Safety Technology for Factory Automation

Catalog News SI 10 N · 2012

Safety Integrated

Answers for industry.

SIEMENS

Related catalogs

Safety Integrated SI 10
Safety Technology for
Factory Automation

E86060-K7010-A101-A2-7600

SIMATIC ST 70
Products for
Totally Integrated Automation
and Micro Automation

E86060-K4670-A101-B3-7600

Industrial Controls IC 10
SIRIUS

E86060-K1010-A101-A2-7600

SIMATIC Ident ID 10
Industrial Identification Systems

E86060-K8310-A101-A7-7600

Motion Control PM 21
SIMOTION, SINAMICS S120
and Motors for
Production Machines

E86060-K4921-A101-A2-7600

Industrial Communication IK PI
SIMATIC NET

E86060-K6710-A101-B7-7600

Process Automation FI 01
Field Instruments for
Process Automation

E86060-K6201-A101-B4-7600

Process Automation PA 01
Process Analytical Instruments

(PDF only: E86060-K3501-A101-A7-7600)

SIMATIC HMI /
PC-based Automation ST 80/ST PC
Human Machine Interface Systems
PC-based Automation

E86060-K4680-A101-B8-7600

SINAMICS G110/SINAMICS G120 D 11.1
Standard Inverters
SINAMICS G120D
Distributed Inverters

E86060-K5511-A111-A6-7600

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

E86060-K5511-A101-A5-7600

SINAMICS S120 D 21.3
Chassis Format
Units and Cabinet Modules
SINAMICS S150
Converter Cabinet Units
E86060-K5521-A131-A3-7600

Motion Control Drives D 31
SINAMICS and motors
for single-axis drives

E86060-K5531-A101-A1-7600

SINAMICS S110 PM 22
The Basic Positioning Drive

E86060-K4922-A101-A1-7600

SITOP KT 10.1
Power supply
SITOP

E86060-K2410-A111-A8-7600

SITRAIN ITC
Training for Automation and
Industrial Solutions

Only available in German
E86060-K6850-A101-C2

Products for Automation
and Drives CA 01
Interactive Catalog

DVD: E86060-D4001-A510-D1-7600

Industry Mall
Information and Ordering Platform
in the Internet:

www.siemens.com/industrymall

Safety Integrated
Safety Technology for Factory Automation

Catalog News SI 10 N · 2012

The products and systems described in this catalog are manufactured/distributed under application of a certified quality management system in accordance with DIN EN ISO 9001. The certificate is recognized by all IQNet countries.

Refer to the Industry Mall for current updates of this catalog:
www.siemens.com/industrymall
and see also under
www.siemens.com/safety-integrated

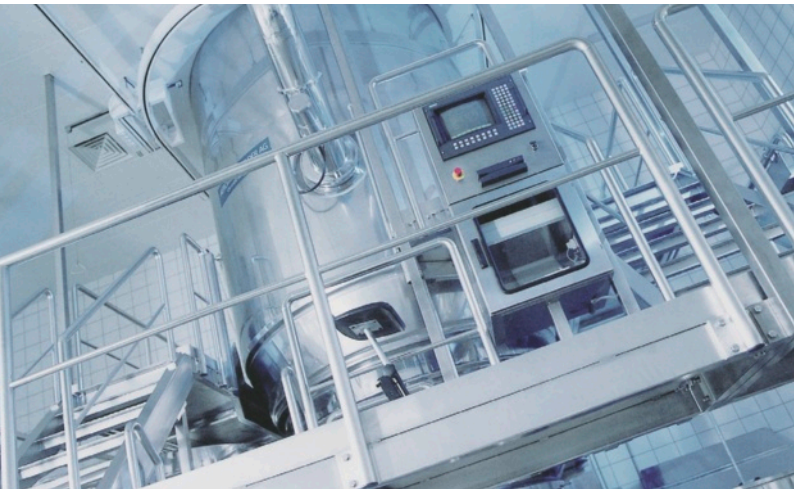
The products contained in this catalog can also be found in the Interactive Catalog CA 01.
Order No.:
E86060-D4001-A510-D1-7600

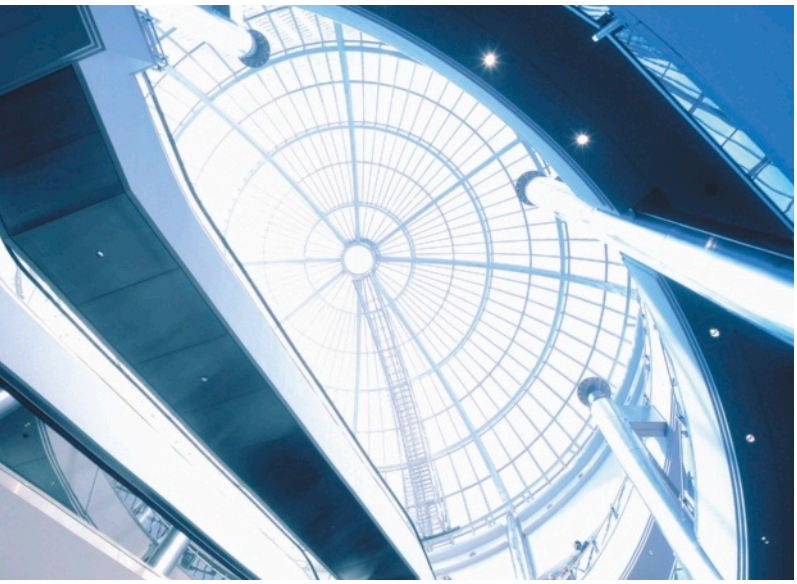
Please contact your local Siemens branch

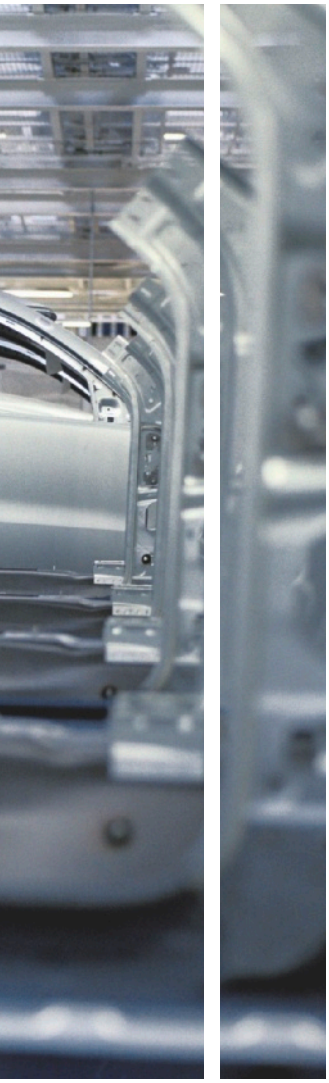
PEFC/ 04-31-1404

Printed on paper from sustainably managed forests and controlled sources.

www.pefc.org







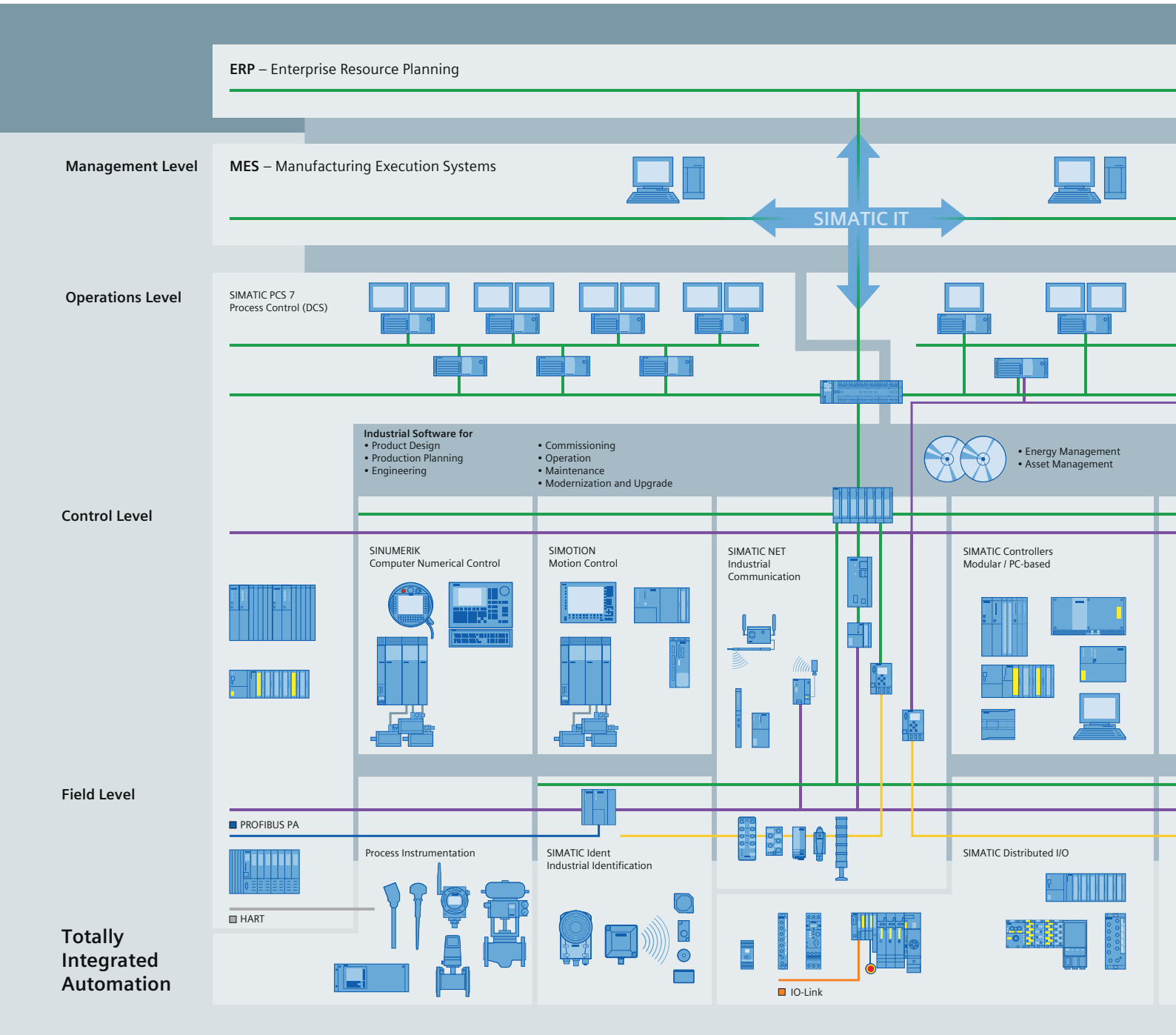
Answers for industry.

