SIEMENS

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

SINAMICS Drives

Catalog D 11

Edition 2015

Related catalogs

SINAMICS GM150/SINAMICS SM150 D 12
Medium-Voltage Converters

E86060-K5512-A101-A3-7600

SINAMICS G180 D 18.1
Converters – Compact Units, Cabinet Systems, Cabinet Units Air-Cooled and Liquid-Cooled

E86060-K5518-A111-A2-7600

SINAMICS S120 D 21.3
Chassis Format Units
and Cabinet Modules
SINAMICS S150
Converter Cabinet Units
PDF (E86060-K5521-A131-A4-7600)

Motion Control Drives D 31
SINAMICS Inverters for Single-Axis Drives and SIMOTICS Motors

E86060-K5531-A101-A2-7600

SINAMICS Drives D 35
SINAMICS G120P and
SINAMICS G120P Cabinet
pump, fan, compressor converters

E86060-K5535-A101-A1-7600

Motion Control PM 21
SIMOTION, SINAMICS S120 & SIMOTICS
Equipment for Production Machines

E86060-K4921-A101-A3-7600

SIMOTICS Low-Voltage Motors D 81.1
Type series 1LE1, 1MB1 and 1PC1
Frame sizes 71 to 315
Power range 0.18 to 200 kW

E86060-K5581-A111-A7-7600

SIMOTICS FD D 81.8
Flexible Duty Motors

PDF (E86060-K5581-A181-A3-7600)

LOHER Low-Voltage Motors D 83.1
Type series 1MD5, 1PS0, 1PS1, 1PS4 and 1PS5
Frame sizes 71 to 500
Power range 0.25 to 1400 kW

E86060-K5583-A111-A2-7600

Industrial Controls IC 10
SIRIUS

E86060-K1010-A101-A5-7600

Industrial Communication IK PI
SIMATIC NET

E86060-K6710-A101-B8-7600

Low-Voltage Power Distribution and Electrical Installation Technology LV 10
SENTRON • SIVACON • ALPHA
Protection, Switching, Measuring and Monitoring Devices, Switchboards and Distribution Systems
E86060-K8280-A101-A2-7600

Products for Automation and Drives CA 01
Interactive Catalog, DVD

E86060-D4001-A510-D4-7600

Industry Mall
Information and Ordering Platform
in the Internet:

www.siemens.com/industrymall

The Engineering Manual

SINAMICS Low Voltage Engineering Manual

Engineering Manual for
- SINAMICS G130 Converter Chassis Units,
- SINAMICS G150 Converter Cabinet Units,
- SINAMICS S120 Built-in and Cabinet Modules,
- SINAMICS S120 Cabinet Modules,
- SINAMICS S150 Converter Cabinet Units

This manual offers users comprehensive support with the configuring of drives and associated system components.

The first three chapters deal mainly with the fundamental physical principles of variable-speed drives and with directives and basic information for EMC and include general system descriptions and general engineering information.

The other chapters then discuss in detail questions relating to the dimensioning of drives as well as the selection of suitable motors.

Note:
The manual is not available in hard copy form, but only as an electronic file in PDF format.

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

SINAMICS Drives

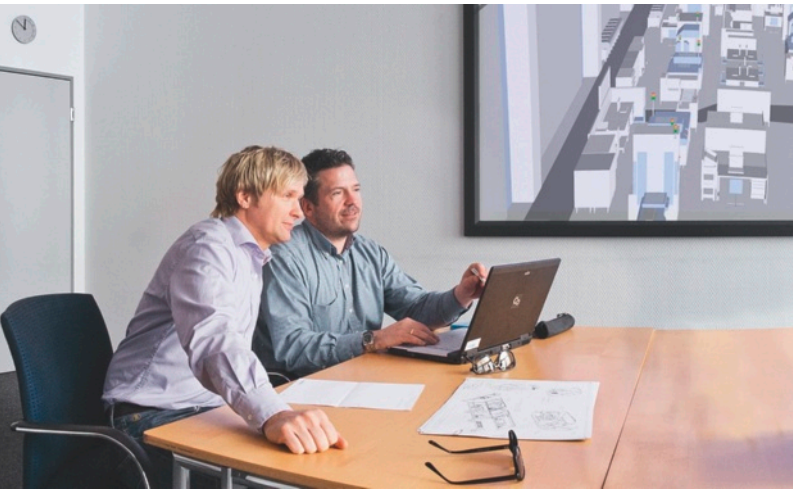
Catalog D 11 · 2015

Supersedes:
Catalog D 11 · 2011
Amendment December 2011 to Catalog D 11 · 2011

Refer to the Industry Mall for current updates of this catalog:
www.siemens.com/industrymall

The products contained in this catalog can also be found in the Interactive Catalog CA 01.
Article No.: E86060-D4001-A510-D4-7600

Please contact your local Siemens branch.



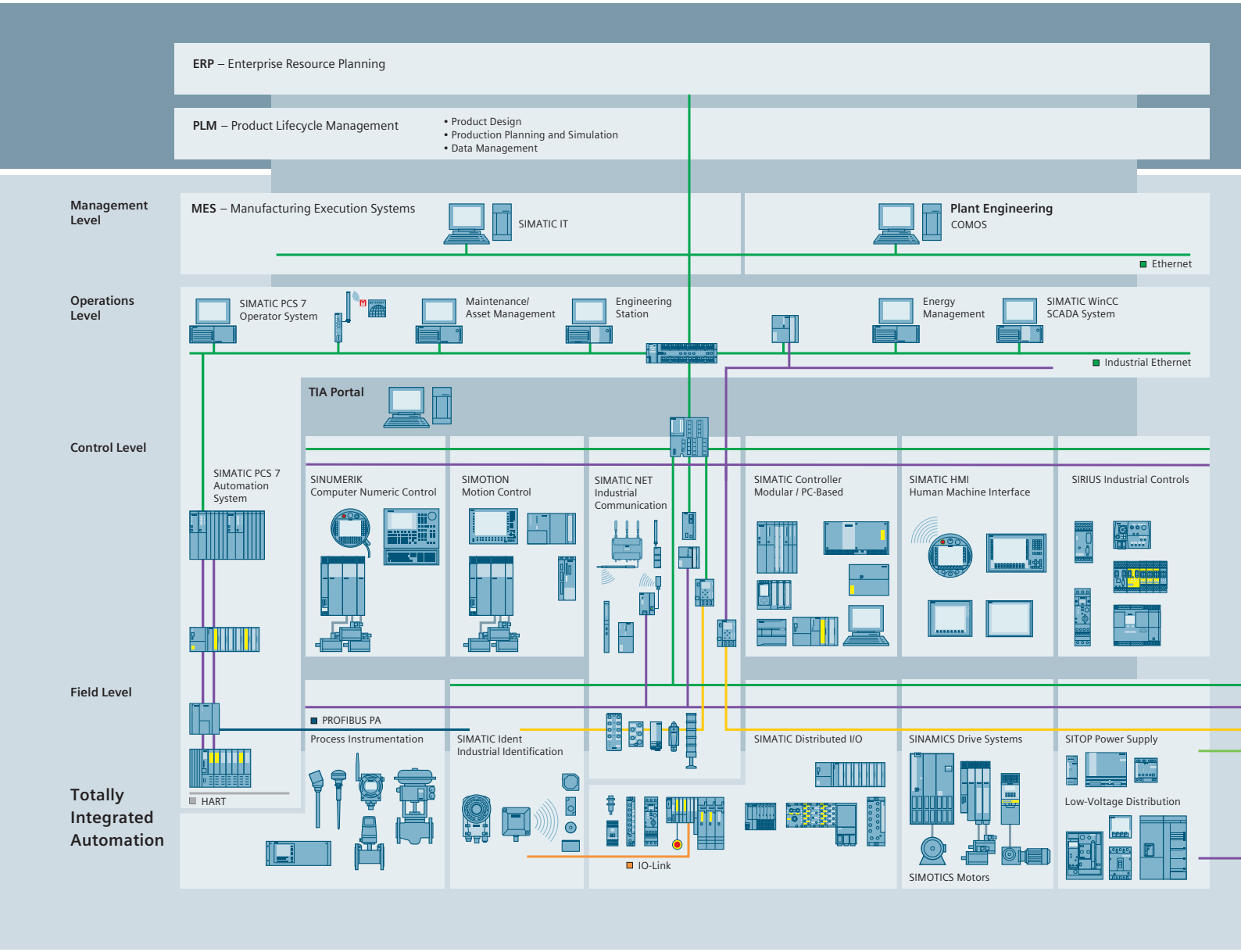
Answers for industry.

Integrated technologies, vertical market expertise and services for greater productivity, energy efficiency, and flexibility.

Siemens is the world's leading supplier of innovative and environmentally friendly products and solutions for industrial companies. End-to-end automation technology and industrial software, solid market expertise, and technology-based services are the levers we use to increase our customers' productivity, efficiency and flexibility.

We consistently rely on integrated technologies and, thanks to our bundled portfolio, we can respond more quickly and flexibly to our customers' wishes. With our globally unmatched range of automation technology, industrial control and drive technology as well as industrial software, we equip companies with exactly what they need over their entire value chain – from product design and development to production, sales and service. Our industrial customers benefit from our comprehensive portfolio, which is tailored to their market and their needs.

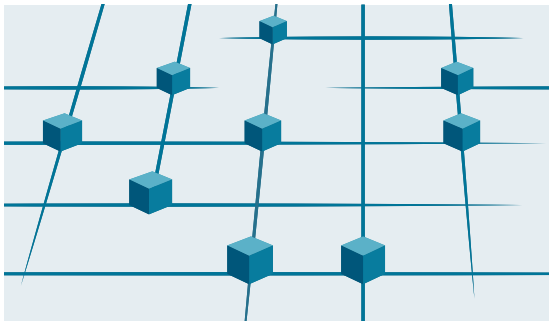
Market launch times can be reduced by up to 50% due to the combination of powerful automation technology and industrial software. At the same time, the costs for energy or waste water for a manufacturing company can be reduced significantly. In this way, we increase our customers' competitive strength and make an important contribution to environmental protection with our energy-efficient products and solutions.



Efficient automation starts with efficient engineering.

Totally Integrated Automation: Efficiency driving productivity.

Efficient engineering is the first step toward better production that is faster, more flexible, and more intelligent. With all components interacting efficiently, Totally Integrated Automation (TIA) delivers enormous time savings right from the engineering phase. The result is lower costs, faster time-to-market, and greater flexibility.



Totally Integrated Automation
Efficient interoperability of all automation components

A unique complete approach for all industries

As one of the world's leading automation suppliers, Siemens provides an integrated, comprehensive portfolio for all requirements in process and manufacturing industries. All components are mutually compatible and system-tested. This ensures that they reliably perform their tasks in industrial use and interact efficiently, and that each automation solution can be implemented with little time and effort based on standard products. The integration of many separate individual engineering tasks into a single engineering environment, for example, provides enormous time and cost savings.

With its comprehensive technology and industry-specific expertise, Siemens is continuously driving progress in manufacturing industries – and Totally Integrated Automation plays a key role.

Totally Integrated Automation creates real value added in all automation tasks, especially for:

- **Integrated engineering**
  Consistent, comprehensive engineering throughout the entire product development and production process
- **Industrial data management**
  Access to all important data occurring in productive operation – along the entire value chain and across all levels
- **Industrial communication**
  Integrated communication based on international cross-vendor standards that are mutually compatible
- **Industrial security**
  Systematic minimization of the risk of an internal or external attack on plants and networks
- **Safety Integrated**
  Reliable protection of personnel, machinery, and the environment thanks to seamless integration of safety technologies into the standard automation

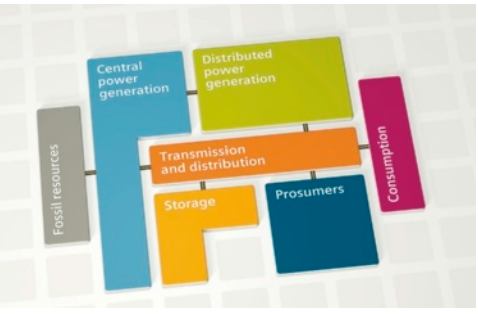
Making things right with Totally Integrated Automation

Totally Integrated Automation, industrial automation from Siemens, stands for the efficient interoperability of all automation components. The open system architecture covers the entire production process and is based on end-to-end shared characteristics: consistent data management, global standards, and uniform hardware and software interfaces.

Totally Integrated Automation lays the foundation for comprehensive optimization of the production process:

- Time and cost savings due to efficient engineering
- Minimized downtime due to integrated diagnostic functions
- Simplified implementation of automation solutions due to global standards
- Better performance due to interoperability of system-tested components

Totally Integrated Power
We bring power to the point – safely and reliably.

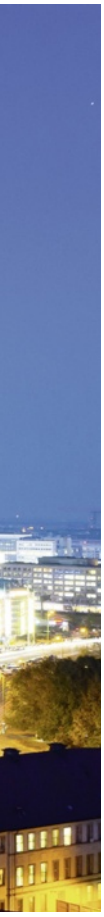


Comprehensive answers for power distribution in complex energy systems – from Siemens

Efficient, reliable, safe: These are the demands placed on electrification and especially power distribution. And our answer – for all application areas of the energy system – is Totally Integrated Power (TIP). It's based on our comprehensive range of products, systems, and solutions for low and medium voltage, rounded out by our support throughout the entire lifecycle – from planning with our own software tools to installation, operation, and services.

Smart interfaces allow linking to industrial or building automation, making it possible to fully exploit all the optimization potential of an integrated solution. This is how we provide our customers around the world with answers to their challenges. With highly efficient, reliable, and safe power distribution, we lay the foundation for sustainable infrastructure and cities, buildings, and industrial plants. We bring power to the point – wherever and whenever it is needed.

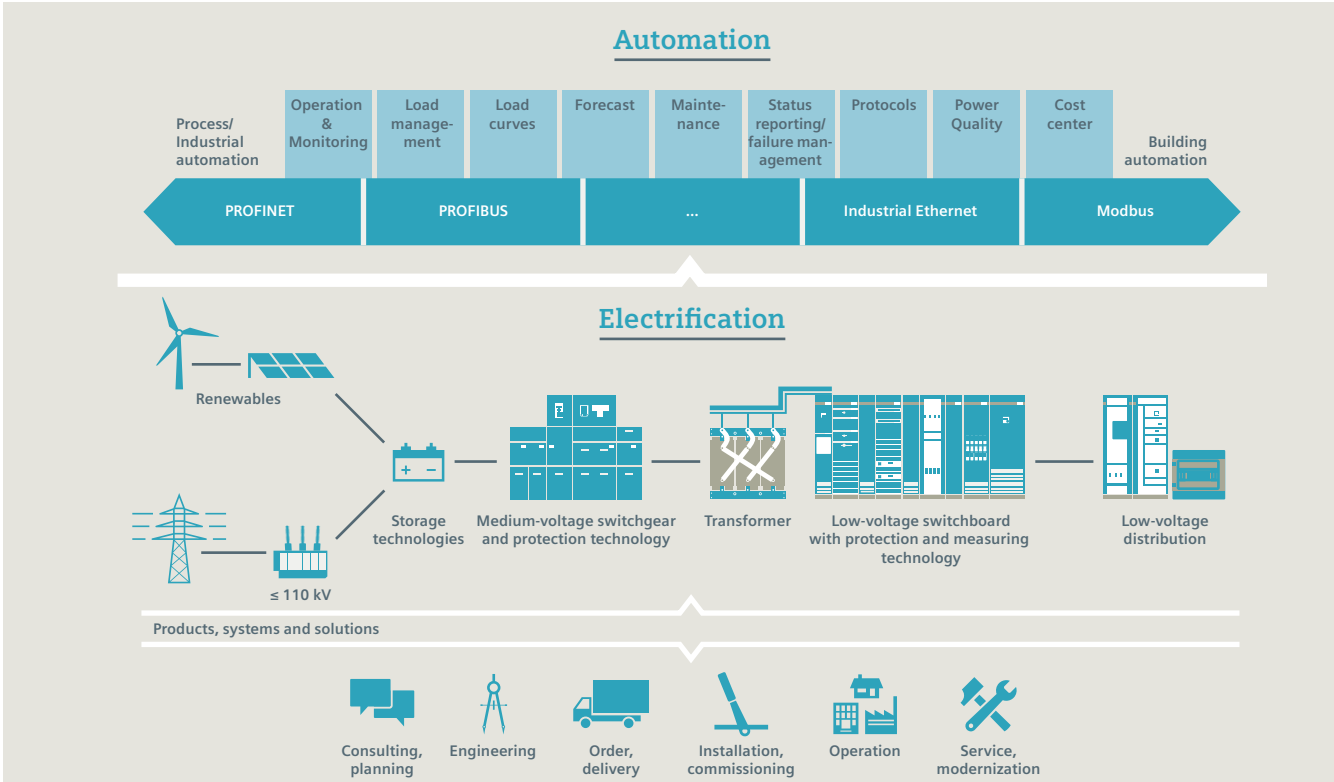
More information: www.siemens.com/tip



Totally Integrated Power offers more:

- **Consistency**:
  For simplified plant engineering and commissioning as well as smooth integration into automation solutions for building or production processes
- **One-stop-shop**:
  A reliable partner with a complete portfolio for the entire process and lifecycle – from the initial idea to after-sales service
- **Safety**:
  A comprehensive range of protection components for personnel safety and line and fire protection, safety by means of type testing
- **Reliability**:
  A reliable partner who works with customers to develop long-lasting solutions that meet the highest quality standards
- **Efficiency**:
  Bringing power to the point means greater plant availability and maximum energy efficiency in power distribution
- **Flexibility**:
  End-to-end consistency and modular design of Totally Integrated Power for any desired expansions and adaptation to future requirements
- **Advanced technology**:
  Reliable power distribution especially for applications in which supply is critical, continuous refinement of the technology

Challenges are our speciality



Integrated Drive Systems

Faster on the market and in the black with Integrated Drive Systems

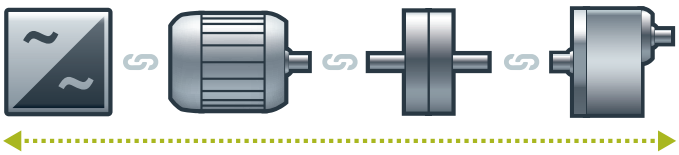
SINAMICS is an important element of a Siemens Integrated Drive System, contributing significantly to increased efficiency, productivity, and availability in industrial production processes.

Integrated Drive Systems are Siemens' trendsetting answer to the high degree of complexity that characterizes drive and automation technology today. The world's only true one-stop solution for entire drive systems is characterized in particular by its threefold integration: Horizontal, vertical, and lifecycle integration ensure that every drive system component fits seamlessly into the whole system, into any automation environment, and even into the entire lifecycle of a plant.

The outcome is an optimal workflow – from engineering all the way to service that entails more productivity, increased efficiency, and better availability. That's how Integrated Drive Systems reduce time to market and time to profit.

Horizontal integration

Integrated drive portfolio: The core elements of a fully integrated drive portfolio are frequency converters, motors, couplings, and gear units. At Siemens, they're all available from a single source. Perfectly integrated, perfectly interacting. For all power and performance classes. As standard solutions or fully customized. No other player in the market can offer a comparable portfolio. Moreover, all Siemens drive components are perfectly matched, so they are optimally interacting.



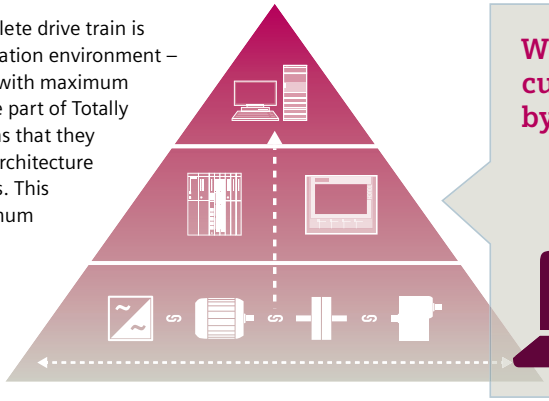
You can boost the availability of your application or plant to up to

99 %*

*e.g., conveyor application

Vertical integration

Thanks to **vertical integration**, the complete drive train is seamlessly integrated in the entire automation environment – an important prerequisite for production with maximum value added. Integrated Drive Systems are part of Totally Integrated Automation (TIA), which means that they are perfectly embedded into the system architecture of the entire industrial production process. This enables optimal processes through maximum communication and control.



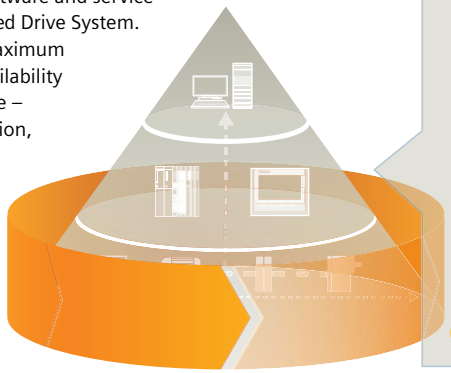
With TIA Portal you can cut your engineering time by up to

30 %

Lifecycle integration

Lifecycle integration adds the factor of time: Software and service are available for the entire lifecycle of an Integrated Drive System. That way, important optimization potential for maximum productivity, increased efficiency, and highest availability can be leveraged throughout the system's lifecycle – from planning, design, and engineering to operation, maintenance, and all the way even to modernization.

With Integrated Drive Systems, assets become important success factors. They ensure shorter time to market, maximum productivity and efficiency in operation, and shorter time to profit.



With Integrated Drive Systems you can reduce your maintenance costs by up to

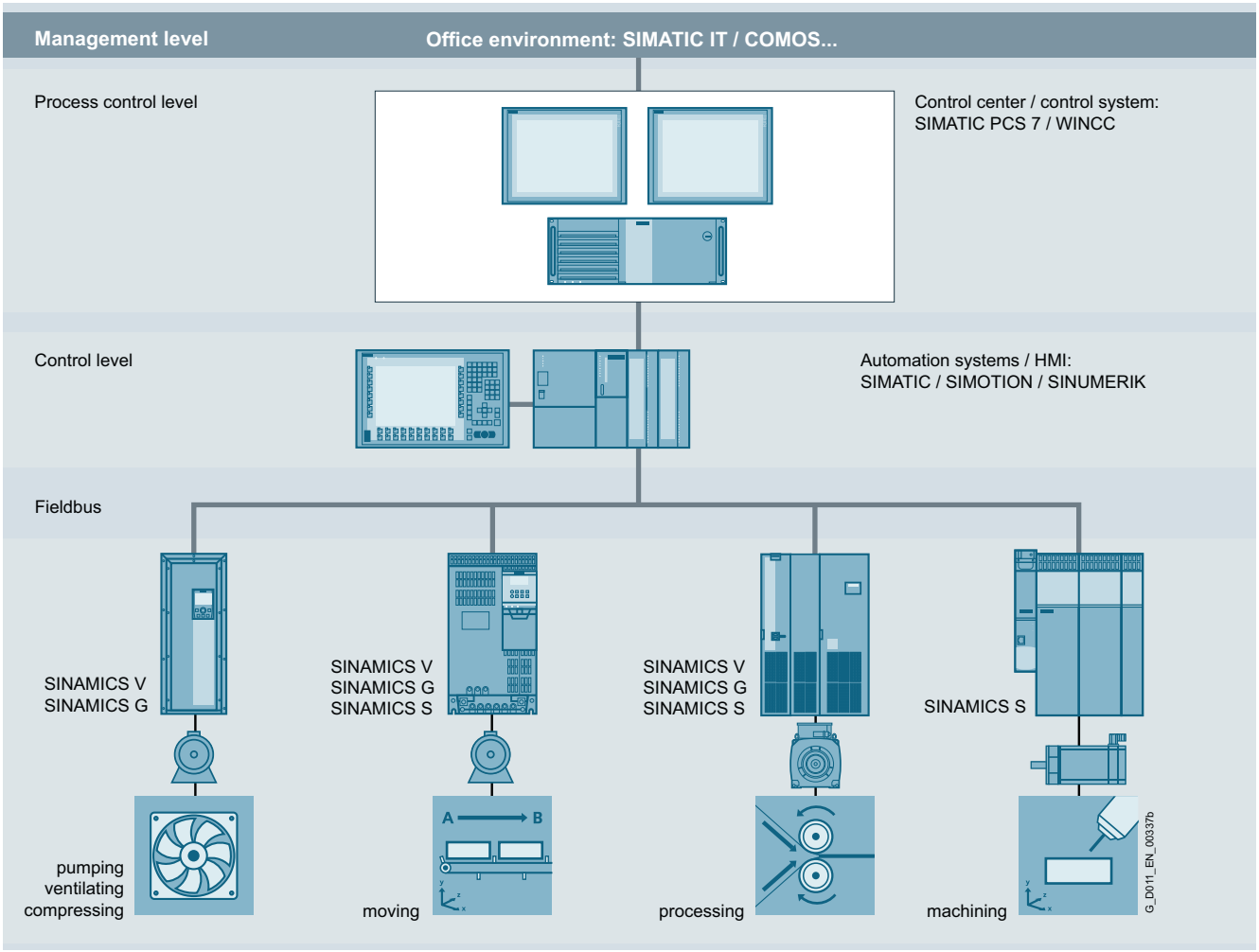
15 %

www.siemens.com/ids

System overview

Overview

Integration in automation



SINAMICS in automation

Totally Integrated Automation and communication

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

Depending on the application, the appropriate variable frequency drives can be selected and incorporated in the automation concept. With this in mind, the drives are clearly subdivided into their different applications. A wide range of communication options (depending on the drive type) are available for establishing a communication link to the automation system:

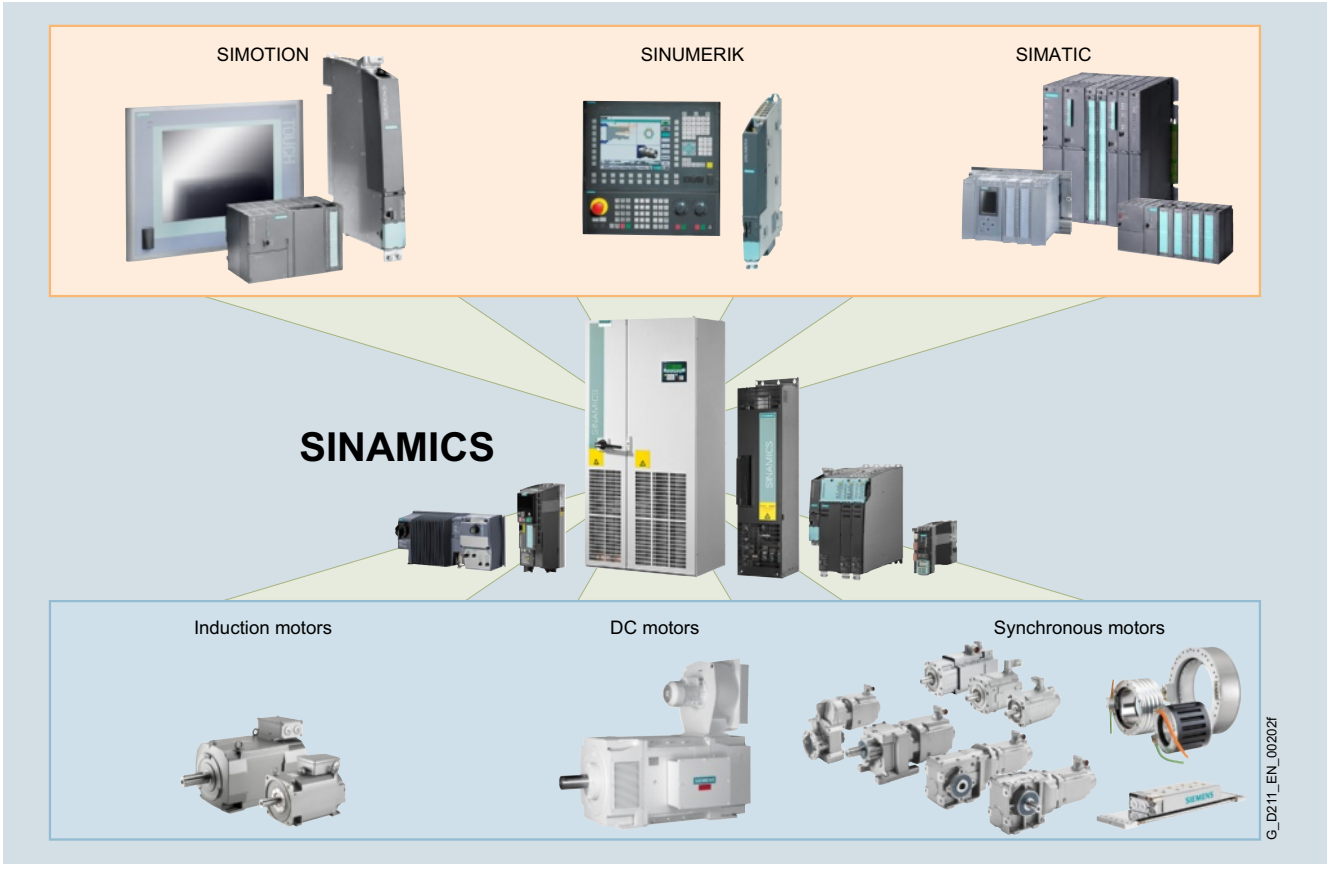
- PROFINET
- EtherNet/IP
- PROFIBUS
- AS-Interface
- USS
- CANopen
- Modbus RTU
- BACnet MS/TP

Applications

SINAMICS is the comprehensive 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
- Demanding 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.
- High-precision servo drives for the manufacture of wind turbines
- Highly dynamic servo drives for machine tools, as well as packaging and printing machines

Overview (continued)



SINAMICS as part of the Siemens modular automation system

Innovative, energy-efficient and reliable drive systems and applications as well as services for the entire drive train

The solutions for drive technology place great emphasis on the highest productivity, energy efficiency and reliability for all torque ranges, performance and voltage classes.

Siemens offers not only the right innovative variable frequency drive for every drive application, but also a wide range of energy-efficient low voltage motors, geared motors, explosion-protected motors and high-voltage motors for combination with SINAMICS.

Furthermore, Siemens supports its customers with global pre-sales and after-sales services, with over 295 service points in 130 countries – and with special services e.g. application consulting or motion control solutions.

Energy efficiency

Energy management process

Efficient energy management consultancy identifies the energy flows, determines the potential for making savings and implements them with focused activities.

Almost two thirds of the industrial power requirement is from electric motors. This makes it all the more important to use drive technology permitting energy consumption to be reduced effectively even in the configuration phase, and consequently to optimize plant availability and process stability. With SINAMICS, Siemens offers powerful energy efficient solutions which, depending on the application, enable a significant reduction in electricity costs.

Up to 70 % potential for savings using variable speed operation

SINAMICS enables great potential for savings to be realized by controlling the motor speed. In particular, huge potential savings can be recovered from pumps, fans and compressors which are operated with mechanical throttle and valves. Here, changing to variable-speed drives brings enormous economic advantages: In contrast to mechanical control systems, the power consumption at partial load operation is always immediately adjusted to the demand at that time. So energy is no longer wasted, permitting savings of up to 60 % – in exceptional cases even up to 70 %. Variable-speed drives also offer clear advantages over mechanical control systems when it comes to maintenance and repair. Current spikes when powering up the motor and strong torque surges become things of the past – and the same goes for pressure waves in pipelines, cavitation or vibrations which cause sustainable damage to the plant. Smooth starting and ramp-down relieve the load on the mechanical system, ensuring a significantly longer service life of the entire drive train.

Regenerative feedback of braking energy

In conventional drive systems, the energy produced during braking is converted to heat using braking resistors. Energy produced during braking is efficiently recovered to the supply system by versions of SINAMICS G and SINAMICS S inverters with regenerative feedback capability and these devices do not therefore need a braking resistor. This permits up to 60 % of the energy requirement to be saved, e.g. in lifting applications. Energy which can be reused at other locations on a machine. Furthermore, this reduced power loss simplifies the cooling of the system, enabling a more compact design.

Overview (continued)

Energy efficiency (continued)

Energy transparency in all configuration phases

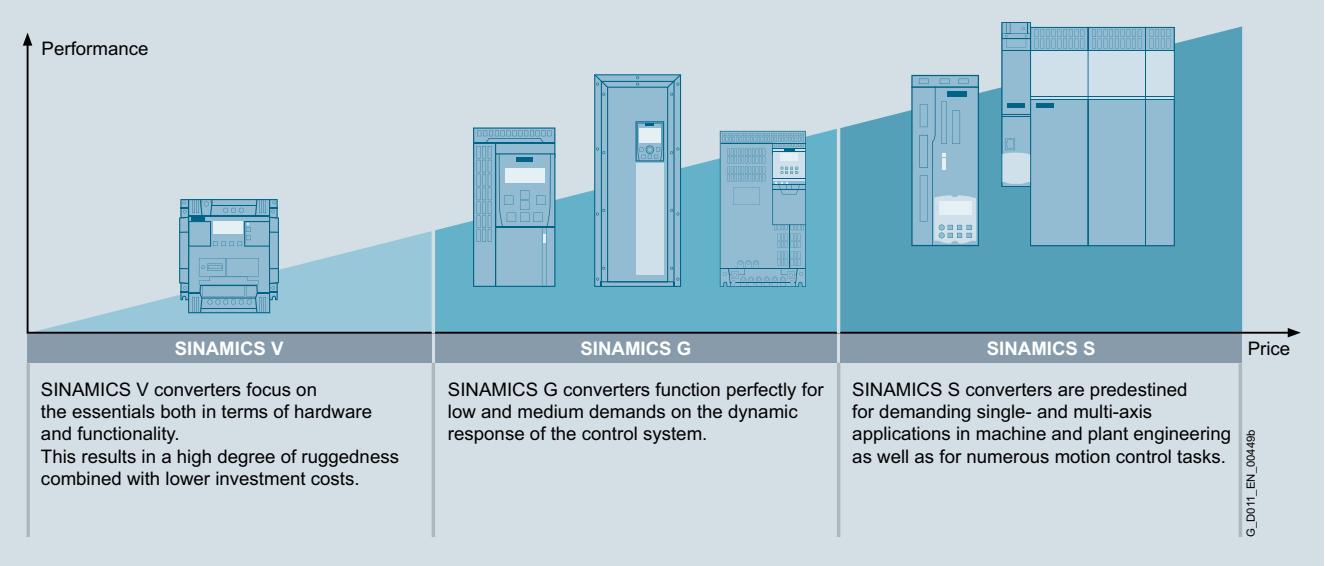
Early on, in the configuration phase, the SIZER for Siemens Drives engineering tool provides information on the specific energy requirement. The energy consumption across the entire drive train is visualized and compared with different plant concepts.

SINAMICS in combination with energy-saving motors

Engineering integration stretches beyond the SINAMICS drive family to higher-level automation systems, and to a broad spectrum of energy-efficient motors with a wide range of performance classes, which, compared to previous motors, are able to demonstrate up to 10 % greater efficiency.

Variants

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



Platform concept

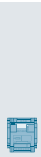
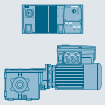
All SINAMICS variants are based on a platform concept. Joint hardware and software components, as well as standardized tools for dimensioning, configuration, and commissioning tasks ensure high-level integration across all components. SINAMICS handles a wide variety of drive tasks with no system gaps.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

Quality management 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 management system is certified by an independent authority in accordance with EN ISO 9001.

Overview (continued)

Low voltage									DC voltage	Medium voltage
Basic performance		General performance					High Performance		DC applications	Applications with high outputs
										
V20	V90	G120C/G120/ G120P/ G120P Cabinet	G110D/ G120D/ G110M	G130/G150	G180	S110	S120	S150	DCM	GH180/GM150/ SM150/GL150/ SL150
0.12 ... 30 kW	0.4 ... 7 kW	0.37 … 400 kW	0.37 ... 7.5 kW	75 ... 2700 kW	2.2 … 6600 kW	0.12 ... 90 kW	0.12 ... 5700 kW	75 ... 1200 kW	6 kW … 30 MW	0.15 ... 85 MW
Pumps, fans, compressors, conveyor belts, mixers, mills, spinning machines and textile machines	Handling machines, packaging machines, automatic assembly machines, metal forming machines, printing machines, winding and unwinding units	Pumps, fans, compressors, conveyor belts, mixers, mills, extruders Building management systems, process industry, HVAC, single-axis positioning applications in machine and plant engineering	Conveyor technology, single-axis positioning applications (G120D)	Pumps, fans, compressors, conveyor belts, mixers, mills, extruders	Sector-specific for pumps, fans, compressors, conveyor belts, extruders, mixers, mills, kneaders, centrifuges, separators	Single-axis positioning applications in machine and plant engineering	Production machines (packaging, textiles and printing machines, paper machines, plastic processing machines) machine tools, plants, process lines and rolling mills, ships and test bays	Test bays, cross cutters, centrifuges	Rolling mill drives, wire-drawing machines, extruders and kneaders, cableways and lifts, test bay drives	Pumps, fans, compressors, mixers, extruders, mills, crushers, rolling mills, conveying technology, excavators, test bays, marine drives, blast furnace fans, retrofit
V20 Brochure	V90 Brochure	Catalogs D 31, D 35	Catalog D 31	Catalog D 11	Catalog D 18.1	Catalog D 31	Catalogs D 21.3 PM 21, NC 62	Catalog D 21.3	Catalogs D 23.1, D 23.2	Catalogs D 15.1, D 12
Engineering tools (e.g. Drive Technology Configurator, SIZER for Siemens Drives, STARTER and SINAMICS Startdrive)										

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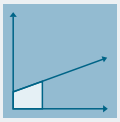
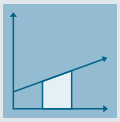
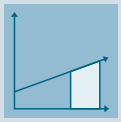
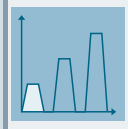
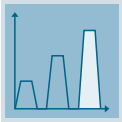
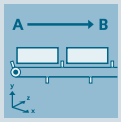
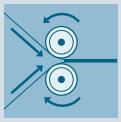
Overview

SINAMICS selection guide – typical applications

Use	Requirements for torque accuracy/speed accuracy/position accuracy/coordination of axes/functionality					
	Continuous motion			Non-continuous motion		
	Basic	Medium	High	Basic	Medium	High
						
Pumping, ventilating, compressing	Centrifugal pumps Radial / axial fans Compressors	Centrifugal pumps Radial / axial fans Compressors	Eccentric screw pumps	Hydraulic pumps Metering pumps	Hydraulic pumps Metering pumps	Descaling pumps Hydraulic pumps
	V20 G110 G120C G120P	G120P **G130/G150** G180 [1]	S120	G120	S110	S120
Moving 	Conveyor belts Roller conveyors Chain conveyors	Conveyor belts Roller conveyors Chain conveyors Lifting/lowering devices Elevators Escalators/moving walkways Indoor cranes Marine drives Cable railways	Elevators Container cranes Mining hoists Excavators for open-cast mining Test bays	Acceleration conveyors Storage and retrieval machines	Acceleration conveyors Storage and retrieval machines Cross cutters Reel changers	Storage and retrieval machines RoboticsPick & place Rotary indexing tables Cross cutters Roll feedsEngagers/ disengagers
	V20 G110 G110D G110M G120C	G120 G120D **G130/G150** G180 [1]	S120 S150 DCM	V90 G120 G120D	S110 DCM	S120 DCM
Processing 	Mills Mixers Kneaders Crushers Agitators Centrifuges	Mills Mixers Kneaders Crushers Agitators Centrifuges Extruders Rotary furnaces	Extruders Winders/unwinders Lead/follower drives Calenders Main press drives Printing machines	Tubular bagging machines Single-axis motion controlsuch as • Position profiles • Path profiles	Tubular bagging machines Single-axis motion controlsuch as • Position profiles • Path profiles	Servo pressesRolling mill drivesMulti-axis motion controlsuch as • Multi-axis positioning • Cams • Interpolations
	V20 G120C	G120 **G130/G150** G180 [1]	S120 S150 DCM	V90 G120	S110	S120 DCM
Machining 	Main drives for • Turning • Milling • Drilling	Main drives for • Drilling • Sawing	Main drives for • Turning • Milling • Drilling • Gear cutting • Grinding	Axis drives for • Turning • Milling • Drilling	Axis drives for • Drilling • Sawing	Axis drives for • Turning • Milling • Drilling • Lasering• • Gear cutting • Grinding • Nibbling and punching
	S110	S110 S120	S120	S110	S110 S120	S120

Using the SINAMICS selection guide

The varying range of demands on modern variable frequency drives requires a large number of different types. Selecting the optimum drive has become a significantly more complex process. The application matrix shown simplifies this selection process considerably, by suggesting the ideal SINAMICS drive for examples of typical applications and requirements.

- The relevant type of use can be found on the vertical axis (supply, movement, processing or machining).
- What type of movement should be realized with what level of quality (basic, medium, high)? Find this using the relevant fields on the horizontal axis.

To make orientation easier, an example selection of typical applications is shown.

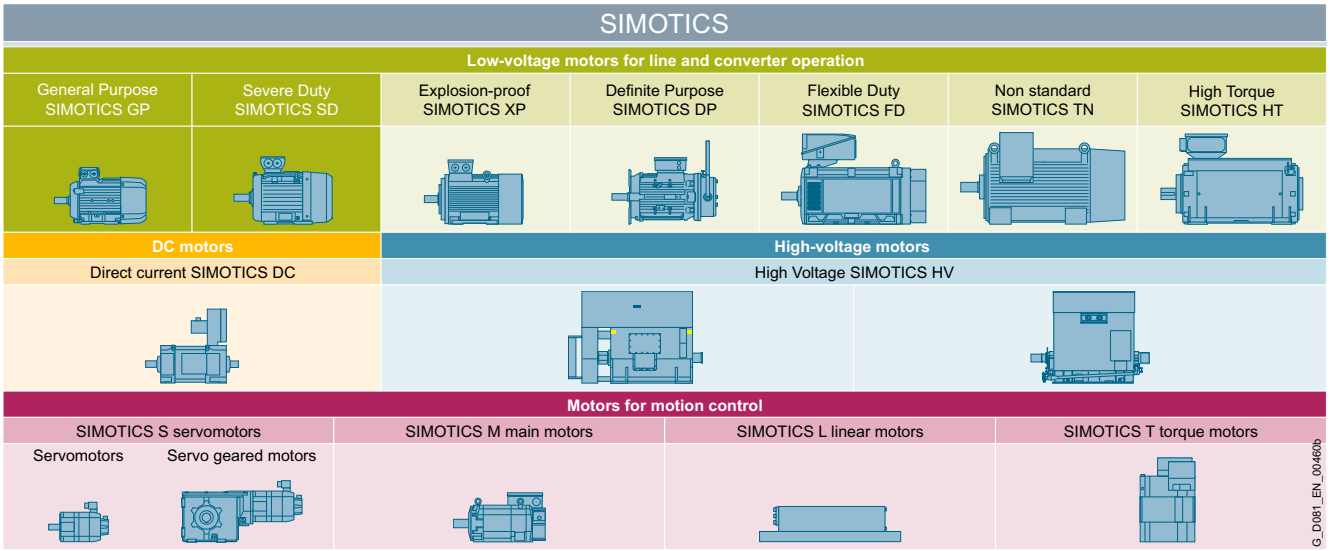
[1] Industry-specific inverters.

More information

Further information about SINAMICS is available on the Internet at
www.siemens.com/sinamics

Practical application examples and descriptions are available on the Internet at
www.siemens.com/sinamics-applications

Overview



SIMOTICS overview

Further information can be found in Catalogs D 41, D 81.1, D 81.8, D 83.1, D 84.1 and PM 21.

SIMOTICS stands for

- 125 years of experience in building electric motors
- The most comprehensive range of motors worldwide
- Optimum solutions in all industries, regions and power/performance classes
- Innovative motor technologies of the highest quality and reliability
- Highest dynamic performance, precision and efficiency together with the optimum degree of compactness
- Our motors can be integrated into the drive train as part of the overall system
- A global network of skill sets and worldwide service around the clock

A clearly structured portfolio

The entire SIMOTICS product portfolio is transparently organized according to application-specific criteria in order to help users select the optimum motor for their application.

The product range extends from standard motors for pumps, fans and compressors to highly dynamic, precise motion control motors for positioning tasks and motion control in handling applications, as well as production machinery and machine tools, to DC motors and powerful high-voltage motors. Whatever it is that you want to move – we can supply the right motor for the task.

An outstanding performance for any job

A key characteristic of all SIMOTICS motors is their quality. They are robust, reliable, dynamic and precise to assure the requisite performance level for any process and deliver exactly the capabilities demanded by the application in hand. Thanks to their compact design, they can be integrated as space-saving units into installations. Furthermore, their impressive energy efficiency makes them effective as a means of reducing operating costs and protecting the environment.

A dense network of skill sets and servicing expertise around the world

SIMOTICS offers not only a wealth of sound experience gleaned from a development history which stretches back over around 150 years, but also the know-how of hundreds of engineers. This knowledge and our worldwide presence form the basis for a unique proximity to industries which feeds through in tangible terms to the specific motor configuration which is tailored to suit your application.

Our specialists are available to answer all your queries regarding any aspect of motor technology. At any time - wherever you are in the world. When you choose SIMOTICS, therefore, you reap the benefits of a global service network which is continuously accessible, thereby helping to optimize response times and minimize downtimes.

Perfection of the complete drive train

SIMOTICS is perfectly coordinated with other Siemens product families. In combination with the SINAMICS integrated inverter family and the SIRIUS complete portfolio of industrial controls, SIMOTICS fits seamlessly as part of the complete drive train into automation solutions which are based on the SIMATIC, SIMOTION and SINUMERIK control systems.

Overview

SINAMICS G130 converter built-in unit and SINAMICS G150 converter cabinet unit

SINAMICS G130 converter built-in units and SINAMICS G150 converter cabinet units are designed for variable-speed drives in mechanical engineering and plant construction.

They have been specially designed to meet the requirements of drives with square-wave and constant load characteristics, with medium performance requirements, and without regenerative feedback capability.

The control accuracy of the sensorless vector control is suitable for most applications, which means that an additional actual speed value encoder is not required.

However, SINAMICS G130/SINAMICS G150 converters are optionally available with an encoder evaluation function in order to handle applications that require an encoder for system-specific reasons.

SINAMICS G130 and SINAMICS G150 offer an economic drive solution that can be matched to customers' specific requirements using the wide range of available components and options.

Benefits

- Particularly quiet and compact converters due to the use of state-of-the-art IGBT power semiconductors and an innovative cooling concept.
- All device modules are easily accessible, making them extremely service-friendly.
- Can be easily integrated into automation solutions using a PROFIBUS or PROFINET interface and various analog and digital interfaces.
- Individual modules and power components can be replaced quickly and easily, which ensures a higher level of plant availability.
- Simple commissioning and parameterization using interactive menus on the AOP30 Advanced Operator Panel with graphic LCD and plain-text display.

Application

Variable-speed drives are ideal for all applications that involve moving, conveying, pumping or compressing solids, liquids or gases.

Key applications include:

- Pumps and fans
- Compressors
- Extruders and mixers
- Mills

Design

SINAMICS G130

The SINAMICS G130 provides machine builders and plant constructors with a modular drive system that can be tailored to specific applications.

SINAMICS G130 essentially consists of two modular, stand-alone components

- Power Module and
- Control Unit

They may be located separately from one another or combined in a single unit. The Power Module contains a slot for the Control Unit.

The AOP30 Advanced Operator Panel can be used for commissioning and local operation.

Predefined interfaces, via terminal block or the CU320-2 Control Unit with either PROFIBUS or PROFINET, make commissioning and control of the drive much easier. The Control Unit interfaces can be expanded with add-on modules.

SINAMICS G150

SINAMICS G150 is a ready-to-connect AC/AC converter in a standard control cabinet.

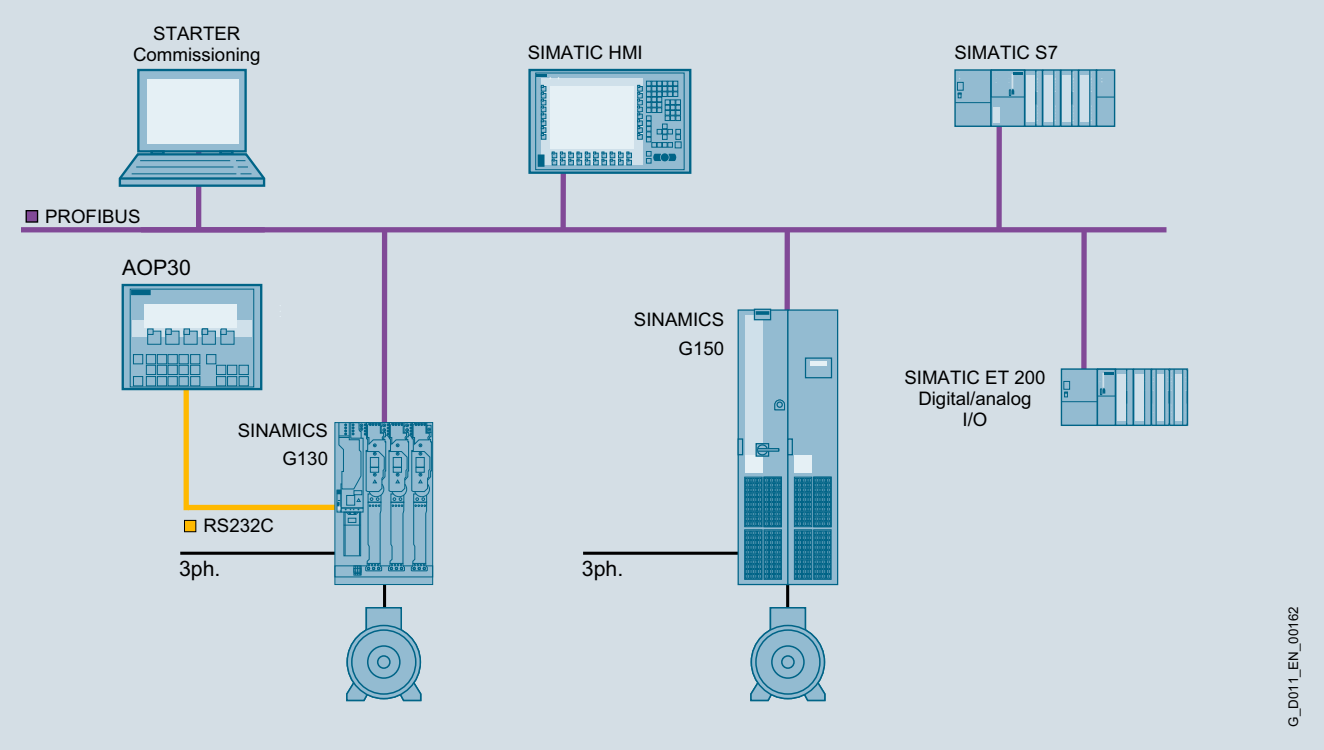
It can be adapted to individual requirements by selecting from an extensive range of options.

It is available in widths from 400 mm, which then increase in intervals of 200 mm, and can be ordered with various degrees of protection up to IP54 in two design versions.

- ***Version A***
  offers sufficient space for all the options available.
  The different versions allow the line and motor connections to be arranged at the top or bottom, as required. This results in excellent flexibility in terms of location in the plant. This version is also available with power units connected in parallel.
- ***Version C***
  is a particularly space-saving version designed for applications where the power supply components are accommodated in a central low-voltage distribution unit and need not be provided again in the control cabinet.

The AOP30 Advanced Operator Panel is fitted as standard in the cabinet door for both versions.

Integration



SINAMICS G130 and SINAMICS G150 configuration example with SIMATIC S7

Notes

Highlights

2

Overview

Legal framework

Machine manufacturers and manufacturing plants must ensure that their machines or plants cannot cause danger due to malfunctions in addition to the general risks of electric shock, heat or radiation.

In Europe, for example, compliance with the machinery directive is required by law by the EC occupational health and safety directive. In order to ensure compliance with this directive, it is recommended that the corresponding harmonized European standards are applied. This triggers the "assumption of conformity" and gives manufacturers and operators the legal security in terms of compliance with both national regulations and 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. For example, EN ISO 12100 specifies standards pertaining to machine safety (risk assessment and risk reduction). IEC 61508 specifies basic requirements for electronic and programmable safety-related systems. EN 62061 (only applicable for electrical and electronic control systems) and EN ISO 13849-1, which has replaced EN 954-1, define the functional and safety-related requirements of safety-oriented control systems.

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 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 higher modularity of machines has seen a shift in safety functions away from the classical central safety functions (for example, shutdown of the complete machine using a main disconnecting means) and into the machine control system and the drives. This is often accompanied by a significant increase in productivity because the equipping times are shortened. Depending on the type of machine, it may even be possible to continue manufacturing other parts while equipping is in progress.

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

Function

Safety functions integral to the SINAMICS drives

SINAMICS drives are characterized by a large number of integrated safety functions. In combination with the sensors and safety control required for the safety functionality, they ensure that highly-effective protection for persons and machines is implemented in a practice-oriented manner.

They fulfill the following equipment requirements:

- SIL 2 according to IEC 61508
- PL d and Category 3 according to EN ISO 13849-1

The Safety Integrated functions of SINAMICS drives are certified by independent institutions. You can obtain the corresponding test certificates and manufacturer's declarations from your Siemens contacts.

The integrated safety functions that are currently available in the SINAMICS drive system are described below. The functional safety of all of the functions satisfies the requirements defined in the international standard IEC 61800-5-2 for variable-speed drive systems.

The safety functions integrated into the SINAMICS drive system can be roughly divided into four categories:

- **Functions for safely stopping a drive**
  - Safe Torque Off (STO)
  - Safe Stop 1 (SS1)
  - Safe Stop 2 (SS2)
  - Safe Operating Stop (SOS)
- **Functions for safe brake management**
  - Safe Brake Control (SBC)
  - Safe Brake Test (SBT) (this function exceeds the scope of IEC 61800-5-2)
- **Functions for safely monitoring the motion of a drive**
  - Safely-Limited Speed (SLS)
  - Safe Speed Monitor (SSM)
  - Safe Direction (SDI)
- **Functions for safely monitoring the position of a drive**
  - Safely Limited Position (SLP)
  - Safe Position (SP) (this function exceeds the scope of IEC 61800-5-2)

The Safety Integrated Function Manual contains detailed information about the safety functions.
http://support.automation.siemens.com/WW/view/en/99668646

Further manuals pertaining to Safety Integrated in drive systems can be found on the Internet at
http://support.automation.siemens.com/WW/view/en/21901735/133300

Further information about Safety Integrated can be found on the Internet at
www.siemens.com/safety-drives

Safe Torque Off (STO)

The STO function is the most common and basic drive-integrated safety function. It ensures that no torque-generating energy can continue to affect a motor and prevents unintentional start-ups.

Activation

This function is a mechanism that prevents the drive from restarting unexpectedly, in accordance with EN 60204-1, Section 5.4. Safe Torque Off suppresses the drive pulses (corresponds to Stop Category 0 of EN 60204-1). The drive is reliably torque-free. This state is monitored internally in the drive.

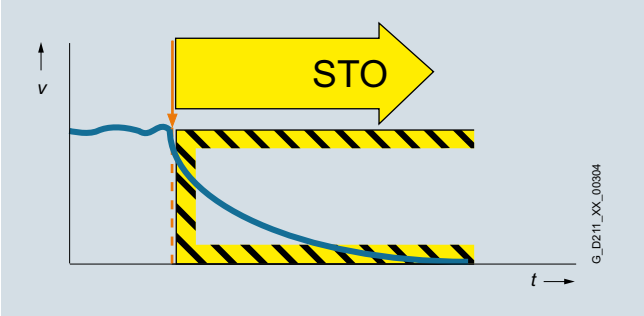
Application

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

STO makes it possible for persons to work safely when the protective door is open (restart interlock) and is used on machines/installations with moving axes, e.g. on handling or conveyor systems.

Customer benefits

The advantage of the integrated STO safety function compared to standard safety technology using electromechanical switchgear is the elimination of separate components and the effort that would be required to wire and service them. Because of the fast electronic switching times, the function provides a shorter reaction time than the conventional solution comprising electromechanical components.



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Function (continued)

Safe Stop 1 (SS1)

The SS1 function causes a motor to stop rapidly and safely and switches the motor to torque-free mode after coming to a standstill, i.e. STO is activated.

Activation

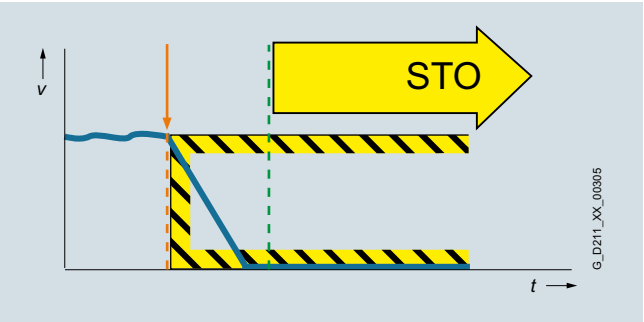
The SS1 function can safely stop the drive in accordance with EN 60204-1, Stop Category 1. When the SS1 function is selected, the drive brakes autonomously along a quick-stop ramp and automatically activates the Safe Torque Off and Safe Brake Control functions (if configured) when the parameterized safety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

Application

The SS1 function is used when, in the event of a safety-relevant incident, the drive must stop as quickly as possible with a subsequent transition into the STO state (e.g. EMERGENCY STOP). It is thus used to bring large centrifugal masses to a stop as quickly as possible for the safety of the operating personnel, or to brake motors at high speeds as quickly as possible. Examples of typical applications are saws, grinding machine spindles, centrifuges, winders and storage and retrieval machines.

Customer benefits

The targeted stopping of a drive by means of SS1 reduces the risk of danger, increases the productivity of a machine, and allows the safety clearances in a machine to be reduced. The principle is to bring the drive actively to a standstill, compared with just using the STO function. Complex mechanical brakes that are susceptible to wear are not normally required to brake the motor.



Safe Stop 2 (SS2)

The SS2 function brings the motor to a standstill quickly and safely and then activates the SOS function once the motor has stopped.

Activation

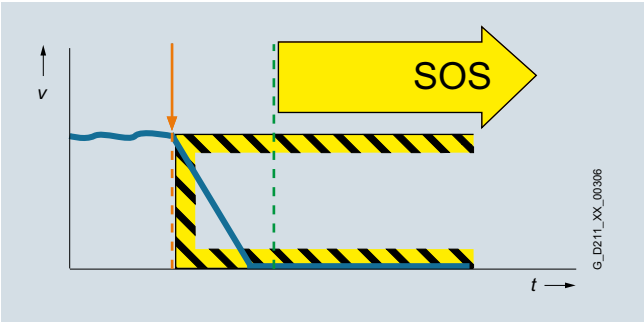
The Safe Stop 2 function can safely stop the drive in accordance with EN 60204-1, Stop Category 2. When the SS2 function is selected, the drive brakes autonomously along a quick stop ramp. In contrast to SS1, the drive control remains operational afterwards, i.e. the motor can supply the full torque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

Application

As with SS1, the SS2 function ensures the quickest possible deceleration of the motor. However, the motor power is not switched off. Instead, a control system prevents it from leaving the standstill position – even if it is affected by external forces. Typical applications for SS2 include machine tools, for example.

Customer benefits

The SS2 function ensures a rapid axis stop. Because the control remains active, after the safety function is deselected, productive operation can continue without referencing. This ensures short setup and standstill times and high productivity.



Function (continued)

Safe Operating Stop (SOS)

With the SOS function, the stopped motor is held in position and monitored by drive control.

Activation

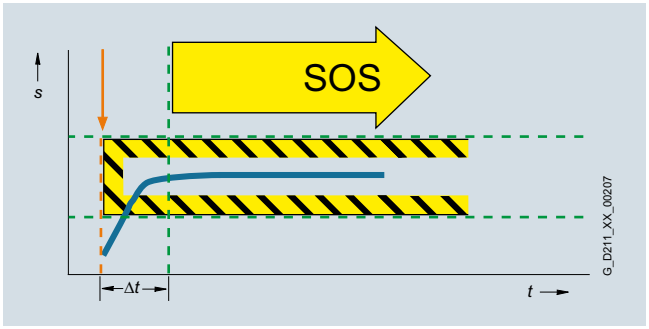
The SOS function constitutes safe standstill monitoring. The drive control remains in operation. The motor can therefore deliver the full torque to hold the current position. The actual position is reliably monitored. In contrast to safety functions SS1 and SS2, the speed setpoint is not influenced autonomously. 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

SOS is an ideal solution for all those applications for which the machine or parts of the machine must be at a safe standstill for 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 autonomously in this case. It expects the higher-level controller to ramp down the relevant axes as a coordinated group within an adjustable delay time. This can be used to prevent any damage to the machine or product. Typical applications for SOS include winders, converting and packaging machines and machine tools.

Customer benefits

No mechanical components are necessary to keep the axis in position despite any counterforce that may occur. Due to the short switching times and the fact that the drive control always remains active, setup and downtimes are reduced. Recalibration of the axis after exiting the SOS function is not necessary. The axis can immediately be moved again after deactivation of the SOS function.



Safe Brake Control (SBC)

The SBC function permits the safe control of a holding brake. SBC is always activated in parallel with STO.

Activation

A holding brake which is active in a de-energized state is controlled and monitored using safe two-channel technology. Due to the two-channel control, the brake may still be activated in the event of an insulation fault in the control cable. Errors of this kind are detected early by means of test pulses.

Notes

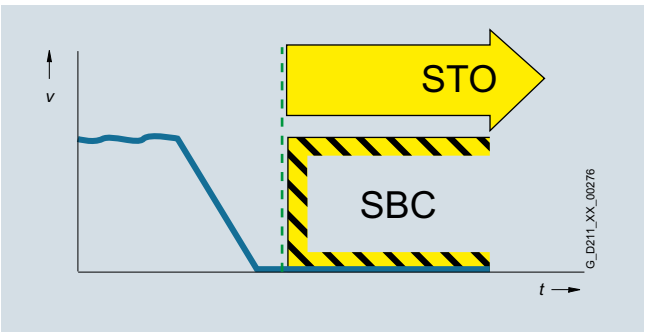
An additional Safe Brake Relay is required for power units in blocksize format. An additional Safe Brake Adapter is necessary for power units in chassis format.

Application

The SBC function is used in conjunction with the functions STO or SS1 to prevent the movement of an axis in the torque-free state, e.g. because of gravity.

Customer benefits

Again, the function saves the use of external hardware and the associated wiring.



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Function (continued)

Safe Brake Test (SBT)

The SBT function carries out a brake function test at regular intervals.

Activation

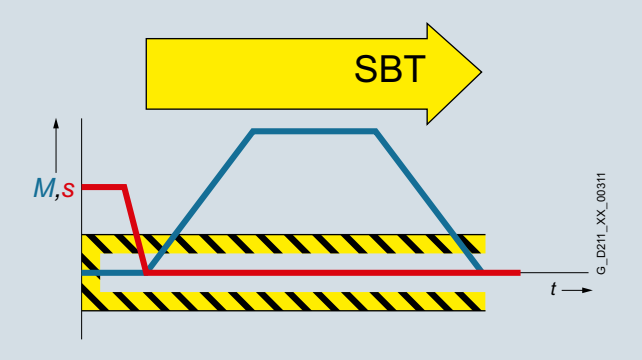
A good way to check the proper functioning of brakes that have become worn is to apply a torque to the closed brake. Drive systems that have two brakes, e.g. motor brake and external brake, can be tested with different torque values.

Application

The SBT function is suitable for implementing a safe brake in combination with the SBC function.

Customer benefits

The function detects faults or wear in the brake mechanics. Automatically testing the effectiveness of brakes reduces maintenance costs and increases the safety and availability of plants/machines.



Safely-Limited Speed (SLS)

The SLS function ensures that the drive does not exceed a preset speed limit.

Activation

The SLS function monitors the drive against a parameterized speed limit. Four different limit values can be selected. As in the case of SOS, the speed setpoint is not influenced independently. After SLS has been selected, the higher-level control must bring the drive down below the selected speed limit within a parameterizable time. If the speed limit is exceeded, a customizable drive-integrated fault reaction occurs.

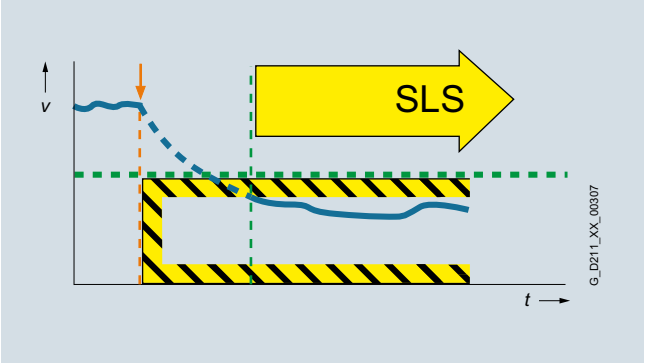
The SLS limit stage 1 can be multiplied by a factor that is transferred in 16-bit resolution via PROFIsafe. This allows an almost unlimited number of limits to be specified.

Application

The SLS function is used if people are in the danger zone of a machine and their safety can only be guaranteed by reduced speed. Typical application cases include those in which an operator must enter the danger zone of the machine for the purposes of maintenance or setting up, such as a winder in which the material is manually threaded by the operator. To prevent injury to the operator, the roller may only spin at a safely reduced speed. SLS is often also used as part of a two-stage safety concept. While a person is in a less critical zone, the SLS function is activated, and the drives are only stopped in a smaller area with higher potential risk. SLS can be used not only for operator protection, but also for machinery protection, e.g. if a maximum speed must not be exceeded.

Customer benefits

The SLS function can contribute to a significant reduction in downtime, or greatly simplify or even accelerate setup. The overall effect achieved is a higher availability of the plant. Moreover, external components such as speed monitors can be omitted.



Function (continued)

Safe Speed Monitor (SSM)

The SSM function warns when a drive is working below an adjustable speed limit. As long as it remains below the threshold, the function issues a safety-related signal.

Activation

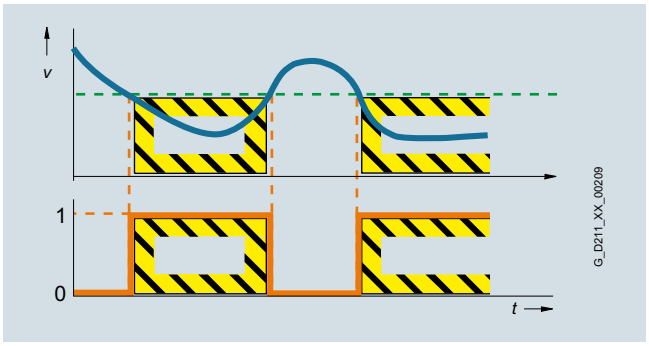
If a speed value drops below a parameterized limit, a safety-related signal is generated. This can, for example, be processed in a safety controller to respond to the event by programming, depending on the situation.

Application

With the SSM function, in the simplest case, a safety door can be unlocked if the speed drops below a non-critical level. Another typical example is that of a centrifuge that may be filled only when it is operating below a configured speed limit.

Customer benefits

Unlike SLS, there is no drive-integrated fault reaction when the speed limit is exceeded. The safe feedback can be evaluated in a safety control unit, allowing the user to respond appropriately to the situation.



Safe Direction (SDI)

The SDI function ensures that the drive can only move in the selected direction.

Activation

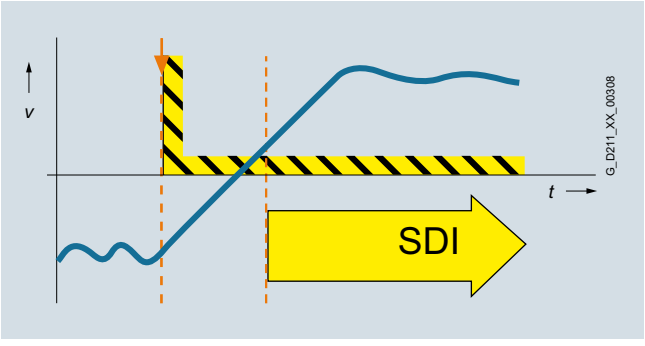
Deviation from the direction of motion currently being monitored is detected reliably and the configured drive-integrated fault reaction is initiated. It is possible to select which direction of rotation is to be monitored.

Application

The SDI function is used when the drive may only move in one direction. A typical application is to permit the operator access to a danger zone, as long as the machine is rotating in the safe direction, i.e. away from the operator. In this state, the operator can feed material into the work zone / remove material from the work zone without danger.

Customer benefits

The function saves the use of external components such as speed monitors and the associated wiring. The release of a danger zone while the machine is moving away from the operator increases productivity. Without the SDI function, the machine must be safely stopped during material loading and removal.



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Function (continued)

Safely Limited Position (SLP)

The SLP function monitors the axis to ensure that it remains within the permissible traversing range.

Activation

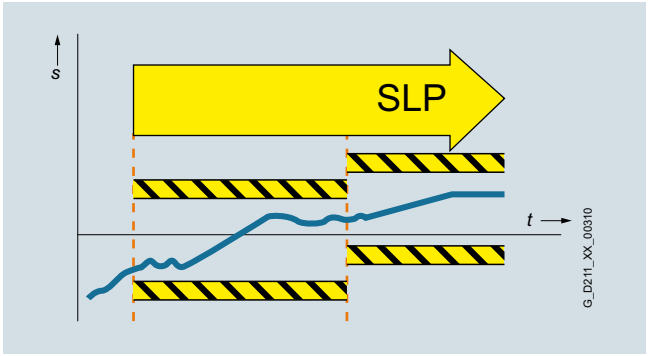
When SLP is activated, the traversing range limited by the configured software limit switches is safely monitored. If the permitted traversing range is exited, a customizable fault reaction occurs. It is possible to toggle between two traversing ranges, even when the machine is in operation.

Application

SLP is used for applications in which machine operators have to enter a protection area, e.g. for feeding in and removing material. Safe monitoring of the axis position ensures that the axis cannot move into the protection area released for operators and so place them in danger, for example, on storage and retrieval machines, gantry cranes or machining centers.

Customer benefits

SLP can be used for highly-effective protection area monitoring. The function does away with the use of external components such as hardware limit switches and the associated wiring expense. Due to the short reaction time following a limit overshoot, safety clearances can be reduced.



Safe Position (SP)

The SP function transfers the actual position values determined safely in the drive over safe PROFIsafe communication to a safety control.

Activation

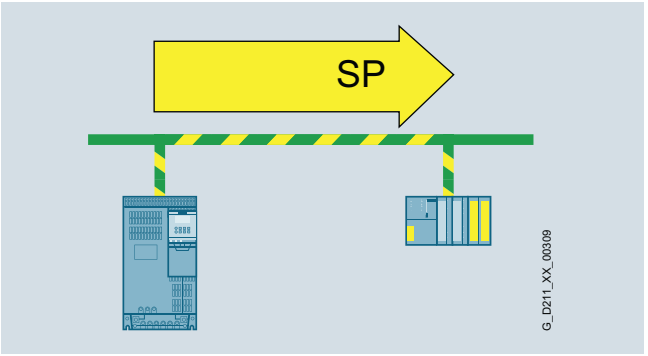
In contrast to the SLP function that monitors the current actual position value against a limit and, in the case of an overshoot, activates a drive-integrated fault reaction, SP transfers the current actual position values to the safety control. Position monitoring is implemented in the safety program of the control. Extended PROFIsafe telegrams are available for transferring the position values. The position values can be transferred in 16-bit or 32-bit resolution, as required. A time stamp is also transferred with the position values.

Application

Tailor-made safety concepts can be created using the SP function. It is ideal for use on machines that require flexible safety functions. It is extremely versatile and can be used, for example, to implement safe, axis-specific range detection by means of the Safe Cams (SCA) function. The SP function can also be used to implement multi-axis safety concepts, multi-dimensional protection areas and zone concepts.

Customer benefits

Position monitoring or speed monitoring is implemented in the safety program of the control, so the user has the flexibility for implementing tailor-made safety functions. The reaction to a limit overshoot must also be specified in the safety program. This means a higher initial programming outlay, but it does offer the opportunity for initiating different fault reactions.



Function (continued)

Basic Functions and Extended Functions

The Safety Integrated functions of the SINAMICS drive system are grouped into Basic Functions and Extended Functions.

- Basic Functions
  - Safe Torque Off (STO)
  - Safe Brake Control (SBC)
  - Safe Stop 1 (SS1)
- Extended Functions
  - Safe Stop 1 (SS1) with SBR or SAM
  - Safe Stop 2 (SS2) with SAM
  - Safe Operating Stop (SOS)
  - Safely Limited Speed (SLS)
  - Safe Speed Monitor (SSM)
  - Safe Direction (SDI)
  - Safely Limited Position (SLP)
  - Safe Position (SP)
  - Safe Brake Test (SBT)

For the Extended Functions Safe Stop 1 (SS1) and Safe Stop 2 (SS2) with SAM, safe acceleration monitoring (SAM) is performed during braking to identify any faults already during the braking phase.

If Safe Stop 1 is used as an encoderless function, a Safe Brake Ramp (SBR) can be configured as an alternative.

The Basic Functions – activated via on-board terminals on the device or via PROFIsafe – do not require an encoder.

Activation of the integrated safety functions

The safety functions for SINAMICS drives can be activated via terminals, e.g. for use of a conventional safety circuit.

For standalone safety solutions for small to medium sized applications, it is frequently sufficient that the various sensing components are directly hardwired to the drive.

For integrated safety solutions, the safety-relevant sequences are generally processed and coordinated in the fail-safe SIMATIC controller. Here, the system components communicate via the PROFINET or PROFIBUS fieldbus. The safety functions are controlled via the safe PROFIsafe communication protocol.

SINAMICS drives can be easily integrated into the plant or system topology.

PROFIsafe

SINAMICS drives support the PROFIsafe profile based on PROFIBUS as well as on PROFINET.

PROFIsafe is an open communications standard that supports standard and safety-related communication over the same communication path (wired or wireless). A second, separate bus system is therefore not necessary. The telegrams that are sent are continually monitored to ensure safety-relevant communication.

Possible errors such as telegrams that have been lost, repeated or received in the incorrect sequence are avoided. This is done by consecutively numbering the telegrams in a safety-relevant fashion, monitoring their reception within a defined time and transferring an ID for transmitter and receiver of a telegram.
A CRC (cyclic redundancy check) data security mechanism is also used.

