
5) Cable available from measuring system manufacturer.
6) Not for 2KG geared motor.
7) For Single Motor Module: X200-X202
For Double Motor Module: X200-X203

Signal cables for SINAMICS S120

Integration (continued)

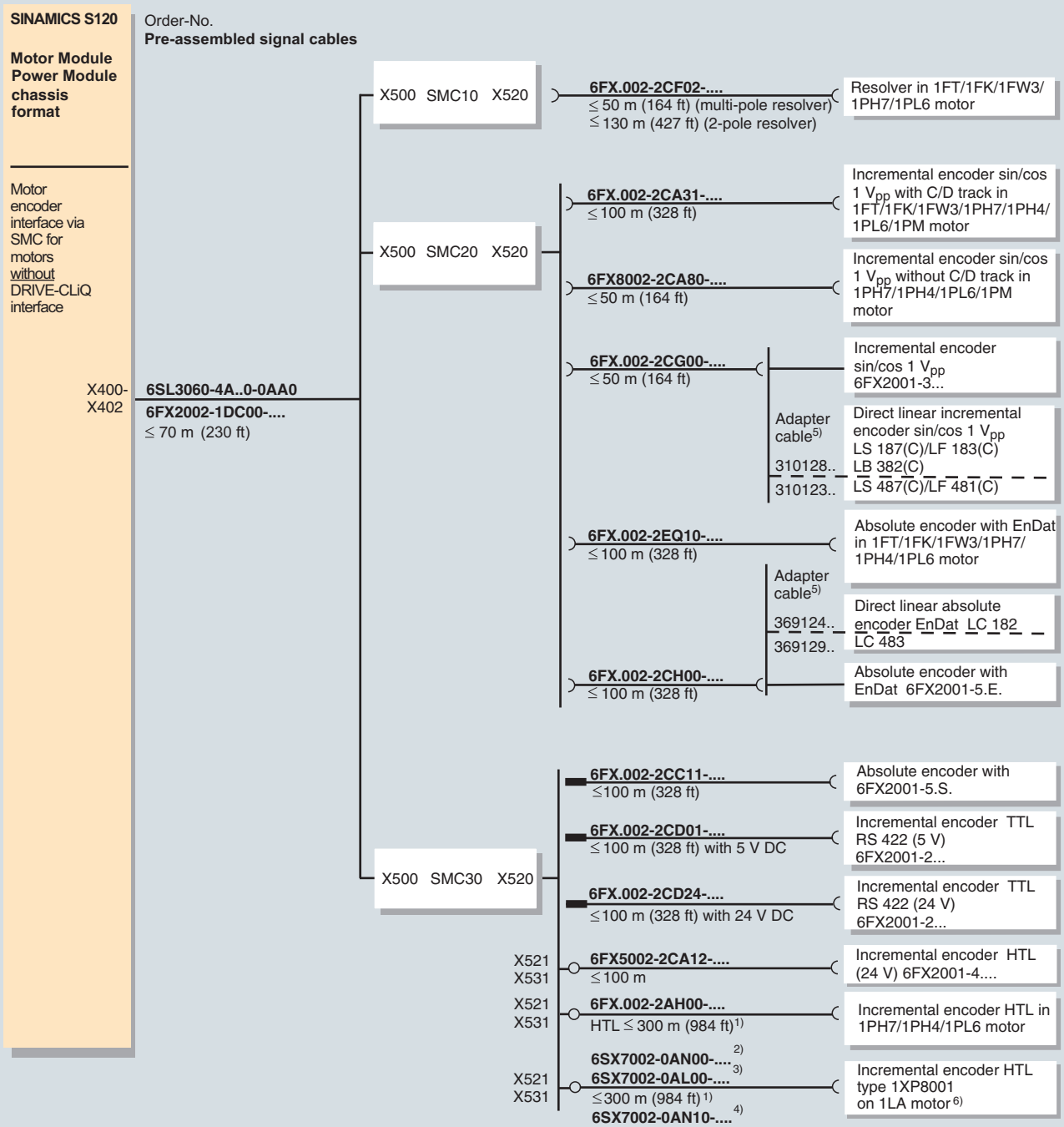
Connection overview of Line Modules and Motor Modules in chassis format

For the standard configuration, the DRIVE-CLiQ cables of type 6SL3060-4A..0-0AA0 are already included in the scope of supply of the Line Modules and Motor Modules. In this case, the modules must be mounted directly adjacent to one another in a row.



Integration (continued)

Connection overview of Line Modules and Motor Modules in chassis format (continued)



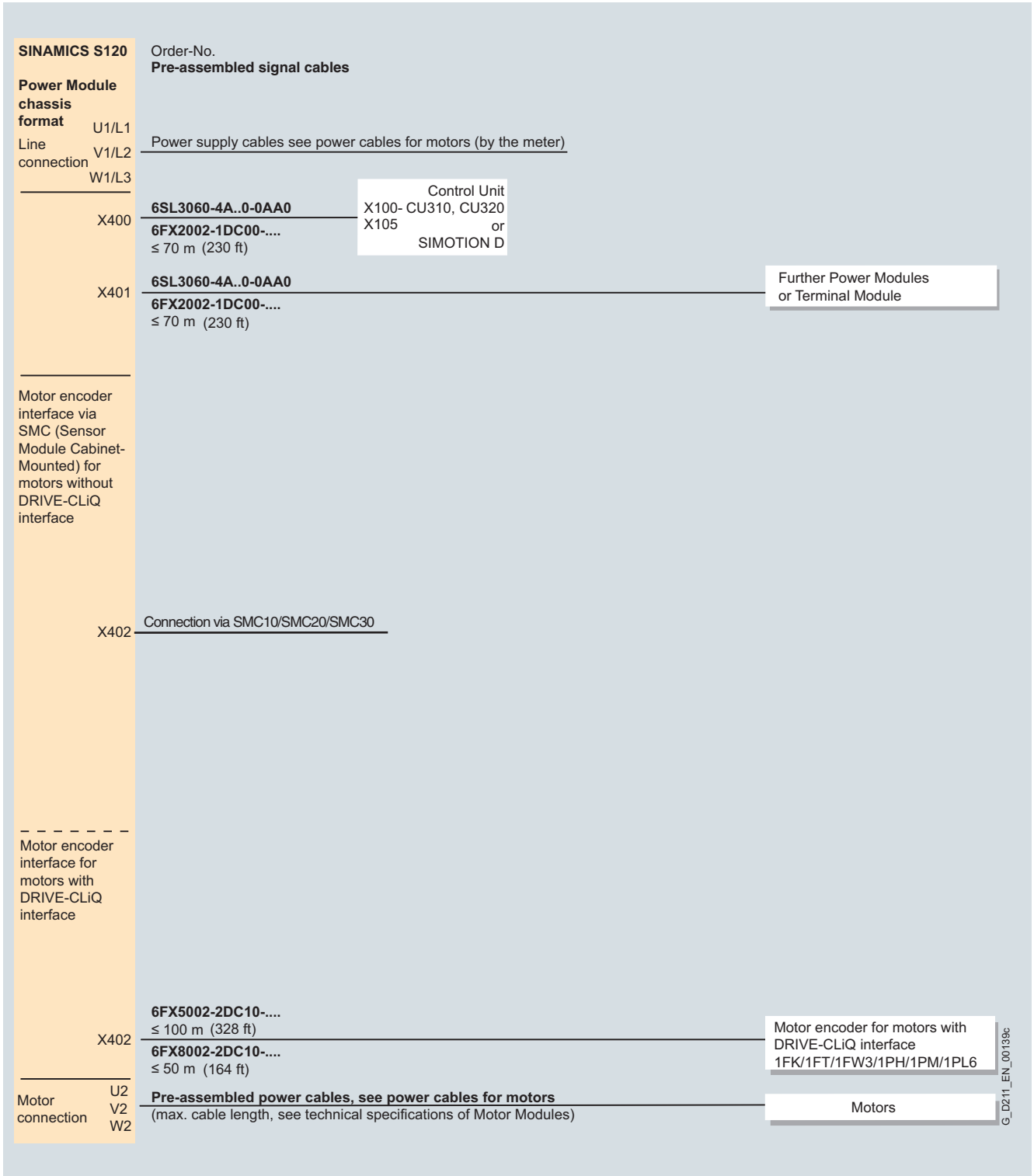
1) With evaluation of difference signals A*, A and B*, B, otherwise ≤100 m (328 ft).
2) Signals A*, A, B*, B, R*, R.
3) Signals A, B.
4) With right-angled connector
5) Cable available from measuring system manufacturer.
6) Not for 2KG geared motor.

Signal cables for SINAMICS S120

Integration (continued)

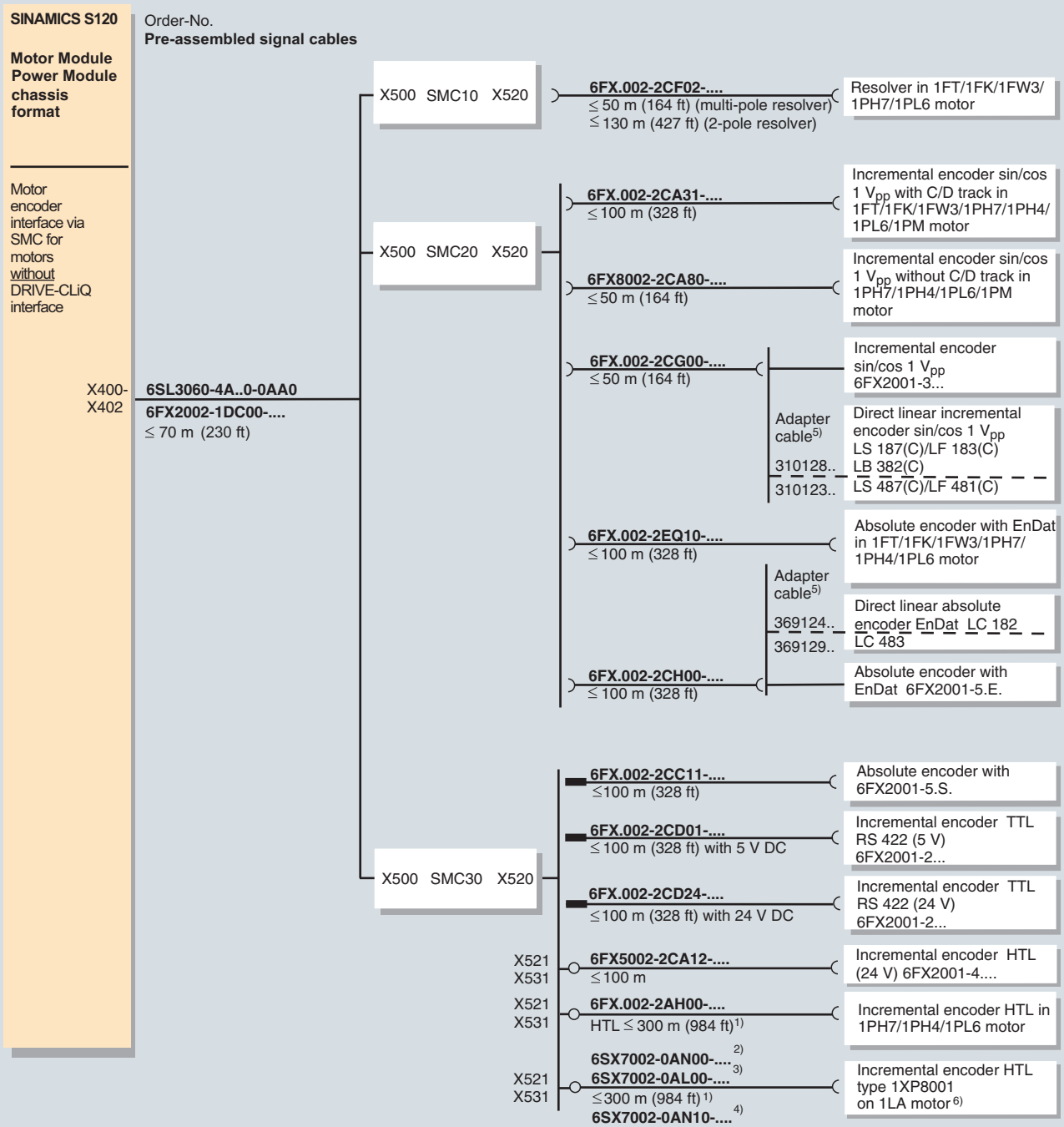
Connection overview of Power Modules in chassis format

A DRIVE-CLiQ cable of type 6SL3060-4A..0-0AA0 for connecting to the Control Unit CU310 and which is built into the chassis is already included in the scope of supply.



Integration (continued)

Connection overview of Power Modules in chassis format (continued)

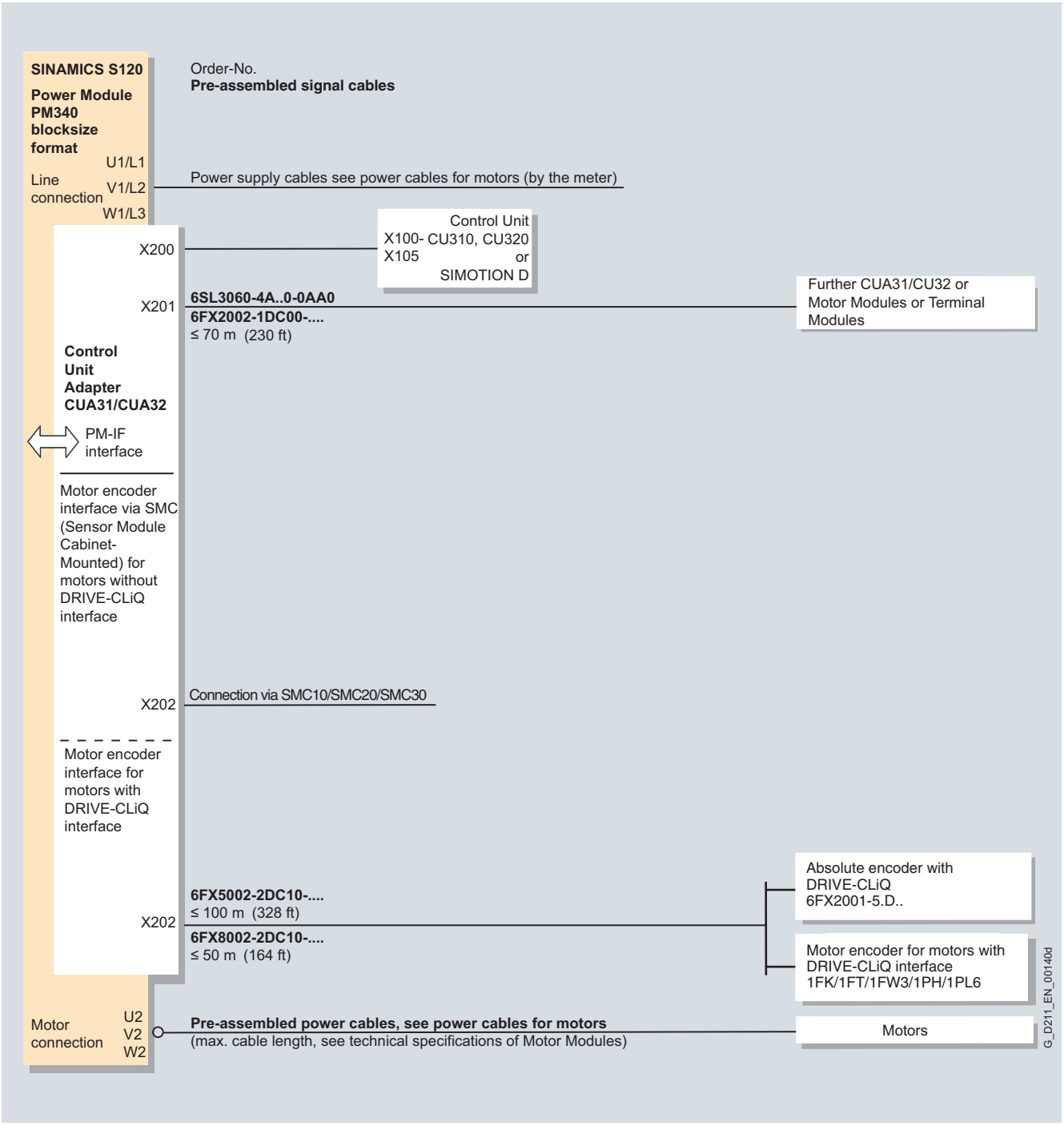


1) With evaluation of difference signals A*, A and B*, B, otherwise ≤100 m (328 ft).
2) Signals A*, A, B*, B, R*, R.
3) Signals A, B.
4) With right-angled connector
5) Cable available from measuring system manufacturer.
6) Not for 2KG geared motor.

Signal cables for SINAMICS S120

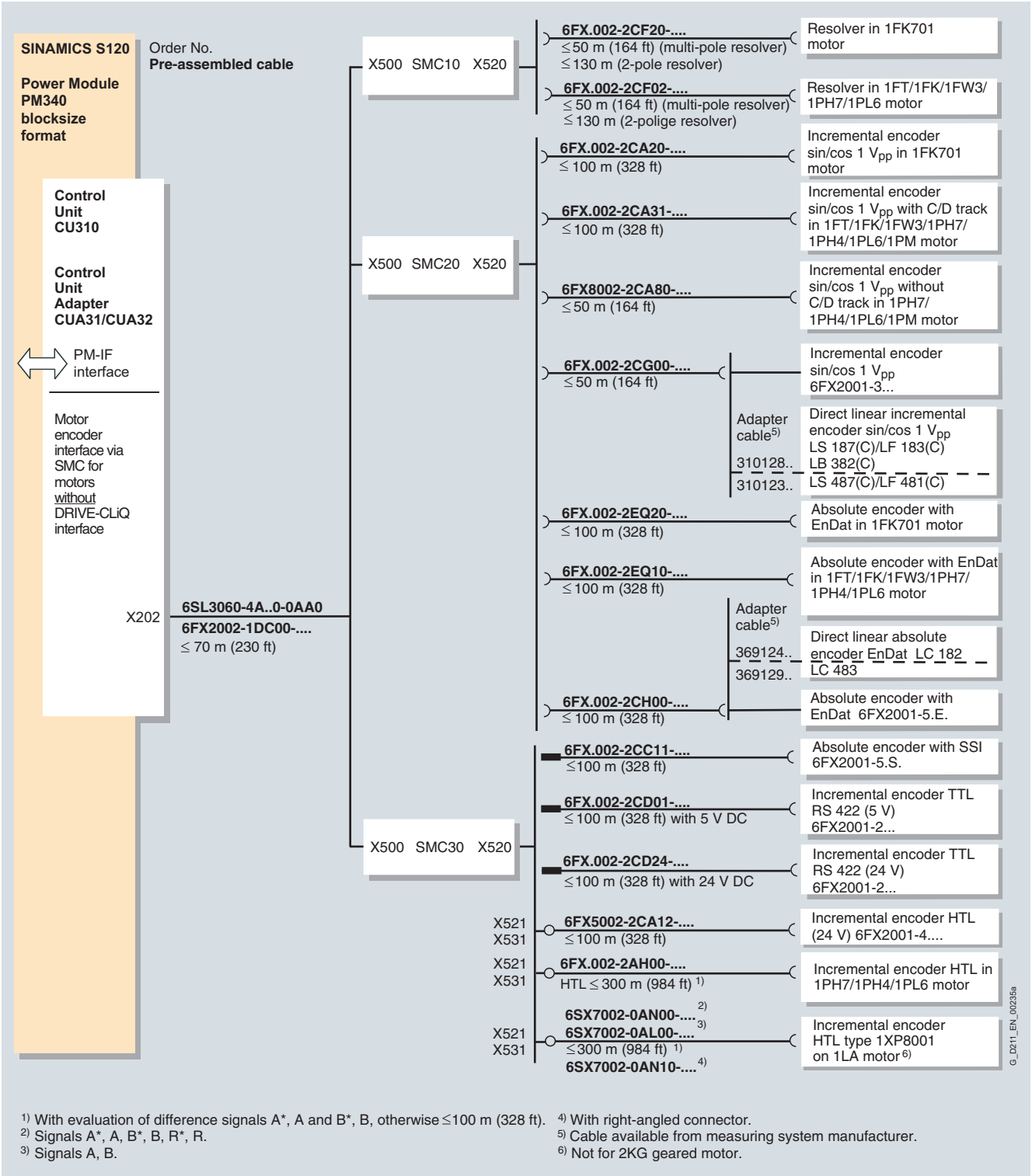
Integration (continued)

Connection overview of Power Modules in blocksize format with Control Unit Adapter CUA31/CUA32



Integration (continued)

Connection overview of Power Modules in blocksize format with Control Unit Adapter CUA31/CUA32 (continued)

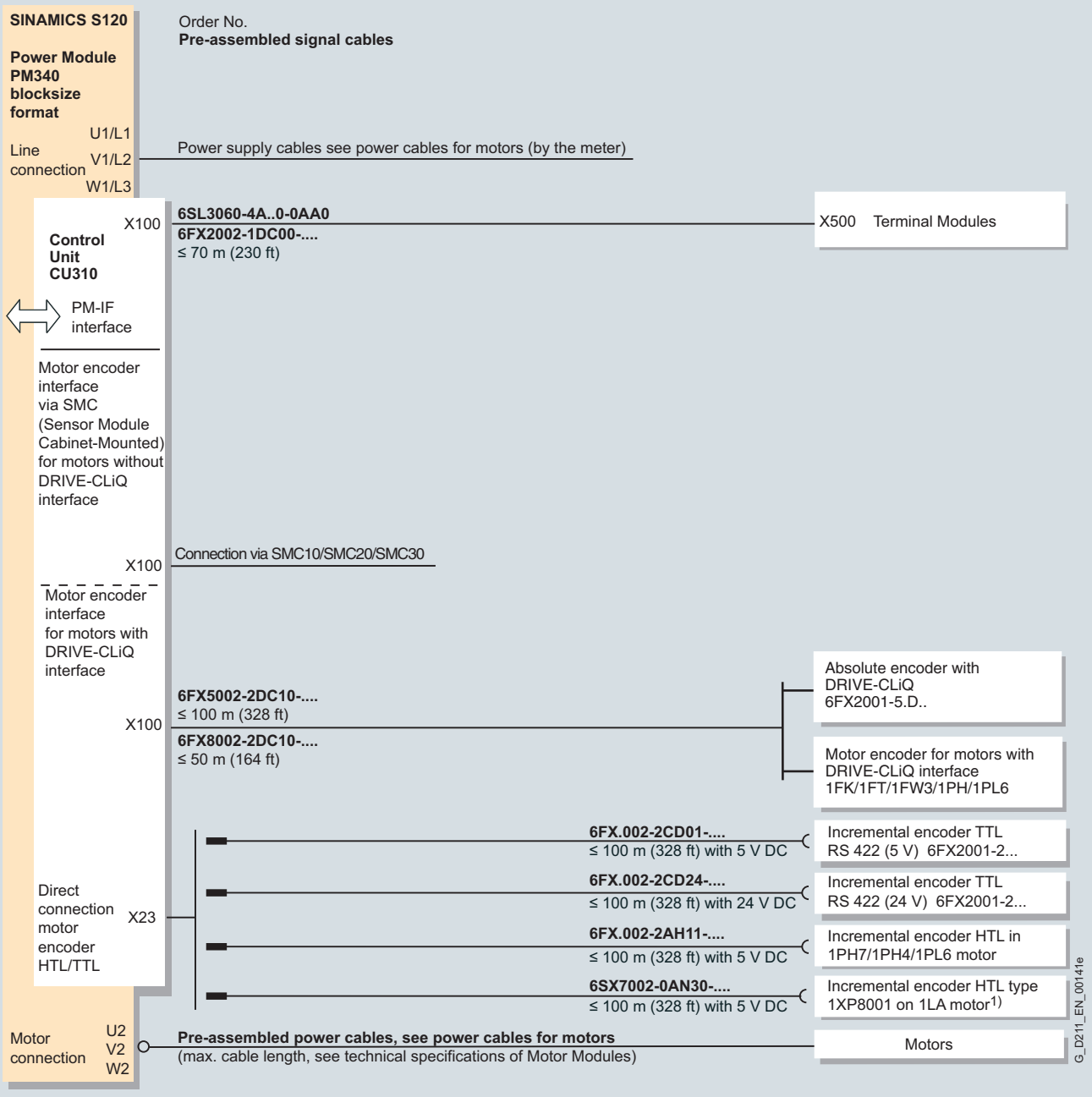


1) With evaluation of difference signals A*, A and B*, B, otherwise ≤100 m (328 ft).
2) Signals A*, A, B*, B, R*, R.
3) Signals A, B.
4) With right-angled connector.
5) Cable available from measuring system manufacturer.
6) Not for 2KG geared motor.

Signal cables for SINAMICS S120

Integration (continued)

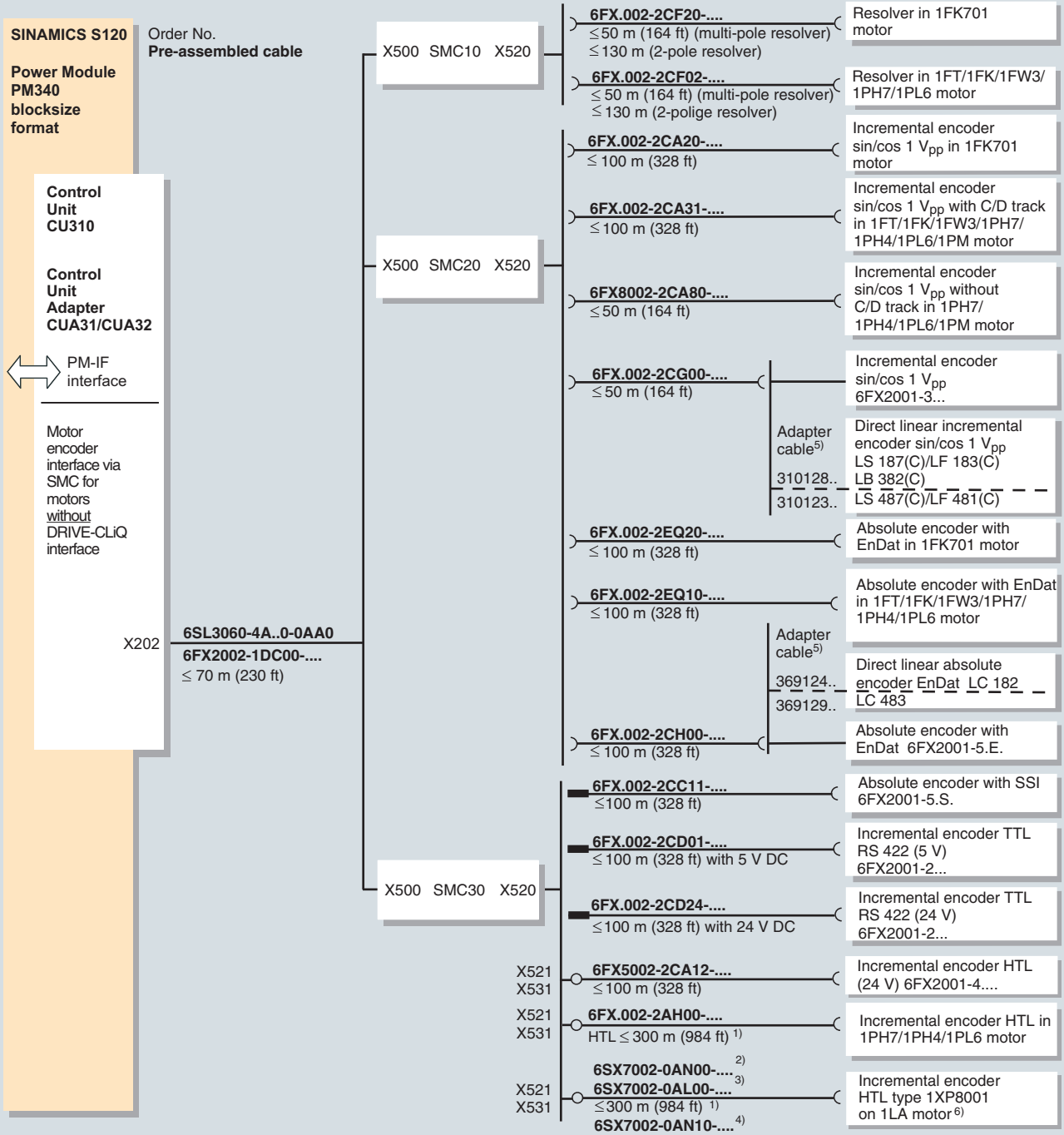
Connection overview of Power Modules in blocksize format with Control Unit CU310



1) Not for 2KG geared motor.

Integration (continued)

Connection overview of Power Modules in blocksize format with Control Unit CU310 (continued)

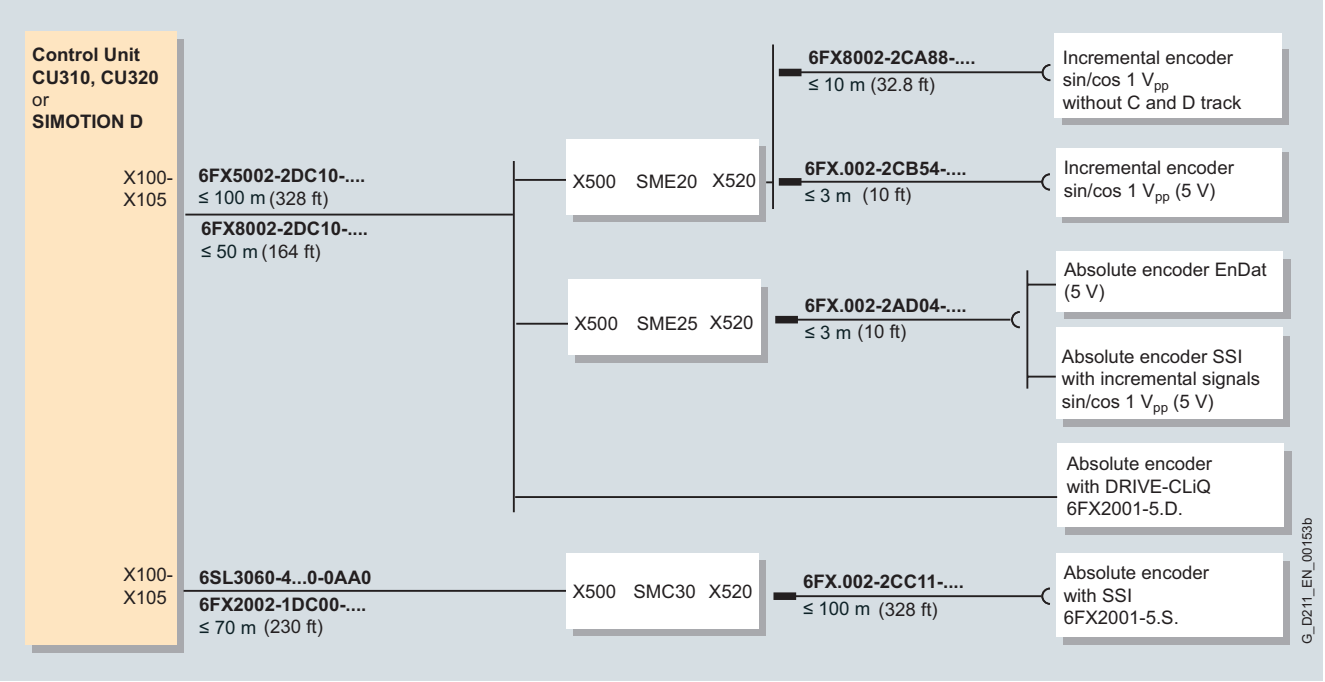


1) With evaluation of difference signals A*, A and B*, B, otherwise ≤100 m (328 ft).
2) Signals A*, A, B*, B, R*, R.
3) Signals A, B.
4) With right-angled connector.
5) Cable available from measuring system manufacturer.
6) Not for 2KG geared motor.

Signal cables for SINAMICS S120

Integration (continued)

Connection of a machine encoder (direct measuring system)



Selection and ordering data

Pre-assembled DRIVE-CLiQ signal cables

Version	Length	Degree of protection Connector	DRIVE-CLiQ signal cables without 24 V DC cores Order No.
In fixed lengths	0.11 m (0.36 ft)	IP20/IP20	**6SL3060-4AB00-0AA0**
	0.16 m (0.52 ft)		**6SL3060-4AD00-0AA0**
	0.21 m (0.69 ft)		**6SL3060-4AF00-0AA0**
	0.26 m (0.85 ft)		**6SL3060-4AH00-0AA0**
	0.31 m (1.02 ft)		**6SL3060-4AK00-0AA0**
	0.36 m (1.18 ft)		**6SL3060-4AM00-0AA0**
	0.41 m (1.35 ft)		**6SL3060-4AP00-0AA0**
	0.60 m (1.97 ft)		**6SL3060-4AU00-0AA0**
	0.95 m (3.12 ft)		**6SL3060-4AA10-0AA0**
	1.20 m (3.94 ft)		**6SL3060-4AW00-0AA0**
	1.45 m (4.76 ft)		**6SL3060-4AF10-0AA0**
	2.80 m (9.19 ft)		**6SL3060-4AJ20-0AA0**
	5.00 m (16.41 ft)		**6SL3060-4AA50-0AA0**
To the meter	max. 70 m (229.67 ft)	IP20/IP20	**6FX2002-1DC00-....**
		IP67/IP67	**6FX2002-1DC20-....**
Length codes			**....**

Encoder system	Motor type	Length, max.	Degree of protection Connector	DRIVE-CLiQ signal cables with 24 V DC cores Order No.
Encoder systems for motors with DRIVE-CLiQ interface: Incremental encoder Absolute encoder Resolver Absolute encoder with DRIVE-CLiQ 6FX2001-5.D..	1FK7/1FT6/1FT7/ 1FW3/1PH4/1PH7/ 1PL6	50 m (164 ft)	IP20/IP20	**6FX8002-2DC00-....**
		100 m (328 ft)		**6FX5002-2DC00-....**
		50 m (164 ft)	IP20/IP67	**6FX8002-2DC10-....**
		100 m (328 ft)		**6FX5002-2DC10-....**
		50 m (164 ft)	IP67/IP67 [1]	**6FX8002-2DC20-....**
		100 m (328 ft)		**6FX5002-2DC20-....**
MOTION-CONNECT 500				**5**
MOTION-CONNECT 800				**8**
Length codes				**....**

[1] No direct connection to modules.

Signal cables for SINAMICS S120

Selection and ordering data (continued)

Pre-assembled signal cables

Encoder system	Motor type	Connection via	Length, max.	Degree of protection Connector	**Basic cables** Order No.	**Extensions** Order No.
Incremental encoder sin/cos 1 V_{pp} 2048 S/R						
• with C and D tracks	1FK [1]/1FT/ 1FW3/1PH4/ 1PH7/1PL6	SMC20	100 m (328 ft)	IP20/IP67	**6FX■002-2CA31-....**	**6FX■002-2CA34-....**
• without C and D tracks	1PH4/1PH7/ 1PL6/1PM4/ 1PM6	SMC20	50 m (164 ft)	IP20/IP67	**6FX 8 002-2CA80-....**	**6FX■002-2CA34-....**
Incremental encoder sin/cos 1 V_{pp} 2048 S/R	1FK701	SMC20	50 m (164 ft)	IP20/IP67	**6FX■002-2CA20-....**	**6FX 5 002-2CA24-....**
Incremental encoder sin/cos 1 V_{pp} 2048 S/R	1FS6	SMC20	50 m (164 ft)	IP20/IP67	**6FX 5 002-2XA00-....** [5]	–
HTL incremental encoder	1PH7/1PH4/ 1PL6	SMC30	100 m (328 ft) 300 m (984 ft) [2]	IP20/IP67	**6FX■002-2AH00-....**	**6FX■002-2AH04-....**
HTL incremental encoder 24 V DC 6FX2001-4		SMC30	100 m (328 ft)		**6FX 5 002-2CA12-....**	–
Incremental encoder TTL RS 422 6FX2001-2						
• 5 V DC		SMC30	100 m (328 ft)	IP20/IP67	**6FX■002-2CD01-....**	**6FX■002-2CB54-....**
• 24 V DC		SMC30	100 m (328 ft)	IP20/IP67	**6FX■002-2CD24-....**	**6FX■002-2CB54-....**
HTL incremental encoder 5 V DC	1PH7/1PH4/ 1PL6	CU310	100 m (328 ft)	IP20/IP67	**6FX■002-2AH11-....**	–
HTL incremental encoder 5 V DC	1LA [3]	CU310DP	300 m (984 ft)	IP20/IP67	**6SX 7 002-0AN30-....**	–
HTL incremental encoder type 1XP8001	1LA [3]	SMC30		IP20/IP67		
• Signals A, B			100 m (328 ft)		**6SX 7 002-0AL00-....**	–
• Signals A*, A, B*, B, R*, R			300 m (984 ft) [2]		**6SX 7 002-0AN00-....**	–
• Signals A*, A, B*, B, R*, R with right-angled connector			300 m (984 ft) [2]		**6SX 7 002-0AN10-....**	–
Incremental encoder sin/cos 1 V_{pp} 6FX2001-3		SMC20	50 m (164 ft)	IP20/IP67	**6FX■002-2CG00-....**	**6FX■002-2CB54-....**
Incremental encoder sin/cos 1 V_{pp} 5 V DC		SME20	3 m (9.84 ft)		**6FX■002-2CB54-....**	–
Direct linear incremental encoder sin/cos 1 V_{pp}	1FN3 [4]/1FW6	SME120			**6FX 7 002-2CB54-....**	–
MOTION-CONNECT 500					**5**	**5**
MOTION-CONNECT 800					**8**	**8**
Length codes					**....**	**....**

The combinations of signal cable extensions shown are only provided by way of example.

Note:
The maximum specified cable length (basic cable and extensions) must not be exceeded. The total maximum permissible length is reduced by 2 m (6.56 ft) for each interruption point.

1) Not for 1FK701.
2) With evaluation of difference signals A*, A, B*, B.
3) Not for 2KG geared motor.
4) Version for continuous load.
5) Temperature-resistant up to 100 °C (212 °F).

Selection and ordering data (continued)

Pre-assembled signal cables

Encoder system	Motor type	Connection via	Length, max.	Degree of protection Connector	**Basic cables** Order No.	**Extensions** Order No.
Absolute encoder with SSI 6FX2001-5.S..		SMC30		IP20/IP67	**6FX■002-2CC11-....**	**6FX■002-2CB54-....**
• Clock-pulse rate 100 ... 250 kHz			100 m (328 ft)			
Absolute encoder with SSI 5 V DC		SME25	3 m (9.84 ft)		**6FX■002-2AD04-....**	**–**
Absolute encoder with EnDat	1FK [1]/1FT/ 1FW3/1PH4/ 1PH7/1PL6	SMC20	100 m (328 ft)	IP20/IP67	**6FX■002-2EQ10-....**	**6FX■002-2EQ14-....**
Absolute encoder with EnDat 512 S/R	1FK701	SMC20	50 m (164 ft)	IP20/IP67	**6FX■002-2EQ20-....**	**6FX 5 002-2EQ24-....**
Absolute encoder with EnDat 2048 S/R	1FS6	SMC20	50 m (164 ft)	IP20/IP67	**6FX 5 002-2XQ10-....** [3]	**–**
Absolute encoder with EnDat 6FX2001-5.E..		SMC20	100 m (328 ft)	IP20/IP67	**6FX■002-2CH00-....**	**6FX■002-2AD04-....**
Absolute encoder with EnDat 5 V DC		SME25	3 m (9.84 ft)		**6FX■002-2AD04-....**	**–**
Direct absolute encoder EnDat	1FN3 [2]/1FW6	SME125			**6FX 7 002-2AD04-....**	**–**
Resolver						
• multi-pole	1FK [1]/1FT/ 1FW3	SMC10	50 m (164 ft)	IP20/IP67	**6FX■002-2CF02-....**	**6FX■002-2CF04-....**
• 2-pole	1FK [1]/1FT/ 1PH7/1PL6	IP20/IP67	130 m (426 ft)	IP20/IP67		
Resolver	1FK701	SMC10	50 m (164 ft)	IP20/IP67	**6FX■002-2CF20-....**	**6FX 5 002-2CF24-....**
PTC thermistor for connection to 3RN10 triggering device	1FS6	–	Unlimited	–	**6FX 5 002-1XA04-....** [3]	**–**
Temperature sensor	1FN3100/ 1FN3150 [2]	SME120/ SME125			**6FX 7 002-2SL01-....**	**6FX 7 002-2SL10-....**
Temperature sensor	1FN3300/ 1FN3900 [2]	SME120/ SME125			**6FX 7 002-2SL02-....**	**6FX 7 002-2SL10-....**
Temperature sensor	1FW6	SME120/ SME125			**6FX 7 002-2SL10-....**	**–**
MOTION-CONNECT 500					**5**	**5**
MOTION-CONNECT 800					**8**	**8**
Length codes					**....**	**....**

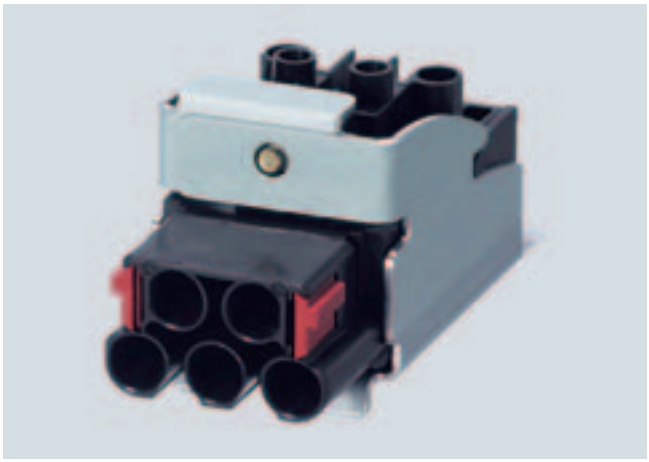
The combinations of signal cable extensions shown are only provided by way of example.

Note:
The maximum specified cable length (basic cable and extensions) must not be exceeded. The total maximum permissible length is reduced by 2 m (6.56 ft) for each interruption point.

[1] Not for 1FK701.
[2] Version for continuous load.
[3] Temperature-resistant up to 100 °C (212 °F).

Accessories for power cables
Power connectors for SINAMICS Motor Modules

Overview



Power connector with screw-type connection

3 A to 30 A Motor Modules in booksize format are shipped without power connector as this is already connected to the MOTION-CONNECT power cables.

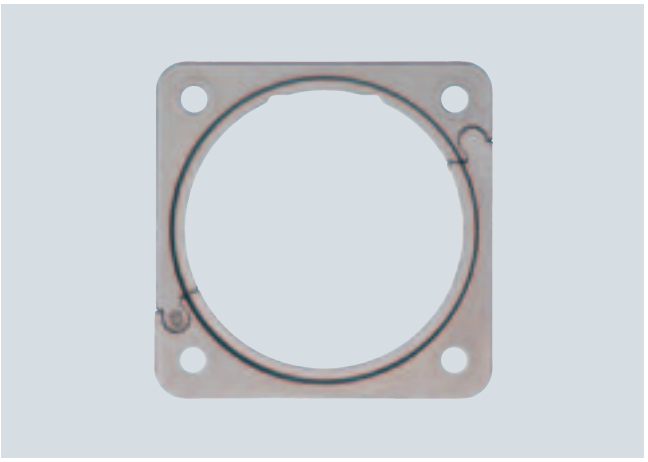
Power connectors can also be ordered separately, e.g. for applications where installation of the motor cable would be difficult if a power connector were attached. Power connectors with crimp terminal or screw-type connection are available.

Selection and ordering data

Designation	Order No.
Power connector Without pin contacts for Motor Modules 3 … 30 A booksize format suitable for pin contacts with crimp terminal (housing, insulator, 2 coding pins)	**6FX2003-1SA00**
Pin contacts for power connector (25 contacts per pack)	
• 1.5 mm^2 (power and brake)	**6FX2003-8PS10**
• 2.5 mm^2 (power)	**6FX2003-8PS20**
• 4 mm^2 (power)	**6FX2003-8PS30**
• 6 mm^2 (power)	**6FX2003-8PS40**
• 10 mm^2 (power)	**6FX2003-8PS50**
Power connector for Motor Modules 3 … 30 A booksize format with screw-type connection (housing, insulator, 2 coding pins, screw-type connection for motor: 1.5 …10 mm^2, brake: 1.5 mm^2)	**6SL3162-2MA00-0AA0**

Accessories for power and signal cables
Mounting flange

Overview



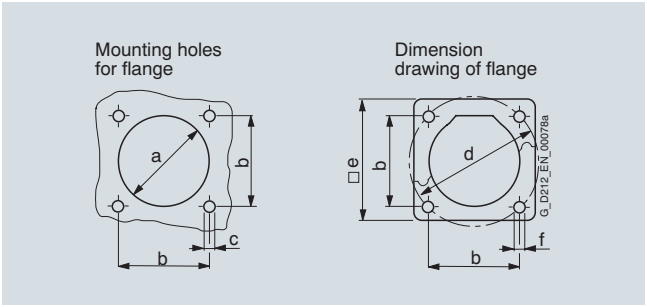
Mounting flanges are used to route or fix connectors, for example, in control cabinets. With the exception of angled connectors, a mounting flange can be mounted post-assembly on connectors with union nuts or connectors with external threads.

Selection and ordering data

Designation	Order No.
Mounting flange for power connectors	
• Connector size 0.5	**6FX2003-7HX00**
• Connector size 1	**6FX2003-7BX00**
• Connector size 1.5	**6FX2003-7CX00**
• Connector size 3	**6FX2003-7AX00**
Mounting flange for	
• M23 signal connector	**6FX2003-7DX00**
• M17 signal connector	**6FX2003-7HX00**

Accessories for power and signal cables
Mounting flange

Dimensional drawings

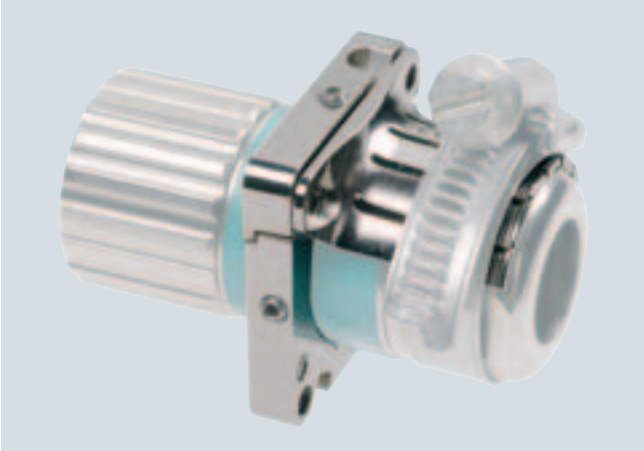


Dimensions	Power connector			
	Connector size 0.5	Connector size 1	Connector size 1.5	Connector size 3
	mm (in)	mm (in)	mm (in)	mm (in)
a	∅ 22.8 (0.90)	∅ 27.8 (1.09)	∅ 46 (1.81)	∅ 65 (2.56)
b	22.6 (0.89)	28.8 (1.13)	42.4 (1.67)	75 (2.95)
c	M2.5 (4×)	M3 (4×)	M4 (4×)	M4 (4×)
d	∅ 32 (1.26)	∅ 40 (1.57)	∅ 60 (2.36)	∅ 63 (2.48)
e	30 (1.18)	35 (1.38)	55 (2.17)	85 (3.35)
f	∅ 3.2 (0.13)	∅ 3.2 (0.13)	∅ 4.4 (0.17)	∅ 4.5 (0.18)

Dimensions	M17 signal connector	M23 signal connector
	mm (in)	mm (in)
a	∅ 22.8 (0.90)	∅ 27 (1.06)
b	22.6 (0.89)	28.3 (1.11)
c	M2.5 (4×)	M3 (4×)
d	∅ 32 (1.26)	∅ 40 (1.57)
e	30 (1.18)	35 (1.38)
f	∅ 3.2 (0.13)	∅ 3.2 (0.13)

Accessories for power and signal cables
HF (high-frequency) clamp

Overview



To permit correct "grounding" on the cable duct or cabinet wall, a ground clamp can be ordered as an accessory together with the flanges for large-area discharging of high-frequency interferences.

Selection and ordering data

Designation	Order No.
HF (high-frequency) clamp for power connectors	
• Power connector size 1	**6FX2003-7FX00**
• Power connector size 1.5	**6FX2003-7GX00**
• Power connector size 3	Not required
HF (high-frequency) clamp for signal connectors	**6FX2003-7FX00**

7

Accessories for signal cables DRIVE-CLiQ cabinet conduit

Overview

The DRIVE-CLiQ cabinet conduit is used to route DRIVE-CLiQ MOTION-CONNECT cables with a high degree of protection into a control cabinet. The DRIVE-CLiQ cabinet conduit features IP54 degree of protection on the outside and IP20 on the inside of the control cabinet.

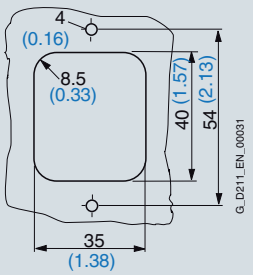
The degree of protection of the plug-in connection depends on the signal cable used; the degree of protection of the connector is IP20 or IP67.

Selection and ordering data

Designation	Order No.
DRIVE-CLiQ cabinet conduit for signal cables	**6SL3066-2DA00-0AA0**

Dimensional drawings

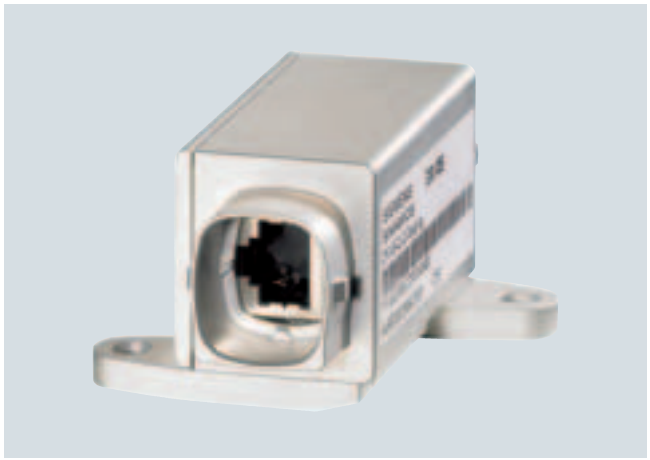
Cabinet cut-out for DRIVE-CLiQ cabinet conduit



Dimensions in mm (inches)

Accessories for signal cables DRIVE-CLiQ coupler

Overview



The DRIVE-CLiQ coupler enables to join two MOTION-CONNECT DRIVE-CLiQ cables with degree of protection IP67.

Selection and ordering data

Designation	Order No.
DRIVE-CLiQ coupler for signal cables	**6SL3066-2DA00-0AB0**

Overview

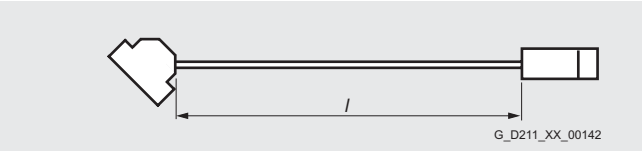
Designation	Type				
Length codes for pre-assembled cables					
	6FX....-.....-	■	■	■	■
	6SX....-.....-	■	■	■	**0**
0 m (0 ft)		**1**			
100 m (328 ft)		**2**			
200 m (656 ft)		**3**			
300 m (984 ft)		**4**			
0 m (0 ft)			**A**		
10 m (32.81 ft)			**B**		
20 m (65.62 ft)			**C**		
30 m (98.43 ft)			**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

Designation	Order No.
Length codes for power and signal cables, sold by the meter [1]	
• 50 m (164 ft)	**6FX.008-.....-1FA0**
• 100 m (328 ft)	**6FX.008-.....-2AA0**
• 200 m (656 ft)	**6FX.008-.....-3AA0**
• 500 m (1640 ft)	**6FX.008-.....-6AA0**

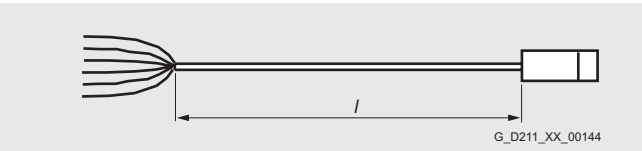
[1] Power cables of ≥ 4 mm^2 can be ordered to the meter in lengths of up to 100 m (328 ft) and in fixed lengths above 100 m (328 ft) on disposable drums. Power cables of 1.5 mm^2 and 2.5 mm^2 are supplied in coils or on disposable drums in lengths of 50 m, 100 m, 200 m and 500 m (164 ft, 328 ft, 656 ft, 1640 ft).

More information

Length definition for pre-assembled cables



Signal cables



Power cables

Tolerance:

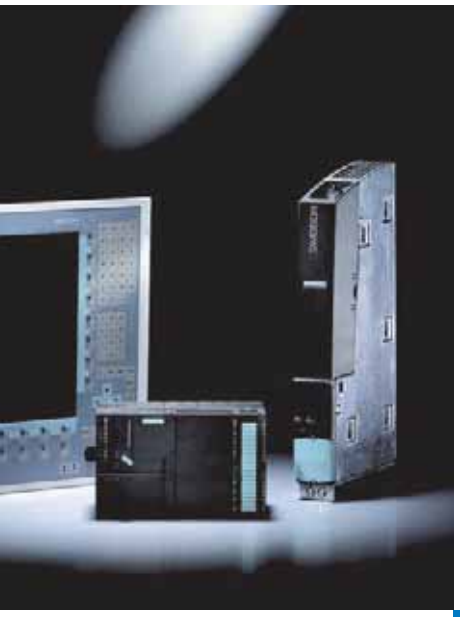
- Cable lengths up to 10 m (32.8 ft): ±2 %
- Cable lengths of 10 m (32.8 ft) and longer: ±1 %

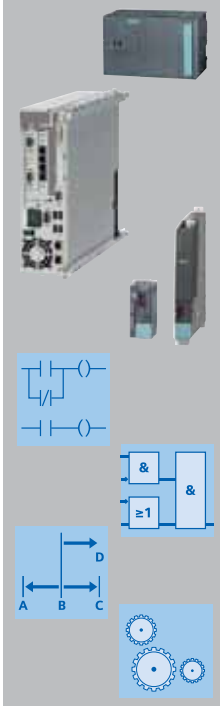
7

Notes

SIMOTION

8



SIMOTION – Motion Control System		Overview, Design	Selection and ordering data	Technical specifications
SIMOTION engineering software				
	Summary	8/59		–
	SIMOTION SCOUT software package	8/60	8/61	–
	CamTool optional package	8/68	8/61	–
	Drive Control Chart (DCC) optional package	8/69	8/61	–
Overview of functions				
	Hardware platforms	8/70		
	Drives on SIMOTION	8/72		
	Encoders on SIMOTION	8/74		
	Measuring inputs	8/75		
	Cam outputs	8/75		
	Integrated I/O interfaces	8/76		
	SIMOTION C centralized I/O modules	8/76		
	Distributed I/Os	8/77		
	SIMOTION HMI	8/78		
	Communication	8/79		
	SIMOTION Kernel	8/82		
	Technology packages	8/84		
	SIMOTION IT	8/85		
	SIMOTION SCOUT	8/86		
	Engineering drives	8/87		

8

SIMOTION C – Controller-based

Summary

Overview

SIMOTION C is the controller variant of the SIMOTION family with the proven design of the SIMATIC S7-300. Flexible modular expansion of SIMOTION C is possible thanks to use of the SIMATIC S7 module spectrum. Both SIMOTION C230-2 and C240 designs represent two powerful motion controllers for advanced control and motion control tasks.

HMI devices can be operated directly on the onboard PROFIBUS or Ethernet interface for operator control and monitoring. Functions such as remote maintenance, diagnostics and teleservice can also be used via these interfaces.

Benefits

- Mounting flexibility thanks to the SIMATIC S7 module spectrum and thus optimal adaptation to automation task
- For universal use with digital and analog coupling to servo/vector, stepper and hydraulic drives
- User-friendly mounting and simple design with no moving parts.
- Flexible networking through onboard PROFIBUS DP and Industrial Ethernet interfaces
- Powerful thanks to a range of integrated functions
- Easy engineering of logic and Motion Control applications in the same program

Application

SIMOTION C can be used wherever

- Motion Control, technology and PLC functionalities are to be programmed, configured and executed in a single unit,
- a modularly expandable device is to be placed at a central point, near or in the machine,
- communication with other programmable controllers is necessary.

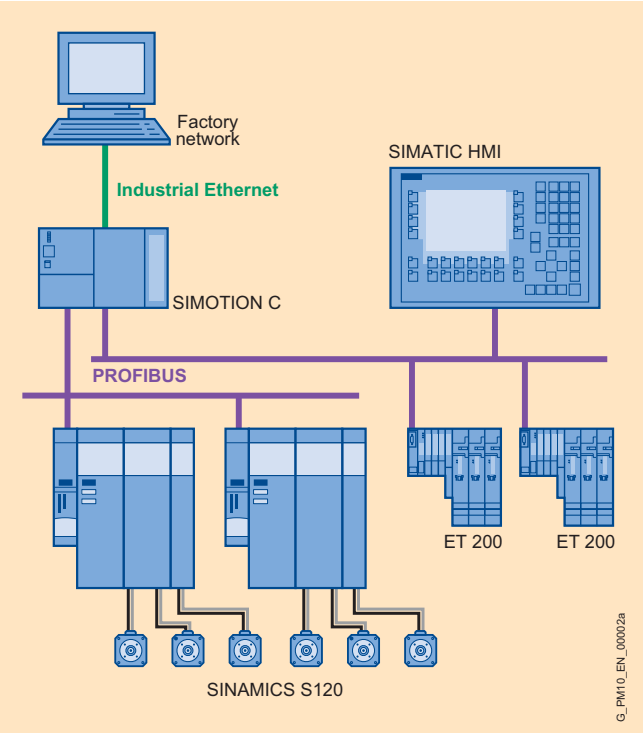
SIMOTION C is universally applicable and meets the highest standards with respect to suitability for industrial use, thanks to high EMC compatibility and resistance against shock and vibration loads.

Important applications include:

- Packaging machines
- Plastic and rubber processing machines
- Presses, wire-drawing machines
- Textile machines
- Printing machines
- Wood, glass, ceramics and stone working machines
- Retrofit

Due to the increasing use of servo drives, these machines require a high degree of integration of PLC, Motion Control and technology functions.

Design



SIMOTION C with central and distributed I/O

The Motion Control System SIMOTION C is designed with modular principles in mind. It comprises of a comprehensive hardware spectrum which uses components of the SIMATIC S7-300 series and Siemens drive technology.

Design (continued)

Components and interfaces of the SIMOTION C Motion Controller:

- Analog drive interfaces
  - For setpoint outputs to servo/vector drives
  - For setpoint outputs to the actuating valves of hydraulic drives
  - As freely assignable analog outputs (C240 only)
- Pulse outputs for controlling stepper drives
- Interfaces for incremental/absolute encoders for cyclic acquisition of an actual position value or as freely assignable up/down counter (C240 only)
- Onboard I/O for high-speed I/O signals
- SIMOTION Micro Memory Card (MMC) for storing:
  - SIMOTION Kernel
  - User programs
  - User variables
- Integrated communications interfaces for linking:
  - Distributed I/Os
  - HMI systems
  - PG/PC
  - Other Motion Control and automation systems
  - Drives with digital setpoint interface
- Various status/error displays and a mode selector

The following components make up a SIMOTION C system:

- Motion Controller and Micro Memory Card (MMC)
- As well as other system components (depending on requirements) such as:
  - Load power supplies (PS) for connecting SIMOTION C to a power supply of 120 V/230 V AC
  - Central (not onboard) and distributed I/O components
  - Servo/vector drives with analog or digital setpoint interface or stepper drives

Mounting and connection technology

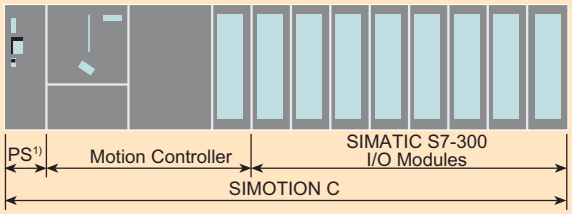
The simple design makes SIMOTION C flexible and easy to maintain:

- Rail mounting
  Simply attach the module to the standard mounting rail, swing it in and screw it tight.
- Integrated backplane bus
  The backplane bus is integrated in the Motion Controller. The Motion Controller is connected to the I/O modules via bus connectors which are plugged into the rear of the housing.
- The front connector coding prevents front connectors from being plugged into the wrong module type.
- Screw-type terminals, spring-loaded terminals or Fast Connect system for I/O modules
- TOP connect
  This connection method provides preassembled wiring with 1 to 3-wire connection systems with screw-type or spring-loaded terminal as an alternative to wiring directly on the I/O module.
- This system uses a defined mounting depth since all connections and connectors are recessed in the module and are protected and covered by doors on the front.
- No slot rules.

Expansion with central I/O modules

Up to 8 slots can be used to the right of the Motion Controller for SIMATIC S7-300 I/O modules.

The IM 365 can be used to connect an expansion rack (two-tier design) to increase the number of slots available for I/O modules from 8 to 16. Multitier configuration with IM 360/IM 361 is not supported by SIMOTION C.



1) Power supply

SIMOTION C can be mounted horizontally or vertically.

If additional I/O modules are required, the distributed SIMATIC ET 200 I/O can be connected to SIMOTION C via PROFIBUS DP.

The number of pluggable I/O modules is also limited by the power required from the backplane bus. The power consumption of all modules which are connected to the same backplane bus must not exceed 1.2 A.

Expansion using distributed I/Os

Distributed I/Os can be assembled with intelligent I/O system components:

- SIMATIC ET 200S
- SIMATIC ET 200M
- SIMATIC ET 200pro
- SIMATIC ET 200eco

Summary

Function

SIMOTION C provides the following basic functionality for the various automation requirements:

- SIMOTION runtime system
  - Programmable with several languages conforming to IEC 61131
  - Various methods of program execution (cyclic, sequential, event-driven)
  - PLC and arithmetic functionality
  - Communication and management functions
  - Motion Control functions (Motion Control Basic)
- Testing and diagnostic tools

This basic functionality can be expanded, for example, with loadable technology packages, if required.

Technology packages (TP)

A special feature of SIMOTION is that the operating system functionality can be expanded by loading technology packages, such as:

- Motion Control with the functions:
  - POS – Positioning
  - GEAR – Synchronous operation/electronic gear
  - CAM – Cam
  - PATH – Path interpolation
- TControl – Temperature controller

Since the technology functions have modular licenses, you only pay for what you use.

Configuration/parameterization/programming

SIMOTION SCOUT is a powerful and user-friendly engineering tool. It is an integrated system for all engineering steps, from configuration and parameterization, through programming, to testing and diagnostics. Graphical operator prompting, using dialog boxes and wizards, as well as text-based and graphical languages for programming, considerably reduce the familiarization and training periods.

Operator control and monitoring (HMI)

Communication utilities which support user-friendly data exchange with HMI devices are integrated in the basic functionality of the SIMOTION C Controller. Operator control and monitoring can be implemented using SIMATIC HMI devices, such as TPs (Touch Panels), OPs (Operator Panels) or MPs (Multi Panels).

These devices can be connected to SIMOTION C via PROFIBUS or Industrial Ethernet and they are configured using ProTool/Pro or WinCC flexible.

With the SIMATIC NET communication software, the open, standardized OPC interface is available for accessing SIMOTION from other Windows-based HMI systems.

Process and data communication

Thanks to its integrated interfaces, SIMOTION C supports both process and data communication. The SCOUT engineering system is provided for user-friendly communication configuration and diagnostics.

More information

Further information

- on power supplies and I/O modules can be found under "SIMOTION I/O components".
- on TOP connect can be found in Catalog KT 10.2 and in the A&D Mall under "Automation Systems/System cabling – control cabinets/SIMATIC TOP connect system cabling".
- on the functionality of SIMOTION platforms can be found under "Overview of functions".
- on runtime software and engineering software can be found under "SIMOTION software".
- on the communication functions of the Motion Controllers can be found under "SIMOTION Runtime Software".
- on HMI can be found under "SIMOTION Human Machine Interface (HMI)".
- on SIMATIC NET Communication Software can be found under "SIMOTION Runtime Software".

Overview

SIMOTION C is a motion controller in S7-300 design. In addition to the already integrated interfaces, the controller can be expanded using I/O modules from the SIMATIC S7-300 range.

The motion controller is available in two versions:
SIMOTION C230-2 and SIMOTION C240.

In addition to the SIMOTION C230-2 functions, SIMOTION C240 offers the following functions:

- Approx. 2.5 times greater performance (application-dependent)
- Larger work memory
- Larger memory for non-volatile process variables
- The analog drive interface can be used for standard outputs (analog and digital outputs).
- The encoder inputs can be used as up/down counters.
- Homing inputs can be used as high-speed inputs for print mark registration.
- Deselectable filter time of the analog outputs
- Improved switching accuracy (jitter) of the cams

Design

Interfaces

Operation, display and diagnostics

- 1 mode selector
- 1 LED strip for fault and status indicators

Integrated I/Os

- 18 digital inputs
  (C230-2: of which 2 for measuring inputs and 4 for zero marks;
  C240: of which 2 for measuring inputs and 4 for measuring inputs/zero marks)
- 8 digital outputs

Drive interfaces

- 1 setpoint output interface for up to 4 axes (alternatively analog, stepper or hydraulic drives; with C240 also as freely assignable analog outputs)
- 4 encoder inputs for incremental or absolute encoders (for C240: can also be used as freely assignable up/down counter)

Communication

- 1 interface for Industrial Ethernet
- 2 interfaces for PROFIBUS DP
  (of which one interface is for MPI)

Data backup

- 1 slot for SIMOTION Micro Memory Card (MMC)

Additional interfaces

- Power supply terminals

Data storage/data backup

The SIMOTION C Motion Controller has an integrated non-volatile data memory for storing process variables.

The data is backed up on a SIMOTION Micro Memory Card (MMC).

Expansion with central I/O modules

The central I/O is directly plugged into the SIMOTION C Motion Controller. The I/O configuration for centralized I/O can comprise of two tiers (second tier using IM 365 interface) with up to 8 I/O modules each and a total of 4 analog modules. I/O modules from the SIMATIC S7-300 spectrum can be used here.

Expansion using distributed I/Os

The following can be used as distributed I/O components:

- All certified PROFIBUS standard slaves
  (DP-V0, DP-V1, DP-V2)
- Isochronous I/O, such as ET 200S or ET 200M
- Servo converter of the MASTERDRIVES, SIMODRIVE and SINAMICS series over PROFIBUS DP interface with PROFIdrive
- MICROMASTER and COMBIMASTER frequency converter
- Stepper drives, such as SIMOSTEP motors with FM STEPDRIVE power unit

SIMOTION C230-2/C240

Function

The control and motion control functionality runs centrally on the SIMOTION C controller.

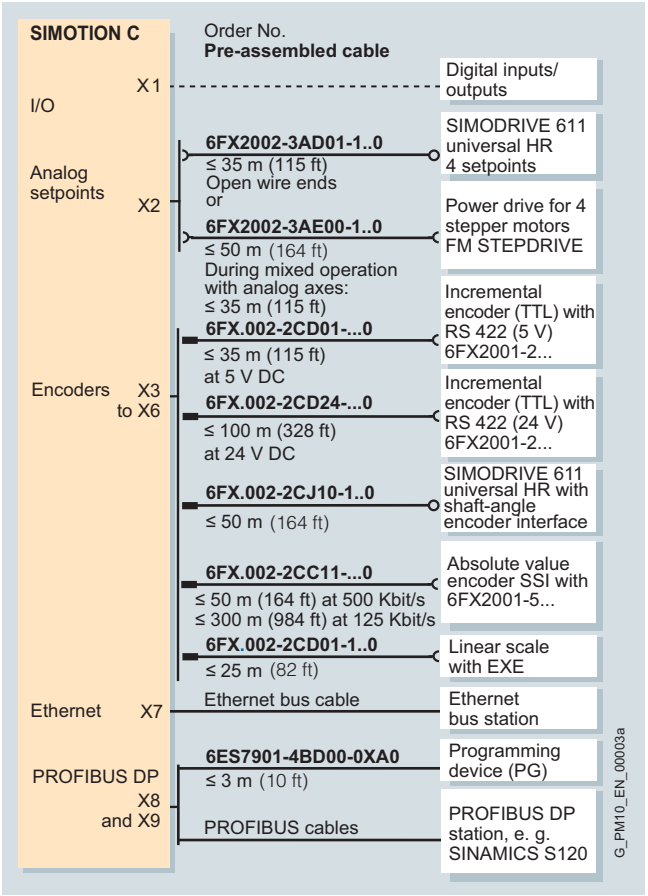
The functionality ranges from simple positioning up to complex motion control tasks over cams.

Position-controlled motion control

Setpoint output/actual value acquisition

- Position control with analog setpoint output
  The SIMOTION C Motion Controllers have one analog output for the speed setpoint and one encoder input for cyclic detection of the actual position value for each axis. In the case of hydraulic drives, the setpoint for the positioning valve is specified via the analog output.
- Position control with pulse direction output for stepper drives
  The SIMOTION C Motion Controllers have one pulse output for the position setpoint for each axis. Stepper drives can either be operated without an encoder or be position-controlled with an encoder.
- Position control with digital setpoint output
  The PROFIBUS DP interface is available with PROFIdrive for this purpose. The actual position value is read in over PROFIBUS DP and the speed setpoint is output.
- Position control with mixed setpoint output
  The analog, stepper and PROFIBUS drive variants can be used in a mixed configuration. The channels of the 4 onboard interfaces can be used for analog, stepper or hydraulic drives.
- Incremental position sensing
  Incremental encoders supply counter pulses for the traversed distance in accordance with their resolution.
  It is usually necessary to search for homing references.
  The following are used:
  - Rotary encoders
  - Translatory encoders (length dimensions)
- Position control/position sensing over ADI 4 or IM 174
  The ADI 4 (Analog Drive Interface for 4 axes) or IM 174 (Interface Module for 4 axes) module can be used to connect drives with analog setpoint interfaces.
  The IM 174 also supports the connection of stepper drives with a pulse direction interface.
  Both modules are connected over PROFIBUS DP.
  The following can be connected to an ADI 4 or IM 174 module:
  - 4 drives
  - 4 encoders
  - Digital inputs and outputs
- Absolute position detection
  Absolute value encoders with serial interfaces can be used (SSI absolute value encoders).
  It is not necessary to search for homing references.
- Isochronous PROFIBUS encoder

Integration



Overview of connections for SIMOTION C

The maximum permissible cable lengths should be taken into account when planning the cable layout.

Functional faults can occur when using longer cables.

The permissible length of PROFIBUS DP cables depends on the configuration.

Technical specifications

SIMOTION C230-2/C240	
General technical specifications	
Supply voltage	
• Rated value	24 V DC
• Permissible range	20.4 ... 28.8 V
Current consumption, typ.	1.2 A
Starting current, typ.	8.0 A
Power loss	15 W
Permissible ambient temperature	
• Storage and transport	-40 ... +70 °C (-40 ... +158 °F)
• Operation	0 ... +55 °C (+32 ... +131 °F)
Permissible relative humidity (without condensation)	5 ... 95 %
Atmospheric pressure	700 ... 1060 hPa
Degree of protection according to EN 60529 (IEC 60529)	IP20
Dimensions (W x H x D)	200 mm x 125 mm x 118 mm (7.87 in x 4.92 in x 4.65 in)
Weight	
• SIMOTION C2xx	1150 g (2.54 lb)
• Memory card	16 g (0.54 oz)
Relay outputs	**5**
of which for	
• Controller enable	4
• READY	1
Electrical data	
• Max. operational voltage	50 V DC
• Max. switching current	1 A
• Max. switching capacity	30 W
Operating cycles	
• at 24 V, 1 A	3×10^6
Analog outputs	**4**
As drive interface, alternatively for analog or hydraulic drives Can be used with C240 as drive interface or standard analog outputs	
Voltage range	± 10.5 V
Resolution	16 bit, including sign
Galvanic isolation	No
Load impedance	> 3 kΩ
Max. cable length	35 m (114 ft)
Pulse outputs for stepper drives	
Output voltage for "1" signal, I_Q = -20 mA	3.7 V
Output voltage for "0" signal, I_Q = 20 mA, max.	1 V
Load resistance, min.	55 Ω
Max. cable length	50 m (164 ft)
Max. pulse frequency	750 kHz

SIMOTION C230-2/C240	
Integrated digital inputs	**18**
of which with special functions for:	
• Measuring input	2
• BERO connection (can also be used as measuring inputs with C240)	4
(all inputs can be used as standard inputs)	
Input voltage	
• Rated value	24 V DC
• For "1" signal	11 ... 30 V
• For "0" signal	-3 ... +5 V
Galvanic isolation	
• Inputs in groups of	18
Input current	
• For signal "1", min. / typ.	6 mA/8 mA
Input delay (at rated value of input voltage)	
• 0 → 1, typ./max.	6 µs/15 µs
• 1 → 0, typ./max.	40 µs/150 µs
Connection of 2-wire BERO	Yes
Permitted quiescent current	2 mA
Integrated digital outputs	**8**
• of which for fast cam output, max.	8
Rated load voltage	24 V DC
• Permissible range	20.4 ... 28.8 V
Output voltage	
• For signal "1", max.	L+
Galvanic isolation in groups of	8
Output current	
• For signal "1", minimum current per channel	5 mA
• For signal "0", max.	0.5 mA
Residual current, max.	2 mA
Derated loading	
• at 40 °C (104 °F)	4 A
• at 55 °C (131 °F)	2 A
Switching frequency of the outputs	
• With resistive load	100 Hz
• With inductive load	2 Hz
Lamp load	5 W
Purge energy/channel	400 mJ (not simultaneous)
Typ. output relay	150 µs
Short-circuit protection	Yes

Technical specifications (continued)

SIMOTION C230-2/C240	
Encoder inputs, max.	**4**
Alternatively for incremental or absolute encoder With C240, can be used alternatively as up/down counter	
Incremental encoder inputs	
Interface type (RS 422)	5 V
Encoder supply	5 V/0.3 A
Galvanic isolation	No
Encoder frequency, max.	1 MHz
Max. cable length	
• at 1 MHz	10 m (32.81 ft)
• at 500 kHz and 300 mA	25 m (82.03 ft)
• at 500 kHz and 210 mA	35 m (114 ft)
Inputs, SSI absolute encoder	
Interface type (RS 422)	5 V synchronous serial, single or multiturn
Encoder supply	24 V/0.3 A
Isolation	No
Transfer rate	187.5/375/750/1500 kbit/s
Message length, max.	25 bit
Max. cable length	
• at 187.5 kbit/s	250 m (820 ft)
• at 1500 kbit/s	10 m (32.81 ft)
Monitoring	
• Short circuit of the sensor supply	Yes
• Wire break	Yes
Additional technical specifications	
Real-time clock buffering	
• Buffer time, typ.	4 weeks
• Charging time, typ.	1 h
Approvals	cULus (File No. E164110)

More information

Further information

- on I/O modules can be found under "SIMOTION I/O components".
- on PROFIBUS DP/MPI cables and MOTION-CONNECT can be found under "Connection system MOTION CONNECT".
- on I/O modules from the SIMATIC S7-300 range can be found under "SIMOTION I/O components".
- on PROFIBUS DP, Industrial Ethernet and PROFINET can be found in Catalog IK PI or in the A&D Mall under "Communication/Networks/SIMATIC NET communication systems".

SIZER configuration tool

With the SIZER configuration tool, you can easily configure the SINAMICS S120 drive family including SIMOTION. It provides you with support for selecting and dimensioning the components required for a motion control task. You can also determine the possible number of axes and the resulting load with SIZER in accordance with your performance requirements.

For further information about SIZER, refer to the section "System description – Dimensioning: SIZER configuration tool".

Selection and ordering data

Description	Order No.
SIMOTION C230-2 Motion Controller	**6AU1230-2AA01-0AA0**
SIMOTION Multi Axes Bundle C230-2 Consists of 1 item each • SIMOTION C230-2 • SIMOTION Micro Memory Card (MMC) 32 MB with MultiAxes Package license for SIMOTION C	**6AU1230-2AA01-0CA0**
SIMOTION Micro Memory Card (MMC) 32 MB for SIMOTION C230-2 Pre-installed license using Z options [1]	**6AU1700-0AA02-0AA0**
SIMOTION Micro Memory Card (MMC) 32 MB for SIMOTION C230-2 with MultiAxes Package license for SIMOTION C	**6AU1700-0AA02-0AA0 -Z M24**
SIMOTION C240 Motion Controller (SIMOTION V4.0 HF2 is required)	**6AU1240-1AA00-0AA0**
SIMOTION Multi Axes Bundle C240 Consists of 1 item each • SIMOTION C240 • SIMOTION Micro Memory Card (MMC) 64 MB with MultiAxes Package license for SIMOTION C	**6AU1240-1AA00-0CA0**
SIMOTION Micro Memory Card (MMC) 64 MB for SIMOTION C240 Pre-installed license using Z options [1]	**6AU1720-1KA00-0AA0**
SIMOTION Micro Memory Card (MMC) 64 MB for SIMOTION C240 with MultiAxes Package license for SIMOTION C	**6AU1720-1KA00-0AA0 -Z M24**
Front connector, 40-pin	
• With screw contacts	**6ES7392-1AM00-0AA0**
• With spring-loaded contacts	**6ES7392-1BM01-0AA0**
• with Fast Connect fast connection method	**6ES7392-1CM00-0AA0**
Connecting comb PS – C2xx for PS307 power supply	**6ES7390-7BA00-0AA0**
IM 365 interface module for expanding the motion controller with max. 1 EU, 2 modules with permanent connecting cable (1 m (3.28 ft))	
• Standard temperature range	**6ES7365-0BA01-0AA0**
Mounting rail, SIMATIC S7-300	
• L = 160 mm (6.30 in)	**6ES7390-1AB60-0AA0**
• L = 480 mm (18.90 in)	**6ES7390-1AE80-0AA0**
• L = 530 mm (20.87 in)	**6ES7390-1AF30-0AA0**
• L = 830 mm (32.68 in)	**6ES7390-1AJ30-0AA0**
• L = 2000 mm (78.74 in)	**6ES7390-1BC00-0AA0**

[1] Notes regarding runtime software
Licenses for runtime software can be ordered either pre-installed on a SIMOTION Micro Memory Card (MMC) or separately. For further information, refer to the section "Runtime software licensing" on page 8/41 and the following.

Summary

Overview

SIMOTION P is a PC-based, motion control system. PLC, motion control, and HMI functions are executed together with standard PC applications in one platform. Benefits to the user: Using the PC platform and the Microsoft Windows operating system, with a real-time expansion for SIMOTION – the advantages of both worlds are combined in SIMOTION P:

Openness thanks to the Windows operating system

SIMOTION P brings the possibilities offered by information technology of the office area into your machine, such as

- Networking
- High storage capacity for data
- Data backup concepts
- Integrated communication

Complex data evaluation, visualization tasks and even engineering can be easily implemented with SIMOTION P directly on the PC. When HMI software from other engineering systems is needed, the standardized OPC server interface can be used.

Functions such as remote maintenance, diagnostics and teleservice can also be used via the integrated Ethernet interface. The standard applications of the PC world are also available for your motion applications and they can be used for:

- Hardware, such as a printer, keyboard, mouse, etc.
- Software, such as visualization software or Microsoft Office programs.

Real-time capability thanks to the SIMOTION operating system

On SIMOTION P, the completely independent real-time operating system of SIMOTION P executes in parallel with Windows XP. A blue screen of the Windows system does not interrupt the machine application, because the real-time operating system of SIMOTION P continues to execute. The real-time expansion for SIMOTION P means that demanding motion control applications with high performance requirements can be implemented simultaneously.

PC technology

- The latest PC processor technology, currently Pentium M, 2 GHz, ensures optimum performance.
- Fast instruction execution opens up completely new application possibilities in the mid-performance to high-performance range.

Benefits

- Open-loop control, motion control, technology, visualization and standard Microsoft applications on the same platform – ready to use without the need for time-consuming installation
- Performance gains due to the latest, powerful PC processor architecture
- Easy configuration of HMI functions using WinCC flexible
- Openness to standard applications on the basis of the Windows operating system
- Standard PC communication mechanisms can be used over Industrial Ethernet
- Easy software upgrades using standard PC methods, such as CD-ROM / DVD
- User-friendly operation
- Versatile networking thanks to onboard PROFIBUS DP and Industrial Ethernet interfaces or optionally over PROFINET with MCI-PN Communication Board
- Powerful thanks to a range of integrated functions
- Easy engineering for open-loop control and motion control applications in the same program

Application

SIMOTION P is ideal for use in:

- Applications for which a PC is preferred, e.g. those with extensive data management, evaluation tasks, etc.
- Applications in which motion control, open-loop control and visualization functions are implemented on one platform to save space
- Applications with maximum performance requirements (e.g. hydraulic applications in which highly dynamic position and pressure control loops are necessary)
- Applications in which the openness provided by the Windows operating system can be optimally utilized (software, drivers, etc.)

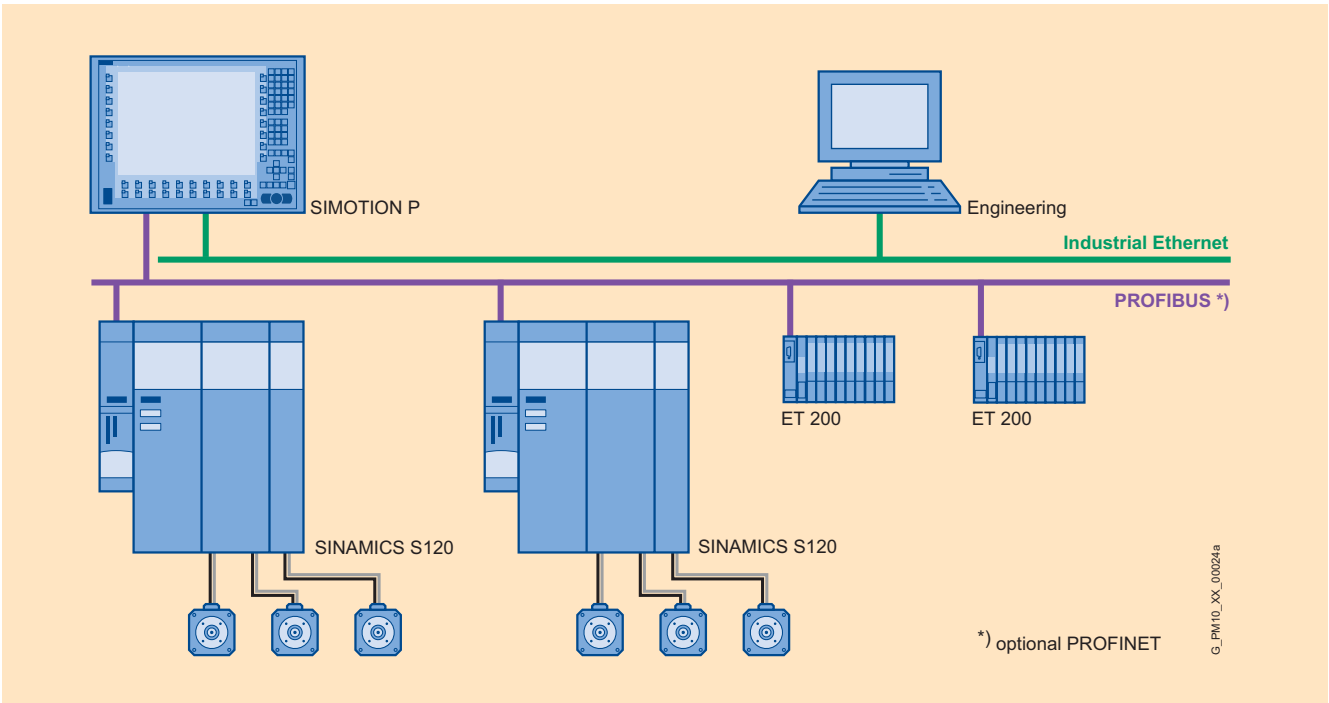
Important applications include:

- Packaging machines
- Plastic and rubber processing machines
- Presses, wire-drawing machines
- Textile machines
- Printing machines
- Wood, glass, ceramics and stone working machines

Due to the increasing use of servo drives, these machines require a high degree of integration of PLC, motion control and technology functions.

Summary

Design



Typical design of an automation solution using SIMOTION P

Equipment for the SIMOTION basic unit

SIMOTION P is a turnkey PC system, consisting of:

- SIMOTION P350-3 (PC box)
- IsoPROFIBUS card (PROFIBUS version)
- MCI-PN board (PROFINET version)
- SIMOTION Kernel
- Windows XP Professional operating system
- DVD drive (optional)

Power supply

The SIMOTION P system requires a 24 V power supply. We recommend that you use an uninterruptible power supply (UPS). For the connection to a 120/230/400 V voltage source, you will require one of the following power supplies, for example:

- SIMATIC PS 307 or
- SITOP power DC-UPS module

Panel fronts

The SIMOTION P system can be supplied with different panel fronts:

- SIMOTION P panel fronts are available with a 12“ or 15“ TFT display for either keyboard or touch screen operation

Distributed I/Os

I/O signals are connected via distributed I/O systems, which are connected via PROFIBUS DP or PROFINET IO, such as:

- SIMATIC ET 200S
- SIMATIC ET 200M
- SIMATIC ET 200pro
- SIMATIC ET 200eco

The signals are transferred from the I/O systems digitally and interference-free at high speed over PROFIBUS DP/PROFINET IO to the SIMOTION P system.

Design (continued)

Communication over PROFIBUS/PROFINET

The SIMOTION P motion control system can control drives and distributed I/O modules over PROFIBUS DP (PROFIBUS version) or over PROFINET (PROFINET version). The PROFIBUS version can also include PROFINET if required and will then support PROFIBUS and PROFINET communication in the same device.

PROFIBUS version

The connection to a PROFIBUS network is made via the integrated IsoPROFIBUS board. This is a PCI card with two ports for PROFIBUS DP (max. 12 Mbit/s). Users can parameterize the clock-pulse rate on the bus. Optionally, one of the two PROFIBUS DP interfaces can also be defined as programming interface (MPI protocol).

PROFINET version

The connection to a PROFINET network is made via the integrated MCI-PN board. This comprises of a PCI card with four Ethernet ports and integrated switch functionality. The PROFINET board supports PROFINET IO with IRT and RT. Standard Ethernet communication (TCP/IP) is also possible over this interface.

In combination with ET 200S High Speed I/O and PROFINET, cycle times of 250 µs can be achieved. This is particularly necessary for applications with fast response times (e.g. hydraulic axes).

In-system communication

The control and motion control software execute on the SIMOTION Kernel basic system.

The internal PC communication provides high-performance data exchange between the SIMOTION Kernel and the Microsoft Windows operating system. Further processing of this data, e.g. using OPC server, is possible in any Microsoft programs.

Integration in Local Area Networks

With the onboard Industrial Ethernet interface, the SIMOTION P system is well-equipped for integration in LANs (Local Area Networks). An external operator station or an engineering system can also be connected (e.g. for remote maintenance).

Engineering

Engineering is performed either using a separate programming device or directly in the SIMOTION P system.

Function

SIMOTION P provides the following basic functionality for the various automation requirements:

- SIMOTION runtime system
  - User-programmable with several languages conforming to IEC 61131
  - Various runtime levels (cyclic, sequential, event-driven)
  - PLC and arithmetic functionality
  - Communications and management functions
  - Technology functions for Motion Control Basic
- Test and diagnostic tools

This basic functionality can be expanded, for example, with loadable technology packages, if required.

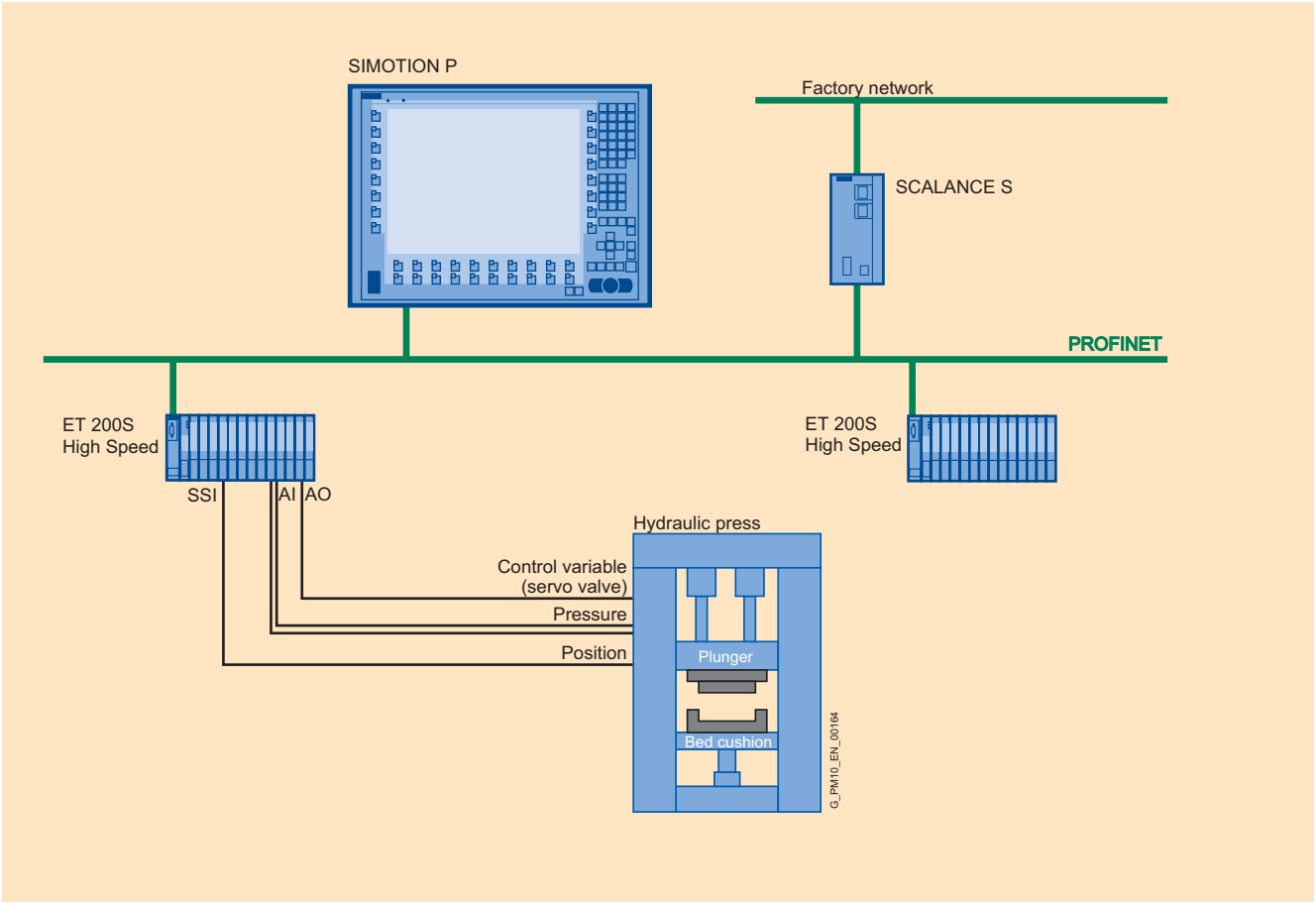
Position-controlled motion control for servo drives

- Drives with digital setpoint interface:
  SIMOTION P enables position-controlled motion control for drives with digital setpoint interfaces via PROFIBUS DP/ PROFINET IO with PROFIdrive.
- Drives with analog setpoint interfaces (for retrofitting):
  The ADI 4 (Analog Drive Interface for 4 axes) or IM 174 (Interface Module for 4 axes) module can be used to connect drives with analog ± 10 V setpoint interfaces.
  The IM 174 also makes it possible to connect stepper drives with pulse direction interface
  (e.g. SIMOSTEP motors with FM STEPDRIVE power unit).
  Both modules are connected over PROFIBUS DP.
  The following can be connected to one ADI 4 or IM 174 module:
  - 4 drives
  - 4 encoders
  - Digital inputs and outputs

Summary

Function (continued)

Position control and pressure control for hydraulic drives



With SIMOTION P and the new SIMATIC ET 200S High Speed I/O, cycle times down to 250 µs can be achieved over PROFINET with IRT (Isochronous Real Time).

Highly dynamic control loops can therefore be achieved for hydraulic applications with position and pressure control.

The necessary sensors and actuators, such as

- position encoders connected through the SSI interface,
- pressure sensors connected through analog inputs (AI),
- servo valves connected through analog outputs (AO) and
- digital I/O for tool safety and cam signal output

are connected over the SIMATIC ET 200S distributed I/O system, which was equipped with the necessary high-speed I/O modules beforehand to suit the application.

On the basis of PROFINET, it is therefore possible to synchronize hydraulic drives as well as electrical drives. In conveyor systems and press lines in the automotive industry, plant-wide automation solutions can be implemented in which both electrical drives (winders, cross cutters, roller feeds) and hydraulic drives (e.g. deep-drawing presses) are implemented.

Technology packages (TP)

A special feature of SIMOTION is that the operating system functionality can be expanded by loading technology packages, such as:

- Motion control with the functions
  - POS – Positioning
  - GEAR – Synchronous operation/electronic gear
  - CAM – Cam
  - PATH – Path interpolation
- TControl – Temperature controller

Since the technology functions have modular licenses, you only pay for what you will actually use.

Configuring/parameterizing/programming

SIMOTION SCOUT is a powerful and user-friendly engineering tool. It is an integrated system for all engineering steps, from configuring and parameterization, through programming, to testing and diagnostics. Graphical operator prompting, using dialog boxes and wizards, as well as text-based and graphical languages for programming, considerably reduce the familiarization and training periods.

Function (continued)

Operator control and monitoring (HMI)

Operator control and monitoring can be performed

- separately on an operator panel or
- on the SIMOTION P system directly

Communication utilities which support user-friendly data exchange with HMI systems are integrated in the basic functionality of the SIMOTION P350. Both PROFIBUS/PROFINET and Industrial Ethernet can be used for communication. The SIMOTION Kernel processes the data exchange independently.

SIMATIC WinCC flexible is the standard HMI system for SIMOTION P. This HMI system can directly configure the data from a SIMOTION project. SIMOTION panel fronts can be used for operation and visualization.

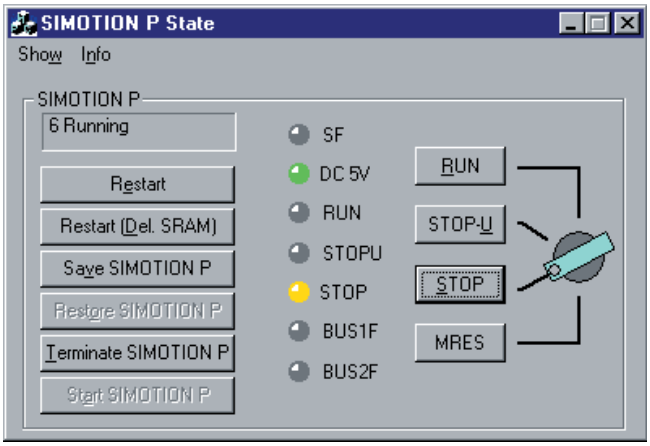
With the SIMATIC NET communications software, an open, standardized OPC interface is available for accessing SIMOTION from other Windows-based HMI systems.

Process and data communication

Thanks to its integrated interfaces, SIMOTION P supports both process and data communication. The SCOUT engineering system is provided for user-friendly communication configuration and diagnostics.

Indication and diagnostics of operating status

A SIMOTION P system does not have any pushbuttons or switches for changing operating modes (RUN/STOP). This task is performed by a software monitor (SIMOTION P State), which is operated using the keyboard or mouse.



SIMOTION P State

This monitor visualizes the operating states during start-up and operation. Other functions are, for example, loading and saving user programs or start up and shut down of the SIMOTION P system. During shutdown, important data (retain data) is stored on the IsoPROFIBUS board or MCI-PN PROFINET board while the device's power supply is shutting down so that the most up-to-date data is ready for use as soon as the device is restarted.

The SIMOTION P intelligent diagnostic system constantly controls the functionality of the system and registers errors or specific system events (e.g., timing errors, module or network failures, etc.). PC-specific functions, such as fan speeds or temperatures, can also be continuously controlled and alarms are generated if they fail.

The stability of the SIMOTION Kernel is **independent** of the Windows XP Professional operating system. Even in the event of a Windows operating system crash (Windows blue screen), SIMOTION P continues to run and the machine can be shut down safely according to user specifications.

More information

More information

- on suitable I/O modules for SIMOTION can be found under "SIMOTION I/O components".
- on the functionality of SIMOTION platforms can be found under "Overview of functions".
- on engineering and the SIMOTION runtime system can be found under "SIMOTION software".
- on HMI can be found under "SIMOTION Human Machine Interface (HMI)".
- on SIMATIC NET communication software can be found under "SIMOTION Runtime Software".

SIMOTION P350-3

Overview

SIMOTION P350-3 is a PC-based, motion control system. The use of an industrial PC platform facilitates the running of the SIMOTION machine application (comprising of PLC, motion control and HMI functions) alongside standard PC applications on one platform. This is particularly useful in the case of applications that involve complex PC-based data management and analysis systems.

The operating system is Windows XP Professional, with a real-time expansion for SIMOTION.

To facilitate the connection of distributed components, SIMOTION P350-3 is available in both PROFINET and PROFIBUS versions.

Design

Interfaces

Display and diagnostics

With SIMOTION P, the display and diagnostics functions for the operating states are performed by a software monitor, which takes the form of an on-screen application window. This software monitor can be operated using your keyboard, mouse or touch panel.

Integrated interfaces

- 1 x COM 1 (V.24), VGA (via DVI adapter)
- 4 x USB 2.0
- 1 x MPI/PROFIBUS DP interface (integrated, not isochronous, isolated)
- 2 x Industrial Ethernet 10/100 Mbit/s (integrated)

Expansion slots

- 1 x PCI slot 265 mm (10.43 in)
  PROFINET version:
  occupied by MCI PN Communication Board
  PROFIBUS version:
  occupied by IsoPROFIBUS board
- 1 x PCI/ISA slot 170 mm (free)
  e.g., for the purpose of retrofitting an additional communication board

Design (continued)

Communication

PROFINET version
The MCI PN Communication Board that has been integrated in the PROFINET version enables the SIMOTION P350-3 to be connected to a PROFINET IO network. From a PROFINET perspective, the SIMOTION P350-3 thus assumes the role of a PROFINET IO controller.

To enable it to communicate with other PROFINET controllers, the SIMOTION P350-3 can be configured as both a PROFINET controller and a PROFINET device at the same time (I-Device).

PROFIBUS version
The PROFIBUS version features an integrated IsoPROFIBUS board, which offers two PROFIBUS DP interfaces for establishing PROFIdrive connections.

The free PCI slot can be used for the purpose of retrofitting an optional MCI PN communication board. This means that the PROFIBUS version can support both PROFIBUS and PROFINET on the same PC.

Compatible panel fronts

SIMOTION P350-3 can be connected to the following panel fronts:

- 12" with membrane-type keys
- 12" for touch screen operation
- 15" with membrane-type keys
- 15" for touch screen operation

The DVI/VGA interface can be used to connect an external monitor.

Expansion using distributed I/Os

PROFINET version

- Distributed I/Os (SIMATIC ET 200S/M/pro)
- Distributed drives (e.g. SINAMICS S120 Motor Modules with CU320 Control Unit and CBE20 Communication Board plus SINAMICS S120 Power Modules and CU310 PN Control Unit)
- Engineering systems (PG/PC) or
- HMI devices (e.g., MP, TP, OP)

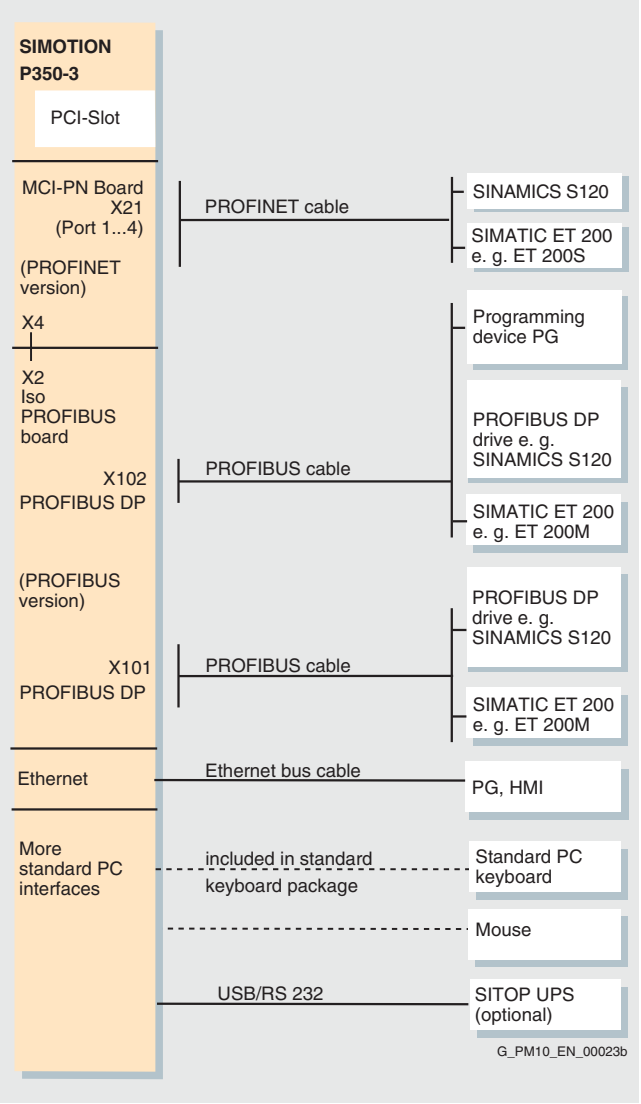
PROFIBUS version

- Certified PROFIBUS standard slaves (DP-V0, DP-V1, DP-V2)
- Distributed I/Os (SIMATIC ET 200S/M/eco/pro)
- Distributed drives (e.g. SINAMICS S120 Motor Modules with CU320 Control Unit plus SINAMICS S120 Power Modules and CU310 DP Control Unit)
- Engineering systems (PG/PC) or
- HMI devices (e.g., MP, TP, OP)

PC technology

- Processor: Intel Pentium M 2 GHz
- Microsoft Windows XP Professional operating system, English
- 512 MB SDRAM, upgradable to 1 GB
- Hard disk with shock damping, approx. 40 GB
- DVD-ROM drive (optional)
- Data backup/restore using the Symantec Ghost data backup software (pre-installed)

Integration



Overview of the SIMOTION P350-3 connections

More information

For additional information about connectable I/O modules, refer to "SIMOTION I/O components" and "SIMOTION Overview of functions".

SIZER configuration tool

With the SIZER configuration tool, you can easily configure the SINAMICS S120 drive family including SIMOTION. It provides you with support for selecting and dimensioning the components required for a motion control task. You can also determine the possible number of axes and the resulting load with SIZER in accordance with your performance requirements.

For further information about SIZER, refer to the section "System description – Dimensioning: SIZER configuration tool".

Technical specifications

SIMOTION P350-3	
Input voltage	24 V DC
Max. power consumption	190 W
Max. mains buffering	20 ms
Degree of protection according to EN 60529 (IEC 60529)	IP20
Max. temperature change	10 K/h
Relative humidity limit values according to IEC 68-2-3, IEC 68-2-30, IEC 68-2-56	
• Storage and transport	5 ... 95 % at +25 °C (+77 °F)
• Operation	5 ... 80 % at +25 °C (+77 °F)
Humidity rating in accordance with EN 60721-3-3	Class 3K5 Condensation and icing excluded Low air temperature 0 °C (32 °F)
Permissible ambient temperature	
• Storage and transport	-20 ... +60 °C (-4 ... +140 °F)
• Operation	+5 ... +45 °C (+41 ... +113 °F)
Weight, approx.	6 kg (13.2 lb)
Dimensions (W x H x D)	297 mm x 267 mm x 85 mm (11.69 in x 10.51 in x 3.35 in) (excluding DVD drive) 297 mm x 267 mm x 106 mm (11.69 in x 10.51 in x 4.17 in) (including DVD drive)
Approvals	cULus (File No. E164110)

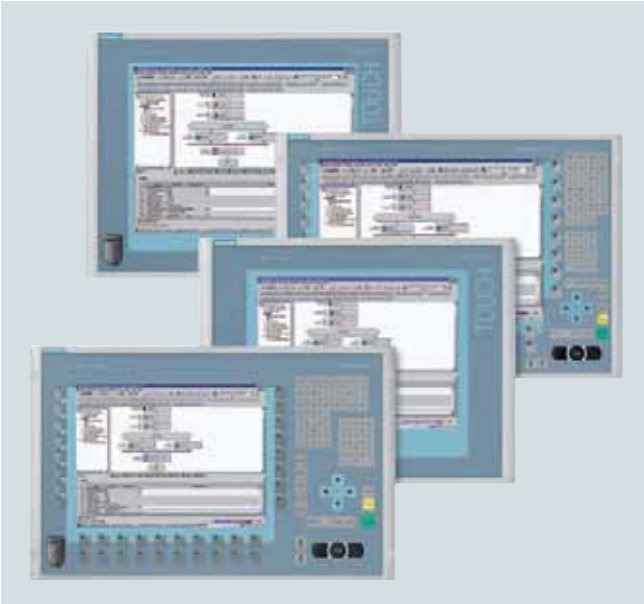
Selection and ordering data

Description	Order No.
SIMOTION P350-3, PROFIBUS version with Intel Pentium M, 2 GHz, Windows XP Professional, English, 512 MB SDRAM, 24 V DC, **with IsoPROFIBUS board**	
• Without DVD drive	**6AU1350-3AK41-1BE2 –Z** [1]
• With DVD drive	**6AU1350-3AK43-1BE2 –Z** [1]
SIMOTION P350-3, PROFINET version with Intel Pentium M, 2 GHz, Windows XP Professional, English, 512 MB SDRAM, 24 V DC, **with MCI PN board**	
• Without DVD drive	**6AU1350-3AK41-2BE2 –Z** [1]
• With DVD drive	**6AU1350-3AK43-2BE2 –Z** [1]
Memory expansion	
• 128 MB DDR2 533 SODIMM	**6ES7648-2AG10-0GA0**
• 256 MB DDR2 533 SODIMM	**6ES7648-2AG20-0GA0**
• 512 MB DDR2 533 SODIMM	**6ES7648-2AG30-0GA0**
MCI PN communication board (for PROFINET upgrade)	**6AU1390-0BA00-0AA0**
Replacement parts	
• Motherboard battery	**6FC5247-0AA18-0AA0**

[1] Note regarding runtime software
When ordering SIMOTION P350-3, the pre-installed runtime version must be specified.
Additional runtime software licenses can either be pre-installed on a SIMOTION P350-3 or ordered separately. For further information, refer to the section "Runtime software licensing" on page 8/41 and the following.

Panel fronts

Overview



Four different panel fronts with TFT color display are available for the SIMOTION P350-3:

- 12” with membrane keyboard, resolution: 800 x 600 pixels
- 12” for touch screen operation, resolution: 800 x 600 pixels
- 15” with membrane keyboard, resolution: 1024 x 768 pixels
- 15” for touch screen operation, resolution: 1024 x 768 pixels

Design

The panel fronts are suitable for installation in consoles, control cabinets and support arm systems.

The SIMOTION P350-3 is mounted directly behind the panel front as standard. Four knurled-head screws are used to form a mechanical interlock between the SIMOTION P350-3 and the panel front. No special tool is needed for this.

It is also possible to distribute the SIMOTION panel fronts at distances of up to 100 m. For the required components, refer to Thin Client Unit (TCU).

Technical specifications

Panel fronts	
Degree of protection at the front according to EN 60529 (IEC 60529)	IP65
Rel. humidity limit values according to IEC 68-2-3, IEC 68-2-30, IEC 68-2-56	
• Storage and transport	5 ... 95 % at +25 °C (+77 °F)
• Operation	5 ... 80 % at +25 °C (+77 °F)
Condensation	Not permissible
Permissible ambient temperature	
• Storage and transport	-20 ... +60 °C (-4 ... +140 °F)
• Operation	+5 ... +45 °C (+41 ... +113 °F)
Weight	
• 12" panel front, membrane keys	6 kg (13.2 lb)
• 12" panel front, touch screen operation	6 kg (13.2 lb)
• 15" panel front, membrane keys	6 kg (13.2 lb)
• 15" panel front, touch screen operation	6 kg (13.2 lb)
Dimensions (W x H x D)	
• 12" panel front, membrane keys	483 mm x 310 mm x 100 mm (19.02 in x 12.20 in x 3.94 in)
• 12" panel front, touch screen operation	400 mm x 310 mm x 125 mm (15.75 in x 12.20 in x 4.92 in)
• 15" panel front, membrane keys	483 mm x 355 mm x 130 mm (19.02 in x 13.98 in x 5.12 in)
• 15" panel front, touch screen operation	483 mm x 310 mm x 130 mm (19.02 in x 12.20 in x 5.12 in)
Approvals	cULus (File No. E164110)

Selection and ordering data

Description	Order No.
The following panel fronts can only be used in combination with SIMOTION P350-3.	
SIMOTION P012K 12" panel front, membrane keys (Key)	**6AU1300-0DA00-0AA0**
SIMOTION P012T 12" panel front, touch screen	**6AU1300-0CA00-0AA0**
SIMOTION P015K 15" panel front, membrane keys (Key)	**6AU1300-0FA00-0AA0**
SIMOTION P015T 15" panel front, touch screen	**6AU1300-0EA00-0AA0**

Accessories

Description	Order No.
Sealing caps, 10 units, for USB port	**6FC5248-0AF05-0AA0**
Key labeling strips For labeling softkeys and function keys, blank, supplied in sets of 3 (plastic) for	
• 12", membrane keys (Key)	**6AV7671-3CA00-0AA0**
• 15", membrane keys (Key)	**6AV7671-5CA00-0AA0**

Overview

The Thin Client Unit (TCU) for distributed installation permits physical separation of operator panel fronts and SIMOTION P350-3. For this purpose, the operator interface is copied to one/several operator panel fronts with one TCU each.

Benefits

- Design of flat operator panels through the shallow installation depth and low power dissipation.
- More stable mounting in the control cabinet

Design

The TCUs are coupled via Industrial Ethernet as Thin Clients in a dedicated subnetwork (via DHCP server).

- Graphics: Resolution 640 x 480 to 1024 x 768, 16-bit color depth

Ports:

- 2 x USB 1.1 for connection of mouse and keyboard
- Industrial Ethernet 10/100 Mbit/s

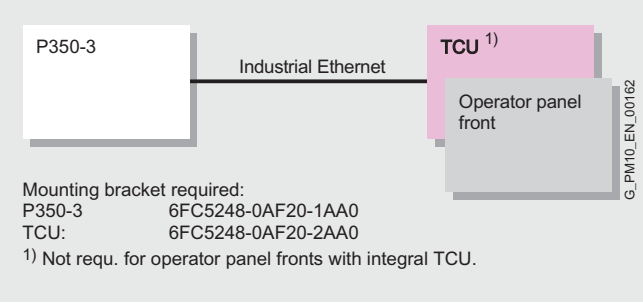
Function

- Signal transmission between P350-3 and operator panel front via Industrial Ethernet
- Easy installation and service-friendly layout thanks to the component structure
- Functionality of the P350-3 as in centralized configuration (e.g. number of PCI slots). The same operating screen is shown synchronously on all operator panel fronts and can be used from all panel fronts. Operation on a Thin Client has the same authorization rights as operation on an operator panel front connected directly to the P350-3. The operator panel in passive mode shows a darkened screen.
- The distance to the operator panel fronts is determined by the maximum distance between two network nodes/access points (100 m/328 ft).

Integration

The TCU can be used for:

- SIMOTION P350-3, operator panel fronts P012T, P012K, P015T, P015K



Connection overview for P350-3 with distributed OP via TCU

Thin Client Unit (TCU)

Technical specifications

Thin Client Unit (TCU)	
Input voltage	24 V DC
Power consumption, max.	28.8 W
Degree of protection acc. to EN 60529 (IEC 60529)	IP00
Humidity rating in accordance with EN 60721-3-3	Class 3K5 condensation and icing excluded. Low air temperature 0 °C (32 °F).
Relative humidity	
• Storage	5 ... 95 % at 25 °C (77 °F)
• Transport	5 ... 95 % at 25 °C (77 °F)
• Operation	5 ... 80 % at 25 °C (77 °F)
Ambient temperature	
• Storage	-25 … +55 °C (-13 ... +131 °F)
• Transport	-25 … +55 °C (-13 ... +131 °F)
• Operation	0 ... 55 °C (32 ... 131 °F)
Dimensions	
• Width	260 mm (10.2 in)
• Height	265 mm (10.4 in)
• Depth	40 mm (1.57 in)
Weight, approx.	1.7 kg (3.75 lb)

Selection and ordering data

Description	Order No.
Thin Client Unit (TCU)	**6FC5312-0DA00-0AA1**

Accessories

Description	Order No.
Mounting bracket, bent for SIMOTION P350-3 with/without video link transmitter in control cabinet	**6FC5248-0AF20-1AA0**
Mounting bracket for TCU behind operator panel front	**6FC5248-0AF20-2AA0**
IE FC Standard Cable GP 2 x 2 (Type A) 4-core, shielded TP installation cable for connection to an IE FC outlet RJ45/IE FC RJ45 plug; PROFINET-compatible; with UL approval; sold by the meter; Max. length 1000 m (3281 ft), minimum order quantity 20 m (65.62 ft)	**6XV1840-2AH10**
IE FC Trailing Cable GP 2 x 2 (Type C) 4-core, shielded TP installation cable for connection to an IE FC outlet RJ45/IE FC RJ45 plug 180/90 for use as trailing cable; PROFINET-compatible; without UL approval; sold by the meter; Max. length 1000 m (3281 ft), minimum order quantity 20 m (65.6 ft)	**6XV1840-3AH10**
IE FC RJ45 Plug 180 RJ cable connector for Industrial Ethernet with rugged metal housing and integrated insulation displacement contacts; with 180° cable outlet	**6GK1901-1BB10-2AA0**

Overview

The KBPC USB US standard PC keyboard with a hub impresses customers with its modern design and hub for three USB ports. A USB mouse can be connected here. The wrist rest supplied with it supports ergonomic working.

Programs and texts can be edited easily with the standard PC keyboard.

The standard PC keyboard is not suitable for industrial use (EMC) and should not be used as a permanent installation. It may be used only for servicing and commissioning.

Integration

The KBPC USB US standard PC keyboard can be used for SIMOTION P350

Technical specifications

SINUMERIK KBPC USB US standard PC keyboard	
Input voltage	5.25 V DC
Power consumption, max.	0.3 W
Degree of protection acc. to DIN EN 60529 (IEC 60529)	IP20
Humidity rating in accordance with DIN EN 60721-3-3	Class 3K5 condensation and icing excluded. Low air temperature 0 °C (32 °F).
Ambient temperature	
• Storage	-20 ... +50 °C (-4 ... +122 °F)
• Transport	-20 ... +50 °C (-4 ... +122 °F)
• Operation	15 ... 32 °C (59 ... 89.6 °F)
Dimensions	
• Width	463 mm (18.2 in)
• Height	37 mm (1.46 in)
• Depth	166 mm (6.54 in)
Weight, approx.	1 kg (2.21 lb)

Selection and ordering data

Description	Order No.
KBPC USB US standard PC keyboard MF II compatible 104/105 key layout with integral hub, connection: USB, incl. connecting cable Length: 1.9 m (6.23 ft)	**6FC5203-0AC01-2AA0**

8

Supplementary components 3.5" disk drive, USB 1.1

Overview

The 3.5" floppy disk drive is suitable for archiving user data and can be installed in front panels. The connection is made via the USB interface.