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

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

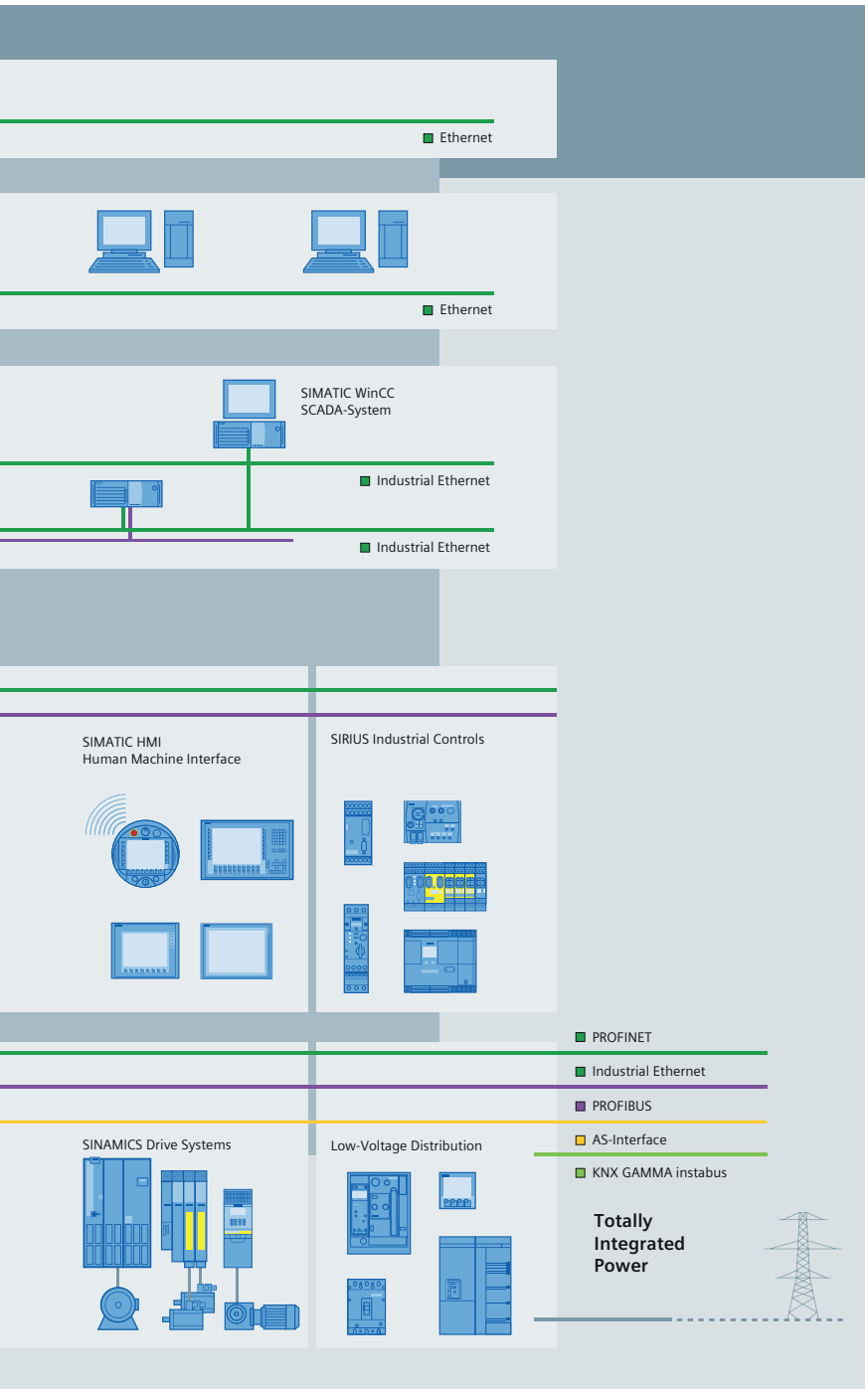
The high quality of our products sets industry-wide benchmarks. High environmental aims are part of our eco-management, and we implement these aims consistently. Right from product design, possible effects on the environment are examined. Hence many of our products and systems are RoHS compliant (Restriction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

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



Setting standards in productivity and competitiveness.

Totally Integrated Automation.



TIA is characterized by its unique continuity.

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

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

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

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

Much more than a catalog. The Industry Mall.

You have a catalog in your hands that will serve you well for selecting and ordering your products. But have you heard of the electronic online catalog (the Industry Mall) and all its benefits? Take a look around it sometime:

www.siemens.com/industrymall

Selecting

Find your products in the structure tree, in the new "Bread-crumb" navigation or with the integral search machine with expert functions. Electronic configurators are also integrated into the Mall. Enter the various characteristic values and the appropriate product will be displayed with the relevant order numbers. You can save configurations, load them and reset them to their initial status.

Ordering

You can load the products that you have selected in this way into the shopping basket at a click of the mouse. You can create your own templates and you will be informed about the availability of the products in your shopping cart. You can load the completed parts lists directly into Excel or Word.

Delivery status

When you have sent the order, you will receive a short e-mail confirmation which you can print out or save. With a click on "Carrier", you will be directly connected to the website of the carrier where you can easily track the delivery status.

Added value due to additional information

So you have found your product and want more information about it? In just a few clicks of the mouse, you will arrive at the image data base, manuals and operating instructions. Create your own user documentation with My Documentation Manager.
Also available are FAQs, software downloads, certificates and technical data sheets as well as our training programs. In the image database you will find, depending on the product, 2D/3D graphics, dimension drawings and exploded drawings, characteristic curves or circuit diagrams which you can download.

Convinced? We look forward to your visit!

Introduction

1

Overview

Basic safety requirements in the production industry

Functional safety

Automation systems and components are responsible for safety-related tasks in many different applications (machines and conveyor systems, process industry, building technology, etc.). This means that the health and safety of persons as well as protecting equipment and the environment depend on the correct functioning of the relevant systems and components. Today, the correct functioning of systems and components is handled under the term of “Functional Safety”.

With the introduction of the uniform European Single Market, national standards and regulations affecting the technical realization of machines were consistently harmonized:

Definition of basic safety requirements, which address, on the one hand, machine manufacturers in terms of the free movement of goods (Article 95) and, on the other hand, machine operators in terms of industrial safety (Article 137).

The EU Directives:

- specify requirements for plants/systems and their operating companies to ensure the health and safety of personnel and the quality of the environment;
- include regulations regarding health and safety at the workplace (minimum-requirements);
- define product requirements (e.g. for machines) to ensure the health and safety of the user;
- differentiate requirements on the implementation of products to ensure the free exchange of goods and requirements on the use of products.

Goals of the standard

It is the goal of safety technology to keep hazards for man and the environment as low as possible through technical equipment and devices. And at the same time, to not restrict industrial production more than is absolutely necessary.

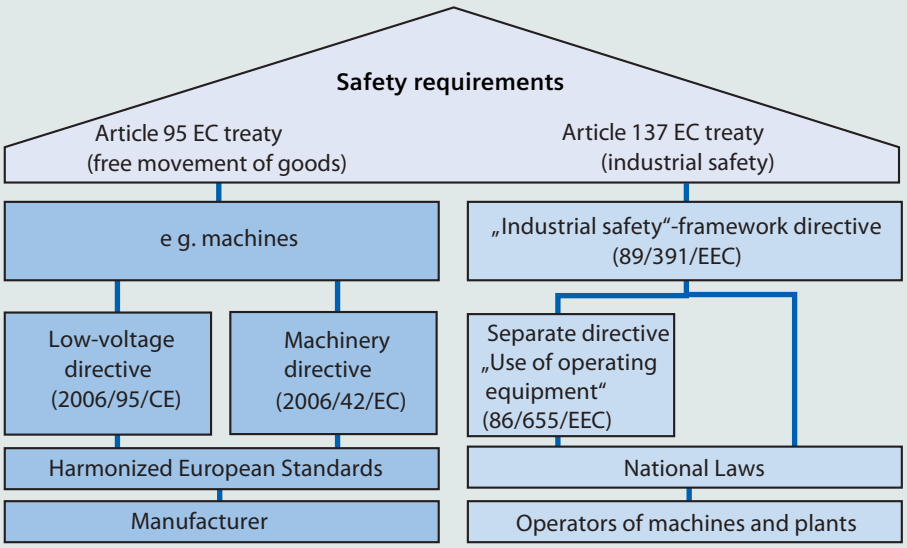
Conformity with the directives

To sell, market or operate products, these products must fulfill the basic safety requirements of the EU Directives.

To ensure compliance with a directive, it is recommended to apply the harmonized European standards, which then confers the so-called “presumption of conformity” and provides both manufacturers and operators with legal certainty concerning compliance with national regulations such as the EC directive.

With the CE marking, the manufacturer of a machine documents the compliance with all applicable directives and regulations in the free movement of goods. As the European directives are globally approved, the CE marking is also useful for exports to EEA countries.

The safety concept in the EC encompasses product requirements and social aspects



Overview (continued)

The IEC 62061 standard

The IEC 62061 standard "safety of machines – functional safety of electrical, electronic and programmable controls of machines" defines comprehensive requirements. It includes recommendations for the development, integration and validation of safety-related electrical, electronic and programmable electronic control systems (SRECS) for machines. With the implementation of IEC 62061, for the first time, one standard covers the entire safety chain, from the sensor to the actuator. To attain a safety integrity level such as, for example, SIL 3, a certification of the individual components is no longer sufficient. Instead, the entire safety function must meet the defined requirements.

Requirements placed upon the capacity of non-electrical – e.g. hydraulic, pneumatic or electromechanical – safety-related control elements for machines are not specified by the standard.

The ISO 13849-1 standard

The ISO 13849-1 standard "safety of machines – safety-related components of controls, part 1 general principles" is based on the known categories of EN 954-1, issue 1996. It covers the entire safety function with all devices involved.

ISO 13849-1 not only includes the quality approach of the EN 954-1, but also discusses safety functions in terms of quantity. Based on the categories, performance levels (PL) are used. The standard describes the determination of the PL for safety-related control components on the basis of designated architectures for the scheduled service life. In case of deviations, ISO 13849-1 refers to the IEC 61508. For the combination of several safety-related components into a total system, the standard contains information on the determination of the resulting PL.

The standard is applicable to safety-related control components (SRP/CS) and all types of machines, irrespective of the technology and energy used (electrical, hydraulic, pneumatic, mechanical, etc.).

Our effort towards global harmonization of standards

To facilitate an even easier and faster realization of future machine concepts and to promote the free exchange of goods on global markets, we have consistently been working on the standardization of safety-related standards for many years. This commitment has contributed to the international acceptance of European directives and the harmonization of international safety standards, which facilitate a more efficient realization of safety tasks by machine manufacturers and system operators.

Our offer

As a partner for all safety-related concerns, we do not only support you by offering adequate safety-related products and systems. We also provide you with the most current know-how on international standards and regulations. We offer comprehensive training and services for machine manufacturers and system operators throughout the entire lifecycle of safety-related systems and machines.

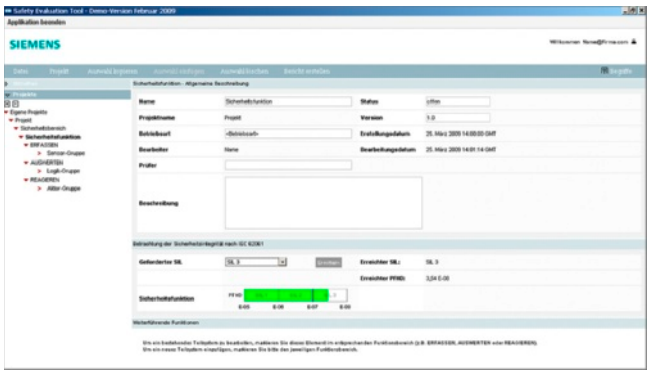
- Consistent, certified product spectrum
- Courses on standards and regulations:
  www.siemens.com/sitrain-safetyintegrated
  (Refer to the appendix for a summary of courses on Safety Integrated)
- Brochure „Functional Safety of Machines and Systems" with step-by-step instructions , available under:
  www.siemens.com/safety-infomaterial
- Reference book for functional security
- Consulting and support provided by Siemens contact partners for verification and validation
- Siemens Solution Partner for Safety Integrated
- World-wide service and support
  http://support.automation.siemens.com

For more information please visit
www.siemens.com/safety-integrated

Safety Evaluation Tool

The Safety Evaluation Tool for the IEC 62061 and ISO 13849-1 standards takes you to your goal directly. This TÜV-tested online tool from the Safety Integrated program by Siemens supports the fast and reliable assessment of your machine's safety functions.
As a result, you are provided with a standard-compliant report, which can be integrated in the documentation as proof of safety.

The Safety Evaluation Tool is available for free use:
www.siemens.com/safety-evaluation-tool



1

Overview

Integrated safety - increased productivity

Safety Integrated is the consistent implementation of safety technology in accordance with Totally Integrated Automation. On the one hand, this refers to the direct integration of safety-related functions in our standard products and, on the other hand, to the consistent and comfortable integration of safety concepts in the standard automation. This offers various advantages both for machine manufacturers and system operators, particularly in terms of efficiency.

Safety Integrated allows machine manufacturers to benefit from the decisive competitive advantage of eased engineering. This allows for a considerably faster realization of machines and systems and facilitates their easy adjustability to new requirements.

This concept also bears advantages for system operators as it does not only support the faster provision of safe machines and systems, but also enhances their productivity. Due to improved diagnostics, a harmonized overall system of safety technology and standard automation reduces downtimes and thus increases the system availability.

As opposed to conventional safety technology, Safety Integrated also facilitates conversion and modernization. On the basis of flexible and modularly expandable concepts, existing machines and systems can be upgraded to state-of-the-art technology. This advantage pays off throughout the entire lifecycle.