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. This ensures that the system is always switched to a safe state 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) 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 state must prevail before each action is carried out and a specific acknowledgement must be made after each action. If these expectations of a monitoring channel are not fulfilled, the drive coasts to a standstill (two channel) and an appropriate message is output.

Forced dormant error detection using test stop

The functions and switch-off signal paths must be tested at least once within a defined time in order to meet requirements as per EN ISO 13849-1 and IEC 61508 in terms of timely fault detection. This must be implemented either in cyclic manual mode or the test stop must be automatically initiated as part of the process. The test stop cycle is monitored, and after a specific time has been exceeded, an alarm is output. A test stop does not require a POWER ON. The acknowledgment is set by canceling the test stop request.

Examples of when forced dormant error detection must be performed:

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

Safe actual value sensing with or without encoders

A drive monitor with encoder is necessary for operation of a series of safety functions.

For applications with encoderless mode or with encoders that have no safety capability, the safety functions can also be implemented without encoder. It is not possible to use all safety functions in this case.

The encoderless safety functions can be implemented on request for chassis format units.

In operation without encoder, the actual speed values are calculated from the measured electrical actual values. Therefore, speed monitoring is also possible during operation without encoder.

An encoder that is used for the purposes of motor control has no significance for the safety function here.

Safety Integrated Extended Functions "without encoder" must not be used if the motor, after it has been switched off, can still be accelerated by the mechanical elements of the connected machine component.

In the hoisting gear of a crane, for example, the suspended load can accelerate the motor as soon as the motor is switched off. In this case, the safety functions "without encoder" are not permitted.

A horizontal conveyor, on the other hand, is always braked to a standstill due to friction as soon as the motor is switched off. In this case, the safety functions "without encoder" can be used without any restriction.

2

Function (continued)

The Safety Integrated Function Manual contains additional information about the encoderless safety functions.
http://support.automation.siemens.com/WW/view/en/27103700/133300

The safety functions are listed below with criteria for actual value sensing

	Functions	Abbreviation	With encoder	Without encoder	Description
Basic Functions	Safe Torque Off	STO	Yes	Yes	Safe Torque Off
	Safe Stop 1	SS1	Yes	Yes	Safe Stop according to stop category 1
	Safe Brake Control	SBC	Yes	Yes	Safe Brake Control
Extended Functions	Safe Torque Off	STO	Yes	Yes [1)]	Safe Torque Off
	Safe Stop 1	SS1	Yes	Yes [1)]	Safe Stop according to stop category 1
	Safe Brake Control	SBC	Yes	Yes [1)]	Safe Brake Control
	Safe Operating Stop	SOS	Yes	No	Safe monitoring of the standstill position
	Safe Stop 2	SS2	Yes	No	Safe Stop according to stop category 2
	Safely-Limited Speed	SLS	Yes	Yes [1)]	Safe monitoring of the maximum speed
	Safe Speed Monitor	SSM	Yes	Yes [1)]	Safe monitoring of the minimum speed
	Safe Direction	SDI	Yes	Yes [1)]	Safe monitoring of the direction of motion
	Safely-Limited Position	SLP	Yes	No	Safely-limited position
	Safe Position	SP	Yes	Yes	Safe transfer of position values
	Safe Brake Test	SBT	Yes	No	Safe test of the required holding torque of a brake

Safe speed/position sensing with encoder

Incremental encoders or absolute encoders with photoelectric sampling are permitted for safe sensing of the position values on a drive. HTL/TTL incremental encoders may also be used.

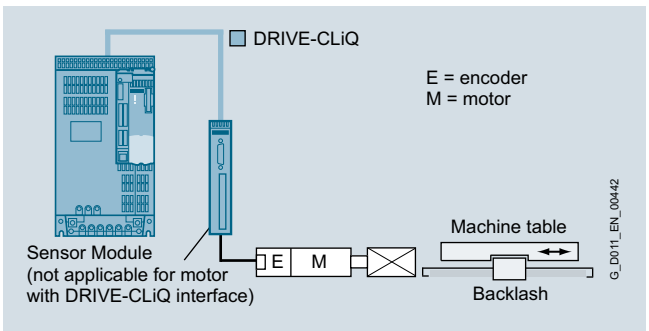
Safe actual value sensing relies on redundant evaluation of the incremental tracks A/B that supply sin/cos signals of 1 V_{pp}. Only encoders of the type whose A/B track signals are created and processed using purely analog techniques can be used. The encoder signals are input via the SMC20 Sensor Module Cabinet-Mounted.

For HTL/TTL incremental encoders, safe actual value sensing is achieved by using two independent encoders. The minimum possible speed resolution must also be taken into account. The encoder signals are input via the SMC30 Sensor Module Cabinet-Mounted.

When motors with a DRIVECLiQ interface are used, the speed/position actual values are generated directly in the motor as safe values and transferred to the Control Unit over a safe DRIVECLiQ communication link.

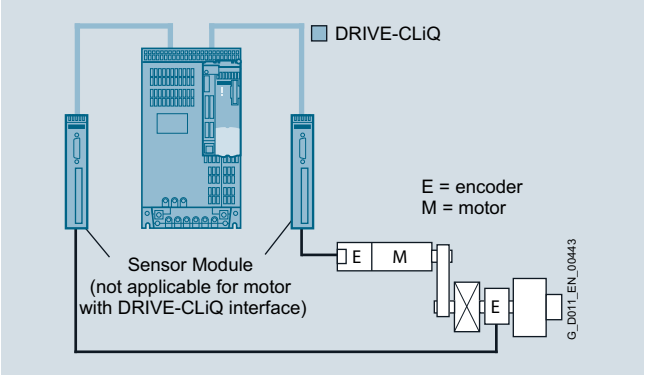
The following can be used for safe speed/position sensing:

- Single-encoder systems or
- 2-encoder systems



Example: Single-encoder system

In a single-encoder system, the motor encoder is used exclusively for safe actual value sensing. An incremental encoder or absolute encoder with photoelectric sampling must be used in this case.



Example: Dual-encoder system

In the case of the 2-encoder system, 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 (SMC20/30, SME20/25/120/125) must be provided. Each measuring system requires a separate DRIVE-CLiQ connection.

For this configuration, either two HTL/TTL encoders, one dual-HTL/TTL encoder or one HTL/TTL encoder and one sin/cos encoder can be used.

[1)] The use of this safety function without encoder is permitted only on request and only for induction motors or synchronous motors of the SIEMOSYN series.

Overview

The safety functions integrated into the drive can greatly reduce the effort required to implement safety concepts.

The Safety Integrated functions are executed electronically and therefore offer short response times compared to solutions with externally executed monitoring functions.

As an alternative to control via terminals and/or PROFIsafe, there is also the option to parameterize some safety functions without selection. In this mode, these functions are permanently selected after parameterization and a POWER ON.

Example:

"SLS without selection" can be used, for example, to monitor the maximum speed to prevent the drive from exceeding a mechanical speed limit. An F-DI does not have to be used when using the "SLS without selection" function.

Safety Integrated with and without encoder

The Safety Integrated basic functions STO, SBC and SS1 can be operated without encoder: two safety-capable incremental encoders (HTL or TTL) are required when using the Safety Integrated extended functions SLS, SDI and SSM.
These are each connected to an SMC30 Sensor Module Cabinet (for SINAMICS G150, first SMC30 option **K50**, second SMC30 option **K52**). The lowest possible velocity resolution for an HTL/TTL encoder system must be observed.

Further information is contained in the Safety Integrated Function Manual.

Licensing

The Safety Integrated basic functions do not require a license.

The Safety Integrated extended functions require a license for each axis with safety functions. It is irrelevant which safety functions are used and how many.

The license for SINAMICS G130 can be ordered as option **F01** with the memory card. Subsequent licensing is possible for the Control Unit Kit.

A license required for SINAMICS G150 can be ordered at the same time as option **K01**.

Safe Brake Adapter

The Safe Brake Control (SBC) function requires a Safe Brake Adapter (option **K88** for SINAMICS G150).

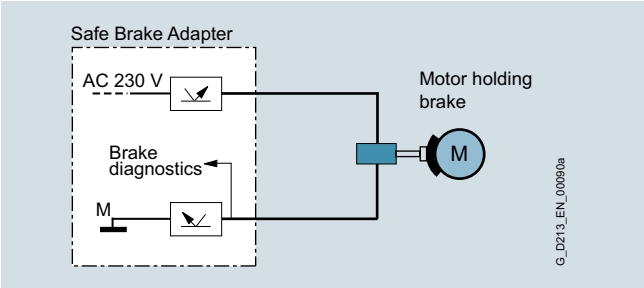
The Safe Brake Adapter enables safe control of electro-mechanical motor brakes.

The Safe Brake Adapter controls 230 V AC brakes. The SBC function monitors the control of the brake, but not its mechanical system.

The converter controls the connected brake using the motor holding brake function.

External surge suppressors are not required. The cable harnesses for connection to the Power Module are included in the scope of delivery.

The brake is controlled in accordance with IEC 61508 SIL 2 and EN ISO 13849-1 PL d and Category 3.



Safe Brake Control (SBC)

2

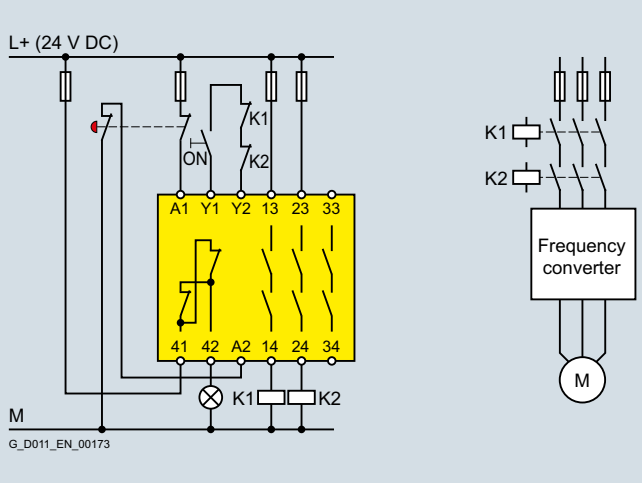
Benefits

Comparison of conventional and integrated safety systems

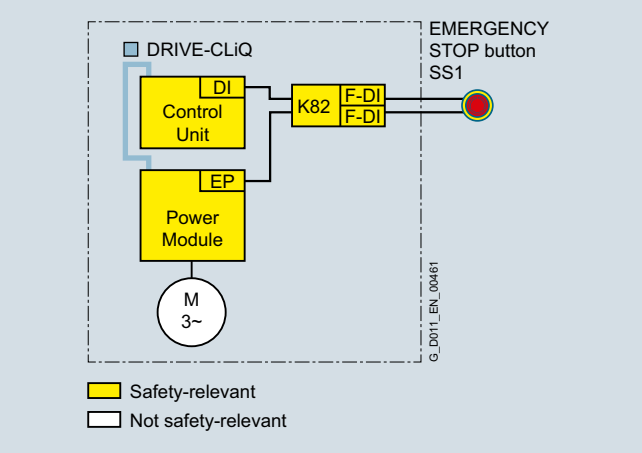
The Safety Integrated functions are fully integrated in the drive system. They can be activated as follows:

- Via safety-related inputs on the power unit (basic functions)
- Via safety-related inputs on the TM54F Terminal Module (extended functions)
- Via PROFIBUS or PROFINET with the PROFIsafe profile (basic and extended functions)

Safe Torque Off (STO)

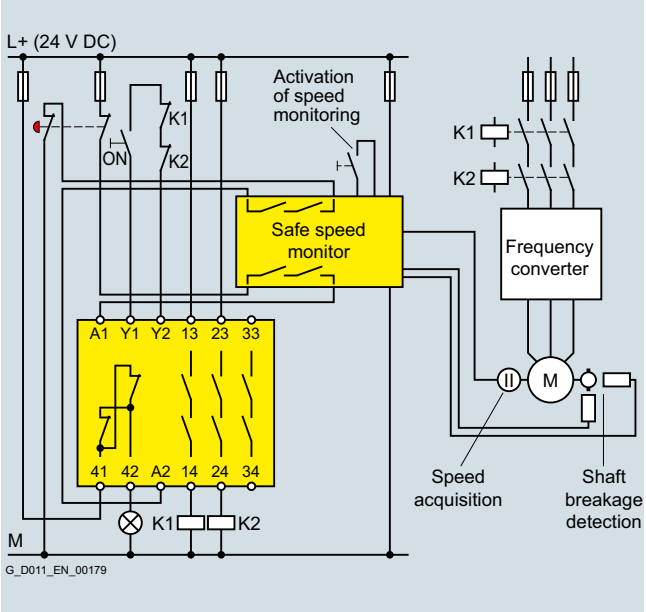


Conventional wiring

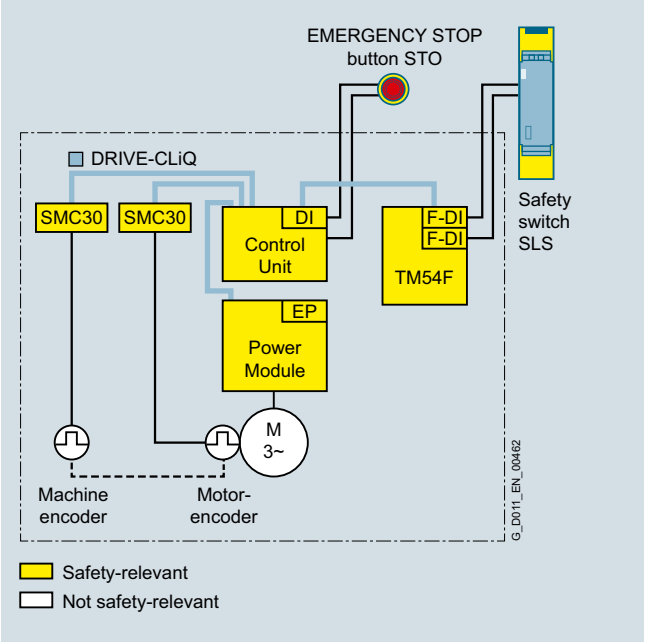


Integrated safety engineering via fail-safe inputs

Safely Limited Speed (SLS)



Conventional wiring



Integrated safety engineering via fail-safe inputs

The TM54F Terminal Module is omitted for selection via PROFIsafe.

Function

Function	Activation	Subordinate function	Reaction to limit overshoot	External setpoint specification active	Encoder required [1]	License required
Basic Functions						
STO	• EP terminals on the Power Module • Terminal Module (option **K82**) • PROFIsafe	SBC (if activated)	–	No	No [2]	No [3]
SBC	• Via Safe Brake Adapter	–	–	–	No	No
SS1	• EP terminals on the Power Module • Terminal Module (option **K82**) • PROFIsafe	STO following expiry of the parameterized delay time, SBC (if activated)	STO	Can be parameterized	No	No
Extended Functions						
STO	• F-DI on TM54F • PROFIsafe	SBC (if activated)	–	No	Yes [2]	Yes [3]
SS1 with SBR/SAM	• F-DI on TM54F • PROFIsafe	Safe monitoring for acceleration (SAM - Safe Acceleration Monitor) or braking ramp monitoring (SBR) during the braking phase. STO and SBC (if activated) following expiry of the parameterized delay time or if the speed falls below the minimum speed limit	STO	Can be parameterized	No	Yes
SLS encoderless	• F-DI on TM54F • PROFIsafe • Permanent activation	–	STO, SS1 (can be parameterized)	Yes	No	Yes
SLS	• F-DI on TM54F • PROFIsafe • Permanent activation	–	STO, SS1 (can be parameterized)	Yes	Yes	Yes
SSM	• Always active, if configured	–	Signals that the speed has fallen below a specified value	Yes	No	Yes
SDI	• F-DI on TM54F • PROFIsafe • Permanent activation	–	STO, SS1 (can be parameterized)	Yes	No	Yes
SBT	• F-DI on TM54F • PROFIsafe	–	Signals test result. Alarm if test fails	Yes	Yes	Yes

[1] The encoderless safety extended functions can be implemented only on request.

[2] Activation via terminals on the TM54F requires an encoder.

[3] Activation via terminals on the TM54F requires a license.

Energy efficiency classes in accordance with EN 50598

Overview

Step by step to more efficiency

One of the core objectives of the European Union is a sustainable power industry. In industrial plants today, around 70 % of the power demand is from electrically driven systems. This high percentage contains huge potential for saving energy in electrical drives. For that reason, the European Union introduced minimum requirements for the energy efficiency of electric motors in the form of a statutory motor regulation as early as 2011.

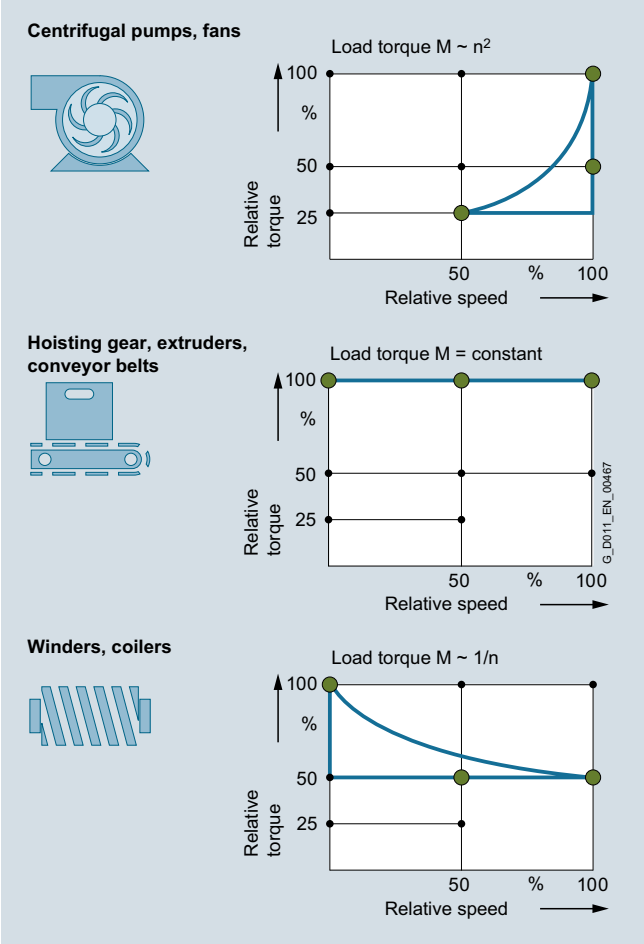
However, measures aimed solely at the motor are not enough to achieve the mandatory energy-saving targets. The European legislation fills this gap with the standard series EN 50598 and extends the focus from individual drive components to entire drive systems, even enabling consideration of specific use cases.

The European standard series EN 50598 defines the ecodesign requirements for drive systems in the low-voltage range with an electrically driven machine. It consists of definitions for energy efficiency (parts 1 and 2) and an ecobalance calculation (part 3).
To take account of the different use cases, consideration of eight application-relevant operating points has been introduced as mandatory for the first time. Determination of loss values at these eight points and definition of efficiency classes are laid down by the standard in a uniform way. Data relevant to operation, such as application-specific load profiles, can now be taken into account more easily in the energy efficiency analysis.

The standard is especially important for variable-speed drives of the following types:

- for AC/AC converters without energy recovery functionality
- for motors with integrated converters
- for supply voltages of 100 V to 1000 V
- for powers of 0.12 kW to 1000 kW

To cover all applications of driven machines, the new standard defines operating points in full-load and partial-load operation, at which the losses of the motor and drive systems have to be determined. Based on the loss data at the operating points in partial-load operation, variable-speed drives can be explicitly considered in more detail. This makes their advantages especially clear.



Duty cycles for different driven machines

Moreover, frequency converters and motor systems are classified in efficiency classes, which permit an initial rough estimate of the potential saving. Definition of reference systems is a key aspect of this because they provide standard reference values. The positioning of these reference systems defines the efficiency class and the relative distance from the reference system can be used as an absolute measure of the efficiency at the operating point in question.

Overview (continued)

Advantages of the detailed loss consideration of EN 50598 over the previous consideration of efficiencies and maximum loss values

For motors, the efficiency consideration was previously only defined for operation without a converter at 50/60 Hz. It provides a good way of comparing the energy efficiency of motors from different manufacturers for this use case.

The more detailed loss analysis of EN 50598, on the other hand, is aimed at speed-controlled operation and therefore now also includes motors especially designed for converter operation in the energy analysis. These were previously not covered by the applicable standards.
Moreover, a loss analysis over the entire setting and load range of the motor is possible. This is done in accordance with the standard EN 50598 with typical values.

For holistic consideration, it is essential to include all the relevant components of a drive system. The EN 50598 standard defines this in detail. The standardized expression of power loss data as a percentage makes comparison considerably easier and more transparent.

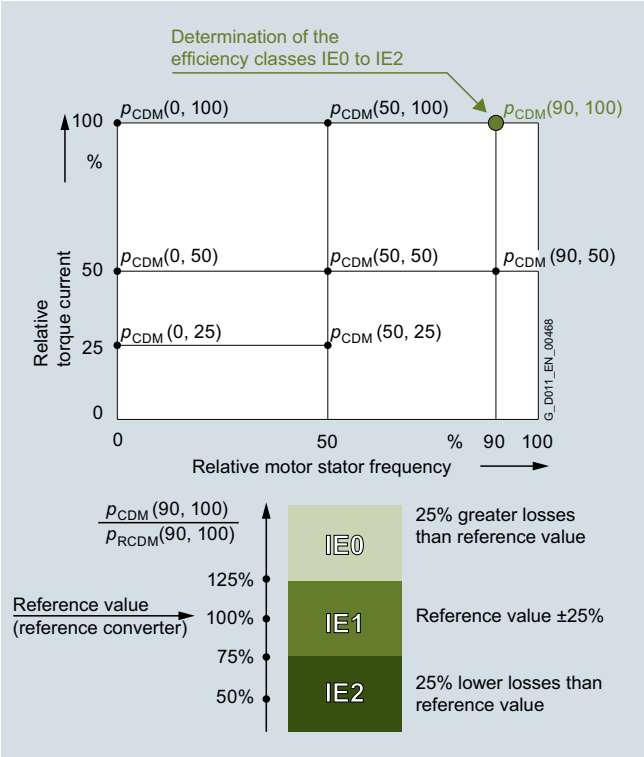
The method also makes it possible to consider a motor that produces a holding torque at speed zero, for example. In this case, the efficiency is zero, but a power loss from current producing magnetization and holding torque does occur. In summary, the key advantage of standard EN 50598 is the ability to perform the energy analysis of an electrical drive system based on standardized load profiles in all operating ranges due to uniform general conditions. This provides the user with complete transparency irrespective of the manufacturer.

Establishing efficiency classes of frequency converters (Complete Drive Modules CDM)

To avoid overmodulation and to ensure comparability between makes, which cannot be achieved otherwise, the efficiency classes of CDMs refer to the 90/100 operating point (90 % motor stator frequency, 100 % torque current).

Standard EN 50598-2 defines the relative losses of a CDM in efficiency classes IE0 to IE2. With reference to the value of a CDM of efficiency class IE1 (reference converter), a CDM of efficiency class IE2 has 25 % lower losses and a CDM of efficiency class IE0 has 25 % higher losses.

Operating points for CDMs



Complete Drive Module (CDM) – determining the efficiency class

Establishing the efficiency classes of drive systems (Power Drive Systems PDS)

What is possible for the individual systems, of course, also applies to the entire electrical PDS (frequency converter plus motor). Detailed comparisons are now possible at this level, too. The reference values for the reference system provide clear indications of the energy performance of the PDS.

Because targeted matching of the motor and CDM provides additional potential for optimization in electrical drive systems, it is especially important for the user to consider the entire drive system.

For the efficiency class of a PDS, too, a specific load point is defined. In this case, the reference point used is the 100/100 operating point (100 % motor stator frequency, 100 % torque).

Standard EN 50598-2 defines the relative losses of a PDS in efficiency classes IES0 to IES2. With reference to the value of a PDS of efficiency class IES1 (reference drive), a PDS of efficiency class IES2 has 20 % lower losses and a PDS of efficiency class IES0 has 20 % higher losses.

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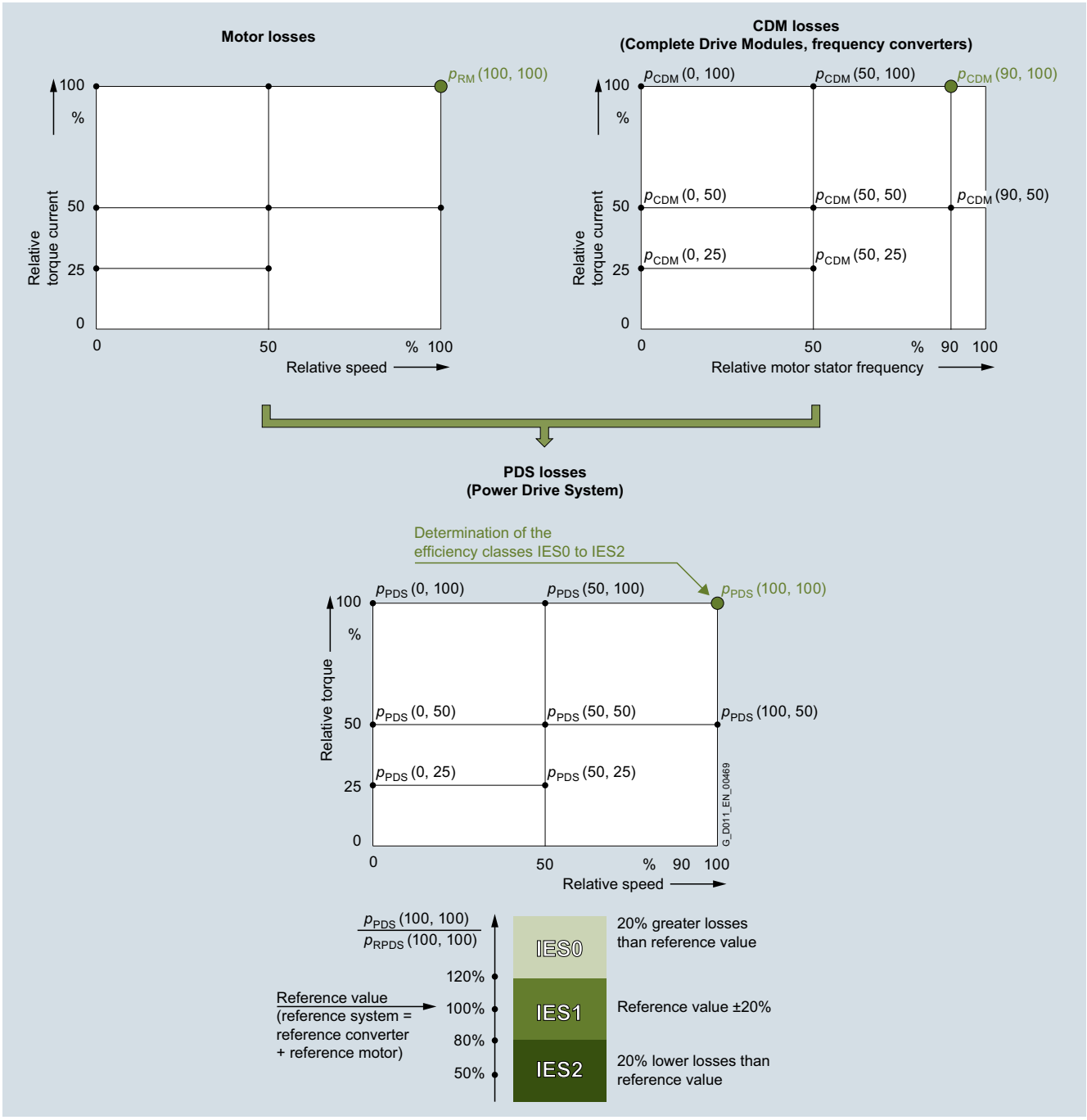
Overview (continued)

Operating points for PDS



Power Drive System (PDS) – determining the efficiency class

More information

Power loss data of SINAMICS converters for single-axis drives are available on the Internet at
http://support.automation.siemens.com/WW/view/en/94059311

Further information on current laws and standards, new standards, and mandatory guidelines is available on the Internet at
www.siemens.com/legislation-and-standards

Overview

Communication overview

Digital bus systems are commonly used in industrial automation today. These handle communication between the control level, the machine control, the sensors and actuators. The SINAMICS product family offers integrated communication interfaces in all product groups – which can be used to connect the most important fieldbus systems in the simplest possible way.

Die Control Unit CU320-2 bietet folgende Möglichkeiten:

- PROFINET
  - PROFINET RT
  - PROFINET IRT (isochronous)
  - PROFINET IRT (not isochronous)
  - PROFINET Shared Device
  - PROFINET media redundancy MRP (surge prone)
  - PROFINET media redundancy MRPD (surge free)
  - PROFIsafe
  - PROFIenergy
  - PROFIdrive application class 1
  - PROFIdrive application class 3
  - PROFIdrive application class 4
- PROFIBUS DP
  - PROFIBUS DP equidistance and isochronous mode
  - PROFIBUS DP peer-to-peer communication
- USS
- EtherNet/IP
- CANopen
- Websever

2

Overview

PROFIBUS – the most successful open fieldbus in the automation environment

The requirements of users for an open, non-proprietary communication system have resulted in the specification and standardization of the PROFIBUS protocol.

PROFIBUS defines the technical and functional features of a serial fieldbus system, with which the distributed field automation devices in the lower area (sensor/actuator level) can be networked up to the mid performance range (cell level).

Standardization according to IEC 61158/EN 50170 secures your investments for the future.

Using the conformity and interoperability test performed by the test laboratories authorized by PROFIBUS & PROFINET International (PI) and the certification of the devices by PI, users have the security of knowing that the quality and functionality is guaranteed, even in multi-vendor installations.

PROFIBUS versions

Three different PROFIBUS versions have been defined in order to comply with the widely differing requirements at the field level:

PROFIBUS FMS (Fieldbus Message Specification) – the universal solution for communication tasks at the field and cell levels in the industrial communication hierarchy.

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

PROFIBUS DP (Distributed Periphery) – this version, which is optimized for speed, is specifically tailored to the communication of automation systems with distributed I/O stations and drives. PROFIBUS DP sets itself apart as a result of very short response times and high noise immunity, and replaces cost-intensive, parallel signal transfer with 24 V and measured value transfer utilizing 0/4 … 20 mA technology.

Design

Bus participants on PROFIBUS DP

PROFIBUS DP makes a distinction between two different master classes and one slave class:

DP master class 1

For PROFIBUS DP, DP master class 1 is the central component. In a defined and continually repeating message cycle the central master station exchanges information with distributed stations (DP slaves).

DP master class 2

Devices of this type (programming, configuring or operator control devices) are used during commissioning, for configuring the DP system, for diagnostics or for operating the active plant or system. A DP master class 2 can, for example, read input, output, diagnostic and configuration data of the slaves.

DP slave

A DP slave is an I/O device which receives output information or setpoints from the DP master, and as response, returns input information, measured values and actual values to the DP master. A DP slave never sends data automatically, but only when requested by the DP master.

The quantity of input and output information depends on the device, and for each DP slave in each send direction can be a maximum of 244 bytes.

Function

Functional scope in DP masters and DP slaves

The functional scope can differ between DP masters and DP slaves. The different functional scopes are classified as DP-V0, DP-V1 and DP-V2.

DP-V0 communication functions

The DP-V0 master functions consist of "Configuration", "Parameter Assignment" and "Reading 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.

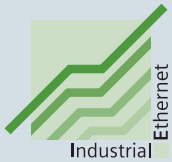
- Isochronous mode:
  Isochronous mode is implemented by means of an equidistant signal in the bus system. This cyclic, equidistant clock signal is sent by the DP master to all bus nodes in the form of a global control frame. Master and slaves can then synchronize their applications with this signal. The signal jitter between cycles is less than 1 µs.
- Slave-to-slave:
  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 done by sending the response frame to the master as a broadcast. Slave-to-slave communication is therefore a cyclic process.

PROFIBUS with SINAMICS

SINAMICS uses the PROFIBUS DP protocol.

The SINAMICS drives can only be used as DP slaves.

Overview



Ethernet is the basic Internet technology for worldwide networking. The wide variety of options of Intranet and Internet, that have long been available in the office environment, are now being made available to factory automation with Industrial Ethernet.

Apart from the use of information technology, the deployment of distributed automation systems is also on the increase. This means the breakdown of complex control tasks into smaller, manageable and drive-based control systems. This in turn is boosting the demand for communication which necessitates an extensive and powerful communication system.

Industrial Ethernet provides a powerful area and cell network for the industrial field, compliant with the IEEE 802.3 (ETHERNET) standard.

Benefits

Ethernet enables a very fast data transfer (10/100 Mbit/s, 1/10 Gbit/s) and at the same time has full-duplex capability. It therefore provides an ideal basis for communication tasks in the industrial field. With a share of over 90%, Ethernet is the number one network worldwide and offers important features which have essential advantages:

- Fast commissioning thanks to extremely simple 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 wide area network (WAN) technology or the Internet
- Protection of investment due to continuous and compatible development
- Wireless communication using industrial wireless LAN

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
- Fail-safety 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 with SINAMICS S

SINAMICS S provides Control Units and Communication Boards with PROFINET interface based on 100 Mbit/s Ethernet. This means that process communication in real-time, as well as engineering and HMI via standard TCP/IP are simultaneously possible.

The CU310-2 und CU320-2 Control Units have an additional Ethernet interface at the front so that service and engineering tasks can be performed very easily.

Communication with SINAMICS S over Industrial Ethernet

PG/OP/PC communication

PG/OP/PC communication is performed using protocols which are based on the basic TCP/IP protocol.

- Engineering and diagnostics with STARTER

IT communication

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

- HTTP/HTTPS: Hypertext Transfer Protocol
  Using a standard Internet browser, it is possible to retrieve predefined Web pages containing diagnostic information from the device. Furthermore, user-defined web pages containing information defined by the user can be stored in the device.
- SNMP: Simple Network Management Protocol

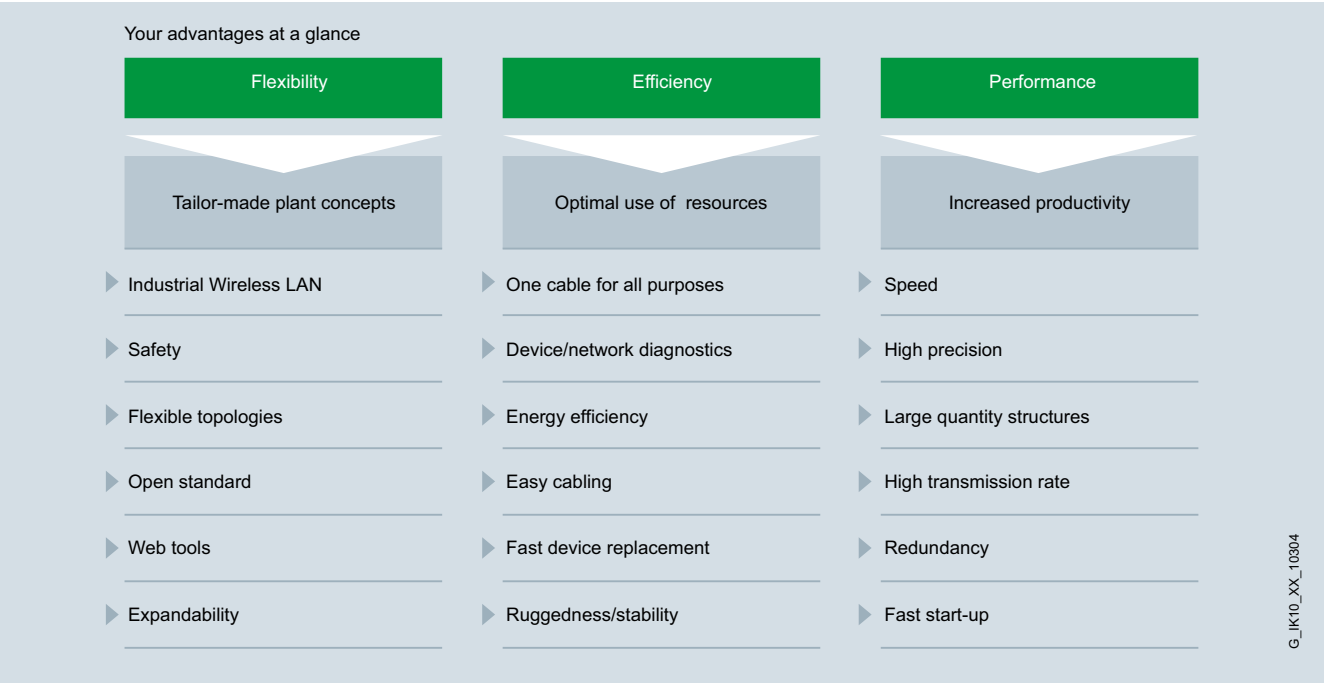
2

Overview

PROFINET – the Ethernet standard for automation

PROFINET is the world's leading Industrial Ethernet standard for automation with more that three million nodes installed worldwide.

PROFINET makes companies more successful, because it speeds up processes and raises both productivity and plant availability.



Flexibility

Short response times and optimized processes are the basic requirements for competitiveness in global markets because the product lifecycles are increasingly becoming shorter.

PROFINET ensures maximum flexibility in plant structures and production processes and enables innovative machine and plant concepts to be implemented. For example, mobile devices can also be integrated at locations that are difficult to access.

Flexible topologies

In addition to the linear structure characterized by the established fieldbuses, PROFINET also enables the use of star, tree and ring structures. This is made possible by the switching technology via active network components, such as Industrial Ethernet switches and media converters, or by integrating switch functionality into the field devices. This creates greater flexibility for the planning of machines and plants, as well as reducing the cabling requirements.

The PROFINET network can be installed without any specialist knowledge at all and meets all requirements that are relevant in the industrial environment. The PROFINET Guideline "Cabling and Interconnection Technology" supports manufacturers and users during network installation. Symmetrical copper cables or RFI-resistant fiber-optic cables are used, depending on the application. Devices from different manufacturers are easily connected via standardized and rugged plug connectors (up to IP65/IP67 degree of protection).

By integrating switch functionality into the devices, linear structures can be created that are directly oriented toward an existing machine or plant structure. This reduces cabling overhead and cuts down on components such as external switches.

IWLAN

PROFINET also supports wireless communication with Industrial Wireless LAN, opening up new fields of application. For example, technologies subject to wear, such as trailing cables, can be replaced and the use of automated guided vehicle systems and mobile operator terminals becomes possible.

Safety

The PROFIsafe safety profile, which has been tried and tested with PROFIBUS and which permits the transmission of standard and safety-related data on a single bus cable, can also be used with PROFINET. No special network components are necessary for fail-safe communication, which means that standard switches and standard network transitions can continue to be used without any restrictions. In addition, fail-safe communication is equally possible via Industrial Wireless LAN (IWLAN).

Open standard

PROFINET, the open multi-vendor standard (IEC 61158/IEC 61784), is supported by PROFIBUS and PROFINET International (PI). It stands for maximum transparency, open IT communication, network security and simultaneous real-time communication.

Overview (continued)

Thanks to its openness, PROFINET provides the basis for a standardized automation network in the plant, to which all other machines and devices can be connected. Even the integration of existing plant components, for example with PROFIBUS, presents no problems due to the use of network transitions.

Use of Web tools

Thanks to the unrestricted support of TCP/IP, PROFINET permits the use of standard Web services in the device, such as Web servers. Irrespective of the tool used, information from the automation level can be accessed from virtually any location using a commercially available Internet browser. This considerably simplifies commissioning and diagnostics. Users can then decide for themselves how much openness to the IT world they want to allow for their machine or plant. This means that PROFINET can be used simply as an isolated plant network or connected via appropriate security modules, such as the SCALANCE S modules, to the office network or the Internet. In this way, new remote maintenance concepts or the high-speed exchange of production data become possible.

Expandability

On the one hand, PROFINET facilitates the integration of existing systems and networks without any great effort or expense. In this way, PROFINET safeguards investments in existing plant components that communicate via PROFIBUS and other fieldbuses such as AS-Interface. On the other hand, additional PROFINET nodes can be added at any time. By using additional network components, network infrastructures can be expanded using cabling or wireless methods – even while the plant is operating.

Efficiency

Greater global competition means that companies must use their resources economically and efficiently. This applies in particular to production. This is where PROFINET ensures greater efficiency. Simple engineering guarantees fast commissioning, while reliable devices ensure a high level of plant availability. Comprehensive diagnostic and maintenance concepts help to reduce plant downtimes and keep maintenance costs to a minimum.

One cable for everything

PROFINET permits simultaneous fieldbus communication with isochronous mode and standard IT communication (TCP/IP) on one cable. This real-time communication for the transmission of the user/process data and diagnostic data takes place on a single cable. Specific profile communication (PROFIsafe, PROFIdrive and PROFIenergy) can be integrated without any additional cabling. This solution offers a wide scope of functions at a low level of complexity.

Device and network diagnostics

By retaining the tried and tested PROFIBUS device model, the same diagnostics information is available with PROFINET. In addition, module- and channel-specific data can also be read out from the devices during device diagnosis, enabling faults to be located quickly and easily. Apart from the availability of device information, the reliability of the network operation has top priority in the network management.

In existing networks the Simple Network Management Protocol (SNMP) has established itself as the de facto standard for the maintenance and monitoring of the network components and their functions. PROFINET uses this standard and gives users the opportunity to maintain their networks with tools that are familiar to them, such as the SINEMA Server network management software.

For easier maintenance of PROFINET devices, both on-site and remotely via a secure VPN connection, application-specific websites can be set up on the integrated Web server of the field devices using the familiar HTML standard.

Energy efficiency

En route to the green factory: PROFIenergy is a profile that provides functions and mechanisms for PROFINET field devices that support energy-efficient production.

The profile, which is defined by the PNO and is independent of any manufacturers or devices, enables the energy demand and costs to be significantly reduced: Using PROFIenergy, any specific loads that are not currently being used can be switched off. This achieves a noticeable reduction in energy costs during breaks in production. PROFIenergy permits the simple, automated activation and deactivation of technologically related plant components. It is coordinated centrally by means of a higher-level controller and is networked via PROFINET. This ensures that as much energy as possible is saved during longer breaks. Temporarily switching off plant components contributes to the even distribution and most efficient use of energy.

The use of PROFIenergy is made easy for the machine builder by its integration into familiar series of products. In addition, PROFIenergy is defined in such a way that the necessary function blocks can easily be integrated into existing automation systems at a later stage.

Simple wiring

Particularly stringent demands are made on the installation of cabling in the industrial environment. In addition, there is a requirement to set up industry-standard networks in the shortest possible time without any special knowledge.

With FastConnect, Siemens is offering a high-speed installation system that meets all of these requirements. FastConnect is the standard-compliant, industrial cabling system consisting of cables, connectors and assembly tools for PROFINET networks. The time required for connecting terminals is minimized by the simple installation method using just a single tool, while installation errors are prevented by the practical color-coding. Both copper cables and glass fiber optic cables can be easily assembled on site.

Fast device replacement

PROFINET devices are identified by means of a name assigned during configuration. On replacing a defective device, a new device can be recognized from its topology information by the IO controller and a new name can be assigned to it automatically. This means that no engineering tool is necessary for the replacement of equipment.

This mechanism can even be used for the initial commissioning of a complete system. This speeds up commissioning, particularly in the case of series machines.

Ruggedness

An automation network must be robustly protected against external sources of interference. The use of Switched Ethernet prevents faults in one part of the network from affecting the entire plant network. For areas that are particularly prone to radio frequency interference (RFI), PROFINET allows the use of fiber optic cables.

2

Overview (continued)

Performance

Productivity and product quality determine the level of success in the market. Precise motion control, dynamic drives, high-speed controllers and the deterministic synchronization of devices are therefore key factors in achieving superior production. They facilitate high production rates and optimum product quality at the same time.

Speed and precision

Fast motion control applications demand precise and deterministic exchange of data. This is implemented by means of drive controllers using isochronous real time (IRT).

With IRT and isochronous mode, PROFINET permits fast and deterministic communication. This synchronizes the various cycles of a system (input, network, CPU processing and output), even in the case of parallel TCP/IP traffic. The short cycle times of PROFINET make it possible to raise the productivity of machines and plants and to guarantee the product quality and high level of precision.

The standardized PROFIdrive profile permits vendor-independent communication between CPUs and drives.

Large quantity structures

The use of PROFINET makes it possible to overcome the existing restrictions regarding the scope of machines and systems that can be implemented. In one network, several different controllers can interact with their assigned field devices. The number of field devices per PROFINET network is virtually unlimited – the entire range of IP addresses is available.

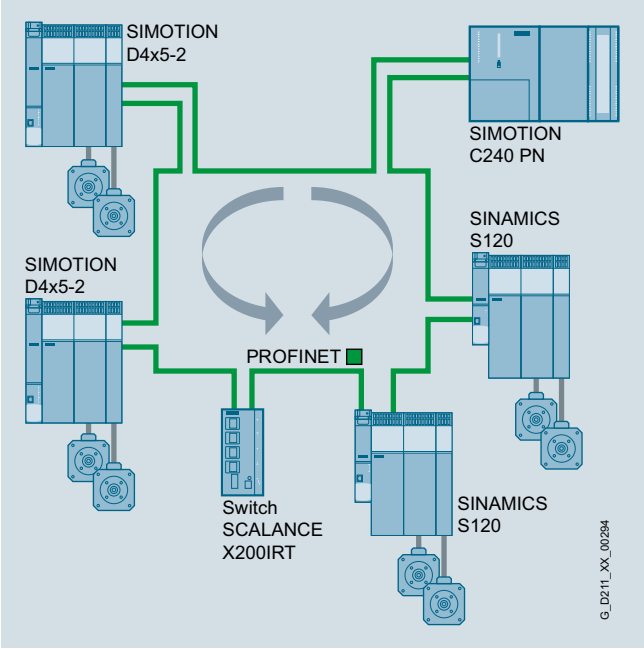
High data rate

By using 100 Mbit/s in full duplex mode, PROFINET achieves a significantly higher data rate than previous fieldbuses. This means that other plant data can be transmitted over TCP/IP without any problems, in addition to the process data. PROFINET therefore meets the combined industrial demands for simultaneously transmitting high-speed IO data and large volumes of data for additional sections of the application. Even the transmission of large volumes of data, such as that from cameras, has no adverse effect on the speed and precision of the IO data transmission, thanks to PROFINET mechanisms.

Media redundancy

A higher plant availability can be achieved with a redundant installation (ring topology). The media redundancy can be implemented not only with the aid of external switches, but also by means of integrated PROFINET interfaces. Using the media redundancy protocol (MRP), reconfiguration times of 200 ms can be achieved. If the communication is interrupted in just one part of the ring installation this means that a plant standstill is prevented and any necessary maintenance or repair work can be performed without any time pressure.

For motion control applications, PROFINET IRT in ring topologies offers the extended media redundancy for planned duplication (MRPD) which operates in a bumpless mode without any reconfiguration time. If communication is interrupted (e.g. a cable break) the process can continue operating without interruption. Until now, the functionality has only been supported by SIMOTION, SINAMICS and SCALANCE X200IRT.



Bumpless media redundancy illustrated by example of SINAMICS S120 with SIMOTION and SCALANCE X200IRT

Benefits

- PROFINET is the open Industrial Ethernet standard for automation
- PROFINET is based on Industrial Ethernet
- PROFINET uses TCP/IP and IT standards
- PROFINET is real-time Ethernet
- PROFINET enables seamless integration of fieldbus systems
- PROFINET supports fail-safe communication via PROFIsafe and also via IWLAN

More information

Further information is available at
www.siemens.com/profinet

Overview

PROFIdrive – the standardized drive interface for PROFINET and PROFIBUS

PROFIdrive defines the device behavior and technique to access internal device data for electric drives connected to PROFINET and PROFIBUS – from basic frequency inverters up to high-performance servo controllers.

It describes in detail the practical use of communication functions – slave-to-slave data transfer, equidistance and clock cycle synchronization (isochronous mode) in drive applications. In addition, it specifies all device characteristics which influence interfaces connected to a controller over PROFINET or PROFIBUS. This also includes the state machine (sequence control), the encoder interface, scaling of values, definition of standard telegrams, access to drive parameters etc.

The PROFIdrive profile supports both central as well as distributed motion control concepts.

What are profiles?

For devices and systems used in automation technology, profiles define properties and modes of behavior. This allows manufacturers and users to define common standards. Devices and systems that comply with such a cross-manufacturer profile, are interoperable on a fieldbus and, to a certain degree, can be interchanged.

Are there different types of profiles?

A distinction is made between what are known as application profiles (general or specific) and system profiles:

- Application profiles (also device profiles) predominantly refer to devices (e.g. drives) and include and agreed selection regarding bus communication as well as also specific device applications.
- System profiles describe classes of systems, including master functionality, program interfaces and integration resources.

Is PROFIdrive fit for the future?

PROFIdrive has been specified by the PROFIBUS and PROFINET International (PI) user organization, and is specified as a standard that is fit for the future through standard IEC 61800-7.

The basic philosophy: Keep it simple

The PROFIdrive profile tries to keep the drive interface as simple as possible and free from technology functions. As a result of this philosophy, referencing models as well as the functionality and performance of the PROFINET/PROFIBUS master have either no influence or only a low influence on the drive interface.

One drive profile – different application classes

The integration of drives into automation solutions depends very strongly on the particular drive application. In order to be able to address the complete, huge bandwidth of drive applications – from basic frequency inverters up to synchronized multi-axis systems with a high dynamic performance – using just one profile, PROFIdrive defines six application classes, to which most drive applications can be assigned:

- Class 1 – standard drives (for example pumps, fans, agitators etc..)
- Class 2 – standard drives with technological functions
- Class 3 – positioning drives
- Class 4 – motion control drives with central, higher-level motion control intelligence and patented position control concept "dynamic servo control"
- Class 5 – motion control drives with central, higher-level motion control intelligence and position setpoint interface
- Class 6 – motion control drives with distributed motion control intelligence integrated in the drives themselves

Design

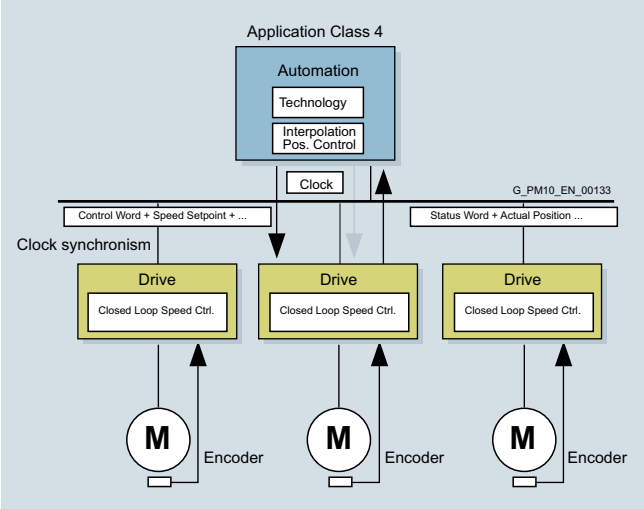
The device model of PROFIdrive

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 (approx. 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 function modules. The elements of a parameter are accessed acyclically via data records.

As a communication protocol, PROFIdrive uses DP-V0, DP-V1, and the DP-V2 expansions for PROFIBUS including the functions "Slave-to-Slave Communication" and "Isochronous Operation", or PROFINET IO with real-time classes RT and IRT.



More information

Further information on PROFINET and PROFIBUS is available at www.profibus.com

See under Download / Technical description & books / PROFIdrive – Technology and Application - System Description

Communication > CANopen

Overview

CANopen is a communication protocol based on CAN physical characteristics, which is predominantly used in the automation industry and for networking within complex devices. Originally conceived as a fieldbus for networking devices in motion control applications such as handling systems, CANopen has since established itself in the field of medical engineering, vehicle automation, rail and ship networking as well as building automation.

Interoperability of CANopen is ensured through the use of application and device profiles, whereby the wide range of options offered by the bus specification enables an appropriate, precise selection to be made for the application or device in question. Furthermore, inverters with CANopen support the "CiA 402 Electrical Drives" device profile.

Communication > EtherNet/IP

Overview

Ethernet Industrial Protocol (EtherNet/IP) is an open standard for industrial networks. EtherNet/IP is used to transmit cyclic I/O data and acyclic parameter data. EtherNet/IP was developed by Rockwell Automation and the ODVA (Open DeviceNet Vendor Association), and belongs to the standardized international standard series IEC 61158. EtherNet/IP is a popular communication standard, particularly in the American market and in the Rockwell controllers environment.

Overview

SINAMICS G130 converter built-in units, frame sizes FX and HX

The SINAMICS G130 is a converter that can be combined very flexibly with the associated system components and installed into customer-specific control cabinets or directly into machines.

SINAMICS G130 converter built-in units are available for the following voltages and power ratings:

Line voltage	Power
380 ... 480 V 3 AC	110 ... 560 kW
500 ... 600 V 3 AC	110 ... 560 kW
660 ... 690 V 3 AC	75 ... 800 kW

A wide range of add-on electrical components allow the drive system to be optimized for specific requirements. Configuration and commissioning are greatly simplified by predefined interfaces.

The control accuracy of the sensorless vector control is suitable for most applications, which means that an additional actual speed value encoder is not required.

However, encoder evaluation units are available for the SINAMICS G130 converters so that they can address applications that require an encoder for plant-specific reasons.

Communication between the Control Unit, the Power Module and other active SINAMICS components is performed via DRIVE-CLiQ, the drive's internal interface. The DRIVE-CLiQ connections, which are available as pre-assembled cables of different lengths, allow a complete converter system to be put together quickly.

For communication with the process control system, with the CU320-2 Control Unit either a PROFIBUS or a PROFINET interface is available as standard. The interface can also be expanded with digital and analog inputs and outputs. The TM31 Terminal Module and TB30 Terminal Board are provided for this purpose. Additional expansion cards can also be installed to allow communication via CANopen or EtherNet/IP.

Benefits

- Particularly quiet and compact converters due to the use of state-of-the-art IGBT power semiconductors and an innovative cooling concept.
- Individual modules and power components can be replaced quickly and easily, which ensures a higher level of plant availability. Replaceable components have been designed so that they can be quickly and easily replaced. In addition, the "Spares On Web" Internet tool makes it easy to view the spare parts that are available for the particular order (www.siemens.com/sow).
- Easily integration in automation solutions by means of a standard communications interface as well as a range of analog and digital interfaces.
- Simple commissioning and parameterization using interactive menus on the AOP30 Advanced Operator Panel with graphic LCD and plain-text display, or PC-supported using the STARTER commissioning tool (www.siemens.com/starter).
- Preset software functions make it easier to adapt the converter to the individual plant.
- All components, from individual parts to the ready-to-connect cabinet, undergo rigorous testing throughout the entire production process. This guarantees a high level of functional reliability during installation and commissioning, as well as in operation.

Application

Variable-speed drives are ideal for all applications that involve moving, conveying, pumping or compressing solids, liquids or gases.

This means the following applications in particular:

- Pumps and fans
- Compressors
- Extruders and mixers
- Mills

Design

The SINAMICS G130 converter built-in units provide machine builders and plant constructors with a modular drive system that can be tailored to specific applications.

SINAMICS G130 converter built-in units mainly consist of the following modular, stand-alone components:

- Power Module
- Control Unit

They may be located separately from one another or combined in a single unit. The Power Module contains a slot for the Control Unit.

The Power Modules are supplied with a DRIVE-CLiQ cable for communication and a cable for the 24 V supply to the Control Unit. These cables are pre-assembled for installing the Control Unit in the Power Module. If the two units are installed in separate locations, the cables must be ordered in the appropriate lengths.

The AOP30 Advanced Operator Panel and the numeric BOP20 Basic Operator Panel can be used for commissioning and local operation.

Predefined interfaces, via terminal block or the CU320-2 Control Unit with either PROFIBUS or PROFINET, make commissioning and control of the drive much easier. The interfaces of the CU320-2 Control Unit can be supplemented with add-on modules, such as the plug-in TB30 Terminal Board or the TM31 Terminal Module.

If further customer interfaces are required for the communication with the drive, an external 24 V supply must be provided.

The following two figures provide assistance when assembling the required converter components. The first figure shows the design and individual components of a SINAMICS G130 drive. The second figure is a flowchart containing the decision and selection criteria required for the individual components.

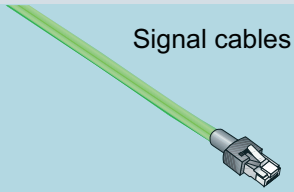
Design (continued)

3 AC supply

Line-side power components
e.g.
Switch disconnectors
Line contactors
Line filters
Line reactors
Line Harmonics Filters

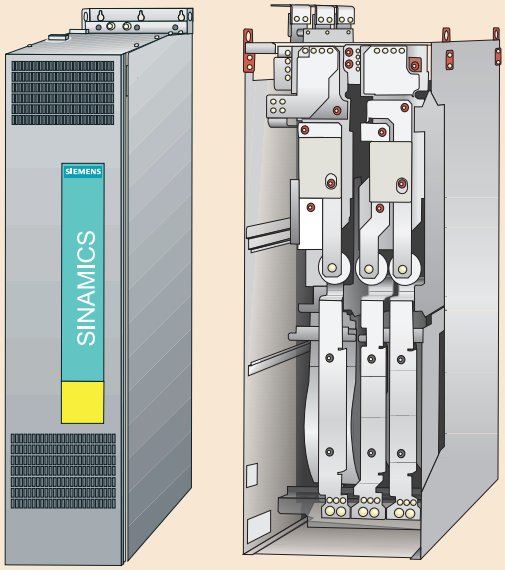
Connection system

Signal cables



SINAMICS G130 components

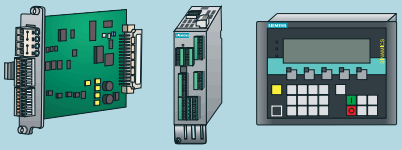
Power Modules



Control Unit Kit

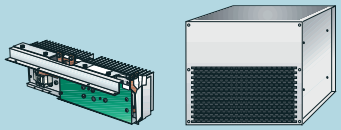
CU320-2 Control Unit
with CompactFlash card

Supplementary system components
e.g.
Terminal Board
Terminal Module
Sensor Module
Advanced Operator Panel
PROFINET board
CANopen board

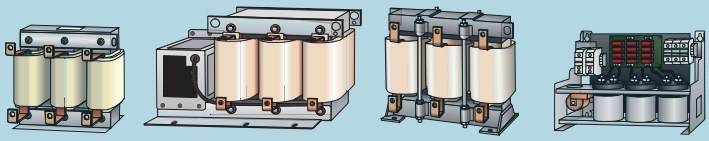


DC link components

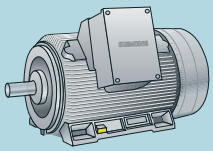
Braking Modules
with braking resistors



Motor-side power components
Motor reactors
Sine-wave filters
dv/dt-filter plus VPL
dv/dt-filter compact plus VPL



Motors



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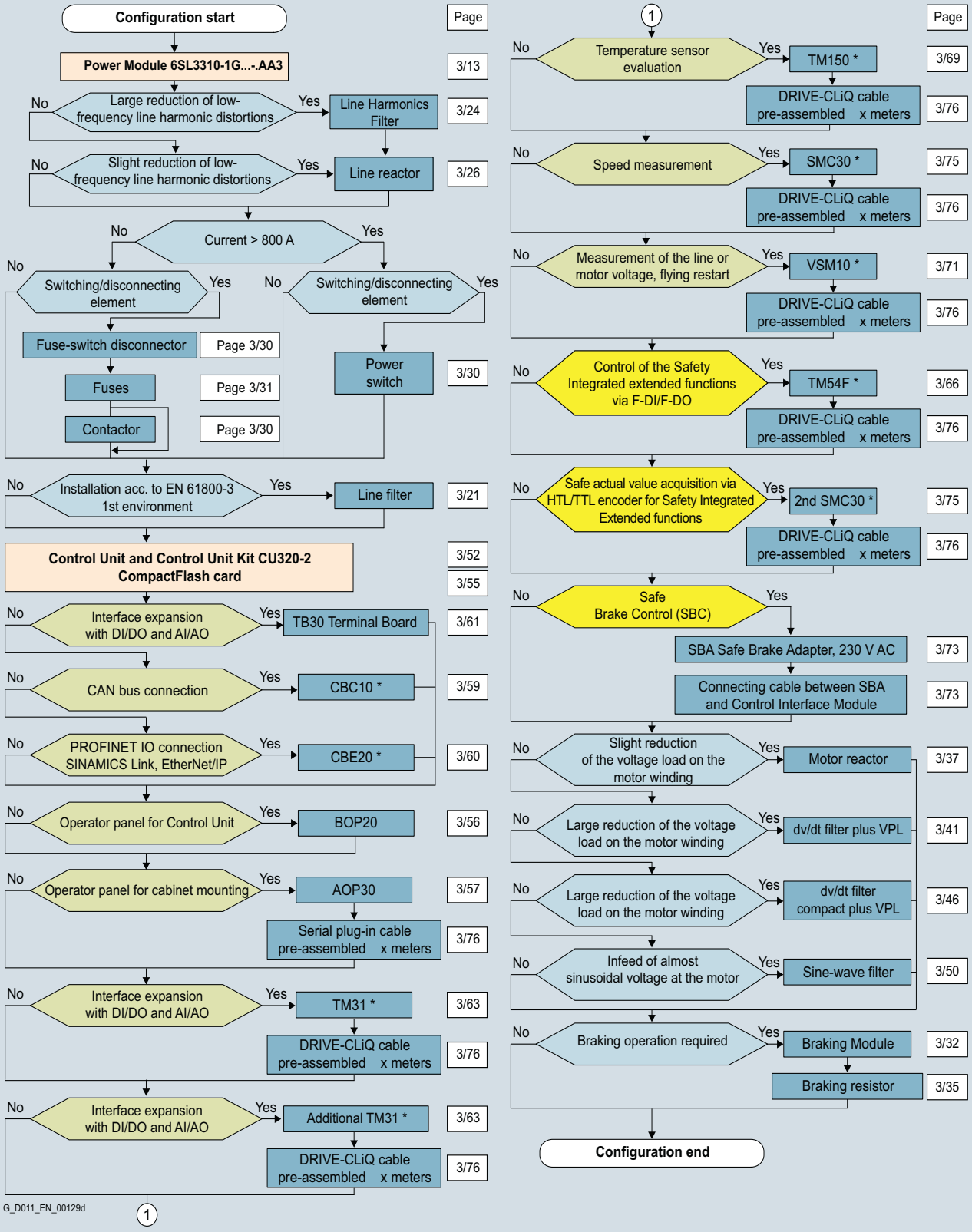
Design (continued)



Note:
The use of an external 24 V supply must be checked for the components marked with *.
For further information, please refer to the SINAMICS Low Voltage Engineering Manual.

Design (continued)

Coated modules

The following converter components are equipped as standard with coated modules:

- Power Modules
- Control Units
- Sensor Modules
- Terminal Modules
- Advanced Operator Panel (AOP30)

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

Nickel-plated busbars

All copper busbars of the Power Modules are nickel-plated in order to achieve the best possible immunity to environmental effects. The bare copper connections also do not have to be cleaned for customer connections.

Function

Communication with higher-level controller and customer terminal block

A PROFIBUS or PROFINET communication interface is provided as standard on the CU320-2 Control Unit for use as a customer interface to the controller; there are also expansions such as the TM31 Terminal Module, the TB30 Terminal Board and modules to support CANopen or EtherNet/IP communication.

These interfaces can be used to connect the system to the higher-level controller using analog and digital signals, or to connect additional devices.

To simplify configuration and commissioning of the drive, the TM31 Terminal Module can be preset with a variety of factory settings.

For further information, please refer to the SINAMICS Low Voltage Engineering Manual.

Open-loop and closed-loop control functions

The converter control contains a high-quality vector control with speed and current control as well as motor and converter protection.

Function (continued)

Software and protective functions

The software functions available as standard are described below:

Software and protective functions	Description
Setpoint specification	The setpoint can be specified both internally and externally; internally as a fixed setpoint, motorized potentiometer setpoint or jog setpoint, externally via the communications interface or an analog input on the customer terminal block. The internal fixed setpoint and the motorized potentiometer setpoint can be switched or adjusted via control commands from any interface.
Motor identification	The automatic motor identification function makes commissioning faster and easier and optimizes closed-loop control of the drive.
Ramp-function generator	A user-friendly ramp-function generator with separately adjustable ramp-up and ramp-down times, together with adjustable rounding times in the lower and upper speed ranges, allows the drive to be smoothly accelerated and braked. As a consequence, this avoids the drive train from being overloaded and reduces the stress on mechanical components. The down ramps can be parameterized separately for quick stop.
$V_{dc\ max}$ controller	The $V_{dc\ max}$ controller automatically prevents overvoltages in the DC link, if the set down ramp is too short, for example. This may also extend the set ramp-down time.
Vdc_min control	For brief line supply failures, the kinetic energy of the rotating drive is used to buffer the DC link and therefore prevents fault trips. The converter remains operational as long as the drive can provide regenerative energy as a result of its motion and the DC-link voltage does not drop below the shutdown threshold. When the line supply recovers within this time, the drive is again accelerated up to its speed setpoint.
Automatic restart [1]	The automatic restart switches the drive on again when the power is restored after a power failure, and ramps up to the current speed setpoint.
Flying restart [1]	The flying restart function allows the converter to be switched to a motor that is still turning. With the voltage sensing capability provided by the optional VSM10 Voltage Sensing Module, the flying restart time for large induction motors can be significantly reduced because the motor does not need to be de-magnetized.
Technology controller	The technology controller function module allows simple control functions to be implemented, e.g. level control or volumetric flow control. The technology controller is designed as a PID controller. The differentiator can be switched to the control deviation channel or to the actual value channel (factory setting). The P, I, and D components can be set separately.
Free function blocks	Using the freely programmable function blocks, it is easy to implement logic and arithmetic functions for controlling the SINAMICS G130. The blocks can be programmed by means of an operator panel or the STARTER commissioning tool.
Drive Control Chart (DCC)	Drive Control Chart (DCC) is an additional tool for the easy configuration of technology functions for the SINAMICS G130. The block library contains a large selection of control, arithmetic and logic blocks as well as extensive open-loop and closed-loop control functions. The user-friendly DCC editor enables easy graphics-based configuration, allows control loop structures to be clearly represented and provides a high degree of reusability of charts that have already been created. DCC is an add-on to the STARTER commissioning tool.
***Pt* detection for motor protection**	A motor model stored in the converter software calculates the motor temperature based on the current speed and load. More exact measurement of the temperature, which also takes into account the influence of the ambient temperature, is possible by means of direct temperature measurement using KTY84 sensors in the motor winding.
Motor temperature evaluation	Motor protection by evaluating a KTY84, PTC or Pt100 temperature sensor. When a KTY84 sensor is connected, the limit values can be set for alarm or trip. When a PTC thermistor is connected, the system reaction to triggering of the thermistor (alarm or trip) can be defined.
Motor blocking protection	A blocked motor is detected and protected against thermal overloading by a fault trip.
Essential service mode	Special converter operating mode that increases the availability of the drive system, e.g. in the event of a fire.
Bypass	This circuit allows the motor to be operated via the converter or directly on the line supply.
Brake control	"Simple brake control" for control of holding brakes: The holding brake is used to secure drives against unwanted motion when deactivated. "Extended brake control" function module for complex brake control, e.g. for motor holding brakes and operational brakes: When braking with a feedback signal, the brake control reacts to the feedback signal contacts of the brake.
Write protection	Write protection to prevent unintentional changing of the setting parameters (without password function).
Know-how protection	Know-how protection for encrypting stored data, e.g. to protect configuration know-how, and to protect against changes and duplication (with password function).
Web server	The integrated web server provides information about the drive unit via its web pages. The web server is accessed using an Internet browser via unsecured (http) or secured transmission (https).
Power unit protection	**Description**
Ground fault monitoring at the output	A ground fault at the output is detected by a total current monitor and results in shutdown in grounded systems.
Electronic short-circuit protection at the output	A short-circuit at the output (e.g. at the converter output terminals, in the motor cable or in the motor terminal box) is detected and the converter shuts down with a "fault".
Thermal overload protection	An alarm is issued first when the overtemperature threshold responds. If the temperature rises further, the device either shuts down or independently adjusts the pulse frequency or output current so that a reduction in the thermal load is achieved. Once the cause of the fault has been eliminated (e.g. cooling has been improved), the original operating values are automatically resumed.

[1] Factory setting: Not activated (can be parameterized).

Technical specifications

The most important directives and standards are listed below. These are used as basis for the SINAMICS G130 converter built-in units and they must be carefully observed to achieve an EMC-compliant configuration that is safe both functionally and in operation.

European directives	
2006/95/EC	Low-voltage directive: Directive of the European Parliament and Council of December 12, 2006, on the approximation of the laws of the member states relating to electrical equipment designed for use within certain voltage limits
2006/42/EC	Machinery directive: Directive of the European Parliament and Council of May 17, 2006 on machinery and for changing Directive 95/16/EC (amendment)
2004/108/EC	EMC directive: Directive of the European Parliament and Council of December 15, 2004, which repeals directive 89/336/EEC, on the approximation of laws of the member states relating to electromagnetic compatibility
European standards	
EN ISO 3744	Acoustics – Determination of the sound power level and sound energy level for noise sources that result from sound pressure measurements – envelope surface procedure of the accuracy class 2 for a largely free sound field over a reflecting plane
EN ISO 13849-1	Safety of machinery – Safety-related parts of control systems Part 1: General design principles (ISO 13849-1:2006) (replaced EN 954-1)
EN 60146-1-1	Semiconductor converters – General requirements and line-commutated converters Part 1-1: Specification of basic requirements
EN 60204-1	Electrical equipment of machines Part 1: General definitions
EN 60529	Degrees of protection provided by enclosures (IP code)
EN 61508-1	Functional safety of electrical/electronic/programmable electronic safety-related systems Part 1: General requirements
EN 61800-2	Adjustable speed electrical power drive systems Part 2: General requirements – Rating specifications for the measurement of low-voltage adjustable frequency AC power drive systems
EN 61800-3	Adjustable speed electrical power drive systems Part 3: EMC product standard including special test procedure
EN 61800-5-1	Adjustable speed electrical power drive systems Part 5: Safety requirements Main section 1: Electrical and thermal requirements
EN 61800-5-2	Adjustable speed electrical power drive systems Part 5-2: Safety requirements – Functional safety (IEC 61800-5-2:2007)
North American standards	
UL508A	Industrial Control Panels
UL508C	Power Conversion Equipment
CSA C22.2 No. 14	Industrial Control Equipment
Approvals	
cULus, cURus	Testing by UL (Underwriters Laboratories, www.ul.com) according to UL and CSA standards

Certification marks: (see Approvals)

General technical specifications

Electrical specifications	
Line voltages and power ranges	• 380 ... 480 V 3 AC ±10% (-15% <1 min) 110 ... 560 kW • 500 ... 600 V 3 AC ±10% (-15% <1 min) 110 ... 560 kW • 660 ... 690 V 3 AC ±10% (-15% <1 min) 75 ... 800 kW
Line system configurations	Grounded TN/TT systems or ungrounded IT systems (a grounded line conductor is not permissible in 690 V line supplies)
Line frequency	47 ... 63 Hz
Output frequency	0 ... 550 Hz[1)]
Line power factor	
• Fundamental	> 0.96
• Total	0.75 ... 0.93
Efficiency	> 98%
Overvoltage category	III according to EN 61800-5-1

Technical specifications (continued)

Electrical specifications (continued)			
Rated short-circuit current according to IEC, in conjunction with the specified fuses			
• 1.1 … 447 kW	65 kA		
• 448 ... 671 kW	84 kA		
• 672 ... 1193 kW	170 kA		
• > 1194 kW	200 kA		
Rated short-circuit current SCCR (Short Circuit Current Rating) according to UL508C (up to 600 V), in conjunction with the specified fuses or circuit breakers			
• 1.1 … 447 kW	65 kA		
• 448 ... 671 kW	84 kA		
• 672 ... 1193 kW	170 kA		
• > 1194 kW	200 kA		
Control method	Vector control with and without encoder or V/f control		
Fixed speeds	15 fixed speeds plus 1 minimum speed, parameterizable (in the default setting, 3 fixed setpoints plus 1 minimum speed are selectable using terminal block / PROFIBUS)		
Speed ranges that can be skipped	4, parameterizable		
Setpoint resolution	0.001 rpm digital 12-bit analog		
Braking operation	By means of additional Braking Modules and braking resistors		
Mechanical specifications			
Degree of protection	IP00 or IP20 depending on type		
Protection class	I according to EN 61800-5-1		
Touch protection	EN 50274 / BGV A3 when used for the intended purpose		
Cooling method	Forced air cooling AF according to EN 60146		
Ambient conditions	**Storage**	**Transport**	**Operation**
Ambient temperature	-25 ... +55° C	-25 ... +70° C as of -40° C for 24 hours	0 ... +40° C up to +55° C see derating data
Relative humidity (condensation not permissible)	5 ... 95%	5 ... 95% at 40° C	5 ... 95%
	Class 1K4 according to EN 60721-3-1	Class 2K3 according to EN 60721-3-2	Class 3K3 according to EN 60721-3-3
Environmental class / harmful chemical substances	Class 1C2 according to EN 60721-3-1	Class 2C2 according to EN 60721-3-2	Class 3C2 according to EN 60721-3-3
Organic/biological influences	Class 1B1 according to EN 60721-3-1	Class 2B1 according to EN 60721-3-2	Class 3B1 according to EN 60721-3-3
Degree of pollution	2 according to EN 61800-5-1		
Installation altitude	Up to 2000 m above sea level without derating; > 2000 m see derating data		
Mechanical stability	**Storage**	**Transport**	**Operation**
Vibratory load			
• Deflection	1.5 mm at 5 ... 9 Hz	3.1 mm at 5 ... 9 Hz	0.075 mm at 10 ... 58 Hz
• Acceleration	5 m/s^2 at > 9 ... 200 Hz	10 m/s^2 at > 9 ... 200 Hz	10 m/s^2 at > 58 … 200 Hz
	Class 1M2 according to EN 60721-3-1	Class 2M2 according to EN 60721-3-2	–
Shock load			
• Acceleration	40 m/s^2 for 22 ms	100 m/s^2 for 11 ms	100 m/s^2 for 11 ms
	Class 1M2 according to EN 60721-3-1	Class 2M2 according to EN 60721-3-2	Class 3M4 according to EN 60721-3-3
Compliance with standards			
CE marking	According to EMC Directive No. 2004/108/EC and Low Voltage Directive No. 2006/95/EC and Machinery Directive No. 2006/42/EC for functional safety.		
Radio interference suppression	The SINAMICS G130 converter systems are not designed for connection to the public power network ("first environment"). Radio interference suppression is compliant with the EMC product standard for variable-speed drives EN 61800-3, "Second environment" (industrial networks). EMC disturbances can occur when connected to the public power networks. However, if additional measures are taken (e.g. line filter), it can also be operated in the "first environment". 2)		
Approvals	cULus (only for 380 ... 480 V 3 AC and 500 ... 600 V 3 AC)		

Deviations from the specified classes are underlined.