Function

The 3.5" floppy disk drive is designed for the transfer of user data. Installation in front panels makes it possible to transfer data without opening the control cabinet door. You can use high density (1.2/1.44 MB) 3.5" floppy disks to store user data.

Integration

The floppy disk drive is suitable for connecting to SIMOTION P350 with Windows XP Professional

Technical specifications

SINUMERIK 3.5" USB 1.1 floppy disk drive	
Input voltage	5.25 V DC
Power consumption, max.	2.5 W
Degree of protection acc. to EN 60529 (IEC 60529)	
• Front	IP54
• Rear	IP00
Humidity rating in accordance with EN 60721-3-3	Class 3K5 condensation and icing excluded. Low air temperature 0 °C (32 °F).
Relative humidity	
• Storage	5 ... 90 % at -22 ... +60 °C (-8 ... +140 °F)
• Transport	5 ... 95 % at -40 ... +65 °C (-40 ... +149 °F)
• Operation	20 ... 80 % at 4 ... 51.7 °C (39 ... 125 °F)
Ambient temperature	
• Storage	-20 ... +60 °C (-4 ... +140 °F)
• Transport	-20 ... +60 °C (-4 ... +140 °F)
• Operation	4 ... 50 °C (39.2 ... 122 °F)
Distance to PCU	5 m (16.4 ft)
Dimensions	
• Width	145 mm (5.71 in)
• Height	50 mm (1.97 in)
• Depth	161 mm (6.34 in)
Weight, approx.	0.32 kg (0.71 lb)

Selection and ordering data

Description	Order No.
SINUMERIK 3.5" floppy disk drive, USB 1.1 Incl. connecting cable Length: 1 m (3.28 ft)	**6FC5235-0AA05-1AA2**

Accessories

Description	Order No.
Cover For SINUMERIK floppy disk drive and card reader with masking frame, cover, and bearing bracket	**6FC5247-0AA20-0AA0**

Overview

The MCI PN Communication Board for SIMOTION P350-3 enables connection to a PROFINET IO network. This means that in terms of PROFINET, SIMOTION P350-3 is a PROFINET IO controller that offers the following functions:

- Communication as: PROFINET IO Controller, I-Device (controller and device simultaneously)
- 100 Mbit/s full duplex
- Supports real-time classes of PROFINET IO:
  - RT (Real Time)
  - IRT (Isochronous Real Time)
- Integration of distributed I/O as PROFINET IO devices
- Integration of drives as PROFINET IO devices through PROFIdrive according to the V4 specification
- Support for standard Ethernet communication, e.g.
  - for interfacing with SIMOTION SCOUT
  - for the connection of HMI systems
  - for communication with any other devices over TCP/IP or UDP communication
- Integrated 4-port switch with 4 RJ45 sockets based on the PROFINET ASIC, ERTEC400. The optimal topology (line, star, tree or ring) can therefore be constructed without the need for additional external switches.

Design

The MCI-PN communication board is inserted in the spare PCI slot of the SIMOTION P350-3.

Technical specifications

MCI-PN Communication Board	
Current consumption	900 mA at 5 V
Permissible ambient temperature	
• Storage and transport	-20 ... +60 °C (-4 ... +140 °F)
• Operation	+5 ... +55 °C (+41 ... +131 °F)
Weight, approx.	110 g (0.24 lb)
Dimensions	107 mm x 167 mm (4.21 in x 6.57 in)
Approvals	cULus (File No. E164110)

Selection and ordering data

Ordering data	Order No.
MCI-PN communication board	**6AU1390-0BA00-0AA0**

Accessories

The following PROFINET connectors and cables are recommended:

Description	Order No.
RJ45 FastConnect connector for Industrial Ethernet/PROFINET	
• 145° cable outlet	
- 1 pack = 1 unit	**6GK1901-1BB30-0AA0**
- 1 pack = 10 units	**6GK1901-1BB30-0AB0**
• 180° cable outlet	
- 1 pack = 1 unit	**6GK1901-1BB10-2AA0**
- 1 pack = 10 units	**6GK1901-1BB10-2AB0**
FastConnect cables for Industrial Ethernet/PROFINET [1]	
• IE FC Standard Cable GP 2x2	**6XV1840-2AH10**
• IE FC Flexible Cable GP 2x2	**6XV1870-2B**
• IE FC Trailing Cable GP 2x2	**6XV1870-2D**
• IE FC Trailing Cable 2x2	**6XV1840-3AH10**
• IE FC Marine Cable 2x2	**6XV1840-4AH10**
Stripping tool for Industrial Ethernet/PROFINET FastConnect cables	
• IE FC stripping tool	**6GK1901-1GA00**

More information

For further information about FastConnect cables, see Catalog IK PI (Industrial Communication for Automation and Drives) or the A&D Mall under "Communication / Networks / SIMATIC NET communication systems / PROFINET / Passive network components".

[1] Sold by the meter; max. length 1000 m (3281 ft); minimum order 20 m (65.62 ft).

SIMOTION D – Drive-based

Summary

Overview

Left: SIMOTION D425/D435/D445 for multi-axis applications
Right: SIMOTION D410 for single-axis applications

SIMOTION D is a compact, drive-based version of SIMOTION based on the SINAMICS S120 drives family.

Two versions are available:

- SIMOTION D410 is a compact control unit for single-axis applications and is snapped on to the SINAMICS S120 PM340 Power Module in blocksize format.
- SIMOTION D4x5 is a control unit for multi-axis applications in SINAMICS S120 booksize format and is offered in several performance variants:
  - SIMOTION D425 (BASIC performance) for up to 16 axes
  - SIMOTION D435 (STANDARD performance) for up to 32 axes
  - SIMOTION D445 (HIGH performance) for up to 64 axes

SIMOTION D4x5 therefore offers maximum scalability and flexibility for multi-axis applications.

With SIMOTION D, the SIMOTION PLC and motion control functionalities as well as the SINAMICS S120 drive software run on a shared control hardware. The IEC 61131-3-compliant PLC integrated in SIMOTION D means that the system is not just capable of controlling sequences of motions, but the entire machine as well.

Depending on the SIMOTION D version, HMI devices can be operated on the onboard PROFIBUS, Ethernet or PROFINET interface for operator control and monitoring. Functions such as remote maintenance, diagnostics and teleservice can also be used via these interfaces.

Benefits

- Cost-effective thanks to integrated Motion Control, technology and PLC functionality direct in the drive
- Employs the innovative SINAMICS S120 design
- Compact form-factor reduces control cabinet size
- Ideally suited to modular or distributed machine concepts
- User-friendly operation
- Flexible networking through integrated interfaces:
  - D410: PROFIBUS DP or PROFINET IO
  - D4x5: PROFIBUS DP, Industrial Ethernet and optional PROFINET IO
- Powerful thanks to a range of technology functions
- Very simple engineering, from drive commissioning to open-loop control and Motion Control applications
- Easy to service thanks to the CompactFlash Card, which can be easily replaced and contains all data (programs, data, drive parameters, and licenses)
- Very dynamic because the interfaces between PLC and Motion Control are no longer required

Application

SIMOTION D can be used optimally wherever

- the SINAMICS S120 drive family is used
- the motion control and PLC functionality are directly executed in the drive (SINAMICS S120)
- a compact, space-saving construction is required
- high performance is required for motion control and high-speed I/O
- high electromagnetic compatibility and a high resistance to shock and vibration are required due to harsh ambient conditions
- modular machine concepts with high-speed isochronous coupling is required

SIMOTION D: the flexible solution for modular machine concepts

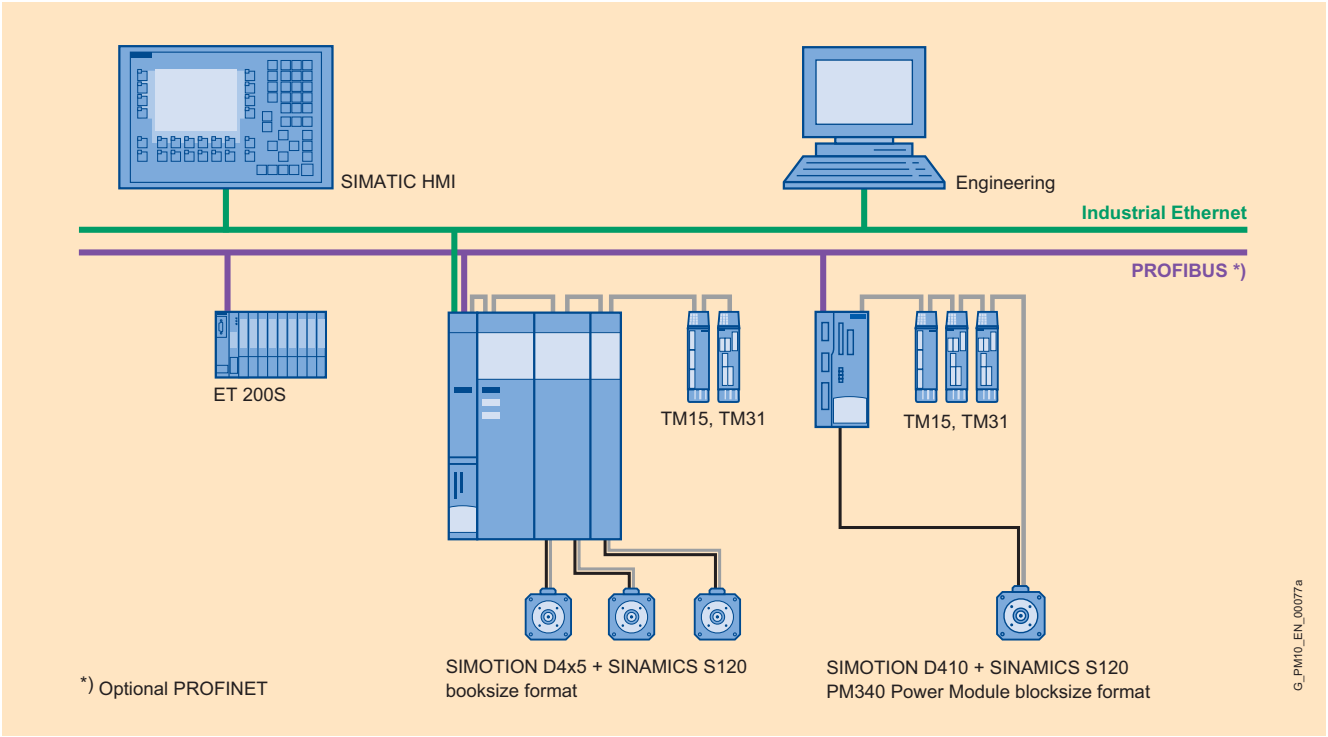
SIMOTION D optimally supports the implementation of modular machine concepts in which high-performance multi-axis and single-axis drives have to be combined: SIMOTION D4x5 undertakes open and closed-loop control of the multi-axis groups, SIMOTION D410 is the cost-effective solution for the compact design of single drive applications.

Important applications include:

- Packaging machines
- Plastic and rubber processing machines
- Presses, wire-drawing machines
- Textile machines
- Printing machines
- Wood, glass, ceramics and stone working machines
- Converting

Due to the increasing use of servo or vector drives, these machines require a high degree of integration of PLC, motion control and technology functions.

Design



Typical design of an automation solution using SIMOTION D

SIMOTION D components and interfaces

- Various status/error displays
- On-board digital inputs and outputs
- Option slot (D4x5 only) for operating
  - an interface for PROFINET IO
  - terminal expansion (additional I/Os)
- Integrated communications ports for linking:
  - SINAMICS S120 drive modules
  - Distributed I/Os
  - HMI systems
  - PG/PC
  - Other motion control and automation systems
  - Other SINAMICS S120 drives with digital setpoint interfaces
- Slot for CompactFlash Card for data backup

Construction of an axis line-up with SIMOTION D4x5

The following components make up a SIMOTION D4x5 axis system:

- A SIMOTION D4x5 Control Unit, designed for open and closed-loop control of a multiple axis line-up
- A SINAMICS S120 Line Module (infeed module)
- One or more SINAMICS S120 Motor Modules (power modules)
- Other drive components, such as
  - Power supply
  - Filter
  - Choke, etc.
- DRIVE-CLiQ provides the link between SIMOTION D4x5 and the SINAMICS S120 drive modules.

Note:
SINAMICS S120 PM340 Power Modules in blocksize format can also be operated on a SIMOTION D4x5 with the Control Unit Adapters CUA31/CUA32.

Construction of a single axis with SIMOTION D410

The following components make up a SIMOTION D410 single axis system:

- A SIMOTION D410 Control Unit, designed for open and closed-loop control of a single axis
- A SINAMICS S120 PM340 Power Module, blocksize format (combined infeed and power module)
- Other drive components, such as
  - Power supply
  - Filter
  - Choke, etc.
- The connection between SIMOTION D410 and the SINAMICS S120 PM340 Power Module is made with the integrated PM-IF interface or, with the CUA31/CUA32 Control Unit Adapter, over DRIVE-CLiQ.

Integration of I/O

SIMOTION D can be expanded with the following I/O:

- Distributed I/O systems (e.g. SIMATIC ET 200S)
- Drive-based control cabinet I/O (e.g. TM15, TM31 Terminal Modules, etc.)

Summary

Function

The SIMOTION D410 and D4x5 basic functionality is supplied with the CompactFlash Card (CF) and is loaded when the power is switched on. The basic functionality includes the following software components:

- SINAMICS S120 drive control
  - SIMOTION D4x5: Current/speed control for up to 6 servo axes, 4 vector axes or 8 V/f axes, closed-loop control for infeed (Active Line Module)
  - SIMOTION D410: Current/speed control for 1 servo axis, 1 vector axis or 1 V/f axis
- SIMOTION runtime system
  - User-programmable with several languages conforming to IEC 61131
  - Various runtime levels (cyclic, sequential, event-driven)
  - PLC and arithmetic functionality
  - Communications and management functions
  - Motion control functions (Motion Control Basic)
- Test and diagnostic tools

This basic functionality can be expanded with loadable technology packages, if required.

Position-controlled motion control for drives

- Integrated drives (D4x5, D410):
  The power modules are connected over DRIVE-CLiQ or over the integrated PM-IF interface (D410 only)
- Drives with digital setpoint interfaces (D4x5 only):
  SIMOTION D enables position-controlled motion control for drives with a digital setpoint interface via PROFIBUS DP/ PROFINET IO with PROFIdrive.
- Drives with analog setpoint interface (D4x5 only, e.g. for retrofit or hydraulic applications):
  The ADI 4 (Analog Drive Interface for 4 axes) or IM 174 (Interface Module for 4 axes) module can be used to connect drives with analog ± 10 V setpoint interfaces. The IM 174 also makes it possible to connect stepper drives with a pulse direction interface (e.g. SIMOSTEP motors with FM STEPDRIVE power unit). Both modules are connected over PROFIBUS DP. The following can be connected to one ADI 4 or IM 174 module:
  - 4 drives
  - 4 encoders
  - Digital inputs and outputs

Technology packages (TP)

A special feature of SIMOTION is that the basic functionality can be expanded by loading technology packages, such as:

- Motion control with the technology functions:
  - POS – Positioning
  - GEAR – Synchronous operation/electronic gear
  - CAM – Cam
  - PATH – Path interpolation
- TControl – Temperature controller

Since the technology functions have modular licenses, you only pay for what you will really use.

With SIMOTION D410, the motion control technology functions (POS/GEAR/CAM) are already included for exactly one real axis, therefore an additional license is not required for this purpose.

Function (continued)

Performance

- Hardware-supported floating-point arithmetic enables complex arithmetic functions to be used effectively.
- Very fast instruction execution times open up completely new application possibilities in the mid-performance to high-performance range.

Configuring/parameterizing/programming

SIMOTION SCOUT is a powerful and user-friendly engineering tool. It is an integrated system for all engineering steps, from configuring and parameterization, through programming, to testing and diagnostics. Graphical operator prompting, using dialog boxes and wizards, as well as text-based and graphical languages for programming, considerably reduce the familiarization and training periods.

Operator control and monitoring (HMI)

Communication services which support user-friendly data exchange with HMI devices are integrated in the basic functionality of SIMOTION D.

Operator control and monitoring can be implemented using SIMATIC HMI devices, such as TPs (Touch Panels), OPs (Operator Panels) or MPs (Multi Panels).

These devices can be connected to SIMOTION D over PROFIBUS, Industrial Ethernet (D4x5 only) or PROFINET and they are configured using ProTool/Pro or WinCC flexible.

With the SIMATIC NET communications software, an open, standardized OPC interface is available for accessing SIMOTION from other Windows-based HMI systems.

Process and data communication

Thanks to its integrated interfaces, SIMOTION D supports both process and data communication. The SCOUT engineering system is provided for user-friendly communication configuration and diagnosis.

Safety Integrated functions

The integrated safety functions of SINAMICS S120 allow SIMOTION D4x5 to provide highly-effective application-oriented protection for personnel and machinery. (Safety Integrated with SIMOTION D410: available soon)

For detailed information about Safety Integrated functions, see Part 11, "Safety Integrated".

More information

More information

- on suitable modules for SIMOTION D can be found under "SIMOTION I/O components".
- on the functionality of SIMOTION platforms can be found under "Overview of functions".
- on the SIMOTION runtime system can be found under "SIMOTION Runtime Software".
- on HMI can be found under "SIMOTION Human Machine Interface (HMI)".
- on SIMATIC NET communication software can be found under "Communication".
- on SINAMICS S120 Motor Modules, Power Modules can be found under "SINAMICS S120".
- on SINAMICS S120 performance features and control characteristics can be found under "System description – Dimensioning".

Overview

Left: SIMOTION D410 with mounting plate
On right: SIMOTION D410, snapped onto PM340 Power Module

SIMOTION D410 is the SIMOTION D platform for single-axis applications. It supplements the SIMOTION D4x5 controller family, which is the solution of choice for multi-axis applications. It is available in both PROFIBUS (D410 DP) and PROFINET (D410 PN) versions.

The SIMOTION D410 Control Unit is specially designed for use with the SINAMICS S120 PM340 Power Modules in blocksize format and can be directly connected to the Power Modules of this series. The SIMOTION D410 can also be installed on a separate mounting plate if required (to be ordered separately).

SIMOTION D410 and mounting plate

The SIMOTION D410 handles the motion control, technology and PLC functions associated with a single axis and is also responsible for the drive control of that axis. The integrated inputs/outputs support up to 4 high-speed cam outputs or 3 measuring inputs.

The drive control supports servo control (for a highly dynamic response), vector control (for maximum torque accuracy) and *V/f* control.

SIMOTION D410 can be used in synchronized groups:

- For PROFINET: over controller – controller or controller – device relationship
- For PROFIBUS: over master – slave relationship

Application

SIMOTION D410 is the ideal solution when PLC functionality and motion control for one axis are required in a compact format.

Examples of SIMOTION D410 applications include:

- Autonomous control of single axes
- Cross cutters
- Winder applications
- Feeder devices, roller infeed, press feeders
- Synchronized machining equipment

Apart from positioning functions, SIMOTION D410 also provides all the synchronizing and cam functions; the second axis required for synchronous operation and camming can be a virtual axis, a position encoder or the axis of another SIMOTION controller. SIMOTION D410 can be easily integrated into synchronized groups.

This is an advantage in modular machine concepts that make up

- a basic machine, e.g. SIMOTION D4x5 as the PROFINET IRT controller with leading axis function
- several machine modules connected over PROFINET based on the SIMOTION D410.

Design

Interfaces

Display and diagnostics

- LEDs to display operating states and errors
- 3 measuring sockets

Integrated I/Os

- 4 digital inputs
- 4 digital inputs/outputs (max. 4 as cam output or 3 measuring inputs)

Communication

- 1 x DRIVE-CLiQ
- 2 x PROFINET ports (D410 PN only)
- 1 x PROFIBUS DP (D410 DP only)

Data backup

- 1 slot for SIMOTION CompactFlash Card

Additional interfaces

- Terminals for 24 V electronic power supply
- 1 encoder input for
  - HTL/TTL incremental encoder
  - SSI absolute encoder
  (with/without TTL/HTL incremental signals)
- 1 temperature sensor input (KTY84-130 or PTC)
- PM IF interface (Power Module interface) on rear for direct operation with a SINAMICS S120 PM340 Power Module in blocksize format

Assembly/Installation

SIMOTION D410 can be directly plugged in to the SINAMICS S120 Power Module PM340 in blocksize format.

Alternatively, the SIMOTION D410 can be mounted on a separate mounting plate (to be ordered separately) and connected to the PM340 Power Module via DRIVE-CLiQ. In this case, the CUA31/CUA32 Control Unit Adapter has to be connected to the PM340 Power Module. No more than one Control Unit Adapter can be connected to a SIMOTION D410.

SIMOTION D410

Design (continued)

Power Modules in AC/AC chassis format are connected to the SIMOTION D410 over the DRIVE-CLiQ interface.

Data storage/data backup

The SIMOTION D410 has a 7 KB memory for remanent storage of process variables. The runtime software, user data and user programs are backed up on the SIMOTION CompactFlash Card. In the event that the SIMOTION D410 needs to be replaced, the process variables can also be backed up on the SIMOTION CompactFlash Card (CF) by means of system commands.

Connectable I/Os

PROFINET IO: (D410 PN only)

- SIMATIC ET 200S/M/pro distributed I/Os
- HMI

PROFIBUS DP: (D410 DP only)

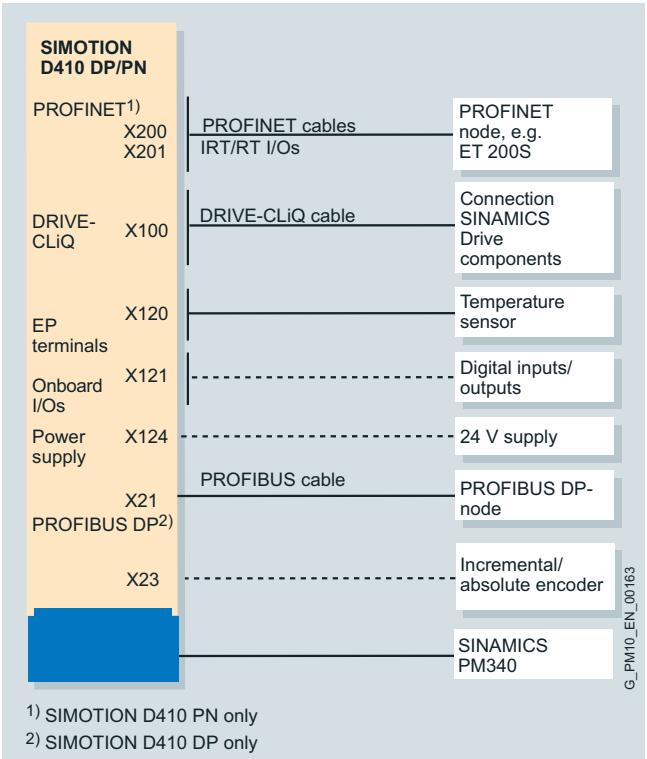
- Certified PROFIBUS standard slaves (DP-V0, DP-V1, DP-V2)
- SIMATIC ET 200S/M/eco/pro distributed I/O systems
- HMI

DRIVE-CLiQ:

Modules from the SINAMICS range:

- TM15, TM17 High Feature, TM31, etc. Terminal Modules (max. 3)
- SMC/SME Sensor Modules (max. 2)
- DMC20 DRIVE-CLiQ hub module (max. 1)
- Motors with DRIVE-CLiQ interface

Integration



1) SIMOTION D410 PN only
2) SIMOTION D410 DP only

Overview of SIMOTION D410 connections

The maximum permissible cable lengths should be taken into account when planning the cable layout. Functional faults can occur when using longer cables.
The permissible length of the PROFIBUS DP cables depends on the configuration.

Technical specifications

SIMOTION D410	
PLC and motion control performance	
Maximum number of axes	1 (real axis)
Minimum PROFIBUS cycle	2 ms (D410 DP)
Minimum PROFINET transmission cycle	0.5 ms (D410 PN)
Minimum servo/interpolator cycle clock	2.0 ms
Integrated drive control	
Max. number of axes for integrated drive control (servo / vector / *V/f*)	1 / 1 / 1
Memory	
RAM (Random Access Memory)	25 MB
RAM disk (load memory)	17 MB
Retentive memory	7 KB
Persistent memory (user data on CF)	300 MB
Communication	
DRIVE-CLiQ interfaces	1
PROFIBUS interfaces	1 (D410 DP only) • Equidistant and isochronous • Can be configured as master or slave
PROFINET interfaces	1 interface with 2 ports (D410 PN only) • Supports PROFINET IO with IRT and RT • Can be configured as PROFINET IO controller or device
General technical specifications	
Fan	Integrated
Supply voltage	
• Rated value	24 V DC
• Permissible range	20.4 ... 28.8 V
Current consumption, typ. (excluding digital outputs and DRIVE-CLiQ supply)	800 mA
Starting current, typ.	3.0 A
Power loss	20 W (0.03 HP)
Permissible ambient temperature	
• Storage and transport	-40 … +70 °C (-40 ... +158 °F)
• Operation	0 ... +55 °C; maximum installation altitude 2000 m (6562 ft) above sea level. Above an altitude of 2000 m (6562 ft), the max. ambient temperature decreases by 7 °C (44.6 °F) every 1000 m (3281 ft). Max. 5000 m (16405 ft) above sea level.
Permissible relative humidity (without condensation)	5 ... 95 %
Atmospheric pressure	700 … 1060 hPa
Degree of protection according to EN 60529 (IEC 60529)	IP20
Dimensions (W x H x D)	73 mm x 183.2 mm x 89.6 mm (2.87 in x 7.21 in x 3.53 in)
Weight	
• SIMOTION D	990 g (2.18 lb)
• CompactFlash Card	7 g (0.25 oz)

Technical specifications (continued)

SIMOTION D410	
Digital inputs	**4**
• Input voltage	
- Rated value	24 V DC
- For "1" signal	15 ... 30 V
- For "0" signal	-3 ... +5 V
• Galvanic isolation	Yes, in groups of 4
• Current consumption typ. at 1-signal level	10 mA at 24 V
• Input delay, typ. (hardware)	L → H: 50 µs H → L: 100 µs
Digital inputs/outputs (parameterizable)	**4 (max. 3 as high-speed measuring inputs, max. 4 as high-speed cam outputs)**
If used as an input	
• Input voltage	
- Rated value	24 V DC
- For "1" signal	15 ... 30 V
- For "0" signal	-3 ... +5 V
• Isolation	No
• Current consumption typ. at 1-signal level	10 mA at 24 V
• Input delay, typ. (hardware)	L → H: 50 µs (5 µs if used as measuring input) H → L: 100 µs (50 µs if used as measuring input)
• Measuring input, accuracy	5 µs
If used as an output	
• Rated load voltage	24 V DC
• Permissible range	20.4 ... 28.8 V
• Isolation	No
• Current load, max.	500 mA per output
• Residual current, max.	2 mA
• Output delay, max. (hardware)	L → H: 400 µs H → L: 100 µs
• Cam output, accuracy	200 µs
• Short-circuit protection	Yes
Onboard encoder interface	
• Encoder interface	• TTL or HTL incremental encoders (with adjustable parameters) • SSI absolute encoders with/without TTL/HTL incremental signals
• Encoder supply	24 V DC/0.35 A or 5 V DC/0.35 A
• Limit frequency, max.	500 kHz
• SSI baud rate	100 ... 250 kBaud
• Resolution absolute position SSI	30 bit
• Max. cable length	
- For TTL incremental encoder (only bipolar signals permitted)	100 m (328 ft)
- For HTL incremental encoder	
• For unipolar signals	100 m (328 ft)
• For bipolar signals	300 m (984 ft)
- For SSI absolute encoder	100 m (328 ft)

SIMOTION D410	
Additional technical specifications	
Input for temperature sensing	
• Temperature sensor	KTY84-130 or PTC
Non-volatile data backup	
• Backup time, min.	Unlimited (maintenance-free backup)
Approvals	cULus (File No. E164110)

Selection and ordering data

Description	Order no.
SIMOTION D410 DP (SIMOTION V4.1 SP1 or higher)	**6AU1410-0AA00-0AA0**
SIMOTION D410 PN (SIMOTION V4.1 SP1 or higher)	**6AU1410-0AB00-0AA0**
Backplane mounting plate For installing the SIMOTION D410 in a different location if you do not wish to connect it directly to the Power Module.	**6AU1400-7AA05-0AA0**
SIMOTION CompactFlash Card (CF) 512 MB With SIMOTION Kernel and up-to-date SINAMICS drive software	**6AU1400-2NA00-0AA0**

More information

For further information and ordering data for SINAMICS S120 drive components such as Power Modules, Terminal Modules, DRIVE-CLiQ cables, etc., see the section „SINAMICS S120“ or in the A&D Mall under „Drive Technology/AC converters/...“.

Licensing notes

SIMOTION D410 is the SIMOTION D version for single-axis applications and already contains the motion control technology functions for one real axis (speed, positioning, synchronous axis or cam). A license is therefore not needed for this purpose. It is not possible to increase the number of axes using licenses. Apart from one real axis, further virtual axes can be configured.

Licensed runtime functions such as SIMOTION IT DIAG require licenses which can be ordered pre-installed on a CompactFlash Card (CF) or individually. For further information, refer to the section „Runtime software licensing“ on page 8/41.

SIZER configuration tool

With the SIZER configuration tool, you can easily configure the SINAMICS S120 drive family including SIMOTION. It provides you with support for selecting and dimensioning the components required for a motion control task. You can also determine the possible number of axes and the resulting load with SIZER in accordance with your performance requirements.

For further information about SIZER, refer to the section „System description – Dimensioning: SIZER configuration tool“.

SIMOTION D425/D435/D445

Overview

SIMOTION D4x5 is the drive-based Control Unit for multi-axis systems. The individual versions SIMOTION D425 (BASIC Performance), SIMOTION D435 (STANDARD performance) and SIMOTION D445 (HIGH Performance) differ in their PLC performance and motion control performance. The main distinguishing features are:

	SIMOTION D425 (BASIC Performance)	SIMOTION D435 (STANDARD Performance)	SIMOTION D445 (HIGH Performance)
Maximum number of axes	16	32	64
Minimum servo/interpolator cycle clock	2.0 ms	1.0 ms	0.5 ms
DRIVE-CLiQ interfaces	4	4	6

SIMOTION D4x5 features PLC and motion control performance (open-loop control and motion control) for up to 16, 32 or 64 axes, as required. The computing functions integrated into the drive allow the D4x5 Control Unit to operate up to 6 servo, 4 vector or 8 V/f axes.

The drive control supports servo control (for a highly dynamic response), vector control (for maximum torque accuracy) and V/f control.

Extension of the drive computing performance

The motion control performance of a SIMOTION D4x5 can be utilized in full by expanding the computing performance at the drive in two different ways:

- Over PROFIBUS or PROFINET, SINAMICS S120 CU320/CU310 Control Units complete with further SINAMICS S120 drive modules can be connected.
- With SIMOTION D435 and D445, the CX32 Controller Extension can be connected over DRIVE-CLiQ. This module is extremely compact and can control up to 6 servo, 4 vector or 8 *V/f* axes.

Application

SIMOTION D4x5 is ideally suited for applications with many coordinated axes with high clock-pulse rates. With SIMOTION D425, D435 and D445, three performance variants are available which offer maximum scalability and flexibility.

Typical applications include:

- Compact multiple-axis machines
- High-performance applications with short machine cycles
- Compact machines
  - Including the complete machine control in the drive
  - With extensive connection possibilities for communication, HMI and I/O
- Distributed drive concepts
  - Applications with many axes
  - Synchronization of several SIMOTION D Control Units using distributed synchronous operation

Design

Interfaces

Display and diagnostics

- LEDs to display operating states and errors
- 3 measuring sockets

Integrated I/Os

- 8 digital inputs
- 8 digital inputs/outputs (max. 8 as high-speed cam outputs, max. 6 as high-speed measuring inputs)

Communication

- 4 x DRIVE-CLiQ (6 x DRIVE-CLiQ for D445)
- 2 x Industrial Ethernet
- 2 x PROFIBUS DP

Option Boards

- CBE30 Communication Board for the connection to PROFINET IO
- TB30 Terminal Board for the expansion with 4 digital inputs, 4 digital outputs, 2 analog inputs and 2 analog outputs

Data backup

- 1 slot for SIMOTION CompactFlash Card

Additional interfaces

- Terminals for 24 V electronic power supply

Assembly/Installation

SIMOTION D4x5 can be mounted in the control cabinet in one of three ways:

- Hooking it in to the Line Module on the left-hand side
- Screwing it on to the rear wall of the control cabinet directly, if it is required/desired that SIMOTION D is separate from the Line Module
- Using spacers if it is not possible to mount SIMOTION D on to the side of the Line Module (e.g. if no Line Module is installed) so the difference between the mounting depth of SIMOTION D4x5 and the Motor Modules will be compensated for.

  SIMOTION D4x5 comes with pre-installed spacers. With SIMOTION D425 and D435, this can be removed if necessary.

Design (continued)

Data storage/data backup

SIMOTION D425, D435 and D445 modules have 320 KB of non-volatile and battery-backed SRAM for retentive process variables. This backup is stored for at least 5 days. There are two options for storing retentive data for a longer period:

- System commands for storing retentive data on the CompactFlash Card (CF) of the SIMOTION D4x5
- Use of a battery module (combined battery/fan module already included in the scope of delivery of a SIMOTION D445, optional for SIMOTION D425/D435)

The runtime software, user data and user programs are saved retentively using a CompactFlash Card (CF).

Connectable I/Os

PROFINET IO: (optionally via CBE30)

- SIMATIC ET 200S/M/pro distributed I/Os
- Distributed drives with the CU320 Control Unit via CBE20 as well as the SINAMICS S120 PM340 Power Modules with the CU310 PN

PROFIBUS DP:

- Certified PROFIBUS standard slaves (DP-V0, DP-V1, DP-V2)
- SIMATIC ET 200S/M/eco/pro distributed I/O systems
- Distributed drives with the CU320 Control Unit as well as SINAMICS S120 PM340 Power Modules with the CU310 DP

DRIVE-CLiQ:

Modules from the SINAMICS range:

- TM15, TM17 High Feature, TM31, etc. Terminal Modules
- SMC/SME Sensor Modules
- DMC20 DRIVE-CLiQ Hub Module

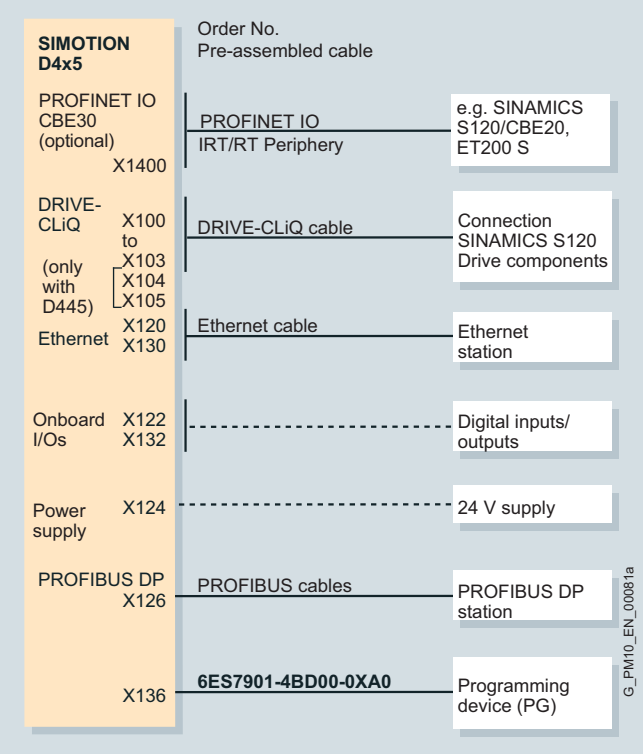
Expansion with SINAMICS S120 drive modules

SINAMICS S120 drive modules (Line Modules, Motor Modules, etc.) are connected to SIMOTION D4x5 over DRIVE-CLiQ.

SINAMICS S120 PM340 Power Modules (blocksize format) can also be operated on a SIMOTION D4x5 with the Control Unit Adapters CUA31/CUA32.

Note:
DRIVE-CLiQ cables, which are required to connect line/motor modules to SIMOTION D, are supplied in a standard length with the line/motor modules.

Integration



Overview of SIMOTION D425/D435/D445 connections

The maximum permissible cable lengths should be taken into account when planning the cable layout.

Functional faults can occur when using longer cables.

The permissible length of the PROFIBUS DP cables depends on the configuration.

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SIMOTION D425/D435/D445

Technical specifications

	SIMOTION D425 BASIC Performance	SIMOTION D435 STANDARD Performance	SIMOTION D445 HIGH Performance
PLC and Motion Control performance			
Maximum number of axes	16	32	64
Minimum PROFIBUS cycle	2 ms	1 ms	1 ms
Minimum PROFINET transmission cycle	0.5 ms	0.5 ms	0.5 ms
Minimum servo/interpolator cycle clock	2.0 ms	1.0 ms	0.5 ms
Integrated drive control			
Max. number of axes for integrated drive control (servo / vector / *V/f*)	6 / 4 / 8	6 / 4 / 8	6 / 4 / 8
Memory			
RAM (Random Access Memory)	25 MB	25 MB	50 MB
RAM disk (load memory)	17 MB	17 MB	23 MB
Retentive memory	320 KB	320 KB	320 KB
Persistent memory (user data on CF)	300 MB	300 MB	300 MB
Communication			
DRIVE-CLiQ interfaces	4	4	6
Ethernet interfaces	2	2	2
PROFIBUS interfaces	2	2	2
PROFINET interfaces	Optionally over CBE30: • 1 interface with 4 ports • Supports PROFINET IO with IRT and RT • Can be configured as PROFINET IO controller and/or device	Optionally over CBE30: • 1 interface with 4 ports • Supports PROFINET IO with IRT and RT • Can be configured as PROFINET IO controller and/or device	Optionally over CBE30: • 1 interface with 4 ports • Supports PROFINET IO with IRT and RT • Can be configured as PROFINET IO controller and/or device
General technical specifications			
Fan	Optional battery/fan module	Optional battery/fan module	Battery/fan module included in scope of supply
Supply voltage			
• Rated value	24 V DC	24 V DC	24 V DC
• Permissible range	20.4 ... 28.8 V	20.4 ... 28.8 V	20.4 ... 28.8 V
Current consumption, typ. (excluding digital outputs and DRIVE-CLiQ supply)	600 mA	600 mA	2 A
Starting current, typ.	6.0 A	6.0 A	6.0 A
Power loss	15 W	15 W	48 W
Permissible ambient temperature			
• Storage and transport	-40 ... +70 °C (-40 ... +158 °F)	-40 ... +70 °C (-40 ... +158 °F)	-40 ... +70 °C (-40 ... +158 °F)
• Operation	0 ... +55 °C (+32 ... +131 °F) Maximum installation altitude 2000 m (6562 ft) above sea level. Above an altitude of 2000 m (6562 ft), the max. ambient temperature decreases by 7 °C (44.6 °F) every 1000 m (3281 ft); maximum 5000 m (16405 ft) above sea level.	0 ... +55 °C (+32 ... +131 °F) Maximum installation altitude 2000 m (6562 ft) above sea level. Above an altitude of 2000 m (6562 ft), the max. ambient temperature decreases by 7 °C (44.6 °F) every 1000 m (3281 ft); maximum 5000 m (16405 ft) above sea level.	0 ... +55 °C (+32 ... +131 °F) Maximum installation altitude 2000 m (6562 ft) above sea level. Above an altitude of 2000 m (6562 ft), the max. ambient temperature decreases by 7 °C (44.6 °F) every 1000 m (3281 ft); maximum 5000 m (16405 ft) above sea level.
Permissible relative humidity (without condensation)	5 ... 95 %	5 ... 95 %	5 ... 95 %
Atmospheric pressure	700 ... 1060 hPa	700 ... 1060 hPa	700 ... 1060 hPa
Degree of protection according to EN 60529 (IEC 60529)	IP20	IP20	IP20
Dimensions (W x H x D)	50 mm x 380 mm x 230 mm (1.97 in x 14.96 in x 9.06 in)	50 mm x 380 mm x 230 mm (1.97 in x 14.96 in x 9.06 in)	50 mm x 380 mm x 270 mm (1.97 in x 14.96 in x 9.06 in)
Weight			
• SIMOTION D	2500 g (5.51 lb)	2500 g (5.51 lb)	3600 g (7.94 lb)
• CompactFlash card	7 g (0.25 oz)	7 g (0.25 oz)	7 g (0.25 oz)

Technical specifications (continued)

	SIMOTION D425 BASIC Performance	SIMOTION D435 STANDARD Performance	SIMOTION D445 HIGH Performance
Digital inputs	**8**	**8**	**8**
• Input voltage			
- Rated value	24 V DC	24 V DC	24 V DC
- For "1" signal	15 ... 30 V	15 ... 30 V	15 ... 30 V
- For "0" signal	-3 ... +5 V	-3 ... +5 V	-3 ... +5 V
• Galvanic isolation	Yes, in groups of 4	Yes, in groups of 4	Yes, in groups of 4
• Current consumption typ. at 1 signal level	10 mA at 24 V	10 mA at 24 V	10 mA at 24 V
• Input delay, typ. (hardware)	L → H: 50 µs H → L: 100 µs	L → H: 50 µs H → L: 100 µs	L → H: 50 µs H → L: 100 µs
Digital inputs/outputs (parameterizable)	**8 (max. 6 as high-speed measuring inputs, max. 8 as high-speed cam outputs)**	**8 (max. 6 as high-speed measuring inputs, max. 8 as high-speed cam outputs)**	**8 (max. 6 as high-speed measuring inputs, max. 8 as high-speed cam outputs)**
If used as an input			
• Input voltage			
- Rated value	24 V DC	24 V DC	24 V DC
- For "1" signal	15 ... 30 V	15 ... 30 V	15 ... 30 V
- For "0" signal	-3 ... +5 V	-3 ... +5 V	-3 ... +5 V
• Galvanic isolation	No	No	No
• Current consumption typ. at 1 signal level	10 mA at 24 V	10 mA at 24 V	10 mA at 24 V
• Input delay, typ. (hardware)	L → H: 50 µs (5 µs if used as measuring input) H → L: 100 µs (50 µs if used as measuring input)	L → H: 50 µs (5 µs if used as measuring input) H → L: 100 µs (50 µs if used as measuring input)	L → H: 50 µs (5 µs if used as measuring input) H → L: 100 µs (50 µs if used as measuring input)
• Measuring input, accuracy	5 µs	5 µs	5 µs
If used as an output			
• Rated load voltage	24 V DC	24 V DC	24 V DC
- Permissible range	20.4 ... 28.8 V	20.4 ... 28.8 V	20.4 ... 28.8 V
• Galvanic isolation	No	No	No
• Current load, max.	500 mA per output	500 mA per output	500 mA per output
• Residual current, max.	2 mA	2 mA	2 mA
• Output delay, max. (hardware)	L → H: 400 µs H → L: 100 µs	L → H: 400 µs H → L: 100 µs	L → H: 400 µs H → L: 100 µs
• Cam output, accuracy	125 µs	125 µs	125 µs
• Switching frequency of the outputs, max.			
- With resistive load	100 Hz	100 Hz	100 Hz
- With inductive load	2 Hz	2 Hz	2 Hz
- With lamp load	11 Hz	11 Hz	11 Hz
• Short-circuit protection	Yes	Yes	Yes
Additional technical specifications			
Non-volatile data backup			
• Backup time, min.	5 days (real-time clock/SRAM backup)	5 days (real-time clock/SRAM backup)	5 days (real-time clock/SRAM backup)
• Charging time, typ.	A few minutes	A few minutes	A few minutes
Approvals	cULus (File No. E164110)	cULus (File No. E164110)	cULus (File No. E164110)

SIMOTION D425/D435/D445

Selection and ordering data

Description	Order No.
SIMOTION D425	**6AU1425-0AA00-0AA0**
SIMOTION D435	**6AU1435-0AA00-0AA1**
SIMOTION D445	**6AU1445-0AA00-0AA0**
CompactFlash Card (CF) 512 MB with SINAMICS S120 drive software and SIMOTION Kernel Pre-installed license using Z options [1]	**6AU1400-2NA00-0AA0**
SIMOTION MultiAxes Bundle D425 consisting of 1 unit each • SIMOTION D425 • CompactFlash Card 512 MB with MultiAxes Package license for D425 platform	**6AU1425-0AA00-0CA0**
SIMOTION MultiAxes Bundle D435 consisting of 1 unit each • SIMOTION D435 • CompactFlash Card 512 MB with MultiAxes Package license for D435 platform	**6AU1435-0AA00-0CA1**
SIMOTION MultiAxes Bundle D445 consisting of 1 unit each • SIMOTION D445 • CompactFlash Card 512 MB with MultiAxes Package license for D445 platform	**6AU1445-0AA00-0CA0**
Battery and fan module Incl. battery Battery and fan module for D425/D435 (option). Included in the scope of supply of D445.	**6FC5348-0AA01-0AA0**

Accessories

Description	Order No.
Battery (replacement part)	**6FC5247-0AA18-0AA0**
PROFIBUS RS485 bus connector with angular cable outlet (35°) With screw-type terminals, max. transmission rate 12 Mbit/s	
• Without PG interface	**6ES7972-0BA41-0XA0**
• With PG interface	**6ES7972-0BB41-0XA0**
PROFIBUS Fast Connect RS485 bus connector with angular cable outlet (35°) With insulation displacement terminals, max. transmission rate 12 Mbit/s	
• Without PG interface	**6ES7972-0BA60-0XA0**
• With PG interface	**6ES7972-0BB60-0XA0**

More information

More information

- on PROFIBUS DP/MPI cables and MOTION-CONNECT can be found under "Connection system MOTION CONNECT".
- on PROFIBUS DP, Industrial Ethernet and PROFINET can be found in Catalog IK PI or in the A&D Mall under "Communication/Networks/SIMATIC NET communication systems" as well as in the chapter "Communication".
- about ordering other SINAMICS drive components such as Line Modules, Motor Modules, DRIVE-CLiQ cables, etc., see the chapter "SINAMICS S120" or in the A&D Mall under "Drive Technology/AC converters/...".

SIZER configuration tool

With the SIZER configuration tool, you can easily configure the SINAMICS S120 drive family including SIMOTION. It provides you with support for selecting and dimensioning the components required for a motion control task. You can also determine the possible number of axes and the resulting load with SIZER in accordance with your performance requirements.

For further information about SIZER, refer to the section "System description – Dimensioning: SIZER configuration tool".

[1] Notes regarding runtime software
Licenses for runtime software can be ordered either pre-installed on a CompactFlash Card (CF) or separately. For further information, refer to the section "Runtime software licensing" on page 8/41 and the following.

Overview

The CBE30 Communication Board for SIMOTION D425, D435 and D445 allows the SIMOTION to be connected to a PROFINET IO network. The SIMOTION D4x5 then assumes the function of a PROFINET IO Controller and can perform the following:

- PROFINET IO Controller, I-Device (controller and device simultaneously)
- 100 Mbit/s full duplex
- Supports real-time classes of PROFINET IO:
  - RT (Real Time)
  - IRT (Isochronous Real Time)
- Integration of distributed I/O as PROFINET IO devices
- Integration of drives as PROFINET IO devices through PROFIdrive according to the V4 specification
- Support for standard Ethernet communication, e.g.
  - for interfacing with SIMOTION SCOUT
  - for the connection of HMI systems
  - for communication with any other devices over TCP/IP or UDP communication
- Integrated 4-port switch with four RJ45 sockets based on the PROFINET ASIC ERTEC400. The optimum topology (line, star, tree) can therefore be configured without additional external switches.

Integration

The CBE30 Communication Board is plugged into the option slot on the SIMOTION D4x5.

Technical specifications

CBE30 Communication Board	
Current requirement at 24 V DC	0.25 A
Permissible ambient temperature	
• Storage and transport	-40 … +70 °C (-40 ... +158 °F)
• Operation	0 … 55 °C (32 ... 131 °F)
Weight, approx.	100 g (0.22 lb)
Dimensions	113 mm x 77 mm (4.45 in x 3.03 in)
Approvals	cULus (File No. E164110)

Selection and ordering data

Description	Order No.
CBE30 Communication Board	**6FC5312-0FA00-0AA0**

Accessories

The following PROFINET cables and connectors are recommended:

Description	Order No.
RJ45 FastConnect connector for Industrial Ethernet/PROFINET	
• 145° cable outlet	
- 1 pack = 1 unit	**6GK1901-1BB30-0AA0**
- 1 pack = 10 units	**6GK1901-1BB30-0AB0**
• 180° cable outlet	
- 1 pack = 1 unit	**6GK1901-1BB10-2AA0**
- 1 pack = 10 units	**6GK1901-1BB10-2AB0**
FastConnect cables for Industrial Ethernet/PROFINET [1]	
• IE FC Standard Cable GP 2x2	**6XV1840-2AH10**
• IE FC Flexible Cable GP 2x2	**6XV1870-2B**
• IE FC Trailing Cable GP 2x2	**6XV1870-2D**
• IE FC Trailing Cable 2x2	**6XV1840-3AH10**
• IE FC Marine Cable 2x2	**6XV1840-4AH10**
Stripping tool for Industrial Ethernet/PROFINET FastConnect cables	
• IE FC stripping tool	**6GK1901-1GA00**

More information

For further information about FastConnect cables, see Catalog IK PI (Industrial Communication for Automation and Drives) or the A&D Mall under "Communication / Networks / SIMATIC NET communication systems / PROFINET / Passive network components".

[1] Sold by the meter; max. length 1000 m (3281 ft); minimum order 20 m (65.62 ft).

Supplementary components SIMOTION CX32

Overview

The SIMOTION CX32 Controller Extension is a component in SINAMICS S120 booksize format and supports scaling of the drive-end computing performance of the SIMOTION D435 and D445 Control Units. Each CX32 can control up to 6 additional servo, 4 vector or 8 V/f axes.

If required, several CX32 components can be operated on a SIMOTION D435/D445 to increase the number of axes:

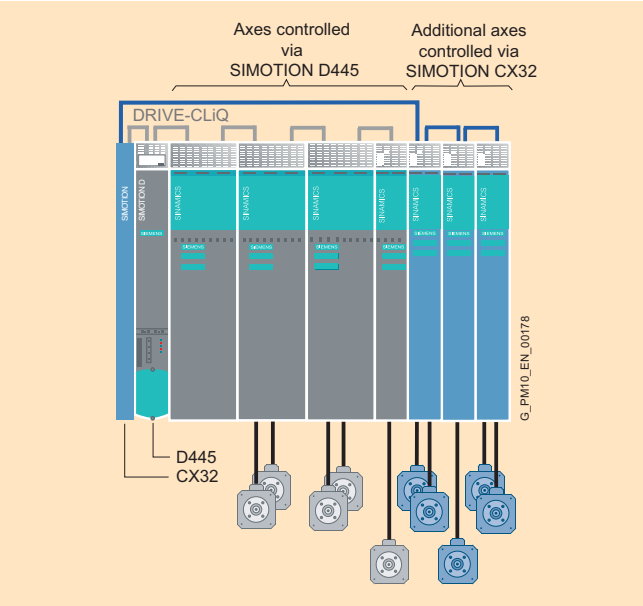
- max. 2 CX32 on one SIMOTION D435
- max. 4 CX32 on one SIMOTION D445

The CX32 Controller Extension and SIMOTION D435/D445 can be used to implement automation solutions with a large number of axes.

Benefits

- With a width of 25 mm (0.98 in), the CX32 requires very little space and is therefore perfectly suited for use in compact machines.
- The CX32 is connected to SIMOTION D435/D445 over DRIVE-CLiQ, so high-performance, isochronous closed-loop control of the drives is possible without the need for additional modules. The communication interfaces on the SIMOTION D435/D445 remain available for other connections.
- The data for the CX32 is stored exclusively on the SIMOTION D435/D445, which means no action has to be taken when the module is replaced.

Design



Example: Group of 10 axes with SIMOTION D445 and CX32

SIMOTION D435/D445 features PLC and motion control functions for up to 32/64 axes and the drive control functions for 6 servo, 4 vector or 8 *V/f* axes are already integrated.

The CX32 Controller Extension is connected to SIMOTION D435/D445 over DRIVE-CLiQ and extends the computing performance of the drive by an additional 6 servo, 4 vector or 8 *V/f* axes.

With SIMOTION D435/D445 and CX32, an axis line-up comprising of 10 axes can be achieved.

Alternatively, additional drive controls can be implemented over PROFIBUS or PROFINET using the SINAMICS CU320/CU310 Control Units.

Technical specifications

SIMOTION CX32	
Integrated drive control	
Max. number of axes for integrated drive control (servo / vector / *V/f*)	6 / 4 / 8
Communication	
DRIVE-CLiQ interfaces	4
General technical specifications	
Supply voltage	
• Rated value	24 V DC
• Permissible range	20.4 ... 28.8 V
Current consumption, typ. (excluding digital outputs and DRIVE-CLiQ supply)	800 mA
Starting current, typ.	1.6 A
Power loss	20 W
Permissible ambient temperature	
• Storage and transport	-40 ... +70 °C (-40 ... +158 °F)
• Operation	0 ... +55 °C (+32 ... +131 °F) Maximum installation altitude 2000 m (6562 ft) above sea level. Above an altitude of 2000 m (6562 ft), the max. ambient temperature decreases by 7 °C (44.6 °F) every 1000 m (3281 ft); maximum 5000 m (16405 ft) above sea level.
Permissible relative humidity (without condensation)	5 ... 95 %
Atmospheric pressure	700 ... 1060 hPa
Degree of protection according to EN 60529 (IEC 60529)	IP20
Dimensions (WxHxD)	25 mm x 380 mm x 230 mm (0.98 in x 14.96 in x 9.06 in)
Weight	1500 g (3.31 lb)

SIMOTION CX32	
Digital inputs	**4**
• Input voltage	
- Rated value	24 V DC
- For "1" signal	15 ... 30 V
- For "0" signal	-3 ... +5 V
• Galvanic isolation	Yes, in groups of 4
• Current consumption typ. at 1 signal level	10 mA at 24 V
• Input delay, typ. (hardware)	L → H: 50 µs H → L: 100 µs
Digital inputs/outputs (parameterizable)	**4 (max. 3 as high-speed measuring inputs)**
If used as an input	
• Input voltage	
- Rated value	24 V DC
- For "1" signal	15 ... 30 V
- For "0" signal	-3 ... +5 V
• Galvanic isolation	No
• Current consumption typ. at 1 signal level	10 mA at 24 V
• Input delay, typ. (hardware)	L → H: approx. 50 µs (5 µs if used as measuring input) H → L: approx. 100 µs (50 µs if used as measuring input)
• Measuring input, accuracy	5 µs
If used as an output	
• Rated load voltage	24 V DC
- Permissible range	20.4 ... 28.8 V
• Galvanic isolation	No
• Current load, max.	500 mA per output
• Residual current, max.	2 mA
• Output delay, max. (hardware)	L → H: 400 µs H → L: 100 µs
• Short-circuit protection	Yes
Additional technical specifications	
Approval	cULus (File No. E164110)

The CX32 comes with pre-installed spacer.

Selection and ordering data

Description	Order No.
SIMOTION CX32 controller extension	**6SL3040-0NA00-0AA0**

Summary

Overview

SIMOTION – The scalable system platform for Motion Control applications

The SIMOTION system has created a scalable system platform for automation tasks, particularly Motion Control applications.

The scalability of the system allows you to implement tailor-made and economic applications.

The modular SIMOTION software is perfectly integrated and offers easy-to-use functions for all phases of the automation process.

SIMOTION – Software for runtime, engineering and commissioning

The software for SIMOTION is divided into the following categories:

Runtime software

- SIMOTION Kernel – Basic functionality
  The SIMOTION Kernel provides the basic functionality and is a component of all SIMOTION devices.
- SIMOTION technology packages
  The SIMOTION technology packages support modular expansion of the functionality.
- SIMOTION IT – Service and diagnostic functions
  Supports simple diagnostics, service or HMI applications without SIMOTION SCOUT.

Engineering software

- SIMOTION SCOUT engineering software (with integrated STARTER commissioning tool)
- Optional CamTool package (cam editor)
- Optional Drive Control Chart (DCC) package

The SCOUT engineering system provides high-performance tools that provide simple, optimal support for all engineering steps required in the context of machine automation.

The SIMOTION CamTool is available as an optional package which permits simple creation of cams.

The optional Drive Control Chart package is available for easy graphical configuration of technology functions using predefined function blocks (Drive Control Blocks DCB).

The SCOUT engineering system can be used in SIMATIC STEP 7 – either with integrated data management and configuration – or as a stand-alone engineering tool.

Supplementary software

In addition to the SIMOTION software, other standard software products are available, for example, for easy programming of HMIs on Operator, Touch or Multi Panels.

SIMATIC HMI software

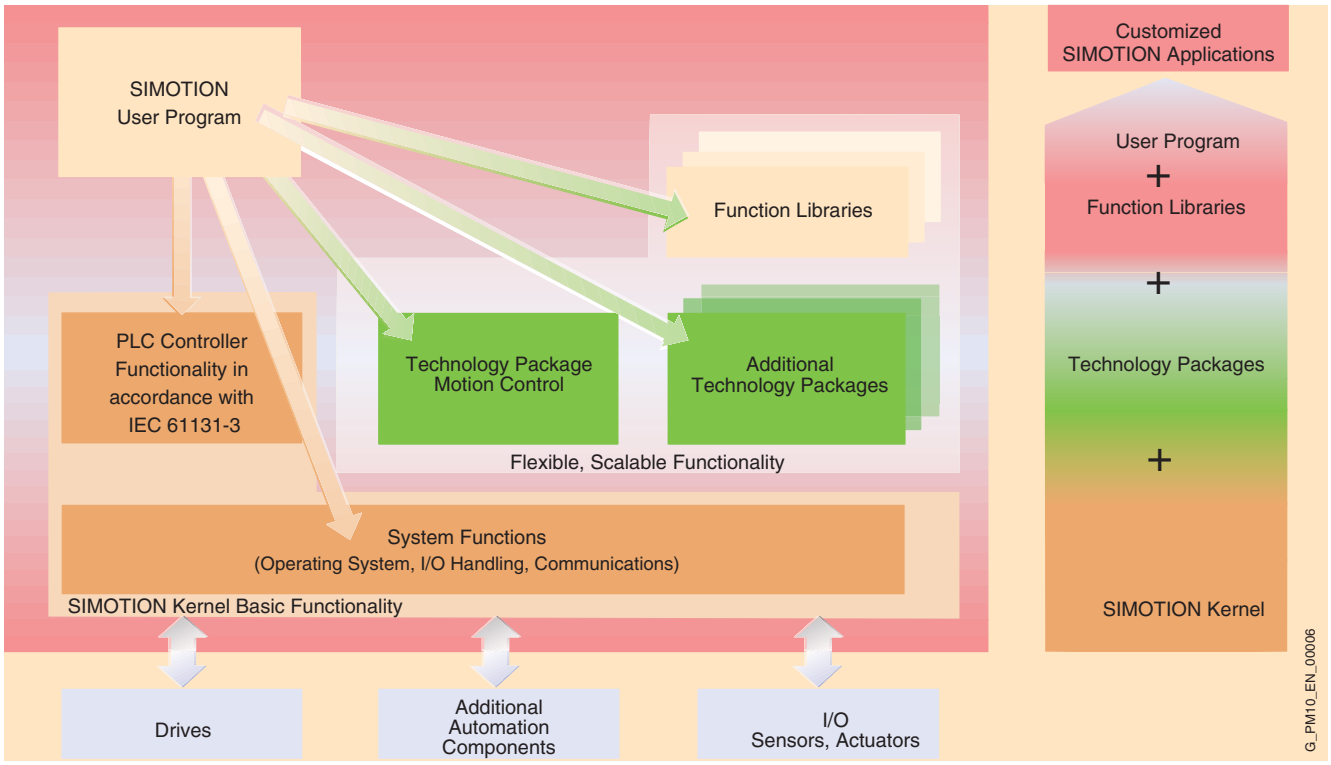
Optional software packages are:

- ProTool/Pro and WinCC flexible for user-friendly configuration of HMIs on Operator, Touch and Multi Panels
- SIMATIC NET for implementing HMI over OPC in Windows environments.

Further optional SIMATIC software

- SIMATIC Logon for user administration in projects with specific support for validation processes, for example, in the pharmaceutical industry.
- SIMATIC Version Trail for the easy versioning of projects (SIMATIC Logon is required).

Overview



SIMOTION software structure

SIMOTION Kernel – Basic functionality

The basic functionalities of the SIMOTION devices are combined within the SIMOTION Kernel.

The SIMOTION Kernel provides, among other features, high-performance functions for

- PLC functionality (to IEC 61131-3)
- Program control
- Timers, counters
- I/O operation
- Communication

It also provides a powerful runtime system with

- Cyclical (synchronized and cyclic) tasks
- Sequential tasks
- Time-driven tasks
- Event-driven tasks

The scope of the language conforms to the IEC 61131-3 standard and contains all PLC commands required for I/O management, process and machine control. LAD (Ladder Diagram), FBD (Function Block Diagram), ST (Structured Text), MCC (Motion Control Chart) and Drive Control Chart (DCC) are used for programming.

The SIMOTION Kernel basic functionality can be expanded by loading SIMOTION technology packages.

SIMOTION technology packages

Technology packages combine software functions which are required for automation in various sectors. They are loaded into the controller during configuration and expand the basic functionality through additional system functions. The functions of the technology packages can be accessed in the SCOUT command library during engineering.

SIMOTION Motion Control technology package

The comprehensive motion control functions offer very open and flexible ways of influencing application programming and ensure that future motion control applications can be implemented.

The SIMOTION Motion Control technology package contains the following functions:

- Motion Control Basic
- Positioning – POS
- Synchronous operation/electronic gear – GEAR
- Cam – CAM
- Path interpolation – PATH
- Supplementary technology functions

The technology package functions are accessed via additional language commands and system variables, as well as with function blocks in accordance with PLCopen. Programming of motion sequences is therefore simple and integrated.

SIMOTION temperature control technology package – (TControl)

The SIMOTION technology package for temperature control provides temperature channels with extensive functions. These functions are also accessed via additional language commands and system variables.

SIMOTION technology package for Drive Control Chart (DCC)

The SIMOTION technology package for Drive Control Chart (DCC) provides a library of "Drive Control Blocks" (DCBs). These blocks can be used to graphically configure open and closed-loop control functions using an optional DCC editor that can be integrated into SCOUT.

Summary

Overview (continued)

SIMOTION function libraries for I/O interfacing

These function libraries contain standard functions for integrating intelligent I/O and communication modules. They are a component part of the SCOUT command library and make it extremely easy to integrate modules such as FM 350-1/-2, FM 352, CP 340/341, SIWAREX FTA or identification systems into the SIMOTION user program. Programming examples are also available on the Utilities & Applications CD. This CD is supplied free of charge in the SCOUT package.

SIMOTION user program

In the SIMOTION user program, the functions of the technology packages, function libraries and system functions of the SIMOTION Kernel are accessed in a uniform manner by means of language commands.

The structure of the SIMOTION application program therefore supports merging of PLC functions with motion control functions and technology functions. This simplifies the optimization of motional sequences (no PLC/Motion interface), reducing engineering costs and increases both product quality and machine productivity (machine cycle and output) by eliminating interfaces and dead times.

A SIMOTION application can be programmed in different ways:

- The graphical programming languages LAD (Ladder Diagram), FBD (Function Block Diagram) and MCC (Motion Control Chart) make graphical programming particularly user-friendly.
- Programming can also be performed textually, using Structured Text (ST).
- Using the optional technology package for Drive Control Chart (DCC), drive-based open and closed-loop control functions can be easily configured graphically.

Direct access to the drive allows:

- Increased uniformity and integration depth as far as the drive (access to control/status words and drive data, flexible torque limits, additive torque setpoint)
- Highly-dynamic applications with servo drives thanks to DSC (Dynamic Servo Control) allows position control cycles of 125 µs
- Highly dynamic applications with hydraulic drives with position control cycles and pressure/force control cycles of 250 µs
- Synchronization with drives and modular open-loop controls

Apart from electrical drives, hydraulic drives within a controller or distributed over several controllers can be synchronized with each other. This supports the implementation of integrated automation solutions such as conveyor systems and press lines in the automotive industry, in which both electrical drives (winders, cross cutters, roller feeds) and hydraulic drives (e.g. deep-drawing presses) are implemented in the same system.

SIMOTION isochronous mode

In the SIMOTION system, all the components (one or more control units, drives, isochronous I/Os) are synchronized to the communication cycle of the machine, the PROFIBUS DP/PROFINET cycle. The application is also synchronized with this cycle through synchronous application tasks (in the servo and interpolator cycle). Isochronous mode therefore permeates the whole machine application (also in the case of distributed systems) and this provides considerable advantages:

- Short response times from terminal to terminal and terminal to axis
- High machine cycle times
- Programming of synchronous closed-loop control tasks
- High product quality thanks to a deterministic and reproducible machine response

Modular concepts – Modular machines

SIMOTION supports modular machine concepts and thus reduces engineering and commissioning costs through:

- modular software development with libraries and reusable modules,
- Real-time synchronization as well as integrated data storage is now possible without any problems
- Division into individual machine modules, which are linked, for example, through distributed synchronous operation (over PROFIBUS DP or PROFINET IO with IRT). Based on a maximum project, the project can be reconfigured, for example, using HMI.
- Activation/deactivation of DP slaves/PROFINET IO devices (I/O components) and technology objects (drives, axes, external encoders, and cams) during engineering and at runtime.

The modular machine concept means that scalable solutions and large axis line-ups can be achieved. Standardized modules can be easily adapted to special requirements and separately tested. These modules are then easily combined to form individual machine variants.

SIMOTION communication functions

Communication via PROFIBUS

The communication functions are available via PROFIBUS on all platforms:

- I/O communication between SIMOTION and/or SIMATIC controllers
- Communication with programming devices (programming device functions)
- Communication with ProTool/Pro and WinCC flexible
- Communication with PCs on which SIMATIC NET OPC is installed.
  A prerequisite on the PC side is the SIMATIC NET SOFTNET S7 software.

Communication using Ethernet/PROFINET

The communication functions below are available via Ethernet on all platforms:

- I/O communication between SIMOTION and/or SIMATIC controllers
- Communication with SIMOTION devices, SIMATIC CPUs and non-Siemens devices via UDP and TCP/IP
- Communication with programming devices (programming device functions)
- Communication with ProTool/Pro and WinCC flexible
- Communication with PCs on which SIMATIC NET OPC is installed.
  A prerequisite on the PC side is the SIMATIC NET SOFTNET S7 software.

SIMOTION IT

SIMOTION IT enables additional communication functions via Industrial Ethernet (HTML over Internet browser):

- Diagnostics functions via SIMOTION IT DIAG
- Communication via SIMOTION IT OPC XML-DA
- SIMOTION IT Virtual Machine: Creation of Java applications for SIMOTION

Overview

The basic concept: "pay only for what you need"

The functionally scalable licenses for SIMOTION runtime software and axis-specific licensing result in a simple pricing structure, allowing you to only pay for what you really need.

Runtime licenses are not bound to specific versions and are therefore valid for all firmware versions. In case of a firmware update the runtime licenses remain valid. The license key generated from the runtime licenses is specific to and stored on the memory card (DP/PN board for the P350-3).

How can licenses be obtained for runtime software?

Licenses for SIMOTION runtime software can be obtained as follows:

- Pre-installed licenses can be ordered when purchasing a SIMOTION memory card (SIMOTION C, D) or for SIMOTION P350-3. The order number is expanded with one or more additional order codes (Z options) that specify the required licenses. Alternatively, pre-installed runtime licenses can be ordered using the configurator for SIMOTION runtime licenses in the A&D Mall.
- Licenses can be ordered separately, independently of purchase of a SIMOTION controller or a SIMOTION memory card.
  The required software options are assigned to hardware (memory cards or P350-3) by generating a license key over the Internet at:
  www.siemens.com/automation/license
- MultiAxes bundles: "MultiAxes bundles" can be obtained for SIMOTION C2xx and D4x5. This bundles contain the following: Motion Controller, memory card and MultiAxes Package license for the respective platform.

You will find detailed information for ordering runtime licenses for SIMOTION on the following pages.

Unlicensed basic functions

The rights of use for these software components are included when the basic unit is purchased:

- SIMOTION Kernel runtime software
  The SIMOTION Kernel is already installed on the device.
- Motion Control Basic technology functions
  Use of technology functions for speed-controlled axes, single output cams and cam tracks, sensor probes, and external encoders.
- Technology functions for Drive Control Chart
  By installing the optional SCOUT package Drive Control Chart, the technology functions of Drive Control Chart are made available to the SIMOTION runtime system.
- Supplementary technology functions
  Use of supplementary technology functions, such as adders, formula objects and fixed gears.
- Function libraries for I/O interfacing
- Communication functions
  This covers SIMATIC S7 communication functions on the SIMOTION side (programming device/OP communication to programming devices, for engineering and communication to TPs/OPs/MPs and PCs with SIMATIC HMI, e.g., ProTool/Pro, WinCC flexible or SIMATIC NET OPC), as well as UDP and TCP/IP communication.

Motion Control technology functions under license

The Motion Control Basic technology functions can be used without a license. When other technology functions of the Motion Control technology package are used, a license is required for each axis used. Licenses are only necessary for real axes; virtual axes and speed-controlled axes are not subject to license. A license is obtained for the different axis types using a separate order number for each.

POS, GEAR, CAM axis licenses

Three different axis licenses are available:

- POS – Use of the positioning technology function for a created positioning axis
- GEAR – Use of the positioning and synchronous operation technology functions for a created synchronous axis as well as additional path interpolation for a created path axis
- CAM – Use of the positioning, synchronous operation, path interpolation and cam technology functions for a created synchronous axis with cam

MultiAxes Packages

The platform-independent MultiAxes Package supports particularly simple licensing. It contains the license for unlimited use of the POS/GEAR/CAM technology functions on one CPU. Variably priced, platform-specific packages for C230-2, C240, P350-3 or D425, D435 and D445 are offered in addition to the platform-independent MultiAxes Package.

Note:
SIMOTION D410 is the SIMOTION D variant for single-axis applications and already contains the motion control technology functions for one real axis (speed, positioning, synchronous axis or cam). A license is therefore not needed for this purpose. It is not possible to increase the number of axes using licenses in the case of SIMOTION D410. Apart from one real axis, further virtual axes can be configured.

TControl technology function subject to license

The TControl technology package is licensed channel-specifically, in packages of 8 temperature channels.

When do technology functions require licenses?

When configuring using SIMOTION SCOUT, the required licenses are displayed.

A license is required for the runtime software

- When it is used in a machine or a machine component before it is supplied by the manufacturer
- When it is used by the customer on completion of initial commissioning
- When it is retrofitted following completion of initial commissioning
- In large-scale plants that are installed directly at the production site without previous initial commissioning by the manufacturer, on completion of initial commissioning before test operation commences.

Overview (continued)

Licensing model for technology functions

License type	Licensed technology functions	Number of axes
POS axis license	Positioning	1
GEAR axis license	Positioning, synchronous operation, path interpolation	1
CAM axis license	Positioning, synchronous operation, path interpolation, cam (all functions of the motion control technology package)	1
Platform-independent MultiAxes Package	Cam (CAM)	Unlimited on one controller
Platform-specific MultiAxes Package	Cam (CAM)	Unlimited on one controller
TControl	8 temperature channels per license	–

Licenses for SIMOTION IT

One license is required for each SIMOTION device for the software options "SIMOTION IT DIAG", "SIMOTION IT OPC XML-DA" and the multiple license "SIMOTION IT".

Licenses for safety functions

SINAMICS S120 drives with safety functions can be integrated into a SIMOTION application.

The Safety Integrated basic functions are unlicensed.

A license is, however, required for each axis with safety functions in the case of Safety Integrated Extended Functions.

Note regarding SIMOTION D410:

SIMOTION D410 is the SIMOTION D version for single-axis applications and already contains the Motion Control technology functions for one real axis (speed, positioning, synchronous axis or cam).

A license is therefore not needed for this purpose. It is not possible to increase the number of axes using licenses in the case of SIMOTION D410.

Licensed runtime functions such as SIMOTION IT DIAG require licenses which can be ordered pre-installed on a CompactFlash Card (CF) or individually.

Note regarding MultiAxes Bundles:

MultiAxes Bundles are available for SIMOTION C230-2, C240 and D4x5 and comprise of the respective Motion Controller, one memory card and one MultiAxes Package license for the respective platform (see SIMOTION C or D ordering data).

It is not possible to append Z options to these MultiAxes Bundles.

A MultiAxes Bundle is not necessary for SIMOTION P 350-3 as the software can be ordered using Z options.

Selection and ordering data - supplements

Ordering pre-installed licenses

Memory cards for SIMOTION C, D (Micro Memory Cards, CompactFlash Cards) and SIMOTION P350-3 can be ordered with pre-installed licenses. The type and number of required licenses can be specified in the order using Z options.

Example 1:

CompactFlash Card 512 MB for SIMOTION D4x5 with

- 3 POS licenses
- 2 CAM licenses
- 1 TControl license and
- 1 Safety Integrated Extended Functions license:

Order No.: 6AU1400-2NA00-0AA0 **-Z P03 C02 T01 F01**

Example 2:

CompactFlash Card 512 MB for SIMOTION D425 with

- MultiAxes Package license for D425:

Order No.: 6AU1400-2NA00-0AA0 **-Z M42**

The possible Z options are listed in the following table.

Z options for pre-installed runtime licenses:

Axis licenses

- Pxx – POS license and number (e.g. P02 = 2 POS licenses)
- Gxx – GEAR license and number (e.g. G03 = 3 GEAR licenses)
- Cxx – CAM license and number (e.g. C01 = 1 CAM license)

MultiAxes Packages

- M00 – MultiAxes Package license (platform independent)
- M24 – MultiAxes Package license for C230-2 and C240
- M35 – MultiAxes Package license for P350-3
- M42 – MultiAxes Package license for D425
- M43 – MultiAxes Package license for D435 (incl. D425)
- M44 – MultiAxes Package license for D445 (incl. D435 and D425)

TControl temperature control

- Txx – TControl license and number (e.g. T03 = 3 TControl licenses)

Special additional options for SIMOTION P350-3

- Vxy – Pre-installed runtime version for SIMOTION P350-3 XP variant (e.g. V40 = Version 4.0)
- K00 – OPC server license, on SIMOTION P350-3, XP variant

SIMOTION IT

- D00 – IT DIAG license
- X00 – OPC XML-DA license
- J00 – Combined license for SIMOTION IT, comprises SIMOTION IT Virtual Machine for Java applications, SIMOTION IT DIAG and SIMOTION IT OPC XML-DA

Safety functions

- Fxx – License for SINAMICS Safety Integrated Extended Functions (for integrated SINAMICS drives for SIMOTION D4x5 and CX32) (e.g. F02 = 2 times Safety Integrated Extended Functions)

Selection and ordering data – supplements

Ordering configurator on the Internet

An electronic ordering configurator is available on the Internet for simple ordering of SIMOTION hardware with corresponding licenses. Customers with access to the A&D Mall can access this ordering configurator in two different ways:

Access via the configurator list of the A&D Mall:

- On the start page of the A&D Mall https://mall.automation.siemens.com/DE/guest/ click the "List of Configurators" entry in the link box in the right-hand margin:

- On the subsequent page, click the item "SIMOTION Runtime licenses":

The page for the ordering configurator is then displayed:

- You will then be guided step by step through the selection and ordering of SIMOTION memory cards and SIMOTION P350-3 with pre-installed runtime licenses.

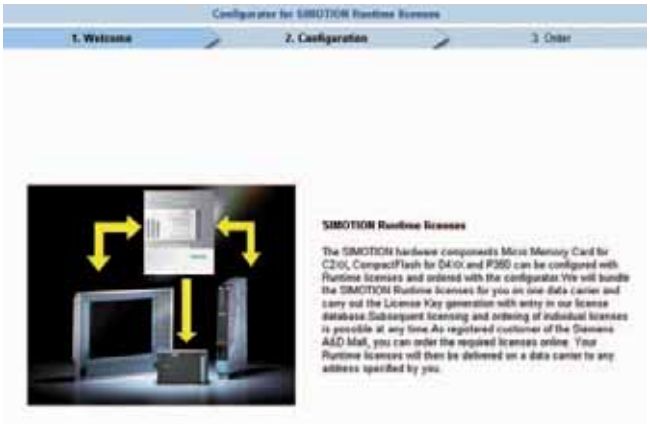
Access via the product tree of the A&D Mall:

In the product tree of the A&D Mall, the ordering configurator for the SIMOTION runtime licenses can be accessed over the following path:

"Automation Systems / SIMOTION Motion Control System / SIMOTION Software / Runtime software".

- In the "Runtime software" node, click on the "SIMOTION Runtime licenses" link:

The ordering configurator is then displayed in the A&D Mall window:



Note:
You will find the selection and ordering data for ordering individual runtime licenses on the following page.

Selection and ordering data – supplements

Ordering individual licenses

Description	Order No.
Axis licenses	
• **POS**, license to use the positioning technology functions for 1 axis	**6AU1820-1AA20-0AB0**
• **GEAR**, license to use the positioning, synchronous operation or path interpolation technology functions for 1 axis	**6AU1820-1AB20-0AB0**
• **CAM**, license to use the positioning, synchronous operation, path interpolation or cam technology functions for 1 axis	**6AU1820-1AC20-0AB0**
MultiAxes Packages	
• **MultiAxes Package**, **platform-independent**, license for unrestricted use of the CAM technology function on a C2xx, P350-3 or D4x5	**6AU1820-0AA20-0AB0**
• **MultiAxes Package for C2xx** License for unrestricted use of the CAM technology function on a C230-2 or C240	**6AU1820-0AA24-0AB0**
• **MultiAxes Package for P350-3** License for unrestricted use of the CAM technology function on a P350-3	**6AU1820-0AA35-0AB0**
• **MultiAxes Package for D425** License for unrestricted use of the CAM technology function on a D425	**6AU1820-0AA42-0AB0**
• **MultiAxes Package for D435** License for unrestricted use of the CAM technology function on a D435 or D425	**6AU1820-0AA43-0AB0**
• **MultiAxes Package for D445** License for unrestricted use of the CAM technology function on a D445, D435 or D425	**6AU1820-0AA44-0AB0**
TControl temperature control	
• **TControl**, license to use the TControl technology functions for 8 temperature channels	**6AU1820-2AA20-0AB0**

Description	Order No.
SIMOTION IT	
In SIMOTION Version V4.1 SP1 and higher, the SIMOTION IT functions are included in the standard firmware of the SIMOTION devices. Use of the functions remains subject to the licenses in the following software options:	
SIMOTION IT DIAG Software option for licensing the integrated web server	**6AU1820-8BA20-0AB0**
SIMOTION IT OPC XML-DA Software option for licensing the integrated OPC XML-DA server	**6AU1820-8BB20-0AB0**
SIMOTION IT (combined license) Software option for licensing SIMOTION IT Virtual Machine for Java applications, SIMOTION IT DIAG and SIMOTION IT OPC XML-DA	**6AU1820-8BD20-0AB0**
Up to SIMOTION Version V4.0, special firmware is required for using the SIMOTION IT functions. The firmware is supplied on CD-ROM and must be ordered separately:	
SIMOTION IT V4.0 CD-ROM Firmware with Ethernet-based HMI and diagnostics functions CD-ROM with firmware for all SIMOTION platforms with SIMOTION IT functions (only necessary for SIMOTION ≤ V4.0)	**6AU1800-0KA40-0AA0**
Safety functions	
SINAMICS Safety Integrated extended functions for SIMOTION D4x5 License for using the function for 1 axis (on SINAMICS Integrated or CX32)	**6AU1820-2AF20-0AB0**
For further information on Safety functions and Safety Integrated, see the section "Safety Integrated".	

SIMOTION Kernel

Function

In addition to the high-performance functions for I/O handling, logic, arithmetic, program control, timers and communication, SIMOTION also has a very powerful runtime system.

The SIMOTION Motion Control system uses high-performance CPUs on which a real-time operating system suitable for fast control processes is implemented. Each task is allocated a slice of the computing time. The organization of the task sequences is performed by the operating system.

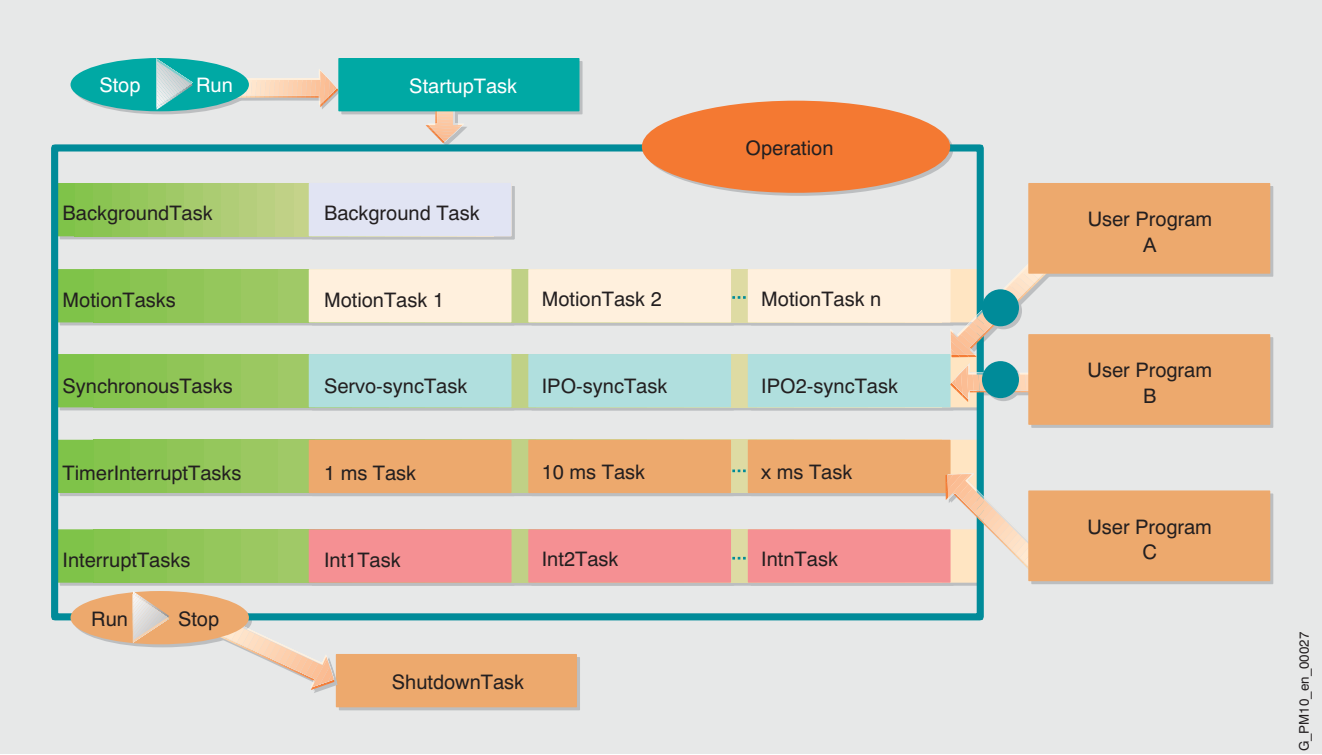
A differentiation is made between user and system tasks that are independent of one another.
The user program is executed in various execution levels (tasks).
The advantage of the task system is that user programs hung in the appropriate task levels can run in parallel.
In addition, execution levels are available which are synchronized with the control cycle of the drives or the isochronous PROFIBUS/PROFINET. In this way, the whole application is in isochronous mode (Application program ↔ Drives ↔ I/O). This results in short response times and the application is easily reproducible.

The task structure of the runtime system supports PLC, technology and Motion Control tasks and provides different program execution options:

- Cyclic
- Sequential
- Time-controlled
- Interrupt-driven

The following execution levels are available:

- StartupTask
  The StartupTask is executed once at the operating mode transition from STOP to RUN; it controls the system start-up.
- BackgroundTask
  The BackgroundTask is executed cyclically and is used for general PLC tasks. Cycle time monitoring checks the maximum processing time of the BackgroundTask. The BackgroundTask can be compared with the OB1 of the SIMATIC.
- SynchronousTasks
  These tasks are synchronized with the isochronous PROFIBUS DP or PROFINET IO. In the servo-synchronous user task, time-critical terminal - terminal responses for I/O or fast influencing of setpoints can be implemented on the servo level (position controller).
  The two IPO synchronous user tasks are started synchronously immediately before the interpolator cycles IPO or the slower IPO2. Fast Motion Control reactions can be implemented here, as well as closed-loop control tasks in which the acquisition of actual values and output of setpoints must be synchronized.
  The user program is therefore synchronized with the control cycle of the drives and with I/O processing. Synchronization ensures short response times and, above all, deterministic and reproducible machine behavior.
- DCC tasks
  Drive Control Chart (option) uses the above-mentioned SynchronousTasks. In addition, further synchronous execution levels (special tasks for DCC) can be assigned to the blocks.



Task structure of a SIMOTION application

Function (continued)

- TimerInterruptTasks
  Several time-controlled tasks are available. The call cycles can be parameterized. Periodically recurring tasks are typically stored here.
- InterruptTasks
  InterruptTasks allow very fast responses to internal events. These can be triggered by system interrupts such as alarms, timeouts or user interrupts.
- Motion Tasks
  Motion tasks are provided for motion sequences. Command sequences in the same Motion Task are usually executed sequentially, for example, the next motion command is only started when the previous command has been completed. The Motion Task does not require computing time for these waiting states.
- ShutdownTask
  The ShutdownTask is called when there is a transition to STOP mode. Here you can define the specific behavior during the transition to this system state.

The complete instruction set is available for all tasks. This allows the current positioning command to be superimposed with an additional movement from a MotionTask which was triggered by a UserInterruptTask, for example.

Other features of the execution system are:

- Operating states – Run, Stop, StopU (Stop User Program for test and commissioning functions)
- Process images for inputs/outputs, is separate for BackgroundTask, SynchronousTasks and TimerInterruptTasks
- Debug functions such as
  - Controlling and monitoring of variables
  - Display of the program status
  - Breakpoints or single steps
  - Trace functions

For further information, see "SIMOTION SCOUT basic functions / diagnostics for testing and commissioning".

- Kernel updates can be implemented with new SCOUT versions.

For further information, see "SIMOTION engineering software / SIMOTION SCOUT software package".

SIMOTION technology packages

Overview

The SIMOTION technology packages expand the basic functionality of the SIMOTION devices with additional language commands which makes adaptation to the respective automation task easy.

The loadable technology packages support the creation of technology objects (e.g. positioning and synchronous axis, cam paths, external encoders, etc.) which can be accessed over system functions and system variables in every SIMOTION programming language.

The Motion Control Basic technology functions can be used without a license. Use of the extended functions of the Motion Control technology package is subject to a license.

For further information about technology function licenses, refer to the section "Runtime software licensing" on page 8/41 and the following.

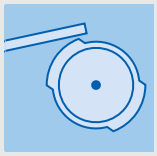
Function

SIMOTION Motion Control technology package

The comprehensive functions of the motion control technology package offer very open and flexible ways of influencing application programming and ensure that you can also implement future motion control applications.

Using the motion control functions in conjunction with the powerful PLC functionality results in high machine cycles thanks to short response times as well as high product quality thanks to reproducible machine behavior.

Technology functions for Motion Control Basic



The "speed-controlled axis" technology object

- Speed setpoints are defined in the program (for servo and vector drives)
- In addition, accumulative torque setpoints and torque limits can be defined, for example, for controlling a winder drive.
- Access to status and control words of the drive
  Release sequence of the PROFIdrive units can be specifically controlled (e.g. for braking signal).
- Reading and writing of drive parameters
- Support for SINAMICS drives that can perform safety-related monitoring (SOS=Safe Operating Stop, SLS=Safely Limited Speed) or stop reactions (STO=Safe Torque Off, SS1=Safe Stop 1, SS2=Safe Stop 2).
  This support ensures that stop reactions are prevented at the drive end in that SIMOTION controls (with SLS) the drive through the application, for example, within the permissible velocity or brings it to a standstill (with SOS).
  Activation and deactivation of SINAMICS Safety Integrated extended functions SS2, SOS, SLS as well as their status are indicated on the axis with specific technology alarms and system variables.

For further information on SINAMICS Safety Integrated, see the section "Safety Integrated".

"External encoder" technology object
External encoders can be used to detect actual position values of axes (on PROFIBUS/PROFINET, onboard for C2xx and as a second encoder on the drive).

"Cam and cam track" technology object

- Generates position-dependent switching signals
- Number of cams and cam tracks depend on available system resources
- Each cam track can have up to 32 cams on one output

The following cam types are available:

- Trip cams
- Position-position cams
- Position-time cams
- Position-time-based cams with maximum ON length
- Counter cams
- Exact time setting of an output, exact time output cams

The cam statuses can be output with:

- Internal variables
- Standard digital outputs (SIMATIC S7-300, ET 200, ...)
- Onboard outputs and D4xx/C2xx and TM15/TM17 High Feature (for high accuracy requirements in the µs range)
- The output can be inverted

The following can be used as reference points for the switching edges of the cams:

- Setpoints for real and virtual axes
- Actual values of real axes and external encoders

The following functions are available:

- Parameterizable hysteresis and effective direction
- Activation and deactivation times can be specified separately (dead time compensation)
- One-time and cyclic output of cam paths
- Parameterizable start/stop mode for cam paths (immediately, with next path cycle, etc.)
- Edge-triggered enable of cam paths in conjunction with TM17 High Feature terminal module
- The status of each individual cam (activated/deactivated) can be read
- Single output cams on a cam track can also be directly defined as valid/invalid

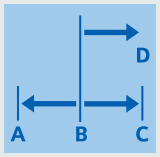
"Sensor" technology object
Sensors can be assigned to positioning and synchronous axes, external encoders or virtual axes and supply the axis position at the time of measuring.

The following functions are available:

- One-time measurement
- Cyclic measurement (2 edges per servo/IPO cycle in conjunction with TM17 High Feature or C240)
- Measuring on virtual axes (in conjunction with TM15, TM17 High Feature, D4xx or C240)
- Several active measuring probes on one axis or one measuring probe for several axes (in conjunction with TM15, TM17 High Feature, D4xx or C240)
- Parameterizable edge evaluation (rising, falling, both edges)
- Dynamic resolution range

Function (continued)

POS –
Positioning technology functions

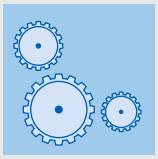


The positioning axis technology object

- Contains the functions of the speed-controlled axis technology object
- Supported axis types:
  - Linear axis, rotary axis
  - Modulo axis for linear and rotary axes
  - Real and virtual axis
  - Simulation axis
- Position control for:
  - Electrical axes
    Position control with digital setpoint output
    The following PROFIBUS DP/PROFINET protocol is used for this purpose: Profile drive technology, PROFIdrive, Version 4 (isochronous mode), use of Dynamic Servo Control (DSC) is possible with position control in the drive in, for example, 125 µs
    Position control with analog setpoint output
    (onboard I/O for C2xx, ADI 4, IM 174)
  - Hydraulic axes
    Position control with analog setpoint output (onboard I/O for C2xx, ADI 4, IM 174, analog outputs in the I/O range, e.g. in combination with ET 200S High Speed I/O)
    The characteristics of the hydraulic valves are specified with cams
  - Stepper motors
    Position control with pulse direction output for stepper drives (onboard I/O for C2xx, IM 174)
    Alternatively, stepper drives with a PROFIBUS interface can be connected, provided that they support the PROFIdrive profile. Stepper drives can be operated without an encoder or be position-controlled with an encoder.
- Position-controlled positioning:
  Axes can be manipulated individually without interpolation context by specifying, for example:
  - Axis name
  - Position
  - Velocity
  - Acceleration/delay, jerk
  - Transition behavior to next motion
- Speed-controlled operation of positioning axes
- Monitoring and limiting (standstill, positioning, dynamic following error, standstill signal, controlled variables, hardware/software end positions, encoder limit frequency, velocity error, measuring system difference/slip, limits for the dynamic response)
- Reversing block (prevents the output of setpoints which would cause a reversing motion)
- Movement profiles on axis defined over cams:
  - Path over time
  - Velocity over time
  - Velocity over path
- Force and pressure control of an axis:
  - Direct switchover from position to pressure-controlled operation and vice versa
  - Several pressure sensors possible
  - Pressure difference measurement
- Force and pressure limitation of an axis:
- Force and pressure profiles specifiable over cams:
  - For closed-loop control and limitation
  - Force/pressure over time
  - Force/pressure over path
- Traveling to a fixed stop point
  - Stop on reaching a following error limit
  - Stop on reaching a torque limit
  - Stop with defined torque
- Traversing with additive torque, adjustable torque limiting and flexible torque limits B+/B-
- Transition behavior of successive motions:
  - attach, i.e. each motion is completed and the axis stops between motions (exact stop)
  - continuous move, i.e. the transition to the next motion begins when braking starts.
  - replace, i.e. the programmed motion is performed immediately. The active command is aborted.
- An additional motion can be performed during an active motion, for example, an active positioning motion can be performed simultaneously to a compensation motion.
- Concurrent start of positioning axes
- Homing:
  The following homing types are currently supported:
  - Active homing (reference point approach)/passive homing (homing on-the-fly)
    - With reference cam and encoder zero mark
    - With external zero mark only
    - With encoder zero mark only
    - BERO proximity switch and hardware limit switch as reversing cam
    - Hardware limit switch as reference cam
  - Direct homing / setting the home position
  - Relative direct homing (shift by specified offset)
  - Absolute encoder homing / absolute encoder calibration
- Compensations and reference points:
  - Reference point offset
  - Backlash on reversal compensation
  - Static friction compensation
  - Sliding friction compensation for hydraulics
  - Drift compensation for analog drives
- Encoder switchover:
  Up to 8 encoders can be specified for an axis:
  - For the position control, only one encoder is active at any one time:
  - The switchover between encoders can be performed on-the-fly (with a change-over smoothing filter).
  - The actual value for the non-active encoder can be read with the application program and used for specific monitoring, for example.
- Override:
  - Factors can be superimposed online on the current traverse velocity and acceleration/deceleration.

Function (continued)

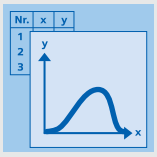
GEAR – Synchronous operation/ Electronic gear technological functions



Synchronized axis technology object

- Contains the functions of the positioning axis technology object
- Synchronized speed for position-controlled axes
- Angular synchronization, electronic gear:
  Stable, long-time angular synchronization over several axes is ensured. The gear ratio can be adjusted in small steps.
- Absolute and relative gearbox synchronism
- Offset of the following axis
- Leading axis:
  The master value can be changed immediately between master value sources (transition dynamics must be specified).
  The following can be used as a leading axis or master value sources for the following axes:
  - Virtual axis:
    The virtual axis only exists in the control and therefore does not have a real drive, motor or encoder. A virtual axis can be controlled with commands in the same way as a real axis. The motion control calculates the setpoints with the interpolator which can be used as a master value for synchronous operation, for example.
  - Real axis:
    The real axis is a leading axis which is part of the SIMOTION system and can be coupled over a setpoint and actual value.
  - External encoder:
    The actual value is detected with an external encoder and supplied as a master value after conditioning.
- Setpoint value linkage as well as actual-value linkage with compensation of dead times.
- Angular position and electronic gear ratio for axes can also be changed during operation.
- Engaging/disengaging:
  Following axes can be stopped for one cycle or moved for only one cycle to remove a faulty component, for example. This can be flexibly implemented with the programmable synchronism functionality.
- Engaging and disengaging:
  - Following axes can be engaged and disengaged while the leading axis is in motion or standing still. The angular position to the leading position can be specified.
- Different synchronization modes are available
  - Synchronization via a specifiable master value distance
  - Synchronization based on specifiable dynamic response parameters
  - Synchronization position
  - Position of the synchronization range
- Terminating synchronized operation of/to positioning
- Comprehensive synchronized operation monitoring functions
- External synchronization:
  By measuring a print-mark, for example, a material slip can be corrected with a simultaneous positioning function.
- Simultaneous motion during synchronized operation:
  A positioning motion or other synchronized operation can be performed during synchronized operation.
- Distributed synchronous operation and the option to implement synchronous operation beyond device limits.
  - PROFIBUS: Leading axis to PROFIBUS master, following axes to PROFIBUS slaves.
  - PROFINET: Changeover between leading axes to different SIMOTION controllers possible. Cascading of the synchronous operation over several SIMOTION controllers.
  - Dead times are compensated automatically.
  - Also possible across different projects (independent projects)

CAM – Cam technology functions

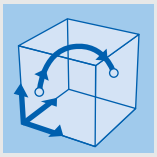


Cam technology object

- Contains the functions of the synchronous axis technology object
- The number of cams depends on the available system resources
- The number of support points or segments per cam depends on the available system resources
- Cam functions:
  - Definition over table support point or polynomials up to 6th degree with trigonometrical functions
  - Motion rules implementable to VDI 2143
  - Transition between support points/polynomials: Linear, continuous, spline
- Scalability, cam functions can be offset and switched even during operation:
  - The leading and following axis positions of the cam functions can be scaled and offset during operation.
  - The active cam function can be defined and switched during operation.
- Non-cyclic and cyclic editing of cams
- Absolute and relative curve synchronization
- Absolute and relative master value referencing
- Synchronization and desynchronization (see synchronous operation technology object)
- Overriding of 2 synchronized cams
- Cams can be defined and modified with the SCOUT engineering system or with an application program during runtime.

Function (continued)

PATH – Path interpolation technology functions

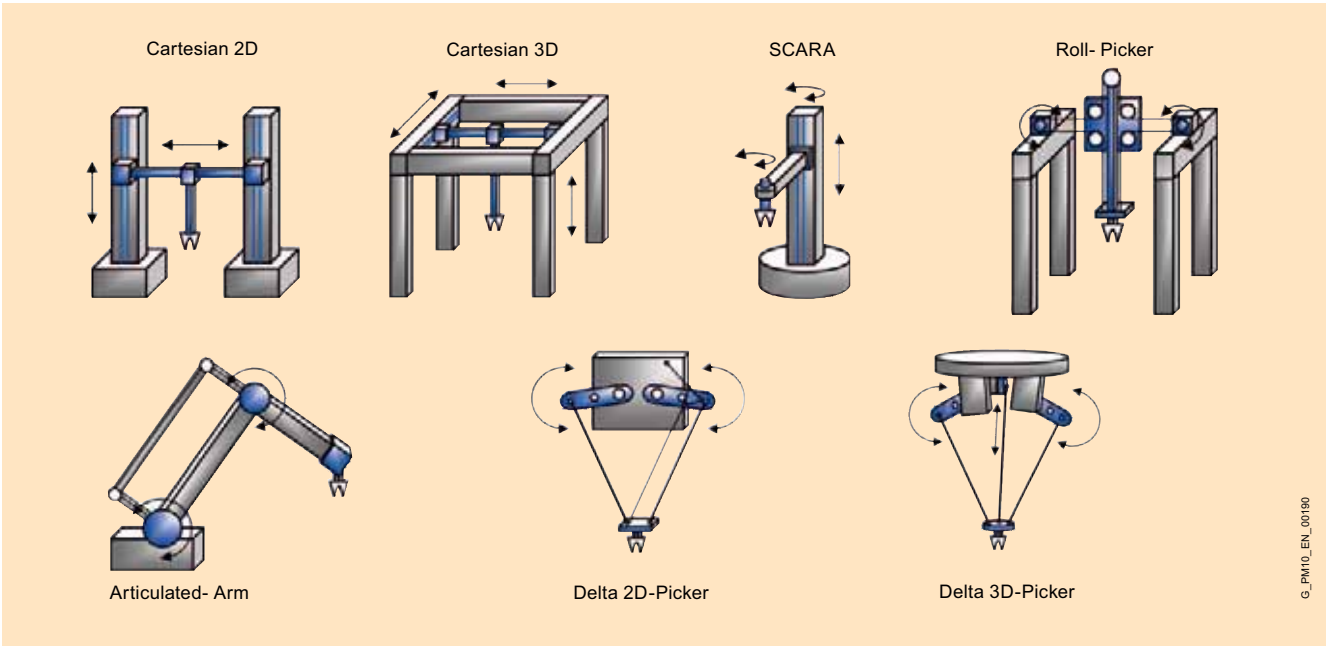


Path interpolation technology object

The path interpolation technology object is primarily intended for the automation of handling robots. Interpolation in machines for material machining is covered by the SINUMERIK powerline and SINUMERIK solution line machine tool controllers. (For further information on the SINUMERIK controllers, see Catalogs NC 60 and NC 61.)

- The number of path objects is dependent on the performance of the hardware platform used.
- Interpolation types:
  - Linear interpolation in 2D and 3D
  - Circle interpolation in 2D and 3D
  - Polynomial interpolation in 2D and 3D
- Interconnection of a path object is possible with:
  - Up to 3 interpolating path axes
  - One positioning axis for path-synchronized motion (axis moves in synchronism with motion)
  - One cam for specifying velocity profiles along the path
- Connection of path-based cams, cam tracks and measuring inputs over the positioning axis for path-synchronized motion
- Interconnection of the Cartesian path coordinates with positioning axes is possible. Cams, cam tracks and probes can also be implemented on the path
- The path dynamics (acceleration, jerk) are specified on the path, axis limits are generally applicable regardless of the limits along the path
- Kinematic transformations for:
  - Cartesian gantry
  - SCARA
  - Robotic arm (Toploader)
  - Roller picker
  - Delta 2 and Delta 3 picker
- Programming in ST and MCC

A sample application that is included in the scope of supply can be used for easy implementation of handling robots, which allows both jog mode and the creation of motion programs (see the Utilities & Applications CD supplied with SIMOTION SCOUT).



Kinematics in the motion control technology package

Function (continued)

Supplementary technology functions

Fixed gear technology object
You can use the technological object fixed gear to implement a fixed synchronous operation (without synchronization/desynchronization) using a specified gear ratio. Fixed gearing converts an input variable to an output variable with a configured transmission ratio (gear ratio).
A Fixed Gear TO can be used as follows, for example:

- To make allowance for diameters in a master variable.
- To implement a fixed gear ratio without coupling
- For speed synchronization on speed-controlled axes
- As a motion-coupled gear on master value, following axes are engaged or disengaged. In this way, the gear is always synchronized with the master value. Example: A paper web runs synchronously with the master.

TO summator
The summator object can be used to add up to four input vectors (motion vectors) with one output vector. An addition object can be used as follows, for example:

- To add up superimpositions/offsets in the main signal path, e.g. color register, cut-off register on the paper web

TO formula
Formula object for scalable variables and motion vectors. A formula object can be used between interconnected objects to modify scalar variables in the main signal path, e.g.:

- Superimposition of torque
- Superimposition of master velocity
- Modification of torque variables B+, B-
- Enabling of torque limitations
- Enabling of torque

TO sensor
The sensor object can be used to acquire scalar measuring values. A sensor object reads out a value from the I/O and supplies an actual value as an output signal in standardized formats.

TO controller
The controller object can be used to prepare and control scalar variables.
A controller object can be used as a universal PIDT1 controller for scalar control variables as well as a PI and P controller.

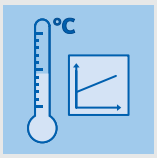
Interconnection

The individual technology objects can be interconnected. The supplementary technology functions, for example, can be used to implement additional winder applications directly on the system level.

Note:
No license is necessary for using the supplementary technology functions.

SIMOTION TControl Technology Object

TControl –
Temperature controller technology functions



Temperature Channel technology object

The controller core of the temperature technology package has a DPID structure. Pure heating controllers and cooling controllers as well as combined heating/cooling controllers can be configured and parameterized.

User-assignable functions are available for each temperature channel:

- Each temperature channel can either be configured as a heating or cooling section or as a combined heating/cooling section.
- The controllers either use a PID or DPID control algorithm or uses the optional control zone functionality.
- In manual output mode, a replacement value can be output.
- You can select the operating mode for each controller channel separately. In this way, you can switch the output to a fixed value.
  The following operating modes are available:
  - Closed-loop control for operating setpoint
  - Actual value acquisition and output of the manual manipulated variable value
  - Actual value acquisition and output of 0
  - Self tuning
- Actual value acquisition and processing
  - Plausibility check for each new actual value and correction before corresponding filter measures
  - Filtering (by PT1 element)
- Actuating signal preparation and output
  - Digital, pulse-length modulated actuating signal
  - Prevention of minimal pulse durations for I/O cycles by integration of lost pulses
  - Distribution of the switch-on times for the actuating signal outout
  - Manual actuating value (for manual output mode)
  - Output value limitation
  - Replacement value (calculated dynamically)
- Self-tuning for heating controllers
  - This ensures fast startup without overshooting and maintains the setpoint value without lasting system deviations.
  - Self-tuning can be used in parallel for all desired channels to ensure optimal parameter acquisition even for strongly coupled temperature sections.
- Monitoring and alarm functions
  - Actual value monitoring by definition of tolerance bands. The inner and outer tolerance bands can be defined independently as absolute or relative tolerance bands:
  - Measuring circuit monitoring for increased operational safety of a plant
  - Plausibility check
  - Alarm functions

The use of the TControl Technology Package is clarified by an application example. The application example provides function interfaces to the application and data interfaces for the HMI and is part of the Utilities & Applications CD, which is contained in the scope of supply of SIMOTION SCOUT.

Function (continued)

SIMOTION technology package for Drive Control Chart (DCC)

Technology functions for Drive Control Chart

With Drive Control Chart (DCC), open and closed-loop control functions can be easily configured graphically.
Multi-instance function blocks are selected from a block library using drag and drop, graphically interconnected and parameterized. The control structures are presented clearly.

The block library comprises a large selection of

- control,
- arithmetic and
- logic blocks as well as
- comprehensive open-loop and closed-loop control functions.

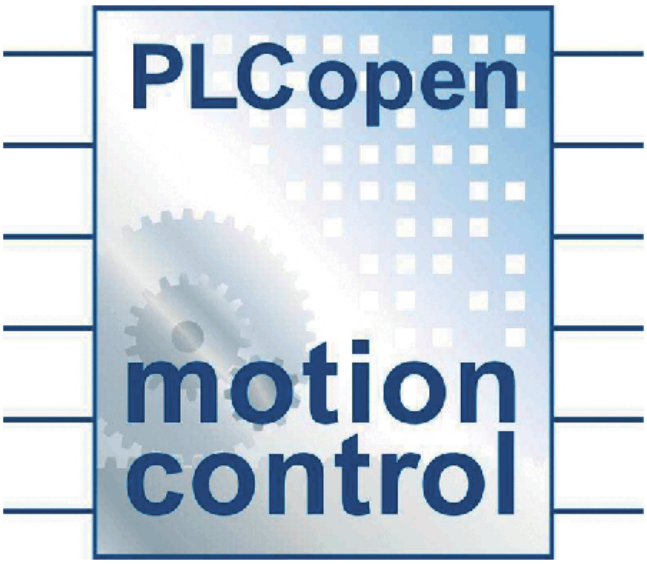
Further functions:

- For linking, evaluating and acquiring binary signals, all the commonly available logic functions are available, for example, AND, XOR, On/Off delays, RS flip-flops or counters.
- For monitoring and evaluating numerical values, numerous arithmetic functions are available, such as:
  - Summation
  - Divider
  - Minimum/maximum evaluation
- Apart from the automatic speed control, winders, PI controls, ramp-function generators and wobble generators can easily be configured.

For further information about Drive Control Chart (DCC), see "Optional SIMOTION SCOUT packages".

SIMOTION PLCopen blocks

Overview



Block library containing certified function blocks in accordance with PLCopen

PLCopen is an association of leading PLC manufacturers that was formed for the purpose of defining international standards in the field of PLC programming and promoting their use.

The PLCopen function blocks integrated into the Motion Control Technology Package are designed for use in cyclic programs/tasks; they enable motion control programming in a PLC environment. The function blocks can be selected from the SCOUT command library and can therefore be easily used in all SIMOTION programming languages. They should preferably be used in LAD/FBD.

The following certified single-axis and multi-axis PLCopen blocks as well as extended functions are available:

Single axis function blocks

- _MC_Power (axis enable)
- _MC_Stop (stop axis)
- _MC_Reset (reset axis)
- _MC_Home (reference point approach for axes)
- _MC_MoveAbsolute (absolute positioning of axes)
- _MC_MoveRelative (relative positioning of axes)
- _MC_MoveVelocity (traversing axes at a specified velocity)
- _MC_MoveAdditive (relative traversing of axes by a defined path additively to the remaining path)
- _MC_MoveSuperimposed (relative superimposition of a new motion in addition to existing motion)
- _MC_PositionProfile (traversing axis by a predefined and specified position/time profile)
- _MC_VelocityProfile (traversing axis by a predefined and specified velocity/time profile)
- _MC_ReadActualPosition (read actual position of axis)
- _MC_ReadStatus (read status of an axis)
- _MC_ReadAxisError (read error of an axis)
- _MC_ReadParameter (axis parameter, read LREAL data type)
- _MC_ReadBoolParameter (axis parameter, read BOOL data type)
- _MC_WriteParameter (axis parameter, write LREAL data type)
- _MC_WriteBoolParameter (axis parameter, write BOOL data type)

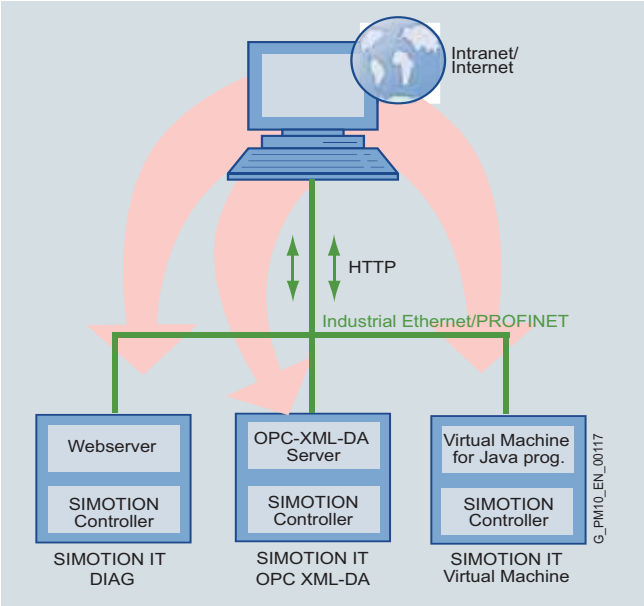
Multi axis function blocks

- _MC_CamIn (enable cam with synchronization) contains implicit _MC_CamTableSelect (selection of cam)
- _MC_CamOut (dis-engage cam with desynchronization length)
- _MC_GearIn (synchronize)
- _MC_GearOut (desynchronize)
- _MC_Phasing (apply phase shift)

Apart from the standard PLCopen functions, the following additional standard axis function is included:

- _MC_Jog (continuous or incremental jogging)

Overview



The SIMOTION controllers support communication with the outside world through the integrated Ethernet or PROFINET interface using standard IT protocols such as HTTP. This makes it possible to access data on the SIMOTION controllers from any location within the network or over the intranet/Internet without the need for special vendor-specific software.

SIMOTION offers three optional software packages for this purpose:

- SIMOTION IT DIAG: integrated web server on the SIMOTION controller
- SIMOTION IT OPC XML-DA: integrated OPC XML-DA server on the SIMOTION controller
- SIMOTION IT Virtual Machine: integrated Java runtime environment on the SIMOTION controller

SIMOTION IT DIAG and SIMOTION IT OPC XML-DA each provide a communications server on the SIMOTION controller. Via Industrial Ethernet/PROFINET, a client PC can then access data in the SIMOTION controller for diagnostic or service purposes or for visualization.

SIMOTION IT Virtual Machine provides a Java runtime environment on the SIMOTION controller. This means that Java applications can be executed on the SIMOTION controller. This allows you to create your own programs for commissioning, service and preventative maintenance.

Function

SIMOTION IT DIAG

SIMOTION controllers have a web server integrated into their operating systems. This functionality is licensed through the "SIMOTION IT DIAG" software option. For implementing applications with SIMOTION IT DIAG, a series of predefined web pages are stored in the SIMOTION controller that offer the following information and functions:

- Device information
  Detailed information about the firmware versions, hardware components and technology objects of the device
- Diagnostics
  Information about device resources, such as CPU load, memory usage, task duration times and operating status, diagnostic buffer, extended diagnostics buffer and alarm technology objects
- Access to the device file system
  An Internet browser can be used to store and access any number of files in the file system of the SIMOTION controller. In this way, documentation and service instructions can be stored directly in the device, for example.
- Firmware update and project update
  Special web pages can be used to update the SIMOTION project and also the SIMOTION firmware of the SIMOTION controller.
- Access protection
  The web pages are protected with a user name and password. Different user groups can be defined for different pages.
- User-specific web pages
  The user can create web pages and save them on the SIMOTION controller. "Server side includes" are used to access SIMOTION variables in these web pages. This is a special HTML syntax extension which allows the values of the selected variable to be included on a web page.

Read and write access to the SIMOTION variables is possible. Java scripts or applets can be used to implement active operation and display functions in the web pages that can be executed on a client PC with an Internet browser.

SIMOTION IT OPC XML-DA

SIMOTION controllers have an OPC XML-DA server integrated in their runtime system. This functionality is licensed through the "SIMOTION IT OPC XML-DA" software option. OPC XML-DA is a communication mechanism defined by the OPC Foundation and is based on the standard IT protocol HTTP. The data requests of a client are coded in XML symbolically and transmitted to SIMOTION using the HTTP protocol. These are evaluated by the integrated OPC XML DA server and the response is then sent back to the client over the same path.

It is therefore possible to create HMI applications for example in different programming languages (C#, Visual Basic, Java) on any client systems independently of the operating system. The application uses the symbolic names of the SIMOTION variables but it is not dependent on the SIMOTION SCOUT database like the SIMATIC NET OPC DA server on Windows basis. This ensures that consistency problems between the version of the client application and the project version in SIMOTION are avoided.

Function (continued)

The OPC XML-DA server offers the following functions for access to the data of the SIMOTION controller:

- Read and write access to the SIMOTION variables
- Access to diagnostic buffer, extended diagnostic buffer and technology object alarms
- Symbolic browsing function via the SIMOTION variables
- Cyclical reading of variables using "subscriptions"
- Access protection (password-based) can be configured, if required.
- Trace functionality:
  Variables can be logged cyclically over the XML mechanism (web services). The variables are stored in an internal buffer. They can then be transferred to a higher-level system where they can be prepared for display with any preferred tool.

SIMOTION IT OPC XML DA is integrated directly in the SIMOTION Kernel. The functionality responds in accordance with the specification of the OPC Foundation "OPC XML-DA Specification Version 1.01".