Reduced expenditures and increased efficiency with Safety Integrated

The integration of safety technology into standard automation offers the following sustainable advantages:

Increased efficiency

- A single system for standard and safety automation minimizes variety of types
- One bus and one engineering system for standard and safety technology reduce costs
- Software solutions allow for an eased reproduction of series machines

Increased productivity

- Fast troubleshooting and extensive diagnostic functions reduce downtimes
- Fast restart after required system modifications
- Our additionally offered safe and fault-tolerant systems allow for production without downtimes

Standardization

- Standard and safety technology come with a standardized interface
- Libraries improve re-usability
- Integration reduces the variety of control cabinets for machines
- Bus systems ease the installation technology in systems

Integrated safety from a single source

Safety Integrated is a unique, complete and consistent safety program. It covers all areas of safety technology, and includes detecting, evaluating, reacting, ranging from sensors and controls to drives.

Our products match the existing safety standards established in industry, including ISO, IEC, TÜV, NFPA, and UL. This catalog contains our comprehensive product range, helpful links to documentation and services associated with Safety.

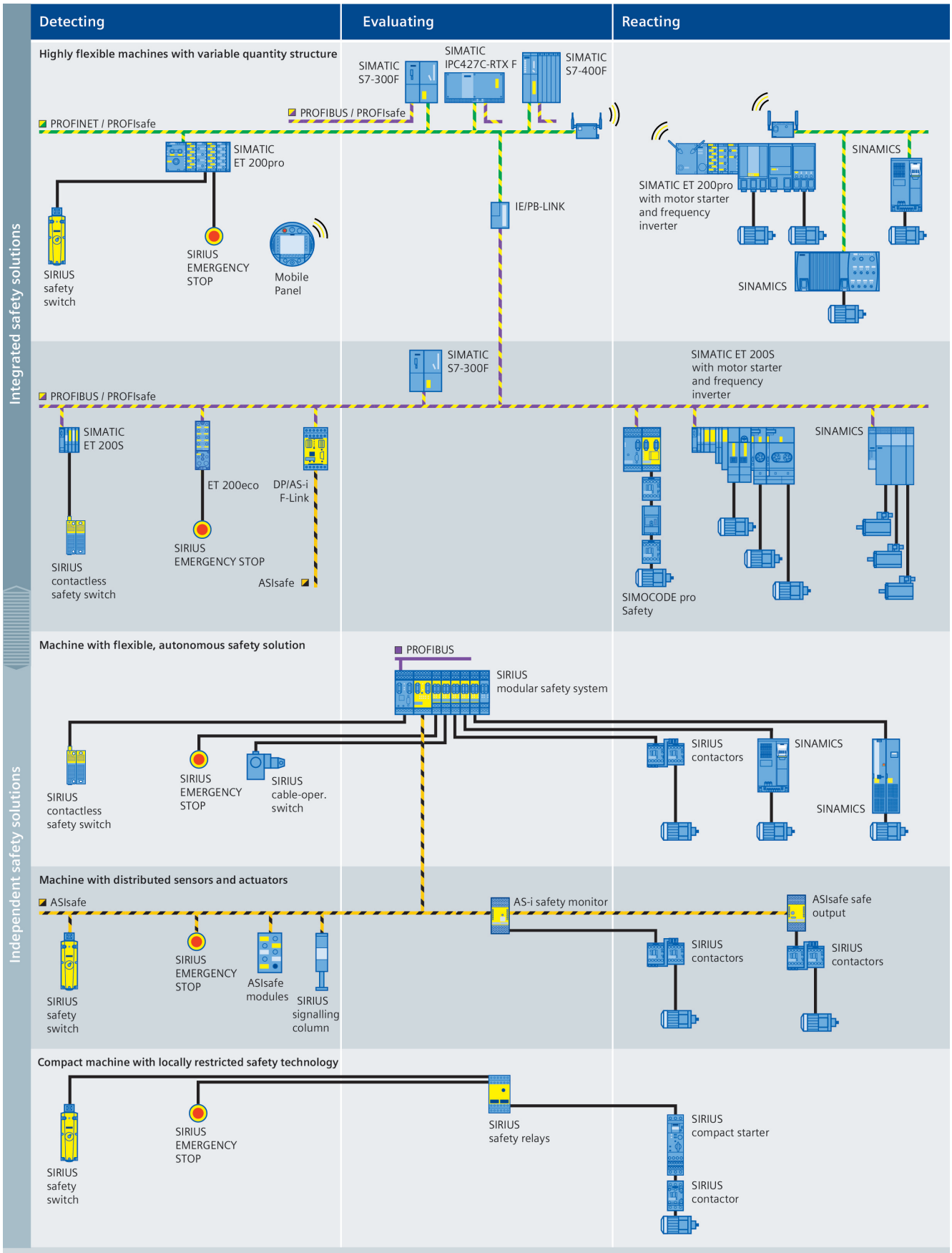
The Internet provides up-to-date information on Safety Integrated:

www.siemens.com/safety-integrated.

Fail-safe communication

For fail-safe communication, Safety Integrated uses both the tried-and-tested field bus systems AS-Interface and PROFIBUS as well as the innovative Industrial Ethernet standard PROFINET, which allows for new approaches to safe and efficient machines and systems – such as wireless fail-safe communication over IWLAN.

Overview (continued)



1

Detecting

Delivery time classes (DT)

►	Preferred type	Preferred types are available immediately from stock, i.e. are dispatched within 24 hours.
A	2 work days	In exceptional cases the actual delivery time may differ from that specified
B	1 week	The transport times depend on the destination and type of shipping. The standard transport time for Germany is 1 day.
C	3 weeks	The delivery times shown represent the state of 10/2011.
D	6 weeks	
X	on request	

3SE63 non-contact RFID safety switches

Overview

Non-contact RFID safety switches
with maximum tamper resistance

3SE63 RFID contactless safety switches meet the highest safety requirements, SIL3 or Cat. 4, for monitoring the positions of movable protective devices.

An RFID safety switch consists of a coded RFID switch with an 8-pole M12 connector plug and an identical RFID actuator.

The switch is available in several versions:

- Family coded with M12 plug or with additional 18 N magnetic catch as an option
- Individually coded, programmable once, with M12 plug or with additional 18 N magnetic catch as an option
- Individually coded, programmable more than once (an unlimited number of times), with M12 plug or variant with additional 18 N magnetic catch

The actuator is therefore available in two versions:

- Standard
- With 18 N magnetic catch

The magnetic catch keeps doors and hinge switches closed with permanent magnets.

Optional accessories

- Covers for sealing mounting holes, also suitable for tamper-proofing screw fixings
- Spacers (approx. 3 mm high) to facilitate cleaning under the installation surface when using pressure washers, for example

Mounting and maintenance

Reduction in the number of versions, because

- switches can be mounted on right or left sides
- the actuator can be mounted on all sides

Quick and easy mounting by thanks to universal mounting holes

- Standard gauge/holes for 3SE6 magnetically operated switch
- Fine adjustment thanks to slotted holes

Little adjustment or maintenance required

- Threshold indication by LED on the switch for quick and easy adjustment during installation and maintenance
- Molded switch allows it to be used as an end stop for small and medium-sized doors

Note:

Keep metal parts and cuttings away from the vicinity of the switch

Minimum distance between two switches 100 mm

Coding

Family coded

These safety switches are delivered ready to use, i.e. no programming is necessary.

Individually coded, programmable once

The assignment of safety switch and actuator thus created is irreversible.

The actuator is programmed simply by routine during startup, thus permanently preventing any form of tampering by means of a replacement actuator.

Individually coded, programmable several times

The procedure for programming a new actuator can be repeated an unlimited number of times. When a new actuator is programmed the previous code becomes invalid. A protected coding process allows new actuators to be programmed for service purposes.

After this, a ten-minute lockout provides enhanced tamper protection. The green LED flashes until the lockout time has ended and the new actuator has been detected. If the operational voltage is interrupted during this time, the ten-minute guard time is restarted.

Programming procedure for individual coding

1. Apply operational voltage to safety sensor

2. Move actuator into detecting range:
red LED lights up, yellow LED flashes (1 Hz)

3. After 10 s it changes to a shorter flashing frequency (3 Hz). In this state switch off operational voltage.

4. After the next time the operational voltage is switched on, the actuator is detected again to activate the programmed actuator code. The activated code is thus stored permanently.

Diagnostics

The RFID safety switch indicates its operating state including faults by means of the LED indicator in the switch and the short-circuit resistant diagnostic output. The signals can then be used for central displays or non-safety-related control tasks.

There are two diagnostics functions:

- Crossover monitoring
- Open-circuit monitoring
- External voltage monitoring
- Ambient temperature too high
- Wrong or defective actuator
- Switching interval threshold identification with LED indication

The signal combination "diagnostics output switched off" and "safety outputs still switched on" can be used to move the machine into a controlled stop position.

Any crossover or a fault that is not currently compromising the safe operation of a safety switch results in the disconnection of the safety channels after a 30 minute delay. However, the diagnostics output switches off instantaneously.

3SE63 non-contact RFID safety switches

Mode of operation of the diagnostics LEDs

The safety switch indicates not only its operating state, but also faults by means of LEDs in three colors at the ends of the RFID switch.

- The green LED indicates readiness for operation when the control supply voltage is connected.
- The yellow LED indicates that there is an actuator in detecting range. If the actuator is in the switching interval threshold, this is indicated by flashing. This flashing can be used to identify a change in the distance between sensor and actuator at an early stage (e.g. as a result of the sagging of a protective door). The installation should be tested before the distance increases further, the safety outputs switch off and the machine stops.
- The red LED indicates the individual causes of the fault by means of defined flashing frequencies.

Benefits

- Maximum tamper resistance by means of individual coding of switches and actuators at the highest safety level
- Plastic enclosure with integrated connector
- 2 electronic short-circuit proof safety outputs, each 250 mA
- Integrated crossover, open circuit and external voltage monitoring, with series circuit as far as the control cabinet
- Safety and diagnostics signals can be connected in series
- Series connection of safety circuits in Cat. 4 / PL e / SIL 3
- LED status indication including switching interval threshold indication for quick and easy adjustment during installation and maintenance
- short-circuit proof conventional diagnostics output
- Optional version with magnetic catch for interlocking hatches or small doors even when de-energized
- Highly rugged thanks to the use of tested enclosure materials, resistant to aggressive cleaning products, with a degree of protection of up to IP69K
- Fine adjustment thanks to slotted holes
- Little adjustment or maintenance required
- Molded switch allows it to be used as an end stop for small and medium-sized doors

Application

RFID contactless safety switches are designed for use in safety circuits, and are used to monitor the positions of movable protective devices. They monitor the positions of rotating, laterally sliding or removable protective devices using the coded electronic actuator.

Their high degree of protection (IP69K) and the use of cleaning product-resistant materials means that these switches are optimized for use under extreme environmental conditions.

Their electronic operating principle makes these switches ideal for metalworking machinery.

The switches have a larger switching interval and switching displacement than mechanical switches, improve the mounting tolerance of the protective door, and offer a wide range of diagnostics options.

The RFID switches can be connected to all standard evaluation units, e. g. a PLC, 3TK28 safety evaluation units (in which the built-in crossover monitoring function can be deactivated), or the 3RK3 modular safety system.