1) The output frequency is also affected by the selected control method and the pulse frequency. For further information, please refer to the SINAMICS Low Voltage Engineering Manual.

2) Applies to motor cable lengths < 100 m.

Characteristic curves

Derating data

SINAMICS G130 built-in units and the associated system components are rated for an ambient temperature of 40° C and installation altitudes up to 2000 m above sea level.

At ambient temperatures > 40° C, the output current must be reduced. Ambient temperatures above 55° C are not permissible.

At installation altitudes > 2000 m above sea level, it must be taken into account that the air pressure, and therefore air density, decreases as the height increases. As a consequence, the cooling efficiency and the insulation capacity of the air also decrease.

Due to the reduced cooling efficiency, it is necessary, on the one hand, to reduce the ambient temperature and on the other hand, to reduce the heat loss in the built-in unit by reducing the output current, whereby ambient temperatures lower than 40° C may be offset to compensate.

The following table lists the permissible output currents depending on the installation altitude and ambient temperature.
The specified values already include a permitted compensation in respect of installation altitude and ambient temperatures < 40° C (temperature at the air intake of the built-in unit).

The values apply under the precondition that a cooling air flow through the devices is guaranteed as specified in the technical specifications.

As additional measure for installation altitudes from 2000 m up to 5000 m, an isolating transformer is required in order to reduce transient overvoltages according to EN 60664-1.

For further information, please refer to the SINAMICS Low Voltage Engineering Manual.

Current derating factors for built-in units depending on the ambient / air intake temperature and the installation altitude

Installation altitude above sea level	**Current derating factor** (as a percentage of the rated current) for an ambient / air intake temperature of							
m	20 °C	25 °C	30 °C	35 °C	40 °C	45 °C	50 °C	55 °C
0 ... 2000						93.3 %	86.7 %	80 %
2001 ... 2500					96.3 %			
2501 ... 3000		100 %		98.7 %				
3001 ... 3500								
3501 ... 4000			96.3 %					
4001 ... 4500		97.5 %						
4501 ... 5000	98.2 %							

Characteristic curves (continued)

Current derating depending on the pulse frequency

To reduce motor noise or to increase output frequency, the pulse frequency can be increased relative to the factory setting (1.25 kHz or 2 kHz). 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.

For further information, please refer to the SINAMICS Low Voltage Engineering Manual.

Derating factor of the output current depending on the pulse frequency for devices with a rated pulse frequency of 2 kHz

Article No.	Type rating	Output current at 2 kHz	**Derating factor** for pulse frequency				
6SL3310-...	kW	A	2.5 kHz	4 kHz	5 kHz	7,5 kHz	8 kHz
380 ... 480 V 3 AC							
1GE32-1AA3	110	210	95 %	82 %	74 %	54 %	50 %
1GE32-6AA3	132	260	95 %	83 %	74 %	54 %	50 %
1GE33-1AA3	160	310	97 %	88 %	78 %	54 %	50 %
1GE33-8AA3	200	380	96 %	87 %	77 %	54 %	50 %
1GE35-0AA3	250	490	94 %	78 %	71 %	53 %	50 %

Derating factor of the output current depending on the pulse frequency for devices with a rated pulse frequency of 1.25 kHz

Article No.	Type rating	Output current at 1.25 kHz	**Derating factor** for pulse frequency				
6SL3310-...	kW	A	2 kHz	2.5 kHz	4 kHz	5 kHz	7.5 kHz
380 ... 480 V 3 AC							
1GE36-1AA3	315	605	83 %	72 %	64 %	60 %	40 %
1GE37-5AA3	400	745	83 %	72 %	64 %	60 %	40 %
1GE38-4AA3	450	840	87 %	79 %	64 %	55 %	40 %
1GE41-0AA3	560	985	92 %	87 %	70 %	60 %	50 %
500 ... 600 V 3 AC							
1GF31-8AA3	110	175	92 %	87 %	70 %	60 %	40 %
1GF32-2AA3	132	215	92 %	87 %	70 %	60 %	40 %
1GF32-6AA3	160	260	92 %	88 %	71 %	60 %	40 %
1GF33-3AA3	200	330	89 %	82 %	65 %	55 %	40 %
1GF34-1AA3	250	410	89 %	82 %	65 %	55 %	35 %
1GF34-7AA3	315	465	92 %	87 %	67 %	55 %	35 %
1GF35-8AA3	400	575	91 %	85 %	64 %	50 %	30 %
1GF37-4AA3	500	735	87 %	79 %	64 %	55 %	35 %
1GF38-1AA3	560	810	83 %	72 %	61 %	55 %	35 %
660 ... 690 V 3 AC							
1GH28-5AA3	75	85	93 %	89 %	71 %	60 %	40 %
1GH31-0AA3	90	100	92 %	88 %	71 %	60 %	40 %
1GH31-2AA3	110	120	92 %	88 %	71 %	60 %	40 %
1GH31-5AA3	132	150	90 %	84 %	66 %	55 %	35 %
1GH31-8AA3	160	175	92 %	87 %	70 %	60 %	40 %
1GH32-2AA3	200	215	92 %	87 %	70 %	60 %	40 %
1GH32-6AA3	250	260	92 %	88 %	71 %	60 %	40 %
1GH33-3AA3	315	330	89 %	82 %	65 %	55 %	40 %
1GH34-1AA3	400	410	89 %	82 %	65 %	55 %	35 %
1GH34-7AA3	450	465	92 %	87 %	67 %	55 %	35 %
1GH35-8AA3	560	575	91 %	85 %	64 %	50 %	35 %
1GH37-4AA3	710	735	87 %	79 %	64 %	55 %	35 %
1GH38-1AA3	800	810	83 %	72 %	61 %	55 %	35 %

Note:

The derating factors for pulse frequencies in the range between the specified fixed values can be determined by linear interpolation.

Characteristic curves (continued)

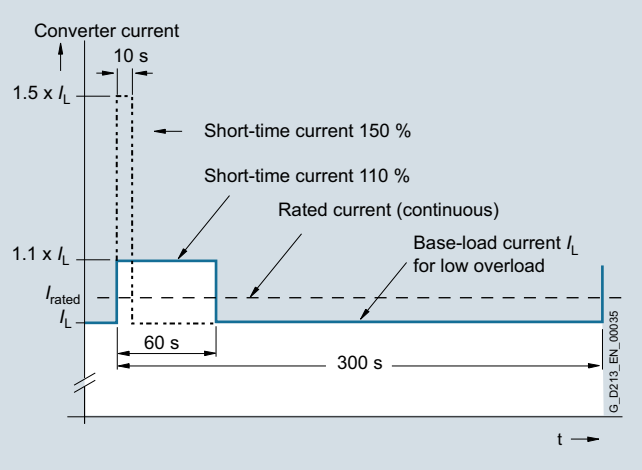
Overload capability

The SINAMICS G130 converters have an overload reserve in order to overcome breakaway torques, for example. If larger surge loads occur, this must be taken into account in the configuration. For drives with overload requirements, the appropriate base load current must, therefore, be used as a basis for the required load.

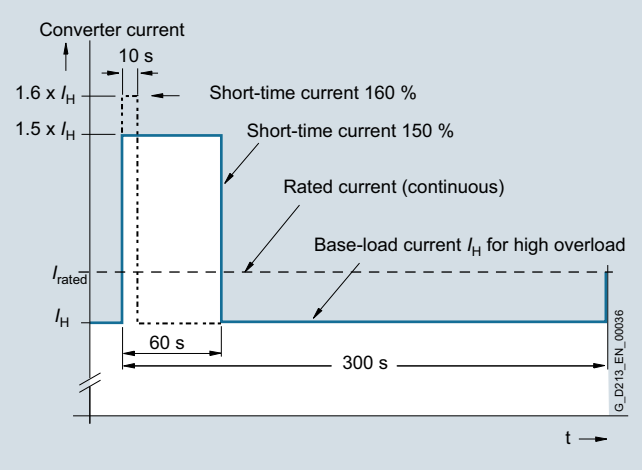
The criterion for overload is that the drive is operated with its base load current before and after the overload occurs on the basis of a duty cycle duration of 300 s.

The base load current for a low overload I_L is based on a duty cycle of 110% for 60 s or 150% for 10 s.

The base load current for a high overload I_H is based on a duty cycle of 150% for 60 s or 160% for 10 s.



Low overload



High overload

More information

Documentation

The device documentation consists of the following parts:

- Operating instructions
- Spare parts list
- Device-specific dimension drawings, layout diagrams, circuit and terminal diagrams

The documentation is available in English, French, German, Italian and Spanish.

Overview

The Power Module contains:

- The line-side 6-pulse rectifier
- The DC-link capacitors
- The inverter in IGBT technology
- The associated control and monitoring electronics
- The precharging circuit for the DC link
- The control and power supply for the fans in the Power Module

Design

As standard, the Power Module has the following interfaces:

- 1 line supply connection
- 1 motor connection
- 1 connection for Braking Module
- 1 connection for dv/dt filter or dv/dt filter compact plus VPL
- 1 connection for external 24 V DC supply
- 24 V power supply (max. 2.5 A) for
  - CU320-2 Control Unit
  - AOP30 Advanced Operator Panel
  - Further DRIVE-CLiQ components
- 3 DRIVE-CLiQ sockets
- 1 temperature sensor input (KTY84-130, PTC or Pt100)
- 1 connection for Safe Brake Adapter
- 1 connection for Safety Integrated
- 2 PE connections

DRIVE-CLiQ cables for connections to further DRIVE-CLiQ devices can be ordered pre-assembled and cut to length as required (see Section Supplementary system components → Signal cables).

The scope of supply of the Power Modules includes:

- 1 DRIVE-CLiQ cable for connection to the Control Unit
- 1 set of warning labels in 30 languages (BG, CN, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IS, IT, JP, KR, LT, LV, MT, NL, NO, PL, PT, RO, RU, SE, SI, SK, TR)

Selection and ordering data

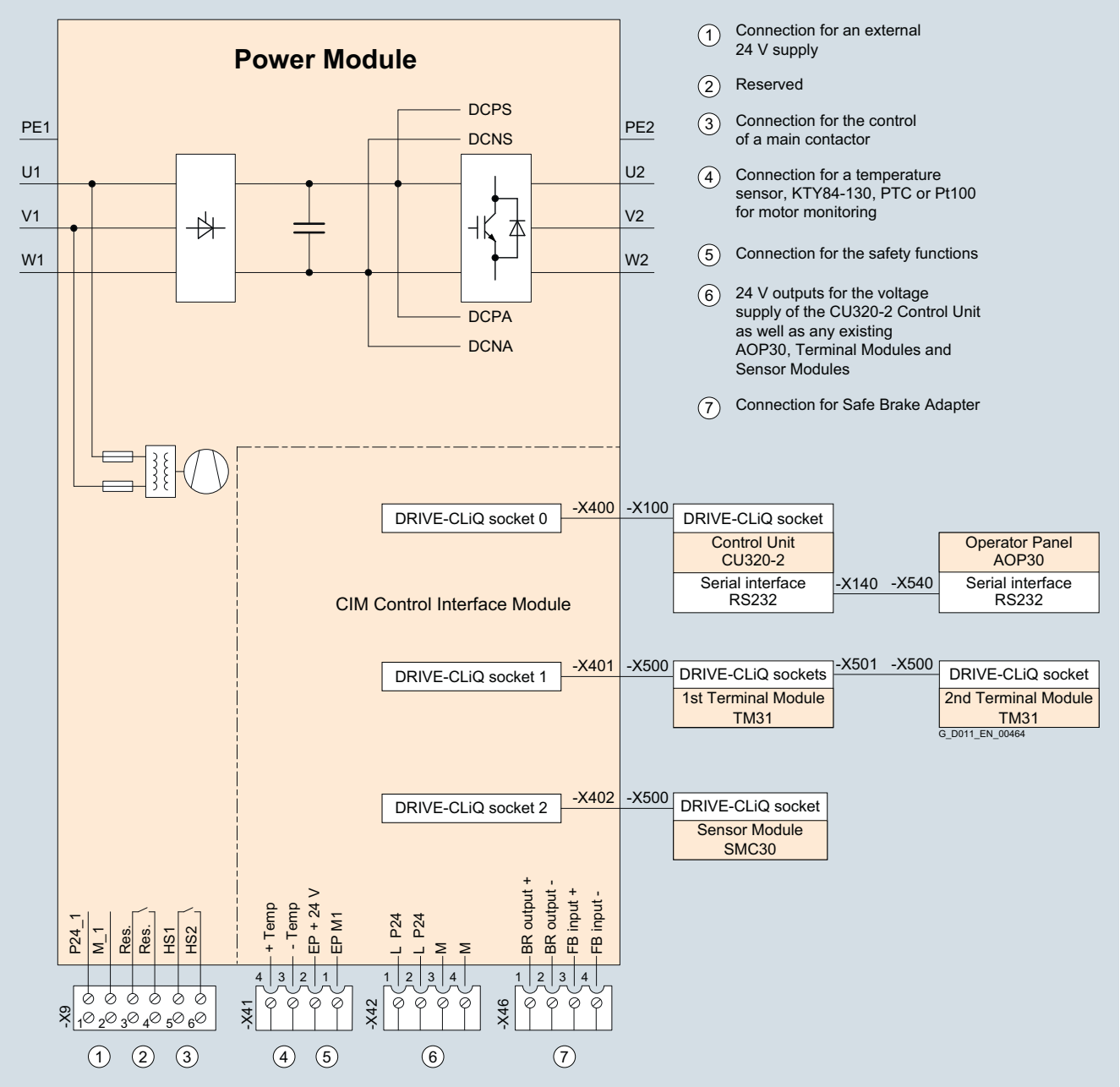
Type rating		Rated output current	Power Module
at 50 Hz 400 V, 500 V or 690 V	at 60 Hz 460 V or 575 V		
kW	hp	A	Article No.
380 ... 480 V 3 AC			
110	150	210	**6SL3310-1GE32-1AA3**
132	200	260	**6SL3310-1GE32-6AA3**
160	250	310	**6SL3310-1GE33-1AA3**
200	300	380	**6SL3310-1GE33-8AA3**
250	400	490	**6SL3310-1GE35-0AA3**
315	500	605	**6SL3310-1GE36-1AA3**
400	600	745	**6SL3310-1GE37-5AA3**
450	700	840	**6SL3310-1GE38-4AA3**
560	800	985	**6SL3310-1GE41-0AA3**
500 ... 600 V 3 AC			
110	150	175	**6SL3310-1GF31-8AA3**
132	200	215	**6SL3310-1GF32-2AA3**
160	250	260	**6SL3310-1GF32-6AA3**
200	300	330	**6SL3310-1GF33-3AA3**
250	400	410	**6SL3310-1GF34-1AA3**
315	450	465	**6SL3310-1GF34-7AA3**
400	600	575	**6SL3310-1GF35-8AA3**
500	700	735	**6SL3310-1GF37-4AA3**
560	800	810	**6SL3310-1GF38-1AA3**
660 ... 690 V 3 AC			
75		85	**6SL3310-1GH28-5AA3**
90		100	**6SL3310-1GH31-0AA3**
110		120	**6SL3310-1GH31-2AA3**
132		150	**6SL3310-1GH31-5AA3**
160		175	**6SL3310-1GH31-8AA3**
200		215	**6SL3310-1GH32-2AA3**
250		260	**6SL3310-1GH32-6AA3**
315		330	**6SL3310-1GH33-3AA3**
400		410	**6SL3310-1GH34-1AA3**
450		465	**6SL3310-1GH34-7AA3**
560		575	**6SL3310-1GH35-8AA3**
710		735	**6SL3310-1GH37-4AA3**
800		810	**6SL3310-1GH38-1AA3**

Note: The power data in hp units is based on the NEC/CEC standards for the North American market.

3

Integration

The Power Module communicates with the CU320-2 Control Unit via DRIVE-CLiQ and receives its control information via this route.



Connection example of a Power Module

Technical specifications

Line voltage 380 ... 480 V 3 AC		Power Modules				
		6SL3310-1GE32-1AA3	6SL3310-1GE32-6AA3	6SL3310-1GE33-1AA3	6SL3310-1GE33-8AA3	6SL3310-1GE35-0AA3
Type rating						
• For I_L at 50 Hz 400 V [1]	kW	**110**	**132**	**160**	**200**	**250**
• For I_H at 50 Hz 400 V [1]	kW	90	110	132	160	200
• For I_L at 60 Hz 460 V [2]	hp	150	200	250	300	400
• For I_H at 60 Hz 460 V [2]	hp	150	200	200	250	350
Output current						
• Rated current I_n	A	210	260	310	380	490
• Base-load current I_L [3]	A	205	250	302	370	477
• Base-load current I_H [4]	A	178	233	277	340	438
Input current						
• Rated input current	A	229	284	338	395	509
• Input current, max.	A	335	410	495	606	781
• Current requirement, 24 V DC auxiliary power supply [5]	A	0.8	0.8	0.9	0.9	0.9
Minimum short-circuit current [6]	A	3000	3600	4400	4400	8000
Power loss, max. [7]						
• At 50 Hz 400 V	kW	2.4	3.2	3.9	4.3	5.6
• At 60 Hz 460 V	kW	2.6	3.3	4.4	4.9	6.1
Cooling air requirement	m^3/s	0.17	0.23	0.36	0.36	0.36
Cable length, max. between Power Module and motor [8]						
• Shielded	m	300	300	300	300	300
• Unshielded	m	450	450	450	450	450
Degree of protection		IP20	IP20	IP20	IP20	IP20
Sound pressure level L_{pA} (1 m) at 50/60 Hz	dB	64/67	64/67	69/73	69/73	69/73
Line connection U1, V1, W1		M10 screw	M10 screw	M10 screw	M10 screw	M10 screw
• Conductor cross section, max. (IEC)	mm^2	2 × 185	2 × 185	2 × 240	2 × 240	2 × 240
Motor connection U2/T1, V2/T2, W2/T3		M10 screw	M10 screw	M10 screw	M10 screw	M10 screw
• Conductor cross section, max. (IEC)	mm^2	2 × 185	2 × 185	2 × 240	2 × 240	2 × 240
PE1/GND connection		M10 screw	M10 screw	M10 screw	M10 screw	M10 screw
• Conductor cross section, max. (IEC)	mm^2	2 × 185	2 × 185	2 × 240	2 × 240	2 × 240
PE2/GND connection		M10 screw	M10 screw	M10 screw	M10 screw	M10 screw
• Conductor cross section, max. (IEC)	mm^2	2 × 185	2 × 185	2 × 240	2 × 240	2 × 240
Dimensions						
• Width	mm	326	326	326	326	326
• Height	mm	1400	1400	1533	1533	1533
• Depth	mm	356	356	545	545	545
Weight, approx.	kg	104	104	176	176	176
Frame size		FX	FX	GX	GX	GX

Note: The power data in hp units is based on the NEC/CEC standards for the North American market.

[1] Rated output of a typical 6-pole standard induction motor based on I_L or I_H for 3 AC 50 Hz 400 V.

[2] Rated output of a typical 6-pole standard induction motor based on I_L or I_H for 3 AC 60 Hz 460 V.

[3] 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 duration of 300 s (see Technical specifications → Overload capability)

[4] 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 duration of 300 s (see Technical specifications → Overload capability).

[5] If the auxiliary supply is to be fed in separately from the load supply, e.g. if the control should be able to continue communication when the line voltage fails

[6] The minimum current required to reliably trigger 3NE1 protective devices.

[7] The specified power losses are the maximum values for a utilization of 100%. The values are lower under normal operating condition.

[8] Longer cable lengths for specific configurations are available on request.

Technical specifications (continued)

Line voltage 380 ... 480 V 3 AC		Power Modules			
		6SL3310-1GE36-1AA3	6SL3310-1GE37-5AA3	6SL3310-1GE38-4AA3	6SL3310-1GE41-0AA3
Type rating					
• For I_L at 50 Hz 400 V [1]	kW	**315**	**400**	**450**	**560**
• For I_H at 50 Hz 400 V [1]	kW	250	315	400	450
• For I_L at 60 Hz 460 V [2]	hp	500	600	700	800
• For I_H at 60 Hz 460 V [2]	hp	350	450	600	700
Output current					
• Rated current I_n	A	605	745	840	985
• Base-load current I_L [3]	A	590	725	820	960
• Base-load current I_H [4]	A	460	570	700	860
Input current					
• Rated input current	A	629	775	873	1024
• Input current, max.	A	967	1188	1344	1573
• Current requirement, 24 V DC auxiliary power supply [5]	A	1	1	1	1.25
Minimum short-circuit current [6]	A	10000	10500	16000	18400
Power loss, max. [7]					
• At 50 Hz 400 V	kW	7.2	8.5	9.1	12.7
• At 60 Hz 460 V	kW	8.1	9.4	10.2	14.5
Cooling air requirement	m^3/s	0.78	0.78	0.78	1.48
Cable length, max. between Power Module and motor [8]					
• Shielded	m	300	300	300	300
• Unshielded	m	450	450	450	450
Degree of protection		IP00	IP00	IP00	IP00
Sound pressure level L_{pA} (1 m) at 50/60 Hz	dB	70/73	70/73	70/73	72/75
Line connection U1, V1, W1		2 × M12 screws	2 × M12 screws	2 × M12 screws	3 × M12 screws
• Conductor cross section, max. (IEC)	mm^2	4 × 240	4 × 240	4 × 240	6 × 240
Motor connection U2/T1, V2/T2, W2/T3		2 × M12 screws	2 × M12 screws	2 × M12 screws	3 × M12 screws
• Conductor cross section, max. (IEC)	mm^2	4 × 240	4 × 240	4 × 240	6 × 240
PE1/GND connection		M12 screw	M12 screw	M12 screw	2 × M12 screws
• Conductor cross section, max. (IEC)	mm^2	2 × 240	2 × 240	2 × 240	4 × 240
PE2/GND connection		2 × M12 screws	2 × M12 screws	2 × M12 screws	3 × M12 screws
• Conductor cross section, max. (IEC)	mm^2	4 × 240	4 × 240	4 × 240	6 × 240
Dimensions					
• Width	mm	503	503	503	909
• Height	mm	1506	1506	1506	1510
• Depth	mm	540	540	540	540
Weight, approx.	kg	294	294	294	530
Frame size		HX	HX	HX	JX

Note: The power data in hp units is based on the NEC/CEC standards for the North American market.

[1] Rated output of a typical 6-pole standard induction motor based on I_L or I_H for 3 AC 50 Hz 400 V.

[2] Rated output of a typical 6-pole standard induction motor based on I_L or I_H for 3 AC 60 Hz 460 V.

[3] 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 duration of 300 s (see Technical specifications → Overload capability).

[4] The base-load current I_L is based on a load cycle of 150% for 60 s or 160% for 10 s with a load cycle duration of 300 s (see Technical specifications → Overload capability).

[5] If the auxiliary supply is to be fed in separately from the load supply, e.g. if the control should be able to continue communication when the line voltage fails.

[6] The minimum current required to reliably trigger 3NE1 protective devices.

[7] The specified power losses are the maximum values for a utilization of 100%. The values are lower under normal operating conditions.

[8] Longer cable lengths for specific configurations are available on request.

Technical specifications (continued)

Line voltage 500 ... 600 V 3 AC		Power Modules				
		6SL3310-1GF31-8AA3	6SL3310-1GF32-2AA3	6SL3310-1GF32-6AA3	6SL3310-1GF33-3AA3	6SL3310-1GF34-1AA3
Type rating						
• For I_L at 50 Hz 500 V [1]	kW	**110**	**132**	**160**	**200**	**250**
• For I_H at 50 Hz 500 V [1]	kW	90	110	132	160	200
• For I_L at 60 Hz 575 V [2]	hp	150	200	250	300	400
• For I_H at 60 Hz 575 V [2]	hp	150	200	200	250	350
Output current						
• Rated current I_n	A	175	215	260	330	410
• Base-load current I_L [3]	A	171	208	250	320	400
• Base-load current I_H [4]	A	157	192	233	280	367
Input current						
• Rated input current	A	191	224	270	343	426
• Input current, max.	A	279	341	410	525	655
• Current requirement, 24 V DC auxiliary power supply [5]	A	0.9	0.9	0.9	0.9	1
Minimum short-circuit current [6]	A	2400	3000	3600	5200	5200
Power loss, max. [7]						
• At 50 Hz 500 V	kW	2.8	3.2	3.7	4.6	6.1
• At 60 Hz 575 V	kW	3.2	3.6	4.1	5.1	7.1
Cooling air requirement	m^3/s	0.36	0.36	0.36	0.36	0.78
Cable length, max. between Power Module and motor [8]						
• Shielded	m	300	300	300	300	300
• Unshielded	m	450	450	450	450	450
Degree of protection		IP20	IP20	IP20	IP20	IP00
Sound pressure level L_{pA} (1 m) at 50/60 Hz	dB	69/73	69/73	69/73	69/73	70/73
Line connection U1, V1, W1		M10 screw	M10 screw	M10 screw	M10 screw	2 × M12 screws
• Conductor cross section, max. (IEC)	mm^2	2 × 240	2 × 240	2 × 240	2 × 240	4 × 240
Motor connection U2/T1, V2/T2, W2/T3		M10 screw	M10 screw	M10 screw	M10 screw	2 × M12 screws
• Conductor cross section, max. (IEC)	mm^2	2 × 240	2 × 240	2 × 240	2 × 240	4 × 240
PE1/GND connection		M10 screw	M10 screw	M10 screw	M10 screw	M12 screw
• Conductor cross section, max. (IEC)	mm^2	2 × 240	2 × 240	2 × 240	2 × 240	2 × 240
PE2/GND connection		M10 screw	M10 screw	M10 screw	M10 screw	2 x M12 screws
• Conductor cross section, max. (IEC)	mm^2	2 × 240	2 × 240	2 × 240	2 × 240	4 × 240
Dimensions						
• Width	mm	326	326	326	326	503
• Height	mm	1533	1533	1533	1533	1506
• Depth	mm	545	545	545	545	540
Weight, approx.	kg	176	176	176	176	294
Frame size		GX	GX	GX	GX	HX

Note: The power data in hp units is based on the NEC/CEC standards for the North American market.

[1] Rated output of a typical 6-pole standard induction motor based on I_L or I_H for 3 AC 50 Hz 500 V.

[2] Rated output of a typical 6-pole standard induction motor based on I_L or I_H for 3 AC 60 Hz 575 V.

[3] 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 duration of 300 s (see Technical specifications → Overload capability).

[4] The base-load current I_L is based on a load cycle of 150% for 60 s or 160% for 10 s with a load cycle duration of 300 s (see Technical specifications → Overload capability).

[5] If the auxiliary supply is to be fed in separately from the load supply, e.g. if the control should be able to continue communication when the line voltage fails.

[6] The minimum current required to reliably trigger 3NE1 protective devices.

[7] The specified power losses are the maximum values for a utilization of 100%. The values are lower under normal operating conditions.

[8] Longer cable lengths for specific configurations are available on request.

Technical specifications (continued)

Line voltage 500 ... 600 V 3 AC		Power Modules			
		6SL3310-1GF34-7AA3	6SL3310-1GF35-8AA3	6SL3310-1GF37-4AA3	6SL3310-1GF38-1AA3
Type rating					
• For I_L at 50 Hz 500 V [1]	kW	**315**	**400**	**500**	**560**
• For I_H at 50 Hz 500 V [1]	kW	250	315	450	500
• For I_L at 60 Hz 575 V [2]	hp	450	600	700	800
• For I_H at 60 Hz 575 V [2]	hp	450	500	700	700
Output current					
• Rated current I_n	A	465	575	735	810
• Base-load current I_L [3]	A	452	560	710	790
• Base-load current I_H [4]	A	416	514	657	724
Input current					
• Rated input current	A	483	598	764	842
• Input current, max.	A	740	918	1164	1295
• Current requirement, 24 V DC auxiliary power supply [5]	A	1	1	1.25	1.25
Minimum short-circuit current [6]	A	6200	8400	10500	10400
Power loss, max. [7]					
• At 50 Hz 500 V	kW	6.7	7.9	11	12.1
• At 60 Hz 575 V	kW	7.7	8.9	12.9	14
Cooling air requirement	m^3/s	0.78	0.78	1.48	1.48
Cable length, max. between Power Module and motor [8]					
• Shielded	m	300	300	300	300
• Unshielded	m	450	450	450	450
Degree of protection		IP00	IP00	IP00	IP00
Sound pressure level L_{pA} (1 m) at 50/60 Hz	dB	70/73	70/73	73/75	73/75
Line connection U1, V1, W1		2 × M12 screws	2 × M12 screws	3 × M12 screws	3 × M12 screws
• Conductor cross section, max. (IEC)	mm^2	4 × 240	4 × 240	6 × 240	6 × 240
Motor connection U2/T1, V2/T2, W2/T3		2 × M12 screws	2 × M12 screws	3 × M12 screws	3 × M12 screws
• Conductor cross section, max. (IEC)	mm^2	4 × 240	4 × 240	6 × 240	6 × 240
PE1/GND connection		M12 screw	M12 screw	2 × M12 screws	2 × M12 screws
• Conductor cross section, max. (IEC)	mm^2	2 × 240	2 × 240	4 × 240	4 × 240
PE2/GND connection		2 × M12 screws	2 × M12 screws	3 × M12 screws	3 × M12 screws
• Conductor cross section, max. (IEC)	mm^2	4 × 240	4 × 240	6 × 240	6 × 240
Dimensions					
• Width	mm	503	503	909	909
• Height	mm	1506	1506	1510	1510
• Depth	mm	540	540	540	540
Weight, approx.	kg	294	294	530	530
Frame size		HX	HX	JX	JX

Note: The power data in hp units is based on the NEC/CEC standards for the North American market.

[1] Rated output of a typical 6-pole standard induction motor based on I_L or I_H for 3 AC 50 Hz 500 V.

[2] Rated output of a typical 6-pole standard induction motor based on I_L or I_H for 3 AC 60 Hz 575 V.

[3] 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 duration of 300 s (see Technical specifications → Overload capability).

[4] The base-load current I_L is based on a load cycle of 150% for 60 s or 160% for 10 s with a load cycle duration of 300 s (see Technical specifications → Overload capability).

[5] If the auxiliary supply is to be fed in separately from the load supply, e.g. if the control should be able to continue communication when the line voltage fails.

[6] The minimum current required to reliably trigger 3NE1 protective devices.

[7] The specified power losses are the maximum values for a utilization of 100%. The values are lower under normal operating conditions.

[8] Longer cable lengths for specific configurations are available on request.

Technical specifications (continued)

Line voltage 660 ... 690 V 3 AC		Power Modules					
		6SL3310-1GH28-5AA3	6SL3310-1GH31-0AA3	6SL3310-1GH31-2AA3	6SL3310-1GH31-5AA3	6SL3310-1GH31-8AA3	6SL3310-1GH32-2AA3
Type rating							
• For I_L at 50 Hz 690 V [1]	kW	**75**	**90**	**110**	**132**	**160**	**200**
• For I_H at 50 Hz 690 V [1]	kW	55	75	90	110	132	160
Output current							
• Rated current I_n	A	85	100	120	150	175	215
• Base-load current I_L [2]	A	80	95	115	142	171	208
• Base-load current I_H [3]	A	76	89	107	134	157	192
Input current							
• Rated input current	A	93	109	131	164	191	224
• Input current, max.	A	131	155	188	232	279	341
• Current requirement, 24 V DC auxiliary power supply [4]	A	0.8	0.8	0.8	0.8	0.9	0.9
Minimum short-circuit current [5]	A	1050	1050	1200	1600	2400	3000
Heat loss, max. [6] at 50 Hz 690 V	kW	1.3	1.6	1.8	2.3	3	3.5
Cooling air requirement	m^3/s	0.17	0.17	0.17	0.17	0.36	0.36
Cable length, max. between Power Module and motor [7]							
• Shielded	m	300	300	300	300	300	300
• Unshielded	m	450	450	450	450	450	450
Degree of protection		IP20	IP20	IP20	IP20	IP20	IP20
Sound pressure level L_{pA} (1 m) at 50/60 Hz	dB	64/67	64/67	64/67	64/67	69/73	69/73
Line connection U1, V1, W1		M10 screw	M10 screw	M10 screw	M10 screw	M10 screw	M10 screw
• Conductor cross section, max. (IEC)	mm^2	2 × 185	2 × 185	2 × 185	2 × 185	2 × 240	2 × 240
Motor connection U2/T1, V2/T2, W2/T3		M10 screw	M10 screw	M10 screw	M10 screw	M10 screw	M10 screw
• Conductor cross section, max. (IEC)	mm^2	2 × 185	2 × 185	2 × 185	2 × 185	2 × 240	2 × 240
PE1/GND connection		M10 screw	M10 screw	M10 screw	M10 screw	M10 screw	M10 screw
• Conductor cross section, max. (IEC)	mm^2	2 × 185	2 × 185	2 × 185	2 × 185	2 × 240	2 × 240
PE2/GND connection		M10 screw	M10 screw	M10 screw	M10 screw	M10 screw	M10 screw
• Conductor cross section, max. (IEC)	mm^2	2 × 185	2 × 185	2 × 185	2 × 185	2 × 240	2 × 240
Dimensions							
• Width	mm	326	326	326	326	326	326
• Height	mm	1400	1400	1400	1400	1533	1533
• Depth	mm	356	356	356	356	545	545
Weight, approx.	kg	104	104	104	104	176	176
Frame size		FX	FX	FX	FX	GX	GX

Note: The power data in hp units is based on the NEC/CEC standards for the North American market.

[1] Rated output of a typical 6-pole standard induction motor based on I_L or I_H for 3 AC 50 Hz 640 V.

[2] 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 duration of 300 s

[3] The base-load current I_L is based on a load cycle of 150% for 60 s or 160% for 10 s with a load cycle duration of 300 s (see Technical specifications → Overload capability).

[4] N:_Laufende_Aufträge\EM_LP_MK&CS_2_3\01_Kataloge\PI_3VA_FR_2015\06_Korrekturläufe\04_Freigabe_Kunde\an_Kunde\3VA_gesamt_DRAFT_2015-08-17.pdfIf the auxiliary supply is to be fed in separately from the load supply, e.g. if the control should be able to continue communication when the line voltage fails.

[5] The minimum current required to reliably trigger 3NE1 protective devices.

[6] The specified power losses are the maximum values for a utilization of 100%. The values are lower under normal operating conditions.

[7] Longer cable lengths for specific configurations are available on request.

Technical specifications (continued)

Line voltage 660 ... 690 V 3 AC		Power Modules						
		6SL3310-1GH32-6AA3	6SL3310-1GH33-3AA3	6SL3310-1GH34-1AA3	6SL3310-1GH34-7AA3	6SL3310-1GH35-8AA3	6SL3310-1GH37-4AA3	6SL3310-1GH38-1AA3
Type rating								
• For I_L at 50 Hz 690 V [1]	kW	**250**	**315**	**400**	**450**	**560**	**710**	**800**
• For I_H at 50 Hz 690 V [1]	kW	200	250	315	400	500	560	710
Output current								
• Rated current I_n	A	260	330	410	465	575	735	810
• Base-load current I_L [2]	A	250	320	400	452	560	710	790
• Base-load current I_H [3]	A	233	280	367	416	514	657	724
Input current								
• Rated input current	A	270	343	426	483	598	764	842
• Input current, max.	A	410	525	655	740	918	1164	1295
• Current requirement, 24 V DC auxiliary power supply [4]	A	0.9	0.9	1	1	1	1.25	1.25
Minimum short-circuit current [5]	A	3600	5200	5200	6200	8400	10500	10400
Heat loss, max. [6] at 50 Hz 690 V	kW	4	5	6.7	7.3	8.6	12.1	13.4
Cooling air requirement	m^3/s	0.36	0.36	0.78	0.78	0.78	1.48	1.48
Cable length, max. between Power Module and motor [7]								
• Shielded	m	300	300	300	300	300	300	300
• Unshielded	m	450	450	450	450	450	450	450
Degree of protection		IP20	IP20	IP00	IP00	IP00	IP00	IP00
Sound pressure level L_{pA} (1 m) at 50/60 Hz	dB	69/73	69/73	70/73	70/73	70/73	73/75	73/75
Line connection U1, V1, W1		M10 screw	M10 screw	2 × M12 screws	2 × M12 screws	2 × M12 screws	3 × M12 screws	3 × M12 screws
• Conductor cross section, max. (IEC)	mm^2	2 × 240	2 × 240	4 × 240	4 × 240	4 × 240	6 × 240	6 × 240
Motor connection U2/T1, V2/T2, W2/T3		M10 screw	M10 screw	2 × M12 screws	2 × M12 screws	2 × M12 screws	3 × M12 screws	3 × M12 screws
• Conductor cross section, max. (IEC)	mm^2	2 × 240	2 × 240	4 × 240	4 × 240	4 × 240	6 × 240	6 × 240
PE1/GND connection		M10 screw	M10 screw	M12 screw	M12 screw	M12 screw	2 × M12 screws	2 × M12 screws
• Conductor cross section, max. (IEC)	mm^2	2 × 240	2 × 240	2 × 240	2 × 240	2 × 240	4 × 240	4 × 240
PE2/GND connection		M10 screw	M10 screw	2 × M12 screws	2 × M12 screws	2 × M12 screws	3 × M12 screws	3 × M12 screws
• Conductor cross section, max. (IEC)	mm^2	2 × 240	2 × 240	4 × 240	4 × 240	4 × 240	6 × 240	6 × 240
Dimensions								
• Width	mm	326	326	503	503	503	909	909
• Height	mm	1533	1533	1506	1506	1506	1510	1510
• Depth	mm	545	545	540	540	540	540	540
Weight, approx.	kg	176	176	294	294	294	530	530
Frame size		GX	GX	HX	HX	HX	JX	JX

Note: The power data in hp units is based on the NEC/CEC standards for the North American market.

1) Rated output of a typical 6-pole standard induction motor based on I_L or I_H for 3 AC 50 Hz 640 V.

2) 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 duration of 300 s

3) The base-load current I_L is based on a load cycle of 150% for 60 s or 160% for 10 s with a load cycle duration of 300 s (see Technical specifications → Overload capability).

4) If the auxiliary supply is to be fed in separately from the load supply, e.g. if the control should be able to continue communication when the line voltage fails.

5) The minimum current required to reliably trigger 3NE1 protective devices.

6) The specified power losses are the maximum values for a utilization of 100%. The values are lower under normal operating conditions.

7) Longer cable lengths for specific configurations are available on request.

Overview

Line-side power components protect the connected components against transient or continuous overvoltages and ensure that specified limit values are maintained.

To limit the emitted interference, the converters are equipped as standard with a radio interference suppression filter that conforms to the limits defined in Category C3. SINAMICS G130 converters equipped with a line filter also meet the limits for use in the first environment (Category C2) according to EN 61800-3 [1].

SINAMICS G130 converters comply with the noise immunity requirements defined in this standard for the first and second environments.

In conjunction with line reactors, line filters also limit the conducted interference emitted by the Power Modules to the limit values of Category C2 defined in product standard EN 61800-3. Provided that the system has been set up in accordance with the EMC installation guidelines, the limit values at the installation location will be in accordance with the requirements for the first environment.

The line filters are suitable for grounded systems (TN or TT systems with grounded neutral point).

Selection and ordering data

Suitable for Power Module	Type rating of the Power Module at 400 V, 500 V or 690 V	**Line filter**
	kW	Article No.
380 ... 480 V 3 AC		
6SL3310-1GE32-1AA3	110	**6SL3000-0BE32-5AA0**
6SL3310-1GE32-6AA3	132	**6SL3000-0BE34-4AA0**
6SL3310-1GE33-1AA3	160	
6SL3310-1GE33-8AA3	200	
6SL3310-1GE35-0AA3	250	**6SL3000-0BE36-0AA0**
6SL3310-1GE36-1AA3	315	**6SL3000-0BE41-2AA0**
6SL3310-1GE37-5AA3	400	
6SL3310-1GE38-4AA3	450	
6SL3310-1GE41-0AA3	560	
500 ... 600 V 3 AC		
6SL3310-1GF31-8AA3	110	**6SL3000-0BG32-5AA0**
6SL3310-1GF32-2AA3	132	
6SL3310-1GF32-6AA3	160	**6SL3000-0BG34-4AA0**
6SL3310-1GF33-3AA3	200	
6SL3310-1GF34-1AA3	250	
6SL3310-1GF34-7AA3	315	**6SL3000-0BG36-0AA0**
6SL3310-1GF35-8AA3	400	**6SL3000-0BG41-2AA0**
6SL3310-1GF37-4AA3	500	
6SL3310-1GF38-1AA3	560	
660 ... 690 V 3 AC		
6SL3310-1GH28-5AA3	75	**6SL3000-0BG32-5AA0**
6SL3310-1GH31-0AA3	90	
6SL3310-1GH31-2AA3	110	
6SL3310-1GH31-5AA3	132	
6SL3310-1GH31-8AA3	160	
6SL3310-1GH32-2AA3	200	
6SL3310-1GH32-6AA3	250	**6SL3000-0BG34-4AA0**
6SL3310-1GH33-3AA3	315	
6SL3310-1GH34-1AA3	400	
6SL3310-1GH34-7AA3	450	**6SL3000-0BG36-0AA0**
6SL3310-1GH35-8AA3	560	**6SL3000-0BG41-2AA0**
6SL3310-1GH37-4AA3	710	
6SL3310-1GH38-1AA3	800	

For further information about EMC-compliant plant construction, please refer to the SINAMICS Low Voltage Engineering Manual.

[1] Applies to motor cable lengths < 100 m.

Technical specifications

Line voltage 380 ... 480 V 3 AC		**Line filter**			
		6SL3000-0BE32-5AA0	6SL3000-0BE34-4AA0	6SL3000-0BE36-0AA0	6SL3000-0BE41-2AA0
Rated current	A	250	440	600	1200
Power loss	kW	0.015	0.047	0.053	0.119
Line/load connection		1 × hole for M10	1 × hole for M10	1 × hole for M10	1 × hole for M12
• Conductor cross section, max. (IEC)	mm^2	Provided for busbar connection	Provided for busbar connection	Provided for busbar connection	Provided for busbar connection
PE connection		Hole for M8	Hole for M8	Hole for M10	Hole for M10
Degree of protection		IP00	IP00	IP00	IP00
Dimensions					
• Width	mm	360	360	400	425
• Height	mm	240	240	265	265
• Depth	mm	116	116	140	145
Weight, approx.	kg	12.3	12.3	19	25.8
Approvals, according to		cURus	cURus	cURus	cURus
Suitable for Power Module		6SL3310-1GE32-1AA3 (110 kW)	6SL3310-1GE32-6AA3 (132 kW) 6SL3310-1GE33-1AA3 (160 kW) 6SL3310-1GE33-8AA3 (200 kW)	6SL3310-1GE35-0AA3 (250 kW)	6SL3310-1GE36-1AA3 (315 kW) 6SL3310-1GE37-5AA3 (400 kW) 6SL3310-1GE38-4AA3 (450 kW) 6SL3310-1GE41-0AA3 (560 kW)

Line voltage 500 ... 600 V 3 AC		**Line filter**			
		6SL3000-0BG32-5AA0	6SL3000-0BG34-4AA0	6SL3000-0BG36-0AA0	6SL3000-0BG41-2AA0
Rated current	A	250	440	600	1200
Power loss	kW	0.015	0.047	0.053	0.119
Line/load connection		1 × hole for M10	1 × hole for M10	1 × hole for M10	1 × hole for M12
• Conductor cross section, max. (IEC)	mm^2	Provided for busbar connection	Provided for busbar connection	Provided for busbar connection	Provided for busbar connection
PE connection		Hole for M8	Hole for M8	Hole for M10	Hole for M10
Degree of protection		IP00	IP00	IP00	IP00
Dimensions					
• Width	mm	360	360	400	425
• Height	mm	240	240	265	265
• Depth	mm	116	116	140	145
Weight, approx.	kg	12.3	12.3	19	25.8
Approvals, according to		cURus	cURus	cURus	cURus
Suitable for Power Module		6SL3310-1GF31-8AA3 (110 kW) 6SL3310-1GF32-2AA3 (132 kW)	6SL3310-1GF32-6AA3 (160 kW) 6SL3310-1GF33-3AA3 (200 kW) 6SL3310-1GF34-1AA3 (250 kW)	6SL3310-1GF34-7AA3 (315 kW)	6SL3310-1GF35-8AA3 (400 kW) 6SL3310-1GF37-4AA3 (500 kW) 6SL3310-1GF38-1AA3 (560 kW)

Technical specifications (continued)

Line voltage 660 ... 690 V 3 AC		Line filter			
		6SL3000-0BG32-5AA0	6SL3000-0BG34-4AA0	6SL3000-0BG36-0AA0	6SL3000-0BG41-2AA0
Rated current	A	250	440	600	1200
Power loss	kW	0.015	0.047	0.053	0.119
Line/load connection		1 × hole for M10	1 × hole for M10	1 × hole for M10	1 × hole for M12
• Conductor cross section, max. (IEC)	mm^2	Provided for busbar connection	Provided for busbar connection	Provided for busbar connection	Provided for busbar connection
PE connection		Hole for M8	Hole for M8	Hole for M10	Hole for M10
Degree of protection		IP00	IP00	IP00	IP00
Dimensions					
• Width	mm	360	360	400	425
• Height	mm	240	240	265	265
• Depth	mm	116	116	140	145
Weight, approx.	kg	12.3	12.3	19	25.2
Approvals, according to		cURus	cURus	cURus	cURus
Suitable for Power Module		6SL3310-1GH28-5AA3 (75 kW) 6SL3310-1GH31-0AA3 (90 kW) 6SL3310-1GH31-2AA3 (110 kW) 6SL3310-1GH31-5AA3 (132 kW) 6SL3310-1GH31-8AA3 (160 kW) 6SL3310-1GH32-2AA3 (200 kW)	6SL3310-1GH32-6AA3 (250 kW) 6SL3310-1GH33-3AA3 (315 kW) 6SL3310-1GH34-1AA3 (400 kW)	6SL3310-1GH34-7AA3 (450 kW)	6SL3310-1GH35-8AA3 (560 kW) 6SL3310-1GH37-4AA3 (710 kW) 6SL3310-1GH38-1AA3 (800 kW)

Overview

Line Harmonics Filters reduce the low-frequency harmonic effects of converters to a level that can otherwise only be achieved using 12-pulse rectifiers.

The stringent limit values of IEEE 519-1992 are fully complied with.

Design

Line Harmonics Filters are supplied as stand-alone components in a rugged housing. They are installed between the customer's low-voltage distribution panel and the converter. The voltage is disconnected and fused in the customer's low-voltage switchgear, as is the power supply cable.

The Line Harmonics Filters have no fans (natural convection cooling). This means that no external auxiliary power supply is required.

The Line Harmonics Filters are equipped with a floating thermostatic switch, which can be monitored externally, for the monitoring thermal overloads, e.g. as a result of insufficient cooling air being supplied.

Note:

The converter must have a line reactor in order to use a Line Harmonics Filter.

Selection and ordering data

Suitable for Power Module	Type rating of the Power Module at 400 V, 500 V or 690 V kW	**Line Harmonics Filter** Article No.
380 ... 480 V 3 AC		
6SL3310-1GE33-1AA3	160	**6SL3000-0JE36-1AA0**
6SL3310-1GE33-8AA3	200	
6SL3310-1GE35-0AA3	250	
6SL3310-1GE36-1AA3	315	
6SL3310-1GE37-5AA3	400	**6SL3000-0JE38-4AA0**
6SL3310-1GE38-4AA3	450	
6SL3310-1GE41-0AA3	560	**6SL3000-0JE41-0AA0**
500 ... 600 V 3 AC		
6SL3310-1GF31-8AA3	110	**6SL3000-0JH33-3AA0**
6SL3310-1GF32-2AA3	132	
6SL3310-1GF32-6AA3	160	
6SL3310-1GF33-3AA3	200	
6SL3310-1GF34-1AA3	250	**6SL3000-0JH34-7AA0**
6SL3310-1GF34-7AA3	315	
6SL3310-1GF35-8AA3	400	**6SL3000-0JH35-8AA0**
6SL3310-1GF37-4AA3	500	**6SL3000-0JH38-1AA0**
6SL3310-1GF38-1AA3	560	
660 ... 690 V 3 AC		
6SL3310-1GH31-8AA3	160	**6SL3000-0JH33-3AA0**
6SL3310-1GH32-2AA3	200	
6SL3310-1GH32-6AA3	250	
6SL3310-1GH33-3AA3	315	
6SL3310-1GH34-1AA3	400	**6SL3000-0JH34-7AA0**
6SL3310-1GH34-7AA3	450	
6SL3310-1GH35-8AA3	560	**6SL3000-0JH35-8AA0**
6SL3310-1GH37-4AA3	710	**6SL3000-0JH38-1AA0**
6SL3310-1GH38-1AA3	800	

For further information on Line Harmonics Filters, please refer to the SINAMICS Low Voltage Engineering Manual.

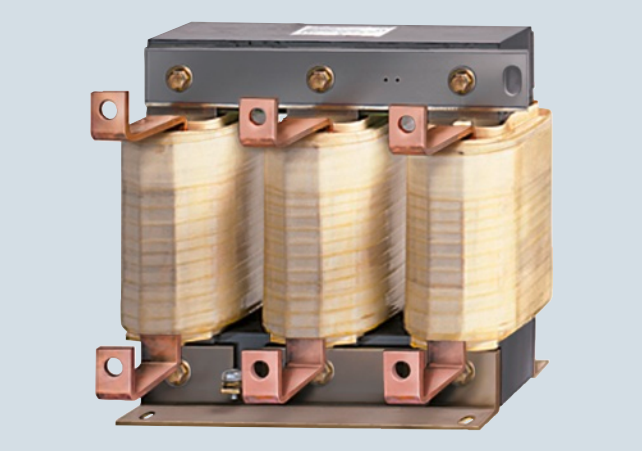
Technical specifications

Line voltage 380 ... 415 V 3 AC (50 Hz) 440 ... 480 V 3 AC (60 Hz)		**Line Harmonics Filter**		
		6SL3000-0JE36-1AA0	6SL3000-0JE38-4AA0	6SL3000-0JE41-0AA0
Rated current [1]	A	500	700	900
Power loss	kW	3.09	4.54	5.6
Line/load connection				
• Conductor cross section, max. (IEC)	mm^2	4 × 240	4 × 240	4 × 240
PE connection		3 × M12 studs	3 × M12 studs	3 × M12 studs
Degree of protection		IP21	IP21	IP21
Dimensions				
• Width	mm	600	800	1000
• Height	mm	1700	1700	1700
• Depth	mm	540	540	540
Weight, approx.	kg	460	600	900
Paint finish		RAL 7035	RAL 7035	RAL 7035
Standards		IEEE 519-1992	IEEE 519-1992	IEEE 519-1992
Suitable for Power Module		6SL3310-1GE33-1AA3 (160 kW) 6SL3310-1GE33-8AA3 (200 kW) 6SL3310-1GE35-0AA3 (250 kW) 6SL3310-1GE36-1AA3 (315 kW)	6SL3310-1GE37-5AA3 (400 kW) 6SL3310-1GE38-4AA3 (450 kW)	6SL3310-1GE41-0AA3 (560 kW)

Line voltage 500 … 600 V 3 AC 660 ... 690 V 3 AC		**Line Harmonics Filter**			
		6SL3000-0JH33-3AA0	6SL3000-0JH34-7AA0	6SL3000-0JH35-8AA0	6SL3000-0JH38-1AA0
Rated current [1]	A	290	400	520	710
Power loss	kW	3.11	4.62	5.69	7.97
Line/load connection					
• Conductor cross section, max. (IEC)	mm^2	4 × 240	4 × 240	4 × 240	4 × 240
PE connection		3 × M12 studs	3 × M12 studs	3 × M12 studs	3 × M12 studs
Degree of protection		IP21	IP21	IP21	IP21
Dimensions					
• Width	mm	600	800	1000	1000
• Height	mm	1700	1700	1700	1700
• Depth	mm	540	540	540	540
Weight, approx.	kg	450	600	830	830
Paint finish		RAL 7035	RAL 7035	RAL 7035	RAL 7035
Standards		IEEE 519-1992	IEEE 519-1992	IEEE 519-1992	IEEE 519-1992
Suitable for Power Module		6SL3310-1GF31-8AA3 (110 kW) 6SL3310-1GF32-2AA3 (132 kW) 6SL3310-1GF32-6AA3 (160 kW) 6SL3310-1GH31-8AA3 (160 kW) 6SL3310-1GF33-3AA3 (200 kW) 6SL3310-1GH32-2AA3 (200 kW) 6SL3310-1GF32-6AA3 (250 kW) 6SL3310-1GH33-3AA3 (315 kW)	6SL3310-1GF34-1AA3 (250 kW) 6SL3310-1GF34-7AA3 (315 kW) 6SL3310-1GH34-1AA3 (400 kW) 6SL3310-1GH34-7AA3 (450 kW)	6SL3310-1GF35-8AA3 (400 kW) 6SL3310-1GH35-8AA3 (560 kW)	6SL3310-1GF37-4AA3 (500 kW) 6SL3310-1GF38-1AA3 (560 kW) 6SL3310-1GH37-4AA3 (710 kW) 6SL3310-1GH38-1AA3 (800 kW)

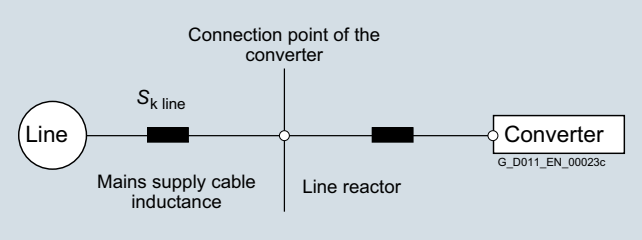
[1] The rated current of the Line Harmonics Filters is defined according to the active power. It can therefore be lower than the rated input current of the associated Power Module.

Overview



A line reactor is needed for high short-circuit power levels, partly to protect the actual converter against excessive harmonic currents, and thus against overload, and partly to limit the line harmonics to the permissible values. The harmonic currents are limited by the complete inductance comprising the line reactor and line supply cable inductance. Line reactors can be omitted if the line supply cable inductance is increased sufficiently, i.e. the RSC value must be sufficiently small.

RSC = Relative Short-Circuit power: Ratio of short-circuit power $S_{K\ line}$ at the supply connection point to fundamental apparent output S_{conv} of the connected converters (according to IEC 60146-1-1).



The following applies for SINAMICS G130 converter built-in units:

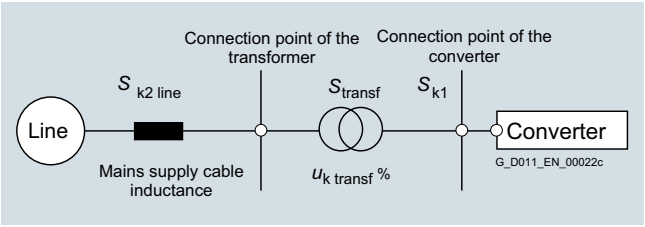
Power	**Line reactor can be omitted**	**Line reactor required**
kW	For RSC	For RSC
<200	≤43	>43
200 ... 500	≤33	>33
>500	≤20	>20

It is recommended that a line reactor is always connected on the line side of the converter, as in practice, it is often not known on which supply configuration individual converters are to be operated, i.e. which supply short-circuit power is present at the converter connection point.

A line reactor can only be omitted when the value for RSC is less than the values listed in the above table. This is the case, when the converter, as shown in the following figure, is connected to the line supply via a transformer with the appropriate rating.

Notice:

However, a line reactor is always required when a line filter is used.



In this case, the line short-circuit power S_{k1} at the connection point of the converter is approximately:
$S_{k1} = S_{transf} / (u_{k\ transf} + S_{transf} / S_{k2\ line})$

Formula symbols	Meaning
S_{transf}	Transformer power rating
$S_{k2\ line}$	Short-circuit power of the higher-level voltage
$u_{k\ transf}$	Per-unit short-circuit voltage

Selection and ordering data

Suitable for Power Module	Type rating of the Power Module at 400 V, 500 V or 690 V kW	**Line reactor** Article No.
380 ... 480 V 3 AC		
6SL3310-1GE32-1AA3	110	**6SL3000-0CE32-3AA0**
6SL3310-1GE32-6AA3	132	**6SL3000-0CE32-8AA0**
6SL3310-1GE33-1AA3	160	**6SL3000-0CE33-3AA0**
6SL3310-1GE33-8AA3	200	**6SL3000-0CE35-1AA0**
6SL3310-1GE35-0AA3	250	
6SL3310-1GE36-1AA3	315	**6SL3000-0CE36-3AA0**
6SL3310-1GE37-5AA3	400	**6SL3000-0CE37-7AA0**
6SL3310-1GE38-4AA3	450	**6SL3000-0CE38-7AA0**
6SL3310-1GE41-0AA3	560	**6SL3000-0CE41-0AA0**
500 ... 600 V 3 AC		
6SL3310-1GF31-8AA3	110	**6SL3000-0CH32-2AA0**
6SL3310-1GF32-2AA3	132	
6SL3310-1GF32-6AA3	160	**6SL3000-0CH32-7AA0**
6SL3310-1GF33-3AA3	200	**6SL3000-0CH33-4AA0**
6SL3310-1GF34-1AA3	250	**6SL3000-0CH34-8AA0**
6SL3310-1GF34-7AA3	315	
6SL3310-1GF35-8AA3	400	**6SL3000-0CH36-0AA0**
6SL3310-1GF37-4AA3	500	**6SL3000-0CH38-4AA0**
6SL3310-1GF38-1AA3	560	
660 ... 690 V 3 AC		
6SL3310-1GH28-5AA3	75	**6SL3000-0CH31-1AA0**
6SL3310-1GH31-0AA3	90	
6SL3310-1GH31-2AA3	110	**6SL3000-0CH31-6AA0**
6SL3310-1GH31-5AA3	132	
6SL3310-1GH31-8AA3	160	**6SL3000-0CH32-2AA0**
6SL3310-1GH32-2AA3	200	
6SL3310-1GH32-6AA3	250	**6SL3000-0CH32-7AA0**
6SL3310-1GH33-3AA3	315	**6SL3000-0CH33-4AA0**
6SL3310-1GH34-1AA3	400	**6SL3000-0CH34-8AA0**
6SL3310-1GH34-7AA3	450	
6SL3310-1GH35-8AA3	560	**6SL3000-0CH36-0AA0**
6SL3310-1GH37-4AA3	710	**6SL3000-0CH38-4AA0**
6SL3310-1GH38-1AA3	800	

Technical specifications

Line voltage 380 ... 480 V 3 AC		**Line reactor**			
		6SL3000-0CE32-3AA0	6SL3000-0CE32-8AA0	6SL3000-0CE33-3AA0	6SL3000-0CE35-1AA0
$I_{th\ max}$	A	224	278	331	508
Nominal inductance L_N	µH	76	62	52	42
Power loss	kW	0.274	0.247	0.267	0.365
Line/load connection • Conductor cross section, max. (IEC)	mm^2	1 × hole for M10 Provided for busbar connection	1 × hole for M10 Provided for busbar connection	1 × hole for M10 Provided for busbar connection	1 × hole for M12 Provided for busbar connection
PE connection		M6 screw	M6 screw	M6 screw	M6 screw
Degree of protection		IP00	IP00	IP00	IP00
Dimensions					
• Width	mm	270	270	270	300
• Height	mm	248	248	248	269
• Depth	mm	200	200	200	212.5
Weight, approx.	kg	24.5	26	27.8	38
Approvals, according to		cURus	cURus	cURus	cURus
Suitable for Power Module		6SL3310-1GE32-1AA3 (110 kW)	6SL3310-1GE32-6AA3 (132 kW)	6SL3310-1GE33-1AA3 (160 kW)	6SL3310-1GE33-8AA3 (200 kW) 6SL3310-1GE35-0AA3 (250 kW)

Line voltage 380 ... 480 V 3 AC		**Line reactor**			
		6SL3000-0CE36-3AA0	6SL3000-0CE37-7AA0	6SL3000-0CE38-7AA0	6SL3000-0CE41-0AA0
$I_{th\ max}$	A	628	773	871	1022
Nominal inductance L_N	µH	27	22	19	16
Power loss	kW	0.368	0.351	0.458	0.498
Line/load connection • Conductor cross section, max. (IEC)	mm^2	1 × hole for M12 Provided for busbar connection	1 × hole for M12 Provided for busbar connection	1 × hole for M12 Provided for busbar connection	1 × hole for M12 Provided for busbar connection
PE connection		M6 screw	M6 screw	M6 screw	M6 screw
Degree of protection		IP00	IP00	IP00	IP00
Dimensions					
• Width	mm	300	300	350	350
• Height	mm	269	269	321	321
• Depth	mm	212.5	212.2	211.5	211.5
Weight, approx.	kg	41.4	51.3	63.2	69.6
Approvals, according to		cURus	cURus	cURus	cURus
Suitable for Power Module		6SL3310-1GE36-1AA3 (315 kW)	6SL3310-1GE37-5AA3 (400 kW)	6SL3310-1GE38-4AA3 (450 kW)	6SL3310-1GE41-0AA3 (560 kW)

Line voltage 500 ... 600 V 3 AC		**Line reactor**			
		6SL3000-0CH32-2AA0	6SL3000-0CH32-2AA0	6SL3000-0CH32-7AA0	6SL3000-0CH33-4AA0
$I_{th\ max}$	A	215	215	270	342
Nominal inductance L_N	µH	150	150	100	81
Power loss	kW	0.24	0.275	0.277	0.27
Line/load connection • Conductor cross section, max. (IEC)	mm^2	1 × hole for M10 Provided for busbar connection	1 × hole for M10 Provided for busbar connection	1 × hole for M10 Provided for busbar connection	1 × hole for M10 Provided for busbar connection
PE connection		M6 screw	M6 screw	M6 screw	M6 screw
Degree of protection		IP00	IP00	IP00	IP00
Dimensions					
• Width	mm	270	270	270	270
• Height	mm	248	248	248	248
• Depth	mm	200	200	200	200
Weight, approx.	kg	31.1	31.1	27.9	38.9
Approvals, according to		cURus	cURus	cURus	cURus
Suitable for Power Module		6SL3310-1GF31-8AA3 (110 kW)	6SL3310-1GF32-2AA3 (132 kW)	6SL3310-1GF32-6AA3 (160 kW)	6SL3310-1GF33-3AA3 (200 kW)

Technical specifications (continued)

Line voltage 500 ... 600 V 3 AC		Line reactor		
		6SL3000-0CH34-8AA0	6SL3000-0CH36-0AA0	6SL3000-0CH38-4AA0
$I_{th\ max}$	A	482	597	840
Nominal inductance L_N	µH	65	46	40
Power loss	kW	0.48	0.485	0.618
Line/load connection • Conductor cross section, max. (IEC)	mm^2	1 × hole for M10 Provided for busbar connection	1 × hole for M12 Provided for busbar connection	1 × hole for M12 Provided for busbar connection
PE connection		M6 screw	M6 screw	M6 screw
Degree of protection		IP00	IP00	IP00
Dimensions				
• Width	mm	350	350	410
• Height	mm	321	321	385
• Depth	mm	232.5	232.5	224
Weight, approx.	kg	55.6	63.8	98
Approvals, according to		cURus	cURus	cURus
Suitable for Power Module		6SL3310-1GF34-1AA3 (250 kW) 6SL3310-1GF34-7AA3 (315 kW)	6SL3310-1GF35-8AA3 (400 kW)	6SL3310-1GF37-4AA3 (500 kW) 6SL3310-1GF38-1AA3 (560 kW)

Line voltage 660 ... 690 V 3 AC		Line reactor			
		6SL3000-0CH31-1AA0	6SL3000-0CH31-6AA0	6SL3000-0CH32-2AA0	6SL3000-0CH32-7AA0
$I_{th\ max}$	A	107	155	230	270
Nominal inductance L_N	µH	310	220	150	100
Power loss	kW	0.252	0.279	0.275	0.277
Line/load connection • Conductor cross section, max. (IEC)	mm^2	1 × hole for M10 Provided for busbar connection	1 × hole for M10 Provided for busbar connection	1 × hole for M10 Provided for busbar connection	1 × hole for M10 Provided for busbar connection
PE connection		M6 screw	M6 screw	M6 screw	M6 screw
Degree of protection		IP00	IP00	IP00	IP00
Dimensions					
• Width	mm	270	270	270	270
• Height	mm	248	248	248	248
• Depth	mm	200	200	200	200
Weight, approx.	kg	24.4	25.9	31.1	27.9
Approvals, according to		cURus	cURus	cURus	cURus
Suitable for Power Module		6SL3310-1GH28-5AA3 (75 kW) 6SL3310-1GH31-0AA3 (90 kW)	6SL3310-1GH31-2AA3 (110 kW) 6SL3310-1GH31-5AA3 (132 kW)	6SL3310-1GH31-8AA3 (160 kW) 6SL3310-1GH32-2AA3 (200 kW)	6SL3310-1GH32-6AA3 (250 kW)

Line voltage 660 ... 690 V 3 AC		Line reactor			
		6SL3000-0CH33-4AA0	6SL3000-0CH34-8AA0	6SL3000-0CH36-0AA0	6SL3000-0CH38-4AA0
$I_{th\ max}$	A	342	482	597	840
Nominal inductance L_N	µH	81	65	46	40
Power loss	kW	0.27	0.48	0.485	0.618
Line/load connection • Conductor cross section, max. (IEC)	mm^2	1 × hole for M10 Provided for busbar connection	1 × hole for M10 Provided for busbar connection	1 × hole for M12 Provided for busbar connection	1 × hole for M12 Provided for busbar connection
PE connection		M6 screw	M6 screw	M6 screw	M6 screw
Degree of protection		IP00	IP00	IP00	IP00
Dimensions					
• Width	mm	270	350	350	410
• Height	mm	248	321	321	385
• Depth	mm	200	232	232	224
Weight, approx.	kg	38.9	55.6	63.8	98
Approvals, according to		cURus	cURus	cURus	cURus
Suitable for Power Module		6SL3310-1GH33-3AA3 (315 kW)	6SL3310-1GH34-1AA3 (400 kW) 6SL3310-1GH34-7AA3 (450 kW)	6SL3310-1GH35-8AA3 (560 kW)	6SL3310-1GH37-4AA3 (710 kW) 6SL3310-1GH38-1AA3 (800 kW)

Selection and ordering data

The table below lists recommended ratings for input-side switching and fuse protection elements according to IEC standards.

Further information about the main contactors, switch disconnectors, fuses and circuit breakers specified in the table can be found in Catalog LV 10.

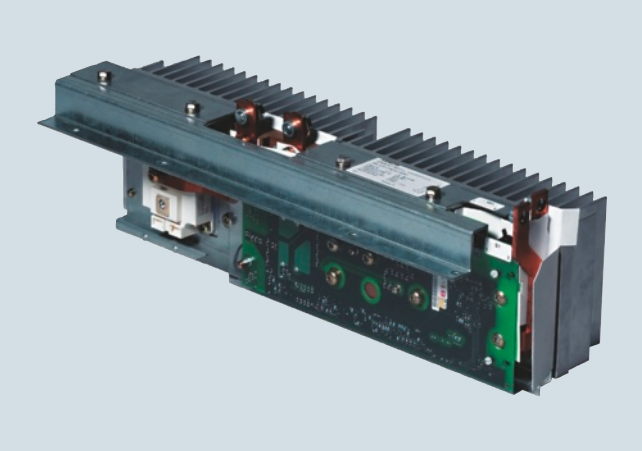
Type rating (for 400V, 500V or 690V)	Rated input current	Assignment to Power Module	**Line contactor**	**Fixed-mounted circuit breaker**	**Switch disconnector** for cable protection fuses incl. semiconductor protection of type 3NE1
kW	A	Typ 6SL3310-...	Type	Type	Type
380 ... 480 V 3 AC					
110	229	1GE32-1AA3	**3RT1456-…..**	–	**3KL5530-…..**
132	284	1GE32-6AA3	**3RT1466-…..**	–	**3KL5730-…..**
160	338	1GE33-1AA3	**3RT1466-…..**	–	**3KL5730-…..**
200	395	1GE33-8AA3	**3RT1476-…..**	–	**3KL6130-…..**
250	509	1GE35-0AA3	**3RT1476-…..**	–	**3KL6130-…..**
315	629	1GE36-1AA3	**3RT1476-…..**	–	**3KL6230-…..**
400	775	1GE37-5AA3	**3RT1466-…..** (3 units)	–	**3KL6230-…..**
450	873	1GE38-4AA3	–	**3WL1110-…** *)	–
560	1024	1GE41-0AA3	–	**3WL1112-…** *)	–
500 ... 600 V 3 AC					
110	191	1GF31-8AA3	**3RT1456-…..**	–	**3KL5530-…..**
132	242	1GF32-2AA3	**3RT1456-…..**	–	**3KL5530-…..**
160	270	1GF32-6AA3	**3RT1466-…..**	–	**3KL5730-…..**
200	343	1GF33-3AA3	**3RT1466-…..**	–	**3KL5730-…..**
250	426	1GF34-1AA3	**3RT1476-…..**	–	**3KL6130-…..**
315	483	1GF34-7AA3	**3RT1476-…..**	–	**3KL6130-…..**
400	598	1GF35-8AA3	**3RT1476-…..**	–	**3KL6230-…..**
500	764	1GF37-4AA3	**3RT1466-…..** (3 units)	–	**3KL6230-…..**
560	842	1GF38-1AA3	–	**3WL1210-…** *)	–
660 ... 690 V 3 AC					
75	93	1GH28-5AA3	**3RT1446-…..**	–	**3KL5230-…..**
90	109	1GH31-0AA3	**3RT1446-…..**	–	**3KL5230-…..**
110	131	1GH31-2AA3	**3RT1446-…..**	–	**3KL5530-…..**
132	164	1GH31-5AA3	**3RT1456-…..**	–	**3KL5530-…..**
160	191	1GH31-8AA3	**3RT1456-…..**	–	**3KL5530-…..**
200	224	1GH32-2AA3	**3RT1456-…..**	–	**3KL5530-…..**
250	270	1GH32-6AA3	**3RT1466-…..**	–	**3KL5730-…..**
315	343	1GH33-3AA3	**3RT1466-…..**	–	**3KL5730-…..**
400	426	1GH34-1AA3	**3RT1476-…..**	–	**3KL6130-…..**
450	483	1GH34-7AA3	**3RT1476-…..**	–	**3KL6130-…..**
560	598	1GH35-8AA3	**3RT1476-….**	–	**3KL6230-…..**
710	764	1GH37-4AA3	**3RT1466-…..** (3 units)	–	**3KL6230-…..**
800	842	1GH38-1AA3	–	**3WL1210-…** *)	–

*) The circuit breakers must always be switched ON and OFF by the sequence control. An interlocking set 3WL9111-0BA21-0AA0 as described in Catalog LV 10 should be provided for the circuit breakers in order to exclude the risk of unintentional manual operation. Manual operation bypasses the pre-charging circuit and can therefore destroy the Power Module.

Selection and ordering data (continued)

Type rating (for 400V, 500V or 690V)	Rated input current	Assignment to Power Module	**Cable protection fuse**		**Cable protection fuse** incl. Semiconductor protection	
				Rated current		Rated current
kW	A	Type 6SL3310-...	Article No.	A	Article No.	A
380 ... 480 V 3 AC						
110	229	1GE32-1AA3	**3NA3144**	250	**3NE1230-2**	315
132	284	1GE32-6AA3	**3NA3250**	300	**3NE1331-2**	350
160	338	1GE33-1AA3	**3NA3254**	355	**3NE1334-2**	500
200	395	1GE33-8AA3	**3NA3260**	400	**3NE1334-2**	500
250	509	1GE35-0AA3	**3NA3372**	630	**3NE1436-2**	630
315	629	1GE36-1AA3	**3NA3475**	800	**3NE1438-2**	800
400	775	1GE37-5AA3	**3NA3475**	800	**3NE1448-2**	850
450	873	1GE38-4AA3	**3NA3365**	2 × 500	**3NE1436-2**	2 × 630
560	1024	1GE41-0AA3	**3NA3472**	2 × 630	**3NE1437-2**	2 × 710
500 ... 600 V 3 AC						
110	191	1GF31-8AA3	**3NA3244-6**	250	**3NE1227-2**	250
132	242	1GF32-2AA3	**3NA3252-6**	315	**3NE1230-2**	315
160	270	1GF32-6AA3	**3NA3354-6**	355	**3NE1331-2**	350
200	343	1GF33-3AA3	**3NA3365-6**	500	**3NE1334-2**	500
250	426	1GF34-1AA3	**3NA3365-6**	500	**3NE1334-2**	500
315	483	1GF34-7AA3	**3NA3252-6**	2 × 315	**3NE1435-2**	560
400	598	1GF35-8AA3	**3NA3354-6**	2 × 355	**3NE1447-2**	670
500	764	1GF37-4AA3	**3NA3365-6**	2 × 500	**3NE1448-2**	850
560	842	1GF38-1AA3	**3NA3365-6**	2 × 500	**3NE1334-2**	2 × 500
660 ... 690 V 3 AC						
75	93	1GH28-5AA3	**3NA3132-6**	125	**3NE1022-2**	125
90	109	1GH31-0AA3	**3NA3132-6**	125	**3NE1022-2**	125
110	131	1GH31-2AA3	**3NA3136-6**	160	**3NE1224-2**	160
132	164	1GH31-5AA3	**3NA3240-6**	200	**3NE1225-2**	200
160	191	1GH31-8AA3	**3NA3244-6**	250	**3NE1227-2**	250
200	224	1GH32-2AA3	**3NA3252-6**	315	**3NE1230-2**	315
250	270	1GH32-6AA3	**3NA3354-6**	355	**3NE1331-2**	350
315	343	1GH33-3AA3	**3NA3365-6**	500	**3NE1334-2**	500
400	426	1GH34-1AA3	**3NA3365-6**	500	**3NE1334-2**	500
450	483	1GH34-7AA3	**3NA3252-6**	2 × 315	**3NE1435-2**	560
560	598	1GH35-8AA3	**3NA3354-6**	2 × 355	**3NE1447-2**	670
710	764	1GH37-4AA3	**3NA3365-6**	2 × 500	**3NE1448-2**	850
800	842	1GH38-1AA3	**3NA3365-6**	2 × 500	**3NE1334-2**	2 × 500

Overview



A Braking Module and the associated braking resistor are required when the drive is to be braked or specifically stopped, e.g. for an EMERGENCY STOP.