Note:
SIMOTION offers two different access possibilities over OPC. The method already described over OPC XML-DA and the method over OPC DA. OPC DA requires that the SIMATIC NET package is installed on the client PC and it is described in the "OPC server" section.

Further information about OPC can be found on the Internet at http://www.opcfoundation.org

SIMOTION IT Virtual Machine

SIMOTION controllers have – in Version V4.1 SP1 and above – an integrated Java runtime environment (Virtual Machine) in their runtime system. This functionality is licensed using the "SIMOTION IT" software option (combined license) – in combination with the "SIMOTION IT DIAG" and "SIMOTION IT OPC XML-DA" options.

Java applications can be executed on a SIMOTION controller with SIMOTION IT Virtual Machine. This allows you to develop your own programs and concepts for commissioning, service and preventative maintenance.

The programs can be created with the standard development tools that are available on the market, such as Eclipse or Borland JBuilder. When they have been created, the programs can be downloaded into the SIMOTION controller online.
There is no dependency on SIMOTION SCOUT.

All Java applications on the SIMOTION controller are not executed in real-time tasks in the SIMOTION task system (c.f. Motion Tasks)

The Java environment provides an interface (API) to the SIMOTION runtime system over special system functions.
The following functions are available:

- Read and write access to the SIMOTION variables
- Read and write access to the non-volatile memory (NVRAM)
- Use of system functions (functions of the technology objects)
- Use of standard Java classes in the device (file access, network functions, string functions, etc.)
- Creation of servlets, for the purpose of enhancing menu interfaces in web pages, in particular.

Selection and ordering data

Description	Order No.
As of SIMOTION Version V4.1 SP1, the SIMOTION IT functions are included in the standard firmware of the SIMOTION devices. Use of the functions remains subject to the licenses in the following software options:	
SIMOTION IT DIAG Software option for licensing the integrated web server	**6AU1820-8BA20-0AB0**
SIMOTION IT OPC XML-DA Software option for licensing the integrated OPC XML-DA server	**6AU1820-8BB20-0AB0**
SIMOTION IT (combined license) Software option for licensing SIMOTION IT Virtual Machine, SIMOTION IT DIAG and SIMOTION IT OPC XML-DA	**6AU1820-8BD20-0AB0**
Up to SIMOTION Version V4.0, special firmware is required for using the SIMOTION IT functions. The firmware is supplied on CD-ROM and must be ordered separately:	
CD-ROM SIMOTION IT V4.0 Firmware with Ethernet-based HMI and diagnostic functions; CD-ROM with firmware for all SIMOTION platforms with SIMOTION IT functions (only necessary for SIMOTION ≤ V4.0)	**6AU1800-0KA40-0AA0**

Overview

OPC server

- are included in the scope of supply of the SIMATIC NET communication software
- and offer standardized, open and vendor-independent interfaces to access SIMOTION and SIMATIC S7 devices from a Windows PC using any software application
- enable OPC-capable Windows applications to be linked with S7 communication
- are based on the software programming interfaces
- implement efficient data exchange for Windows 2000 and Windows XP
- have an OPC client tool (SIMATIC NET OPC-Scout) with browser functionality and OCX-Data-Control

Benefits

- Standardized access to SIMATIC S7 and SIMOTION for OPC-capable applications under Windows 2000/XP
- Integration of automation products of different manufacturers
- The same, easy-to-use user interface for different components
- Can be accessed from every computer in the LAN
- High-performance data access over the "Custom Interface" (C++)
- Easy to use with the "Automation Interface" (VB) or the supplied OCX data control

Application

OPC (OLE for Process Control) is used by Windows 2000/XP as a communications interface.

This is based on the COM (Component Object Model) and DCOM (Distributed COM) functions.

The basic principle of OPC is that OPC client applications communicate with the OPC server over a standardized, open and manufacturer-independent interface.

It is also possible to connect to COM-capable Windows applications (MS Office or HMI systems).

The following OPC servers are available:

- S7 OPC servers for S7 communication, S5-compatible communication as well as SIMOTION communication.
- The OPC servers fulfill the following specifications of the OPC Foundation:
  - Data Access Automation Interface
  - Data Access Custom Interface
  - Alarm and Events Custom Interface

Requirements

The corresponding SIMATIC NET communication package is required for communication from a PC/PG to SIMOTION C/P/D over OPC (depends on bus system and communication module).

The following shows which software package (which SIMATIC NET license) is required for which communication path to SIMOTION:

Communication via PROFIBUS for

- PC/PG with integrated communications module (CP5611): communication software for PROFIBUS DP SOFTNET S7
- PC with CP5611 PCI card: communication software for PROFIBUS DP SOFTNET S7
- Notebook with CP5511/CP5512 PCMCIA card: communication software for PROFIBUS DP SOFTNET S7

Communication via Industrial Ethernet for

- PC/ PG with standard Ethernet interface: communication software for Industrial Ethernet SOFTNET S7 or communication software for Industrial Ethernet SOFTNET S7/ LEAN (only 8 connections)

For internal communication on SIMOTION P350-3

- From Windows level to SIMOTION runtime level over internal bus (softbus): SIMATIC NET OPC server, pre-installed on P350-3

OPC server

Technical specifications

OPC server	
Programming	• Synchronous and asynchronous reading and writing of variables • Monitoring of variables using the OPC server with a signal to the client when a change occurs • Transmission of alarms and events to client • Use of batch operations, therefore a large volume of data can be processed in a short time
Interfaces	• Custom Interface (C++) for high OPC performance • Automation Interface (VB, Excel, Access, Delphi, etc.) for ease of use • Graphics with OCX for configuring instead of programming
Bus systems	• Communication over OPC for PROFIBUS and Industrial Ethernet is supported.
Operating systems	• Windows 2000 • Windows XP Professional

Selection and ordering data

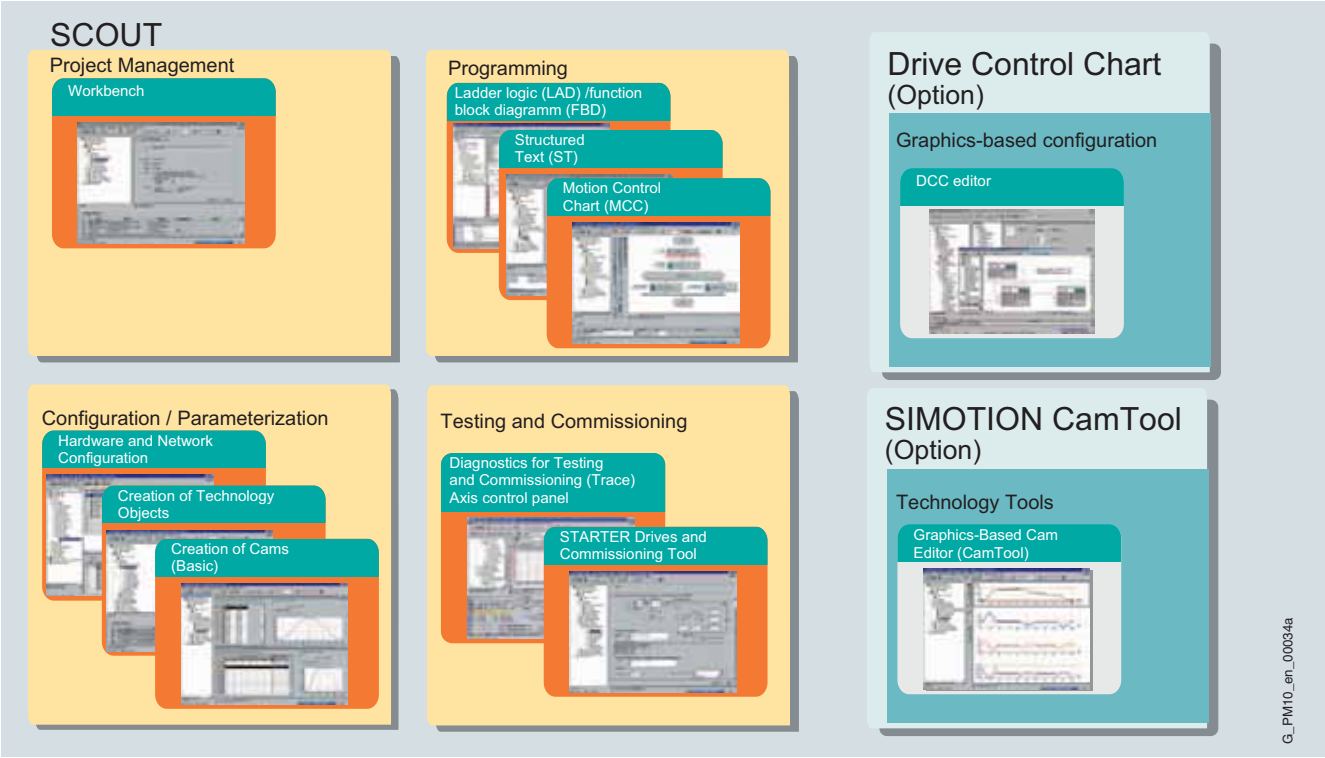
Description	Order No.
SOFTNET S7 communication software for PROFIBUS DP Software for S7 communication incl. FDL and S7 OPC server, with electronic manual on CD-ROM, for use with CP 5512 and CP 5611 modules	**6GK1704-5CW64-3AA0**
CP 5512 PCMCIA card for connecting a PG or notebook computer to PROFIBUS DP and MPI	**6GK1551-2AA00**
CP 5611 PCI card for connecting a PG or AT-PC to PROFIBUS DP and MPI	**6GK1561-1AA00**
SOFTNET S7 communication software for Industrial Ethernet Software for S7 communication, S5-compatible communication (SEND/RECEIVE) incl. OPC, PG/PC communication incl. S7 OPC server, with electronic manual	**6GK1704-1CW64-3AA0**
SOFTNET S7 LEAN communication software for Industrial Ethernet Software for S7/S5-compatible communication, incl. OPC, PG/OP communication and NCM PC, up to 8 connections	**6GK1704-1LW64-3AA0**
SIMATIC NET OPC server pre-installed on P350-3 License for the communication software already pre-installed on SIMOTION P	**6AU1380-0AA20-0YB0**

More information

For further information on the SIMATIC NET software package with OPC server, see Catalog IK PI and the A&D Mall under "Communication/Networks".

Note:
The current version of the communication packages of SIMATIC NET incl. OPC server is only available for Windows XP Professional and Windows 2000.

Overview



SIMOTION SCOUT: a uniform view of your automation task

SIMOTION SCOUT – The holistic engineering system for your motion control applications

The SIMOTION Motion Control system provides a wide variety of preprogrammed functions and you can assign parameters and program it for customized use.

For practical implementation of your automation tasks, you therefore require a tool that will support all the necessary engineering steps in a user-friendly manner: SIMOTION SCOUT

SCOUT is the environment for uniform automation in mechanical engineering. It supports simple engineering of complex production machines with demanding PLC and Motion Control functions.

SCOUT is available as an optional STEP 7 package or as SCOUT stand-alone. SCOUT is integrated in STEP 7 and is therefore also integrated into the SIMATIC landscape to ensure Totally Integrated Automation (TIA).

SCOUT provides

- an integrated, function-oriented view of your automation task, combined with
- a high level of user friendliness.

The possible SIMOTION applications range from a simple, parameterizable, speed-controlled single axis through to complex, mechatronically-coupled and programmable multi-axis machines.

Therefore, SCOUT provides views adapted to the task and can be expanded with additional tools (e.g. tool for the graphic creation of cams).

SIMOTION SCOUT – A tool for engineering, testing and diagnostics

SCOUT supports all the steps required for creating a Motion Control application: configuration, parameterization, programming, testing and diagnostics.

The integrated test and diagnostics functions are useful when commissioning and servicing.

The graphical menu system of SCOUT supports the user with important tasks, such as:

- Creation of the hardware and network configuration
- Creation, configuration and parameterization of technology objects such as axes, measuring inputs, output cams, cam tracks and cams.

SIMOTION SCOUT – Support for textual and graphical programming

With SCOUT the following programming languages are available for programming a SIMOTION application:

- Structured Text according to IEC 61131
- LAD (Ladder Diagram) and FBD (Function Block Diagram)
- MCC (Motion Control Chart): the graphical "flow diagram language" for easily describing and programming motion sequences for production machines
- DCC (Drive Control Chart): graphical configuration of open and closed-loop control functions

Optional CamTool package (cam editor)

The optional CamTool package expands SCOUT with a powerful graphical tool for creation and optimization of cams. Simple editors for creating cams are already integrated in SCOUT as standard.

Optional Drive Control Chart (DCC) package

With Drive Control Chart (DCC), drive-based open and closed-loop control functions can be easily configured graphically. Multi-instance function blocks are selected from a standard function block library, and then graphically linked by means of drag and drop and parameterized. The control structures are presented clearly in SCOUT.

The optional CamTool and Drive Control Chart packages are completely integrated in the SCOUT user interface.

SIMOTION SCOUT software package

Overview

The SIMOTION SCOUT software package is the basis for implementation of the SIMOTION Motion Control System.

It mainly contains the SIMOTION SCOUT engineering system including the integrated STARTER commissioning tool and the runtime software for all SIMOTION platforms.

SCOUT also supports the engineering of SIMOTION platforms with older runtime versions.

Scope of supply

SIMOTION SCOUT engineering software

- SCOUT with corresponding license
- License key for SCOUT
- Integrated STARTER commissioning tool

Optional packages for SIMOTION SCOUT

- Optional CamTool package without license
  The license must be ordered separately.
- Optional Drive Control Chart (DCC) package without license
  The license must be ordered separately.

Documentation

- Complete SIMOTION documentation on CD

Other software

- SIMOTION – Utilities & Applications
  Free utilities (e.g. calculation tools, optimization tools, etc.) and application examples (ready-to-apply solutions such as winders, cross cutters or handling)
- SIMATIC NET without license
- DriveES Basic with license
- SIMATIC software:
  With SCOUT stand-alone, the necessary components of STEP 7.

System requirements

Software

- Windows XP Professional SP2
- STEP7 V5.4 SP2 (not required for SCOUT stand-alone)

Hardware

Minimum system requirements PG/PC for SCOUT:

- Pentium III or higher, 1 GHz/512 MB RAM
- At least 512 MB main memory for PG/PC and SIMOTION P350-3; 1 GB main memory is recommended
- Screen resolution: 1024 x 768 pixels, 16 bit color depth
- Free hard disk memory: 1.6 GB, 2.3 GB for SCOUT stand-alone

With additional installation of WinCC flexible (ES):

- Windows XP, Pentium IV, 2.5 GHz/4 GB RAM

Integrated STARTER commissioning tool

The STARTER commissioning tool is directly integrated in SCOUT. It supports the simple and rapid commissioning, optimization and diagnostics of all new-generation Siemens drives with only one tool.

STARTER supports the drives:

- SINAMICS
- MICROMASTER 420/430/440
- MICROMASTER 411/COMBIMASTER 411
- COMBIMASTER

SIMOTION SCOUT stand-alone software package

If STEP 7 is not installed, the SIMOTION SCOUT stand-alone software package can be used. It also contains the components of STEP 7 that are required for SIMOTION SCOUT as well as the license key for SCOUT stand-alone.

SIMOTION Kernel updates

SIMOTION Kernel updates for all SIMOTION platforms are supplied on CD/DVD and can then be copied from the PG/PC to the SIMOTION Micro Memory Card (C2xx) or SIMOTION CompactFlash card (D4x5, D410) or installed on P350-3.

A PC card adapter is needed to write to the SIMOTION MMC (Micro Memory Card) or the SIMOTION CF (CompactFlash card).

Adapters can usually be found in PC shops and at electronics shops.

Selection and ordering data

Description	Order No.
SIMOTION SCOUT software package	
SIMOTION SCOUT V4.1 SP1 (English/French/German/Italian), single license including STARTER, runtime software and documentation with data carrier for SIMOTION SCOUT	**6AU1810-■BA41-1XA0**
• on CD-ROM	**0**
• on DVD	**1**
SIMOTION SCOUT V4.1 SP1 upgrade (English/French/German/Italian), single license including STARTER, runtime software and documentation with data carrier for SIMOTION SCOUT	**6AU1810-■BA41-1XE0**
• on CD-ROM	**0**
• on DVD	**1**
SIMOTION SCOUT stand-alone software package	
SIMOTION SCOUT V4.1 SP1 stand-alone (English/French/German/Italian), single license including STARTER, runtime software and documentation with data carrier for SIMOTION SCOUT	**6AU1810-■CA41-1XA0**
• on CD-ROM	**0**
• on DVD	**1**
SIMOTION SCOUT V4.1 SP1 stand-alone upgrade (English/French/German/Italian), single license including STARTER, runtime software and documentation with data carrier for SIMOTION SCOUT	**6AU1810-■CA41-1XE0**
• on CD-ROM	**0**
• on DVD	**1**
Software maintenance service	
SIMOTION SCOUT software maintenance service current software version required	**6AU1810-0BA00-0XL0**
SIMOTION SCOUT stand-alone software maintenance service current software version required	**6AU1810-0CA00-0XL0**

Description	Order No.
Optional SCOUT packages	
Optional package SIMOTION CamTool V2.2 (English/German), single license, with data carrier	**6AU1810-0FA22-0XA0**
Optional package SIMOTION CamTool V2.2 upgrade (English/German), single license, with data carrier	**6AU1810-0FA22-0XE0**
DCC SIMOTION/SINAMICS V2.0 SP1 for SCOUT/STARTER V4.1 SP1 (single license, with DCC data carrier) DCC editor + DCB libraries for use on • SIMOTION V4.1 SP1 (German/English/French/Italian) • SINAMICS S120 V2.5 SP1 (German/English/French/Italian/Spanish)	**6AU1810-1JA20-1XA0**
DCC SINAMICS V2.0 SP1 for STARTER V4.1 SP1 (single license, with DCC data carrier) DCC editor + DCB library for use on SINAMICS S120 V2.5 SP1 (German/English/French/Italian/Spanish)	**6AU1810-1HA20-1XA0**

More information

A number of additional software products can be used in conjunction with SIMOTION SCOUT. It must be ensured that the corresponding versions of these software products are compatible. Please consult the "Compatibility table of the software products in the SIMOTION environment".

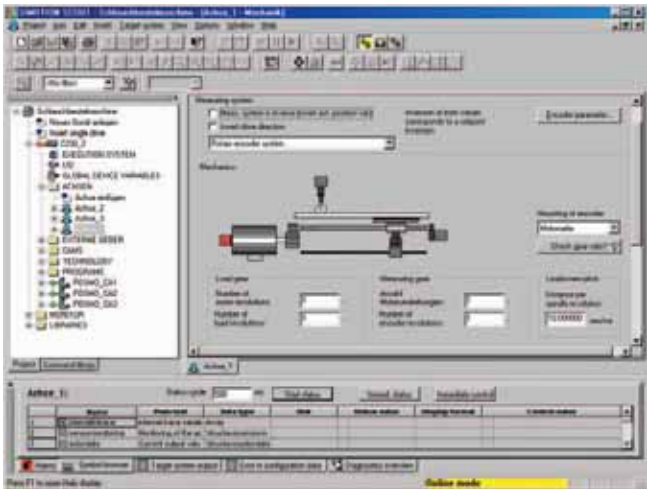
Additional information is available in the Internet under:

http://support.automation.siemens.com/WW/view/com/18857317

8

SIMOTION SCOUT basic functions
SCOUT Workbench

Overview



The SCOUT Workbench is the common frame for all tools of the engineering system. The Workbench is thus the central navigation point for the individual engineering steps. It is used for the creation and management of SIMOTION projects and provides a uniform and integrated view of all devices, data and programs.

The SCOUT Workbench:
Project navigator – Work area – Information area

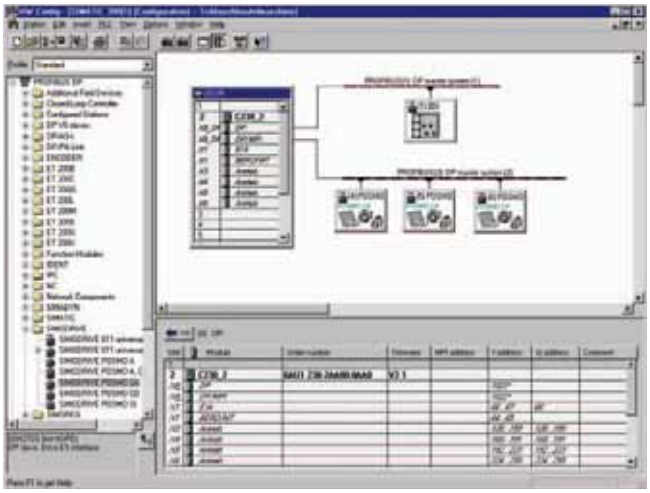
- Project navigator (left): The project navigator displays the technological tree structure of the project. All devices (controller, drives, etc.), all technological objects (axes, cam tracks, cams, etc.) and user programs are displayed in filterable hierarchical views. From here, new objects/programs can be created or existing ones called for modification.
- Work area (right): All editing tools of the engineering system (parameterization dialogs, program editors, etc.) can be integrated (SNAP IN) in this work area. This provides you with an individual view adapted to the situation in a fixed outer frame for each engineering task. If more than one window is open at the same time, they can be arranged as required or you can toggle between them by selecting the tabs.
- Information area (bottom): The situation-dependent views for data and messages provided by the detailed display can be activated and deactivated. The data involves system variables provided by the devices and the technological objects, the peripheral data (inputs/outputs) and the user variables that you have defined. Their current states for an online connection with the SIMOTION device can be visualized. The message view refers both to the messages and alarms reported online from the SIMOTION devices and to warnings and faults created during the program creation.

Benefits

- Integrated, function-oriented view optimized for ease-of-use
- Integrated intuitive engineering system
- Central data and program management, even for distributed systems
- Function-oriented, technological project structure with filterable views
- Fast access to individual engineering tools, e. g. configuration, programming, and commissioning

SIMOTION SCOUT basic functions
Hardware and network configuration

Overview



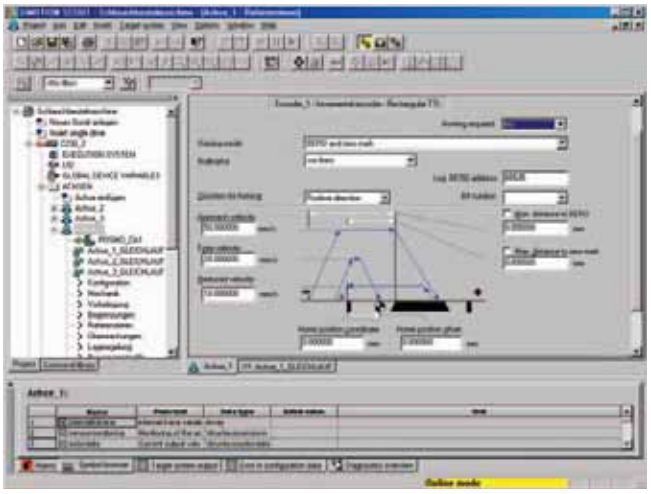
One of the first engineering steps to define the automation topology and assign parameters to the components and networks is to create:

- Hardware configuration
- Network configuration

To do so, SCOUT uses the STEP 7 tools HW-Config and NetPro.

You make selections from a hardware catalog to combine all required hardware components graphically in the work area, assign parameters to the components, and create bus connections between the individual components. You are warned immediately of any illegal inputs, so that only plausible configurations can be generated.

Overview



All SIMOTION controllers feature basic functions which are predefined by the SIMOTION Kernel. The scope of the language is compatible with the IEC 61131-3 standard and contains all of the necessary PLC commands for I/O management and process or machine control.

Additional functions such as positioning, synchronous operation, cams and temperature channels are available with loadable technology packages.

These technology packages permit the generation of technology objects which provide you with a very simple and uniform view of the functions of the technology packages.

There are many technology objects, but all are generated, configured and parameterized in the same way.

In addition, the technology objects have programming interfaces through which you can use the functionality from application programs.

Benefits

- Easy generation of the technology object for determining the quantity structure
  - Axes
  - Output cams and cam tracks
  - Measuring input
  - Cams, etc.
- Menu-guided parameterization, graphically supported for easy understanding
- Easy visualization and access to functions through system variables and system functions of the technology objects
- User-friendly diagnostic information for function optimization of the technology objects
- Meaningful alarms in the form of numbers and plain text in the event of errors

Function

Working with technology objects

A brief description of the individual engineering steps will be given using the example of the technology object "Axis".

Generating

A new axis object is generated by double-clicking the "Insert New Axis" tab.

Configuration

A wizard helps to specify object properties such as:

- Name of the axis
- Functionality
  (e. g. positioning axis or synchronized axis)
- Connection to the drive
  (e. g. SINAMICS S120 over PROFIBUS DP or PROFINET IO or an analog drive on SIMOTION C2xx)

After the axis has been generated or configured, it is displayed in the project tree along with additional tabs for parameterizing the axis and an option for generating other technological objects associated with the axis (e.g. cam paths, probes).

Assigning parameters

By double-clicking the "Referencing" tab, for example, all parameters for referencing can be set.

The "axis" object generated in this way also has a specified number of system variables which can be displayed in the detailed view when the axis is selected in the project tree.

The system variables are mainly used to visualize axis states such as:

- Display of the following error
- Target position to be reached
- Motion status
  (axis is accelerating, braking, motionless, etc.)

These system variables can also be used for:

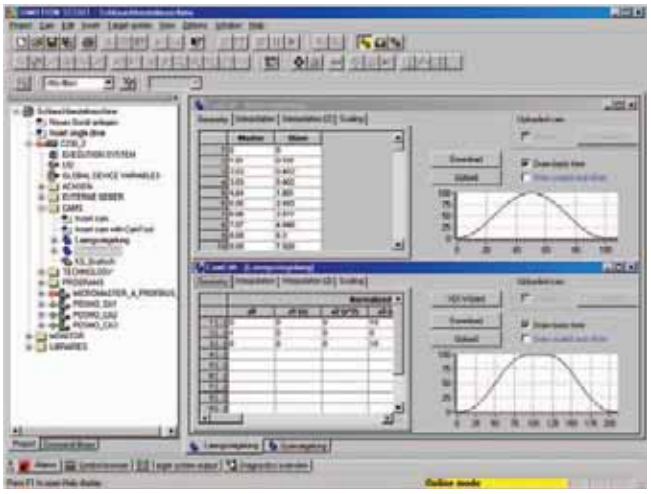
- Online diagnostics
- Display on HMI
- Logging with the SIMOTION trace functionality
- Application programming through querying/comparing these system variables.

Application programs access the axis functionality with system functions (selected from the command library), which are part of the "axis" object when it is generated.

The command _pos(axis:=Axis1, position:=100, velocity:=123) would cause axis "Axis1" to move to Position 100 with Velocity 123 (example for system function in Structured Text).

SIMOTION SCOUT basic functions
Creation of cams (basic)

Overview



A cam generally specifies the motion relationship between a leading axis (master axis) and a following axis (slave axis). Cams can also mirror velocity profiles, pressure characteristics or valve characteristic compensation for hydraulic axes. The cam technology object can process cams which are defined as support point tables or polynomial descriptions.

The basic scope of SCOUT contains editors to create simple cams in the form of text in a table or using polynomials (VDI assistant) in the form of graphics symbols with configuration support.

Benefits

- Editors for simple cams are already included in the basic configuration of SCOUT
- Graphics-based display of the cam to permit rapid detection of erroneous entries
- Display as interpolation point table with the option of importing from external sources (ASCII, Excel)
- Polynomials to the 6th degree with input support using polynomial description dialog and VDI wizard

Function

When the technological object "Cam" is generated, the type "Interpolation table" or "Polynomial" is defined.

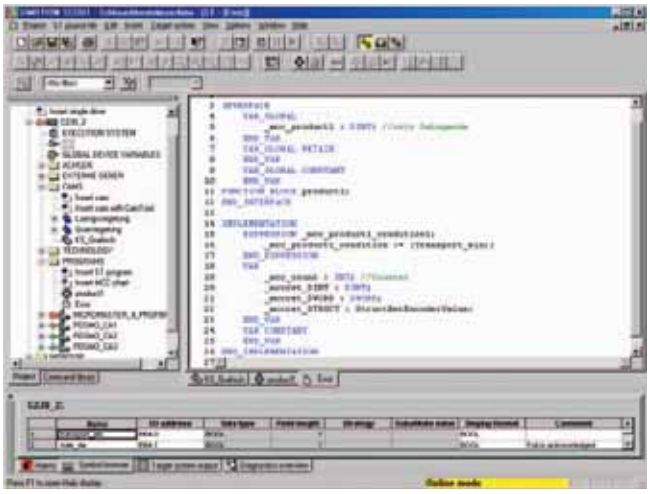
- Interpolation table:
  With this type, the master and slave positions are entered in a two-column table. It is also possible to use external tables (ASCII file, Excel table).
- Polynomials:
  Polynomials describe motion rules in accordance with VDI 2143. SIMOTION supports polynomials up to the 6th degree. In polynomial mode, the cam is described by a number of consecutive polynomials. Polynomials are entered in the form of a polynomial table. Users can use a polynomial description dialog and/or VDI assistant.

The result of the input is displayed in the right-hand side of the window in the form of a curve in the coordinate system.

In addition, other parameters such as the interpolation type between the curve support points or the scale of the cam can be specified. The SIMOTION CamTool option package can be used to display and optimize cams graphically.

SIMOTION SCOUT basic functions
Structured Text (ST)

Overview



The high-level language ST (Structured Text) provides all language elements as text commands. This enables well-structured applications to be created.

The basic scope of commands includes:

- Commands for data management
- Arithmetic functions
- Control structures
- Commands for accessing I/O and
- Communication functions.

The addition of technology packages for Motion Control adds powerful, extremely flexible Motion Control commands to the mix (e.g.: _pos(...) for position-controlled positioning axes). The system functions can be selected from a clearly arranged library and can be used in the ST source by means of drag & drop.

An ST source file basically consists of continuous text. This text can be structured by dividing it into sections. These sections represent logical units of an ST source.

These sections can be:

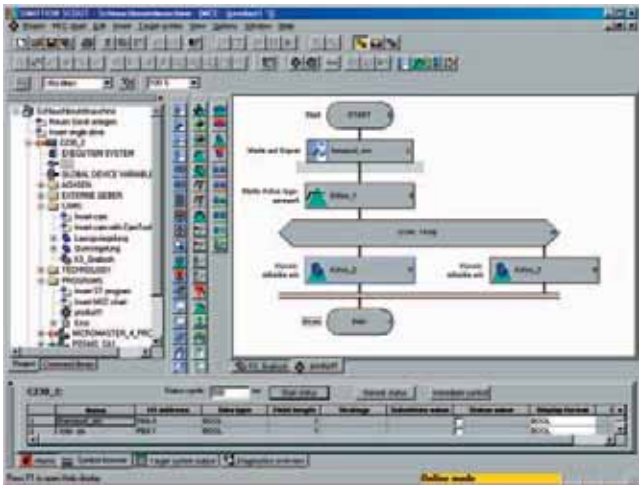
- A program that is assigned to a runtime level
- A function block with its own memory
- A function without its own memory

Function blocks and functions are not allocated to a runtime level, but are instead called in programs and supplied with parameters.

Benefits

- Motion Control, PLC, and technology functions in one language
- Well-structured programs with comment capability
- Powerful editing functions, such as syntax coloring and automatic indenting
- Easy-to-use debug functions for ONLINE testing and diagnostics: e. g. display of actual variable content of the code sequence and break points selected in the editor.

Overview



MCC (Motion Control Chart) is a "flow diagram language" that can be used to graphically formulate the process procedures of the machines in a simple manner. The result is one or more flow diagrams, comprising of MCC blocks that describe the time sequence of the individual machine actions. Due to its special means of expression, MCC (Motion Control Chart) is ideally suited to programming sequential processes.

Motion Control Chart supports the simple description of the motion sequences of machines with the help of powerful Motion Control commands, such as reference axis, position axis, synchronize or desynchronize cam, and many more.

Various MCC blocks are available for controlling the machine, for example, if conditions must be fulfilled, I/O signals can be read or set, calculations can be formulated and different control structures such as condition (IF), cases (CASE) and loops (WHILE, REPEAT UNTIL) can be programmed.

Several MCC programs may be created to describe different process situations. For example, you can create one MCC program to bring the machine to a defined initial state when it is switched on, a second MCC program for the normal production sequence, and a third MCC program to specify what the machine is to do in the event of a fault.

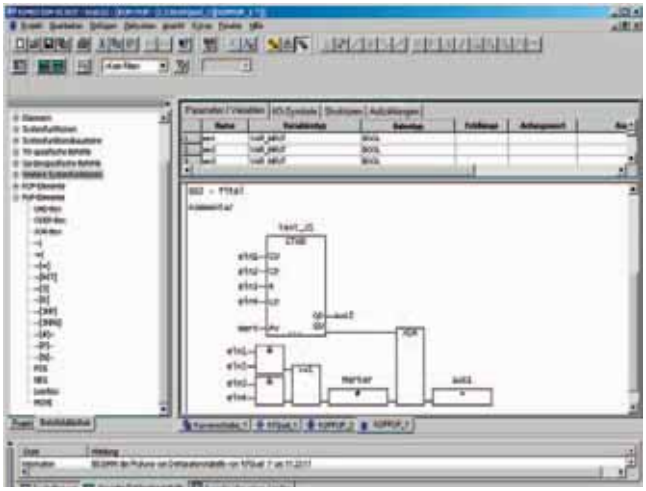
All MCC blocks – a selection of the most important SIMOTION functions – are available in toolbars. They are grouped according to function and are automatically inserted in the flow diagram at the point marked with a click. By clicking on different elements, individual dialog boxes are opened for further parameterization. Of course, it is also possible to include individual comments to document the process sequence. Functions from the SIMOTION command library that are not individually offered as MCC blocks can be used in an MCC program by means of a special command.

Benefits

- Easy to use thanks to graphical flowchart representation
- Hierarchical command library for motion control, PLC, and technology functions
- Control structures (IF, WHILE, CASE, etc.)
- Zoom-in functions for LAD, FBD and ST
- Subroutine calls (FB/FC)
- Structuring based on module creation, i.e. combination of command sequences to form a module command. Clicking on the module command invokes the corresponding command sequence.
- Powerful test functions for ONLINE connection with the SIMOTION controller such as graphical step tracing, single-step mode and breakpoints.

SIMOTION SCOUT basic functions – Ladder Diagram/Function Block Diagram (LAD/FBD)

Overview



A powerful editor for LAD/FBD programming is available for ladder diagrams (LAD) or function block diagrams (FBD).

LAD/FBD also include commands for SIMOTION control using standard logic functions. It is recommended that motion control tasks are programmed with PLCopen blocks. Also, blocks which have been programmed in other SIMOTION languages can be called from LAD/FBD. User-friendly functions such as "on the fly" variable declarations or automatic syntax checks are available when programming in LAD or FBD. It is possible to switch over between LAD and FBD in the editor at any time. Any program can be viewed and processed in either LAD or FBD.

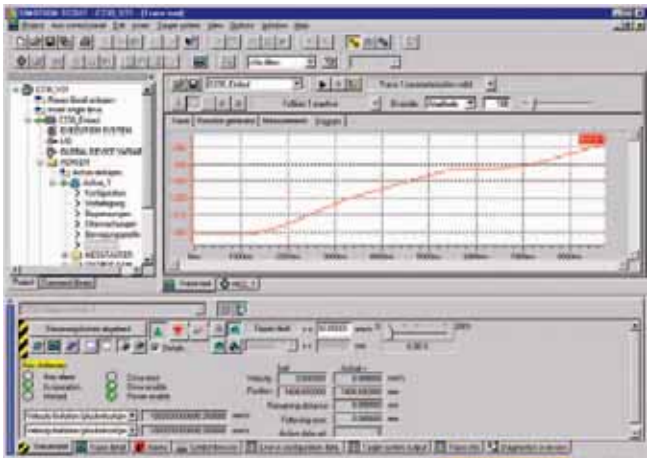
Benefits

- The LAD/FBD blocks are stored in the SIMOTION project
- Existing PLCopen, ST, LAD/FBD or MCC blocks can be called from within the LAD/FBD program.
- Network titles and comments are available.
- Special functions such as automatic syntax checking or "on the fly" variable declaration can be activated.
- The commands are loaded from a library

For startup and troubleshooting purposes, the status of the LAD/FBD program is displayed while in monitoring mode. In addition, break points can also be defined in LAD/FBD programs.

SIMOTION SCOUT basic functions Diagnostics for testing and commissioning

Overview



SCOUT includes a number of diagnostic tools to make testing and startup of SIMOTION applications as simple as possible:

- Device diagnostics can be used to display program execution status, system load and memory usage.
- The diagnostic buffer is used to log the fault history. The following events are logged in the diagnostic buffer of the SIMOTION device:
  - All system status changes (RUN, STOP, etc.)
  - System interrupts with date and time.
- All error messages related to technology objects (e.g. axis errors) are displayed in the Alarms window of SCOUT with the fault number and description.
- All SIMOTION system and application variables can be dynamically updated, monitored and controlled while online with the SIMOTION controller.
- All programming errors are displayed with the location and cause during compilation.
- The status display for programs with possible break points (LAD/FBD, MCC, ST) and additional step-by-step tracing (MCC) helps the user to troubleshoot and optimize their code. During program execution, the values of the variables are displayed as they arise, not only at the end of the cycle when the sum of all changes has been implemented.
- Watch tables can be used to combine important variables of different objects in the project to monitor them, even those of different SIMOTION devices.

Axis control panel

The axis control panel can be used to commission the axes with SIMOTION SCOUT. The axes can also be traversed and optimized without any user programs.

Overview (continued)

Trace function

The most powerful tool for testing and commissioning is the trace function integrated in SCOUT.

In this manner, a selection of any of the data in the system (user variables, I/O variables, data of the technology objects such as actual position of an axis) can be recorded and traced, real-time. Up to 32 signals are possible in test mode.

Each SIMOTION device has a trace buffer which can be configured with the trace functionality of SCOUT. When the trace is started, the configured data is logged in the SIMOTION device. On completion of the trace, the contents of the trace buffer is read by SCOUT and displayed graphically.

The trace function can be configured using the following parameters.

- Trigger condition (e.g. rising edge of a definable signal) and pre-trigger
- Time Limit Recording (a multiple of the basic cycle time of the SIMOTION device)
- Continuous Recording (or endless trace with ring buffer)
- System variables to be logged (system, I/O and user variables)

The logged data is displayed in the form of graphs over time for evaluation. The following functions are offered here:

- Different colors can be selected for the curves. Curves can be switched off and on again.
- The zoom function can be used to show details.
- Rules support the measuring of, for example, signal level and duration.
- Possible changes can be viewed by superimposing measuring curves from different trace logs.

Apart from recording, the trace function also offers a "function generator" and mathematical functions.

The traced curves can be stored or exported to Microsoft Excel as a table for further evaluation. Of course, the plots can also be stored for documentation purposes, inserted in documents or printed out.

Automatic optimization of the control loops

Automatic optimization of the control loops makes commissioning of the axes and drives particularly easy. For SINAMICS S120 drives, the parameters for the speed controller and the position controller are automatically determined (with DSC).

Integrated measuring functions

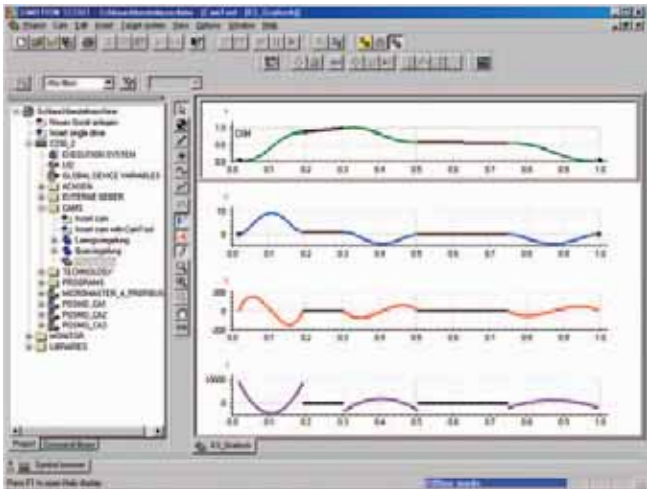
The integrated measuring functions support the recording of, for example, step responses for optimization as well as the detection of electromagnetic weak points or resonant frequencies (using, for example, bode diagrams and FFT analysis). Electronic filters can be optimally placed at these resonant frequencies to achieve higher dynamics.

Benefits

- Numerous easy-to-use and expressive diagnostic tools are fully integrated in SCOUT
- Extremely useful support with optimizing and troubleshooting
- All information can be printed in the form displayed on the screen for documentation purposes.
- Axis control panel for commissioning and optimizing the axes without the need for an application program
- Automatic controller optimization for fast commissioning

Optional SIMOTION SCOUT packages CamTool (graphical cam editor)

Overview



SIMOTION CamTool is a powerful, graphical editor for creating and optimizing cams.

SIMOTION CamTool can be used as an expansion package for SIMOTION SCOUT and is completely integrated in the SCOUT environment.

Benefits

- Precise, graphic display of the CAM profile
- Entries can be made quickly and easily by inserting curve elements with drag-and-drop operation
- Fast and easy optimization of the curve by means of "dragging the profile"
- Simultaneous display of position, speed, acceleration, and jerk characteristics immediately indicates the effect on the maximum speed, the required motor torque, and the mechanical load
- Curve can also be optimized in relation to speed, acceleration, or jerk
- Basic principles of motion correspond to VDI 2143

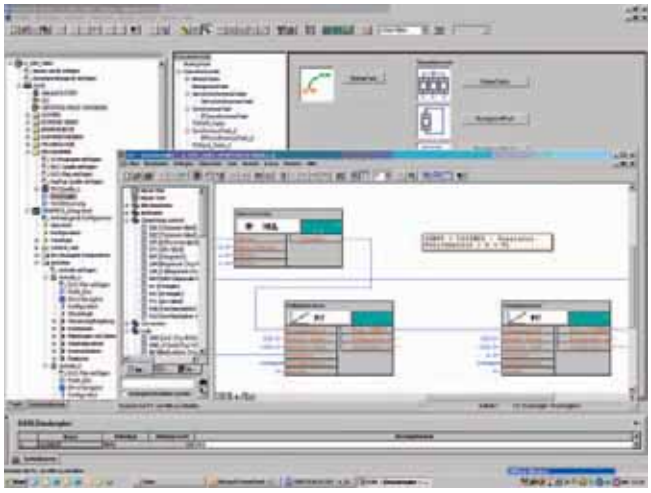
Function

- The curve is displayed graphically in an x-y-diagram (positions of master and following axes). The curve profile is first roughly entered here with individual elements such as fixed points, lines and support points. Lines can be entered as straight lines, sine curves or arc sine curves.
- SIMOTION CamTool then connects these individual elements automatically to form a continuous curve. The transitions between the individual curve sections are automatically shaped as smooth as possible.
- You can optimize the curve by simply moving the specified curve sections with the mouse. The curve profile immediately adapts to your changes.
- In addition, SIMOTION CamTool can display the effects on the velocity, acceleration and jerk of the following axis over the motion of the leading axis.
- SCOUT can be used to convert cams created with CamEdit to the format used by CamTool or vice versa.

Selection and ordering data

Selection and ordering data for the optional CamTool package can be found under "SIMOTION SCOUT software package" on page 8/61.

Overview



The Drive Control Chart (DCC) option packages for SIMOTION and SINAMICS extend the possibilities of SIMOTION SCOUT and the STARTER commissioning tool to graphically configure technology functions using predefined function blocks.

Multi-instance function blocks are selected from a library and are graphically interconnected using drag and drop capability. The function block library comprises of a large number of control, calculation and logic blocks as well as extensive open and closed-loop control functions. Numerous calculation functions, such as summation, division and minimum/maximum evaluation are available for monitoring and evaluating numeric variables.

Drive Control Chart (DCC) does not limit the number of functions that can be used.

Benefits

- Clear visualization of technical control structures
- High degree of reusability of previously created plans
- Graphical editor for configuring open and closed-loop control functions which can be operated without any programming know-how
- With Drive Control Chart for SIMOTION, closed-loop control structures can be programmed almost without constraints. These can then be combined with other programs to form complete program functionality.
- Drive Control Chart for SINAMICS S120 provides a convenient basis for implementing drive tasks directly in the converter.

Selection and ordering data

Selection and ordering data for the option package Drive Control Chart (DCC) can be found under "SIMOTION SCOUT software package" on page 8/61.

More information

For further information about Drive Control Chart (DCC), refer to the section "System description".

● Basic version (function or license is purchased with the device or SCOUT) ○ Option (must be acquired as a software license or as hardware) – Not possible		SIMOTION C	SIMOTION P	SIMOTION D
	Note	C2xx	P350-3	D4xx
SIMOTION hardware platforms				
System cycles/performance				
PROFIBUS DP cycle	For integrated drives with D445: 0.5 ... 8 ms	in 0.25 ms steps: C230-2: 1.5 ... 8 ms C240: 1 ... 8 ms	in 0.125 ms steps: 1 ... 8 ms	in 0.125 ms steps: D410 DP: 2 ... 8 ms D425: 2 ... 8 ms D435/D445: 1 ... 8 ms
PROFINET cycle		–	In 0.125 ms steps: 0.25 ... 4 ms	In 0.125 ms steps: 0.5 ... 4 ms
Minimum position control cycle		C230-2: 1.5 ms C240: 1 ms	0.25 ms	D410: 2 ms D425: 2 ms D435: 1 ms D445: 0.5 ms
Position control cycle and interpolation cycle (IPO) are a multiple of the PROFIBUS/PROFINET cycle	Adjustable transformation ratio			
• Position control cycle to PROFIBUS cycle		1:1, 2:1	1:1 ... 4:1	1:1 ... 4:1
• Position control cycle to PROFINET cycle		–	1:1 ... 16:1	1:1 ... 16:1
• Interpolation cycle 1 (IPO1) to position control cycle		1:1 ... 6:1	1:1 ... 6:1	1:1 ... 6:1
• Interpolation cycle 2 (IPO2) to interpolation cycle 1 (IPO1)		2:1 ... 64:1	2:1 ... 64:1	2:1 ... 64:1
With Dynamic Servo Control (DSC), the control loop of the position controller is located in the drive (with cycles of 125 µs or higher)	With SINAMICS S120, SIMODRIVE and MASTERDRIVES MC	●	●	●

Notes:

With SIMOTION P and SIMOTION D, the availability of a PROFIBUS or PROFINET interface depends on the variant used (e.g. D410 DP or D410 PN) or on the communications modules used (e.g. MCI-PN Communication Boards with P350-3 or CBE30 with D4x5). This information is not explicitly provided for every connection option or function.

The performance requirements for a SIMOTION application can be estimated using the SIZER configuring tool. For further information about SIZER, refer to the section "System description".

● Basic version (function or license is purchased with the device or SCOUT) ○ Option (must be acquired as a software license or as hardware) – Not possible		SIMOTION C	SIMOTION P	SIMOTION D
	Note	C2xx	P350-3	D4xx
SIMOTION hardware platforms (continued)				
Memory				
• Exchangeable memory media	MMC: Micro Memory Card CF: CompactFlash Card	MMC C230-2: 32 MB C240: 64 MB	File(s) on hard disk	CF 512 MB
• Remanent user variable (retain variable)	SIMOTION P: with UPS up to 256 KB	C230-2: 12 KB C240: 100 KB	15 KB	D410: 7 KB D4x5: 320 KB
• Permanent memory for user data (data storage on exchangeable memory medium)		C230-2: 26 MB C240: 58 MB	Any	300 MB
• Load memory (RAM disk) for user data (for downloading the configuration and programs)	Memory sizes can be configured with SIMOTION P	C230-2: 16 MB C240: 20 MB	16 MB	D410: 17 MB D425/ D435: 17 MB D445: 23 MB
• User memory (user RAM) (for code and data)		C230-2: 16 MB C240: 21 MB	14 MB	D410: 25 MB D425/D435: 25 MB D445: 50 MB
Address range				
• Logical I/O address space in KB		C230-2: 2 C240: 4	4	16
• Physical I/O address space in KB	When PROFIBUS and PROFINET are used, the total address space applies			
- PROFIBUS: max. per ext. subnet each for inputs and outputs		1	1	1
- PROFINET: max. for inputs and outputs (each):		–	4	4
• Permanent process image for background task (I/O variables) in bytes		64	64	64
• Additional configurable process image for each cyclic task (I/O variables)		●	●	●
• Address space per PROFIBUS DP station in bytes		244	244	244
• Address space per PROFINET device in bytes		–	1400	1400

● Basic version (function or license is purchased with the device or SCOUT) ○ Option (must be acquired as a software license or as hardware) – Not possible		SIMOTION C	SIMOTION P	SIMOTION D
	Note	C2xx	P350-3	D4xx
Drives on SIMOTION				
Maximum number of axes	Higher number of axes possible using multiple synchronized devices D410: max. 1 real axis; additional virtual axes can be created	32 axes	64 axes	D410: 1 axis D425: 16 axes D435: 32 axes D445: 64 axes
Integrated drive control (in combination with SINAMICS S120)	SIMOTION D: with D435 and D445 more are possible via CX32	–	–	D410: Servo: 1 Vector: 1 *V/f*: 1 D4x5: Servo: 1..6 Vector: 1..4 *V/f*: 1..8
Speed-controlled axis over PROFIBUS DP • SINAMICS S / SINAMICS G (servo, vector control) • SIMODRIVE 611 universal • SIMODRIVE POSMO CA • SIMODRIVE POSMO CD • SIMODRIVE POSMO SI • SIMOVERT MASTERDRIVES MC • SIMOVERT MASTERDRIVES VC • MICROMASTER/MICROMASTER Vector • MIDIMASTER Vector • COMBIMASTER/MICROMASTER Integrated • Drives with speed profile in accordance with standard message frames (PROFIdrive profile 1-6)	SIMOTION D: SINAMICS as the standard drive technology	●	●	● (D4x5)
Intelligent positioning motor over PROFIBUS DP • SIMODRIVE POSMO A	Standard functions available in SCOUT command library	●	●	●

● Basic version (function or license is purchased with the device or SCOUT)
○ Option (must be acquired as a software license or as hardware)
– Not possible

	Note	SIMOTION C	SIMOTION P	SIMOTION D
		C2xx	P350-3	D4xx
Drives on SIMOTION (continued)				
Position-controlled axis over PROFIBUS DP with PROFIdrive	SIMOTION D: SINAMICS as the drive technology as standard	●	●	● (D4x5)
• SINAMICS S120 (Blocksize, Booksize and Chassis formats)				
- Servo control	Also linear motor (see Catalog NC 61)			
- Vector control	With external encoder (limited dynamic response)			
• SIMODRIVE 611 universal	Also linear motors			
• SIMODRIVE POSMO CA				
• SIMODRIVE POSMO CD				
• SIMODRIVE POSMO SI				
• SIMOVERT MASTERDRIVES MC				
• SIMOVERT MASTERDRIVES VC	With external encoder (limited dynamic response)			
• MICROMASTER MM4				
• Certified servo, vector or stepper drives in accordance with standard message frames (PROFIdrive profile 1-6)				
Speed and position-controlled axis over PROFINET IO with IRT (PROFIdrive)		–	○	○ (D4x5)
• SINAMICS S120 (Blocksize, Booksize and Chassis formats)				
- Servo control	Also linear motor (see Catalog NC 61)			
- Vector control	With external encoder (limited dynamic response)			
Drives with analog ±10 V setpoint interface				
• Integrated I/Os	Configuration either as analog or stepper drive	4	–	–
• ADI 4 (Analog Drive Interface for 4 axes)	ADI 4/IM 174, see "SIMOTION I/O components"	●	●	● (D4x5)
• IM 174 (interface module for 4 axes)		●	●	● (D4x5)
Hydraulic drives over ±10 V setpoint interface				
• Integrated I/Os	Note: With D410, the max. number of real axes is 1.	4	–	–
• Analog outputs through I/O		●	●	●
• ADI 4 (Analog Drive Interface for 4 axes)		●	●	● (D4x5)
• IM 174 (interface module for 4 axes)		●	●	● (D4x5)
• Encoders through I/O		●	●	●
Stepper drives				
• Integrated I/Os with pulse direction interface	Configuration either as analog or stepper drive	4	–	–
• IM 174 (interface module for 4 axes)		●	●	● (D4x5)

● Basic version (function or license is purchased with the device or SCOUT)
○ Option (must be acquired as a software license or as hardware)
– Not possible

	Note	SIMOTION C	SIMOTION P	SIMOTION D
		C2xx	P350-3	D4xx
Encoders on SIMOTION				
Connectable measuring systems integrated	See "Measuring systems"			
Number	SIMOTION D4x5: Encoder connection over Motor Modules (DRIVE-CLiQ)	4	–	1 (D410) – (D4x5)
Absolute encoder connection with SSI interface		●	–	● (D410) – (D4x5)
Incremental measuring systems with TTL		●	–	● (D410) – (D4x5)
Measuring systems that can be connected over the bus				
Resolver, absolute encoder (SSI and EnDat), incremental encoder (TTL and sin/cos)	Connected through drive or ADI 4/IM 174 (ADI 4/IM 174 for SSI absolute encoder and TTL incremental encoder)	●	●	●
Connection options for second encoder (external encoder)				
Integrated interfaces		●	–	–
Second encoder acquisition in SIMOVERT MASTERDRIVES MC	Option for SIMOVERT MASTERDRIVES MC	●	●	–
SIMODRIVE 611 universal over second axis control (Double Motor Module)	Option for SIMODRIVE 611 universal	●	●	–
SINAMICS S120	SIMOTION D: Encoder connection over motor modules (DRIVE-CLiQ)	●	●	●
Isochronous PROFIBUS encoder	See "Measuring systems"	●	●	●
Encoder on ADI 4 (Analog Drive Interface for 4 axes)	At least one electric or hydraulic axis must be configured on ADI 4 / IM 174.	●	●	● (D4x5)
Encoder on IM 174 (interface module for 4 axes)		●	●	● (D4x5)

● Basic version (function or license is purchased with the device or SCOUT) ○ Option (must be acquired as a software license or as hardware) – Not possible	Note	SIMOTION C C2xx	SIMOTION P P350-3	SIMOTION D D4xx
Measuring inputs				
Integrated measuring inputs				
• Number		C230-2: 2 C240: 2+4	–	D410: 3 D4x5: 6
• Accuracy		6 µs		5 µs
Measuring inputs on the drives				
• SIMODRIVE 611 universal, SIMOVERT MASTERDRIVES MC		1/axis	1/axis	–
• SINAMICS S120 (CU320)		6/closed-loop control	6/closed-loop control	6/closed-loop control
• SINAMICS S120 (CU310)		3/closed-loop control	3/closed-loop control	3/closed-loop control
• Over TM15 Terminal Module on SINAMICS S120 or SIMOTION D	See "SIMOTION I/O components"			
- Accuracy		125 µs	125 µs	125 µs
- Number of measuring inputs per Terminal Module, max.		24	24	24
• Over TM17 High Feature Terminal Module on SINAMICS S120 or SIMOTION D	See "SIMOTION I/O components"			
- Accuracy		≤ 1 µs	≤ 1 µs	≤ 1 µs
- Number of measuring inputs per Terminal Module, max.		16	16	16
Cam outputs				
High-speed output cams (hardware-supported cam outputs with higher resolution)				
• Integrated cam outputs		●	–	●
- Accuracy		C230-2: 140 µs C240: 70 µs	–	D410: 200 µs D4x5: 125 µs
• Over TM15 Terminal Module on SINAMICS S120 or SIMOTION D	See "SIMOTION I/O components"			
- Accuracy		125 µs	125 µs	125 µs
• Over TM17 High Feature Terminal Module on SINAMICS S120 or SIMOTION D	See "SIMOTION I/O components"			
- Accuracy		≤ 10 µs	≤ 10 µs	≤ 10 µs
Standard output cams (update in position controller or interpolation cycle, switching accuracy depends on the output accuracy of the I/O)				
• Integrated cam outputs		●	–	●
• Over TM15 / TM17 High Feature Terminal Module on SINAMICS S120 or SIMOTION D	See "SIMOTION I/O components"	●	●	●
• Over S7-300 backplane bus of SIMOTION C		●	–	–
• Over PROFIBUS DP		●	●	● (D4x5, D410 DP)
• Over PROFINET IO		–	● (PROFINET version)	● (D410 PN) ○ (D4x5)
• Output to internal system variable		●	●	●

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● Basic version (function or license is purchased with the device or SCOUT)
○ Option (must be acquired as a software license or as hardware)
– Not possible

	Note	SIMOTION C	SIMOTION P	SIMOTION D
		C2xx	P350-3	D4xx
Integrated I/O interfaces				
Programmable digital inputs/outputs (can be parameterized individually as either input or output)	Further inputs/outputs can be implemented for cam output or measuring inputs via the TM15 or TM17 High Feature Terminal Modules.	–	–	D410: 4 D4x5: 8
• of which for cam output, max.		–	–	D410: 4 D4x5: 8
• of which as measuring inputs, max.		–	–	D410: 3 D4x5: 6
Digital inputs (fixed inputs, cannot be parameterized)		18	–	D410: 4 D4x5: 8
• of which inputs with specific functions				
- Measuring inputs, max.		C230-2: 2 C240: 2+4	–	–
- External zero mark signal for referencing, max.		4	–	–
Digital outputs (fixed outputs, cannot be parameterized)		8	–	–
• of which for fast cam output, max.		8	–	–
Relay outputs with specific functions				
• Controller enable		4	–	–
• Ready		1	–	–
Analog outputs	SIMOTION C: C230-2: Can only be used as a drive interface. C240: Can be used as drive interface or standard analog outputs. SIMOTION D: D410: Over TM. D4x5: Over TM or TB. See "SIMOTION I/O components"	4	–	○
Pulse direction interface for stepper drives	SIMOTION C: each, as alternative to analog drive.	4	–	–
SIMOTION C centralized I/O modules	(see also "SIMOTION I/O components")			
• Centralized I/O – modules per system, max.		16	–	–
• Central/expansion rack, max.	SIMOTION C: max. two-tier configuration with IM 365 interface module	○	–	–
• Connectable central SIMATIC S7-300 I/O	For modules that can be used, see "SIMOTION I/O components"	●	–	–

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● Basic version (function or license is purchased with the device or SCOUT)
○ Option (must be acquired as a software license or as hardware)
– Not possible

	Note	SIMOTION C	SIMOTION P	SIMOTION D
		C2xx	P350-3	D4xx
Distributed I/Os	(see also "SIMOTION I/O components")			
SINAMICS drive I/O (over DRIVE-CLiQ)				
• TM15, TM17 High Feature, TM31, TM41 Terminal Modules	For connection to SIMOTION C and P over SINAMICS S120	●	●	●
• TB30 Terminal Board	Plug-in card for SIMOTION D4x5 and SINAMICS CU320	●	●	– (D410) ● (D4x5)
Distributed I/O (over PROFIBUS DP) • ET 200S • ET 200pro • ET 200M • ET 200eco • ADI 4 (Analog Drive Interface for 4 axes) • IM 174 (Interface Module for 4 axes) • All certified standard slaves (DP-V0, DP-V1, DP-V2)	For modules that can be used, see "SIMOTION I/O components" Isochronous: ET 200S, ET 200M, ADI 4, IM 174	●	●	● (D410 DP, D4x5)
Distributed I/Os (over PROFINET IO) • ET 200S • ET 200M • ET 200pro	Isochronous: ET 200S	–	○	● (D410 PN) ○ (D4x5)

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● Basic version (function or license is purchased with the device or SCOUT) ○ Option (must be acquired as a software license or as hardware) – Not possible		SIMOTION C	SIMOTION P	SIMOTION D
	Note	C2xx	P350-3	D4xx
SIMOTION HMI	(see also "SIMOTION Human Machine Interface")			
Connectable HMI devices				
Connection via PROFIBUS DP		●	●	●
• SIMATIC MP 170 Mobile Panel				
• SIMATIC MP 177 DP Mobile Panel				
• SIMATIC MP 277 Mobile Panel				
• SIMATIC TP 170B and TP 270 Touch Panel				
• SIMATIC TP 177B and TP 277 Touch Panel				
• SIMATIC OP 170B and OP 270 Operator Panel				
• SIMATIC OP 177B and OP 277 Operator Panel				
• SIMATIC MP 270B and MP 370 Multi Panel				
• SIMATIC MP 277 and MP 377 Multi Panel				
• SIMATIC Panel PC 477, PC 670, PC 677, PC 877				
Connection over Ethernet (when configured using ProTool/Pro)		●	●	●
• SIMATIC Panel PC 477, PC 670, PC 677, PC 877				
Connection over Ethernet/PROFINET (when configured using WinCC flexible)		●	●	●
• SIMATIC MP 177 PN Mobile Panel *)				
• SIMATIC MP 277 Mobile Panel *)				
• SIMATIC TP 277 Touch Panel *)				
• SIMATIC TP 177B Touch Panel Color *)				
• SIMATIC OP 177B Operator Panel Color *)				
• SIMATIC TP 270 Touch Panel				
• SIMATIC OP 270 Operator Panel				
• SIMATIC OP 277 Operator Panel *)				
• SIMATIC MP 270B and MP 370 Multi Panel				
• SIMATIC MP 277 *) and MP 377 *) Multi Panel				
• SIMATIC Panel PC 477, PC 577, PC 670, PC 677, PC 877				
HMI Software				
• WinCC flexible		○	○	○
• ProTool/Pro		○	○	○
• SIMATIC NET OPC server	See "SIMOTION Runtime Software"	○	○	○
• SIMOTION IT OPC XML-DA (over Ethernet) - Open communication over TCP/IP and SOAP standard protocols - Clients on any hardware with various operating systems (Windows, Linux, etc.) - According to OPC Foundation standard OPC XML-DA V1.01		○	○	○

*) PROFINET IO capable

● Basic version (function or license is purchased with the device or SCOUT) ○ Option (must be acquired as a software license or as hardware) – Not possible		SIMOTION C	SIMOTION P	SIMOTION D
	Note	C2xx	P350-3	D4xx
Communication				
PROFIBUS DP interfaces				
• Onboard/support isochronous communication	One interface can be used as MPI. SIMOTION P350-3: The PROFIBUS version can be optionally equipped with PROFINET.	2/2	PROFIBUS version: 2/2 PROFINET version: 0/0	D410 DP: 1/1 D410 PN: 0/0 D4x5: 2/2
• Integrated CP5611	For PG/PC and HMI	–	1	–
• Baud rates in Mbaud (transfer rates in Mbit/s)		1.5; 3; 6; 12	1.5; 3; 6; 12	1.5; 3; 6; 12
• Number of PROFIBUS DP slaves	Per PROFIBUS DP subnet	64	64	64
PROFINET interfaces				
• Ports for MCI-PN Board (standard with SIMOTION P350-3 PROFINET version, retrofittable for PROFIBUS version)		–	○, 4	–
• Ports for CBE30 board (retrofittable for SIMOTION D4x5)		–	–	○, 4
• Integrated D410 PN ports		–	–	●, 2
• Number of PROFINET devices		–	64	64
Integrated interfaces				
• Ethernet		1 x 10/100 Mbit/s	2 x 10/100 Mbit/s	D410: – D4x5: 2 x 10/100 Mbit/s
• Serial interface		–	1	–
• USB interface	e.g. for mouse and keyboard	–	4 x USB 2.0	–
• DRIVE-CLiQ interface		–	–	D410: 1 D425/D435: 4 D445: 6
Connections over PROFIBUS DP and Ethernet/PROFINET	No PROFINET on SIMOTION C			
The connection resources can be assigned as required, over PROFIBUS DP or Ethernet.				
• PROFIBUS DP		●	●	●
• Ethernet/PROFINET		●/–	●	●
Online connections, max.		16	16	16
• Basic communication Xsend / Xreceive (not via Ethernet)		5	5	5
• Engineering system SCOUT (SCOUT reserves up to 3 connections)		1	1	1
• HMI		5	5	5
• OPC		●	●	●

● Basic version (function or license is purchased with the device or SCOUT)
○ Option (must be acquired as a software license or as hardware)
– Not possible

	Note	SIMOTION C	SIMOTION P	SIMOTION D
		C2xx	P350-3	D4xx
Communication (continued)				
Communication functions over PROFIBUS between:	Basic version with regard to SIMOTION	●	●	●
• SIMOTION – SIMATIC HMI/WinCC flexible - HMI data exchange: Support from the SIMOTION operating system - Plant-wide access to process data and displays - Interrupt mechanism: Alarms are event-driven				
• SIMOTION – SIMATIC HMI/ProToolPro - HMI data exchange: Support from the SIMOTION operating system - Interrupt mechanism: Alarms are event-driven				
• SIMOTION – SIMOTION - Distributed I/O mechanisms Process image, e.g. (% I1.3) I/O variables (symbolic) - XSND/XRCV, max. 200 bytes				
• SIMOTION – SIMATIC S7 - Distributed I/O mechanisms Process image, e.g. (% I1.3) I/O variables - XSND/XRCV, max. 76 bytes				
• SIMOTION – SIMATIC NET OPC				
• SIMOTION – PG/PCs with STEP 7 and SCOUT				
• PROFIBUS DP slave-to-slave communication				
Communication functions over PROFINET IO between:	Basic version with regard to SIMOTION			
• SIMOTION – SIMOTION - Distributed I/O mechanisms Process image, e.g. (% I1.3) I/O variables (symbolic)	Currently no PROFINET on SIMOTION C	–	●	●
• SIMOTION – SIMATIC S7 - Distributed I/O mechanisms Process image, e.g. (% I1.3) I/O variables - For SIMATIC – SIMOTION: SIMOTION as I-Device - For SIMOTION – SIMATIC: over SIMATIC CP		–	●	●
• Slave-to-slave communication between SIMOTION controllers		–	●	●

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● Basic version (function or license is purchased with the device or SCOUT)
○ Option (must be acquired as a software license or as hardware)
– Not possible

	Note	SIMOTION C	SIMOTION P	SIMOTION D
		C2xx	P350-3	D4xx
Communication (continued)				
Communication functions over Ethernet/PROFINET between:	SIMOTION C: Functions only available over Ethernet; currently no PROFINET with SIMOTION C			
• SIMOTION – SIMATIC HMI/WinCC flexible - HMI data exchange: Support from the SIMOTION operating system - Plant-wide access to process data and displays - Interrupt mechanism: Alarms are event-driven		●	●	●
• SIMOTION – SIMATIC HMI/ProToolPro - HMI data exchange: Support from the SIMOTION operating system - Interrupt mechanism: Alarms are event-driven		●	●	●
• SIMOTION – SIMATIC NET OPC		●	●	●
• SIMOTION – OPC-XML clients		○	○	○
• SIMOTION – PG/PCs with STEP 7 and SCOUT		●	●	●
• Ethernet/PROFIBUS DP routing		●	●	●
UDP and TCP/IP communication functions over Ethernet/PROFINET between: • SIMOTION – SIMOTION • SIMOTION – SIMATIC • SIMOTION – PC	SIMOTION C: Functions only available over Ethernet; currently no PROFINET with SIMOTION C	●	●	●
Serial communication via a point-to-point connection	Basic version with regard to SIMOTION			
• CP 340 and CP 341 communication modules		●	●	●
• 1SI communication module (connected over ET 200S)		●	●	●
Communication via AS-Interface	Basic version with regard to SIMOTION			
• CP 343-2 P communication module		●	●	●
• DP/AS-Interface link 20E and DP/AS-Interface link Advanced		●	●	●
• IE/AS-Interface link PN IO		●	●	●
Connectable network couplers	Basic version with regard to SIMOTION			
• DP/DP coupler for connecting two PROFIBUS DP networks		●	●	●
• PN/PN coupler for connecting two PROFINET IO networks		–	●	●

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● Basic version (function or license is purchased with the device or SCOUT) ○ Option (must be acquired as a software license or as hardware) – Not possible		SIMOTION C	SIMOTION P	SIMOTION D
	Note	C2xx	P350-3	D4xx
SIMOTION Kernel	(see also "SIMOTION Runtime Software")			
Execution system				
• Task structure / program execution				
- BackgroundTask (cyclic)	Adjustable monitoring time	1	1	1
- TimerInterruptTasks (time-controlled as of 1 ms)		5	5	5
- MotionTasks (sequential)		20	32	32
- ServoSynchronousTask (cyclic, synchronous with the position control cycle)		1	1	1
- IPOSynchronousTask (cyclic, synchronous with the interpolation cycle)		2	2	2
- InterruptTasks (for user) (event-driven)		2	2	2
- TControlTasks (temperature control)		5	5	5
- StartupTask (for transition from STOP to RUN)		1	1	1
- ShutdownTask (for transition from RUN to STOP)		1	1	1
• Task structure / error processing (SystemInterruptTasks)	Central troubleshooting is possible			
- ExecutionFaultTask (starts in the event of an error when executing a program)		1	1	1
- TechnologicalFaultTask (starts in the event of an error on a technology object)		1	1	1
- PeripheralFaultTask (starts in the event of an error on the I/O)		1	1	1
- TimeFaultTask (starts in the event of a TimerInterruptTask timeout)		1	1	1
- TimeFaultBackgroundTask (starts in the event of a BackgroundTask timeout)		1	1	1
• Program organization		●	●	●
- Units (source program) - Programs - Function blocks (FBs) - Functions (FCs)				
- System functions (SFs)				
- Libraries				

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● Basic version (function or license is purchased with the device or SCOUT) ○ Option (must be acquired as a software license or as hardware) – Not possible		SIMOTION C	SIMOTION P	SIMOTION D
	Note	C2xx	P350-3	D4xx
SIMOTION Kernel (continued)				
PLC operation set (according to IEC 61131-3; optionally expandable with technology functions)		●	●	●
System functions, e.g. for • Interrupt and error handling • Copying data • Clock functions • Diagnostic functions • Module parameterization • Operating mode transitions, Run/Stop • Reading and writing of data blocks from the user program from and to an exchangeable memory medium • DPV1 communication to DP slaves • Read/write drive parameters • DP slaves/PROFINET devices can be connected to and disconnected from application • DP slave and IP address can be set in user program • DP station diagnostics • Activate/deactivate technology objects • Counter (IEC commands) • Timer (IEC commands) • Real-time clock, format [DATE_AND_TIME]		●	●	●

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● Basic version (function or license is purchased with the device or SCOUT) ○ Option (must be acquired as a software license or as hardware) – Not possible		SIMOTION C	SIMOTION P	SIMOTION D
	Note	C2xx	P350-3	D4xx
Technology packages	(see also "SIMOTION Runtime Software")			
Motion Control technology package				
With the technology functions: • Motion Control Basic		●	●	●
• POS – Positioning	Use of the functions during runtime is subject to license. SIMOTION D410 already contains the Motion Control technology functions for one real axis (speed, positioning, synchronous axis or cam); no license is required for this.	○	○	○
• GEAR – Synchronous operation		○	○	○
• CAM – Cam		○	○	○
• PATH – path interpolation		○	○	○
The technology package functions are accessed via language commands, system variables and through function blocks in accordance with PLCopen.				
Axis types				
• Electrical / hydraulic / stepper motor axes		●	●	●
• Speed-controlled axis		●	●	●
• Positioning axes - Rotary axis - Linear axis - Modulo for linear and rotary axes - Force/pressure-controlled axis - Force/pressure-limited axis	Included with POS license or higher	○	○	○
• Synchronous axis	Included with GEAR license or higher	○	○	○
• Path axis	Included with GEAR license or higher	○	○	○
• Cam axis	Included with CAM license or higher	○	○	○
• Virtual axis		●	●	●
• Simulation axis		●	●	●
Unit system				
• Metric (mm, m, Nm, Pa, etc.)		●	●	●
• US (inch, feet, PSI, lb, etc.)		●	●	●
Axis monitoring functions				
The activated monitoring functions are executed cyclically. • Watchdog • Hardware and software limit switches • Position/zero-speed monitoring • Dynamic following error monitoring • Encoder monitoring, cable break • Force/pressure monitoring • Setpoint • Plausibility in data exchange		●	●	●

● Basic version (function or license is purchased with the device or SCOUT) ○ Option (must be acquired as a software license or as hardware) – Not possible		SIMOTION C	SIMOTION P	SIMOTION D
	Note	C2xx	P350-3	D4xx
Technology packages (continued)				
TControl technology package				
• With technology functions for temperature control		○	○	○
Technology package for Drive Control Chart				
• With technology functions for Drive Control Chart		○	○	○
SIMOTION IT	(see also "SIMOTION Runtime Software")			
SIMOTION IT supports service and diagnostic functions without SCOUT over Ethernet/PROFINET				
SIMOTION IT DIAG (integrated web server on the SIMOTION controller)	Licensed through the SIMOTION IT DIAG software option			
• Service/diagnostic functions over Internet browsers		○	○	○
• Project update		○	○	○
• Firmware update		○	–	○
• Password-protected access		○	○	○
• Remote access to SIMOTION file system		○	○	○
• User-defined service and diagnostic pages		○	○	○
SIMOTION IT OPC XML-DA (integrated OPC XML-DA server on the SIMOTION controller) • Read/write variables • Browse variables • Trace interface via SOAP • Password-protected access	Licensed through the SIMOTION IT OPC XML-DA software option	○	○	○
SIMOTION IT Virtual Machine (integrated Java runtime environment on the SIMOTION controller) • Read and write access to the SIMOTION variables • Read and write access to the non-volatile memory (NVRAM) • Use of system functions (functions of the technology objects) • Use of standard Java classes in the device (file access, network functions, string functions, etc.) • Creation of servlets, especially for the purpose of enhancing the display of menu interfaces in HTML pages	Licensed through the SIMOTION IT (combined license) software option	○	○	○

8

● Basic version (function or license is purchased with the device or SCOUT)
○ Option (must be acquired as a software license or as hardware)
– Not possible

	Note	SIMOTION C	SIMOTION P	SIMOTION D
		C2xx	P350-3	D4xx
SIMOTION SCOUT	(see also "SIMOTION engineering software")			
SIMOTION SCOUT is the uniform engineering system for SIMOTION.				
Basic SCOUT functions		●	●	●
• Workbench				
• STARTER Drive commissioning/parameterization				
• Hardware and network configuration				
• Diagnostics for testing and commissioning				
• Axis control panel				
• Program editors / programming languages (command set in accordance with IEC 61131-3)				
- Structured Text (ST)				
- Ladder Logic (LAD)				
- Function Block Diagram (FBD)				
- Motion Control Chart (MCC)				
• Creation of cams (basic)				
• Creation of technology objects				
• Technology tools (function generator)				
• Operator user interface, online help and documentation in English, French, German and Italian				
Optional SCOUT packages				
• CamTool (graphical cam editor)		○	○	○
• DCC editor (graphical editor for Drive Control Chart)		○	○	○
Testing and diagnostics with SCOUT				
• Information functions		●	●	●
- Hardware/software version				
- Processor utilization				
- Memory utilization				
- Diagnostic buffer				
- Task runtimes				
- User logbook				
- Operating status				
- Time				
• Program test functions		●	●	●
- Control/status variables				
- Watch tables				
- Status program / FB / FC (with specification of the call point)				
- Single-step MCC				
- Breakpoints in all languages (ST, MCC, LAD/FBD)				

● Basic version (function or license is purchased with the device or SCOUT)
○ Option (must be acquired as a software license or as hardware)
– Not possible

	Note	SIMOTION C	SIMOTION P	SIMOTION D
		C2xx	P350-3	D4xx
SIMOTION SCOUT (continued)				
Testing and diagnostics with SCOUT (continued)				
• Trace		●	●	●
- Recording of I/O, system and program variables				
- Recording from position control cycle onwards (n × position control cycle)				
- Trigger: Instantaneous, rising/falling edge, at code point system variable				
- Measuring functions (step response for speed controller/position controller, ramp, frequency curve)				
- Bode diagram, FFT analysis, function generator, mathematical functions				
- Endless trace				
- Recording over defined measuring period				
• Module diagnostics		●	●	●
- Centralized				
- Distributed (e.g. ET 200M)				
• PROFIBUS DP station diagnostics		●	●	●
• PROFINET station diagnostics		–	●	●
• Diagnostic buffer				
- No. of entries, max.		200	200	200
• Process fault diagnostics (Alarm_S)				
- Messages from user program		●	●	●
- No. of entries, max.		40	40	40
Engineering drives				
STARTER (integrated in SCOUT) Drive/commissioning software for:		●	●	●
• MICROMASTER 410/420/430/440				
• COMBIMASTER 411				
• SINAMICS S / SINAMICS G				
Drive ES BASIC Engineering tools and integrated data storage in SIMATIC S7 / SIMOTION projects for:	Drive ES BASIC is included complete with license in the SIMOTION SCOUT software package.	●	●	●
• MICROMASTER 410/420/430/440 (STARTER)				
• COMBIMASTER 411 (STARTER)				
• SINAMICS S / SINAMICS G (STARTER)				
• SIMODRIVE (SimoCom U/SimoCom A)				
• SIMOVERT MASTERDRIVES (DriveMonitor)				

8

Notes

SIMOTION
I/O components

9

Load power supplies for SIMOTION C/ET 200M

Overview

PS 307 power supply, 5 A

The PS 305/PS 307 load power supplies convert the line voltage (120/230 V AC, 24 to 110 V DC) into the 24 V DC operating voltage.

The following versions are available for the output currents:

- 2 A
- 5 A
- 10 A

The required summation current should be taken into account when sizing in the load power supply (e.g. current draw of SIMOTION C, supply for the digital outputs, etc.).

Application

The PS 305/PS 307 modules supply 24 V DC for:

- SIMOTION C
- Distributed I/O (ET 200M, ...)
- Sensors
- Actuators

The PS 305/PS 307 load power supplies are snapped directly onto the SIMATIC S7-300 mounting rail and convert the line voltage (120 V/230 V AC, 24 V to 110 V DC) into the 24 V DC operating voltage.

Design

The load power supplies are mounted to the left of the SIMOTION C Motion Controller or ET 200M interface (IM 153) on the mounting rail.

The front of the module contains:

- An LED
  (signals that the 24 V DC output voltage is ON)
- Supply voltage selector switch with protective cap
  for selecting the input voltage of 120 V AC or 230 V AC
- ON/OFF switch for 24 V DC output voltage
- Terminals
  for input voltage, output voltage and ground covered by the front door

The load power supplies can also be mounted onto a 35 mm DIN rail (EN 50022). Mounting adapters are required for this purpose:

- 1 adapter for PS 307, 24 V DC/2 A, 24 V DC/5 A
- 2 adapters for PS 307, 24 V DC/10 A

Selection and ordering data

Description	Order No.
SIMATIC S7-300, load power supplies	
• 120/230 V AC; 24 V DC/2 A	**6ES7307-1BA00-0AA0**
• 24 V ... 110 V DC; 24 V DC/2 A (extended temperature range)	**6ES7305-1BA80-0AA0**
• 120/230 V AC; 24 V DC/5 A	**6ES7307-1EA00-0AA0**
• 120/230 V AC; 24 V DC/5 A (extended temperature range)	**6ES7307-1EA80-0AA0**
• 120/230 V AC; 24 V DC/10 A	**6ES7307-1KA01-0AA0**
Mounting adapter for snapping the PS 307 onto 35 mm standard rails (EN 50022)	**6ES7390-6BA00-0AA0**

More information

For further information see Catalog ST 70 and the A&D Mall under "Automation Systems/Industrial automation systems SIMATIC/Programmable controllers/SIMATIC S7/S7-300/S7-300F/Power supplies".

Universal SITOP power supplies

Overview

Power supplies (one, two or three-phase)

In contrast to the PS 305/PS 307 load power supplies, the SITOP power supplies are snapped onto 35 mm DIN rails (EN 50022). They cannot be snapped onto the SIMATIC S7-300 mounting rail.

Application

SITOP modular power supplies

The SITOP modular power supply comprises of basic devices with 5 A, 10 A, 20 A and 40 A options which can be expanded with additional modules. The modularity offers advantages with respect to flexibility, simple handling, price and performance. The wide-range input, Class B radio interference category according to EN 55022 and limitation of input current harmonics to EN 61000-3-2 make these power supplies suitable for use in many different application areas.

Basic units/features

- 5 A and 10 A basic units
  with 120/230 to 500 V AC wide-range input for operation on single-phase network as well as two-phase operation on three-phase network (connection to two phases of a three-phase supply network)
- 20 A and 40 A basic units
  with 120/230 V AC input voltage for single-phase operation or with 400 to 500 V 3 AC wide-range input for three-phase operation
- Extremely small width of the three-phase 20 A basic unit (70 mm (2.76 in) wide)
- Selectable "constant current" or "stored tripping" short-circuit behavior
- 3 LEDs for signaling "24 V o.k.", "Overload" and "Stored tripping"
- Adjustable output voltage up to 28.8 V to compensate for voltage drops
- Power boost supports up to three times the rated current

Supplementary modules for function expansions

- Buffer module for extending the network failure buffering time to 100 ms for 40 A load currents and up to 800 ms for 5 A load currents
- Signaling module for providing signals about the operating status of the power supply ("DC Voltage OK", "Ready") as well as for remote activation/deactivation of the power supply.
- Redundancy module for decoupling two power supplies during parallel operation

SITOP select diagnostics module

The SITOP select diagnostics module is used for dividing the load current into four current paths for monitoring the individual subcurrents.

SITOP smart

The single-phase power supply for universal applications with a narrow construction; 150 % extra power and 120 % rated power up to 45 °C (113 °F). Without limitation of the line harmonics according to EN 61000-3-2 with the industrial version (-2AA01 types).

SITOP power in flat design

SITOP power in flat design is preferred where only small mounting depths are available, for example, when distributed I/O is used, in machines or recesses.

Selection and ordering data

Description	Order No.
SITOP modular power supplies	
• Single-phase and two-phase	
- 120/230 ... 500 V AC; 24 V DC/5 A	**6EP1333-3BA00**
- 120/230 ... 500 V AC; 24 V DC/10 A	**6EP1334-3BA00**
- 120/230 V AC; 24 V DC/20 A	**6EP1336-3BA00**
- 120/230 V AC; 24 V DC/40 A	**6EP1337-3BA00**
• Three-phase	
- 400 ... 500 V AC; 24 V DC/20 A	**6EP1436-3BA01**
- 400 ... 500 V AC; 24 V DC/40 A	**6EP1437-3BA00**
Add-on modules for SITOP modular	
• Buffer module	**6EP1961-3BA00**
• Signaling module	**6EP1961-3BA10**
• Redundancy module	**6EP1961-3BA20**
SITOP select diagnostics module (4 channels)	**6EP1961-2BA00**
SITOP smart power supply, single-phase	
• 120/230 V AC; 24 V DC/2.5 A	**6EP1332-2BA10**
• 120/230 V AC; 24 V DC/5 A	**6EP1333-2BA01**
• 120/230 V AC; 24 V DC/5 A (industrial version)	**6EP1333-2AA01**
• 120/230 V AC; 24 V DC/10 A	**6EP1334-2BA01**
• 120/230 V AC; 24 V DC/10 A (industrial version)	**6EP1334-2AA01**
Power supply SITOP power, slimline design, single-phase	
• 120/230 V AC; 24 V DC/5 A	**6EP1333-1AL12**
• 120/230 V AC; 24 V DC/10 A	**6EP1334-1AL12**

More information

For further information and additional power supplies see Catalog KT 10.1 and the A&D Mall under "Power supplies/SITOP power supply".

Uninterruptible power supplies

Overview

DC UPS module with Battery module

By combining a DC UPS module with at least one 24 V Battery module and SITOP power supply, longer power failures can be completely bridged.

This combination can be used e. g. in

- mechanical engineering
- textile industry
- all types of production lines and filling systems

This prevents the negative effects which often result due to power failures.

Siemens offers the uninterruptible power supplies DC UPS 6 A, DC UPS 15 A and DC UPS 40 A as well as the Battery modules 1.2 Ah, 2.5 Ah, 3.2 Ah, 7 Ah and 12 Ah for "NONSTOP" applications.

Application

DC UPS modules for complete uninterruptible bridging of power failures including exhaustive discharge protection, battery life time monitoring and ON/OFF control current circuit.

- 24 V DC input voltage
  (supply through SITOP power supply from 5 A rated current)
- Rated output power 144 W (0.19 HP) (DC UPS 6 A) and 360 W (0.48 HP) (DC UPS 15 A)
- Rated output power 480 W (0.64 HP) or 960 W (1.29 HP) (DC UPS 40 A with one or two Battery modules)
- High efficiency of approx. 95 to 97 %
- Power ON threshold adjustable through DIP switch between 22 V and 25.5 V
- Bridging time adjustable with DIP switch in the range between 5 and 635 s or until switched off automatically due to complete discharge
- Option: Signals can be output via serial interface or USB interface, automatic restart of industrial PCs supported through selectable shut-down behavior

Function

The rechargeable battery is connected to the system as soon as the load voltage or the voltage between the connections L+/M of the DC UPS module falls below the set value of the 22 to 25.5 V threshold.

After a power failure the battery module is disconnected automatically from the loads by electronic means and immediately recharged with a 0.2/0.4 A (DC UPS module 6 A), 0.35/0.7 A (DC UPS module 15 A) or 1 or 2 A (DC UPS module 40 A) constant current (U/I characteristic with 26.3 to 29.3 V end-of-charge voltage).

For increased load current demands (e.g., when incandescent lamps, power contactors with DC auto-connected windings, DC motors, DC/DC converters, electronic modules with high input capacity are connected to the system), electronically limited peak currents are supplied automatically.

The operating state (mains/battery operation, battery level > 85 % as well as buffer ready/alarm) is signaled with LEDs and isolated relay contacts.

For SIMOTION P350 applications, the UPS module can be used with a serial interface or USB interface. The operating state is indicated on an SP_SITOP application that is already installed on SIMOTION P350. An action can be defined for each status change of the UPS during configuration of the application. The operating status of the UPS is also available to the user program via a system variable.

Selection and ordering data

Description	Order No.
DC UPS modules	
• DC UPS module 6 A	**6EP1931-2DC21**
• DC UPS module 6 A with serial interface	**6EP1931-2DC31**
• DC UPS module 6 A with USB interface	**6EP1931-2DC42**
• DC UPS module 15 A	**6EP1931-2EC21**
• DC UPS module 15 A with serial interface	**6EP1931-2EC31**
• DC UPS module 15 A with USB interface	**6EP1931-2EC42**
• DC UPS module 40 A	**6EP1931-2FC21**
• DC UPS module 40 A with USB interface	**6EP1931-2FC42**
Battery modules	
• 1.2 Ah Battery module for DC UPS modules, 6 A	**6EP1935-6MC01**
• 2.5 Ah Battery module for DC UPS modules, 6 A and 15 A	**6EP1935-6MD31**
• 3.2 Ah Battery module for DC UPS modules, 6 A and 15 A	**6EP1935-6MD11**
• 7 Ah Battery module for DC UPS module, 6 A, 15 A and 40 A	**6EP1935-6ME21**
• 12 Ah Battery module for DC UPS module, 6 A, 15 A and 40 A	**6EP1935-6MF01**

More information

For further information see Catalog KT 10.1 and the A&D Mall under "Power Supplies/SITOP power supply".

Summary

Overview

SIMATIC S7-300 I/O Modules

The following SIMATIC S7-300 I/O modules can be used as:

- Central I/O within SIMOTION C2xx.
  The I/O configuration comprises of two tiers for central I/O with up to 8 I/O Modules per tier, of which up to 4 can be Analog Modules. The second tier is connected over the IM 365 interface module.
- Distributed I/O in the modular I/O system ET 200M with the IM 153 Head Module
  (up to 8 or 12 I/O Modules per ET 200M, depending on the head module)

The I/O Modules which can be used with SIMOTION are listed in a compatibility list which can be found at:

http://support.automation.siemens.com/WW/view/en/11886029

Benefits

Advantages to the customer through the use of SIMATIC S7-300 I/O modules

- Optimal adaptation
  The number of inputs/outputs can be adapted to the corresponding task with the help of modules which can be combined as required. Unnecessary investments can be avoided.
- Flexible process connection
  SIMOTION can be connected to the process over different digital and analog actuators and sensors.
- Powerful analog technology
  Different input/output ranges and high resolution allows for the connection of many different analog sensors and actuators.
- Intelligent function modules
  Function Modules (FM) relieve the CPU from time-intensive tasks such as counting and output cams.
- Communication modules
  Communication modules (CP) implement serial data exchange over point-to-point connections and connection of AS-Interface slaves.

Application

Signal conditioning

I/O modules transform the levels of the external digital and analog process signals into the internal signal levels for SIMOTION and vice versa. In addition, signal-preprocessing Function Modules and Communication Modules are available.

Connectable devices

The following can be connected to SIMOTION over I/O Modules:

- Digital and analog sensors/actuators
- Switches
- Encoders
- Printers, barcode readers, ...
- AS-Interface slaves
- Identification systems
- Weighing systems
- …

Design

SIMATIC S7-300 I/O Modules for digital and analog inputs/outputs have the following mechanical characteristics:

- Compact design
  The rugged plastic casing contains:
  - Green LEDs for indicating the signal states on the inputs/outputs
  - Red LED to indicate that a diagnosis is being performed (for modules capable of diagnostics)
  - Sockets for front connectors, protected behind front door
  - Labeling area on front door
- Simple assembly
  The modules are mounted one after the other to the mounting rail from the left to the right and connected to neighboring modules with bus connectors. There are no slot rules.
- User-friendly wiring
  The modules are wired with front connectors. When the module is connected for the first time, a coding latches in the connector so that the connector now only fits onto modules of the same type. When a module is replaced, the front connector can be plugged onto the new module of the same type with the complete wiring. The front connectors are available with screw-type or spring-loaded terminals or with the Fast Connect connection system.

More information

For further information see Catalog ST 70 and the A&D Mall under "Automation Systems/Industrial automation systems SIMATIC/Programmable controllers/SIMATIC S7/S7-300/S7-300F".

Digital Modules

Selection and ordering data

Description	Order No.
Digital Input Modules SM 321, isolated [1]	
• 16 DI, 24 V DC	
- Standard	**6ES7321-1BH02-0AA0**
- Isochronous, High Speed	**6ES7321-1BH10-0AA0**
- Source input	**6ES7321-1BH50-0AA0**
• 32 DI, 24 V DC, 40-pole	**6ES7321-1BL00-0AA0**
• 64 DI, 24 V DC, active high/low (parameterizable) *Note: Terminal blocks and connecting cables are necessary, see accessories*	**6ES7321-1BP00-0AA0**
• 8 DI, 120/230 V AC	
- Standard	**6ES7321-1FF01-0AA0**
- With single-root, 40-pole	**6ES7321-1FF10-0AA0**
• 16 DI, 24 to 48 V AC/DC with single root, 40-pole	**6ES7321-1CH00-0AA0**
• 16 DI, 48 to 125 V DC	**6ES7321-1CH20-0AA0**
• 16 DI, 120/230 V AC	**6ES7321-1FH00-0AA0**
• 32 DI, 120 V AC, 40-pole	**6ES7321-1EL00-0AA0**
• 16 DI, 24 V DC Process alarm, diagnostics, parameterizable input delay, isochronous	**6ES7321-7BH01-0AB0**
Digital Output Modules SM 322, isolated [1]	
• 8 DO, 24 V DC, 2 A	**6ES7322-1BF01-0AA0**
• 8 DO, 48 to 125 V DC, 1.5 A	**6ES7322-1CF00-0AA0**
• 16 DO, 24 V DC, 0,5 A	
- Standard	**6ES7322-1BH01-0AA0**
- Isochronous, High Speed	**6ES7322-1BH10-0AA0**
• 32 DO, 24 V DC, 0.5 A, 40-pole	**6ES7322-1BL00-0AA0**
• 64 DO, 24 V DC, 0,3 A	
- Current sourcing	**6ES7322-1BP00-0AA0**
- Current sinking	**6ES7322-1BP50-0AA0**
Note: Terminal blocks and connecting cables are necessary, see accessories	

Description	Order No.
• 8 DO, 120/230 V AC, 1 A	**6ES7322-1FF01-0AA0**
• 8 DO, 120/230 V AC, 2 A, with single root and selectable failure mode, 40-pole	**6ES7322-5FF00-0AB0**
• 16 DO, 120/230 V AC, 1 A	**6ES7322-1FH00-0AA0**
• 32 DO, 120 /230 V AC, 1 A, double-width, 2 x 20-pole	**6ES7322-1FL00-0AA0**
• 8 DO (relay outputs), 24 V DC, 2 A or 230 V AC, 2 A	**6ES7322-1HF01-0AA0**
• 8 DO (relay outputs), 120 V DC, 5 A or 230 V AC, 5 A, connector with spring-loaded terminal can be used for 6ES7392-1BM01-0AA0 and higher, 40-pole	**6ES7322-1HF10-0AA0**
• 8 DO (relay outputs), 24 V DC, 120 to 230 V AC, 5 A, with RC filter, overvoltage protection, 40-pole	**6ES7322-5HF00-0AB0**
• 16 DO, solid state relays, 24 to 48 V AC/DC, 0.5 A, with single root, 40-pole	**6ES7322-5GH00-0AB0**
• 16 DO (relay outputs), 24 to 120 V DC, 2 A or 48 to 230 V AC, 2 A	**6ES7322-1HH01-0AA0**
• 8 DO, 24 V DC, 0.5 A, short-circuit protection, diagnostics	**6ES7322-8BF00-0AB0**
Digital Input/Output Modules SM 323/SM 327, isolated [1]	
• 8 DI, 8 DO, 24 V DC, 0.5 A	**6ES7323-1BH01-0AA0**
• 16 DI, 16 DO, 24 V DC, 0.5 A, 40-pole	**6ES7323-1BL00-0AA0**
• 8 DI, 8 DX, 24 V DC, 0.5 A, 8 DX per single channel parameterizable as DI or DO	**6ES7327-1BH00-0AB0**
Accessories and spare parts	**See "Accessories and spare parts"**

[1] incl. labeling strips and bus connectors, 20-pole front connector required (if not specified otherwise).
64-channel modules require special terminal blocks and connecting cable, see Accessories and spare parts.

Selection and ordering data

Description	Order No.
Analog Input Modules SM 331, isolated [1]	
• 2 AI (1 AI for resistance-based sensor), U/I/thermoelement/resistor/ Pt 100/Ni 100, alarm, diagnostics, resolution 9/12/14 bit (+ sign)	**6ES7331-7KB02-0AB0**
• 8 AI (4 AI for resistance-based sensor), U/I/thermoelement/resistor/ Pt 100/Ni 100, alarm, diagnostics, resolution 9/12/14 bit (+ sign)	**6ES7331-7KF02-0AB0**
• 8 AI, U/I/resistor/Pt 100/Ni 100/ Ni 1000/LG-Ni 1000 (standard, air-conditioned), resolution 12 bit + sign/13 bit, 40-pole	**6ES7331-1KF01-0AB0**
• 8 AI, U/I, alarm and diagnostics, resolution 13 bit + sign/14 bit, isochronous, high speed	**6ES7331-7HF01-0AB0**
• 8 AI, U/I, alarm and diagnostics, resolution 15 bit (+sign), 40-pole	
- 2 channels with limit value monitoring, isolation between channels and backplane bus	**6ES7331-7NF00-0AB0**
- Fast measured value update, 8 channels with limit value monitoring, isolation between channels and backplane bus as well as between channels in groups of 2	**6ES7331-7NF10-0AB0**
• 8 AI, 2/3/4-wire, resistor, Pt 100/200/500/1000, Ni 100/120/200/500/1000, Cu 10, characteristics acc. to Ghost, 16 bit (24 bit internally), 40-pole	**6ES7331-7PF01-0AB0**
• 8 AI, thermoelements Type B, E, J, K, L, N, R, S, T, U, TXK/TXK(L) according to Ghost 16 bit (24 bit internally), 40-pole	**6ES7331-7PF11-0AB0**
Analog Output Modules SM 332, isolated [1]	
• AO, 0 to 10 V, ±10 V, 1 V to 5 V, 0/4 to 20 mA, ± 20 mA 11 bit + sign/12 bit	
- 2 AO	**6ES7332-5HB01-0AB0**
- 4 AO	**6ES7332-5HD01-0AB0**
- 8 AO, 40-pole	**6ES7332-5HF00-0AB0**
• 4 AO, 0 to 10 V, ± 10 V, 1 to 5 V, 0/4 to 20 mA, ± 20 mA 14 bit +sign/15 bit + sign, isochronous, High Speed	**6ES7332-7ND02-0AB0**

Description	Order No.
Analog Input/Output Modules SM 334 [1]	
• 4 AI, 2 AO, non-isolated, 0 to 10 V, 0 to 20 mA, 8 bit	**6ES7334-0CE01-0AA0**
• 4 AI, 2 AO (2 AI under power), isolated, 12 bit, input: 0 to 10 V, Pt 100 (climatic range only), resistance measurement 10 kΩ, output: 0 ... 10 V	**6ES7334-0KE00-0AB0**
Fast SM 335 Analog Input/Output Module [1]	
4 fast analog inputs (basic conversion time for 4 channels, max. 1 ms), 4 fast analog outputs (conversion time per channel, max. 0.8 ms), encoders supplied with 10 V/25 mA, 1 counter input (24 V/500 Hz), special operating modes: "Measuring only" and "Comparator"	
• 4 AI, 4 AO, isolated, alarm and diagnostics, input: ± 1 V, ± 2.5 V, ± 10 V, 0 V to 2 V, 0 V to 10 V, ± 10 mA, 0/4 to 20 mA, 13 bit + sign, 14 bit; (up to 2 channels parameterizable as current input) Output: ± 10 V, 0 to 10 V, 11 bit + sign, 12 bit	**6ES7335-7HG01-0AB0**
• Interference protection filter The interference protection filter must be connected to the 24 V power circuit of the power supply for the SM 335 and can protect up to 4 SM 335. This is specified to ensure that the usual interference immunity for SIMOTION can be achieved.	**6ES7335-7HG00-6AA0**
Manual for SM 335	
• German	**6ES7335-7HG00-8AA1**
• English	**6ES7335-7HG00-8BA1**
Accessories and spare parts	**See "Accessories and spare parts"**

[1] Incl. labeling strips and bus connectors, 20-pole front connector required (if not specified otherwise).

SM 338 POS Input Module

Overview

The SM 338 POS Input Module converts SSI encoder signals from the process into digital values for SIMOTION.

In addition, SSI encoder statuses can be picked up via two module-internal digital inputs.

The POS Input Module supports isochronous operation and has:

- 3 SSI encoder inputs
- 2 digital inputs
- 24 V DC encoder supply

Application

The SM 338 POS Input Module can be used as an encoder module for position-controlled hydraulic applications, for example.

It can be used with SIMOTION in the following way:

- Centrally on SIMOTION C
- Distributed (via ET 200M) on SIMOTION C, SIMOTION P and SIMOTION D

Selection and ordering data

Description	Order No.
POS Input Module SM 338 For connecting 3 SSI encoders, incl. 2 freeze inputs	**6ES7338-4BC01-0AB0**
20-pole front connector	**See "Accessories and spare parts"**

FM 350-1 Counter Module

Overview

- Single-channel intelligent Counter Module for simple counting tasks
- For direct connection of incremental encoders
- Compare function with two definable comparison values
- Integrated digital outputs for response output when the comparison value is reached
- Operating modes:
  - Continuous counting
  - One-time counting
  - Periodic counting
- Special functions:
  - Set counter
  - Latch counter
  - Start/stop counter via gate function

Application

The single-channel FM 350-1 Counter Module can be operated as follows:

- Centrally on SIMOTION C
- Distributed (via ET 200M) on SIMOTION C, SIMOTION P and SIMOTION D

The standard functions required to use the FM 350-1 in connection with SIMOTION are part of the SCOUT command library.

Selection and ordering data

Description	Order No.
FM 350-1 Counter Module Incl. SIMATIC configuration package on CD with 1 channel, max. 500 kHz; for incremental encoders	**6ES7350-1AH03-0AE0**
20-pole front connector, shield connecting element and shield terminals	**See "Accessories and spare parts"**
Connectable incremental encoder 6FX2 001-2...	**See the section "Measuring systems"**

FM 350-2 Counter Module

Overview

- 8-channel intelligent Counter Module for universal counting and measuring tasks
- For direct connection of 24 V incremental encoders, direction encoders, initiators, or NAMUR encoders
- Compare function with definable comparison values (number depends on operating mode)
- Integrated digital outputs for response output when the comparison value is reached
- Operating modes:
  - Continuous/one-time/periodic counting
  - Frequency/speed measurement
  - Period measurement
  - Dosing

Application

The 8-channel FM 350-2 counter module can be operated as follows:

- Centrally on SIMOTION C
- Distributed (via ET 200M) on SIMOTION C, SIMOTION P and SIMOTION D

The standard functions required to use the FM 350-2 in connection with SIMOTION are part of the SCOUT command library.

Selection and ordering data

Description	Order No.
FM 350-2 Counter Module Incl. SIMATIC configuration package on CD with 8 channels, max. 20 kHz; for 24 V incremental encoders and NAMUR encoders	**6ES7350-2AH00-0AE0**
40-pole front connector, shield connecting element and shield terminals	**See "Accessories and spare parts"**

FM 352 Electronic output cam controller

Overview

- High-speed electronic output cam controller
- Economic alternative to mechanical output cam controllers
- 32 output cam tracks, 13 on board digital outputs for direct output of actions
- Position sensing by means of incremental encoders or absolute encoders with synchronous-serial transmission (SSI)

Application

The FM 352 Electronic cam controller can be operated as follows:

- Centrally on SIMOTION C
- Distributed (via ET 200M) on SIMOTION C, SIMOTION P and SIMOTION D

The standard functions required to use the FM 352 in connection with SIMOTION are included in the SCOUT Function Library.

Selection and ordering data

Description	Order No.
FM 352 Electronic output cam controller Incl. SIMATIC configuration package on CD	**6ES7352-1AH02-0AE0**
Sub D connector 15-pole, pins; for encoder cable	**6ES5750-2AA21**
20-pole front connector, Shield connection element and shield terminals	**See "Accessories and spare parts"**

FM 352-5 High-speed Boolean processor

Overview

The FM 352-5 Module is a high-speed processor for boolean operations (LAD, FBD) that processes these operations with a fixed cycle time of 1 microsecond.

Application

The module has been designed for applications which require extremely short response times.

The program stored on the module links:

- 12 integrated digital inputs
- 8 integrated digital outputs

An SSI absolute encoder, 5 V incremental encoder (RS 422) or 24 V incremental encoder can be connected to the encoder interface.

The application program is written with the STEP 7 program editor and stored on the Micro Memory Card (MMC) in compiled form after successful simulation.

The FM 352-5 Module can be operated as follows:

- Centrally on SIMOTION C
- Distributed (via ET 200M) on SIMOTION C, SIMOTION P and SIMOTION D

Selection and ordering data

Description	Order No.
FM 352-5 High-speed Boolean processor	
• With current sinking digital outputs	**6ES7352-5AH00-0AE0**
• With current sourcing digital outputs	**6ES7352-5AH10-0AE0**
Configuration software for FM 352-5 (German, English, French, Italian, Spanish) on CD with electronic manual	**6ES7352-5AH00-7XG0**
Micro Memory Card	
• 128 KB	**6ES7953-8LG11-0AA0**
• 512 KB	**6ES7953-8LJ11-0AA0**
• 2 MB	**6ES7953-8LL11-0AA0**
40-pole front connector	**See "Accessories and spare parts"**

CP 340 Communication Module

Overview

- The cost-effective, complete solution for serial communication over a point-to-point connection
- 3 versions with different physical transmission characteristics:
  - RS 232 C (V.24)
  - 20 mA (TTY)
  - RS 422/RS 485 (X.27)
- Implemented protocols: ASCII, 3964 (R) and printer driver (3964 (R) not for RS 485)
- Simple configuration over SCOUT with integrated parameterization tool

Application

The CP 340 Communication Module can be operated as follows:

- Centrally on SIMOTION C
- Distributed (via ET 200M) on SIMOTION C, SIMOTION P and SIMOTION D

The standard functions required to use the CP 340 in connection with SIMOTION are part of the SCOUT command library.

CP 341 Communication Module

Overview

- The fast and powerful serial data exchange over a point-to-point connection
- 3 versions with different physical transmission characteristics:
  - RS 232 C (V.24)
  - 20 mA (TTY)
  - RS 422/RS 485 (X.27)
- Implemented protocols: ASCII, 3964 (R), RK 512 (3964 (R), RK 512 not for RS 485)
- Simple configuration over SCOUT with integrated parameterization tool

Application

The CP 341 Communication Module can be operated as follows:

- Centrally on SIMOTION C
- Distributed (via ET 200M) on SIMOTION C, SIMOTION P and SIMOTION D

The loadable special driver of the CP 341 is not supported by SIMOTION.

The standard functions required to use the CP 341 in connection with SIMOTION are part of the SCOUT command library.

Selection and ordering data

Description	Order No.
CP 340 Communication Module Incl. SIMATIC configuration package on CD with:	
• 1 RS 232 C interface (V.24)	**6ES7340-1AH02-0AE0**
• 1 20 mA interface (TTY)	**6ES7340-1BH02-0AE0**
• 1 RS 422/485 (X.27) interface	**6ES7340-1CH02-0AE0**
CP 341 Communication Module Incl. SIMATIC configuration package on CD with:	
• 1 RS 232 C interface (V.24)	**6ES7341-1AH01-0AE0**
• 1 20 mA interface (TTY)	**6ES7341-1BH01-0AE0**
• 1 RS 422/485 (X.27) interface	**6ES7341-1CH01-0AE0**

Description	Order No.
RS 232 C connecting cable 9-pin sub D socket each	
• 5 m (16.41 ft)	**6ES7902-1AB00-0AA0**
• 10 m (32.81 ft)	**6ES7902-1AC00-0AA0**
• 15 m (49.22 ft)	**6ES7902-1AD00-0AA0**
20 mA (TTY) connecting cable 9-pin sub D connector each	
• 5 m (16.41 ft)	**6ES7902-2AB00-0AA0**
• 10 m (32.81 ft)	**6ES7902-2AC00-0AA0**
• 50 m (164 ft)	**6ES7902-2AG00-0AA0**
RS 422/485 connecting cable 15-pin sub D connector each	
• 5 m (16.41 ft)	**6ES7902-3AB00-0AA0**
• 10 m (32.81 ft)	**6ES7902-3AC00-0AA0**
• 50 m (164 ft)	**6ES7902-3AG00-0AA0**

SM 374 Simulator Module

Overview

- Simulator Module for program testing during commissioning and operation
- Simulation of sensor signals over switches
- Display of signal states on outputs with LEDs

Design

The front panel is equipped with:

- 16 switches for the simulation of input signals
- 16 LEDs for displaying the signal state at outputs
- Mode selector
  With the aid of a screwdriver, you can set three operating modes:
  - 16 inputs (input simulation only)
  - 16 outputs (output simulation only)
  - 8 inputs and 8 outputs (input and output simulation)

Function

The module is mounted onto the mounting rail instead of a Digital Input or Output Module.

The CPU reads the set input signal states of the Simulator Module and processes these in the user program. The output signal states are sent to the module as a result and indicated there with LEDs.

Selection and ordering data

Description	Order No.
SM 374 Simulator Module For the simulation of 16 inputs or 16 outputs (16 switches, 16 LEDs)	**6ES7374-2XH01-0AA0**

DM 370 Dummy Module

Overview

- Dummy Module for reserving slots for unconfigured Signal Modules
- When replaced with a Signal Module (SM), configuration and address assignment remain unchanged.

The DM 370 Dummy Module reserves a slot for an unconfigured Signal Module.

When replaced with a Signal Module, the mechanical configuration and address assignment of the overall configuration remain unchanged.

Selection and ordering data

Description	Order No.
DM 370 Dummy Module Incl. bus connector, labeling strips	**6ES7370-0AA01-0AA0**

Selection and ordering data

Description	Order No.
Bus connector (spare part)	**6ES7390-0AA00-0AA0**
Slot label	**6ES7912-0AA00-0AA0**
Labeling sheet (for Word template, see: http://support.automation.siemens.com/WW/view/en/11978022) for signal modules (except 32-channel) and function modules, DIN A4, for printing with laser printer; 10 units	
• Petrol	**6ES7392-2AX00-0AA0**
• Light-beige	**6ES7392-2BX00-0AA0**
• Yellow	**6ES7392-2CX00-0AA0**
• Red	**6ES7392-2DX00-0AA0**
For 32-Channel Signal Modules, DIN A4, for printing with laser printer; 10 units	
• Petrol	**6ES7392-2AX10-0AA0**
• Light-beige	**6ES7392-2BX10-0AA0**
• Yellow	**6ES7392-2CX10-0AA0**
• Red	**6ES7392-2DX10-0AA0**
Labeling strips 10 units (spare part)	
• For modules with 20-pole front connector	**6ES7392-2XX00-0AA0**
• For modules with 40-pole front connector	**6ES7392-2XX10-0AA0**
Cover foil for labeling strips 10 units (spare part)	
• For modules with 20-pole front connector	**6ES7392-2XY00-0AA0**
• For modules with 40-pole front connector	**6ES7392-2XY10-0AA0**
Shield connection element	**6ES7390-5AA00-0AA0**
Shield terminal element 2 units per packing unit	
• For 2 cables with 2 to 6 mm Ø each	**6ES7390-5AB00-0AA0**
• For 1 cable with 3 to 8 mm Ø each	**6ES7390-5BA00-0AA0**
• For 1 cable with 4 to 13 mm Ø each	**6ES7390-5CA00-0AA0**

Description	Order No.
Front door Raised design 5 units per packing unit	**6ES7328-0AA00-7AA0**
Front connector With screw-type terminals	
• 20-pole, 1 unit	**6ES7392-1AJ00-0AA0**
• 20-pole, 100 units	**6ES7392-1AJ00-1AB0**
• 40-pole, 1 unit	**6ES7392-1AM00-0AA0**
• 40-pole, 100 units	**6ES7392-1AM00-1AB0**
Front connector With spring-loaded terminals	
• 20-pole, 1 unit	**6ES7392-1BJ00-0AA0**
• 20-pole, 100 units	**6ES7392-1BJ00-1AB0**
• 40-pole, 1 unit	**6ES7392-1BM01-0AA0**
• 40-pole, 100 units	**6ES7392-1BM01-1AB0**
Front connector With Fast Connect terminals	
• 20-pole, 1 unit	**6ES7392-1CJ00-0AA0**
• 40-pole, 1 unit	**6ES7392-1CM00-0AA0**
Terminal block and connecting cable for 64-channel modules 2 terminal blocks and 2 connecting cables are required per module	
• 1 m (3.28 ft) connecting cable, 2 units	**6ES7392-4BB00-0AA0**
• 2.5 m (8.20 ft) connecting cable, 2 units	**6ES7392-4BC50-0AA0**
• 5 m (16.41 ft) connecting cable, 2 units	**6ES7392-4BF00-0AA0**
• Terminal block with screw-type terminals, 2 units	**6ES7392-1AN00-0AA0**
• Terminal block with spring-loaded terminals, 2 units	**6ES7392-1BN00-0AA0**
2 Effective Range Modules for analog inputs (spare part)	**6ES7974-0AA00-0AA0**
Fuse set (spare part) 10 fuses, 8 A, quick-response, 2 fuse holders	**6ES7973-1HD00-0AA0**
SIMATIC Manual Collection Electronic manuals on DVD, multilingual	**6ES7998-8XC01-8YE0**
SIMATIC Manual Collection Update service for 1 year Current manual collection DVD as well as the three subsequent updates	**6ES7998-8XC01-8YE2**
Sub D connector	
• 9-pole, pins	**6ES5750-2AA11**
• 9-pole, socket	**6ES5750-2AB11**
• 15-pole, pins	**6ES5750-2AA21**
Mounting rail, SIMATIC S7-300	
• L = 160 mm (6.30 in)	**6ES7390-1AB60-0AA0**
• L = 480 mm (18.90 in)	**6ES7390-1AE80-0AA0**
• L = 530 mm (20.87 in)	**6ES7390-1AF30-0AA0**
• L = 830 mm (32.68 in)	**6ES7390-1AJ30-0AA0**
• L = 2000 mm (78.74 in)	**6ES7390-1BC00-0AA0**
Connection method SIMATIC TOP connect	**See Catalog ST 70 and electronic Catalog CA 01**

Summary

Overview

ET 200 variants

Perfect communication on all levels

Distributed machine and plant configurations have now become common practice in automation technology. This reduces the wiring layout and significantly increases flexibility and reliability.

For connecting distributed I/O, in addition to PROFIBUS DP as the most successful open fieldbus in automation engineering, PROFINET is also available. And the AS-Interface handles communication on the actuator/sensor level. This allows problem-free data exchange throughout the whole automation world.

PROFIBUS DP

PROFIBUS DP is a fast, standardized bus system for the field level.

The following automation components, for example, can be connected to each other over the PROFIBUS DP fieldbus:

- Programmable SIMATIC controllers
- SIMOTION Motion Control System
- Numerical SINUMERIK controls
- SINAMICS drive system
- SIMATIC ET 200 distributed I/O system

With the distributed SIMATIC ET 200 I/O system, digital and analog inputs and outputs can be connected to SIMOTION. Intelligent, distributed I/O modules can also be used with SIMATIC ET 200.

The isochronous mode functionality also allows PROFIBUS DP to be used for high-speed, deterministic I/O processing as well as for integrating drives.

PROFINET

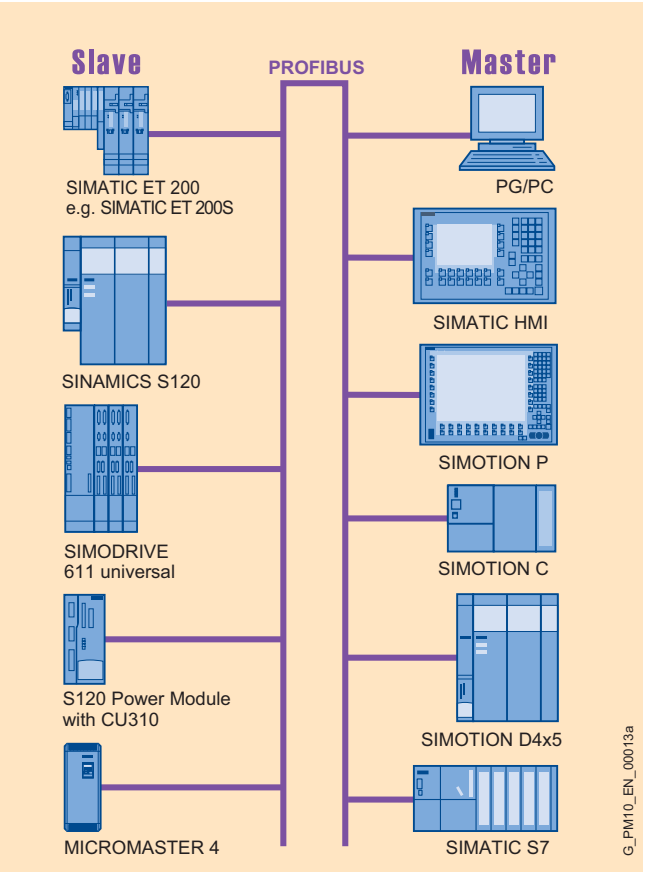
PROFINET is the innovative and open Industrial Ethernet standard (IEC 61158) for industrial automation. With PROFINET, devices can be linked up from the field level through to the management level. PROFINET is supported by the SINAMICS drive system and the SIMATIC ET 200S, ET 200M and ET 200pro distributed I/O systems.