The following safety categories can be achieved in safety circuits:

- Category 4 according to EN ISO 13849-1 (EN 954-1)
- PL e according to EN ISO 13849-1
- SIL 3 according to IEC 61508

Technical specifications

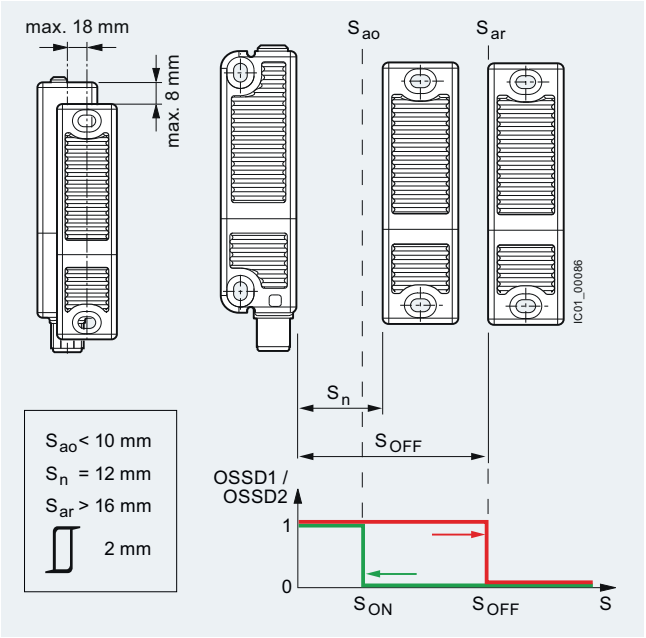
Type		3SE6 3
General data		
Standards		IEC 60947-5-3, IEC 61508, EN ISO 13849-1
Enclosure material		Fiber-glass strengthened thermoplast, self-extinguishing
Degree of protection		IP69K
Ambient temperature		
• During operation	°C	-25 ... +70
• During storage, transport	°C	-25 ... +85
Shock resistance		30 *g*/11 ms
Vibration resistance		10 ... 55 Hz amplitude 1 mm
Electrical specifications		
Rated insulation voltage U_i	V	32
Pollution degree acc. to IEC 60664-1		3
Rated impulse withstand voltage U_{imp}	V	800
Rated conditional short-circuit current	A	100
Rated operational voltage U_e (PELV acc. to IEC 60204-1)	V DC	24 –15/+10 %
Protection class		II
Overvoltage category		III
Rated operational current I_e	A	0.6
Smallest operational current I_m	mA	0.5
No-load supply current i_0	mA	35

Type		3SE6 3
Inputs/outputs		
Safety inputs X1/X2		
• Input voltage	V DC	24 –15/+10 %
• Power consumption per input	mA	5
Safety outputs OSSD1/OSSD2		p operation
• Max. rated operational current I_e	A	0.25
• Rated operational current I_e/DC-12/DC-13 at U_e	A	0.25
• Voltage drop U_e	V	< 1
• Switching frequency	Hz	1
• Response time, max.	ms	100
• Risk time, max.	ms	200
• Recovery, max.	s	5
Diagnostics ouput		p operation
• Max. rated operational current $I_{e2\ max}$	A	0.05
• Rated operational current I_e/DC-12/DC-13 at U_e	A	0.05
• Voltage drop U_e	V	< 2
• Operational current	mA	150
• Conductor capacity, max.	nF	50

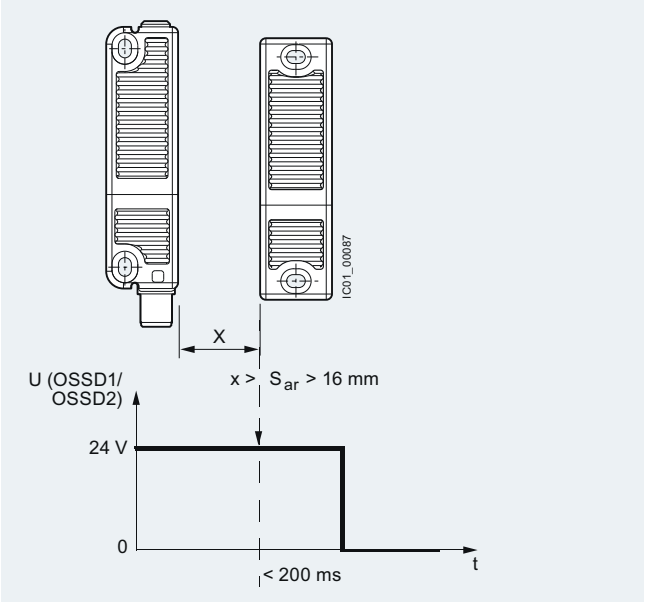
3SE63 non-contact RFID safety switches

Directions of approach and switching interval

The side area permits a maximum height offset of the switch and actuator of ±8 mm (e.g. mounting tolerance or due to sagging of the protective door). The transverse offset also equals max. ±8 mm.

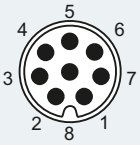


Switching interval: output signal with hysteresis



Switching interval: Output signal

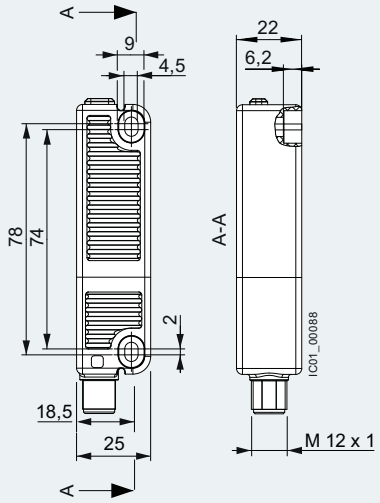
Connector assignment



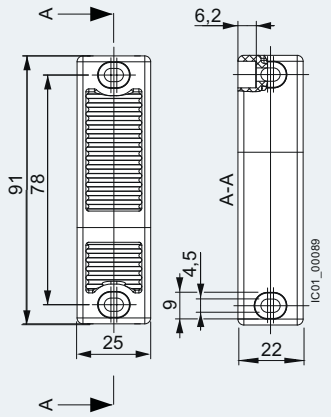
Pin 1: A1 rated operational voltage 24 V DC
Pin 2: X1 safety input 24 V DC
Pin 3: A2 grounding
Pin 4: OSSD1 safety output
Pin 5: OUT conventional diagnostics output
Pin 6: X2 safety input 24 V DC
Pin 7: OSSD2 safety output
Pin 8: Not used

Dimensional drawings

RFID switches
3SE6 315

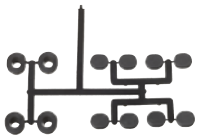


RFID actuator
3SE6 310



Selection and ordering data

With M12 connector, 8-pole

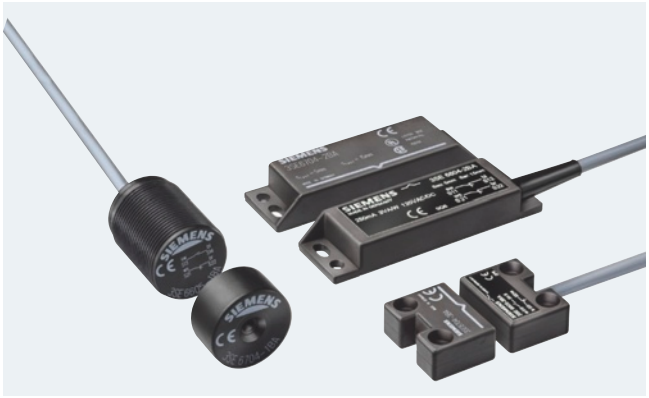
	Version/coding	Latching / length	DT	Order No.
Rectangular safety switches 91 mm x 25 mm				
 3SE6 315	**RFID safety switches**			
	• Family coded	None	A	**3SE6 315-0BB01**
		With 18 N magnetic catch	A	**3SE6 315-1BB01**
	• Individually coded, programmable several times	None	A	**3SE6 315-0BB02**
		With 18 N magnetic catch	A	**3SE6 315-1BB02**
	• Individually coded, programmable once	None	A	**3SE6 315-0BB03**
		With 18 N magnetic catch	A	**3SE6 315-1BB03**
 3SE6 310	**RFID actuators**			
	• Standard	None	A	**3SE6 310-0BC01**
		With 18 N magnetic catch	A	**3SE6 310-1BC01**
Optional accessories				
 3SX5 600-1G	**Covers and spacers** One pack (1 unit) contains 8 covers and 4 spacers		A	**3SX5 600-1G**
 3SX5 601-2GA	**Connecting cables, 8-pole**, with 1 straight M12 socket Rated voltage 30 V Rated current 2 A	Length 3 m	A	**3SX5 601-2GA03**
		Length 5 m	A	**3SX5 601-2GA05**
		Length 10 m	A	**3SX5 601-2GA10**

For monitoring units see Catalog IC 10, Chapter 2, "Industrial Communication" → "AS-Interface" and Chapter 11, "Safety Technology" as well as Catalogs IK PI and ST 70.

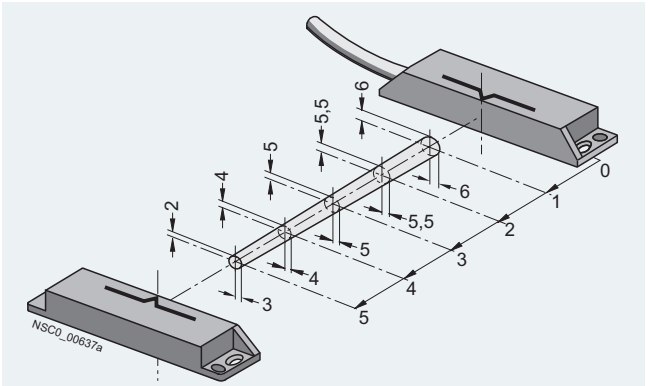
Magnet

3SE6 6, 3SE6 7
non-contact magnetically operated switches

Overview



Switching magnets and contact blocks



Enabling range (example)

A magnetically operated switch is comprised of a coded switching magnet and a contact block (sensor unit). Evaluation requires a safety relay or connection to a bus system.

3SE6 806 safety relays

Up to six protective devices (sensors) can be connected to the safety relay.

The device has six current-sourcing semiconductor outputs (Y1 ... Y6) which signal the state of the connected protective devices.

The 3SE6 806 safety relay has two floating enabling circuits (safe circuits) as NO contact circuits and one floating signaling circuit as a NC circuit. The number of enabling circuits can be increased by adding one or more 3TK28 30 expansion modules.

Application

SIRIUS 3SE6 magnetically operated switches are designed for mounting on movable protective guards (hoods, hinge switches, doors, etc.). Evaluation can be performed by means of a safety relay or through connection to a bus system.

The 3SE6 6 non-contact, magnetically operated safety switches stand out due to their enclosed design with degree of protection IP67. They are particularly suitable therefore for areas exposed to contamination, cleaning or disinfecting.

A magnetic monitoring system comprises one or more magnetically operated switches and an evaluation unit, e.g. a safety relay. When contact blocks 1 NO + 1 NC are used the 3SE6 806 safety relay provides a high degree of protection against manipulation and can be installed in safety circuits up to Category 3 according to ISO 13849-1 (EN 954-1).

Combination of monitoring units and magnetically operated switches

Monitoring units		**Magnetically operated switches (contact block + switching magnet)**					**Achievable category** (EN 954-1)/ **Performance level** (EN ISO 13849-1)
		1 NO + 1 NC			2 NC	1 NO + 2 NC	
		3SE6 605-1BA	3SE6 605-2BA	3SE6 605-3BA	3SE6 604-2BA	3SE6 606-3BA	
		3SE6 704-1BA	3SE6 704-2BA	3SE6 704-3BA	3SE6 704-2BA	3SE6 704-3BA	
Relay outputs							
SIRIUS safety relays, 6-fold	3SE6 806-2CD00	✓	✓	✓	--	✓	**Cat. 3**
SIRIUS safety relays	3TK28 20	--	--	--	✓	✓	**Cat. 4/e**
	3TK28 26	✓	✓	✓	✓	✓	**Cat. 4/e**
Solid-state outputs							
SIRIUS safety relays	3TK28 40	--	--	--	✓	✓	**Cat. 3/d**
	3TK28 41, 3TK28 42, 3TK28 45	--	--	--	✓	✓	**Cat. 4/e**
SIRIUS safety relays with contactor relay	3TK28 50, 3TK28 51, 3TK28 52	--	--	--	✓	✓	**Cat. 3/d**
	3TK28 53	--	--	--	✓	✓	**Cat. 4/e**
ASIsafe compact safety modules	3RK1 205, 3RK1 405	--	--	--	✓	✓	**Cat. 4**
SIMATIC S7-31xF-2 DP or SIMATIC ET 200M	SM 326 F, 24 DI, 24 V DC, SM 326 F, 8 DI, NAMUR	✓	✓	✓	✓	✓	**Cat. 4**
SIMATIC ET 200S PROFIsafe	4/8 F-DI / 3 F-DO, 24 V DC	✓	✓	✓	✓	✓	**Cat. 3**
	4/8 F DI, 24 V DC	✓	✓	✓	✓	✓	**Cat. 4**
SIMATIC ET 200eco	4/8 F DI, 24 V DC	✓	✓	✓	✓	✓	**Cat. 4**
SIMATIC ET 200pro	8/16 F-DI, 24 V DC, 4/8 F-DI / 4 F-DO 2 A, 24 V DC, F-Switch	✓	✓	✓	✓	✓	**Cat. 4**
Modular Safety System	3RK3	✓	✓	✓	✓	✓	**Cat. 4/e**

✓ Suitable magnetically operated switch

Selection and ordering data

	Version	Size mm	Contacts	DT	Order No.
Round sensor units					
	**Switching magnets (coded)**	M30		A	**3SE6 704-1BA**
	**Contact blocks**				
	• With cable, 3 m	M30	1 NO + 1 NC	A	**3SE6 605-1BA**
	• With M12 plug, 4-pole	M30	1 NO + 1 NC	C	**3SE6 605-1BA02**
Rectangular sensor units					
	**Switching magnets (coded)**	25 × 88		A	**3SE6 704-2BA**
	**Contact blocks**				
	• With cable, 3 m	25 × 88	1 NO + 1 NC	A	**3SE6 605-2BA**
			2 NC	A	**3SE6 604-2BA**
	• With M8 plug, 4-pole	25 × 88	1 NO + 1 NC	C	**3SE6 605-2BA01**
			2 NC	C	**3SE6 604-2BA01**
	**Switching magnets (coded)**			A	**3SE6 704-3BA**
	Contact blocks				
	• With cable, 3 m	25 × 33	1 NO + 1 NC	A	**3SE6 605-3BA**
	• With cable, 1 m	25 × 33	1 NO + 2 NC	B	**3SE6 606-3BA**
Accessories					
	**Spacers**	25 × 88		D	**3SX3 260**
	**Spacers**	25 × 33		D	**3SX3 261**

	Version	Number of sensors	Enabling/ signaling circuits	DT	Order No.
Monitoring units					
	**Safety relays with relay output, 6-fold** Rated control supply voltage 24 V DC	6	2 NO / 1 NC	B	**3SE6 806-2CD00**

For more monitoring units see Catalog IC 10, Chapters 2, 8, 9 and 11 as well as Catalog IK PI.