The Braking Module includes the power electronics and the associated control circuit. The supply voltage for the electronics is taken from the DC link.

During operation, the DC-link power is converted into heat loss in an external braking resistor.

The Braking Module works independently of the converter control. If more braking power is required than provided by the Braking Modules listed here, then braking units may be connected in parallel for higher converter outputs (on request). In this case, a Braking Module is assigned to each braking resistor.

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 Module is inserted in a slot inside the Power Module; it is force-cooled by the Power Module fan.

Several Braking Modules can be used for Power Modules with more than one power block:

- Frame size HX: 2 Braking Modules
- Frame size JX: 3 Braking Modules

Each Braking Module is always assigned a dedicated braking resistor.

The Braking Module is connected to the DC link by means of the busbar sets or flexible cables contained in the scope of delivery.

The Braking Module has the following interfaces as standard:

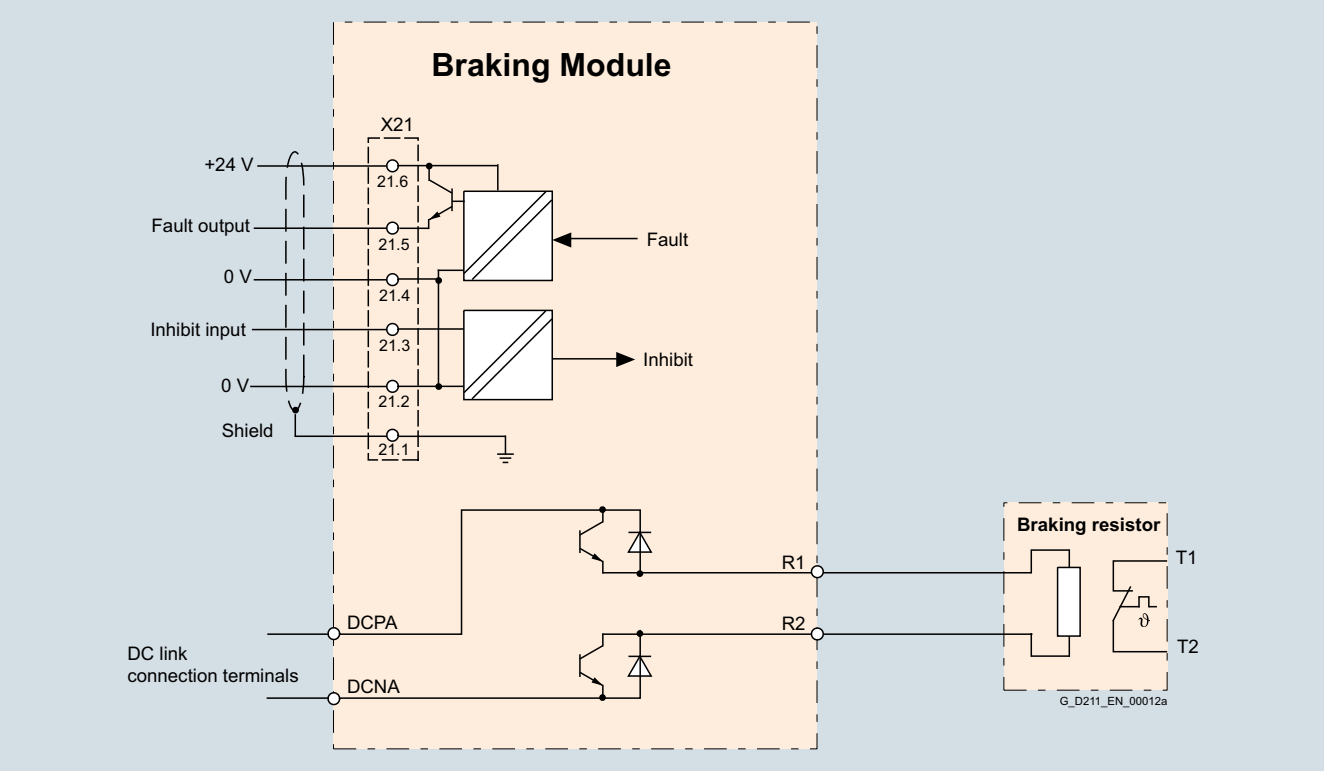
- DC-link connection
- Braking resistor connection
- 1 digital input (block Braking Module / acknowledge error)
- 1 digital output (Braking Module faulty)
- 1 DIP switch for adjusting the activation threshold

Information about Braking Module activation thresholds as well as further configuration information is contained in the SINAMICS Low Voltage Engineering Manual.

Selection and ordering data

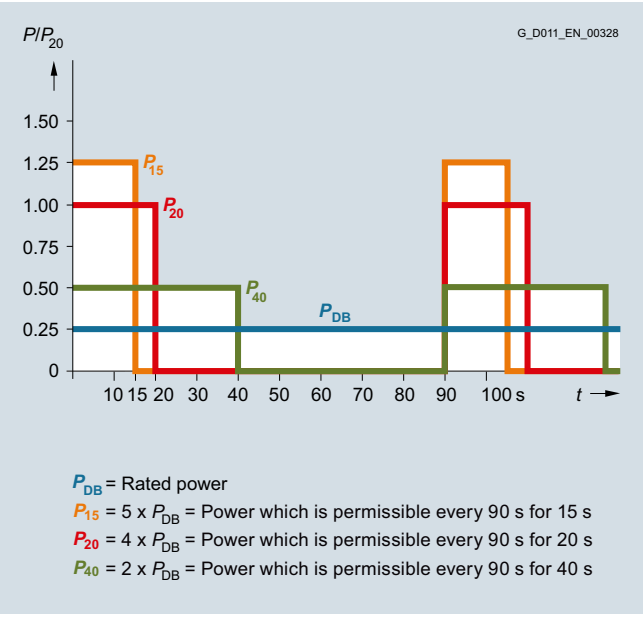
Suitable for Power Module	Type rating of the Power Module at 400 V, 500 V or 690 V	**Braking Module**
	kW	Article No.
380 ... 480 V 3 AC		
6SL3310-1GE32-1AA3	110	**6SL3300-1AE31-3AA0**
6SL3310-1GE32-6AA3	132	
6SL3310-1GE33-1AA3	160	**6SL3300-1AE32-5AA0**
6SL3310-1GE33-8AA3	200	
6SL3310-1GE35-0AA3	250	
6SL3310-1GE36-1AA3	315	**6SL3300-1AE32-5BA0**
6SL3310-1GE37-5AA3	400	
6SL3310-1GE38-4AA3	450	
6SL3310-1GE41-0AA3	560	
500 ... 600 V 3 AC		
6SL3310-1GF31-8AA3	110	**6SL3300-1AF32-5AA0**
6SL3310-1GF32-2AA3	132	
6SL3310-1GF32-6AA3	160	
6SL3310-1GF33-3AA3	200	
6SL3310-1GF34-1AA3	250	**6SL3300-1AF32-5BA0**
6SL3310-1GF34-7AA3	315	
6SL3310-1GF35-8AA3	400	
6SL3310-1GF37-4AA3	500	
6SL3310-1GF38-1AA3	560	
660 ... 690 V 3 AC		
6SL3310-1GH28-5AA3	75	**6SL3300-1AH31-3AA0**
6SL3310-1GH31-0AA3	90	
6SL3310-1GH31-2AA3	110	
6SL3310-1GH31-5AA3	132	
6SL3310-1GH31-8AA3	160	**6SL3300-1AH32-5AA0**
6SL3310-1GH32-2AA3	200	
6SL3310-1GH32-6AA3	250	
6SL3310-1GH33-3AA3	315	
6SL3310-1GH34-1AA3	400	**6SL3300-1AH32-5BA0**
6SL3310-1GH34-7AA3	450	
6SL3310-1GH35-8AA3	560	
6SL3310-1GH37-4AA3	710	
6SL3310-1GH38-1AA3	800	

Integration



Connection diagram for Braking Module

Characteristic curves

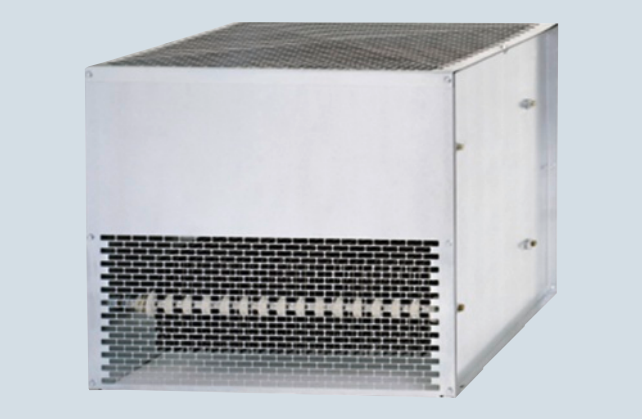


Load diagram for Braking Modules and braking resistor

Technical specifications

		Braking Module				
		6SL3300-1AE31-3AA0	6SL3300-1AE32-5AA0 6SL3300-1AE32-5BA0	6SL3300-1AF32-5AA0 6SL3300-1AF32-5BA0	6SL3300-1AH31-3AA0	6SL3300-1AH32-5AA0 6SL3300-1AH32-5BA0
Line voltage		**380 ... 480 V 3 AC**		**500 ... 600 V 3 AC**	**660 ... 690 V 3 AC**	
Rated power P_{DB}	kW	25	50	50	25	50
Peak power P_{15}	kW	125	250	250	125	250
Power P_{20}	kW	100	200	200	100	200
Power P_{40}	kW	50	100	100	50	100
Activation thresholds (adjustable via DIP switch)	V	774 (factory setting) or 673	774 (factory setting) or 673	967 (factory setting) or 841	1158 (factory setting) or 1070	1158 (factory setting) or 1070
Digital inputs						
• Voltage	V	24	24	24	24	24
• Low level (an open digital input is interpreted • as "low")	V	-3 ... +5	-3 ... +5	-3 ... +5	-3 ... +5	-3 ... +5
• High level	V	15 ... 30	15 ... 30	15 ... 30	15 ... 30	15 ... 30
• Current consumption at 24 V DC, typ.	mA	10	10	10	10	10
• Conductor cross section, max. (IEC)	mm^2	1.5	1.5	1.5	1.5	1.5
Digital outputs (continued short-circuit-proof)						
• Voltage	V	24	24	24	24	24
• Load current per digital output, max.	mA	500	500	500	500	500
• Conductor cross section, max. (IEC)	mm^2	1.5	1.5	1.5	1.5	1.5
Design conforms to		UL and IEC	UL and IEC	UL and IEC	IEC	IEC
R1/R2 connection		M8 nut	M8 nut	M8 nut	M8 nut	M8 nut
• Conductor cross section, max. (IEC)	mm^2	35	50	50	35	50
Weight, approx.	kg	3.6	7.3 (6SL3300-1AE32-5AA0) 7.5 (6SL3300-1AE32-5BA0)	7.3 (6SL3300-1AF32-5AA0) 7.5 (6SL3300-1AF32-5BA0)	3.6	7.3 (6SL3300-1AH32-5AA0) 7.5 (6SL3300-1AH32-5BA0)
Approvals, according to		cULus	cULus	cULus	–	–
Braking Module 6SL3300-.....-.AA0						
Suitable for Power Module		6SL3310-1GE32-1AA3 (110 kW) 6SL3310-1GE32-6AA3 (132 kW)	6SL3310-1GE33-1AA3 (160 kW) 6SL3310-1GE33-8AA3 (200 kW) 6SL3310-1GE35-0AA3 (250 kW)	6SL3310-1GF31-8AA3 (110 kW) 6SL3310-1GF32-2AA3 (132 kW) 6SL3310-1GF32-6AA3 (160 kW) 6SL3310-1GF33-3AA3 (200 kW)	6SL3310-1GH28-5AA3 (75 kW) 6SL3310-1GH31-0AA3 (90 kW) 6SL3310-1GH31-2AA3 (110 kW) 6SL3310-1GH31-5AA3 (132 kW)	6SL3310-1GH31-8AA3 (160 kW) 6SL3310-1GH32-2AA3 (200 kW) 6SL3310-1GH32-6AA3 (250 kW) 6SL3310-1GH33-3AA3 (315 kW)
Braking Module 6SL3300-.....-.BA0						
Suitable for Power Module		–	6SL3310-1GE36-1AA3 (315 kW) 6SL3310-1GE37-5AA3 (400 kW) 6SL3310-1GE38-4AA3 (450 kW) 6SL3310-1GE41-0AA3 (560 kW)	6SL3310-1GF34-1AA3 (250 kW) 6SL3310-1GF34-7AA3 (315 kW) 6SL3310-1GF35-8AA3 (400 kW) 6SL3310-1GF37-4AA3 (500 kW) 6SL3310-1GF38-1AA3 (560 kW)	–	6SL3310-1GH34-1AA3 (400 kW) 6SL3310-1GH34-7AA3 (450 kW) 6SL3310-1GH35-8AA3 (560 kW) 6SL3310-1GH37-4AA3 (710 kW) 6SL3310-1GH38-1AA3 (800 kW)

Overview



Excess energy in 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 enables the resulting heat loss around the Power Modules to be dissipated. This reduces the level of air conditioning required.

Two braking resistors with different rated and peak power values are available for the devices.

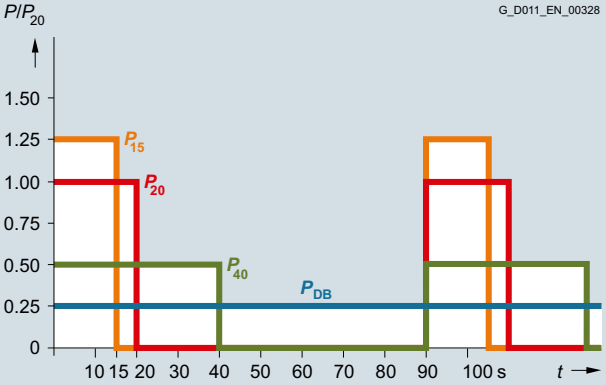
The braking resistor is monitored on the basis of the duty factor. A temperature switch (NC contact) is also fitted. This responds when the maximum permissible temperature is exceeded and can be evaluated by a controller. The maximum permissible cable length between the Braking Module and braking resistor is 100 m.

Information about possible duty cycles of the braking resistors as well as other configuration information is contained in the SINAMICS Low Voltage Engineering Manual.

Selection and ordering data

P_{DB} rated power kW	Suitable for Braking Module	**Braking resistor** Article No.
Line voltage 380 ... 480 V 3 AC		
25	6SL3300-1AE31-3AA0	**6SL3000-1BE31-3AA0**
50	6SL3300-1AE32-5.A0	**6SL3000-1BE32-5AA0**
Line voltage 500 ... 600 V 3 AC		
50	6SL3300-1AF32-5.A0	**6SL3000-1BF32-5AA0**
Line voltage 660 ... 690 V 3 AC		
25	6SL3300-1AH31-3AA0	**6SL3000-1BH31-3AA0**
50	6SL3300-1AH32-5.A0	**6SL3000-1BH32-5AA0**

Characteristic curves



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 Modules and braking resistor

Technical specifications

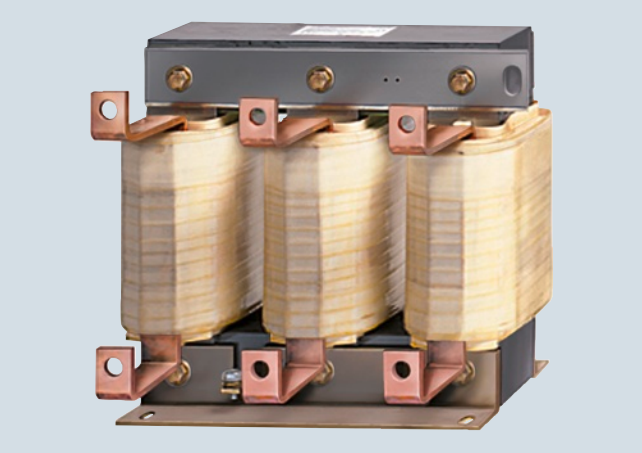
Line voltage 380 ... 480 V 3 AC		**Braking resistor** 6SL3000-1BE31-3AA0	6SL3000-1BE32-5AA0
Resistance	Ω	4.4 (±7.5%)	2.2 (±7.5%)
P_{DB} rated power (continuous braking power)	kW	25	50
P_{15} power	kW	125	250
P_{20} power	kW	100	200
P_{40} power	kW	50	100
Current, max.	A	189	378
Conductor cross section, max. (IEC)	mm^2	50	70
Power connection		M10 stud	M10 stud
Degree of protection		IP20	IP20
Dimensions			
• Width	mm	740	810
• Height	mm	600	1325
• Depth	mm	486	486
Weight, approx.	kg	50	120
Approvals, according to		cURus	cURus
Suitable for Braking Module		6SL3300-1AE31-3AA	6SL3300-1AE32-5.A0

Technical specifications (continued)

Line voltage 500 ... 600 V 3 AC		Braking resistor 6SL3000-1BF32-5AA0
Resistance	Ω	3.4 (±7.5%)
P_{DB} rated power (continuous braking power)	kW	50
P_{15} power	kW	250
P_{20} power	kW	200
P_{40} power	kW	100
Current, max.	A	255
Conductor cross section, max. (IEC)	mm^2	70
Power connection		M10 stud
Degree of protection		IP20
Dimensions		
• Width	mm	810
• Height	mm	1325
• Depth	mm	486
Weight, approx.	kg	120
Approvals, according to		cURus
Suitable for Braking Module		6SL3300-1AF32-5.A0

Line voltage 660 ... 690 V 3 AC		Braking resistor 6SL3000-1BH31-3AA0	6SL3000-1BH32-5AA0
Resistance	Ω	9.8 (±7.5%)	4.9 (±7.5%)
P_{DB} rated power (continuous braking power)	kW	25	50
P_{15} power	kW	125	250
P_{20} power	kW	100	200
P_{40} power	kW	50	100
Current, max.	A	125	255
Conductor cross section, max. (IEC)	mm^2	50	70
Power connection		M10 stud	M10 stud
Degree of protection		IP20	IP20
Dimensions			
• Width	mm	740	810
• Height	mm	600	1325
• Depth	mm	486	486
Weight, approx.	kg	50	120
Approvals, according to		cURus	cURus
Suitable for Braking Module		6SL3300-1AH31-3AA0	6SL3300-1AH32-5.A0

Overview



Motor reactors reduce the voltage load on the motor windings by reducing the voltage gradients at the motor terminals that occur during converter operation. At the same time, the capacitive charge/discharge currents that place an additional load on the converter output 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 Power Module.

Selection and ordering data

Suitable for Power Module	Type rating of the Power Module at 400 V, 500 V or 690 V kW	**Motor reactor** Article No.
380 ... 480 V 3 AC		
6SL3310-1GE32-1AA3	110	**6SL3000-2BE32-1AA0**
6SL3310-1GE32-6AA3	132	**6SL3000-2BE32-6AA0**
6SL3310-1GE33-1AA3	160	**6SL3000-2BE33-2AA0**
6SL3310-1GE33-8AA3	200	**6SL3000-2BE33-8AA0**
6SL3310-1GE35-0AA3	250	**6SL3000-2BE35-0AA0**
6SL3310-1GE36-1AA3	315	**6SL3000-2AE36-1AA0**
6SL3310-1GE37-5AA3	400	**6SL3000-2AE38-4AA0**
6SL3310-1GE38-4AA3	450	
6SL3310-1GE41-0AA3	560	**6SL3000-2AE41-0AA0**
500 ... 600 V 3 AC		
6SL3310-1GF31-8AA3	110	**6SL3000-2AH31-8AA0**
6SL3310-1GF32-2AA3	132	**6SL3000-2AH32-4AA0**
6SL3310-1GF32-6AA3	160	**6SL3000-2AH32-6AA0**
6SL3310-1GF33-3AA3	200	**6SL3000-2AH33-6AA0**
6SL3310-1GF34-1AA3	250	**6SL3000-2AH34-5AA0**
6SL3310-1GF34-7AA3	315	**6SL3000-2AH34-7AA0**
6SL3310-1GF35-8AA3	400	**6SL3000-2AH35-8AA0**
6SL3310-1GF37-4AA3	500	**6SL3000-2AH38-1AA0**
6SL3310-1GF38-1AA3	560	
660 ... 690 V 3 AC		
6SL3310-1GH28-5AA3	75	**6SL3000-2AH31-0AA0**
6SL3310-1GH31-0AA3	90	
6SL3310-1GH31-2AA3	110	**6SL3000-2AH31-5AA0**
6SL3310-1GH31-5AA3	132	
6SL3310-1GH31-8AA3	160	**6SL3000-2AH31-8AA0**
6SL3310-1GH32-2AA3	200	**6SL3000-2AH32-4AA0**
6SL3310-1GH32-6AA3	250	**6SL3000-2AH32-6AA0**
6SL3310-1GH33-3AA3	315	**6SL3000-2AH33-6AA0**
6SL3310-1GH34-1AA3	400	**6SL3000-2AH34-5AA0**
6SL3310-1GH34-7AA3	450	**6SL3000-2AH34-7AA0**
6SL3310-1GH35-8AA3	560	**6SL3000-2AH35-8AA0**
6SL3310-1GH37-4AA3	710	**6SL3000-2AH38-1AA0**
6SL3310-1GH38-1AA3	800	

Technical specifications

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						
• At 50 Hz	kW	0.436	0.454	0.422	0.477	0.448
• At 150 Hz	kW	0.486	0.5	0.47	0.5	0.5
Load connection		1 × hole for M10	1 × hole for M10	1 × hole for M10	1 × hole for M10	1 × hole for M12
PE connection		M8 screw	M8 screw	M8 screw	M8 screw	M8 screw
Cable length, max. between motor reactor and motor [1]						
• Shielded	m	300	300	300	300	300
• Unshielded	m	450	450	450	450	450
Degree of protection		IP00	IP00	IP00	IP00	IP00
Dimensions						
• Width	mm	300	300	300	300	300
• Height	mm	285	315	285	285	365
• Depth	mm	257	277	257	277	277
Weight, approx.	kg	60	66	62	73	100
Approvals, according to		cURus	cURus	cURus	cURus	cURus
Suitable for Power Module		6SL3310-1GE32-1AA3 (110 kW)	6SL3310-1GE32-6AA3 (132 kW)	6SL3310-1GE33-1AA3 (160 kW)	6SL3310-1GE33-8AA3 (200 kW)	6SL3310-1GE35-0AA3 (250 kW)

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		6SL3000-2AE41-0AA0
Rated current	A	605	840	840	985
Power loss					
• At 50 Hz	kW	0.798	0.75	0.834	0.939
• At 150 Hz	kW	0.9	0.84	0.943	1.062
Load connection		1 × hole for M12	1 × hole for M12	1 × hole for M12	1 × hole for M12
PE connection		M10 screw	M10 screw	M10 screw	M10 screw
Cable length, max. between motor reactor and motor [1]					
• Shielded	m	300	300	300	300
• Unshielded	m	450	450	450	450
Degree of protection		IP00	IP00	IP00	IP00
Dimensions					
• Width	mm	410	410	410	410
• Height	mm	392	392	392	392
• Depth	mm	292	292	292	302
Weight, approx.	kg	130	140	140	146
Approvals, according to		cURus	cURus	cURus	cURus
Suitable for Power Module		6SL3310-1GE36-1AA3 (315 kW)	6SL3310-1GE37-5AA3 (400 kW)	6SL3310-1GE38-4AA3 (450 kW)	6SL3310-1GE41-0AA3 (560 kW)

Technical specifications (continued)

Line voltage 500 ... 600 V 3 AC		Motor reactor (for pulse frequencies of 1.25 kHz to 2.5 kHz)				
		6SL3000-2AH31-8AA0	6SL3000-2AH32-4AA0	6SL3000-2AH32-6AA0	6SL3000-2AH33-6AA0	6SL3000-2AH34-5AA0
Rated current	A	175	215	260	330	410
Power loss						
• At 50 Hz	kW	0.357	0.376	0.389	0.4	0.481
• At 150 Hz	kW	0.403	0.425	0.441	0.454	0.545
Load connection		1 × hole for M10	1 × hole for M10	1 × hole for M10	1 × hole for M10	1 × hole for M10
PE connection		M8 screw	M8 screw	M8 screw	M8 screw	M8 screw
Cable length, max. between motor reactor and motor [1]						
• Shielded	m	300	300	300	300	300
• Unshielded	m	450	450	450	450	450
Degree of protection		IP00	IP00	IP00	IP00	IP00
Dimensions						
• Width	mm	300	300	300	300	350
• Height	mm	285	285	285	285	330
• Depth	mm	212	212	212	212	215
Weight, approx.	kg	34	34	40	43	56
Approvals, according to		cURus	cURus	cURus	cURus	cURus
Suitable for Power Module		6SL3310-1GF31-8AA3 (110 kW)	6SL3310-1GF32-2AA3 (132 kW)	6SL3310-1GF32-6AA3 (160 kW)	6SL3310-1GF33-3AA3 (200 kW)	6SL3310-1GF34-1AA3 (250 kW)

Line voltage 500 ... 600 V 3 AC		Motor reactor (for pulse frequencies of 1.25 kHz to 2.5 kHz)			
		6SL3000-2AH34-7AA0	6SL3000-2AH35-8AA0	6SL3000-2AH38-1AA0	
Rated current	A	465	575	810	810
Power loss					
• At 50 Hz	kW	0.631	0.705	0.78	0.877
• At 150 Hz	kW	0.723	0.801	0.91	1.003
Load connection		1 × hole for M12	1 × hole for M12	1 × hole for M12	1 × hole for M12
PE connection		M8 screw	M8 screw	M8 screw	M8 screw
Cable length, max. between motor reactor and motor [1]					
• Shielded	m	300	300	300	300
• Unshielded	m	450	450	450	450
Degree of protection		IP00	IP00	IP00	IP00
Dimensions					
• Width	mm	410	410	410	410
• Height	mm	392	392	392	392
• Depth	mm	292	292	279	279
Weight, approx.	kg	80	80	146	146
Approvals, according to		cURus	cURus	cURus	cURus
Suitable for Power Module		6SL3310-1GF34-7AA3 (315 kW)	6SL3310-1GF35-8AA3 (400 kW)	6SL3310-1GF37-4AA3 (500 kW)	6SL3310-1GF38-1AA3 (560 kW)

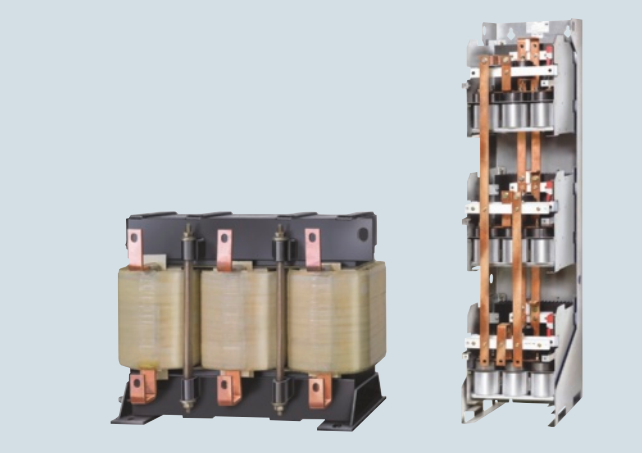
Technical specifications (continued)

Line voltage 660 ... 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	6SL3000-2AH32-6AA0
Rated current	A	100	100	150	150	175	215	260
Power loss								
• At 50 Hz	kW	0.215	0.269	0.237	0.296	0.357	0.376	0.389
• At 150 Hz	kW	0.26	0.3	0.26	0.332	0.403	0.425	0.441
Load connection		1 × hole for M10	1 × hole for M10	1 × hole for M10	1 × hole for M10	1 × hole for M10	1 × hole for M10	1 × hole for M10
PE connection		M8 screw	M8 screw	M8 screw	M8 screw	M8 screw	M8 screw	M8 screw
Cable length, max. between motor reactor and motor [1]								
• Shielded	m	300	300	300	300	300	300	300
• Unshielded	m	450	450	450	450	450	450	450
Degree of protection		IP00	IP00	IP00	IP00	IP00	IP00	IP00
Dimensions								
• Width	mm	270	270	270	270	300	300	300
• Height	mm	248	248	248	248	285	285	285
• Depth	mm	200	200	200	200	212	212	212
Weight, approx.	kg	26	26	26	26	33	35	40
Approvals, according to		–	–	–	–	–	–	–
Suitable for Power Module		6SL3310-1GH28-5AA3 (75 kW)	6SL3310-1GH31-0AA3 (90 kW)	6SL3310-1GH31-2AA3 (110 kW)	6SL3310-1GH31-5AA3 (132 kW)	6SL3310-1GH31-8AA3 (160 kW)	6SL3310-1GH32-2AA3 (200 kW)	6SL3310-1GH32-6AA3 (250 kW)

Line voltage 660 ... 690 V 3 AC		Motor reactor (for pulse frequencies of 1.25 kHz to 2.5 kHz)					
		6SL3000-2AH33-6AA0	6SL3000-2AH34-5AA0	6SL3000-2AH34-7AA0	6SL3000-2AH35-8AA0	6SL3000-2AH38-1AA0	
Rated current	A	330	410	465	575	810	810
Power loss							
• At 50 Hz	kW	0.4	0.481	0.631	0.705	0.78	0.877
• At 150 Hz	kW	0.454	0.545	0.723	0.801	0.91	1.003
Load connection		1 × hole for M10	1 × hole for M10	1 × hole for M12	1 × hole for M12	1 × hole for M12	1 × hole for M12
PE connection		M8 screw	M8 screw	M8 screw	M8 screw	M8 screw	M8 screw
Cable length, max. between motor reactor and motor [1]							
• Shielded	m	300	300	300	300	300	300
• Unshielded	m	450	450	450	450	450	450
Degree of protection		IP00	IP00	IP00	IP00	IP00	IP00
Dimensions							
• Width	mm	300	350	410	410	410	410
• Height	mm	285	330	392	392	392	392
• Depth	mm	212	215	292	292	279	279
Weight, approx.	kg	43	56	80	80	146	146
Approvals, according to		–	–	–	–	–	–
Suitable for Power Module		6SL3310-1GH33-3AA3 (315 kW)	6SL3310-1GH34-1AA3 (400 kW)	6SL3310-1GH34-7AA3 (450 kW)	6SL3310-1GH35-8AA3 (560 kW)	6SL3310-1GH37-4AA3 (710 kW)	6SL3310-1GH38-1AA3 (800 kW)

[1] Longer cable lengths for specific configurations are available on request.

Overview



dv/dt filter plus VPL (**V**oltage **P**eak **L**imiter) limit the voltage rate-of-rise dv/dt to values < 500 V/µs and the typical voltage peaks to the following values in accordance with the limit value curve according to IEC/TS 60034-17: 2006:

- < 1000 V at U_{line} < 575 V
- < 1250 V at 660 V < U_{line} < 690 V

Standard motors with standard insulation and without insulated bearings with a supply voltage of up to 690 V can be used for converter operation if a dv/dt filter plus VPL is used.

dv/dt filters plus VPL are designed for the following maximum motor cable lengths:

- Shielded cables: 300 m (e.g. Protodur NYCWY)
- Unshielded cables: 450 m (e.g. Protodur NYY)

For shorter cable lengths (100 m shielded, 150 m unshielded), refer to dv/dt filter compact plus VPL.

Notice:

The max. permissible cable length between the dv/dt filter and Power Module is 5 m.

Design

The dv/dt filter plus VPL consists of two components, which are also supplied as separate mechanical units:

- dv/dt reactor
- Voltage limiting network, which cuts-off the voltage peaks and feeds the energy back to the DC link.

Selection and ordering data

Suitable for Power Module	Type rating of the Power Module at 400 V, 500 V or 690 V	**dv/dt filter plus VPL**
	kW	Article No.
380 ... 480 V 3 AC		
6SL3310-1GE32-1AA3	110	**6SL3000-2DE32-6AA0**
6SL3310-1GE32-6AA3	132	
6SL3310-1GE33-1AA3	160	**6SL3000-2DE35-0AA0**
6SL3310-1GE33-8AA3	200	
6SL3310-1GE35-0AA3	250	
6SL3310-1GE36-1AA3	315	**6SL3000-2DE38-4AA0**
6SL3310-1GE37-5AA3	400	
6SL3310-1GE38-4AA3	450	
6SL3310-1GE41-0AA3	560	**6SL3000-2DE41-4AA0**
500 ... 600 V 3 AC		
6SL3310-1GF31-8AA3	110	**6SL3000-2DH32-2AA0**
6SL3310-1GF32-2AA3	132	
6SL3310-1GF32-6AA3	160	**6SL3000-2DH33-3AA0**
6SL3310-1GF33-3AA3	200	
6SL3310-1GF34-1AA3	250	**6SL3000-2DH34-1AA0**
6SL3310-1GF34-7AA3	315	**6SL3000-2DH35-8AA0**
6SL3310-1GF35-8AA3	400	
6SL3310-1GF37-4AA3	500	**6SL3000-2DH38-1AA0**
6SL3310-1GF38-1AA3	560	
660 ... 690 V 3 AC		
6SL3310-1GH28-5AA3	75	**6SL3000-2DH31-0AA0**
6SL3310-1GH31-0AA3	90	
6SL3310-1GH31-2AA3	110	**6SL3000-2DH31-5AA0**
6SL3310-1GH31-5AA3	132	
6SL3310-1GH31-8AA3	160	**6SL3000-2DH32-2AA0**
6SL3310-1GH32-2AA3	200	
6SL3310-1GH32-6AA3	250	**6SL3000-2DH33-3AA0**
6SL3310-1GH33-3AA3	315	
6SL3310-1GH34-1AA3	400	**6SL3000-2DH34-1AA0**
6SL3310-1GH34-7AA3	450	**6SL3000-2DH35-8AA0**
6SL3310-1GH35-8AA3	560	
6SL3310-1GH37-4AA3	710	**6SL3000-2DH38-1AA0**
6SL3310-1GH38-1AA3	800	

For further information on dv/dt filters, please refer to the SINAMICS Low Voltage Engineering Manual.

Technical specifications

Line voltage 380 ... 480 V 3 AC		dv/dt filter plus VPL			
		6SL3000-2DE32-6AA0	6SL3000-2DE35-0AA0	6SL3000-2DE38-4AA0	6SL3000-2DE41-4AA0
$I_{th\ max}$	A	260	490	840	1405
Degree of protection		IP00	IP00	IP00	IP00
Cable length, max. between dv/dt filter and motor [1]					
• Shielded	m	300	300	300	300
• Unshielded	m	450	450	450	450
Approvals, according to		cURus	cURus	cURus	cURus
dv/dt reactor					
Power loss					
• At 50 Hz	kW	0.701	0.874	1.106	1.111
• At 60 Hz	kW	0.729	0.904	1.115	1.154
• At 150 Hz	kW	0.78	0.963	1.226	1.23
Connections					
• To Power Module		1 × hole for M10	1 × hole for M12	1 × hole for M12	2 × holes for M12
• To load		1 × hole for M10	1 × hole for M12	1 × hole for M12	2 × holes for M12
• PE		M6 screw	M6 screw	M6 screw	M6 screw
Dimensions					
• Width	mm	410	460	460	445
• Height	mm	370	370	385	385
• Depth	mm	229	275	312	312
Weight, approx.	kg	66	122	149	158
Voltage Peak Limiter (VPL)					
Power loss					
• At 50 Hz	kW	0.029	0.042	0.077	0.134
• At 60 Hz	kW	0.027	0.039	0.072	0.125
• At 150 Hz	kW	0.025	0.036	0.066	0.114
Connections					
• To dv/dt reactor		M8 nut	70 mm^2 terminals	1 × hole for M8	1 × hole for M10
• To DC link		M8 nut	70 mm^2 terminals	1 × hole for M8	1 × hole for M10
• PE		M8 stud	35 mm^2 terminals	M8 stud	M8 stud
Dimensions					
• Width	mm	263	392	309	309
• Height	mm	265	285	1312.5	1312.5
• Depth	mm	188	210	400	400
Weight, approx.	kg	6	16	48	72
Suitable for Power Module		6SL3310-1GE32-1AA3 (110 kW) 6SL3310-1GE32-6AA3 (132 kW)	6SL3310-1GE33-1AA3 (160 kW) 6SL3310-1GE33-8AA3 (200 kW) 6SL3310-1GE35-0AA3 (250 kW)	6SL3310-1GE36-1AA3 (315 kW) 6SL3310-1GE37-5AA3 (400 kW) 6SL3310-1GE38-4AA3 (450 kW)	6SL3310-1GE41-0AA3 (560 kW)

Note: Two dv/dt reactors are required for Power Modules with a type rating of 560 kW.
The listed technical specifications refer to one dv/dt reactor.

[1] Longer cable lengths for specific configurations are available on request.

Technical specifications (continued)

Line voltage 500 ... 600 V 3 AC		dv/dt filter plus VPL				
		6SL3000-2DH32-2AA0	6SL3000-2DH33-3AA0	6SL3000-2DH34-1AA0	6SL3000-2DH35-8AA0	6SL3000-2DH38-1AA0
$I_{th\ max}$	A	215	330	410	575	810
Degree of protection		IP00	IP00	IP00	IP00	IP00
Cable length, max. between dv/dt filter and motor [1]						
• Shielded	m	300	300	300	300	300
• Unshielded	m	450	450	450	450	450
Approvals, according to		cURus	cURus	cURus	cURus	cURus
dv/dt reactor						
Power loss						
• At 50 Hz	kW	0.578	0.595	0.786	0.862	0.828
• At 60 Hz	kW	0.604	0.62	0.826	0.902	0.867
• At 150 Hz	kW	0.645	0.661	0.884	0.964	0.927
Connections						
• To Power Module		1 × hole for M10	1 × hole for M10	1 × hole for M12	1 × hole for M12	2 × holes for M12
• To load		1 × hole for M10	1 × hole for M10	1 × hole for M12	1 × hole for M12	2 × holes for M12
• PE		M6 screw	M6 screw	M6 screw	M6 screw	M6 screw
Dimensions						
• Width	mm	460	460	460	460	445
• Height	mm	360	360	385	385	385
• Depth	mm	275	275	312	312	312
Weight, approx.	kg	83	135	147	172	160
Voltage Peak Limiter (VPL)						
Power loss						
• At 50 Hz	kW	0.032	0.042	0.051	0.063	0.106
• At 60 Hz	kW	0.03	0.039	0.048	0.059	0.1
• At 150 Hz	kW	0.027	0.036	0.043	0.054	0.091
Connections						
• To dv/dt reactor		70 mm^2 terminals	70 mm^2 terminals	1 × hole for M8	1 × hole for M8	1 × hole for M10
• To DC link		70 mm^2 terminals	70 mm^2 terminals	1 × hole for M8	1 × hole for M8	1 × hole for M10
• PE		35 mm^2 terminals	35 mm^2 terminals	M8 stud	M8 stud	M8 stud
Dimensions						
• Width	mm	392	392	309	309	309
• Height	mm	285	285	1312.5	1312.5	1312.5
• Depth	mm	210	210	400	400	400
Weight, approx.	kg	16	16	48	48	72
Suitable for Power Module		6SL3310-1GF31-8AA3 (110 kW) 6SL3310-1GF32-2AA3 (132 kW)	6SL3310-1GF32-6AA3 (160 kW) 6SL3310-1GF33-3AA3 (200 kW)	6SL3310-1GF34-1AA3 (250 kW)	6SL3310-1GF34-7AA3 (315 kW) 6SL3310-1GF35-8AA3 (400 kW)	6SL3310-1GF37-4AA3 (500 kW) 6SL3310-1GF38-1AA3 (560 kW)

Note: Two dv/dt reactors are required for Power Modules with a type rating of 500 kW and 560 kW.
The listed technical specifications refer to one dv/dt reactor.

[1] Longer cable lengths for specific configurations are available on request.

Technical specifications (continued)

Line voltage 660 ... 690 V 3 AC		dv/dt filter plus VPL			
		6SL3000-2DH31-0AA0	6SL3000-2DH31-5AA0	6SL3000-2DH32-2AA0	6SL3000-2DH33-3AA0
$I_{th\ max}$	A	100	150	215	330
Degree of protection		IP00	IP00	IP00	IP00
Cable length, max. between dv/dt filter and motor [1]					
• Shielded	m	300	300	300	300
• Unshielded	m	450	450	450	450
Approvals, according to		cURus	cURus	cURus	cURus
dv/dt reactor					
Power loss					
• At 50 Hz	kW	0.49	0.389	0.578	0.595
• At 60 Hz	kW	0.508	0.408	0.604	0.62
• At 150 Hz	kW	0.541	0.436	0.645	0.661
Connections					
• To Power Module		1 × hole for M10	1 × hole for M10	1 × hole for M10	1 × hole for M10
• To load		1 × hole for M10	1 × hole for M10	1 × hole for M10	1 × hole for M10
• PE		M6 screw	M6 screw	M6 screw	M6 screw
Dimensions					
• Width	mm	350	350	460	460
• Height	mm	320	320	360	360
• Depth	mm	227	227	275	275
Weight, approx.	kg	48	50	83	135
Voltage Peak Limiter (VPL)					
Power loss					
• At 50 Hz	kW	0.016	0.02	0.032	0.042
• At 60 Hz	kW	0.015	0.019	0.03	0.039
• At 150 Hz	kW	0.013	0.018	0.027	0.036
Connections					
• To dv/dt reactor		M8 nut	M8 nut	70 mm^2 terminals	70 mm^2 terminals
• To DC link		M8 nut	M8 nut	70 mm^2 terminals	70 mm^2 terminals
• PE		M8 stud	M8 stud	35 mm^2 terminals	35 mm^2 terminals
Dimensions					
• Width	mm	263	263	392	392
• Height	mm	265	265	285	285
• Depth	mm	188	188	210	210
Weight, approx.	kg	6	6	16	16
Suitable for Power Module		6SL3310-1GH28-5AA3 (75 kW) 6SL3310-1GH31-0AA3 (90 kW)	6SL3310-1GH31-2AA3 (110 kW) 6SL3310-1GH31-5AA3 (132 kW)	6SL3310-1GH31-8AA3 (160 kW) 6SL3310-1GH32-2AA3 (200 kW)	6SL3310-1GH32-6AA3 (250 kW) 6SL3310-1GH33-3AA3 (315 kW)

[1] Longer cable lengths for specific configurations are available on request.

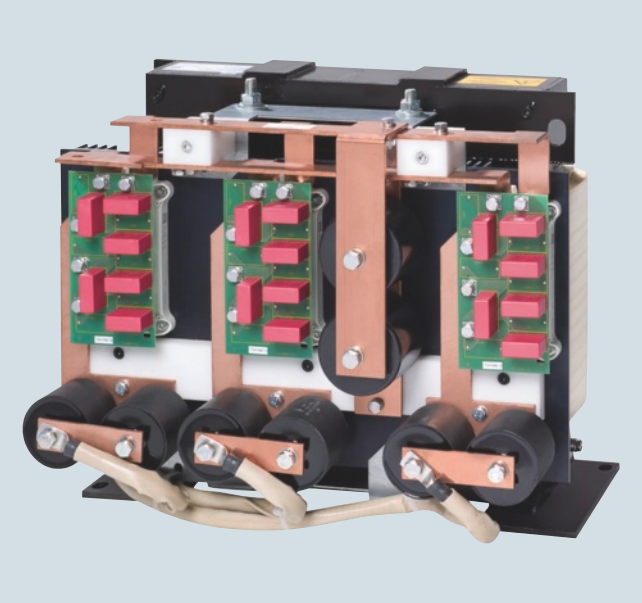
Technical specifications (continued)

Line voltage 660 ... 690 V 3 AC		dv/dt filter plus VPL		
		6SL3000-2DH34-1AA0	6SL3000-2DH35-8AA0	6SL3000-2DH38-1AA0
$I_{th\ max}$	A	410	575	810
Degree of protection		IP00	IP00	IP00
Cable length, max. between dv/dt filter and motor [1]				
• Shielded	m	300	300	300
• Unshielded	m	450	450	450
Approvals, according to		cURus	cURus	cURus
dv/dt reactor				
Power loss				
• At 50 Hz	kW	0.786	0.862	0.828
• At 60 Hz	kW	0.826	0.902	0.867
• At 150 Hz	kW	0.884	0.964	0.927
Connections				
• To Power Module		1 × hole for M12	1 × hole for M12	2 × holes for M12
• To load		1 × hole for M12	1 × hole for M12	2 × holes for M12
• PE		M6 screw	M6 screw	M6 screw
Dimensions				
• Width	mm	460	460	445
• Height	mm	385	385	385
• Depth	mm	312	312	312
Weight, approx.	kg	147	172	160
Voltage Peak Limiter (VPL)				
Power loss				
• At 50 Hz	kW	0.051	0.063	0.106
• At 60 Hz	kW	0.048	0.059	0.1
• At 150 Hz	kW	0.043	0.054	0.091
Connections				
• To dv/dt reactor		1 × hole for M8	1 × hole for M8	1 × hole for M10
• To DC link		1 × hole for M8	1 × hole for M8	1 × hole for M10
• PE		M8 stud	M8 stud	M8 stud
Dimensions				
• Width	mm	309	309	309
• Height	mm	1312.5	1312.5	1312.5
• Depth	mm	400	400	400
Weight, approx.	kg	48	48	72
Suitable for Power Module		6SL3310-1GH34-1AA3 (400 kW)	6SL3310-1GH34-7AA3 (450 kW) 6SL3310-1GH35-8AA3 (560 kW)	6SL3310-1GH37-4AA3 (710 kW) 6SL3310-1GH38-1AA3 (800 kW)

Note: Two dv/dt reactors are required for Power Modules with a type rating of 710 kW and 800 kW.
The listed technical specifications refer to one dv/dt reactor.

[1] Longer cable lengths for specific configurations are available on request.

Overview



dv/dt filters compact plus VPL (**V**oltage **P**eak **L**imiter) limit the voltage rate-of-rise dv/dt to values of < 1600 V/µs and the typical voltage peaks to the following values in accordance with the limit value curve A according to IEC 60034-25: 2007:

- < 1150 V at U_{line} < 575 V
- < 1400 V at 660 V < U_{line} < 690 V

Standard motors with standard insulation and without insulated bearings with a supply voltage of up to 690 V can be used for converter operation if a dv/dt filter compact plus VPL is used.

dv/dt filters compact plus VPL are designed for the following maximum motor cable lengths:

- Shielded cables: 100 m (e.g. Protodur NYCWY)
- Unshielded cables: 150 m (e.g. Protodur NYY)

For longer cable lengths (> 100 m shielded, > 150 m unshielded) refer to dv/dt filter plus VPL.

Notice:

- The max. permissible cable length between the dv/dt filter and Power Module is 5 m.
- Operation with output frequencies < 10 Hz is permissible for max. 5 min.

Design

The dv/dt filter compact plus VPL consists of two components, which are supplied together as a compact mechanical unit:

- dv/dt reactor
- Voltage limiting network, which cuts-off the voltage peaks and feeds the energy back to the DC link.

Selection and ordering data

Suitable for Power Module	Type rating of the Power Module at 400 V, 500 V or 690 V kW	**dv/dt filter compact plus VPL** Article No.
380 ... 480 V 3 AC		
6SL3310-1GE32-1AA3	110	**6SL3000-2DE32-6EA0**
6SL3310-1GE32-6AA3	132	
6SL3310-1GE33-1AA3	160	**6SL3000-2DE35-0EA0**
6SL3310-1GE33-8AA3	200	
6SL3310-1GE35-0AA3	250	
6SL3310-1GE36-1AA3	315	**6SL3000-2DE38-4EA0**
6SL3310-1GE37-5AA3	400	
6SL3310-1GE38-4AA3	450	
6SL3310-1GE41-0AA3	560	**6SL3000-2DE41-4EA0**
500 ... 600 V 3 AC		
6SL3310-1GF31-8AA3	110	**6SL3000-2DG32-2EA0**
6SL3310-1GF32-2AA3	132	
6SL3310-1GF32-6AA3	160	**6SL3000-2DG33-3EA0**
6SL3310-1GF33-3AA3	200	
6SL3310-1GF34-1AA3	250	**6SL3000-2DG34-1EA0**
6SL3310-1GF34-7AA3	315	**6SL3000-2DG35-8EA0**
6SL3310-1GF35-8AA3	400	
6SL3310-1GF37-4AA3	500	**6SL3000-2DG38-1EA0**
6SL3310-1GF38-1AA3	560	
660 ... 690 V3 AC		
6SL3310-1GH28-5AA3	75	**6SL3000-2DG31-0EA0**
6SL3310-1GH31-0AA3	90	
6SL3310-1GH31-2AA3	110	**6SL3000-2DG31-5EA0**
6SL3310-1GH31-5AA3	132	
6SL3310-1GH31-8AA3	160	**6SL3000-2DG32-2EA0**
6SL3310-1GH32-2AA3	200	
6SL3310-1GH32-6AA3	250	**6SL3000-2DG33-3EA0**
6SL3310-1GH33-3AA3	315	
6SL3310-1GH34-1AA3	400	**6SL3000-2DG34-1EA0**
6SL3310-1GH34-7AA3	450	**6SL3000-2DG35-8EA0**
6SL3310-1GH35-8AA3	560	
6SL3310-1GH37-4AA3	710	**6SL3000-2DG38-1EA0**
6SL3310-1GH38-1AA3	800	

For further information on dv/dt filters compact, please refer to the SINAMICS Low Voltage Engineering Manual.

Technical specifications

Line voltage 380 ... 480 V 3 AC		**dv/dt filter compact plus VPL**			
		6SL3000-2DE32-6EA0	6SL3000-2DE35-0EA0	6SL3000-2DE38-4EA0	6SL3000-2DE41-1EA0
Rated current	A	260	490	840	1405
$I_{th\ max}$	A	260	490	840	1405
Power loss, max.					
• At 50 Hz 400 V	kW	0.21	0.29	0.518	Reactor: 1.027 VPL: 0.127 Total: 1.154
• At 60 Hz 460 V	kW	0.215	0.296	0.529	Reactor: 1.077 VPL: 0.12 Total: 1.197
• At 150 Hz 400 V	kW	0.255	0.344	0.609	Reactor: 1.354 VPL: 0.09 Total: 1.444
Power connection, input and output side		Hole for M10	Hole for M10	Hole for M12	2 x elongated holes, 14 x 18 mm
• Conductor cross section, max. (IEC)		Provided for busbar connection	Provided for busbar connection	Provided for busbar connection	Provided for busbar connection
DC-link connection, DCPS, DCNS		Threaded socket M8	Threaded socket M8	Hole for M8	Hole for M8
• Conductor cross section, max. (IEC)	mm^2	16	25	50	95
PE/GND connection		Threaded socket M6	Threaded socket M6	Threaded socket M6	Threaded socket M6 (reactor and VPL)
Cable length, max. between dv/dt filter and motor					
• Shielded	m	100	100	100	100
• Unshielded	m	150	150	150	150
Degree of protection		IP00	IP00	IP00	IP00
Dimensions					
• Width	mm	310	350	440	Reactor: 430 VPL: 277
• Height	mm	283	317	369	Reactor: 385 VPL: 360
• Depth	mm	238	260	311	Reactor: 323 VPL: 291
Weight, approx.	kg	41	61	103	Reactor: 168.8 VPL: 19.2 Total: 188
Approvals, according to		cURus	cURus	cURus	cURus
Suitable for Power Module		6SL3310-1GE32-1AA3 (110 kW) 6SL3310-1GE32-6AA3 (132 kW)	6SL3310-1GE33-1AA3 (160 kW) 6SL3310-1GE33-8AA3 (200 kW) 6SL3310-1GE35-0AA3 (250 kW)	6SL3310-1GE36-1AA3 (315 kW) 6SL3310-1GE37-5AA3 (400 kW) 6SL3310-1GE38-4AA3 (450 kW)	6SL3310-1GE41-0AA3 (560 kW)

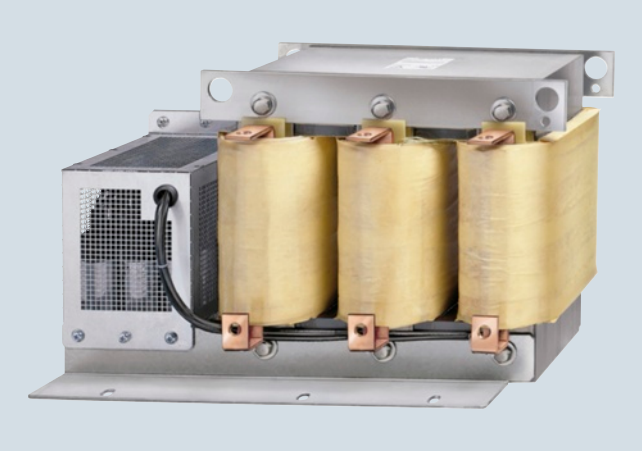
Technical specifications (continued)

Line voltage 500 ... 690 V 3 AC		dv/dt filter compact plus VPL			
		6SL3000-2DG31-0EA0	6SL3000-2DG31-5EA0	6SL3000-2DG32-2EA0	6SL3000-2DG33-3EA0
Rated current	A	100	150	215	330
$I_{th\ max}$	A	100	150	215	330
Power loss, max.					
• At 50 Hz 500/690 V	kW	0.227	0.27	0.305	0.385
• At 60 Hz 575 V	kW	0.236	0.279	0.316	0.399
• At 150 Hz 500/690 V	kW	0.287	0.335	0.372	0.48
Power connection, input and output side		Hole for M10	Hole for M10	Hole for M10	Hole for M10
• Conductor cross section, max. (IEC)		Provided for busbar connection	Provided for busbar connection	Provided for busbar connection	Provided for busbar connection
DC-link connection, DCPS, DCNS		Threaded socket M8	Threaded socket M8	Hole for M8	Hole for M8
• Conductor cross section, max. (IEC)	mm^2	16	16	25	25
PE/GND connection		Threaded socket M6	Threaded socket M6	Threaded socket M6	Threaded socket M6
Cable length, max. between dv/dt filter and motor					
• Shielded	m	100	100	100	100
• Unshielded	m	150	150	150	150
Degree of protection		IP00	IP00	IP00	IP00
Dimensions					
• Width	mm	310	310	350	350
• Height	mm	283	283	317	317
• Depth	mm	238	238	260	260
Weight, approx.	kg	34	36	51	6
Approvals, according to		cURus	cURus	cURus	cURus
Suitable for Power Module					
• 500 ... 600 V 3 AC		–	–	6SL3310-1GF31-8AA3 (110 kW)	6SL3310-1GF32-6AA3 (160 kW)
				6SL3310-1GF32-2AA3 (132 kW)	6SL3310-1GF33-3AA3 (200 kW)
• 660 ... 690 V 3 AC		6SL3310-1GH28-5AA3 (75 kW)	6SL3310-1GH31-2AA3 (110 kW)	6SL3310-1GH31-8AA3 (160 kW)	6SL3310-1GH32-6AA3 (250 kW)
		6SL3310-1GH31-0AA3 (90 kW)	6SL3310-1GH31-5AA3 (132 kW)	6SL3310-1GH32-2AA3 (200 kW)	6SL3310-1GH33-3AA3 (315 kW)

Technical specifications (continued)

Line voltage 500 ... 690 V 3 AC		dv/dt filter compact plus VPL		
		6SL3000-2DG34-1EA0	6SL3000-2DG35-8EA0	6SL3000-2DG38-1EA0
Rated current	A	410	575	810
$I_{th\ max}$	A	410	575	810
Power loss, max.				
• At 50 Hz 500/690 V	kW	0.55	0.571	Reactor: 0.88 VPL: 0.084 Total: 0.964
• At 60 Hz 575 V	kW	0.568	0.586	Reactor: 0.918 VPL: 0.08 Total: 0.998
• At 150 Hz 500/690 V	kW	0.678	0.689	Reactor: 1.137 VPL: 0.059 Total: 1.196
Power connection, input and output side		Hole for M12	Hole for M12	2 x elongated holes, 14 x 18 mm
• Conductor cross section, max. (IEC)		Provided for busbar connection	Provided for busbar connection	Provided for busbar connection
DC-link connection, DCPS, DCNS		Hole for M8	Hole for M8	Hole for M8
• Conductor cross section, max. (IEC)	mm^2	50	50	95
PE/GND connection		Threaded socket M6	Threaded socket M6	Threaded socket M6 (reactor and VPL)
Cable length, max. between dv/dt filter and motor				
• Shielded	m	100	100	100
• Unshielded	m	150	150	150
Degree of protection		IP00	IP00	IP00
Dimensions				
• Width	mm	440	440	Reactor: 430 VPL: 277
• Height	mm	369	369	Reactor: 385 VPL: 360
• Depth	mm	311	311	Reactor: 323 VPL: 291
Weight, approx.	kg	87	100	Reactor: 171.2 VPL: 18.8 Total: 190
Approvals, according to		cURus	cURus	cURus
Suitable for Power Module				
• 500 ... 600 V 3 AC		6SL3310-1GF34-1AA3 (250 kW)	6SL3310-1GF34-7AA3 (315 kW) 6SL3310-1GF35-8AA3 (400 kW)	6SL3310-1GF37-4AA3 (500 kW) 6SL3310-1GF38-1AA3 (560 kW)
• 660 ... 690 V 3 AC		6SL3310-1GH34-1AA3 (400 kW)	6SL3310-1GH34-7AA3 (450 kW) 6SL3310-1GH35-8AA3 (560 kW)	6SL3310-1GH37-4AA3 (710 kW) 6SL3310-1GH38-1AA3 (800 kW)

Overview



Sine-wave filters are available in the voltage range 380 V to 480 V up to a type rating of 250 kW, and in the voltage range 500 V to 600 V up to a type rating of 132 kW.

The sine-wave filter at the converter output supplies almost perfect sinusoidal voltages on the motor so that standard motors can be used without special cables or power derating. Standard cables can be used.

Note the following when a sine-wave filter is used:

- The output frequency is limited to max. 150 Hz (at 380 to 480 V) and 115 Hz (at 500 to 600 V).
- The maximum output voltage is limited to approx. 85% of the input voltage.
- Maximum permissible motor cable lengths:
  - Unshielded cable: 450 m
  - Shielded cable: 300 m
- During commissioning, the pulse frequency is increased to double the factory setting. This induces current derating, which must be applied to the built-in units' rated currents listed in the technical specifications.

Note:

The reduced voltage at the motor terminals compared to the rated motor voltage means that the motor reaches the field weakening range earlier.

The sine-wave filter may be operated only when the motor is connected; sine-wave filters are not no-load-proof!

For further information on sine-wave filters, please refer to the SINAMICS Low Voltage Engineering Manual.

Selection and ordering data

Suitable for Power Module	Type rating of the Power Module at 400 V or 500 V kW	**Sine-wave filter** Article No.
380 ... 480 V 3 AC		
6SL3310-1GE32-1AA3 6SL3310-1GE32-6AA3	110 132	**6SL3000-2CE32-3AA0**
6SL3310-1GE33-1AA3	160	**6SL3000-2CE32-8AA0**
6SL3310-1GE33-8AA3	200	**6SL3000-2CE33-3AA0**
6SL3310-1GE35-0AA3	250	**6SL3000-2CE34-1AA0**
500 ... 600 V 3 AC		
6SL3310-1GF31-8AA3 6SL3310-1GF32-2AA3	110 132	**6SL3000-2CF31-7AA0**

Technical specifications

Line voltage 380 ... 480 V 3 AC		**Sine-wave filter**			
		6SL3000-2CE32-3AA0	6SL3000-2CE32-8AA0	6SL3000-2CE33-3AA0	6SL3000-2CE34-1AA0
Rated current [1]	A	225	276	333	408
Power loss	kW	0.6	0.69	0.53	0.7
Connections					
• Load		1 × hole for M10	1 × hole for M10	1 × hole for M10	1 × hole for M10
• PE		1 × hole for M10	1 × hole for M10	1 × hole for M10	1 × hole for M10
Cable length, max. between sine-wave filter and motor					
• Shielded	m	300	300	300	300
• Unshielded	m	450	450	450	450
Degree of protection		IP00	IP00	IP00	IP00
Dimensions					
• Width	mm	620	620	620	620
• Height	mm	300	300	370	370
• Depth	mm	320	320	360	360
Weight, approx.	kg	124	127	136	198
Approvals, according to		cURus	cURus	cURus	cURus
Suitable for Power Module		6SL3310-1GE32-1AA3 (110 kW) 6SL3310-1GE32-6AA3 (132 kW)	6SL3310-1GE33-1AA3 (160 kW)	6SL3310-1GE33-8AA3 (200 kW)	6SL3310-1GE35-0AA3 (250 kW)

Line voltage 500 ... 600 V 3 AC		**Sine-wave filter**
		6SL3000-2CF31-7AA0
Rated current [2]	A	188
Power loss	kW	0.8
Connections		
• Load		1 × hole for M10
• PE		1 × hole for M10
Cable length, max. between sine-wave filter and motor		
• Shielded	m	300
• Unshielded	m	450
Degree of protection		IP00
Dimensions		
• Width	mm	620
• Height	mm	370
• Depth	mm	360
Weight, approx.	kg	210
Approvals, according to		cURus
Suitable for Power Module		6SL3310-1GF31-8AA3 (110 kW) 6SL3310-1GF32-2AA3 (132 kW)

[1] Output current of the Power Module at an adapted pulse frequency of 4 kHz.

[2] Output current of the Power Module at an adapted pulse frequency of 2.5 kHz.

Overview

The communication, open-loop and closed-loop control functions for the Power Modules are executed in a CU320-2 Control Unit. Communication with the higher-level control system is performed via PROFIBUS DP or PROFINET.

The CU320-2 Control Unit and the associated CompactFlash card can be ordered separately or as Control Unit Kit.
The Control Unit Kit comprises the CU320-2 Control Unit, a CompactFlash card and the stored drive software.

Design

The CU320-2 Control Unit features the following connections and interfaces as standard:

- Fieldbus interface:
  - CU320-2 PN: 1 PROFINET interface with 2 ports (RJ45 sockets) with PROFIdrive V4 profile
  - CU320-2 DP: 1 PROFIBUS interface with PROFIdrive V4 profile
- 4 DRIVE-CLiQ sockets for communication with other DRIVE-CLiQ devices, e.g. Power Modules, Terminal Modules
- 12 parameterizable digital inputs (floating)
- 8 parameterizable bidirectional digital inputs/outputs (non-floating)
- 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 to install an option module for the interface expansion
- 2 rotary coding switches for manually setting the PROFIBUS address
- 1 Ethernet interface for commissioning and diagnostics
- 3 measuring sockets and one reference ground for commissioning support
- 1 connection for the electronics power supply via the 24 V DC supply connector
- 1 PE connection
- 1 ground connection

A shield connection for the signal cable shield of the option module is located on the CU320-2 Control Unit.

The available option slot is used to expand the interfaces, e.g. number of terminals.

The status of the CU320-2 Control Unit is indicated via multi-color LEDs.
As the firmware and set parameters are stored on a plug-in CompactFlash card, the Control Unit can be changed without the need for tools.

Selection and ordering data

Description	Article No.
CU320-2 PN Control Unit without CompactFlash card	**6SL3040-1MA01-0AA0**
CU320-2 DP Control Unit without CompactFlash card	**6SL3040-1MA00-0AA0**
PROFINET PN Control Unit Kit comprising: • CU320-2 PN Control Unit • CompactFlash card with the latest firmware • STARTER commissioning tool on DVD-ROM	**6SL3040-1GA01-1AA0**
PROFIBUS DP Control Unit Kit comprising: • CU320-2 DP Control Unit • CompactFlash card with the latest firmware • STARTER commissioning tool on DVD-ROM	**6SL3040-1GA00-1AA0**
Accessories	
For CU320-2 PN: **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 CU320-2 DP: **PROFIBUS connector**	
• Without PG/PC connection	**6ES7972-0BA42-0XA0**
• With PG/PC connection	**6ES7972-0BB42-0XA0**
STARTER commissioning tool on DVD-ROM	**6SL3072-0AA00-0AG0**
Accessories for re-ordering	
Dust protection blanking plugs (50 units) for sealing unused DRIVE-CLiQ ports	**6SL3066-4CA00-0AA0**

For further information on the CU320-2 Control Unit, please refer to the SINAMICS Low Voltage Engineering Manual.

Integration

Communication between a CU320-2 Control Unit and the connected components takes place via DRIVE-CLiQ.

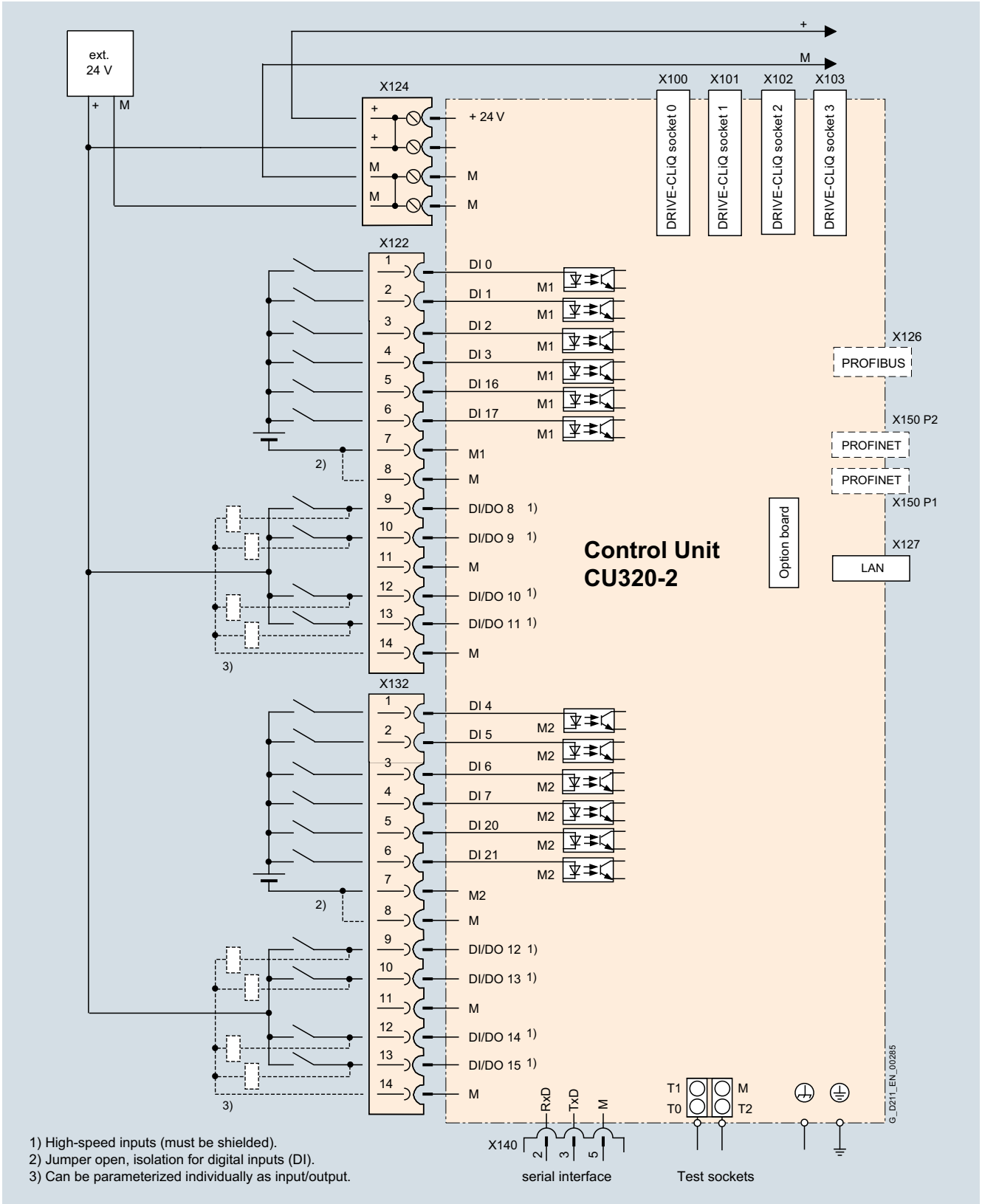
A DRIVE-CLiQ cable for connecting the CU320-2 to the SINAMICS G130 converter is included in the scope of delivery of the Power Module.

The BOP20 Basic Operator Panel can also be snapped onto the CU320-2 Control Unit during operation for diagnostic purposes.

The CU320-2 Control Unit and other connected components are commissioned and diagnosed with the STARTER commissioning tool and the installed SINAMICS Support Package.

The CU320-2 PN Control Unit requires a CompactFlash card with firmware as of V4.4.
The CU320-2 DP Control Unit requires a CompactFlash card with firmware as of V4.3.

Integration (continued)



1) High-speed inputs (must be shielded).
2) Jumper open, isolation for digital inputs (DI).
3) Can be parameterized individually as input/output.

Connection example of a CU320-2 Control Unit

Technical specifications

CU320-2 Control Unit	6SL3040-1MA0 . -0AA0
Current requirement, max. at 24 V DC, typ. without taking into account digital outputs, expansion option slot and DRIVE-CLiQ supply	1 A
• Conductor cross section, max.	2.5 mm^2
• Fuse protection, max.	20 A
Digital inputs according to IEC 61131-2 Type 1	12 floating digital inputs 8 bidirectional non-floating digital inputs/outputs
• Voltage	-3 ... +30 V
• Low level (an open digital input is interpreted as "low")	-3 ... +5 V
• High level	15 ... 30 V
• Current consumption at 24 V DC, typ.	9 mA
• Delay time of digital inputs, approx. [1]	
- L → H	50 µs
- H → L	100 µs
• Delay time of high-speed digital inputs, approx. [1]	
- L → H	5 µs
- H → L	50 µs
• Conductor cross section, max.	1.5 mm^2
Digital outputs (continued short-circuit-proof)	8 bidirectional non-floating digital inputs/outputs
• Voltage	24 V DC
• Load current per digital output, max.	500 mA
• Delay time, typ./max.	
- L → H	150/400 µs
- H → L	75/100 µs
• Conductor cross section, max.	1.5 mm^2
Power loss	24 W
PE connection	M5 screw
Ground connection	M5 screw
Dimensions	
• Width	50 mm
• Height	300 mm
• Depth	226 mm
Weight, approx.	2.3 kg
Approvals, according to	cULus

[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.

Overview

The CompactFlash card contains the firmware and set parameters. The CompactFlash card is inserted into the appropriate slot of the CU320-2 Control Unit.

Design

A CU320-2 Control Unit can process the communication, open-loop and closed-loop control functions of the power units. The computing capacity requirement increases in proportion to the number of power units and system components and in relation to the dynamic response required. The computing capacity requirement and utilization of the CU320-2 Control Unit can be calculated with the SIZER for Siemens Drives engineering tool.

In addition to the firmware, the CompactFlash card also contains license keys which are required to enable firmware options, e.g. for the Safety Integrated extended functions. The Safety Integrated extended functions must be ordered for each axis via order codes (**F..**) in addition to the article number.

Converter cabinets with a Control Unit already contain the CompactFlash card with the current firmware. The Safety license can be added as a cabinet option.

The firmware options can be also enabled subsequently. You require the serial number of the CompactFlash card and the article number of the firmware license to be enabled. With this information, you can purchase the associated license key via a license database to enable the firmware option. The license key is only valid for the identifed CompactFlash card and cannot be transferred to other CompactFlash cards.

A PDF guide for the purchase of the license key can be found at the following link at Usage Guide / Demonstration
www.siemens.com/automation/license

Selection and ordering data

Description		Article No.
CompactFlash card for CU320-2 Control Unit without Safety license		**6SL3054-3E□00-1BA0**
CompactFlash card for CU320-2 Control Unit with Safety license		
• For one axis		**6SL3054-3E□00-1BA0-Z F01**
Firmware V4.x		↑
	.3	**D**
	.4	**E**
	.5	**F**
	.6	**G**
	.7	**H**
	.8	**J**
	.9	**K**
Firmware license		
• **Safety Integrated extended functions** option including Certificate of License for one axis for upgrading the license of a CompactFlash card.		**6SL3074-0AA10-0AA0**
• **SINAMICS DCB extension** option Runtime license as of firmware V 4.6 including Certificate of License for upgrading the license of a CompactFlash card (see Section Tools and configuration, Drive Control Chart engineering software).		**6SL3077-0AA00-0AB0**

The current firmware version at the time of printing this catalog is firmware 4.7.

Overview

BOP20 Basic Operator Panel

Faults can be acknowledged, parameters set and diagnostics information read-out (e.g. alarm and fault messages) using the BOP20 Basic Operator Panel.

Design

The BOP20 Basic Operator Panel has a backlit two-line display area and 6 keys.

The integrated plug connector on the rear of the BOP20 Basic Operator Panel provides its power and establishes communication with the Control Unit.