With Isochronous Real-Time (IRT) and the new SIMATIC ET 200S High Speed I/O, cycle times of 250 µs are achieved on the basis of PROFINET cycle times.

AS-Interface

With AS-Interface, actuators and sensors on the field level can be connected with a simple two-wire line. In addition to communication, this two-wire line is also used to supply the individual stations with power.

Overview (continued)



Master/slave configuration on PROFIBUS DP

ET 200 distributed I/Os

The distributed SIMATIC ET 200 I/Os provide I/O systems for many different applications:

- SIMATIC ET 200M: The modular I/O system for control cabinet installation and high channel densities
- SIMATIC ET 200S: The finely scalable I/O system for control cabinet installation and time-critical applications in particular; including motor starters, safety technology and individual grouping of load groups
- SIMATIC ET 200pro: The modular I/O system with IP65/67 degree of protection for cabinet-free use close to the machine; with features such as small frame size, integrated PROFIsafe safety technology, PROFINET connection and hot swapping of modules
- SIMATIC ET 200eco: The compact, economical I/O system with IP65/67 degree of protection for local use without a control cabinet with flexible and fast ECOFAST or M12 connection system

Complete list of I/O that can be used

A list of all the I/O modules that can currently be used with SIMOTION is available under the following link:

http://support.automation.siemens.com/WW/view/en/11886029

More information

For further information see Catalog IK PI and the A&D Mall under "Automation Systems/Industrial automation systems SIMATIC/ Distributed I/O".

Application

ET 200M with power supply

SIMATIC ET 200M is a modular I/O system with IP20 degree of protection.

It can be expanded with Signal Modules, Communication Modules and Function Modules of the SIMATIC S7-300 automation system.

Due to the wide range of modules available, the SIMATIC ET 200M I/O system is especially well-suited for complex automation tasks with high channel densities.

For SIMATIC ET 200M, interface modules are available with PROFIBUS DP or PROFINET interfaces.

Signal states can be detected and output synchronously and at specified times via the isochronous PROFIBUS DP in conjunction with the IM 153-2 High Feature interface module. Isochronous mode is supported by selected I/O Modules (see the section "SIMATIC S7-300 I/O" or ET 200M manual). It is possible to combine isochronous and non-isochronous modules in a single station.

Design

The SIMATIC ET 200M modular distributed I/O system consists of

- One IM 153 interface module
- Depending on the IM 153 interface module, 8 or 12 I/O modules of the SIMATIC S7-300 automation system
- A PS 307 power supply, if required

The I/O modules can be combined as required and therefore optimally adapted to requirements.

The SIMATIC ET 200M I/O system is connected to PROFIBUS DP or PROFINET over an IM 153 interface module.

It can be connected to PROFIBUS DP with fiber-optic cables through integrated interfaces on the IM 153-2 FO or through additional OLMs (Optical Link Modules) or OBTs (Optical Bus Terminals).

Connection with bus connectors

The simple design with bus connectors of the SIMATIC S7-300 series makes SIMATIC ET 200M flexible and service-friendly:

- Module installation
  The modules are simply hooked onto the rail, swung into place and screwed tight.
- Integral backplane bus
  The backplane bus is integrated in the modules. Module interfacing takes place by means of bus connectors inserted into the rear of the housing.

Function

The user program in the SIMOTION Motion Control System can access the inputs and outputs of the SIMATIC ET 200M modular I/O system in the same manner as central inputs and outputs.

Communication over the bus system is handled completely by the SIMOTION Master and the IM 153 interface module. The diagnostics function is used to check that the SIMATIC ET 200M is operating correctly.

The SIMATIC ET 200M I/O system diagnoses the following:

- Module faults
- Short-circuits (outputs)
- Bus faults, i.e. faulty data transfer
- 24 V DC load voltage supply

Selection and ordering data

Description	Order No.
IM 153-1 interface module For connecting to PROFIBUS DP, with RS 485 interface, for max. 8 SIMATIC S7-300 modules	**6ES7153-1AA03-0XB0**
IM 153-2 High Feature interface module For connecting to PROFIBUS DP, with RS 485 interface, for max. 12 SIMATIC S7-300 modules, isochronous	**6ES7153-2BA02-0XB0**
IM 153-2 FO High Feature interface module For connecting to PROFIBUS DP, with fiber-optic interface, for max. 8 SIMATIC S7-300 modules	**6ES7153-2BB00-0XB0**
IM 153-4 PN interface module For connecting to PROFINET, for max. 12 SIMATIC S7-300 modules Note: CP 340, CP 341, FM 350-1, FM 350-2, FM 352, CP 343-2 P and SIWAREX FTA are not currently supported by SIMOTION with IM 153-4 PN. For up-to-date information, please refer to: http://support.automation.siemens.com/WW/view/en/11886029	**6ES7153-4AA00-0XB0**
Manual for ET 200M distributed I/O system with description of the signal modules S7-300	**Available as a PDF file in different languages over the Internet.**
I/O modules For use with the ET 200M distributed I/O system	**See SIMATIC S7-300 I/O**

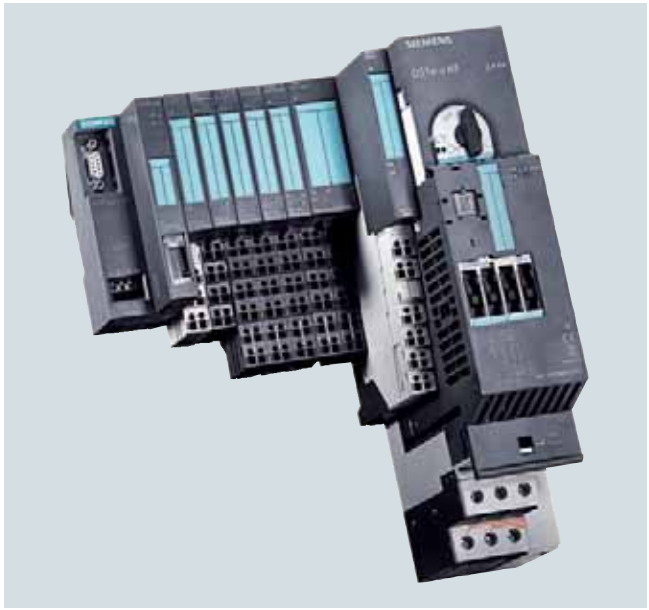
More information

For further information see Catalog IK PI or the A&D Mall under "Automation Systems/Industrial automation systems SIMATIC/ Distributed I/O".

ET 200 Configurator software is available as a download for planning the ET 200M and creating order lists:
http://www.siemens.com/ET200

SIMATIC ET 200S

Overview



SIMATIC ET 200S Compact

- Extended block I/O with IP20 degree of protection and 32 integrated channels, comprising of terminal block and electronic block
- 2 variants: 32 DI or 16 DI/16 DO
- Finely scalable expansion to a maximum of 128 channels or 12 modules
- The complete ET 200S module spectrum can be used (with the exception of PROFIsafe modules and reserve modules)
- Minimal width supports installation in particularly small, compact terminal boxes
- Separation of connections and electronics with permanent wiring
- Screw-type and spring-loaded terminal connections
- Standard terminal block with 2-wire connection system; 3-wire and 4-wire systems available using optional add-on terminals
- Installation on a DIN rail
- Hot swapping of expansion modules
- Communication via PROFIBUS
- Up to 100 bytes inputs and outputs (address space)
- The system characteristics meet high machine and plant availability requirements.
- ET 200 Configurator software for designing the ET 200S Compact and creating order lists

SIMATIC ET 200S

- Distributed I/O system with IP20 degree of protection with minimal wiring
- Can be used with integrated SIMATIC S7-CPU as mini PLC:
  - also available as a fail-safe PROFIsafe version
  - with optional lower-level PROFIBUS DP
- Finely modular design for adaptation to the automation task in hand.
- Interface modules available with PROFIBUS DP or PROFINET interfaces
- PROFINET modules with integrated 2-port switch for a line topology
- The optimum solution for extremely time-critical tasks
  - Cycle times down to 250 µs based on PROFINET IO with Isochronous Real-Time (IRT)
  - Short terminal-to-terminal times through High Speed analog modules with conversion times of ≤ 20 µs per channel
- Combined from digital and analog input or output modules, technology modules, motor starters and frequency converters
- Modules can be replaced during operation (hot swapping)
- Channel-specific diagnostics for high availability
- Can be supplied with integrated fiber optic interface if required
- Transfer rate up to 12 Mbit/s (PROFIBUS) or 100 Mbit/s (PROFINET)
- Flexible connection method (2/3/4-wire connections as screw-type and spring-loaded terminals and Fast Connect which requires no insulation stripping)
- Variable potential groups through power modules
- Option handling with or without reserve modules
- ET 200 Configurator software for designing the ET 200S and creating order lists

Application

The comprehensive module range with uniform handling for configuration, assembly and programming allows the SIMATIC ET 200S to be used as a universal I/O system.

The finely scalable design permits fast and optimal adaptation to the requirements of the automation task:

- No reserves
- No unnecessary channels

Even if requirements change frequently, setup times can be reduced significantly by replacing or combining different I/O Modules.

The transmission rate of up to 12 Mbit/s with PROFIBUS DP and 100 Mbit/s with PROFINET IO as well as the powerful internal data transmission makes the SIMATIC ET 200S also perfectly suited for extremely time-critical applications such as highly dynamic hydraulic applications with position and pressure control.

In combination with the interface module

- IM 151-1 High Feature (PROFIBUS) or
- IM 151-3 PN High Speed (PROFINET)

Signal states can be synchronously acquired or output over the isochronous PROFIBUS DP or over PROFINET IO with IRT at precisely defined points in time. Isochronous mode is supported by selected I/O modules (see selection and ordering data in this section or the ET 200S manual). It is possible to combine Isochronous and Non-isochronous modules in a single station.

In addition to Interface Modules for connecting the ET 200S to PROFIBUS DP or PROFINET IO (either electrical or optical interface) for distributed automation tasks, an Interface Module with an integrated CPU is also available. The maintenance free CPU (without battery) integrated in the Interface Module is based on the SIMATIC S7-300 CPU 314 and is programmed with STEP 7. The CPU permits distributed on-site preprocessing of process data and communicates with the higher-level motion control system as a PROFIBUS DP slave.

Two different variants are available for integrating safety technology with ET 200S:

- Over local safety components in motor starter applications
- Over PROFIsafe components that replace the wiring-based safety logic with a freely programmable controller (up to SIL 3 according to IEC 61508 and Category 4 according to EN 954-1).

The construction of the SIMATIC ET 200S allows it to be used under increased mechanical load. The system features support high machine availability requirements.

Design

The SIMATIC ET 200S distributed I/O system consists of:

- IM 151 Interface Module
- Digital and Analog Electronic Modules
- Technology modules, e.g., for counter/position detection tasks
- Motor starters and frequency converters
- Terminating module (part of the scope of supply of the IM 151)
- Power modules

One SIMATIC ET 200S station comprises of up to 63 I/O modules. The I/O modules can be combined as required.

The SIMATIC ET 200S is installed with permanent wiring:

All modules are plugged onto purely mechanical Terminal Modules. These Terminal Modules contain the complete wiring and can be mounted on standard 35 x 15 mm (1.38 x 0.59 in) or 35 x 7.5 mm (1.38 x 0.30 in) mounting rails.

This results in the following advantages:

- Simple implementation of the wiring without additional electronics components
- Fast and safe testing of wiring even under power
- Tool-free replacement of Electronics Modules
- Automatic coding of Electronics Modules for safe replacement (protected against polarity reversal)

ET 200 Configurator software is available as a download for planning the ET 200S and creating order lists:

http://www.siemens.com/ET200

Function

IM 151-3 PN High Speed Interface Module: Ideal for fast I/O processing with ET 200S and PROFINET

The IM 151-3 PN High Speed Interface Module supports the following on a PROFINET IO basis with Isochronous Real-Time (IRT):

- Isochronous acquisition/output of signal states, synchronized with the user program
- Implementation of fast cycle times of 250 µs.

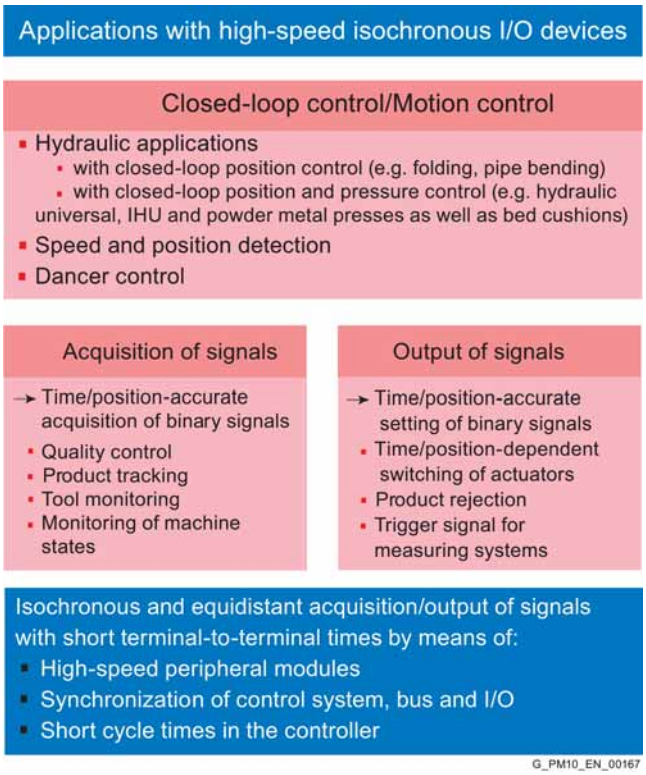
In comparison to PROFIBUS applications, much shorter terminal-to-terminal times can be implemented on the basis of PROFINET.

- The high data transmission rate of 100 Mbit/s and full-duplex mode (simultaneous transmitting and receiving) enable larger I/O volumes to be transmitted with the same bus cycle time as compared to PROFIBUS (125 bytes are transferred in approximately 10 µs).
- The communication performance is available on every PROFINET port of the controller – i.e. 4 times with SIMOTION D4x5 with CBE30 and SIMOTION P350-3 with MCI-PN Communication Board.
- The IM 151-3 PN High Speed Interface Module as well as the associated I/O modules have extremely short signal processing times (e.g. conversion time of 20 µs per channel for Analog Modules) so that even during the same bus cycle significantly shorter terminal-to-terminal times can be achieved with PROFINET than with a comparable PROFIBUS cycle. The big advantage: the terminal-to-terminal times are reduced without reducing the computing time available to the application.
- Apart from Isochronous Real-Time (IRT) communication, due to the bandwidth reserved for IRT, Real-Time (RT) communication and standard TCP/IP communication can also be executed without losing the deterministic response of the IRT message frames.

The minimum cycle times are usually dependent on the application to be implemented (computing load) and the performance capability of the controller used, e.g.
SIMOTION P350-3: minimum 250 µs;
SIMOTION D445: minimum 500 µs.

ET 200S is the optimum I/O system for closed-loop control and motion control applications in which short cycle times, isochronous/equidistant signal acquisition and signal output are required.

ET 200S also supports the accurate and high-speed acquisition of digital inputs as well as time or position-accurate switching of digital outputs. For position-accurate switching of digital outputs, the ET 200S output is assigned to the SIMOTION technology object "TO Output Cam" or "TO Cam Track".



The modules listed below support isochronous operation with bus cycle times of 250 µs minimum:

Description	Order No.	Note
IM 151-3 PN High Speed	**6ES7151-3BA50-0AB0**	STEP 7 V5.4, SP2: Hardware Support Package 139 V1.1 or higher is necessary
PM-E DC 24 V	**6ES7138-4CA01-0AA0**	
PM-E 24 to 48 V DC	**6ES7138-4CA50-0AB0**	
4 DI 24 V DC High Feature	**6ES7131-4BD01-0AB0**	
4 DO 24 V DC/0.5 A Standard	**6ES7132-4BD02-0AA0**	Available soon
4 DO 24 V DC/2 A Standard	**6ES7132-4BD32-0AA0**	
2 AI I 2-wire High Speed	**6ES7134-4GB52-0AB0**	
2 AI I 4-wire High Speed	**6ES7134-4GB62-0AB0**	Available soon
2 AI U High Speed	**6ES7134-4FB52-0AB0**	Available soon
2 AO U High Speed	**6ES7135-4FB52-0AB0**	
2 AO I High Speed	**6ES7135-4GB52-0AB0**	Available soon
1 SSI position acquisition	**6ES7138-4DB03-0AB0**	
1COUNT 24 V/100 kHz 1COUNT 5 V/500 kHz	**6ES7138-4DA04-0AB0** **6ES7138-4DE02-0AB0**	New firmware version available soon. Minimum cycle time expected to be 500 µs

Requirement:
SIMOTION V4.1, SP1 and higher and STEP 7 V5.4, SP2 and higher; the controller and the implemented I/O modules must support the bus cycle time that is required.

Up-to-date information about the modules that can be implemented with IM 151-3 PN High Speed can be found at:
http://support.automation.siemens.com/WW/view/en/25469217

Selection and ordering data

Description	Order No.
IM 151-1 Compact Interface Module for PROFIBUS DP Transmission rate up to 12 Mbit/s; for connecting to PROFIBUS DP, with RS 485 interface; expandable with up to 12 power, electronic and motor starter modules (no F or reserve modules); including termination module	
• **32 DI, 24 V DC** 32 digital inputs	**6ES7151-1CA00-1BL0**
• **16 DI, 24 V DC; 16 DO, 24 V DC/0.5 A** 16 digital inputs and 16 digital outputs	**6ES7151-1CA00-3BL0**
Terminal Modules for ET 200S Compact	
• **TM-C120S Compact** With screw terminals	**6ES7193-4DL10-0AA0**
• **TM-C120C Compact** With spring-loaded terminals	**6ES7193-4DL00-0AA0**
Add-on terminals for Terminal Modules of ET 200S Compact (TM-C120S/TM-C120C)	
• **TE-U120S 4x10 Compact Terminal Module** Screw-type terminals for 3-wire connection. Please order two for 4-wire connection.	**6ES7193-4FL10-0AA0**
• **TE-U120C 4x10 Compact Terminal Module** Spring-loaded terminals for 3-wire connection. Please order two for 4-wire connection. *Notes:* *The add-on terminals can also be attached to TM-E/TM-P Terminal Modules, provided at least 120 mm (4.72 in) of the construction width attains the same overall height as the Terminal Module.*	**6ES7193-4FL00-0AA0**
Interface Modules for PROFIBUS DP Transmission rate up to 12 Mbit/s; incl. termination module	
• **IM 151-1 Basic Interface Module** Data volume 88 bytes each for inputs and outputs; up to 12 power, electronic and motor starter modules can be connected (except F modules), for connection to PROFIBUS DP, with RS 485 interface	**6ES7151-1CA00-0AB0**
• **IM 151-1 Standard Interface Module** Data volume 244 bytes each for inputs and outputs; up to 63 I/O modules are connectable (except F modules), for connection to PROFIBUS DP with RS 485 interface	**6ES7151-1AA04-0AB0**
• **IM 151-1 High Feature Interface Module** As IM 151-1 Standard, but also for use with isochronous I/O and F modules	**6ES7151-1BA02-0AB0**
• **IM 151-1 FO Interface Module** As IM 151-1 Standard, but with 128 byte data volume each for inputs and outputs (no F or reserve modules); with fiber-optic interface	**6ES7151-1AB02-0AB0**

Description	Order No.
• **IM 151-7 CPU Interface Module** With integrated PROFIBUS DP interface (RS 485 interface); 96 KB RAM	**6ES7151-7AA13-0AB0**
• **IM 151-7 CPU FO Interface Module** As IM 151-7 CPU, but with FOC interface, 48 KB RAM	**6ES7151-7AB00-0AB0**
• **IM 151-7 F-CPU Interface Module** Integrated, failsafe CPU *For further information on the F-CPU and F-I/O, see Catalog IK PI and in the A&D Mall under "Automation Systems/Industrial Automation Systems/Distributed I/O".*	
Master Interface Module Expands the IM 151-7 CPU/ IM 151-7 F-CPU interface module with a DP master interface; up to one module per CPU	**6ES7138-4HA00-0AB0**
Interface Modules for PROFINET Transmission rate up to 100 Mbit/s, 2 x bus connection via RJ45, incl. termination module	
• **IM 151-3 PN Standard Interface Module** Max. 63 I/O modules can be connected (except F modules; reserve modules available soon)	**6ES7151-3AA22-0AB0**
• **IM 151-3 PN High Feature Interface Module** As IM 151-3 PN Standard, but F modules can be used	**6ES7151-3BA22-0AB0**
• **IM 151-3 PN FO Interface Module** As IM 151-3 PN High Feature, but with 2 PROFINET fiber-optic interfaces	**6ES7151-3BB22-0AB0**
• **IM 151-3 PN High Speed Interface Module** Max. 32 power modules and electronic modules can be connected; for the use of isochronous I/O with cycle times of 250 µs minimum; only for use with selected I/O modules *For detailed information, see under "Function"*	**6ES7151-3BA50-0AB0**
Micro Memory Card (MMC) With IM 151-7 CPU, essential for program back-up; with IM 151-3 PN essential for saving the device name (64 KB); required for firmware updates (more than 2 MB)	
• 64 KB	**6ES7953-8LF11-0AA0**
• 128 KB	**6ES7953-8LG11-0AA0**
• 512 KB	**6ES7953-8LJ11-0AA0**
• 2 MB	**6ES7953-8LL11-0AA0**
• 4 MB	**6ES7953-8LM11-0AA0**
• 8 MB	**6ES7953-8LP11-0AA0**
External prommer for MMC with USB interface	**6ES7792-0AA00-0XA0**

Selection and ordering data (continued)

Description	Order No.
Power Modules Ordering unit: 1 unit Width 15 mm (0.59 in)	
• **PM-E 24 V DC** For electronic modules, with diagnostics	**6ES7138-4CA01-0AA0**
• **PM-E 24 ... 48 V DC** For electronic modules, with diagnostics	**6ES7138-4CA50-0AB0**
• **PM-E 24 ... 48 V DC, 24 ... 230 V AC** For electronic modules, with diagnostics and fuse	**6ES7138-4CB11-0AB0**
Potential Distributor Module for ET 200S For preparing the load voltage on additional terminals; ordering unit: 1 unit, 15 mm (0.59 in) width	**6ES7138-4FD00-0AA0**
TM-P Terminal Modules for Power Modules [2] Ordering unit: 1 unit, width 15 mm (0.59 in)	
• **2 x 3 terminals with terminal access to AUX1, AUX1 connected through to the left**	
- TM-P15S23-A1, screw-type terminal	**6ES7193-4CC20-0AA0**
- TM P15C23-A1, spring-loaded terminals	**6ES7193-4CC30-0AA0**
- TM-P15N23-A1, Fast Connect	**6ES7193-4CC70-0AA0**
• **2 x 3 terminals with terminal access to AUX1, AUX1 interrupted to the left**	
- TM-P15S23-A0, screw-type terminal	**6ES7193-4CD20-0AA0**
- TM-P15C23-A0, spring-loaded terminals	**6ES7193-4CD30-0AA0**
- TM-P15N23-A0, Fast Connect	**6ES7193-4CD70-0AA0**
• **2 x 2 terminals without terminal access to AUX1, AUX1 connected through to the left**	
- TM-P15S22-01, screw-type terminal	**6ES7193-4CE00-0AA0**
- TM-P15C22-01, spring-loaded terminals	**6ES7193-4CE10-0AA0**
- TM-P15N22-01, Fast Connect	**6ES7193-4CE60-0AA0**

Description	**Order No.**
Digital Electronic Modules Ordering unit: 5 units, (unless specified otherwise) Width 15 mm (0.59 in)	
• 2 DI, 24 V DC, standard	**6ES7131-4BB01-0AA0**
• 4 DI, 24 V DC, standard	**6ES7131-4BD01-0AA0**
• 8 DI, 24 V DC, standard (ordering unit: 1 unit)	**6ES7131-4BF00-0AA0**
• 4 DI, 24 V DC, SOURCE INPUT, source inputs	**6ES7131-4BD51-0AA0**
• 8 DI, 24 V DC, SOURCE INPUT, source inputs (ordering unit: 1 unit)	**6ES7131-4BF50-0AA0**
• 4 DI, 24 V DC, NAMUR (ordering unit: 1 unit)	**6ES7131-4RD00-0AB0**
• 2 DI, 120 V AC	**6ES7131-4EB00-0AB0**
• 2 DI, 230 V AC	**6ES7131-4FB00-0AB0**
• With parameterizable input delay and diagnostics	
- 2 DI, 24 V DC, High Feature [1]	**6ES7131-4BB01-0AB0**
- 4 DI, 24 V DC, High Feature [1]	**6ES7131-4BD01-0AB0**
- 4 DI, 24 ... 48 V DC [1]	**6ES7131-4CD00-0AB0**
• 2 DO, 24 V DC/0.5 A, standard	**6ES7132-4BB01-0AA0**
• 4 DO, 24 V DC/0.5 A, standard [1]	**6ES7132-4BD01-0AA0**
• 8 DO, 24 V DC/0.5 A, standard [1] (ordering unit: 1 unit)	**6ES7132-4BF00-0AA0**
• 4 DO, 24 V DC/0.5 A, current sinking [1]	**6ES7132-4BD50-0AA0**
• 8 DO, 24 V DC/0.5 A, current sinking [1] (ordering unit: 1 unit)	**6ES7132-4BF50-0AA0**
• 2 DO, 24 V DC/2 A, standard	**6ES7132-4BB31-0AA0**
• 4 DO, 24 V DC/2 A, standard [1]	**6ES7132-4BD32-0AA0**
• With diagnostics for short-circuit and wire break, output of replacement value	
- 2 DO, 24 V DC/0.5 A, High Feature [1]	**6ES7132-4BB01-0AB0**
- 2 DO, 24 V DC/2 A, High Feature [1]	**6ES7132-4BB31-0AB0**
• 2 DO, 24 ... 230 V AC/1 A, output of substitute value	**6ES7132-4FB01-0AB0**
• 2 DO, 24 V DC ... 230 V AC/5 A, relay, NO contact, output of substitute value	**6ES7132-4HB01-0AB0**
• 2 DO, 24 V DC ... 230 V AC/5 A, relay, changeover contact, output of substitute value	**6ES7132-4HB10-0AB0**

[1] Can be used as isochronous I/O.
[2] Consult corresponding TM-P/TM-E manual or ET 200 Configurator software for selection.

Selection and ordering data (continued)

Description	Order No.
Analog Electronic Modules Ordering unit: 1 unit, (unless specified otherwise) Width 15 mm (0.59 in)	
• 2 AI, U, standard, cycle time 65 ms per channel, ± 5 V, ± 10 V, 1 ... 5 V, 13 bit (+ sign)	**6ES7134-4FB01-0AB0**
• 2 AI, U, High Feature [1], process and diagnostic alarm, cycle time 0,5 ms (both channels), ± 5 V, ± 10 V, 1 ... 5 V, 15 bit (+ sign), basic error limit ± 0.05 %	**6ES7134-4LB02-0AB0**
• 2 AI, U, High Speed [1], process and diagnostic alarm, cycle time 100 µs (both channels), ± 2.5 V, ± 5 V, ± 10 V, 1 ... 5 V, 15 bit (+ sign)	**6ES7134-4FB52-0AB0** **(available soon)**
• 2 AI, I, 2-wire, standard, cycle time 65 ms per channel, 4 ... 20 mA, 13 bit	**6ES7134-4GB01-0AB0**
• 4 AI, I, 2-wire, standard, cycle time 40 ms (both channels), 4 ... 20 mA, 13 bit	**6ES7134-4GD00-0AB0**
• 2 AI, I, 4-wire, standard, cycle time 65 ms per channel, 4 ... 20 mA, ± 20 mA, 13 bit (+ sign)	**6ES7134-4GB11-0AB0**
• 2 AI, I, 2/4-wire, High Feature [1], cycle time 0.5 ms (both channels), 4 ... 20 mA, ± 20 mA, 15 bit (+ sign), basic error limit ± 0.05 %	**6ES7134-4MB02-0AB0**
• 2 AI, I, 2-wire, High Speed [1], process and diagnostic interrupt, cycle time 100 µs (both channels), 0/4 ... 20 mA, 15 bit	**6ES7134-4GB52-0AB0**
• 2 AI, I, 4-wire, High Speed [1], process and diagnostic alarm, cycle time 100 µs (both channels), 0/4 ... 20 mA, ± 20 mA, 15 bit (+ sign)	**6ES7134-4GB62-0AB0** **(available soon)**
• 2 AI, TC, standard, cycle time 65 ms per channel, characteristic linearization for thermoelements of types: B, E, J, K, L, N, R, S, T, voltage measuring: ± 80 mV, 15 bit + sign	**6ES7134-4JB00-0AB0**
• 2 AI, TC, High Feature, with internal temperature compensation Cycle time 80 ms per channel, characteristic linearization for thermoelements of types: B, C, E, J, K, L, N, R, S, T, voltage measuring: ± 80 mV, 15 bit + sign (special TM required)	**6ES7134-4NB01-0AB0**
• 2 AI, RTD, standard, cycle time 130 ms per channel, Pt 100, Ni 100, (Standard, climate) Resistance: 150 Ω, 300 Ω and 600 Ω, 14 ... 15 bit + sign	**6ES7134-4JB50-0AB0**
• 2 AI, RTD, High Feature As RTD standard, but with additional functions such as: higher accuracy, additional measuring ranges, internal compensation of cable resistances	**6ES7134-4NB51-0AB0**
• 2 AO, U, standard, cycle time < 1.5 ms (both channels), ± 10 V, 13 bit + sign, 1 ... 5 V, 12 bit	**6ES7135-4FB01-0AB0**
• 2 AO, U, High Feature [1], cycle time 0.5 ms (both channels), ± 5 V, ± 10 V, 15 bit + sign, 1 ... 5 V, 15 bit, basic error limit ± 0.05 %	**6ES7135-4LB02-0AB0**
• 2 AO, U, High Speed [1], cycle time 100 µs (both channels), ± 5 V, 14 bit + sign, ± 10 V, 15 bit + sign, 1 ... 5 V, 14 bit	**6ES7135-4FB52-0AB0**
• 2 AO, I, standard, cycle time < 1.5 ms (both channels), ± 20 mA, 13 bit + sign, 4 ... 20 mA, 13 bit	**6ES7135-4GB01-0AB0**
• 2 AO, I, High Feature [1], cycle time < 0.5 ms (both channels), ± 20 mA, 15 bit + sign, 4 ... 20 mA, 15 bit, basic error limit ± 0.05 %	**6ES7135-4MB02-0AB0**
• 2 AO, I, High Speed [1], cycle time 100 µs (both channels), ± 20 mA, 15 bit + sign, 4 ... 20 mA, 15 bit	**6ES7135-4GB52-0AB0** **(available soon)**

[1] Can be used as isochronous I/O.

Selection and ordering data (continued)

Description	Order No.
Technology modules Ordering unit: 1 unit (if not specified otherwise)	
• **SSI module, 1 channel** [1] For connecting SSI absolute encoders, with latch input and comparison value, width 15 mm (0.59 in)	**6ES7138-4DB03-0AB0**
• **Pulse generator 2 PULSES, 2 channels** Pulse generator and Timer Module for controlling actuators, valves, heating elements, etc., optionally over PWM modulation, pulse chains or time-limited permanent signals at the 24 V output, width 15 mm (0.59 in)	**6ES7138-4DD00-0AB0**
• **Counter module 1 COUNT, 24 V/100 kHz, 1 channel** [1] Connection of incremental encoders, direction encoders and initiators; with DI, DO and comparison value; operating modes: counting, measuring, position detection; width 15 mm (0.59 in)	**6ES7138-4DA04-0AB0**
• **Counter module 1 COUNT, 5 V/500 kHz, 1 channel** [1] Connection of RS 422 incremental encoders; with DI, DO and comparison value; operating modes: counting, measuring, position detection; width 30 mm (1.18 in)	**6ES7138-4DE02-0AB0**
• **Sensor module 4 IQ-Sense** For connecting up to 4 IQ-Sense sensors, with SF-LED, width 15 mm (0.59 in), ordering unit: 5 units	**6ES7138-4GA00-0AB0**

For suitable sensors, see Catalogs NS K, IK PI or the A&D Mall under "Sensor, measuring and testing technology"

Description	Order No.
• **1 SI interface module** Serial interface (1 channel): RS 232C, RS 422, RS 485, protocols: ASCII, 3964 (R), 15 mm (0.59 in) width The standard functions required to use the module in conjunction with SIMOTION are part of the SCOUT command library.	**6ES7138-4DF01-0AB0**
• **1 STEP stepper module, 1 channel** For controlled positioning of stepper motor axes, interface to RS 422 and 2 DI, width 15 mm (0.59 in)	**6ES7138-4DC00-0AB0**

For power module for FM STEPDRIVE stepper motors, see Catalog NC 60 or the A&D Mall under "Automation Systems/Industrial automation systems SIMATIC/Programmable controllers/SIMATIC S7/S7-300/S7-300F/Function modules".

• **Positioning module 1 POS U, 1 channel** For controlled positioning with digital outputs for 5 V/24 V incremental encoder, SSI encoder, width 30 mm (1.18 in)	**6ES7138-4DL00-0AB0**
• **SIWAREX CS** Electronic weighing system for scales in SIMATIC ET200S for applications with and without verified calibration, EU type approval 2000 d, 30 mm (1.18 in) width	**7MH4910-0AA01**
• **SIWAREX CF** Transmitter for connecting DMS sensors, e.g. for force and torque measurement, 30 mm (1.18 in) width	**7MH4920-0AA01**

Further information about SIWAREX Weighing systems can be found at: http://www.siemens.com/siwarex

[1] Can be used as isochronous I/O.

Selection and ordering data (continued)

Description	Order No.
Reserve Module for reserving space in unused slots	
• Width 15 mm (0.59 in) (5 units)	**6ES7138-4AA01-0AA0**
• Width 30 mm (1.18 in) (1 unit)	**6ES7138-4AA11-0AA0**
TM-E Terminal Module for Electronic Modules [1] Ordering unit: 1 unit, width 30 mm (1.18 in) for 1 COUNT 5 V/500 kHz, 1 POS U and SIWAREX CS/CF	
• **4 x 4 terminals** Without terminal access to AUX1, AUX1 connected through to the left	
- TM-E30S44-01, screw-type terminals	**6ES7193-4CG20-0AA0**
- TM-E30C44-01, spring-loaded terminals	**6ES7193-4CG30-0AA0**
• **4 x 6 terminals** With terminal access to AUX1, AUX1 connected through to the left	
- TM-E30S46-A1, screw-type terminals	**6ES7193-4CF40-0AA0**
- TM-E30C46-A1, spring-loaded terminals	**6ES7193-4CF50-0AA0**
TM-E Terminal Modules for Electronic Modules [1] Ordering unit: 1 unit, width 15 mm (0.59 in), for 2 AI TC High Feature	
• **Terminal Modules for internal temperature compensation for 2 AI TC High Feature**	
- TM-E15S24-AT, screw-type terminals	**6ES7193-4CL20-0AA0**
- TM-E15C24-AT, spring-loaded terminals	**6ES7193-4CL30-0AA0**

Description	Order No.
TM-E Terminal Modules for Electronic Modules [1] Ordering unit: 5 units, Width 15 mm (0.59 in)	
• **2 x 4 terminals** With terminal access to AUX1, AUX1 connected through to the left	
- TM-E15S24-A1, screw-type terminals	**6ES7193-4CA20-0AA0**
- TM-E15C24-A1, spring-loaded terminals	**6ES7193-4CA30-0AA0**
- TM-E15N24-A1, Fast Connect	**6ES7193-4CA70-0AA0**
• **2 x 6 terminals** With terminal access to AUX1, AUX1 connected through to the left	
- TM-E15S26-A1, screw-type terminals	**6ES7193-4CA40-0AA0**
- TM-E15C26-A1, spring-loaded terminals	**6ES7193-4CA50-0AA0**
- TM-E15N26-A1, Fast Connect	**6ES7193-4CA80-0AA0**
• **2 x 3 terminals** Without terminal access to AUX1, AUX1 connected through to the left	
- TM-E15S23-01, screw-type terminals	**6ES7193-4CB00-0AA0**
- TM-E15C23-01, spring-loaded terminals	**6ES7193-4CB10-0AA0**
- TM-E15N23-01, Fast Connect	**6ES7193-4CB60-0AA0**
• **2 x 4 terminals** Without terminal access to AUX1, AUX1 connected through to the left	
- TM-E15S24-01, screw-type terminals	**6ES7193-4CB20-0AA0**
- TM-E15C24-01, spring-loaded terminals	**6ES7193-4CB30-0AA0**
- TM-E15N24-01, Fast Connect	**6ES7193-4CB70-0AA0**

[1] Consult corresponding TM-P/TM-E manual or ET 200 Configurator software for selection.

Selection and ordering data (continued)

Description	Order No.
Standard motor starter With diagnostics, electromechanical, fuseless, expandable with Brake Control Module	
• DS1-x direct-on-line starters	**3RK1301-■■B00-0AA2**
• RS1-x reversing starters	**3RK1301-■■B00-1AA2**
< 0.06 kW [1]; 0.14 ... 0.20 A [2]	**0 B**
0.06 kW [1]; 0.18 ... 0.25 A [2]	**0 C**
0.09 kW [1]; 0.22 ... 0.32 A [2]	**0 D**
0.10 kW [1]; 0.28 ... 0.40 A [2]	**0 E**
0.12 kW [1]; 0.35 ... 0.50 A [2]	**0 F**
0.18 kW [1]; 0.45 ... 0.63 A [2]	**0 G**
0.21 kW [1]; 0.55 ... 0.80 A [2]	**0 H**
0.25 kW [1]; 0.70 ... 1.0 A [2]	**0 J**
0.37 kW [1]; 0.9 ... 1.25 A [2]	**0 K**
0.55 kW [1]; 1.1 ... 1.6 A [2]	**1 A**
0.75 kW [1]; 1.4 ... 2.0 A [2]	**1 B**
0.90 kW [1]; 1.8 ... 2.5 A [2]	**1 C**
1.1 kW [1]; 2.2 ... 3.2 A [2]	**1 D**
1.5 kW [1]; 2.8 ... 4.0 A [2]	**1 E**
1.9 kW [1]; 3.5 ... 5.0 A [2]	**1 F**
2.2 kW [1]; 4.5 ... 6.3 A [2]	**1 G**
3.0 kW [1]; 5.5 ... 8.0 A [2]	**1 H**
4.0 kW [1]; 7.0 ... 10 A [2]	**1 J**
5.5 kW [1]; 9.0 ... 12 A [2]	**1 K**
High Feature motor starters With diagnostics, fuseless, expandable with brake control module	
• DS1e-x direct-on-line starters	**3RK1301-■■B10-0AA4**
• RS1e-x reversing starters	**3RK1301-■■B10-1AA4**
• DSS1e-x soft starters	**3RK1301-■■B20-0AA4**
0.3 ... 3.0 A [2]	**0 A**
2.4 ... 8.0 A [2]	**0 B**
2.4 ... 16.0 A [2]	**0 C**

Description	Order No.
Power Module for motor starter	
• PM-D Power Module for 24 V DC with diagnostics	**3RK1903-0BA00**
• Terminal Module for motor starter power module PM-DTM-P15-S27-01	**3RK1903-0AA00**
Accessories for standard motor starters	
• Control kit	
- For manually operating the contacts during start-up and servicing (one set contains five control kits)	**3RK1903-0CA00**
- For direct control of contactor (manual control) 24 V DC	**3RK1903-0CG00**
• Terminal Modules for direct starter	
- TM-DS45-S32 With supply connection for power bus incl. three caps for terminating the power bus	**3RK1903-0AB00**
- TM-DS45-S31 Without supply connection for power bus	**3RK1903-0AB10**
• Terminal Modules for reversing starter	
- TM-RS90-S32 With supply connection for power bus incl. three caps for terminating the power bus	**3RK1903-0AC00**
- TM-RS90-S31 Without supply connection for power bus	**3RK1903-0AC10**
Accessories for DS1-x, RS1-x motor starters	
• DM-V15 Distance Module	**3RK1903-0CD00**
- For direct online starters with high temperature and current load; 15 mm (0.59 in) wide	
• Terminal block PE/N	
- M45-PEN-F, 45 mm (1.77 in) wide; incl. 2 caps; in combination with TM-DS45-S32 or TM-RS90-S32	**3RK1903-2AA00**
- M45-PEN-S, 45 mm (1.77 in) wide; in combination with TM-DS45-S31 or TM-RS90-S31	**3RK1903-2AA10**

[1] Motor output for three-phase standard motor at 400 V.
[2] Setting range of the overcurrent release.

Selection and ordering data (continued)

Description	Order No.
Accessories for standard and High Feature motor starters	
• **Jumper module**	
- M30-PEN, 30 mm (1.18 in) wide; for bridging a 30 mm (1.18 in) module	**3RK1903-0AJ00**
- M15-PEN, 15 mm (0.59 in) wide; for bridging a 15 mm (0.59 in) module	**3RK1903-0AH00**
- M30-L123, 30 mm (1.18 in) wide; jumper module; for bridging a 30 mm (1.18 in) module	**3RK1903-0AF00**
- M15-L123, 15 mm (0.59 in) wide; bridge module; for bridging a 15 mm (0.59 in) module	**3RK1903-0AE00**
• **Brake Control Module** For motors with a mechanical brake	
- xB1 24 V DC/4 A	**3RK1903-0CB00**
- xB2 500 V DC/0.7 A	**3RK1903-0CC00**
- xB3 24 V DC/4 A, 2 DI 24 V DC Local control with diagnostics: with 2 inputs with quick-stop function	**3RK1903-0CE00**
- xB4 500 V DC/0.7 A, 2 DI 24 V DC Local control with diagnostics: with 2 inputs with quick-stop function	**3RK1903-0CF00**
• **Terminal Modules**	
- TM-xB15 S24-01 for xB1 or xB2	**3RK1903-0AG00**
- TM-xB215 S24-01 for xB3 ... xB4	**3RK1903-0AG01**

Description	Order No.
Accessories for High Feature motor starters	
• **Control Module 2DI, 24 V DC COM** Digital input module with two inputs	
- For local motor start functions for mounting to the front of a motor starter	**3RK1903-0CH10**
- For local motor start functions or manual operation for mounting to the front of a motor starter	**3RK1903-0CH20**
• **LOGO! PC cable** For connecting the High Feature motor starter with Switch ES interface to a PC	**6ED1057-1AA00-0BA0**
• **Terminal Modules**	
- **TM-DS65-S32** For direct on-line starters DS1e-x, DSS1e-x, with supply cable connection for power bus; incl. three caps for terminating the power bus	**3RK1903-0AK00**
- **TM-DS65-S31** For direct on-line starters DS1e-x, DSS1e-x, without supply cable connection for power bus	**3RK1903-0AK10**
- **TM-RS130-S32** For RS1e-x reversing starter, with supply cable connection for power bus; incl. three caps for terminating power bus	**3RK1903-0AL00**
- **TM-RS130-S31** For RS1e-x reversing starter, without supply cable connection for power bus	**3RK1903-0AL10**
• **M65-PEN-F Infeed Module** 65 mm (2.56 in) wide, incl. two caps, in conjunction with TM-DS65-S32/ TM-RS130-S32	**3RK1903-2AC00**
• **M65-PEN-S Connection Module** 65 mm (2.56 in) wide, in conjunction with TM-DS65-S31/ TM-RS130-S31	**3RK1903-2AC10**

Selection and ordering data (continued)

Description	Order No.
Local Safety Modules	
• **Safety Modules**	
- PM-D F1, with diagnostics, Safety Module for EMERGENCY-STOP applications, monitored startup	**3RK1903-1BA00**
- PM-D F2, with diagnostics, Safety Module for protective door monitoring automatic startup	**3RK1903-1BB00**
- PM-D F3, with diagnostics, Safety Module for expansion of PM-D F1/2 for an additional voltage group, time-delayed 0 to 15 s	**3RK1903-1BD00**
- PM-D F4, with diagnostics, Safety Module for expansion of PM-D F1/2 for an additional voltage group	**3RK1903-1BC00**
- PM-D F5, with diagnostics, Safety Module for expansion of PM-D F1 to F4 with four isolated enabling circuits, contact multiplier	**3RK1903-1BE00**
- PM-X, safety module with diagnostics; connection module for connecting a safety group and an external incoming supply contactor or external safety circuit	**3RK1903-1CB00**
• **Terminal Modules for Safety Modules**	
- TM-PF30 S47-B1, for PM-D F1/2 Safety Module with incoming supply U1/U2 and sensor connection	**3RK1903-1AA00**
- TM-PF30 S47-B0, for PM-D F1/2 Safety Module with sensor connection	**3RK1903-1AA10**
- TM-PF30 S47-C1, for PM-D F 3/4 Safety Module with incoming supply U1/U2 and IN+/IN- control input	**3RK1903-1AC00**
- TM-PF30 S47-C0, for PM-D F3/4 Safety Module with incoming supply U2	**3RK1903-1AC10**
- TM-PF30 S47-D0, for PM-D F5 Safety Module	**3RK1903-1AD10**
• **PM-X Safety Module**	**3RK1903-1AB00**
• **F kit 1** Failsafe equipment for DS1-x standard motor starter [1]	**3RK1903-1CA00**
• **F kit 2** Failsafe equipment for RS1-x standard motor starter [1]	**3RK1903-1CA01**
ET 200S accessories	
• **Shield connection element** Ordering unit: 5 units, pluggable on TM-E and TM-P	**6ES7193-4GA00-0AA0**
• **Shield terminal** Ordering unit: 5 units, for 3 x 10 mm (0.39 in) busbar	**6ES7193-4GB00-0AA0**
• **Grounding terminal** Ordering unit: 1 unit, for cable cross-sections up to 25 mm^2	**8WA2 868**
• **3 x 10 mm (0.39 in) busbars** Ordering unit: 1 unit	**8WA2 842**
• **SIMATIC, DIN rail**	
- 35 mm (1.38 in), length 483 mm (19.02 in) for 19" cabinets	**6ES5710-8MA11**
- 35 mm (1.38 in), length 530 mm (20.87 in) for 600 mm (23.62 in) cabinets	**6ES5710-8MA21**
- 35 mm (1.38 in), length 830 mm (32.68 in) for 900 mm (35.43 in) cabinets	**6ES5710-8MA31**
- 35 mm (1.38 in), length 2 m (6.56 ft)	**6ES5710-8MA41**
Label sheets DIN A4 (10 units) Each sheet contains 60 label strips for I/O Modules and 20 label strips for Interface Modules	
• Petrol	**6ES7193-4BH00-0AA0**
• Red	**6ES7193-4BD00-0AA0**
• Yellow	**6ES7193-4BB00-0AA0**
• Light beige	**6ES7193-4BA00-0AA0**
Accessories for coding	
Color coding plates Ordering unit: 200 units for TM-P, TM-E	
• White	**6ES7193-4LA20-0AA0**
• Yellow	**6ES7193-4LB20-0AA0**
• Yellow/green	**6ES7193-4LC20-0AA0**
• Red	**6ES7193-4LD20-0AA0**
• Blue	**6ES7193-4LF20-0AA0**
• Brown	**6ES7193-4LG20-0AA0**
• Turquoise	**6ES7193-4LH20-0AA0**
Labels, inscribed Ordering unit: 1 set	
• 200 units for slot numbering (1 to 20) 10 x	**8WA8861-0AB**
• 200 units for slot numbering (1 to 40) 5 x	**8WA8861-0AC**
• 200 units for slot numbering (1 to 64) 1 x, (1 to 68) 2 x	**8WA8861-0DA**
Labels, blank	
• 200 units for slot numbering	**8WA8848-2AY**
ET 200S manual Manuals for the ET 200S distributed I/O system are available as PDF files on the Internet at: http://www.siemens.com/simatic-docu	

More information

For further information on SIMATIC ET 200S (frequency converters, fail-safe modules, additional accessories as well as the detailed technical specifications, see Catalog IK PI and the A&D Mall under "Automation Systems/Industrial automation systems SIMATIC/Distributed I/O".

[1] The function of the failsafe kit is already integrated into High Feature motor starters.

Overview

- Compact, cost-effective I/O devices for processing digital signals
- Designed for use without a control cabinet with IP65/67 degree of protection with flexible and fast connections
- Comprises of a basic module and various connection blocks for application-specific implementation options
  - ECOFAST: 2 x RS 485 hybrid fieldbus connection with identification plug for setting the PROFIBUS address
  - M12: 2 x M12 and 2 x 7/8" with 2 rotary coding switches for assigning the PROFIBUS address
- Connection block contains T-functionality for PROFIBUS DP and power supply so that during commissioning and service, the modules can be disconnected and reconnected to the PROFIBUS without interruption
- Module variants:
  8 DI, 16 DI, 8 DI/8 DO (1.3 A), 8 DI/8 DO (2.0 A), 8 DO, 16 DO
- Module diagnostics for load voltage and encoder short-circuit
- Transmission rates up to 12 Mbit/s

Application

ET 200eco is the compact block I/O with IP65/67 degree of protection and is distinguished by simple handling and installation.

Et 200eco allows the user to cost-effectively process digital signals on PROFIBUS DP.

Thanks to its high degree of protection and ruggedness, it is particularly suitable for use close to the machine.

The flexible connection blocks can be used to connect PROFIBUS DP over M12 or a standardized hybrid fieldbus connection (ECOFAST).

The compact ET 200eco can be used as an expansion for applications with high degree of protection in addition to the ET 200pro modular I/O family.

Design

ET 200eco comprises a Basic Module and a connection block.

For applications in many different sectors, a compact, perfectly matched module spectrum of digital I/Os is available:

Number of channels	Type of connection
8 DI	8 individual channels over 8 x M12 screw connections for 8 digital input signals
16 DI	16 channels over 8 x M12 screw connections with double assignment for 16 digital input signals
8 DO	8 individual channels over 8 x M12 screw connections for 8 digital output signals (2 A)
16 DO	16 channels over 8 x M12 screw connections with double assignment for 16 digital output signals (0.5 A)
8 DI/8 DO (2 variants)	16 channels over 8 x M12 screw connections with double assignment for 8 digital input and 8 digital output signals (2 A or 1.3 A)

With the variable and flexible connection blocks, PROFIBUS DP can be connected over 2 x M12, 2 x 7/8" or 2 x hybrid fieldbus interfaces (ECOFAST).

The T-functionality for PROFIBUS DP and power supply are integrated in the connection block so that machines can be operated without interruption during commissioning and service of bus lines and without having to use supplementary components.

The pin assignment for the actuators and sensors is modelled on the IP65/67 standardization trends.

The PROFIBUS address can be set and seen from the outside or plugged. The proven identification connector is used for ECOFAST interfaces. For M12 7/8" interfaces, two rotary coding switches which can be seen from the outside are used to set the PROFIBUS address.

Function

Communication is handled completely over PROFIBUS DP.

Diagnostic functions are available for checking the mode of operation of the ET 200eco:

- BF (bus fault)
- SF (system fault)
- Encoder and load power supply

The diagnostic data is indicated by LEDs on the module and can be evaluated by software on the PG/PC or by SIMOTION.

Short-circuits of the encoder supply as well as missing load voltages are identified for each module.

The connection block can be removed from and screwed back to the Basic Module while the power is on so that PROFIBUS and the power supply remain active for the application all the time.

More information

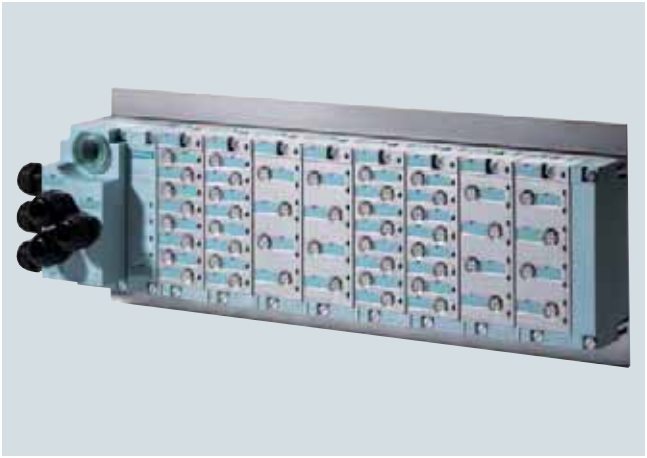
For further information and ordering data, see Catalog IK PI and the A&D Mall under "Automation Systems/Industrial automation systems SIMATIC/Distributed I/O".

ET 200 Configurator software is available as a download for planning the ET 200eco and creating order lists:

http://www.siemens.com/ET200

SIMATIC ET 200pro

Overview



SIMATIC ET200pro is the modular I/O system with high IP65/67 degree of protection for local, cabinet-free applications.
ET 200pro distinguishes itself through a small frame size and an innovative installation concept. The ET 200pro station can be easily adapted to the requirements of the corresponding automation task with respect to the connection method, required I/Os and fieldbus connection. New features such as the integrated PROFIsafe safety technology, the PROFINET interface and the ability to hotswap modules permit it to be used for a wide range of applications.

Benefits

- Distributed I/O system with high IP65/67 degree of protection
- Flexible fieldbus connection through interface modules for PROFIBUS DP and PROFINET
- Modular design with up to 16 expansion modules for flexible adaptation to the automation task
- Comprehensive module range
  - Digital and Analog Input and Output Modules
  - Power module for simple implementation of 24 V load groups
  - Motor starter
  - PROFIsafe module
- Simple, quick assembly and high vibration strength of the module carrier
- Integration of safety technology with PROFIsafe
- High plant availability through permanent wiring and the ability to replace Electronic Modules during operation and hot swapping
- Low space requirements through small footprint (I/O module e.g. 130 mm (5.12 in) high and 45 mm (1.77 in) wide)
- Graduated diagnostics concept, optionally with module-specific or channel-specific diagnosis of faults of connected sensors or actuators
- Simple configuration through ET 200pro configurator software

Design

SIMATIC ET 200pro comprises of an interface module which contains the fieldbus interface and is expandable with a comprehensive module range.

The system bus and 24 V power wiring are configured with a busbar system which is integrated in the modules. Wiring using connecting cables is therefore not necessary.

Quick assembly and high vibration strength is achieved through a rack which is available in different options and is an integral part of the system. The modules are first latched onto this rack and then secured with a few screws to achieve a good fit and very high vibration strength.

The modules of the ET 200pro series usually have two or three components. Interface and Power Modules as well as Digital and Analog Expansion Modules comprise:

- one bus connector which constitutes the backplane bus of the system,
- one Electronics Module or Interface Module and
- one Connection Module.

The separation of module and bus/power connection technology, which has already been used for the ET 200eco, is now also used for the Digital and Analog Expansion Modules of the ET 200pro. For the interface module, this allows use of the T-functionality for the bus and 24 V power supply, and for the Expansion Modules it permits pre-wiring of sensor/actuator connections. This permanent wiring allows exactly one Electronics Module to be hotswapped in the event of a fault without having to switch off the whole station. This ensures very high machine and plant availability. When an electronics component is replaced, the whole I/O wiring can remain on the Connection Module and does not have to be marked or removed.

Power Modules can be added to the system if selective load groups have to be configured within a station or if a 24 V backfeed is required. The power modules interrupt the busbar integrated into the system for the 24 V load supply and feed the power back into the system at the point of connection.

- Up to 16 expansion modules can be used (max. station width: 1 meter (3.28 ft))
- Build-as-you-go busbars for 24 V power and communication within the station
- Flexible connection system
  - Connection for PROFIBUS DP and 24 V power supply over direct coupling (M20 cable gland), ECOFAST or M12 / 7/8“
  - Connection for PROFINET and 24 V power supply over M12 / 7/8“
  - Sensors and actuators for 8-channel I/O modules can be optionally connected to 4 x M12 or 8 x M12.

More information

ET 200 Configurator software is available as a download for planning the ET 200pro and creating order lists:

http://www.siemens.com/ET200

ADI 4 (Analog Drive Interface)
IM 174 (Interface Module for 4 Axes)

Overview

The ADI 4 (Analog Drive Interface for 4 Axes) or IM 174 (Interface Module for 4 Axes) modules can be used to connect drives with analog ± 10 V setpoint interfaces.

The IM 174 module also allows stepper drives with pulse/direction interfaces to be connected.

Application

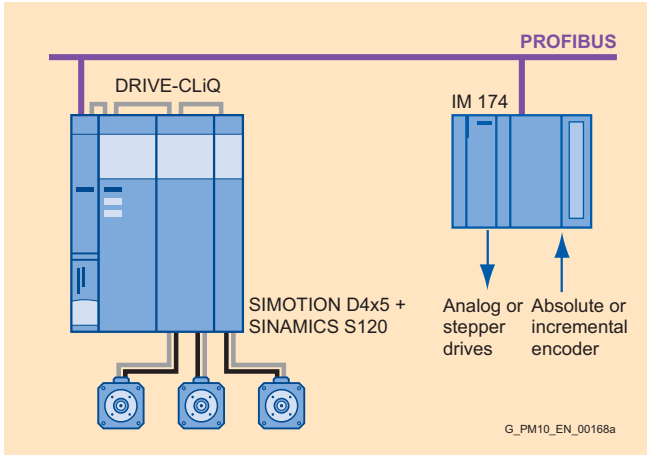
Up to four drives with analog setpoint interfaces can be operated on each of these modules. The isochronous PROFIBUS DP is used for coupling to SIMOTION.

The following can be connected:

- Electrical servo drives with analog ± 10 V setpoint interface
- Hydraulic drives with analog ± 10 V setpoint interface (e.g. for servo hydraulic valve)
- For IM 174 only: Stepper drives with pulse direction interface (e.g. SIMOSTEP motors with FM STEPDRIVE power module)

ADI 4 and IM 174 can also be used for "external encoders"; at least one axis must be created.

Mixed operation of the 4 drive interfaces is possible.



Additional notes

- The modules are not certified PROFIBUS DP standard slaves and can therefore only be used in combination with the controllers intended for this purpose (e.g. SIMOTION C/P/D). The modules do not support acyclic communication and the I/O interfaces can only be used in combination with the encoder or drive functions.
- ADI 4 and IM 174 must be operated on an isochronous PROFIBUS DP.
  Supported DP cycles:
  - ADI 4: 1 ms and above (isochronous, max. 12 Mbit/s)
  - IM 174: 1.5 ms and above (isochronous, max. 12 Mbit/s)

Design

Interfaces

Display and diagnostics

- Onboard status display on 4 diagnostics LEDs

Drive interfaces

- 4 analog outputs ± 10 V for connecting drives with analog setpoint interface
- For IM 174 only: 4 interfaces for controlling stepper drives with or without encoder connection
- 4 relay contacts for drive enable axes 1 to 4

Encoder interfaces

- 4 encoder inputs for position acquisition. Each input can be connected either to an RS422 incremental encoder or to an SSI absolute encoder.
  Encoders with SINE/COSINE signals (1 V_{pp}) can be connected using external pulse shaping electronics (EXE) which convert the signals to the 5 V TTL level.

Communication

- PROFIBUS DP interface with motion control functionality (isochronous, max. 12 Mbit/s)

Digital inputs and outputs

- 10 DI, 24 V DC (e.g. for BERO, probe and "Drive Ready" signal)
- 8 DO, 24 V DC, 0.5 A (e.g. for drive enable)

Additional interfaces

- 2 relay contacts for "Ready" signal

An external power source (24 V DC) is required for supplying the module and the digital outputs.

All connections are at the front panel.

Function

The following functions are available in conjunction with SIMOTION:

- Speed-controlled axes
- Position-controlled axes
- External encoder for SIMOTION (at least one axis must be configured)
- Homing over BERO or
- Homing over zero marks (non-distance-coded zero marks/ reference marks)
- Measuring over Sensor 1 and Sensor 2
  (one edge, rising or falling)

ADI 4 (Analog Drive Interface)
IM 174 (Interface Module for 4 Axes)

Technical specifications

	ADI 4	IM 174
Input voltage	24 V DC	24 V DC
Power consumption, max.	max. 30 W	typ. 12 W
Inputs/outputs	Isolated	Isolated
Relay contacts	Max. current carrying capacity: 2 A for 150 V DC or 125 V AC Switching cycles: - for 24 V DC, 1 A: 1 x 10^7 - for 24 V DC, 2 A: 1 x 10^5	Max. current carrying capacity: 1 A for 30 V DC Switching cycles: - for 30 V DC, 1 A: at least. 5 x 10^5
Encoder inputs Can be used alternatively for incremental encoders (symmetrical) or absolute encoders (SSI)	4	4
Drive interfaces Used for:	4	4
• Analog drives (over analog output ± 10 V)	Yes	Yes
• Hydraulic drives (hydraulic valve over analog output, ± 10 V)	Yes	Yes
• Stepper drives (over pulse/direction interface)	No	Yes
Communication		
• PROFIBUS DP interfaces	1 (isochronous, max. 12 Mbit/s)	1 (isochronous, max. 12 Mbit/s)
• Minimum PROFIBUS DP cycle	1 ms	1.5 ms
Degree of protection in accordance with EN 60529	IP20	IP20
Condensation	Not permissible	Not permissible
Permissible ambient temperature		
• Storage	-20 ... +55 °C (-4 ... +131 °F)	-40 ... +70 °C (-40 ... +158 °F)
• Transportation	-40 ... +70 °C (-40 ... +158 °F)	-40 ... +70 °C (-40 ... +158 °F)
• Operation	0 ... +55 °C (+32 ... +131 °F)	0 ... +60 °C (+32 ... +140 °F)
Design	Housing in booksize format; fixed by screwing	S7-300 design (no backplane bus, connected over PROFIBUS)
Weight, approx.	1.5 kg (3.31 lb)	1 kg (2.21 lb)
Dimensions (W × H × D)	48.5 mm × 325 mm × 154.4 mm (1.91 in × 12.80 in × 6.08 in)	160 mm × 125 mm × 118 mm (6.30 in × 4.92 in × 4.65 in)

Selection and ordering data

Description	Order No.
ADI 4 (Analog Drive Interface for 4 Axes)	**6FC5211-0BA01-0AA3**
Manual for ADI 4	
• German	**6FC5297-0BA01-0AP4**
• English	**6FC5297-0BA01-0BP4**
IM 174 (Interface Module for 4 Axes)	**6ES7174-0AA00-0AA0**
IM 174 Manual	Available as a PDF file in different languages over the Internet.
40-pole front connector	See "Accessories and spare parts" under SIMATIC S7-300 I/O

More information

For power modules for FM STEPDRIVE stepper motors, see the Catalog NC 60 or the A&D Mall under "Automation Systems/ Industrial automation systems SIMATIC/Programmable controllers SIMATIC/SIMATIC S7/S7-300/S7-300F/Function modules".

Overview

An important characteristic of the AS-Interface technology is the use of an unshielded two-core cable for data transmission and distribution of auxiliary power to the sensors and actuators. The special AS-Interface power supply unit supports the AS-Interface transmission method. The mechanically coded and thus polarized AS-Interface cable is used for wiring. The AS-Interface Modules are connected to the AS-Interface cable with insulation piercing contacts.

The ASIsafe concept supports direct integration of safety-related components, such as EMERGENCY-STOP switches, protective door switches or safety light arrays, in the AS-Interface network.

Application

Process or field communication

Complex control cable wiring in the control cabinet and control cabinets full of terminal blocks can be replaced with AS-Interface. Thanks to a specially developed ribbon cable (easily recognized by its yellow color) and insulation piercing technology, the AS-Interface cable can be connected anywhere. This concept results in enormous flexibility and significant cost savings. AS-Interface is an open standard (EN 50295/IEC 62026-2). Leading manufacturers of actuators and sensors worldwide support AS-Interface.

AS-Interface is used where individual actuators/sensors are spatially distributed over a machine (e. g. in a bottling plant or production line). AS-Interface replaces complex cable harnesses as well as connects binary and analog actuators and sensors such as proximity switches, measuring sensors, valves or indicator lights with a SIMOTION control. In practice, this means: Installation runs smoothly because data and power are transported together over a single line. No special expertise is required for installation and commissioning. Furthermore, through simple cable laying and the freely configurable network topology as well as the special design of the cable, you not only significantly reduce the risk of errors, but also service and maintenance costs.

Safety included

The ASIsafe concept supports direct integration of safety-related components, such as EMERGENCY-STOP switches, protective door switches or safety light arrays, in the AS-Interface network. These are fully compatible with the other AS-Interface components (masters, slaves, power supply units, repeaters, etc.) and are operated together on the yellow AS-Interface cable.

The signals of the safety sensors are evaluated by a safety monitor. The safety monitor not only monitors the switching signals of the safety sensors, but also continuously checks whether data transmission is functioning properly. Depending on the variant, the safety monitor has one or two release circuits which are used to put the machine or plant into a safe state. Each release circuit has two switching contacts to fulfill Safety Category 4 in accordance with EN 954-1 or SIL 3 to IEC 61508. Sensors and monitor can be connected at any point in the AS-Interface network. It is also possible to use several safety monitors on a single network.

A failsafe control or special master is not required. The master treats safety slaves in the same way as all other slaves. The safety data is evaluated in the safety monitor. In this way, existing AS-Interface networks can also be expanded.

Design

AS-Interface is a single master system. A communications processor (CP 343-2 P), which controls the process or field communication as a master, is used for central application with SIMOTION C or distributed applications over ET 200M. The DP/AS-Interface Link 20E and DP/AS-Interface Link Advanced are used to establish a direct connection between AS-Interface and PROFIBUS DP.

IE/AS-Interface Link PN IO can also be used to connect AS-Interface to PROFINET.

The gateways enable AS-Interface to be used as a subnet for PROFIBUS DP or PROFINET on SIMOTION.

Up to 62 slaves can be operated on the AS-Interface. SIMOTION supports all digital and analog AS-Interface slaves (with Analog Profile 7.3 and higher).

The maximum extension of an AS-Interface network is 200 m (656 ft) (with AS-i extension plug) or 100 m (328 ft) (without AS-i extension plug). This length can be increased with the help of repeaters.

The following AS-Interface masters are available for SIMOTION:

- DP/AS-Interface Link 20E and DP/AS-Interface Link Advanced connect PROFIBUS DP to AS-Interface
- The IE/AS-Interface Link PN IO connects PROFINET IO with AS-Interface.
- The CP 343-2 P is the AS-Interface master for central application with SIMOTION C or for the ET 200M distributed I/O system.

DP/AS-Interface Link Advanced and IE/AS-Interface Link PN IO support particularly easy diagnostics and commissioning on site over the integrated pixel graphics display and control keys or over the web interface using a standard browser.

The modules operate in compliance with the latest AS-i specification 3.0 and therefore also support the operation of digital A/B slaves with 4 inputs and 4 outputs as well as analog A/B slaves.

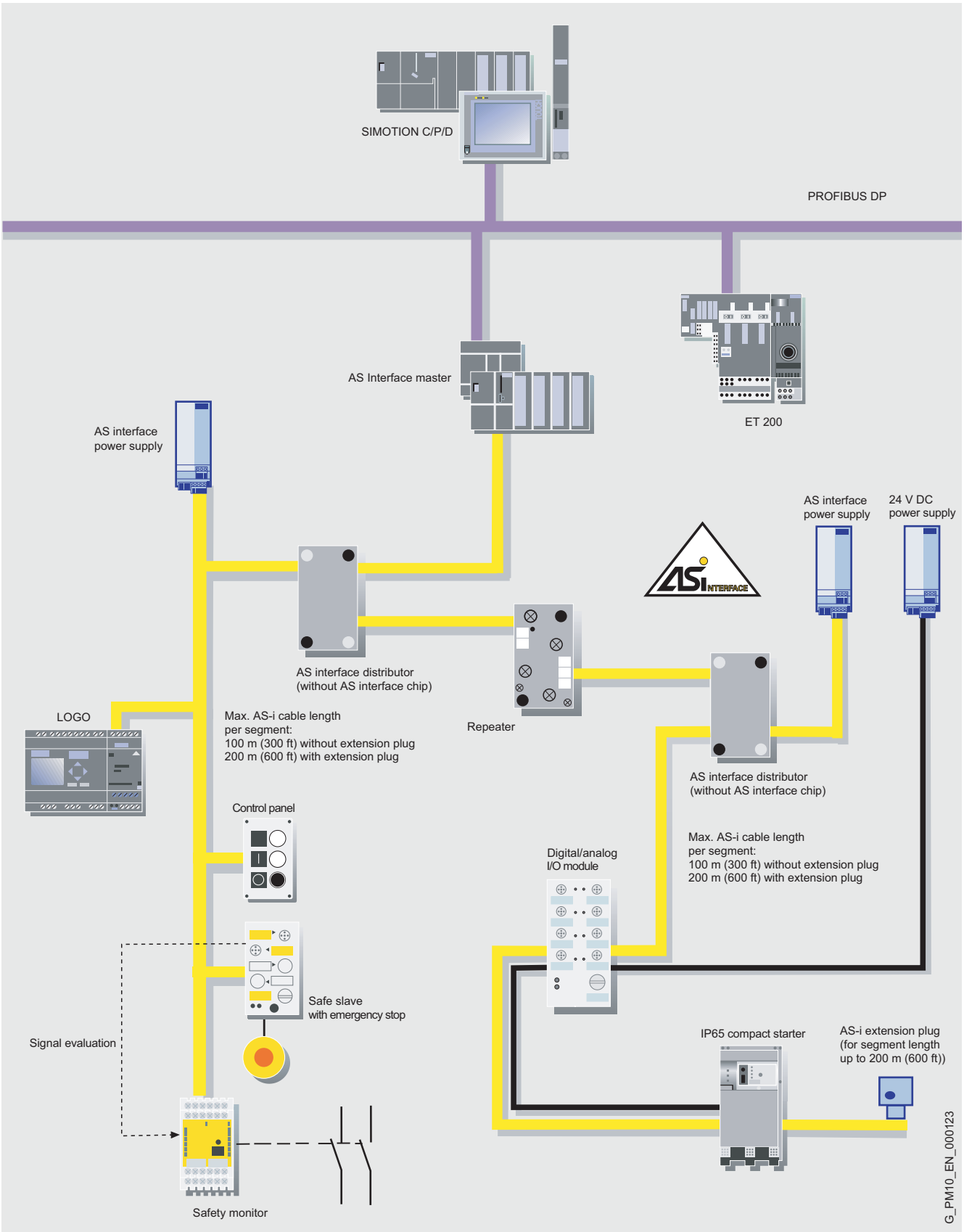
If the optional C-PLUG is used, modules can be replaced without the need to set PROFIBUS or Ethernet addresses.

The SCOUT command library contains standard functions for easy handling of the AS-Interface components, e.g.

- for operating the command interface of the AS-Interface master
- for reading out the diagnostic information from the ASIsafe safety monitor

AS-Interface

Design (continued)



AS-Interface network topology

Selection and ordering data

Description	Order No.
DP/AS-Interface Link 20E Router between PROFIBUS DP and AS-Interface with IP20 degree of protection	**6GK1415-2AA01**
RS 485 bus connector with angled cable outlet (35°) With screw-type terminals, without PG interface	**6ES7972-0BA41-0XA0**
Manual DP/AS-Interface Link 20E Printed version including type and GSD files	
• German	**6GK1971-2DS01-0AA0**
• English	**6GK1971-2DS01-0AA1**
• French	**6GK1971-2DS01-0AA2**
• Italian	**6GK1971-2DS01-0AA4**

Description	Order No.
DP/AS-Interface Link Advanced Router between PROFIBUS DP and AS-Interface; master profiles M3 and M4, extended AS-Interface specification V3.0; IP20 degree of protection; manual on CD-ROM	
• Single master with display	**6GK1415-2BA10**
• Dual master with display	**6GK1415-2BA20**
C-PLUG Swap medium for easy replacement of the devices in the event of a fault; for storing configuration data or engineering data and user data	**6GK1900-0AB00**
RS 485 bus connector with angled cable outlet (35°) With screw-type terminals, without PG interface	**6ES7972-0BA41-0XA0**
IE FC RJ45 Plug 90 RJ45 plug-in connector for Industrial Ethernet with a rugged metal housing and integrated insulation displacement contacts for connecting Industrial Ethernet FC installation cables; with 90° cable outlet	
• 1 pack = 1 unit	**6GK1901-1BB20-2AA0**
• 1 pack = 10 units	**6GK1901-1BB20-2AB0**
• 1 pack = 50 units	**6GK1901-1BB20-2AE0**

Description	Order No.
IE/AS-Interface Link PN IO Router between Industrial Ethernet and AS-Interface; master profiles M3 and M4, enhanced AS-Interface specification V3.0; IP20 degree of protection; manual on CD-ROM	
• Single master with display	**6GK1411-2AB10**
• Dual master with display	**6GK1411-2AB20**
C-PLUG Swap medium for easy replacement of the devices in the event of a fault; for storing configuration data or engineering data and user data	**6GK1900-0AB00**
IE FC RJ45 Plug 90 RJ45 plug-in connector for Industrial Ethernet with a rugged metal housing and integrated insulation displacement contacts for connecting Industrial Ethernet FC installation cables; with 90° cable outlet	
• 1 pack = 1 unit	**6GK1901-1BB20-2AA0**
• 1 pack = 10 units	**6GK1901-1BB20-2AB0**
• 1 pack = 50 units	**6GK1901-1BB20-2AE0**

Description	Order No.
CP 343-2 P Communications processor For connecting SIMOTION C and ET 200M to AS-Interface; without front connector	**6GK7343-2AH10-0XA0**
20-pole front connector for CP 343-2 P	See "Accessories and spare parts" under SIMATIC S7-300 I/O
CP 343-2 P Manual Printed version	
• German	**6GK7343-2AH00-8AA0**
• English	**6GK7343-2AH00-8BA0**
• French	**6GK7343-2AH00-8CA0**
• Italian	**6GK7343-2AH00-8EA0**

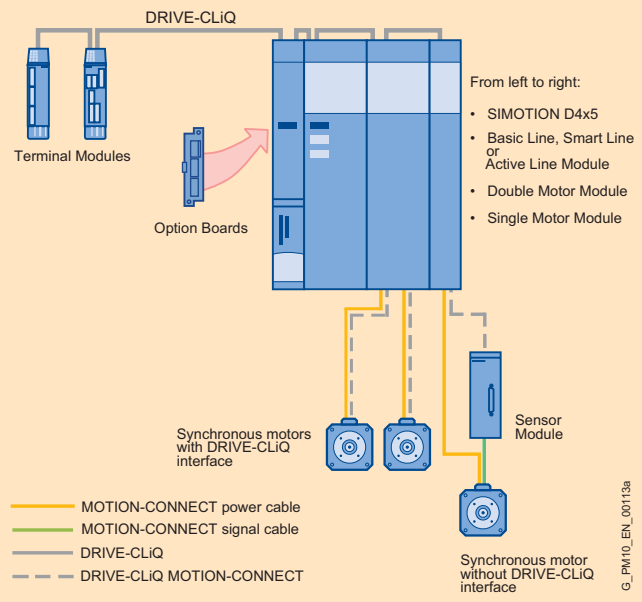
More information

For further information on AS-Interface slaves, ASIsafe and ordering data please go to

- http://www.siemens.com/as-interface
- Catalog IK PI
- In the A&D Mall under "Communication/Networks/ SIMATIC NET communication systems/AS-Interface".

Summary

Overview



SINAMICS drive I/O

With the modules of the SINAMICS drive I/O, the SIMOTION Motion Control system as well as the SINAMICS S120 drive system can be expanded with digital and analog inputs and outputs as well as encoder interfaces.

The following modules are available:

- TB30 Terminal Board that is plugged into the option slot of the SINAMICS CU320/SIMOTION D4x5 Control Unit. It provides additional digital and analog inputs and outputs.
- TM Terminal Modules that are connected to SINAMICS/SIMOTION over DRIVE-CLiQ. The Terminal Modules expand SINAMICS/SIMOTION with additional digital and analog inputs/outputs.
- SMC/SME Sensor Modules that are connected to the SINAMICS/SIMOTION Control Unit over DRIVE-CLiQ. The SMC Sensor Modules (for control cabinet installation) and SME (IP67 version for installation outside the control cabinet) are required if motors are to be connected without DRIVE-CLiQ and/or if other encoders must be evaluated in addition to the motor encoder.

Connection to SINAMICS/SIMOTION

The modules of the SINAMICS drive I/O are connected to SINAMICS/SIMOTION over DRIVE-CLiQ. The only exception is the TB30 Terminal Board, which is plugged directly into the SINAMICS or SIMOTION Control Unit as a plug-in card.

DRIVE-CLiQ is used to connect SINAMICS Control Units and SIMOTION controllers to other drive-based components, such as line modules, motor modules, motors and encoders. Setpoints and actual values, control commands, status messages and electronic name plate data for the connected components are transferred via DRIVE-CLiQ.

Benefits

- DRIVE-CLiQ significantly simplifies commissioning and diagnostics since all connected components are identified with the help of an electronic nameplate.
- The standardized cables and connectors reduce the variety of different parts and cut storage costs.

Application

TB30 Terminal Board

Fields of application
Expansion of the Control Unit with additional digital and analog inputs/outputs. (Plug-in Module for option slot of SIMOTION D4x5/SINAMICS S120 CU320 Control Unit)

Main features
4 DI, 4 DO, 2 AI, 2 AO

TM15/TM17 High Feature Terminal Modules

Fields of application
Implementation of measuring inputs and cam outputs as well as drive-related digital inputs and outputs with short signal delay times (TM17 High Feature can only be used in conjunction with SIMOTION)

Main features of TM15
24 isolated, bidirectional DI/DO with measuring input and cam functionality (measuring input and cam functionality is available only in conjunction with SIMOTION)

Main features of TM17 High Feature
16 non-isolated, bidirectional DI/DO with measuring input and cam functionality for the highest requirements with respect to resolution, accuracy and short input delay times. In addition, enabling inputs can be parameterized.

TM31

Fields of application
Expansion of digital and analog inputs and outputs over DRIVE-CLiQ

Main features

- 8 DI, 4 bidirectional DI/DO, 2 relay outputs
- 2 AI, 2 AO
- 1 temperature sensor input (KTY84-130 or PTC)

TM41

Fields of application
The TM41 Terminal Module is used for incremental encoder emulation. A master value (incremental signal) can be made available to a second control unit as an external encoder signal via the TM 41.

Main features

- 4 DI, 4 DI/O
- 1 AI
- 1 interface for TTL incremental encoder emulation (RS422)

TM54F

Fields of application
The TM54F provides safe digital inputs and outputs for controlling the Safety Integrated functions of SINAMICS.

Main features

- 4 fail-safe digital outputs (F-DO)
- 10 fail-safe digital inputs (F-DI)

Application (continued)

SMC10/SMC20/SMC30 Sensor Modules

Fields of application
Motor encoder and temperature evaluation of motors without DRIVE-CLiQ or when additional encoders are used (for example, machine encoders)

Main features of SMC10
One encoder connection for evaluating the resolver signals (two-pole and multi-pole). In addition, the motor temperature can be monitored with a KTY84-130 or PTC thermistor.

Main features of SMC20
One encoder connection for evaluating

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

In addition, the motor temperature can be monitored with a KTY84-130 or PTC thermistor.

Main features of SMC30
One encoder connection for evaluating

- Incremental encoders (TTL/HTL)
- SSI encoders with and without incremental signals (TTL/HTL)

In addition, the motor temperature can be monitored with a KTY84-130 or PTC thermistor.

SME20/SME25 Sensor Modules External

Fields of application
SME20/SME25 Sensor Modules External are encoder evaluation units for machine encoders (direct measuring systems). The devices are designed with IP67 degree of protection. This means that the units can be installed outside the control cabinet near the machine encoder.

Main features of SME20
One encoder connection for evaluating incremental encoders (sin/cos 1 V_{pp}) without rotor position track (C/D track).

Main features of SME25
An encoder connection for evaluating absolute encoders (EnDat) and SSI absolute encoders with incremental signals (sin/cos 1 V_{pp}).

SME120/SME125 Sensor Modules External

The SME120/SME125 Sensor Modules External are encoder evaluation units with degree of protection IP67, especially suitable for use in linear and torque motor applications. They can be installed close to the motor systems and encoders in the machine.

Main features of SME120

One encoder connection for evaluating incremental encoders (sin/cos 1 V_{pp}).

Main features of SME125

One encoder connection for evaluating absolute encoders (EnDat).

With SME120 and SME125, the motor temperature can also be detected using KTY84-130 or PTC thermistors.

DMC20 DRIVE-CLiQ Hub Module

Fields of application
The DMC20 can be used to increase the number of DRIVE-CLiQ interfaces.

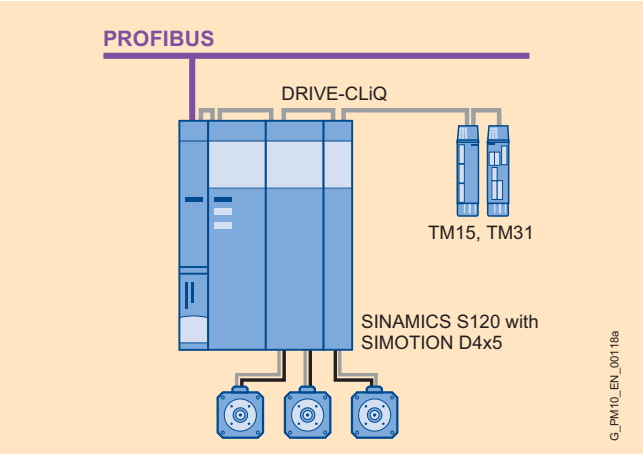
Main features
DRIVE-CLiQ hub with 6 DRIVE-CLiQ sockets for connecting 5 additional DRIVE-CLiQ nodes.

Integration

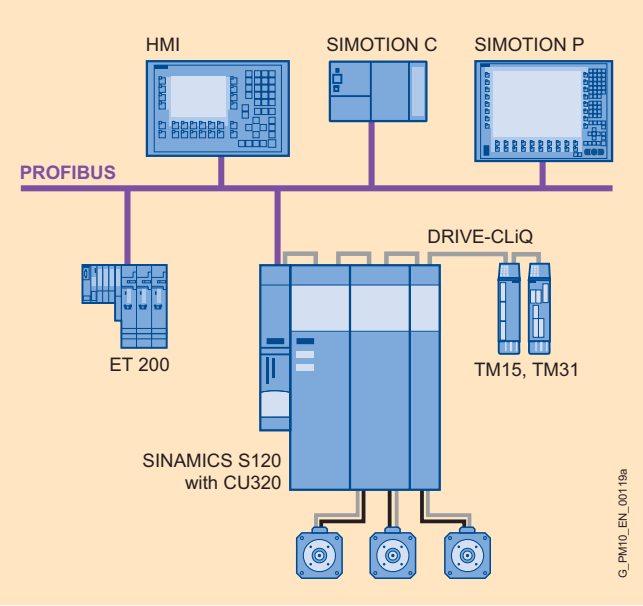
Integration of the SINAMICS drive I/O in a SIMOTION system

Two main options are available for SIMOTION for integrating the SINAMICS drive I/O via DRIVE-CLiQ:

- System configuration with integrated drives:
  In this configuration, the drive I/O are connected directly to SIMOTION D or to the CX32 Controller Extension (not shown in the figure).
- System configuration with external drives:
  In this configuration, the drive I/O are connected to a SINAMICS CU310 or CU320 Control Unit, which is connected to
  - SIMOTION C, P or D (see figure) via PROFIBUS DP, or
  - SIMOTION P or D via PROFINET IO.



Coupling of TM15 and TM31 with SIMOTION D4x5



Coupling of TM15 and TM31 with SIMOTION C, P over CU320

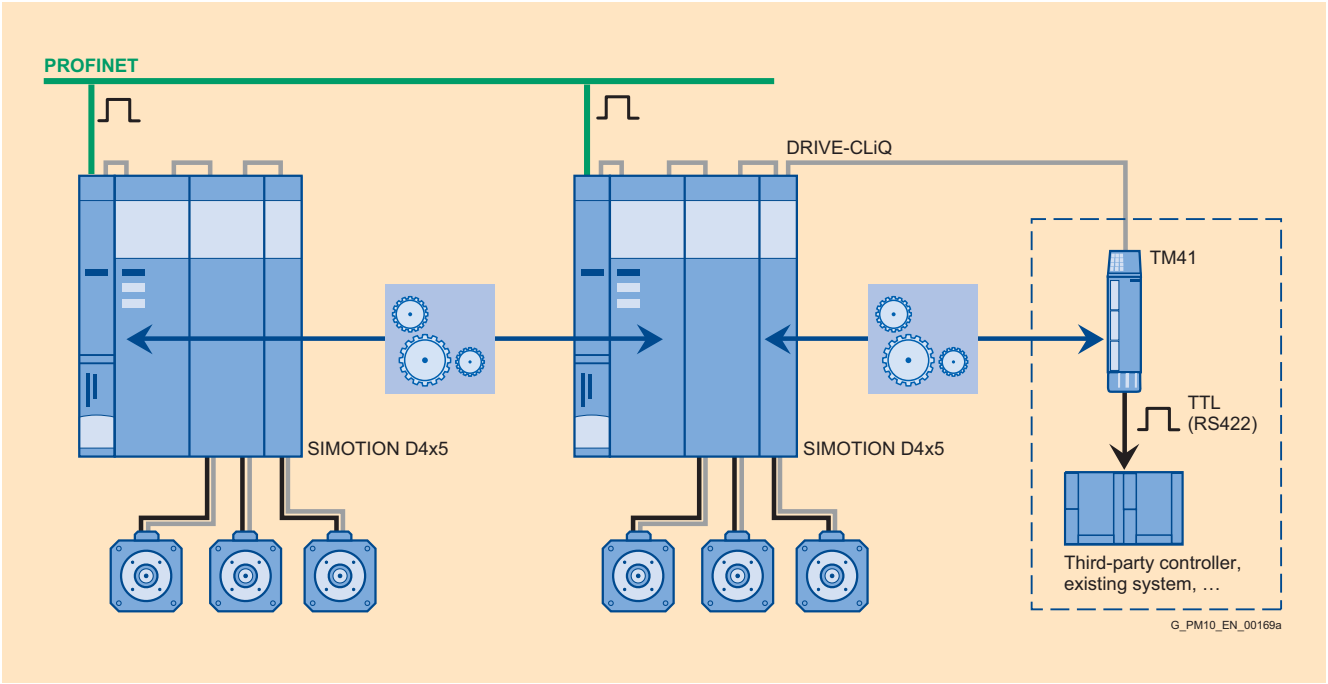
Summary

Integration (continued)

Integration of the TM41 as incremental encoder emulation

The TM41 Terminal Module supplies TTL signals for incremental encoder emulation, e.g. for a higher-level control. The encoder interface (incremental encoder emulation) can be linked to an encoder signal from the Control Unit, e.g. incremental encoder sin/cos, by parameter assignment.

Alternatively, as far as SIMOTION is concerned, TM41 can be handled in the same manner as an axis. This allows you to return the axis position (a master value) as an encoder signal to a second controller, for example.



Use of the TM41 as incremental encoder emulation

More information

Further information

- on the TM15 and TM17 High Feature Terminal Modules can be found on the next pages.
- on the remaining components of the SINAMICS drive I/O can be found in the chapter "SINAMICS S120".

Overview

Terminal Modules TM15 (left) and TM17 High Feature (right)

Terminal Modules TM15 and TM17 High Feature provide the measuring inputs and cam outputs for the Motion Control System SIMOTION. Furthermore the Terminal Modules provide drive-related digital inputs and outputs with short signal delay times.

The "Measuring input", "Cam" and "Cam Track" technology objects support easy integration in SIMOTION.

Application

The main field of application for the TM15 and TM17 High Feature Terminal Modules are applications which in addition to regular digital inputs and outputs, also require very accurate measuring inputs and cam outputs. Several measuring inputs or cam outputs can be assigned to a real, virtual axis, or external encoder.

Examples for precise sensing with binary signals:

- Edge detection
- Quality monitoring (e. g. product is good/bad)
- Product tracing (e. g. product is available/not available)
- Detection of print marks
- Misalignment correction with two print marks
- Tool monitoring (e. g. for presses)
- Machine status monitoring (e. g. for broken threads in the textile industry)

Examples for precise output of binary signals

- Position-dependent switching of actuators
  - Camera trigger signal (quality assurance)
  - Control of an air nozzle for blowing away cut-offs
  - Controlling a nozzle for applying glue
- Product extraction from production line
- Implementation of line Motion Control systems
- Output of pulse patterns

Design

Interfaces

Display and diagnostics

- The status of the TM15/TM17 High Feature Terminal Module is indicated via a multi-color LED.
- The logical status of a channel is indicated with the corresponding green status LED.

I/O

- TM15: 24 DI/DO, parameterizable channel-by-channel
- TM17 High Feature: 16 DI/DO, parameterizable channel-by-channel

Communication

- 2 DRIVE-CLiQ sockets

Power supply

- Connection for the electronic power supply over the 24 V DC infeed connector

Installation

The signal cable shield is connected to the TM15 and TM17 High Feature Terminal Modules with a shield connection terminal, e.g. type SK8 by Phoenix Contact or type KLBÜ CO 1 by Weidmüller.

The TM15 and TM17 High Feature Terminal Modules are snapped onto a standard mounting rail according to EN 50022 (35 x 15 / 7.5).

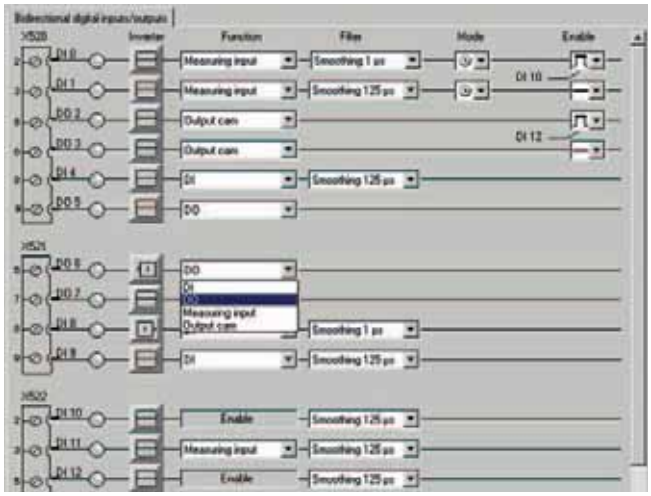
Function

Each of the 24 DI/DO (TM15) or 16 DI/DO (TM17 High Feature) can be parameterized channel by channel as:

- Digital input (DI) or digital output (DO)
- Measuring input
- Cam output

Each channel can also be inverted, as required.

Parameterization is performed with the SIMOTION SCOUT engineering software.



Parameterization of the TM17 High Feature Terminal Module

The differences between the TM15 and TM17 High Feature Terminal Modules depend on the field of application. TM17 High Feature has fewer I/O channels than TM15, but more functionality.

TM17 High Feature is distinguished by especially high resolution and accuracy as well as a parameterizable input filter and enabling inputs.

Terminal Modules TM15 and TM17 High Feature

Function (continued)

Parameterized enable inputs can enable measuring inputs or cam outputs (gate function).

- Level-controlled enable for sensor inputs
- Level or edge-controlled enable for cam outputs

TM17 High Feature also supports cyclic measuring of up to 2 edges per servo/interpolator cycle.

Due to their high accuracy, the DI/O channels of the TM17 High Feature are non-isolated.

Integration

The TM15 and TM17 High Feature Terminal Modules are connected directly to SIMOTION D via DRIVE-CLiQ. Alternatively, TM15 and TM17 High Feature Terminal Modules can be connected to a SINAMICS CU310 or CU320 Control Unit, which is connected to

- SIMOTION C, P or D via PROFIBUS DP, or
- SIMOTION P or D via PROFINET IO

Integration (continued)

The number of terminal modules which can be used depends on the number of axes configured with SIMOTION D, CU310, CU320 or CX32 as well as the functionality configured for TM15 and TM17 High Feature.

For details refer to the TM15 and TM17 High Feature terminal modules commissioning manual.

Important information:

TM17 High Feature can only be used on a SINAMICS CU310 or CU320 Control Unit in conjunction with the SIMOTION motion control system.

The use of TM15 with DI/DO functionality on a

- SINAMICS CU320 Control Unit without SIMOTION is possible with SINAMICS V2.3 and higher.
- SINAMICS CU310 Control Unit without SIMOTION is is possible with SINAMICS V2.4 and higher.

Technical specifications

		TM15 Terminal Modules	TM17 High Feature Terminal Modules
General data			
Power supply (rated value)		24 V DC	24 V DC
No-load current consumption (max.)		0.15 A	0.2 A
Power loss, max.		3 W	4 W
Max. conductor cross-section		2.5 mm²	2.5 mm²
Communication			
Number of DRIVE-CLiQ interfaces		2	2
I/O			
Digital inputs/outputs		24 DI/DO, parameterizable channel-by-channel	16 DI/DO, parameterizable channel-by-channel
Isolation		Yes, in groups of 8	No
Connections		Plug-in screw-type terminals	Plug-in screw-type terminals
Conductor cross-section, max.		1.5 mm²	1.5 mm²
Digital inputs			
Functions		Each channel can be parameterized as: Digital input/measuring input	Each channel can be parameterized as: Digital input/measuring input/enabling input (max. 6 units)
Input voltage (rated value)		24 V DC	24 V DC
For signal "0"	min.	-30 V	-30 V
	max.	5 V	5 V
For signal "1"	min.	15 V	15 V
	max.	30 V	30 V
Input delay			
at rated value of input voltage		0 → 1 / 1 → 0: typical 50 µs/100 µs	1 µs/125 µs ± 15 % (parameterizable in 2 steps)
Measuring input function	Accuracy	± 125 µs	≤ ± 1 µs
	Resolution	125 µs	1 µs
Digital outputs			
Functions		Each channel can be parameterized as: Digital output/cam output	Each channel can be parameterized as: Digital output/cam output
Note		The logical status of the digital outputs can be read back for diagnostic purposes	The logical status of the digital outputs can be read back for diagnostic purposes
Output voltage (rated value)		24 V DC	24 V DC
Sustained-short-circuit-proof		Yes	Yes
Output current per channel		0.5 A	0.5 A

Technical specifications (continued)

		TM15 Terminal Modules	TM17 High Feature Terminal Modules
Aggregate current of outputs (per group)			
• Up to 60 °C (140 °F)		2 A	2 A
• Up to 50 °C (122 °F)		3 A	3 A
• Up to 40 °C (104 °F)		4 A	4 A
Output delay (ohmic load)			
At "0" to "1"			
• Typical		50 µs	50 µs
• Max.		100 µs	100 µs
At "1" to "0"			
• Typical		150 µs	75 µs
• Max.		225 µs	150 µs
Cam function	Accuracy	± 125 µs	≤ ± 10 µs
	Resolution	125 µs	1 µs
Further data			
Weight, approx.		0.86 kg (1.90 lb)	0.86 kg (1.90 lb)
Dimensions	Width	50 mm (1.97 in)	50 mm (1.97 in)
	Height	150 mm (5.91 in)	150 mm (5.91 in)
	Depth	111 mm (4.37 in)	111 mm (4.37 in)
Approvals		UL and cULus File: E164110, Vol. 2, Sec. 9	UL and cULus File: E164110, Vol. 2, Sec. 9

Selection and ordering data

Description	Order No.
TM15 Terminal Modules 24 DI/DO; 24 V/0.5 A DC (without DRIVE-CLiQ cable)	**6SL3055-0AA00-3FA0**
TM17 High Feature Terminal Modules 16 DI/DO; 24 V DC/0.5 A (without DRIVE-CLiQ cable)	**6SL3055-0AA00-3HA0**
Commissioning Manual TM15 and TM17 High Feature Terminal Modules	Included as a PDF file in the scope of supply of SIMOTION SCOUT
Technical manual Complementary SINAMIC module system for SIMOTION incl. TM15 and TM17 High Feature instructions	Included as a PDF file in the scope of supply of SIMOTION SCOUT

More information

For further information about accessories that can be used and about the DRIVE-CLiQ cables, see the section "Connection system MOTION-CONNECT".

For the Terminal Modules TM15 and TM17 High Feature, the same DRIVE-CLiQ cables as for Terminal Module TM31 can be used.

SIPLUS extreme

Overview

SIPLUS is the product family with hardened/specially designed components based on standard products (e.g. SIMATIC S7, ET 200, MICROMASTER, POSMO A). SIPLUS permits distributed use of automation components, even under harsh environmental conditions.

- Ambient temperature range from -40/-25 °C (-40/-13 °F) to +60/+70 °C (+140/+158 °F)
- Condensation, increased humidity, increased degree of protection (dust, water)
- Extreme loading by media, e.g. toxic atmospheres
- Increased mechanical load, increased noise immunity
- Voltage ranges deviating from the standard
- Sector-specific solutions

For further information on SIPLUS, see:

http://www.siemens.com/siplus

SIMATIC RFID systems

Overview

SIMATIC RFID systems control and optimize the material flow. They identify reliably, quickly and economically, are unaffected by contamination and they store data directly on the product.

The data exchange between the tag (mobile data memory) and the reader (write/read device) is fully automatic and contactless by means of radio frequencies (RF) and does not require a direct line of sight.

SIMATIC RFID systems are available for different fields of application, e.g. for smart labels (ultra-slim data memory) for logistics, rugged tags for production lines or "long-range" tags for locating and localization.

For user-friendly, standardized data exchange between the SIMOTION system and the standard profile RFID systems (PIB = Proxy Ident Block), function blocks (FB) are available in the SCOUT command library. This standard profile is, for example, supported by the SIMATIC RFID system ASM 456, which is connected to SIMOTION over PROFIBUS DP.

For further information on SIMATIC RFID systems, see:

http://www.siemens.com/simatic-sensors/rf

SIMATIC Machine Vision

Overview

Visual inspection and recognition of products in manufacturing is becoming more important because the demands on quality and production speed are increasing. The advantages:

- Increased productivity
- Reliable, automatic visual inspection saves time and costs
- Optimization of the material flow
- Reduced machine standstill times

The intelligent SIMATIC MV220, MV230, VS 110, VS 120 and VS 130 vision sensors have been developed especially for application-specific image processing. Thanks to their user-friendly operation, no special image processing knowledge is required since the intelligent vision sensors are trained rather than programmed.

The general purpose systems of the SIMATIC VS 720 series offer the perfect image processing solution for every sector and image processing task. The intelligent cameras offer scalability with respect to the test task, processing speed, resolution, monochrome and color identification.

For further information on Machine Vision, see:

http://www.siemens.com/simatic-sensors/vision

SIWAREX Weighing systems

Overview

Wherever forces or weights have to be measured in automation and process engineering today, modern weighing systems are involved in monitoring and controlling the different production sequences.

They are used in simple applications for monitoring forces, detecting fill levels of containers and even in complex proportioning tasks such as filling containers with liquid and bagging solid material.

In the case of the SIWAREX FTA Weighing module in SIMATIC S7-300 design, the function block (FB) is an integral component of the SCOUT command library. SIWAREX FTA is therefore the optimum solution for applications that can be calibrated such as filling systems, loading stations, bagging stations, rotary packers or inspection stations.

Apart from SIWAREX FTA, the S7-300 module SIWAREX U as well as the ET 200S modules SIWAREX CS and SIWAREX CF are available for simple applications such as load and force measurements for SIMOTION.

For further information on SIWAREX weighing systems, see:

http://www.siemens.com/siwarex

SIMOTION Safety Unit TM 121C

Overview

SIMOTION Safety Unit TM 121C

The SIMOTION Safety Unit TM 121C is an independent, parameterizable electronic safety controller which complies with the requirements of Cat. 4 according to EN 954 as well as SIL 3 according to IEC 61508. The Canadian requirements for mechanical presses (CSA-Z142-02) are also approved. The safety unit is distinguished by extremely short response times, compact dimensions and simple handling. It has been designed to replace contactor-based safety combinations.

This offers important advantages:

- Low wiring outlay
- User-friendly diagnosis
- Fast commissioning
- Small space requirements

The SIMOTION safety unit is parameterized with software which can be run on any PC with Windows NT4.0/2000/XP. The PC is connected to the Safety Unit over the RS 232 C (V.24) interface for this purpose.

The machine-specific parameter set is stored on a plug-in memory card.

Application

This controller can be used on all production machines with safety-related characteristics, such as presses and woodworking machines.

Design

Depending on its type, the Safety Unit has the following elements:

- 24 or 32 safe inputs
- 8 safe outputs
- 2 safe frequency counters (e. g. for watchman's reporting of operations)
- 8 additional standard outputs for encoder clocking or other output signals

Operating statuses and error messages can be displayed using a 4-digit, 7-segment display.

Function

The safe function blocks listed below are stored on the Safety Unit as blocks. These function blocks are already programmed and approved; they must simply be parameterized by the user for the specific application or linked with the inputs/outputs.

The function blocks can be used several times within a parameter set.

Available function blocks:

- Two-hand operation including simultaneous operation
- Foot operation
- EMERGENCY-OFF connection with monitoring and step-enabling
- Protective door and guard monitoring
- Light curtain (protection and cyclic operation)
- Safe operating mode selection
- Control and monitoring of safety valves
- Safe evaluation of cam signals
- Safe rotary control
- Control of the clutch/brake combination (with monitoring)
- Follow-on time measurement (CSA)
- Start variants for mechanical presses (CSA)

Technical specifications

TM 121C Safety Unit	
Power supply	24 V DC
Weight, approx.	3 kg (6.62 lb)
Dimensions (H × W × D)	125 mm × 365 mm × 115 mm (4.92 in × 14.37 in × 4.53 in)
UL approval	Certificate No. 280303-E179336

Selection and ordering data

Description	Order No.
SIMOTION Safety Unit TM 121C 8 F-DO 24 V DC/2 A; 8 DO, 24 V DC/0.5 A; two 24 V/500 Hz counter inputs; including 128 KB memory card; connector set and manual	
• With 24 F-DI, 24 V DC; stand-alone device	**6AU1121-2CA00-0AA0**
• With 32 F-DI, 24 V DC; stand-alone device	**6AU1121-3CA00-0AA0**
• With 32 F-DI, 24 V DC; stand-alone device; **Canadian version** for mechanical presses	**6AU1121-3CA00-1AA0**
Accessories	
Connector sets For TM 121C Safety Unit	
• 5 connector sets (spare part)	**6AU1712-1CB00-0AA0**
Memory card For TM 121C Safety Unit, spare part, 128 KB memory	**6AU1712-1MA00-0AA0**
Software package V2.0 Configuration tool for TM 121C Safety Unit in German and English, standard license including manuals on CD-ROM and link cable (RS 232 C)	**6AU1810-0XA20-0XA0**
Manual For TM 121C Safety Unit in German and English	Available as PDF file as a component of the software package or over the Internet
Application manual For presses in German and English	Available as PDF file as a component of the software package or over the Internet

Other I/O modules / Notes on use

Overview

Use of standard PROFIBUS slaves

The PROFIBUS DP fieldbus is a powerful, open and rugged bus system for fast, cyclic data exchange between field devices. The openness of PROFIBUS DP permits connection of standard components from other manufacturers.

In addition to the I/O modules approved for SIMOTION, all certified standard slaves can, in principle, be connected to SIMOTION if they support

- cyclic data traffic (DP-V0) and, possibly,
- acyclic data traffic (DP-V1) or
- isochronous data traffic (DP-V2).

These modules are integrated via the GSD file of the respective device manufacturer.
Please note that in individual cases further boundary conditions must be fulfilled in order to integrate standard slaves into SIMOTION. Thus, "driver modules" that permit (or simplify) a linking, for example, in the form of function blocks, are required for some modules.
For the modules released with SIMOTION, these Driver Modules up to Version V3.2, SP1 are part of the function library and in Version V4.0 and higher, they are an integral part of the SCOUT command library.

Complete list of I/O that can be used

A list of all the I/O modules that can currently be used with SIMOTION (centralized, distributed PROFIBUS/PROFINET, DRIVE-CLiQ) is available under the following link:

http://support.automation.siemens.com/WW/view/en/11886029

More information

For more information on **"Industrial Communication and Field Devices"**, see Catalog IK PI or the A&D Mall under "Communication/Networks – SIMATIC NET communication systems" or the SIMATIC NET homepage at:

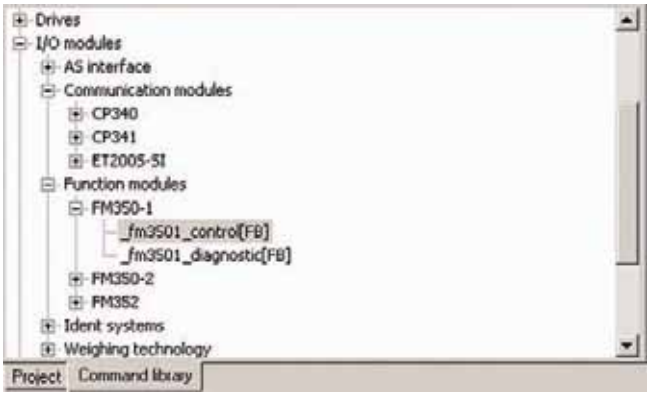
http://www.siemens.com/simatic-net

Up-to-date information on PROFIBUS and PROFINET can be found at:

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

Function blocks for I/O modules

Overview



Function blocks for I/O modules

Function blocks for I/O modules are available as an integral component of the SCOUT command library. The function blocks are easily copied into the application program by means of drag & drop. Sample programs are also provided on the Utilities & Applications CD which demonstrate integration of the function blocks.

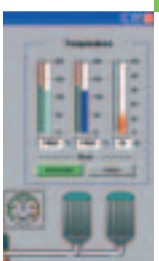
Function blocks are available in the SCOUT command library for the following I/O modules:

- SIMODRIVE POSMO A, intelligent positioning motor
- FM 350-1, single-channel Counter Module
- FM 350-2, 8-channel Counter Module
- FM 352, cam controller
- CP 340, Communication Module
- CP 341, Communication Module
- SIWAREX FTA, Weighing module
- ET 200S, 1SI serial Interface Module (3964R, ASCII)
- ET 200S, frequency converter
- ASM 456, RFID system
- AS-Interface master (function block for operation of the command interface)
- ASIsafe safety monitor (with one or two enabling circuits)

Notes

SIMOTION
Human Machine Interface (HMI)

10



Overview

Overview

HMI devices

A finely graded range of HMI devices is available for local operator control and monitoring.

Mobile Panels

The portable HMI devices allow operator control and monitoring on the actual scene of the event with direct process access and visualization. They offer simple and secure hot-swapping and can be used flexibly on individual machines or with entire systems.

177/277 series graphics panels

These panels have pixel graphic displays for realistic representation of sequences (for 177B and higher also in color). They are available as touch panels (TPs) with touch-sensitive display or as operator panels (OPs) with membrane keyboard.

277/370 series Multi Panels

These can be used for operator control and monitoring in the same way as the panels, by means of touch screens or membrane keyboards. In addition, the Multi Panels (MPs) permit installation of additional applications and thus allow integration of several automation tasks on a single platform; for example, with PLC WinAC MP software.

Rugged and compact for use at machine level

With IP65/NEMA 4 degree of protection on the front side, high EMC and extreme vibration resistance, the SIMATIC HMI devices are ideally suited for use in rough industrial environments. Thanks to their compact design with a shallow mounting depth, the stationary HMI devices can be fitted anywhere, even where only restricted space is available.

The extremely rugged and shock-proof enclosure with IP65 degree of protection makes the Mobile Panels especially suitable for industrial applications. Their low weight and ergonomic design means they are user-friendly and easy to operate.

One configuration software for everything

SIMATIC ProTool and SIMATIC WinCC flexible are the HMI engineering software packages used to configure all SIMATIC panels as well as PC-based systems with the visualization software ProTool/Pro Runtime and WinCC flexible Runtime.

Please note that the panels of the 177/277 and Mobile series can only be configured using WinCC flexible.

Various options are available for every task. The software permits simple and efficient configuration. Programming experience is not required.

Completed configurations can be reused within the family.

Innovative operator control and monitoring

The Mobile Panels, panels and Multi Panels of the 177, 277 and 370 series, which are based on the Windows CE operating system, allow innovative operator control and monitoring combined with ruggedness, stability and simplicity. Standard hardware and software interfaces provide more flexibility and openness to the office world via the MMC/PC/CF card, USB, Ethernet, PROFIBUS DP, Visual Basic scripts or customer-specific ActiveX controls.

HMI software

With the SIMATIC WinCC flexible and SIMATIC WinCC product families, SIMATIC HMI offers visualization and configuration software for the entire spectrum.

SIMATIC WinCC flexible

is the consistent further development of the SIMATIC HMI software products. WinCC flexible is an essential hub for HMI applications close to the machine (until now this has been covered by the ProTool family) with respect to configuration efficiency and new innovative automation concepts. For process-oriented plant and mechanical engineering as well as series production of machines, SIMATIC WinCC flexible 2007 offers:

- Further productivity improvements (configuration efficiency) when creating HMI projects
- Implementation of innovative TCP/IP and web-based automation and HMI concepts
- Reduced downtime of the machines and systems through new service concepts
- Secure, flexible and world-wide access to process data
- New SIMATIC HMI devices
- Integration of WinCC flexible in SIMOTION SCOUT

Changing from the ProTool family to WinCC flexible is possible by simply converting the old configuration data to WCF. The ProTool family, however, will be available alongside WinCC flexible for the foreseeable future.

SIMATIC WinCC will remain the process visualization system for plant monitoring with single or multiple station solutions and the platform for IT & Business integration under Windows 2000 and XP Professional.

Connection of HMI systems from other manufacturers to SIMOTION, via TCP/IP, is available on request.

More information

Further information on HMI can be found in

- the Catalog ST 80
- the A&D Mall under "Automation Systems/SIMATIC HMI (Human Machine Interface System)".

Overview

- Mobile HMI device for direct operator control of the plant and machine from anywhere in the plant
- Supports optimized monitoring of the workpiece or process, while at the same time, providing direct access to the HMI device
- Flexible implementation thanks to hot swapping
- Pixel graphics, brilliant 5.7" color STN display with touch screen (analog/resistive), 256 colors
- PROFIBUS or PROFINET variants
- 14 user-configurable and user-label function keys (8 with LED)
- 2 three-stage enabling buttons
- Communication is supported via a serial, MPI/PROFIBUS or PROFINET link
- Connection point detection
- Fast system availability after plugging into the junction box
- Connected to the PLC and power supply via the junction box and the connecting cable

Benefits

- Hot swapping without interruption of the emergency stop circuit (with connection box variant "Plus") and without the occurrence of bus faults
- Fast, accurate setup and positioning
- Ergonomic, compact and light-weight (approx. 1.3 kg)
- Rugged enough to withstand industrial use
- Graphics library available with off-the-shelf picture objects
- The data in the message buffer is retained even when the Mobile Panel is disconnected from the supply even without battery backup
- Can be used worldwide:
  - 32 languages can be configured (incl. Asian and Cyrillic character sets)
  - Up to 5 languages can be selected online with the Mobile Panel
- Reduction of service and commissioning costs through:
  - Backup/restore via a process interface or via a standard Multi Media Card
  - Updates of the configuration with automatic transfer recognition via all device interfaces
  - Long service life of the backlit display
- Simple engineering with comprehensive documentation on the SIMATIC HMI Manual Collection DVD

Application

Regardless of the industry or application, if mobility is required for the on-site control and monitoring of machines and plants, SIMATIC Mobile Panels offer many crucial advantages: The machine operators and commissioning engineers are therefore able to work exactly where they have the best view of the workpiece or process. Even with larger production facilities, complex or enclosed machines, long materials handling or production lines and conveyor systems, mobile HMI devices allow faster and more precise setting up and positioning during commissioning. They also ensure shorter downtimes during retooling, maintenance or repairs.

Design

- Ergonomic and compact with different holding and gripping points (suitable for right-handed and left-handed personnel)
- Pixel graphics, brilliant 5.7" color STN display with 256 colors and touch screen (analog/resistive)
- 14 user-configurable and permanently labeled function keys (8 with LED)
- The front is resistant to various oils, greases and standard detergents
- 2 three-stage enabling buttons
- Extremely impact-resistant due to twin-wall construction and rounded enclosure
- Dust-proof and jet-proof enclosure with IP65 degree of protection on all sides
- Integrated serial, MPI and PROFIBUS interface (up to 12 Mbit/s) with Mobile Panel 177 DP or
- Integrated Ethernet (PROFINET) interface (up to 100 Mbit/s) with Mobile Panel 177 PN
- Slot for a standard Multi Media Card for backups and restoring or for storing recipes
- Connection to the PLC via the rugged and reliable junction boxes with IP65 degree of protection
  - "BASIC" junction box: Enables the STOP pushbutton to be integrated into the safety circuit
  - "PLUS" junction box: Enables the STOP pushbutton to be integrated into the safety circuit. The emergency stop circuit remains closed regardless of whether a Mobile Panel is plugged in or not. If the Mobile Panel is disconnected during operation, the emergency stop circuit in the junction box is automatically closed which prevents triggering of the emergency stop circuit.
- Fast system availability after plugging into the junction boxes:
  - By using an optional rechargeable battery pack, the connection boot-up time of the Mobile Panel – after a short period of separation from the junction box – can again be significantly reduced.
- Detection of the connection point can be used to perform machine-specific HMI authorizations or actions depending on the selected connection point

SIMATIC Mobile Panel 277

Overview

- Mobile HMI device for direct operator control of the plant and machine from anywhere in the plant
- Supports optimized monitoring of the workpiece or process, while at the same time, providing direct access to the HMI device
- Flexible implementation thanks to hot swapping
- Pixel graphics, brilliant 7.5" color TFT display with touch screen (analog/resistive), 65536 colors
- PROFIBUS or PROFINET variants
- 18 user-configurable and user-label function keys (18 with LED)
- 2 three-stage enabling buttons
- Communication is supported via a serial, MPI/PROFIBUS or PROFINET link
- Connection point detection
- Fast system availability after plugging into the junction box
- Connected to the PLC and power supply via the junction box and the connecting cable

Benefits

- Hot swapping without interruption of the emergency stop circuit (with connection box variant "Plus") and without the occurrence of bus faults
- Fast, accurate setup and positioning
- Ergonomic, compact and light-weight
- Rugged enough to withstand industrial use
- Graphics library available with off-the-shelf picture objects
- The data in the message buffer is retained even when the Mobile Panel is disconnected from the supply even without battery backup
- Can be used worldwide:
  - 32 languages can be configured (incl. Asian and Cyrillic character sets)
  - Up to 5 languages can be selected online with the Mobile Panel
- Reduction of service and commissioning costs through:
  - Backup/restore via a process interface or via a standard Multi Media Card
  - Updates of the configuration with automatic transfer recognition via all device interfaces
  - Long service life of the backlit display
- Simple engineering with comprehensive documentation on the SIMATIC HMI Manual Collection DVD

Application

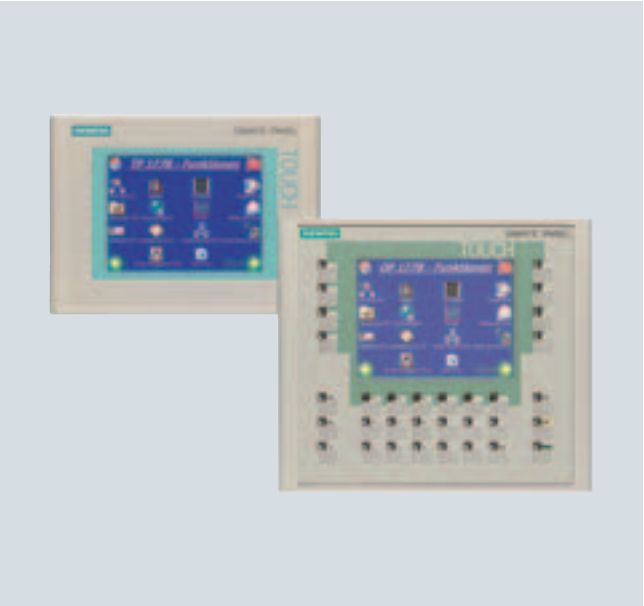
Regardless of the industry or application, if mobility is required for the on-site control and monitoring of machines and plants, SIMATIC Mobile Panels offer many crucial advantages: The machine operators and commissioning engineers are therefore able to work exactly where they have the best view of the workpiece or process. Even with larger production facilities, complex or enclosed machines, long materials handling or production lines and conveyor systems, mobile HMI devices allow faster and more precise setting up and positioning during commissioning. They also ensure shorter downtimes during retooling, maintenance or repairs.