Actuators and Indicators, Plastic, Round, 22 mm

Complete units

Selection and ordering data

The following applies to all complete units:

PE (ST) = 1
PKG* = 1 ST
PG = 41J

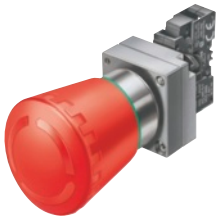
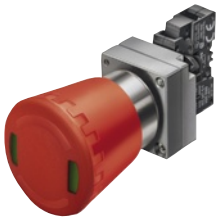
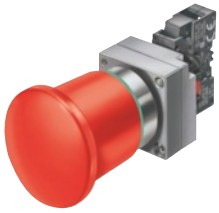
Color of handle	Contacts for front plate mounting	DT	Screw terminals Configurator Order No.	DT	Spring-type terminals Configurator Order No.
EMERGENCY-STOP devices according to ISO 13850, with yellow name plate, Ø 80 mm, with inscription					
 With rotate-to-unlatch mechanism	**EMERGENCY-STOP mushroom pushbuttons, Ø 40 mm, with positive latching function,** with rotate-to-unlatch mechanism				
	• German inscription "NOT-HALT"				
Red	1 NC	▶	**3SB32 03-1HA20**	B	**3SB32 03-1HA20-0CC0**
	1 NC with mounting monitoring	X	**3SB32 66-1HA20**		--
Red	1 NO + 1 NC	B	**3SB32 01-1HA20**	B	**3SB32 01-1HA20-0CC0**
	• English inscription "EMERGENCY STOP"				
Red	1 NC	B	**3SB32 03-1HR20**		--
	1 NC with mounting monitoring	X	**3SB32 66-1HR20**		--
Red	1 NO + 1 NC	B	**3SB32 01-1HR20**		--
	• French inscription "ARRET D'URGENCE"				
Red	1 NC	B	**3SB32 03-1HP20**		--
Red	1 NO + 1 NC	B	**3SB32 01-1HP20**		--
 With rotate-to-unlatch mechanism and switch position indication	With rotate-to-unlatch mechanism and mechanical switch position indication				
	• German inscription "NOT-HALT"				
Red	1 NC	▶	**3SB32 03-1HA26**	B	**3SB32 03-1HA26-0CC0**
	1 NC with mounting monitoring	X	**3SB32 66-1HA26**		--
Red	1 NO + 1 NC	B	**3SB32 01-1HA26**	B	**3SB32 01-1HA26-0CC0**
	• English inscription "EMERGENCY STOP"				
Red	1 NC	B	**3SB32 03-1HR26**		--
	1 NC with mounting monitoring	X	**3SB32 66-1HR26**		--
Red	1 NO + 1 NC	B	**3SB32 01-1HR26**		--
 With pull-to-unlatch mechanism	With pull-to-unlatch mechanism				
	• German inscription "NOT-HALT"				
Red	1 NC	B	**3SB32 03-1TA20**		--
Red	1 NO + 1 NC	B	**3SB32 01-1TA20**		--
	• English inscription "EMERGENCY STOP"				
Red	1 NC	B	**3SB32 03-1TR20**		--
Red	1 NO + 1 NC	B	**3SB32 01-1TR20**		--

For online configurator see www.siemens.com/sirius/configurators.

Positive opening according to IEC 60947-5-1, Appendix K.
Can be used with 3TK28 safety relays.
Certificate:

Complete units

PE (ST) = 1
PKG* = 1 ST
PG = 41J

Color of handle	Contacts for front plate mounting		DT	Screw terminals Configurator Order No.	DT	Spring-type terminals Configurator Order No.
EMERGENCY-STOP devices according to ISO 13850, with yellow name plate, Ø 80 mm, with inscription						
 EMERGENCY-STOP mushroom pushbutton with rotate-to-unlatch mechanism	**EMERGENCY-STOP mushroom pushbuttons, Ø 40 mm, with positive latching function,** with rotate-to-unlatch mechanism					
	• German inscription "NOT-HALT"					
	Red	1 NC	➔	▶ **3SB36 03-1HA20**	B	**3SB36 03-1HA20-0CC0**
		1 NC with mounting monitoring	➔	X **3SB36 66-1HA20**		**--**
		1 NO + 1 NC	➔	B **3SB36 01-1HA20**	B	**3SB36 01-1HA20-0CC0**
		1 NC, 1 NC	➔	**--**	B	**3SB36 11-1HA20-0CC0**
	• English inscription "EMERGENCY STOP"					
	Red	1 NC	➔	B **3SB36 03-1HR20**		**--**
		1 NC with mounting monitoring	➔	X **3SB36 66-1HR20**		**--**
		1 NO + 1 NC	➔	B **3SB36 01-1HR20**		**--**
	• French inscription "ARRET D'URGENCE"					
	Red	1 NC	➔	B **3SB36 03-1HP20**		**--**
		1 NO + 1 NC	➔	B **3SB36 01-1HP20**		**--**
 EMERGENCY-STOP mushroom pushbutton with rotate-to-unlatch mechanism and switch position indication	With rotate-to-unlatch mechanism and mechanical switch position indication					
	• German inscription "NOT-HALT"					
	Red	1 NC	➔	▶ **3SB36 03-1HA26**	B	**3SB36 03-1HA26-0CC0**
		1 NC with mounting monitoring	➔	X **3SB36 66-1HA26**		**--**
		1 NO + 1 NC	➔	B **3SB36 01-1HA26**	B	**3SB36 01-1HA26-0CC0**
	• English inscription "EMERGENCY STOP"					
	Red	1 NC	➔	B **3SB36 03-1HR26**		**--**
		1 NC with mounting monitoring	➔	X **3SB36 66-1HR26**		**--**
		1 NO + 1 NC	➔	B **3SB36 01-1HR26**		**--**
 EMERGENCY-STOP mushroom pushbutton Pull-to-unlatch mechanism	With pull-to-unlatch mechanism, solvent-resistant					
	• German inscription "NOT-HALT"					
	Red	1 NC	➔	B **3SB36 03-1TA20**	B	**3SB36 03-1TA20-0CC0**
		1 NO + 1 NC	➔	B **3SB36 01-1TA20**	B	**3SB36 01-1TA20-0CC0**
		1 NC, 1 NC	➔	**--**	B	**3SB36 11-1TA20-0CC0**
	• English inscription "EMERGENCY STOP"					
	Red	1 NC	➔	B **3SB36 03-1TR20**		**--**
		1 NO + 1 NC	➔	B **3SB36 01-1TR20**		**--**
	• French inscription "ARRET D'URGENCE"					
	Red	1 NC	➔	B **3SB36 03-1TP20**		**--**
		1 NO + 1 NC	➔	B **3SB36 01-1TP20**		**--**

⚙ For online configurator see www.siemens.com/sirius/configurators.

➔ Positive opening according to IEC 60947-5-1, Appendix K.
Can be used with 3TK28 safety relays.
Certificate:

8WD42 signaling columns, 50 mm diameter

Overview

Features:
- Thermoplast enclosure, diameter 50 mm
- Degree of protection IP54
- Up to 4 elements can be mounted

Accesories see Catalog IC 10, Chapter 13.

Selection and ordering data

	Version	Rated voltage V	Color	DT	Order No.
Acoustic elements[1]					
	**Buzzer elements** 80 dB, pulsating or continuous tone, adjustable by means of a wire jumper	24 AC/DC	Black	A	**8WD42 20-0FA**
		115 AC		A	**8WD42 40-0FA**
		230 AC		A	**8WD42 50-0FA**
Light elements for incandescent lamps/LEDs, BA 15d bases[2]					
	**Continuous light elements**	24 ... 230 AC/DC	Red	A	**8WD42 00-1AB**
			Green	A	**8WD42 00-1AC**
			Yellow	A	**8WD42 00-1AD**
			Clear	A	**8WD42 00-1AE**
			Blue	A	**8WD42 00-1AF**
Light elements with integrated LED					
	**Continuous light elements**	24 AC/DC	Red	A	**8WD42 20-5AB**
			Green	A	**8WD42 20-5AC**
			Yellow	A	**8WD42 20-5AD**
			Clear	X	**8WD42 20-5AE**
			Blue	X	**8WD42 20-5AF**
	**Blinklight elements**	24 AC/DC	Red	A	**8WD42 20-5BB**
			Green	A	**8WD42 20-5BC**
			Yellow	A	**8WD42 20-5BD**
			Clear	A	**8WD42 20-5BE**
			Blue	A	**8WD42 20-5BF**
		115 AC	Red	A	**8WD42 40-5BB**
			Green	A	**8WD42 40-5BC**
			Yellow	A	**8WD42 40-5BD**
			Clear	D	**8WD42 40-5BE**
			Blue	D	**8WD42 40-5BF**
		230 AC	Red	A	**8WD42 50-5BB**
			Green	A	**8WD42 50-5BC**
			Yellow	A	**8WD42 50-5BD**
			Clear	A	**8WD42 50-5BE**
			Blue	A	**8WD42 50-5BF**
Adapter elements for AS-Interface					
	**AS-Interface adapter elements** with external auxiliary voltage	For 4 signaling elements 24 V DC	Black	A	**8WD42 28-0BB**
Connection elements[3]					
	**Connection elements with cover** For mounting on pipes, floors and angles		Black	A	**8WD42 08-0AA**

1) One acoustic element can be mounted per signaling column. The cover is included in the scope of supply of the acoustic elements and fixed in place.

2) The lamp is not included in the scope of supply. Please order separately.

3) The connection element with cover is an essential part for assembling the signaling columns.

Note:

For mounting and configuring aid see the publication "Versatile, robust, communication-capable: SIRIUS signaling columns and integrated signal lamps", Order No. E20001-A670-P305.

Overview

Features:
- Thermoplast enclosure, diameter 70 mm
- Advanced design and significantly improved illumination
- Fast and flexible connection using spring-type terminals
- Integrated degree of protection IP65
- Up to 5 elements can be mounted

Accessories see Catalog IC 10, Chapter 13.