Integration

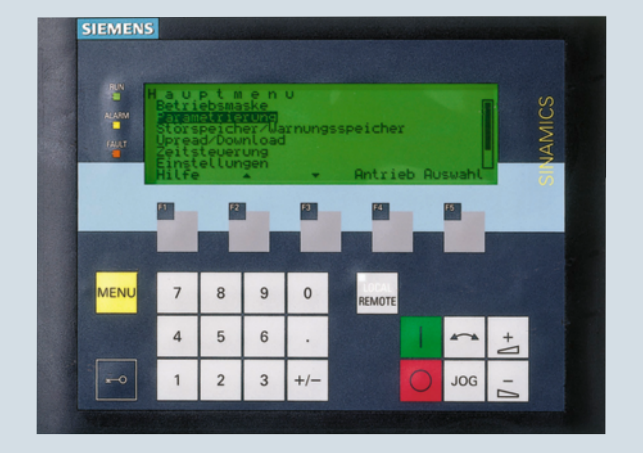
The BOP20 Basic Operator Panel can be snapped onto any CU305, CU310-2 or CU320-2 Control Unit.

CU320-2 Control Unit with attached BOP20 Basic Operator Panel

Selection and ordering data

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

Overview



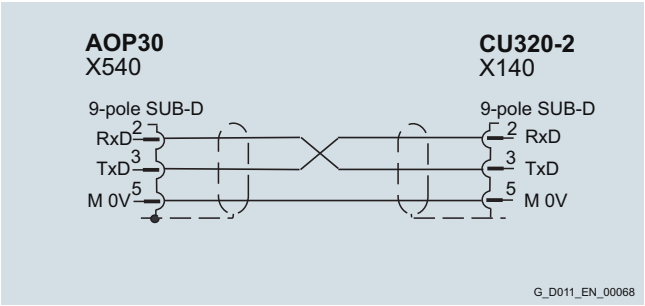
The AOP30 Advanced Operator Panel is an input/output device for converters of the SINAMICS series, preferably for cabinet installation.

It has the following characteristics:

- Graphical backlit LCD display for plain text display and a bar display of process variables
- LEDs for display of the operating states
- Help function describing causes of and remedies for faults and alarms
- Keypad for controlling drives during operation
- Local/remote switchover for selecting the operating location (control priority assigned to operator panel or customer terminal block / communication channel)
- Numeric keypad for input of setpoint or parameter values
- Function keys for guided navigation in the menu
- Two-stage safety strategy to protect against accidental or unauthorized changes to settings.
  - Operation of the drive from the operator panel can be disabled by the keyboard lock so that only parameter values and process variables can be displayed on the operator panel.
  - A password can be used to prevent the unauthorized modification of converter parameters.
- Front panel with degree of protection IP55

The AOP30 and SINAMICS drive communicate via the RS232 serial interface with PPI protocol.

The AOP30 may be omitted if the drive is only operated via PROFIBUS, for example, and no local display is required on the cabinet. The AOP30 can then be used simply for commissioning purposes and to obtain diagnostic information, in which case, it is plugged into the RS232 interface on the CU320-2 Control Unit. In this case, an external 24 V power supply (max. current requirement 200 mA) is required.



Assignment of the serial plug-in cable

Design

The AOP30 is an operator panel with graphical display and membrane keyboard. The device can be installed in a cabinet door which is between 2 mm and 4 mm thick.

Features:

- Display with green backlighting, resolution 240 × 64 pixels
- Membrane keyboard with 26 keys
- Connection for a 24 V power supply
- RS232 interface
- Time and date memory with internal battery backup
- 4 LEDs to indicate the operating state of the drive:
  - RUN green
  - ALARM yellow
  - FAULT red
  - Local/Remote green

Function

The current operating states, setpoints and actual values, parameters, indices, faults and alarms are displayed on the display panel.

German, English, French, Italian, Spanish and **Chinese** are stored on the CU320-2 Control Unit CompactFlash card as operator panel languages. The desired language must be downloaded to the AOP30 prior to commissioning. In addition to these preinstalled languages, **Russian** and **Portuguese** (Brazil) are also available for subsequent installation. Further languages are available on request.

Selection and ordering data

Description	Article No.
AOP30 Advanced Operator Panel	**6SL3055-0AA00-4CA5**
Accessories	
RS232 plug-in cable for connecting the AOP30 to the CU320-2	
1 m long	**6FX8002-1AA01-1AB0**
2 m long	**6FX8002-1AA01-1AC0**
3 m long	**6FX8002-1AA01-1AD0**
4 m long	**6FX8002-1AA01-1AE0**
5 m long	**6FX8002-1AA01-1AF0**
6 m long	**6FX8002-1AA01-1AG0**
7 m long	**6FX8002-1AA01-1AH0**
8 m long	**6FX8002-1AA01-1AJ0**
9 m long	**6FX8002-1AA01-1AK0**
10 m long	**6FX8002-1AA01-1BA0**

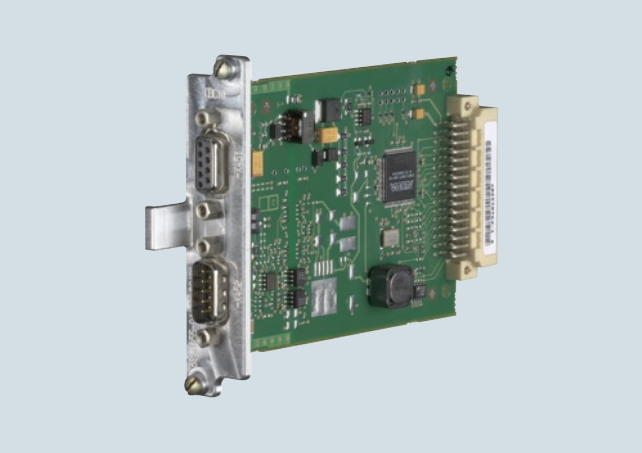
For the SINAMICS G150 and SINAMICS S150, the AOP30 Advanced Operator Panel is installed in the cabinet door as standard.

For the SINAMICS S120 Cabinet Modules, the AOP30 can be ordered as an option by specifying order code **K08**.

Technical specifications

AOP30 Advanced Operator Panel	6SL3055-0AA00-4CA5
Power supply	24 V DC (20.4 ... 28.8 V)
Current requirement • Without backlighting • For max. backlighting	 < 100 mA < 200 mA
Data interface	RS232 interface, PPI protocol
Backup battery	3 V lithium CR2032
Operating temperature	0 ... 55° C
Storage and transport temperature	-25 ... +70° C
Degree of protection	IP20 for the inside of the cabinet IP55 for the outside of the cabinet
Dimensions • Width • Height • Depth	 212 mm 156 mm 31 mm
Weight, approx.	0.55 kg

Overview



CBC10 Communication Board

The CBC10 Communication Board is used to interface the CU320-2 Control Unit (and therefore the drive system) to the CAN (Controller Area Network) protocol. The board's driver software fulfils 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

Note:

The CAN address is set on the CU320-2 DP Control Unit by means of the two address switches.
These address switches are not available on the CU320-2 PN Control Unit. In this case, the address can be set by means of parameters.

Integration

The CBC10 Communication Board plugs into the option slot on the CU320-2 Control Unit. Two SUB-D connections for input and output are provided for the CAN interface on the CBC10 Communication Board.

Selection and ordering data

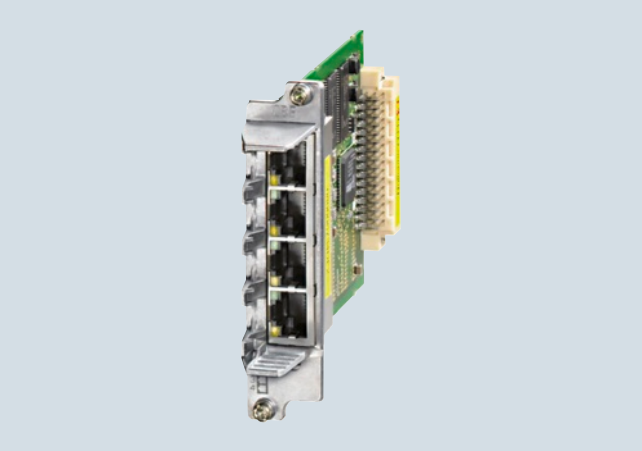
Description	Article No.
CBC10 Communication Board	**6SL3055-0AA00-2CA0**
Accessories	
SUB-D connector 9-pin, female (3 units)	**6FC9341-2AE**
SUB-D connector 9-pin, male (3 units)	**6FC9341-2AF**

For the SINAMICS G150, SINAMICS S150 and SINAMICS S120 Cabinet Modules, the CBC10 Communication Board can be ordered as an option by specifying order code **G20**.

Technical specifications

CBC10 Communication Board	6SL3055-0AA00-2CA0
Power requirement, max. at 24 V DC via CU320-2 Control Unit	0.05 A
Power loss, max.	3 W
Weight, approx.	0.1 kg (0.22 lb)
Approvals, according to	cULus

Overview



The CBE20 Communication Board is required when:

- A SINAMICS G130 or SINAMICS G150 converter, equipped with a CU320-2 DP (PROFIBUS) Control Unit, is to be connected to a PROFINET IO network
- SINAMICS Link is to be used to directly exchange data between several CU320-2 DP (PROFIBUS) or CU320-2 PN (PROFINET) Control Units without using a higher-level control system
- EtherNet/IP is to be supported

With the CBE20 Communication Board, SINAMICS G130 or SINAMICS G150 is a PROFINET IO device in the sense of PROFINET and offers 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 controllers as a PROFINET IO device according to the PROFIdrive profile
- Standard TCP/IP communication for engineering processes using the STARTER commissioning tool
- Integrated 4-port switch with four RJ45 sockets based on PROFINET ASICs 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 CU320-2 Control Unit.

SINAMICS Link

SINAMICS Link is to be used to directly exchange data between several CU320-2 DP (PROFIBUS) or CU320-2 PN (PROFINET) Control Units without using a higher-level control system. In this case, the CBE20 Communication Board is required. Possible applications for the SINAMICS Link include:

- Torque distribution for several drives
- Setpoint cascading for several drives
- Load distribution for drives coupled through a material web
- Couplings between SINAMICS G or SINAMICS S with CU320-2 and SINAMICS DC Master with CUD

Nodes other than the SINAMICS CU320-2 Control Units and the CUD Control Units of the SINAMICS DC MASTER cannot be integrated into this communication network.

SINAMICS Link is activated by appropriately parameterizing the Control Units of the nodes.

Selection and ordering data

Description	Article No.
CBE20 Communication Board	**6SL3055-0AA00-2EB0**
Accessories	
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 SINAMICS G150, the CBE20 Communication Board can be ordered as an option by specifying order code **G33**.

Technical specifications

CBE20 Communication Board	6SL3055-0AA00-2EB0
Current requirement at 24 V DC	0.16 A
Power loss, max.	2.4 W
Weight, approx.	0.1 kg

Overview

TB30 Terminal Board

The TB30 Terminal Board supports the addition of digital inputs/digital outputs and analog inputs/analog outputs to a Control Unit.

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

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

Selection and ordering data

Description	Article No.
TB30 Terminal Board	**6SL3055-0AA00-2TA0**

For SINAMICS G150 and SINAMICS S150, the TB30 Terminal Board can be ordered as an option by specifying order code **G62**.

Technical specifications

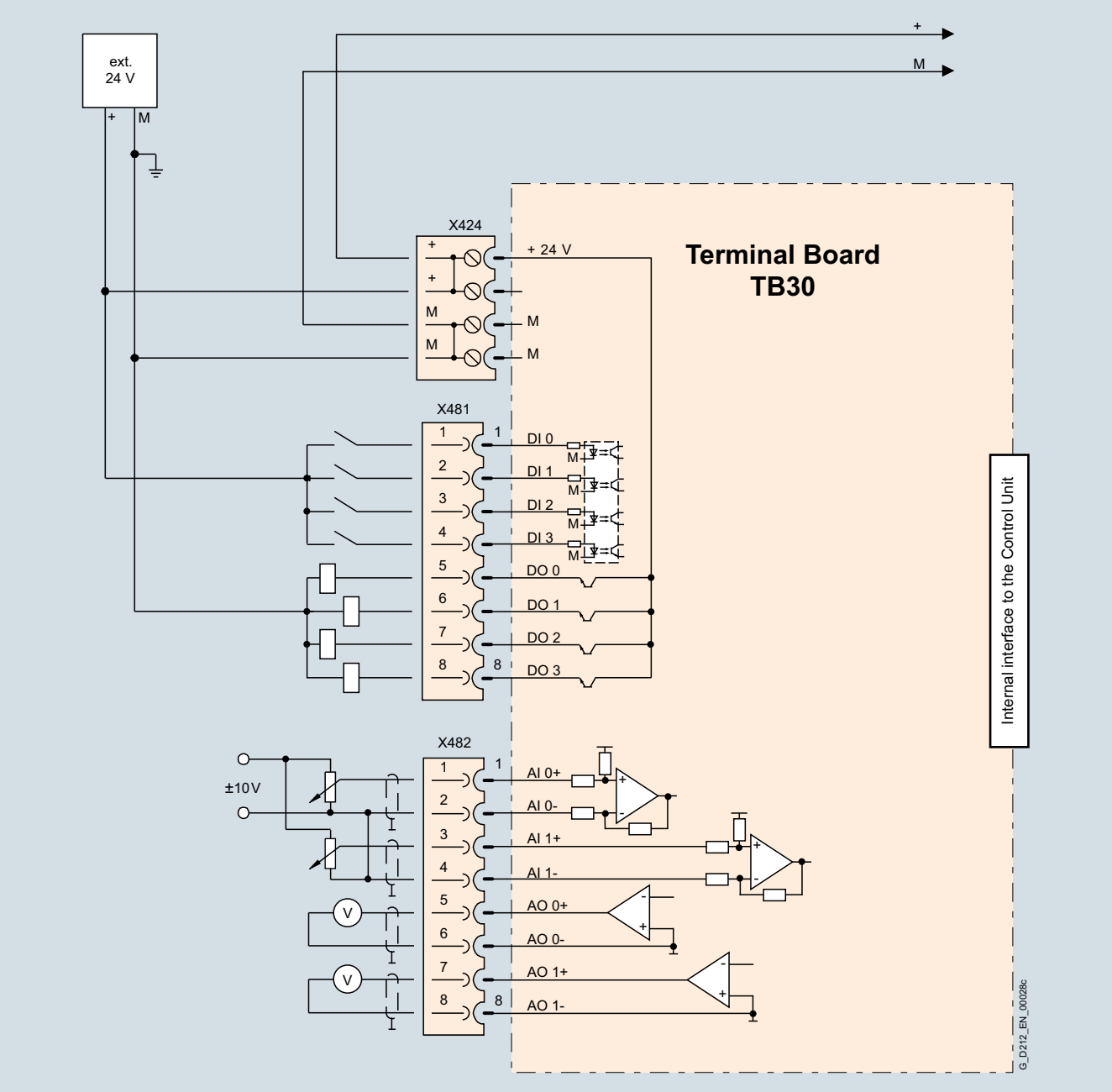
TB30 Terminal Board	6SL3055-0AA00-2TA0
Power requirement, max. at 24 V DC via Control Unit without taking account of digital outputs	0.05 A
• Conductor cross-section, max.	2.5 mm^2
• Fuse protection, max.	20 A
Digital inputs In accordance with IEC 61131-2 Type 1	
• Voltage	-3 ... +30 V
• Low level (an 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 (continuously 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 (continuously short-circuit proof)	
• Voltage range	-10 ... +10 V
• Max. load current	-3 ... +3 mA
• Resolution	11 bit + sign
• Settling time, approx.	200 µs
• Conductor cross-section, max.	0.5 mm^2
Power loss, max.	3 W
Weight, approx.	0.1 kg (0.22 lb)
Approvals, according to	cULus

[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 $f_a = 1/t_{time\ slot}$ must be at least twice the value of the highest signal frequency f_{max}.

Integration

The TB30 Terminal Board plugs into the option slot on a CU320-2 Control Unit.



Connection example of TB30 Terminal Board

Overview

TM31 Terminal Module

With the TM31 Terminal Module, the number of available digital inputs and outputs and the number of analog input and outputs within a drive 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 supply connector
- 1 PE/protective conductor connection

The status of the TM31 Terminal Module is indicated via a multi-color LED.

The TM31 Terminal Module can be snapped onto a TH 35 standard mounting 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. type SK8 supplied by Phoenix Contact or type KLBÜ CO 1 supplied by Weidmüller. The shield connection terminal must not be used for strain relief.

Selection and ordering data

Description	Article No.
TM31 Terminal Module Without DRIVE-CLiQ cable	**6SL3055-0AA00-3AA1**
Accessories for re-ordering	
SINAMICS/SINUMERIK/SIMOTION dust-proof blanking plugs (50 units) For DRIVE-CLiQ port	**6SL3066-4CA00-0AA0**

For the SINAMICS G150, SINAMICS S150 and SINAMICS S120 Cabinet Modules, the TM31 Terminal Module can be ordered as an option by specifying order code **G60** or **G61**.

Technical specifications

TM31 Terminal Module	6SL3055-0AA00-3AA1
Power requirement, max. At 24 V DC without taking account of the digital outputs and DRIVE-CLiQ supply	0.5 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 (continuously 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 resistive load
- Max.	500 µs
• Conductor cross-section, max.	1.5 mm^2
Analog inputs (a switch is used to toggle between voltage and current input)	
• As voltage input	
- Voltage range	-10 ... +10 V
- Internal resistance R_i	100 kΩ
- Resolution [2]	11 bits + sign
• As current input	
- Current ranges	4 ... 20 mA, -20 ... +20 mA, 0 ... 20 mA
- Internal resistance R_i	250 Ω
- Resolution [2]	10 bits + sign
• Conductor cross-section, max.	1.5 mm^2

TM31 Terminal Module	6SL3055-0AA00-3AA1
Analog outputs (continuously short-circuit proof)	
• Voltage range	-10 ... +10 V
• Max. load current	-3 ... +3 mA
• Current ranges	4 ... 20 mA, -20 ... +20 mA, 0 ... 20 mA
• Load resistance, max.	500 Ω for outputs in the range -20 ... +20 mA
• Resolution	11 bit + sign
• Conductor cross-section, max.	1.5 mm^2
Relay outputs (changeover contacts)	
• Max. load current	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 = 0.4)
- At 30 V DC	240 W (resistive load)
• Required minimum current	100 mA
• Conductor cross-section, max.	2.5 mm^2
Power loss, max.	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, according to	cULus

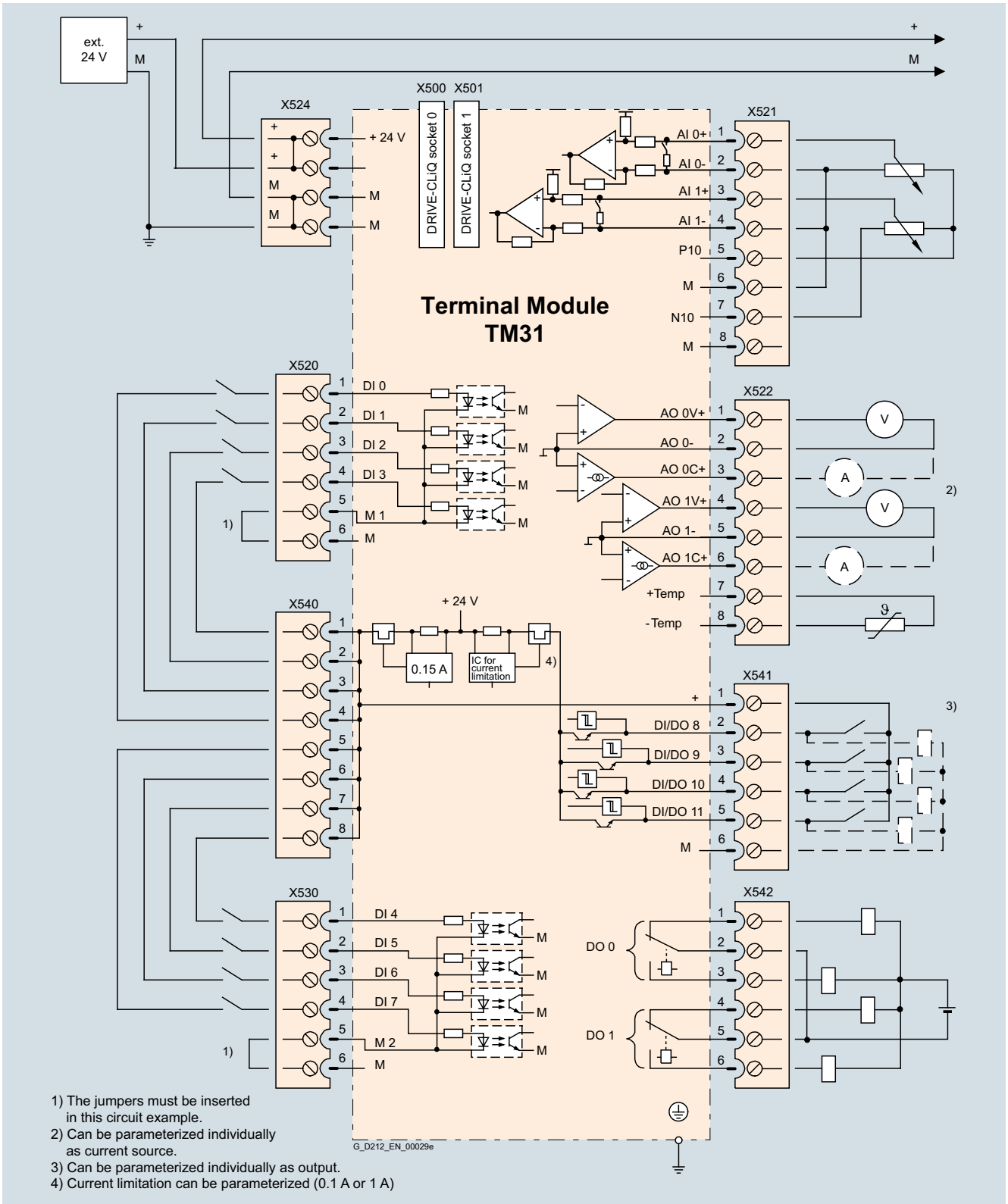
[1] The specified delay times refer to the hardware. The actual reaction time depends on the time slot in which the digital input/output is processed.

[2] If the analog input is to be operated in the signal processing sense with continuously variable input voltage, the sampling frequency $f_a = 1/t_{time\ slot}$ must be at least twice the value of the highest signal frequency f_{max}.

Integration

The TM31 Terminal Module can communicate via DRIVE-CLiQ with the following Control Units.

- CU310-2 Control Unit
- CU320-2 Control Unit
- SINUMERIK Control Unit
- SIMOTION D Control Unit
- SINAMICS DCM Advanced CUD



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

Overview

TM54F Terminal Module

The TM54F Terminal Module is a dual-processor I/O interface with four fail-safe digital outputs and ten fail-safe digital inputs for utilization of the Safety Integrated functions of the SINAMICS drive system via external actuators and sensors.

Every available safety function integrated in the drive can be controlled via the fail-safe digital inputs on the TM54F Terminal Module. In the event that the parameterized safety functions of several drives operated together on a Control Unit are to be executed together, then these drives can be grouped in the TM54F Terminal Module. The advantage of this approach is that only one fail-safe digital input needs to be connected for these drives.

The fail-safe digital inputs and outputs have two channels and are redundantly configured with an internal data cross-check using the two processors. A fail-safe digital output consists of one P-switching and one M-switching output as well as one digital input to read back the switching state. A fail-safe digital input consists of two digital inputs.

Safety sensors can be connected over 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 dynamized to detect dormant errors (this dynamization is used to check the shutdown paths). An unswitchable 24 V sensor supply is additionally provided by the TM54F Terminal Module for connecting undynamizable safety sensors.

The TM54F Terminal Module must be directly connected to a Control Unit via a DRIVE-CLiQ cable. Only one TM54F Terminal Module can be assigned to each Control Unit. It is not permissible to make the TM54F connection via another DRIVE-CLiQ device, e.g. a Power Module, a Motor Module or a Line 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 electronics power supply via the 24 V DC power supply connector
- 1 connection for the 24 V power supply to digital outputs and sensors
- 1 PE (protective earth) connection

The status of the TM54F Terminal Module is indicated via a multi-color LED.

The TM54F Terminal Module can be snapped onto a TH 35 standard mounting rail in accordance with EN 60715 (IEC 60715).

The signal cable shield can be connected to the TM54 Terminal Module via a shield connection terminal, e.g. type SK8 supplied by Phoenix Contact or type KLBÜ CO 1 supplied by Weidmüller. The shield connection terminal must not be used for strain relief.

Pins for connector coding are supplied with the TM54F Terminal Module.

Selection and ordering data

Description	Article No.
TM54F Terminal Module Without DRIVE-CLiQ cable	**6SL3055-0AA00-3BA0**
Accessories for re-ordering	
SINAMICS/SINUMERIK/SIMOTION dust-proof blanking plugs (50 units) For DRIVE-CLiQ port	**6SL3066-4CA00-0AA0**

For the SINAMICS G150, SINAMICS S150 and SINAMICS S120 Cabinet Modules, the TM54F Terminal Module can be ordered as an option by specifying order code **K87**.

Technical specifications

TM54F Terminal Module	6SL3055-0AA00-3BA0
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. power 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 an internal test routine for dynamizing fail-safe digital inputs, current carrying capacity 0.5 A each
• Cables and connections	Plug-in screw-type terminals
• Conductor cross-section, max.	1.5 mm^2
Digital inputs in accordance with IEC 61131-2 Type 1, with galvanic isolation	
• 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.	> 2 mA
• Delay time of digital inputs, approx. [1]	
- L → H, typ.	30 µs
- H → L, typ.	60 µs
• Safe state	Low level (for inputs that can be inverted: without inversion)

TM54F Terminal Module	6SL3055-0AA00-3BA0
Digital outputs (continuously short-circuit proof)	
• Voltage	24 V DC
• Load current per fail-safe digital output, max. [2]	0.5 A
• Delay times (resistive load) [1]	
- L → H, typ.	300 µs
- H → L, typ.	350 µs
• Safe state	Output switched off
Scanning cycle t_{SI} for fail-safe digital inputs or fail-safe digital outputs	4 ... 25 ms (adjustable)
Power loss, max. At 24 V	4.5 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.	0.9 kg (2 lb)
Approvals, according to	cULus
Safety Integrated	According to IEC 61508 SIL 2 and EN ISO 13849-1 PL d and Category 3

Integration

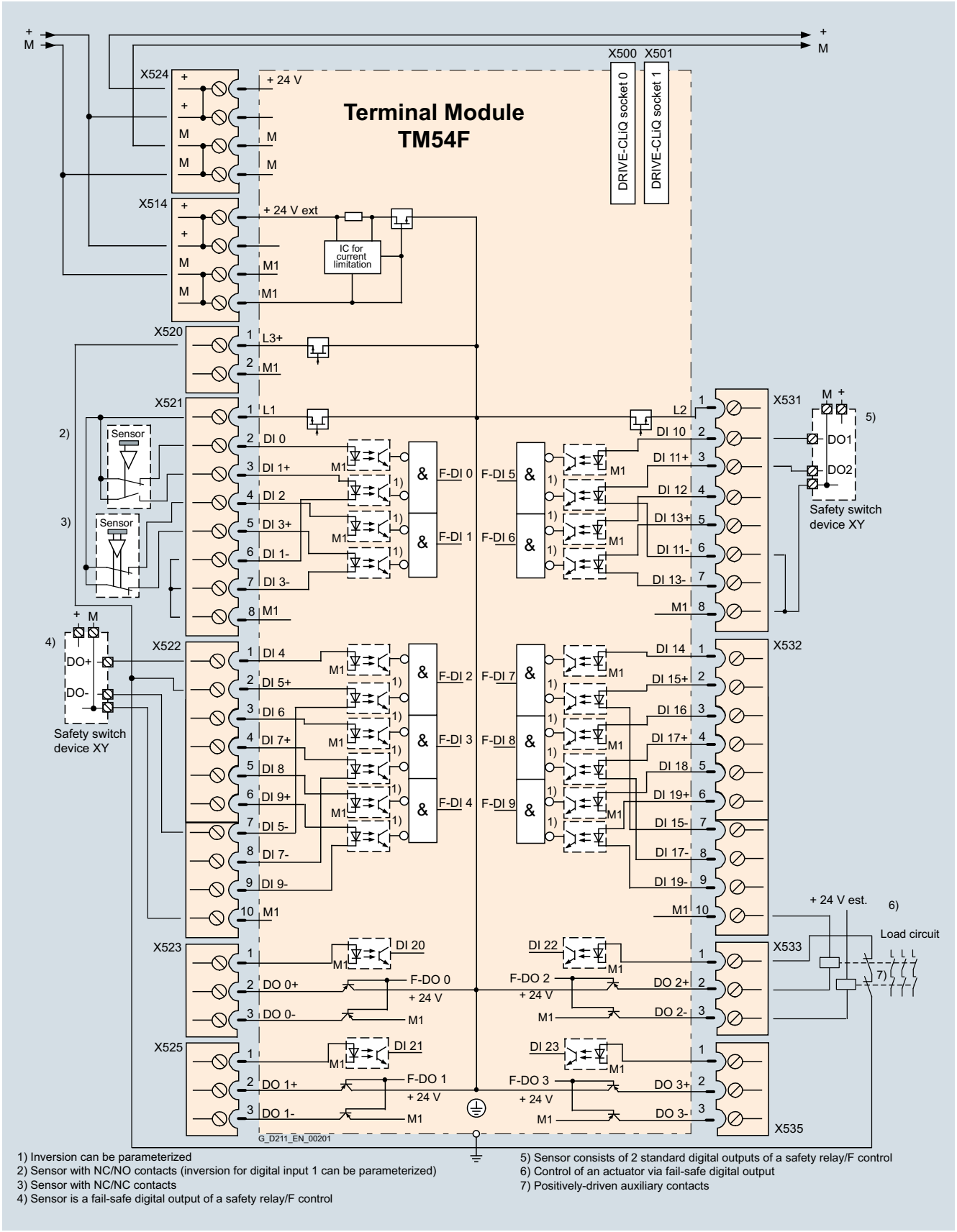
The TM54F Terminal Module can communicate via DRIVE-CLiQ with the following Control Units.

- CU310-2 Control Unit
- CU320-2 Control Unit
- SINUMERIK Control Unit
- SIMOTION D Control Unit or Controller Extension

[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.

Integration (continued)



1) Inversion can be parameterized
2) Sensor with NC/NO contacts (inversion for digital input 1 can be parameterized)
3) Sensor with NC/NC 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

Overview

TM150 Terminal Module

The TM150 Terminal Module is a DRIVE-CLiQ component for temperature evaluation. The temperature is measured in a temperature range from -99 °C to +250 °C (-146.2 °F to 482 °F) for the following temperature sensors:

- Pt100 (with monitoring for open-circuit and short-circuit)
- Pt1000 (with monitoring for open-circuit and short-circuit)
- KTY84 (with monitoring for open-circuit and short-circuit)
- PTC (with short-circuit monitoring)
- Bimetallic NC contact (without monitoring)

For the temperature sensor inputs, for each terminal block the evaluation can be parameterized for 1×2-wire, 2×2-wire, 3-wire or 4-wire. There is no galvanic isolation in the TM150 Terminal Module.

The temperature channels can be subdivided into 3 groups and evaluated together.

Design

The following are located on the TM150 Terminal Module:

- 6 terminal blocks for max. 12 temperature sensor inputs
- 2 DRIVE-CLiQ sockets
- 1 connection for the electronics power supply via the 24 V DC supply connector
- 1 PE/protective conductor connection

The status of the TM150 Terminal Module is indicated via a multi-color LED.

The TM150 Terminal Module can be snapped onto a TH 35 standard mounting rail in accordance with EN 60715 (IEC 60715).

Selection and ordering data

Description	Article No.
TM150 Terminal Module Without DRIVE-CLiQ cable	**6SL3055-0AA00-3LA0**
Accessories for re-ordering	
SINAMICS/SINUMERIK/SIMOTION dust-proof blanking plugs (50 units) For DRIVE-CLiQ port	**6SL3066-4CA00-0AA0**

For the SINAMICS G150, SINAMICS S150 and SINAMICS S120 Cabinet Modules, the TM150 Terminal Module can be ordered as an option by specifying order code **G51** or **G51 ... G54**.

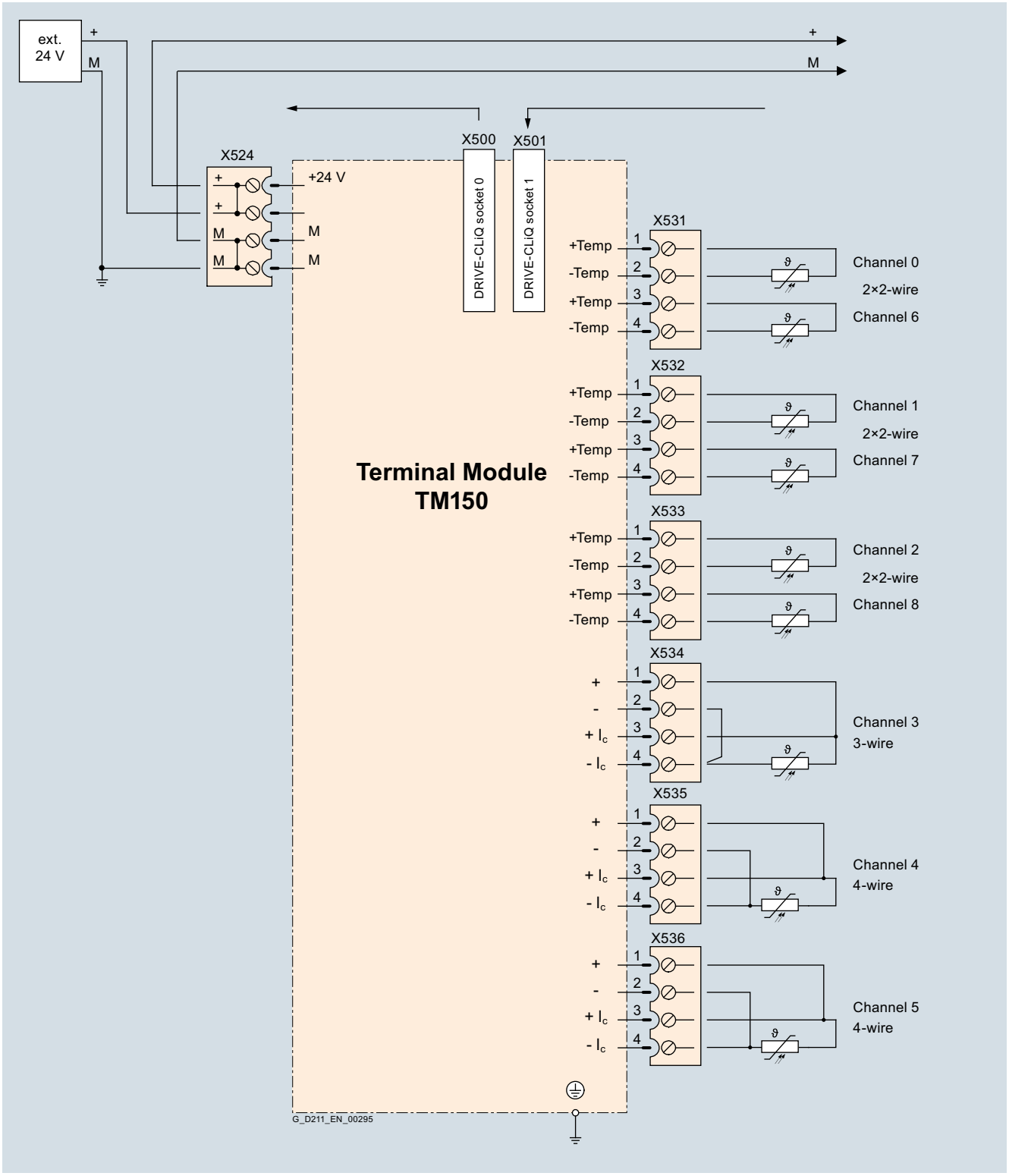
Technical specifications

TM150 Terminal Module	6SL3055-0AA00-3LA0
Power requirement, max. at 24 V DC	0.5 A
• Conductor cross section, max.	2.5 mm^2
• Fuse protection, max.	20 A
Temperature sensor inputs The inputs can be parameterized individually for the evaluation of sensors	
• Conductor cross section, max.	1.5 mm^2
• Measuring current per sensor, approx.	0.8 mA
Power loss	1.6 W
PE connection	M4 screw
Dimensions	
• Width	30 mm (1.18 in)
• Height	150 mm (5.91 in)
• Depth	119 mm (4.69 in)
Weight, approx.	0.41 kg (0.90 lb)

Integration

The TM150 Terminal Module can communicate via DRIVE-CLiQ with the following Control Units.

- CU310-2 Control Unit
- CU320-2 Control Unit
- SINAMICS DCM Advanced CUD



Connection example of TM150 Terminal Module

Overview

The VSM10 Voltage Sensing Module enables the line or motor voltage characteristic to be measured precisely. The phase differential voltage can be measured, either grounded (in the delivery state with jumper plugged in) or isolated.

In addition, the VSM10 Voltage Sensing Module is used to connect to rotating synchronous motors – or for a "quick flying restart" of rotating induction motors.

Design

The VSM10 Voltage Sensing Module has the following interfaces:

- 1 connection for direct voltage sensing up to 690 V
- 1 connection for voltage sensing using voltage transformers, maximum voltage 100 V
- 1 temperature sensor input (KTY84-130 or PTC)
- 1 DRIVE-CLiQ socket
- 1 connection for the electronics power supply via the 24 V DC supply connector
- 1 plug-in jumper for either grounded (delivery state) or isolated measurement
- 1 PE connection

The status of the VSM10 Voltage Sensing Module is indicated by a two-color LED.

The VSM10 Voltage Sensing Module can be snapped onto a TH 35 mounting rail according to EN 60715 (IEC 60715).

Selection and ordering data

Description	Article No.
VSM10 Voltage Sensing Module Without DRIVE-CLiQ cable	**6SL3053-0AA00-3AA1**

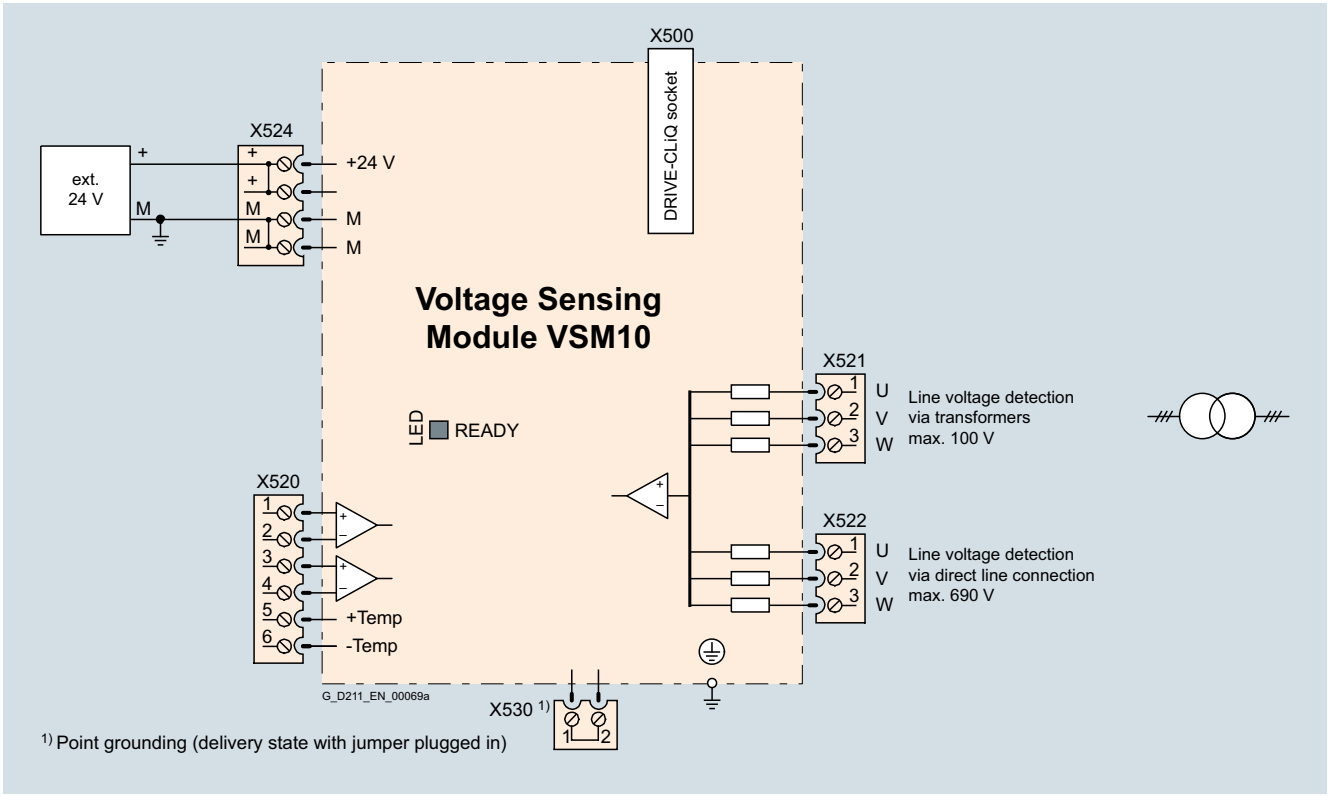
For the SINAMICS G150, the VSM10 Voltage Sensing Module can be ordered as an option with order code **K51** to implement the flying restart function.

Technical specifications

VSM10 Voltage Sensing Module	6SL3053-0AA00-3AA1
Power requirement, max. at 24 V DC	0.2 A
• Conductor cross section, max.	2.5 mm^2
Power loss	< 10 W
Line voltage detection	
• Insulation resistance neutral point - ground when the jumper is not inserted	> 10 MΩ
• Input resistance	
- Terminal X521	> 362 kΩ/phase
- Terminal X522	> 2.5 MΩ/phase
2 analog inputs (reserved for monitoring an Active Interface Module in chassis format)	
• Internal resistance (between differential inputs)	Approx. 100 kΩ
• Resolution	12-bit
PE connection	On housing with M4 screw
Dimensions	
• Width	50 mm
• Height	150 mm
• Depth	111 mm
Weight, approx.	0.9 kg

Integration

The VSM10 Voltage Sensing Module communicates with the CU320-2 Control Unit via DRIVE-CLiQ.



Connection example of a VSM10 Voltage Sensing Module

Overview

Safe Brake Adapter SBA

The Safe Brake Adapter SBA is required to implement a Safe Brake Control (Safety Integrated function "SBC") in conjunction with Motor Modules and Power Modules in chassis format.

The Safe Brake Adapter is available for a 230 V AC brake control voltage.

Design

The Safe Brake Adapter SBA has the following connections and interfaces:

- 1 connection for controlling and transferring feedback from the integrated safety relay (X11)
- 1 connection for controlling the motor brake solenoid (X14)
- 2 connections for supplying power to the brake, either via 24 V DC (X13) or 230 V AC (X12)
- 1 connection for quick de-excitation of the operating solenoid (X15)

The Safe Brake Adapter is designed for attachment to a support rail in accordance with EN 50022

Selection and ordering data

Description	Article No.
Safe Brake Adapter 230 V AC/2 A	**6SL3355-2DX00-1AA0**
Accessories	
Connecting cable for connecting the SBA to the Control Interface Module in the Motor Module/ Power Module	**6SL3060-4DX04-0AA0**

Technical specifications

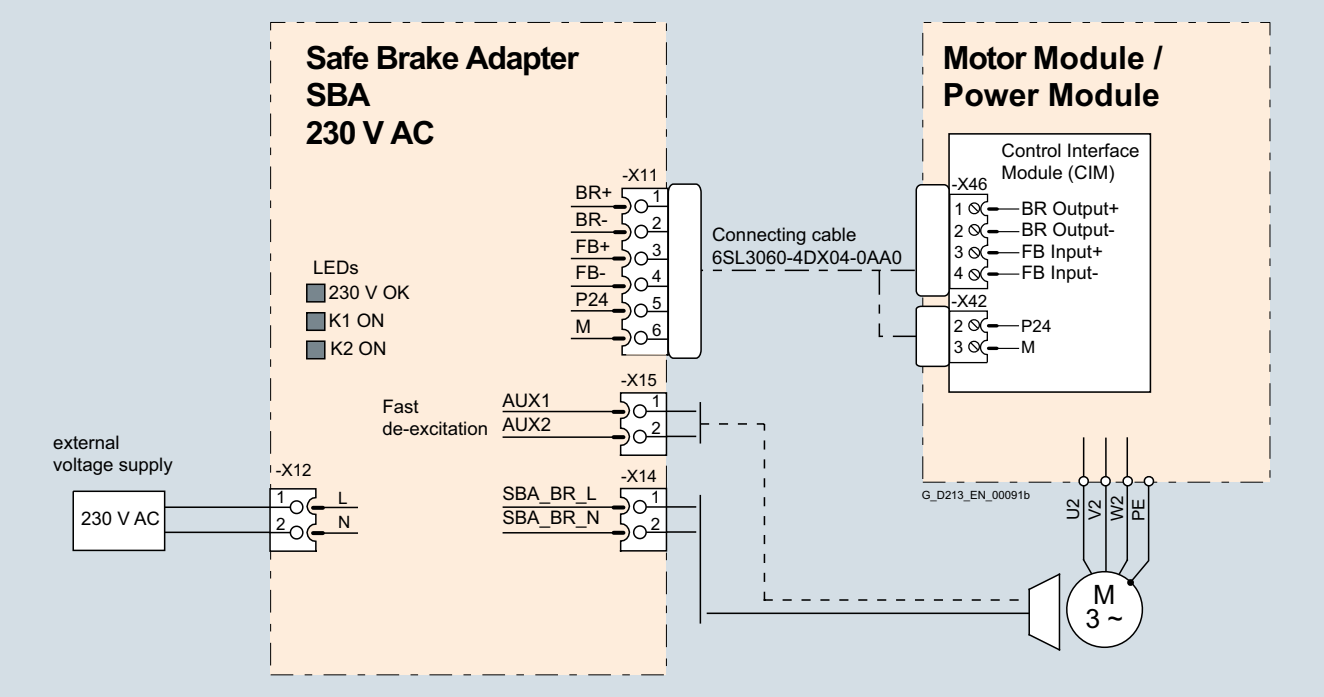
Safe Brake Adapter	6SL3355-2DX00-1AA0
Electronics power supply	
• Supply voltage (via the Control Interface Module)	24 V DC (20.4 ... 28.8 V)
Supply voltage of the motor holding brake	230 V AC
Current consumption, max perm.	
• Motor holding brake	2 A
• Fast de-energization	2 A
Cable length, max.	
• To the Control Interface Module	10 m (32 ft)
• To the brake	300 m (984 ft)
Conductor cross-section	2.5 mm^2
Dimensions	
• Width	75 mm (2.95 in)
• Height	111 mm (4.37 in)
• Depth	89 mm (3.50 in)
Weight, approx.	0.25 kg (0.55 lb)
Safety Integrated	According to IEC 61508 SIL 2, EN ISO 13849-1 PL d and Category 3

3

Integration

The control and feedback signal regarding the switching state of the SBA relay is implemented via terminals of the Control Interface Module (CIM) in the Motor Module/Power Module. The excitation coil of the holding brake is connected directly at the SBA.

For SINAMICS S120, the brake supply voltage must be externally supplied at the SBA.



Connection example of a Safe Brake Adapter SBA

Overview

SMC30 Sensor Module Cabinet-Mounted

The SMC30 Sensor Module Cabinet-Mounted is required to evaluate the encoder signals 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 connections and interfaces as standard:

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

The status of the SMC30 Sensor Module Cabinet-Mounted is indicated using a multi-color LED.

The SMC30 Sensor Module Cabinet-Mounted can be snapped onto a TH 35 mounting rail according to EN 60715 (IEC 60715).

The maximum encoder cable length between SMC30 modules and encoders is 100 m. For HTL encoders, this length can be increased to 300 m if the A+/A- and B+/B- signals 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. type SK8 from Phoenix Contact or type KLBÜ CO 1 from Weidmüller. The shield connection terminal must not be used as a strain relief mechanism.

Integration

SMC30 Sensor Modules Cabinet-Mounted communicate with a Control Unit via DRIVE-CLiQ.

Selection and ordering data

Description	Article No.
SMC30 Sensor Module Cabinet-Mounted Without DRIVE-CLiQ cable	**6SL3055-0AA00-5CA2**

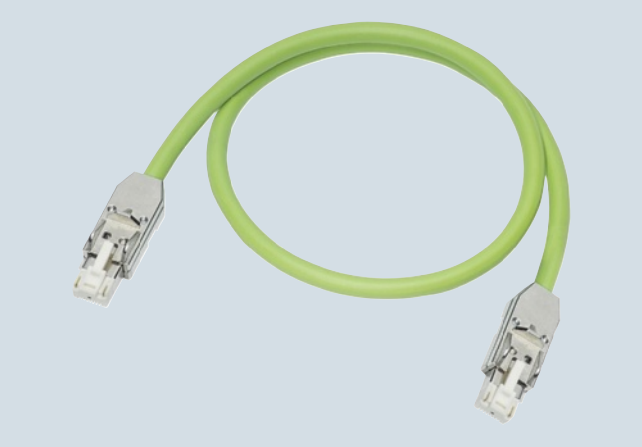
For the SINAMICS S150 and SINAMICS S120 Cabinet Modules, the SMC30 Sensor Module Cabinet-Mounted can be ordered as an option by specifying order code **K50**.

Technical specifications

SMC30 Sensor Module Cabinet-Mounted	6SL3055-0AA00-5CA2
Power requirement, max. at 24 V DC, without taking encoder into account	0.2 A
• Conductor cross-section, max.	2.5 mm^2
• Fuse protection, max.	20 A
Power loss, max.	10 W
Encoders which can be evaluated	• Incremental encoder TTL/HTL • SSI encoder with TTL/HTL incremental signals • SSI encoder without incremental signals
• Input impedance	
- TTL	570 Ω
- HTL, max.	16 mA
• Encoder supply	24 V DC/0.35 A or 5 V DC/0.35 A
• Encoder frequency, max.	300 kHz
• SSI baud rate	100 ... 1000 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, according to	cULus

[1] Signal cables twisted in pairs and shielded.

Overview



Signal cables are required for the DRIVE-CLiQ connection between different components. Signal cables are pre-assembled and are sold by the meter. The following signal cables are available:

- DRIVE-CLiQ signal cables
- MOTION-CONNECT DRIVE-CLiQ signal cables
- MOTION-CONNECT pre-assembled signal cables

Type of delivery for pre-assembled signal cables

Pre-assembled signal cables are available in units of 10 cm. Cables up to 30 kg or 100 m are supplied as coils; above this, they are supplied on drums.

Application

DRIVE-CLiQ signal cables

DRIVE-CLiQ signal cables are used to connect components with DRIVE-CLiQ connections, which have a separate or external 24 V DC power supply.

MOTION-CONNECT DRIVE-CLiQ signal cables

MOTION-CONNECT DRIVE-CLiQ signal cables are used whenever components with DRIVE-CLiQ connections must meet high requirements such as mechanical stress and oil resistance, e.g. where a connection is made outside the cabinet between

- Power Modules and Sensor Modules
- Power Modules and motors with DRIVE-CLiQ interface

MOTION-CONNECT DRIVE-CLiQ signal cables have 24 V DC cores.

Serial plug-in cable for connecting the AOP30 to the CU320-2

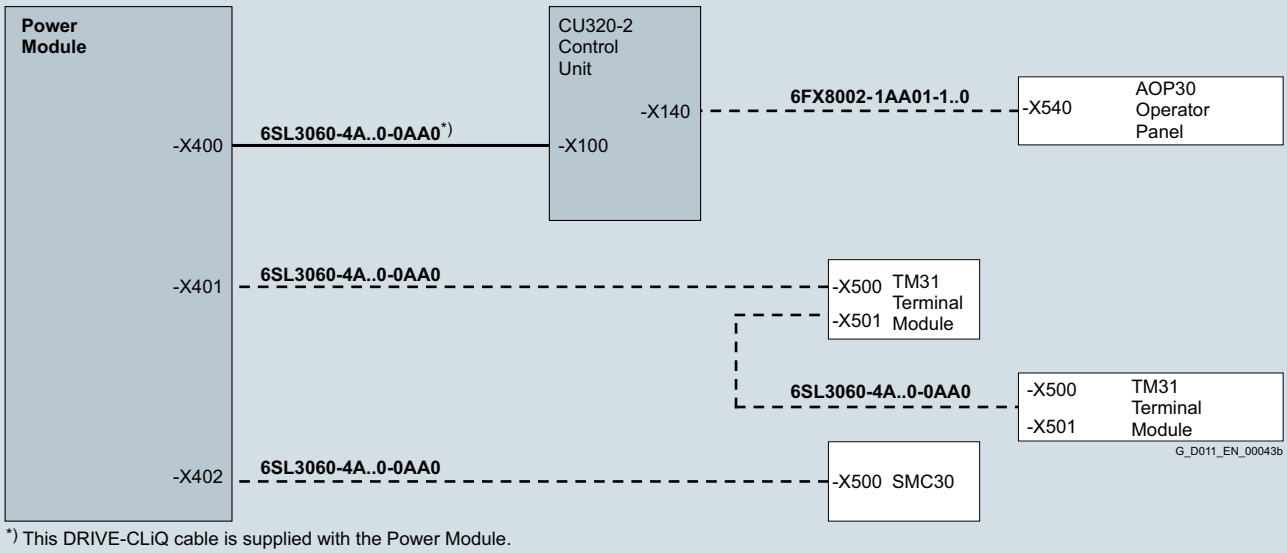
The AOP30 Advanced Operator Panel is connected to the CU320-2 Control Unit via a serial plug-in cable (RS232C cable).

The maximum cable length is 10 m. To guarantee disturbance-free communication, a shielded cable is recommended, and the cable shield should be connected to both connector housings.

Selection and ordering data

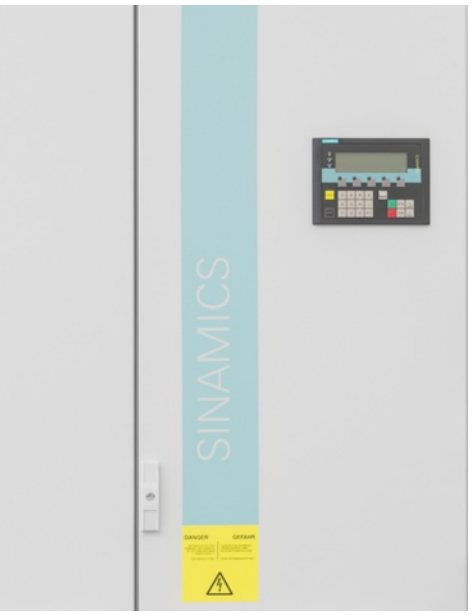
Signal cable	Length m	Article No.
Pre-assembled DRIVE-CLiQ signal cables (without 24 V DC cores)	0.11	**6SL3060-4AB00-0AA0**
	0.16	**6SL3060-4AD00-0AA0**
Connectors with degree of protection IP20/IP20	0.21	**6SL3060-4AF00-0AA0**
	0.26	**6SL3060-4AH00-0AA0**
	0.36	**6SL3060-4AM00-0AA0**
	0.6	**6SL3060-4AU00-0AA0**
	0.95	**6SL3060-4AA10-0AA0**
	1.2	**6SL3060-4AW00-0AA0**
	1.45	**6SL3060-4AF10-0AA0**
	2.8	**6SL3060-4AJ20-0AA0**
	5	**6SL3060-4AA50-0AA0**

Integration



*) This DRIVE-CLiQ cable is supplied with the Power Module.

Connection example of a CU320-2 Control Unit



Overview

SINAMICS G150 converter cabinet units, versions A and C

With its SINAMICS G150 converter cabinet units, a drive system is available on which all line-side and motor-side components are integrated together with the Power Module extremely compact into a specially designed cabinet enclosure. This approach minimizes the effort and expense required to configure and install them.

SINAMICS G150 has been specially designed to meet the requirements of drives with square-wave and constant load characteristics, with medium performance requirements, and without regenerative feedback capability.

The control accuracy of the sensorless vector control is suitable for most applications, which means that an additional actual speed value encoder is not required.

SINAMICS G150 converter cabinet units are optionally available with an encoder evaluation function in order to handle applications that require an encoder for plant-specific reasons.

SINAMICS G150 converter cabinet units offer an economic drive solution that can be adapted to customer-specific requirements through a wide range of components and options.

SINAMICS G150 is available in two versions:

- **Version A**
  All optionally available line connection components, such as the main switch, circuit breakers, line contactor, line fuses, line filter or motor-side components and additional monitoring devices, can be installed as required. This version is also available with power units connected in parallel.
- **Version C**
  Offers an extremely space-optimized structure without line-side components. This particularly slimline version can be used, for example, when line connection components are accommodated in a central low-voltage distribution panel (MCC) in the plant.

The following voltages and power ratings are available:

Line voltage	**Power range single connection** (versions A and C)	**Power range parallel connection** (version A)
380 ... 480 V 3 AC	110 ... 560 kW	630 ... 900 kW
500 ... 600 V 3 AC	110 ... 560 kW	630 ... 1000 kW
660 ... 690 V 3 AC	75 ... 800 kW	1000 ... 2700 kW

Degrees of protection are IP20 (standard) and optionally IP21, IP23, IP43 and IP54.

Benefits

- Particularly quiet and compact converters thanks to state-of-the-art IGBT power semiconductors and an innovative cooling concept.
- Individual modules and power components can be replaced quickly and easily, which ensures a higher level of plant availability. Replaceable components have been designed so that they can be quickly and easily replaced. In addition, the "Spares On Web" Internet tool makes it easy to view the spare parts that are available for the particular order at all times.
- Can be easily integrated in automation solutions by means of a standard communications interface as well as a range of analog and digital interfaces.
- Easy commissioning and parameterization using interactive menus on the AOP30 Advanced Operator Panel with graphic LCD and plain-text display, or PC-supported using the STARTER commissioning tool (see Chapter Tools and configuration).
- Preset software functions make it easier to adapt the converter to the individual plant. For example, the key functions for controlling pumps are stored as a preprogrammed macro in the drive.
- With regard to EMC, the devices are subdivided into various zones, and as a consequence, they are extremely insensitive to disturbances and are very reliable in operation. With the help of simulated conditions, partitions have been designed to act as air guides and to help dissipate heat.
- Special measures used in the construction of the cabinets ensure that they remain mechanically durable over their entire life cycle. All components, from individual parts to the ready-to-connect cabinet, undergo rigorous testing throughout the entire production process. This guarantees a high level of functional reliability during installation and commissioning, as well as in operation.

Application

Variable-speed drives are ideal for all applications that involve moving, conveying, pumping or compressing solids, liquids or gases.

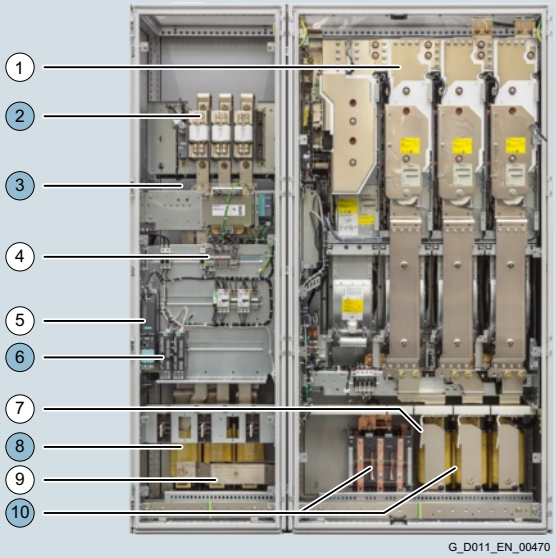
This means the following applications in particular:

- Pumps and fans
- Compressors
- Extruders and mixers
- Mills

Design

SINAMICS G150 converter cabinet units are characterized by their compact, modular and service-friendly design.

A wide range of options is available depending on the cabinet version which permit optimum adaptation of the drive system to the respective requirements (see Options).

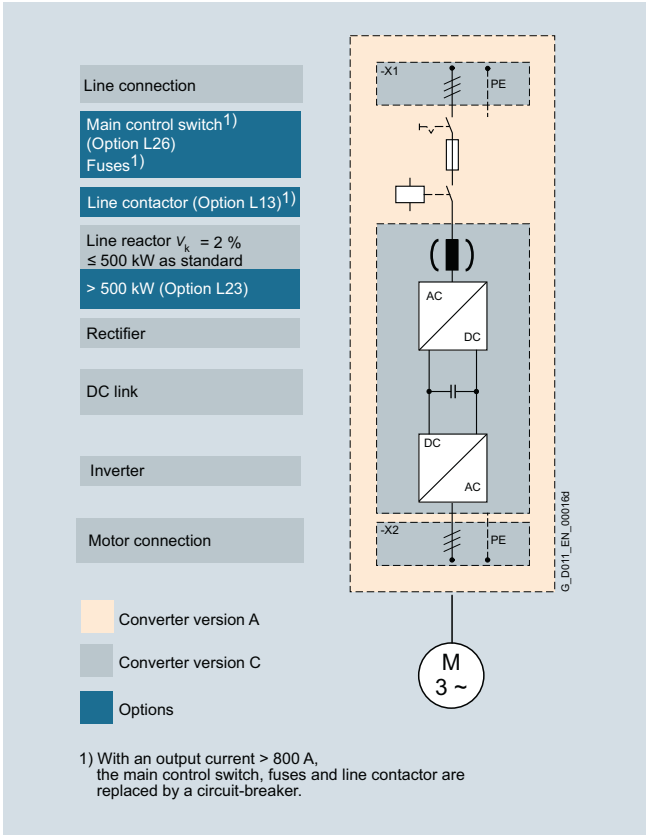


1 Power unit
2 Main switch with fuses (option **L26**)
3 Main contactor (option **L13**)
4 Customer terminal block
5 CU320-2 Control Unit
6 TM31 Terminal Module (option **G60**)
7 Motor connection
8 Line reactor (≤ 500 kW standard) (option **L23**)
9 Line connection
10 dv/dt-Filter compact plus VPL (option **L07**)

○ Standard version
● Option

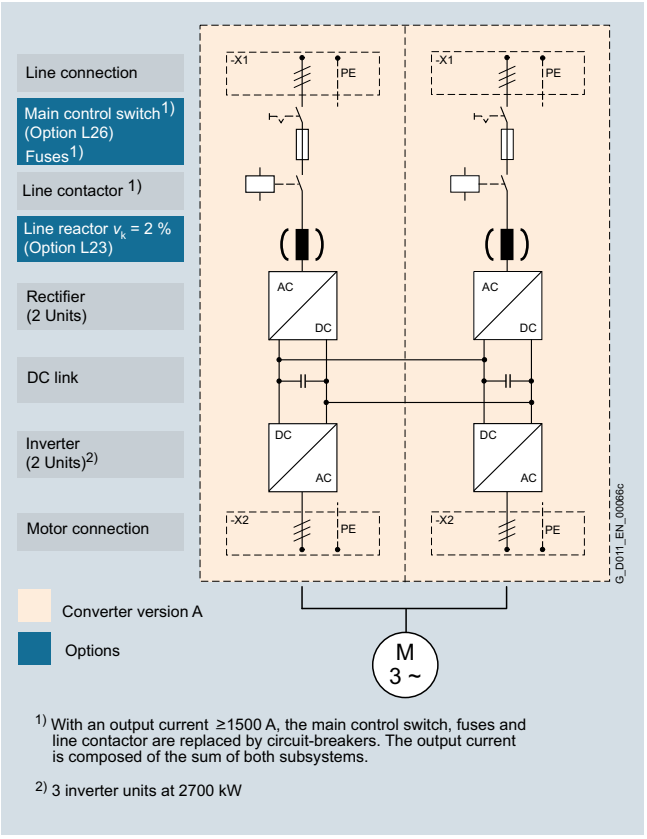
Example of the design of a SINAMICS G150 converter cabinet unit, version A

Design (continued)



1) With an output current > 800 A, the main control switch, fuses and line contactor are replaced by a circuit-breaker.

Basic design of a SINAMICS G150 converter cabinet unit with several essential options



1) With an output current ≥1500 A, the main control switch, fuses and line contactor are replaced by circuit-breakers. The output current is composed of the sum of both subsystems.

2) 3 inverter units at 2700 kW

Basic design of a SINAMICS G150 converter cabinet unit in parallel connection in order to increase the power rating, with several essential options

Design (continued)

Coated modules

The following converter components are equipped as standard with coated modules:

- Power Modules
- Control Units
- Sensor Modules
- Terminal Modules
- Advanced Operator Panel (AOP30)

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

Nickel-plated busbars

All of the copper busbars used in the converter cabinet are nickel-plated in order to achieve the best possible immunity to environmental effects. The bare copper connections also do not have to be cleaned for customer connections.

Note:

With some options, parts of the copper busbars cannot be nickel-plated for technical reasons.

Degrees of protection of the cabinet units

The EN 60529 standard covers the protection of electrical equipment by means of housings, covers or equivalent, and includes:

- Protection of persons against accidental contact with live or moving parts within the housing and protection of the equipment against the ingress of solid foreign bodies (touch protection and protection against ingress of solid foreign bodies)
- Protection of the equipment against the ingress of water (water protection)
- Abbreviations for the internationally agreed degrees of protection

The degrees of protection are specified by abbreviations comprising the code letters IP and two digits.

Degrees of protection for the converter cabinet unit	**First digit** (touch protection and protection against ingress of foreign solid bodies)	**Second digit** (protection of the equipment against the ingress of water)
IP20 (standard)	Protected against solid foreign bodies with a diameter ≥ 12.5 mm	No water protection
IP21 (option **M21**)	Protected against solid foreign bodies with a diameter ≥ 12.5 mm	Protected against drip water Vertically falling water drops must not have any harmful effects.
IP23 (option **M23**)	Protected against solid foreign bodies with a diameter ≥ 12.5 mm	Protected against spray water Water sprayed on at an angle of up to 60° both sides of the vertical must not have any harmful effects.
IP43 (option **M43**)	Protected against solid foreign bodies with a diameter ≥ 1 mm	Protected against spray water Water sprayed on at an angle of up to 60° both sides of the vertical must not have any harmful effects.
IP54 (option **M54**)	Dust protected. Ingress of dust is not totally prevented, but dust must not be allowed to enter in such quantities that the functioning or safety of the equipment is impaired.	Protected against splash water Water splashing onto the housing from any direction must not have any harmful effects.

Function

AOP30 Advanced Operator Panel

An AOP30 Advanced Operator Panel is located in the cabinet door of the converter for the operator control and monitoring as well as for the commissioning.

The AOP30's two-stage safety concept prevents unintentional or unauthorized changes to settings. Operation of the drive from the operator panel can be disabled by the keyboard lock so that only parameter values and process variables can be displayed on the operator panel. The OFF key is factory-set to "active", but can be deactivated by the customer. A password can be used to prevent the unauthorized changing of converter parameters.

The user is guided by interactive menus through the drive commissioning screens. When commissioning the drive for the first time, only six motor parameters (which can be found on the motor rating plate) have to be entered on the AOP30. The closed-loop control is then optimized automatically to adapt the converter to the motor.

German, **English**, **French**, **Italian**, **Spanish** and **Chinese** are stored on the CU320-2 Control Unit CompactFlash card as operator panel languages. The desired language must be downloaded to the AOP30 prior to commissioning. In addition to these preinstalled languages, **Russian** and **Portuguese** (Brazil) are also available for subsequent installation. Further languages are available on request.

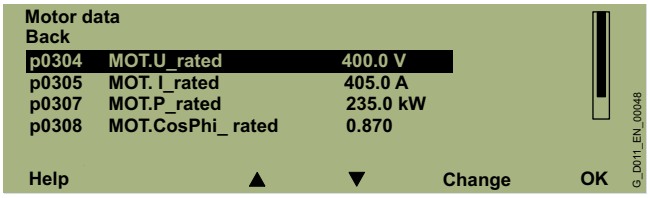
Examples of plain-text displays during various phases of operation are shown below.

The **first commissioning** is performed via the operator panel.

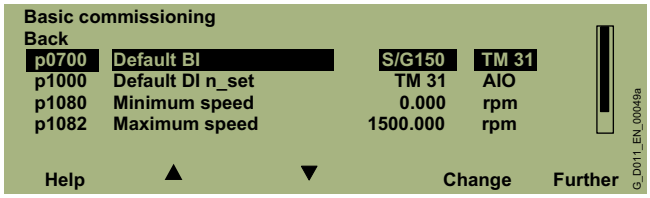
Only six motor parameters have to be entered:

Power, speed, current, cos φ, voltage and frequency of the motor.

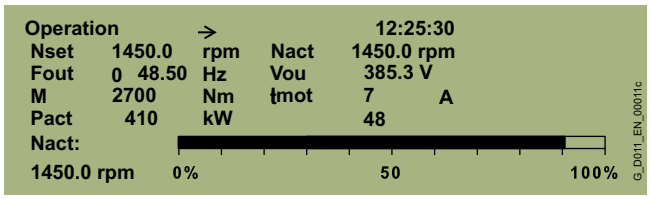
This information can be found on the motor rating plate, and must be entered in the screens on the display by following a short, menu-assisted procedure. The motor cooling method must also be specified.

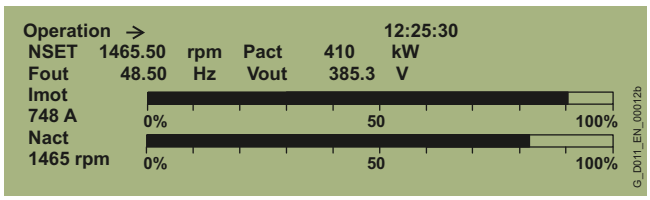


The next screen contains the parameter values that are used to automatically optimize the control.

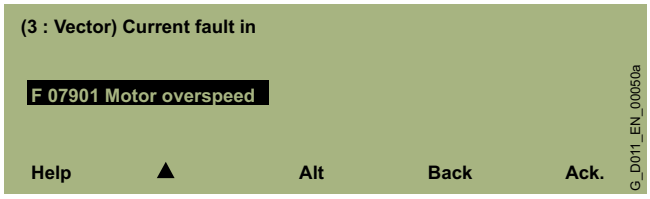


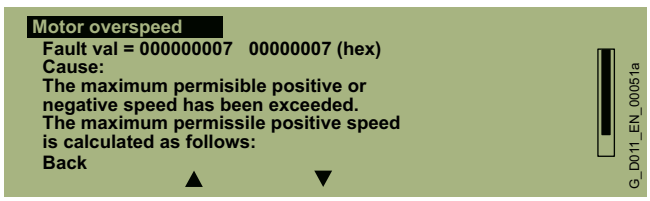
During **operation**, the display shows current data, such as set-points and actual values as absolute values or it is possible to parameterize up to three process variables as a quasi-analog bar display.





Any **alarms** which occur are signaled by the flashing of the yellow "ALARM" LED, **faults** by the lighting up of the red "FAULT" LED. There is also an indication of the cause displayed in plain text on the display's status line.





Function (continued)

Communication with higher-level controller and customer terminal block

A PROFIBUS interface on the CU320-2 DP Control Unit is provided as standard as the customer interface for the controller.

When using the CU320-2 PN (PROFINET) Control Unit (option **K95**), communication is via PROFINET in accordance with the PROFIdrive profile.

The Control Unit can be connected to the higher-level controller via its digital inputs and outputs to exchange digital signals.

The inputs and outputs available as standard can be optionally expanded using a TB30 Terminal Board (option **G62**) and/or up to two TM31 Terminal Modules (option **G60** or **G61**).

To simplify configuration and commissioning of the drive, the optional TM31 Terminal Module can be preset with a variety of factory settings.

For further information, please refer to the SINAMICS Low Voltage Engineering Manual.

Open-loop and closed-loop control functions

The converter control contains a high-quality sensorless vector control with speed and current control as well as motor and converter protection.

Software and protective functions

The software functions available as standard are described below:

Software and protective functions	Description
Setpoint specification	The setpoint can be specified both internally and externally; internally as a fixed setpoint, motorized potentiometer setpoint or jog setpoint, externally via the communications interface or an analog input on the customer terminal block. The internal fixed setpoint and the motorized potentiometer setpoint can be switched or adjusted via control commands from any interface.
Motor identification	The automatic motor identification function makes commissioning faster and easier and optimizes closed-loop control of the drive.
Ramp-function generator	A user-friendly ramp-function generator with separately adjustable ramp-up and ramp-down times, together with adjustable rounding times in the lower and upper speed ranges, allows the drive to be smoothly accelerated and braked. As a consequence, this avoids the drive train from being overloaded and reduces the stress on mechanical components. The down ramps can be parameterized separately for quick stop.
$V_{dc\ max}$ controller	The $V_{dc\ max}$ controller automatically prevents overvoltages in the DC link, if the set down ramp is too short, for example. This may also extend the set ramp-down time.
Vdc_min control	For brief line supply failures, the kinetic energy of the rotating drive is used to buffer the DC link and therefore prevents fault trips. The converter remains operational as long as the drive can provide regenerative energy as a result of its motion and the DC-link voltage does not drop below the shutdown threshold. When the line supply recovers within this time, the drive is again accelerated up to its speed setpoint.
Automatic restart [1]	The automatic restart switches the drive on again when the power is restored after a power failure, and ramps up to the current speed setpoint.
Flying restart [1]	The flying restart function allows the converter to be switched to a motor that is still turning. With the voltage sensing capability provided by the optional VSM10 Voltage Sensing Module, the flying restart time for large induction motors can be significantly reduced because the motor does not need to be de-magnetized.
Technology controller	The technology controller function module allows simple control functions to be implemented, e.g. level control or volumetric flow control. The technology controller is designed as a PID controller. The differentiator can be switched to the control deviation channel or to the actual value channel (factory setting). The P, I, and D components can be set separately.
Free function blocks	Using the freely programmable function blocks, it is easy to implement logic and arithmetic functions for controlling the SINAMICS G150. The blocks can be programmed by means of an operator panel or the STARTER commissioning tool.
Drive Control Chart (DCC)	Drive Control Chart (DCC) is an additional tool for the easy configuration of technology functions for the SINAMICS G150. The block library contains a large selection of control, arithmetic and logic blocks as well as extensive open-loop and closed-loop control functions. The user-friendly DCC editor enables easy graphics-based configuration, allows control loop structures to be clearly represented and provides a high degree of reusability of charts that have already been created. DCC is an add-on to the STARTER commissioning tool.
***I²t* detection for motor protection**	A motor model stored in the converter software calculates the motor temperature based on the current speed and load. More exact measurement of the temperature, which also takes into account the influence of the ambient temperature, is possible by means of direct temperature measurement using KTY84 sensors in the motor winding.
Motor temperature evaluation	Motor protection by evaluating a KTY84, PTC or Pt100 temperature sensor. When a KTY84 sensor is connected, the limit values can be set for alarm or trip. When a PTC thermistor is connected, the system reaction to triggering of the thermistor (alarm or trip) can be defined.
Motor blocking protection	A blocked motor is detected and protected against thermal overloading by a fault trip.
Essential service mode	Special converter operating mode that increases the availability of the drive system, e.g. in the event of a fire.
Bypass	This circuit allows the motor to be operated via the converter or directly on the line supply.
Brake control	"Simple brake control" for control of holding brakes: The holding brake is used to secure drives against unwanted motion when deactivated. "Extended brake control" function module for complex brake control, e.g. for motor holding brakes and operational brakes: When braking with a feedback signal, the brake control reacts to the feedback signal contacts of the brake.
Write protection	Write protection to prevent unintentional changing of the setting parameters (without password function).