Design

- Ergonomic and compact with different holding and gripping points (suitable for right-handed and left-handed personnel)
- Pixel graphics, brilliant 7.5" color TFT display with touch screen (analog/resistive), 65536 colors
- 18 user-configurable and user-label function keys (18 with LED)
- The front is resistant to various oils, greases and standard detergents
- 2 three-stage enabling buttons
- Extremely impact-resistant due to twin-wall construction and rounded enclosure
- Dust-proof and jet-proof enclosure with IP65 degree of protection on all sides
- Integrated serial, MPI and PROFIBUS interface (up to 12 Mbit/s) for the Mobile Panel 277 DP or
- Integral Ethernet (PROFINET) interface (up to 100 Mbit/s) with the Mobile Panel 277 PN
- Slot for a standard Multi Media Card for backups and restoring or for storing recipes
- Connection to the PLC via the rugged and reliable junction boxes with IP65 degree of protection
  - "BASIC" junction box: Enables the STOP pushbutton to be integrated into the safety circuit
  - "PLUS" junction box: Enables the STOP pushbutton to be integrated into the safety circuit
    The emergency stop circuit remains closed regardless of whether a Mobile Panel is plugged in or not. If the Mobile Panel is disconnected during operation, the emergency stop circuit in the junction box is automatically closed which prevents triggering of the emergency stop circuit.
- Fast system availability after plugging into the junction boxes:
  - By using an optional rechargeable battery pack, the connection boot-up time of the Mobile Panel – after a short period of separation from the junction box – can again be significantly reduced.
- Detection of the connection point can be used to perform machine-specific HMI authorizations or actions depending on the selected connection point

SIMATIC TP/OP 177B

Overview



- Touch panel for controlling and monitoring machines and plants
- Touch/Key combination for OP 177B
- Universal entry-level device in the touch panel class with graphics capability featuring an extensive range of functions
- Pixel-graphics 5.7" STN display with touch screen (analog/resistive)
  - Blue mode (4 levels) or
  - Color (256 colors)
- Configurable system keys for OP 177B
- Interfaces for communication with Siemens SIMATIC S7 PLCs are integrated (e.g. MPI, PROFIBUS DP, Ethernet interface for color variant)
- USB interface for I/O, e.g. for downloads, printer
- S5 controllers and non-Siemens PLCs can be connected through easy-to-use drivers/converters

Benefits

- Integral component of Totally Integrated Automation (TIA): Increased productivity, minimized engineering, reduced life-cycle costs
- Reduction of service and commissioning costs through:
  - Backup/restore via a process interface, USB or via a standard Multi Media Card
  - Remote downloading of the configuration with automatic transfer recognition even via WAN (Wide Area Network) using TeleService adapter
  - Maintenance-free design (no battery) and long service life of the backlit display
- Non-volatile, maintenance-free message buffer
- Can be used worldwide:
  - 32 languages can be configured (incl. Asian and Cyrillic character sets)
  - Up to 16 online languages can be selected directly on the device
- Graphics library available with off-the-shelf picture objects
- Standard hardware and software interfaces for increased flexibility:
  - Standard Multi Media Card slot
    Used for recipe data records and for backups of configuration/system data
  - Integrated printer port
- Extensive documentation on the SIMATIC HMI Manual Collection DVD

Application

The TP/OP 177B Touch Panels can be used wherever machines and systems are controlled and monitored directly on-site – whether in production, process or building automation. They are used in all types of sectors and applications.

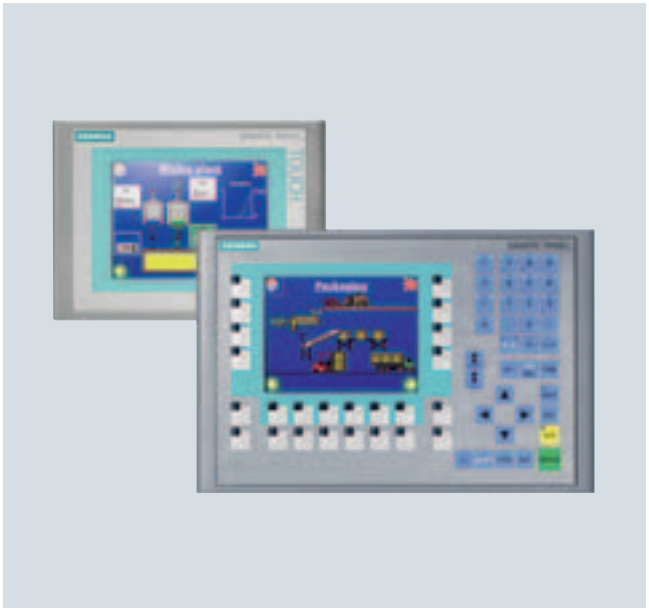
Design

- STN, CCFL [1] backlit display, blue mode or color
- Resistive analog touch
- Numerical "on-screen" system keyboard with decimal, binary and hexadecimal number formats
- OnScreen alphabetic keyboard (English font)
- Compact design with low mounting depth
- Rugged plastic enclosure
- The front is resistant to various oils, greases and standard detergents
- A protective cover is available as an option to achieve NEMA 4 degree of protection and as additional protection against scratching
- Plug-in terminals for connecting the power supply
- Interfaces for connection to the PLC, printer and engineering computer are integrated
- Standard Multi Media Card slot

[1] **C**old **C**athode **F**luorescence **L**amps

SIMATIC TP/OP 277

Overview



- Touch Panel TP 277 and Operator Panel OP 277 with comprehensive functionality for demanding machine visualization
- Display:
  - TP 277: Pixel graphics 5.7" TFT touch screen (analog/resistive)
  - OP 277: TFT display, color (256 colors)
- Keyboard:
  - TP 277: Numeric and alphanumeric on-screen keyboard
  - OP 277: Membrane keyboard with 36 system keys, 24 user-programmable function keys, 18 of which with LEDs
- All interfaces are on-board, e.g. MPI/PROFIBUS DP, USB, PROFINET/Ethernet
- Maintenance-free, non-volatile (retentive) message buffer

Benefits

- Integral component of Totally Integrated Automation (TIA): Increased productivity, minimized engineering, reduced lifecycle costs
- Modular expansion possible with options such as
  - WinCC flexible/Sm@rtAccess for communication between different SIMATIC HMI systems
  - WinCC flexible Sm@rtService for remote maintenance and servicing of machines/plants via the Intranet/Internet
- Reduction of service and commissioning costs through:
  - Backup/restore via USB, MPI, PROFIBUS DP, RS 232 (serial), Ethernet (TCP/IP) or CompactFlash Card (CF Card)
  - Remote download/upload of configuration and firmware
  - Specific drivers can be reloaded
  - Long service life of the backlit display
- Graphics library available with off-the-shelf picture objects
- Can be used worldwide:
  - 32 languages can be configured (incl. Asian and Cyrillic character sets)
  - Up to 16 languages can be selected online
- Standard hardware and software interfaces for increased flexibility
- External Multi Media Card can be used for recipe data records, archives and for backups of configuration/system data
- Integrated USB interface for "hot swapping" of peripherals (printer, keyboard, mouse, barcode reader)
- Standard Windows storage formats (CSV) for archives and recipes for use with other standard tools (e.g. Microsoft Excel)
- The Smart Access and Smart Services options can be used

Application

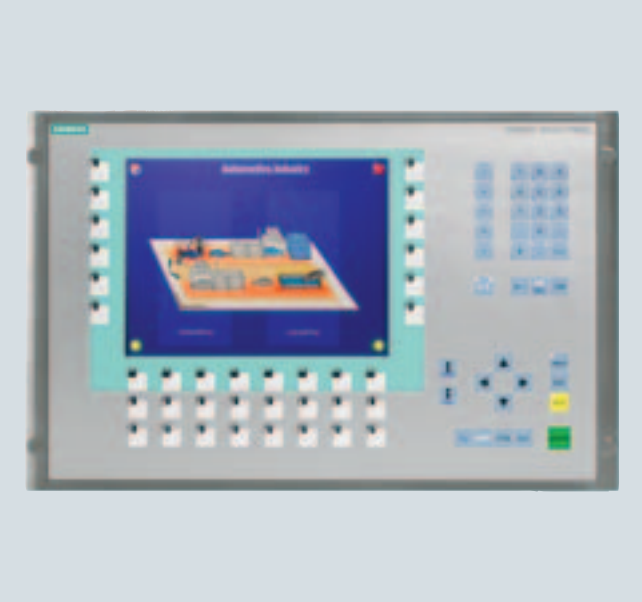
The SIMATIC TP 277 Touch Panels/SIMATIC OP 277 Operator Panels can be used wherever machines and systems are controlled and monitored on-site – whether in production, process or building automation. They are used in all types of sectors and applications.

Diskless and fan-free operation, real-time capability and short boot-up times support demanding machine visualization even under harsh industrial conditions.

Design

- Display:
  - TP 277: Pixel graphics 5.7" TFT touch screen (analog/resistive)
  - OP 277: TFT display, color (256 colors)
- Keyboard:
  - TP 277: Numeric and alphanumeric on-screen keyboard
  - OP 277: Membrane keyboard with 36 system keys, 24 user-programmable function keys (18 with LEDs)
- Scripts and archives
- Compact design with low mounting depth
- IP65/NEMA 4/NEMA 12 (front) or IP20 (rear)
- The front is resistant to various oils, greases and standard detergents
- High electromagnetic protection and extreme vibration strength
- Plug-in terminals for 24 V DC power supply
- Interfaces:
  - MPI, PROFIBUS DP (up to 12 Mbit/s) as well as USB 1.1 (max. 100 mA) on-board
  - Ethernet (PROFINET IO capable)
- External Multi Media Card can be used for the recipe data, records, archives and for backups of configuration/system data.

Overview



- Like operator panels, Multi Panels (MP) are used for on-site machine operation and monitoring
- Their functionality can be expanded with the installation of additional Windows CE applications (Multi Panel and Panel options)
- SIMATIC MP 277B devices running Windows CE combine the ruggedness of operator panels with the flexibility of a PC
- Pixel graphics TFT display, color (64 k colors) with 7.5" or 10.4" display diagonals
- MP 277 8" Key: 26 function keys or direct keys (e.g. over PROFINET IO)
- MP 277 10" Key: 36 function keys or direct keys (e.g. over PROFINET IO)
- MP 277 8" and 10" Touch: Touch screen (analog/resistive)
- All interfaces are on-board, e.g. MPI, PROFIBUS DP, USB, Ethernet, serial
- Maintenance-free, non-volatile (retentive) message buffer
- Windows CE 5.0

Benefits

- Integral component of Totally Integrated Automation (TIA): Increased productivity, minimized engineering, reduced lifecycle costs
- Modular expansion possible with options such as:
  - ThinClient/MP for use as a terminal client on a Windows terminal server
  - WinCC flexible/Sm@rtAccess for communication between different SIMATIC HMI systems
  - WinCC flexible/Sm@rtService for remote maintenance and servicing of machines/plants via the Intranet/Internet
  - WinCC flexible/OPC server for communication with applications from various manufacturers
  - MS Pocket Internet Explorer (already included in scope of delivery)
- Reduction of service and commissioning costs through:
  - Backup/restore via Ethernet (TCP/IP), USB, MPI, PROFIBUS DP, RS 232 (serial) or PC/CF Card
  - Remote download/upload for configuration and firmware
  - Specific drivers can be reloaded
  - Long service life of the backlit display
- Graphics library available with off-the-shelf picture objects
- Can be used worldwide:
  - 32 languages can be configured (incl. Asian and Cyrillic character sets)
  - Up to 16 languages can be selected online
- Standard hardware and software interfaces for increasing flexibility:
  - SD/Multi Media Card combination slot for memory expansions, backup/restore or additional interfaces
  - Ethernet (TCP/IP) for central data and project management; when configuring with WinCC flexible, and for communication with SIMATIC S7
  - Standard Windows storage formats (CSV) for archives and recipes permit use with other standard tools (e.g. Microsoft Excel)

Application

The SIMATIC MP 277 Multi Panels can be used wherever machines and systems are operated and monitored directly on-site – whether in production, process or building automation. These are used in the most popular branches and applications and can be expanded in their applications with the Multi Panel options, e.g. displaying HTML documents via the Microsoft Pocket Internet Explorer.

Windows CE meets the basic prerequisites for applications in rough industrial environments. The diskless and fan-free design enables implementation in areas where high vibration or dust load limits the operation of a PC. Short boot-up times make the Multi Panels ready for operation quickly.

Design

- Compact design with low mounting depth
- The front is resistant to various oils, greases and standard detergents
- Degree of protection IP65/NEMA 4x/NEMA 12 (front) or IP20 (rear)
- Plug-in terminals for 24 V DC power supply

Interfaces:
- RS 485/RS 422 or Ethernet interface for process connections (MPI, PROFIBUS DP up to 12 Mbit/s, PROFINET)
- USB for mouse, keyboard, printer, barcode reader and downloading/uploading the configuration
- Ethernet (TCP/IP), for exchanging data with a higher-level PC, connection of a network printer and downloading/uploading the configuration

- SD/Multi Media Card combination slot

SIMATIC MP 377

Overview

- Like operator panels, Multi Panels (MP) are used for on-site machine operation and monitoring
- Their functionality can be expanded with the installation of additional Windows CE applications (Multi Panel and Panel options)
- SIMATIC MP 377 devices with Windows CE combine the rugged construction of operator panels with the flexibility of a PC
- Pixel graphics 12.1", 15.1" and 19" TFT display, color (64 k colors)
- MP 377 12" Key:
  38 system keys, 36 user-configurable and freely inscribable function keys
- MP 377 12", 15", and 19" Touch:
  Touch screen (analog/resistive)
- All interfaces are on-board, e.g. MPI, PROFIBUS DP, PROFINET IO, USB, Ethernet, serial

Benefits

- Integral component of Totally Integrated Automation (TIA): Increased productivity, minimized engineering, reduced lifecycle costs
- Modular expansion possible with options such as:
  - Software PLC SIMATIC WinAC MP
  - WinCC flexible/Sm@rtAccess for communication between different SIMATIC HMI systems
  - WinCC flexible/Sm@rtService for remote maintenance and servicing of machines/plants via the Intranet/Internet
  - WinCC flexible/OPC server for communication with applications from various manufacturers
  - MS Pocket Internet Explorer (already included in scope of delivery)
  - Multimedia: Viewer for .pdf, .xls, .doc files; Internet Explorer, Media Player and cameras over standard interfaces
- Reduction of service and commissioning costs through:
  - Backup/restore via Ethernet (TCP/IP), USB, MPI, PROFIBUS DP, RS 232 (serial) or via PC/CF Card
  - Remote download/upload for configuration and firmware changes
  - Specific drivers can be reloaded
  - Long service life of the backlit display
- Graphics library with off-the-shelf picture objects
- Can be used worldwide:
  - 32 languages can be configured (incl. Asian and Cyrillic character sets)
  - Up to 5 languages can be selected online
- Standard hardware and software interfaces for increasing flexibility:
  - PC/CF Card slot for memory expansions, backup/restore or for additional interfaces
  - Ethernet (TCP/IP) for central data and project management
  - Standard Windows storage formats (CSV) for archives and recipes permit use with other standard tools (e.g. Microsoft Excel)

Application

The SIMATIC MP 377 Multi Panels can be used wherever machines and systems are operated and monitored directly on-site – whether in production, process or building automation. These are used in the most popular branches and applications and can be expanded with the Multi Panel options, e.g. by displaying HTML documents via the Microsoft Pocket Internet Explorer.

Windows CE meets the basic prerequisites for applications in rough industrial environments. The diskless and fan-free design enables implementation in areas where high vibration or dust load limits the operation of a PC. Short boot-up times make the Multi Panels ready for operation quickly.

Design

- 12.1", 15.1" and 19" TFT Color Display, 64 k colors
- MP 377 12" Key:
  - Membrane keyboard, 38 system keys, 36 freely inscribable function keys, of which 36 are soft keys
- MP 377 12", 15", and 19" Touch:
  - Touch screen (analog/resistive)
- Compact design with low mounting depth
- The front is resistant to various oils, greases and standard detergents
- Degree of protection IP65/NEMA 4x/NEMA 12 (front) or IP20 (rear)
- Plug-in terminals for 24 V DC power supply
- Interfaces:
  - TTY/RS 232, RS 485/RS 422 interface for process connections (MPI, PROFIBUS DP up to 12 Mbit/s)
  - USB for mouse, keyboard, printer, barcode reader and downloading/uploading the configuration
  - Ethernet (TCP/IP), PROFINET for exchanging data with a higher-level PC, connection of a network printer and downloading/uploading the configuration
- Retentive, maintenance-free message buffer
- Slot for CompactFlash Card (CF Card)
- Slot for PC card

SIMATIC Panel PC 477B

Overview

- Embedded PC platform with extremely high industrial compatibility for demanding tasks in the field of PC-based automation
- Maintenance-free (no rotating components such as fan and hard disk)
- Rugged construction:
  The PC can withstand the most harsh mechanical stresses while maintaining reliable operation
- Compact design (only 75 mm (2.95 in) mounting depth)
- High investment security
- Fast integration capability
- Front panel versions:
  - 12", 15" and 19" TFT Touch
  - 12" and 15" TFT Key

Benefits

- Excellent industrial compatibility due to rugged construction, even when subjected to extreme vibration and shock
- High investment protection thanks to assured spare parts availability of the components (for 5 years following the end of active marketing)
- Excellent continuity of components for long-term machine concepts without any new engineering costs
- Front and rear USB 2.0 interfaces for quick and easy connection of additional hardware components
- High degree of industrial functionality thanks to integrated PROFIBUS DP/MPI and Ethernet interfaces
- Maintenance-free since there are no rotating parts (fans and hard disk)
- Reduction in downtime thanks to high system availability
  - Efficient self-diagnostics (SIMATIC PC DiagMonitor)
  - The high security and reliability of an embedded platform
- Integral component of Totally Integrated Automation (TIA): Increased productivity, minimized engineering, reduced lifecycle costs
- Ready-to-run, complete solutions (software is already installed and preconfigured) for visualization and automation with WinCC flexible and WinAC RTX

Application

The SIMATIC Panel PC 477B is designed for use on site at the machine, when a combination of ruggedness and reliability (i.e. the reliability of an embedded platform) and the openness of a PC are required (e.g. module expansion and the connection of I/O devices such as printers, keyboards, etc.).

Due to the low mounting depth of only 75 mm (2.95 in), it can also be used in confined spaces.

The PC can be used in production automation as well as in process automation and can be mounted in control cabinets, control desks, 19" cabinets/racks and in gantries.

SIMATIC Panel PCs are the ideal platform for PC based Automation:

- PC based visualization on site at the machine with SIMATIC WinCC flexible
- PC based Control with SIMATIC WinAC RTX
- SIMATIC WinCC Web Client for web-based solutions with WinCC/Web Navigator

Siemens offers the complete modular system of automation components that are designed to integrate perfectly.

Design

The Panel PC 477B embedded is a compact unit comprising of an operator control unit with an integrated computing unit.

Components of the computer unit:

- Rugged metal installation housing, resistant to vibrations and shocks, with high electromagnetic protection.
- Processor: Celeron M 1.0 GHz
- Main memory: 1 GB (DDR2-SDRAM)
- Battery-backed retentive memory 2 MB
- Compact Flash Drive (internal) with pre-installed Windows XP embedded (Image) operating system and optional software
- Graphics on-board (VGA analog, 1024 x 768)

Interfaces

- 2 x Ethernet onboard (10/100/1000 Mbit/s)
- PROFIBUS DP/MPI onboard, isolated
- 5 x USB 2.0 port, 500 mA (1 x front)
- 1 x COM 1 (RS 232)
- 1 x DVI-I interface (for connecting a second display unit)
- 24 V DC power supply module

SIMATIC Panel PC 477B

Design (continued)

Components of the operator control unit:

The operator control units are available in the following versions:

12" Key

- 12.1" TFT color display, 800 x 600 pixels (SVGA)
- Membrane keyboard with international PC character set and 36 additional function keys with LED and an integrated mouse

12" Touch

- 12.1" TFT color display, 800 x 600 pixels (SVGA)
- Touch screen (analog/resistive)

15" Key

- 15.1" TFT color display, 1024 x 768 pixels (XGA)
- Membrane keyboard with international PC character set and 36 additional function keys with LED and an integrated mouse

15" Touch

- 15.1" TFT color display, 1024 x 768 pixels (XGA)
- Touch screen (analog/resistive)

19" Touch

- 19.1" TFT color display, 1280 x 1024 pixels (SXGA)
- Touch screen (analog/resistive)

The operator control units feature a USB 2.0 port on the front for connecting external peripheral devices, such as a mouse or keyboard. They fulfill the requirements of IP65 degree of protection and NEMA 4. All operator control units are also available without a USB port on the front.

The computer unit is connected via a connecting cable attached at the rear of the operator control unit.

Expansion components

SIMATIC PC DiagMonitor

- PC diagnostics/alarm software for the early detection and diagnostics of PC problems
- Comprehensive monitoring of temperature and watchdog timer
- Operating hours counter for preventive maintenance
- Integrated log functions, comprehensive text messages, online help (English/German)
- Network-wide monitoring via SNMP and OPC interface possible

SIMATIC PC/PG Image & Partition Creator

- Software tool for preventive data backup of mass storage contents (CF cards, hard disks)
- Fast, bit-exact restoration of system and data partitions; application software and special installations are also backed up.
- Software tool for adaptation of mass storage partitioning

3.5" USB disk drive

The USB disk drive is provided for the high-speed transfer of user data, such as recipes, or files. The drive should not be used as a cyclic archiving drive. The front-panel mounting and degree of protection IP54 permit data exchange from the front without opening the control cabinet door.

The device is connected via the USB interface of the Panel PC. The power is also supplied over the USB interface. A USB cable of 1 m (3.28 ft) length is included in the scope of supply. The disk drive complies with the USB 1.1 standard. 3.5" high density diskettes can be used (1.44 MB).

SIMATIC PC USB FlashDrive

- Mobile memory medium for SIMATIC PC/PG
- High-speed data transfer (USB 2.0) and high memory capacity
- Ultra-compact and rugged

Industrial USB Hub 4

- USB peripherals can be connected and operated via the USB Hub 4 without opening the control cabinet door
- Industry-standard USB 2.0 Hub, Front IP65
- Mounting in control cabinet door or on DIN rail
- Inspection window and LEDs for each of the four interfaces

SIMATIC Panel PC 577

Overview

- Industry-standard PC platform for demanding operator control and monitoring tasks
- Maximum performance thanks to high processor performance at an attractive entry-level price
- Fast integration capability
- Intel Pentium 4 architecture with up to 2.4 GHz
- RAM expandable up to 3 GB
- Gigabit Ethernet port
- High-speed USB 2.0 port on front
- Versions of fronts:
  - 12", 15" and 19" TFT Touch
  - 12" and 15" TFT Key

Benefits

- Suitable for industrial environments subject to vibration and shock loads
- High investment protection thanks to guaranteed availability of spare parts
- Excellent continuity of components for long-term machine concepts without any new engineering costs
- USB interface for quick and easy connection of required components
- Reduction in downtime thanks to high system availability
  - Efficient self-diagnostics (SIMATIC PC DiagMonitor)
  - Solutions for data backup
- Integral component of Totally Integrated Automation (TIA): Increased productivity, minimized engineering, reduced lifecycle costs

Application

The SIMATIC Panel PC 577 is used in production and process automation and can be installed in control cabinets and control desks.

SIMATIC Panel PCs are a flexible platform for PC based Automation:

- PC based visualization on site at the machine with SIMATIC WinCC flexible
- Complex solutions with SIMATIC WinCC process visualization
- PC based Control with SIMATIC WinAC Software PLC or with SIMATIC WinAC Slot PLC

Siemens offers the complete modular system of automation components that are designed to interact perfectly.

The SIMATIC Panel PCs can be ordered in combination with WinCC flexible or WinCC as SIMATIC HMI packages at a lower price (see SIMATIC HMI complete systems).

Design

The Panel PC 577 comprises of a computer and an operator control unit.

Components of the computer unit:

- Rugged metal installation housing, resistant to vibrations and shocks, with high electromagnetic protection.
- Processor:
  - Mobile Intel 915 GM Express Chipset
  - Intel Celeron 2.0 GHz or
  - Intel Pentium 4 2.4 GHz
- Main memory basic configuration: 256 MB (DDR 400)
- 3.5" hard disk: ≥ 40 GB
- On-board graphics
- Interfaces:
  - 1 x Gigabit Ethernet onboard
  - 4 x USB 2.0 port, 1 x USB at front
  - 1 x serial V.24 (9-pin)
  - 1 x parallel
- Free slots for expansion:
  - 3 x PCI (slots with card retainers)
- Power supply: 110/230 V AC (autorange), 50/60 Hz

Optional additional components:

- Memory expansion with: 512 MB DDR 400, 1 GB DDR 400, expandable to 3 GB
- DVD-ROM drive
- DVD±RW±R combo drive
- Windows 2000 MUI or Windows XP Professional MUI

SIMATIC Panel PC 577

Design (continued)

Components of the operator control unit:

The operator control units are available in the following versions:

12" Key
- 12.1" TFT color display, 800 x 600 pixels (SVGA)
- Membrane keyboard with international PC character set and 36 additional function keys and an integrated mouse
- USB 2.0 port on front

12" Touch
- 12.1" TFT color display, 800 x 600 pixels (SVGA)
- Touch screen (analog/resistive)
- USB 2.0 port on front

15" Key
- 15.1" TFT color display, 1024 x 768 pixels (XGA)
- Membrane keyboard with international PC character set and 36 additional function keys and an integrated mouse
- USB 2.0 port on front

15" Touch
- 15.1" TFT color display, 1024 x 768 pixels (XGA)
- Touch screen (analog/resistive)
- USB 2.0 port on front

19" Touch
- 19.1" TFT color display, 1280 x 1024 pixels (SXGA)
- Touch screen (analog/resistive)

Expansion components

SIMATIC PC/PG Image & Partition Creator
- Software tool for data backup of hard disk contents
- Fast, bit-exact restoration of system and data partitions; application software and special installations are also backed up
- Software tool for adaptation of hard disk partitioning

3.5" USB disk drive

The USB disk drive is provided for the high-speed transfer of user data, such as recipes, or files. The drive should not be used as a cyclic archiving drive. The front-panel mounting and degree of protection IP54 permit data exchange from the front without opening the control cabinet door.

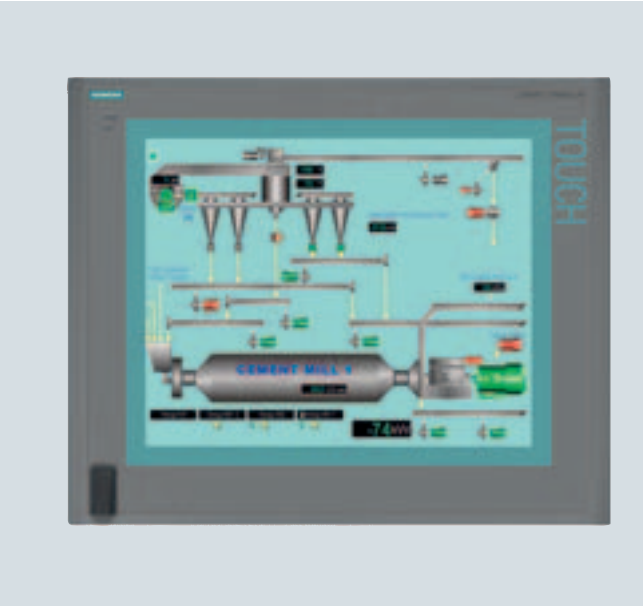
The device is connected via the USB interface of the Panel PC. The power is also supplied over the USB interface. A USB cable of 1 m (3.28 ft) length is included in the scope of supply. The disk drive complies with the USB 1.1 standard. 3.5" high density diskettes can be used (1.44 MB).

Operation of the USB disk drive with SIMATIC Panel PCs:
- Windows XP: possible without separate driver
- Windows 2000: the required driver is included in the scope of supply of the operating system

Industrial USB Hub 4
- USB peripherals can be connected and operated via the USB Hub 4 without opening the control cabinet door
- Industry-standard USB 2.0 Hub, Front IP65
- Mounting in control cabinet door or on DIN rail
- Inspection window and LEDs for each of the four interfaces

SIMATIC Panel PC 677B

Overview



- PC platform with high degree of industrial compatibility for demanding tasks in the area of PC-based automation
- Rugged construction:
  The PC can withstand the harshest mechanical stress and maintains reliable operation
- Compact design
- High investment security
- Fast integration capability
- Front panel versions:
  - 12", 15", 17" and 19" TFT Touch
  - 12" and 15" TFT Key
- Operator control unit can be located at a distance of up to 30 m (98 ft) from the computer unit (optional)

Benefits

- Excellent industrial compatibility due to rugged construction, even when subjected to extreme vibration and shock
- High investment protection thanks to spare parts availability of the components (for 5 years following the end of active marketing)
- Excellent continuity of components for long-term machine concepts without any new engineering costs
- Savings in time and costs due to service-friendly equipment construction:
  - The operating unit and computing unit can be simply hinged apart for the rapid replacement of components or for future expansions
  - Front and rear USB 2.0 interfaces for quick and easy connection of additional hardware components
- High degree of industrial functionality thanks to integrated PROFIBUS DP/MPI and two Gigabit Ethernet interfaces
- Operational reliability:
  Using the optional direct key module, the process can be controlled without delay over PROFIBUS DP independently of the operating system
- 2 x ≥ 80 GB SATA hard disk system (configured as a single disk system or RAID1)
- Reduction in downtime thanks to high system availability
- Efficient self-diagnostics (SIMATIC PC DiagMonitor)
  - Solutions for preventive data backup
- Integral component of Totally Integrated Automation (TIA): Increased productivity, minimized engineering, reduced lifecycle costs
- Additional mounting possibilities available due to separation of the computing unit and operating unit by means of the Remote Kit (up to 30 m (98 ft), optionally available as accessory)

Application

SIMATIC Panel PC 677B is designed for use directly at the machine. Due to the minimal mounting depth of only 105/130 mm (4.13/5.12 in), it can also be used in confined spaces.

The PC can be used in production automation as well as in process automation and can be mounted in control cabinets, control desks, 19" cabinets/racks and in gantries.

The Dual Core CPUs with Intel Core Duo technology support high-performance control and visualization.

With PCIe (x4), the new PCI express (PCIe) cards (x1 and x4) are also supported.

A SIMATIC Panel PC is the ideal platform for PC based Automation:

- PC based visualization on site at the machine with SIMATIC WinCC flexible
- Complex solutions with SIMATIC WinCC process visualization
- PC based Control with SIMATIC WinAC Software PLC or with SIMATIC WinAC Slot PLC

Siemens offers a complete modular system of automation components that are designed to integrate perfectly.

The SIMATIC Panel PCs can be ordered in combination with WinCC flexible or WinCC as SIMATIC HMI packages at a lower price (see SIMATIC HMI complete systems).

Design

The Panel PC 677B comprises of a computer and an operator control unit.

Components of the computer unit:

- Rugged metal installation housing, resistant to vibrations and shocks, with high electromagnetic protection.
- Processor:
  Mobile processors
  - Core 2 Duo T7400, 2.16 GHz, Dual Core, 4 MB SLC
  - Core 2 Duo T5500, 1.66 GHz, Dual Core, 2 MB SLC
  - Celeron M 440, 1.86 GHz, 1 MB SLC
- Intel chipset: 945 GM Express with ICH7R - integrated RAID controller
- Intel graphics media accelerator GMA950 for high-performance graphics
- Standard main memory configuration:
  512 MB, expandable up to 4 GB (DDR2 667 RAM)
- SATA hard disks with up to 160 GB capacity and NCQ technology,
  the special vibration-absorbing hard disk support ensures reliable operation even under extreme mechanical stress
- On-board graphics

SIMATIC Panel PC 677B

Design (continued)

- Interfaces:
  - 2 x Ethernet 10/100/1000 Mbit/s ports (gigabit LAN)
  - 4 x high-speed USB 2.0 ports on the computing unit
  - PROFIBUS DP/MPI on-board, isolated
  - 1 x serial RS 232 C (9-pin)
  - DVI-I interface (for VGA and/or DVI-D monitor)
- Second monitor with identical screen content (Clone) or in extended monitor mode (Extended)
- Latching mechanism for innovative RJ45 Fast Connect plug
- Slot for CompactFlash Card externally accessible
- Diskless version (optional with Windows XPe on CompactFlash Card)
- Slots either 2 x PCI or 1 x PCI and 1 x PCIe x4
- Power supply: 110 V/230 V AC (autorange), 50/60 Hz or 24 V DC
- 2 MB battery-backed SRAM memory onboard (for use with WinAC RTX 2005 SP2)

Optional additional components:

- Main memory expansion to 1, 2 or 4 GB
- SATA hard disk ≥ 160 GB
- Double hard disk module 2 x ≥ 60 GB SATA
- DVD-ROM drive
- DVD±RW±R combo drive
- Direct key module

Components of the operator control unit:

The operator control units are available in the following versions:

12" Key

- 12.1" TFT color display, 800 x 600 pixels (SVGA)
- Membrane keyboard with international PC character set and 36 additional function keys with LED and an integrated mouse

15" Key

- 15.1" TFT color display, 1024 x 768 pixels (XGA)
- Membrane keyboard with international PC character set and 36 additional function keys with LED and an integrated mouse

12" Touch

- 12.1" TFT color display, 800 x 600 pixels (SVGA)
- Touch screen (analog/resistive)

15" Touch

- 15.1" TFT color display, 1024 x 768 pixels (XGA)
- Touch screen (analog/resistive)

17" Touch

- 17" TFT color display, 1280 x 1024 pixels (SXGA)
- Touch screen (analog/resistive)
- Front with power and status LED

19" Touch

- 19.1" TFT color display, 1280 x 1024 pixels (SXGA)
- Touch screen (analog/resistive)

The operator control units feature a USB 2.0 port on the front for connecting external peripheral devices, such as a mouse or keyboard. They fulfill the requirements of IP65 degree of protection and NEMA 4. All operator control units are also available without a USB port on the front.

The computer unit is connected via a connecting cable attached at the rear of the operator control unit.

Expansion components

SIMATIC Panel PC Remote Kit

- Separate mounting of computer and operator control unit is possible
- At a maximum distance of 30 m (98 ft)
- Pure hardware solution, no need to install additional software
- Maintaining the panel PC front functionality

SIMATIC PC DiagMonitor

- PC diagnostics/alarm software for the early detection and diagnostics of PC problems
- Comprehensive monitoring of temperature, fans, hard disks (SMART), watchdog
- Operating hours counter for preventive maintenance
- Integrated log functions, comprehensive text messages, online help (English/German)
- Network-wide monitoring via SNMP and OPC interface possible

SIMATIC PC/PG Image & Partition Creator

- Software tool for data backup of hard disk contents
- Fast, bit-exact restoration of system and data partitions; application software and special installations are also backed up
- Software tool for hard disk partitioning

3.5" USB disk drive

The USB disk drive is provided for the high-speed transfer of user data, such as recipes, or files. The drive must not be used as a cyclic archiving drive. The front-panel mounting and degree of protection IP54 permit data exchange from the front without opening the control cabinet door.

The device is connected via the USB interface of the Panel PC. The power is also supplied over the USB interface. A USB cable of 1 m (3.28 ft) length is included in the scope of supply. The disk drive complies with the USB 1.1 standard. 3.5" high density diskettes can be used (1.44 MB).

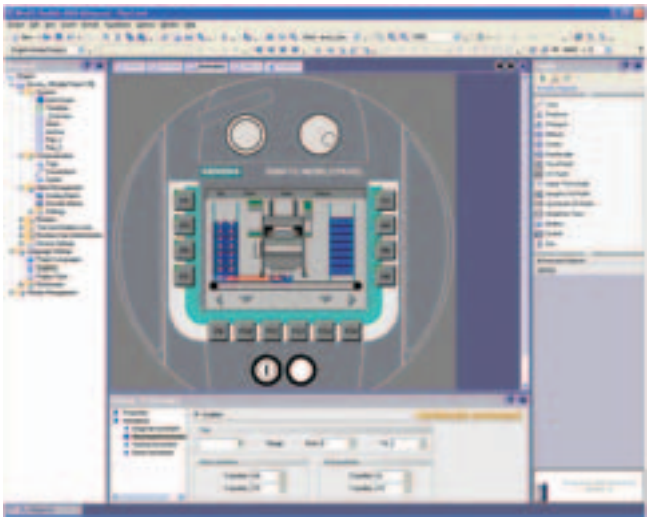
SIMATIC PC USB FlashDrive

- Mobile memory medium for SIMATIC PC/PG
- High-speed data transfer (USB 2.0) and high memory capacity
- Ultra-compact and rugged

Industrial USB Hub 4

- USB peripherals can be connected and operated via the USB Hub 4 without opening the control cabinet door
- Industry-standard USB 2.0 Hub, Front IP65
- Mounting in control cabinet door or on DIN rail
- Inspection window and LEDs for each of the four interfaces

Overview



- Uniform family of **engineering tools** for configuring SIMATIC HMI Operator Panels, the operator control part of SIMATIC C7 units, SIMOTION/SINUMERIK Panel PCs as well as the PC-based visualization software WinCC flexible Runtime
- Executable under Windows 2000/XP Professional
- **Current version:**
  - SIMATIC WinCC flexible 2007 Advanced
  - SIMATIC WinCC flexible 2007 Standard
  - SIMATIC WinCC flexible 2007 Compact
  - SIMATIC WinCC flexible 2007 Micro

Benefits

- Uniformity of configuration software reduces training, maintenance, updating requirements, and guarantees future compatibility
- Minimization of engineering requirements and reduction in life cycle costs through Totally Integrated Automation (TIA)
- Minimization of configuration requirements through repeated use of scalable, dynamic objects
- Intelligent tools for simple and efficient configuration:
  - Wizard for the basic configuration of an HMI project
  - Table-based editors simplify the generation and processing of objects of the same type, e.g. for variables, texts or messages
  - Graphic configuration simplifies complex tasks such as the definition of trajectories or the generation of fundamental operator prompting
- Comprehensive support of multi-language configurations for global use
  - Selectable views for multi-language input of configuration data
  - System-specific and user-specific dictionaries
  - Export/import of language-dependent texts
- Investment protection through
  - Conversion possible from existing ProTool Pro projects
  - Transfer of static picture components and variables from WinCC V6.0

Design

The engineering tools of the SIMATIC WinCC flexible range are based on one another. Dynamic editors only show available functionality of the selected hardware.
A more comprehensive engineering tool such as WinCC flexible Standard offers all functionalities of the smaller engineering tools, e.g. WinCC flexible Compact or Micro.

Upgrading of a smaller engineering tool to a larger one is possible using a Powerpack. The exception is WinCC flexible Micro.

The scope of functions of the WinCC flexible engineering tools already includes support for the Runtime options available for SIMATIC Panels or WinCC flexible Runtime, independent of the RT licenses purchased. Separate licensing is required for the target system in order to use the configured Runtime options.

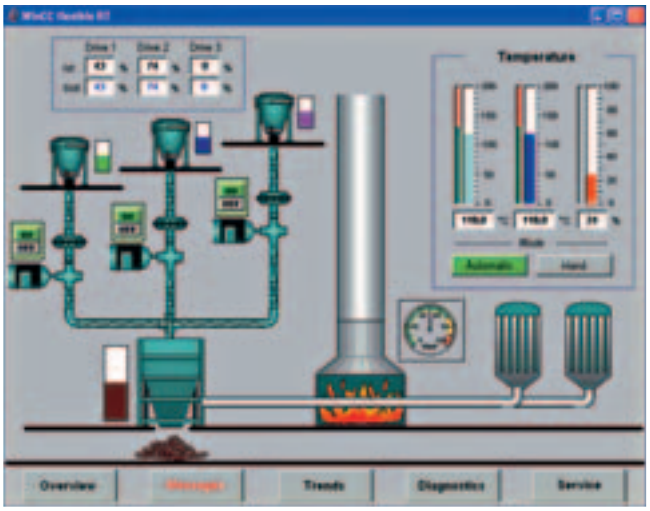
Function

Integration into automation systems

- Integration into SIMATIC STEP 7 (Version V5.3 and higher or Professional Edition 2004)
  - Administration of the HMI projects within STEP 7
  - Shared use of communication settings and process point definitions, i.e. symbols and messages
  - Display of the HMI engineering objects in the SIMATIC Manager of STEP 7
- Integration into Component Based Automation (CBA) with SIMATIC iMap
  - Management of CBA components with runtime and HMI components in SIMATIC iMap
  - Interconnection of CBA components with/without HMI components in SIMATIC iMap
  - Generation of HMI basic data in SIMATIC iMap for WinCC flexible Advanced, e.g. tag list and interconnected HMI modules
- Integration of WinCC flexible in SIMOTION SCOUT

SIMATIC WinCC flexible RT

Overview



- **PC-based visualization software** for single-user systems directly at the machine
- Executable under Windows 2000/XP Professional
- **Current version:**
  - SIMATIC WinCC flexible 2007 Runtime with 128, 512 or 2048 PowerTags
- SIMATIC WinCC flexible Runtime is configured with SIMATIC WinCC flexible Advanced engineering software.

Benefits

- Optimum price/performance ratio thanks to individually scalable system functionality
- Functions for all visualization tasks:
  Operator functions, graphical and trend displays, signaling system, system logs, archiving (option), recipe management (option), Audit Trail (option), process fault diagnostics (option)
- Flexible runtime functionality thanks to Visual Basic scripts
- Innovative service concepts with remote operation, diagnostics and administration via Intranet and Internet as well as e-mail communication to reduce downtime (option)
- Support for simple distributed automation solutions based on TCP/IP networks at the machine level (option)

Application

SIMATIC WinCC flexible Runtime is the high-performance visualization software for simple visualization tasks at machine level. It can be used as a single-user solution for all automation applications in manufacturing automation, process automation and building services automation.

SIMATIC WinCC flexible Runtime can be employed in connection with the following operator devices:

- SIMATIC Panel PCs
  - Panel PC 477B
  - Panel PC 577
  - Panel PC 677B
- SIMOTION P350
- Standard PCs with resolutions (W x H in pixels) of:
  - 640 x 480, 800 x 600, 1024 x 768, 1280 x 1024, 1600 x 1200

Design

SIMATIC WinCC flexible Runtime is available as a software package with 128, 512 and 2048 PowerTags. The term PowerTags is applied only to process variables that have a process connection to the PLC. Variables with no process link, constant limit values of variables and messages (up to 4000 bit-triggered messages) are also available as additional system performance.

The scope of WinCC flexible Runtime functions includes the central HMI components for visualization and signaling, and can be expanded using option packages.

SIMATIC WinCC flexible Runtime is configured using the SIMATIC WinCC flexible Advanced configuration software.

Options

WinCC flexible RT can be expanded with the following features:

- WinCC flexible Archives for logging process values and messages
- WinCC flexible Recipes for managing data sets which contain associated machine or production data
- SIMATIC WinCC flexible /Audit for
  - recording of operator actions in an Audit Trail
  - The ChangeControl option restricts users based on plant validation
  - Checking for later changes via security mechanisms
  - Simplified compliance with GPM guidelines
- SIMATIC Logon for central, plant-wide user administration
- WinCC flexible Sm@rtAccess for communication between different Simatic HMI systems
- WinCC flexible Sm@rtService for remote maintenance and servicing of machines/plants via the Intranet/Internet
- WinCC flexible OPC server for use as a data server (OPC server) for higher-level automation components such as control systems or systems in the office area.

11

Safety Integrated

Safety Integrated

Overview

The integrated safety functions of SINAMICS S120 provide highly effective application-oriented protection for personnel and machinery.

The current version of SINAMICS S120 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 completely integrated into the drive system. They can be activated as follows:

- Over terminals on the Control Unit and on the power module (only for STO, SBC, SS1)
- Over terminals on the TM54F Terminal Module
- Over 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.

If SINAMICS drives are controlled by SIMOTION, they report the selection of a safety function to SIMOTION. The SIMOTION user program is then able to respond to the selected safety function. SIMOTION can thus prevent fault reactions on the drive side due to limit violations by ensuring in case of safety-related functions that the drive does not exit the monitored operating mode, for example, by controlling drives (with SLS) or coasting down (with SOS) within the permissible speed range.

The selection and deselection of SINAMICS Safety Integrated functions and their state are indicated by means of specific technological alarms and system variables on the axis.

The SINAMICS Safety Integrated extended functions SS2, SOS and SLS are activated and deactivated and their status is displayed with specific technological alarms and system variables on the axis.

Legal framework

Machine manufacturers and plant managers must ensure that their machines or plants cannot cause danger due to malfunctions apart from the general risks.

In Europe, for example, compliance with the machinery directive is required by law in the EU industrial safety directive. In order to ensure the conformity 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 EU directives. 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 (only applicable for electrical and electronic control systems) and EN ISO 13849-1, which will replace the previously used EN 954-1 as from 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 toward greater complexity and increasing modularity of machines have 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 and during this changeover, depending on the type of machine, some subcomponents can even continue to manufacture.

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 interfering by the operator of the machine due to the custom actions, so the motivation to consciously bypass safety functions is significantly reduced.

Function

Safety functions integrated into the drive with SINAMICS S120

SINAMICS S120 is characterized by a number 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

The Safety Integrated functions of SINAMICS S120 are certified by independent institutions. The appropriate external test certificates and manufacturer declarations are available from the Siemens representatives, as well as at http://support.automation.siemens.com/WW/view/en/23158850

The Safety Integrated functions currently available in SINAMICS S120 are listed below (terms as defined in IEC 61800-5-2):

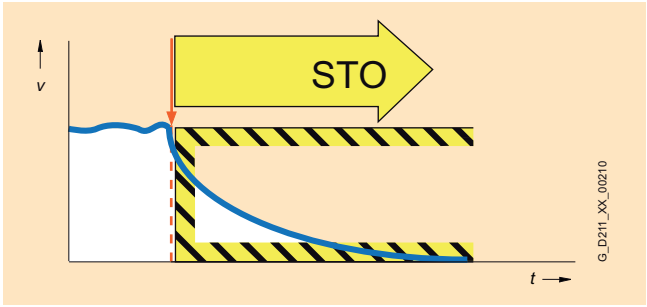
Safe Torque Off (STO)

Description of function

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 more torque-generating energy. STO can be used wherever the drive will reach a standstill in a sufficiently short time based on the load or when coasting down of the drive will not have any relevance for safety.



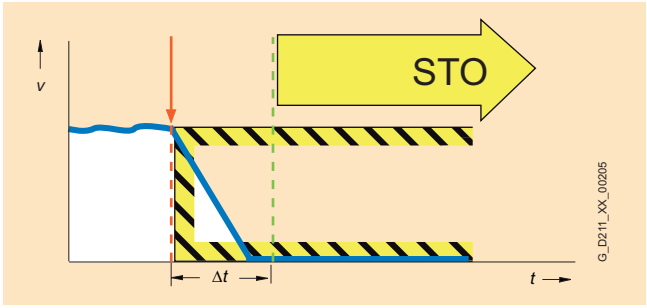
Safe Stop 1 (SS1)

Description of function

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 it does not come to a halt quickly enough due to the 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.



Safety Integrated

Function (continued)

Safe Brake Control (SBC)

Description of function

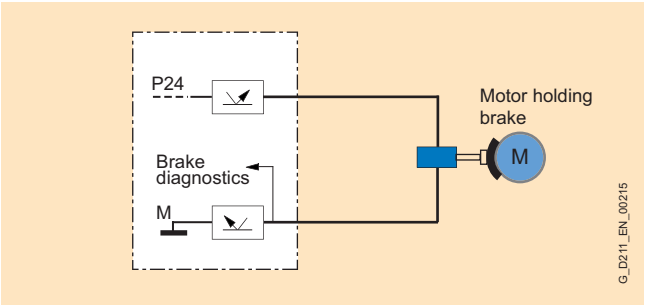
Safe Brake Control SBC is used to control holding brakes which are operative at zero current, e.g. motor holding brakes. The brake control circuit is a fail-safe, two-channel design.

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: For Motor Modules in booksize format, the terminals for the motor brake are integrated. For blocksize format, an additional Safe Brake Relay is required (see the Section SINAMICS S120)

Application, customer benefits

In combination with STO and SS1, SBC can also be activated. SBC allows a holding brake to be safely activated on the motor after the torque-generating energy has been shut down, to prevent, for example, sudden drop of suspended axes.



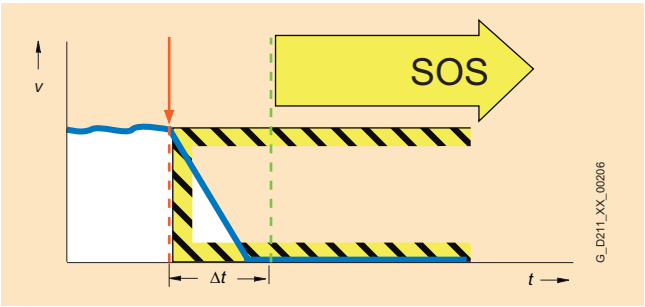
Safe Stop 2 (SS2)

Description of function

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 in 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.



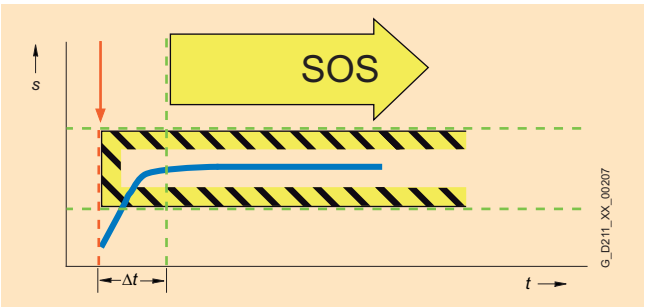
Safe Operating Stop (SOS)

Description of function

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 which the machine or parts of the machine must be at a safe standstill in certain 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 that the higher-level control ramps down the axes involved within an adjustable delay time in a coordinated manner in the grouping. This can be used to prevent any damage to the machine or product.



Function (continued)

Safely Limited Speed (SLS)

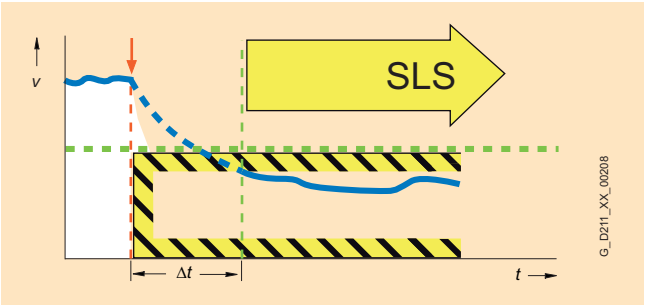
Description of function

The Safely Limited Speed function is used to monitor the drive against 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.



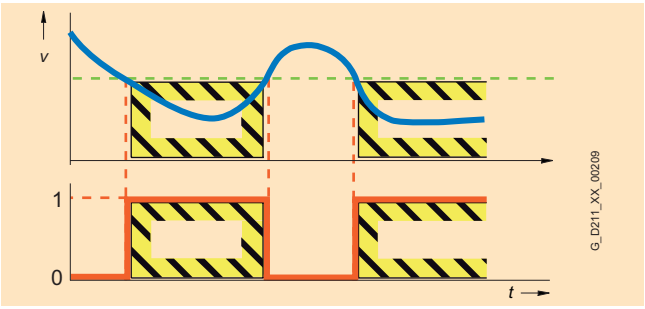
Safe Speed Monitor (SSM)

Description of function

The Safe Speed Monitor function supplies a safe checkback signal (active High), when the drive undershoots a settable speed limit. In contrast to the functions described above, the drive does not react automatically when the limit is overshot.

Application, customer benefits

The safe SSM checkback can be used in a higher-level control for safety-related reactions, e.g. for enabling a protective door.



The Safety Integrated functions of the SINAMICS S120 drive system are grouped into basic functions and extended functions. No license is required for basic functions.

One license is required for each safety axis in the case of extended functions. The extended functions are activated over terminals on the TM54F Terminal Module (see Section SINAMICS S120) or over the safe communication of PROFIsafe. The basic functions can also be activated via on-board terminals on the SINAMICS S120 device.

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

The following constraints currently exist with regard to the integrated safety functions:

- Safe Brake Control (SBC) is not available for Motor Modules in chassis format
- The extended functions are not available for Motor Modules in chassis format
- The extended functions are available for Motor Modules in booksize format as of Version 3 (last position of Order No. ≥ 3)

The functions SS2, SLS, SOS and SSM require safe speed/position sensing.

When SS1 is activated over TM54F or PROFIsafe, safe acceleration monitoring is performed during the braking phase to ensure that any fault will be detected during the braking phase. Safe acceleration monitoring requires safe speed/position sensing.

Safety Integrated

Function (continued)

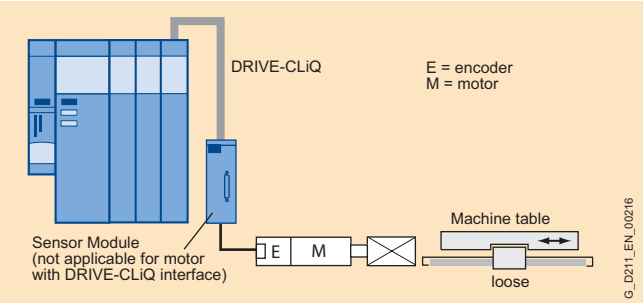
Safe speed/position sensing

For safe speed/position sensing, in principle

- single-encoder systems or
- dual-encoder systems

can be used.

Single-encoder system



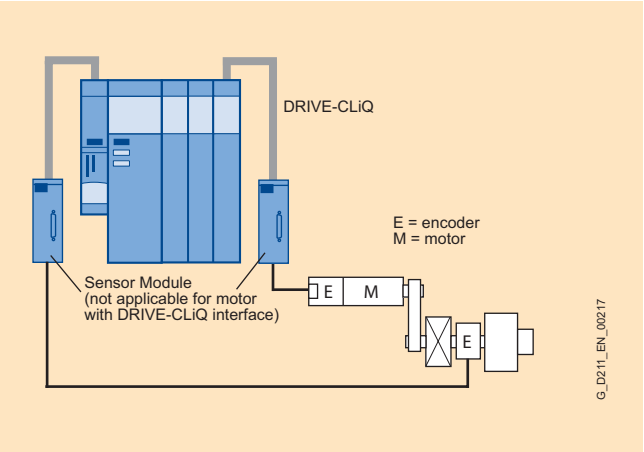
Example of a single-encoder system

In a single-encoder system, the motor encoder is used exclusively for safe actual value sensing. This motor encoder must be appropriately qualified (see encoder types).

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

For motors without DRIVE-CLiQ interface, the connection is made using additional sensor modules (SMC or SME; see Section SINAMICS S120)

Dual-encoder system



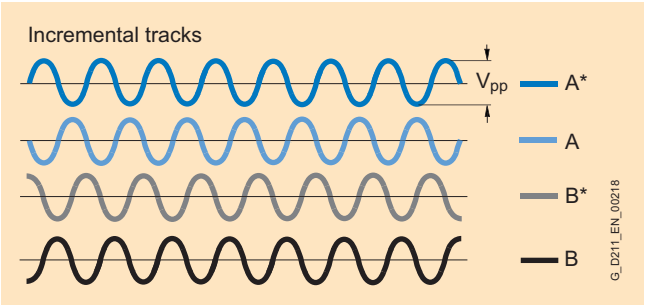
Example of a dual-encoder system on a spindle

The safe actual values for a drive are provided by two separate encoders. The actual values are transferred to the Control Unit over DRIVE-CLiQ. When motors without a DRIVE-CLiQ connection are used, a sensor module (SMC or SME) must be implemented. Each measuring system requires a separate DRIVE-CLiQ connection.

A CPU310DP/PN can only be used with additional hardware (e.g. DMC20).

Encoder types

Incremental encoders or absolute encoders can be used for safe sensing of the position values 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

The absolute position values can be transferred over the serial EnDat interface or an SSI interface to the control.

Encoder types for single-encoder system

In single-encoder systems, encoders with photoelectric sampling only are permitted for safe actual value sensing. 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 for single-encoder systems.

Encoder types for dual-encoder system

With a dual-encoder system, the required redundancy can also be achieved using less highly qualified encoders. In this case, therefore, encoders with a microprocessor in the signal path can also be used. Each encoder output signal must also supply sin/cos signals of 1 V_{pp} on the incremental channels A/B.

In general, for safe actual value sensing, apart from the permissible motors with a DRIVE-CLiQ connection, encoders can be used that can be connected to the following sensor modules:

- SMC20
- SME20/SME25
- SME120/SME125

Function (continued)

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 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 S120, PROFIsafe is currently only possible on PROFIBUS. This will be extended to include PROFINET soon.

Licensing

The Safety Integrated basic functions do not require a license.

In the case of Safety Integrated extended functions, however, a license is required for every axis using these functions. It is of no consequence here which safety functions are used and how many.

The required licenses can be optionally ordered with the CompactFlash Card:

For the order numbers of the CompactFlash Cards, see SINAMICS S120 and SIMOTION.

Notes: On one CU320/SIMOTION D4.5/CX32, up to 5 safety axes are currently possible with extended functions.

The CU310 Control Unit has been designed to control only single axes. Only one license is therefore required for the extended safety functions (short code **F01**).

An overview of the Safety Integrated functions of SINAMICS S120 and their boundary conditions is given in the following table:

Functions	Activation	Underlying function	Reaction to limit overshoot	External set-point input effective	Encoder required	License required
STO	• EP terminals on the device and on the CU • Terminals on TM54F • PROFIsafe	SBC (if activated)	–	No	No [1]	No [2]
SBC	• With STO (directly or following expiry of the delay with SS1)	–	–	–	No	No
SS1	• Terminals on the device and on the CU	STO following expiry of the parameterized delay, followed by SBC (if activated)	–	No	No	No [2]
SS1	• Terminals on TM54F • PROFIsafe	Safe acceleration monitoring during the braking phase. STO and SBC (if activated) following expiry of the parameterized delay or undershooting of the minimum speed limit	STO	No	Yes	No [2]
SS2	• Terminals on TM54F • PROFIsafe	Safe acceleration monitoring during the braking phase. SOS following expiry of the OFF3 time	STO	No	Yes	Yes (per safety axis)
SLS	• Terminals on TM54F • PROFIsafe		SS1, STO, or SOS (parameterizable)	Yes	Yes	Yes (per safety axis)
SOS	• Terminals on TM54F • PROFIsafe		SS1 or STO (parameterizable)	Yes	Yes	Yes (per safety axis)
SSM	• Terminals on TM54F • PROFIsafe		–	Yes	Yes	Yes (per safety axis)

[1] For activation over terminals on TM54F or PROFIsafe, an encoder is currently required.

[2] For activation over terminals on TM54F or PROFIsafe, a license is currently required.

Function (continued)

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 status if a component fails or in the event of cable breakage. 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 previous 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 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 checking procedure using test stop

The proper function of the two shutdown signal paths must be tested at least once within a defined time in order to meet requirements according to EN 954-1/ISO13859-1 and IEC 61508 in terms of timely 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 a warning is output following a timeout.

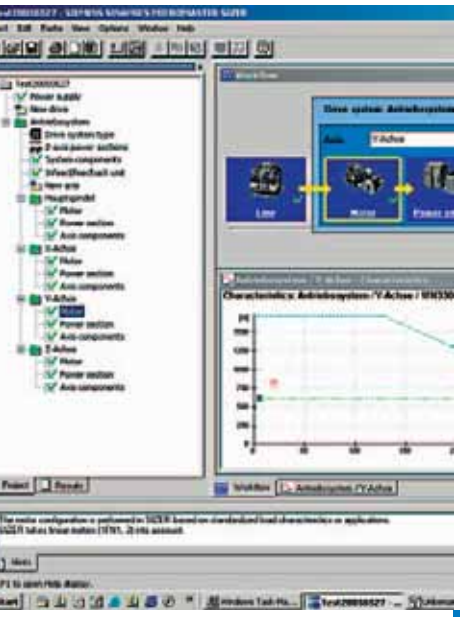
It can be assumed that a running machine will not pose any risk to personnel if appropriate safety equipment (e.g. protective doors) is installed. For this reason, only an alarm is output to inform the user that a forced dormant error detection run is due, thereby requesting that this be carried out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

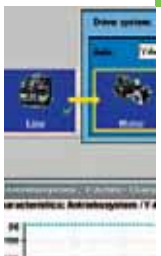
Examples of when forced dormant error detection runs are required:

- 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, dependent on time and event

System description
Dimensioning

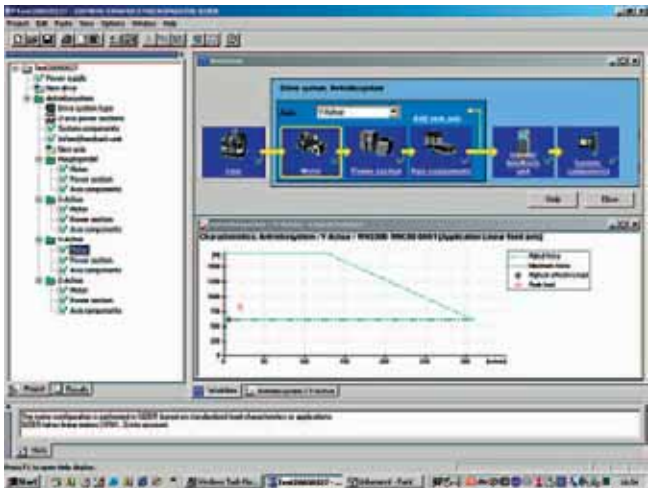
12





SIZER configuration tool

Overview



The SIZER configuration tool provides an easy-to-use means of configuring the SINAMICS and MICROMASTER 4 drive families, as well as the SINUMERIK solution line CNC control and SIMOTION Motion Control. It provides support when setting up the technologies involved in the hardware and firmware components required for a drive task. SIZER supports the complete configuration of the drive system, from simple individual drives to complex multi-axis applications.

SIZER supports all of the engineering steps in one workflow:

- Configuring the power supply
- Designing the motor and gearbox, icluding 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 and German.

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 Exel, using the Exel 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 and dimension drawings of the motors

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 English and German

Minimum system requirements

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

256 MB RAM (512 MB recommended)

At least 1.7 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 SP2 / XP Professional SP1 / XP Home Edition SP1

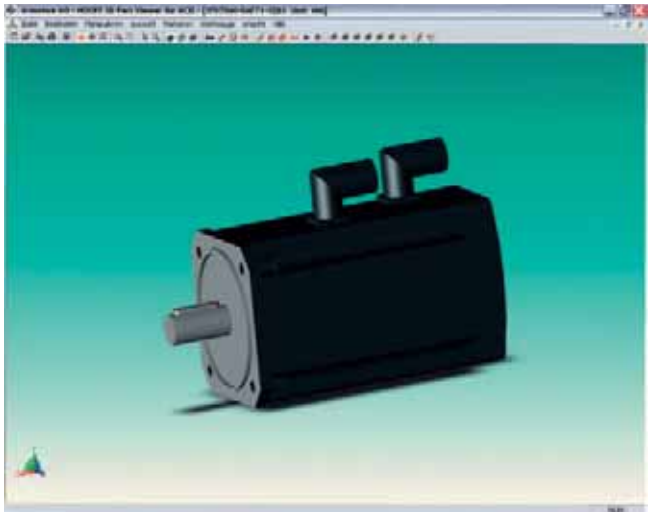
Microsoft Internet Explorer 5.5 SP2

Selection and ordering data

	Order No.
SINAMICS MICROMASTER SIZER configuration tool English/German	**6SL3070-0AA00-0AG0**

CAD CREATOR
Dimension sheet and 2D/3D CAD generator

Overview



The CAD CREATOR provides a user-friendly interface which helps you to create product-specific data quickly and supports you in generating plant documentation considering project-specific information.

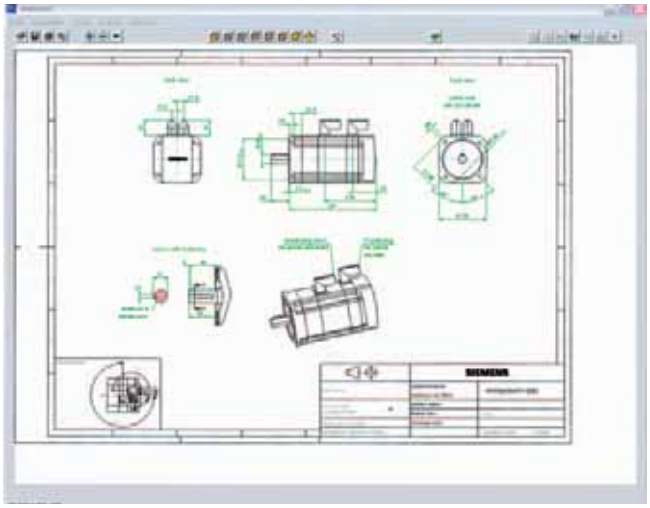
Benefits

- Multilingual operator interface in English, French, German, Italian and Spanish
- Dimension sheets with measurements in mm or inches
- Dimension sheets and 2D/3D CAD data for
  - Motors
    - 1FK7/1FT6/1FT7/1FE1 synchronous motors
    - 1FW3 torque motors
    - 1FK7/1FK7 DYA/1FT6 geared motors
    - 1PH7/1PH4/1PL6 asynchronous motors
    - 1PM4/1PM6 asynchronous motors
  - SINAMICS S120
    - Control Units
    - Line Modules (booksize)
    - Line-side components
    - Motor Modules (booksize)
    - DC link components
    - Supplementary system components
    - Encoder system connection
    - MOTION-CONNECT connection system
  - SINUMERIK solution line
    - Controls
    - Operator components for CNC controls

The CAD CREATOR provides you with various options to begin the product configuration:

- Order number
- Order number search
- Geometric data

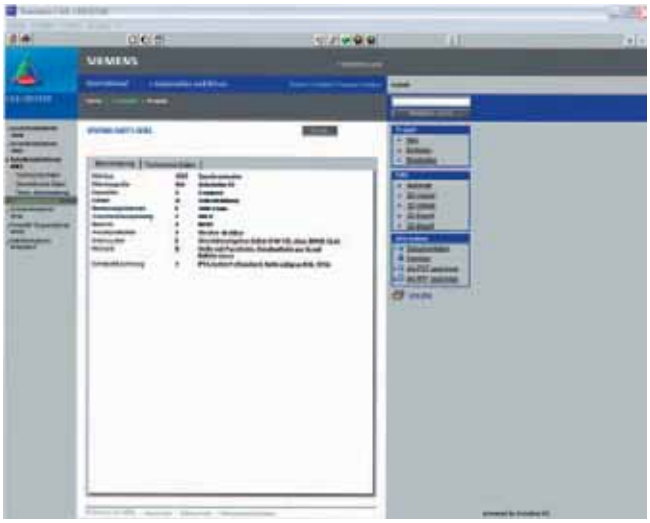
Once a product is successfully configured, the product-specific information, such as dimension drawing and 2D/3D CAD data are displayed and offered for storing in various formats, e.g.: *.pdf, *.dxf, *.stp or *.igs.



The CAD CREATOR is available on CD-ROM and as an Internet application.

Additional information is available in the Internet at:

http://www.siemens.com/cad-creator



Planning

Overview

General configuration sequence

The function description of the machine provides the basis for the configuration. The definition of the components is based on physical dependencies and is usually carried out as follows:

Step	Description of configuration activity
1	Clarification of type of drive
2	Definition of boundary conditions and integration into automated system
3	Definition of loading case, calculation of max. load torque, definition of motor
4	Definition of the Motor Module
5	Repetition of steps 3 and 4 for additional axes
6	Calculation of the required DC link power and definition of the Line Module
7	Specification of the required control performance and selection of the Control Unit, definition of component cabling
8	Specification of the line-side options (main switch, fuses, line filters, etc.) and cable cross-sections for system connection and motor connection
9	Definition of additional system components
10	Calculation of the current requirement for the 24 V DC supply for the components and specification of power supplies (SITOP devices, Control Supply Modules)
11	Specification of components for connection system
12	Configuration of drive group components
13	Thermal design of the control cabinet

Configuration begins with the mechanical interface to the machine. A suitable motor is selected according to the specified torques and speeds. A matching power unit is then also chosen. Depending on the requirements of the machine, the motor is supplied as a single drive via a Power Module or within a multi-motor drive group via a Motor Module. Once the basic components have been defined, the system components for matching to the electrical and mechanical interfaces are selected.

The SIZER configuring tool helps the user to select the correct components quickly and easily. The user enters the relevant torque and speed characteristics and SIZER then guides him confidently through the configuring process, identifying suitable motors and matching SINAMICS power units and other system components.

The following sections describe those SINAMICS S120 components which are needed to create a drive system subject to certain boundary conditions. For information about individual components, please refer to the online help in the SIZER configuring tool system.

Overview

Basic technological tasks can be carried out by the SINAMICS S120 Control Units. The CU320 Control Unit is available for multi-axis applications and the CU310 Control Unit for single drives.

Sophisticated Motion Control tasks are best supported by the powerful SIMOTION D Control Units (D410, D425, D435 und D445) with graded performance.

Each of these Control Units is based on an object-oriented SINAMICS S120 standard firmware which contains all the most popular *V/f* control modes and closed-loop control variants, that can be scaled to meet even the most advanced performance requirements.

The following are ready-to-configure drive objects (drive controls):

- the control of a line module: "Infeed Control"
- the control for the broad scope of robust asynchronous motors (induction motors): "Vector Control"
- the control for permanent-field synchronous motors with demanding dynamic requirements: "Servo Control"

All these control variants are based on the principle of field-oriented, closed-loop Vector control.

The most commonly used *V/f* control modes are stored in the "Vector Control" drive object and are ideal for implementing even simple applications such as, for example, group drives with SIEMOSYN motors.

Guide to selecting a closed-loop control variant

The two following tables titled "Performance characteristics" and "Closed-loop control characteristics" are provided to help users select the "right" type of closed-loop control.

The SIMOTION D425, D445 und CX32 control units have the integral drive computing power of a SINAMICS CU320 control unit. For this reason, the statements in the following sections concerning performance features and closed-loop control properties of a CU320 Control Unit are also valid for this SIMOTION Control Unit (exception: EPos basic positioner is not possible on D4x5 and CX32).

SINAMICS S120 Control Units

Configuration

Performance characteristics: SINAMICS S120 CU320/CU310 Control Units

Characteristics	Servo Control	Vector Control	*V/f* Control	Notes
Typical application	• Drives with highly dynamic motion control • Angular-locked synchronism with isochronous PROFIBUS/PROFINET in conjunction with SIMOTION • For use in machine tools and clocked production machines	• Speed-controlled drives with high speed and torque stability in general mechanical engineering systems • Particularly suitable for asynchronous motors (induction motors)	• Drives with low requirements on dynamic response and accuracy • Highly synchronized group drives, e.g. on textile machines with SIEMOSYN motors	Mixed operation of Servo Control and Vector Control is not possible on CU320. Mixed operation with *V/f* control modes is possible. It is for this reason that the *V/f* control modes are stored only once in the Vector drive object. The *V/f* characteristic stored in the Servo drive object is provided only for diagnostic purposes.
Dynamic response	Very high	High	Low	Highest dynamic response with 1FK7 High Dynamic synchronous motors and Servo Control.
Control modes with encoder	Position control/ Speed control/ Torque control	Position control/ speed control/ torque control	None	SIMOTION D with Servo Control is standard for coordinated motion control.
Control modes without encoder	Speed control	Speed control/torque control	All *V/f* control modes	With Servo for asynchronous motors (induction motors) only. With *V/f* control the speed can be kept constant by means of selectable slip compensation.
Asynchronous motor (induction motor)	Yes	Yes	Yes	*V/f* control (textiles) is recommended for SIEMOSYN motors
Synchronous motor	Yes	No	No	
Torque motor	Yes	Yes	No	
Linear motor	Yes	No	No	
Permissible ratio of motor rated current to rated current of Motor Module	1:1 to 1:4	1.3:1 to 1:4	1:1 to 1:12	Maximum control quality in the case of Servo and Vector Control up to 1:4. Between 1:4 and 1:8 increasing restrictions as regards torque and rotational accuracy. *V/f* Control is recommended for < 1:8.
Maximum number of parallel-connected motors per Motor Module	4	1	Unlimited in theory	With Servo Control, identical motors connected in parallel must be asynchronous motors (induction motors). With *V/f* Control, the motors can have different power ratings.
Setpoint resolution position controller	31 bits + sign	31 bits + sign	–	
Setpoint resolution speed/frequency	31 bits + sign	31 bits + sign	0.001 Hz	
Setpoint resolution torque	31 bits + sign	31 bits + sign	–	
Performance CU320 for booksize			–	Servo mode is recommended for position controls. Notice: When AC/AC power sections are connected via CUA31, either an EPos or an axis must be deducted.
• with default sampling rate EPos/position controller, and with speed controller/ current controller/ pulse frequency	3 axes EPos or 2 axes EPos and 2 axes speed control or 1 axis EPos and 4 axes speed control: 4 ms/1 ms at 125 µs/125 µs/4 kHz	2 axes EPos or 1 axis EPos and 1 axis speed control: 4 ms/2 ms at 250 µs/1000 µs/4 kHz	Positioning with *V/f*	
• with default sampling rate EPos/position controller, and with speed controller/ current controller/ pulse frequency		3 axes EPos or 2 axes EPos and 1 axis speed control or or 1 axis EPos and 2 axes speed control: 4 ms/4 ms at 500 µs/2000 µs/2 kHz	–	

Configuration (continued)

Characteristics	Servo Control	Vector Control	*V/f* Control	Notes
Performance CU320 for booksize	Closed-loop speed/torque control	Closed-loop speed/torque control	*V/f* Control	The sampling rate has an important influence on the dynamic control response. Servo: With asynchronous motors only 5 axes Notice: When AC/AC power sections are connected via CUA31, one axis must be deducted.
• with default sampling rate current controller/ speed controller/ pulse frequency	6/5 axes: 125 µs/125 µs/4 kHz	2 axes: 250 µs/1000 µs/4 kHz 4 axes: 500 µs/2000 µs/2 kHz	4 axes: 250 µs/4 kHz 6 axes: 400 µs/2.5 kHz 8 axes: 500 µs/4 kHz	
Performance CU320 for chassis frame size FX and GX	Closed-loop speed/torque control	Closed-loop speed/torque control	*V/f* Control	Notice: When activating additional software functions (DCC, safety, etc.), correspondingly fewer axes can be calculated on a CU320.
• with default sampling rate current controller/ speed controller/ pulse frequency	6 axes: 250 µs/250 µs/2 kHz	2 axes: 250 µs/1000 µs/2 kHz 4 axes: 500 µs/2000 µs/2 kHz	4 axes: 250 µs/2 kHz 8 axes: 500 µs/4 kHz	
Performance CU320 for chassis frame sizes HX and JX and 690 V all frame sizes	Servo mode not provided for this size	Closed-loop speed/torque control	V/f control	
• with default sampling rate current controller/ speed controller/ pulse frequency		4 axes: 400 µs/1600 µs/ 1.25 kHz	6 axes: 400 µs/1.25 kHz	
Maximum output frequency				
• for current controller clock cycle/pulse frequency	650 Hz with 125 µs/4 kHz	300 Hz with 250 µs/4 kHz	400 Hz with 250 µs/4 kHz	Note limit voltage (2 kV) and use of VPM Module with synchronous motors. When using edge modulation, 600 Hz are possible at 4 kHz, or 300 Hz at 2 kHz and 200 Hz at 1.25 kHz.
• with current controller clock cycle/pulse frequency (chassis frame sizes FX and GX)	300 Hz with 250 µs/2 kHz	160 Hz with 250 µs/2 kHz	200 Hz with 250 µs/2 kHz	
• with current controller clock cycle/pulse frequency (chassis frame sizes HX and JX)	300 Hz with 250 µs/2 kHz	100 Hz with 400 µs/1.25 kHz	100 Hz with 400 µs/1.25 kHz	
Maximum field weakening				
• for asynchronous (induction) motors	5 times	5 times	5 times	With Servo Control combined with encoder and appropriate special motors, field weakening up to 16 times the field-weakening threshold speed is possible.
• for synchronous motors	2 times	2 times	–	These values refer to 1FT7/1FK7 synchronous motors. Note limit voltage (kE factor) with non-Siemens motors.

Closed-loop control characteristics: SINAMICS S120 CU320/CU310 Control Units

Criteria for assessing control quality	Explanations, definitions
Rise time	The rise time is the period which elapses between an abrupt change in a setpoint and the moment the actual value first reaches the tolerance band (2 %) around the setpoint. The dead time is the period which elapses between the abrupt change in the setpoint and the moment the actual value begins to increase. The dead time is partially determined by the read-in, processing and output cycles of the digital closed-loop control. Where the dead time constitutes a significant proportion of the rise time, it must be separately identified.
Characteristic angular frequency -3 dB	The limit frequency is a measure of the dynamic response of a closed-loop control. A pure sinusoidal setpoint is input to calculate the limit frequency; no part of the control loop must reach the limit. The actual value is measured under steady-state conditions and the ratio between the amplitudes of actual value and setpoint is recorded. "-3 dB limit frequency": Frequency at which the absolute value of the actual value drops by 3 dB (to 71 %) for the first time. The closed-loop control can manage frequencies up to this value and remain stable.
Ripple	The ripple is the undesirable characteristic of the actual value which is superimposed on the mean value (useful signal). Oscillating torque is another term used in relation to torque. Typical oscillating torques are caused by motor slot grids, by limited encoder resolution or by the limited resolution of the voltage control of the IGBT power unit. The torque ripple is also reflected in the speed ripple as being indirectly proportional to the mass inertia of the drive.
Accuracy	Accuracy is a measure of the magnitude of the average, repeatable deviation between the actual value and setpoint under nominal conditions. Deviations between the actual value and setpoint are caused by internal inaccuracies in the measuring and control systems. External disturbances, such as temperature or speed, are not included in the accuracy assessment. The closed-loop and open-loop controls should be optimized with respect to the relevant variable.

SINAMICS S120 Control Units

Configuration (continued)

Basic closed-loop control characteristics of CU320/CU310 Control Unit

- Booksize format, pulse frequency 4 kHz, closed-loop torque control

	Servo Control		Vector Control		Notes
Synchronous motor	**1FK7 with resolver**	**1FT6/1FT7 with absolute encoder 2048 S/R**	Vector Control is not designed as an operating mode for 1FK7/1FT6/1FT7 synchronous motors.		
Controller cycle	125 µs	125 µs			
Rise time (without delay)	0.7 ms	0.5 ms			At a speed operating range from 50 rpm for resolver.
Characteristic angular frequency –3 dB	650 Hz	900 Hz			In this case, the dynamic response is determined primarily by the encoder system.
Torque ripple	3 % of M_0	0.6 % of M_0			With speed operating range of 20 rpm up to rated speed. A ripple of < 1 % is possible with an absolute encoder ≤ 1 rpm. Not possible with resolver.
Torque accuracy	± 1.5 % of M_0	± 1.5 % of M_0			Measured value averaged over 3 s. With motor identification and friction compensation. In torque operating range up to ± M_0. Speed operating range 1:10 up to rated speed. Notice: External influences such as motor temperature can cause an additional long-time inaccuracy (constancy) of about ± 2.5 %. Approx. ± 1 % less accuracy in field-weakening range.
Asynchronous motor (induction motor)	**1PH7/1PL6 without encoder**	**1PH7/1PL6 with incremental encoder 1024 S/R**	**1PH7/1PL6 without encoder**	**1PH7/1PL6 with incremental encoder 1024 S/R**	
Controller cycle	125 µs	125 µs	250 µs	250 µs	
Total rise time (without delay)	–	0.8 ms	2 ms	1.2 ms	With encoderless operation in speed operating range 1:10, with encoder 50 rpm and above up to rated speed.
Characteristic angular frequency –3 dB	–	600 Hz	250 Hz	400 Hz	With encoderless operation in speed operating range 1:10. The dynamic response is enhanced by an encoder feedback.
Torque ripple	–	1.5 % of M_{rated}	2 % of M_{rated}	2 % of M_{rated}	With encoderless operation in speed operating range 1:20, with encoder 20 rpm and above up to rated speed.
Torque accuracy	–	±3.5 % of M_{rated}	±2 % of M_{rated}	±1.5 % of M_{rated}	Measured value averaged over 3 s. With motor identification and friction compensation, temperature effects compensated by KTY84 and mass model. In torque operating range up to ± M_{rated}. Approx. additional inaccuracy of ± 2.5 % in field-weakening range. Servo: Speed operating range 1:10 referred to rated speed. Vector: Speed operating range 1:50 referred to rated speed.

Configuration (continued)

- Booksize format, pulse frequency 4 kHz, closed-loop speed control

	Servo Control		Vector Control		Notes
Synchronous motor	**1FK7 with resolver**	**1FT6/1FT7 with absolute encoder 2048 S/R**	Vector Control is not designed as an operating mode for 1FK7/1FT6/1FT7 synchronous motors.		
Controller cycle	125 µs	125 µs			
Total rise time (without delay)	3.5 ms	2.3 ms			With encoderless operation in speed operating range 1:10, with encoder 50 rpm and above up to rated speed.
Characteristic angular frequency –3 dB	140 Hz	250 Hz			In this case, the dynamic response is determined primarily by the encoder system.
Speed ripple	See note	See note			Determined primarily by the total mass moment of inertia, the torque ripple and especially the mechanical configuration. It is not therefore possible to specify a generally applicable value.
Speed accuracy	≤ 0.001 % of n_{rated}	≤ 0.001 % of n_{rated}			Determined primarily by the resolution of the control deviation and encoder evaluation in the converter. This is implemented on a 32-bit basis for SINAMICS.
Asynchronous motor (induction motor)	**1PH7/1PL6 without encoder**	**1PH7/1PL6 with incremental encoder 1024 S/R**	**1PH7/1PL6 without encoder**	**1PH7/1PL6 with incremental encoder 1024 S/R**	
Controller cycle	125 µs	125 µs	250 µs	250 µs	
Total rise time (without delay)	12 ms	3 ms	25 ms	12 ms	With encoderless operation in speed operating range 1:10, with encoder 50 rpm and above up to rated speed.
Characteristic angular frequency –3 dB	40 Hz	120 Hz	10 Hz	30 Hz	With encoderless operation in speed operating range 1:10. The dynamic response is enhanced by an encoder feedback. Servo with encoder is slightly more favorable than Vector with encoder, as the speed controller cycle with Servo is quicker.
Speed ripple	See note	See note	See note	See note	Determined primarily by the total mass moment of inertia, the torque ripple and especially the mechanical configuration. It is not therefore possible to specify a generally applicable value.
Speed accuracy	0.1 × f_{slip}	≤ 0.001 % of n_{rated}	0.05 × f_{slip}	≤ 0.001 % of n_{rated}	Without encoder: Determined primarily by the accuracy of the calculation model for the torque-producing current and rated slip of the asynchronous motor (induction motor) (see table "Typical slip values"). With speed operating range 1:50 (vector) or 1:10 (servo) and with activated temperature evaluation.

SINAMICS S120 Control Units

Configuration (continued)

- Blocksize, booksize compact, booksize and chassis, pulse frequency 4 kHz, position control

	Servo Control		Vector Control		Notes
Synchronous motor	**1FT6/1FT7 with absolute encoder 2048 S/R**	**1FK7 with resolver (Zp=2)**	Vector Control is not designed as an operating mode for 1FT6/1FT7/1FK7 synchronous motors.		
Position controller cycle	1 ms	1 ms			
Resolution	16.8×10^6 incr./rev.	4096 incr./rev.			Correspondingly better with multi-pole resolver.
Attainable positioning accuracy	10^5 ... 10^6 incr./rev.	1024 incr./rev.			In practice, the resolution must be higher than the required positioning accuracy by a factor of 4 to 10. These values are approximate nominal values only.
Asynchronous motor (induction motor)	**1PH7/1PL6 with absolute encoder 2048 S/R**	**1PH7/1PL6 with incremental encoder 1024 S/R**	**1PH7/1PL6 with absolute encoder 2048 S/R**	**1PH7/1PL6 with incremental encoder 1024 S/R**	
Position controller cycle	1 ms	1 ms	2 ms	2 ms	
Resolution	$16{,}8 \times 10^6$ incr./rev.	4096 incr./rev.	$16{,}8 \times 10^6$ incr./rev.	4096 incr./rev.	
Attainable positioning accuracy	10^5 ... 10^6 incr./rev.	1024 incr./rev.	10^5 ... 10^6 incr./rev.	512 incr./rev.	In practice, the resolution must be higher than the required positioning accuracy by a factor of 4 to 10. These values are approximate nominal values only. Vector is less accurate than servo by a factor of approximately 2.

Configuration (continued)

- Chassis format, pulse frequency 2 kHz, closed-loop torque control

	Servo Control		Vector Control		Notes
Synchronous motor	**1FT6/1FT7 without encoder**	**1FT6/1FT7 with absolute encoder 2048 S/R**	Vector Control is not designed as an operating mode for 1FT6/1FT7 synchronous motors.		
Controller cycle	250 µs	250 µs			
Total rise time (without delay)	–	1.2 ms			
Characteristic angular frequency –3 dB	–	400 Hz			In this case, the dynamic response is determined primarily by the encoder system.
Torque ripple	–	1.3 % of M_0			A ripple of < 1 % is possible with an absolute encoder ≤ 1 rpm. Not possible with resolver.
Torque accuracy	–	± 1.5 % of M_0			Measured value averaged over 3 s. With motor identification and friction compensation. In torque operating range up to ± M_0. Speed operating range 1:10 up to rated speed. Notice: External influences such as motor temperature can cause an additional long-time inaccuracy (constancy) of about ± 2.5 %. Approx. ± 1 % less accuracy in field-weakening range.
Asynchronous motor (induction motor)	**1PH7/1PL6 without encoder**	**1PH7/1PL6 with incremental encoder 1024 S/R**	**1PH7/1PL6 without encoder**	**1PH7/1PL6 with incremental encoder 1024 S/R**	
Controller cycle	250 µs	250 µs	250 µs	250 µs	
Total rise time (without delay)	–	1.6 ms	2.5 ms	1.6 ms	With encoderless operation in speed operating range 1:10, with encoder 50 rpm and above up to rated speed.
Characteristic angular frequency –3 dB	–	350 Hz	200 Hz	300 Hz	With encoderless operation in speed operating range 1:10. The dynamic response is enhanced by an encoder feedback.
Torque ripple	–	2 % of M_{rated}	2.5 % of M_{rated}	2 % of M_{rated}	With encoderless operation in speed operating range 1:20, with encoder 20 rpm and above up to rated speed.
Torque accuracy	–	± 3.5 % of M_{rated}	± 2 % of M_{rated}	± 1.5 % of M_{rated}	Measured value averaged over 3 s. With motor identification and friction compensation, temperature effects compensated by KTY84 and mass model. In torque operating range up to ± M_{rated}. Approx. additional inaccuracy of ± 2.5 % in field-weakening range. Servo: Speed operating range 1:10 referred to rated speed. Vector: Speed operating range 1:50 referred to rated speed.

SINAMICS S120 Control Units

Configuration (continued)

- Chassis format, pulse frequency 2 kHz, closed-loop speed control

	Servo Control		Vector Control		Notes
Synchronous motor	**1FT6/1FT7 without encoder**	**1FT6/1FT7 with absolute encoder 2048 S/R**	Vector Control is not designed as an operating mode for 1FT6/1FT7 synchronous motors.		
Controller cycle	250 µs	250 µs			
Total rise time (without delay)	–	5 ms			With encoderless operation in speed operating range 1:10, with encoder 50 rpm and above up to rated speed.
Characteristic angular frequency –3 dB	–	100 Hz			In this case, the dynamic response is determined primarily by the encoder system.
Speed ripple	–	See note			Determined primarily by the total mass moment of inertia, the torque ripple and especially the mechanical configuration. It is not therefore possible to specify a generally applicable value.
Speed accuracy	–	≤ 0.001 % of n_{rated}			Determined primarily by the resolution of the control deviation and encoder evaluation in the converter. This is implemented on a 32-bit basis for SINAMICS.
Asynchronous motor (induction motor)	**1PH7/1PL6 without encoder**	**1PH7/1PL6 with incremental encoder 1024 S/R**	**1PH7/1PL6 without encoder**	**1PH7/1PL6 with incremental encoder 1024 S/R**	
Controller cycle	250 µs	250 µs	250 µs	250 µs	
Total rise time (without delay)	21 ms	8 ms	20 ms	12 ms	With encoderless operation in speed operating range 1:10, with encoder 50 rpm and above up to rated speed.
Characteristic angular frequency –3 dB	25 Hz	80 Hz	35 Hz	60 Hz	With encoderless operation in speed operating range 1:10. The dynamic response is enhanced by an encoder feedback. Servo with encoder is slightly more favorable than Vector with encoder, as the speed controller cycle with Servo is quicker.
Speed ripple	See note	See note	See note	See note	Determined primarily by the total mass moment of inertia, the torque ripple and especially the mechanical configuration. It is not therefore possible to specify a generally applicable value.
Speed accuracy	0.1 × f_{slip}	≤ 0.001 % of n_{rated}	0,05 × f_{slip}	≤ 0.001 % of n_{rated}	Without encoder: Determined primarily by the accuracy of the calculation model for the torque-producing current and rated slip of the asynchronous motor (induction motor) (see table "Typical slip values"). With speed operating range 1: 50 (Vector) or 1:10 (Servo) and with active temperature evaluation.

Typical slip values for standard asynchronous motors (induction motors)

Motor output	Slip values	Notes
< 1 kW (1.34 HP)	6 % of n_{rated} e.g. motor with 1500 rpm: 90 rpm	The slip values of 1PH7 motors are very similar to those of standard motors
< 10 kW (13.4 HP)	3 % of n_{rated} e.g. motor with 1500 rpm: 45 rpm	
< 30 kW (40.2 HP)	2 % of n_{rated} e.g. motor with 1500 rpm: 30 rpm	
< 100 kW (134 HP)	1 % of n_{rated} e.g. motor with 1500 rpm: 15 rpm	
> 500 kW (671 HP)	0.5 % of n_{rated} e.g. motor with 1500 rpm: 7.5 rpm	

Computing performance: Scaling

The performance of the CU320 Control Unit can be scaled by means of firmware when using performance expansion 1.

The performance requirement is dependent on the scope of functions and control dynamic response demanded by the application and, above all, by the number of drives to be operated on one Control Unit. Performance expansion 1 will be required for capacity utilization of 55 % or higher.

The following "scaling table" for the CU320 Control Unit provides a rough overview of computing performance as a function of current controller clock cycle (dynamic response) and number of axes with basic scope of functions (factory setting).

If a CUA31 Control Unit adapter is connected to the CU320, the number of axes is reduced by one in each case.

Note: The SIZER configuring tool is needed to calculate the exact performance requirement.

Configuration (continued)

Overview of performance scale for CU320 Control Unit

Notice: When activating additional software functions (DCC, safety, etc.), correspondingly fewer axes can be calculated on a CU320.

	Dynamic response (current controller clock cycle)	Number of axes without performance expansion 1	Number of axes with performance expansion 1	Note
Servo Control	125 µs	3	6	Plus one infeed (BLM, SLM, ALM). Number of axes applies only to basic functionality. Without expanded setpoint channel. Note power unit derating where applicable.
	250 µs	3	6	
Vector Control	250 µs	1	2	Plus one infeed (BLM, SLM, ALM). Number of axes applies only to basic functionality. Expanded setpoint channel included as standard. Note power unit derating where applicable.
	500 µs	2	4	
***V/f* Control**	250 µs	2	4	Plus one infeed (BLM, SLM, ALM). Number of axes applies only to basic functionality. Expanded setpoint channel included as standard.
	400 µs	3	6	
	500 µs	4	8	
Mixed operation				
Servo Control plus *V/f* Control	125 µs + 250 µs/500 µs	–	5	Maximum 2 *V/f* axes with 250 µs current controller clock cycle, otherwise divide as required.
Vector Control plus *V/f* Control	250 µs/500 µs	1/2	2/4	In mixed Vector-with-*V/f* operation, no difference to pure Vector operation.

SINAMICS S120 Control Units

Configuration (continued)

Influencing variables on minimum required pulse frequency of power unit

Basic requirements such as maximum speed or necessary dynamic response of the control have a direct effect in determining the minimum pulse frequency of the power unit. If the minimum pulse frequency exceeds the rated pulse frequency, derating must be implemented accordingly (see power unit description).

The following table provides a general overview.

Influencing variables		Minimum pulse frequency	Notes
Servo Control, Vector Control (required max. output frequency/speed)	100 Hz correspond to: 3000 rpm for Z_p = 2 1500 rpm for Z_p = 4 428 rpm for Z_p = 14 352 rpm for Z_p = 17	1.25 kHz	Z_p is the number of pole pairs of the motor. This equals 2 on 1PH7 asynchronous motor (induction motors). 1FT6/1FT7/1FK7 synchronous motors have between 2 and 4 pairs of poles. For torque motors, the numbers of pole pairs are typically 14 and 17. In the case of edge modulation, the values are increased by a factor of 2.
	160 Hz correspond to: 4800 rpm for Z_p = 2 2400 rpm for Z_p = 4 685 rpm for Z_p = 14 565 rpm for Z_p = 17	2 kHz	
	200 Hz correspond to: 6000 rpm for Z_p = 2 3000 rpm for Z_p = 4 856 rpm for Z_p = 14 704 rpm for Z_p = 17	2.5 kHz	
	300 Hz correspond to: 9000 rpm for Z_p = 2 4500 rpm for Z_p = 4 1284 rpm for Z_p = 14 1056 rpm for Z_p = 17	4 kHz	
	400 Hz correspond to: 12000 rpm for Z_p = 2 6000 rpm for Z_p = 4	4 kHz	Notice: For Servo Control with 1FT6/1FT7/1FK7 motors only. Note field weakening requirements and suitable encoder system for higher speeds.
***V/f* Control (required max. output frequency/speed)**	100 Hz correspond to: 6000 rpm for Z_p = 1 3000 rpm for Z_p = 2	1.25 kHz	*V/f* Control is designed only for asynchronous (induction motors) and SIEMOSYN motors. Z_p is the number of pole pairs of the motor. This is mainly between 1 and 4 on 1LA/1LG standard asynchronous motors (induction motors). SIEMOSYN motors have 1 or 2 pole pairs or, with larger shaft heights, 3 pairs.
	160 Hz correspond to: 9600 rpm for Z_p = 1 4800 rpm for Z_p = 2	2 kHz	
	200 Hz correspond to: 12000 rpm for Z_p = 1 6000 rpm for Z_p = 2	2.5 kHz	
	300 Hz correspond to: 18000 rpm for Z_p = 1 9000 rpm for Z_p = 2	4 kHz	
	400 Hz correspond to: 24000 rpm for Z_p = 1 12000 rpm for Z_p = 2	4 kHz	
Dynamic response requirement (current controller clock cycle)	125 µs 250 µs 400 µs 500 µs	4 kHz 2 kHz 2.5 kHz 1 kHz	Servo Control requires a minimum pulse frequency of 2 kHz.
Sinusoidal filters	–	4 kHz	Notice: If sinusoidal filters are operated at low frequencies, resonance problems can occur and cause the filters to severely overheat.
Output reactor to motor	Max. frequency: 150 Hz correspond to 4500 rpm for Z_p = 2		The output reactor can be operated at maximum 2 kHz only.

Configuration (continued)

Core topologies: Component cabling with DRIVE-CLiQ

The components communicate with one another via the standard DRIVE-CLiQ interface.

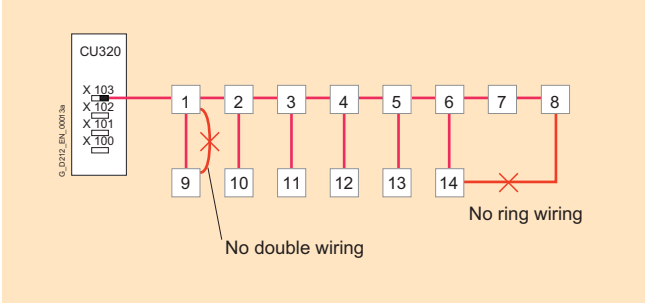
This interface connects a Control Unit with the power components, encoders and other system components, e.g. Terminal Modules. Setpoints and actual values, control commands, status messages, and rating plate data for the components are transferred via DRIVE-CLiQ.

Basic rules for wiring with DRIVE-CLiQ

One SINAMICS CU320 control is integrated on each of the control units SIMOTION D425, D435, D445 and CX32. For this reason, the statements in the following sections concerning DRIVE-CLiQ topologies of a CU320 Control Unit are also valid for these SIMOTION Control Units.

The following rules apply to the wiring of components with DRIVE-CLiQ:

- A maximum of 14 nodes can be connected to a DRIVE-CLiQ socket on the CU320 Control Unit.
- Up to eight nodes can be connected in a line. A line is always seen from the perspective of the Control Unit
- Maximum 6 Motor Modules in a line
- Ring wiring is not permitted
- Components must not be double-wired
- The motor encoder should be connected to the associated Motor Module.
- Up to 9 encoders can be operated on one Control Unit
- A maximum of 8 Terminal Modules can be connected
- The Terminal Module TM54F must not be operated on the same DRIVE-CLiQ line as Motor Modules.
- The Terminal Modules TM15, TM17 and TM41 have faster sampling cycles than the TM31 and TM54F. For this reason, the two groups of Terminal Modules must be connected in separate DRIVE-CLiQ lines.
- A DRIVE-CLiQ Hub DMC20 counts as two stations

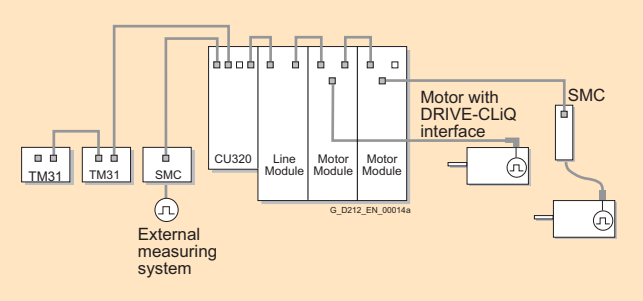


DRIVE-CLiQ configuration examples

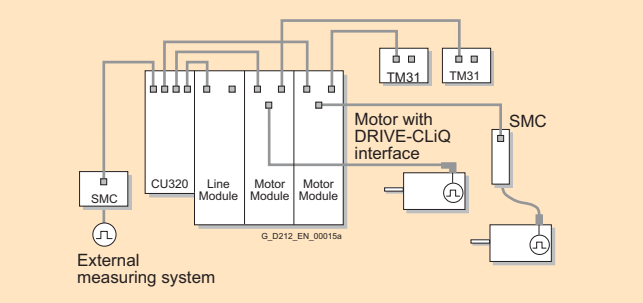
There is a basic clock cycle within a DRIVE-CLiQ connection. For this reason, only combinations of modules with the same sampling cycle or integer-divisible sampling times can be operated on a DRIVE-CLiQ connection. To simplify the configuring process, it is advisable to supply the Line Module and Motor Modules via separate DRIVE-CLiQ connections.

The power components are supplied with the required DRIVE-CLiQ connecting cable for connection to the adjacent DRIVE-CLiQ node in the axis grouping (line topology). Pre-assembled DRIVE-CLiQ cables in various lengths up to 100 m (328 ft) are available for connecting motor encoders, direct measuring encoders, Terminal Modules, etc.

The DRIVE-CLiQ cable connections inside the control cabinet must not exceed 70 m (230 ft) in length, e.g. connection between the CU320 Control Unit and the first Motor Module or between Motor Modules. The maximum permissible length of DRIVE-CLiQ MOTION-CONNECT cables to external components is 100 m (328 ft).



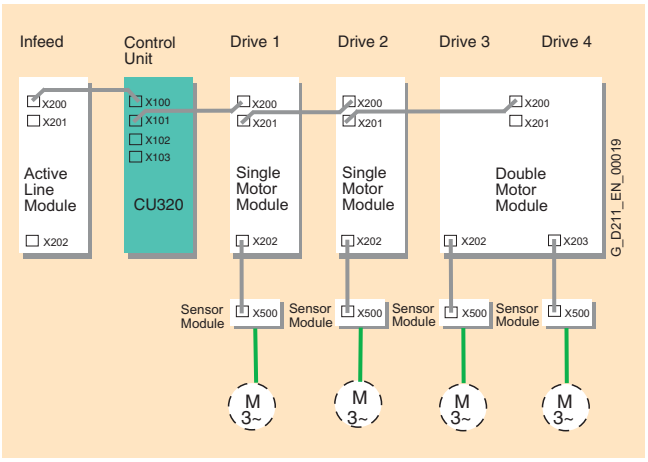
Example of a line topology for standard solutions with servo Control



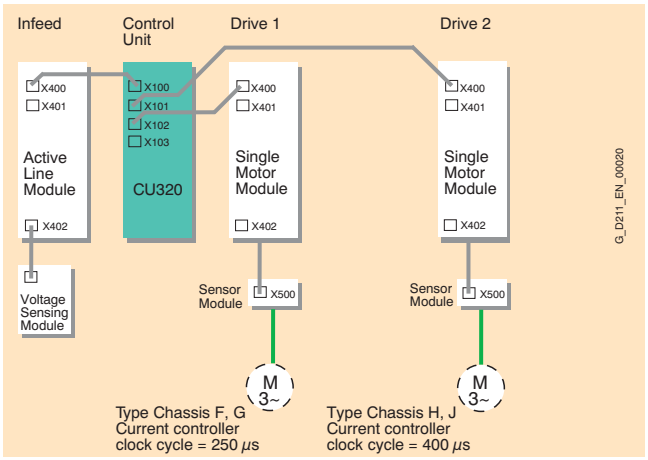
Example of a tree topology for high-performance solutions, e.g. high-dynamic axes in direct motion control group, selective access to individual axes/axis groupings for maintenance operation, etc.

SINAMICS S120 Control Units

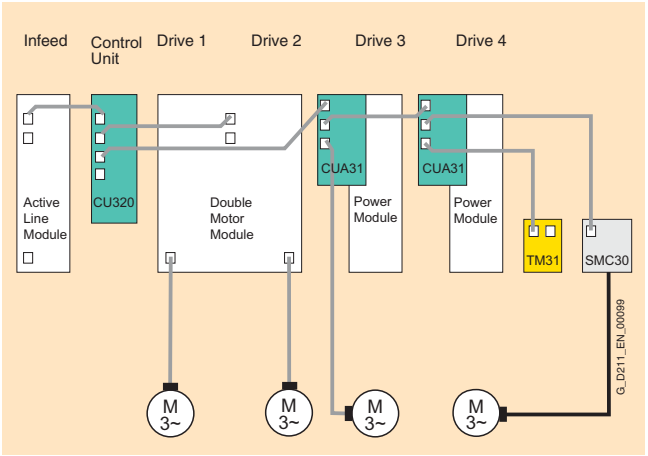
Configuration (continued)



Preferred wiring of DRIVE-CLiQ connections illustrated by example of booksize format
Active Line Module: Current controller clock cycle 250 µs.
Motor Modules: 4 × vector control = current controller clock cycle 500 µs



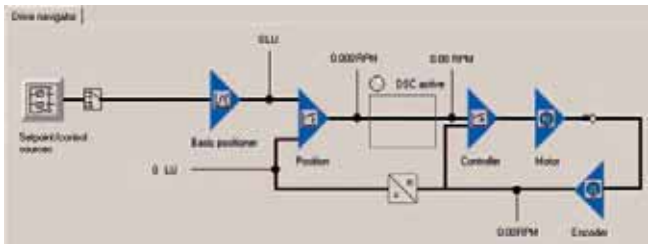
Wiring illustrated by example of chassis format with different current controller clock cycles

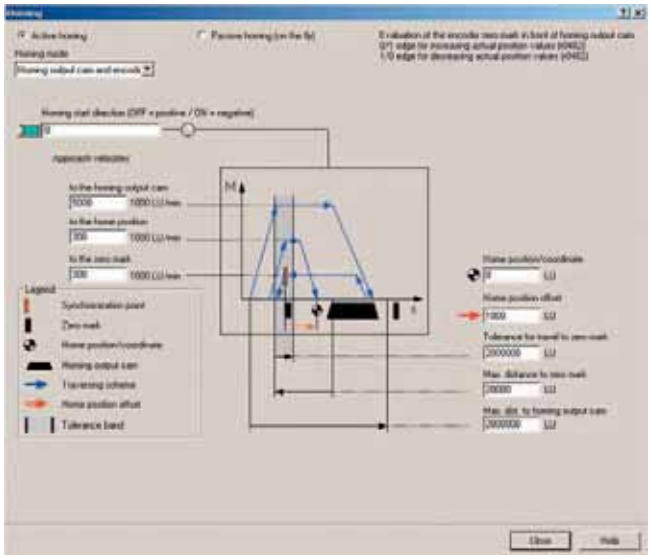


Example of wiring: Power Modules can also be operated on a CU320 when connected via a CUA31

Overview

Integral functionality for absolute and relative positioning of linear and rotary axes with motor encoders or machine encoders.





The EPos basic positioner in the SINAMICS S120 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.

In many applications, external position controllers can be eliminated by using the positioning fuctions built into the SINAMICS S120 drives.

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 or direct measuring system).

EPos is a function module that can be activated in Servo Control and in Vector Control.

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.

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, and 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 that has reached its target position)
- 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 (proximity switch)")
- Flying referencing (seamless homing possible during "normal" traversing with the aid of the measuring input evaluation; generally evaluation, e.g. of a BERO) Subordinate function for the modes "jog", "direct setpoint input/MDI" and "traversing blocks"
- Absolute encoder alignment

Traversing blocks mode (64 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. wait 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".

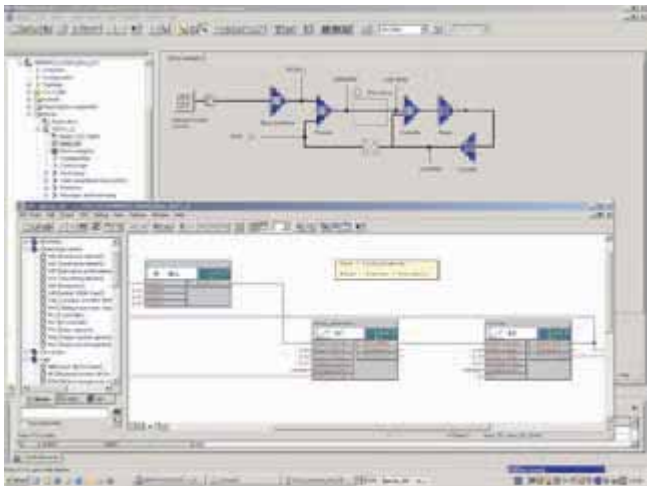
Jog mode

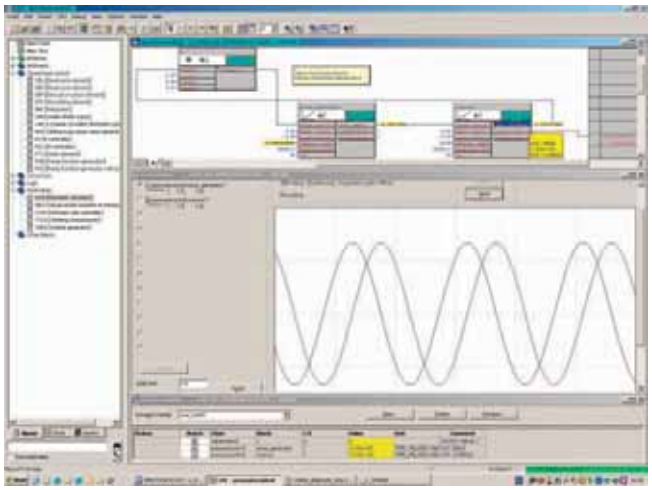
- Closed-loop position controlled traversing of the axis with the "endless position controlled" or "jog incremental" modes, which can be toggled between (traverse through a "step width")

Drive Control Chart (DCC)

Overview

Graphical configuring and expansion of the device functionality by means of available closed-loop control, arithmetic, and logic function blocks





Drive Control Chart (DCC) allows for drive-related automation and process tasks to be accomplished directly in the SINAMICS S120 drive system or Motion Control System SIMOTION. The ability to process directly in the drive supports the implementation of modular machine concepts and results in an increase of the complete machine performance.
DCC has no restriction with regard to the number of usable functions; this is only limited by the performance capability of the target platform.

The user-friendly DCC editor enables easy graphical configuration and a clear representation of control loop structures as well as a high degree of reusability of existing diagrams.

The open-loop and closed-loop control functionality is defined by using multi-instance-enabled blocks (Drive Control Blocks (DCBs)) from a pre-defined library (DCB library) that are selected and graphically linked by dragging and dropping. Test and diagnostic functions allow verification of program behavior or the identification of causes in the event of faults.

The block library encompasses a large selection of technology, arithmetic and logic function blocks, as well as comprehensive open-loop and closed-loop control functions.

For combining, analyzing and acquiring binary signals, all commonly used logic functions are available for selection (AND, XOR, on/off delay, RS flipflop, counter, etc.). Diverse arithmetic functions such as absolute-value generation, dividers and minimum/maximum analysis are available for monitoring and evaluating numeric variables. In addition to the automatic speed control, axial winder functions, closed-loop PI controller, ramp function generator or wobble generator can be configured simply and without problems.

Almost unlimited programming of control structures is possible in conjunction with the Motion Control system SIMOTION. These can be combined with other program sections to form an overall program.

Drive Control Chart for SINAMICS S120 also provides a convenient basis for resolving drive-level open-loop and closed-loop control tasks directly in the converter. This results in further adaptability of SINAMICS for the application requirements. The ability to process tasks directly in the drive supports modular machine concepts and results in increased overall machine performance.

Minimum hardware and software requirements

See the SCOUT or STARTER engineering software, since DCC is installed in association to these programs.

Selection and ordering data

DCC comprises the graphical configuring tool (DCC Editor) and the block library (DCB Library).

DCC is installed in association with SCOUT or STARTER engineering software.

The necessary engineering license for each PC (floating) for DCC is acquired at the same time the order is placed; additional runtime licenses are not required.

DCC can be supplied in two versions: the version for SIMOTION and SINAMICS applications, or the version for SINAMICS applications only.

	Order No.
DCC SIMOTION/SINAMICS V2.0 SP1 for SCOUT/STARTER V4.1 SP1 (Single engineering license, with DCC data carrier) DCC editor + DCB libraries for use on SIMOTION V4.1 SP1 and SINAMICS S120 V2.5 SP1 German/English/French/Italian (SIMOTION) German/English/French/Italian/Spanish (SINAMICS)	**6AU1810-1JA20-1XA0**
DCC SINAMICS V2.0 SP1 for STARTER V4.1 SP1 (Single engineering license, with DCC data carrier) DCC editor + DCB libraries for use on SINAMICS S120 V2.5 SP1 German/English/French/Italian/Spanish	**6AU1810-1HA20-1XA0**

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Configuration

Motor selection

The motor is selected on the basis of the required torque, which is defined by the application, e.g. traveling drives, hoisting drives, test stands, centrifuges, paper and rolling mill drives, feed drives or main spindle drives. Gear units for movement conversion or for adapting the motor speed and motor torque to the load conditions must also be considered.

As well as the load torque, which is determined by the application, the following mechanical data are among those required to calculate the torque to be provided by the motor:

- Masses to be moved
- Diameter of the drive wheel/diameter
- Leadscrew pitch, gear ratios
- Frictional resistance data
- Mechanical efficiency
- Traversing paths
- Maximum velocity
- Maximum acceleration and maximum deceleration
- Cycle time

You must decide whether synchronous or asynchronous motors (induction motors) are to be used.

Synchronous motors should be selected for compact construction volume, low rotor moment of inertia and therefore maximum dynamic response.

In this context, suitable motors would be the 1FT and 1FK, which can operate in "Servo" control mode.

Asynchronous motors (induction motors) can be used to increase maximum speeds in the field-weakening range. Asynchronous motors (induction motors) for higher powers are also available.

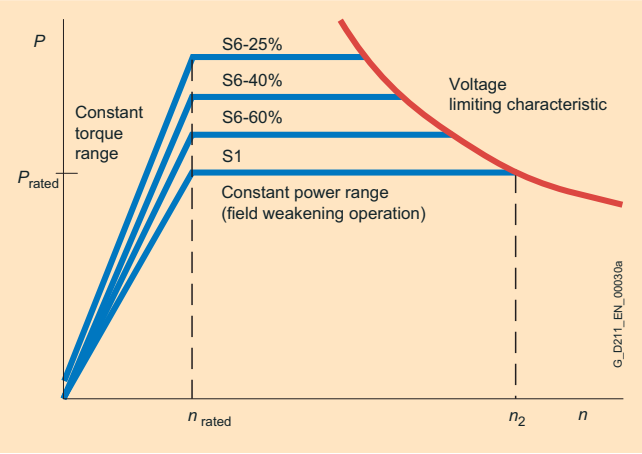
In this context, suitable motors would be the 1PL, 1PH, 1LA and 1LG, which can operate in "Vector" control mode.

The following factors are of prime importance during configuration:

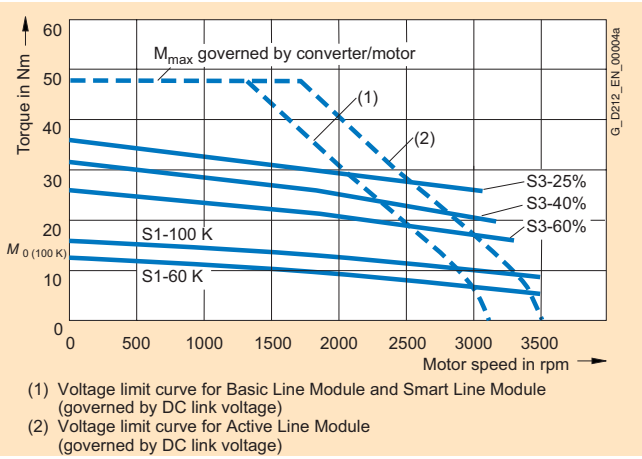
- The type of line supply, when using specific types of motor and/or line filters on IT systems (non-grounded systems)
- The ambient temperatures and the installation altitude of the motors and drive components

The motor-specific limiting characteristics provide the basis for defining the motors.