Selection and ordering data

	Version	Rated voltage V	Color	DT	Order No.
Light elements with integrated LED					
	**Continuous light elements**	24 AC/DC	Red	A	**8WD44 20-5AB**
			Green	A	**8WD44 20-5AC**
			Yellow	A	**8WD44 20-5AD**
			Clear	A	**8WD44 20-5AE**
			Blue	A	**8WD44 20-5AF**
		115 AC	Red	A	**8WD44 40-5AB**
			Green	A	**8WD44 40-5AC**
			Yellow	A	**8WD44 40-5AD**
			Clear	A	**8WD44 40-5AE**
			Blue	A	**8WD44 40-5AF**
		230 AC	Red	A	**8WD44 50-5AB**
			Green	A	**8WD44 50-5AC**
			Yellow	A	**8WD44 50-5AD**
			Clear	A	**8WD44 50-5AE**
			Blue	A	**8WD44 50-5AF**
	**Blinklight elements**	24 AC/DC	Red	A	**8WD44 20-5BB**
			Green	A	**8WD44 20-5BC**
			Yellow	A	**8WD44 20-5BD**
			Clear	X	**8WD44 20-5BE**
			Blue	A	**8WD44 20-5BF**
		115 AC	Red	A	**8WD44 40-5BB**
			Green	A	**8WD44 40-5BC**
			Yellow	A	**8WD44 40-5BD**
			Clear	A	**8WD44 40-5BE**
			Blue	A	**8WD44 40-5BF**
		230 AC	Red	A	**8WD44 50-5BB**
			Green	A	**8WD44 50-5BC**
			Yellow	A	**8WD44 50-5BD**
			Clear	A	**8WD44 50-5BE**
			Blue	A	**8WD44 50-5BF**
	**Rotating light elements**	24 AC/DC	Red	A	**8WD44 20-5DB**
			Green	A	**8WD44 20-5DC**
			Yellow	A	**8WD44 20-5DD**

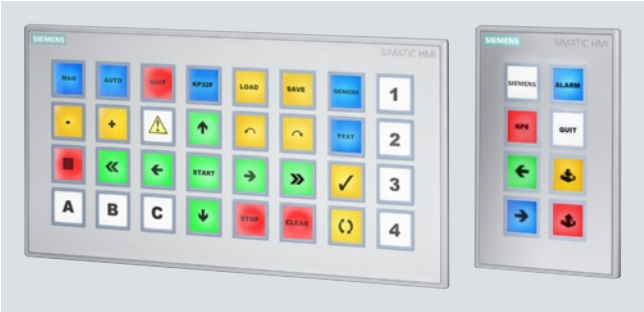
8WD44 signaling columns, 70 mm diameter

	Version	Rated voltage	Color	DT	Order No.
		V			
Adapter elements for AS-Interface					
	**AS-Interface adapter elements** With/without external auxiliary voltage, switchable				
	• A/B technology	For 3 signaling elements 24 V DC	Black	A	**8WD44 28-0BD**
	• Standard AS-i	For 4 signaling elements 24 V DC	Black	A	**8WD44 28-0BE**
Connection elements[1]					
	**Connection elements with cover**		Black		
	Screw terminals				
	• For mounting on pipes			A	**8WD44 08-0AA**
	• For mounting on brackets and floors			A	**8WD44 08-0AB**
	Spring-type terminals				
	• For mounting on pipes			A	**8WD44 08-0AD**
	• For mounting on brackets and floors			A	**8WD44 08-0AE**
	Cover (replacement)			A	**8WD44 08-0XA**

[1] The connection element with cover is an essential part for assembling the signaling columns.

SIMATIC HMI KP8/KP8F/KP32F

Overview



SIMATIC HMI Key Panels

- Integrated 2-port Ethernet switch for the setup of linear and ring topologies
- Freely configurable digital I/Os for connecting further operator controls (key switches, indicator lights, etc.) on the rear
- Problem-free installation or replacement thanks to plastic tensioners
- Communication via PROFINET
- For the connection of emergency stop buttons or for recording other fail-safe signals, rear fail-safe outputs (KP8F and KP32F) are available
- Over 60% less overhead for wiring and installation and savings of more than 30% in material costs compared to conventional key panels
- Connection to any type of controller via a bus cable (PROFINET) instead of complex wiring
- Optimal operator control thanks to large mechanical keys with tactile feedback
- Optimally suited for installation in the expansion units of all-round IP65-protected HMI devices (KP8 and KP8F only)
- Following connection to the controller, all buttons and LEDs are ready for immediate use
- Can be parameterized in the most restricted space to offer maximum flexibility at an extremely reasonable price

Benefits

Machine operation is rarely possible without hard-wired operator controls such as emergency stop units, pushbuttons, switches, indicator lights, or key-operated switches. These controls must be planned, ordered, installed, labeled and maintained. The modern Key Panels combine a host of necessary basic functions at optimal cost.

The configuration and installation costs are reduced to the necessary minimum while flexibility increases! It is not necessary to engrave plates for labeling purposes. A simple standard printer is sufficient for labeling keys with texts or symbols. Since the power supply is looped through direct to the Key Panel, no separate terminals are required for this. An integrated diagnostics function indicates faults and thus significantly reduces servicing times.

The new SIMATIC HMI Key Panels facilitate the integration of keys and indicator lights considerably. The operator controls no longer have to be individually wired. Instead, control and queries are performed via a PROFINET cable. Up to five colors are available per key for clear and intuitive operator control. Other controls such as key-operated switches, knob-operated switches, acoustic signaling devices, and emergency-stop pushbuttons[1)] can, of course, also be connected to the Key Panel.

The use of SIMATIC HMI Key Panels has the following advantages:

- Lower planning and installation overheads than with discrete components (only one installation cutout)
- Savings in hardware costs: No distributed I/O, no external switches, fewer terminals, and therefore reduced space requirements
- SIL safety can be connected directly[1)]
- Planning freedom with minimum space requirements
- Easily inscribed using standard printer in IP65
- High flexibility (for example, due to freely configurable colors and switch/button functions)
- Intuitive design of operator controls possible because the key color can be adapted dynamically to the process
- Easy to expand thanks to integrated inputs and outputs
- Dummy fronts can be installed as placeholders for later plant expansions using the SIMATIC HMI KP8 PN or KP8F PN Key Panels
- Functions and design are optimally coordinated with the SIMATIC HMI range

Not only can the SIMATIC HMI KP8 PN and KP8F PN Key Panels be used in stand-alone mode, but they are also optimally equipped for the SIMATIC HMI PRO devices.
Extension units are available for integrating operator controls into PRO devices. They are mounted on the side of the PRO device. Each extension unit of the SIMATIC HMI PRO devices can accommodate up to two SIMATIC HMI KP8 PN or KP8F PN.

[1)] Safety versions

Application

Safety over PROFINET

With the SIMATIC HMI KP8F PN and SIMATIC HMI KP32F PN, key panels are available for use in safety-related applications. The devices offer additional safety-related inputs and achieve safety standard SIL 2 if used with one channel and SIL 3 if used with two channels. Depending on the safety level, up to two (KP8F) or four (KP32F) emergency stop switches can be connected. Due to the support of PROFINET Shared Device, it is also possible to communicate with two controllers simultaneously.

Empty front

The dummy front (to be ordered separately) has the same look & feel as the SIMATIC HMI Key Panels, and it can be installed seamlessly and modularly into a KP8 or KP8F. The design dummy front is a purely mechanical component without electronics. It is designed for accommodating customer-specific control elements such as long-stroke keys, emergency stops, key-operated switches etc. The dummy front is preperforated on the rear such that a max. of 4 holes for 22.5 mm standard operator controls can be punched out without cutting tools.

Using the Key Panels in PRO devices

SIMATIC HMI KP8 PN and KP8F PN as well as the design dummy front are the ideal supplement to the all-round IP65-protected PRO devices of SIMATIC HMI because they can be installed easily into the associated extension boxes thanks to precise dimensions.

SIMATIC HMI KP8/KP8F/KP32F

Design

SIMATIC HMI Key Panels

The SIMATIC HMI Key Panels offered by Siemens feature large, easy-to-operate keys. The devices are supplied pre-assembled and ready for installation and thus no time-consuming individual mounting and wiring is required as for conventional operator panels.

Typical fields of application for key operator panels are applications that require the deterministic transmission of operator commands. Each key offers tactile feedback for optimal user friendliness. Each key can also be freely configured. In addition, the intensity and color of the LED backlighting of all keys can be adapted. The configurability of the colors (default: white, green, red, yellow, blue) increases the user-friendliness and the brightness improves readability under difficult lighting conditions such as extremely bright or dark environments. All keys can be individually and intuitively labeled and adapted to the application by means of slide-in labels. The connection to the control is implemented via PROFINET. An integrated 2-port PROFINET switch permits the establishment of a linear bus topology without external hubs, switches or supplementary modules.

The SIMATIC HMI Key Panels support MRP (Media Redundancy Protocol), a redundancy mechanism with which faults can be bridged. By means of the Media Redundancy Protocol (MRP) for networks in a ring topology, a cable break or component failure is compensated for by means of a switch that opens a second communication path through the network. For this purpose, a device in the topology assumes the role of redundancy manager (configurable with SIMATIC STEP 7) that directs communication to the alternative path in real time in the event of a fault on a data line, thus guaranteeing continuous and reliable communication between the components.

The 24 V power supply on the Key Panel can be looped through and can thus be routed directly to the neighboring panel.

SIMATIC HMI KP8 PN

- 8 large mechanical illuminated pushbuttons with extremely good tactile feedback, thus also suitable for harsh industrial environments
- 8 freely configurable digital I/Os for connecting further operator controls (key switches, indicator lights, etc.) on the rear

SIMATIC HMI KP8F PN

- 8 large mechanical illuminated pushbuttons with extremely good tactile feedback, thus also suitable for harsh industrial environments
- 8 freely configurable digital I/Os for connecting further operator controls (key switches, indicator lights, etc.) on the rear
- 2 additional digital fail-safe inputs for connecting one or two emergency stop buttons, for example

SIMATIC HMI KP32F PN

- 32 large mechanical illuminated pushbuttons with extremely good tactile feedback, thus also suitable for harsh industrial environments
- 16 freely configurable digital I/Os for connecting further operator controls (key switches, indicator lights, etc.), as well as another 16 digital inputs on the rear
- 4 additional digital fail-safe inputs for connecting up to four emergency stop buttons, for example

Technical specifications

	6AV3 688-3AY36-0AX0	6AV3 688-3AF37-0AX0	6AV3 688-3EH47-0AX0
General information			
Short lift keys/additional inputs as pushbuttons or switches			Yes
Control elements			
Function keys, programmable	8 function keys	8 function keys	32 function keys, 32 with LEDs
Membrane keyboard	Yes	Yes	No
Connection for mouse/keyboard/barcode reader	- / - / -	- / - / -	- / - / -
Input current			
Rated current			0.9 A
Type of output			
Color modes for LED	5	5	5
Number of LEDs			32
Digital inputs			
Number of digital inputs			32
Voltage (DC)			24 V
Digital outputs			
Number of digital outputs			16
Short-circuit protection			Yes
Test commissioning functions			
Pushbutton and lamp test			Yes

Technical specifications (continued)

	6AV3 688-3AY36-0AX0	6AV3 688-3AF37-0AX0	6AV3 688-3EH47-0AX0
Ambient conditions			
Storage/transport temperature			
• Transport, storage	-20 °C to +60 °C	-20 °C to +60 °C	-20 °C to +60 °C
Relative humidity			
• max. relative humidity	95 %	95 %	95 %
Degree and class of protection			
Rear			IP20
Standards, approvals, certificates			
KC approval	Yes	Yes	No
Mechanics/material			
Lifetime, typ.			
• Short-stroke keys (in switching cycles)	1000000	1000000	1000000
• LEDs (ON period)	100 %	100 %	100 %
Weight			
Weight	330 g	316 g	1 220 g