[1] Factory setting: Not activated (can be parameterized).

Function (continued)

Software and protective functions	Description
Know-how protection	Know-how protection for encrypting stored data, e.g. to protect configuration know-how, and to protect against changes and duplication (with password function).
Web server	The integrated web server provides information about the drive unit via its web pages. The web server is accessed using an Internet browser via unsecured (http) or secured transmission (https).
Power unit protection	**Description**
Ground fault monitoring at the output	A ground fault at the output is detected by a total current monitor and results in shutdown in grounded systems.
Electronic short-circuit protection at the output	A short-circuit at the output (e.g. at the converter output terminals, in the motor cable or in the motor terminal box) is detected and the converter shuts down with a "fault".
Thermal overload protection	An alarm is issued first when the overtemperature threshold responds. If the temperature rises further, the device either shuts down or independently adjusts the pulse frequency or output current so that a reduction in the thermal load is achieved. Once the cause of the fault has been eliminated (e.g. cooling has been improved), the original operating values are automatically resumed.

Selection and ordering data

Single connection

Type rating		Rated output current	SINAMICS G150 converter cabinet units, versions A and C
at 50 Hz 400 V, 500 V or 690 V	at 60 Hz 460 V or 575 V		(Article No. supplement, see below)
kW	hp	A	Article No.
380 ... 480 V 3 AC			
110	150	210	**6SL3710-1GE32-1 A3**
132	200	260	**6SL3710-1GE32-6 A3**
160	250	310	**6SL3710-1GE33-1 A3**
200	300	380	**6SL3710-1GE33-8 A3**
250	400	490	**6SL3710-1GE35-0 A3**
315	500	605	**6SL3710-1GE36-1 A3**
400	600	745	**6SL3710-1GE37-5 A3**
450	700	840	**6SL3710-1GE38-4 A3**
560	800	985	**6SL3710-1GE41-0 A3**
500 ... 600 V 3 AC			
110	150	175	**6SL3710-1GF31-8 A3**
132	200	215	**6SL3710-1GF32-2 A3**
160	250	260	**6SL3710-1GF32-6 A3**
200	300	330	**6SL3710-1GF33-3 A3**
250	400	410	**6SL3710-1GF34-1 A3**
315	450	465	**6SL3710-1GF34-7 A3**
400	600	575	**6SL3710-1GF35-8 A3**
500	700	735	**6SL3710-1GF37-4 A3**
560	800	810	**6SL3710-1GF38-1 A3**
660 ... 690 V 3 AC			
75		85	**6SL3710-1GH28-5 A3**
90		100	**6SL3710-1GH31-0 A3**
110		120	**6SL3710-1GH31-2 A3**
132		150	**6SL3710-1GH31-5 A3**
160		175	**6SL3710-1GH31-8 A3**
200		215	**6SL3710-1GH32-2 A3**
250		260	**6SL3710-1GH32-6 A3**
315		330	**6SL3710-1GH33-3 A3**
400		410	**6SL3710-1GH34-1 A3**
450		465	**6SL3710-1GH34-7 A3**
560		575	**6SL3710-1GH35-8 A3**
710		735	**6SL3710-1GH37-4 A3**
800		810	**6SL3710-1GH38-1 A3**

Article No. supplement	
• **Version A** All available options can be installed as required	**A**
• **Version C** Especially space-saving design	**C**

Note: The power data in hp units is based on the NEC/CEC standards for the North American market.

Parallel connection

Type rating		Rated output current	SINAMICS G150 converter cabinet units, version A
at 50 Hz 400 V, 500 V or 690 V	at 60 Hz 460 V or 575 V		
kW	hp	A	Article No.
380 ... 480 V 3 AC			
630	900	1120	**6SL3710-2GE41-1AA3**
710	1000	1380	**6SL3710-2GE41-4AA3**
900	1250	1560	**6SL3710-2GE41-6AA3**
500 ... 600 V 3 AC			
630	900	860	**6SL3710-2GF38-6AA3**
710	1000	1070	**6SL3710-2GF41-1AA3**
1000	1250	1360	**6SL3710-2GF41-4AA3**
660 ... 690 V 3 AC			
1000		1070	**6SL3710-2GH41-1AA3**
1350		1360	**6SL3710-2GH41-4AA3**
1500		1500	**6SL3710-2GH41-5AA3**
1750		1729	**6SL3710-2GH41-8EA3**
1950		1948	**6SL3710-2GH42-0EA3**
2150		2158	**6SL3710-2GH42-2EA3**
2400		2413	**6SL3710-2GH42-4EA3**
2700		2752	**6SL3710-2GH42-7EA3**

Note: The power data in hp units is based on the NEC/CEC standards for the North American market.

Options

When ordering a converter with options, add the suffix **"-Z"** to the article number and then the order code(s) for the desired option(s).

Example:
6SL3710-1GE32-1CA3-Z
+M07+D60+...

See also ordering examples.

Available options	Order code	Version A	Version C
Input-side options			
Use in the first environment according to EN 61800-3 Category C2 (TN systems or TT systems with grounded neutral point) [1]	**L00**	✓	–
Clean Power version with integrated Line Harmonics Filter compact [2]	**L01**	✓	–
Line contactor (for currents ≤ 800 A for single connection)	**L13**	✓	–
Surge suppression	**L21**	✓	–
Scope of delivery without line reactor (for converters ≤ 500 kW)	**L22**	✓	✓
Line reactor u_k = 2% (for converters > 500 kW)	**L23**	✓	✓
Main switch incl. fuses or circuit breakers	**L26**	✓	–
Quick start (for option **L01**)	**L76**	✓	–
EMC shield bus [3] (cable connection from below)	**M70**	✓	✓
PE busbar [3] [4] (cable connection from below)	**M75**	–	✓
Output-side options			
dv/dt filter compact plus Voltage Peak Limiter	**L07**	✓	–
Motor reactor	**L08**	✓	–
dv/dt filter plus Voltage Peak Limiter [2]	**L10**	✓	–
Sine-wave filter (up to 250 kW at 380 ... 480 V, up to 132 kW at 500 ... 600 V)	**L15**	✓	–
EMC shield bus [3] (cable connection from below)	**M70**	✓	✓
PE busbar [3] [4] (cable connection from below)	**M75**	–	✓
Motor protection and safety functions			
EMERGENCY OFF pushbutton installed in the cabinet door	**L45**	✓	–
EMERGENCY OFF Category 0, 230 V AC or 24 V DC	**L57**	✓	–
EMERGENCY STOP Category 1, 230 V AC [5]	**L59**	✓	–
EMERGENCY STOP Category 1, 24 V DC [5]	**L60**	✓	–
Thermistor motor protection (alarm)	**L83**	✓	–
Thermistor motor protection (trip)	**L84**	✓	–
Pt100 evaluation unit	**L86**	✓	–
Insulation monitoring	**L87**	✓	–
Degree of protection increase			
Degree of protection IP21	**M21**	✓	✓
Degree of protection IP23	**M23**	✓	✓
Degree of protection IP43	**M43**	✓	✓
Degree of protection IP54	**M54**	✓	✓
Mechanical options			
Base 100 mm high, RAL 7022	**M06**	✓	✓
Cable-marshaling compartment 200 mm high, RAL 7035	**M07**	✓	✓
Line connection from above [2]	**M13**	✓	–
Motor connection from above [2]	**M78**	✓	–
Crane transport assembly (top-mounted)	**M90**	✓	✓

✓	Option can be ordered
–	Option cannot be ordered

Please refer to the selection matrix for information about possible option combinations.

[2] Applies to motor cable lengths < 100 m.

[3] Not available for converters > 1500 kW with power units connected in parallel.

[4] This option is listed for the input- and output-side options, but is only required once.

[5] This option is contained as standard in version A.

[6] The stopping requirements must be taken into account with this option. Additional braking units may be required.

Options (continued)

Available options	Order code	Version A	Version C
Safety Integrated			
Safety license for one axis	**K01**	✓	–
Additional SMC30 Sensor Module Cabinet-Mounted	**K52**	✓	–
Terminal module for controlling the "Safe Torque Off" and "Safe Stop 1" safety functions	**K82**	✓	–
TM54F Terminal Module	**K87**	✓	–
SBA Safe Brake Adapter, 230 V AC	**K88**	✓	–
Other options			
CBC10 Communication Board	**G20**	✓	✓
CBE20 Communication Board	**G33**	✓	✓
TM150 temperature sensor evaluation unit	**G51**	✓	✓
TM31 Terminal Module	**G60**	✓	✓
Additional TM31 Terminal Module	**G61**	✓	–
TB30 Terminal Board	**G62**	✓	✓
SMC30 Sensor Module Cabinet-Mounted	**K50**	✓	✓
VSM10 Voltage Sensing Module	**K51**	✓	–
Auxiliary power supply, 230 V AC	**K74**	✓	–
CU320-2 PN Control Unit	**K95**	✓	–
Connection for external auxiliary equipment	**L19**	✓	–
Cabinet lighting with service socket	**L50**	✓	–
Cabinet anti-condensation heating	**L55**	✓	✓
Braking unit 25 kW (P_{20} power: 100 kW)	**L61**	✓	–
Braking unit 50 kW (P_{20} power: 200 kW)	**L62**	✓	–
Marking of all control cable conductor ends	**M91**	✓	✓
Special cabinet paint finish [1]	**Y09**	✓	✓
One-line label for system identification, 40 × 80 mm	**Y31**	✓	✓
Two-line label for system identification, 40 × 180 mm	**Y32**	✓	✓
Four-line label for system identification, 40 × 180 mm	**Y33**	✓	✓
Documentation (standard: English/German)			
Documentation, production flowchart: Created once	**B43**	✓	✓
Documentation, production flowchart: Created every two weeks	**B44**	✓	✓
Documentation, production flowchart: Updated every month	**B45**	✓	✓
Additional documentation in German	**D00**	✓	✓
Customer documentation (circuit diagram, terminal diagram, layout diagram) in DXF format	**D02**	✓	✓
Customer documentation as hard copy	**D04**	✓	✓
Preliminary version of customer documentation	**D14**	✓	✓
Additional documentation in Russian	**D56**	✓	✓
Documentation language: English/French	**D58**	✓	✓
Documentation language: English/Spanish	**D60**	✓	✓
Additional documentation in Italian	**D72**	✓	✓
Additional documentation in English	**D76**	✓	✓
Additional documentation in French	**D77**	✓	✓
Additional documentation in Spanish	**D78**	✓	✓
Documentation language: English/Italian	**D80**	✓	✓
Additional documentation in Chinese	**D84**	✓	✓
Documentation language English/Chinese	**D91**	✓	✓
Documentation language English/Russian	**D94**	✓	✓

✓	Option can be ordered
–	Option cannot be ordered

Please refer to the selection matrix for information about possible option combinations.

[1] The order code Y.. requires data in plain text.

Options (continued)

Available options	Order code	Version A	Version C
Rating plate language (standard: English/German)			
Rating plate data in English/French	**T58**	✓	✓
Rating plate data in English/Spanish	**T60**	✓	✓
Rating plate data in English/Italian	**T80**	✓	✓
Rating plate data in English/Russian	**T85**	✓	✓
Rating plate data in English/Chinese	**T91**	✓	✓
Options specific to the chemical industry			
NAMUR terminal block	**B00**	✓	–
Protective separation for 24 V supply (PELV)	**B02**	✓	–
Outlet for external auxiliary equipment (uncontrolled)	**B03**	✓	–
Options specific to the shipbuilding industry			
Marine version	**M66**	✓	✓
Individual certificate from Germanische Lloyd (GL)	**E11**	✓	✓
Individual certificate from Lloyds Register (LR)	**E21**	✓	✓
Individual certificate from Bureau Veritas (BV)	**E31**	✓	✓
Individual certificate from Det Norske Veritas (DNV)	**E51**	✓	✓
Individual certificate from American Bureau of Shipping (ABS)	**E61**	✓	✓
Individual certificate from Chinese Classification Society (CCS)	**E71**	✓	✓
Converter acceptance in presence of customer			
Visual acceptance	**F03**	✓	✓
Function test without connected motor	**F71**	✓	✓
Function test with test bay motor under no-load conditions	**F75**	✓	✓
Insulation test	**F77**	✓	✓
Customer-specific acceptance inspections (on request)	**F97**	✓	✓
Converter acceptance without the customer present			
Function test without connected motor	**F72**	✓	✓
Function test with test bay motor under no-load conditions	**F74**	✓	✓
Insulation test	**F76**	✓	✓

✓	Option can be ordered
–	Option cannot be ordered

Please refer to the selection matrix for information about possible option combinations.

Options (continued)

Option selection matrix

Certain options are mutually exclusive. The tables below only provide an overview. Please refer to the descriptions of the individual options for a precise description of the options and other exclusions.

Electrical options

	G20	G33	G51	G61	G62	K50	K51	K87	L00	L01	L13	L22	L23	L26	L57	L59	L60	L61	L62	L86	L87
G20		–	✓	✓	–	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
G33	–		✓	✓	–	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
G51	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	–	✓
G61	✓	✓	✓		✓	✓	✓	4)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
G62	–	–	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
K50	✓	✓	✓	✓	✓		–	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
K51	✓	✓	✓	✓	✓	–		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
K87	✓	✓	✓	4)	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
L00	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	–	1)	✓	✓	✓	✓	✓	✓	✓	–
L01	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	–	–	✓	✓	✓	✓	✓	✓	✓	✓
L13	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	2)	3)	3)	3)	✓	✓	✓	✓
L22	✓	✓	✓	✓	✓	✓	✓	✓	–	–	✓		–	✓	✓	✓	✓	✓	✓	✓	✓
L23	✓	✓	✓	✓	✓	✓	✓	✓	1)	–	✓	–		✓	✓	✓	✓	✓	✓	✓	✓
L26	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	2)	✓	✓		3)	3)	3)	✓	✓	✓	✓
L57	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	3)	✓	✓	3)		–	–	✓	✓	✓	✓
L59	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	3)	✓	✓	3)	–		–	✓	✓	✓	✓
L60	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	3)	✓	✓	3)	–	–		✓	✓	✓	✓
L61	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		–	✓	✓
L62	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	–		✓	✓
L86	✓	✓	–	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓
L87	✓	✓	✓	✓	✓	✓	✓	✓	–	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	

✓	Option can be ordered
–	Option cannot be ordered

1) For converters ≤ 500 kW / 700 hp, the line reactor (order code **L23**) is included in the converter scope of delivery. For converters > 500 kW / 700 hp, option **L23** must be ordered separately when the converter is to be operated on line supplies with high short-circuit power (R_{SC} > 20) or when a line filter is used (option **L00**).

2) Combination **L13/L26** only possible for currents < 800 A. As of 800 A, circuit breakers are used that also include the function of options **L13** and **L26**.

3) Options **L57**, **L59** and **L60** always require electrical separation from the line supply, this means for converters in a single circuit, for converter currents ≤ 800 A, option **L13** and for converter currents > 800 A, option **L26**. For converters with power units connected in parallel, electrical separation from the line supply is included as standard.

4) A combination of options **G61** and **K87** as a special version is available on request.

Options (continued)

Mechanical options / electrical options

	E11	E21	E31	E51	E61	E71	L00	L01	L07	L08	L10	L15	M06	M07	M13	M21	M23	M43	M54	M66	M70	M78
E11		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	–	1)	✓	✓	✓	✓	✓
E21	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	–	1)	✓	✓	✓	✓	✓
E31	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	–	1)	✓	✓	✓	✓	✓
E51	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	–	1)	✓	✓	✓	✓	✓
E61	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	–	1)	✓	✓	✓	✓	✓
E71	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	–	1)	✓	✓	✓	✓	✓
L00	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	2)	✓
L01	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	–	✓	✓
L07	✓	✓	✓	✓	✓	✓	✓	✓		–	–	–	✓	✓	✓	✓	✓	✓	✓	✓	✓	–
L08	✓	✓	✓	✓	✓	✓	✓	✓	–		–	–	✓	✓	✓	✓	✓	✓	✓	✓	✓	–
L10	✓	✓	✓	✓	✓	✓	✓	✓	–	–		–	✓	✓	✓	✓	✓	✓	✓	✓	✓	–
L15	✓	✓	✓	✓	✓	✓	✓	✓	–	–	–		✓	✓	✓	✓	✓	✓	✓	✓	✓	–
M06	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		–	✓	✓	✓	✓	✓	✓	✓	✓
M07	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	–		✓	✓	✓	✓	✓	✓	✓	✓
M13	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		–	✓	✓	✓	✓	3)	✓
M21	–	–	–	–	–	–	✓	✓	✓	✓	✓	✓	✓	✓	–		–	–	–	–	✓	–
M23	1)	1)	1)	1)	1)	1)	✓	✓	✓	✓	✓	✓	✓	✓	✓	–		–	–	1)	✓	✓
M43	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	–	–		–	✓	✓	✓
M54	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	–	–	–		✓	✓	✓
M66	✓	✓	✓	✓	✓	✓	✓	–	✓	✓	✓	✓	✓	✓	✓	–	1)	✓	✓		✓	✓
M70	✓	✓	✓	✓	✓	✓	2)	✓	✓	✓	✓	✓	✓	✓	3)	✓	✓	✓	✓	✓		3)
M78	✓	✓	✓	✓	✓	✓	✓	✓	–	–	–	–	✓	✓	✓	–	✓	✓	✓	✓	3)	

✓	Option can be ordered
–	Option cannot be ordered

1) Option **M66** includes option **M23**.

2) Option **L00** includes option **M70**.

3) If the line connection (option **M13**) and the motor connection (option **M78**) are from above, the EMC shield bus (option **M70**) is not required in the lower cabinet area.

Rating plate data

	T58	T60	T80	T85	T91
T58		–	–	–	–
T60	–		–	–	–
T80	–	–		–	–
T85	–	–	–		–
T91	–	–	–	–	

Ordering examples

Example 1

Task:
A converter cabinet unit is required to control the fan speed for a 380 kW fan drive connected to an existing 400 V MCC outgoing feeder. The rated speed of the fan is 975 rpm. Due to the prevailing ambient conditions, the converter must be mounted on a 100 mm cabinet base and have IP54 degree of protection. The installation altitude is < 1000 m above sea level, the ambient temperature is 45° C.

Solution:
Because an MCC outgoing feeder already exists, line connection components, such as main switch, line contactor and line fuses, can be omitted and the space-saving version C can be selected. If we take into account the derating factors for the IP54 degree of protection and the increased ambient temperature, a 450 kW, 400 V converter cabinet unit with options
M06 (cabinet base 100 mm) and
M54 (IP54 degree of protection) must be selected for this constellation.

The ordering data is as follows:
6SL3710-1GE38-4CA3-Z
+M06 +M54

Example 2

Task:
A 280 kW pump to control pressure compensation is to be supplied via a converter for a completely new district heating pumping station. A 690 V supply is available. The installation altitude is 350 m above sea level and the ambient temperature is 40° C. The rated speed of the pump is 740 rpm. The pump unit and motor are located in an unmanned substation, so the winding temperature of the motor must be monitored by Pt100 thermistors and evaluated by the converter. The color of the converter cabinet units is to be RAL 3002.

Solution:
A converter cabinet unit with 315 kW, 690 V in the version A with the following options should be selected:
L26 (main switch including fuses),
L13 (line contactor),
L86 (Pt100 evaluation unit) and
Y09 (special cabinet paint finish).

The ordering data is as follows:
6SL3710-1GH33-3AA3-Z
+L26 +L13 +L86 +Y09
cabinet color RAL 3002

Options (continued)

Description of options

Further descriptions of the options are provided in the SINAMICS Low Voltage Engineering Manual.

B00, B02, B03
Options compliant with NAMUR requirements

Exclusion list with other options:

The following restrictions and exclusions applicable to the NAMUR terminal block **B00** with regard to other available options must be taken into account.

Remark on the option	Reason
L45, L57, L59, L60	An EMERGENCY OFF Category 0 is already provided in the NAMUR version. The forced line supply disconnection is connected at terminal -A1-X2: 17, 18.
L83, L84	A thermistor evaluation unit (trip) is already included as standard with option **B00**.
L19	Alternatively, option **B03** can be selected. This means that a reduced scope is available for external auxiliaries.
L87	The insulation monitor monitors the complete electrically coupled network. This combination is available on request. An insulation monitor can also be provided on site.
G60	A TM31 Terminal Module is already included as standard with option **B00**.

With options such as **L50, L55, L86**, the connection is made as described in the standard. There is no wiring to the NAMUR terminal block.

Notice:

In addition to option **B00** for supply disconnection, option **L13** for currents ≤ 800 A or option **L26** for currents > 800 A must be ordered. For converters with power units connected in parallel, electrical separation from the line supply is included as standard.

B00
NAMUR terminal block

The terminal block has been designed and implemented in accordance with the requirements and guidelines of the Standards Working Group for Instrumentation and Control in the Chemical Industry (NAMUR Recommendation NE37), i.e. certain functions of the device are assigned to specified terminals. The inputs and outputs connected to the terminals fulfill PELV requirements ("protective extra-low voltage with protective separation").

The terminal block and associated functions have been reduced to the necessary minimum. Unlike the NAMUR recommendation, optional terminals are not available.

Terminal -A1-X2:	Meaning	Default	Remark
10	DI	ON (dynamic) / ON/OFF (static)	The effective mode can be encoded using a wire jumper at terminal -A1-400:9; 10.
11	DI	OFF (dynamic)	
12	DI	Faster	
13	DI	Slower	
14	DI	RESET	
15	DI	Interlock	
16	DI	Counter-clockwise	"0" signal for CW rotating field "1" signal for CCW rotating field
17, 18		Supply disconnection	EMERGENCY OFF circuit
30, 31		Ready	Relay output (NO contact)
32, 33		Motor is turning	Relay output (NO contact)
34	DO (NO)	Fault	Relay output (changeover contact)
35	DO (COM)		
36	DO (NC)		
50, 51	AI 0/4-20 mA	Speed setpoint	
60, 61	AO 0/4-20 mA	Motor frequency	
62, 63	AO 0/4-20 mA	Motor current	Motor current is default setting; can be reparameterized for other variables

The 24 V supply is provided on the plant side via terminals -A1-X2:1-3 (fused in the converter with 1 A). It must be ensured that the PELV safety requirements are fulfilled (protective extra-low voltage with protective separation).

Terminal -A1-X2:	Meaning	
1	M	Reference conductor
2	P24	24 V DC supply
3	P24	24 V DC outgoing feeder

For temperature monitoring of explosion-proof motors, option **B00** includes a PTC thermistor evaluation unit. Exceeding the limit value causes a shutdown. The associated PTC sensor is connected to terminal -A1-X3:90, 91.

Terminal -A1-X3:	Meaning	
90, 91	AI	Connection of PTC sensor

In parallel to operation via the NAMUR terminal block, there is also the option to operate the converter via the communications interface provided as standard on the CU320-2 Control Unit. The PROFIdrive profile "Process engineering" employed in the chemical industry can be selected by macros.

Options (continued)

B02
Protective separation for 24 V supply (PELV)

If no protective separation for 24 V supply (PELV) is available at the customer site, this option is used to provide a second power supply to guarantee compliance with the PELV voltage. (Terminal assignments as for option **B00**, 24 V supply at terminals -X1:1, 2, 3 is not required)

Note:

Option **B02** is only possible in conjunction with option **B00**.

B03
Outgoing feeder for external auxiliaries (uncontrolled)

If a motor fan is to be supplied with power from the plant, option **B03** provides an uncontrolled external outgoing feeder with a 10 A fuse. As soon as the supply voltage is present at the converter input, a voltage is also present at these terminals. This corresponds to the converter input voltage ($U = U_{line}$). You must take this into account when configuring an external fan.

Terminal -A1-X1:	Meaning
1, 2, 3, PE	Outgoing feeder for external auxiliary equipment

Note:

Option **B03** is only possible in conjunction with option **B00**.

B43, B44, B45
Production flowcharts

Production flowcharts are provided with options **B43**, **B44** and **B45**. After the order has been clarified, these are e-mailed as a dual language (English/German) PDF file.

Order code	Description
B43	Documentation, production flowchart: Created once
B44	Documentation, production flowchart: Updated every two weeks
B45	Documentation, production flowchart: Updated every month

D00, D56, D72, D76, D77, D78, D84
Additional documentation

When options **D00, D56, D72, D76, D77, D78** and **D84** are selected, additional documentation is supplied in the appropriate language.

Order code	Description
D00	German
D56	Russian
D72	Italian
D76	English
D77	French
D78	Spanish
D84	Chinese

D02
Customer documentation (circuit diagram, terminal diagram, layout diagram) in DXF format

This option can be used to order documents such as circuit diagrams, terminal diagrams, layout diagrams, and dimension drawings in DXF format, in order to process them further in CAD systems, for example.

D04
Customer documentation as hard copy

Device documentation is supplied electronically on a CD-ROM as standard. If the customer also requires a hard copy of the documentation and selects option **D04**, the following documents will be supplied in a folder with the converter:

- Operating instructions
- Circuit diagram
- Terminal diagram
- Layout diagram
- Dimension drawing
- Spare parts list
- Test certificate

Regardless of whether option **D04** is selected, hard copies of the safety and transportation guidelines, a check list and a registration form are always supplied.

D14
Preliminary version of customer documentation

If documents such as circuit diagrams, terminal diagrams, layout diagrams and dimensional drawings are required in advance for system engineering, a preliminary copy of the relevant documentation can be ordered with the converter. These documents are then supplied electronically a few working days following receipt of the order. If the order includes options that fall outside the scope of standard delivery, these will not be covered by the documentation due to the obvious time constraints. The system-specific documentation is supplied to the customer via e-mail in the desired language (standard is English/German, for other languages, see options for the documentation). The recipient's e-mail address must be specified with the order for this purpose. If option **D02** is selected at the same time, the documents are provided in the DXF format, otherwise they are sent in PDF format. In the e-mail, the recipient is also provided with a link for downloading general documentation which is not order-specific such as operating instructions, manual and commissioning guide.

D58, D60, D80, D91, D94
Documentation language

Order code	Language
D58	English/French
D60	English/Spanish
D80	English/Italian
D91	English/Chinese
D94	English/Russian

Note:

If a documentation option is not selected, the relevant documentation is supplied as standard in English/German.

Options (continued)

E11 to E71
Individual certification of the converter

The individual certification of the converter by the relevant certification body contains the expansions described in option **M66**.

Order code	Description
E11	Individual certificate from Germanische Lloyd (GL)
E21	Individual certificate from Lloyds Register (LR)
E31	Individual certificate from Bureau Veritas (BV)
E51	Individual certificate from Det Norske Veritas (DNV)
E61	Individual certificate from American Bureau of Shipping (ABS)
E71	Individual certificate from Chinese Classification Society (CCS)

Note:

It is not possible to combine several individual certificates.

F03, F71, F75, F77, F97
Converter acceptance tests with the customer present

F72, F74, F76
Converter acceptance tests without the customer present

Option	Description
F03	**Visual acceptance** The tests are carried out with the converter de-energized. The following is included in the scope of the acceptance tests: • Check of degree of protection • Check of equipment (components) • Check of equipment identifiers • Check of clearance and creepage distances • Check of cables • Check of customer documentation • Submission of the acceptance report
F71, F72	**Function test without connected motor** After the visual acceptance with the converter switched off, the converter is connected to rated voltage. No current at the converter output end. The following is included in the scope of the acceptance tests: • Visual acceptance as described for option **F03** • Check of power supply • Check of protective and monitoring devices (simulation) • Check of fans • Pre-charging test • Function test without connected motor • Submission of the acceptance report
F74, F75	**Function test with test bay motor under no-load conditions** After the visual acceptance with the converter switched off, the converter is connected to rated voltage. A small current flows at the converter output end in order to operate the test bay motor under no-load conditions. The following is included in the scope of the acceptance tests: • Visual acceptance as described for option **F03** • Check of power supply • Check of protective and monitoring devices (simulation) • Check of fans • Function test with test bay motor under no-load conditions • Submission of the acceptance report
F76, F77	**Acceptance of the converter insulation test** The following is included in the scope of the acceptance tests: • High-voltage test • Measurement of the insulation resistance • Submission of the acceptance report
F97	**Customer-specific system acceptance tests (on request)** If acceptance tests are desired which are not covered by the options **F03**, **F71/F72**, **F74/F75** or **F76/F77**, customer-specific acceptance tests / supplementary tests can be ordered using order code **F97** on request and following technical clarification.

G20
CBC10 Communication Board

The CBC10 Communication Board is used to connect the CU320-2 Control Unit and thus the SINAMICS G150 to the CAN (Controller Area Network) protocol. The associated driver software fulfils the standards of the following CANopen specification of the CiA organization (CAN in Automation):

- Communication profiles according to DS 301
- Drive profile according to DSP 402 (in this case Profile Velocity Mode)
- EDS (Electronic Data Sheet) according to DSP 306
- Operational state signaling according to DSP 305

The CBC10 Communication Board is inserted into the option slot on the CU320-2 Control Unit. The CAN interface on the CBC10 has two SUB-D connections for input and output.

For a description of the CBC10 Communication Board, see SINAMICS G130 converter built-in units, Supplementary system components.

G33
CBE20 Communication Board

The CBE20 Communication Board is required when:

- A SINAMICS G130 or SINAMICS G150 converter, equipped with a CU320-2 DP (PROFIBUS) Control Unit, is to be connected to a PROFINET IO network
- SINAMICS Link is to be used to directly exchange data between several CU320-2 DP (PROFIBUS) or CU320-2 PN (PROFINET) Control Units without using a higher-level control system.

With the CBE20 Communication Board, a SINAMICS G130 or a SINAMICS G150 is a PROFINET IO device in the sense of PROFINET and offers 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 controllers as a PROFINET IO device according to the PROFIdrive profile
- Standard TCP/IP communication for engineering processes using the STARTER commissioning tool
- Integrated 4-port switch with four RJ45-B sockets based on PROFINET ASICs ERTEC400. The optimum topology (line, star, tree) can therefore be configured without additional external switches.

The CBE20 Communication Board is inserted into the option slot of the CU320-2 Control Unit.

For a description of the CBE20 Communication Board, see SINAMICS G130 converter built-in units, Supplementary system components.

Options (continued)

G51
TM150 temperature sensor evaluation unit

The TM150 Terminal Module is a DRIVE-CLiQ component that is used to acquire and evaluate data from several temperature sensors. The temperature is measured in a temperature range from -99° C to +250° C for the following temperature sensors:

- Pt100 (with monitoring for wire breakage and short-circuit)
- Pt1000 (with monitoring for wire breakage and short-circuit)
- KTY84 (with monitoring for wire breakage and short-circuit)
- PTC (with monitoring for short-circuit)
- Bimetallic NC contact (without monitoring)

For the temperature sensor inputs, for each terminal block the evaluation can be parameterized for 1 × 2-wire, 2 × 2-wire, 3-wire or 4-wire. There is no galvanic isolation in the TM150 Terminal Module.

A maximum of 12 temperature sensors can be connected to the TM150 Terminal Module.

For a description of the TM150 Terminal Module, see SINAMICS G130 converter built-in units, Supplementary system components.

G60
TM31 Terminal Module

The TM31 Terminal Module is used to extend the customer terminals on the CU320-2 Control Unit.

The following additional interfaces are available:

- 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/PTC)
- 2 DRIVE-CLiQ sockets
- 1 connection for the electronics power supply via the 24 V DC supply connector
- 1 PE connection

To simplify configuration and commissioning of the drive, the optional TM31 Terminal Module can already be preset to a variety of factory settings, which can then be selected during commissioning.

For further information, please refer to the SINAMICS Low Voltage Engineering Manual.

For a description of the TM31 Terminal Module, see SINAMICS G130 converter built-in units, Supplementary system components.

G61
Additional TM31 Terminal Module

With option **G61**, the number of digital inputs/outputs, as well as the number of analog inputs/outputs in the drive system can be expanded using a second TM31 Terminal Module (in addition to the TM31 Terminal Module that can be selected using option **G60**).

Note:

Option **G61** requires option **G60**.

For a description of the TM31 Terminal Module, see SINAMICS G130 converter built-in units, Supplementary system components.

G62
TB30 Terminal Board

The TB30 Terminal Board is inserted into the option slot of the Control Unit and offers the possibility of expanding the CU320-2 Control Unit by four digital inputs/outputs each as well as two analog inputs/outputs each.

Note:

Option **G62** cannot be combined with options **G20** (CBC10 communication board) or **G33** (CBE20 communication board).

For a description of the TB30 Terminal Board, see SINAMICS G130 converter built-in units, Supplementary system components.

K01
Safety license for one axis

The Safety Integrated basic functions do not require a license. However, the Safety Integrated extended functions require a license for each axis equipped with safety functions. It is irrelevant which safety functions are used and how many. Option **K01** contains the license for one axis.

Subsequent licensing is possible in the Internet via the WEB License Manager by generating a license key:
www.siemens.com/automation/license

K50
SMC30 Sensor Module Cabinet-Mounted

The SMC30 Sensor Module Cabinet-Mounted can be used 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 and without wire break detection (wire break detection is only available with bipolar signals)
- SSI encoders with TTL/HTL incremental signals
- SSI encoders without incremental signals

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

For a description of the SMC30 Sensor Module Cabinet-Mounted, see SINAMICS G130 converter built-in units, Supplementary system components.

K51
VSM10 Voltage Sensing Module Cabinet-Mounted

The VSM10 Voltage Sensing Module is used to measure the voltage characteristic on the motor side, so that the following function can be implemented:

- Operation of a permanent-magnet synchronous motor without encoder with the requirement to be able to connect to a motor that is already running (flying restart function).
- Quick flying restart of large induction motors: The time for the demagnetization of the motor is eliminated through the measurement of the voltage.

For a description of the VSM10 Voltage Sensing Module Cabinet-Mounted, see SINAMICS G130 converter built-in units, Supplementary system components.

K52
Second SMC30 Sensor Module Cabinet-Mounted

With option **K50**, the converter cabinet contains an SMC30 Sensor Module Cabinet-Mounted. An additional SMC30 Sensor Module enables reliable actual-value acquisition when using Safety Integrated extended functions (requires a license: Option **K01**).

Options (continued)

K74
Provision of a cabinet-internal 230 V AC auxiliary power supply

If there is no 230 V AC power supply in the plant, option **K74** can be used to provide a cabinet-internal auxiliary power supply for the required auxiliary voltages of the external control circuits of the cabinet unit. The auxiliary voltages are generated by a transformer.

Note:

If there is no 230 V AC power supply in the plant, it is essential to select option **K74** in order to ensure proper functioning of the following SINAMICS G150 cabinet units:

- Type 6SL3710-2...
- Type 6SL3710-1... for options **B00, G61, K50, L13, L26 > 800 A, L57, L59, L60, L83, L84, L86** and **L87** for cabinet version A

Options **L50** and **L55** always require an external supply voltage and must not be supplied via option **K74**.

K82
Terminal Module for controlling the Safe Torque Off and Safe Stop 1 safety functions

The Terminal Module is used to control the "Safety Integrated basic functions" with isolation

- Safe Torque Off (STO) and
- Safe Stop 1 (SS1) (time-controlled)

over a wide voltage range from DC/AC 24 V to 240 V (terminology according to IEC 61800-5-2).

As a consequence, the STO and SS1 safety functions can be flexibly controlled by the plant signal voltages.

The integrated safety functions, starting from the Safety Integrated (SI) input terminals of the components (Control Unit and Power Module), satisfy the requirements of EN 61800-5-2, EN 60204-1, DIN EN ISO 13849-1 Category 3 for Performance Level (PL) d and IEC 61508 SIL 2.

With option **K82**, the requirements specified in EN 61800-5-2, EN 60204-1, DIN EN ISO 13849-1 Category 3 for Performance Level (PL) d and IEC 61508 SIL 2 are fulfilled.

The Safety Integrated functions using option **K82** are only available in conjunction with certified components and software versions.

The Safety Integrated functions of SINAMICS are generally certified by independent institutes. An up-to-date list of certified components is available on request from your local Siemens office.

K87
TM54F Terminal Module

The TM54F Terminal Module is a terminal expansion module with safe digital inputs and outputs for controlling the Safety Integrated functions.

The TM54F provides four fail-safe digital outputs and ten fail-safe digital inputs. A fail-safe digital output consists of one 24 V DC switching output, one output switching to ground and one digital input to check the switching state. A fail-safe digital input consists of two digital inputs.

For a description of the TM54F Terminal Module, see SINAMICS G130 converter built-in units, Supplementary system components.

K88
SBA Safe Brake Adapter, 230 V AC

Safe Brake Control (SBC) is a safety function that is used in safety-related applications. In the no-current state, the brake acts on the drive motor using spring force. The brake is released when current flows in it (low active).

The SBA Safe Brake Adapter is installed in the converter cabinet in the factory. An infeed is connected to terminal -X12 on the SBA Safe Brake Adapter for the power supply. For control, a connection is also made between the SBA and the Control Interface Module in the factory using a cable harness.

On the plant side, to control the brake, a connection must be made between terminal -X14 on the SBA Safe Brake Adapter and the brake.

For a description of the SBA Safe Brake Adapter, see SINAMICS G130 converter built-in units, Supplementary system components.

K95
CU320-2 PN Control Unit (PROFINET)

Instead of the CU320-2 DP Control Unit (PROFIBUS) supplied as standard, the converter is supplied with a CU320-2 PN (PROFINET).

For a description of the CU320-2 Control Unit, see SINAMICS G130 converter built-in units, Supplementary system components.

L00
Use in the first environment according to EN 61800-3, Category C2 (TN systems or TT systems with grounded neutral point)

To limit the **emitted interference**, the converters are equipped as standard with a radio interference suppression filter that conforms to the limits defined in Category C3. SINAMICS G150 converters equipped with a line filter also meet the limits for use in the first environment (Category C2) according to EN 61800-3 [1].

SINAMICS G150 units comply with the **noise immunity** requirements defined in this standard for the first and second environments.

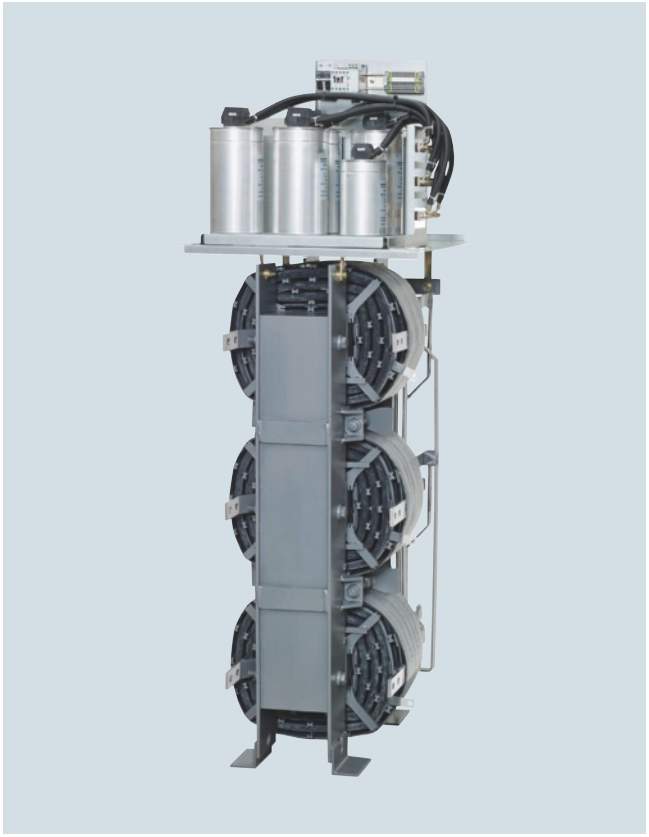
In conjunction with line reactors, line filters also limit the conducted interference emitted by the Power Modules to the limit values of Category C2 defined in product standard EN 61800-3. For converter power ratings > 500 kW, option **L23** must also be ordered (not required when option **L01** has been selected).

To allow the power cable shield to be connected in conformance with EMC requirements, an additional EMC shield bus (option **M70**) is installed at the converter input and output. A separate order is not required in this case.

[1] Applies to motor cable lengths < 100 m.

Options (continued)

L01
Clean Power version with integrated Line Harmonics Filter compact



Instead of the line reactor, a line harmonics filter is integrated in the control cabinet; this minimizes the harmonics that occur due to the principle of operation. As a consequence, the unit fully complies with the limit values stipulated in standard IEEE 519: 1992 without any exceptions (precondition: $u_k \leq 5\%$ or RSC ≥ 20).

Option **L01** always requires electrical separation from the line supply, this means for converters in a single circuit, for converter currents ≤ 800 A, option **L13** and for converter currents > 800 A, option **L26**. For converters with power units connected in parallel, electrical separation from the line supply is included as standard.

SINAMICS G150 Clean Power with integrated Line Harmonics Filter is available for power ratings up to 1500 kW in all available degrees of protection up to IP54 (see options M21 to M54).

Notice:

When using option **L01** on 60 Hz line supplies, a restricted voltage tolerance of +8% applies!

Note:

Option **L01** is not available for converters > 1500 kW with power units connected in parallel and cannot be combined with the following options:

- **L22** (without line reactor)
- **L23** (line reactor u_k = 2%)
- **M66** (marine version)

Power loss, width and weight of the SINAMICS G150 Clean Power converter cabinet units

SINAMICS G150 Clean Power 6SL3710-...	Type rating	Power loss at 50 Hz/60 Hz [1]	Width	Weight
Z = +L01	kW	kW	mm	kg
380 ... 480 V 3 AC				
1GE32-1AA3-Z	110	5.36/4.52	1200	685
1GE32-6AA3-Z	132	6.26/5.34	1200	685
1GE33-1AA3-Z	160	7.38/6.57	1200	940
1GE33-8AA3-Z	200	8.28/7.17	1400	940
1GE35-0AA3-Z	250	10.03/9.01	1400	955
1GE36-1AA3-Z	315	12.77/12.2	1800	1115
1GE37-5AA3-Z	400	15.22/14.5	1800	1170
1GE38-4AA3-Z	450	15.72/15	1800	1200
1GE41-0AA3-Z	560	22.07/21.45	2200	1580
2GE41-1AA3-Z	630	25.34/24.4	3600	2430
2GE41-4AA3-Z	710	30.24/29	3600	2550
2GE41-6AA3-Z	900	31.14/30	3600	2970
500 ... 600 V 3 AC				
1GF31-8AA3-Z	110	6.93/6.5	1200	705
1GF32-2AA3-Z	132	7.33/6.9	1200	705
1GF32-6AA3-Z	160	9.68/8.95	1200	755
1GF33-3AA3-Z	200	10.78/9.95	1200	755
1GF34-1AA3-Z	250	13.97/13.1	1800	1130
1GF34-7AA3-Z	315	13.67/13.9	1800	1130
1GF35-8AA3-Z	400	16.07/16.2	1800	1270
1GF37-4AA3-Z	500	19.32/19.6	2200	1730
1GF38-1AA3-Z	560	20.72/20.9	2200	1730
2GF38-6AA3-Z	630	27.14/27.8	3600	2460
2GF41-1AA3-Z	710	31.94/32.4	3600	2460
2GF41-4AA3-Z	1000	37.04/39.2	4400	3780
660 ... 690 V 3 AC				
1GH28-5AA3-Z	75	3.71	1200	655
1GH31-0AA3-Z	90	4.11	1200	655
1GH31-2AA3-Z	110	4.96	1200	695
1GH31-5AA3-Z	132	5.06	1200	695
1GH31-8AA3-Z	160	6.93	1200	935
1GH32-2AA3-Z	200	7.33	1200	935
1GH32-6AA3-Z	250	9.68	1200	975
1GH33-3AA3-Z	315	10.78	1200	975
1GH34-1AA3-Z	400	13.97	1800	1150
1GH34-7AA3-Z	450	14.97	1800	1150
1GH35-8AA3-Z	560	18.17	1800	1250
1GH37-4AA3-Z	710	20.12	2200	1900
1GH38-1AA3-Z	800	21.32	2200	1940
2GH41-1AA3-Z	1000	36.04	3600	2560
2GH41-4AA3-Z	1350	39.84	4400	3780
2GH41-5AA3-Z	1500	42.24	4400	3860

[1] Associated voltages for 50 Hz/60 Hz, see Section Technical specifications.

Options (continued)

L07
dv/dt filter compact plus Voltage Peak Limiter

dv/dt filters compact plus VPL (**V**oltage **P**eak **L**imiter) limit the voltage rate-of-rise dv/dt to values of < 1600 V/µs and the typical voltage peaks to the following values in accordance with the limit value curve A according to IEC 60034-25: 2007:

- < 1150 V at U_{line} < 575 V
- < 1400 V at 660 V < U_{line} < 690 V

The dv/dt filter compact plus VPL functionally consists of two components that are supplied as a compact mechanical unit, the dv/dt reactor and the voltage limiting network (VPL), which limits voltage peaks and feeds back the energy to the DC link. It is so compact that it can be completely integrated into the cabinet, even for high power ratings. A supplementary cabinet is not required.

By using a dv/dt filter compact plus VPL, standard motors with standard insulation and without insulated bearings can be used with supply voltages up to 690 V in converter operation.

dv/dt filters compact plus VPL are designed for the following maximum motor cable lengths:

- Shielded cables: 100 m (e.g. Protodur NYCWY)
- Unshielded cables: 150 m (e.g. Protodur NYY)

For longer cable lengths (> 100 m shielded, >150 m unshielded), the dv/dt filter plus VPL (option **L10**) should be used.

Notice:

- Operation with output frequencies < 10 Hz is permissible for max. 5 min.
- The maximum permissible output frequency is 150 Hz.

The appropriate information in the SINAMICS Low Voltage Engineering Manual should also be carefully observed.

Note:

Option **L07** cannot be combined with the following options:

- **L08** (motor reactor)
- **L10** (dv/dt filter plus VPL)
- **L15** (sine-wave filter)
- **M78** (motor connection from above)

L08
Motor reactor

Motor reactors reduce the voltage load on the motor windings by reducing the voltage gradients at the motor terminals that occur during converter operation. At the same time, the capacitive charge/discharge currents that place an additional load on the converter output when long motor cables are used, are reduced. The maximum permissible output frequency when a motor reactor is used is 150 Hz.

Motor reactors are designed for the following maximum motor cable lengths:

- Shielded cables: 300 m (e.g. Protodur NYCWY)
- Unshielded cables: 450 m (e.g. Protodur NYY)

Note:

Option **L08** cannot be combined with the following options:

- **L07** (dv/dt filter compact plus VPL)
- **L10** (dv/dt filter plus VPL)
- **L15** (sine-wave filter)
- **M78** (motor connection from above)

L10
dv/dt filter plus Voltage Peak Limiter

dv/dt filters plus VPL (Voltage Peak Limiter) limit the voltage rate-of-rise dv/dt to values < 500 V/µs and the typical voltage peaks to the following values in accordance with the limit value curve according to IEC/TS 60034-17: 2006:

- < 1000 V at U_{line} < 575 V
- < 1250 V at 660 V < U_{line} < 690 V

The dv/dt filter plus VPL functionally consists of two components, the dv/dt reactor and the voltage limiting network (VPL), which limits voltage peaks and feeds the energy back to the DC link.

Depending on the converter output rating, option **L10** can be accommodated in the converter cabinet unit or an additional cabinet of 400 mm or 600 mm width is required.

Voltage range	Installation of the dv/dt filter plus VPL within the converter cabinet unit	Installation of the dv/dt filter plus VPL in an additional cabinet
V	kW	kW
380 ... 480	110 ... 250	315 ... 900
500 ... 600	110 ... 200	250 ... 1000
660 ... 690	75 ... 315	400 ... 2700

By using a dv/dt filter plus VPL, standard motors with standard insulation and without insulated bearings can be used with supply voltages up to 690 V in converter operation.

dv/dt filters plus VPL are designed for the following maximum motor cable lengths:

- Shielded cables: 300 m (e.g. Protodur NYCWY)
- Unshielded cables: 450 m (e.g. Protodur NYY)

For cable lengths < 100 m shielded or < 150 m unshielded, the dv/dt filter compact plus VPL (option **L07**) can be advantageously used.

The appropriate information in the SINAMICS Low Voltage Engineering Manual should also be carefully observed.

Note:

Option **L10** cannot be combined with the following options:

- **L07** (dv/dt filter compact plus VPL)
- **L08** (motor reactor)
- **L15** (sine-wave filter)
- **M78** (motor connection from above)

Options (continued)

L13
Line contactor (for currents ≤ 800 A for single connection)

SINAMICS G150 converter cabinet units in a single connection do not have a line contactor as standard. Option **L13** is required if a switching element is required for disconnecting the cabinet from the supply (required for EMERGENCY OFF). The contactor is controlled and powered inside the converter. For devices with rated input currents > 800 A in single connection, the function of option **L13** is provided by option **L26**.

Note:

For converters with power units connected in parallel, the line contactor is included as standard.

Terminal -X50:	Meaning
4	Checkback contact (NO contact), contactor closed
5	Checkback contact (NC contact), contactor closed
6	Common potential

L15
Sine-wave filter

Sine-wave filters are available in the voltage range 380 V to 480 V up to a type rating of 250 kW, and in the voltage range 500 V to 600 V up to a type rating of 132 kW.

The sine-wave filter at the converter output supplies almost perfect sinusoidal voltages to the motor so that standard motors can be used without special insulation and without insulated bearings. The sine-wave filter also reduces the converter-related supplementary motor noise. The maximum permissible motor supply cable length is limited to 300 m.

Notice:

In conjunction with the option **L15**, the pulse frequency of the converter must be increased. This reduces the power available at the converter output (for the derating factor, see SINAMICS Low Voltage Engineering Manual). The modulation depth of the output voltage decreases to approx. 85% (380 V to 480 V) or approx. 83% (500 V to 600 V). The maximum output frequency is 150 Hz (for 380 V to 480 V) or 115 Hz (for 500 V to 600 V). It should be noted that the reduced voltage at the motor terminals compared to the rated motor voltage means that the motor switches to field weakening mode earlier.

Note:

Option **L15** cannot be combined with the following options:

- **L07** (dv/dt filter compact plus VPL)
- **L08** (motor reactor)
- **L10** (dv/dt filter plus VPL)
- **M78** (motor connection from above)

L19
Connection for external auxiliary equipment

An outgoing, controlled feeder fused with max. 10 A for external auxiliary equipment (e.g. motor external fan).

The voltage is tapped at the converter input upstream of the main contactor / circuit breaker and, therefore, has the same level as the supply voltage.

The outgoing feeder can be controlled internally by the converter or externally.

Terminal -X155:	Meaning	Range
1	L1	380 ... 690 V AC
2	L2	380 ... 690 V AC
3	L3	380 ... 690 V AC
11	Contactor control	230 V AC
12	Contactor control	230 V AC
13	Feedback signal, circuit breaker	230 V AC / 0.5 A; 24 V DC / 2 A
14	Feedback signal, circuit breaker	230 V AC / 0.5 A; 24 V DC / 2 A
15	Feedback signal, contactor	230 V AC / 6 A
16	Feedback signal, contactor	230 V AC / 6 A
PE	PE	

L21
Surge suppression

In ungrounded IT systems, the line voltage is not permanently connected to the ground potential because of the missing ground connection of the supply network. Therefore, when a ground fault occurs during operation, a voltage against ground increased by a factor of 2 can occur. For this reason, it is recommended that a surge suppression against ground be installed for operation on IT systems. The surge suppression option includes the installation of line-side surge arresters and upstream fuses for each system phase. The signaling contacts of the surge arresters are connected in series for the monitoring and connected to a customer interface.

Note:

Option **L21** does not include the installation of an insulation monitor for the IT system. An insulation monitor should always be ordered separately as option **L87** when the supplying IT system is not monitored at another position (e.g. at the transformer outgoing feeder). Only one insulation monitor can be used in each galvanically coupled network.
Option **L21** also does not include the factory-side removal of the metal bracket which establishes the connection to ground of the radio interference suppression filter installed as standard. The metal bracket should therefore be removed during the installation or commissioning of the converter if the device is to be operated on an ungrounded IT system.

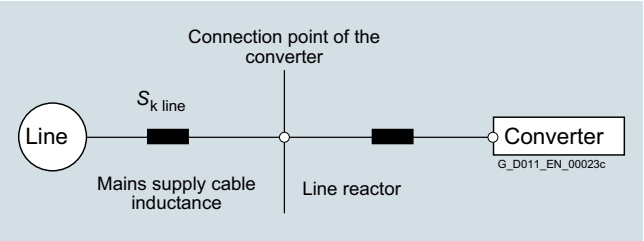
Options (continued)

L22
Scope of delivery without line reactor (for converters ≤ 500 kW)
L23
Line reactor u_k = 2% (for converters > 500 kW)

The line reactor is included as standard in converters up to 500 kW. For converter power ratings > 500 kW, including the parallel connections, the line reactor (u_K = 2%) is optionally available, as in this power range, the converter is often connected to the medium-voltage line supply via transformers that are adapted to the converter rating.

A line reactor is needed for high short-circuit power levels, partly to protect the actual converter against excessive harmonic currents, and thus against overload, and partly to limit the line harmonics to the permissible values. The harmonic currents are limited by the complete inductance comprising the line reactor and line supply cable inductance. Line reactors can be omitted if the line supply cable inductance is increased sufficiently, i.e. the RSC value must be sufficiently small.

RSC = Relative Short-Circuit power: Ratio of short-circuit power $S_{K\ line}$ at the supply connection point to fundamental apparent output S_{conv} of the connected converters (according to EN 50178/VDE 0160).

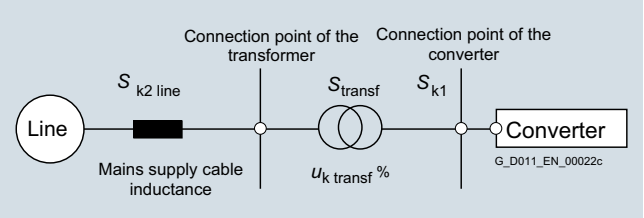


The following applies for SINAMICS G150 converter cabinet units:

Type rating	**Line reactor can be omitted**		**Line reactor required**	
kW	For RSC	Order code (option)	For RSC	Order code (option)
<200	≤43	**L22**	>43	–
200 ... 500	≤33	**L22**	>33	–
≥500	≤20	–	>20	**L23**

It is recommended that a line reactor is always connected on the line side of the converter, as in practice, it is often not known on which supply configuration individual converters are to be operated, i.e. which supply short-circuit power is present at the converter connection point.

The line reactor can only be omitted (option **L22**) if the values for RSC are lower than those shown in the table. This is the case, as shown in the following diagram, when the converter is connected to the line supply via a transformer with the appropriate rating.



As high-rating converters are usually connected to medium-voltage supply systems via transformers to reduce their harmonic effects on the supply, cabinet units over 500 kW are not equipped with line reactors as standard.

A line reactor (option **L23**) is always required when

- For cabinet units > 500 kW, the RSC ratio is > 20, or
- Several converters are connected to the same line connection point
- For cabinet units in a parallel connection, the line supply is not fed-in through a three-winding transformer, or
- A line filter is used

For further information, please refer to the SINAMICS Low Voltage Engineering Manual.

Note:

When option **L01** is selected, a line reactor is not required (options **L22**/**L23** and **L01** cannot be combined).

L26
Main switch incl. fuses or circuit breakers

A switch disconnector with fuses is available as main switch for converters in single connection with ratings up to 800 A. With currents above 800 A, a circuit breaker is used instead of a switch disconnector. The circuit breaker is controlled and supplied within the converter.

Option L26 is included as standard for converters with power units connected in parallel and a rated input current of ≥ 1500 A. Circuit breakers are installed in this case. For rated input currents < 1500 A, by selecting option **L26**, main switches including fuses are installed in addition to the line contactors provided as standard.

L45
EMERGENCY OFF pushbutton installed in the cabinet door

Option **L45** only includes the EMERGENCY OFF pushbutton. This is fitted with a protective collar in the cabinet door of the converter. The contacts of the pushbutton are brought out and connected to a terminal block. The EMERGENCY OFF functions, Category 0 or 1, can be activated in conjunction with options **L57**, **L59** and **L60** .

Notice:

By pressing the EMERGENCY OFF pushbutton, in compliance with IEC 60204-1 (VDE 0113), the motor is stopped – either uncontrolled or controlled depending on the selected Category 0 or 1 – and the converter disconnected from the line supply. Auxiliary voltages such as the supply for an external fan or anti-condensation heating may still be present. Certain areas within the converter also remain live (under voltage), such as the control or auxiliary equipment. If complete disconnection of all voltages is required, the EMERGENCY OFF pushbutton must be incorporated into a protective system to be implemented by the customer. For this purpose, an NC contact is provided at terminal -X120.

The EMERGENCY OFF button is preconfigured at the factory only when one of the options **L57** to **L60** is selected simultaneously. Additional wiring must be provided at the plant.

Options (continued)

L50
Cabinet lighting with service socket

With option **L50**, cabinet lighting is included with an additional service socket for a SCHUKO connector (connector type F) according to CEE 7/4. The power supply for the cabinet lighting and the service socket is external and must be fuse-protected for max. 10 A.

The cabinet lighting consists of an LED hand lamp with On/Off switch and with magnetic fasteners on an approx. 3 m long connecting cable. The lamp is factory-positioned in the cabinet door at a defined marking, and the connecting cable is wound on the associated mount.

L55
Anti-condensation heating for cabinet

The anti-condensation heating is recommended at low ambient temperatures and high levels of humidity to prevent condensation. A 100 W cabinet heater is installed in each cabinet section (two heaters are installed per cabinet with cabinet section widths of between 800 mm and 1200 mm).

The power supply for the anti-condensation heating (110 V to 230 V AC, at terminal block -X240) must be provided externally and fused with max. 16 A.

Terminal -X240:	Meaning
1	L1 (110 ... 230 V AC)
2	N
3	PE

L57
EMERGENCY OFF Category 0, 230 V AC or 24 V DC

EMERGENCY OFF Category 0 for uncontrolled stopping according to EN 60204-1.

The function includes interrupting the power supply for the converter via the line contactor and bypassing the microprocessor controller using a safety combination according to EN 60204-1. The motor coasts to a standstill. When delivered, the pushbutton circuit is preset to 230 V AC. Jumpers must be appropriately set when using 24 V DC.

Notice:

Option **L57** always requires electrical separation from the line supply, this means for converters in a single circuit, for converter currents ≤ 800 A, option **L13** and for converter currents > 800 A, option **L26**. For converters with power units connected in parallel, electrical separation from the line supply is included as standard.

Terminal -X120:	Meaning
7	Loop in the EMERGENCY OFF pushbutton from the plant side; remove jumper 7-8!
8	Loop in the EMERGENCY OFF pushbutton from the plant side; remove jumper 7-8!
15	"On" for monitored start; remove jumper 15-16!
16	"On" for monitored start; remove jumper 15-16!
17	Checkback signal, "Safety combination has tripped"
18	Checkback signal, "Safety combination has tripped"

L59
EMERGENCY STOP Category 1, 230 V AC

EMERGENCY STOP Category 1 for controlled stopping according to EN 60204-1.

The function stops the drive using a fast stop along a down ramp that is parameterized by the user. The power supply to the converter is then interrupted as described for EMERGENCY OFF Category 0.

In order to maintain the specified stopping times, it may be necessary to use a braking unit.

Notice:

Option **L59** always requires electrical separation from the line supply, this means for converters in a single circuit, for converter currents ≤ 800 A, option **L13** and for converter currents > 800 A, option **L26**. For converters with power units connected in parallel, electrical separation from the line supply is included as standard.

Terminal -X120:	Meaning
7	Loop in the EMERGENCY OFF pushbutton from the plant side; remove jumper 7-8!
8	Loop in the EMERGENCY OFF pushbutton from the plant side; remove jumper 7-8!
15	"On" for manual start; remove jumper 15-16!
16	"On" for manual start; remove jumper 15-16!
17	Checkback signal, "Safety combination has tripped"
18	Checkback signal, "Safety combination has tripped"

L60
EMERGENCY STOP Category 1, 24 V DC

EMERGENCY STOP Category 1 for controlled stopping according to EN 60204-1.

The function stops the drive using a fast stop along a down ramp that is parameterized by the user. The power supply to the converter is then interrupted as described for EMERGENCY OFF Category 0.

In order to maintain the specified stopping times, it may be necessary to use a braking unit.

Notice:

Option **L60** always requires electrical separation from the line supply, this means for converters in a single circuit, for converter currents ≤ 800 A, option **L13** and for converter currents > 800 A, option **L26**. For converters with power units connected in parallel, electrical separation from the line supply is included as standard.

Terminal -X120:	Meaning
7	Loop in the EMERGENCY OFF pushbutton from the plant side; remove jumper 7-8!
8	Loop in the EMERGENCY OFF pushbutton from the plant side; remove jumper 7-8!
15	"On" for manual start; remove jumper 15-16!
16	"On" for manual start; remove jumper 15-16!
17	Checkback signal, "Safety combination has tripped"
18	Checkback signal, "Safety combination has tripped"

Options (continued)

L61, L62
Braking units

Braking units may be required for drives in which motors might operate in generator mode, but have no facility for feeding energy back into the supply system.

The braking unit comprises two components:

- A Braking Module that is installed in the converter cabinet
- A braking resistor to be mounted externally (IP20 degree of protection).

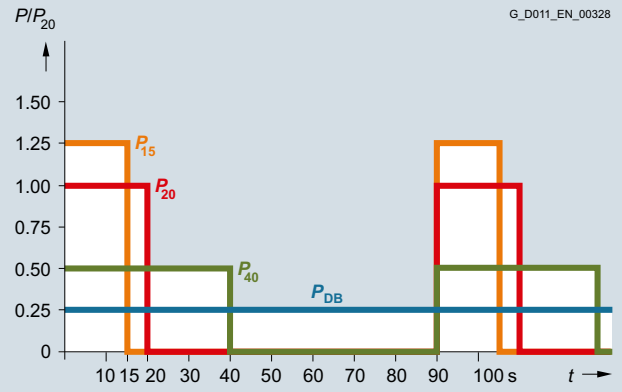
The braking unit functions as an autonomous unit, and does not require an external power supply. The braking energy is converted into heat in the braking resistor that must be mounted externally.

A max. cable length of 100 m is permissible between the Braking Module and the braking resistor. This allows the braking resistor to be mounted externally so that heat losses can be dissipated outside the converter enclosure.

The braking resistor is connected to terminal block –X5 on the converter cabinet unit:

Terminal -X5:	Meaning
1	Braking resistor connection
2	Braking resistor connection

Characteristic curves



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 Modules and braking resistors

Information about possible duty cycles of the braking units and other configuration notes are contained in the SINAMICS Low Voltage Engineering Manual.

The following braking units are available for SINAMICS G150 converters – depending on the converter type:

Option	SINAMICS G150 converter cabinet units	Braking Module				Braking resistor R_B
	Type rating	P_{DB}	P_{40}	P_{20}	P_{15}	
	kW	kW	kW	kW	kW	Ω
380 ... 480 V 3 AC						
L61	110 ... 132	25	50	100	125	4.4 ±7.5 %
L62	160 ... 900	50	100	200	250	2.2 ±7.5 %
3500 ... 600 V AC						
L62	110 ... 1000	50	100	200	250	3.4 ±7.5 %
660 ... 690 V 3 AC						
L61	75 ... 132	25	50	100	125	9.8 ±7.5 %
L62	160 ... 2700	50	100	200	250	4.9 ±7.5 %

P_{DB}: Rated power (continuous braking power)
P_{40}: 40 s power in relation to a braking interval of 90 s
P_{20}: 20 s power in relation to a braking interval of 90 s
P_{15}: 15 s power in relation to a braking interval of 90 s

A second 50 kW braking unit can be used in converters with power units connected in parallel in order to increase the braking power. In this case, a Braking Module is assigned to each braking resistor. You can order a second braking unit by selecting option **L62** twice.

If more braking power is required than provided by the braking units listed here, then braking units may be connected in parallel for higher converter outputs (on request).
For further information, please refer to the SINAMICS Low Voltage Engineering Manual.

L76
Quick start (for option L01)

If **L01** (line harmonics filter) is in use, after the converter has been switched off, as a result of the principle of operation, a waiting period of at least 30 seconds must be allowed to elapse before switching on again. With option **L76**, the wait time is shortened to approx. 3 s.

L83
Thermistor motor protection device (alarm)

Thermistor motor protection device for PTC thermistors (PTC resistors, type A) for alarm. The thermistor motor protection device is supplied with power and evaluated internally in the converter.

Terminal -F127:	Meaning
T1	Sensor circuit connection
T2	Sensor circuit connection

Options (continued)

L84
Thermistor motor protection device (trip)

Thermistor motor protection device for PTC thermistors (PTC resistors, type A) for trip. The thermistor motor protection device is supplied with power and evaluated internally in the converter.

Terminal -F125:	Meaning
T1	Sensor circuit connection
T2	Sensor circuit connection

L86
Pt100 evaluation unit

The Pt100 evaluation unit can monitor up to six sensors. The sensors can be connected using a two-wire or three-wire system. The limit values can be freely programmed for each channel.

In the factory setting, the measuring channels are subdivided into two groups, each with three channels. With motors, for example, this means that three Pt100s in the stator windings and two Pt100s in the motor bearings can be monitored. Unused channels can be hidden via parameters.

The output relays are integrated into the internal fault and shutdown sequence of the converter.

L87
Insulation monitoring

An insulation monitor must be used if the converter is connected to an ungrounded line supply. The device monitors the entire galvanically coupled circuit for insulation faults.

An alarm is output in the event of a fault.

Notice:

Only **one** insulation monitor can be used in each galvanically coupled network.

As there are different response strategies when a ground fault occurs in an ungrounded system, output relays of the insulation monitor are provided for integration in a plant-side control. It is also possible to integrate the outputs into the converter monitoring system on the plant side.

Terminal -A1-A101:	Meaning
11	Signaling relay ALARM 1
12	Signaling relay ALARM 1
14	Signaling relay ALARM 1
21	Signaling relay ALARM 2
22	Signaling relay ALARM 2
24	Signaling relay ALARM 2
M+	External kΩ display, 0 – 400 µA
M-	External kΩ display, 0 – 400 µA
R1	External reset button (NC contact or wire jumper, otherwise the error message is not stored)
R2	External reset button (NC contact or wire jumper)
T1	External test button
T2	External test button

Insulation monitoring can be supplied on request for converter cabinet units with power units connected in parallel.

M06
Base 100 mm high, RAL 7022

The additional cabinet base allows larger bending radii for cables (cable inlet from below) and enables them to be routed within the cabinet base.

The cabinet base is supplied in RAL 7022 as standard. A special paint finish is not available for the base. It is delivered completely assembled with the cabinet. The height of the operator panel changes accordingly.

M07
Cable marshalling space 200 mm high, RAL 7035

The cable marshalling space is made of strong sheet steel and allows cables to be connected more flexibly (entry from below). It also allows routing of cables within the marshalling compartment. It is delivered completely assembled with the cabinet. The height of the operator panel changes accordingly.

Note:

The cable compartment is painted as standard with RAL 7035. If a special color is requested for the cabinet (order code **Y09**), the cable-marshaling space is also painted in this color.

M13
Line connection from above

The control cabinet is provided with an additional roof section to allow a line connection from above. The connection lugs for the power cables, the clamping bar for mechanically securing the cables, an EMC shield bus, and a PE busbar are located within this roof section.

This increases the cabinet height by 405 mm. The busbars for the connection from above are delivered completely pre-installed. For transport reasons, the roof sections are delivered separately and must be fitted on site. Crane transport assemblies (option **M90**) can still be used.

However, they must be removed on site before the roof sections can be installed. Use of rope spreaders should be considered in the case of small crane hook heights.

An undrilled aluminum mounting plate (5 mm thick) is provided in the roof section for feeding in the cables. Depending on the number of cables and the cross-sections used, holes for attaching cable glands for feeding in the cables must be drilled in this mounting plate on site.

Notice:

The control cables are still connected from below. When option **M13** is selected, the standard line connection from below is omitted.

The degree of protection of the roof sections is IP21. In combination with options **M23, M43** and **M54** , additional plastic ventilation grilles and filter elements are provided.

Note:

The roof sections are painted in RAL 7035 as standard. If a special color is requested for the cabinet (order code **Y09**), the roof sections are also painted in this color. Ventilation grilles used with IP23, IP43 and IP54 degrees of protection are in RAL 7035 and cannot be painted.

Option **M13** is not available for converters > 1500 kW with power units connected in parallel.

Options (continued)

M21
Degree of protection IP21

Cabinet version in IP20, but with additional top cover or canopy. This increases the cabinet height by 250 mm.

For transport reasons, the top covers or canopies are delivered separately and must be fitted on site.

Note:

The top covers or canopies are painted in RAL 7035 as standard. If a special color is requested for the cabinet (order code **Y09**), the top covers or canopies will also be painted this color.

M23/M43/M54
Degree of protection IP23/IP43/IP54

When **M23, M43** or **M54** is selected, the converter is equipped with a roof section. This increases the cabinet height by 400 mm.

For transport reasons, the roof sections are delivered separately and must be fitted on site.

Note:

The roof sections are painted in RAL 7035 as standard. If a special color is requested for the cabinet (order code **Y09**), the roof sections are also painted in this color. The molded plastic parts (e.g. ventilation grilles) are in RAL 7035 and cannot be painted.

M66
Marine version

For compliance with the requirements of the classification institutes:

- Lloyds Register
- American Bureau of Shipping
- Germanischer Lloyd
- Bureau Veritas
- Det Norske Veritas
- Chinese Classification Society

This option includes a strengthened mechanical version of the cabinet, handles (handrail) below the operator panel and mechanical locking of the cabinet doors. The cabinet has degree of protection IP23 (option **M23**) and includes a cabinet anti-condensation heater (option **L55**). To attach the converter to the ship's deck, a welding frame (5 mm high) is supplied separately.

Option **M66** is not available for converters > 1500 kW with power units connected in parallel.

Note:

A combination with options **M21, M23** and **L01** or **L55** is not possible. If the converter is used for a safety-relevant drive on a ship, then individual certification is also required (see options E11 to E71) – these include option **M66**.

M70
EMC shield bus (cable connection from below)

The EMC shield bus is used to connect shielded line and motor supply cables. The EMC shield bus is included as standard with option **L00** (RFI suppression filter).

M75
PE busbar (cable connection from below)

The PE busbar is used to connect and secure PE cables. The PE busbar is contained as standard in version A. For version C, the PE busbar can be ordered separately as option **M75**.

M78
Motor connection from above

The control cabinet is provided with an additional roof section for a motor connection from above. The connection lugs for the power cables, the clamping bar for mechanically securing the cables, an EMC shield bus, and a PE busbar are located within this roof section.

This increases the cabinet height by 405 mm. The busbars for the connection from above are delivered completely pre-installed. For transport reasons, the roof sections are delivered separately and must be fitted on site. Crane transport assemblies (option **M90**) can still be used. However, they must be removed on site before the roof sections can be installed.

An undrilled aluminum mounting plate (5 mm thick) is provided in the roof section for feeding in the cables. Depending on the number of cables and the cross-sections used, holes for attaching cable glands for feeding in the cables must be drilled in this mounting plate on site.

Notice:

The control cables are still connected from below. When option **M78** is selected, the standard motor connection from below is omitted. A combination with motor-side options **L07**, **L08, L10** and **L15** is not possible. If option **L61** or **L62** is selected at the same time as option **M78**, the braking-resistor should also be connected from above.

The degree of protection of the roof sections is IP21. In combination with options **M23, M43** and **M54** , additional plastic ventilation grilles and filter elements are provided.

Note:

The roof sections are painted in RAL 7035 as standard. If a special color is requested for the cabinet (order code **Y09**), the roof sections are also painted in this color. Ventilation grilles used with IP23, IP43 and IP54 degrees of protection are in RAL 7035 and cannot be painted.
Option **M78** is not available for converters > 1500 kW with power units connected in parallel

M90
Crane transport assembly (top-mounted)

For single cabinets up to a width of 600 mm, the crane transport assembly consists of transport eyebolts. For cabinet widths of 800 mm and wider, transport rails are used.

Rope spreaders should be used for low crane hook heights.

Options (continued)

M91
Marking of all control cable conductor ends

When this option is selected, all control cables or conductor ends (including all customer-specific options) are labeled throughout the cabinet.

T58, T60, T80, T85, T91
Rating plate data

The standard version of the rating plate is in English/German.

A rating plate in another language can be selected using the following order code for the option.

Order code	Rating plate language
T58	English/French
T60	English/Spanish
T80	English/Italian
T85	English/Russian
T91	English/Chinese

Y09
Special cabinet paint finish

The converter cabinet units are delivered in RAL7035 as standard. The special paint finish must be specified in plain text when ordering. All RAL colors which are available as powder coatings can be selected.

Note:

If options such as cable marshalling space (order code **M07**), top covers or canopies (order code **M21**), roof sections (order codes **M23/M43/M54**) or cable connection from above (order codes **M13/M78**) are ordered for the converter cabinet units, they will also be supplied in the paint finish specified in the order. The molded plastic parts (e.g. ventilation grilles) are in RAL 7035 and cannot be painted.