These define the torque or power characteristic over speed and take into account the motor limits based on the DC-link voltage of the Power or Motor Module. The DC-link voltage in turn is dependent on the line voltage and, with multi-motor drives, on the type of Line Module.



Limiting characteristics for asynchronous motors (induction motors) (example)



Limiting characteristics for synchronous motors (example)

12

Motors

Configuration (continued)

Duty cycles

The motor is defined on the basis of the type of duty prescribed by the application. Different characteristics must be used for different duty requirements. The following operating scenarios have been defined:

- Duty cycles with constant ON duration
- Duty cycles with varying ON duration
- Free duty cycle

The aim is to identify characteristic torque and speed operating points, on the basis of which the suitable motor can be selected for a particular duty cycle.

Once the operating scenario has been defined and specified, the maximum motor torque is calculated. In general, this takes place during the acceleration phase. The load torque and the torque required to accelerate the motor are added together.

The maximum motor torque is then verified with the limiting characteristics of the motors.

The following applies to 1PL and 1PH asynchronous motors (induction motors): Maximum motor torque = 2 × rated torque.

The following criteria must be taken into account when defining the motor:

- The dynamic limits must be observed, i.e. all speed-torque points of the relevant duty cycle must lie below the relevant limiting chacteristic.
- The thermal limits must be observed, i.e. for synchronous motors, the effective motor torque at the average motor speed resulting from the duty cycle must lie below the S1 characteristic (continuous duty). For asynchronous motors (induction motors), the rms value of the motor current within a load duty cycle must be less than the rated motor current.
- It should be noted that the maximum permissible motor torque on synchronous motors at higher speeds is reduced as a result of the voltage limiting characteristic. In addition, a margin of 10 % below the voltage limiting characteristic should be observed to safeguard against voltage fluctuations.
- When using asynchronous motors (induction motors), the permissible motor torque in the field-weakening range is restricted by the voltage limiting characteristic (stability limit). A margin of 30 % should be observed.
- When using an absolute encoder, the rated torque of the motor is reduced by 10 % due to the thermal limits of the encoder.

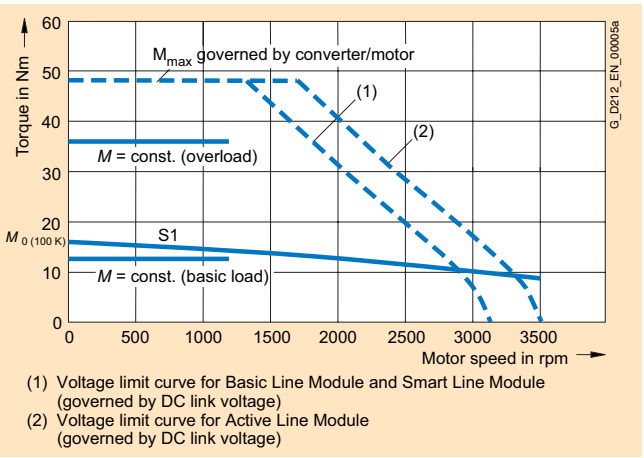
Duty cycles with constant ON duration

Duty cycles with constant ON duration place specific requirements on the torque characteristic as a function of the speed, e.g. M = constant, $M \sim n^2$, $M \sim n$ or P = constant.

These drives typically work at a steady-state operating point. Base load dimensioning is applied. The base load torque must lie below the S1 characteristic.

In the event of transient overloads (e.g. when accelerating) an overload has to be taken into consideration. The peak torque must lie below the voltage limiting characteristic on synchronous motors or below the stability limit on asynchronous motors (induction motors).

In summary, the dimensioning is as follows:



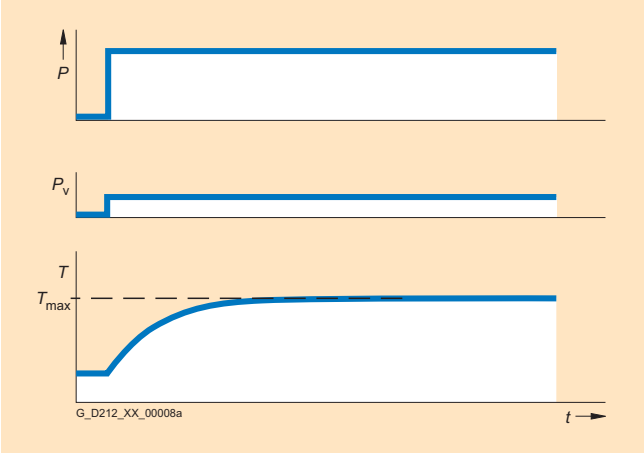
(1) Voltage limit curve for Basic Line Module and Smart Line Module (governed by DC link voltage)
(2) Voltage limit curve for Active Line Module (governed by DC link voltage)

Selection of motors for duty cycles with constant ON duration (example)

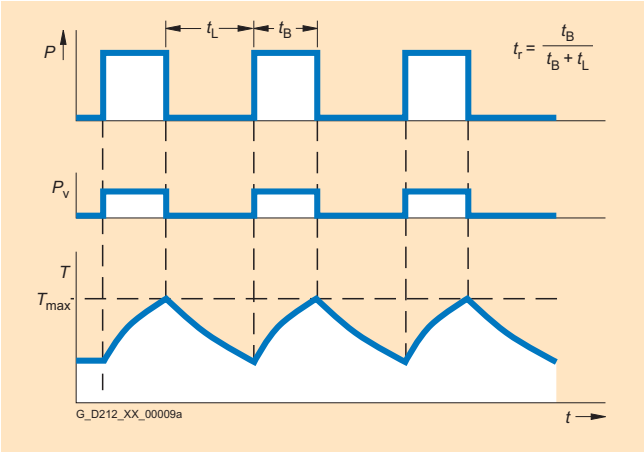
Configuration (continued)

Duty cycles with varying ON duration

As well as continuous duty (S1), standardized intermittent duty types (S3) are also defined for duty cycles with varying ON durations. This is an operation which comprises of a sequence of similar cycles, each of which comprises of a time with constant load and a break.



S1 duty (continuous operation)



S3 duty (intermittent duty without affecting the starting process)

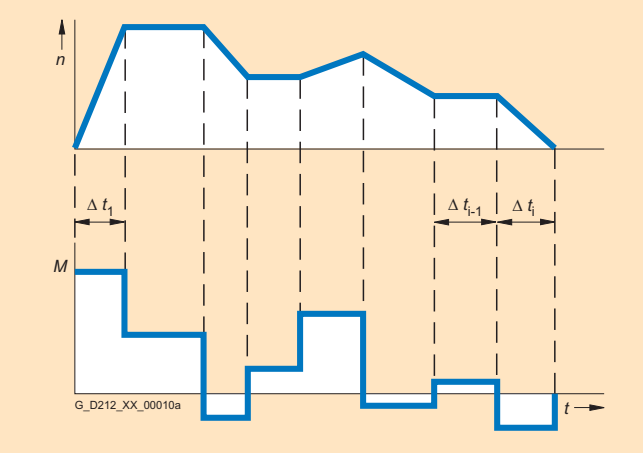
Fixed variables are usually used for the relative ON duration:

- S3 – 60 %
- S3 – 40 %
- S3 – 25 %

Corresponding motor characteristics are provided for these specifications. The load torque must lie below the corresponding thermal limiting characteristic of the motor. Overload dimensioning is taken into account for duty cycles with varying ON duration.

Free duty cycle

A load duty cycle defines the characteristics of the motor speed and the torque with respect to time.



A load torque is set for each time period. In addition to the load torque, the average load moment of inertia and motor moment of inertia must be taken into account for acceleration. A friction torque, which works in opposition to the direction of movement, may be required.

The gear ratio and gear efficiency must be taken into account when calculating the load and/or acceleration torque to be provided by the motor. A higher gear ratio increases positioning accuracy in terms of encoder resolution. At the given motor encoder resolution, as the gear ratio increases, so should the resolution of the machine position to be detected.

For further information about the importance of gearboxes, see the motor descriptions.

The effective torque M_{eff} must lie below the S1 characteristic.

The maximum torque M_{max} is reached during the acceleration process and must lie below the voltage limiting characteristic on synchronous motors and below the stability limit on asynchronous motors (induction motors).

Motor selection

Based on the motor data it is now possible to identify a motor which meets the requirements of the application.

In a second step, a check is made as to whether the thermal limits are maintained. For this purpose, the motor current at base load must be calculated. For configuration based on duty cycle with constant ON duration with overload, the overload current based on the required overload torque must be calculated. The calculation rules for this purpose depend on the type of motor used (synchronous motor, asynchronous motor (induction motor)) and the operating scenario (duty cycles with constant ON duration, duty cycles with varying ON duration, free duty cycle).

Finally, the other characteristics of the motor must be defined. This is done by configuring the motor options (see motor description).

Motors

Configuration (continued)

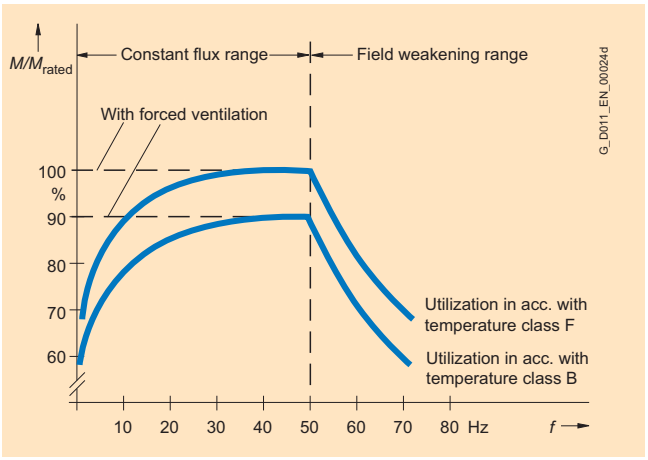
Drives with quadratic load torque

Drives with a quadratic load torque ($M \sim n^2$), such as drives for pumps and ventilators, require the full torque at the rated speed. Increased starting torques or high load surges do not usually occur. It is therefore unnecessary to provide a higher overload capability for the Motor Module.

The following applies to selection of a suitable Motor Module for drives with a quadratic load torque: The rated current of the Motor Module must be at least as large as the motor current at full torque in the required load point.

When using standard 1LG and 1LA motors, these motors can also be loaded with the full rated power even in converter mode. They are then utilized according to temperature class F. However, if the motors may only be used according to temperature class B, the motor output must be derated by 10 %.

Selection of suitable motors and power units for a specific application is supported by the SIZER configuring tool.



Typical response of the permissible torque with self-cooled motors (e.g. 1LG/1LA) with a rated frequency of 50 Hz

Drives with constant load torque

The 1LG and 1LA self-cooled motors cannot produce their full rated torques throughout the complete speed range in continuous operation. The continuous permissible torque decreases as the speed decreases because of the reduced cooling effect (see diagram).

Depending on the speed range, the torque, and thus the output, must be derated for self-cooled motors.

In the case of 1PL, 1PH and 1PQ forced-ventilated motors, no derating or only relatively minor derating (depending on their speed range) is required.

In the case of frequencies above the rated frequency f_{rated}, the motors are operated in the field-weakening range. The usable torque is reduced in this case by approx. f_{rated}/f, and the output remains constant. Especially in the control modes with V/f characteristic, a sufficient margin of ≥ 30 % from the breakdown torque, which decreases as a function of $(f_{rated}/f)^2$, must be provided.

The selected basic load current of the Power Module or Motor Module should be at least as high as the motor current at full torque in the required load point.

Selection of suitable motors and power units for a specific application is supported by the SIZER configuring tool.

Configuration (continued)

Motor types

1LA and 1LG standard motors are recommended for applications with no special mechanical requirements. With regard to the voltage stress, the standard insulation of the motors is designed such that operation on the converter is possible without limitation at voltages $V \leq 500$ V (corresponding to a DC link voltage of $V_d \leq 720$ V).

1LA8, 1PQ8, 1LG6, 1PH7 and 1PL6 motors with shaft height 280 are also available with a higher winding insulation resistance for converter-fed operation with supply voltages up to a line voltage of 690 V (corresponding to a DC link voltage of $V_d \leq 1035$ V) and do not require a filter.

With the reinforced insulation system, there is less slot space for the same number of winding turns as compared to normal insulation; this means that the rated output of these motors is slightly lower.

For higher torque requirements, self-cooled motors 1LA4 or forced-ventilated motors 1PQ4 (IP55 degree of protection) from the H-compact II series are available for the higher output range.

1PH7 and 1PL6 motors are recommended where a wide speed range and high maximum speeds are required, but mounting space is limited. 1PH7/1PL6 motors with the same rated power are on average 1 to 2 shaft heights smaller than comparable standard asynchronous motors (induction motors).

For further information about motor types 1LA, 1LG and 1PQ8, refer to Catalog D 81.1.

The full performance capability of the SINAMICS S120 drive system can be utilized when it is combined with 1FT6, 1FT7, 1FK7 synchronous motors, 1FW3 torque motors and 1PH7, 1PL6 and 1PH4 asynchronous motors (induction motors). The Control Unit evaluates the electronic rating plate and the motor-integrated encoders via the DRIVE-CLiQ interface. This means that motor and encoder data do not need to be parameterized when the system is commissioned or serviced. The following motor types are available with integrated DRIVE-CLiQ interface:

- 1FT6, 1FT7, 1FK7 synchronous motors
- 1FW3 torque motors
- 1PH7, 1PL6, 1PH4 asynchronous motors (induction motors)

The DRIVE-CLiQ interface is supplied with 24 V DC via the encoder cable.

For further information see three-phase Motors.

Motor protection

The Control Units which control the Power and Motor Modules contain a I^2t detection circuit with which they supply a thermal model for calculating the motor temperature. These units therefore provide a simple, thermal motor protection function which requires no external components.

If necessary, more precise motor protection can be afforded by direct temperature measurement using KTY84 sensors or PTC thermistors in the motor winding.

When using KTY84 sensors, **A23** is the relevant motor option which must be specified when ordering the 1LA8 and 1LG4/1LG6 motors. These sensors are fitted as standard in 1FK, 1FT, 1FW3, 1PH and 1PL motors.

If PTC thermistors are required, the motor option **A11** or **A12** must be specified when ordering the 1LG4/1LG6 motors. With 1LA8/1PQ8 motors, the sensors are fitted as standard.

Bearing currents

In order to apply currents to the motor which are as sinusoidal as possible (smooth running, oscillation torques, stray losses), a high clock frequency is required for the output voltage. The steep voltage pulses generated at this frequency cause charge/discharge currents in the motor winding capacitance, which in turn generate circular magnetic flux in the motor. This physical effect is particularly evident with larger motors. As a result, the circuit can close via the two motor bearings, resulting in dangerous bearing currents. To eliminate the risk of these so-called circular currents, it is advisable to insulate the bearings at the NDE on converter-fed motors.

The insulated bearing is standard for all 1LA8 motors which are designated for converter operation.

With the 1LG4/1LG6 motors of size 280 and above, an insulated bearing at the NDE is available as an option (order code **L27**). With the 1PH7 and 1PL6 motors of size 180 and above, an insulated bearing at the NDE is available as an option (order code **L27**).

Grounding deficiencies can cause rotor ground currents to flow from the motor shaft to the connected load. To prevent this type of bearing current, it is essential to ground the motor casing effectively, e.g. by means of a shielded motor cable. The motor housing and the housing of the Power Module or Motor Module must be coupled with the lowest possible resistance for the high-frequency charge/discharge currents.

For this purpose, it is advisable to use a symmetrical, shielded three-core motor cable in which the PE conductor is arranged symmetrically around the conductors.

Motor reactors are also a suitable means of reducing the types of bearing current described above.

The motors must be mounted in the machine in such a way that no axial forces can act on the motor shaft and that vibration transfer to the shaft is eliminated as far as possible.

Operation of motors with type of protection "d"

Siemens 1MJ asynchronous motors (induction motors) can be connected as explosion-proof motors with "flameproof enclosure" Eex de IIC both to the mains supply and to Power Modules or Motor Modules.

In accordance with the test directives, 1MJ motors must be equipped with PTC thermistors.

If 1MJ motors are connected to Power Modules or Motor Modules, their maximum permissible torque must be reduced and according to the load characteristic, when utilized according to temperature class B; this also applies to the 1LA motors of the same output.

1MJ motors have a terminal box with "increased safety" EEx e II as standard.

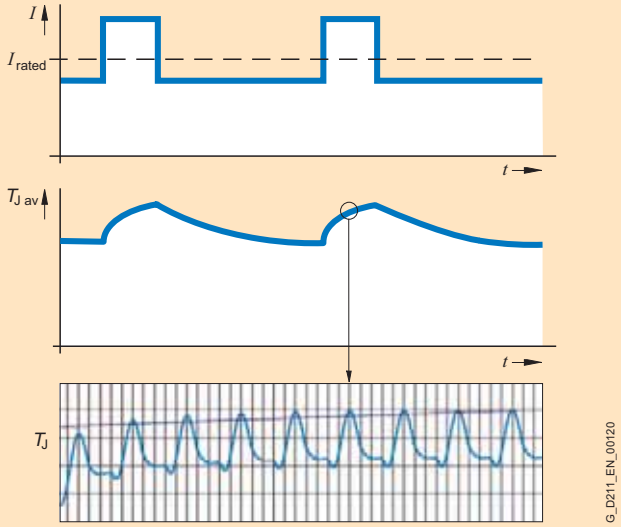
For further information about these motors, please refer to Catalog D 81.1.

Power units

Configuration

Overload capability

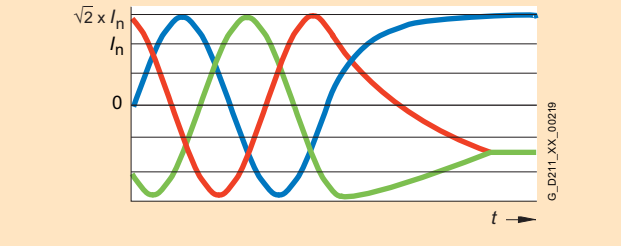
The power units of the Line Modules, Motor Modules and Power Modules are designed for brief overloads, i.e. the Modules are capable of supplying more than the rated current I_{rated} for short periods. In this instance, the thermal capacity of the heat sink is utilized, allowing for the relevant thermal time constants. The power semiconductors and actual current sensing circuit are rated for a maximum current I_{max} which must not be exceeded. The overload capability is determined by I_{max}, I_{rated} and the thermal time constants. A number of characteristic duty cycles are specified in the technical data for the power units. The SIZER configuring tool calculates the load on the basis of a specified duty cycle with optional time characteristic and then identifies the power unit which is required.



$T_{J\,av}$ medial junction temperature of the power semiconductor
T_J junction temperature of the power semiconductor

The thermal time constant of a power semiconductor chip is typically within the range of 100 ms. With frequencies below 10 Hz, the overload capacity is therefore limited. The software takes account of these limitations by means of a thermal model and protects the devices against overload in all operating states. It must be noted, especially at frequencies around 0 Hz, that the specified rated current I_n is the root-mean-square value of a sinusoidal current. If the frequency of the three-phase system is reduced to 0 Hz, a pure direct current flows in all phases at standstill. The root-mean-square value of this direct current can reach the peak value of the sinusoidal current depending on the phase relation.

The output current in this state is greater than the rated current I_n by a factor of $\sqrt{2}$. The individual motor terminals and cables are designed thermically for the rated current in normal operation, so the devices are protected against this overload while taking account of the thermal time constant.



Derating characteristics

The power units can be operated with rated current or power and the specified pulse frequency up to an ambient temperature of 40 °C (104 °F). The heat sink reaches the maximum permissible temperature at this operating point. If the ambient temperature increases above 40 °C (104 °F), the resulting heat loss must be reduced to prevent the heat sink from overheating.

At a given current, the heat loss increases in proportion to the pulse frequency. The rated output current I_{rated} must be reduced to ensure that the maximum heat loss or heat sink temperature for higher pulse frequencies is not exceeded. When the correction factor k_f for the pulse frequency is applied, the rated output current I_{ratedf} that is valid for the selected pulse frequency is adjusted.

When configuring a drive, please note that power units may not be capable of supplying the full current or power in the temperature range between 40 °C (104 °F) and 55 °C (131 °F). The power units measure the heat sink temperature and protect themselves against thermal overloading at temperatures > 40 °C (104 °F).

The air pressure, and therefore air density, drop at altitudes above sea level. At these altitudes, the same quantity of air does not have the same cooling effect and the air gap between two electrical conductors can only insulate a lower voltage. Typical air pressure values are:

0 m above sea level: 100 kPa

2000 m (6562 ft) above sea level: 80 kPa

3000 m (9843 ft) above sea level: 70 kPa

4000 m (13124 ft) above sea level: 62 kPa

5000 m (16405 ft) above sea level: 54 kPa

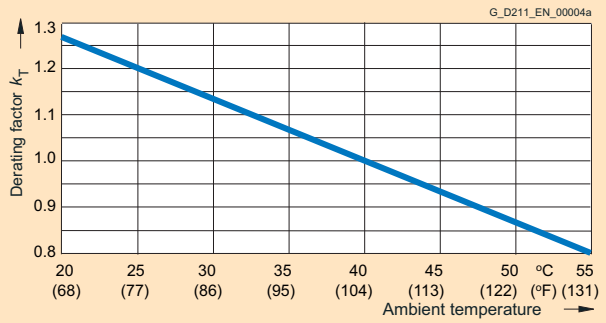
At installation altitudes above 2000 m (6562 ft), the line voltage must not exceed certain limits to ensure that surge voltages can be insulated in accordance with EN 60664-1 for surge voltage category III. If the line voltage is higher than this limit at installation altitudes > 2000 m (6562 ft), measures must be taken to reduce transient category III surge voltages to category II values, e.g. equipment must be supplied via an isolating transformer.

In order to calculate the permissible output current or power, the derating factors must be multiplied for the effects described above. The derating factor k_I for current as a function of installation altitude can be offset against the derating factor k_T for ambient temperature. If the result of multiplying derating factor k_T by derating factor k_I is greater than 1, then the calculation must be based on a rated current of I_{rated} or I_{ratedf}. If the result is < 1, then it must be multiplied by the rated current I_{rated} or I_{rated} to calculate the maximum permissible continuous current. The derating factor $k = k_f \times k_T \times k_I$ calculated by this method to obtain the total derating value must be applied to all current values in the specified duty cycles I_{rated}, I_H, I_L).

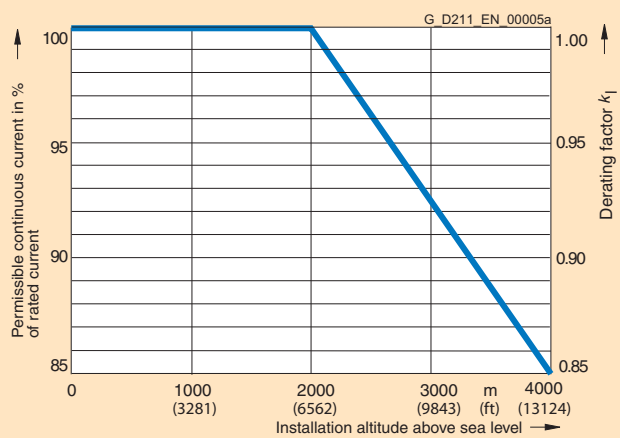
The derating characteristic curves of Power Modules, Line Modules and Motor Modules can be found in the technical data of the relevant Modules (see SINAMICS S120 descriptions).

Configuration (continued)

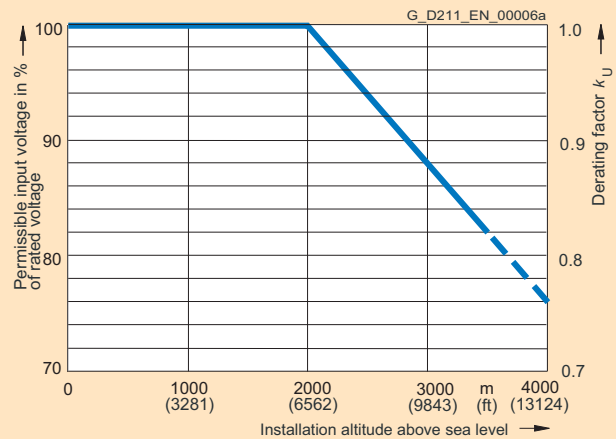
Examples of derating characteristic curves and calculation of the permissible output current:



Current derating as a function of the ambient temperature



Current derating as a function of the installation altitude



Voltage derating as a function of the installation altitude

Example 1

A drive system is to be operated at an altitude of 2500 m (8202.5 ft) at a maximum ambient temperature of 30 °C (86 °F) and rated pulse frequency.

Since the ambient temperature is below 40 °C (104 °F), a compensation calculation (installation altitude/ambient temperature) can be applied.

Installation altitude 2500 m (8202.5 ft): Derating factor $k_I = 0.965$, $k_U = 0.94$

Max. ambient temperature 30 °C (86 °F): Derating factor $k_T = 1.133$

$k_I \times k_T = 0.965 \times 1.133 = 1.093 \Rightarrow 1.0$ due to installation altitude/ambient temperature compensation

$k = k_f \times (k_I \times k_T) = 1.0 \times (1.0) = 1.0$

Result: Current derating is not required.

However, IEC 60664-1 stipulates that voltage derating is required.

The units in voltage range 380 V to 480 V can be operated up to a voltage of 480 V x 0.94 = 451 V, and the units in voltage range 660 V to 690 V up to 690 V × 0.94 = 648 V.

Example 2

When a drive line-up is configured, a Motor Module with the order number 6SL3320-1TE32-1AA0 is selected (rated output current 210 A, base load current for high overload 178 A). The drive line-up is to be operated at an altitude of 3000 m (9843 ft) where ambient temperatures could reach 35 °C (95 °F) as a result of the installation conditions. The pulse frequency must be set to 4 kHz to provide the required dynamic response.

Installation altitude 3000 m (9843 ft): Derating factor $k_I = 0.925$, $k_U = 0.88$

Max. ambient temperature 35 °C (95 °F): Derating factor $k_T = 1.066$

$k_I \times k_T = 0.925 \times 1.066 = 0.987 \Rightarrow$ not fully compensated by installation altitude/ambient temperature

$k = k_f \times (k_I \times k_T) = 0.82 \times (0.925 \times 1.066) = 0.809$

Result: Current derating is required.

Where these boundary conditions apply,

- the max. permissible continuous current of the Motor Module is: 210 A × 0.809 = 170 A
- the base-load current for high overloading is: 178 A × 0.809 = 144 A

IEC 60664-1 stipulates that voltage derating is required.

The selected unit can be operated up to a voltage of 480 V 3 AC × 0.88 or 720 V DC × 0.88 = 422 V 3 AC or 634 V DC, i.e. under these conditions, a 400 V asynchronous motor (induction motor) can be operated without restriction. Due to the installation altitude, however, derating might be required for the asynchronous motor (induction motor).

Power units

Configuration (continued)

Selection of the Power Module or Motor Module

The Motor Module is selected initially on the basis of standstill current $I_{0\ 100\ K}$ (rated current for winding temperature rise 100 K) for synchronous motors and the rated current I_{rated} for asynchronous motors (induction motors), and is specified in the motor description. Dynamic overloads, e.g. during acceleration, must be taken into account by duty cycles and may demand a more powerful Power Module or Motor Module. In this context, it is also important to remember that the output current of the Power Module or Motor Module decreases as a function of installation altitude, ambient temperature and pulse frequency setting (see explanations of derating characteristic curves).

For an optimum configuration, the rms motor current I_{load} calculated from the duty cycle is replicated on the Power Module or Motor Module. The following must apply:

$I_{rated,\ module} \geq I_{load}$

$I_{rated,\ module}$ = permissible continuous current of Power Module or Motor Module taking derating characteristic curves into account

The Power Modules or Motor Modules can be required to supply a higher output current for specific time periods. To configure an overload, the following must apply:

$I_{rated,\ module} \times$ *overload factor* $< I_{overload}$

Overload factor = ratio $I_{rated,\ module}/I_{max}$, taking switching cycles into account (see component descriptions).

SIZER is capable of performing precise overload calculations.

Rated current – permissible and non-permissible motor/converter combinations

- Motor rated current higher than rated output current of the Power Module or Motor Module:
  In cases where a motor with a higher rated current than the rated output current of the Power Module or Motor Module is to be connected, the motor will only be able to operate under partial load. The following limit applies:
  The short-time current (=1.5 × base-load current I_H) should be higher or equal to the rated current of the connected motor. Adhering to this dimensioning rule is important because the low leakage inductance of large motors causes current peaks which may result in drive system shutdown or in continuous output limiting by the internal protective electronic circuitry.
- Motor rated current significantly lower than rated output current of the Power Module or Motor Module:
  With the sensorless vector control system used, the motor rated current must equal at least ¼ of the rated output current of the Power Module or Motor Module. With smaller motor currents, the drive can be operated in *V/f* control mode.

Using pulse width modulation, the Power Modules or Motor Modules generate an AC voltage to feed the connected motor from the DC voltage of the DC link. The magnitude of the DC link voltage is determined by the line voltage and, in the case of a Motor Module, by the Line Module used and thus the maximum possible output voltage (see component descriptions). The speed and loading of the connected motor define the required motor voltage. The maximum possible output voltage must be greater than or equal to the required motor voltage; it may be necessary to select a motor with a different winding.

It is not possible to utilize all modes of pulse width modulation when a sinusoidal filter is connected. The maximum possible output voltage (see sinusoidal filter) is lower as a result.

Long motor cables

Using pulse width modulation, the Power Modules or Motor Modules generate an AC voltage to feed the connected motor from the DC voltage of the DC link. Capacitive leakage currents are generated in clocked operation and these limit the permissible length of the motor cable. The maximum permissible motor cable length is specified for each Power Module or Motor Module in the component description.

Motor reactors limit the rate of rise and magnitude of the capacitive leakage currents, thereby allowing longer motor cables to be used. The motor reactor and motor cable capacitance form an oscillating circuit which must not be stimulated by the pulse pattern of the output voltage. The resonant frequency of this oscillating circuit must therefore be significantly higher than the pulse frequency. The longer the motor cable, the higher the cable capacitance and the lower the resonant frequency. To provide a sufficient safety margin between this resonant frequency and the pulse frequency, the maximum possible motor cable length is limited, even when several motor reactors are connected in series. The maximum cable lengths in combination with motor reactors are specified in the technical data for the motor reactors.

Booksize format Motor Modules

Where a long motor cable is required, a higher rating of Motor Module must be selected or the permissible continuous output current $I_{continuous}$ must be reduced in relation to the rated output current I_{rated}. The configuring data for booksize format Motor Modules are given in the following table:

Motor Module	**Length of motor cable (shielded)**			
Rated output current I_{rated}	> 50 … 100 m (164 … 328 ft)	> 100 … 150 m (328 … 492 ft)	> 150 … 200 m (492 … 656 ft)	> 200 m (656 ft)
3 A/5 A	Use Motor Module 9 A	Use Motor Module 9 A	Not permissible	Not permissible
9 A	Use Motor Module 18 A	Use Motor Module 18 A	Not permissible	Not permissible
18 A	Use Motor Module 30 A or $I_{max} \leq 1.5 \times I_{rated}$ $I_{continuous} \leq 0.95 \times I_{rated}$	Use Motor Module 30 A	Not permissible	Not permissible
30 A	Always permissible	$I_{max} \leq 1.35 \times I_{rated}$ $I_{continuous} \leq 0.9 \times I_{rated}$	$I_{max} \leq 1.1 \times I_{rated}$ $I_{continuous} \leq 0.85 \times I_{rated}$	Not permissible
45 A/ 60 A	Always permissible	$I_{max} \leq 1.75 \times I_{rated}$ $I_{continuous} \leq 0.9 \times I_{rated}$	$I_{max} \leq 1.5 \times I_{rated}$ $I_{continuous} \leq 0.85 \times I_{rated}$	Not permissible
85 A/ 132 A	Always permissible	$I_{max} \leq 1.35 \times I_{rated}$ $I_{continuous} \leq 0.95 \times I_{rated}$	$I_{max} \leq 1.1 \times I_{rated}$ $I_{continuous} \leq 0.9 \times I_{rated}$	Not permissible
200 A	Always permissible	$I_{max} \leq 1.25 \times I_{rated}$ $I_{continuous} \leq 0.95 \times I_{rated}$	$I_{max} \leq 1.1 \times I_{rated}$ $I_{continuous} \leq 0.9 \times I_{rated}$	Not permissible

The permissible cable length for an unshielded motor cable is 150 % of the length for a shielded motor cable.

Motor reactors can also be used on motors operating in Vector and *V/f* control modes to allow the use of longer motor cables.

Configuration (continued)

Line Modules

In multi-axis drive applications, a number of Motor Modules are operated on a common DC link, which is supplied with power by a Line Module.

The first task is to decide whether a Basic Line Module, Smart Line Module or an Active Line Module will be used. On the one hand, this depends on whether the drive must be capable of regenerative feedback to the supply and, on the other hand, whether the power supply infeed is to be unregulated and therefore dependent on the power supply voltage, or regulated to a constant DC link voltage.

The chassis format units are available in the 380 V to 480 V voltage range, but also include units in the 500 V to 690 V range. Basic Line Modules are designed for infeed operation only. Active Line Modules have regulated infeeds which feature a step-up function.

In order to calculate the required DC link power and select the correct Line Module, it is important to analyse the entire operating sequence of the drive line-up connected to the DC link. Factors such as partial load, redundancies, duty cycles, coincidence factors and the operating mode (motor / generator mode) must be taken into account.

The DC link power P_d of a single Motor Module is calculated from the shaft output P_{mech} of the motor and the efficiency of the motor η_m and Motor Module η_{wr}

The following applies in motor mode: $P_d = P_{mech} / (\eta_m \times \eta_{wr})$

The following applies in generator mode: $P_d = P_{mech} \times \eta_m \times \eta_{wr}$

The motor and generator outputs must be added with the corresponding sign in order to calculate the total DC link power. For performance assessment purposes, the DC link voltage U_d can be assumed as a constant, so the required DC link voltage can be calculated as $I_d = P_d/V_d$

Basic Line Modules

The DC link voltage U_d of the Basic Line Modules is load-dependent. Under no-load conditions, the DC link is charged to the line voltage crest value U_L, i.e. $U_d = \sqrt{2} \times U_L$, e.g. U_d = 566 V when a 400 V supply system is connected.

Under load conditions, the DC link voltage reaches the average value of the rectified line voltage applied to the terminals. This average value is determined by the line voltage x factor 1.35. Owing to the voltage drop across the line reactor and in the line feeder cable, the DC link voltage under full load conditions is slightly lower than the theoretical value. In practice, the range of the DC link voltage U_d is as follows:

$1.41 \times U_L > U_d > 1.32 \times U_L$ (no load → rated output)

Smart Line Modules

The DC link voltage U_d of Smart Line Modules is regulated to the average value of the rectified line voltage U_L, i.e. $U_d \approx 1.35 \times U_L$

Due to the voltage drop across the line reactor and in the line feeder cable, the DC link voltage decreases in motor operation and increases in generator operation. The DC link voltage U_d thus varies within the same range as on drives with a Basic Line Module:

$1.41 \times U_L > U_d > 1.32 \times U_L$ (rated output generator mode → rated output motor mode)

Active Line Modules

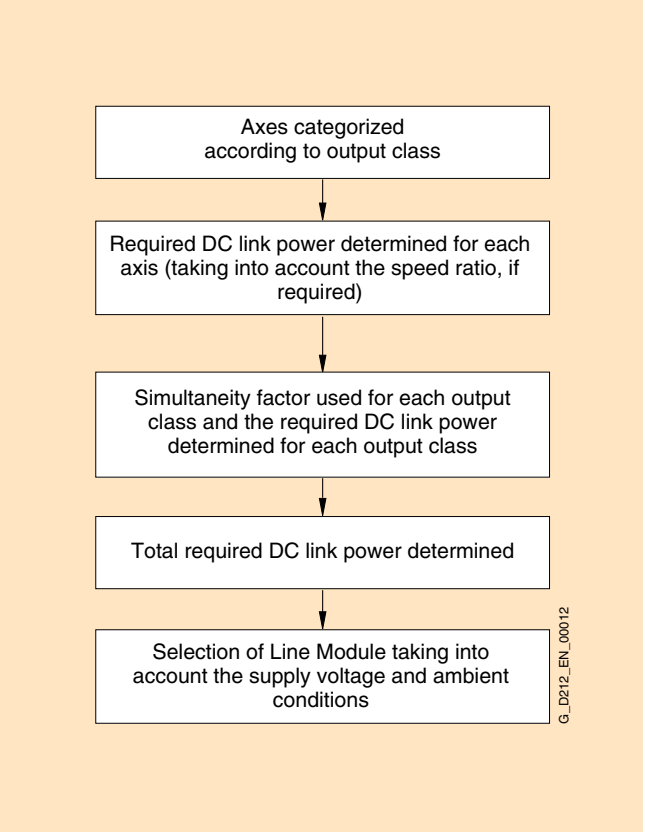
The DC link voltage U_d is regulated to an adjustable value (Active Mode). An Active Line Module can also be switched to Smart Mode and then operates like a Smart Line Module. In Active Mode, the Active Line Module draws a virtually sinusoidal current from the supply system.

The rated infeed power of the Line Module refers to a line voltage of 380 V, 400 V or 690 V (690 V applies only to chassis format Line Modules). Fluctuations in line voltage can affect the output power of the Line Modules. However, the maximum possible output corresponds to the rated power of the relevant type size.

Depending on the ambient conditions (installation altitude, ambient temperature), the rated infeed power of the Line Modules may need to be reduced (see component description).

The coincidence factor takes into account the time characteristic of the torque for each individual axis.

On the basis of these principles, the following procedure can be used to dimension the Line Module:



Power units

Configuration (continued)

The following factors must also be taken into account when dimensioning the DC link:

Braking operation

As device losses are important in motor mode, the dimensioning for motor mode is also applicable to generator mode. With respect to motor braking operation, check that the energy fed back into the DC link does not exceed the permissible peak load capability of the Line Module.

In the case of higher regenerative outputs and to control the "line failure" operating scenario, a Braking Module must be provided, the Smart or Active Line Module must be overdimensioned or the regenerative output reduced by longer braking times.

For the configuration of the "EMERGENCY STOP" operating scenario, the Line Module must either be overdimensioned or an additional Braking Module must be used, so that the DC link energy can be dissipated as quickly as possible.

Checking the DC link capacitance

During power-up, the Line Modules limit the charging current for the DC link capacitors. Due to the limits imposed by the pre-charging circuit, it is essential to observe the maximum permissible DC link capacitance values for the drive line-up specified in the technical data.

DC link pre-charging frequency

The pre-charging frequency of the DC link via a booksize format Line Module is calculated using the following formula:

$$\text{Number of precharges within 8 min} = \frac{\text{Max. permissible DC link capacitance infeed module in } \mu F}{\Sigma \text{ DC-link capacitance of configured drive line-up in } \mu F}$$

For chassis format Line Modules, the maximum permissible DC link pre-charging interval is 3 minutes.

Special considerations for operation on Basic or Smart Line Module

Basic Line Modules and Smart Line Modules provide a lower DC link voltage than Active Line Modules. As a result, the following boundary conditions apply:

- When operating asynchronous motors (induction motors), a lower maximum motor power is available at high speeds at the same line voltage.
- On synchronous motors, a reduction in the dynamic drive characteristics must be expected at high speeds.
- On synchronous motors, the rated motor speed cannot be fully utilized when an overload capability is required.

Parallel connection of power units

Up to 4 Motor Modules or Line Modules in chassis format can be connected in parallel. Parallel connections can operate only in Vector control mode.

Parallel connections may only include Motor Modules or Line Modules of the same type and with the same voltage and output ratings. Mixtures of different modules, e.g. Basic Line Modules and Active Line Modules, cannot be connected in parallel. The CU320 or SIMOTION D Control Unit can control only one drive object of type "Parallel connection Line Modules" and one of type "Parallel connection Motor Modules". It is assumed that all Line Modules or Motor Modules linked to the Control Unit are connected in parallel. A Control Unit can control, for example, the following components:

1 Line Module + 2 Motor Modules connected in parallel, 2 Line Modules connected in parallel + 3 Motor Modules connected in parallel. Combinations such as the following are not permissible: 2 Line Modules + 2 Motor Modules connected in parallel + 1 Motor Module

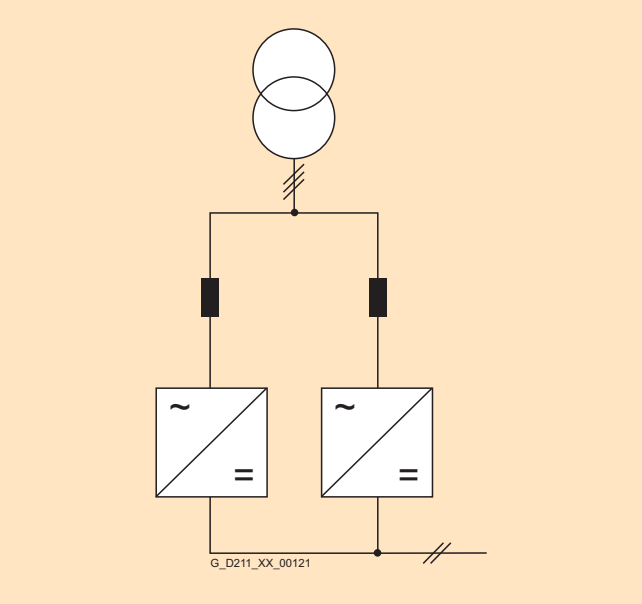
In order to ensure symmetrical current distribution among all parallel-connected modules, inductances must be provided for subsystem decoupling. However, the current compensatory control cannot completely prevent asymmetrical current distribution, which means that the following derating factors apply to parallel connections:

Designation	Derating factor for parallel connection of 2 to 4 Modules	Max. permissible number of parallel-connected Modules
Active Line Modules	0.95	4
Basic Line Modules	0.925	4
Motor Modules	0.95	4

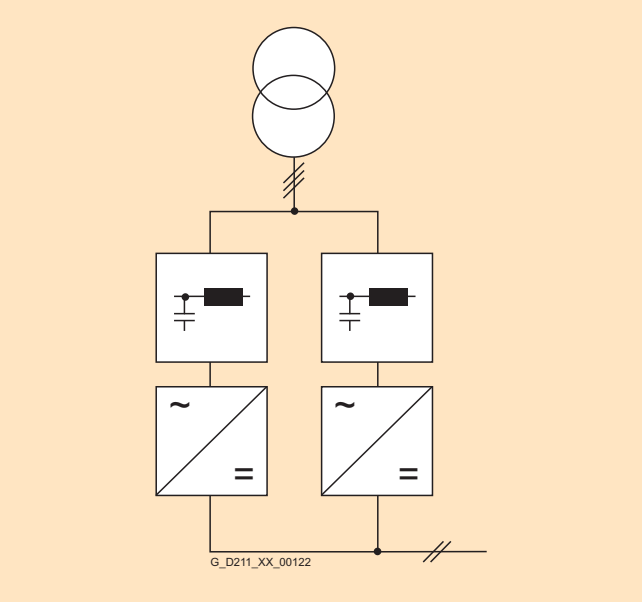
Configuration (continued)

Chassis format Line Modules

Line reactors are needed to decouple individual Basic Line Modules, while the appropriate Active Interface Modules are required to decouple Active Line Modules.



Parallel connection of Basic Line Modules using line reactors



Parallel connection of Active Line Modules using Active Interface Modules

Chassis format Motor Modules

Three-wire or four-wire cables should be used where possible to connect Motor Modules in parallel.

In this case, a minimum clearance of 50 mm (1.97 in) must be left between the cables of the individual subsystems. A three-phase system must be connected to each of the cables of equal length (U2, V2, W2). In order to ensure adequate decoupling between subsystems, the motor cables must be of a minimum length so as to provide the necessary inductance.

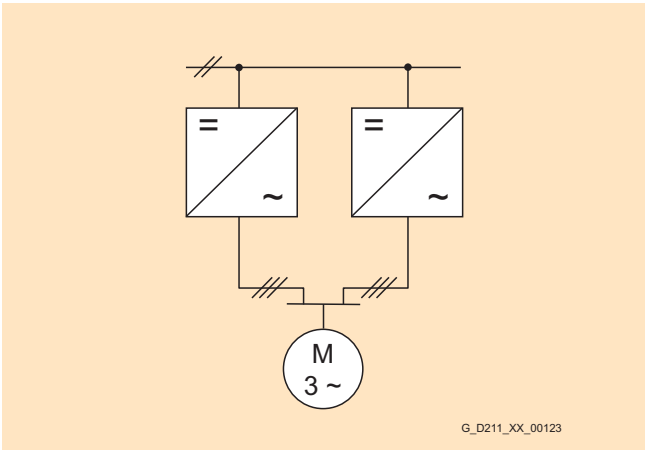
Motor Module	P_M	$I_{rated\ rms}$	Minimum length of motor feeder cable
Frame size	kW (HP)	A	m (ft)
Output voltage 380 to 480 V			
FX	110 (148)	210	30 (98.4)
FX	132 (177)	260	27 (88.6)
GX	160 (215)	310	20 (65.6)
GX	200 (268)	380	17 (55.8)
GX	250 (335)	490	15 (49.2)
HX	315 (422)	605	13 (42.7)
HX	400 (536)	745	10 (32.8)
HX	450 (603)	840	9 (29.5)
JX	560 (751)	985	8 (26.3)
JX	710 (952)	1260	6 (19.7)
JX	800 (1073)	1405	5 (16.4)
Output voltage 660 to 690 V			
FX	75 (101)	85	80 (262)
FX	90 (121)	100	72 (236)
FX	110 (148)	120	65 (213)
FX	132 (177)	150	55 (180)
GX	160 (215)	175	50 (164)
GX	200 (268)	215	40 (131)
GX	250 (335)	260	32 (105)
GX	315 (422)	330	25 (82.0)
HX	400 (536)	410	20 (65.6)
HX	450 (603)	465	18 (59.0)
HX	560 (751)	575	15 (49.2)
JX	710 (952)	735	13 (42.7)
JX	800 (1073)	810	11 (36.1)
JX	900 (1207)	910	10 (32.8)
JX	1000 (1341)	1025	8.5 (27.9)
JX	1200 (1609)	1270	7 (23.0)

If the drive configuration cannot accommodate the minimum required cable length, the appropriate motor reactor for the Motor Module must be installed. Alternatively, motors with two separate winding systems can be used.

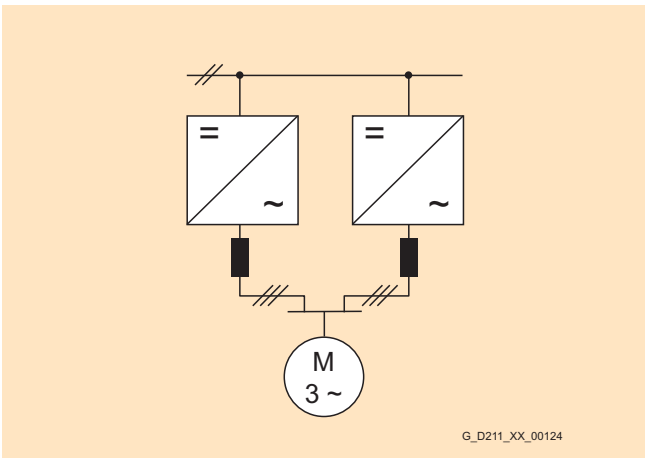
The latter option is preferable for drives with higher outputs, as the motor terminal boxes are subject to current limits in this case. Motors with separate winding systems allow all types of modulation (i.e. space vector modulation and edge modulation). If the parallel-connected Motor Modules are supplying a joint winding system, edge modulation cannot be used and the maximum possible line-to-line output voltage U_a is limited to 0.67 x DC link voltage.

Power units

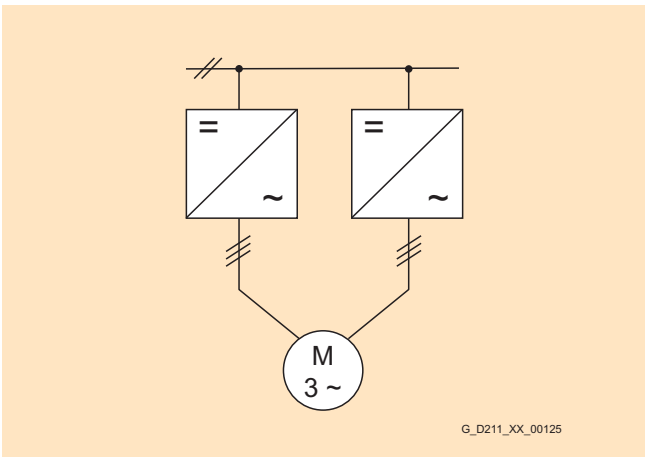
Configuration (continued)



Parallel connection with identical motor cables of the required minimum length



Use of motor reactors



Asynchronous motor (induction motor) with two separate winding systems

Fan control

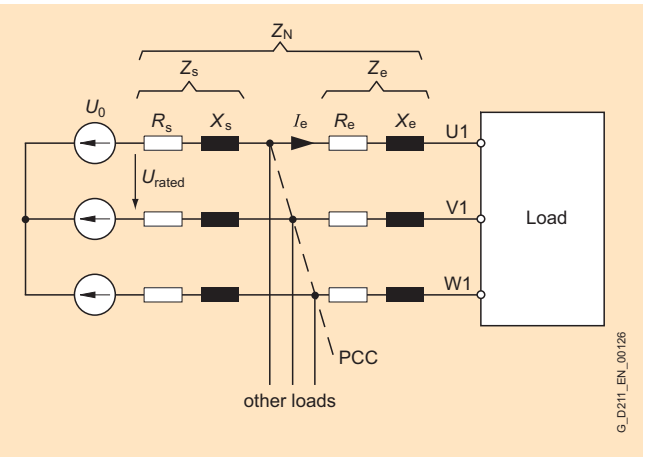
Units in booksize format feature a temperature-controlled fan for cooling the power unit. The fan is not switched on until the heat sink temperature exceeds the threshold value of 56 °C (132.8 °F). The fan is supplied by an external 24 V DC power source or from the DC link via a switched-mode power supply.

On blocksize units, the Control Unit switches the fan on and off according to temperature. The fan is supplied from the DC link via a switched-mode power supply.

On chassis units, the fan is switched on when the power unit pulses are enabled. The fan is supplied from the mains via a transformer.

System disturbances

The voltage drops across the impedance between the supply system and a load as soon as the load draws current. In a symmetrical three-phase supply system, this is the network impedance Z_n which is calculated from the impedance Z_s of the supply system and the line-side impedance Z_e of the load.



Effective impedance when a load is connected to a three-phase supply system

$$Z_N = Z_s + Z_e = R_s + j\,X_s + R_e + j\,X_e = R_n + j\,X_n$$

On a variable-speed drive, the line-side impedance Z_e is normally the total impedance provided by the line reactor and the feeder cable up to the PCC (Point of Common Coupling) for further loads. The ohmic component R_n is generally negligible as compared to the inductive component X_n. The inductance of an RI suppression filter is irrelevant for the purpose of this calculation, as this inductance is effective only for asymmetrical interference voltages, but not for a symmetrical line current.

If a load causes voltage drops across the impedance Z_s, this system disturbance has an impact at the PCC and thus also in the supply voltage to all other loads.

The voltage drop is proportional to current I_e and the impedance. To facilitate comparison of voltage drops under different supply and load conditions, the voltage drop is specified – normally at rated current – with reference to the phase voltage U_o. The calculation formula, e.g. for the per unit voltage drop u_k across an impedance Z is as follows:

$$u_k = Z \times I_e / U_o$$

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Configuration (continued)

Example 1:

A Power Module with rated line current I_e is directly connected to a low-voltage transformer and the PCC is the transformer connection terminal. The equation for the ratio between rated line current I_e of the Power Module and rated current I_{rated} of the transformer is $I_e = 0.25 \times I_{rated}$. The per unit voltage drop u_k of the 400 V transformer is 4 %. If the transformer is loaded with its rated current I_{rated}, the voltage drop across impedance Z_s is 9.2 V (corresponding to 4 % of the phase voltage U_o = 230 V).

$u_k = (Z_s \times I_{rated}) / 230\ V = 0.04$

The following formula applies to the rated line current I_e of the Power Module: $I_e = k \times I_{rated}$

The per unit voltage drop across the transformer when loaded with I_e is thus: $u_k = Z_s \times I_e / U_o = Z_s \times k \times I_{rated} / U_o$

With the specified ratio between I_e and I_{rated}, the per unit voltage drop is calculated as u_k = 1 % or 2.3 V. In relation to the Power Module, this transformer therefore functions like a line impedance in accordance with u_k = 1 %.

The magnitude of system disturbance in converter systems is assessed on the basis of short-circuit power ratio R_{sc}:

$R_{sc} = S_{cv} / P$

According to this definition in accordance with EN 60146-1, P is the fundamental-wave apparent power drawn by the converter. S_{cv} is the short-circuit power drawn from the mains in the event of a short-circuit on the terminals U1, V1, W1. Since the ohmic components of impedances are negligible in practice, $Z_n \approx j\ X_n$ applies

$S_{cv} \approx 3 \times U_o^2 / X_n$

and thus $R_{sc} \approx 3 \times U_o^2 / (X_n \times P)$

The short-circuit power ratio R_{sc} is therefore dependent on the current output power P of the converter and is determined by network impedance X_n.

If we assume the power to be $P \approx 3 \times U_o \times I_e = \sqrt{3} \times U_{rated} \times I_e$

the short-circuit power ratio R_{sc} is in inverse proportion to the per unit voltage drop u_k across the effective line impedance.

$R_{sc} \approx 3 \times U_o^2/(X_n \times P) = 3 \times U_o^2/(X_n \times 3 \times U_o \times I_e) = U_o/(X_n \times I_e) = 1/u_k$

The short-circuit power ratio for example 1 is $R_{sc} \approx 100$ if no line reactor is installed (Z_e = 0).

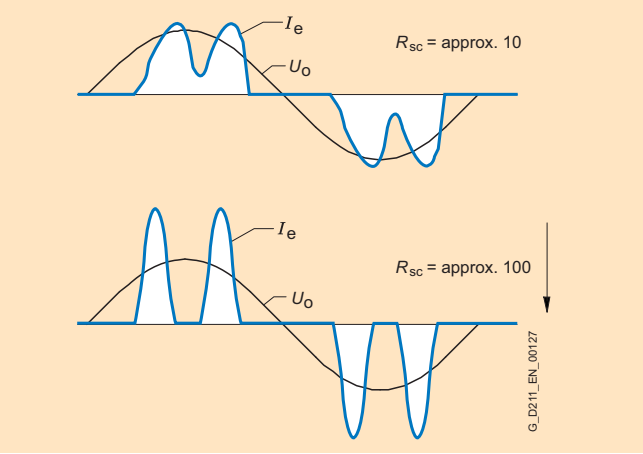
Note:

The term "short-circuit power ratio" as used in technical standards is not a harmonized definition. The short-circuit power ratio R_{sce} defined according to IEC 61000-3-12 is calculated from the short-circuit power S_{SC} at the PCC referred to the power $S_{equ} = 3 \times U_o \times I_e$ consumed by the load.

Basic Line Modules and Power Modules are designed with a rectifier bridge on the line side. An inherent feature of the principle of rectification with load-side capacitance for DC link voltage smoothing are harmonics in the line current which result in a non-sinusoidal power input. The diagram shows the basic current waveform of a Power Module or Basic Line Module as a function of short-circuit power ratio R_{sc}.

Active Line Modules generate virtually no current harmonics (Active Mode) at all and are employed when system disturbance needs to be minimized, e.g. stipulation of IEEE 519 that THD (Total Harmonic Distortion) must be < 10 %.

The SIZER configuring tool calculates the system disturbance on the basis of the supply data entered and lists them against the limit values of relevant standards.



Line current of a Basic Line Module or Power Module as a function of the short-circuit power ratio R_{sc}

The rms of the line current I_e for which the line-side components must be rated comprises fundamental wave I_{e1} and the current harmonics, which increase in relation to the rise in short-circuit power ratio R_{sc}. If the DC link power P_d has been calculated (see Line Modules), the required line-side active power is a known quantity with Line Module efficiency, or the rectifier efficiency in the case of a Power Module. However, this active power is connected only with the current fundamental wave I_{e1}. The rms of the line current I_e is always greater than I_{e1} as a result of the current harmonics. The following applies for a short-circuit power ratio R_{sc} = 100:

$I_e \approx 1.3 \times I_{e1}$

The apparent power of a transformer selected to supply the drive must be greater than the drive power by a factor of about 1.3.

The harmonic currents produce only alternating power, but no active power. The following applies to the apparent power S on the line side:

$S^2 = P^2 + Q_1^2 + D^2$

- with active component $P = 3 \times U_o \times I_1 \times \cos\ \phi_1$, produced solely by the current fundamental wave
- and apparent component $Q_1 = 3 \times U_o \times I_1 \times \sin\ \phi_1$
- and the distortion component

$$D = 3 \times U_0 \sqrt{\sum_{\nu=2}^{\infty} I_\nu^2}$$

The ratio between active power and apparent power is referred to as power factor λ or total power factor:

$$\lambda = \frac{P}{S} = \frac{P}{\sqrt{P^2 + Q_1^2 + D^2}}$$

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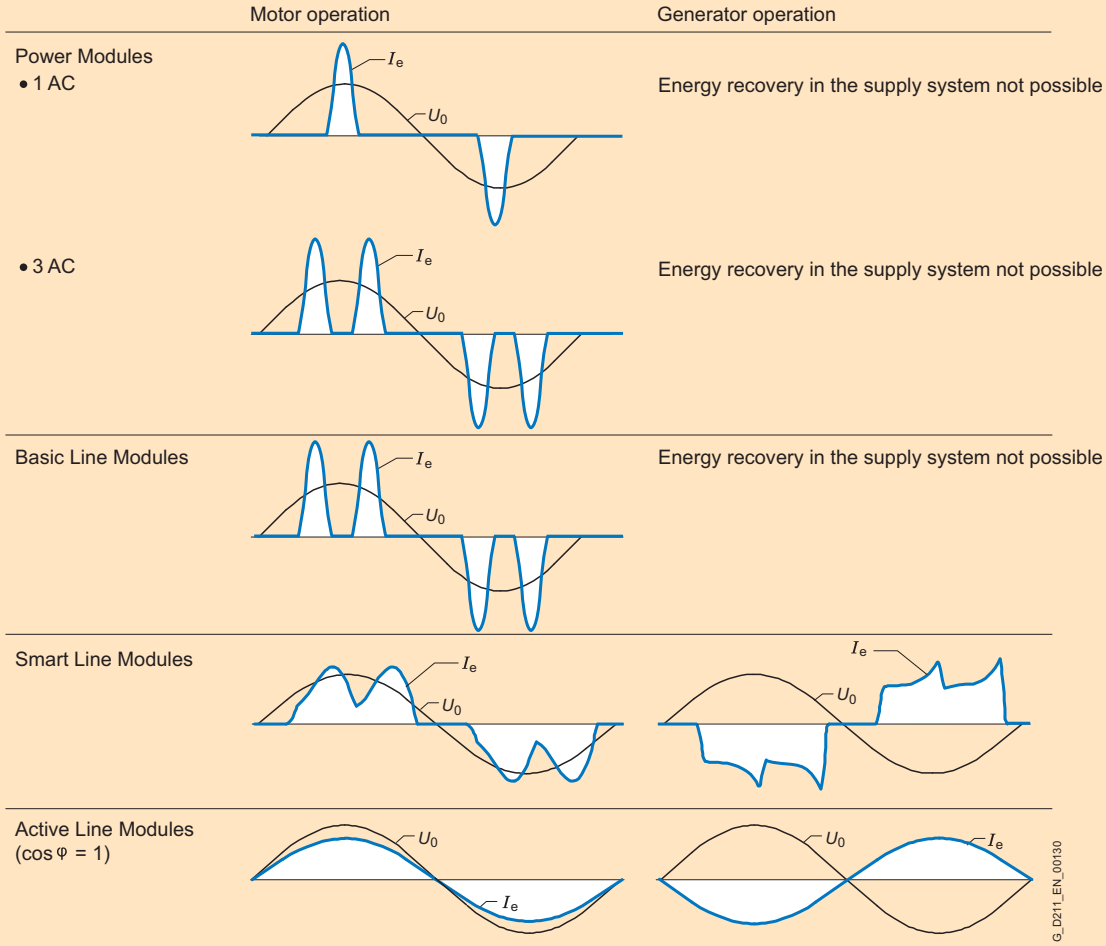
Power units

Configuration (continued)



Typical waveform of the line current with Power Modules and Line Modules

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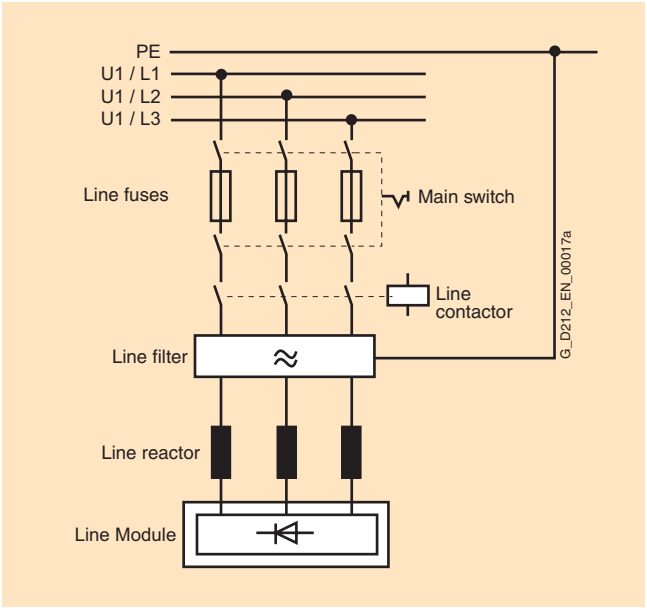
Configuration (continued)

Line-side options (main switch, fuses, line filters, etc.)

The following line-side options are recommended for the drive configuration:



The main switch may take various formats:

- Main and EMERGENCY STOP switch + fuse switch disconnector (with leading signal via auxiliary contact for trip mode)
- Load interruptor with fuses
- Circuit-breaker

To protect the units against line-side surge voltages, it is advisable to install overvoltage protection directly at the infeed point (upcircuit of main switch). Surge protection is essential in order to satisfy the requirements of Canadian standard CSA C22.2 No. 14. For examples of suitable surge voltage arresters, go to http://www.raycap.com

Depending on the performance required, a fuse switch disconnector combined with a contactor or a circuit-breaker can be provided as the main switch.

A line contactor can be used, for example, if the drive has to be disconnected from the line supply in the event of a fault or for remote tripping. Follow the instructions in the SINAMICS S120 Configuration Guides to interlock the line contactor in the context of safety functions.

A line filter should be used on TN (grounded) systems to reduce system disturbance.

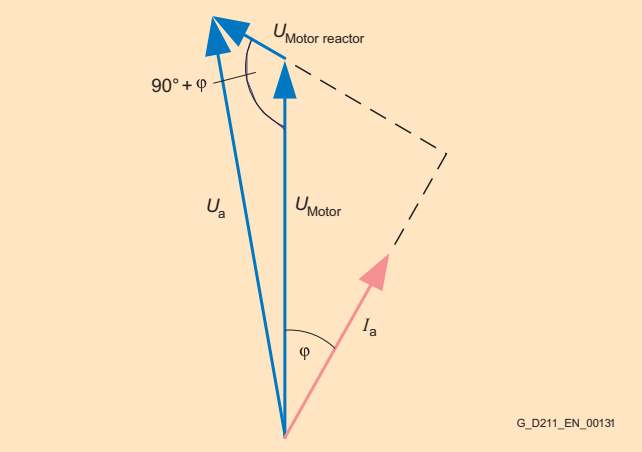
System components

Configuration

Motor reactors

High-speed switching of the power transistors causes capacitive charge/discharge currents in the motor cable and motor, as well as steep voltage rises and peak voltages in the motor windings. These currents can be reduced through the installation of a motor reactor.

The voltage drop across the motor reactor is normally negligible at output frequencies of 60 Hz and below. The per unit voltage drop u_k across the reactor is between 1 % and 4 % at rated current and 50 Hz. With a cos φ of 0.86 and an output frequency of 50 Hz, the motor voltage across the motor reactor is about 2 % lower than in systems without a motor reactor.



Motor reactors are approved for use only in conjunction with Vector and *V/f* control modes. Motor reactors are compatible with all modulation types (space vector modulation, edge modulation).

Sinusoidal filter

Sinusoidal filters are low-pass LC filters which allow easy passage to only the fundamental component of the square-wave, pulse-width-modulation output voltage of a Power Module or Motor Module. The resonant frequency of the sinusoidal filter must be significantly lower than the pulse frequency of the Power Module or Motor Module and be dimensioned with a sufficient margin to the maximum permissible output frequency. Sinusoidal filters therefore define the choice of pulse frequency and place a limit on the maximum possible output frequency. This type of filter is compatible only with space vector modulation. The output voltage of a Power Module or Motor Module is thus limited to an output voltage (rms value) of approximately 0.67 x DC link voltage. With the voltage drop across the sinusoidal filter, the maximum possible output voltage (rms value) is approximately 0.63 x DC link voltage. A sinusoidal filter is registered on the Control Unit by a parameter setting, where defaults for all the relevant filter-dependent values, such as permissible modulation types, maximum output frequency, etc. are stored.

Sensor Modules

Signal conditioning for various encoders (incremental encoder sin/cos 1 V_{pp}, absolute encoder, resolver) takes place remotely, i.e. in the vicinity of the encoder, with customized Sensor Modules. Depending on the measuring system, SMC10, SMC20 or SMC30 Sensor Modules will be used. The Sensor Modules are designed to be mounted on DIN rails. They are also used for the signal conditioning of external (machine) encoders.

Expansion Modules

Even the standard version of the CU320 Control Unit features interfaces and terminals for communication. SINAMICS S120 offers the following expansion modules:

- TB30 Terminal Board (terminal expansion for plugging into the option slot on the CU320 Control Unit)
- TM31 Terminal Module (terminal expansion for connection via DRIVE-CLiQ)

The following criteria regarding the use of expansion modules must be taken into account:

- Only one option board can be plugged into the option slot on the CU320 Control Unit.
- A maximum of 8 Terminal Modules may be operated in a drive line-up.

Braking Modules and braking resistors

Braking units comprise of a Braking Module and a braking resistor, which must be attached externally.

Braking units are used when

- regenerative energy occurs occasionally and briefly, for example when the brake is applied to the drive (EMERGENCY STOP) and the drive has no regenerative feedback capability
- the drive features regenerative feedback units, but cannot return the energy fast enough to the supply on an "EMERGENCY STOP"
- the drive needs to be shut down after a power failure

The braking units for Power Modules in blocksize format consist of braking resistors only, as they feature a Braking Module as standard.

A number of Braking Modules can be connected in parallel to the DC link in order to increase the braking power. Each Braking Module requires its own braking resistor. It is not permissible to operate a mix of braking units in booksize and chassis format on the same DC link.

The braking power required is calculated from the DC link power P_d of the drive line-up or Power Module in generator operation.

Configuration (continued)

Braking Modules and braking resistors for booksize format

To operate booksize format Braking Modules, a minimum capacitance is required in the DC link. This capacitance is determined by the braking resistor used.

Braking resistor 0.3 kW/25 kW → DC link capacitance 220 µF

Braking resistor 1.5 kW/100 kW → DC link capacitance 330 µF

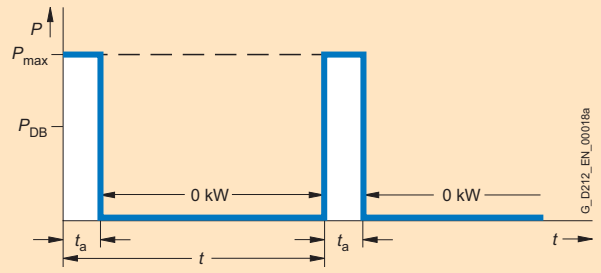
The capacitance of the booksize format Braking Module of 110 µF is included in the total capacitance value. If the DC link capacitance is not sufficient for the use of one or more Braking Modules, a Capacitor Module can be added to increase the effective DC link capacitance of the drive line-up.

When booksize format Braking Modules are connected in parallel, the minimum capacitance specified above must be available for each Braking Module.

Note: Only booksize format modules that are directly connected to each other via the DC link busbar can be included in the total capacitance.

If the DC link capacitance is not sufficient for the operation of a number of Braking Modules, Capacitor Modules can be used to increase the DC link capacitance. The max. permissible DC link capacitance of a drive line-up on a Line Module must be taken into account. The max. DC link capacitances to be taken into account for pre-charging current limiting on the Line Modules are listed in the technical specifications for the Line Modules.

The braking resistor discharges the excess energy from the DC link:



t Period of braking duty cycle in s
t_a Load duration in s
P_{DB} Continuous power of braking resistor in kW
P_{max} Peak power of braking resistor in kW

Duty cycle for braking resistors

Braking Modules and braking resistors for chassis format

Braking Modules with a braking power of 25 kW (for type FX) and 50 kW (for types GX, HX and JX) are available with matching braking resistors for chassis format units. Braking units can be connected in parallel to obtain higher braking powers. In this case, the units can be installed at the Line Module end or Motor Module end.

When a Braking Module is installed in a Basic Line Module of size GB, the cables supplied for the DC link connection are too short. In this case, the cable harness set 6SL3366-2NG00-0AA0 must be ordered to make the Braking Module connection.

Frame size	Rated power P_{DB} power	Peak power P_{15}	Max. possible mounting locations for Braking Module
FB	25 kW	125 kW	1
GB	50 kW	250 kW	1
FX	25 kW	125 kW	1
GX	50 kW	250 kW	1
HX	50 kW	250 kW	2
JX	50 kW	250 kW	3

The Braking Module features an electronics interface (X21) with monitoring function. The braking resistor housing contains a monitoring thermocontact. Both these monitors can be integrated into the warning or shutdown circuits of the drive system.

System components

Configuration (continued)

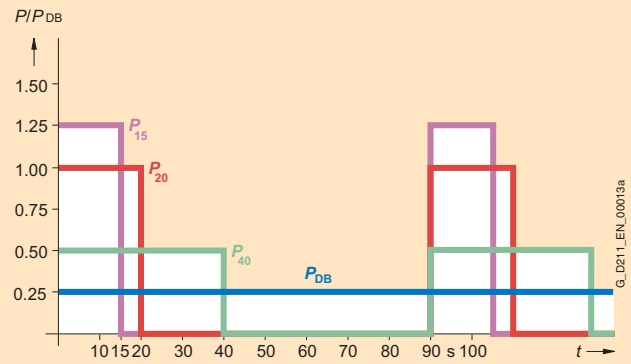
Calculation of Braking Module and braking resistor requirements

- For periodic duty cycles with a cycle duration of ≤ 90 s, the average value of the braking power within this duty cycle must be defined. The relevant cycle duration must be applied as the time base.
- For periodic duty cycles with a cycle duration of ≥ 90 s or for sporadic braking operations, a time interval of 90 s in which the highest average value occurs must be selected. The 90 s period must be applied as the time base.

Apart from the average braking power, the required peak braking power must also be taken into account when braking units are selected (Braking Module and braking resistor).

Basic data

Supply voltage	Power range Motor Modules	Braking Module Continuous power P_{DB}	Braking Module Power P_{40}	Braking Module Power P_{20}	Braking Module Peak power P_{15}
380 … 480 V	110 … 132 kW (148 … 177 HP)	25 kW (33.5 HP)	50 kW (67.1 HP)	100 kW (134 HP)	125 kW (168 HP)
	160 … 800 kW (215 … 1073 HP)	50 kW (67.1 HP)	100 kW (134 HP)	200 kW (268 HP)	250 kW (335 HP)
660 … 690 V	75 … 132 kW (101 … 177 HP)	25 kW (33.5 HP)	50 kW (67.1 HP)	100 kW (134 HP)	125 kW (168 HP)
	160 … 1200 kW (215 … 1609 HP)	50 kW (67.1 HP)	100 kW (134 HP)	200 kW (268 HP)	250 kW (335 HP)



P_{DB} = Rated power
P_{15} = 5 x P_{DB} = Power which is permissible every 90 s for 15 s
P_{20} = 4 x P_{DB} = Power which is permissible every 90 s for 20 s
P_{40} = 2 x P_{DB} = Power which is permissible every 90 s for 40 s

Load diagram

Braking resistors for Power Modules in blocksize format

The braking resistors for the FSA and FSB frame sizes are designed as substructure components. Braking resistors for frame sizes FSC to FSF should be mounted outside the control cabinet due to their high heat losses.

The Control Unit monitors the pulse/pause ratio (ON time/OFF time) of the braking resistor and shuts it down on faults if it calculates that the resistor is at risk of overheating.

Braking resistors feature a temperature switch with NC contacts that open when the permissible temperature is exceeded. The temperature switch must be evaluated to prevent consequential damage if the braking resistor overheats.

The braking power P_{mech} on the motor shaft is higher than the power loss of the braking resistor, as this only needs to convert the DC link energy into heat. The DC link power P_d of the Power Module in generator mode is calculated from the shaft power P_{mech} of the motor and the power loss in the motor $P_{v\ Motor}$ and in the Power Module $P_{v\ Power\ Module}$ as:

$$P_d = P_{mech} - P_{v\ Motor} - P_{v\ Power\ Module} = P_{braking\ resistor}$$

These power losses can be estimated from the efficiency values of the motor η_m and Power Module η_{wr}:

$$P_{braking\ resistor} = P_d = P_{mech} \times \eta_m \times \eta_{wr}$$

Booksize format Capacitor Module

The Capacitor Module functions as a short-term energy buffer, e.g. for bridging brief power failures or for storing braking energy. The buffered energy W can be calculated with the following formula:

$$W = ½ \times C \times (U_{d1}^2 - U_{d2}^2)$$

C = effective capacity of Capacitor Module 4 mF

U_{d1} = DC link voltage when buffering starts

U_{d2} = DC link voltage when buffering ends

Example:

U_{d1} = 600 V; U_{d2} = 430 V

The resultant energy calculation is W = 350 Ws

With this energy, for example, it is possible to buffer a 3 kW Motor Module for about 100 ms.

Booksize format Control Supply Module

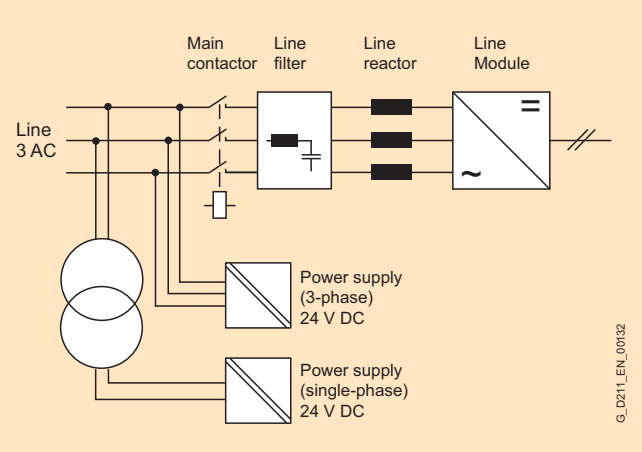
The Control Supply Module provides a 24 V DC power supply via the line or DC link in order to maintain the electronics power supply for the components in the event of a line failure. This makes it possible, for example, to make emergency retraction movements in the event of the failure of the line supply.

Configuration (continued)

External 24 V DC supply of components

Power units (Line Modules and Motor Modules) and other system components must be provided with a 24 V DC voltage via an electronics power supply made available externally.

SITOP devices, which are available as a modular solution, are suggested as the external 24 V DC electronics power supply.



Connecting the external electronics power supply

The current requirement $I_{DC\ ext}$ is calculated with the following formula:

Σ [Control Unit + built-in options (e.g. TB30 + CBC10) + system components + Line Module + Σ (Motor Modules + SMCxx + motor brake control)]

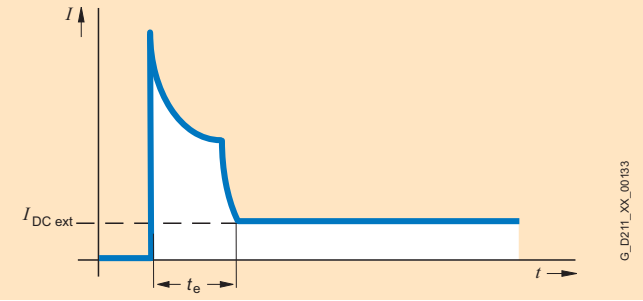
The other system components (e.g. line contactor) must also be taken into account.

The current requirement of individual components can be found in the relevant technical data.

Limit values for the configuration:

- The current-carrying capacity of the integrated 24 V DC busbar (featured only in booksize format) is max. 20 A.
- In the event of higher current requirements, a number of 24 V DC power supplies must be provided in one drive line-up. The other infeeds are implemented by means of 24 V terminal adapters (booksize format only).
- Cable cross sections of up to 2.5 mm² may be connected to the Control Units, Terminal Boards, Terminal Modules and Sensor Modules.
- Cable cross sections of up to 6 mm² may be connected to the 24 V terminal adapters (booksize format only) for the Line Modules and Motor Modules.
- The external 24 V DC power supply should only be used for the SINAMICS components and the direct loads.

Capacitors in the electronics supply of most components must be charged when the 24 V DC supply is first switched on. To charge these capacitors, the power supply must first supply a current peak which can be a multiple of the current requirement $I_{DC\ ext}$ calculated above. Allowance must be made for this current peak when selecting protective elements, e.g. miniature circuit-breakers, for incorporation in the 24 V DC supply system (types with let-through I^2t values according to characteristic D). The current peak flows for an interval t_e of less than 100 ms. The crest value is determined by the impedance of the 24 V DC supply and its electronically limited maximum current.



Typical waveform of the switch-on current of the external 24 V DC supply

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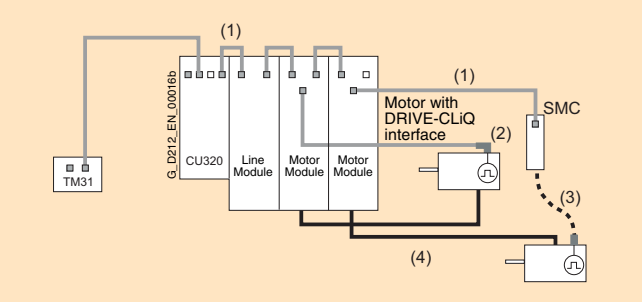
Mechanical configuration of the drive system

Configuration

Specification of components for connection system

To complete the drive system, components such as motors and encoders must be connected to it via cables.

On motors with DRIVE-CLiQ interface, the 24 V DC power supply is provided via the DRIVE-CLiQ cables. On all other Sensor Modules, a separate 24-V-DC power supply must be provided.



Drive connection system

Legend	Cable	Description
(1)	DRIVE-CLiQ cables	Standard cables for cabinet-internal configuration without 24-V cores
(2)	DRIVE-CLiQ MOTION-CONNECT 500/800 cables	MOTION-CONNECT 500 shielded cables with 24 V cores for fixed installation (e.g. in the cable duct), and MOTION-CONNECT 800 for flexible installation (e.g. in cable carriers)
(3)	MOTION-CONNECT 500/800 signal cables	Suitable for the measuring system in question; in versions MOTION-CONNECT 500 for fixed installation (e.g. in the cable duct), and MOTION-CONNECT 800 for flexible installation (e.g. in cable carriers)
(4)	MOTION-CONNECT 500/800 power cables	MOTION-CONNECT 500 shielded motor cables for fixed installation (e.g. in the cable duct), and MOTION-CONNECT 800 for flexible installation (e.g. in cable carriers)

DRIVE-CLiQ cables are available in various designs and lengths (see Connection System).

The required bending radii apply particularly to short cables. In addition to the distance between the two DRIVE-CLiQ sockets to be connected by the cable, a cable length of at least 60 mm (2.36 in) must be allowed for the bending radii.

Unused DRIVE-CLiQ sockets can be protected with a blanking plug. Suitable blanking plugs are available, e.g. from YAMAICHI, order no.: Y-ConAS-13,
http://www.yamaichi.de

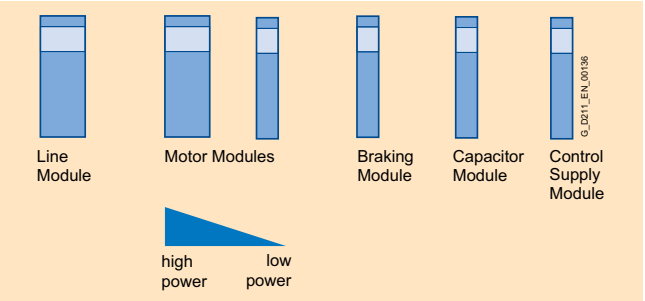
Mechanical configuration of the drive

A SINAMICS S drive line-up comprises of a Line Module, Motor Modules, DC link components, a Control Unit, and the optional expansion modules.

Configuration of a drive group in booksize format

The following criteria must be taken into account when a drive group of booksize format units is configured:

- The Smart Line Modules 5 kW and 10 kW *must* always be arranged on the left as the first module. All other Line Modules *should* be arranged on the left as the first module. The Control Unit CU320 or SIMOTION D in this case can be "snapped onto" the left side of the Line Module.
- The DC link busbars can be connected on the right and left with Basic Line Modules, Active Line Modules and Smart Line Modules rated 16 kW and larger. In this case, the drive can be configured in the reverse order (from right to left) or on both sides (see arrangement for chassis format units).
- Only one Line Module is permitted in each drive group.
- A number of drive groups must be configured for power supplies which cannot be provided by the highest rating.
- The Motor Modules must be arranged beside the Line Module in descending order of the rated currents, that is, the Motor Module with the highest rated current is to be mounted immediately adjacent to the Line Module, and the Motor Module with the lowest rated current is positioned furthest away from the Line Module.
- DC link busbars are integrated into the Line Modules, Motor Modules, Braking Modules, Capacitor Modules, Control Supply Modules and Voltage Clamping Modules for connecting the drive line-up. The current carrying capacity of the integral DC link busbars depends on the power rating of the module and is 100 A or 200 A (see technical data). Within the drive line-up, you must ensure that the DC link busbar meets the required current carrying capacity at each point in the drive line-up. For example, when using Motor Modules with high power ratings (DC link busbars 200 A) and Motor Modules with low power ratings (DC link busbars 100 A), the Braking Module (DC link busbars 100 A) must be installed after the Motor Modules with high power ratings.
- DC link adapters can be used to implement multi-tier configurations.
- The drive line-ups should be configured such that the total length of all power cables for the motor cables and the line cable, which should preferably be shielded, in each individual line-up does not exceed the permissible total cable length.



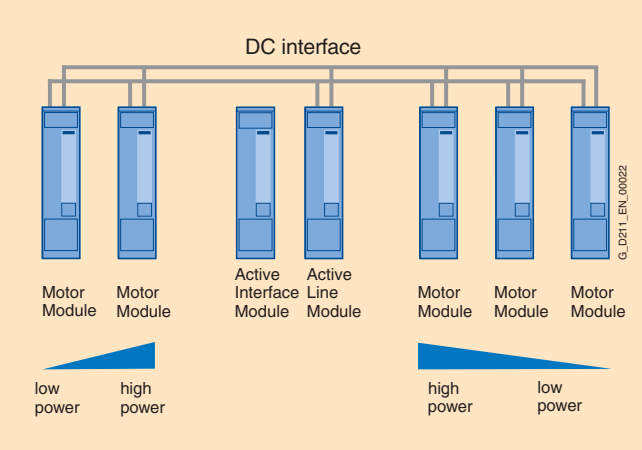
Power-oriented arrangement of booksize format Motor Modules

- The Control Unit configuration is flexible. The following configuration options are possible:
  - "Docking" on the left-hand side of the Line Module
  - Direct mounting next to the drive group on a mounting plate
  - Mounting in other cabinet areas, taking the permissible DRIVE-CLiQ cable lengths into account

Configuration (continued)

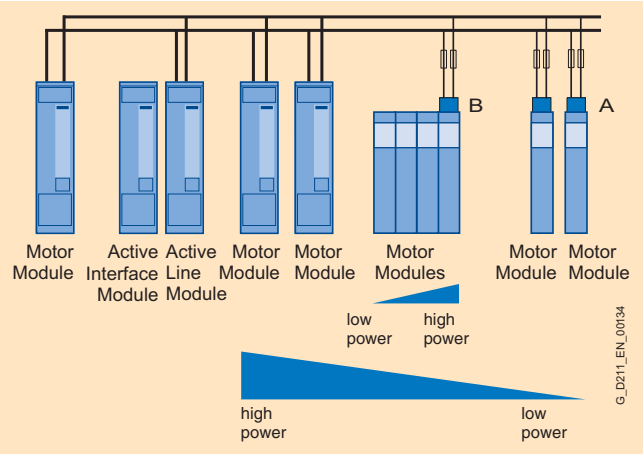
Configuration of a drive group in chassis format

- The Motor Modules must be positioned to the left or right of the Line Module with decreasing rated currents (i.e. the Motor Module with the highest rated current is positioned next to the Line Module, while the Motor Module with the lowest rated current is at the end on the left or right). You must ensure that the cables/busbars for the DC link meet the current-carrying capacity requirements for all connected Motor Modules.
- The inductance of the DC link busbars must be low, achieved, for example, by arranging the bars as close as possible in parallel, but observing the required creepage distances and air gaps.
- The Control Unit configuration is flexible. The following configuration options are possible:
  - "Docking" on the left-hand side of the Line Module
  - Direct mounting next to the drive group on a mounting plate
  - Mounting in other cabinet areas, taking the permissible DRIVE-CLiQ cable lengths into account



Configuration of a mixed drive group in chassis and booksize formats

A mixed drive group must be configured according to the rules for chassis format units. The Motor Modules in booksize format can be connected to the higher-level DC link busbars by means of DC link rectifier adapters. There are two possible connection options – A and B. With A, each Motor Module in booksize format is connected using the appropriate DC link rectifier adapter. With B, Motor Modules in booksize format are connected to one another and the internal DC link busbars and a DC link rectifier adapter are used on the last Motor Module to make the connection to the higher-level DC link busbars. In the latter case, the DC link rectifier adapter must be attached to the last Motor Module on the right-hand side of the line. As regards the arrangement of modules with different current ratings, the guidelines specified under "Configuration of a drive group in booksize format" also apply to mixed drive groups.



Ideally, the entire length of the higher-level DC link busbars can be dimensioned for the rated DC link current of the Line Module. The busbars are then protected by the line fuses at the infeed end.

If the cross section of the DC link busbars or cabling is reduced, this branch must be designed to be short-circuit-proof. The current limiting mechanism of the Motor Modules connected to the branch with reduced cross section then protects it against overloading. It is not advisable to reduce busbars or cables down to the mandatory minimum cross section. No additional overload protection (fuse) is required on the assumption that overloading cannot occur as a result of cable damage on the cable route to the Motor Module and that the circuit branch is protected against overloading by the Motor Module.

Where the cross section has been significantly reduced, or the circuit design is not inherently short-circuit-proof, a branch fuse must be installed at the beginning of the section with reduced cross section in order to protect the DC link connections involved. In the event of a fault, the fuse must be capable of interrupting DC fault currents; other types of miniature circuit-breaker are not suitable.

Mechanical configuration of the drive system

Configuration (continued)

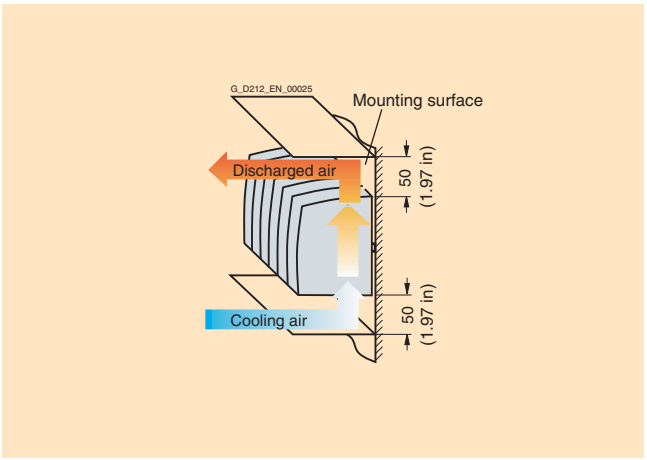
Allocation of branch fuses for option (A) in a supply system with grounded neutral (TN system). The calculations are based on the assumption that $\tau = L/R < 10$ ms applies to the time constant τ in the DC fault circuit and that the fault current is interrupted by the fuse after maximum 1 s.

Motor Module booksize format I_{rated}	**DC link rectifier adapter**	**Branch fuse**		**Recommended cable cross-section for Cu conductors and PVC insulation with a permissible operating temperature of 70 °C (158°F) on the conductor**
A	Order No.	Order No.	A	mm^2
3	6SL3162-2BD00-0AA0	3NE1813-0	16	2.5
5		3NE1813-0	16	2.5
9		3NE1803-0	35	4
18		3NE1818-0	63	10
30		3NE1820-0	80	10
45	6SL3162-2BM00-AA0	3NE1022-0	125	35
60		3NE1224-0	160	70
85		3NE1225-0	200	95
132		3NE1230-0	315	95
200		3NE1332-0	400	95
2 × 3	6SL3162-2BD00-0AA0	3NE1814-0	20	2.5
2 × 5		3NE1803-0	35	4
2 × 9		3NE1818-0	63	10
2 × 18		3NE1022-0	125	10

Configuration

Mandatory minimum installation clearances

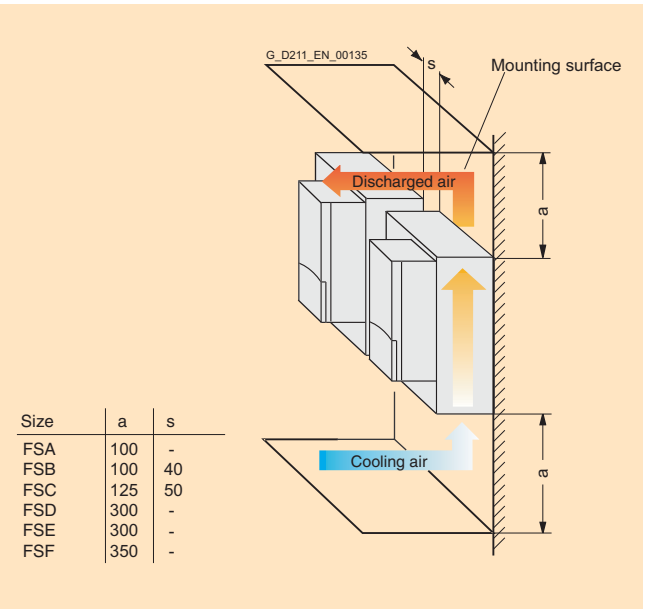
Ventilation clearances for Sensor Modules and Terminal Modules



Sensor Modules and Terminal Modules can be mounted directly adjacent to one another.

When mounted on the wall, line reactors and line filters require a ventilation space of 100 mm (3.94 in) above and below respectively.

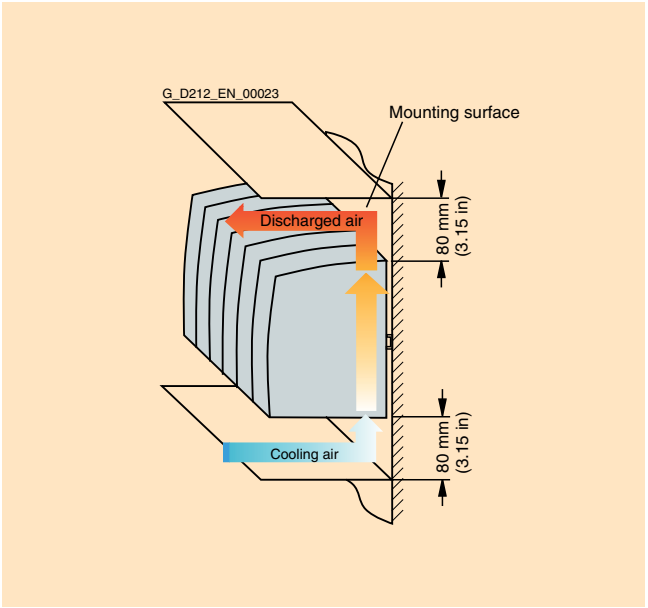
Ventilation clearances for blocksize format components



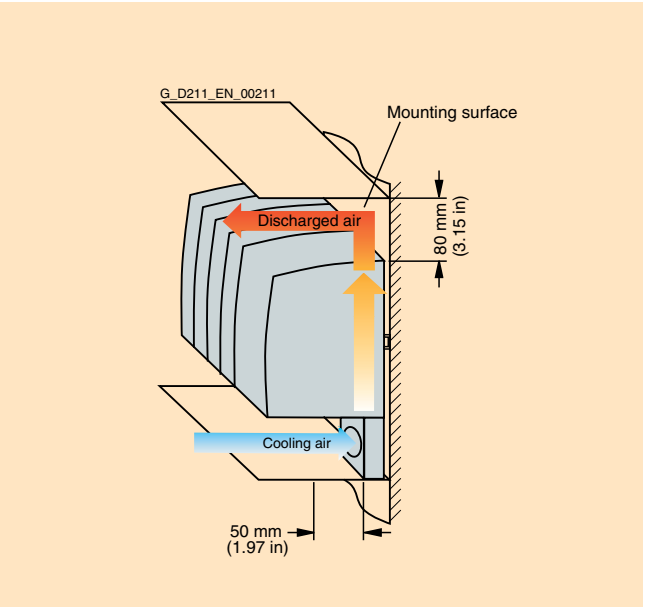
Size	a	s
FSA	100	-
FSB	100	40
FSC	125	50
FSD	300	-
FSE	300	-
FSF	350	-

When several devices are mounted adjacent to one another, a minimum side clearance between Power Modules must be maintained for certain frame sizes. Power Modules of frame sizes FSA, FSD, FSE and FSF can be mounted directly adjacent to one another.

Ventilation clearances for booksize format components with internal air cooling



Line Modules 5 kW to 55 kW
Active Interface Modules
Motor Modules up to 85 A



Active Line Modules 80 kW and 120 kW
Motor Modules 132 A and 200 A

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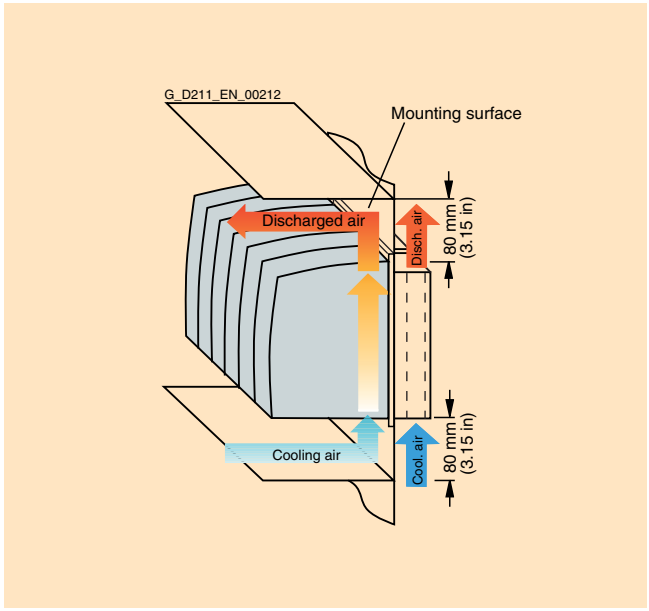
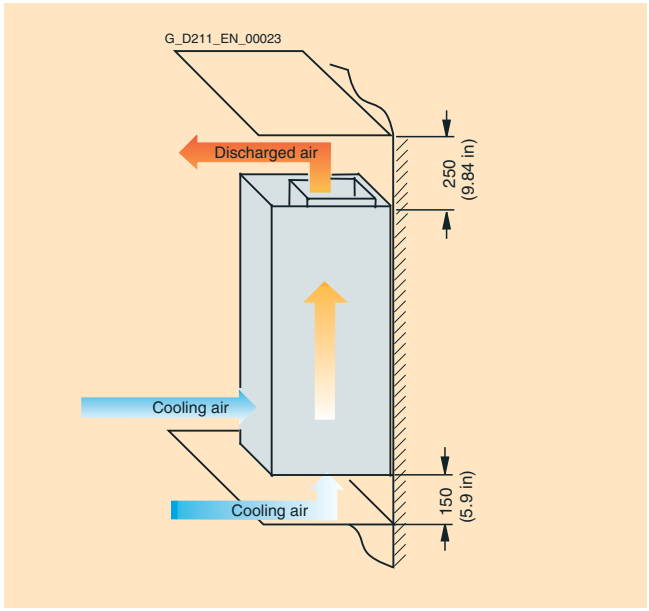
Heat dissipation

Configuration (continued)

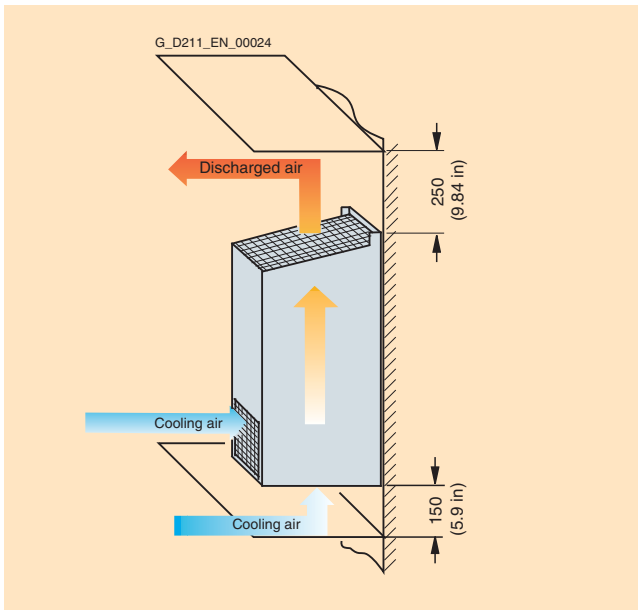
Ventilation clearances for booksize format components with external air cooling



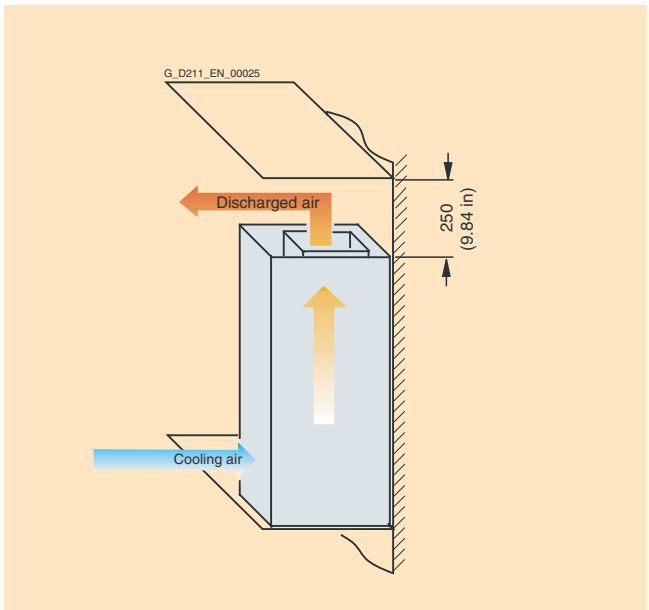
Ventilation clearances for chassis format components Basic Line Modules



Ventilation clearances for chassis format components



Active Interface Modules in frame sizes FI and GI



Active Interface Modules in frame sizes HI and JI

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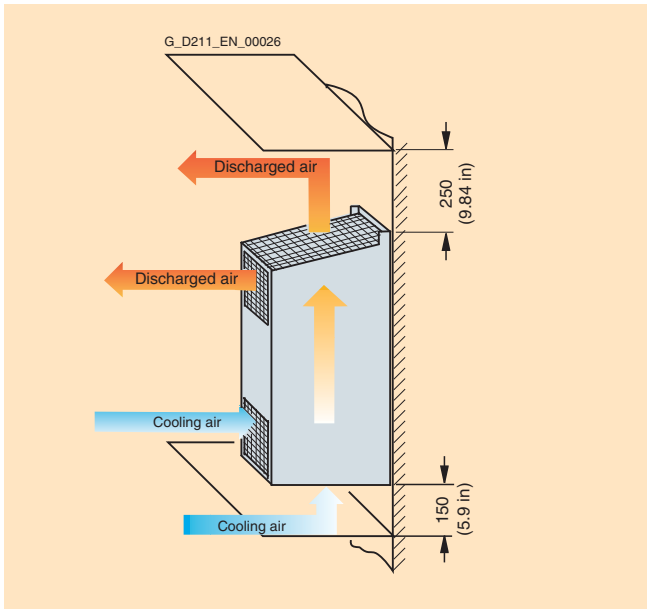
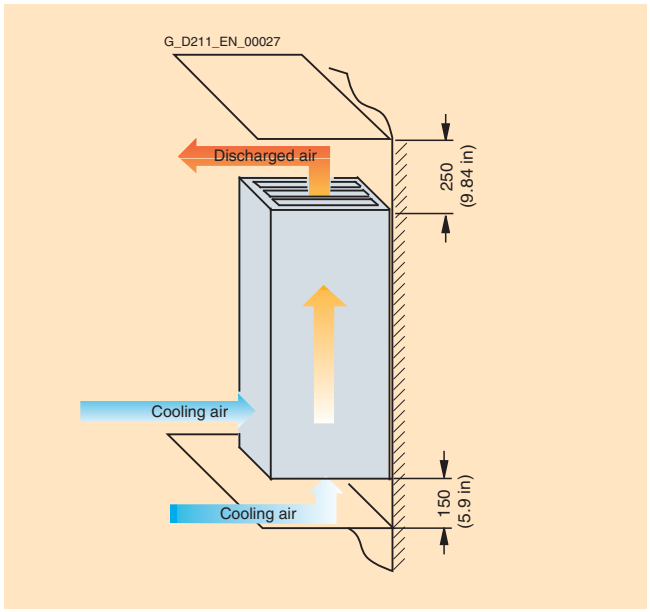
Configuration (continued)

Ventilation clearances for chassis format components



Power Modules, Motor Modules and Active Line Modules in frame sizes FX and GX



Active Line Modules in frame sizes HX and JX
Motor Modules in frame sizes HX and JX

Calculation of internal control cabinet temperature

Control cabinet with forced ventilation

In a control cabinet with forced ventilation, the heat loss P_V passes to the through-flowing air that then rises in temperature by $\Delta\vartheta$. In the time interval Δt, the air absorbs the heat $Q = c \times m \times \Delta\vartheta = P_V \times \Delta t$, and at the same time the air volume V flows through the control cabinet (c is the specific heat capacity of the air). Mass m and volume V are linked via density ρ. $m = \rho \times V$ applies. Used in the above formula, the following equation results: $P_V = c \times \rho \times (V/\Delta t) \times \Delta\vartheta$

The heat loss P_V, that can be dissipated by forced ventilation, is thus proportional to the volume flow

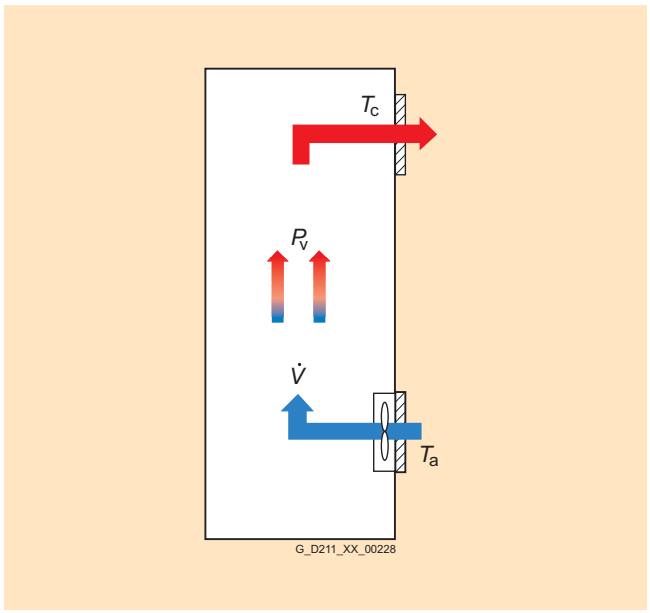
$\dot{V} = V/\Delta t$ that the fan delivers through the control cabinet

and the permissible degree of heating $\Delta\vartheta = T_c - T_a$

The heat capacity and density of the air depend on the humidity level and atmospheric pressure. For this reason, the equation is dependent on other parameters. To estimate the level of control cabinet heating in a typical industrial environment, c = 1 kJ/kg × K and ρ = 1.2 kg/m^3 can be assumed. This results in the following quantity equation:

P_V [W] = 1200 × $\dot{V}$ [m^3/s] × $\Delta\vartheta$ [K]

with $\Delta\vartheta = T_c - T_a$



The temperature T_c as the ambient temperature of the components in the interior of the control cabinet can be estimated with the formula given and must be checked by means of measurements for each application because local hot spots can form, e.g. in close proximity to a heat source or heat accumulation through unfavorable air circulation.

Heat dissipation

Configuration (continued)

Control cabinet without forced ventilation

A control cabinet without forced ventilation conducts the heat loss P_V generated in the interior to the surrounding air T_a via the surface.

For the heat flow, $\dot{Q}$ the following applies in the steady state:

$$\dot{Q} = k \times A \times \Delta\vartheta = P_v$$

k is the heat transfer coefficient, A is the effective cooling surface of the control cabinet, and $\Delta\vartheta$ is the temperature difference between the internal cabinet temperature and the external temperature $\Delta\vartheta = T_c - T_a$

The transfer of heat through the walls of the control cabinet is determined by the heat transfer of the interior air to the cabinet wall, heat conduction within the cabinet wall and heat transfer from the cabinet wall to the external air. The heat transfer is to be calculated by the heat transfer coefficient α, and heat conduction by the heat conductivity λ and the thickness d of the cabinet wall. The resulting equation for the possible heat loss P_V is:
$P_V = [1/(1/\alpha_i + d/\lambda + 1/\alpha_a)] \times A \times \Delta\vartheta = k \times A \times \Delta\vartheta$

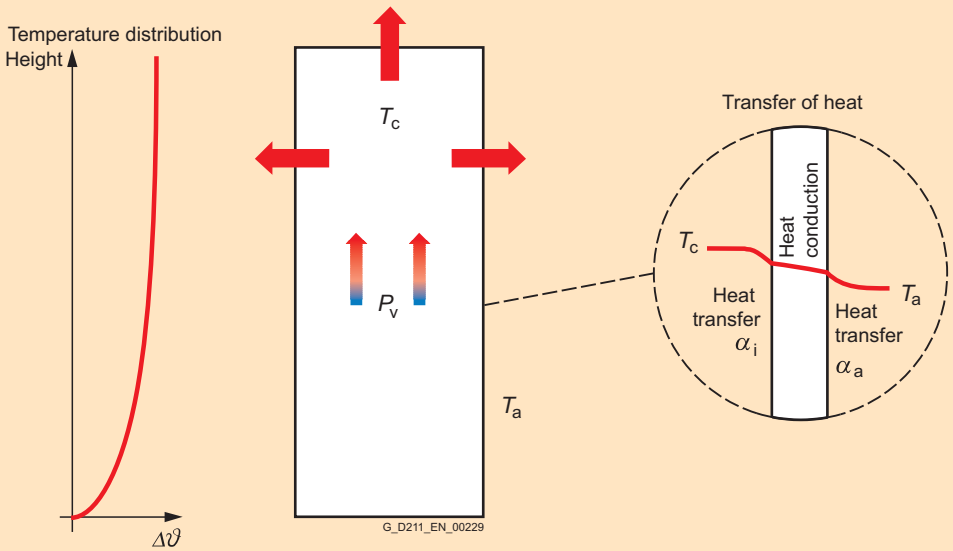
$$\boldsymbol{P_V = k \times A \times \Delta\vartheta}$$

Typical values for the heat transfer coefficient k in the case of control cabinets with walls of painted stainless steel which are up to 2 mm (0.08 in) thick:

	***k* value**
Non-circulating air in the control cabinet and non-circulating external air $\alpha_i = \alpha_a = 6$ W/(m² × K)	approx. 3 W/(m² × K)
Circulating air in the control cabinet and non-circulating external air $\alpha_i = 40$ W/(m² × K); $\alpha_a = 6$ W/(m² × K)	approx. 5.2 W/(m² × K)

The calculating procedures of IEC 60890 (VDE 0660 Part 507) can be used for determining the ambient temperature T_c in the interior of the control cabinet. All heat sources in the control cabinet must be taken into account in the calculation, e.g. Line Modules, Motor Modules, power supplies, filters, reactors. It is important to determine the effective cooling surface dependent on the method of setting up the control cabinet. The standard can also be used for control cabinets with ventilation openings (natural convection).

The estimated temperature T_c and the temperature distribution in the control cabinet must be checked with measurements for every application since local hot spots can form, e.g. in close proximity to a heat source or heat accumulation.



Configuration (continued)

Control cabinet with air conditioner

The control cabinet emits heat via its surface and the air conditioner.

Manufacturers provide information on the design of the air conditioner, e.g. Rittal's practical tips on the use of "control cabinet cooling devices" http://www.rittal.de

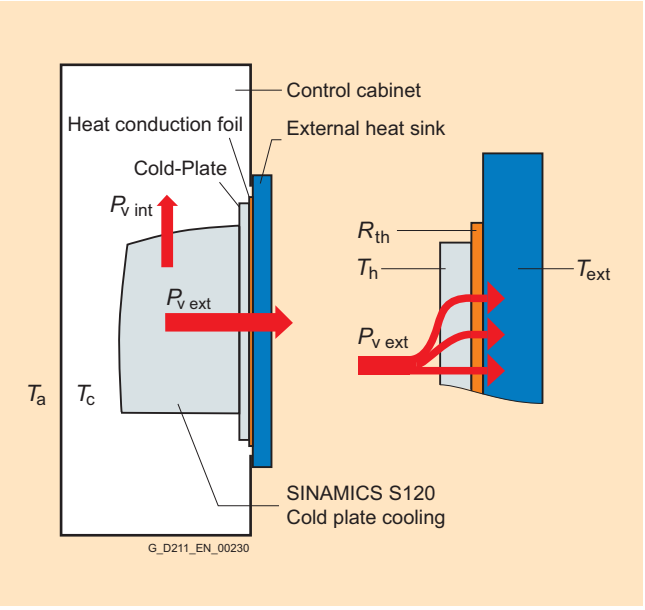
Control cabinet with cold plate cooling

Devices with cold plate cooling dissipate part of the generated heat losses to the surrounding air in the control cabinet ($P_{v\ int}$). However, the greatest part is dissipated as $P_{v\ ext}$ via the backplane designed as a cooling surface – the cold plate – to the external heat sink. The heat losses $P_{v\ ext}$ heat the cold plate to the temperature T_h that is linked via the thermal resistance R_{th} with the temperature T_{ext} of the external heat sink:
$T_h = R_{th} \times P_{v\ ext} + T_{ext}$

To ensure the specified value for the thermal resistance R_{th}, the supplied heat conduction foil must be used between the cold plate and the external heat sink, the device must be screwed together with the specified tightening torque, and the surface finish of the external heat sink must be maintained. The temperature difference between the cold plate and the external heat sink (T_h - T_{ext}) must not exceed 40 K, since otherwise mechanical warping can result. The devices with a width of 300 mm (11.81 in) are preferred in cold plate cooling for clocked applications that only briefly require the full rated current, but run on average with a smaller load, corresponding to the derating or less.

For the heat losses $P_{v\ int}$ given off in the control cabinet, one of the previously named calculation methods can be used for calculating the internal control cabinet temperature T_c.

All calculated maximum temperatures must be ensured by means of measurements under realistic load conditions after setup of the system.



You must ensure that the temperature T_{ext} of the external heat sink does not exceed the defined limit value on the surface contacting the heat conduction foil. Recommended external heat sink, e.g. Rittal DCP – Direct Cooling Package http://www.rittal.de

Condensation protection with cold plate cooling

On devices with cold plate cooling, warm surrounding air can condense on the cold surface of the external heat sink. The resulting condensate can cause electrical damage such as leakage current bridges and flashovers. The volume of condensate must be minimized by means of an appropriate temperature of the external heat sink by always maintaining the temperature of the heat sink above the dew point of the surrounding air. This can be achieved either by a permanently set and correspondingly high temperature, or by controlling the temperature of the heat sink in accordance with the surrounding air.

Notes

Services and documentation

13

Applications

Overview

Our understanding of an application is the customer-specific solution of an automation task based on standard hardware and software components. In this respect, industry knowledge and technological expertise are just as important as expert knowledge about how our products and systems work. We are set for this challenge with more than 140 application engineers at 15 locations in 9 countries.

Application centers

We currently have application centers in:

- Germany:
  Chemnitz, Erlangen, Cologne, Mannheim, Munich, Stuttgart
- Italy: Bologna, Milan
- USA: Atlanta
- China: Beijing
- France: Paris
- Turkey: Istanbul
- India: Mumbai
- Switzerland: Zurich
- United Kingdom: Manchester

Other application centers are under construction.

These application centers specialize in the use of SIMOTION/ SINAMICS. You therefore can rely on automation and drive specialists for implementing successful applications. By involving your personnel at an early stage in the process, we can provide a solid basis for rapid knowledge transfer, maintenance and further development of your automation solution.

Advice on applications and implementation

We offer a variety of consultation services to help you find the optimum solution for the SIMOTION/SINAMICS application you want to implement.

The quotation phase includes

- clarification of technical questions
- discussion of machine concepts and customer-specific solutions
- selection of suitable technology and
- suggestions for implementation.

A technical feasibility study is also performed at the outset. In this way, difficult points of the application can be identified and solved early on. We can also configure and implement your application as a complete solution including control cabinet from a single source.

During the implementation phase a number of proven standards can be applied. This saves engineering costs.

The system can be commissioned by experienced, competent personnel, if required. This saves time and trouble.

If servicing is required, we can support you on site or via teleservice. For further information about servicing, please see "Service and Support".

On-site application training

Training for the implemented applications can be organized and carried out on site. This training for machine manufacturers and their customers does not deal with individual products, but the entire hardware and software system (for example, automation, drives and visualization).

From an initial concept to successful installation and commissioning: We can provide complete support for SIMOTION/ SINAMICS!
Contact your Siemens representative.

For more information, go to:
http://www.siemens.com/motioncontrol/apc

Faster and more applicable know-how: Hands-on training from the manufacturer

SITRAIN® – the Siemens Training for Automation and Industrial Solutions – provides you with comprehensive support in solving your tasks.

Training by the market leader in automation and plant engineering enables you to make independent decisions with confidence. Especially where the optimum and efficient use of products and plants are concerned. You can eliminate deficiencies in existing plants, and exclude expensive faulty planning right from the beginning.

First-class know-how directly pays for itself: In shorter startup times, high-quality end products, faster troubleshooting and reduced downtimes. In other words, increased profits and lower costs.