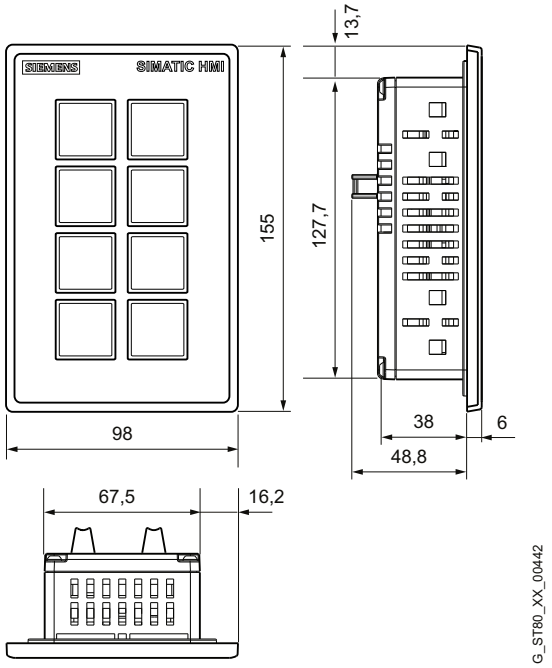
Ordering data

	Order No.
SIMATIC HMI KP8 PN Key Panel, 8 short-stroke keys with multicolored LEDs, PROFINET interfaces, can be assigned parameters with STEP 7 V5.5 or higher, 8 configurable DI/DO, 24 V DC can be looped through	**6AV3 688-3AY36-0AX0**
SIMATIC HMI KP8F PN Key Panel, 8 short-stroke keys with multicolored LEDs, PROFINET interfaces with PROFIsafe, can be assigned parameters with STEP 7 V5.5 or higher, 8 DI/DO and 2 safety DI, 24 V DC can be looped through	**6AV3 688-3AF37-0AX0**
SIMATIC HMI KP32F PN Key Panel, 32 short-stroke keys with multicolored LEDs, PROFINET interfaces with PROFIsafe, can be assigned parameters with STEP 7 V5.5 or higher, 32 DI/DO and 4 safety DI, 24 V DC can be looped through	**6AV3 688-3EH47-0AX0**

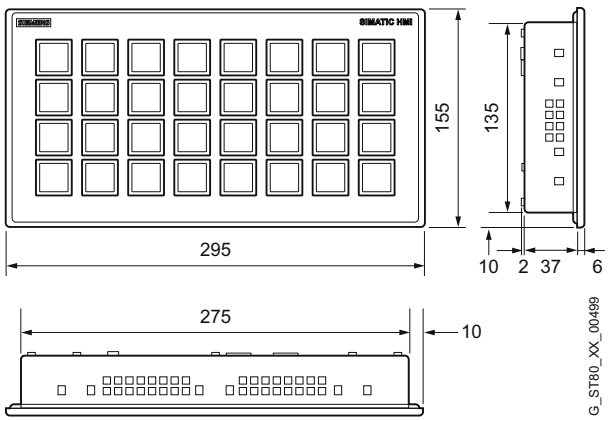
	Order No.
Empty front Empty front for KP8 and KP8F in combination with the HMI PRO devices	**6AV3 688-3XY38-3AX0**
Documentation The manual for the Key Panels can be found by entering the product name on the Internet at:	http://support.automation.siemens.com
Accessories	See Catalog ST 80/ST PC

SIMATIC HMI KP8/KP8F/KP32F

Dimensional drawings



SIMATIC HMI Key Panel KP8



SIMATIC HMI Key Panel KP32F

More information

Further information can be found on the Internet at:

http://www.siemens.com/simatic-key-panels

Note:

Do you need a specific modification or extension to the products described here? Then refer to "Customized Automation". There you will find information about additional and generally available sector-specific products as well as options for customer-specific modification and adaptation.

Overview

Ordering data	Order No.
SIMATIC Mobile Panel 277 IWLAN V2 (RoW version [1])	
• Communication via WLAN (PROFINET)	**6AV6 645-0DD01-0AX1**
• Communication via WLAN (PROFINET) with integrated handwheel, key-operated switch and two illuminated pushbuttons	**6AV6 645-0DE01-0AX1**
SIMATIC Mobile Panel 277F IWLAN V2 PROFIsafe (RoW version [1])	
• Communication via WLAN (PROFINET) with acknowledgement button and emergency stop button	**6AV6 645-0EB01-0AX1**
• Communication via WLAN (PROFINET) with acknowledgement button and emergency stop button with integrated handwheel, key-operated switch, and two illuminated pushbuttons	**6AV6 645-0EC01-0AX1**
• RFID tag version: Communication via WLAN (PROFINET) with acknowledgement button and emergency stop button with integrated handwheel, key-operated switch, and two illuminated pushbuttons	**6AV6 645-0EF01-0AX1**
SIMATIC Mobile Panel 277 IWLAN V2 (USA version)	
• Communication via WLAN (PROFINET)	**6AV6 645-0FD01-0AX1**
• Communication via WLAN (PROFINET) with integrated handwheel, key-operated switch and two illuminated pushbuttons	**6AV6 645-0FE01-0AX1**

Ordering data	Order No.
SIMATIC Mobile Panel 277F IWLAN V2 PROFIsafe (USA version)	
• with acknowledgement button and emergency stop button	**6AV6 645-0GB01-0AX1**
• with acknowledgement button and emergency stop button with integrated handwheel, key-operated switch, and two illuminated pushbuttons	**6AV6 645-0GC01-0AX1**
• with acknowledgement button and emergency stop button with integrated handwheel, key-operated switch, and two illuminated pushbuttons (tag version)	**6AV6 645-0GF01-0AX1**
Starter kit SIMATIC Mobile Panel 277(F) IWLAN (RoW version[1])	
for	
• Mobile Panel 277 IWLAN V2	**6AV6 651-5GA01-0AA1**
• Mobile Panel 277F IWLAN V2	**6AV6 651-5HA01-0AA1**
Accessories	
Note: Please order the table-top power supply or charging station as well. Required for charging the battery	
• Table-top power supply incl. power cable for EU, US, UK, JP (only suitable for operation under laboratory/office conditions)	**6AV6 671-5CN00-0AX2**
• Charger V2 for safe storage and charging of device incl. lock for securing the device in the charger. Charging capabilities for up to two additional batteries	**6AV6 671-5CE00-0AX1**
• Additional battery with LED indicator for indicating the charge status	**6AV6 671-5CL00-0AX0**
• Transponder V2 incl. batteries (3x AA)	**6AV6 671-5CM00-0AX1**
• Service pack V2 for Mobile Panel 277(F) IWLAN V2 contains accessories pack for Mobile Panel 277 (labeling strip cover), battery compartment cover (device), cover left/right (charger), power supply connector counterpart (charger), replacement key (charger)	**6AV6 671-5CA00-0AX2**
• Service pack for Mobile Panels 177/277, consisting of: Blanking plugs for cable duct , 2 x cable glands for connectivity box, 1 set of screws for connectivity box cover, 2 x terminal box (12-pin), 1 x terminal box (3-pin), 1 x blanking cap for connectivity box	**6AV6 574-1AA04-4AA0**

1) RoW version: "Rest of World" version: Version for worldwide sales except in the U.S.

2) Already prepared for Rapid Roaming (iPCF-MC). iPCF-MC is already included from Scalance FW version V4.3.37 and higher.

SIMATIC Mobile Panel 277(F) IWLAN

Ordering data	Order No.
SCALANCE W-788 access points	
• IWLAN access points with built-in wireless interface; wireless networks IEEE 802.11b/g/a/h at 2.4/5 GHz to 54 Mbit/s; national approvals; WPA2/AES; Power over Ethernet (PoE), degree of protection IP65 (-20°C to +60°C); scope of delivery: 2 ANT795-4MR antennas, IP 67 hybrid connector, installation material, manual on CD-ROM, German/English	
SCALANCE W788-2RR	
IWLAN Dual Access Point with two built-in radio interfaces for establishment of radio links with iPCF	
• National approvals for operation outside the U.S. [1)2)]	**6GK5 788-2AA60-6AA0**
• National approvals for operation within the U.S. [2)]	**6GK5 788-2AA60-6AB0**
SCALANCE W788-1PRO	
IWLAN access point with one built-in radio interface	
• National approvals for operation outside the U.S. [1)]	**6GK5 788-1AA60-2AA0**
• National approvals for operation within the U.S.	**6GK5 788-1AA60-2AB0**
SCALANCE W-786 Access Points for SIMATIC Mobile Panel 277(F) IWLAN	
• IWLAN Access Points with integrated radio interfaces; radio networks; IEEE 802.11b/g/a/h at 2.4/5 GHz up to 54 Mbit/s. National approvals; WPA2/AES; Power over Ethernet (PoE), degree of protection IP65 (-40 °C to +70 °C); scope of delivery: Mounting hardware, 48 V DC terminal block; manual on CD-ROM; German/English;	
SCALANCE W-786-2RR	
IWLAN Dual Access Point with two integrated radio interfaces for setting up radio links with iPCF; RJ45 connection	
Four internal antennas	
• National approvals for operation outside the U.S. [1)2)]	**6GK5 786-2BA60-6AA0**
• National approvals for operation within the U.S. [2)]	**6GK5 786-2BA60-6AB0**
SCALANCE W-786-1PRO	
IWLAN Access Points with built-in wireless interface RJ45 connection	
Two internal antennas	
• National approvals for operation outside the U.S. [1)]	**6GK5 786-1BA60-2AA0**
• National approvals for operation within the U.S.	**6GK5 786-1BA60-2AB0**

	Order No.
Further IWLAN Access Point versions:	
SCALANCE W-784 access points	**6GK5 784-1AA30-...**
IWLAN Access Points with integrated radio interfaces (see Catalog IK PI), radio networks IEEE 802.11b/g/a/h at 2.4/5 GHz up to 54 Mbit/s. National approvals; WPA2/AES; Power over Ethernet (PoE), degree of protection IP30 (-20 °C to +60 °C); scope of delivery: Mounting hardware, 24 V DC terminal block; manual on CD-ROM; German/English;	(See Catalog IK PI)
SCALANCE W-786 Access Points	**6GK5 786-...**
IWLAN Access Points with integrated radio interfaces (see Catalog IK PI); radio networks IEEE 802.11b/g/a/h at 2.4/5 GHz up to 54 Mbit/s. National approvals; WPA2/AES; Power over Ethernet (PoE), degree of protection IP65 (-40°C to +70°C); scope of delivery: Mounting hardware, 48 V DC terminal block; manual on CD-ROM; German/English;	(See Catalog IK PI)
SCALANCE W-788 access points	**6GK5 788-...**
IWLAN Access Points with integrated radio interfaces (see Catalog IK PI); radio networks IEEE 802.11b/g/a/h at 2.4/5 GHz up to 54 Mbit/s. National approvals; WPA2/AES; Power over Ethernet (PoE), degree of protection IP65 (-20°C to +60°C); scope of delivery: 2 ANT795-4MR antennas, IP67 hybrid plug-in connector, mounting hardware, manual on CD-ROM, German/English	(See Catalog IK PI)
PS791-2DC power supply	**6GK5 791-2DC00-0AA0**
• 24 V DC power supply for installation in SCALANCE W-786 products; operating instructions in German/English	
PS791-2AC power supply	**6GK5 791-2AC00-0AA0**
• 110 V AC to 230 V AC power supply for installation in SCALANCE W-786 products; operating instructions in German/English	

1) RoW version: "Rest of World" version: Version for worldwide sales except in the U.S.

2) Already prepared for Rapid Roaming (iPCF-MC). iPCF-MC is already included from Scalance FW version V4.3.37 and higher.