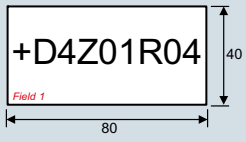
Y31
One-line label for system identification, 40 × 80 mm

Resopal labels (white with black lettering) for identifying the control cabinets are available. The labels are stuck to the cabinet door.

Dimensions H × W: 40 × 80 mm

The text must be specified in plain text when ordering.

Field 1: Max. 9 characters, font size 10 mm.



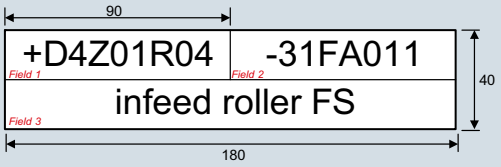
Y32
Two-line label for system identification, 40 × 180 mm

Resopal labels (white with black lettering) for identifying the control cabinets are available. The labels are stuck to the cabinet door.

Dimensions H × W: 40 × 180 mm

The text must be specified in plain text when ordering.

Field 1: Max. 9 characters, font size 10 mm
Field 2: Max. 9 characters, font size 10 mm
Field 3: Max. 20 characters, font size 10 mm.



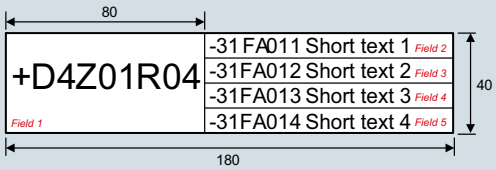
Y33
Four-line label for system identification, 40 × 180 mm

Resopal labels (white with black lettering) for identifying the control cabinets are available. The labels are stuck to the cabinet door.

Dimensions H × W: 40 × 180 mm

The text must be specified in plain text when ordering.

Field 1: Max. 9 characters, font size 10 mm
Field 2: Max. 20 characters, font size 6 mm
Field 3: Max. 20 characters, font size 6 mm
Field 4: Max. 20 characters, font size 6 mm
Field 5: Max. 20 characters, font size 6 mm



Technical specifications

The most important directives and standards are listed below. These are used as basis for the SINAMICS G150 converter cabinet units and they must be carefully observed to achieve an EMC-compliant configuration that is safe both functionally and in operation.

European directives	
2006/95/EC	Low-voltage directive: Directive of the European Parliament and Council of December 12, 2006, on the approximation of the laws of the member states relating to electrical equipment designed for use within certain voltage limits
2006/42/EC	Machinery directive: Directive of the European Parliament and Council of May 17, 2006 on machinery and for changing Directive 95/16/EC (amendment)
2004/108/EC	EMC directive: Directive of the European Parliament and Council of December 15, 2004, which repeals directive 89/336/EEC, on the approximation of laws of the member states relating to electromagnetic compatibility
European standards	
EN ISO 3744	Acoustics – Determination of the sound power level and sound energy level for noise sources that result from sound pressure measurements – envelope surface procedure of the accuracy class 2 for a largely free sound field over a reflecting plane
EN ISO 13849-1	Safety of machinery – Safety-related parts of control systems Part 1: General design principles (ISO 13849-1:2006) (replaced EN 954-1)
EN 60146-1-1	Semiconductor converters – General requirements and line-commutated converters Part 1-1: Specification of basic requirements
EN 60204-1	Electrical equipment of machines Part 1: General definitions
EN 60529	Degrees of protection provided by enclosures (IP code)
EN 61508-1	Functional safety of electrical/electronic/programmable electronic safety-related systems Part 1: General requirements
EN 61800-2	Adjustable speed electrical power drive systems Part 2: General requirements – Rating specifications for the measurement of low-voltage adjustable frequency AC power drive systems
EN 61800-3	Adjustable speed electrical power drive systems Part 3: EMC product standard including special test procedure
EN 61800-5-1	Adjustable speed electrical power drive systems Part 5: Safety requirements Main section 1: Electrical and thermal requirements
EN 61800-5-2	Adjustable speed electrical power drive systems Part 2: Safety requirements – Functional safety (IEC 61800-5-2:2007)

Technical specifications (continued)

General technical specifications

Electrical specifications		Single connection	Parallel connection
Line voltages and power ranges	• 380 ... 480 V 3 AC ±10% (-15% < 1 min)	110 ... 560 kW	630 ... 900 kW
	• 500 ... 600 V 3 AC ±10% (-15% < 1 min)	110 ... 560 kW	630 ... 1000 kW
	• 660 ... 690 V 3 AC ±10% (-15% < 1 min)	75 ... 800 kW	1000 ... 2700 kW
Line system configurations	Grounded TN/TT systems or ungrounded IT systems (a grounded line conductor is not permissible in 690 V line supplies)		
Line frequency	47 ... 63 Hz		
Output frequency	0 ... 550 Hz[1]		
Line power factor			
- Fundamental	> 0.96		
- Total	0.75 ... 0.93		
Efficiency	> 98%		
Overvoltage category	III according to EN 61800-5-1		
Control method	Vector control with and without encoder or V/f control		
Fixed speeds	15 fixed speeds plus 1 minimum speed, parameterizable (in the default setting, 3 fixed setpoints plus 1 minimum speed are selectable using terminal block / PROFIBUS)		
Speed ranges that can be skipped	4, parameterizable		
Setpoint resolution	0.001 rpm digital 12-bit analog		
Braking operation	Optional via braking unit		
Mechanical specifications			
Degree of protection	IP20 (higher degrees of protection up to IP54 optional)		
Protection class	I according to EN 61800-5-1		
Touch protection	EN 50274 / BGV A3 when used for the intended purpose		
Cabinet system	Rittal TS8, doors with double-bit key, three-section base plates for cable entry		
Paint finish	RAL 7035 (indoor requirements)		
Cooling method	Forced air cooling AF according to EN 60146		
Ambient conditions	**Storage**	**Transport**	**Operation**
Ambient temperature	-25 ... +55° C	-25 ... +70° C as of -40° C for 24 hours	0 ... +40° C to +50° C see derating data
Relative humidity (condensation not permissible)	5 ... 95%	5 ... 95% at 40° C	5 ... 95%
	Class 1K4 according to EN 60721-3-1	Class 2K3 according to EN 60721-3-2	Class 3K3 according to EN 60721-3-3
Environmental class / harmful chemical substances	Class 1C2 according to EN 60721-3-1	Class 2C2 according to EN 60721-3-2	Class 3C2 according to EN 60721-3-3
Organic/biological influences	Class 1B1 according to EN 60721-3-1	Class 2B1 according to EN 60721-3-2	Class 3B1 according to EN 60721-3-3
Degree of pollution	2 according to EN 61800-5-1		
Installation altitude	Up to 2000 m above sea level without derating; > 2000 m see derating data		
Mechanical stability	**Storage**	**Transport**	**Operation**
Vibratory load			
- Deflection	1.5 mm at 5 ... 9 Hz	3.1 mm at 5 ... 9 Hz	0.075 mm at 10 ... 58 Hz
- Acceleration	5 m/s^2 at > 9 ... 200 Hz	10 m/s^2 at > 9 ... 200 Hz	10 m/s^2 at > 58 ... 200 Hz
	Class 1M2 according to EN 60721-3-1	Class 2M2 according to EN 60721-3-2	–
Shock load			
- Acceleration	40 m/s^2 for 22 ms	100 m/s^2 for 11 ms	100 m/s^2 for 11 ms
	Class 1M2 according to EN 60721-3-1	Class 2M2 according to EN 60721-3-2	Class 3M4 according to EN 60721-3-3
Compliance with standards			
CE marking	According to EMC Directive No. 2004/108/EC and Low Voltage Directive No. 2006/95/EC and Machinery Directive No. 2006/42/EC for functional safety		
Radio interference suppression	The SINAMICS G150 converter systems are not designed for connection to the public power network ("first environment"). Radio interference suppression is compliant with the EMC product standard for variable-speed drives EN 61800-3, "Second environment" (industrial networks). EMC disturbances can occur when connected to the public power networks. However, if supplementary measures are taken (e.g. line filter, see option **L00**) operation in the "first environment" is possible. [2]		

Deviations from the specified classes are underlined.

[1] The output frequency is also affected by the selected control method and the pulse frequency. For further information, please refer to the SINAMICS Low Voltage Engineering Manual.

[2] Applies to motor cable lengths < 100 m.

Technical specifications (continued)

Technical specifications for single connection

Line voltage 380 ... 480 V 3 AC		SINAMICS G150 converter cabinet units 6SL3710-1GE..-....								
Single connection		**32-1.A3**	**32-6.A3**	**33-1.A3**	**33-8.A3**	**35-0.A3**	**36-1.A3**	**37-5.A3**	**38-4.A3**	**41-0.A3**
Type rating										
• For I_L at 50 Hz 400 V [1]	kW	**110**	**132**	**160**	**200**	**250**	**315**	**400**	**450**	**560**
• For I_H at 50 Hz 400 V [1]	kW	90	110	132	160	200	250	315	400	450
• For I_L at 60 Hz 460 V [2]	hp	150	200	250	300	400	500	600	600	800
• For I_H at 60 Hz 460 V [2]	hp	125	150	200	250	350	350	450	500	700
Output current										
• Rated current I_n	A	210	260	310	380	490	605	745	840	985
• Base-load current I_L [3]	A	205	250	302	370	477	590	725	820	960
• Base-load current I_H [4]	A	178	233	277	340	438	460	570	700	860
Input current										
• Rated input current [5]	A	229	284	338	395	509	629	775	873	1024
• Input current, max.	A	335	410	495	606	781	967	1188	1344	1573
• Current requirement, 24 V DC auxiliary power supply [6]	A	1.1	1.1	1.35	1.35	1.35	1.4	1.4	1.4	1.5
Rated short-circuit current according to IEC [7]	kA	65	65	65	65	65	65	65	84	84
Minimum short-circuit current [8]	A	3000	3600	4400	4400	8000	10000	10500	16000/1800 [9]	18400/2000 [9]
Power loss, max. [10]										
• At 50 Hz 400 V	kW	2.9	3.8	4.4	5.3	6.4	8.2	9.6	10.1	14.4
• At 60 Hz 460 V	kW	2.54	3.36	4.07	4.67	5.96	8.3	9.7	10.2	14.7
Cooling air requirement	m^3/s	0.17	0.23	0.36	0.36	0.36	0.78	0.78	0.78	1.48
Sound pressure level L_{pA} (1 m) at 50/60 Hz	dB	67/68	69/73	69/73	69/73	69/73	70/73	70/73	70/73	72/75
Cable lengths between converter and motor [11]										
• Shielded	m	300	300	300	300	300	300	300	300	300
• Unshielded	m	450	450	450	450	450	450	450	450	450
Dimensions										
• Width for version A/C	mm	800/400	800/400	800/400	1000/400	1000/400	1200/600	1200/600	1200/600	1600/1000
• Height [12]	mm	2000	2000	2000	2000	2000	2000	2000	2000	2000
• Depth	mm	600	600	600	600	600	600	600	600	600
Weight, approx. (degree of protection IP20, without options) for version A/C	kg	460/225	460/225	670/300	670/300	670/300	750/670	750/670	780/670	1100/880

Note: The power data in hp units is based on the NEC/CEC standards for the North American market.

For information on the line connection, motor connection and cabinet grounding, see Section Configuration.

1) Rated output of a typical 6-pole standard induction motor based on I_L or I_H for 3 AC 50 Hz 400 V.

2) Rated output of a typical 6-pole standard induction motor based on I_L or I_H for 3 AC 60 Hz 460 V.

3) 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 duration of 300 s. See Characteristic curves, Section Overload capability.

4) The base-load current I_H is based on a duty cycle of 150% for 60 s or 160% for 10 s with a duty cycle duration of 300 s. See Characteristic curves, Section Overload capability.

5) The currents listed here are based on the rated output current.

6) If the drive control is to remain active after a main infeed failure, the converter must be externally supplied with 24 V DC.
The following must also be taken into account:
– CU320-2: 1 A
– TM31: 0.5 A
– AOP30: 0.2 A
– SMC: 0.6 A
– Current requirement of digital inputs/outputs.

7) In conjunction with the specified fuses or circuit breakers.

8) Minimum current required for reliably triggering the protective devices.

9) For option **L26** (version A) the low value applies.

10) The specified power losses are the maximum values for a utilization of 100%. The values are lower under normal operating conditions.

11) Longer cable lengths for specific configurations are available on request.

12) Version A: The cabinet height increases by
– 250 mm for degree of protection IP21
– 400 mm for degrees of protection IP23, IP43 and IP54
– 405 mm for options **M13** and **M78**
Version C: The cabinet height increases by
– 250 mm for degree of protection IP21
– 400 mm for degrees of protection IP23, IP43 and IP54

Technical specifications (continued)

Line voltage 500 ... 600 V 3 AC		SINAMICS G150 converter cabinet units 6SL3710-1GF..-....								
Single connection		**31-8.A3**	**32-2.A3**	**32-6.A3**	**33-3.A3**	**34-1.A3**	**34-7.A3**	**35-8.A3**	**37-4.A3**	**38-1.A3**
Type rating										
• For I_L at 50 Hz 500 V [1]	kW	**110**	**132**	**160**	**200**	**250**	**315**	**400**	**500**	**560**
• For I_H at 50 Hz 500 V [1]	kW	90	110	132	160	200	250	315	450	500
• For I_L at 60 Hz 575 V [2]	hp	150	200	250	300	400	450	600	700	800
• For I_H at 60 Hz 575 V [2]	hp	150	200	200	250	350	450	500	700	700
Output current										
• Rated current I_n	A	175	215	260	330	410	465	575	735	810
• Base-load current I_L [3]	A	171	208	250	320	400	452	560	710	790
• Base-load current I_H [4]	A	157	192	233	280	367	416	514	657	724
Input current										
• Rated input current [5]	A	191	224	270	343	426	483	598	764	842
• Input current, max.	A	279	341	410	525	655	740	918	1164	1295
• Current requirement, 24 V DC auxiliary power supply [6]	A	1.35	1.35	1.35	1.4	1.4	1.4	1.4	1.5	1.5
Rated short-circuit current according to IEC [7]	kA	65	65	65	65	65	65	65	84	84
Minimum short-circuit current [8]	A	2400	3000	3600	5200	5200	6200	8400	10500	10400/1800 [9]
Power loss, max. [10]										
• At 50 Hz 500 V	kW	3.8	4.2	5	6.1	8.1	7.8	8.7	12.7	14.1
• At 60 Hz 575 V	kW	3.2	3.6	4.1	5.1	6.7	7.5	8.4	12.5	13.8
Cooling air requirement	m^3/s	0.36	0.36	0.36	0.36	0.78	0.78	0.78	1.48	1.48
Sound pressure level L_{pA} (1 m) at 50/60 Hz	dB	69/73	69/73	69/73	69/73	72/75	72/75	72/75	72/75	72/75
Cable lengths between converter and motor [11]										
• Shielded	m	300	300	300	300	300	300	300	300	300
• Unshielded	m	450	450	450	450	450	450	450	450	450
Dimensions										
• Width for version A/C	mm	800/400	800/400	800/400	800/400	1200/600	1200/600	1200/600	1600/1000	1600/1000
• Height [12]	mm	2000	2000	2000	2000	2000	2000	2000	2000	2000
• Depth	mm	600	600	600	600	600	600	600	600	600
Weight, approx. (degree of protection IP20, without options) for version A/C	kg	460/300	460/300	460/300	460/300	750/670	750/670	860/670	1150/940	1150/960

Note: The power data in hp units is based on the NEC/CEC standards for the North American market.

For information on the line connection, motor connection and cabinet grounding, see Section Configuration.

1) Rated output of a typical 6-pole standard induction motor based on I_L or I_H for 3 AC 50 Hz 400 V.

2) Rated output of a typical 6-pole standard induction motor based on I_L or I_H for 3 AC 60 Hz 460 V.

3) 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 duration of 300 s. See Characteristic curves, Section Overload capability.

4) The base-load current I_H is based on a duty cycle of 150% for 60 s or 160% for 10 s with a duty cycle duration of 300 s. See Characteristic curves, Section Overload capability.

5) The currents listed here are based on the rated output current.

6) If the drive control is to remain active after a main infeed failure, the converter must be externally supplied with 24 V DC.
The following must also be taken into account:
– CU320-2: 1 A
– TM31: 0.5 A
– AOP30: 0.2 A
– SMC: 0.6 A
– Current requirement of digital inputs/outputs.

7) In conjunction with the specified fuses or circuit breakers.

8) Minimum current required for reliably triggering the protective devices.

9) For option **L26** (version A) the low value applies.

10) The specified power losses are the maximum values for a utilization of 100%. The values are lower under normal operating conditions.

11) Longer cable lengths for specific configurations are available on request.

12) Version A: The cabinet height increases by
– 250 mm for degree of protection IP21
– 400 mm for degrees of protection IP23, IP43 and IP54
– 405 mm for options **M13** and **M78**
Version C: The cabinet height increases by
– 250 mm for degree of protection IP21
– 400 mm for degrees of protection IP23, IP43 and IP54

Technical specifications (continued)

Line voltage 660 ... 690 V 3 AC		SINAMICS G150 converter cabinet units 6SL3710-1GH..-....						
Single connection		**28-5.A3**	**31-0.A3**	**31-2.A3**	**31-5.A3**	**31-8.A3**	**32-2.A3**	**32-6.A3**
Type rating								
• For I_L at 50 Hz 690 V [1]	kW	**75**	**90**	**110**	**132**	**160**	**200**	**250**
• For I_H at 50 Hz 690 V [1]	kW	55	75	90	110	132	160	200
Output current								
• Rated current I_n	A	85	100	120	150	175	215	260
• Base-load current I_L [2]	A	80	95	115	142	171	208	250
• Base-load current I_H [3]	A	76	89	107	134	157	192	233
Input current								
• Rated input current [4]	A	93	109	131	164	191	224	270
• Input current, max.	A	131	155	188	232	279	341	410
• Current requirement, 24 V DC auxiliary power supply [5]	A	1.1	1.1	1.1	1.1	1.35	1.35	1.35
Rated short-circuit current according to IEC [6]	kA	65	65	65	65	65	65	65
Minimum short-circuit current [7]	A	1500	1500	1200	1600	2400	3000	3600
Power loss, max. [8] at 50 Hz 690 V	kW	1.7	2.1	2.7	2.8	3.8	4.2	5
Cooling air requirement	m^3/s	0.17	0.17	0.17	0.17	0.36	0.36	0.36
Sound pressure level L_{pA} (1 m) at 50/60 Hz	dB	67/68	67/68	67/68	67/68	67/73	67/73	67/73
Cable lengths between converter and motor [9]								
• Shielded	m	300	300	300	300	300	300	300
• Unshielded	m	450	450	450	450	450	450	450
Dimensions								
• Width for version A/C	mm	800/400	800/400	800/400	800/400	800/400	800/400	800/400
• Height [10]	mm	2000	2000	2000	2000	2000	2000	2000
• Depth	mm	600	600	600	600	600	600	600
Weight, approx. (degree of protection IP20, without options) for version A/C	kg	460/225	460/225	460/225	460/225	670/300	670/300	670/300

Note: The power data in hp units is based on the NEC/CEC standards for the North American market.

For information on the line connection, motor connection and cabinet grounding, see Section Configuration.

1) Rated output of a typical 6-pole standard induction motor based on I_L or I_H for 3 AC 50 Hz 400 V.

2) 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 duration of 300 s. See Characteristic curves, Section Overload capability.

3) The base-load current I_H is based on a duty cycle of 150% for 60 s or 160% for 10 s with a duty cycle duration of 300 s. See Characteristic curves, Section Overload capability.

4) The currents listed here are based on the rated output current.

5) If the drive control is to remain active after a main infeed failure, the converter must be externally supplied with 24 V DC.
The following must also be taken into account:
– CU320-2: 1 A
– TM31: 0.5 A
– AOP30: 0.2 A
– SMC: 0.6 A
– Current requirement of digital inputs/outputs.

6) In conjunction with the specified fuses or circuit breakers.

7) Minimum current required for reliably triggering the protective devices.

8) The specified power losses are the maximum values for a utilization of 100%. The values are lower under normal operating conditions.

9) Longer cable lengths for specific configurations are available on request.

10) Version A: The cabinet height increases by
– 250 mm for degree of protection IP21
– 400 mm for degrees of protection IP23, IP43 and IP54
– 405 mm for options **M13** and **M78**
Version C: The cabinet height increases by
– 250 mm for degree of protection IP21
– 400 mm for degrees of protection IP23, IP43 and IP54

Technical specifications (continued)

Line voltage 660 ... 690 V 3 AC		SINAMICS G150 converter cabinet units 6SL3710-1GH..-....					
Single connection		**33-3.A3**	**34-1.A3**	**34-7.A3**	**35-8.A3**	**37-4.A3**	**38-1.A3**
Type rating							
• For I_L at 50 Hz 690 V [1]	kW	**315**	**400**	**450**	**560**	**710**	**800**
• For I_H at 50 Hz 690 V [1]	kW	250	315	400	450	560	710
Output current							
• Rated current I_n	A	330	410	465	575	735	810
• Base-load current I_L [2]	A	320	400	452	560	710	790
• Base-load current I_H [3]	A	280	367	416	514	657	724
Input current							
• Rated input current [4]	A	343	426	483	598	764	842
• Input current, max.	A	525	655	740	918	1164	1295
• Current requirement, 24 V DC auxiliary power supply [5]	A	1.35	1.4	1.4	1.4	1.5	1.5
Rated short-circuit current according to IEC [6]	kA	65	65	84	84	85	85
Minimum short-circuit current [7]	A	5200	5200	6200	8400	10500	10400/1800 [8]
Power loss, max. [9] at 50 Hz 690 V	kW	6.1	8.1	9.1	10.8	13.5	14.7
Cooling air requirement	m^3/s	0.36	0.78	0.78	0.78	1.48	1.48
Sound pressure level L_{pA} (1 m) at 50/60 Hz	dB	67/73	72/75	72/75	72/75	72/75	72/75
Cable lengths between converter and motor [10]							
• Shielded	m	300	300	300	300	300	300
• Unshielded	m	450	450	450	450	450	450
Dimensions							
• Width for version A/C	mm	800/400	1200/600	1200/600	1200/600	1600/1000	1600/1000
• Height [11]	mm	2000	2000	2000	2000	2000	2000
• Depth	mm	600	600	600	600	600	600
Weight, approx. (degree of protection IP20, without options) for version A/C	kg	670/300	780/670	780/670	840/670	1320/940	1360/980

Note: The power data in hp units is based on the NEC/CEC standards for the North American market.

For information on the line connection, motor connection and cabinet grounding, see Section Configuration.

1) Rated output of a typical 6-pole standard induction motor based on I_L or I_H for 3 AC 50 Hz 690 V.

2) 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 duration of 300 s. See Characteristic curves, Section Overload capability.

3) The base-load current I_H is based on a duty cycle of 150% for 60 s or 160% for 10 s with a duty cycle duration of 300 s. See Characteristic curves, Section Overload capability.

4) The currents listed here are based on the rated output current.

5) If the drive control is to remain active after a main infeed failure, the converter must be externally supplied with 24 V DC.
The following must also be taken into account:
– CU320-2: 1 A
– TM31: 0.5 A
– AOP30: 0.2 A
– SMC: 0.6 A
– Current requirement of digital inputs/outputs.

6) In conjunction with the specified fuses or circuit breakers.

7) Minimum current required for reliably triggering the protective devices.

8) For option **L26** (version A) the low value applies.

9) The specified power losses are the maximum values for a utilization of 100%. The values are lower under normal operating conditions.

10) Longer cable lengths for specific configurations are available on request.

11) Version A: The cabinet height increases by
– 250 mm for degree of protection IP21
– 400 mm for degrees of protection IP23, IP43 and IP54
– 405 mm for options **M13** and **M78**
Version C: The cabinet height increases by
– 250 mm for degree of protection IP21
– 400 mm for degrees of protection IP23, IP43 and IP54

Technical specifications (continued)

Technical specifications for parallel connection

		SINAMICS G150 converter cabinet units, version A 6SL3710-2GE..-....			SINAMICS G150 converter cabinet units, version A 6SL3710-2GF..-....		
Parallel connection		**41-1AA3**	**41-4AA3**	**41-6AA3**	**38-6AA3**	**41-1AA3**	**41-4AA3**
Line voltage		**380 ... 480 V 3 AC**			**500 ... 600 V 3 AC**		
Type rating							
• For I_L [1]	kW	**630**	**710**	**900**	**630**	**710**	**1000**
• For I_H [1]	kW	500	560	710	560	630	800
• For I_L at 60 Hz 460 V or 575 V [2]	hp	900	1000	1250	900	1000	1250
• For I_H at 60 Hz 460 V or 575 V [2]	hp	700	900	1000	800	900	1000
Output current							
• Rated current I_n [3]	A	1120	1380	1560	860	1070	1360
• Base-load current I_L [3][4]	A	1092	1340	1516	836	1036	1314
• Base-load current I_H [3][5]	A	850	1054	1294	770	950	1216
Input current							
• Rated input current [3][6]	A	1174	1444	1624	904	1116	1424
• Input current, max.	A	1800	2215	2495	1388	1708	2186
• Current requirement, 24 V DC auxiliary power supply [7]	A	2.8	2.8	3	2.8	2.8	3
Rated short-circuit current according to IEC [8]	kA	2 × 65	2 × 65	2 × 65	2 × 65	2 × 65	2 × 84
Minimum short-circuit current [9]	A	2 × 1000	2 × 10500	2 × 1800	2 × 6200	2 × 8400	2 × 10500
Power loss, max. [10]							
• At 50 Hz 400 V / 500 V	kW	16.2	19	19.9	15.4	17.2	23.8
• At 60 Hz 460 V / 575 V	kW	16.6	19.4	20.4	15	16.8	25
Cooling air requirement	m^3/s	1.56	1.56	1.56	1.56	1.56	2.96
Sound pressure level L_{pA} (1 m) at 50/60 Hz	dB	73/76	73/76	73/76	75/78	75/78	75/78
Cable lengths between converter and motor [11]							
• Shielded	m	300	300	300	300	300	300
• Unshielded	m	450	450	450	450	450	450
Dimensions							
• Width [12]	mm	2400	2400	2400	2400	2400	3200
• Height [13]	mm	2000	2000	2000	2000	2000	2000
• Depth	mm	600	600	600	600	600	600
Weight, approx. (degree of protection IP20, without options)	kg	1700	1710	2130	1700	1700	2620

Note: The power data in hp units is based on the NEC/CEC standards for the North American market.

For information on the line connection, motor connection and cabinet grounding, see Section Configuration.

1) Rated output of a typical 6-pole standard induction motor based on I_L or I_H for 3 AC 50 Hz 400 V, 500 V or 690 V.

2) Rated output of a typical 6-pole standard induction motor based on I_L or I_H for 3 AC 60 Hz 460 V or 575 V.

3) The currents listed here are the aggregate current of the two converter sections.

4) 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 duration of 300 s. See Characteristic curves, Section Overload capability.

5) The base-load current I_H is based on a duty cycle of 150% for 60 s or 160% for 10 s with a duty cycle duration of 300 s. See Characteristic curves, Section Overload capability.

6) The currents listed here are based on the rated output current.

7) If the drive control is to remain active after a main infeed failure, the converter must be externally supplied with 24 V DC.
The following must also be taken into account:
– CU320-2: 1 A
– TM31: 0.5 A
– AOP30: 0.2 A
– SMC: 0.6 A
– Current requirement of digital inputs/outputs.

8) In conjunction with the specified fuses or circuit breakers.

9) Minimum current required for reliably triggering the protective devices.

10) The specified power losses are the maximum values for a utilization of 100%. The values are lower under normal operating conditions.

11) Longer cable lengths for specific configurations are available on request.

12) Power units connected in parallel are shipped as two transport units.

13) Version A: The cabinet height increases by
– 250 mm for degree of protection IP21
– 400 mm for degrees of protection IP23, IP43 and IP54
– 405 mm for options **M13** and **M78**

Technical specifications (continued)

		SINAMICS G150 converter cabinet units, version A 6SL3710-2GH..-....							
Parallel connection		**41-1AA3**	**41-4AA3**	**41-5AA3**	**41-8EA3**	**42-0EA3**	**42-2EA3**	**42-4E A3**	**42-7E A3**
Line voltage		**660 ... 690 V 3 AC**							
Type rating									
• For I_L [1]	kW	**1000**	**1350**	**1500**	**1750**	**1950**	**2150**	**2400**	**2700**
• For I_H [1]	kW	900	1200	1350	1500	1750	1950	2150	2400
• For I_L at 60 Hz 460 V or 575 V [2]	hp	–	–	–	–	–	–	–	–
• For I_H at 60 Hz 460 V or 575 V [2]	hp	–	–	–	–	–	–	–	–
Output current									
• Rated current I_n [3]	A	1070	1360	1500	1729	1948	2158	2413	2752
• Base-load current I_L [3] [4]	A	1036	1314	1462	1720	1940	2150	2390	2685
• Base-load current I_H [3] [5]	A	950	1216	1340	1547	1742	1930	2158	2463
Input current									
• Rated input current [3] [6]	A	1116	1424	1568	1800	2030	2245	2510	2865
• Input current, max.	A	1708	2186	2406	2765	3115	3450	3860	4400
• Current requirement, 24 V DC auxiliary power supply [7]	A	2.8	2.8	3	4.7	4.7	4.7	4.7	6
Rated short-circuit current according to IEC [8]	kA	2 × 65	2 × 84	2 × 84	2 × 85	2 × 85	2 × 85	2 × 85	2 × 85
Minimum short-circuit current [9]	A	2 × 8400	2 × 10500	2 × 1800	2 × 1800	2 × 2000	2 × 2300	2 × 2500	2 × 3000
Power loss, max. [10] at 50 Hz 690 V	kW	21.3	26.6	29	35	38	40	46	52
Cooling air requirement	m^3/s	1.56	2.96	2.96	3.67	3.67	3.67	3.67	5.15
Sound pressure level L_{pA} (1 m) at 50/60 Hz	dB	75/78	75/78	75/78	75/78	75/78	75/78	75/78	75/78
Cable lengths between converter and motor [11]									
• Shielded	m	300	300	300	300	300	300	300	300
• Unshielded	m	450	450	450	450	450	450	450	450
Dimensions									
• Width [12]	mm	2400	3200	3200	3600	3600	3600	3600	4400
• Height [13]	mm	2000	2000	2000	2000	2000	2000	2000	2000
• Depth	mm	600	600	600	600	600	600	600	600
Weight, approx. (degree of protection IP20, without options)	kg	1700	2620	2700	3010	3010	3070	3860	4580

Note: The power data in hp units is based on the NEC/CEC standards for the North American market.

For information on the line connection, motor connection and cabinet grounding, see Section Configuration.

1) Rated output of a typical 6-pole standard induction motor based on I_L or I_H for 3 AC 50 Hz 400 V, 500 V or 690 V.

2) Rated output of a typical 6-pole standard induction motor based on I_L or I_H for 3 AC 60 Hz 460 V or 575 V.

3) The currents listed here are the aggregate current of the two converter sections.

4) 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 duration of 300 s. See Characteristic curves, Section Overload capability.

5) The base-load current I_H is based on a duty cycle of 150% for 60 s or 160% for 10 s with a duty cycle duration of 300 s. See Characteristic curves, Section Overload capability.

6) The currents listed here are based on the rated output current.

7) If the drive control is to remain active after a main infeed failure, the converter must be externally supplied with 24 V DC.
The following must also be taken into account:
– CU320-2: 1 A
– TM31: 0.5 A
– AOP30: 0.2 A
– SMC: 0.6 A
– Current requirement of digital inputs/outputs.

8) In conjunction with the specified fuses or circuit breakers.

9) Minimum current required for reliably triggering the protective devices.

10) The specified power losses are the maximum values for a utilization of 100%. The values are lower under normal operating conditions.

11) Longer cable lengths for specific configurations are available on request.

12) Power units connected in parallel are shipped as two transport units.

13) Version A: The cabinet height increases by
– 250 mm for degree of protection IP21
– 400 mm for degrees of protection IP23, IP43 and IP54
– 405 mm for options **M13** and **M78**

Characteristic curves

Derating data

SINAMICS G150 converter cabinet units and the associated system components are rated for an ambient temperature of 40° C and installation altitudes up to 2000 m above sea level.

At ambient temperatures > 40° C, the output current must be reduced. Ambient temperatures above 50° C are not permissible.

At installation altitudes > 2000 m above sea level, it must be taken into account that the air pressure, and therefore air density, decreases as the height increases. As a consequence, the cooling efficiency and the insulation capacity of the air also decrease.

Due to the reduced cooling efficiency, it is necessary, on the one hand, to reduce the ambient temperature and on the other hand, to lower heat loss in the converter cabinet unit by reducing the output current, whereby ambient temperatures lower than 40° C may be offset to compensate.

The following table lists the permissible output currents depending on the installation altitude and ambient temperature for the various degrees of protection. The specified values already include a permitted compensation in respect of installation altitude and ambient temperatures < 40° C (temperature at the air intake of the converter cabinet unit).

The values apply under the precondition that it is guaranteed that the cooling air, as specified in the technical data, flows through the units as a result of the cabinet arrangement.

As additional measure for installation altitudes from 2000 m up to 5000 m, an isolating transformer is required in order to reduce transient overvoltages according to EN 60664-1.

For further information, please refer to the SINAMICS Low Voltage Engineering Manual.

Current-derating factors for converter cabinet units depending on the ambient / air intake temperature, the installation altitude and the degree of protection

Degree of protection	Installation altitude above sea level	**Current derating factor** (as a percentage of the rated current) for an ambient / air intake temperature of						
	m	20 °C	25 °C	30 °C	35 °C	40 °C	45 °C	50 °C
IP20, IP21, IP23 and IP43	0 ... 2000						93.3 %	86.7 %
	2001 ... 2500					96.3 %		
	2501 ... 3000		100 %		98.7 %			
	3001 ... 3500							
	3501 ... 4000			96.3 %				
	4001 ... 4500		97.5 %					
	4501 ... 5000	98.2 %						
IP54	0 ... 2000					93.3 %	86.7 %	80 %
	2001 ... 2500		100 %		96.3 %	89.8 %		
	2501 ... 3000			98.7 %	92.5 %			
	3001 ... 3500			94.7 %				
	3501 ... 4000		96.3 %	90.7 %				
	4001 ... 4500	97.5 %	92.1 %					
	4501 ... 5000	93 %						

Characteristic curves (continued)

Current derating depending on the pulse frequency

To reduce motor noise or to increase output frequency, the pulse frequency can be increased relative to the factory setting (1.25 kHz or 2 kHz). 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.

For further information, please refer to the SINAMICS Low Voltage Engineering Manual.

Derating factor of the output current depending on the pulse frequency for devices with a rated pulse frequency of 2 kHz

SINAMICS G150	Type rating	Output current at 2 kHz	**Derating factor** for pulse frequency	
6SL3710-...	kW	A	2.5 kHz	4 kHz
380 ... 480 V 3 AC				
1GE32-1 . A3	110	210	95 %	82 %
1GE32-6 . A3	132	260	95 %	83 %
1GE33-1 . A3	160	310	97 %	88 %
1GE33-8 . A3	200	380	96 %	87 %
1GE35-0 . A3	250	490	94 %	78 %

Derating factor of the output current depending on the pulse frequency for devices with a rated pulse frequency of 1.25 kHz

SINAMICS G150	Type rating	Output current at 1.25 kHz	**Derating factor** for pulse frequency		
6SL3710-...	kW	A	2 kHz	2.5 kHz	4 kHz
380 ... 480 V 3 AC					
1GE36-1 . A3	315	605	83 %	72 %	64 %
1GE37-5 . A3	400	745	83 %	72 %	64 %
1GE38-4 . A3	450	840	87 %	79 %	64 %
1GE41-0 . A3	560	985	92 %	87 %	70 %
2GE41-1AA3	630	1120	83 %	72 %	64 %
2GE41-4AA3	710	1380	83 %	72 %	64 %
2GE41-6AA3	900	1560	87 %	79 %	64 %
500 ... 600 V 3 AC					
1GF31-8 . A3	110	175	92 %	87 %	70 %
1GF32-2 . A3	132	215	92 %	87 %	70 %
1GF32-6 . A3	160	260	92 %	88 %	71 %
1GF33-3 . A3	200	330	89 %	82 %	65 %
1GF34-1 . A3	250	410	89 %	82 %	65 %
1GF34-7 . A3	315	465	92 %	87 %	67 %
1GF35-8 . A3	400	575	91 %	85 %	64 %
1GF37-4 . A3	500	735	87 %	79 %	64 %
1GF38-1 . A3	560	810	83 %	72 %	61 %
2GF38-6AA3	630	860	92 %	87 %	67 %
2GF41-1AA3	710	1070	91 %	85 %	64 %
2GF41-4AA3	1000	1360	87 %	79 %	64 %

Characteristic curves (continued)

SINAMICS G150	Type rating	Output current at 1.25 kHz	**Derating factor** for pulse frequency		
6SL3710-...	kW	A	2 kHz	2.5 kHz	4 kHz
660 ... 690 V 3 AC					
1GH28-5 . A3	75	85	93 %	89 %	71 %
1GH31-0 . A3	90	100	92 %	88 %	71 %
1GH31-2 . A3	110	120	92 %	88 %	71 %
1GH31-5 . A3	132	150	90 %	84 %	66 %
1GH31-8 . A3	160	175	92 %	87 %	70 %
1GH32-2 . A3	200	215	92 %	87 %	70 %
1GH32-6 . A3	250	260	92 %	88 %	71 %
1GH33-3 . A3	315	330	89 %	82 %	65 %
1GH34-1 . A3	400	410	89 %	82 %	65 %
1GH34-7 . A3	450	465	92 %	87 %	67 %
1GH35-8 . A3	560	575	91 %	85 %	64 %
1GH37-4 . A3	710	735	87 %	79 %	64 %
1GH38-1 . A3	800	810	83 %	72 %	61 %
2GH41-1AA3	1000	1070	91 %	85 %	64 %
2GH41-4AA3	1350	1360	87 %	79 %	64 %
2GH41-5AA3	1500	1500	83 %	72 %	61 %
2GH41-8EA3	1750	1729	92 %	87 %	67 %
2GH42-0EA3	1950	1948	91 %	86 %	64 %
2GH42-2EA3	2150	2158	87 %	79 %	55 %
2GH42-4EA3	2400	2413	87 %	79 %	55 %
2GH42-7EA3	2700	2752	91 %	86 %	64 %

Characteristic curves (continued)

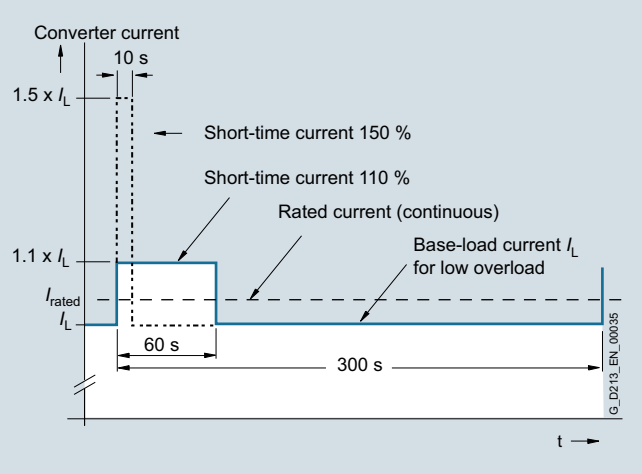
Overload capability

The SINAMICS G150 converter cabinet units have an overload reserve in order to overcome breakaway torques, for example. If larger surge loads occur, this must be taken into account in the configuration. For drives with overload requirements, the appropriate base load current must, therefore, be used as a basis for the required load.

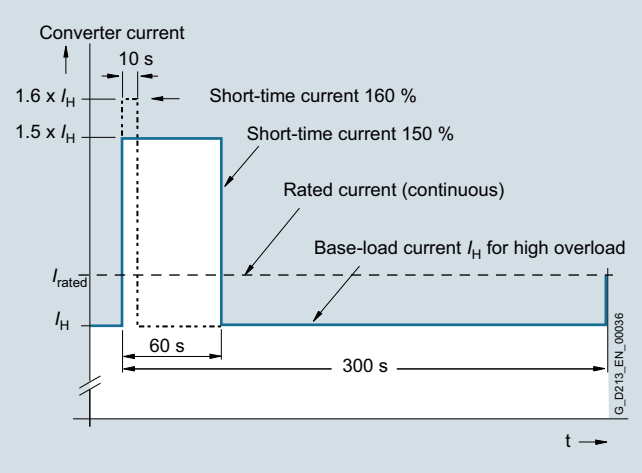
The criterion for overload is that the drive is operated with its base load current before and after the overload occurs on the basis of a duty cycle duration of 300 s.

The base load current for a low overload I_L is based on a duty cycle of 110% for 60 s or 150% for 10 s.

The base load current for a high overload I_H is based on a duty cycle of 150% for 60 s or 160% for 10 s.



Low overload



High overload

Configuration

Cable cross-sections and connections

The following tables list the recommended and maximum possible cable connections at the line and motor ends for a single connection (versions A and C) and a parallel connection (version A).

The recommended cross-sections are based on the specified fuses. They are valid for a three-conductor copper cable routed horizontally in air with PVC insulation and a permissible conductor temperature of 70° C (e.g. Protodur NYY or NYCWY) at an ambient temperature of 40° C and individual routing.

For deviating conditions (cable routing, cable accumulation, ambient temperature), the appropriate correction factors according to IEC 60364-5-52 must be taken into account.

For further information, please refer to the SINAMICS Low Voltage Engineering Manual.

Single connection

Type rating	Converter cabinet unit	Line connection			Motor connection			Cabinet grounding	
	SINAMICS G150, versions A and C	Recommended cross-section [1]	Maximum cable cross-section	Fixing screws	Recommended cross-section [1]	Maximum cable cross-section	Fixing screws	Fixing screws	Remark
		IEC	IEC		IEC	IEC			
kW	6SL3710-...	mm^2	mm^2		mm^2	mm^2			
380 ... 480 V 3 AC									
110	1GE32-1 . A3	2 × 70	4 × 240	M12	2 × 50	2 × 150	M12	M12	
132	1GE32-6 . A3	2 × 95	4 × 240	M12	2 × 70	2 × 150	M12	M12	
160	1GE33-1 . A3	2 × 120	4 × 240	M12	2 × 95	2 × 150	M12	M12	
200	1GE33-8 . A3	2 × 120	4 × 240	M12	2 × 95	2 × 150	M12	M12	
250	1GE35-0 . A3	2 × 185	4 × 240	M12	2 × 150	2 × 240	M12	M12	
315	1GE36-1 . A3	2 × 240	4 × 240	M12	2 × 185	4 × 240	M12	M12	
400	1GE37-5 . A3	3 × 185	4 × 240	M12	2 × 240	4 × 240	M12	M12	Cu busbar
450	1GE38-4 . A3	4 × 150	8 × 240	M12	3 × 185	4 × 240	M12	M12	Cu busbar
560	1GE41-0 . A3	4 × 185	8 × 240	M12	4 × 185	6 × 240	M12	M12	Cu busbar
500 ... 600 V 3 AC									
110	1GF31-8 . A3	120	4 × 240	M12	95	2 × 150	M12	M12	
132	1GF32-2 . A3	2 × 70	4 × 240	M12	120	2 × 150	M12	M12	
160	1GF32-6 . A3	2 × 95	4 × 240	M12	2 × 70	2 × 185	M12	M12	
200	1GF33-3 . A3	2 × 120	4 × 240	M12	2 × 95	2 × 240	M12	M12	
250	1GF34-1 . A3	2 × 185	4 × 240	M12	2 × 120	4 × 240	M12	M12	
315	1GF34-7 . A3	2 × 185	4 × 240	M12	2 × 150	4 × 240	M12	M12	
400	1GF35-8 . A3	2 × 240	4 × 240	M12	2 × 185	4 × 240	M12	M12	
500	1GF37-4 . A3	3 × 185	8 × 240	M12	2 × 240	6 × 240	M12	M12	Cu busbar
560	1GF38-1 . A3	4 × 150	8 × 240	M12	3 × 185	6 × 240	M12	M12	Cu busbar
660 ... 690 V 3 AC									
75	1GH28-5 . A3	50	4 × 240	M12	35	2 × 70	M12	M12	
90	1GH31-0 . A3	50	4 × 240	M12	50	2 × 150	M12	M12	
110	1GH31-2 . A3	70	4 × 240	M12	70	2 × 150	M12	M12	
132	1GH31-5 . A3	95	4 × 240	M12	70	2 × 150	M12	M12	
160	1GH31-8 . A3	120	4 × 240	M12	95	2 × 150	M12	M12	
200	1GH32-2 . A3	2 × 70	4 × 240	M12	120	2 × 150	M12	M12	
250	1GH32-6 . A3	2 × 95	4 × 240	M12	2 × 70	2 × 185	M12	M12	
315	1GH33-3 . A3	2 × 120	4 × 240	M12	2 × 95	2 × 240	M12	M12	
400	1GH34-1 . A3	2 × 185	4 × 240	M12	2 × 120	4 × 240	M12	M12	
450	1GH34-7 . A3	2 × 185	4 × 240	M12	2 × 150	4 × 240	M12	M12	
560	1GH35-8 . A3	2 × 240	4 × 240	M12	2 × 185	4 × 240	M12	M12	
710	1GH37-4 . A3	3 × 185	8 × 240	M12	3 × 150	6 × 240	M12	M12	Cu busbar
800	1GH38-1 . A3	4 × 150	8 × 240	M12	3 × 185	6 × 240	M12	M12	Cu busbar

[1] The recommendations for the North American market in AWG or MCM must be taken from the appropriate NEC (National Electrical Code) and CEC (Canadian Electrical Code) standards.

Configuration (continued)

Parallel connection

Type rating	Converter cabinet unit	Line connection			Motor connection			Schrankerdung	
	SINAMICS G150, version A	Recommended cross-section [1]	Maximum cable cross-section	Fixing screws	Recommended cross-section [1]	Maximum cable cross-section	Fixing screws	Fixing screws	Remark
		IEC	IEC		IEC	IEC			
kW	6SL3710-...	mm^2	mm^2		mm^2	mm^2			
380 ... 480 V 3 AC									
630	2GE41-1AA3	2 × 240	4 × 240	M12	2 × 185	4 × 240	M12	M12	
710	2GE41-4AA3	3 × 185	4 × 240	M12	2 × 240	4 × 240	M12	M12	Cu busbar
900	2GE41-6AA3	4 × 150	8 × 240	M12	2 × 240	4 × 240	M12	M12	Cu busbar
500 ... 600 V 3 AC									
630	2GF38-6AA3	2 × 185	4 × 240	M12	2 × 150	4 × 240	M12	M12	
710	2GF41-1AA3	2 × 240	4 × 240	M12	2 × 185	4 × 240	M12	M12	
1000	2GF41-4AA3	3 × 185	8 × 240	M12	2 × 240	6 × 240	M12	M12	Cu busbar
660 ... 690 V 3 AC									
1000	2GH41-1AA3	2 × 240	4 × 240	M12	2 × 185	4 × 240	M12	M12	
1350	2GH41-4AA3	3 × 185	8 × 240	M12	3 × 150	6 × 240	M12	M12	Cu busbar
1500	2GH41-5AA3	4 × 150	8 × 240	M12	3 × 185	6 × 240	M12	M12	Cu busbar
1750	2GH41-8EA3	2 × 4 × 150	2 × 8 × 240	M12	2 × 3 × 185	2 × 6 × 240	M12	M12	Cu busbar
1950	2GH42-0EA3	2 × 4 × 150	2 × 8 × 240	M12	2 × 3 × 185	2 × 6 × 240	M12	M12	Cu busbar
2150	2GH42-2EA3	2 × 4 × 150	2 × 8 × 240	M12	2 × 3 × 185	2 × 6 × 240	M12	M12	Cu busbar
2400	2GH42-4EA3	2 × 4 × 150	2 × 8 × 240	M12	2 × 3 × 185	2 × 6 × 240	M12	M12	Cu busbar
2700 [2]	2GH42-7EA3	2 × 4 × 150	2 × 8 × 240	M12	3 × 3 × 185	3 × 6 × 240	M12	M12	Cu busbar

Note:

The recommended and maximum conductor cross-sections refer to one of the two converter sections in the parallel connection.

Minimum motor cable lengths for operation with power units connected in parallel

When using power units connected in parallel, the following motor cable lengths must be observed if a motor is connected with only one winding system and no motor-side reactors or filters are used:

Type rating	Converter cabinet unit SINAMICS G150, version A	Minimum cable length
kW		m
380 ... 480 V 3 AC		
630	6SL3710-2GE41-1AA3	13
710	6SL3710-2GE41-4AA3	10
900	6SL3710-2GE41-6AA3	9
500 ... 600 V 3 AC		
630	6SL3710-2GF38-6AA3	18
710	6SL3710-2GF41-1AA3	15
1000	6SL3710-2GF41-4AA3	13
660 ... 690 V 3 AC		
1000	6SL3710-2GH41-1AA3	20
1350	6SL3710-2GH41-4AA3	18
1500	6SL3710-2GH41-5AA3	15
1750	6SL3710-2GH41-8EA3	12
1950	6SL3710-2GH42-0EA3	10
2150	6SL3710-2GH42-2EA3	8
2400	6SL3710-2GH42-4EA3	8
2700	6SL3710-2GH42-7EA3	8

[1] The recommendations for the North American market in AWG or MCM must be taken from the appropriate NEC (National Electrical Code) and CEC (Canadian Electrical Code) standards.

[2] The motor-side inverter comprises three Motor Modules connected in parallel.

Configuration (continued)

Cable cross-sections for line and motor connection

It is generally recommended to use shielded 3-conductor three-phase cables between the converter and motor – and for higher power ratings, symmetrical cables where possible. If required, several of these cables can be connected in parallel. There are two main reasons for this:

- Only then can the high IP55 degree of protection at the motor terminal box be easily achieved. The reason for this is that cables are routed into the terminal box through glands, and the number of possible glands is restricted by the terminal box geometry. Therefore single cables are less suitable.
- With symmetrical, 3-conductor, three-phase cables, the summed ampere-turns over the cable outer diameter are equal to zero and they can be routed in conductive, metal cable ducts or racks without any significant currents (ground current or leakage current) being induced in these conductive, metal connections. The danger of induced leakage currents and thus of increased cable sheath losses is significantly higher with single-conductor cables.

The cable cross-section required depends on the current being conducted in the cable. The permissible current load capability of cables is defined, for example in IEC 60364-5-52. It depends partly on the ambient conditions such as temperature, but also on the routing method. It should be taken into account whether cables are individually routed with relatively good cooling, or whether several cables are routed together; in this case, cable ventilation is significantly poorer, which can therefore result in higher cable temperatures. Regarding this topic, reference is made to the corresponding correction factors for these secondary conditions in IEC 60364-5-52.

For 3-conductor copper and aluminum cables with PVC insulation and a permissible conductor temperature of 70° C (e.g. Protodur NYY or NYCWY), as well as an ambient temperature of 40° C, the cross-sections can be determined from the following table, which is based on IEC 60364-5-52.

Current-carrying capacity according to IEC 60364-5-52 at 40° C

Cross-section of 3-conductor cable	**Copper cable**		**Aluminum cable**	
	Individual routing	Several cables next to one another [1]	Individual routing	Several cables next to one another [1]
mm^2	A	A	A	A
3 × 2.5	22	17	17	13
3 × 4	30	23	23	18
3 × 6	37	29	29	22
3 × 10	52	41	40	31
3 × 16	70	54	53	41
3 × 25	88	69	68	53
3 × 35	110	86	84	65
3 × 50	133	104	102	79
3 × 70	171	133	131	102
3 × 95	207	162	159	124
3 × 120	240	187	184	144
3 × 150	278	216	213	166
3 × 185	317	247	244	190
3 × 240	374	292	287	224

[1] Maximum nine cables may be routed directly next to one another horizontally on a cable tray.

Cables must be connected in parallel for higher currents.

Note:

The recommendations for the North American market in AWG or MCM must be taken from the appropriate NEC (National Electrical Code) and CEC (Canadian Electrical Code) standards.

Grounding and protective conductor cross-section

The protective conductor must be dimensioned taking into account the following data:

- In the case of a ground fault, no impermissibly high contact voltages resulting from voltage drops on the PE conductor caused by the ground fault current may occur (< 50 V AC or < 120 V DC, IEC 61800-5-1, IEC 60364, IEC 60543).
- The protective conductor must not be excessively loaded by any ground fault current it carries.
- If it is possible for continuous currents to flow through the PE conductor when a fault occurs, the PE conductor cross-section must be dimensioned for this continuous current.
- The protective conductor cross-section must be selected according to EN 60204-1, EN 60439-1, IEC 60364.

Cross-section, line conductor	**Minimum cross-section, external protective conductor**
mm^2	mm^2
Bis 16	Minimum cross-section of line conductor
16 ... 35	16
As of 35	Minimum half the cross-section of line conductor

Note:

The recommendations for the North American market in AWG or MCM must be taken from the appropriate NEC (National Electrical Code) and CEC (Canadian Electrical Code) standards.

- Switchgear and motors are usually grounded separately via a local grounding electrode. With this constellation, the ground fault current flows via the parallel ground connections and is divided. In spite of the relatively low protective conductor cross-sections used in accordance with the table above, no inadmissible touch voltages occur with this grounding system. However, from experience gained with different grounding constellations, we recommend that the ground cable from the motor returns directly to the converter. For EMC reasons and to prevent bearing currents, symmetrical 3-conductor, three-phase cables should be used where possible instead of 4-conductor cables, especially on drives in the higher power range. For 3-conductor cables, the protective or PE conductor must be routed separately or arranged symmetrically in the motor cable. The symmetry of the PE conductor is achieved using a conductor surrounding all phase conductors or using a cable with a symmetrical arrangement of the three phase conductors and three ground conductors. For more detailed information on this topic, please refer to the SINAMICS Low Voltage Engineering Manual.
- Through their high-speed control, the converters limit the load current (motor and ground fault currents) to an rms value corresponding to the rated current. Based on this, we recommend that the cross-section of the protective conductor to ground the cabinets be the same as for the line conductor.

Selection and ordering data

The fuses specified below are the recommended types for protecting the unit on the low-voltage distribution panel. If option **L26** (main switch or circuit breaker) has been selected, the converter already has integrated semiconductor protection. In this case, a fuse of type 3NA can be used on the distribution panel.

If option **L26** has not been selected, we strongly advise that type 3NE fuses are used [1].

Further information on the fuses is provided in Catalog LV 10.

Single connection

Type rating		**SINAMICS G150 converter cabinet units**	**Fuse with existing fuse switch disconnector (option L26)**			**Fuse (incl. semiconductor protection) without fuse switch disconnector**		
at 50 Hz, 400 V, 500 V or 690 V	at 60 Hz, 460 V or 575 V	Versions A and C		Rated current	Frame size acc. to IEC 60269-2		Rated current	Frame size acc. to IEC 60269-2
kW	hp	6SL3710-...	Article No.	A		Article No.	A	
380 ... 480 V 3 AC								
110	150	1GE32-1 . A3	**3NA3144**	250	2	**3NE1230-2**	315	1
132	200	1GE32-6 . A3	**3NA3250**	300	2	**3NE1331-2**	350	2
160	250	1GE33-1 . A3	**3NA3254**	355	3	**3NE1334-2**	500	2
200	300	1GE33-8 . A3	**3NA3260**	400	3	**3NE1334-2**	500	2
250	400	1GE35-0 . A3	**3NA3372**	630	3	**3NE1436-2**	630	3
315	500	1GE36-1 . A3	**3NA3475**	800	4	**3NE1438-2**	800	3
400	600	1GE37-5 . A3	**3NA3475**	800	4	**3NE1448-2**	850	3
450	600	1GE38-4 . A3	**3NA3365**	2 × 500	3	**3NE1436-2**	2 × 630	3
560	800	1GE41-0 . A3	**3NA3472**	2 × 630	3	**3NE1437-2**	2 × 710	3
500 ... 600 V 3 AC								
110	150	1GF31-8 . A3	**3NA3244-6**	250	2	**3NE1227-2**	250	1
132	200	1GF32-2 . A3	**3NA3252-6**	315	2	**3NE1230-2**	315	1
160	250	1GF32-6 . A3	**3NA3354-6**	355	3	**3NE1331-2**	350	2
200	300	1GF33-3 . A3	**3NA3365-6**	500	3	**3NE1334-2**	500	2
250	400	1GF34-1 . A3	**3NA3365-6**	500	3	**3NE1334-2**	500	2
315	450	1GF34-7 . A3	**3NA3352-6**	2 × 315	3	**3NE1435-2**	560	3
400	500	1GF35-8 . A3	**3NA3354-6**	2 × 355	3	**3NE1447-2**	670	3
500	700	1GF37-4 . A3	**3NA3365-6**	2 × 500	3	**3NE1448-2**	850	3
560	800	1GF38-1 . A3	**3NA3365-6**	2 × 500	3	**3NE1343-2**	2 × 500	2
660 ... 690 V 3 AC								
75		1GH28-5 . A3	**3NA3132-6**	125	1	**3NE1022-2**	125	00
90		1GH31-0 . A3	**3NA3132-6**	125	1	**3NE1022-2**	125	00
110		1GH31-2 . A3	**3NA3136-6**	160	1	**3NE1224-2**	160	1
132		1GH31-5 . A3	**3NA3240-6**	200	2	**3NE1225-2**	200	1
160		1GH31-8 . A3	**3NA3244-6**	250	2	**3NE1227-2**	250	1
200		1GH32-2 . A3	**3NA3252-6**	315	2	**3NE1230-2**	315	1
250		1GH32-6 . A3	**3NA3354-6**	355	3	**3NE1331-2**	350	2
315		1GH33-3 . A3	**3NA3365-6**	500	3	**3NE1334-2**	500	2
400		1GH34-1 . A3	**3NA3365-6**	500	3	**3NE1334-2**	500	2
450		1GH34-7 . A3	**3NA3352-6**	2 × 315	3	**3NE1435-2**	560	3
560		1GH35-8 . A3	**3NA3354-6**	2 × 355	3	**3NE1447-2**	670	3
710		1GH37-4 . A3	**3NA3365-6**	2 × 500	3	**3NE1448-2**	850	3
800		1GH38-1 . A3	**3NA3365-6**	2 × 500	3	**3NE1334-2**	2 × 500	2

Note: The power data in hp units is based on the NEC/CEC standards for the North American market.

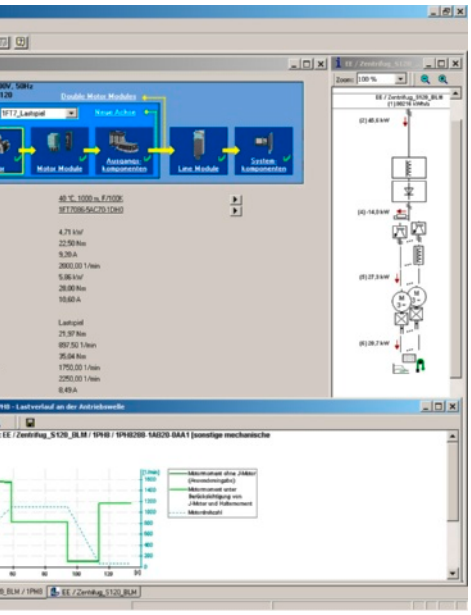
[1] The double function fuses (3NE1) with operating class gS for cable and semiconductor protection are recommended to protect the converter. These fuses are specially adapted to the requirements of the semiconductors in the input rectifier
- Superfast
- Adapted to the limit current integral of the semiconductor
- Lower arc voltage
- Improved current limiting

Selection and ordering data (continued)

Parallel connection (data for each converter subsystem)

Type rating		SINAMICS G150 converter cabinet units	Fuse with existing fuse switch disconnector (option L26)			Fuse (incl. semiconductor protection) without fuse switch disconnector		
at 50 Hz, 400 V, 500 V or 690 V	at 60 Hz, 460 V or 575 V	Version A		Rated current	Frame size acc. to IEC 60269-2		Rated current	Frame size acc. to IEC 60269-2
kW	hp	6SL3710-...	Article No.	A		Article No.	A	
380 ... 480 V 3 AC								
630	900	2GE41-1AA3	**3NA3475**	800	4	**3NE1438-2**	800	3
710	1200	2GE41-4AA3	**3NA3475**	800	4	**3NE1448-2**	850	3
900	1200	2GE41-6AA3	**3NA3365**	2 × 500	3	**3NE1436-2**	2 × 630	3
500 ... 600 V 3 AC								
630	900	2GF38-6AA3	**3NA3352-6**	2 × 315	3	**3NE1435-2**	560	3
710	1000	2GF41-1AA3	**3NA3365-6**	2 × 500	3	**3NE1447-2**	670	3
1000	1600	2GF41-4AA3	**3NA3365-6**	2 × 500	3	**3NE1448-2**	850	3
660 ... 690 V 3 AC								
1000		2GH41-1AA3	**3NA3354-6**	2 × 355	3	**3NE1447-2**	670	3
1350		2GH41-4AA3	**3NA3365-6**	2 × 500	3	**3NE1448-2**	850	3
1500		2GH41-5AA3	**3NA3365-6**	2 × 500	3	**3NE1334-2**	2 × 500	2
1750		2GH41-8EA3	**3NA3365-6**	2 × 500	3	**3NE1435-2**	2 × 560	3
1950		2GH42-0EA3	**3NA3362-6**	3 × 425	3	**3NE1436-3**	2 × 630	3
2150		2GH42-2EA3	**3NA3365-6**	3 × 500	3	**3NE1334-2**	3 × 500	2
2400		2GH42-4EA3	**3NA3365-6**	3 × 500	3	**3NE1334-2**	3 × 500	2
2700		2GH42-7EA3	**3NA3372**	3 × 630	3	**3NE1436-3**	3 × 630	3

Note: The power data in hp units is based on the NEC/CEC standards for the North American market.



Security information

Siemens provides products and solutions with industrial security functions that support the secure operation of plants, solutions, machines, equipment and/or networks. They are important components in a holistic industrial security concept. With this in mind, Siemens' products and solutions undergo continuous development. Siemens recommends strongly that you regularly check for product updates.

For the secure operation of Siemens products and solutions, it is necessary to take suitable preventive action (e.g. cell protection concept) and integrate each component into a holistic, state-of-the-art industrial security concept. Third-party products that may be in use should also be considered. For more information about industrial security, visit
www.siemens.com/industrialsecurity

To stay informed about product updates as they occur, sign up for a product-specific newsletter. For more information, visit
http://support.automation.siemens.com

SinaSave Energy Efficiency Tool

Overview

The SinaSave Energy Efficiency Tool calculates potential savings and payback periods on the basis of your specific operating conditions, providing valuable decision guidance with respect to investment in energy-efficient technologies.

The drive systems to be compared and the relevant parameters of the drive components are displayed graphically with SinaSave version 6.0 and higher. The wide range of options for comparing different control modes and comprehensive product combinations for drive solutions for pump and fan applications are useful additions. The portfolio of products includes SIMOTICS motors and SINAMICS converters as well as SIRIUS switching devices, offering a wide spectrum of possibilities for comparison according to your requirements.

SinaSave offers a wide range of possiblities for comparison:

- Comparison of drive systems for pump and fan applications with
  - Throttle control (fixed speed; motor and switching device)
  - Bypass control (fixed speed; motor and switching device)
  - Speed control (variable speed; motor and converter)
- Comparison and evaluation of products in various energy efficiciency classes
- Comparison of Siemens drive systems with third-party drive components

Access to the SinaSave Energy Efficiency Tool

SinaSave can be used without registration and without login:
www.automation.siemens.com/sinasave

More information

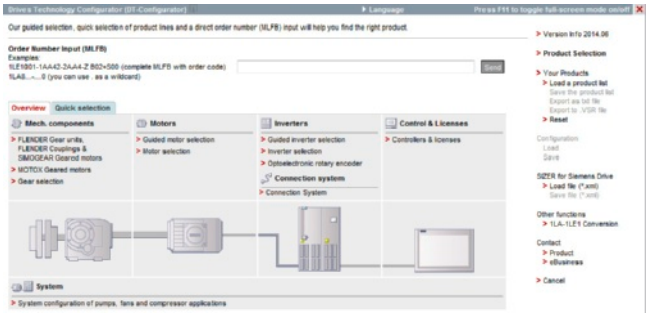
More information about the amortization calculator for energy-efficient drive systems is available at
www.siemens.com/sinasave

More information about services for energy saving is available on the Internet at
www.siemens.com/energy-efficient-production

Overview

The Drive Technology Configurator (DT Configurator) helps you to configure the optimum drive technology products for your application – starting with gear units, motors, inverters and the associated options and components and ending with controllers, software licenses and connection technology. Whether with little or detailed knowledge of products: You can easily, quickly and efficiently configure your particular drive using product group preselectors, targeted navigation through selection menus or by entering article numbers directly to select the products.

In addition to all this, comprehensive documentation comprising technical data sheets, 2D/3D dimensional drawings, operating instructions, certificates etc. can be selected in the DT Configurator. The products that you select can be directly ordered by transferring a parts lists to the shopping cart of the Industry Mall.



Drive Technology Configurator for efficient drive configuration with the following functions:

- Quick, efficient configuration of drive products and associated components – gear units, motors, inverters, controllers, connection technology
- Configuration of drive systems for pump, fan and compressor applications from 1 kW to 2.6 MW
- Retrievable documentation for configured products and components, such as
  - Data sheets in up to 7 languages in PDF or RTF formats
  - 2D/3D dimensional drawings in various formats
  - Terminal box diagram and terminal connection diagram
  - Operating instructions
  - Certificates
  - Starting calculation for SIMOTICS motors
  - EPLAN macros
- Support for retrofit projects in conjunction with Spares On Web (www.siemens.com/sow)
- Products can be ordered directly through the Siemens Industry Mall

Access to the Drive Technology Configurator

The Drive Technology Configurator can be accessed without registration and login:
www.siemens.com/dt-configurator

Selection and ordering data

Description	Article No.
Interactive catalog CA 01 on DVD-ROM including Drive Technology Configurator, English	**E86060-D4001-A510-D4-7600**

More information

Online access to the Drive Technology Configurator

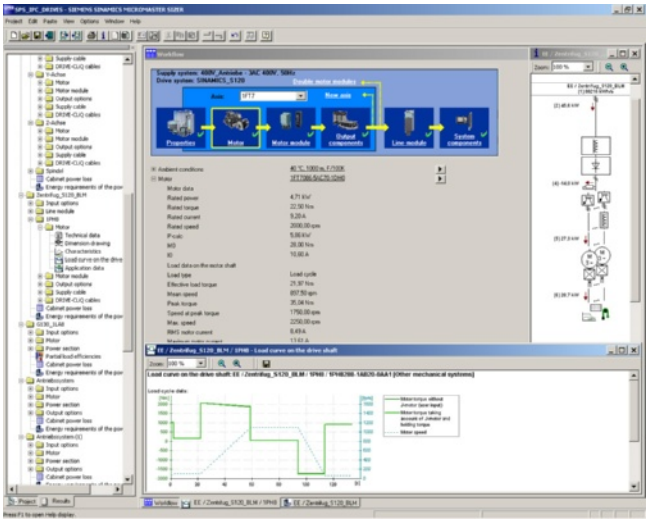
More information about the Drive Technology Configurator is available on the Internet at
www.siemens.com/dtconfigurator

Offline access to the Drive Technology Configurator in the Interactive Catalog CA 01

In addition, the Drive Technology Configurator is also included in the interactive catalog CA 01 on DVD-ROM – the offline version of the Siemens Industry Mall.
The Interactive Catalog CA 01 can be ordered from the relevant Siemens sales office or via the Internet:
www.siemens.com/automation/CA01

SIZER for Siemens Drives engineering tool

Overview



The following drives and controls can be engineered in a user-friendly way using the SIZER for Siemens Drives engineering tool:

- SIMOTICS low-voltage motors, including servogeared motors
- SINAMICS low-voltage drive systems
- Motor starters
- SINUMERIK CNC
- SIMOTION Motion Control system
- SIMATIC Technology

It provides support when selecting the technologies involved in the hardware and firmware components required for a drive task. SIZER for Siemens Drives supports the complete configuration of the drive system, from basic single drives to demanding multi-axis applications.

SIZER for Siemens Drives supports all of the configuring steps in a workflow:

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

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

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

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

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

The configuration process produces the following results:

- A parts list of the required components (export to Excel, use of the Excel data sheet for import to SAP)
- Technical specifications of the system
- Characteristic curves
- Comments on system reactions
- Mounting arrangement of drive and control components and dimension drawings of motors
- Energy requirements of the configured application

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

Technological online help is available:

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

System requirements

- PG or PC with Pentium III min. 800 MHz (recommended > 1 GHz)
- 512 MB RAM (1 GB RAM recommended)
- At least 4.1 GB of free hard disk space
- An additional 100 MB of free hard disk space on Windows system drive
- Screen resolution 1024 × 768 pixels (1280 × 1024 pixels recommended)
- Operating system:
  - Windows 7 Professional (32/64 bit)
  - Windows 7 Enterprise (32/64 bit)
  - Windows 7 Ultimate (32/64 bit)
  - Windows 7 Home (32/64 bit)
  - Windows 8.1 Professional (32/64 bit)
  - Windows 8.1 Enterprise (32/64 bit)
- Microsoft Internet Explorer V5.5 SP2

Selection and ordering data

Description	Article No.
SIZER for Siemens Drives engineering tool on DVD-ROM English, French, German, Italian	**6SL3070-0AA00-0AG0**

More information

The SIZER for Siemens Drives engineering tool is available free on the Internet at
www.siemens.com/sizer

Overview

SIZER WEB ENGINEERING is used to engineer motors, converters and drive systems in various applications and covering a wide power range starting below 1 kW up to 30 MW and above. Engineering can be performed by entering parameters for the motor, converter or system – as well as entering parameters for your particular application.

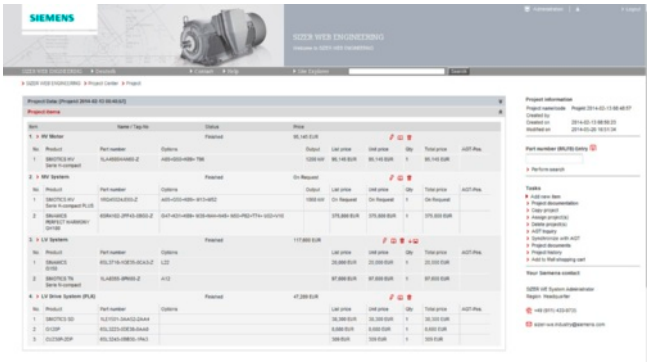
You obtain comprehensive technical documentation (e.g. 3D models) including pricing information as result.

Based on an integrated inquiry function, the tool also offers special individual solutions for your drive applications.

SIZER WEB ENGINEERING supports you from inquiry, through the product and drive system engineering, to an individual quotation, provides pricing information and finally transfers the engineered products to the shopping cart of the Industry Mall. The seamless support of the process helps you to save time and increase productivity as all data have to be entered once only. The input data as well as the result can be reused for the inquiry and ordering.

SIZER WEB ENGINEERING is the platform to flexibly engineer your drive tasks and manage your projects in a user-friendly fashion interacting with other tools, namely Drive Technology Configurator and SIZER for Siemens Drives.

Function



You can quickly find a solution for your drive task with the web-based tool: menu-prompted workflows navigate you through the technical selection and dimensioning of products and drive systems, including the accessories. Based on an integrated inquiry functionality, SIZER WEB ENGINEERING also offers you special customized solutions for applications which cannot be addressed using "Standard Products"; i.e. the focus is on flexibility and customized solutions.

In addition to the products from the low-voltage range, you can also configure high voltage motors, medium voltage systems and DC converters for your projects. Comprehensive documentation, such as data sheets, startup calculations for low-voltage and high-voltage motors, 2D dimensional drawings and 3D CAD models, offer documentation, and a lot more are integrated in the tool.

Access to the SIZER WEB ENGINEERING tool

After successful registration and approval, SIZER WEB ENGINEERING is available at:

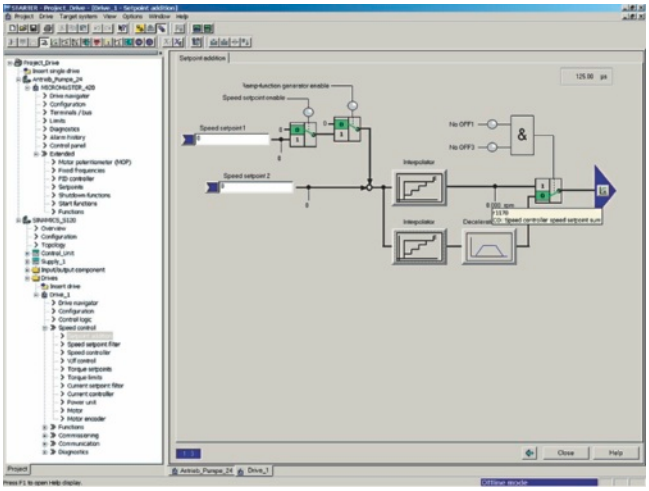
www.siemens.com/sizer-we

More information

- Further information on the SIZER WEB ENGINEERING tool is available on the Internet at www.siemens.com/sizer-we
- Home page "Selection and engineering tools": www.siemens.com/engineering-tools

STARTER commissioning tool

Overview



The user-friendly STARTER commissioning tool can be used for:

- Commissioning
- Optimization
- Diagnostics

This software can be operated as a standalone PC application, or integrated as a TIA-compatible program in SIMATIC STEP 7, or highly integrated into the SCOUT Engineering System (for SIMOTION). The basic functions and handling are the same in both cases.

In addition to the SINAMICS drives, STARTER also supports MICROMASTER 4 devices.

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

Beginners are supported by solution-based dialog guidance, whereby a standard graphics-based display maximizes clarity when setting the drive parameters.

First commissioning is guided by a wizard which makes all the basic settings in the drive. Therefore, getting a motor up and running is merely a question of setting a few of the drive parameters as part of the drive configuration process.

The individual settings required are made using graphics-based parameterization screens, which also precisely visualize the principle of operation of the drive.

Examples of individual settings that can be made include:

- How terminals are used
- Bus interface
- Setpoint channel (e.g., fixed setpoints)
- Closed-loop speed control (e.g., ramp-function generator, limits)
- BICO interconnections
- Diagnostics

For experts, the expert list can be used to specifically and quickly access individual parameters at any time. An individual compilation of frequently used parameters can be saved in dedicated user lists and watch tables.