Achieve more with SITRAIN

- Shorter times for startup, maintenance and servicing
- Optimized production operations
- Reliable configuration and startup
- Minimization of plant downtimes
- Flexible plant adaptation to market requirements
- Compliance with quality standards in production
- Increased employee satisfaction and motivation
- Shorter familiarization times following changes in technology and staff

Contact

Visit our site on the Internet at:

www.siemens.com/sitrain

or let us advise you personally. You can request our latest training catalog from:

SITRAIN Customer Support Germany:

Phone: +49 (0)1805 / 23 56 11
(0.14 €/min from the German landline network)

Fax: +49 (0)1805 / 23 56 12

Training office, US

Phone: 1-800-241-44 53

E-mail: sitrain.register.sea@siemens.com

SITRAIN highlights

Top trainers

Our trainers are skilled specialists with direct practical experience. Course developers have close contact with product development, and directly pass on their knowledge to the trainers.

Practical experience

The practical experience of our trainers enables them to teach theory effectively. But since theory has it's grey areas, we attach great importance to practical exercises which can comprise up to half of of the course time. You can therefore immediately implement your new knowledge in practice. We train you methodically on state-of-the-art training equipment. This training approach will give you all the confidence you need.

Wide variety

With a total of some 300 participant based courses, we train the complete range of A&D products as well as interaction of the products in systems. Telecourses, self-teach software and seminars with a presenter on the Web supplement our classic range of courses.

Tailor-made training

We are only a short distance away. You can find us at more than 50 locations in Germany, and in 62 countries worldwide. You wish to have individual training instead of one of our 300 courses? Our solution: We will provide a program tailored exactly to your personal requirements. Training can be carried out in our Training Centers or at your company location.

The right mixture: Blended learning

"Blended learning" means a combination of various training media and sequences. For example, a participant based course in a Training Center can be optimally supplemented by a self-teach program as preparation or follow-up. Additional effect: Reduced traveling costs and periods of absence.

Training
SINAMICS S120 training courses

Overview

Training courses for SINAMICS S120 drive system

This provides an overview of the training courses available for the SINAMICS S120 drive system.

The courses are modular in design and are intended for a variety of target groups as well as individual customer requirements.

The system overview will acquaint decision-makers and sales personnel with the system very quickly.

The configuration course provides all the information you need to size the drive system.

The basic and follow-up courses are sure to provide all the technical knowledge service engineers will need for servicing/commissioning motion control applications, communication and cabinet-mounted units.

All courses contain as many practical exercises as possible in order to enable intensive and direct training on the drive system and with the tools in small groups.

You will find further information about course contents and dates on the Internet.

Title (all courses available in English and German)	Target group: Decision-makers, sales personnel	Project managers, project assistants	Programmers	Commissioning engineers, configuring engineers	Service engineers	Maintenance personnel	Duration	Course code
Basic courses								
SINAMICS System Overview	✓	✓					2 days	DR-SN-UEB
SINAMICS S120 Configuration	✓	✓	✓				5 days	DR-SNS-PRJ
SINAMICS S120 Service and Commissioning			✓	✓	✓	✓	5 days	DR-SNS-SI
Follow-up courses								
SINAMICS Communication			✓	✓	✓		5 days	DR-SN-COM
SINAMICS S120 Chassis Unit Servicing			✓	✓	✓		2 days	DR-SNS-CHA
SINAMICS S120 on SIMOTION and T-CPU				✓	✓		4 days	DR-SNS-MC
Commissioning SINAMICS S120 with SINUMERIK solution line			✓	✓	✓		3 days	DR-SNS-SL

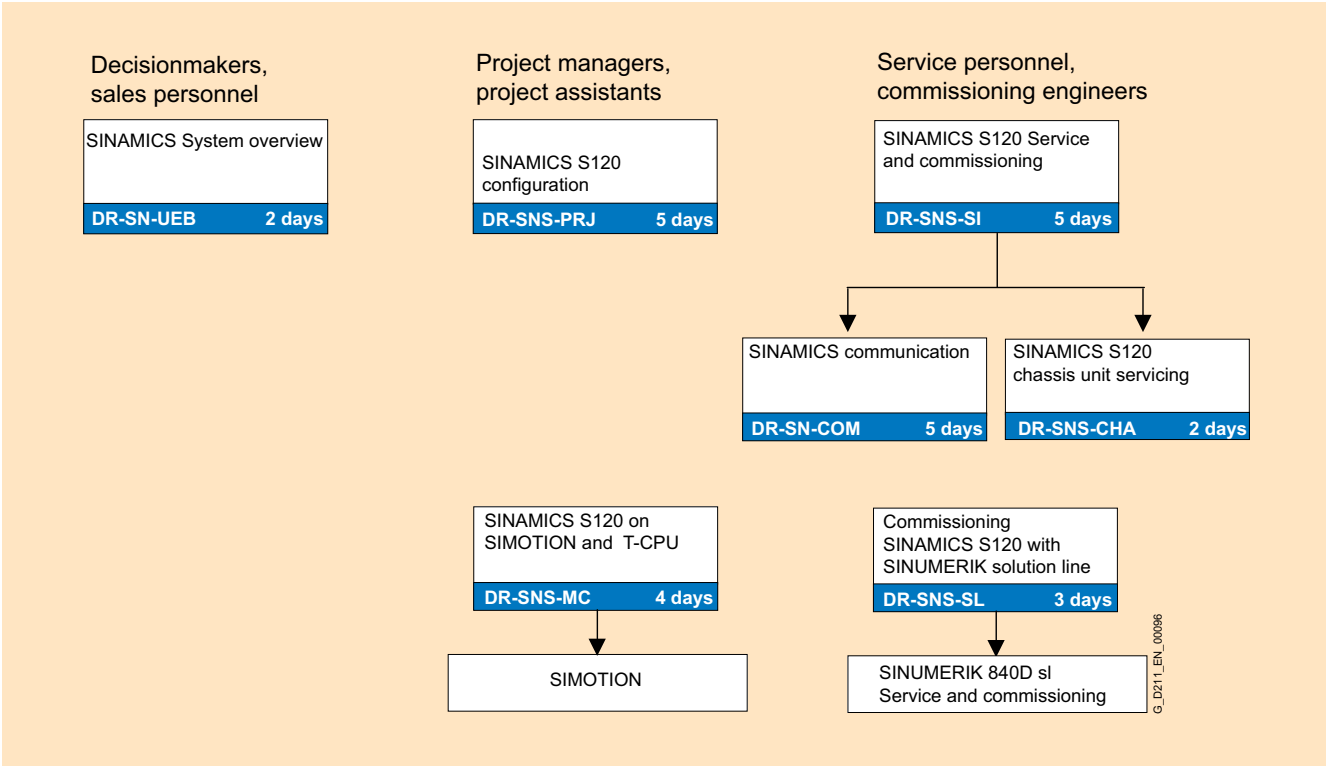
Training devices for SINAMICS S120

Practice-oriented training devices are used for successful presentations, training courses or even staff training.

Information on training devices can be found at
www.siemens.com/sidemo
via → Products & Solutions → Training

Overview (continued)

SINAMICS S120 training program



Training
SIMOTION training courses

Overview

Training courses for SIMOTION Motion Control system

The SITRAIN training courses for SIMOTION offer a broad spectrum of courses that makes users fit for their tasks in project engineering, commissioning and maintenance. The standard courses are offered in our training centers or somewhere close to you. We also offer customer-specific courses in our training centers or at the customer site.

The practical exercises are based on the course content and are performed on specially developed and well-equipped training devices.

You will find further information about course contents and dates on the internet.

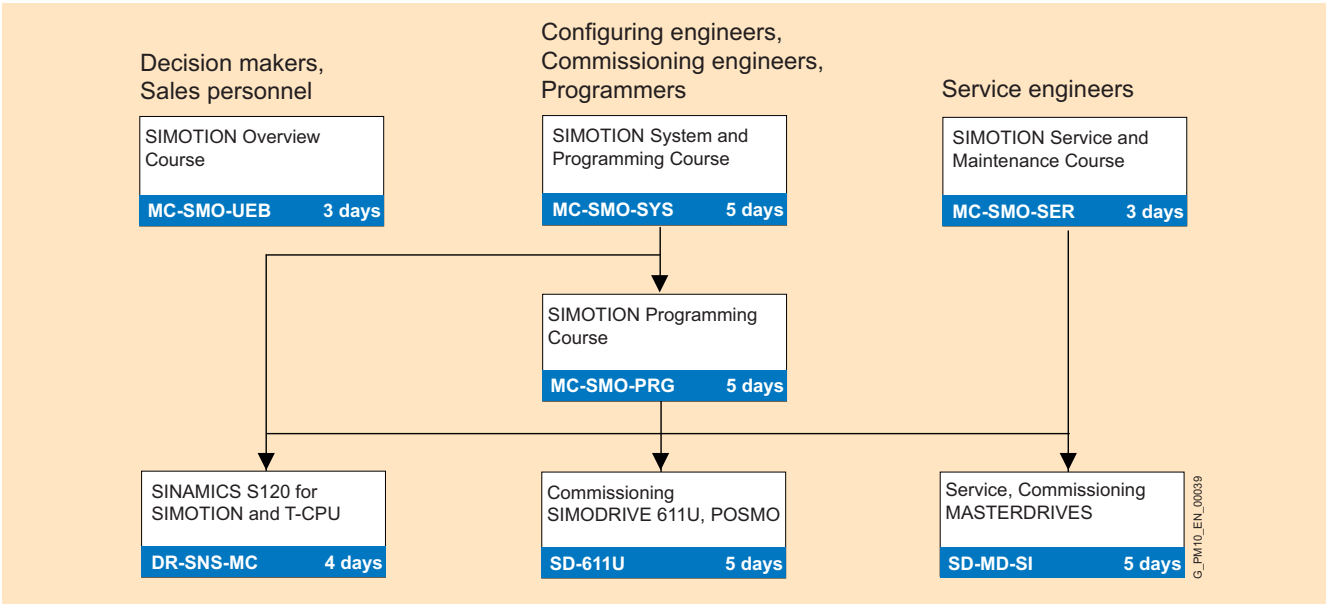
Training devices for SIMOTION

Practice-oriented training devices are used for successful presentations, training courses or even staff training.

Information on training devices can be found at
www.siemens.com/sidemo
via → Products & Solutions → Training

Title (all courses available in English and German)	Target group: Decision-makers, sales personnel	Target group: Project managers, project assistants	Target group: Programmers	Target group: Commissioning engineers, configuring engineers	Target group: Service engineers	Target group: Operators, users	Target group: Maintenance personnel	Duration	Course code
SIMOTION Overview Course	✓	✓						3 days	MC-SMO-UEB
SIMOTION System and Programming Course			✓	✓	✓			5 days	MC-SMO-SYS
SIMOTION Programming Course			✓	✓				5 days	MC-SMO-PRG
SIMOTION Service and Maintenance Course					✓	✓	✓	3 days	MC-SMO-SER
SINAMICS S120 on SIMOTION and T-CPU				✓	✓			4 days	DR-SNS-MC

SIMOTION training program



Overview

Virtual Prototyping

We combine mechanics, electronics and information technology in one simulation environment.

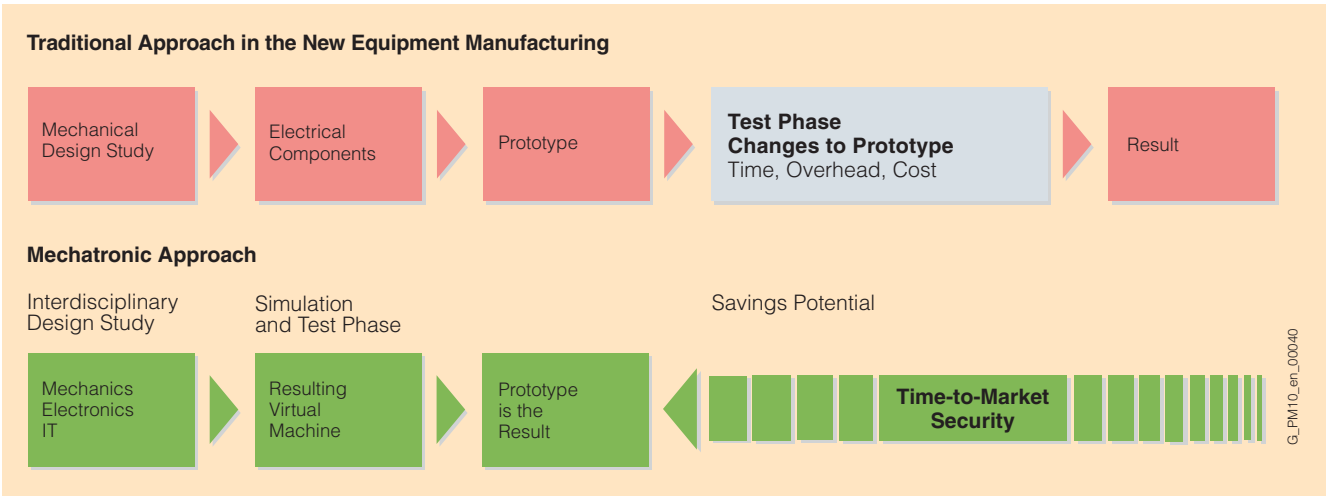
This philosophy is implied by the name: Mechatronics is more than just mechanics and more than just electronics. Mechatronics is the integration of mechanical and electrical engineering with electronics, sensors, diagnostic equipment and information technology.

And this means:

With Mechatronics Support, the developers first create and analyze a mechatronic simulation model of the new machine. This allows all the key performance characteristics of a new machine to be determined and verified before the first (and then only) real prototype is built. This simulation process is an important source for quality improvements and development cost cutting and a valuable tool which you should utilize.

We offer this service.

We at Siemens do not consider ourselves as merely manufacturers of products, systems and plants, but as solution providers as well. With our Mechatronics Support service, we start helping you with the design of your new machine – with selective analysis and optimization using pure simulation models so that we can eliminate a prototype.



Mechatronics Support was previously only applied when the prototypes of new machines were unable to achieve the prescribed performance characteristics. However, it is far more effective to integrate a holistic simulated mechatronic assessment at a very early stage of product development.

Using our Mechatronics Support, it is then possible to create a mechatronic simulation model of the machine and obtain a virtual prototype instead of producing a real prototype or series of prototype models.
Computer-aided simulation tools are applied in a standardized procedure to test and analyze the virtual prototype under production conditions in simulation mode.

Early on in the development phase, it is possible to identify any weak points and rectify them economically and quickly.

Complete implementation

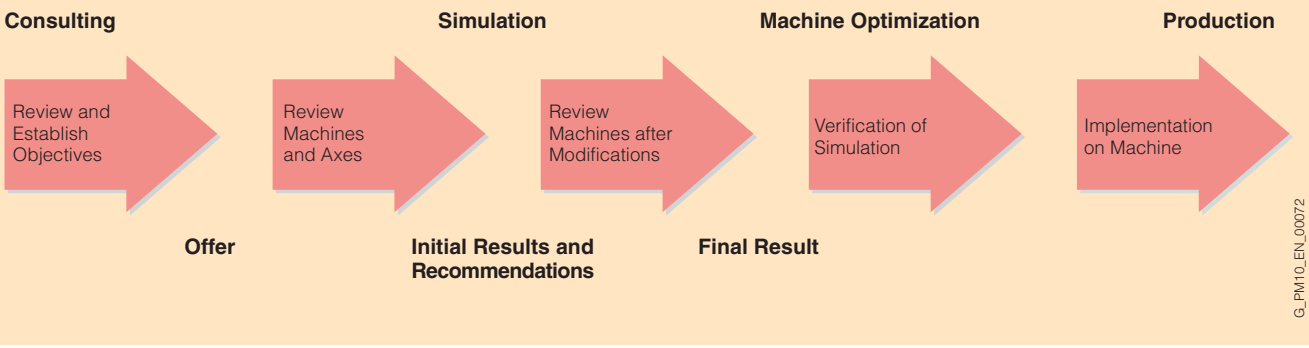
With our Mechatronics Support service, we offer the means of creating a simulation model which combines the mechanical machine components with the motors, converter systems, drive control and CNC/motion controller in such a way as to produce an intelligently controlled virtual machine.

Mechatronics Support

Overview (continued)

Virtual Prototyping is the TOP feature of our Mechatronics Support service

Virtual Prototyping with Mechatronics Support



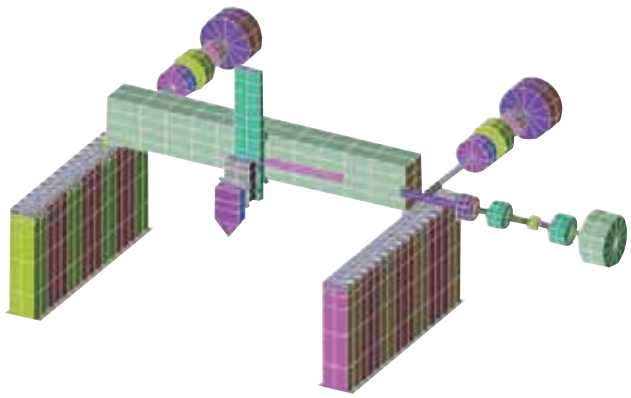
Procedure

The scope of tasks to be performed is defined during the **consultation process** during the machine design phase and provides the basis for a simulation quotation. **Simulation** of the machine with the FE model (finite element model) determines the forms of natural vibration, includes simulation of the closed-loop control drive systems and control technology and offers the means of calculating variations. **Machine optimization** verifies the results obtained from the simulation on the prototype or the final machine design.

Mechatronics Support modules

The scope of services can be tailored to meet the customer's individual requirements and special needs. Service modules are provided for this purpose. These can be ordered individually or as packages – as in the case of Virtual Prototyping.

Whether you want to improve or upgrade an existing machine and wish to discuss possible options with experts in an initial technical consultation or whether you would like a feasibility assessment of new ideas at the development stage, our Mechatronics Support service can provide you with the individual help you need.



Example: FE model

Benefits

- Quicker development reduces the time to market
- Increased development reliability
- Creative concepts – higher quality – increased productivity

Selection and ordering data

Designation	Order No.
Consultation Technical consultation with customer	**6FC5088-1....**
Machine optimization Optimum setting of control and drives on the customer's machine	**6FC5088-2....**
Machine analysis and optimization Analysis of the machine and its limits. Recommendations for manufacturer	**6FC5088-3....**
Machine simulation Simulation of individual axes and the dynamic response on the machine	**6FC5088-4....**
Machine simulation with interpolating axes Simulation of interpolating axes	**6FC5088-5....**
Machine simulation with FE model Modeling of machine using the Finite Element method	**6FC5088-6....**

More information

For further information and individualized quotations, please contact your Motion Control Partner at your local Siemens sales office or regional company.

Overview

Innovative installations for production machines and plants

Providing complete installations involves more than just wiring control cabinets. From consultation to configuration of software and hardware to customer acceptance, you get a complete range of services from a single source.

Consultation

Our aim is to transform functional requirements into efficient automation solutions. In this process, we advise you on material selection, implementation of country-specific standards (such as UL/CSA), particular end-customer regulations, and assurance of effective protective measures for segment-specific environmental impacts.

Engineering

For us, engineering means implementation of automation requirements in software and hardware configurations in conformance with standards. To this end, we use mainstream CAD systems (Sigraph, Eplan, and AutoCad). We tailor our scope of services (list of components, installation layout, schematic diagrams, PLC program, user interface program, closed-loop controller structures, etc.) to suit customer requirements for each project.
We create software solutions using our knowledge of each technology process and industry sector, based on proven standards.

Logistics

Our aim:
One automation solution – **one** order – **one** point of contact!

We achieve this objective and provide high quality supply performance by means of:

- Customized internal processes
- Preferred suppliers
- Customer-specific logistics agreements
- Experience with transborder deliveries
- Ship to line deliveries

Production

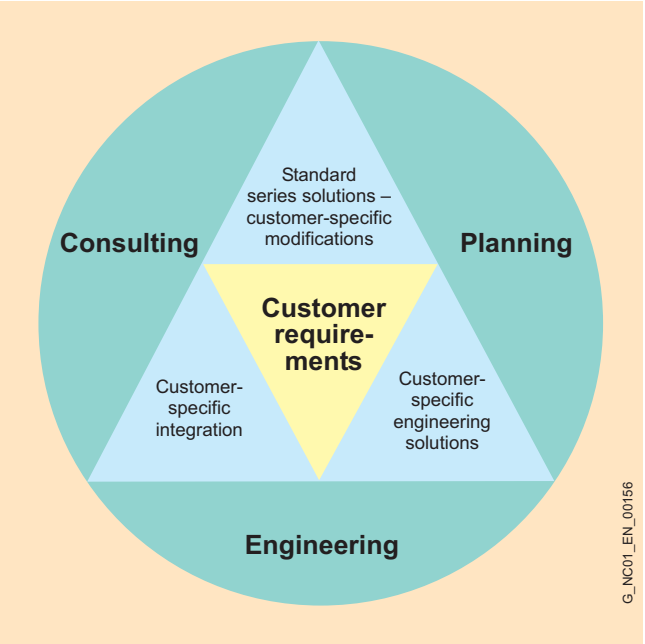
Complete installations are produced in accordance with high industry standards. Innovative production concepts ensure short delivery times and flexible available capacity.

We also provide:

- Examining consistency of the job documentation
- Verification of compliance with the relevant specifications and standards
- Testing and preliminary commissioning in accordance with agreed-upon functional scopes
- Documentation (including multilingual documentation)
- Conformance declaration for low-voltage guidelines and manufacturer's declaration for machine guidelines

Quality management

Quality assurance and certification of the overall installation considerably increase worldwide sales opportunities for your plant. Our production is based on the EFQM quality model and is DIN/ISO 9001-certified.



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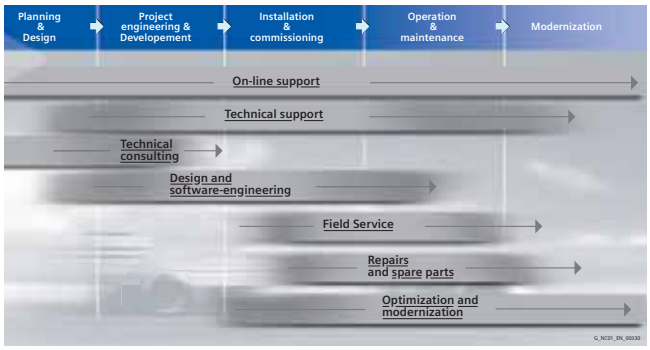
Service & Support



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.

In every phase: from planning and startup to maintenance and upgrading.

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

Online Support

The comprehensive information system available round the clock via Internet ranging from Product Support and Service & Support services to Support Tools in the Shop.

http://www.siemens.com/automation/service&support

Technical Support

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

Phone: +49 (0)180 50 50 222
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:
Phone: +1 888 303 3353
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)]

Service On Site

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

In Germany, call:
Phone: +49 (0)180 50 50 444 [1)]

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

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

Repairs and Spare Parts

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.

In Germany, call:
Phone: +49 (0)180 50 50 448 [1)]

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

Overview

SPARESonWeb – Online spare parts catalog

SPARESonWeb is a web-based tool for selecting the spare parts available for the SINAMICS system. After you have registered and entered the serial number and order number, the spare parts available for the relevant unit are displayed.

The delivery state for specific orders can be displayed for all shipped SINAMICS products.

http://workplace.automation.siemens.com/sparesonweb

Documentation

Overview

Documentation for SIMOTION

A powerful programmable controller can only be used in the best possible way if in addition to training you also have access to professionally prepared documentation.

Information is available in the following formats:

- Windows Help in conjunction with the SCOUT engineering system
- PDF documentation on the product CD

The SIMOTION documentation comprises different documentation packages and is supplied as different manuals sorted according to functionality and content.

The SIMOTION documentation can be found at
http://support.automation.siemens.com/WW/view/en/10805436/133300

Documentation for SINAMICS and motors

The documentation is clearly divided into a number of manuals. The manuals must be ordered separately (in the required language and quantities) from the actual equipment.

Information is available in the following formats:

- **Paper version**, printed copy
- **PDF file** available on Internet as DOConWEB – application with 'search all documents' function
  http://www.siemens.com/automation/doconweb

The following manuals are available:

- *Manual/Configuration Manual*
  containing all necessary information about the intended use of the components of a system, e.g. technical data, interfaces, dimension drawings, characteristics and possible applications.
  The Manual/Configuration Manual is intended for use during the following phases: Cabinet configuration/setup, circuit diagram configuration/drawing.
- *Commissioning Manual*
  containing all information relevant to commissioning after installation and wiring. It also contains all safety and warning notices relevant to commissioning in addition to overview drawings.
  The Commissioning Manual is intended for use during the following phases: Commissioning of components that have already been connected, configuration of system functions.
- *List Manual*
  containing all parameters, function charts, and faults/warnings for the product/system as well as their meanings and setting options. It contains parameter data, descriptions of faults/warnings and how they affect functions.
  The List Manual is intended for use during the following phases: Commissioning of components that have already been connected, configuration of system functions, fault cause/diagnosis.
- *Getting Started*
  providing information about getting started for the first-time user as well as references to additional information. It contains information about the basic steps to be taken during commissioning. For more advanced operations, see the information in other documentation.
  Getting Started is intended for use during the following phases: Commissioning of components that have already been connected.
- *Function Manual Drive Functions*
  containing all the relevant information about individual drive functions: Description, commissioning and integration in the drive system.
  The Function Manual is intended for use during the following phases: Commissioning of components that have already been connected, configuration of system functions.
- *DOConCD*
  DOConCD is a CD-ROM containing manufacturer and service documentation for the SINAMICS motors and drive systems.

For further information about the availability of publications and languages, go to
http://www.siemens.com/motioncontrol/docu

Selection and ordering data

Description	German edition Order No.	English edition Order No.
SINAMICS S120		
Equipment Manual for Control Units and Additional System Components	**6SL3097-2AH00-0AP3**	**6SL3097-2AH00-0BP3**
Equipment Manual for Booksize and Booksize Compact Power Units	**6SL3097-2AC00-0AP4**	**6SL3097-2AC00-0BP4**
Equipment Manual for Booksize Cold-Plate Power Units	**6SL3097-2AJ00-0AP4**	**6SL3097-2AJ00-0BP4**
Equipment Manual for Chassis Power Units	**6SL3097-2AE00-0AP2**	**6SL3097-2AE00-0BP2**
Equipment Manual for Chassis Liquid Cooled Power Units	**6SL3097-2AM00-0AP2**	**6SL3097-2AM00-0BP2**
Equipment Manual AC Drive	**6SL3097-2AL00-0AP2**	**6SL3097-2AL00-0BP2**
Commissioning Manual	**6SL3097-2AF00-0AP7**	**6SL3097-2AF00-0BP7**
SINAMICS S List Manual	**6SL3097-2AP00-0AP6**	**6SL3097-2AP00-0BP6**
Getting Started	**6SL3097-2AG00-0AP4**	**6SL3097-2AG00-0BP4**
Function Manual Drive Functions	**6SL3097-2AB00-0AP2**	**6SL3097-2AB00-0BP2**
Function Manual Safety Integrated	**6SL3097-2AR00-0AP0**	**6SL3097-2AR00-0BP0**
Description of DCC Blocks	**6SL3097-2AQ00-0AP1**	**6SL3097-2AQ00-0BP1**
Operating and Programming Manual DCC Editor	**6SL3097-2AN00-0AP1**	**6SL3097-2AN00-0BP1**
DOConCD, The SINAMICS System (German/English)	**6SL3097-2CA00-0YG4**	
Motors		
General Section for Three-Phase Asynchronous Motors	**6SN1197-0AC62-0AP0**	**6SN1197-0AC62-0BP0**
1PH7 Motors Configuration Manual	**6SN1197-0AC71-0AP0**	**6SN1197-0AC71-0BP0**
1PL6 Motors Configuration Manual	**6SN1197-0AC67-0AP1**	**6SN1197-0AC67-0BP1**
1PH4 Motors Configuration Manual	**6SN1197-0AC64-0AP2**	**6SN1197-0AC64-0BP2**
General Section for Synchronous Motors	**6SN1197-0AD07-0AP4**	**6SN1197-0AD07-0BP4**
1FT6 Motors Configuration Manual	**6SN1197-0AD12-0AP0**	**6SN1197-0AD12-0BP0**
1FT7 Motors Configuration Manual	**6SN1197-0AD13-0AP0**	**6SN1197-0AD13-0BP0**
1FK7 Motors Configuration Manual	**6SN1197-0AD16-0AP1**	**6SN1197-0AD16-0BP1**
1FS6 Motors Configuration Manual	**6SN1197-0AD08-0AP0**	**6SN1197-0AD08-0BP0**
1FW3 Motors Configuration Manual	**6SN1197-0AD70-0AP0**	**6SN1197-0AD70-0BP0**
SIMODRIVE Sensor User Manual, Absolute Encoders with PROFIBUS Encoders (German/English)	**6SN1197-0AB10-0YP4**	
SIMAG H2 Configuration Manual	**6SN1197-0AB31-0AP5**	**6SN1197-0AB31-0BP5**
The SINAMICS S Lists Manual and the Motor Configuration Manuals are also available in the following languages: French: ...-0**D**P. Italian: ...-0**C**P. Spanish: ...-0**E**P. Replace the third-last letter in the order number with the corresponding letter.		

Notes

Sector-specific solutions

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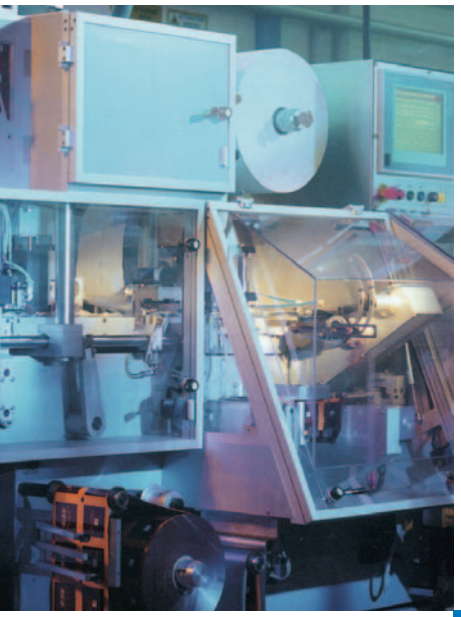
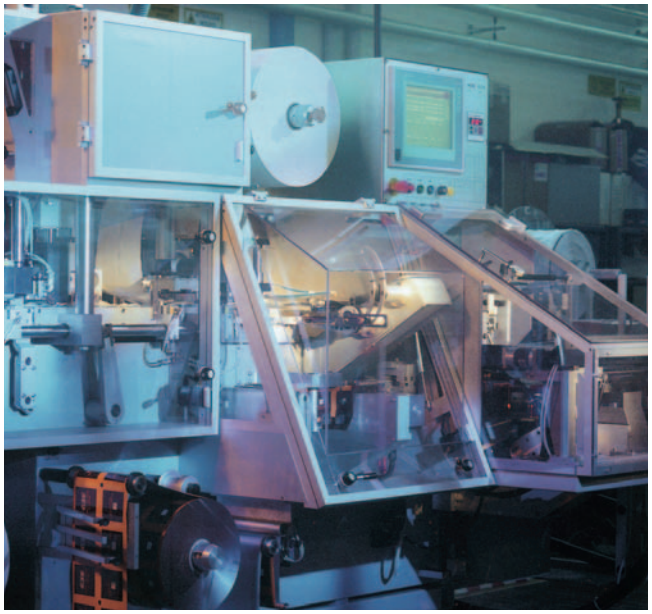


Summary

Overview



The ability to innovate and to directly address the interests of customers is more important today than ever. Products alone, as innovative as they may be, do not suffice any longer. To recognize trends and respond to them, that is the key – whether in the form of innovative systems, intelligent solutions or the provision of unique services.

Innovative systems and intelligent solutions

One of the most important trends is toward modular machines and plant. One-off solutions are being gradually replaced by modular systems and distributed automation concepts. This offers advantages especially with regard to project runtimes and enhanced quality through the use of tried and tested modules in the hardware and software.

In modular machine concepts, the mechanical components are being replaced more and more with electronic components (e.g. electronic gearing), which means, for example, that by isolating the drives, the line shaft can be completely omitted. The individual mechanical machine components can be separately designed, built, modified and individually combined to suit requirements for increased flexibility and reduced commissioning time. Siemens is offering an integrated solution here with distributed automation concepts in combination with a drive system.

Our extremely wide range of powerful and innovative standard components for automation technology and drive systems has a uniform system basis and supports integrated programming, data management and communication. This prevents problems with interfaces. Holistic, integrated solutions are created with uniform handling and uniform engineering and yet considerable scope remains for implementing your individual solutions.

Using our SIMOTION and SINAMICS system platforms, on the one hand you have ready-to-use solutions such as SIMOTION Baggers & Wrappers and on the other hand thanks to the openness you have plenty of freedom for your special expertise. Our solutions and components are open for you to integrate your own developments, because we use open standards. Your special expertise is neither changed nor revealed.

Our specialists will, however, be happy to help you to create individual complete solutions, either for new projects or for modernization of existing plants including development, dimensioning of components and engineering with clearly defined statements on the performance of the overall system, with us as the partner who accepts responsibility for it.

Our technology is as long-lived as your machines. Expansions are still possible after many years, you therefore rely on a system expansion capability that is assured for the long term.

Provision of unique services

Innovative services such as mechatronic support and application support round off Siemens' range of products, systems and services. With "Mechatronic support", for example, the generally costly construction of a prototype can become considerably less risky and faster by using virtual prototypes – the first real prototype is then final. The time to market and construction costs are therefore drastically reduced. The range of complete solutions offers potential for rationalization, e.g. a completely assembled, tested and customized control cabinet that can practically be delivered to the production line of the end customer with plug and play functionality.

Another emerging trend is the transformation into a "full supplier". In this case, the end customer requests everything from a single source for the new production line with vertical and horizontal integration throughout the complete process. To satisfy these and further future requirements and to open up new markets at the same time, machine manufacturers need strong partners at their side. With Siemens, you have an experienced partner that focuses on a wide range of different sectors and that will support you with individual solutions, powerful systems and innovative services and which, as a global player, maintains an all-encompassing, worldwide service network. Wherever your machine may be one day: our technology complies with the applicable standards – and is supported locally. If you wish, round the clock, every day of the year. Always exactly what you want.

All types of references

Our extensive experience in various sectors helps us to concentrate on the important aspects. This is one of the reasons for the considerable amount positive feedback concerning our complete range of products and services.

Investment in the future

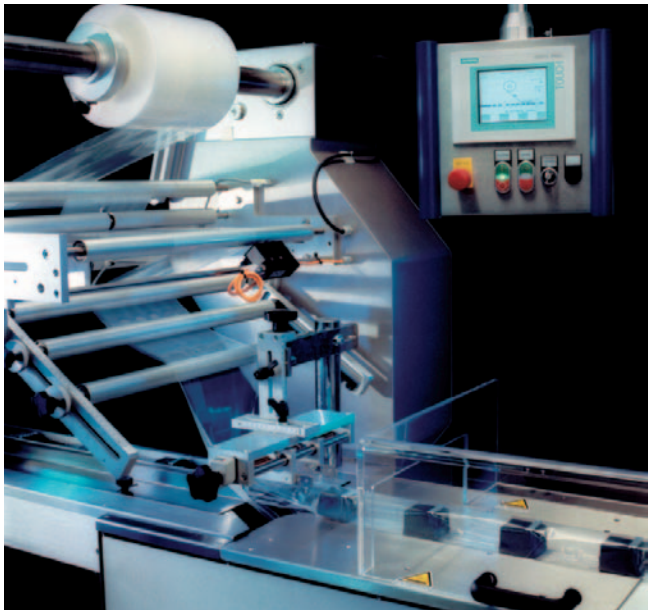
We are competent and reliable partners for Motion Control solutions in machine construction. We will be happy to work out future-oriented solutions with you for many different sectors. Partnership with Siemens secures your future.

The following are examples of various sector solutions implemented with SIMOTION. We make a distinction here between system-tested packages that can be ordered and applications in the form of ordering examples that we will be happy to adapt to your specific machine.

More information

You will find further information about reference projects and sector-specific solutions with SIMOTION on the Internet at http://www.siemens.com/simotion and http://www.siemens.com/simotion/solutions or get in touch with your contact at your local Siemens office.

Overview



SIMOTION Baggers & Wrappers is a system comprising hardware and software packages for automating tubular bag machines. The technological basis of the packages is the Motion Control System SIMOTION.

The hardware packages are available in two versions: comfort package and basic package.

The comfort packages offer you an "80 % solution" for automating your machine and can be adapted to the design of the machine by means of ordering options.

The basic package is more general and contains only the basics for automating your machine with SIMOTION.

As an option, we can offer you support with tasks ranging from hardware adaptation to your machines through to delivery of a control cabinet that is ready for operation.

The software library contains expandable software modules for standard tasks and a pre-configured user interface. This significantly simplifies program development and commissioning.

Comfort packages SIMOTION Baggers & Wrappers

The following comfort packages are available:

SIMOTION Baggers & Wrappers for

- intermittent, vertical tubular bag machines
- continuous, vertical tubular bag machines
- standard horizontal tubular bag machines (up to approximately 300 bags/min.)
- horizontal high-speed tubular bag machines (from approx. 300 bags/min.)

Scope of delivery

The comfort packages contain:

- SITOP 24 V/20 A power supply
- SIMOTION D4x5 Control Unit with CompactFlash Card and all the necessary runtime licenses (temperature controller for 8 channels, positioning and synchronized axes)
- The SINAMICS S120 drive system with
  - SINAMICS 5 kW (6.71 HP) or 10 kW (13.4 HP) rectifier infeed/regenerative feedback unit (Smart Line Module) with line reactor and line filter
  - SINAMICS Motor Modules with 5 A each for foil extractor and cross-sealer (for synchronous and asynchronous motors)
- Distributed ET 200S I/O system (bit modular expendability) with
  - 20 digital inputs (24 V)
  - 20 digital outputs (24 V/0.5 A)
  - 4 analog inputs for resistance thermometer (e.g. PT 100)
- Control cabinet on request

Order options

The order options are used to adapt the comfort packages to the machine design. Refer to the explanations in the description of functions and the Selection and ordering data.

In addition to the options listed there, other adaptations to the hardware design can also be made, for example, by adding Drive and I/O Modules.

Supplementary components

Operator panel (HMI), motors, gear units, connection system, and switchgear are not included in the package. These components must be ordered separately.

Basic package SIMOTION Baggers & Wrappers

If Motor Modules with a different power rating are required for automating the tubular bag machine than are included in the comfort packages, the SIMOTION Baggers & Wrappers basic package can be used. The basic package also contains a SINAMICS rectifier infeed/regenerative feedback unit (Smart Line Module) and must be expanded with the required Motor Modules.

Difference to the comfort packages

- CompactFlash Card for SIMOTION D, runtime licenses and required individual SINAMICS S120 Motor Modules must be ordered separately.

Scope of delivery

The basic package contains:

- SITOP 24 V/20 A power supply
- SIMOTION D4x5 Control Unit
- SINAMICS S120 rectifier infeed/regenerative feedback unit with line reactor and line filter; SINAMICS Motor Modules must be ordered separately
- Distributed ET 200S I/O system (bit modular expendability) with
  - 20 digital inputs (24 V)
  - 20 digital outputs (24 V/0.5 A)
- Control cabinet on request

Supplementary components

Motors, gear units, connection system and switchgear are not included in the package. These components must be ordered separately.

Comfort packages and basic package

Overview (continued)

SIMOTION Baggers & Wrappers software library

In addition to the hardware packages, a SIMOTION Baggers & Wrappers software library is available. This library contains the following components:

- Function blocks for automating the machine functions of tubular bag machines
- SIMOTION application examples for the various machine types
  - intermittent, vertical tubular bag machine
  - continuous, vertical tubular bag machine
  - horizontal tubular bag machine
- Standard user interfaces
- Electronic manual on CD-ROM (German/English)

SIMOTION Baggers & Wrappers support package

For easy familiarization with SIMOTION Baggers & Wrappers, Siemens offers a support package for first commissioning. This package comprises the following freely selectable services:

- Hardware and software instructions
- Support with
  - creation and modification of software
  - expansion with customized machine functionality
  - commissioning of the machine

Please direct all enquiries to your local Siemens contact.

Benefits

The intense competition in packaging machine manufacture means that new applications must be created quickly and easily. Our response to this is: SIMOTION Baggers & Wrappers reduces the outlay for creating the basic functionality of the packaging machine. This gives you more time to create customer-specific functions.

Using SIMOTION Baggers & Wrappers has the following advantages:

- Significant reduction of the time required for program creation and commissioning
- Increased program reliability through standardized and comprehensively tested software modules
- Simple expansion with customer-specific software functions
- Reduced costs for the configuration and commissioning phase by more than 50 %
- No additional resources are required for electrical construction and modification of peripherals – when ordered mounted in a control cabinet

Application

Tubular bag machines form, fill and seal bags made of strips of packaging material which is pulled off a packaging material reel.

Tubular bag machines are categorized as intermittent (clocked) and continuous tubular bag machines according to the motion of the foil, and as machines with vertical or horizontal motion in accordance with the filling method of the tubular bags:

- Vertical tubular bag machines are used to package bulk solids, pasty solids and liquids in bags. Bag sizes vary from a few cubic centimeters up to several liters. The cycle time depends on the size of the package and its contents. Depending on the actual application, up to 200 bags per minute can be achieved.
- Horizontal tubular bag machines are used to package individual items. Depending on the application, cycle times of up to 1500 bags per minute can be achieved with the current state of the art (2007).

The following machine functions can be automated with the help of SIMOTION Baggers & Wrappers:

- Intermittent (clocked packaging material extraction) or continuous operation
- Use of synchronous servo motors, asynchronous motors or linear drives
- For operating mode management and data acquisition acc. to the OMAC Standard (OMAC = Open Modular Architecture Controls), see http://www.omac.org
- Coordination of the movements of the packaging material extractor, cross-sealer, dosing device or infeed unit
- No Product – No Bag
- No Gap – No Seal
- Optimization of the parallel movement of the aggregates to increase the cycle time
- Packaging material extractor with print-mark correction and/or slip compensation
- Pre-extractor with dancer control
- Web aligner
- Control of marking devices
  - by means of high-speed cam outputs
  - via PROFIBUS
- Different designs of cross-sealing tools, e.g.
  - rotating cross-sealers
  - coupled-motion cross-sealers (box motion)
- Lagging cross-sealer opposite to packaging material extractor (compress factor)
- Temperature control for continuously heated seal plates with autotuning function
- Connection of external impulse welding devices
- Interfacing to different dosing and counting devices, e.g.
  - multihead scale
  - auger filler
  - cup filler
- Automatic product feed unit with accumulating conveyors for horizontal tubular bag machines
- Recipe management
- Linking higher-level controllers on the management level (operating data, messages) in accordance with OMAC standard

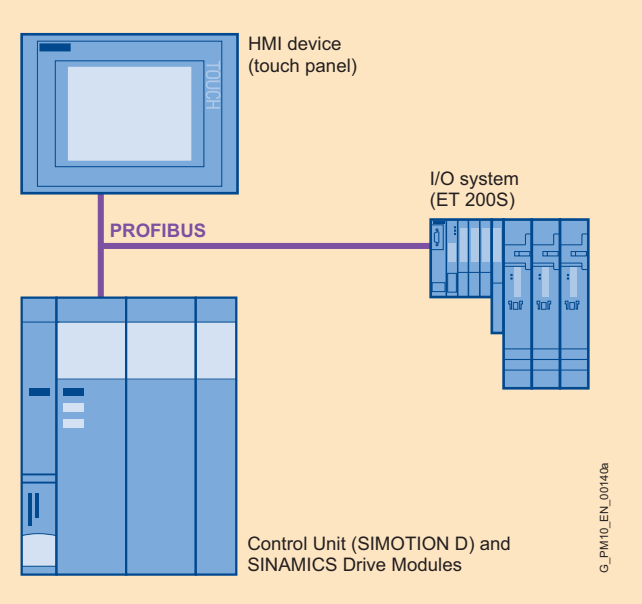
In addition, other aggregates can be integrated or created depending on the application, for example,

- Side gusset, block bottom, punching and zipping unit
- Edge sealing (Quattro Seal)
- Vacuum chamber
- Gassing units (MAP)
- Sidelay control
- Detection of trapped products in sealing seams

Design

Hardware structure

The SIMOTION Baggers & Wrappers comfort packages include all essential automation components such as open-loop control, drive modules and I/O system. The automation components communicate with each other over PROFIBUS or alternatively over PROFINET. The hardware is configured depending on the machine design.



Automation solution example for SIMOTION D

Software structure

Automating with pre-configured software modules

With the help of the SIMOTION Baggers & Wrappers open software library, all machine functions of tubular bag machines that are listed under "Function" can be automated. The software modules offer functionalities for the different aggregates of a tubular bag machine, for example, for cross-sealers, foil extractors, temperature control with self-adjustment.

The modular software concept makes it easier to automate different machine types. When different cross-sealing stations are used, the corresponding software module from the library is selected. In addition, the software modules can be expanded and adapted to individual machine requirements. Special know-how of the machine manufacturer can therefore be implemented.

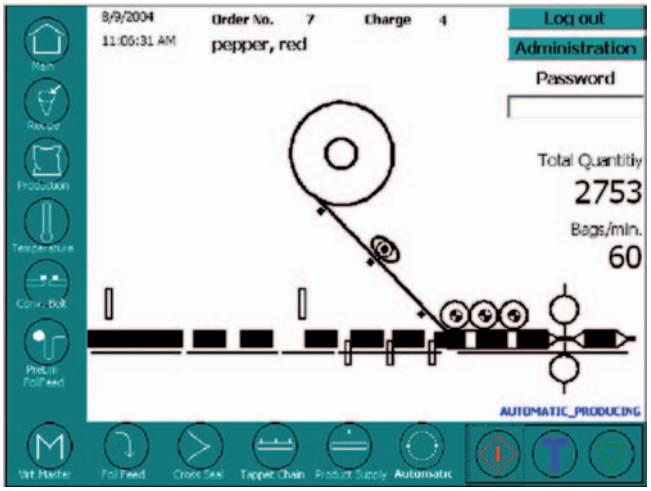
The operating modes of the machine are coordinated clearly in an OMAC PACK ML-compatible operating mode manager (OMAC = Open Modular Architecture Controls). The coordination of the continuous tubular bag machine aggregates can be checked visually with the "Jog in synchronous operation group" function.

Sample project as starting point

The Baggers & Wrappers software library contains a SIMOTION project example. This sample project can be the starting point for individual expansions and adaptations to actual machines. The modules of the software library can be changed and expanded by customer-specific functions with the help of the SCOUT engineering system.

Adaptable user interface

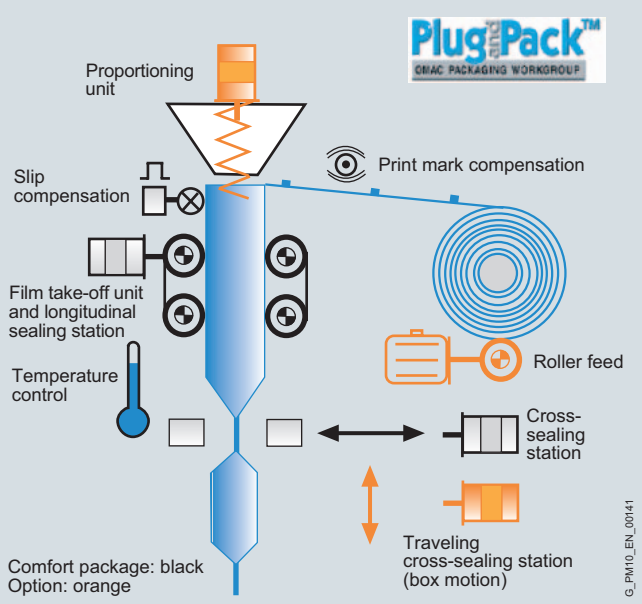
The SIMOTION Baggers & Wrappers software library also contains a standard configuration for the user interface. This configuration is usually optimized for 10" Touch Panels of the MP277 type and covers standard machine control tasks such as jogging drives, setting the temperature control or displaying diagnostic information. The user interface can be changed and adapted to the individual requirements of the machine manufacturer and to the panels used with the help of the SIMATIC WinCC flexible HMI software.



Comfort packages and basic package

Function

Description of function of vertical tubular bag machines



Vertical tubular bag machine

Note:
This functional description explains the functional relationships in a simplified manner. It serves to explain the ordering options for the comfort packages. The detailed description can be found in the function manual on the CD "Software Library SIMOTION Baggers & Wrappers".

For up-to-date information, visit
www.siemens.com/packaging

Film take-off unit

The film take-off unit pulls the film over the forming part. It consists of take-down rollers which are powered by a servo motor. The SINAMICS Motor Module required for film take-off is included in the comfort package.

Print-mark compensation/slip compensation

These functions are used to compensate the slip between the take-down rollers and film. The position of the film is determined with a print-mark sensor or measuring wheel with position encoder which runs on the film. Both software functions influence the film take-off unit and are contained in the comfort package.

Cross-sealing station

The cross-sealing station seals the film bag in the transverse direction. The cross-sealing station is powered by a servo motor.

The SINAMICS Motor Module required for the cross-sealing station is included in the comfort package.

Temperature control

The temperature control for 8 heating elements is included in the comfort package. The controller parameters are set with an autotuning function.

Traveling cross-sealing station option

In continuous machines the sealing jaws are moved with the film. In box motion systems this motion is achieved with a second servo motor. The SINAMICS Motor Module required for the traveling cross-sealing station is included in this option.

Pre-extractor option (Roller feed)

The pre-extractor supports film take-off with an asynchronous motor at the packaging material reel. The MICROMASTER frequency converter required for this purpose is included in this option.

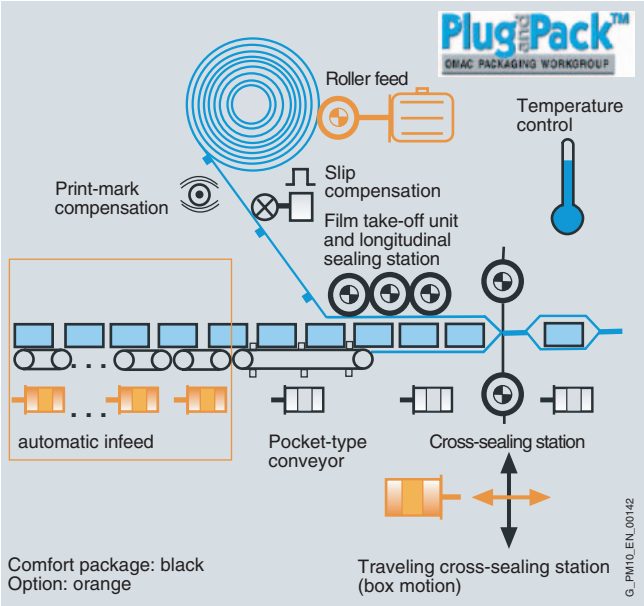
Proportioning unit option

The proportioning unit fills the product to be packaged into the tubular bag. The comfort package includes a controller for an external proportioning unit (e.g. multihead scale) which uses the handshake procedure.

An additional servo motor is required when using an auger filler or cup filling device. The required SINAMICS Motor Module is included in this option.

Function (continued)

Description of function of horizontal tubular bag machines



Horizontal tubular bag machine

Note:
This functional description explains the functional relationships in a simplified manner. It serves to explain the ordering options for the Comfort Packages. The detailed description can be found in the Function Manual on the CD "Software Library SIMOTION Baggers & Wrappers".

For up-to-date information, visit
www.siemens.com/paccaging

Film take-off unit

The film take-off unit guides the film over the forming shaft. It consists of take-down rollers which are powered by a servo motor.

The SINAMICS Motor Module required for film take-off is included in the comfort package.

Print-mark compensation/slip compensation

These functions are used to compensate the slip between the take-down rollers and film. The position of the film is determined with a print-mark sensor or measuring wheel with position encoder which runs on the film. Both software functions influence the film take-off unit and are contained in the comfort package.

Flighted chain (Pocket-type conveyor)

The flighted chain pushes the products into the foil bag and is powered by a servo motor. The SINAMICS Motor Module required is included in the comfort package.

Cross-sealing station

The cross-sealing station seals the film bag in the transverse direction. The rotating cross-sealer is powered by a servo motor.

The SINAMICS Motor Module required for the rotating cross-sealer is included in the comfort package.

Temperature control

The temperature control for 8 heating elements is included in the comfort package. The controller parameters are set with an autotuning function.

Traveling cross-sealing station

In box motion systems this coupled motion of the cross-sealer jaws is achieved with a second servo motor. The required SINAMICS Motor Module is included in this option.

Pre-extractor option (Roller feed)

The pre-extractor supports film take-off with an asynchronous motor at the packaging material reel. The MICROMASTER frequency converter required for this purpose is included in this option.

Automatic infeed option

When the tubular bag machine is coupled with an upstream automatic production plant, the products must be correctly spaced and positioned for the flighted chain. For this purpose, the products are aligned on 4 infeed belts and synchronized with the flighted chain. The infeed belts can be powered with servo or asynchronous motors. The required SINAMICS Motor Modules are included in this option.

For information about contact-free product infeed, visit
www.siemens.com/packaging

Comfort packages and basic package

Selection and ordering data

Ordering data for comfort packages for vertical tubular bag machines

Description	Order No.
SIMOTION Baggers & Wrappers	**6AU1650-0DA0 ■ -1 ■ A0**
For intermittent, vertical tubular bag machines	
Comfort package with	
• SITOP 24 V/20 A power supply	
• SIMOTION D425 with CompactFlash Card and licenses for intermittent vertical tubular bag machine	
• The SINAMICS S120 drive system with - SINAMICS 5 kW (6.71 HP) rectifier infeed/regenerative feedback unit (Smart Line Module) with line reactor and line filter - SINAMICS Double Motor Module with 5 A each for film take-off unit and cross-sealing station (for synchronous and asynchronous motors)	
• Distributed ET 200S I/O system (bit modular expendability)	
Proportioning unit	
• External	0
• Internal (additional 5 A motor module for synchronous or asynchronous motor)	1
Pre-extractor	
• Without	A
• With - Additional 0.37 kW (0.50 HP) MICROMASTER frequency converter - Communication Board PROFIBUS for MICROMASTER	E

Description	Order No.
SIMOTION Baggers & Wrappers	**6AU1650-0CA0 ■ -1 ■ ■ 0**
for continuous, vertical tubular bag machines	
Comfort package with	
• SITOP 24 V/20 A power supply	
• SIMOTION D435 with CompactFlash Card and licenses for continuous vertical tubular bag machine	
• The SINAMICS S120 drive system with - SINAMICS 5 kW (6.71 HP) rectifier infeed/regenerative feedback unit (Smart Line Module) with line reactor and line filter - SINAMICS Double Motor Module with 5 A each for film take-off unit and cross-sealing station (for synchronous and asynchronous motors)	
• Distributed ET 200S I/O system (bit modular expendability)	
Proportioning unit	
• External	0
• Internal (additional 5 A motor module for synchronous or asynchronous motors)	1
Pre-extractor	
• Without	A
• With - Additional 0.37 kW (0.50 HP) MICROMASTER frequency converter - Communication Board PROFIBUS for MICROMASTER	E
Cross-sealing station	
• Rotating	A
• Traveling cross-sealing station/box motion (additional 5 A Motor Module for synchronous or asynchronous motors)	D

Selection and ordering data (continued)

Ordering data for comfort packages for horizontal tubular bag machines

Description	Order No.
SIMOTION Baggers & Wrappers	**6AU1650-0LA0 ■-1■■0**
For horizontal standard tubular bag machines (up to 300 bags/min.)	
Comfort package with	
• SITOP 24 V/20 A power supply	
• SIMOTION D435 with CompactFlash Card and licenses for horizontal tubular bag machine	
• The SINAMICS S120 drive system with - SINAMICS 5 kW (6.71 HP) rectifier infeed/regenerative feedback unit (Smart Line Module) with line reactor and line filter - SINAMICS Double Motor Module with 5 A each for film take-off unit, flighted chain and cross-sealing station (for synchronous or asynchronous motors)	
• Distributed ET 200S I/O system (bit modular expendability) with - Additional 0.37 kW (0.50 HP) MICROMASTER frequency converter - Communication Board PROFIBUS for MICROMASTER	
Automatic infeed	
• None	0
• 4 buffer conveyors [1]	1
Pre-extractor	
• Without	A
• With Additional 0.37 kW (0.50 HP) frequency converter	E
Cross-sealing station	
• Rotating	A
• Traveling cross-sealing station/ box motion (additional 5 A Motor Module for synchronous or asynchronous motor)	D

Description	Order No.
SIMOTION Baggers & Wrappers	**6AU1650-0HA0 ■-1■■0**
For horizontal tubular bag machines High Speed (from 300 bags/min.)	
Comfort package with	
• SITOP 24 V/20 A power supply	
• SIMOTION D445 with CompactFlash Card and licenses for horizontal tubular bag machine	
• The SINAMICS S120 drive system with - SINAMICS 5 kW (6.71 HP) rectifier infeed/regenerative feedback unit (Smart Line Module) with line reactor and line filter - SINAMICS Double Motor Module with 5 A each for film take-off unit, flighted chain and cross-sealing station (for synchronous or asynchronous motors)	
• Distributed ET 200S I/O system (bit modular expendability) with - Additional 0.37 kW (0.50 HP) MICROMASTER frequency converter - Communication Board PROFIBUS for MICROMASTER	
Automatic infeed	
• None	0
• 4 buffer conveyors [1]	1
Pre-extractor	
• Without	A
• With Additional 0.37 kW (0.50 HP) frequency converter	E
Cross-Sealing station	
• Rotating	A
• Traveling cross-sealing station/ box motion (additional 5 A Motor Module for synchronous or asynchronous motors)	D

[1] Also included: SINAMICS CU320 Control Unit with CompactFlash Card and performance expansion 1 as well as SINAMICS 10 kW (13.4 HP) rectifier infeed/regenerative feedback unit (Smart Line Module) and Motor Modules, 5 A each for 4 synchronous or asynchronous motors.

Comfort packages and basic package

Selection and ordering data (continued)

Ordering data for basic package and software library

Description	Order No.
SIMOTION Baggers & Wrappers basic package	**6AU1650-0A■■0-0AA0**
Basic package with	
• SITOP 24 V/20 A power supply	
• SIMOTION D4x5 Control Unit	
• Distributed ET 200S I/O system (bit modular expendability)	
Ordering options for basic package	
Control Unit	
• SIMOTION D425	**B**
• SIMOTION D435	**A**
Rectifier infeed/regenerative feedback unit (Smart Line Module)	
• SINAMICS 5 kW (6.71 HP) rectifier infeed/regenerative feedback unit	**0**
• SINAMICS 10 kW (13.4 HP) rectifier infeed/regenerative feedback unit	**1**
CompactFlash Cards	
The CompactFlash Cards required to operate the SIMOTION D control contain the drive software and SIMOTION Kernel. The CompactFlash Cards and required runtime licenses are already contained in the comfort packages. With the basic packages, the CompactFlash Cards have to be ordered extra together with the required runtime licenses.	
Refer to "SIMOTION Software" in the section "SIMOTION" in the catalog..	

Description	Order No.
SIMOTION Baggers & Wrappers software library	**6AU1836-5AA11-0XA8**
Software library and configuring example	
SIMOTION Baggers & Wrappers mounted in control cabinet ready for switch on	**On request**
acc. to customer specification for batches of 5 items or more	
SIMOTION Baggers & Wrappers support package	**On request**
Hardware and software instructions	
Support with	
• creating and modifying software	
• expansion with customized machine functions	
• commissioning of the machine	

More information

Supplementary components

Further information on selection and ordering of supplementary components can be found in the following catalogs:

- Touch Panels: Catalog ST 80 (SIMATIC HMI: HMI systems)
- For SINAMICS and motors, see the sections "SINAMICS S120", "Synchronous motors" and "Asynchronous motors"
- Distributed I/O, PROFIBUS: Catalog IK PI (Industrial Communication)
- Control cabinet components, for SINAMICS and other systems: See the section "SINAMICS S120" or Catalog LV 10

SIMOTION Baggers & Wrappers – completely assembled

The SIMOTION Baggers & Wrappers components in batches of 5 items upwards can also be ordered mounted in the control cabinet and wired up. Please direct all enquiries to your local Siemens contact.

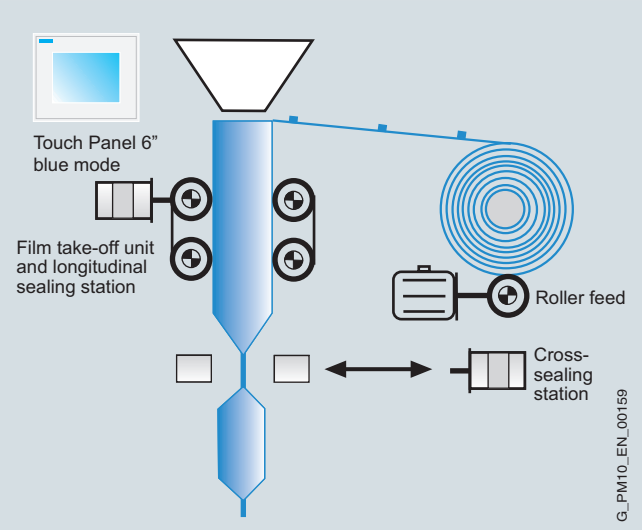
Advice and support

A&D Technical Support will be pleased to help you adapt SIMOTION Baggers & Wrappers to your packaging machine. Please contact:

A&D Technical Support
Phone: +49 (180) 50 50 222
E-mail: packaging.aud@siemens.com
Internet: www.siemens.com/packaging

Ordering example for comfort package

Overview



Vertical intermittent tubular bag machine

The vertical, intermittent tubular bag machine in this example features a pre-extractor in addition to a film take-off unit and jaw drive.

5 A power sections are adequate for the drive tasks. Consequently, the comfort package **SIMOTION Baggers & Wrappers** can be used for automation of the machine.

The options selected for the comfort package are:

- External proportioning unit (no further components included for it)
- With pre-extractor (additional 0.37 kW (0.50 HP) MICROMASTER frequency converter and Communication Board PROFIBUS for MICROMASTER included)

Selection and ordering data

Description	Order No.
SIMOTION Baggers & Wrappers comfort package	**6AU1650-0DA00-1EA0**
for intermittent, vertical tubular bag machines	
The package contains	
• SIMOTION Multi Axes Bundle D425 (6AU1425-0AA00-0CA0), consisting of 1 unit each	
- SIMOTION D425 (6AU1425-0AA00-0AA0)	
- CompactFlash Card 512 MB with Multi Axes Package license for D425 platform	
• TCONTROL runtime license for temperature control (6AU1820-2AA20-0AB0)	
• Filter package for 5 kW (6.71 HP) Smart Line Module (6SL3000-0GE15-0AA0)	
• Smart Line Module 5 kW (6.71 HP), 400 V (6SL3130-6AE15-0AA0)	
• Double Motor Module, 5 A (6SL3120-2TE15-0AA0)	
• SITOP power supply, 24 V/20 A (6EP1436-3BA00)	

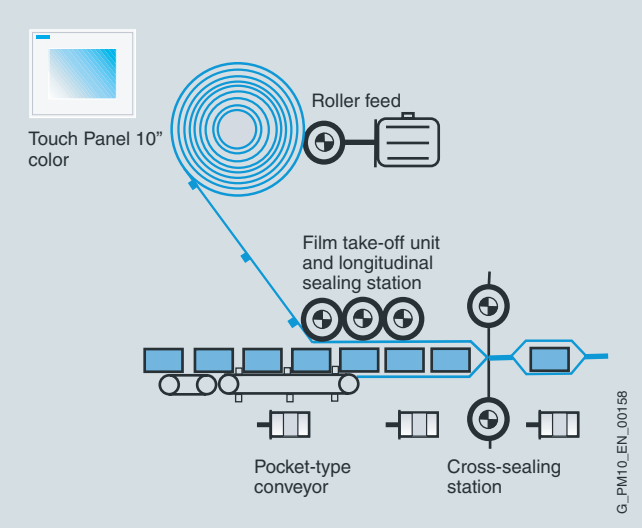
Selection and ordering data (continued)

Description (continued)	Order No.
• ET 200S Interface Module (6ES7151-1AA04-0AB0)	
• ET 200S Terminal Module (6ES7193-4CC20-0AA0)	
• ET 200S Power Module (6ES7138-4CA01-0AA0)	
• 3 x 5 ET 200S universal terminal module (6ES7193-4CA40-0AA0)	
• 5 x 4 ET 200S digital inputs (6ES7131-4BD01-0AA0)	
• 5 x 4 ET 200S digital outputs (6ES7132-4BD01-0AA0)	
• 2 PT 100 ET 200S analog inputs (6ES7134-4JB50-0AB0)	
External proportioning unit option	No further components included for it
Pre-extractor option	
• MICROMASTER 420 frequency converter, 0.37 kW (0.50 HP), 230 V, with line filter (6SE6420-2AB13-7AA1)	
• Communication Board PROFIBUS for MICROMASTER 4 (6SE6400-1PB00-0AA0)	

In addition, the following components must be ordered:

Description	Order No.
Operating unit, touch panel	
• SIMATIC Touch Panel TP177B DP blue mode	**6AV6642-0BC01-1AX0**
Motor for film take-off unit	
• Servo motor 3 Nm, 3000 rpm, resolver with DRIVE-CLiQ interface, LP90 alpha gearbox, i = 10	**1FK7042-5AF71-1UG0 –Z V42**
• Power cable, 5 m (16.41 ft)	**6FX5002-5CS01-1AF0**
• DRIVE-CLiQ signal line, 5 m (16.41 ft) (IP20/IP67)	**6FX5002-2DC10-1AF0**
Motor for cross-sealing station	
• Servo motor 6 Nm, 3000 rpm, resolver with DRIVE-CLiQ interface, LP120 alpha gearbox, i = 10	**1FK7060-5AF71-1UG0 –Z V42**
• Power cable, 5 m (16.41 ft)	**6FX5002-5CS01-1AF0**
• DRIVE-CLiQ signal line, 5 m (16.41 ft) (IP20/IP67)	**6FX5002-2DC10-1AF0**
SIMOTION Baggers & Wrappers software library	
(required only once)	
• SIMOTION Baggers & Wrappers software library	**6AU1836-5AA11-0XA8**

Overview



Horizontal tubular bag machine

The horizontal tubular bag machines in this example require higher-rated power sections than those included in the **SIMOTION Baggers & Wrappers** comfort packages.
The **SIMOTION Baggers & Wrappers** basic package is used for automation. Power sections and licenses must be ordered separately (see additional components).

The motors are designed for mounting on servo gear units.

Selection and ordering data

Description	Order No.
SIMOTION Baggers & Wrappers basic package	**6AU1650-0AA10-0AA0**
With SIMOTION D435 and 10 kW (13.4 HP) Smart Line Module, for horizontal tubular bag machines	
The package contains	
• D435 Control Unit (6AU1435-0AA00-0AA1)	
• Filter package for 10 kW (13.4 HP) Smart Line Module (6SL3000-0GE21-0AA0)	
• Smart Line Module, 10 kW (13.4 HP), 400 V (6SL3130-6AE21-0AA0)	
• SITOP power supply, 24 V/20 A (6EP1436-3BA00)	
• ET 200S Interface Module (6ES7151-1AA04-0AB0)	
• ET 200S Terminal Module (6ES7193-4CC20-0AA0)	
• ET 200S Power Module (6ES7138-4CA01-0AA0)	
• 10 x ET 200S universal terminal module (6ES7193-4CA40-0AA0)	
• 5 x 4 ET 200S digital inputs (6ES7131-4BD01-0AA0)	
• 5 x 4 ET 200S digital outputs (6ES7132-4BD01-0AA0)	

Ordering example for basic package

In addition, the following components must be ordered

Description	Order No.
• SIMATIC Multi Panel MP277 10" color	**6AV6643-0CD01-1AX0**
• ET 200S universal terminal module [1]	**6ES7193-4CA40-0AA0**
• 2 analog inputs PT 100 ET 200S (1 unit)	**6ES7134-4JB50-0AB0**
• Double Motor Module 18 A (film take-off unit, cross-sealing station)	**6SL3120-2TE21-8AA0**
• Double Motor Module 5 A (finger chain conveyor, pre-extractor)	**6SL3120-2TE15-0AA0**
SIMOTION CompactFlash Card with pre-installed licenses	
• CompactFlash Card 512 MB for SIMOTION D4x5 with: - 1 TControl runtime license - 2 GEAR runtime licenses (finger chain conveyor, film take-off unit) - 1 CAM runtime license (cross-sealing station)	**6AU1400-2NA00-0AA0 –Z T01 G02 C01**
Motor for finger chain conveyor	
• Servo motor 6 Nm, 3000 rpm, resolver with DRIVE-CLiQ interface	**1FK7060-5AF71-1UG0**
• Power cable, 10 m (32.81 ft)	**6FX5002-5CS01-1BA0**
• DRIVE-CLiQ signal cable, 10 m (32.81 ft) (IP20/IP67)	**6FX5002-2DC10-1BA0**
Motor for pre-extractor	
• Servo motor 6 Nm, 3000 rpm, resolver with DRIVE-CLiQ interface	**1FK7060-5AF71-1UG0**
• Power cable, 10 m (32.81 ft)	**6FX5002-5CS01-1BA0**
• DRIVE-CLiQ signal cable, 10 m (32.81 ft) (IP20/IP67)	**6FX5002-2DC10-1BA0**
Motor for film take-off and longitudinal sealer	
• Servo motor 11 Nm, 3000 rpm, resolver with DRIVE-CLiQ interface	**1FK7063-5AF71-1UG0**
• Power cable, 10 m (32.81 ft)	**6FX5002-5CS01-1BA0**
• DRIVE-CLiQ signal cable, 10 m (32.81 ft) (IP20/IP67)	**6FX5002-2DC10-1BA0**
Motor for cross-sealing station	
• High Dynamic servo motor 12 Nm, 3000 rpm, resolver with DRIVE-CLiQ interface, holding brake	**1FK7064-5AF71-1UH0**
• Power cable, 10 m (32.81 ft), with brake cores	**6FX5002-5DS01-1BA0**
• DRIVE-CLiQ signal cable, 10 m (32.81 ft) (IP20/IP67)	**6FX5002-2DC10-1BA0**
SIMOTION Baggers & Wrappers software library	
(required only once)	
• SIMOTION Baggers & Wrappers software library	**6AU1836-5AA11-0XA8**

[1] The supply quantity is 5 items

Electric injection molding machine

Overview

Machine requirements

Electric injection molding machines require high-speed, finely tuned closed-loop control of the velocities, positions, and pressures of all machine axes involved in the process. Moreover, the temperatures of the heating strips on the cylinder, the injection screw on the injection nozzle, and the mold temperature must all be precisely controlled.

The typical process sequence of an injection molding machine is as follows:

- Mold closure:
  The mold is closed, and the clamping pressure builds up. This enables the mold to remain closed while the liquified plastic is being injected. During this process, the mold protection function continually monitors the clamping pressure, thus preventing the mold from being damaged during closure in the event that material remains in the mold.
- Injection unit forward:
  For injection to take place, the injection nozzle must be seated in the mold. In this step of the process, the nozzle is seated in the mold at a defined nozzle contact pressure.
- Injection:
  The plasticated material located in the tab of the injection screw is injected at high pressure into the mold until the mold is filled. The material is injected using velocity profiles that are adjusted for the mold.
- Hold:
  To compensate for material loss during the cooling phase, pressure is reapplied. This hold-pressure phase requires closed-loop pressure control.
- Decompression:
  To discharge the melted material, the screw can be retracted before and after recovery.
- Injection unit retracted:
  To prevent cooled molds from affecting the temperature of the heated injection cylinder, the entire injection unit is retracted, thus removing the heated nozzle from the mold.
- Mold open:
  When the cooling period is complete, the mold is reopened. The mold contains the finished, cooled part.
- Ejector:
  The produced part is ejected from the mold, falls from the machine or is removed by the gripper of a retrieving device, and is then fed to additional production steps (such as imprinting).
- Recovery
  The granulate is melted (plasticated) by the rotation (shear warmth) and heating of the screw. The plasticated material is transported to the retention chamber by the rotation and simultaneous retraction (performed using pressure control, for example) of the screw.

Benefits

The SIMOTION automation solution described below offers you the following advantages:

- Cost savings thanks to the scalability of the SIMOTION system, which enables precise customization to the performance requirements
- Easy engineering thanks to well-structured software with wide-ranging options for access by the machine manufacturer
- Flexible expansion for injection molding cells with retrieving devices using the application solution "Retrieving device for injection molding machines"
- Simple commissioning of the machines due to powerful engineering tools
- No need for belts and gearing, and increased dynamic response when using torque motors instead of standard servo motors

More information

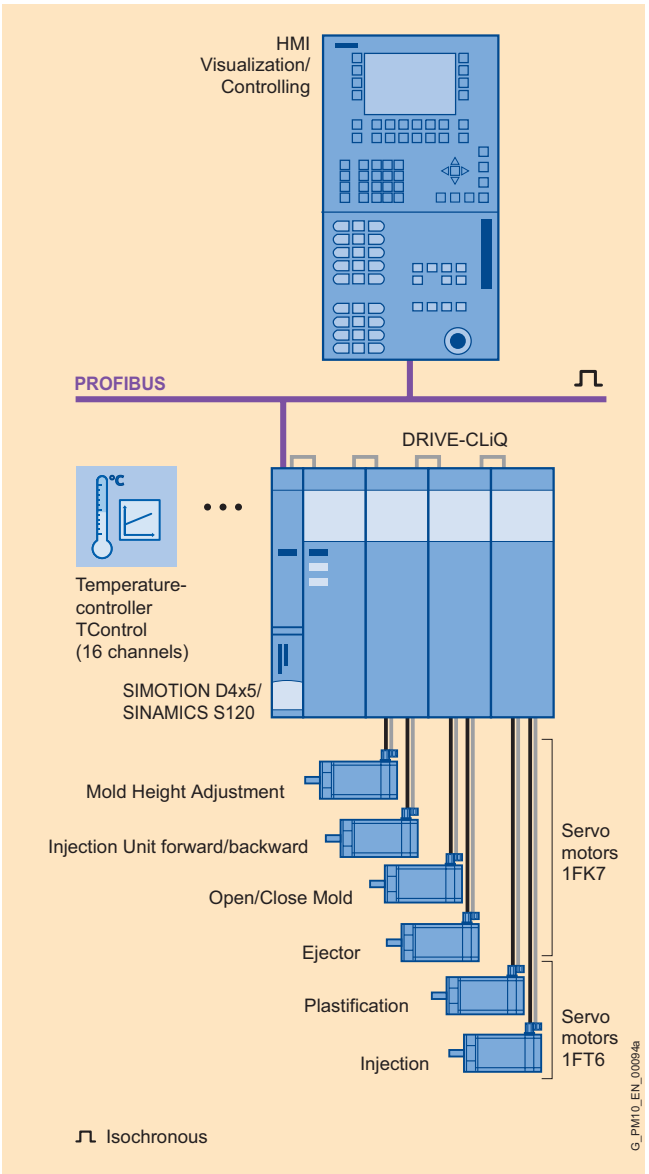
A&D Technical Support
Phone: +49 (180) 50 50 222
Internet: www.siemens.com/plastics

Design

Automation solution

The SIMOTION Motion Control System offers, in combination with the SINAMICS S120 drive system and our highly dynamic motors (e.g. the 1FT series), sophisticated complete solutions for electrically driven injection molding machines.

The motor range offered can implement forces in full stroke position of over 8000 kN. Torque motors allow axes with high torques to be directly driven at a low speed, so no mechanical translation by means of belts or gears is required. In combination with the SIGUARD 3TK safety relay, protection against restarting of axes after emergency stop can be cost-effectively implemented in accordance with EN 954-1 Category 3. Corresponding test certificates are available.



Automation solution example for SIMOTION D4x5

Application IMe (Injection Molding Electric) for SIMOTION

- **Supports** the complete machine control
- **Comprises** all the technology functions for controlling a fully-electronic injection molding machine with 6 axes: dosing, decompression, injection, injection unit, mold, ejector and mold height adjustment.
- **Implements**
  - motion control (closed-loop control of position, speed and pressure) of all machine axes as well as
  - temperature control
- **Executes** on
  - Drive-based (SIMOTION D) controls in combination with SINAMICS S120
  - PC-based (SIMOTION P)
  - Controller-based (SIMOTION C) controls in combination with SIMATIC Panels
  - A special machine control panel can be connected over PROFIBUS, if required
- **The application** is supplied with the complete documentation (German and English).
- **Prerequisite** for using the application IMe for SIMOTION is the software license "Injection molding". This license supports operation of 6 electrical axes and 16 temperature channels.

Machine control

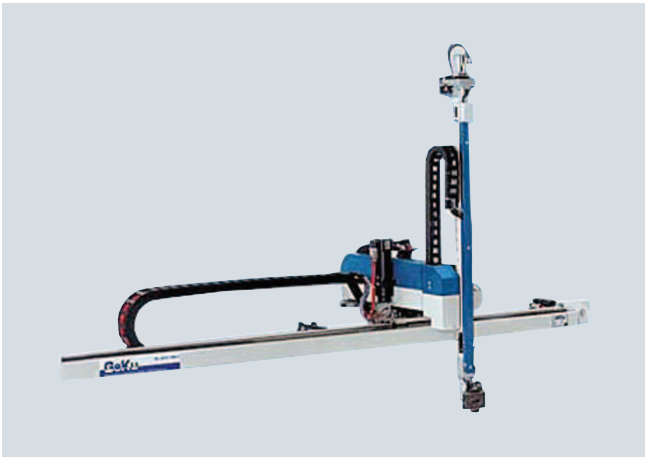
- Structured Text (ST) programming language according to the IEC 61131-3 standard
- Support for different mechanical construction types (e.g. dual-plate locking system or toggle lever locking unit, nozzle unit pressure through motor torque or locked through a motor brake)
- Predefined sequence using the operating modes automatic, semi-automatic, manual for setting up the machine, dry cycle (dry running of the locking unit) or jog mode for single axes
- Freely definable speed profile "Velocity over distance" with optional jerk limitation for smooth traversing of axes during all positioning movements
- Freely definable pressure profile "Pressure over distance" or "Pressure over time"
- Pressure control during the dwell pressure phase
- Mold protection function either via pressure sensor or motor torque
- Kinematics of the toggle lever can be adapted by means of electronic cams or formulas
- Logging (trace) of all important process values (up-to-date speed and pressure curves) for the mold also during dosing and injection

Temperature control

- 16 temperature channels (expandable)
- Self tuning of closed-loop controllers on heating up with self tuning of all controllers in parallel
- Switching of the strip-type heaters with digital, pulse length modulated actuating signal with adjustable minimum on-time
- Operation of heating sections, cooling sections or combined heating and cooling sections
- Operating modes (operating setpoint closed-loop control, reduced setpoint closed-loop control, metering mode, self tuning, etc.)
- Starting function, e.g. for defined drying of hot channels
- Plausibility check and filtering of actual values
- Parameterizable PID or DPID controller with high dynamic response and control quality

Retrieving device for injection molding machines

Overview



Machine requirements

Use of retrieving devices for injection molding machines support the completely automated, operator-free production of plastic parts, as retrieving devices remove the plastic part directly from the injection molding machine and feed it to subsequent production stages. In these subsequent processes, the plastic part may be labeled, partially assembled or welded to other parts, for example. Retrieving devices for injection molding machines are usually implemented as linear robots with three Cartesian axes. The shape and function of the grippers are adapted to the part to be removed.

Requirements

- Scalable system for standard and special machines (e.g. subsequent processes)
- Simple, intuitive interface
- The machine is commissioned via user interfaces
- Different password levels can be freely configured (basic/advanced/manufacturer)
- Up to 800 DI + 800 DO provided as standard
- Camera systems and analog I/O can be connected
- Simple sequential programming → "Traversing blocks"
- Teach-in functionality
- Up to 18 axes can be configured
- Multilingual user interface (English, German, French, Italian, Czech are included as standard)
- Hand-held terminal for machine operation
- File management → Portable sequential program
- EUROMAP 12 and 67

More information

A&D Technical Support
Phone: +49 (180) 50 50 222
Internet: www.siemens.com/plastics

Benefits

The automation solution with SIMOTION described below offers you the following advantages:

- Cost savings thanks to the scalability of the SIMOTION system that allows it to be precisely matched to the performance requirements
- Easy adaptation to special machine requirements thanks to the open software structure
- Prepared operator screens for the series commissioning of machines
- Easy commissioning of the drives due to powerful engineering tools
- Shortest possible cycle times thanks to the ability to use linear motors for high-performance applications

Design

Automation solution

The SIMOTION Motion Control System offers, in combination with the SINAMICS S120 drive system and the 1FK7/1FT7 motors optimized for a highly dynamic response, powerful complete solutions for unloading units. For vertical axes, the motors can be fitted with integral holding brakes. All the functions necessary for controlling the holding brakes are included in the drive system. Linear motors are available for maximum performance requirements. Safety-related functions such as reliable protection against restarting or safely reduced velocity are available in the SINAMICS S120 drive system. Portable handheld units (e.g. Mobile Panel 277) can be connected, if required.

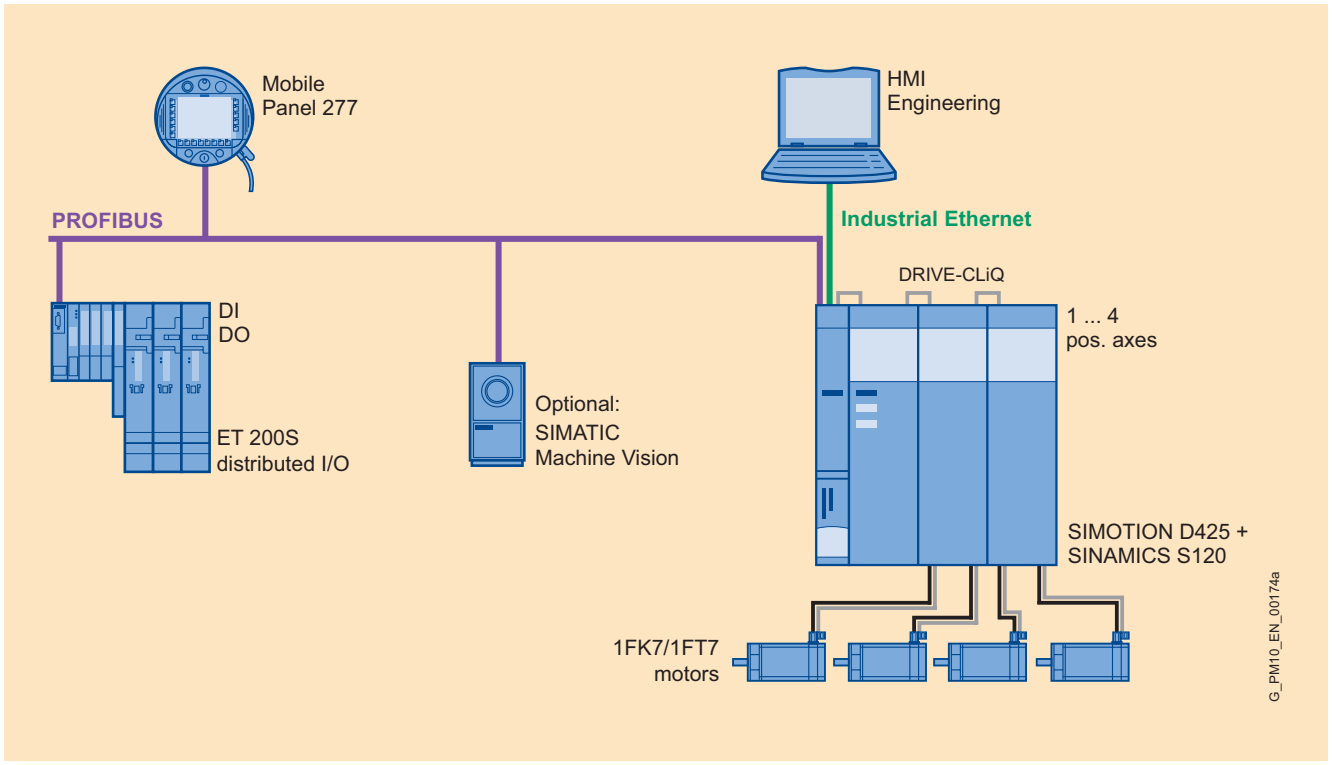
Application IMt (Injection Molding Unloading Take Out Systems) for SIMOTION

- **Used for** machine control for standard retrieving devices (up to 4 axes) as well as special machines (up to 18 axes).
- **Contains** prepared user interfaces for operation, programming and commissioning of the machines tailored to the requirements of the plastics industry.
- **Executes** on
  - Drive-based (SIMOTION D) controls in combination with SINAMICS S120
  - PC-based (SIMOTION P) controls in combination with SINAMICS S120
  - Various SIMATIC Panels are available for visualization

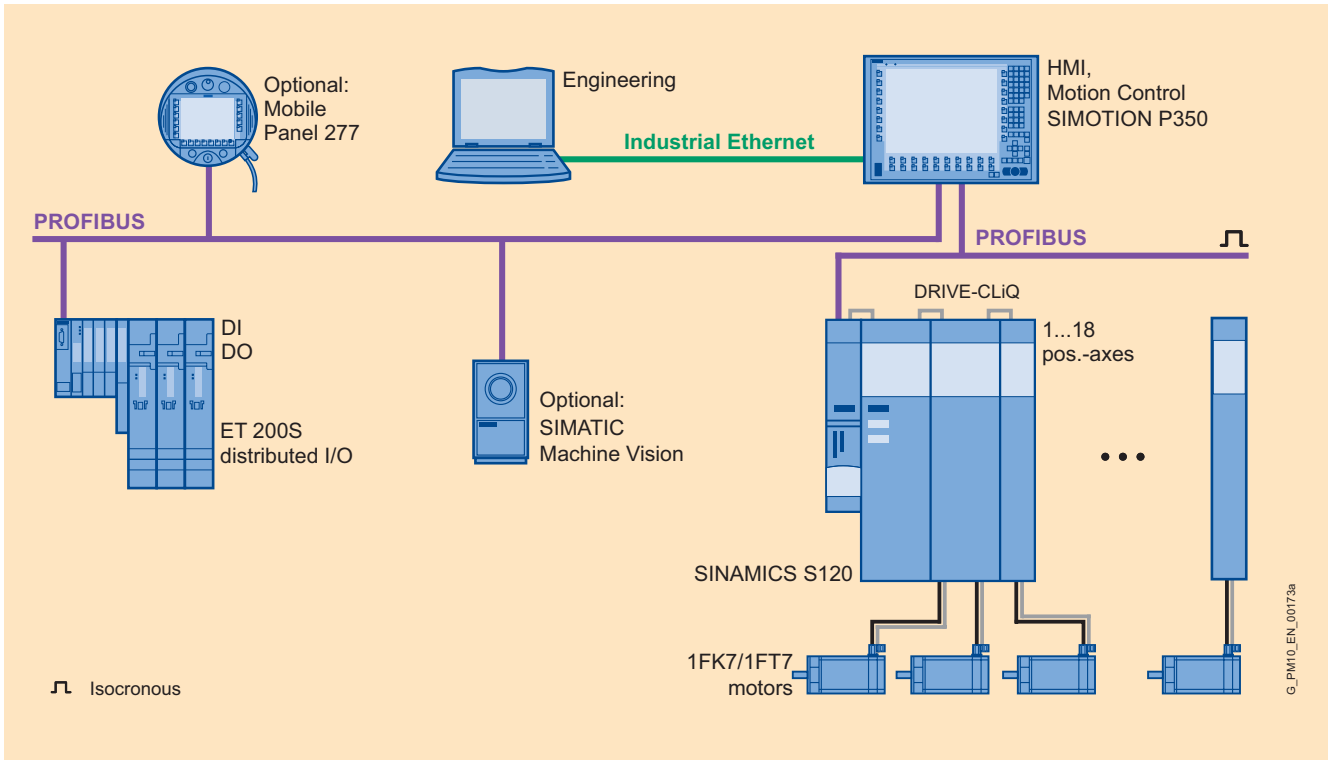
Software functions

- Operating screens created with ProTool/Pro / WinCC flexible; screens that can be expanded by the user
- Operating modes:
  - The machine is commissioned via HMI screens
  - Manual mode (JOG mode) fast/slow forwards/backwards
  - ± 0.1 mm (0.0004 in) positioning from the handheld unit
  - Position approach (position, speed)
  - Override, teach-in
  - Reference point approach
  - Traversing block editor
  - Automatic mode (restart, stop, continue)
  - Single-step
- Reduced speeds in set-up mode, with emergency stop button in handheld terminal
- Safety functions integrated into the drive

Design (continued)



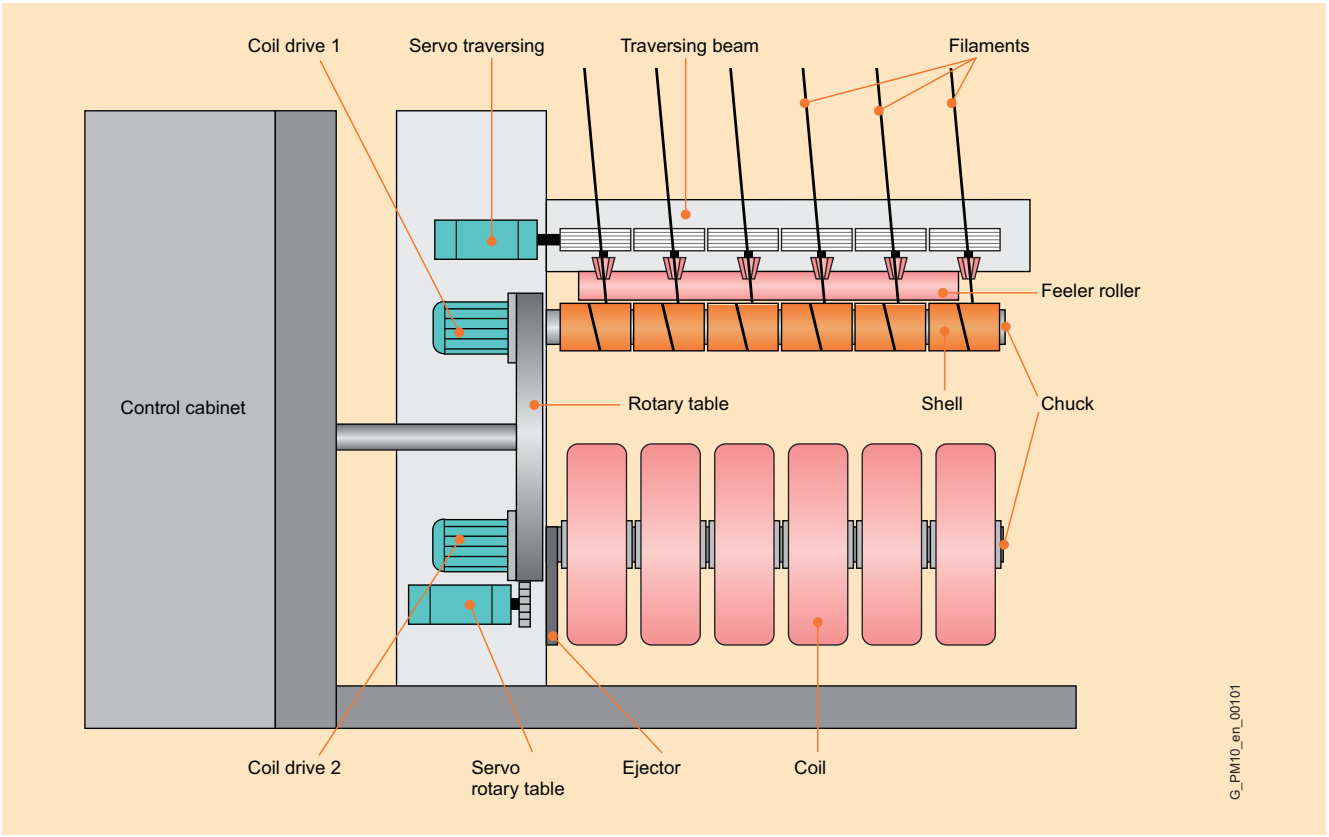
Machine configuration 3 (+1) axes



Machine configuration for special machine

Filament winder

Overview



Principle of a filament winder

Machine requirement

In a chemical fiber spinning plant, the winder represents the last step in the process.

In modern synthetic fiber spinning plants, spinning speeds can reach up to 8000 m/min. This means, that the winder draws off and spools between 2 to 12 filament chains at this velocity. The finished spools are then changed on-the-fly to ensure a continuous spinning process.

A spool weighs up to 35 kg and can hold several million meters of filament. There are different requirements for the structure of the coil due to the different technological values of the various filaments, as well as the subsequent processes. The type of coil structure determines the draw-off behavior of the filament from the coil and the ability to further process the filament in subsequent processes.

Filament winders today are usually center winders (in the past perimeter winders were used), i.e. the spool carriers are directly driven. A synchronous motor creates the overlaid changing movement.

The single drives for winding cylinders and traversing ensure the maximum possible degree of freedom for the interaction of the units and for the coil structure.

The peripheral speed of the coils is taken from the feeler roller and reported to the calculator for diameter. The increase in diameter of the coils is compensated by the rotation of the rotary table.

When the coils are changed on the fly, the mandrel is accelerated with the empty reels to spin speed, the full coils swivel from the feeler roller, the filaments are cut and caught by the new reels. If the new (empty) coils butt against the feeler roller, the change is completed.

Essential requirements for the automation and drive system:

- During the production process, defective winders must be replaced very quickly, which requires a modular automation and drive concept for spinning plants.
- The new winders must be automatically addressed and parameterized.

Benefits

The SIMOTION automation solution with described below offers you the following advantages:

- One system for vector/servo drives, logic and technology instead of three
- Transparency due to comprehensive diagnostic tools and dialog control via SIMOTION SCOUT
- Maximum flexibility thanks to the open programmability of the winding modes
- High flexibility and short resetting times when changing products
- Reproducibility of lots due to recipe memory (compensation value tables)

Design

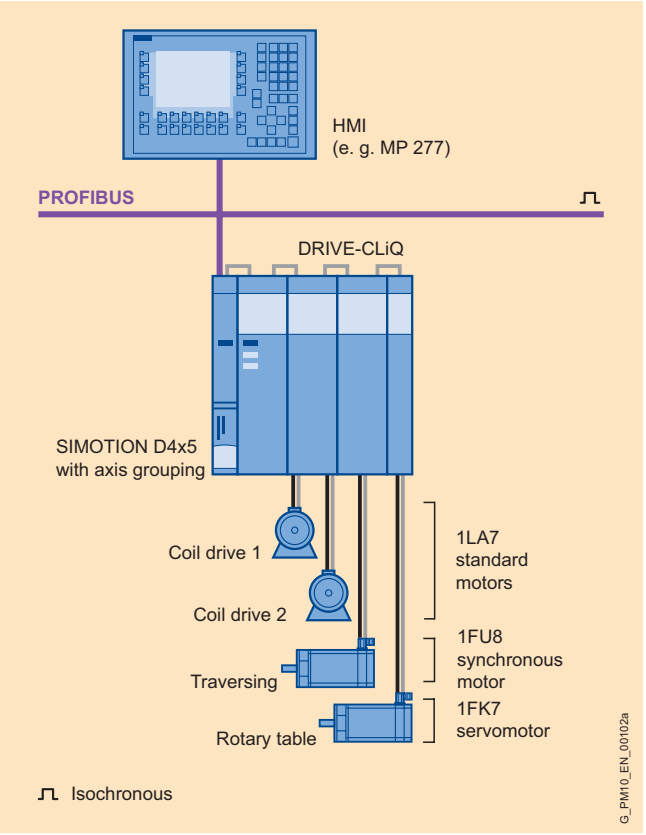
Automation solution

The drive-based Motion Control variant SIMOTION D is used with a 4-axis closed-loop control. Control, motion control, technology and drive functions are combined in a hardware and software solution.

Technological functions for calculating the changier procedure, wobble generator and coil diameter, as well as motion control functions such as positioning of the rotary table and the procedural control (setpoint cascade, logic PLC) are covered with SIMOTION D. The central operation of several winders can be implemented, for example, with the MP 277 as an option. All implementations of filament winders can be covered.

Further features of the automation solution:

- Selectable winding mode (wild, ribbon-free random winding, precision and stepped precision winding)
- Coupling the drive via the DRIVE-CLiQ system interface
- Scalable and open software menus for integrating software parameters



Automation solution example for SIMOTION D4x5

More information

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Phone: +49 (180) 50 50 222
Internet: www.siemens.com/textiles

Fleece folding machine

Overview

Machine requirements

The fleece folding or cross folding machine is arranged in a nonwoven textile machine between the carding machine and the needle felting machine. The web arriving from the carding machine rarely has the weight per unit area required for the application. The cross folding machine therefore lays the number of web layers on top of each other that are required for the application.

The task to be resolved is to intermittently layer the web that is fed in at constant speed while achieving a constant weight per unit area. The material is transported to the actual laying position between the feeding conveyor and covering conveyor. Two traversing carriages layer the web in zigzag form on a conveyor belt that is arranged perpendicular to the machine axis.

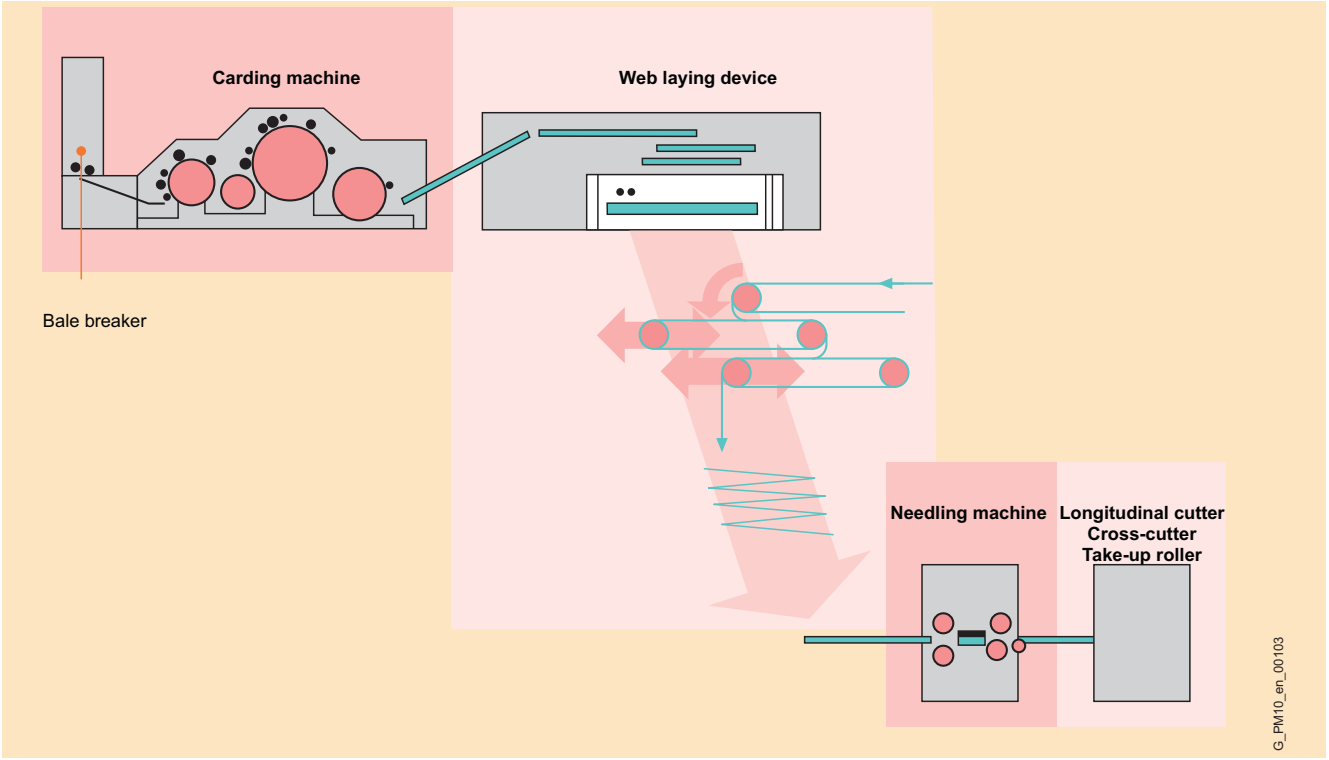
The motion of the lower carriage determines the width of the product and the upper carriage acts as a material buffer that compensates for the difference in velocity between the feeding conveyor and layering carriage.

The motion relationship between the two carriages is also influenced by process parameters, such as the web delay at the edges, also referred to as profiling. The highly dynamic reversing movements of the carriages are implemented with servo motors without additional gearing.

The required number of layers in the material cross-section and therefore the fleece strength (measured in g/m^2) is determined by the velocity ratio between the infeed and output.

The machine has the following automation requirements:

- High dynamic response
  in the reversing motion for exact web edges
- Flexible traversing profiles
  for different material requirements
- Draft-free layering of the fibrous web
  at high velocity



Principle of the fleece folding machine

Benefits

The SIMOTION automation solution described below offers you the following advantages:

- Memory space is saved due to cam disk calculation in real time
- Faster and more convenient set-up due to flexible parameters adjustment
- Scalable and open software menus for linking software parameters
- High flexibility and short resetting times when changing products
- Reproducibility of lots due to recipe memory
- Higher degree of user-friendliness due to graphics-based programming
- Transparency due to comprehensive diagnostic tools and dialog control via SIMOTION SCOUT
- All machines that are involved in the process, e.g. carding machines and needle looms, can be easily automated using SIMOTION and SIMATIC S7 programmable logic controllers and networked to form a line.
- The machine data that are relevant to the process are available on a SIMATIC Panel MP 277 with WinCC/ProTool/Pro and can be supplied to an operating data management system through an OPC interface (Industrial Ethernet).

Design

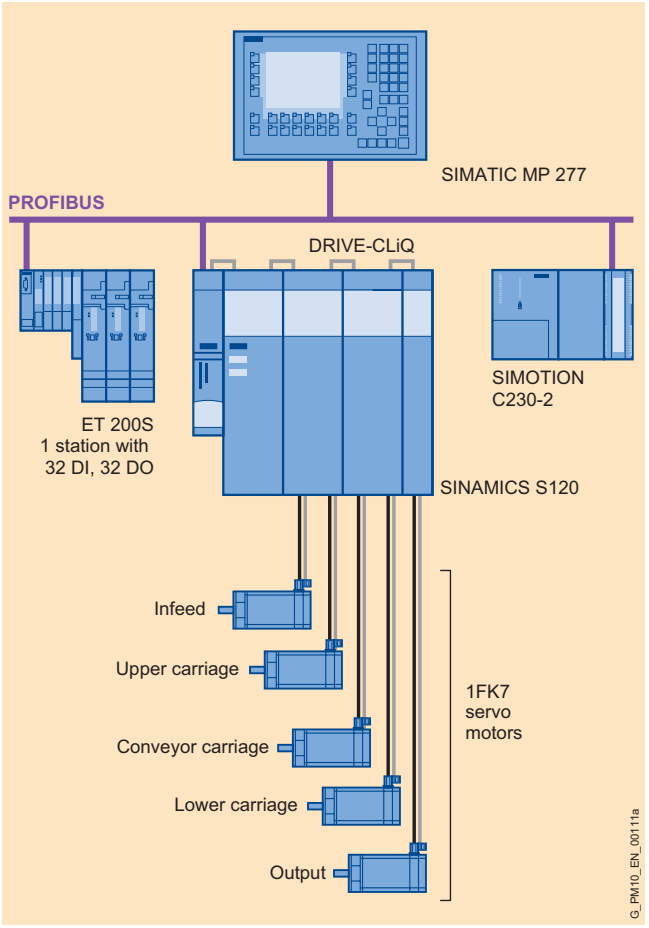
Automation solution

The SINAMICS S120 drive system is used in combination with the 1FK7 High Dynamic servo motors.

To ensure short cycle times, the SIMOTION C230-2 Motion Control System is used.

Features of the automation solution:

- Calculation of the traversing curve profiles of the laying trolleys and adaptation of the curve profile in real time
- Transfer of data to the drives over the isochronous PROFIBUS



Automation solution based on the example of SIMOTION C230-2 and SINAMICS S120

More information

A&D Technical Support
Phone: +49 (180) 50 50 222
Internet: www.siemens.com/textiles

Weaving machine

Overview

Machine requirements

Weaving is the most widely used method of fabric production for the decorative, apparel, and home furnishing textile sectors. Even technical textiles, including wire cloth, are also produced on modern weaving machines.

Irrespective of the weft insertion process, weaving machines depend on maximum clock-pulse rates and accelerations.

In addition, weaving machines are characterized by a large number of nonlinear motion sequences and time-critical starting times. This is the reason why essential components of weaving machines are mechanic. Up to now, mechatronic solutions could not offer an economic alternative with adequate performance for many parts of the weaving machine. Accordingly, the weaving reed will probably continue to be mechanically coupled to the main shaft.

Nevertheless, electronics still offer tremendous advantages for weaving machines in terms of flexible application and simple operator control.

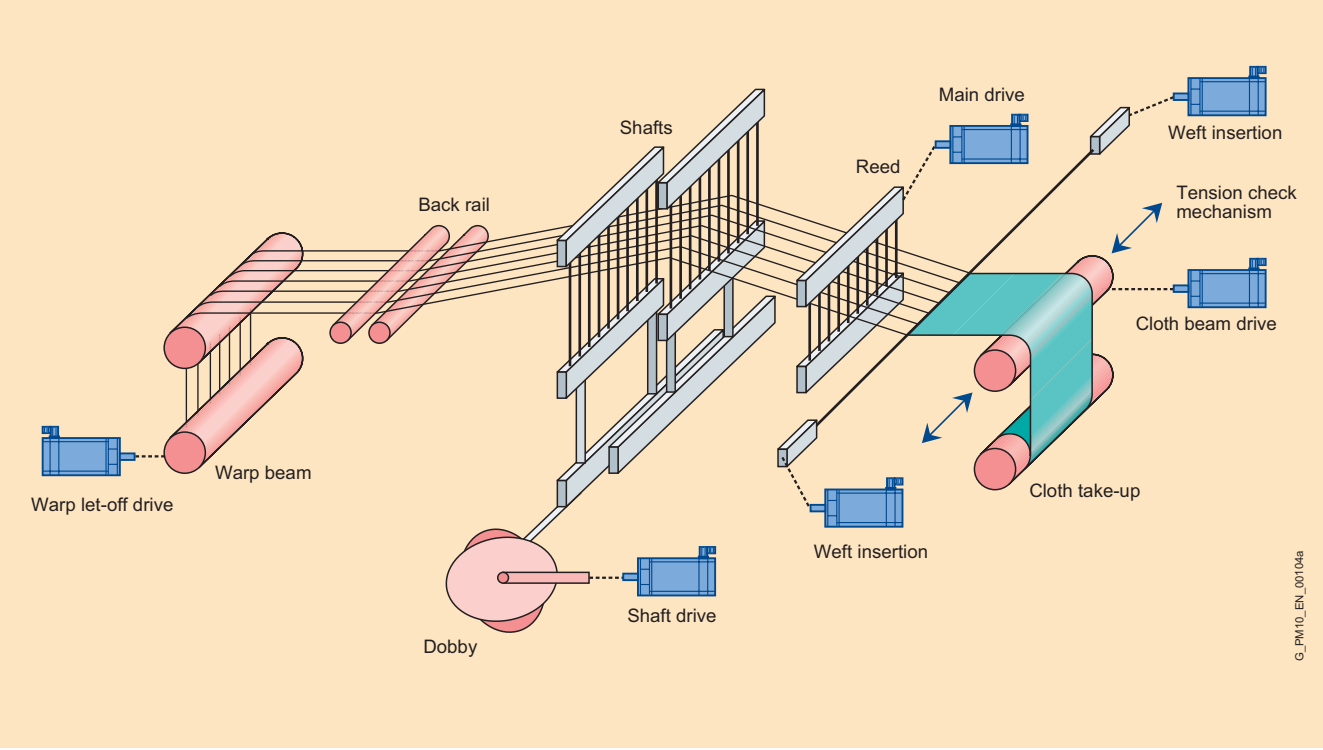
Automation requirements are as follows:

- Constant velocity ratio of warp let-off and loom take-up subject to the main drive
- Constant thread tension during the process (uniform fabric quality)
- Weft insertion with clock pulse accuracy
- Fast position-oriented supply of weft threads corresponding to the color selection
- Increase in machine clock pulses (increased number of revolutions)
- Different weft insertion processes using a projectile, airjet, or rapier
- Short resetting times for a lot change
- Reproducibility of process data
- Pattern data management and preparation

Benefits

The SIMOTION automation solution described below offers you the following advantages:

- To attain even faster resetting times, the mechanical cam can be replaced by a high resolution SIMOTION cam function for shaft motions.
- Variable user interfaces enable process parameters to be quickly adapted to the execution system. These data can be reproduced at any time and assigned according to process technology. A lot change no longer requires you to make manual adjustments.
- Tools for remote diagnostics, commissioning, and configuration integrated in the uniform, scalable SCOUT engineering system reduce service and configuration times.



Principle of operation of weaving machines

More information

A&D Technical Support
Phone: +49 (180) 50 50 222
Internet: www.siemens.com/textiles

Design

Automation solution

With the newest machine types, the flexible automation architecture is implemented in accordance with the technological requirements for the weaving machine.

The performance features for

- operation/visualization/diagnostics/pattern,
- process control,
- motion control and
- drive-related control

are matched in accordance with process engineering requirements.

The solution model is determined by preprocessing the process data and their implementation as a Motion Control process.

Machine control, implemented by SIMOTION D:

- Setpoint input
- Control of warp let-off and fabric take-off
- Weft entry control
- Machine monitoring

Operator control and monitoring (HMI)

Using a Touch Panel (e.g. SIMATIC TP 177B) or a multi panel (e.g. SIMATIC MP 277B) based on the runtime and configuring software ProTool/Pro:

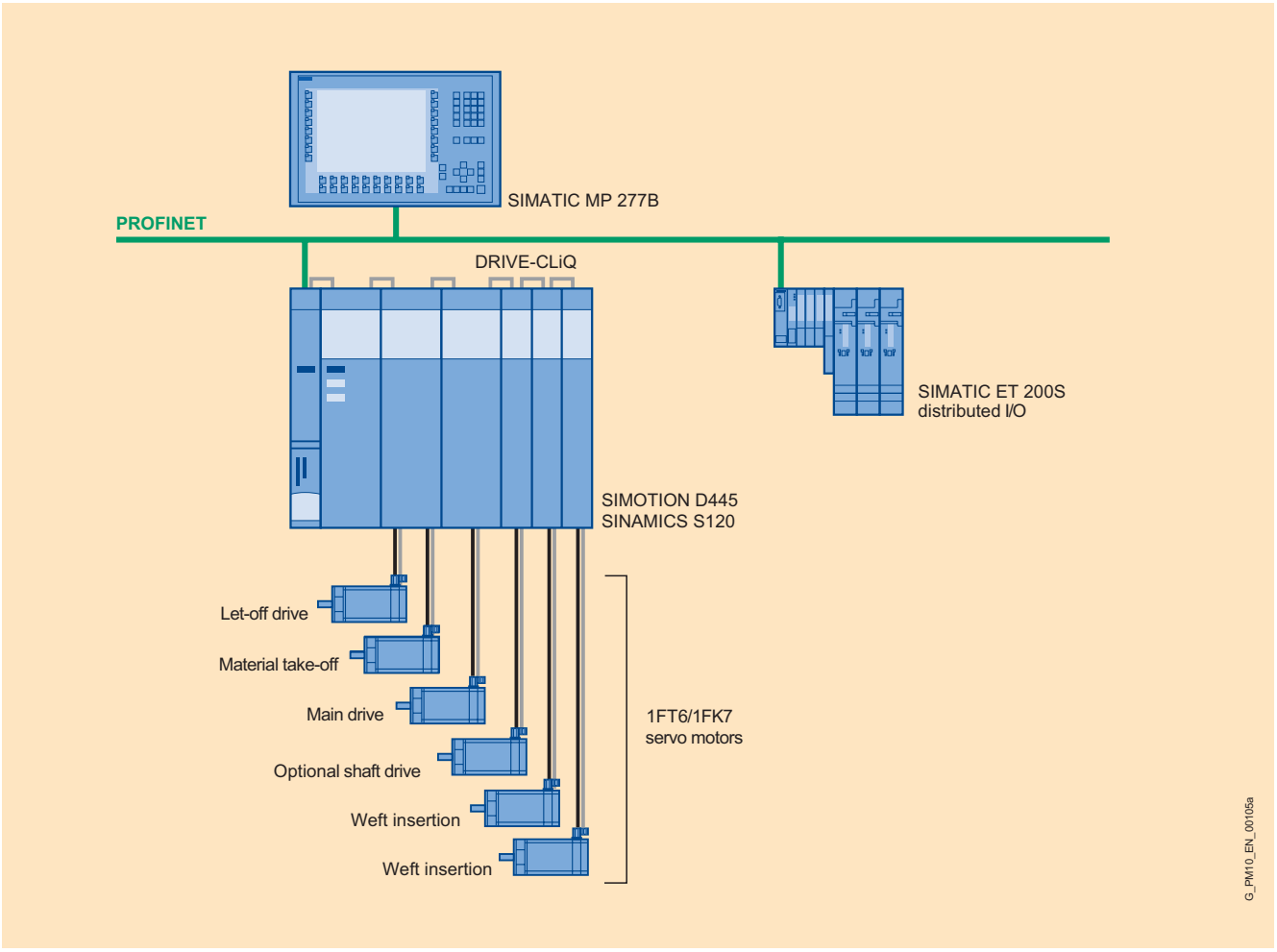
- Process data management, e.g.:
  - Speed specification
  - Presetting of weft density
  - Presetting of technology values
- Recipe management
- Diagnostics/remote diagnostics

Drives

The integrated automation and drives structure is rounded off by the bus-coupled dynamic converter system SINAMICS S120 and the 1FT6/1FK7 motors.

Features of the automation solution:

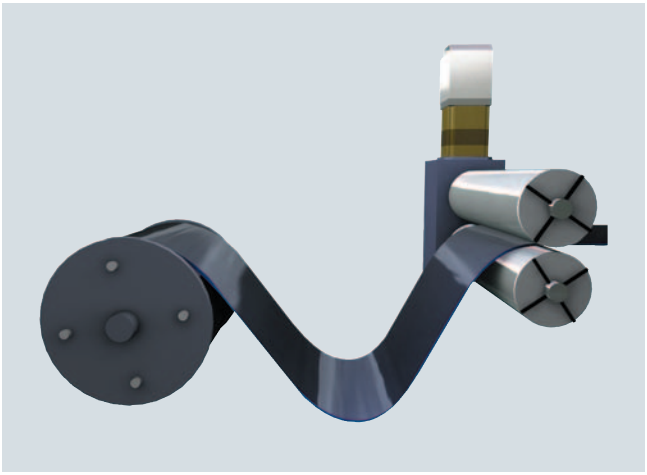
- Constant thread tension control during the winding and unwinding process, correct provision of thread and accurate positioning when entering the weft are closely coupled to the process control and are processed synchronously with the machine cycle. SIMOTION D445 has to be used for this purpose.
- A virtual master that obtains its actual values from an encoder mounted on the main shaft, outputs appropriate setpoint signals to the slaves of the drive and control system.
- Coupling through an OPC interface (Ethernet) ensures operating data management and coupling to a pattern system (CAD systems).



Automation solution example for SIMOTION D445

Roller feed

Overview



Machine requirements

The electronic roller feed is an integral part of almost every modern conveyor fed press and punch and is frequently implemented as a stand-alone, electrically driven machine unit. Mechanical components of a complex construction are replaced with intelligent feed units. Apart from the flexibility, the productivity of the production equipment is permanently increased.

In sheet-metal processing too, the trend continues in cost-effective manufacturing both of large batches at maximum cycle rates as well as a broad range of components in small batches. Accordingly, the roller feed has to respond to changing production data and at the same time avoid unnecessary production downtimes. The production stroke number of the press or punch directly depends on the positioning time, so the feed distances must be covered in a time optimized for the parameterized traversing data. This can only be achieved when highly dynamic motional sequences are used. The sheet metal is transported (force-fit) between the two rollers. In order to reduce the risk of impairing the surface of the sheet metal, the conveyor between these rollers must be reliably prevented from slipping. For this reason, Motion Control to protect the material is necessary which pays particular attention to favorable jerk and bump conditions.

The automation system must provide the following functions:

- Relative positioning that supports isochronous material feed
- Special positioning algorithms to prevent slipping and for simultaneous time-optimization

Benefits

The automation solution with SIMOTION offers you the following advantages:

- Maximum flexibility due to scalable products, systems and solutions.
- Transparency in the process due to comprehensive diagnostic tools.
- Preconfigured sample screens in WinCC flexible/Pro Tool Pro.
- Highly dynamic and fast motion control.
- Open, application-based solution which can be individually adapted by the OEM.
- Sector-specific functions are provided, such as operating mode management, slip monitoring, encoder switchover, feed control, roller diameter compensation
- Feed lengths changed on the fly.

More information

A&D Technical Support
Phone: +49 (180) 50 50 222
Internet: www.siemens.com/metalforming

Design

Automation solution

The modular Motion Control System SIMOTION in combination with the SINAMICS S120 drive system as well as highly dynamic servo motors provide a precise and highly dynamic response and therefore create a high-quality roller feed solution for optimized adaptation to the specific field of application.

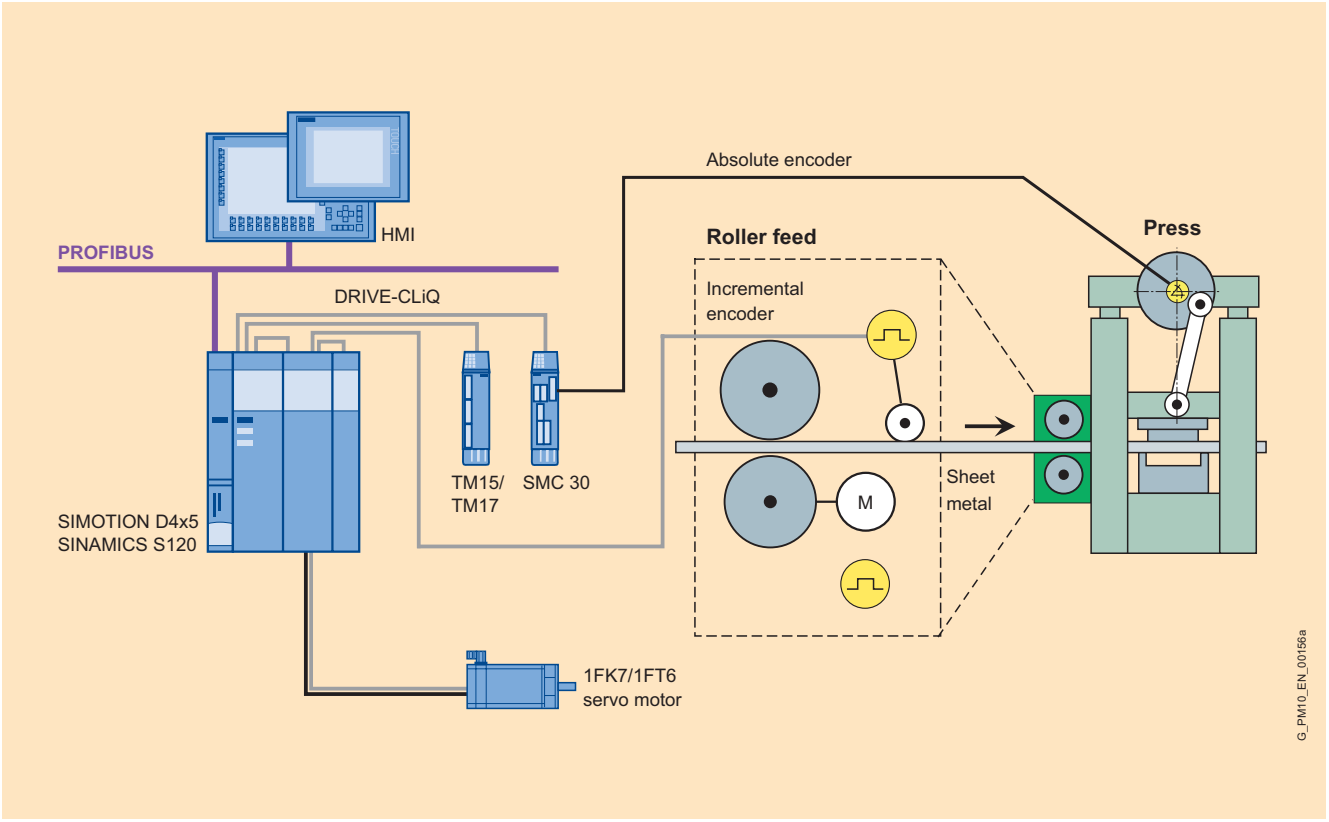
Due to the independence of the SIMOTION platform from the drives to be controlled, the SIMOTION application SimoRoll is also ideally suited for retrofitting of an existing plant.

The following options are covered by the SIMOTION application SimoRoll:

- Single-axis roller feed
- Two-axis roller feed in the versions:
  - Double-axis roller feed comprising one roller pair in front and another roller pair behind the press or punch
  - Zig-zag roller feed comprising a roller feed in the direction of travel and a cross motion matched to the feed motion. (optional)

To promote a highly dynamic traversing response and the resulting maximization of productivity, a number of process-oriented functions are provided:

- Specification of the traversing motion over position and velocity
- Specification of the speed profile
  - Acceleration and delay ramps can be adjusted separately
  - Separately adjustable initial and final rounding
  - Presetting of maximum velocity
  - Override parameter can be adjusted during operation
- Operating modes:
  - Jog
  - Set-up
  - Reference point approach
  - Single traversing block MDI
  - Automatic single block and program processing
- Discharge rollers
- Actual value switch-over from measuring wheel to motor encoder
- Calculation of the maximum number of strokes for the specified dynamics and feed data
- Messages and monitoring functions:
  - Slip monitoring
  - Approach position reached (VPE)
  - Position reached and stop (PEH)
  - Difference between direct and indirect measuring system
  - Load ratio
- Documented sample project



Automation solution based on the example of SIMOTION D4x5 and SINAMICS S120

Electronic transfer

Overview

Machine requirements

Transfer systems are used to transport work pieces within a press with transfer press tools or large-component transfer presses. They are designed as a stand-alone machine or integrated as universal transfer in the press. Transfer systems are used in sheet-metal processing, punching and metalforming, as well as for cold, warm and hot massive forming in forges. The persistent trend toward greater automation in industrial production technology causes more and more machine manufacturers to replace conventional mechanically coupled transfer systems (cams mechanically linked to the plunger) with freely parameterizable electronic transfer controls in which electrical positioning drives are increasingly implemented. In contrast to mechanical transfer systems, modern electronic transfer involves considerably less mechanical drive elements. These are replaced almost completely by electrical positioning drives that operate in synchronism with the main movement of the press. Transfer systems generally comprise gripper rails that are steered in three directions of motion that convey the work pieces in synchronism with the plant cycle. These rails are equipped with pneumatically operated active tongs or blades depending on the geometry of the sheet-metal, which hold the part during transport. The axes are then traversed continuously by means of electrical positioning drives such that they follow a predefined traversing profile in accordance with the master setpoint of the plunger encoder. Transfers therefore offer a high flexibility with regard to the motional sequence to be implemented and therefore offer considerable advantages when changing tools.

Benefits

The automation solution with SIMOTION offers the following advantages:

- Configuration with the standard components of SIMOTION, SINAMICS, SIMATIC HMI and I/O
- Graded performance of drive and operating components can be optimized to suit requirements
- Number of axes is scalable
- Reduction of production delays, such as during servicing and (repeated) commissioning after tool changeover
- Flexible parameterization of the motional sequence by the press operator
- High-dynamic and low-wear response due to motion in accordance with variable polynomials

More information

A&D Technical Support
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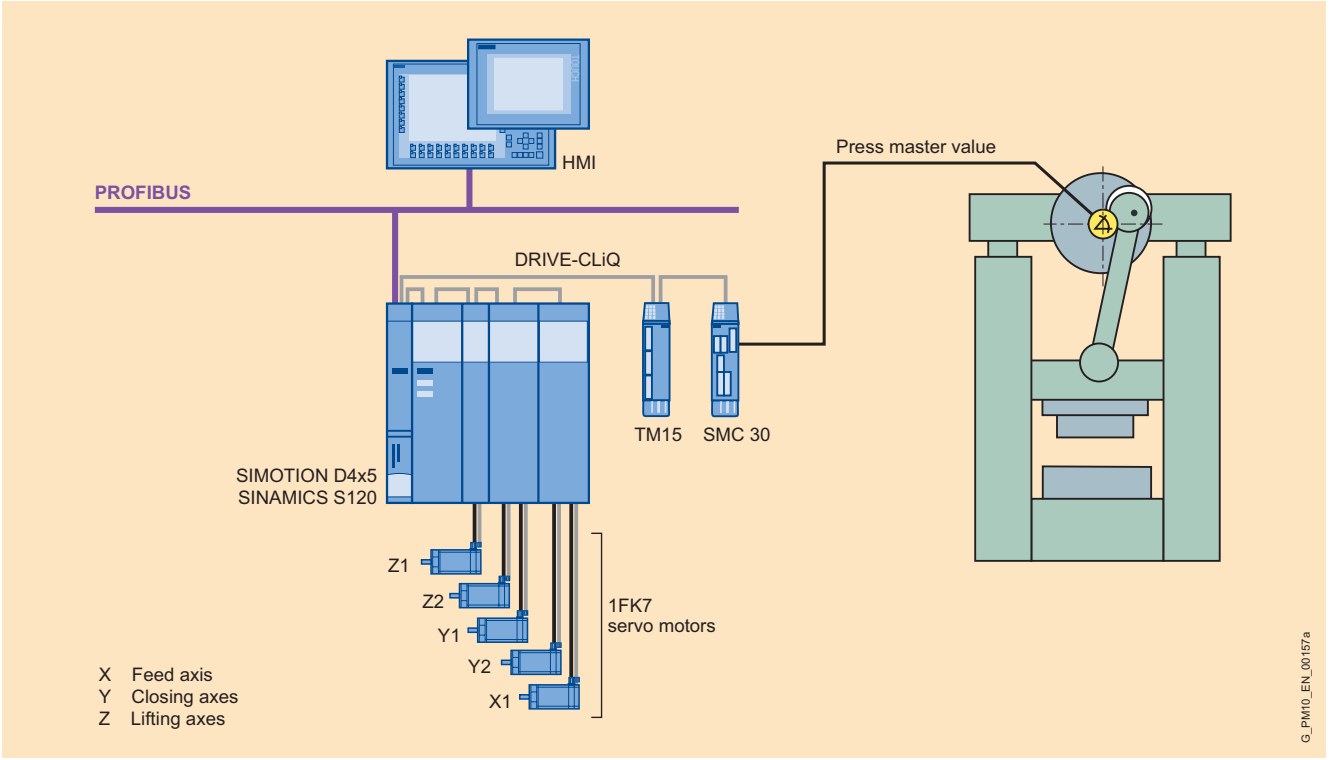
Design

A variable number of drives is supported for transfer presses depending on the machine construction. For fast and flexible adaptation to current as well as future production requirements, the electronic transfer application SIMOTION SimoTrans is based on the universal Motion Control system SIMOTION and the SINAMICS drive platform. In accordance with the general SIMOTION concept, the SIMOTION application SimoTrans has access to high-dynamic Motion Control and PLC functionality in the same environment; time-critical communications interfaces are not used. The master value coupling to the presses allows all drives of a motion axis to be traversed synchronously and in accordance with the same laws of motion.



Automation solution based on the example of SIMOTION D4x5

Apart from a highly dynamic traversing response and the resulting maximization of productivity, further process-oriented functions are provided by the SIMOTION application SIMOTION SimoTrans:

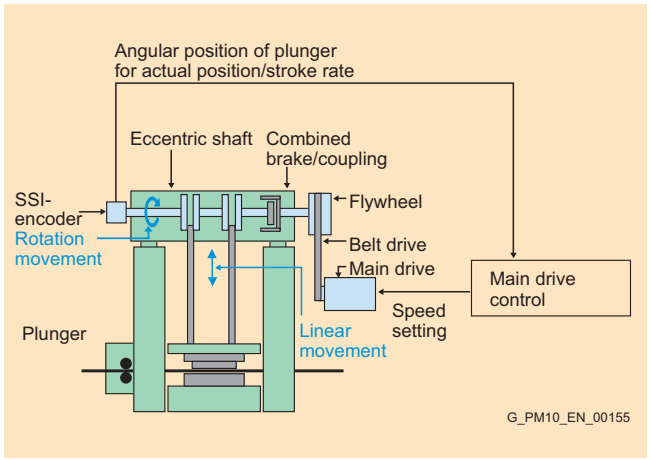
- Coupling of the motion system to a higher-level master value
- Traversing in accordance with standardized motion principles (5th-order polynomials) resulting in favorable jerk and bump conditions
- Tool data management
- Master value encoder changeover on the fly for adaptation to the mechanical conditions
- Modular, parameterizable program structure supports press variations
- Sequence parameterization using tables
- Operating modes: service mode, setup, single stroke and automatic
- Openness for customization by the OEM
- Calculation of the maximum possible stroke number
- Encoder functionality can be monitored through redundant master value coupling
- Plausibility check of entered traversing data
- Additional functions, such as master value filter, collision monitoring can be optionally implemented

The transfer application SIMOTION SimoTrans can be used either separately or in addition to the press control SIMOTION SimoPress, in which case synergies can be effectively utilized along the complete press line.

Mechanical universal press

Overview

Mechanical universal press



Principle of the mechanical universal press

Machine requirements

Mechanical universal presses are characterized by high flexibility because they are suitable both for cutting and reforming. In combination with single, follow-on and progression tools, small to medium-sized parts can be manufactured. In these machines, the drive concept of the main press drive is identical. The press plunger complete with tool is driven via a mechanical conversion (eccentric, toggle lever) using an electrical drive and flywheel. The plunger motion is activated via the combined clutch and brake.

With insertion presses, the material is introduced by hand and with automated presses (punching and reforming machines) continuously from a roll and then over the conveyor system by means of rollers or extractor tongs to the press itself. The press control performs various tasks such as operator control and monitoring, general machine control, operating mode control, main drive control, tool management, cam control and positioning tasks.

With reforming and punching machines, stringent requirements apply to the sampling time for time-critical functions (cam control, process controllers, etc.). Universal presses with stroke numbers of up to 100, max. 200 strokes per minute, are usually simple presses with a minimal degree of automation. For 200 to 500 strokes per minute, and in the case of punching machines even up to 2000 strokes per minute, the complexity increases and better response times and an increased degree of automation are required.

Benefits

The automation task demands almost complete integration of sequencing (logic) functions, motion functions and technology functions. With SIMOTION, it has been possible to resolve the different tasks with one system concept.

- Sequence programming can be implemented in the familiar LAD or FBD languages.
- Technology-specific programs are programmed wherever possible in Structured Text (similar to a high-level language) and the motion tasks are programmed with the graphical tool Motion Control Chart (MCC).

Different tasks are, for example:

- Operating mode control
- Main drive control with stroke number preset and ramp up
- Positioning of the main drive for stroke depth adjustment or tool changing
- Cam control with dynamic deceleration angle calculation for OT Stop
- Process monitoring functions such as tool position safety and press force monitoring

All these tasks can be programmed using the same engineering system and finally implemented with a machine-specific hardware platform.

Consequently,

- the number of interfaces is reduced,
- engineering and commissioning costs are optimized,
- and standardization is made easier.

Design

Automation solution

In the represented automation concept of mechanical universal presses, the tested sector-specific application solutions are summed up under the designation SIMOTION SimoPress. With this technology software, we offer finished press functions for the main drive control, cam controller, tool position securing and pressing force monitoring. SIMOTION D4x5 with the SINAMICS S120 drive system has been selected as the hardware platform.

Both the machine control and the SIMOTION SimoPress technology functions are programmed on SIMOTION D4x5 and they control and monitor the machine through the distributed ET200 I/O. The cam signals are output or sensor signals are acquired for process control over the drive-related, high-speed I/O modules TM15 or TM17 High Feature.

The motors are controlled via the SINAMICS S120 Motor Modules. The SIMOTION SimoPress technology software covers all main properties for a mechanical universal press. The software together with the SIMOTION SimoRoll and SIMOTION SimoTrans solutions provides a complete press package.

More information

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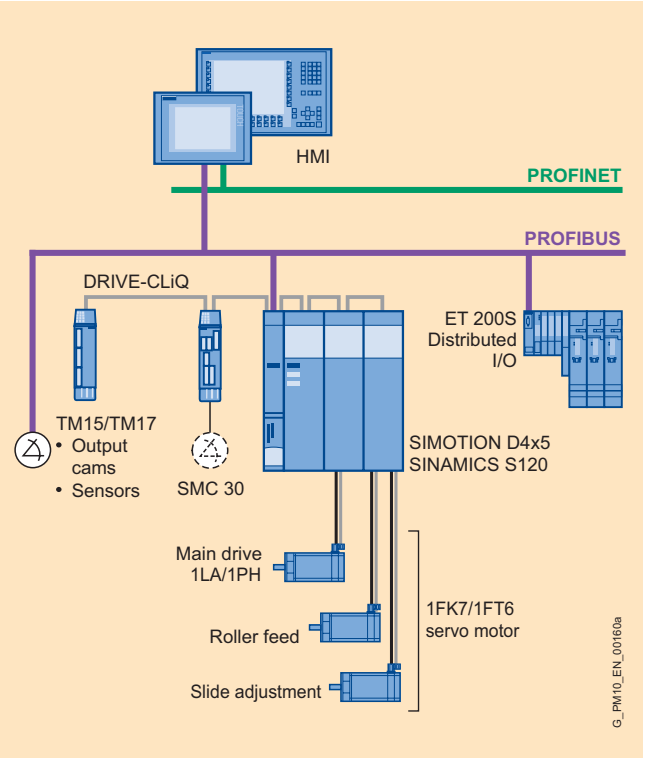
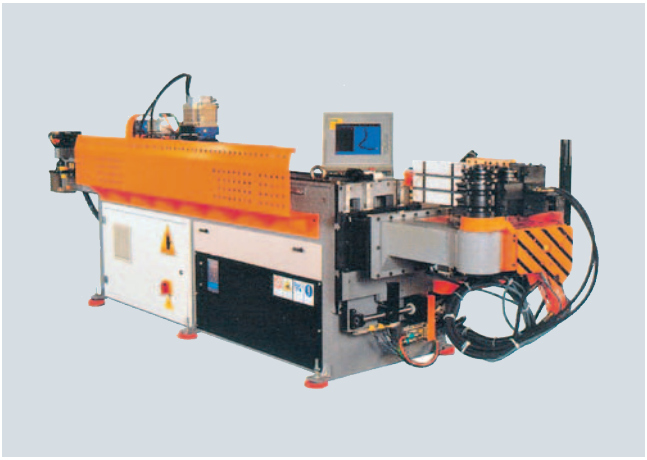


Automation solution based on the example of SIMOTION D4x5

Pipe bending

Overview



Machine requirements

In pipe bending, round material (pipe, rod, wire, cable. etc.) is actively reformed using a bending head. The bending head guides the material around a bending roller or die. The end position of the bending head is the dimension for the bending angle. The bending radius is dependent on the die and can therefore not be altered during machining.

The bending programs are frequently created on the PC using special programs. The respective bending program comprising positions, angles, speed and pressure is selected via the operator panel and loaded into the controller. A bending machine typically has 3 to 5 positioning axes that are often implemented electrically, but the bending axes for large pipe diameters are frequently implemented hydraulically.

The pipe is inserted by hand as far as the stop in the clamping chuck of the rotary axis. On starting, the pipe is clamped hydraulically and the transport unit moves the pipe to the first bending point. The sliding rails or jaws are then hydraulically positioned. Clamping force and pressure are set in accordance with the material. The bending head is rotated by a defined angle and the first bend is formed. The bending axis of the pipe is automatically moved forwards in the Y direction (follow-up mode) or is positioned by means of a cam. The bending radius is defined permanently by the bending roller (tool). The sliding rail is then opened, the pipe is positioned at the next bending point and also rotated if necessary. Multi-dimensional shapes can be created in this manner. Different radii are achieved by means of different dies of various heights, so-called "multi-groove dies". For this purpose, the pipe is moved in the X direction away from the contour of the roller using the mandrel and transport unit, then aligned in the Z direction on the next roller and in the X direction on the roller again before it is moved to the next bending position. The sliding rails are then repositioned and the pipe is bent. This procedure is repeated until the bending program has been completed and the pipe is removed manually.

In order to ensure the shortest possible bending procedures and reproducible quality, it is important to be able to adapt the various parameters, such as acceleration, speed and pressure, to suit the respective product.

The following functions of the SIMOTION Motion Control System are provided to perform this task:

- Positioning of electrical and hydraulic axes
- Follow-up mode
- Cam disk
- Axis-dependent starting
- Output cam

Benefits

The automation concept with SIMOTION/SINAMICS combines the following advantages for you:

- Reduced engineering overhead due to configuration, programming and commissioning with one system, the SCOUT engineering system
- Fewer interfaces, since different tasks are performed on the same hardware
- Simplified commissioning of drives by means of an electronic motor rating plate
- Optimized machine operation due to user-friendly, flexibly adjustable and reproducible process parameters on the operator panel, e.g. pressure, positions
- High availability of the machine through wide-ranging diagnostic functions in SIMOTION in the case of a plant failure.
- TIA integration simplifies integration of HMI, I/O and drives

Design

Automation solution

As the system platform, SIMOTION P, the PC-based version with touch panel is a good choice. Without additional interfaces, the PC bending program, the Touch HMI functions and the control logic and motion control can execute on a hardware platform.

SINAMICS S120 and 1FK7 motors are used for the electrical drives and provide highly dynamic and reproducible positioning. In the case of a hydraulic bending axis, the hydraulic servo valve can be activated via the TM31 Terminal Module with analog inputs and outputs. An isochronous PROFIBUS encoder is available for position detection of the bending axis.

More information

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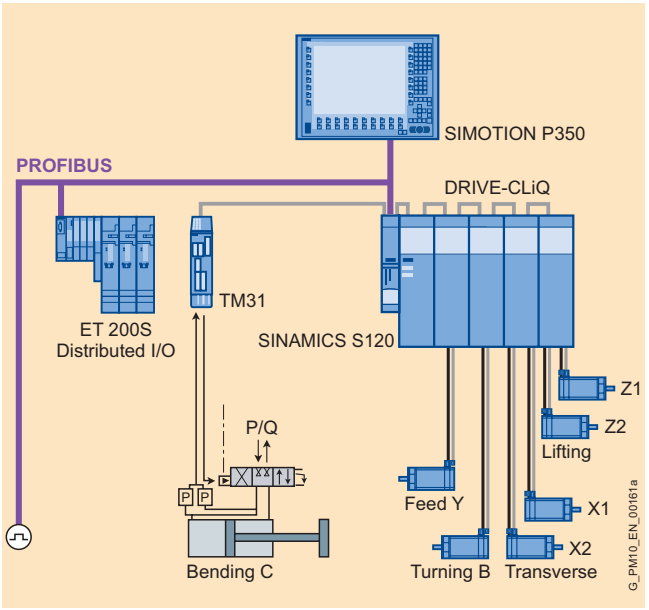


Automation based on the example of SIMOTION P and SINAMICS S120

Hydraulic presses

Overview

Machine requirements

A hydraulic universal press is characterized by its plunger mechanism in the form of one or more hydraulic cylinders. It is used for tasks such as punching, deep-drawing or pressing through to internal high-pressure forming (IHU).

A machine comprises not just the hydraulic press itself, the tool can also include hydraulic actuators and control loops, especially in the case of internal high-pressure forming. A distinction is made between single or multiple-action drawing presses, depending on the number of axes acting on the metal sheet (plungers, die cushions, sheet metal holders, ejectors).

In the case of hydraulic universal presses, a distinction is made between closed-loop and open-loop controlled axis motion. With complex workpieces and molding processes such as internal high-pressure forming (IHU), intervention of the tool at the workpiece must be precisely controlled.

Here, the position of the workpiece in relation to the tool, the seamless transition of the die cushion from position to pressure control and back to position control and the exact press forces in the individual axes all play an essential role.

Benefits

The SIMOTION Motion Control System is the best possible way of achieving automation and drive technology in a complex hydraulic press. The SIMOTION platform is ideally suited for use with modular machines. Due to its open and modular structure, this motion control system combines all the necessary subareas of the overall machine control system: motion control, PLC functionality and technology functions.

An automation solution based on SIMOTION and PROFINET therefore offers the following advantages:

- Implementation of motion control, PLC and technology functions in one integrated system
- Optimized machine cycles due to deterministic real time and short cycle times result in high product quality and productivity
- Combination of any number of electric and hydraulic axes
- Prefabricated Functional Modules (hydraulic control, synchronization, cam disks, cam control, etc.)
- Synchronized axes can be distributed between several control systems
- On-the-fly switchover between position and pressure control
- Automatic acquisition of the valve characteristic/controlled system
- Valve curves can be graphically edited and adapted using the CAM tool
- Press force measurement and tool protection with scanning rates significantly lower than 1 ms due to fast signal acquisition/signal output via the SIMATIC ET200S High-Speed I/O
- Open, application-based solution, can be individually adapted by the OEM

Flexible selection of the hardware platform

An application created using the SIMOTION SCOUT engineering system can be implemented on different hardware platforms. You can, therefore, always select the platform that suits your machine best:

- SIMOTION C, the compact controller in SIMATIC S7-300 design with interfaces for four position-controlled hydraulic drives (4 analog outputs and 4 encoder interfaces for SSI absolute encoders or RS422 incremental encoders)
- SIMOTION D, the solution integrated into the drive based on SINAMICS S120, for applications that require electrical drives in addition to hydraulic drives
- SIMOTION P, the open PC-based solution for applications with demanding performance requirements or when, for example, visualization functions are required

More information

- A&D Technical Support
  Phone: +49 (180) 50 50 222
  Internet: www.siemens.com/metalforming

Design

Automation solution

With SIMOTION P and the new SIMATIC ET 200S High Speed I/O, cycle times down to 250 µs can be achieved over PROFINET with IRT (Isochronous Real Time).

Highly dynamic control loops can therefore be achieved for hydraulic applications with position and pressure control.

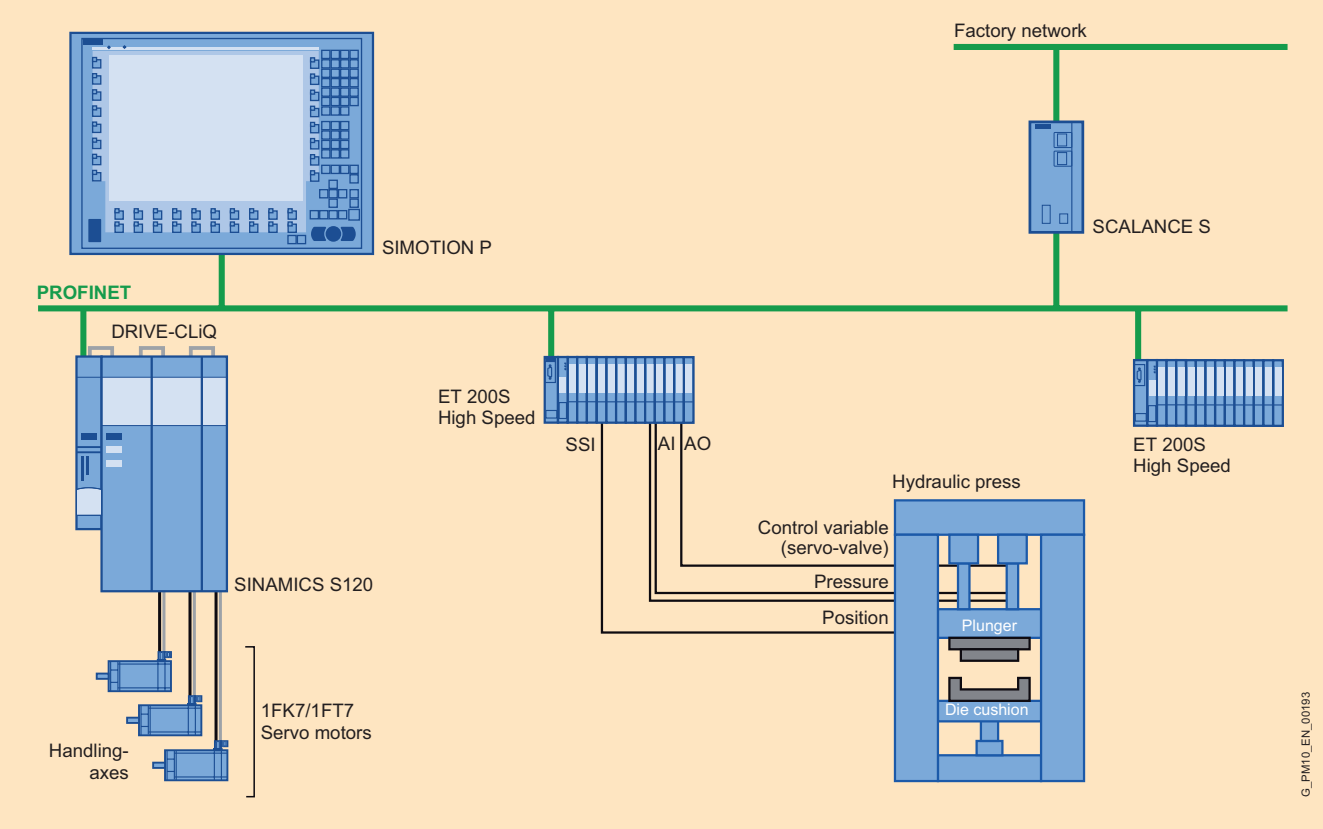
The necessary sensors and actuators, such as

- position encoders connected through the SSI interface,
- pressure sensors connected through analog inputs (AI),
- servo valves connected through analog outputs (AO) and
- digital I/O for tool safety and cam signal output

are connected over the SIMATIC ET 200S distributed I/O system, which was equipped with the necessary high-speed I/O modules beforehand to suit the application.

On the basis of PROFINET, it is therefore possible to synchronize hydraulic drives as well as electrical drives.

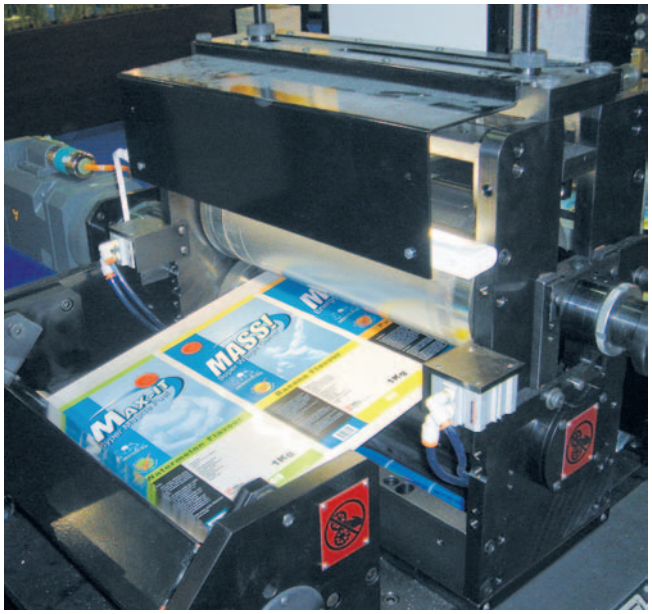
In conveyor systems and press lines in the automotive industry or domestic appliance industry, uniform automation solutions can be implemented in this manner in which both electrical drives (roller feeders, electronic transfer, feeders) and hydraulic drives (e.g. deep-drawing presses) are used.



Automation example based on SIMOTION P350-3 and SIMATIC ET 200S High-Speed

Printing, stamping and embossing machines

Overview



Machine requirements

Printing, stamping and embossing machines are used, for example, in the manufacture of labels and tickets. The material to be processed ranges from paper through plastic to metal foil, depending on the product.

The original material is usually on a roll. The end product comprises either rolls (endless material) or sheets which are cut to a specified format by cross cutters.

Printing, stamping and embossing machines are constructed in modular form which demands a flexible automation concept with regard to hardware and functionality.

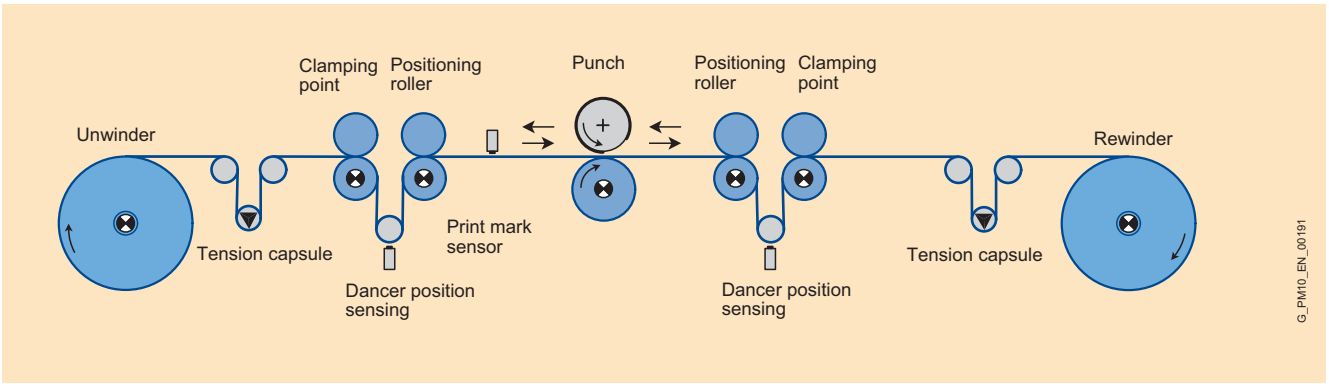
The function modules can, for example, be:

- Winder and unwinder
- Punching module
- Print module
- Coating module
- Laminating module
- Cross cutter module

Apart from the velocity of the machine, the accuracy and repeatability of product processing are also important. The required accuracy is < ±0.1 mm (0.0004 in).

The demands on the automation are:

- Constant velocity ratio between the machine modules through geared synchronous motion or velocity ratio
- Constant tension during the process (tension and dancer roll control)
- Cams disks for motion control (punch and cross cutter)
- Winder control
- Print mark correction
- Modular software and hardware structure for implementing customized machine configurations
- Parameterizable software for adaptation to different materials and products



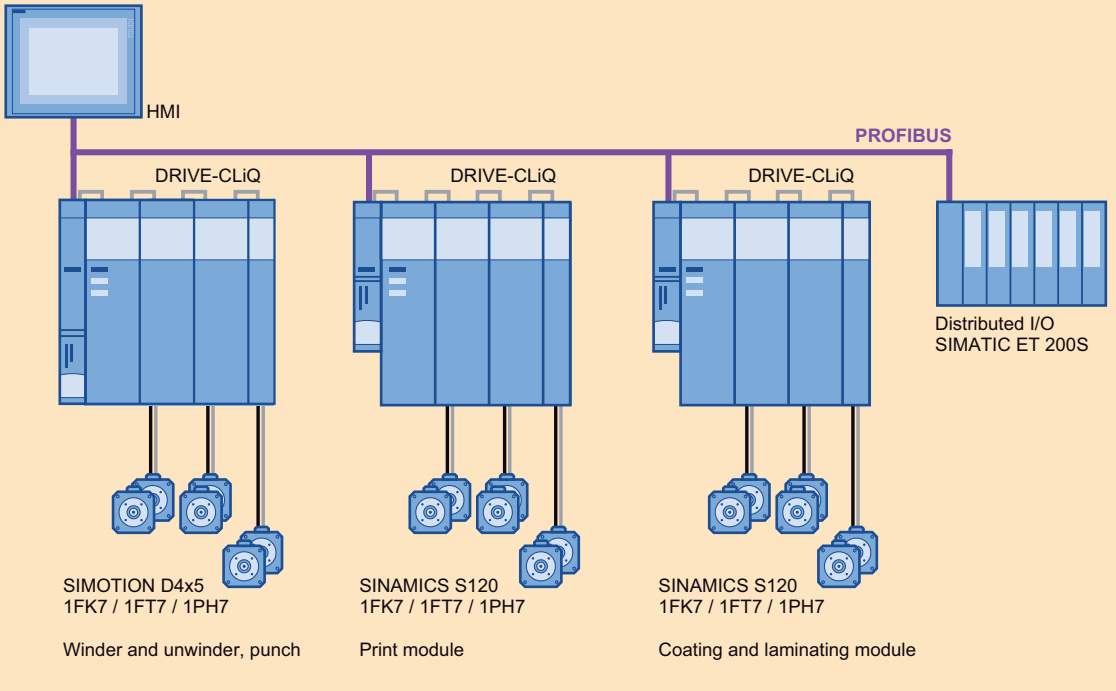
Basic structure of a punching machine

Benefits

The automation solution with SIMOTION described below offers you the following advantages:

- Adaptation of the configuration to the structure of the machine thanks to the modular software and hardware concept
- The SIMOTION controller combines functions such as logic, synchronous operation and cam disks as well as technology functions such as winder controls, print mark synchronization and cross cutters, so that the complete machine functionality can be implemented on the same controller hardware.
- Adaptable user interfaces enable the process parameters to be adapted to the runtime system quickly
- Scalable hardware platform for different machine requirements
- Prepared software elements for simplifying commissioning, e.g. control mode manager, winder, axis control, cross cutter, etc.
- Remote diagnostics, commissioning and configuring tools that are integrated into the uniform and scalable SCOUT engineering system reduce the servicing and configuring times.

Design



Automation solution based on the example of SIMOTION D4x5

Automation solution

With the newest machine types, the flexible automation architecture is implemented in accordance with the technological requirements for the machine.

The performance features for

- Operator control, visualization and diagnostics
- Process control
- Motion control
- Drive-related control

are matched in accordance with process engineering requirements.

Machine control

The machine control is implemented with SIMOTION D4x5. It performs the following PLC and motion control functions:

- Logic
- Operating mode manager
- Setpoint input
- Closed-loop controls (winder, tensioner, dancer roll)
- Cross cutters
- Machine monitoring
- Synchronous operation
- Cams
- Print mark correction

Operator control and monitoring (HMI)

Operator control and monitoring of the machine is performed, for example, using a Multi Panel with the WinCC flexible runtime and configuring software. The following functions are implemented using the Multi Panel:

- Machine module selection
- Process data management
- Velocity specification
- Presetting of technology values
- Diagnostics/remote diagnostics

Drives

The integrated automation and drives structure is rounded off by the bus-coupled dynamic converter system SINAMICS S120 and 1FT6/1FK7 motors.

More information

A&D Technical Support
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Optimized Packaging Line

Overview

Machine requirements

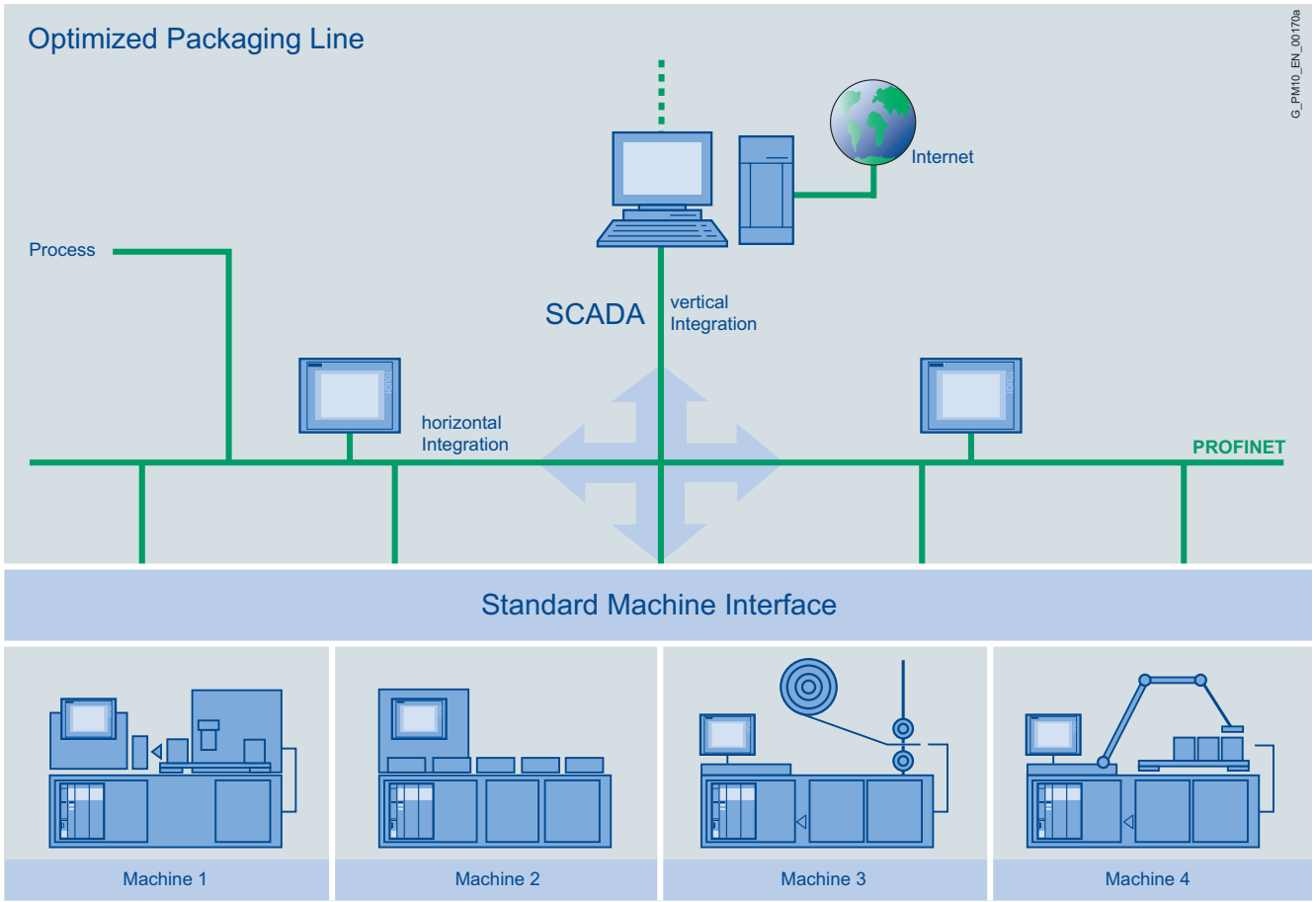
The packaging industry requires greater flexibility than almost any other industrial sector: new types and sizes of packaging, new markets and new drive technologies – requirements change quickly.

This opens up many opportunities and presents sectors such as food & beverages or pharmaceuticals with considerable challenges. In these sectors, only those who act flexibly on the one hand and cost-consciously, efficiently and productively on the other hand will be successful in the long term.
With a holistic concept, we as your automation partner will support you in this. With the Optimized Packaging Line, we offer machine users and machine manufacturers integrated automation solutions for packaging lines and machines.

With components that can be freely selected to solve the specific task. These include SIMOTION, SINAMICS and PROFINET – reliable standards which will support the implementation of any system solution.
Automate packaging lines from a single source. With components that can be freely selected to solve the specific task – and which do not limit the modularity of the packaging machine.

Automating packaging machines and lines uniformly and system-wide – this is the concept of the Optimized Packaging Line. As an automation partner, we have developed a concept that is based on Totally Integrated Automation (TIA), which offers maximum benefits for the machine users and machine manufacturers through standardization of interfaces, Software Modules and hardware components. The automation architecture is horizontally and vertically standardized. Based on international standards - such as OMAC - solutions with a high potential for innovation can be implemented in this manner.

The technology comes from a company that masters everything – from initial consultation through engineering as far as the finished solution and servicing. An all-in-one solution.



Overview of a packaging line

Benefits

The uniform and system-wide integration of components on the basis of standards reduces their number. This reduces the integration, engineering and fixed costs and increases productivity.

The standardization of components and interfaces reduces the number of different types and increases the line efficiency through:

- Reduced complexity
- Reduced spare parts inventories

Software blocks such as SIMOTION Technology Objects for technology functions lead to:

- Less engineering outlay for the application
- More reliable functioning due to pretested software

Interface data blocks simplify the acquisition and presentation of production data, resulting in:

- Less engineering outlay during line integration
- Greater cost-effectiveness due to the easy addition of machines
- Less risk on plant start-up

Increase in efficiency and reduction in downtimes due to:

- Uniform overview of the complete line or plant
- Integrated diagnostics and alarm concept
- Identical user interfaces for all machines

Higher productivity results in:

- Better availability of the bottling line
- Less training

Design

Automation solution

The packaging world has become more transparent and simpler with the Optimized Packaging Line: The components are optimally tuned to each other and the software structures are standardized. A uniform operating concept with totally integrated diagnostics ensures high availability.

Due to consistent implementation of the specified components, high productivity and availability is ensured over the entire service life of the packaging plant.

The components:

SIMOTION®, SIMATIC®, SINAMICS®, PROFINET® … reliable standards which will support the implementation of any system solution. From the control of simple auxiliary aggregates through to complex, high-velocity packaging machines.

The concept:

Uniformity, integration, simplicity – due to identical design of the hardware, identical Software Modules and user interfaces, and due to using the same tools for simulation, configuration, programming, commissioning and diagnostics.

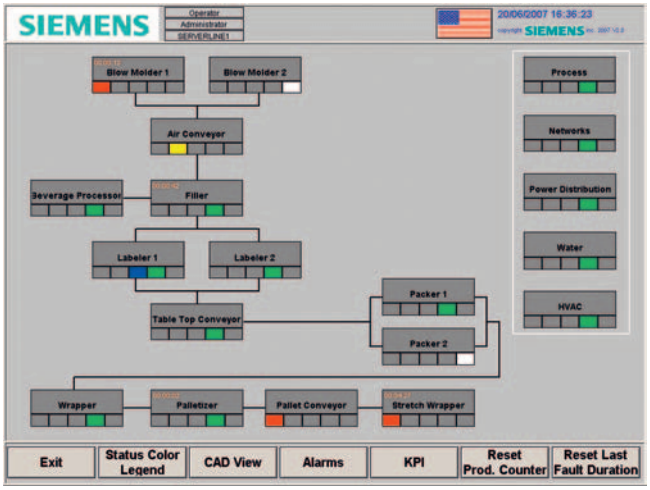
Machine manufacturers and operators benefit consistently from the synergy effects – starting with configuration, simulation and commissioning and continuing through staff training, maintenance and service.

Flexibility:

Our customers are able, at any time, to introduce further modifications on the basis of these standards. The design of our technology is determined by the task, not vice-versa.

Our project service:

Our solutions are building blocks integrated into a seamless system. This not only includes the planning phase and clarification of the interfaces, but also active support well into the operating phase of the plant – with the emphasis on training, courses and service. This is why automation solutions from Siemens stand for maximum availability and productivity in packaging lines throughout the world.



Line overview with status indicator

More information

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SIMOTION Top Loading

Overview

Machine requirements

Change in the packaging machine market is resulting in a demand for greater use of handling robots directly in the process. This is not only due to the higher speed of the machines, but to the ever-increasing flexibility. Whereas robots were only used in the past in the "end-of-line" applications, they are now increasingly implemented in the primary and secondary packaging processes. The manufacturer of packaging machines is therefore faced with the challenge of integrating PLC, motion control and handling tasks in a single system.

For these handling applications, Siemens offers SIMOTION Top Loading, a standardized software library for handling and special Top Loading Modules for all SIMOTION platforms. The software is standardized and tested. This reduces the engineering outlay and prevents programming errors. Top Loading cells of different kinematics can be configured and programmed with other Software Modules on one controller or on several distributed controllers. Synchronization with proprietary control architectures is then no longer necessary. Real-time synchronization as well as uniform data storage is now possible without any problems. Familiarization time for programming languages for robot controls can be completely discounted because the system supports uniform programming of all functionalities according to IEC 61131-3.

Benefits

The automation solution with SIMOTION offers you the following advantages:

- Faster and better quality engineering through standardized and tested software and previously implemented kinematics
- Simpler implementation and data storage because a uniform control and development environment is required
- Total flexibility by integrating new kinematics
- Optimized curves due to flexible specification of the path velocity
- Ideal for any application due to free selection of the SIMOTION platform
- Three-dimensional definition of work areas, 1 to n inhibit zones, alarm zones or product zones that can be individually activated.

More information

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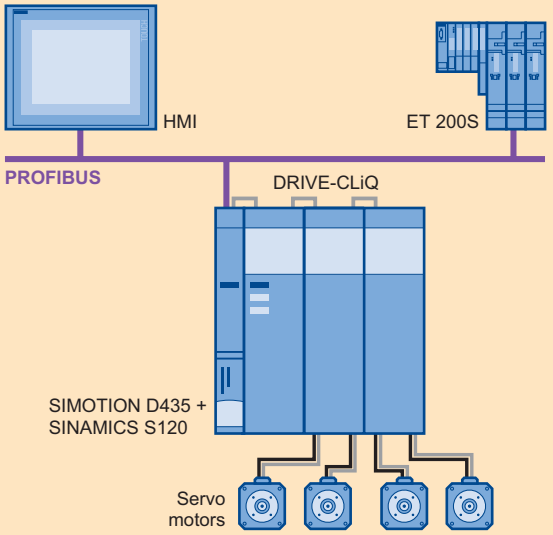
Design

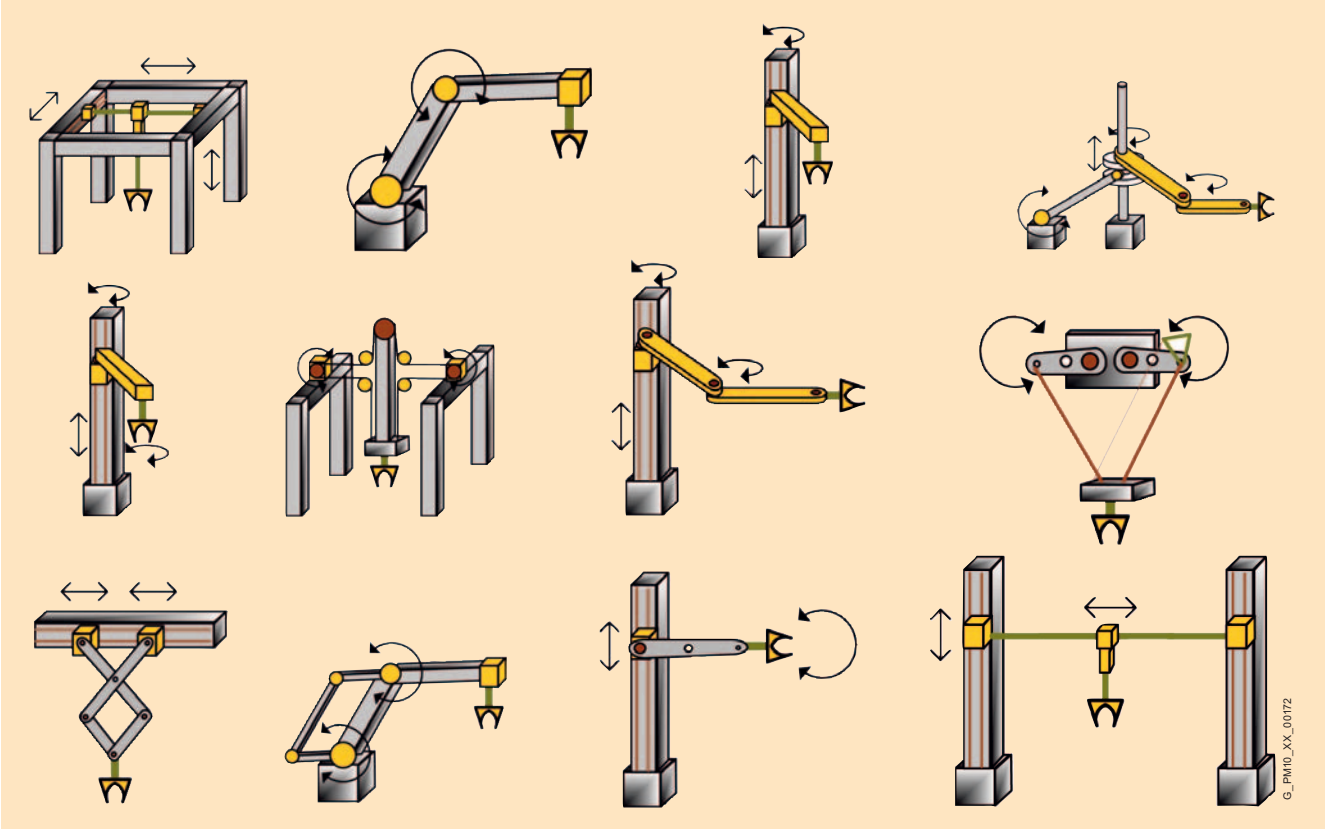
Automation solution

The automation concept shown is an example of a gantry robot with 3 servo drives as well as one additional drive for the infeed conveyor. It is easy to see the advantage that direct coupling of the gantry robot with the infeed axis is possible thanks to integration of the handling functionality in the SIMOTION Motion Control System. Costly interfaces and separate control units for the robots can be omitted. It can be controlled by a machine HMI, in this case a TP177B Touch Panel.



Kinematics already implemented

The figure shows the robot kinematics already integrated into SIMOTION Top Loading. More can easily be added if your mathematical transformations are known.



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SIMOTION Intelligent Infeed

Overview

Machine requirements

Automatic product infeeds play a central role when intermittently operating production machines have to be coupled with packaging machines. Until now the distances between the individual products could only be equalized by calculating and setting the acceleration and speed individually for all motors. With SIMOTION Intelligent Infeed, costly programming of the motor movements is a thing of the past. Instead of this, an innovative technology package automatically calculates and controls the appropriate accelerations and velocities of the products and therefore equalizes the spacing between them. This is achieved without contact, so SIMOTION Intelligent Infeed is recommended for particularly sensitive products.

Benefits

SIMOTION Intelligent Infeed transfers the concept of programming robots to the product infeed of production machines. This means that: The programmer determines the motion of the products – and the controller automatically calculates the necessary speeds and acceleration values for the motors

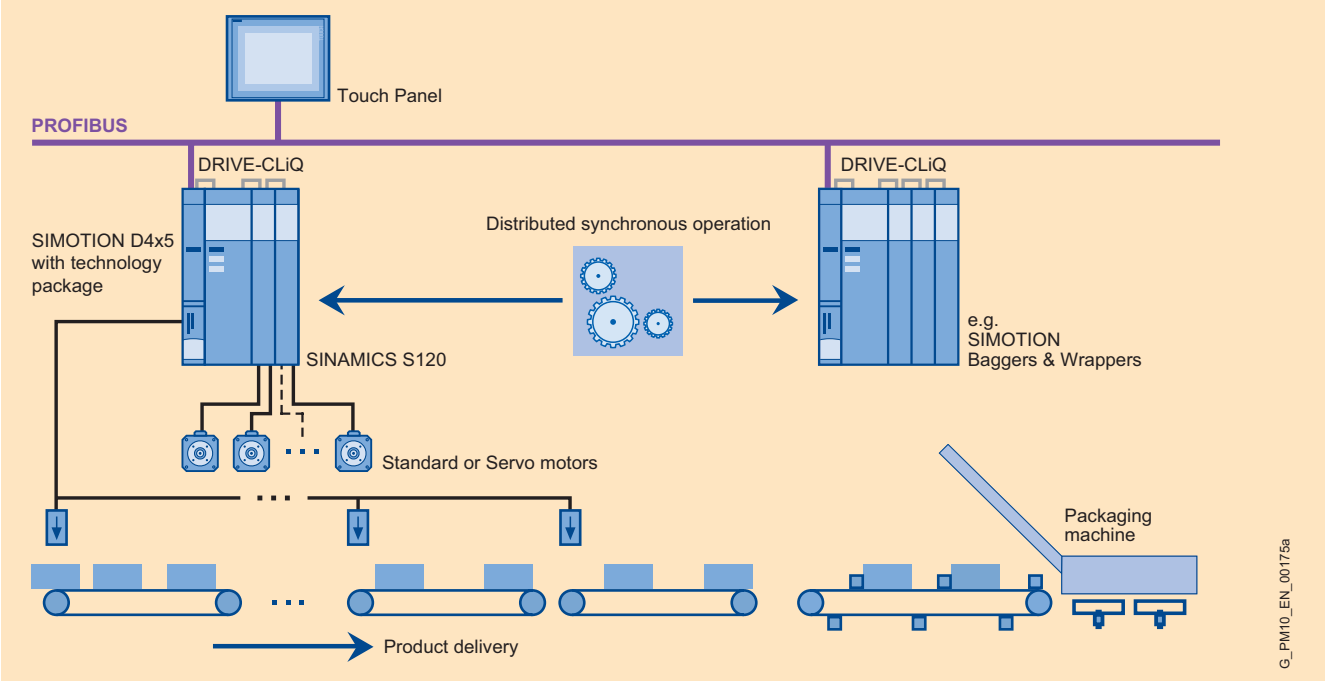
The intelligent technology package, Direct Product Motion (DPM), operates on the basis of speed-controlled axes. Both servo motors (high dynamic response) and asynchronous motors (lower dynamic response) can be used. For the product infeed drives, apart from the DPM runtime license, no other licenses are necessary. The mechanical structure of the product infeed – e.g. the number and length of conveyors, position of sensors, etc. – is parameterized. The connection to the subsequent machine can be implemented, for example, using distributed synchronous operation.

SIMOTION Intelligent Infeed provides the basic functions required for aligning the product.

The application

- Calculates where the products are located in the conveyor system based on the sensor signals
- Assigns a separate ID to each product and therefore provides information about the number of products in the conveyor system
- Sorts the product list according to position within the conveyor system
- Adjusts the velocity of the product
- Sets the distance between two neighboring products
- Ensures that the product is transferred from the conveyor system to the infeed chain of a subsequent system correctly aligned

Design



Automation solution

The SIMOTION Motion Control System offers, in combination with the SINAMICS S120 drive system and our highly dynamic motors (e.g. the 1FK series), sophisticated complete solutions for demanding and highly dynamic drive tasks.

PROFIBUS DP or PROFINET IO is used isochronously for communication with packaging machines and for "distributed synchronous operation".

More information

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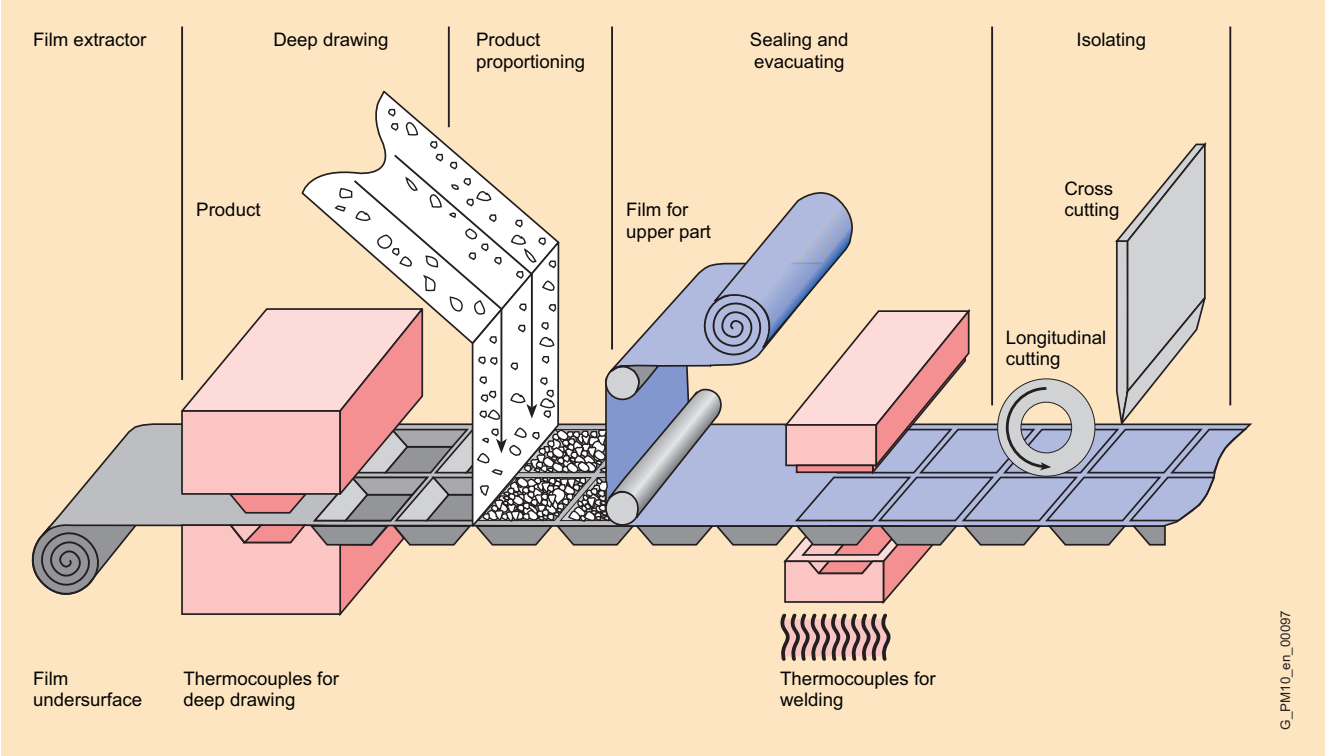
Molding, filling and sealing machine

Overview



Principle of the molding, filling and sealing machine

Machine requirements

With the molding, filing and sealing machine, the film for the underparts is transferred from station to station by a main drive.

The film is molded to suitable containers in accordance with the product that is to be packed. The mold that is submerged in the film is guided with different velocity levels that depend on the path of the tool and with the appropriate heating temperature.

The product must be filled into the container accurately in terms of clock cycle and quantity.

To prevent deterioration of the product and to seal it, the covering film must be drawn off by a second coil. The heated surface is then placed on the container from the top and the container is sealed due to the effect of the heat.

The sealed packages are then cut into smaller units and removed for further packaging.

The cross-cutter is moved pneumatically or electrically. The objective is to control the procedure such that as many parts as possible pass through the machine per unit of time. Foil-specific parameters have to be taken into account on accelerating and braking.

High clock rates and changes in format at the press of a button are the main requirements.

The following Motion Control and technology functions were used for the implementation of the machine:

- Position
- Cam
- Output cams
- Longitudinal cutter
- Temperature control

Benefits

The automation solution with SIMOTION described below offers you the following advantages:

- ONE system for the logic, Motion Control and technology functions. The engineering is considerably simplified and the hardware outlay is minimized.
- Intuitively operable SCOUT engineering system for creating applications quickly and easily.
- Comprehensive diagnostic functions with SIMOTION, such as trace functions, Alarm S concept and teleservice reduce the commissioning times, increase the availability of the machine and its flexibility.
- Smooth running of the machine due to cams and servo drives
- High productivity
- Machine parameters can be easily and flexibly adjusted on the operator panel: e.g. shifting the print pattern, sealing time
- TIA integration simplifies integration of HMI, I/O and drives

Design

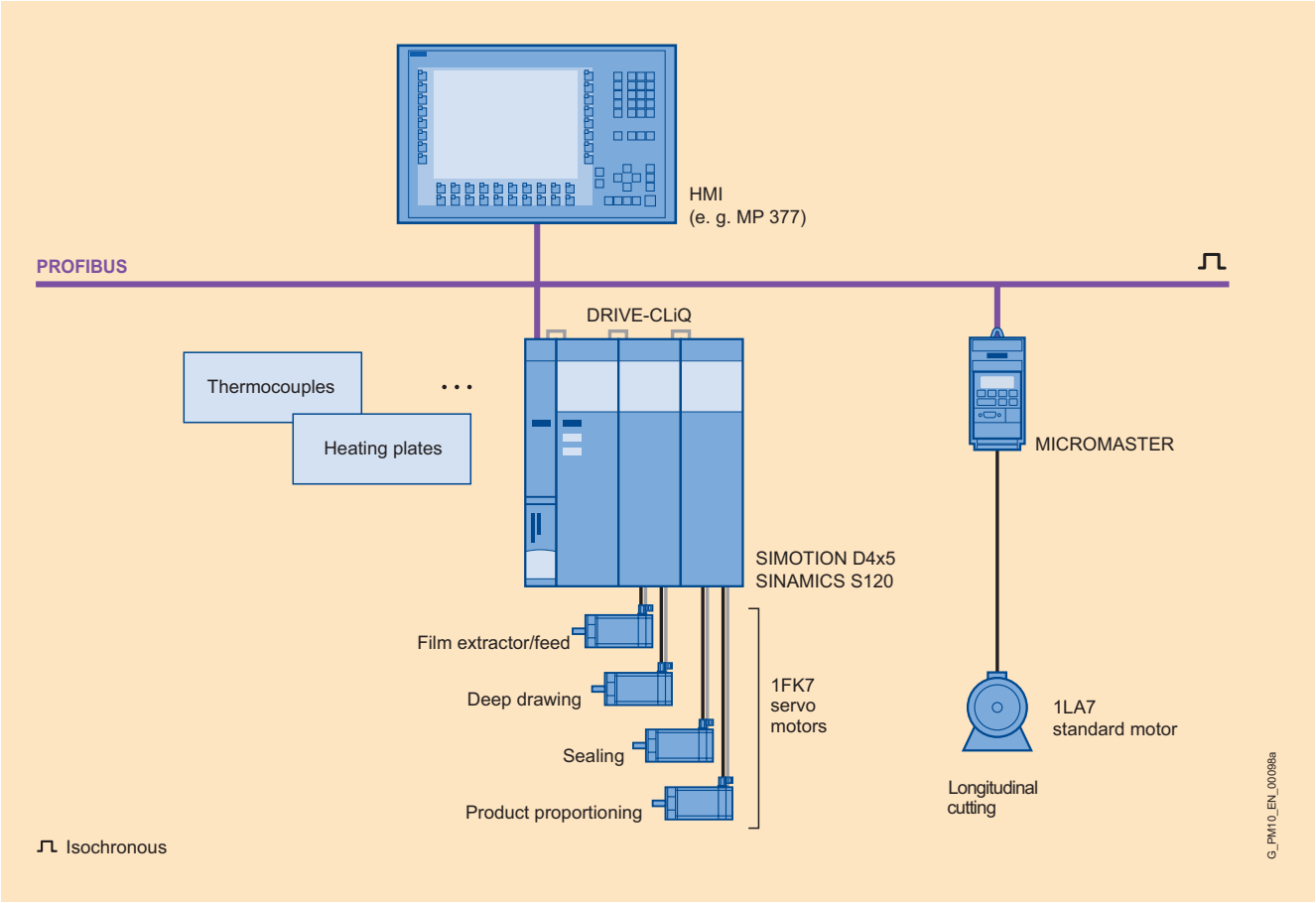
Automation solution

The drive-based version of SIMOTION for multiple-axes solutions, SIMOTION D4x5, is selected. In this manner, controll logic, Motion Control, drive functionality and HMI functions are combined in a single hardware and software system.

Technology functions such as temperature control and cam controller are available in the form of software.

The SINAMICS S120 drive system in combination with 1FK7 servo motors offers optimized interfacing to SIMOTION D. It resolves demanding drive tasks and provides an accurate, highly dynamic response.

The isochronous PROFIBUS DP is used for communication.



Automation solution example for SIMOTION D4x5

More information

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Notes

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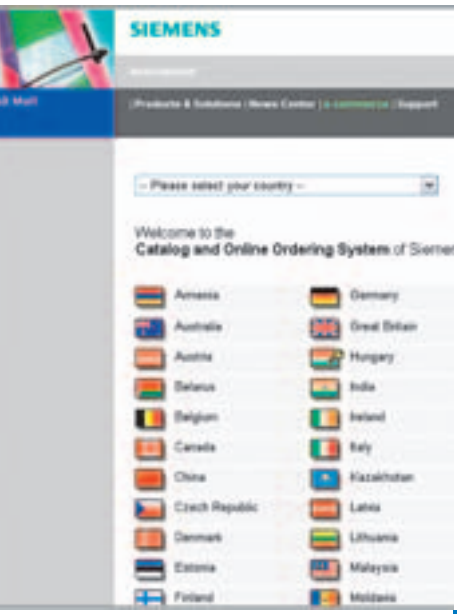
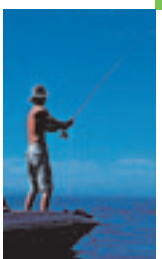
Appendix





Glossary

Absolute encoder

After switching on the supply voltage, this position encoder immediately provides the position of the drive as an absolute actual value. For single-turn encoders, the detection range is one turn, whereas multiturn encoders have a detection range of several turns (a typical number is, for example, 4096 turns). If an absolute encoder is used as a position encoder, no search for reference is required after the switch-on and the reference switch (e.g. BERO) which could normally be required is not necessary in this case.

There are rotary and linear absolute encoders.

Example of an absolute encoder:

1FK and 1FT motors can be delivered with integrated multiturn absolute encoders with 2048 sinusoidal/cosinusoidal signals per turn, over 4096 turns absolute and → "EnDat protocol".

Active Infeed

Overall functionality of an infeed with → Active Line Module, including the required additional components (filters, switching devices, computing power portion of a → Control Unit, voltage detection, etc.).

Active Interface Module

This module includes the line-side components required for an → Active Line Module like, for example, the pre-charging input circuit (pre-charging contactors and bypass connector).

Active Line Module

A controlled, self-commutating feed/feedback unit (with IGBTs in feed/feedback direction) which supplies a constant DC link voltage for the → Motor Modules. The Active Line Module operates together with the → Line reactor as a step-up converter.

Asynchronous (induction) motor

The asynchronous motor is an AC motor whose speed runs "behind" the synchronous speed.

Asynchronous motors can be connected to the three-phase system either directly in a star or delta connection or via a converter.

In combination with a converter, the asynchronous motor becomes a variable-speed drive system.

Other commonly used terms: squirrel-cage motor, cage motor.

See also → Synchronous motor.

Automatic restart

Upon power recovery after a mains failure, the Automatic restart function switches a converter automatically ON without requiring an acknowledgement of the power failure error. The automatic restart function e.g. minimizes drive standstill times and production failures.

However, operators must be aware of the danger situation which can occur when a drive recovers automatically after a longer power failure period without any operator action. If required, safe behavior in such a danger situation must be ensured by external control actions (e.g. withdrawal of the ON command).

Typical applications of the automatic restart: pump/fan/compressor drives working as single drives and often do not provide local control options.The automatic restart function is not used for coordinated drives for continuous material webs and motion control.

The following variants of this function can be set by means of parameters for SINAMICS:

- restart after a power failure if the 24 V electronic suppply does not yet exist
- restart after a failure of the 24 V electronic supply
- restart after any shut down on fault

The following actions can be specified via parameters:

- only acknowledgement of the mains failure message (e.g. for multi-motor drives, DC compound)
- ON command upon expiry of the parameterized delay time
- ON command with flying restart

The number of possible restart trials within a parameterizable time can be specified.

It is also possible to activate the → Flying restart function in addition to the automatic restart function to ensure a bumpless switching to a possibly still rotating motor.

Basic Line Filter

In combination with a line reactor, line filters limit the conducted electromagnetic interference emission in accordance with EMC legislation. See → Wideband Line Filter.

Basic Line Module

Unregulated infeed unit (diode bridge or thyristor bridge, without power feedback) for rectifying the line voltage of the → DC link.

Basic Operator Panel

Simple small operator panel for plugging on a SINAMICS → Control Unit with numeric display and some keys.

BOP20 is part of the SINAMICS product range.

Glossary

Blocksize

Volume-optimized, cubic construction of a drive unit. Mostly used for operating a motor.

See → Booksize, → Chassis unit.

Booksize

Book-shaped construction of the components of a drive group appropriate for back-mounting. Designed primarily for operating several → Motors.

Brake control

Software function specifying the instant when an existing mechanical holding brake or operational brake has to be applied; either within the framework of a load cycle in the case of a momentary standstill, or in the case of a fault.

Brake Relay

Component with a 24 V relay for brake control. Brakes can be switched using this relay with a rating of 24 V DC/12 A or 440 V AC/12 A.

Braking Module

Electronic switch or chopper (brake chopper), which connects a → Braking resistor with a specific pulse/pause ratio to the DC link voltage to convert regenerative (braking) energy to heat energy and to finally restrict the DC link voltage to permissible values. For SINAMICS, no braking resistor is incorporated in the braking module. It must be mounted outside the braking module.

Braking power

Regenerative power injected into the → DC link by one or several → Motor Modules, e.g. when lowering a load or decelerating a motor.

See → Braking resistor.

Braking resistor

Resistor which reduces the excess energy in the → DC link. The resistor is connected to a → Braking Module.

In this way, the resulting thermal loss is displaced outside the cabinet.

See → Braking power.

Capacitor Module

The module is used for increasing and buffering the DC link capacity.

It can be used for compensating a short-time power failure or for intermediate storage of the braking energy.

Chassis unit

In the upper output power range, chassis units are mostly used for incorporation in control panels. The components are mounted on supporting panels or frames.

See → Booksize, → Blocksize.

Cold plate

The cold plate is a flat aluminum plate that is used as a thermal interface by the SINAMICS power modules with the → Cooling method → Cold plate cooling.

Cold plate cooling

Cold plate cooling is a → Cooling method for SINAMICS power modules that is only available currently for the → Booksize units. The cold plate is fixed to the rear of the unit instead of the normal ribbed heat sink.

Command data set

Parameter data set consisting of the binector inputs (e.g. for control commands) and the connector inputs (e.g. for setpoints).

The individual data sets are represented as indexed parameters. The changeover is performed via input signals.

The appropriate parameterization of several command data sets and the changeover of the data sets allows the optional operation of the drive with different preconfigured signal sources.

Communication Board

A module for external communication, e.g. → PROFIBUS, → PROFINET, CAN or Ethernet. It is plugged into the option slot of a → Control Unit.

Communication Board Ethernet 20

A module for operation with → PROFINET (the open Industrial Ethernet standard of PROFIBUS International for automation systems).

PROFINET IO with IRT (Isochronous Real Time) and PROFINET IO with RT (Real Time) are supported. It is plugged into the option slot of a → Control Unit.

Glossary

CompactFlash card

Memory card for non-volatile storing of the drive software and of the corresponding parameters. The memory card can be plugged into the → Control Unit from outside.

Control Supply Module

24 V power supply module for the electronic circuitry of components in a SINAMICS drive group.

The Control Supply Module is supplied via two inputs: The incoming supply and the → DC link. The DC link connection ensures that the electronics power supply is buffered in the event of a power failure or voltage dip, thereby enabling emergency retraction and kinetic buffering.

Control Unit

Central control module: the feedforward and feedback control functions for several SINAMICS → Line Modules and/or → Motor Modules are implemented in this module.

Control Unit Adapter

A module for → DRIVE-CLiQ communication between a → Power Module in blocksize format (PM340) and a → Control Unit for several drives (e.g. CU320).

The Control Unit Adapter is connected through the → Power Module interface (PM-IF) to the → Power Module and through → DRIVE-CLiQ to the → Control Unit.

DC link

The component of the converter (or converter system) that connects the input current converter (rectifier) and the output current converter (one or more converters).

With voltage source DC link converters like SINAMICS, a constant DC voltage is present in the DC link (rectified line voltage).

Direct measuring system

Position encoder which is connected directly to the moving machine part as well as to the associated evaluation electronics. In the case of linear axes, it is also possible to use linear scales for this purpose.

In many cases, a direct measuring system must be used because the → Motor encoder for position sensing and control does not suit this purpose, e.g. due to excessive elasticity and backlash in the drive train.

Double Motor Module

Two motors can be connected to and operated with a Double Motor Module.

See → Motor Module, → Single Motor Module.

Drive system

A drive system includes all components of a family of products (e.g. SINAMICS) belonging to a drive. A drive system includes components such as → Line Modules, → Motor Modules, → Encoders, → Motors, → Terminal Modules and → Sensor Modules, as well as complementary components such as reactors, filters, lines, etc.

DRIVE-CLiQ

Abbreviation of “Drive Component Link with IQ”.

Communication system for connecting the various components of a SINAMICS drive system, such as the → Control Unit, the → Line Modules, the → Motor Modules, the → Motors and speed/position encoders.

The DRIVE-CLiQ hardware is based on the Industrial Ethernet standard and uses twisted-pair lines. The DRIVE-CLiQ line provides the transmitted and received signals and also the +24 V power supply.

Droop

Droop involves making the speed controller artificially "soft" by entering an adjustable percentage of the speed controller output signal with negative sign at the speed controller input. This means that the speed is slightly reduced at higher load torques. The droop function is used to reduce the response to load surges and for certain variations of load sharing control for drives which are coupled with one another through a continuous material web. The *I* component or the summed output signal can be used as speed output signal. The droop can be switched-on and switched-off using a control command.

Dynamic Servo Control

Dynamic Servo Control (DSC) allows the position actual value to be evaluated in a fast speed control clock cycle directly in the drive. The position reference value (position setpoint) is entered in the position controller clock cycle from the higher-level control via the isochronous → PROFIBUS with → PROFIdrive telegrams.

With sophisticated signal filtering and pre-control, DSC ensures optimum dynamics in the position control loop with a low bus bandwidth load.

DSC allows high control gains to be achieved and therefore a high level of stiffness – for instance to quickly compensate and correct load-related track/path deviations.

Edge modulation

Type of modulation for a drive converter gating unit, where the pulses “chopped” from the DC link voltage do not appear in a fixed time grid. The edges of the output voltage which is generated are formed by several short pulses near the zero crossing, while a wide pulse is generated at the center of every half-wave. This allows a high output voltage roughly approximating to 100 % of the line connection voltage and therefore ensuring good motor utilization.

Glossary

Electronic rating plate

Each component of the SINAMICS drive system, which is connected via → DRIVE-CLiQ has an electronic rating plate.

This plate can be read out via the → STARTER commissioning tool and provides the following information: type, order number, version, manufacturer, serial number and rated technical data.

Encoder

An encoder is a measuring system capturing actual values for the speed and/or angular/position values and provides them for electronic processing. Depending on the mechanical construction, encoders can be incorporated in the → Motors (→ Motor encoder) or mounted on the external mechanics. Depending on the individual type of movement, we distinguish between rotary encoders and translatory encoders (e.g. linear encoder). In terms of measured-value provision, we distinguish between → Absolute encoders (code sensors) and →Incremental encoders.

See → Incremental encoder TTL/HTL, → Incremental encoder sin/cos 1 V_{pp}, → Resolver

EnDat protocol

Serial transmission protocol for transmitting position/angular actual values from an → Absolute encoder to the drive or positioning control.

The EnDat protocol also allows parameterization and diagnostics of the encoder.

Fault buffer

Once a fault has occurred, the drive enters it in a fault buffer. The fault buffer can be read out via parameters.

Field weakening

The term field weakening designates the reduction of the magnetizing current of an electric motor to further increase the speed upon reaching the rated current.

Flexible response

With this function, the converter can be operated even in case of a voltage dip up to a minimum DC link voltage of approx. 50 % of the rated value (or of the parameterized line connection voltage value). In case of a voltage dip, the maximum output power of the converter decreases analogous to the current line voltage.

In contrast to kinetic buffering, a significant speed decrease can be avoided as long as the remaining power is sufficient for operating the drive with the required torque.

Flying measurement

When a hardware signal is received, the instantaneous position actual value is saved and, for example, is made available via PROFIBUS. The hardware signal can, for instance, be received from a measuring probe or a print index sensor (mechanical switch, BERO proximity switch or optical sensor). The active edge of the hardware signal can be parameterized (rising, falling or both).

Flying restart

After Power on, the "flying restart" function automatically switches a converter to a possibly coasting motor. When switching to the rotating motor, the motor first needs to be magnetized by an → Asynchronous motor. For drives not equipped with an encoder, a search for the current speed is carried out. The current speed setpoint in the ramp-function generator is then set to the current actual speed value. Ramp-up to the definitive speed setpoint starts out at this value. The flying restart function can help to shorten the ramp-up procedure following power-up when the load is still coasting down.

Application example:

After a power failure, a fan drive can be quickly reconnected to the running fan impeller by means of the flying restart function.

See → Automatic restart.

Heat dissipation

The thermal losses are conducted away from the converter and/or motor so that the permissible temperatures are not exceeded.

Hub

Central connecting element in a network based on star connection technology. A hub distributes arriving data packages to all devices connected.

Incremental encoder

Incremental position and speed encoder. In contrast to the → Absolute encoder, this encoder does not output an actual position value signal corresponding to the absolute path, but outputs incremental “delta position or angular signals” instead.

The following three types of incremental encoders are available → Incremental encoder TTL/HTL, → Incremental encoder sin/cos 1 V_{pp} or → Resolver.

Glossary

Incremental encoder sin/cos 1 V_{pp}

An incremental encoder sin/cos 1 V_{pp} is defined as a high-resolution optical sine/cosine encoder which can, for example, be incorporated in 1FK motors as a → Motor encoder.

As a rule, the following signals are output:

- Two signals displaced by 90 degrees, with respectively 2048 sinusoidal signal periods per revolution as differential signals with a 1 V_{pp} amplitude ("A/B sinusoidal encoder tracks").
- A reference signal (zero pulse) per revolution as a differential signal with a 0.5 V_{pp} amplitude.
- For some types, additionally two sinusoidal signal periods displaced by 90 degrees as differential signals with a 1V_{pp} amplitude ("C/D track").

For determining the actual position or angular value, the zero crossings of the sinusoidal encoder tracks are evaluated first (rough evaluation, e.g. totally 4 x 2048 = 8192 zero crossings per revolution). In addition to this, a fine evaluation can be performed by means of an analog detection of the amplitude. By combining the rough and fine evaluation, resolutions of more than 1,000,000 increments can be achieved per encoder revolution.

Examples of typical sin/cos encoders: ERN1387, ERN1381.

Incremental encoder TTL/HTL

Incremental position and speed measuring encoder (→ Incremental encoder). In most cases, it outputs two pulse chains (tracks) displaced by 90 degrees with rectangular output signals and often additionally one zero pulse per revolution, respectively. The output signals feature TTL levels (in most cases +5 V RS422 differential signals; TTL = Transistor-Transistor Logic) or HTL levels (+15 or +24 V logic level; HTL = High Level Transistor Logic).

Line filter

Line filters are filters in the converter input which protect the network from harmonic loads and/or interference voltages created in the converter.

Line filters can be passive or active filters, for the lower-frequency harmonics (designated with the term line feedback) with 5, 7, 11, 13, etc. times the line frequency, and also filters for high frequency interference voltages from 10 kHz onward (i.e. RFI suppression filters).

With SINAMICS, the term line filter only designates passive RFI suppression filters.

Line Module

A Line Module is a power component which creates the DC link voltage for one or several → Motor Modules from a three-phase line voltage.

The following three Line Module types are used for SINAMICS:

→ Basic Line Module, → Smart Line Module and → Active Line Module.

Line reactor

Line reactors are used for reducing the line-side harmonic currents and harmonic effects. With the → Active Line Modules, line reactors are used as an additional energy storage.

Line-side power components

Power components arranged between the line and the converter unit, such as line reactors, line filters, line contactors, etc.

Liquid cooling

Liquid cooling is a cooling method for SINAMICS power modules and is only available for the → Chassis units. For this cooling method, a liquid cooler with inlet and outlet nozzles is permanently integrated. The specifications quoted by Siemens AG are applicable to the liquid quality, volumetric flow (quantity of liquid per time unit) and liquid pressure. Liquid cooling can also be retrofitted by the customer in the case of the → Cold plate cooling method.

Motor

For the electric motors which can be driven by SINAMICS, a principle distinction is made between rotary and linear motors with regard to their moving direction, and between synchronous and asynchronous (induction) motors with regard to their electromagnetic operating principle. For SINAMICS, the motors are connected to a → Motor Module.

See → Synchronous motor, → Asynchronous (induction) motor, → Motor encoder.

Motor encoder

An → Encoder integrated in the motor or built on the motor, e.g. → Resolver, → Incremental encoder TTL/HTL or → Incremental encoder sin/cos 1 V_{pp}.

The encoder detects the motor speed and, in the case of synchronous motors, also the rotor position angle (of the commutation angle for the motor currents).

For drives without an additional → Direct measuring system, it is also used as a position encoder for position controlling.

Motor Module

A Motor Module is a power unit (DC-AC inverter) ensuring the power supply for the connected motor.

Power is supplied through the → DC link of the drive group.

A Motor Module must be connected to a → Control Unit via → DRIVE-CLiQ. The open-loop and closed-loop control functions of the Motor Module are stored in the Control Unit.

There are → Single Motor Modules and → Double Motor Modules.

Glossary

Motor potentiometer

This function is used to simulate an electromechanical motor potentiometer for setpoint input. The setpoint is adjusted via one control command for "higher" and one for "lower".

Motor with DRIVE-CLiQ

The motors with → DRIVE-CLiQ comprise of a motor, encoder and an integrated encoder evaluation system. To operate these motors, a power cable and a → DRIVE-CLiQ cable must be connected to the → Motor Module.

Motor-side power components

Power components arranged between the converter unit and the motor, e.g. output filters, output reactors, etc.

Optimized pulse patterns

Complicated modulation procedure of a converter gating unit, where the voltage pulses are arranged in such a way that the output current has a sinusoidal curve at an optimum aproximation. This is of primary importance for achieving a high gate factor and a particularly slow torque ripple.

Output reactor

Reactor (inductance) in the converter or inverter output for reducing the capacitive charge/discharge currents of long power cables.

Power Module

A Power Module is an AC-AC converter, which does not have a built-in → Control Unit.

Power supply unit

This component provides electric energy for electric and electronic components.

For SINAMICS, all components are internally connected via 24 V terminals or rails.

The power supply can be ensured by a power supply unit available on the market (e.g. SITOP power) or via a conventional → Control Supply Module.

PROFIBUS

Field bus in accordance with the IEC 61158 standard, sections 2 to 6.

PROFIdrive

This PROFIBUS profile was specified for speed- and position-controlled drives by PI (PROFIBUS & PROFINET International).

The PROFIdrive V3 profile is the latest version.

PROFINET

This is an open component-based industrial communication system using Ethernet for distributed automation systems.

Resolver

Mechanically and electrically very robust and cost-efficient → Motor encoder which does not require any incorporated electronics and which operates according to a fully electromagnetic principle: one sine and cosine signal, respectively, are induced in two coils displaced by 90 degrees. The resolver delivers all signals required for speed-controlled operation of the converter or for position control. The number of sine and cosine periods per revolution is equal to the number of pole pairs of the resolver. In the case of a 2-pole resolver, the evaluation electronics may output an additional zero pulse per encoder revolution. This zero pulse ensures a unique assignment of the position information in relation to an encoder revolution. A 2-pole resolver can be used as a single-turn encoder.

2-pole resolvers are suitable for motors with any pole number. In the case of multi-pole resolvers, the pole pair number of the motor and of the resolver are always identical. For this reason, multi-pole resolvers ensure a higher resolution than 2-pole resolvers.

Safe Brake Control

Function associated with → Safety Integrated.

For SINAMICS → Booksize units the motor holding brake is controlled through two channels each with an electronic switch in the +24 V channel and in the ground channel. Both of these channels are monitored. If one of the two channels fails, then this is detected and signaled. For the Booksize drive units, the braking cables are integrated into the power cable.

See → Brake control.

Safe Brake Relay

Certified components for the safe control of a 24 V brake coil.

See → Brake Relay.

Safe standstill

Function of → Safety Integrated.

In case of an error or in combination with a machine function, this function is used to safely disconnect the torque-generating energy flow to the motor. This procedure is executed drive-specific and contactless. See → Safety Integrated.

Glossary

Safety Integrated

These safety functions are integrated into the products and ensure efficient personal and machine protection in accordance with the EC 98/37/EG machinery directive.

By means of the integrated safety functions, the requirements of safety class 3 in accordance with EN 954-1 can be met in a simple and efficient way.

Sensor Module

Hardware module for evaluating speed/position encoder signals.

Single Motor Module

A Single Motor Module is a → Motor Module to which one single motor can be connected and operated.

See also → Double Motor Module.

Sinusoidal filter

The sinusoidal filter is connected to the converter or inverter output on the motor side. This filter has been designed for the generation of a converter output voltage with an almost sinusoidal shape.

This method protects motors whose isolation system could be damaged by voltage peaks.

In addition to this, a shielded power cable is not required in many cases.

Sinusoidal filters are often required in the chemical industry, e.g. to ensure that the permissible isolation voltage in the motor terminal box is not exceeded.

SIZER

SIZER is a tool for configuring the SINAMICS and MICROMASTER drive systems. SIZER assists with the correct technical specifications for the drive systems and selection of the drive components required for the system.

See → STARTER.

Skip frequency band

A skip frequency band is a speed/frequency setpoint range in which the drive must not be operated. The upper and lower limits of the skip frequency band can be parameterized. If a signal value is entered from an external or internal setpoint source within the skip frequency band, this signal value is replaced by one of the skip frequency limits. This function allows for the suppression of undesirable mechanical resonant oscillation by suppressing those speeds which could possibly excite this type of resonant oscillation.

Smart Line Module

Unregulated line infeed/feedback unit with a diode bridge for feeding; stall-protected, line-commutated feedback via IGBTs (Insulated Gate Bipolar Transistor).

The Smart Line Module provides the DC link voltage for the → Motor Module.

STARTER

The STARTER commissioning tool has been designed for the startup and parameterization of drive units. Moreover, diagnostic functions required for service tasks (e.g. PROFIBUS diagnostics, function generator, trace) can be executed.

See → SIZER.

Synchronous motor

Synchronous motors run at the same frequency with which they are operated. They do not have a slip (like → Asynchronous (induction) motors). Synchronous motors require different feed forward and feedback control concepts depending on their design to ensure that they can be operated with converters.

Synchronous motors are distinguished by the following features:

- Permanent-magnet/separately excited
- With/without damping cage
- With/without position encoder

Synchronous motors are used for different reasons:

- High drive dynamic response (→ Synchronous servo motors)
- High overload capability
- High speed accuracy with exactly specified frequency (SIEMOSYN motors)

Synchronous servo motor

Synchronous servo motors (e.g. 1FK, 1FT) are permanent-magnet → Synchronous motors with position encoders such as an → Absolute encoder. As the moments of self-inertia are low, the drive is extremely dynamic, e.g. because there are no power losses due to the electric resistance of copper in the rotor, a high power density is achieved with a low construction volume. Synchronous servo motors can only be operated in combination with converters. Due to the servo control required for this purpose, the motor current is moment-dependent. The momentary phase relation of the motor current is derived from the (mechanical) rotor position detected by the position encoder.

Terminal Board

Terminal extension module for plugging into a → Control Unit.

With SINAMICS, the Terminal Board TB30 is available with analog and digital I/O terminals.

Terminal Module

Terminal expansion module that snaps onto the installation rail, for installation in the control cabinet.

With SINAMICS, there is, for example, the Terminal Module TM31 available with analog and digital I/O terminals.

Third-party motor

A motor is designated as a third-party motor if its motor data is not known to the drive line-up and it cannot be identified by means of its order number.

The motor data of an external motor is required for commissioning. It must be manually entered in the corresponding parameters.

Topology

The topology describes the structure of a drive system with → Control Unit, → Motor Modules, → Motors, → Encoders, → Terminal Modules, including the connection system.

Travel to a fixed stop

With this function, a motor can be travelled to a fixed stop with a defined torque/force, without any fault message. As soon as the fixed stop is reached, the torque/force defined via parameters is built up and persists.

Vector control

Vector control (field-oriented control) is a high-performance control type for induction machines. It is based on an exact model calculation of the motor and of two current components which control the flow and the torque by means of software algorithms. In this way, the predefined speeds and torques to be respected and limited accurately and with a good dynamic response.

There are two vector control types:

- frequency control (sensorless vector control)
- speed-torque control with speed feedback (→ Encoder).

Voltage Clamping Module

Component which limits the → DC link voltage and therefore also the motor voltages to permissible values in the case of resonance.

With power cables of excessive length, excitation of the system's resonant frequency under adverse conditions can cause overvoltages to develop in the DC link. In such cases, the insulation systems of the connected motors are particularly at risk and partial discharges can occur.

This component must be used if the total length of all power cables exceeds 350 m (shielded cables) and 500 m (unshielded cables).

Voltage Sensing Module

Component which measures the actual line voltage and makes the measured data available via → DRIVE-CLiQ. Used in conjunction with an → Active Line Module for feeding back the actual line voltage value.

It can be mounted on a top-hat rail and also features 2 analog inputs and a connection for a temperature sensor.

Approvals

Overview

Many of the products in this catalog comply with UL/CSA and FM requirements and are labeled with the corresponding approval mark.

All approvals and certifications have been carried out for the associated system components as described in the catalogs and configuration manuals. They are therefore only valid if the system components described are used in the device or plant.

UL: Underwriters Laboratories
Independent public testing institution in North America

Approval marks:

- UL — for end products, tested by UL in accordance with UL standard
- cUL — for end products, tested by UL in accordance with CSA standard
- cULus — for end products, tested by UL in accordance with UL and CSA standards
- UR — for mounting parts in end products, tested by UL in accordance with UL standard
- cUR — for mounting parts in end products, tested by UL in accordance with CSA standard
- cURus — for mounting parts in end products, tested by UL in accordance with UL and CSA standards

Test standards:

- SIMOTION: Standard UL 508
- SINAMICS: Standard UL 508C
- SIMODRIVE: Standard UL 508C
- Motors: Standard UL 547

Product category/File No.:

- SIMOTION: E164110
- SINAMICS: E192450
- SIMODRIVE: NMMS2/E192450
- Motors: E93429

TUV: TUV Rheinland of North America Inc.
Independent public testing institution in North America
National recognized testing laboratory (NRTL)

Approval mark:

- **cTUVus** — tested by TUV in accordance with UL and CSA standards

CSA: Canadian Standards Association
Independent public testing institution in Canada

Approval mark:

- CSA — tested by CSA in accordance with CSA standard

Test standard:

- Standard CAN/CSA-C22.2/No. 14-Industrial Control Equipment/No. 14-05/No. 14-M95/No. 142-M1987

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Overview

Software types

Software requiring a license is categorized into types.
The following software types have been defined:

- Engineering software
- Runtime software

Engineering software

This includes all software products for creating (engineering) user software, e.g. for configuring, programming, parameterizing, testing, commissioning or servicing.

Data generated with engineering software and executable programs can be duplicated for your own use or for use by third-parties free-of-charge.

Runtime software

This includes all software products required for plant/machine operation, e.g. operating system, basic system, system expansions, drivers, etc.

The duplication of the runtime software and executable programs created with the runtime software for your own use or for use by third-parties is subject to a charge.

You can find information about license fees according to use in the ordering data (e.g. in the catalog). Examples of categories of use include per CPU, per installation, per channel, per instance, per axis, per control loop, per variable, etc.

Information about extended rights of use for parameterization/configuration tools supplied as integral components of the scope of delivery can be found in the readme file supplied with the relevant product(s).

License types

Siemens Automation & Drives offers various types of software license:

- Floating license
- Single license
- Rental license
- Trial license
- Factory license

Floating license

The software may be installed for internal use on any number of devices by the licensee. Only the concurrent user is licensed. The concurrent user is the person using the program. Use begins when the software is started.
A license is required for each concurrent user.

Single license

Unlike the floating license, a single license permits only one installation of the software.

The type of use licensed is specified in the ordering data and in the Certificate of License (CoL). Types of use include for example per device, per axis, per channel, etc.

One single license is required for each type of use defined.

Rental license

A rental license supports the "sporadic use" of engineering software. Once the license key has been installed, the software can be used for a specific number of hours (the operating hours do not have to be consecutive).
One license is required for each installation of the software.

Trial license

A trial license supports "short-term use" of the software in a non-productive context, e.g. for testing and evaluation purposes.
It can be transferred to another license.

Factory license

With the Factory License the user has the right to install and use the software at one permanent establishment only. The permanent establishment is defined by one address only.The number of hardware devices on which the software may be installed results from the order data or the Certificate of License (CoL).

Certificate of license

The Certificate of License (CoL) is the licensee's proof that the use of the software has been licensed by Siemens. A CoL is required for every type of use and must be kept in a safe place.

Downgrading

The licensee is permitted to use the software or an earlier version/release of the software, provided that the licensee owns such a version/release and its use is technically feasible.

Delivery versions

Software is constantly being updated.
The following delivery versions

- PowerPack
- Upgrade

can be used to access updates.

Existing bug fixes are supplied with the ServicePack version.

PowerPack

PowerPacks can be used to upgrade to more powerful software. The licensee receives a new license agreement and CoL (Certificate of License) with the PowerPack. This CoL, together with the CoL for the original product, proves that the new software is licensed.
A separate PowerPack must be purchased for each original license of the software to be replaced.

Upgrade

An upgrade permits the use of a new version of the software on the condition that a license for a previous version of the product is already held.
The licensee receives a new license agreement and CoL with the upgrade. This CoL, together with the CoL for the previous product, proves that the new version is licensed.
A separate upgrade must be purchased for each original license of the software to be upgraded.

ServicePack

ServicePacks are used to debug existing products.
ServicePacks may be duplicated for use as prescribed according to the number of existing original licenses.

License key

Siemens Automation & Drives supplies software products with and without license keys.

The license key serves as an electronic license stamp and is also the "switch" for activating the software (floating license, rental license, etc.).

The complete installation of software products requiring license keys includes the program to be licensed (the software) and the license key (which represents the license).

Detailed explanations concerning license conditions can be found in the “Terms and Conditions of Siemens AG” or under http://www.siemens.com/automation/mall
(A&D Mall Online-Help System)

A&D/Software licenses/En 03.08.06

Setup Texts and Software Update Services

Overview

The "General License Conditions for Software Products for Automation and Drives" are applicable for supplies and deliveries of A&D software products.

Legal notes during setup for new software products

All software products feature a uniform reference to the license conditions. The license conditions are enclosed either with the documentation or in the software pack. When software is downloaded from the Internet, the license contract is displayed before the ordering procedure and must be accepted by the user before downloading can continue.

Notice:
This software is protected by German and/or US copyright laws and the regulations of international agreements. Unauthorized reproduction or sale of this software or parts of it is a criminal offense. This will lead to criminal and civil prosecution, and may result in significant fines and/or claims for damages. Prior to installing and using the software, please read the applicable license conditions for this software. You will find these in the documentation or packaging.

If you have received this software on a CD that is marked "Trial version", or accompanying software that is licensed for your use, the software is only permitted to be used for test and validation purposes in accordance with the accompanying conditions for the trail license. To this end, it is necessary for programs, software libraries, etc. are installed on your computer. We therefore urgently recommend that installation is performed on a single-user computer or on a computer that is not used in the production process or for storing important data, since it cannot be completely excluded that existing files will be modified or overwritten. We accept no liability whatsoever for damage and/or data losses that result from this installation or the non-observance of this warning. Every other type of use of this software is only permitted if you are in possession of a valid license from Siemens is obtained.

If you are not in possession of a valid license that can be proven by presenting an appropriate Certificate of License/software product certificate, please abort installation immediately and contact a Siemens office without delay to avoid claims for damages.

Software Update Services

Order
To order the Software Update Service, an order number must be specified. The Software Update Service can be ordered when the software products are ordered or at a later date. Subsequent orders require that the ordering party is in posession at least of a single license.

Note:
It is recommended that the Software Update Service is ordered as early as possible. If a new software version of a software product is released for delivery by Siemens, only those customers will receive it automatically who are entered in the appropriate delivery list at Siemens at this time. Previous software versions, or the current software version are not supplied when the Software Update Service is ordered. The Software Update Service requires that the software product is up-to-date at the time of completion of the contract for the Software Update Service.

Delivery
When a Software Update Service is ordered, you will be sent the contractual conditions of this service and the price is due for payment. At the same time, you will be included in a delivery list for the software product to be updated. If Siemens releases a new software version for the corresponding software product for general sale (function version or product version), it will be delivered automatically to the goods recipient specified in the delivery address within the contract period.

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.

Information and Ordering in the Internet and on CD-ROM

Siemens Industry Automation and Motion Control 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 Motion Control 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

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 Automation and Drives 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 CD-ROM or DVD.

Easy Shopping with the A&D Mall

The A&D 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 A&D Mall on the Internet under:

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

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Notes

Conversion tables

Rotary inertia (to convert from A to B, multiply by entry in table)

A \ B	lb-in^2	lb-ft^2	lb-in-s^2	lb-ft-s^2 slug-ft^2	kg-cm^2	kg-cm-s^2	gm-cm^2	gm-cm-s^2	oz-in^2	oz-in-s^2
lb-in^2	1	6.94×10^{-3}	2.59×10^{-3}	2.15×10^{-4}	2.926	2.98×10^{-3}	2.92×10^{3}	2.984	16	4.14×10^{-2}
lb-ft^2	144	1	0.3729	3.10×10^{-2}	421.40	0.4297	4.21×10^{5}	429.71	2304	5.967
lb-in-s^2	386.08	2.681	1	8.33×10^{-2}	1.129×10^{3}	1.152	1.129×10^{6}	1.152×10^{3}	6.177×10^{3}	16
lb-ft-s^2 slug-ft^2	4.63×10^{3}	32.17	12	1	1.35×10^{4}	13.825	1.355×10^{7}	1.38×10^{4}	7.41×10^{4}	192
kg-cm^2	0.3417	2.37×10^{-3}	8.85×10^{-4}	7.37×10^{-5}	1	1.019×10^{-3}	1000	1.019	5.46	1.41×10^{-2}
kg-cm-s^2	335.1	2.327	0.8679	7.23×10^{-2}	980.66	1	9.8×10^{5}	1000	5.36×10^{3}	13.887
gm-cm^2	3.417×10^{-4}	2.37×10^{-6}	8.85×10^{-7}	7.37×10^{-8}	1×10^{-3}	1.01×10^{-6}	1	1.01×10^{-3}	5.46×10^{-3}	1.41×10^{-5}
gm-cm-s^2	0.335	2.32×10^{-3}	8.67×10^{-4}	7.23×10^{-5}	0.9806	1×10^{-3}	980.6	1	5.36	1.38×10^{-2}
oz-in^2	0.0625	4.34×10^{-4}	1.61×10^{-4}	1.34×10^{-5}	0.182	1.86×10^{-4}	182.9	0.186	1	2.59×10^{-3}
oz-in-s^2	24.13	0.1675	6.25×10^{-2}	5.20×10^{-3}	70.615	7.20×10^{-2}	7.09×10^{4}	72.0	386.08	1

Torque (to convert from A to B, multiply by entry in table)

A \ B	lb-in	lb-ft	oz-in	N-m	kg-cm	kg-m	gm-cm	dyne-cm
lb-in	1	8.333×10^{-2}	16	0.113	1.152	1.152×10^{-2}	1.152×10^{3}	1.129×10^{6}
lb-ft	12	1	192	1.355	13.825	0.138	1.382×10^{4}	1.355×10^{7}
oz-in	6.25×10^{-2}	5.208×10^{-3}	1	7.061×10^{-3}	7.200×10^{-2}	7.200×10^{-4}	72.007	7.061×10^{4}
N-m	8.850	0.737	141.612	1	10.197	0.102	1.019×10^{4}	1×10^{7}
kg-cm	0.8679	7.233×10^{-2}	13.877	9.806×10^{-2}	1	10^{-2}	1000	9.806×10^{5}
kg-m	86.796	7.233	1.388×10^{3}	9.806	100	1	1×10^{5}	9.806×10^{7}
gm-cm	8.679×10^{-4}	7.233×10^{-5}	1.388×10^{-2}	9.806×10^{-5}	1×10^{-3}	1×10^{-5}	1	980.665
dyne-cm	8.850×10^{-7}	7.375×10^{-8}	1.416×10^{-5}	10^{-7}	1.0197×10^{-6}	1.019×10^{-8}	1.019×10^{-3}	1

Length (to convert from A to B, multiply by entry in table)

A \ B	inches	feet	cm	yd	mm	m
inches	1	0.0833	2.54	0.028	25.4	0.0254
feet	12	1	30.48	0.333	304.8	0.3048
cm	0.3937	0.03281	1	1.09×10^{-2}	10	0.01
yd	36	3	91.44	1	914.4	0.914
mm	0.03937	0.00328	0.1	1.09×10^{-3}	1	0.001
m	39.37	3.281	100	1.09	1000	1

Power (to convert from A to B, multiply by entry in table)

A \ B	HP	Watts
HP (English)	1	745.7
(lb-in) (deg./sec)	2.645×10^{-6}	1.972×10^{-3}
(lb-in) (rpm)	1.587×10^{-5}	1.183×10^{-2}
(lb-ft) (deg./sec)	3.173×10^{-5}	2.366×10^{-2}
(lb-ft) (rpm)	1.904×10^{-4}	0.1420
Watts	1.341×10^{-3}	1

Force (to convert from A to B, multiply by entry in table)

A \ B	lb	oz	gm	dyne	N
lb	1	16	453.6	4.448×10^{5}	4.4482
oz	0.0625	1	28.35	2.780×10^{4}	0.27801
gm	2.205×10^{-3}	0.03527	1	1.02×10^{-3}	N.A.
dyne	2.248×10^{-6}	3.59×10^{-5}	980.7	1	0.00001
N	0.22481	3.5967	N.A.	100000	1

Mass (to convert from A to B, multiply by entry in table)

A \ B	lb	oz	gm	kg	slug
lb	1	16	453.6	0.4536	0.0311
oz	6.25×10^{-2}	1	28.35	0.02835	1.93×10^{-3}
gm	2.205×10^{-3}	3.527×10^{-2}	1	10^{-3}	6.852×10^{-5}
kg	2.205	35.27	10^{3}	1	6.852×10^{-2}
slug	32.17	514.8	1.459×10^{4}	14.59	1

Rotation (to convert from A to B, multiply by entry in table)

A \ B	rpm	rad/sec.	degrees/sec.
rpm	1	0.105	6.0
rad/sec.	9.55	1	57.30
degrees/sec.	0.167	1.745×10^{-2}	1

Temperature Conversion

°F	°C	°C	°F
0	*–17.8*	*–10*	14
32	0	0	32
50	10	10	50
70	21.1	20	68
90	32.2	30	86
98.4	37	37	98.4
212	100	100	212
subtract 32 and multiply by $^5/_9$		multiply by $^9/_5$ and add 32	

Mechanism Efficiencies

Acme-screw with brass nut	~0.35–0.65
Acme-screw with plastic nut	~0.50–0.85
Ball-screw	~0.85–0.95
Chain and sprocket	~0.95–0.98
Preloaded ball-screw	~0.75–0.85
Spur or bevel-gears	~0.90
Timing belts	~0.96–0.98
Worm gears	~0.45–0.85
Helical gear (1 reduction)	~0.92

Friction Coefficients

Materials	μ
Steel on steel (greased)	~0.15
Plastic on steel	~0.15–0.25
Copper on steel	~0.30
Brass on steel	~0.35
Aluminum on steel	~0.45
Steel on steel	~0.58

Mechanism	μ
Ball bushings	<0.001
Linear bearings	<0.001
Dove-tail slides	~0.2++
Gibb ways	~0.5++

Material Densities

Material	lb-in^3	gm-cm^3
Aluminum	0.096	2.66
Brass	0.299	8.30
Bronze	0.295	8.17
Copper	0.322	8.91
Hard wood	0.029	0.80
Soft wood	0.018	0.48
Plastic	0.040	1.11
Glass	0.079–0.090	2.2–2.5
Titanium	0.163	4.51
Paper	0.025–0.043	0.7–1.2
Polyvinyl chloride	0.047–0.050	1.3–1.4
Rubber	0.033–0.036	0.92–0.99
Silicone rubber, without filler	0.043	1.2
Cast iron, gray	0.274	7.6
Steel	0.280	7.75

Wire Gauges [1)]

Cross-section mm^2	Standard Wire Gauge (SWG)	American Wire Gauge (AWG)
0.2	25	24
0.3	23	22
0.5	21	20
0.75	20	19
1.0	19	18
1.5	17	16
2.5	15	13
4	13	11
6	12	9
10	9	7
16	7	6
25	5	3
35	3	2
50	0	1/0
70	000	2/0
95	00000	3/0
120	0000000	4/0
150	–	6/0
185	–	7/0

1) The table shows approximate SWG/AWG sizes nearest to standard metric sizes; the cross-sections do not match exactly.

Metal surcharges

Explanation of the metal factor

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.

The surcharges will be determined based on the following criteria:

- Official price of the metal

  Official price on the day prior to receipt of the order or prior to the release order (= daily price) for
  - silver (sale price of the processed material),
  - gold (sale price of the processed material)

  Source: Umicore, Hanau
  (http://www.metalsmanagement.umicore.com)
  and for
  - copper (low DEL notation + 1 %),
  - aluminum (aluminum in cables) and
  - lead (lead in cables)

  Source: German Trade Association for Cables and Conductors
  (http://www.kabelverband.de)

- Metal factor of the products

  Certain products are assigned a metal factor. The metal factor determines the official price as of which the metal surcharges are charged and the calculation method used (weight or percentage method). An exact explanation is given below.

Structure of the metal factor

The metal factor consists of several digits; the first digit indicates whether the method of calculation refers to the list price or a discounted price (customer net price)
(L = list price / N = customer net price).

The remaining digits indicate the method of calculation used for the respective metal. If no surcharge is added, a "–" is used.

1st digit	List or customer net price using the percentage method
2nd digit	for silver (AG)
3rd digit	for copper (CU)
4th digit	for aluminum (AL)
5th digit	for lead (PB)
6th digit	for gold (AU)

Weight method

The weight method uses the basic official price, the daily price and the raw material weight. In order to calculate the surcharge, the basic official price must be subtracted from the daily price. The result is then multiplied by the raw material weight.

The basic official price can be found in the table below using the number (2 to 9) of the respective digit of the metal factor. The raw material weight can be found in the respective product descriptions.

Percentage method

Use of the percentage method is indicated by the letters A – Z at the respective digit of the metal factor.

The surcharge is increased – dependent on the deviation of the daily price compared with the basic official price – using the percentage method in "steps" and consequently offers surcharges that remain constant within the framework of this "step range". A higher percentage rate is charged for each new step. The respective percentage level can be found in the table below.

Metal factor examples

L E A – – –

Basis for % surcharge: List price
Silver: basis 150 €, step range 50 €, 0.5 %
Copper: basis 150 €, step range 50 €, 0.1 %
No surcharge for aluminum
No surcharge for lead
No surcharge for gold

N – A 6 – –

Basis for % surcharge: Customer net price
No surcharge for silver
Copper: basis 150 €, step range 50 €, 0.1 %
Aluminum acc. to weight, basic offic. price 225 €
No surcharge for lead
No surcharge for gold

– – 3 – – –

No basis necessary
No surcharge for silver
Copper acc. to weight, basic official price 150 €
No surcharge for aluminum
No surcharge for lead
No surcharge for gold

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Values of the metal factor

Percentage method	Basic official price	Step range	% surcharge 1st step	% surcharge 2nd step	% surcharge 3rd step	% surcharge 4th step	% surcharge per additional step
			Official price	Official price	Official price	Official price	
			151 € – 200 €	201 € – 250 €	251 € – 300 €	301 € – 350 €	
A	150	50	0.1	0.2	0.3	0.4	0.1
B	150	50	0.2	0.4	0.6	0.8	0.2
C	150	50	0.3	0.6	0.9	1.2	0.3
D	150	50	0.4	0.8	1.2	1.6	0.4
E	150	50	0.5	1.0	1.5	2.0	0.5
F	150	50	0.6	1.2	1.8	2.4	0.6
G	150	50	0.7	1.4	2.1	2.8	0.7
H	150	50	1.2	2.4	3.6	4.8	1.2
I	150	50	1.6	3.2	4.8	6.4	1.6
J	150	50	1.8	3.6	5.4	7.2	1.8
K	150	50	2.0	3.5	5.0	6.5	1.5
L	150	50	2.2	4.4	6.6	8.8	2.2
M	150	50	2.5	5.0	7.5	10.0	2.5
			176 € – 225 €	226 € – 275 €	276 € – 325 €	326 € – 375 €	
O	175	50	0.1	0.2	0.3	0.4	0.1
P	175	50	0.2	0.4	0.6	0.8	0.2
Q	175	50	0.3	0.6	0.9	1.2	0.3
R	175	50	0.5	1.0	1.5	2.0	0.5
			226 € – 275 €	276 € – 325 €	326 € – 375 €	376 € – 425 €	
S	225	50	0.2	0.4	0.6	0.8	0.2
T	225	50	0.5	1.0	1.5	2.0	0.5
U	225	50	1.0	2.0	3.0	4.0	1.0
V	225	50	1.0	1.5	2.0	3.0	1.0
W	225	50	1.2	2.5	3.5	4.5	1.0
			126 € – 150 €	151 € – 175 €	176 € – 200 €	201 € – 225 €	
X	125	25	1.9	3.8	5.7	7.6	1.9
			151 € – 175 €	176 € – 200 €	201 € – 225 €	226 € – 250 €	
Y	150	25	0.3	0.6	0.9	1.2	0.3
			401 € – 425 €	426 € – 450 €	451 € – 475 €	476 € – 500 €	
Z	400	25	0.1	0.2	0.3	0.4	0.1

Price basis (1st digit)	
L	Charged on the list price
N	Charged on the customer net price or discounted list price

Weight method	Basic official price	
2	100	Calculation based on raw material weight
3	150	
4	175	
5	200	
6	225	
7	300	
8	400	
9	555	

Misc.	
–	No metal surcharge

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Notes

Suggestions for improving the catalog
Fax form

To

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Fax: +49/9131-98-1145

E-mail:

docu.motioncontrol@
siemens.com

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Function

Company/Department

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ZIP, town

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Your opinion is important to us!

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That's why we would ask you to complete this questionnaire and fax it back to us.

Thank you!

For the following points, please enter your personal assessment with values from 1 (= good) to 6 (= bad):

Do the contents meet your requirements? ☐

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Is the text easy to understand? ☐

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How do you assess the quality of the graphics and diagrams? ☐

Do you have any suggestions for improvement? Have you found any printing errors?

Notes

Notes

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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

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SINAMICS G130 Drive Converter Chassis Units, SINAMICS G150 Drive Converter Cabinet Units	D 11
SINAMICS GM150/SINAMICS SM150 Medium-Voltage Converters	D 12
SINAMICS S150 Drive Converter Cabinet Units	D 21.3
Asynchronous Motors Standardline	D 86.1
Synchronous Motors with Permanent-Magnet Technology, HT-direct	D 86.2
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MOTOX Geared Motors	D 87.1
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• Converter Systems SIMODRIVE 611/POSMO	
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• Motors	
• Drive System SINAMICS S120	
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PDF: *DELTA Switches and Socket Outlets*	*ET D1*
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SIVENT Fans	LV 65
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