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

- Self-optimization of the controller settings (depending on drive unit)
- Setup and evaluation of trace recordings [1)]
  Tool function for recording 2 × 8 signals with
  - Measuring cursor function
  - Extensive trigger functions
  - Several Y scales
  - Sampling times in the current controller cycle clock

Diagnostics functions provide information about:

- Control/status words
- Parameter status
- Operating conditions
- Communication states

Performance features

- User-friendly: Only a small number of settings need to be made for successful first commissioning: The motor starts to rotate
- Solution-oriented dialog-based user guidance simplifies commissioning
- Self-optimization functions reduce manual effort for optimization.

Minimum system requirements

The following minimum requirements must be complied with:

- Hardware
  - PG or PC with Pentium III min. 1 GHz (recommended >1 GHz)
  - Work memory 1 GB (2 GB recommended)
  - Screen resolution 1024 × 768 pixels, 16-bit color depth
  - Free hard disk memory: min. 3 GB
- Software
  - Microsoft Internet Explorer V6.0 or higher
  - 32-bit operating systems:
    Microsoft Windows XP Professional SP3
    Microsoft Windows 7 Professional incl. SP1
    Microsoft Windows 7 Ultimate incl. SP1
    Microsoft Windows 7 Enterprise incl. SP1
    (standard installation)
  - 64-bit operating systems:
    Microsoft Windows 7 Professional SP1
    Microsoft Windows 7 Ultimate SP1
    Microsoft Windows 7 Enterprise SP1 (standard installation)
    Microsoft Windows Server 2008 R2 SP1

Integration

Data can be exchanged (depending on the version) via PROFIBUS or PROFINET/Ethernet or via a serial interface.

For commissioning and service, a PG/PC can be connected to the CU320-2 Control Unit via PROFIBUS. A PROFIBUS connection must be available with a connecting cable at the PG/PC.

Further, communication between a CU320-2 Control Unit and PG/PC can also be established via Ethernet, either via an (optional) CBE20 Communication Board or the Ethernet interface -X127 on the CU320-2 Control Unit.

Note:

The terminal strip -X127 is suitable as a communication link to the PG/PC only for the purposes of servicing and commissioning.

1) Depending on drive unit.
Not supported for MICROMASTER 4, SINAMICS G110, SINAMICS G120 <firmware V4.4, SINAMICS G110D and SINAMICS G120D <firmware V4.5.

Selection and ordering data

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

Note:

In addition to the STARTER commissioning tool, SINAMICS Drive Control Chart (SINAMICS DCC) can be installed. This allows the device functionality in the SINAMICS drive system to be expanded with technology functions as required.

More information about SINAMICS DCC can be found in section "SINAMICS Drive Control Chart (SINAMICS DCC)".

Accessories

Depending on the version of the Control Unit (CU), the Control Unit of the drive unit can communicate with the programming device (PG) or PC via PROFIBUS or PROFINET/Ethernet or via a serial interface. The following accessories are available for the particular drive system as listed in the following table.

Description		**Recommended accessories** For communication between the drive unit and the programming device or PC Article No.
SINAMICS G130 and SINAMICS G150		
• PROFIBUS	**CP 5711 communication module** USB adapter for connecting a PG or notebook to PROFIBUS or MPI USB cable (2 m (6.56 ft)) included in scope of supply	**6GK1571-1AA00**
	SIMATIC DP plug-in cable 12 MBaud, for PG connection, pre-assembled with 2 × 9-pin SUB D connector, 3 m (9.84 ft)	**6ES7901-4BD00-0XA0**
• PROFINET/ Ethernet	Standard CAT5 Ethernet cable or PROFINET cable	–

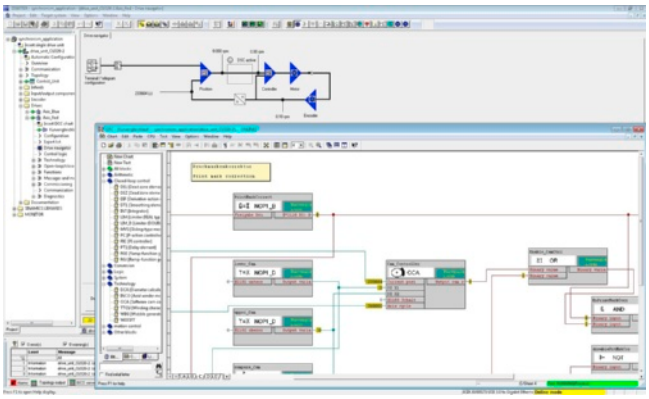
More information

The STARTER commissioning tool is also available on the Internet at
www.siemens.com/starter

SINAMICS Drive Control Chart (SINAMICS DCC)

Overview

SINAMICS Drive Control Chart (SINAMICS DCC) expands the scope of device functions by means of freely available closed-loop control, arithmetic and logic blocks and offers a means by which technological functions can be graphically configured in the SINAMICS drive system. SINAMICS DCC is the first stage of the Advanced Technology Function and is installed as an add-on to the STARTER commissioning tool.



SINAMICS DCC provides users with greater scope to adapt these systems to the specific functions of their machines. SINAMICS DCC does not limit the number of functions that can be used. The number of functions is limited only by the performance capability of the Control Unit.

SINAMICS DCC is available for the following SINAMICS drive systems:

- SINAMICS G130
- SINAMICS G150
- SINAMICS S120
- SINAMICS S150
- SINAMICS DCM
- SINAMICS DCP
- SINAMICS GM150
- SINAMICS SM150
- SINAMICS GL150
- SINAMICS SL150

The user-friendly DCC editor enables easy graphics-based configuration, allows control loop structures to be clearly represented and provides a high degree of reusability of diagrams that have already been created.

The open-loop and closed-loop control functions are defined by using multi-instance-capable blocks (Drive Control Blocks (DCBs)) from a library (DCB library) that are selected and graphically linked with one another by dragging and dropping. Test and diagnostic functions allow the program behavior to be verified and, in the case of a fault, the cause identified.

Two types of DCB library are available, i.e. DCB Standard and DCB Extension. The DCB Standard library supplied with SINAMICS DCC contains a large selection of closed-loop, arithmetic and logic blocks, as well as comprehensive open-loop and closed-loop control functions.

For logically combining, evaluating and acquiring binary signals, all commonly used logic functions are available for selection (AND, XOR, on/off delay, RS flipflop, counter, etc.). A wide range of arithmetic functions, such as absolute value generation, dividers and minimum/maximum evaluation are available to monitor and evaluate numerical quantities. In addition to the closed-loop drive control, axial winder functions, PI controllers, ramp-function generators or wobble generators are simple to configure.

In addition to the standard library, the DCB Extension library is also available with SINAMICS DCC, firmware version V4.6 and higher. This contains an extended range of blocks that can be used as an additional, independent library in the DCC Editor.

DCB Extension provides new motion control blocks as a GMC library and blocks for supplementary mathematical and logical functions as a Math Extended library.

Using these blocks, it is possible to implement the following applications with SINAMICS DCC:

- Positioning
- 1:1 synchronous operation
- Gearing
- Gearing and positioning
- Camming
- Flying saws
- Cross cutters
- Calculation of trigonometric or logarithmic functions

These applications are available for downloading from the Siemens Application Support pages at:
www.siemens.com/sinamics-applications

With the blocks provided by DCB Extension, it is also possible to commission the programming of user-specific blocks.

SINAMICS DCC provides a convenient basis for resolving drive-level open-loop and closed-loop control tasks directly in the converter. This further extends the possibility of adapting SINAMICS to the particular application. Local data processing in the drive supports the implementation of modular machine concepts and results in an increase in the overall machine performance.

Minimum hardware and software requirements

See STARTER commissioning tool.

Selection and ordering data

SINAMICS DCC comprises the graphical configuring tool (DCC Editor) and the DCB standard library. SINAMICS DCC is installed as an add-on to the STARTER commissioning tool.

The necessary engineering license for each PC (floating) for SINAMICS DCC is acquired at the same time the order is placed. No runtime license is required for the DCB standard library included in the scope of supply.

Existing licenses for SINAMICS DCC V2.1 and V2.2 SP1 and V2.3 are also valid for SINAMICS DCC V2.3 SP1. An upgrade variant including an engineering license for applications with STARTER V4.4 SP1 is available for existing SINAMICS DCC V2.0 SPx.

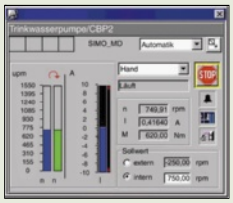
Description	Article No.
SINAMICS DCC V2.3 SP1 for STARTER V4.4 SP1	
Graphic configuring with SINAMICS DCC	
DCC Editor + DCB standard library	
• Single-user engineering license, with data carrier	**6AU1810-1HA23-1XA0**
• Upgrade engineering license, with data carrier	**6AU1810-1HA23-1XE0**

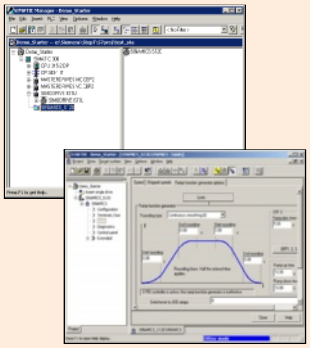
The blocks of the DCB Extension library are also configured with the graphical configuring tool (DCC Editor). Use of these blocks requires a runtime license.

Description	Article No.
SINAMICS DCB Extension license Runtime license for license upgrading with firmware version V4.6 or later (can also be ordered in conjunction with the CompactFlash card, see CompactFlash card for CU310-2 and CU320-2 Control Units)	**6SL3077-0AA00-0AB0**

Overview

SIMATIC Programs	Configuration / Commissioning
Drive ES PCS 7	Drive ES Basic





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Drive ES is the engineering system used to integrate the communication, configuration and data management functions of Siemens drive technology into the SIMATIC automation world easily, efficiently and cost-effectively.

Various software packages are available for selection:

- Drive ES Basic
- Drive ES PCS 7

Drive ES (**D**rive **E**ngineering **S**oftware) fully integrates drives from Siemens into the world of Totally Integrated Automation.

Design

Various software packages are available for selection:

- **Drive ES Basic**
- **Drive ES PCS 7** (APL Style or Classic Style)

Drive ES Basic

Drive ES Basic is for first-time users of the world of Totally Integrated Automation and the basic software for setting the parameters of all drives online and offline in this environment. Drive ES Basic enables both the automation system and the drives to be handled using the SIMATIC Manager software. 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 and ensures that drives with PROFINET IO are simply integrated into the SIMATIC environment.

Note:

For SINAMICS and MICROMASTER 4 drives, this TIA functionality is also provided with the STARTER commissioning tool (V4.3.2 and above).

Drive ES PCS 7 (APL Style or Classic Style)

Drive ES PCS 7 links the drives with a PROFIBUS DP interface into the SIMATIC PCS 7 process control system, and it requires that SIMATIC PCS 7, V6.1 or higher has first been installed. 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. From version V6.1 and higher, drives will also be able to be represented in the PCS 7 Maintenance Station.

In Drive ES PCS 7 version V8.0 and higher, two versions of the library are available: The APL (Advanced Process Library) variant and the previous version in the so-called Classic Style.

Contents of the Drive ES PCS 7 package (APL Style or Classic Style) in detail

- **Function block library for SIMATIC PCS 7** Faceplates and control blocks for SIMOVERT MASTERDRIVES VC and MC, as well as MICROMASTER/MIDIMASTER of the third and fourth generation as well as SIMOREG DC-MASTER and SINAMICS
- **STEP 7 slave object manager** for convenient configuration of drives and non-cyclic PROFIBUS DP communication with the drives
- **STEP 7 device object manager** for easy configuration of drives with PROFINET-IO interfaces (V8.0 SP1 and higher)
- **SETUP program** for installing the software in the PCS 7 environment

Selection and ordering data

Description	Article No.
Drive ES Basic V5.5 SPx *)	
Configuration software for the integration of drives into TIA (Totally Integrated Automation)	
Requirement: STEP 7 from V5.3, SP3 and higher	
Type of delivery: DVD Languages: Ger, Eng, Fr, It, Sp with electronic documentation	
• Floating license, 1 user	**6SW1700-5JA00-5AA0**
• Floating license, (copy license), 60 users	**6SW1700-5JA00-5AA1**
• Upgrade from V5.x to V5.5 SPx *)	**6SW1700-5JA00-5AA4**
Drive ES PCS 7 V7.0 SPx *)	
Function block library for PCS 7 for the integration of drives	
Requirement: PCS 7 V7.0 and higher	
Type of delivery: CD-ROM Languages: Ger, Eng, Fr, It, Sp with electronic documentation	
• Single-user license incl. 1 runtime license	**6SW1700-7JD00-0AA0**
• Runtime license (without data storage medium)	**6SW1700-5JD00-1AC0**
• Update service for single-user license	**6SW1700-0JD00-0AB2**
Drive ES PCS 7 V7.1 SPx *)	
Function block library for PCS 7 for the integration of drives	
Requirement: PCS 7 V7.1 and higher	
Type of delivery: CD-ROM Languages: Ger, Eng, Fr, It, Sp with electronic documentation	
• Single-user license incl. 1 runtime license	**6SW1700-7JD00-1AA0**
• Runtime license (without data storage medium)	**6SW1700-5JD00-1AC0**
• Update service for single-user license	**6SW1700-0JD00-0AB2**
• Upgrade from V6.x to V7.1 SPx *)	**6SW1700-7JD00-1AA4**
Drive ES PCS 7 V8.0 SPx *)	
Function block library for PCS 7 for the integration of drives in Classic Style (as predecessor)	
Requirement: PCS 7 V8.0 and higher	
Type of delivery: CD-ROM Languages: Ger, Eng, Fr, It, Sp with electronic documentation	
• Single-user license incl. 1 runtime license	**6SW1700-8JD00-0AA0**
• Runtime license (without data storage medium)	**6SW1700-5JD00-1AC0**
• Update service for single-user license	**6SW1700-0JD00-0AB2**
• Upgrade from V6.x to V8.0 SPx *)	**6SW1700-8JD00-0AA4**
Drive ES PCS 7 APL V8.0 SPx *)	
Function block library for PCS 7 for the integration of drives in APL style (Advanced Process Library)	
Requirement: PCS 7 V8.0 and higher	
Type of delivery: CD-ROM Languages: Ger, Eng, Fr, It, Sp with electronic documentation	
• Single-user license incl. 1 runtime license	**6SW1700-8JD01-0AA0**
• Runtime license (without data storage medium)	**6SW1700-5JD00-1AC0**
• Update service for single-user license	**6SW1700-0JD01-0AB2**
• Upgrade of APL V8.0 to V8.0 SP1 or Drive ES PCS7 V6.x, V7.x, V8.x classic to Drive ES PCS7 APL V8.0 SPx *)	**6SW1700-8JD01-0AA4**
Drive ES PCS 7 V8.1 SPx *)	
Function block library for PCS 7 for the integration of drives in Classic Style (as predecessor)	
Requirement: PCS 7 V8.1 and higher	
Type of delivery: CD-ROM Languages: Ger, Eng, Fr, It, Sp with electronic documentation	
• Single-user license incl. 1 runtime license	**6SW1700-8JD00-1AA0**
• Runtime license (without data storage medium)	**6SW1700-5JD00-1AC0**
• Update service for single-user license	**6SW1700-0JD00-0AB2**
• Upgrade from V6.x/V7.x/V8.x to V8.1 SPx *)	**6SW1700-8JD00-1AA4**
Drive ES PCS 7 APL V8.1 SPx *)	
Function block library for PCS 7 for the integration of drives in APL style (Advanced Process Library)	
Requirement: PCS 7 V8.1 and higher	
Type of delivery: CD-ROM Languages: Ger, Eng, Fr, It, Sp with electronic documentation	
• Single-user license incl. 1 runtime license	**6SW1700-8JD01-1AA0**
• Runtime license (without data storage medium)	**6SW1700-5JD00-1AC0**
• Update service for single-user license	**6SW1700-0JD01-0AB2**
• Upgrade of APL V8.x to V8.1 SPx *) or Drive ES PCS 7 V6.x, V7.x, V8.x classic to Drive ES PCS 7 APL V8.1 SPx *)	**6SW1700-8JD01-1AA4**

*) Orders are automatically supplied with the latest Service Pack (SP).

Options

Drive ES software update service

A software update service can also be purchased for the Drive ES software. The user will automatically receive the latest software, service packs and full versions for one year after ordering.

The update service can only be ordered in addition to an existing (i.e. previously ordered) full version.

- Period of update service: 1 year

The update service is automatically extended by 1 further year unless canceled up to 6 weeks prior to expiration.

Description	Article No.
Drive ES PCS 7	
• Update service for single-user license	**6SW1700-0JD00-0AB2**
Drive ES PCS 7 APL	
• Update service for single-user license	**6SW1700-0JD01-0AB2**

More information

Additional information is available on the Internet at www.siemens.com/drive-es

Overview

Configuring with EPLAN

EPLAN is an engineering software for configuring electrical installations. The EPLAN platform combines expert systems for various disciplines, such as electrical, fluid and EMC engineering, as well as control cabinet and plant engineering. It provides the wiring information required to determine the optimal laying routes, connection lengths, bundle diameters, and design of the cable tree.

EPLAN Electric P8 – an EPLAN module – is CAE software specifically for configuring documentation and managing electrical automation projects for machines and systems.
EPLAN Electric P8 offers the following functions:

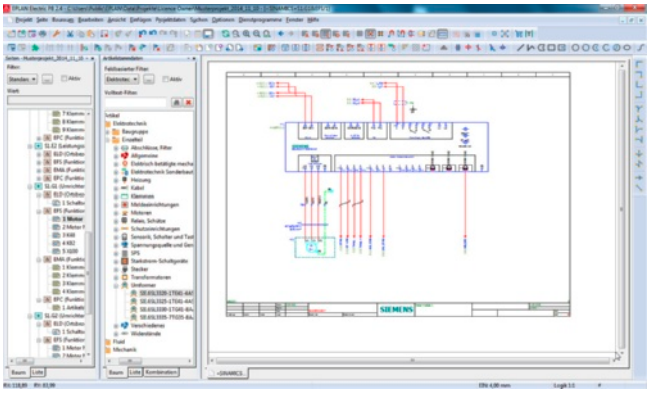
- Creating circuit diagrams for control cabinets
- Managing article master data
- Automatic generation of bills of materials, terminal plans, PLC diagrams and overviews
- Preparation of the documentation for the configured system
- Design of the mechanical control cabinet configuration

EPLAN macros for SINAMICS components

EPLAN Electric P8 macros are available as downloads without charge, so that SINAMICS components can be easily and cost-effectively integrated into an EPLAN project. Macros are available for the following components:

- SINAMICS G120P, PM330 Power Modules
- SINAMICS G130 built-in units
- SINAMICS S120 chassis units
- SINAMICS DCM DC converters
- Line and motor-side components
- DC link components
- Control Units
- Supplementary system components

Using EPLAN Electric P8 macros substantially shortens the configuration time. All the necessary information about a component is supplied at the press of a button. This ensures that the data is up-to-date and correct – and mistakes/errors can be avoided.



EPLAN user interface

The macros are provided in the file format EDZ (EPLAN Data Archived Zipped). An EDZ file is an archive for article master data, CAx data and macros. A macro in EDZ format contains the following data:

- Internal circuit diagrams
- Wiring diagrams
- Product master data
- Product images
- Data sheets

EPLAN Electric P8 macros for SINAMICS components are available in the following tools:

- Drive Technology Configurator (www.siemens.com/dt-configurator)
- CAx Onlinemanager
- Image database (download)

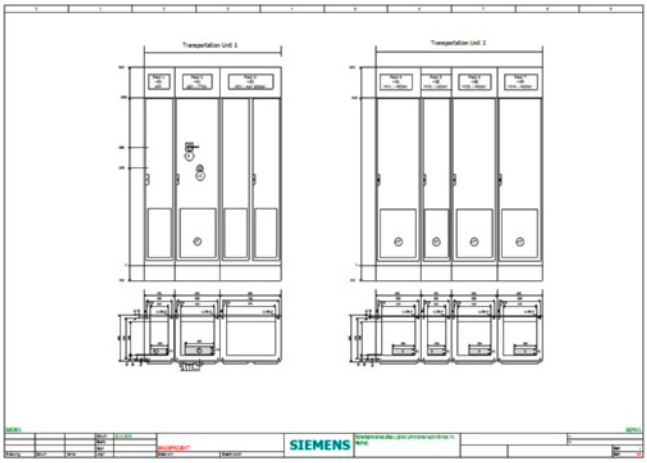
EPLAN projects fo SINAMICS converter cabinet units

EPLAN projects are available for SINAMICS converter cabinet units, that simplify the configuration, and save time throughout the entire engineering process. EPLAN projects are available for the following converter cabinet units:

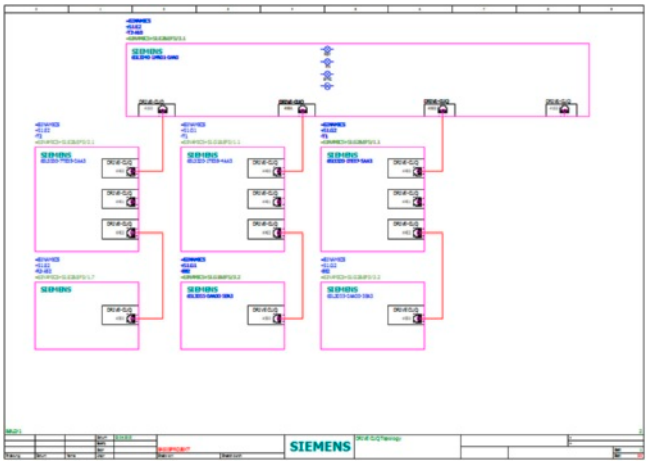
- SINAMICS G120P Cabinet
- SINAMICS G150
- SINANICS G180
- SINAMICS S120 Cabinet Modules
- SINAMICS S150
- SINAMICS DCM Cabinet

The complete EPLAN project is supplied on a separate DVD-ROM together with the converter. The order is made by stating an additional article no. or a cabinet option.

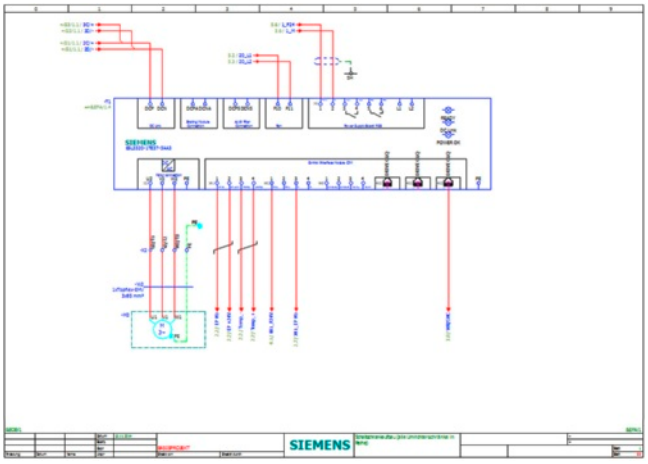
Overview (continued)



EPLAN project: Control cabinet layout



EPLAN project: DRIVE-CLiQ topology



EPLAN project: Circuit diagram

The following data are available when you purchase the DVD-ROM:

- EPLAN project as a ZW1 file
- Updated, customer-specific, project article master database
- List of the article nos. created in the project
- A PDF version of the project

The EPLAN project includes the following documentation components:

- Title sheet
- Table of contents
- List of the structure identifiers used
- Single-line diagram
- General layout, external view
- General layout, internal view
- Circuit diagram
- Terminal diagram
- Connector diagram
- Parts list
- Order list/complete parts list

Selection and ordering data

Description	Article No.
EPLAN Electric P8 Project documentation on DVD-ROM for: • SINAMICS S120 P Cabinet • SINAMICS S120 Cabinet Modules • SINAMICS S150 • SINAMICS G150	**6SL3780-0AK00-0AA0**

Description	**Order code** (**-Z** and the order code must be added to the article no. of the corresponding converter)
EPLAN Electric P8 Project documentation on DVD-ROM for:	
• SINAMICS G180	**X80**
• SINAMICS DCM Cabinet	**D03**

Overview

To correctly select and configure the devices listed in Catalog D 11, we would like to refer to the SINAMICS Low Voltage Engineering Manual. This supplements the Catalogs D 11 and D 21.3, and is intended to simplify the handling of SINAMICS series devices.

This manual is only available in electronic form and only in German and English. It is available as a PDF in the Information and Download Center.

The Engineering Manual contains general information on the basics of variable-speed electric AC drives, as well as detailed system descriptions and direct specifications for the following SINAMICS series devices:

- SINAMICS G130 converter built-in units (Catalog D 11)
- SINAMICS G150 converter cabinet units (Catalog D 11)
- Modular SINAMICS S120 built-in units (Catalogs D 21.3 and PM 21 / "SINAMICS S120 drive system")
- Modular SINAMICS S120 cabinet units (Catalog D 21.3)
- SINAMICS S150 converter cabinet units (Catalog D 21.3)

The Engineering Manual is divided into several sections with different layouts.

The first chapter – Basics and system description – essentially explains the physical basics of variable-speed electric AC drives and provides a generally valid system description of the SINAMICS series devices.

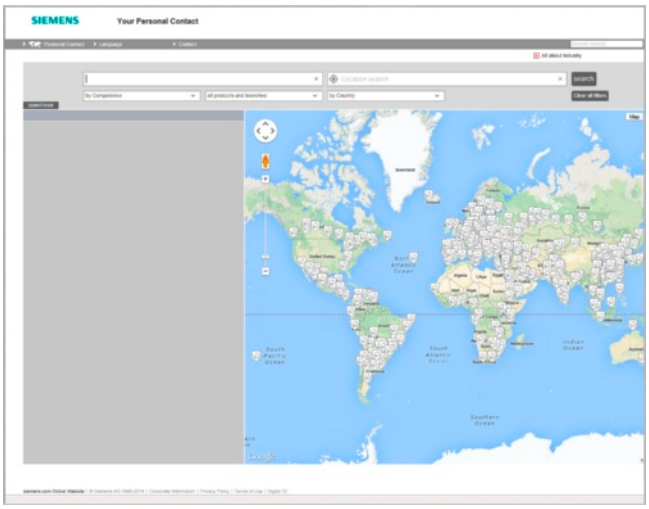
The second chapter – EMC design guideline – discusses the topic of electromagnetic compatibility (**EMC**) and provides all the information required to configure and install drives with the specified SINAMICS devices in compliance with EMC guidelines.

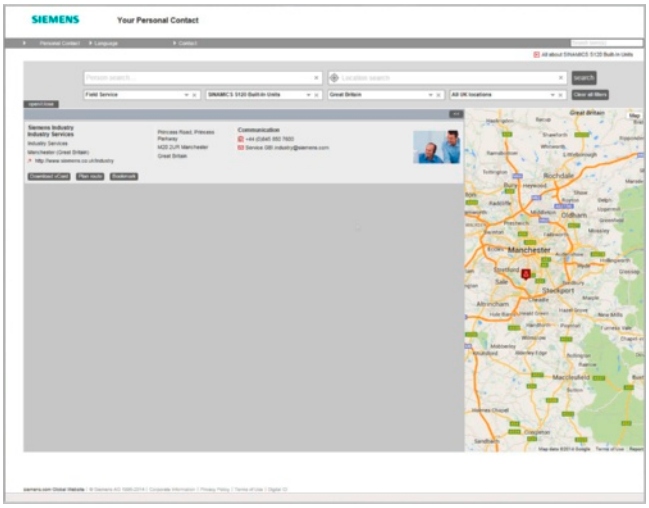
The following chapters – Configuration of the SINAMICS G130, G150, S120 built-in units, S120 Cabinet Modules and S150 devices – discuss device-specific topics, which go beyond the contents of the generally valid system descriptions.

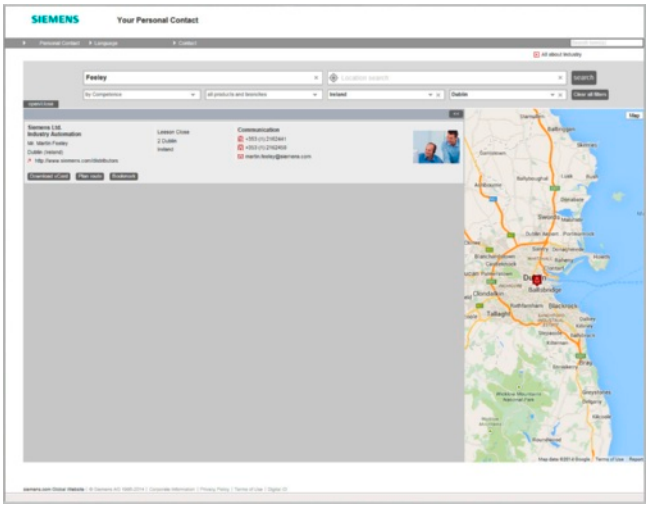
The information provided addresses technically qualified and trained personnel. It is the responsibility of the configuration engineer to evaluate the completeness of the information provided for the respective application. This person also has the final system responsibility for the entire drive or the plant.

Notes

Services and documentation







At Siemens we are resolutely pursuing the same goal: long-term improvement of your competitive ability.
We are committed to this goal. Thanks to our commitment, we continue to set new standards in automation and drive technology. In all industries – worldwide.

At your service locally, around the globe for consulting, sales, training, service, support, spare parts ... on the entire Industry Automation and Drive Technologies range.

Your personal contact can be found in our Contacts Database at:
www.siemens.com/automation/partner

You start by selecting

- the required competence,
- products and branches,
- a country,
- a city

or by a

- location search or
- person search.

The Future of Manufacturing in the WWW

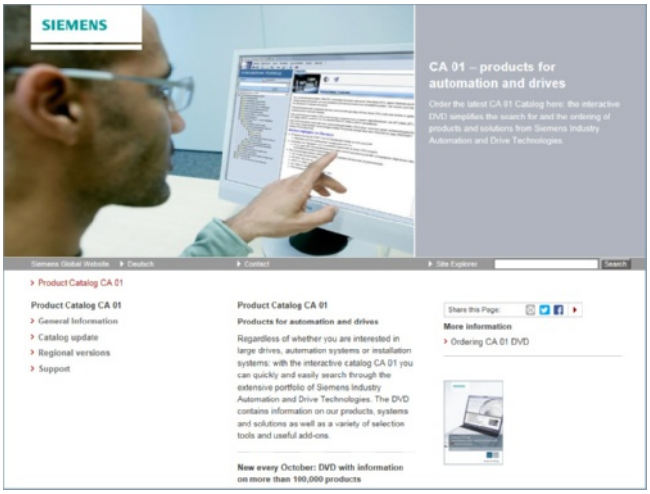
Detailed knowledge of the range of products and services available is essential when planning and engineering automation systems. It goes without saying that this information must always be as up-to-date as possible.

Industry is on the threshold of the fourth industrial revolution as digitization now follows after the automation of production. The goals are to increase productivity and efficiency, speed, and quality. In this way, companies can remain competitive on the path to the future of industry.

You will find everything you need to know about products, systems and services on the internet at:

www.siemens.com/industry

Product Selection Using the Interactive CA 01 Automation and Drives Catalog



Detailed information together with user-friendly interactive functions:
The CA 01 interactive catalog covers more than 100,000 products, thus providing a comprehensive overview of the product range provided by Siemens.

You will find everything you need here for solving tasks in the fields of automation, switching, installation and drives.
All information is provided over a user interface that is both user-friendly and intuitive.

You can order the CA 01 product catalog from your Siemens sales contact or in the Information and Download Center:

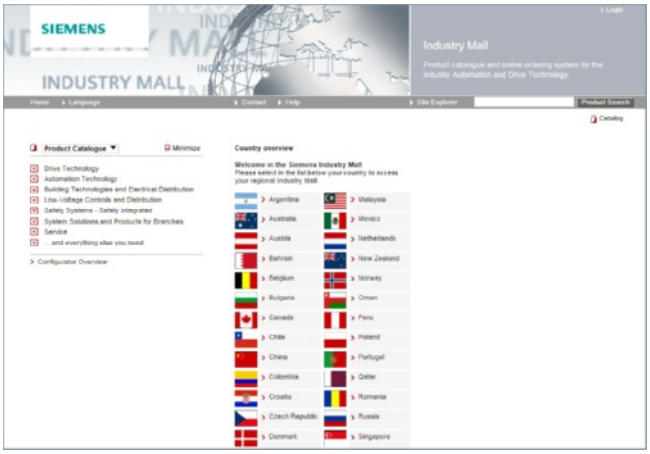
www.siemens.com/industry/infocenter

Information about the CA 01 interactive catalog can be found on the Internet at:

www.siemens.com/automation/ca01

or on DVD.

Easy Shopping with the Industry Mall



The Industry Mall is the electronic ordering platform of Siemens AG on the Internet. Here you have online access to a huge range of products presented in an informative and attractive way.

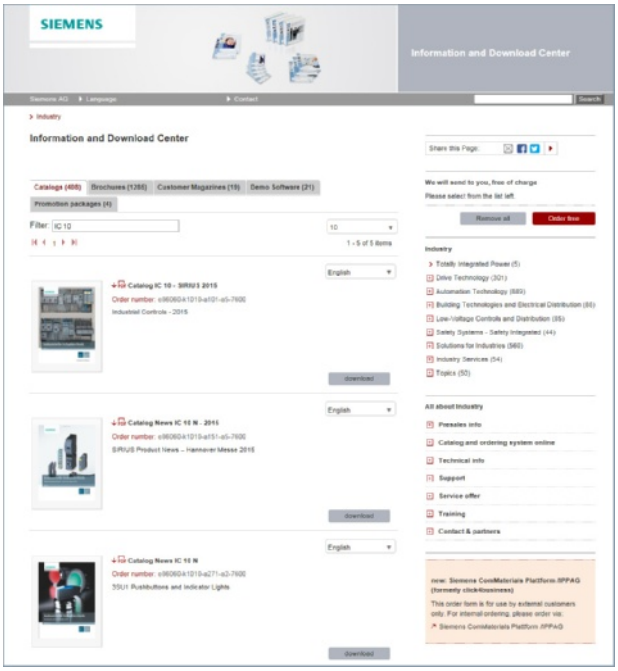
Data transfer via EDIFACT allows the whole procedure, from selection through ordering to tracking and tracing, to be carried out online. Availability checks, customer-specific discounts and bid creation are also possible.

Numerous additional functions are provided for your support. For example, powerful search functions make it easy to select the required products. Configurators enable you to configure complex product and system components quickly and easily. CAx data types are also provided here.

You can find the Industry Mall on the Internet at:

www.siemens.com/industrymall

Downloading Catalogs



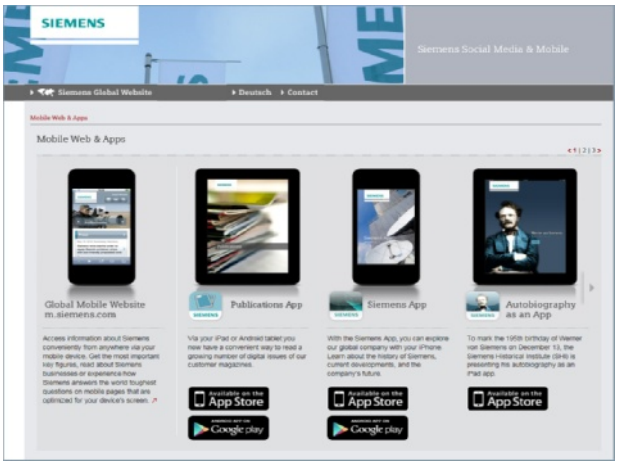
In addition to numerous other useful documents, you can also find the catalogs listed on the back inside cover of this catalog in the Information and Download Center. You can download these catalogs in PDF format without having to register.

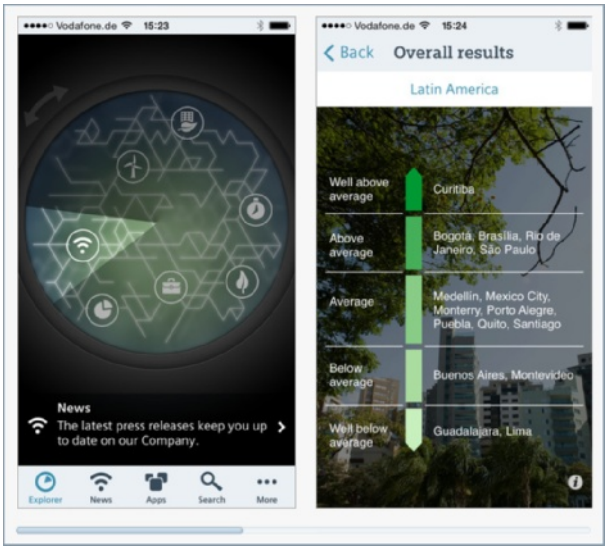
The filter dialog above the first catalog displayed makes it possible to carry out targeted searches. If you enter "MD 3" for example, you will find both the MD 30.1 and MD 31.1 catalogs. If you enter "IC 10", both the IC 10 catalog and the associated news or add-ons are displayed.

Visit us at:

www.siemens.com/industry/infocenter

Social and Mobile Media





Connect with Siemens through social media: visit our social networking sites for a wealth of useful information, demos on products and services, the opportunity to provide feedback, to exchange information and ideas with customers and other Siemens employees, and much, much more. Stay in the know and follow us on the ever-expanding global network of social media.

To find out more about Siemens' current social media activities, visit us at:

www.siemens.com/socialmedia

Or via our product pages at:

www.siemens.com/automation or www.siemens.com/drives

Connect with Siemens Industry at our central access point to read all the news on the future of manufacturing, watch current videos and inform yourself about all the latest industry developments:

www.siemens.com/future-of-manufacturing/news.html

Discover the world of Siemens.

We are also constantly expanding our offering of cross-platform apps for smartphones and tablets. You will find the current Siemens apps at the App Store (iOS) or at Google Play (Android):

https://itunes.apple.com/en/app/siemens/id452698392?mt=8

https://play.google.com/store/search?q=siemens

The Siemens app, for example, tells you all about the history, latest developments and future plans of the company – with informative pictures, fascinating reports and the most recent press releases.

Your machines and plant can do more – with Industry Services.

Whether it is production or process industry - in view of rising cost pressure, growing energy costs, and increasingly stringent environmental regulations, services for industry are a crucial competitive factor in manufacturing as well as in process industries.

All over the world Siemens supports its customers with product, system, and application-related services throughout the entire life cycle of a plant. Right from the earliest stages of planning, engineering, and building, all the way to operation and modernization. These services enable customers to benefit from the Siemens experts' unique technological and product knowledge and industry expertise.

Thus downtimes are reduced and the utilization of resources is optimized. The bottom line: increased plant productivity, flexibility, and efficiency, plus reduced overall costs.

Discover all advantages of our service portfolio:
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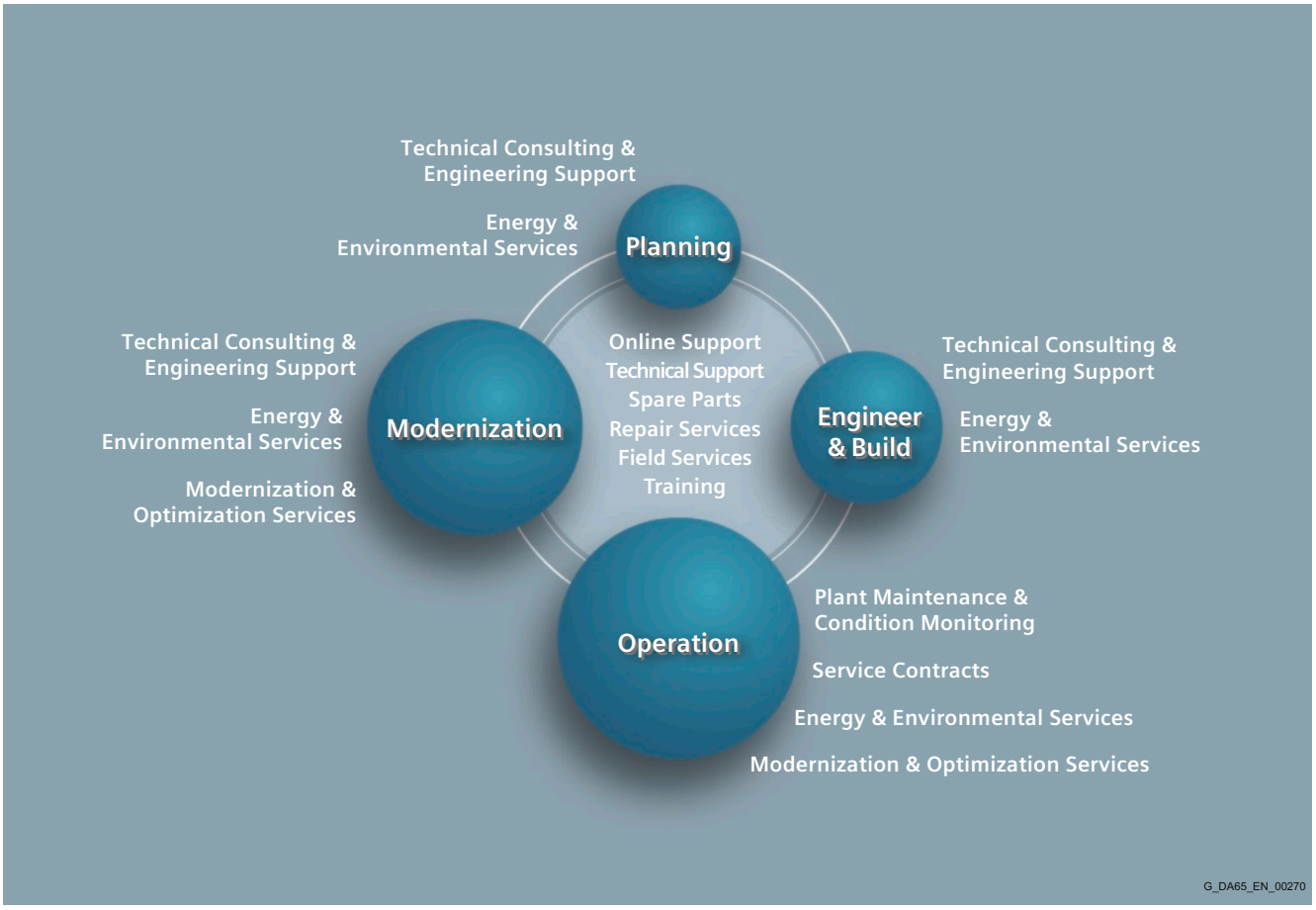


Siemens supports its clients with technology based Services across a plants entire life cycle.

Industry Services for the entire life cycle

Online Support

Online support is a comprehensive information system for all questions relating to products, systems, and solutions that Siemens has developed for industry over time. With more than 300,000 documents, examples and tools, it offers users of automation and drive technology a way to quickly find up-to-date information. The 24-hour service enables direct, central access to detailed product information as well as numerous solution examples for programming, configuration and application.

The content, in six languages, is increasingly multimediabased – and now also available as a mobile app. Online support's "Technical Forum" offers users the opportunity to share information with each other. The "Support Request" option can be used to contact Siemens' technical support experts. The latest content, software updates, and news via newsletters and Twitter ensure that industry users are always up to date.

www.siemens.com/industry/onlinesupport

Online Support App

Using the Online Support app, you can access over 300,000 documents covering all Siemens industrial products - anywhere, any time. Regardless of whether you need help implementing your project, fault-finding, expanding your system or are planning a new machine.

You have access to FAQs, manuals, certificates, characteristics curves, application examples, product notices (e.g. announcements of new products) and information on successor products in the event that a product is discontinued.

Just scan the product code printed on the product directly using the camera of your mobile device to immediately see all technical information available on this product at a glance. The graphical CAx information (3D model, circuit diagrams or EPLAN macros) is also displayed. You can forward this information to your workplace using the e-mail function.

The search function retrieves product information and articles and supports you with a personalized suggestion list. You can find your favorite pages – articles you need frequently – under "mySupport". You also receive selected news on new functions, important articles or events in the News section.

Scan the QR code for information on our Online Support app.

The app is available free of charge from the Apple App Store (iOS) or from Google Play (Android).

www.siemens.com/industry/onlinesupportapp

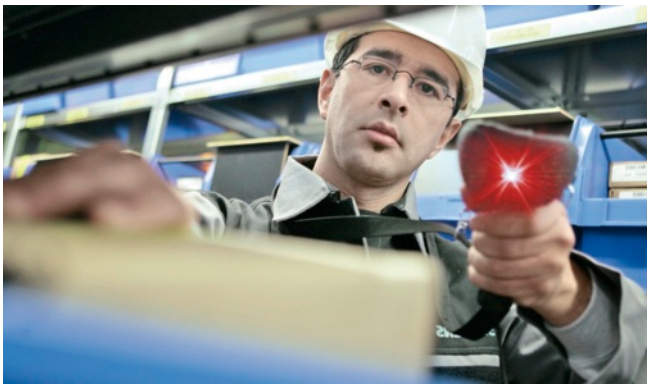
Technical Support

The ability to quickly analyze system and error messages and take appropriate action are key factors in ensuring that plants run safely and efficiently. Questions can arise at any time and in any industry, whether it's an individual product or a complete automation solution. Siemens technical support offers individual technical assistance in matters related to functionality, how to operate, applications, and fault clearance in industrial products and systems – at any time and globally, over the phone, by e-mail, or via remote access. Experienced experts from Siemens answer incoming questions promptly. Depending on the requirements, they first consult specialists in the areas of development, on-site services, and sales. Technical support is also available for discontinued products that are no longer available. Using the support request number, any inquiry can be clearly identified and systematically tracked.

http://support.automation.siemens.com/WW/view/en/16605032

Spare Parts

Drive and automation systems must be available at all times. Even a single missing spare part can bring the entire plant to a standstill – and result in substantial financial losses for the operator. The spare parts services from Siemens protects against such losses – with the aid of quickly available, original spare parts that ensure smooth interaction with all other system components. Spare parts are kept on hand for up to ten years; defective parts can be returned. For many products and solutions, individual spare parts packages ensure a preventive stock of spare parts on-site. The spare parts services is available around the world and around the clock. Optimum supply chain logistics ensure that replacement components reach their destination as quickly as possible. Siemens' logistics experts take care of planning and management as well as procurement, transportation, customs handling, warehousing, and complete order management for spare parts.



http://support.automation.siemens.com/WW/view/en/43502238

Repair Services

Reliable electrical and electronic equipment is crucial for operating continuous processes. That is why it is essential that motors and converters always undergo highly specialized repair and maintenance. Siemens offers complete customer and repair services – on site and in repair centers – as well as technical emergency services worldwide. The repair services include all measures necessary to quickly restore the functionality of defective units. In addition, services such as spare parts logistics, spare parts storage and rapid manufacturing are available to plant operators in all verticals. With a global network of certified repair shops operated by Siemens as well as third parties, Siemens handles the maintenance and overhaul of motors, converters, and other devices as an authorized service partner.

http://support.automation.siemens.com/WW/view/en/16610214

Field Services

It's a top priority in all industries: the availability of plants and equipment. Siemens offers specialized maintenance services such as inspection and upkeep as well as rapid fault clearance in industrial plants – worldwide, continuously, and even with emergency services as needed. The services include startup as well as maintenance and fault clearance during operation. The startup service includes checking the installation, function tests, parameterization, integration tests for machines and plants, trial operation, final acceptance, and employee training. All services, including remote maintenance of drives, are also available as elements of customized service contracts.

http://support.automation.siemens.com/WW/view/en/66012486

Industry Services for the entire life cycle

Training

Increasingly, up-to-date knowledge is becoming a determining factor in success. One of the key resources of any company is well-trained staff that can make the right decision at the right moment and take full advantage of the potential. With SITRAIN – Training for Industry, Siemens offers comprehensive advanced training programs. The technical training courses convey expertise and practical knowledge directly from the manufacturer. SITRAIN covers Siemens' entire product and system portfolio in the field of automation and drives. Together with the customer, Siemens determines the company's individual training needs and then develops an advanced training program tailored to the desired requirements. Additional services guarantee that the knowledge of all Siemens partners and their employees is always up-to-date.

http://support.automation.siemens.com/WW/view/en/43514324

Technical Consulting & Engineering Support

The efficiency of plants and processes leads to sustainable economic success. Individual services from Siemens help save substantial time and money while also guaranteeing maximum safety. Technical consulting covers the selection of products and systems for efficient industrial plants. The services include planning, consulting, and conceptual design as well as product training, application support, and configuration verification – in all phases of a plant's lifecycle and in all questions related to product safety. Engineering support offers competent assistance throughout the entire project, from developing a precise structure for startup to product-specific preparation for implementation as well as support services in areas such as prototype development, testing and acceptance.

http://support.automation.siemens.com/WW/view/en/16605680

Energy & Environmental Services

Efficient energy use and resource conservation – these top sustainability concerns pay off – both for the environment and for companies. Siemens offers integrated solutions that unlock all technical and organizational potential for successful environmental management. Customized consulting services are aimed at sustainably lowering the cost of energy and environmental protection and thus increasing plant efficiency and availability. The experts provide support in the conceptual design and implementation of systematic solutions in energy and environmental management, enabling maximum energy efficiency and optimized water consumption throughout the entire company. Improved data transparency makes it possible to identify savings potential, reduce emissions, optimize production processes, and thereby noticeably cut costs.

http://support.automation.siemens.com/WW/view/en/42350774

Modernization & Optimization Services

High machine availability, expanded functionality and selective energy savings – in all industries, these are decisive factors for increasing productivity and lowering costs. Whether a company wants to modernize individual machines, optimize drive systems, or upgrade entire plants, Siemens' experts support the projects from planning to commissioning.

Expert consulting and project management with solution responsibility lead to security and make it possible to specifically identify savings potential in production. This secures investments over the long term and increases economic efficiency in operation.

http://support.automation.siemens.com/WW/view/en/66005532

Plant Maintenance & Condition Monitoring

Modern industrial plants are complex and highly automated. They must operate efficiently in order to ensure the company's competitive strength. In addition, the steadily increasing networking of machines and plants require consistent security concepts. Maintenance and status monitoring as well as the implementation of integrated security concepts by Siemens' experts support optimum plant use and avoid downtime. The services include maintenance management as well as consulting on maintenance concepts, including the complete handling and execution of the necessary measures. Complete solutions also cover remote services, including analysis, remote diagnosis, and remote monitoring. These are based on the Siemens Remote Services platform with certified IT security.

http://support.automation.siemens.com/WW/view/en/59456862

Service Contracts

Making maintenance costs calculable, reducing interfaces, speeding up response times, and unburdening the company's resources – the reduced downtimes that these measures achieve increase the productivity of a plant. Service contracts from Siemens make maintenance and repairs more cost-effective and efficient. The service packages include local and remote maintenance for a system or product group in automation and drive technology. Whether you need extended service periods, defined response times, or special maintenance intervals, the services are compiled individually and according to need. They can be adjusted flexibly at any time and used independently of each other. The expertise of Siemens' specialists and the capabilities of remote maintenance thus ensure reliable and fast maintenance processes throughout a plant's entire lifecycle.

http://support.automation.siemens.com/WW/view/en/65961857

You benefit from practical training right from the manufacturer

SITRAIN Training for Industry provides you with comprehensive support in solving your tasks.

Training right from the manufacturer enables you to make better choices with more confidence in your decision-making processes.

SITRAIN Training means:

- Less time for commissioning, maintenance and servicing
- Optimized production operations
- Safe engineering and commissioning
- Shorter start-up times, reduced downtimes and faster fault clearance
- Swift elimination of deficits in existing plants
- Avoidance of costly planning errors right from the start
- Flexible plant adaptation to market requirements
- Ensure quality standards in production
- Increased employee satisfaction and motivation
- Shorter orientation periods in case of technology or personnel change

Contact

Visit our website at:

www.siemens.com/sitrain

or let us advise you personally. You can request our latest training catalog from:

SITRAIN – Training for Industry
Customer Support Germany:

Phone: +49 911 895-7575

Fax: +49 911 895-7576

E-mail: info@sitrain.com

Important key data

Top trainers

Our trainers are skilled specialists with direct and extensive practical experience. Course developers have close contact with product development and directly pass on their knowledge to the trainers, and with that at the end to you.

Practical experience

Practice makes perfect – that's why we attach greatest importance to hands-on learning. Practical exercises can comprise up to half of the course time. You can therefore immediately implement your new knowledge in your day-to-day work.

300 courses in 62 countries

We offer a total of about 300 local attendance courses. You can find us at more than 50 locations in Germany, and in 62 countries worldwide. To find out which course is held at which location, go to:

www.siemens.com/sitrain

Customized training

Would you prefer individual training instead? Our solution: We will provide a program tailored exactly to your personal requirements. Training can be carried out in our Training Centers or onsite at your company.

We instruct you using state-of-the-art training equipment which has been especially designed by our developers for the SITRAIN courses. This training approach will give you all the assurance you need.

The right mixture: Blended learning

Blended learning involves a combination of various training media. For example, a face-to-face course in a training center can be optimally supplemented by teach-yourself Web-based training (WBT) courses as preparation or follow-up.
The add-on effect: Reduced traveling costs and periods of absence.

Overview

Training courses for SINAMICS G150/G130/S150

Here you will find an overview of the training courses available for the SINAMICS G150/G130/S150.

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 basic and follow-up courses are guaranteed to provide all of the technical knowledge that service personnel will need for commissioning and service.

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 in Catalog ITC and on the Internet.

Title	**Target group**			**Duration**	**Course code**
(all courses are available in English and German)	Sales personnel, planners, decision makers	Commissioning engineers, programmers	Service personnel, maintenance technicians		
SINAMICS system overview	✓	–	–	2 days	DR-SN-UEB
Integrated drive systems - introduction and basic information	✓	–	–	3 days	DR-IDS
SIMOTICS induction motors - planning and configuration	✓	–	–	3 days	DR-ASM-PL
SINAMICS G150/G130/S150 - diagnostics and service	–	✓	✓	5 days	DR-G15-DG
SINAMICS on PROFINET and PROFIBUS - diagnostics and service	–	–	✓	3 days	DR-NET-DG

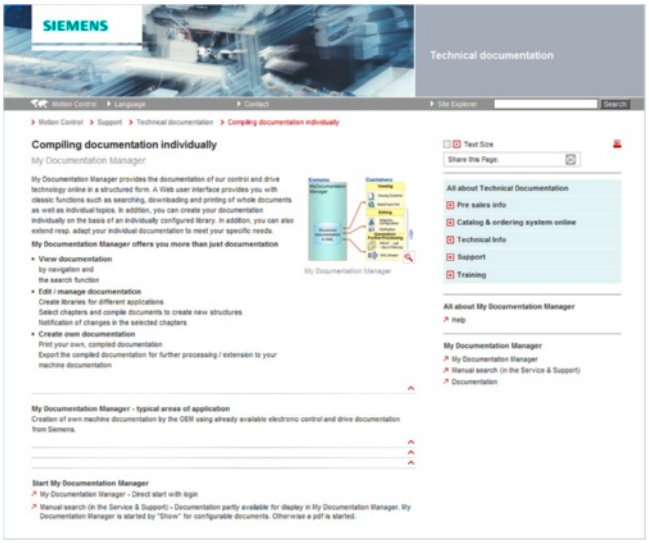
Overview

Spares on Web – Identification of spare parts on the Internet

Spares on Web is a web-based tool for identifying spare parts. After you have entered the Article No. and serial number, the spare parts available for the relevant unit are displayed.

www.siemens.com/sow

Overview



My Documentation Manager – Customizing information

My Documentation Manager offers all Motion Control customers an innovation with extended usability: Machine manufacturers and end customers are not only able to assemble their own customized technical documents for a specific product or system, they can also generate complete libraries with individually configured contents. The content that matches your topic can be found from the full range of documentation stored under Service & Support using the operator interface and assembled using drag & drop into application-based libraries, generated and even combined with your own documentation. The self-generated collections can be saved in the commonly used RTF and PDF formats or even in XML format.

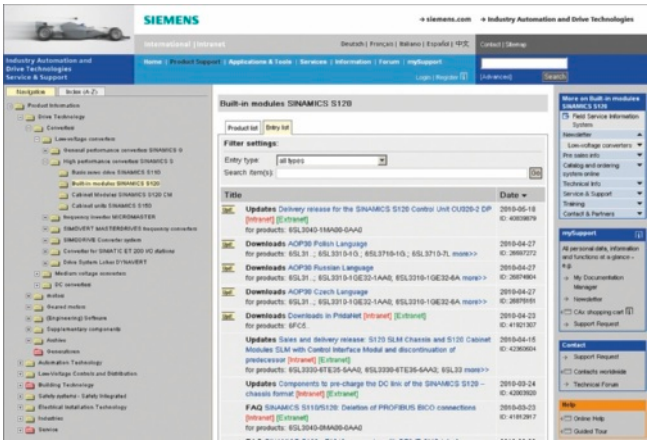
You must register for configuring and generating/managing (the existing login can be used, e.g. Industry Mall
www.siemens.com/industrymall

Benefits

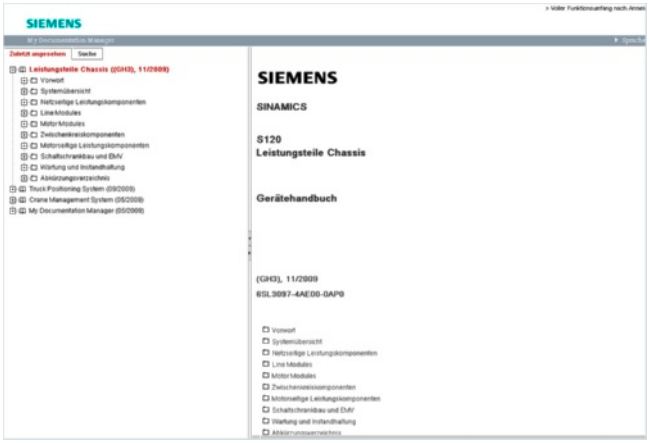
- Display
  View, print or download standard documents or personalized documents
- Configure
  Transfer standard documents or parts of them to personalized documents
- Generate/Manage
  Produce and manage personalized documents in the formats PDF, RTF or XML

Design

My Documentation Manager is the web-based system to generate personalized documentation based on standard documents. It is part of the Service & Support Portal.



Search in the Service & Support portal



Document in My Documentation Manager

Function

Opening My Documentation Manager

My Documentation Manager opens in two ways

- Search in the Service & Support portal
  www.siemens.com/automation/service&support
  The appropriate manuals are designated by "configurable". My Documentation Manager opens by clicking on "Display and configure". The selected document is displayed as the current document.
- Using the direct link from the Service & Support portal
  www.automation.siemens.com/docconf/
  After logon/registration, the online help is displayed as current document.

More information

You can find more information on the Internet at
www.siemens.com/mdm

Documentation

Overview

SINAMICS G130 converter built-in units

Comprehensive documentation is available for the SINAMICS G130 converter built-in units ranging from Operating Instructions through List Manuals to the Engineering Manual.

Information is available in the following formats:

- PDF file
- Documents/documentation for the configuration and for downloading at:

https://support.industry.siemens.com/cs/ww/en/ps/13226/man

SINAMICS G150 converter cabinet units

The documentation is provided as standard in the PDF format on CD-ROM, and comprises the following parts:

- Description
- Installation instructions
- Commissioning guide
- Description of functions
- Maintenance information
- Engineering Manual
- Lists of spare parts

As well as device-specific documentation, such as circuit diagrams, dimension drawings, layout diagrams and terminal diagrams.

Documentation in English/German is supplied as standard with the device.

The scope of delivery also includes a DVD-ROM with the STARTER commissioning tool.

If one of the languages subsequently listed is required, when ordering this should be specified using the corresponding option order code (see Description of options):

Language	Order code
English/French	**D58**
English/Spanish	**D60**
English/Italian	**D80**
English/Chinese	**D91**
English/Russian	**D94**

Configuring documents/documentation available for downloading at:

https://support.industry.siemens.com/cs/ww/en/ps/13227/man

Application

Explanations for the manuals:

- **Operating Instructions**
  contain all the information needed for the installation and for the electrical connection of the components, information about commissioning and a description of the converter functions.
  Phases of use: Control cabinet construction, commissioning, operation, maintenance and servicing.
- **Engineering Manual**
  contains all the information needed for the EMC-compliant installation and for the configuration of control cabinets and drive systems.
  Phases of use: Control cabinet configuration/construction.
- **List Manual**
  describes all parameters, function diagrams and faults/alarms for the product/system as well as their meaning and setting options. It contains parameter data and fault/alarm descriptions with functional correlations.
  Phases of use: Commissioning of components that have already been connected, configuration of system functions, fault cause/diagnostics.
- **Function Manual**
  contains all the relevant information about individual drive functions.
  Phases of use: Commissioning of components that have already been connected, configuration of system functions.

Appendix

Overview

Many products in this catalog are in compliance with UL/CSA and FM requirements and are labeled with the appropriate certification markings.

All approvals, certificates, declarations of conformity, test certificates, e.g. CE, UL, Safety Integrated etc. have been performed with the associated system components as they are described in the Catalogs and Engineering Manuals.

The certificates are only valid if the products are used with the described system components, are installed according to the Installation Guidelines and are used for their intended purpose.

In other cases, the vendor of these products is responsible for arranging for new certificates to be issued.

UL: Underwriters Laboratories independent public testing institution in North America

Test symbol:

- **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:

- SINUMERIK: Standard UL 508
- SINAMICS: Standard UL 508C
- SIMODRIVE: Standard UL 508C
- Motors: Standard UL 547

Product category/file No.:

- SINUMERIK: 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)

Test symbol:

- **cTUVus** tested by TUV in accordance with UL and CSA standards

Test standards:

- SIMODRIVE: NRTL Listing according to standard UL 508C

Product category/file No.:

- SIMODRIVE: TUV.COM/4335304002

CSA: Canadian Standards Association independent public testing institution in Canada

Test symbol:

- **CSA** tested by CSA in accordance with CSA standard

Test standard:

- Standard CAN/CSA-C22.2 No. 0-M91/No. 14-05/ No. 142-M1987

File No.:

- SINUMERIK FM ... : LR 102527

FMRC: Factory Mutual Research Corporation Independent public testing institution in North America

Test symbol:

- **FM** tested by FM in accordance with FM standard

Test standard:

- Standard FMRC 3600, FMRC 3611, FMRC 3810 Class I, Div.2, Group A, B, C, D

File No.:

- SINUMERIK FM... : 4Y1A7.AX
  5B0A2.AX
  2D7A2.AX
  3007320

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 Industry Automation & Drive Technologies offers various types of software license:

- Floating license
- Single license
- Rental license
- Rental floating license
- Trial license
- Demo license
- Demo floating 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 per license.

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 instance, 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 period of time (the operating hours do not have to be consecutive).
One license is required for each installation of the software.

Rental floating license

The rental floating license corresponds to the rental license, except that a license is not required for each installation of the software. Rather, one license is required per object (for example, user or device).

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.

Demo license

The demo license support the "sporadic use" of engineering software in a non-productive context, for example, use for testing and evaluation purposes. It can be transferred to another license. After the installation of the license key, the software can be operated for a specific period of time, whereby usage can be interrupted as often as required.

One license is required per installation of the software.

Demo floating license

The demo floating license corresponds to the demo license, except that a license is not required for each installation of the software. Rather, one license is required per object (for example, user or device).

Certificate of license (CoL)

The 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.

Software Licenses

Overview

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 Industry Automation & Drive Technologies 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).

Software Update Service (SUS)

As part of the SUS contract, all software updates for the respective product are made available to you free of charge for a period of one year from the invoice date. The contract will automatically be extended for one year if it is not canceled three months before it expires.

The possession of the current version of the respective software is a basic condition for entering into an SUS contract.

You can download explanations concerning license conditions from www.siemens.com/automation/salesmaterial-as/catalog/en/terms_of_trade_en.pdf

Appendix

Article number index

Appendix

Subject index

Page

Subject index

Explanation of the raw material/metal surcharges[1]

Surcharge calculation

To compensate for variations in the price of the raw materials silver, copper, aluminum, lead, gold, dysprosium[2] and/or neodym[2], surcharges are calculated on a daily basis using the so-called metal factor for products containing these raw materials. A surcharge for the respective raw material is calculated as a supplement to the price of a product if the basic official price of the raw material in question is exceeded.

The surcharges are calculated in accordance with the following criteria:

- Basic official price of the raw material
  Basic official price from the day prior to receipt of the order or prior to release order (daily price) for[3]
  - Silver (sales price, processed)
  - Gold (sales price, processed)

  and for[4]
  - Copper (lower DEL notation + 1 %)
  - Aluminum (aluminum in cables)
  - Lead (lead in cables)
- Metal factor of the products
  Certain products are displayed with a metal factor. The metal factor determines the official price (for those raw materials concerned) as of which the metal surcharges are applied 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 percentage method of calculation refers to the list price or a possible discounted price (customer net price) (L = list price / N = customer net price).

The remaining digits indicate the method of calculation used for the respective raw material. If no surcharge is added for a raw material, 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)
7th digit	for dysprosium (Dy)[2]
8th digit	for neodym (Nd)[2]

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 difference is then multiplied by the raw material weight.

The basic official price can be found in the table below using the number (1 to 9) of the respective digit of the metal factor. The raw material weight can be found in the respective product descriptions.

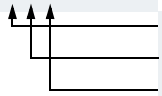
Percentage method

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.

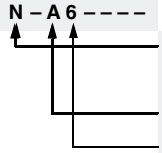
Metal factor examples

L E A – – – – –



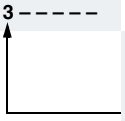
Basis for % surcharge: List price
Silver Basis 150 €, Step 50 €, 0.5 %
Copper Basis 150 €, Step 50 €, 0.1 %
No surcharge for aluminum
No surcharge for lead
No surcharge for gold
No surcharge for dysprosium
No surcharge for neodym

N – A 6 – – – –



Basis for % surcharge: Customer net price
No surcharge for silver
Copper Basis 150 €, Step 50 €, 0.1 %
Aluminum acc. to weight, basic offic. price 225 €
No surcharge for lead
No surcharge for gold
No surcharge for dysprosium
No surcharge for neodym

– – 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
No surcharge for dysprosium
No surcharge for neodym

1) Refer to the separate explanation on the next page regarding the raw materials dysprosium and neodym (= rare earths).
2) For a different method of calculation, refer to the separate explanation for these raw materials on the next page.
3) Source: Umicore, Hanau (www.metalsmanagement.umicore.com).
4) Source: Schutzvereinigung DEL-Notiz e.V. (www.del-notiz.org).

Explanation of the raw material/metal surcharges for dysprosium and neodym (rare earths)

Surcharge calculation

To compensate for variations in the price of the raw materials silver[1], copper[1], aluminum[1], lead[1], gold[1], dysprosium and/or neodym, surcharges are calculated on a daily basis using the so-called metal factor for products containing these raw materials. The surcharge for dysprosium and neodym is calculated as a supplement to the price of a product if the basic official price of the raw material in question is exceeded.

The surcharge is calculated in accordance with the following criteria:

- Basic official price of the raw material[2]
  Three-month basic average price (see below) in the period before the quarter in which the order was received or the release order took place (= average official price) for
  - dysprosium (Dy metal, 99 % min. FOB China; USD/kg)
  - neodym (Nd metal, 99 % min. FOB China; USD/kg)
- Metal factor of the products
  Certain products are displayed with a metal factor. The metal factor indicates (for those raw materials concerned) the basic official price as of which the surcharges for dysprosium and neodym are calculated using the weight method. An exact explanation of the metal factor is given below.

Three-month average price

The prices of rare earths vary according to the foreign currency, and there is no freely accessible stock exchange listing. This makes it more difficult for all parties involved to monitor changes in price. In order to avoid continuous adjustment of the surcharges, but to still ensure fair, transparent pricing, an average price is calculated over a three-month period using the average monthly foreign exchange rate from USD to EUR (source: European Central Bank). Since not all facts are immediately available at the start of each month, a one-month buffer is allowed before the new average price applies.

Examples of calculation of the average official price:

Period for calculation of the average price:	Period during which the order/release order is effected and the average price applies:
Sep 2012 - Nov 2012	Q1 in 2013 (Jan - Mar)
Dec 2012 - Feb 2013	Q2 in 2013 (Apr - Jun)
Mar 2013 - May 2013	Q3 in 2013 (Jul - Sep)
Jun 2013 - Aug 2013	Q4 in 2013 (Oct - Dec)

Structure of the metal factor

The metal factor consists of several digits; the first digit is not relevant to the calculation of dysprosium and neodym.

The remaining digits indicate the method of calculation used for the respective raw material. If no surcharge is added for a raw material, a "-" is used.

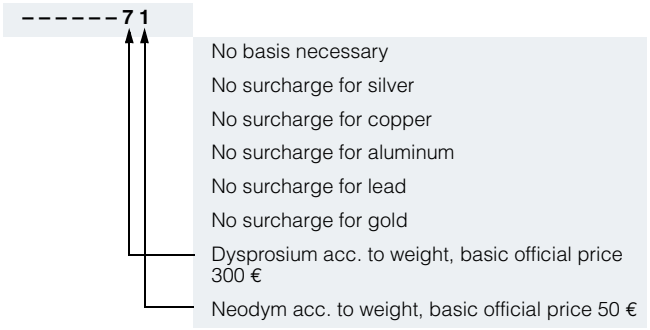
1st digit	List or customer net price using the percentage method
2nd digit	for silver (AG)[1]
3rd digit	for copper (CU)[1]
4th digit	for aluminum (AL)[1]
5th digit	for lead (PB)[1]
6th digit	for gold (AU)[1]
7th digit	for dysprosium (Dy)
8th digit	for neodym (Nd)

Weight method

The weight method uses the basic official price, the average price and the raw material weight. In order to calculate the surcharge, the basic official price must be subtracted from the average price. The difference is then multiplied by the raw material weight.

The basic official price can be found in the table below using the number (1 to 9) of the respective digit of the metal factor. Your Sales contact can inform you of the raw material weight.

Metal factor examples



[1] For a different method of calculation, refer to the separate explanation for these raw materials on the previous page.
[2] Source: Asian Metal Ltd (www.asianmetal.com)

Values of the metal factor

Percentage method	Basic official price in €	Step range in €	% surcharge 1st step Price in €	% surcharge 2nd step Price in €	% surcharge 3rd step Price in €	% surcharge 4th step Price in €	% surcharge per additional step
			150.01 - 200.00	200.01 - 250.00	250.01 - 300.00	300.01 - 350.00	
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	1.0	2.0	3.0	4.0	1.0
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
			175.01 - 225.00	225.01 - 275.00	275.01 - 325.00	325.01 - 375.00	
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
R	175	50	0.5	1.0	1.5	2.0	0.5
			225.01 - 275.00	275.01 - 325.00	325.01 - 375.00	375.01 - 425.00	
S	225	50	0.2	0.4	0.6	0.8	0.2
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
			150.01 - 175.00	175.01 - 200.00	200.01 - 225.00	225.01 - 250.00	
Y	150	25	0.3	0.6	0.9	1.2	0.3
			400.01 - 425.00	425.01 - 450.00	450.01 - 475.00	475.01 - 500.00	
Z	400	25	0.1	0.2	0.3	0.4	0.1
	Price basis (1st digit)						
L	Calculation based on the list price						
N	Calculation based on the customer net price (discounted list price)						
Weight method	**Basic official price in €**						
1	50	Calculation based on raw material weight					
2	100						
3	150						
4	175						
5	200						
6	225						
7	300						
8	400						
9	555						
Miscellaneous							
-	No metal surcharge						

Notes

Appendix

Conditions of sale and delivery

1. General Provisions

By using this catalog you can acquire hardware and software products described therein from Siemens AG subject to the following Terms and Conditions of Sale and Delivery (hereinafter referred to as "T&C"). Please note that the scope, the quality and the conditions for supplies and services, including software products, by any Siemens entity having a registered office outside Germany, shall be subject exclusively to the General Terms and Conditions of the respective Siemens entity. The following T&C apply exclusively for orders placed with Siemens Aktiengesellschaft, Germany.

1.1 For customers with a seat or registered office in Germany

For customers with a seat or registered office in Germany, the following applies subordinate to the T&C:

- the "General Terms of Payment"[1)] and,
- for software products, the "General License Conditions for Software Products for Automation and Drives for Customers with a Seat or Registered Office in Germany"[1)] and,
- for other supplies and services, the "General Conditions for the Supply of Products and Services of the Electrical and Electronics Industry"[1)].

1.2 For customers with a seat or registered office outside Germany

For customers with a seat or registered office outside Germany, the following applies subordinate to the T&C:

- the "General Terms of Payment"[1)] and,
- for software products, the "General License Conditions for Software Products for Automation and Drives for Customers with a Seat or Registered Office outside of Germany"[1)] and
- for other supplies and/or services, the "General Conditions for Supplies of Siemens Industry for Customers with a Seat or Registered Office outside of Germany"[1)].

2. Prices

The prices are in € (Euro) ex point of delivery, exclusive of packaging.

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

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

To compensate for variations in the price of raw materials (e.g. silver, copper, aluminum, lead, gold, dysprosium and neodym), surcharges are calculated on a daily basis using the so-called metal factor for products containing these raw materials. A surcharge for the respective raw material is calculated as a supplement to the price of a product if the basic official price of the raw material in question is exceeded.

The metal factor of a product indicates the basic official price (for those raw materials concerned) as of which the surcharges on the price of the product are applied, and with what method of calculation.

You will find a detailed explanation of the metal factor on the page headed "Metal surcharges".

To calculate the surcharge (except in the cases of dysprosium and neodym), the official price from the day prior to that on which the order was received or the release order was effected is used.

To calculate the surcharge applicable to dysprosium and neodym ("rare earths"), the corresponding three-month basic average price in the quarter prior to that in which the order was received or the release order was effected is used with a one-month buffer (details on the calculation can be found in the explanation of the metal factor).

3. Additional Terms and Conditions

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

Illustrations are not binding.

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SINAMICS G180 Converters – Compact Units, Cabinet Systems, Cabinet Units Air-Cooled and Liquid-Cooled	D 18.1
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