Ordering data

	Order No.
Other compatible accessories:	
• Wall mounting bracket for Mobile Panels	**6AV6 574-1AF04-4AA0**
• Multimedia card, 128 MB	**6AV6 671-1CB00-0AX2**
• SD Card, 512 MB	**6AV6 671-8XB10-0AX1**
• Mobile Panel 277 cover membrane; 2 membranes per packaging unit	**6AV6 671-5BC00-0AX0**
• Key labeling strips for Mobile Panel 277; 2 sheets per packaging unit	**6AV6 671-5BF00-0AX0**
• Spare key for Mobile Panels; pack of 10 keys	**6AV6 574-1AG04-4AA0**
• Connecting cable DP (MPI/ PROFIBUS) for Mobile Panels Standard lengths:	
2 m	**6XV1 440-4AH20**
5 m	**6XV1 440-4AH20**
8 m	**6XV1 440-4AH80**
10 m	**6XV1 440-4AN10**
15 m	**6XV1 440-4AN15**
20 m	**6XV1 440-4AN20**
25 m	**6XV1 440-4AN25**
• Connecting cable PN (PROFINET) for Mobile Panels Standard lengths:	
2 m	**6XV1 440-4BH20**
5 m	**6XV1 440-4BH50**
8 m	**6XV1 440-4BH80**
10 m	**6XV1 440-4BN10**
15 m	**6XV1 440-4BN15**
20 m	**6XV1 440-4BN20**
25 m	**6XV1 440-4BN25**
• Accumulator option pack for Mobile Panels (DP and PN)	**6AV6 671-5AD00-0AX0**
• Touch pen including nylon line for securing it to the Mobile Panel 277 10" (set of 5, packed ready for shipping)	**6AV6 645-7AB14-0AS0**
• Extra battery for Mobile Panel 277(F) IWLAN	**6AV6 671-5CL00-0AX0**

	Order No.
Configuration	
with SIMATIC WinCC flexible	See catalog ST 80/ST PC
Documentation (to be ordered separately)	
Mobile Panel 277F IWLAN V2 Operating Instructions	
• German	**6AV6 691-1DQ01-2AA1**
• English	**6AV6 691-1DQ01-2AB1**
• French	**6AV6 691-1DQ01-2AC1**
• Italian	**6AV6 691-1DQ01-2AD1**
• Spanish	**6AV6 691-1DQ01-2AE1**
Mobile Panel 277 IWLAN V2 Operating Instructions	
• German	**6AV6 691-1DM01-2AA1**
• English	**6AV6 691-1DM01-2AB1**
• French	**6AV6 691-1DM01-2AC1**
• Italian	**6AV6 691-1DM01-2AD1**
• Spanish	**6AV6 691-1DM01-2AE1**
User Manual WinCC flexible Compact/Standard/Advanced	
• German	**6AV6 691-1AB01-3AA0**
• English	**6AV6 691-1AB01-3AB0**
• French	**6AV6 691-1AB01-3AC0**
• Italian	**6AV6 691-1AB01-3AD0**
• Spanish	**6AV6 691-1AB01-3AE0**
WinCC flexible Communication User Manual	
• German	**6AV6 691-1CA01-3AA0**
• English	**6AV6 691-1CA01-3AB0**
• French	**6AV6 691-1CA01-3AC0**
• Italian	**6AV6 691-1CA01-3AD0**
• Spanish	**6AV6 691-1CA01-3AE0**
Accessories	See catalog ST 80/ST PC

The Function Manuals "Fail-Safe Operation of the Mobile Panel 277F IWLAN V1" are available for downloading in English, German, and Japanese.

http://support.automation.siemens.com/WW/view/en/31255853

SITRANS LR560

Overview

SITRANS LR560 2-wire, 78 GHz FMCW radar level transmitter for continuous monitoring of solids in silos to a range of 100 m (329 ft).

Benefits

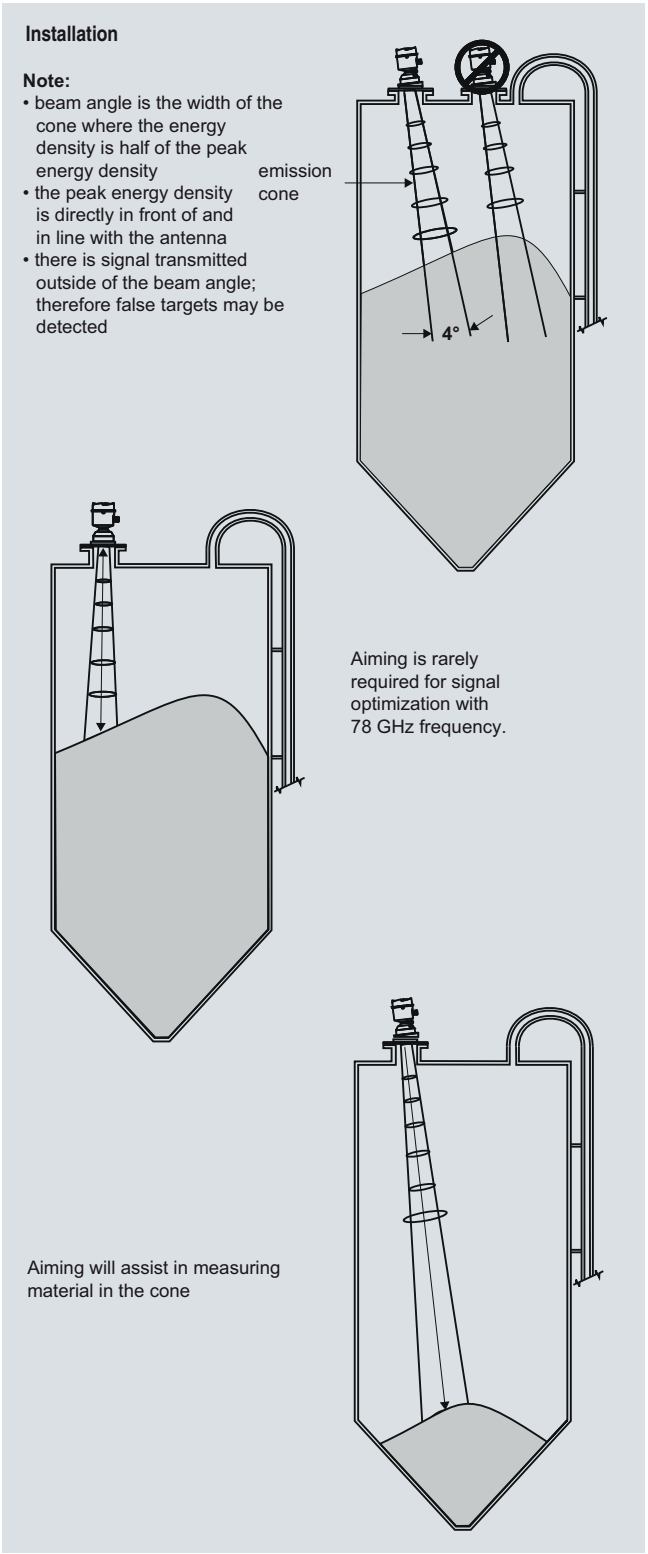
- rugged stainless steel design for industrial applications
- 78 GHz high frequency provides very narrow beam, virtually no mounting nozzle noise, and optimal reflection from sloped solids
- aimer option to direct beam to area of interest, such as draw point of cone
- lens antenna is highly resistant to product build up
- air purge connection is included for self-cleaning of extremely sticky solids
- local display interface (LDI) allows local programming and diagnostics

Application

SITRANS LR560's plug and play performance is ideal for most solids applications, including those with extreme dust and high temperatures to 200 °C (392 °F). Unique design allows safe and simple programming using the Intrinsically Safe handheld programmer without having to open the instrument's lid.
SITRANS LR560 includes an optional graphical local display interface (LDI) that improves setup and operation using an intuitive Quick Start Wizard, and echo profile display for diagnostic support. Startup is easy using the Quick Start wizard with a few parameters required for basic operation.
SITRANS LR560 measures practically any solids material to a range of 100 m (328 ft).

- Key Applications: cement powder, plastic powder/pellets, grain, coal, wood powder, fly ash

Configuration



SITRANS LR560 installation

Selection and Ordering data	Order No.
SITRANS LR560	**7ML5440-**
2-wire, 78 GHz FMCW radar level transmitter for continuous monitoring of solids in silos to a range of 100 m (329 ft).	**00-**
Order handheld programmer separately!	
Measurement and process temperature range	
40 m (131 ft) max range, -40 ... +100 °C	**0**
100 m (329 ft) max range, -40 ... +200 °C	**1**
Process connection	
Universal flat-faced flange fits ANSI/DIN/JIS flanges	
3"/80 mm, 304 stainless steel	**A**
4"/100 mm, 304 stainless steel	**B**
6"/150 mm, 304 stainless steel	**C**
3"/80 mm, 316L stainless steel	**D**
4"/100 mm, 316L stainless steel	**E**
6"/150 mm, 316L stainless steel	**F**
3"/80 mm, painted aluminum, with integral aimer[1]	**G**
4"/100 mm, painted aluminum, with integral aimer[1]	**H**
6"/150 mm, painted aluminum, with integral aimer[1]	**J**
Enclosure (with cable inlet)	
Stainless Steel, 1 X ½" NPT	**A**
Stainless Steel, 1 X M20 x 1.5 (plastic gland included)	**B**
Pressure rating	
0.5 bar g (7.5 psi g) maximum	**0**
3 bar g (40 psi g) maximum	**1**
Output/communication	
4 to 20 mA, HART	**A**
PROFIBUS PA	**B**
Foundation Fieldbus	**C**
Approvals	
General Purpose, $CSA_{US/C}$, Industry Canada, FCC, CE, R&TTE, C-TICK	**A**
CSA/FM Class I, Div. 2, Gr. A,B,C,D, Class II, Div.1, Gr. E,F,G, Class III	**B**
ATEX II 1 D, ½ D, 2 D, 3G Ex nA/nL, CE, R&TTE, C-TICK	**C**
Local display interface	
Without LDI (local display interface)	**1**
With LDI (local display interface)	**2**

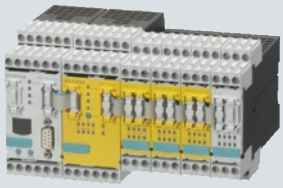
1) Rated to 120 °C max. when used with Pressure rating option 1

Selection and Ordering data	Order code
Further designs	
Please add "**-Z**" to Order No. and specify Order code(s).	
Plug M12 with mating connector[1)2)3)]	**A50**
Plug 7/8" with mating connector[2)4)]	**A55**
Stainless steel tag [69 x 50 mm (2.71 x 1.97 inch)]: Measuring-point number/identification (max. 16 characters); specify in plain text	**Y15**
Test certificate: Manufacturer's test certificate M to DIN 55350, Part 18 and to ISO 9000	**C11**
Inspection Certificate Type 3.1 per EN 10204[4)]	**C12**
NAMUR NE43 compliant, device preset to failsafe < 3.6 mA[5)]	**N07**
Operating Instructions for HART device	Order No.
English	**7ML1998-5KB01**
German	**7ML1998-5KB31**
Multi-language Quick Start manual This device is shipped with the Siemens Milltronics manual CD containing the complete ATEX Quick Start and Operating Instructions library.	**7ML1998-5XF81**
Operating Instructions for PROFIBUS PA device	
English	**7ML1998-5LT01**
German	**7ML1998-5LT31**
Multi-language Quick Start manual This device is shipped with the Siemens Milltronics manual CD containing the complete ATEX Quick Start and Operating Instructions library.	**7ML1998-5XQ81**
Operating Instructions for Foundation Fieldbus device	
English	**7ML1998-5LY01**
German	**7ML1998-5LY31**
Multi-language Quick Start manual This device is shipped with the Siemens Milltronics manual CD containing the complete ATEX Quick Start and Operating Instructions library.	**7ML1998-5XR81**
Accessories	
Hand Programmer, Intrinsically safe	**7ML1930-1BK**
Local display interface	**7ML1930-1FJ**
Sun Shield Cover	**7ML1930-1FK**
Housing lid with window	**7ML1930-1FL**
One metallic cable gland M20x1.5, rated -40 ... +80 °C (-40 ... +176 °F), HART[6)]	**7ML1930-1AP**
One metallic cable gland M20x1.5, rated -40 ... +80 °C (-40 ... +176 °F), PROFIBUS PA[7)]	**7ML1930-1AQ**
SITRANS RD100 Remote display - see Catalog FI 01, Chapter 8	
SITRANS RD200 Remote display - see Catalog FI 01, Chapter 8	
SITRANS RD500 web, datalogging, alarming, ethernet, and modem support for instrumentation - see Catalog FI 01, Chapter 8	**7ML5 750-1AA00-0**

1) Available with Approval option A only
2) Available with Enclosure option B only
3) Available with Output/communication options B and C only
4) Available with Pressure rating option 1 only
5) Available with Output/communication option A only
6) Product shipped with plastic cable gland, rated to -20 °C. If -40 °C rating required, then metallic cable gland is recommended.

Evaluating / Communication

3

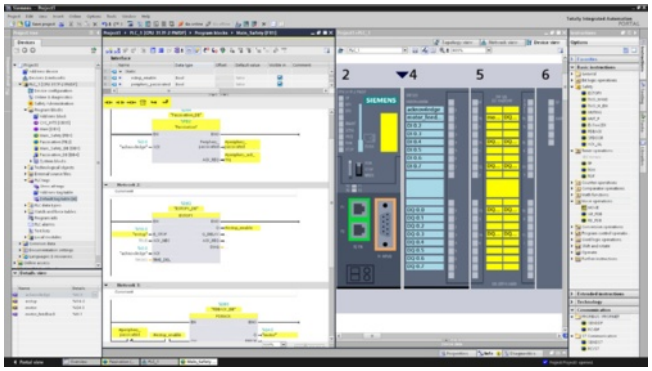


Delivery time classes (DT)

►	Preferred type	Preferred types are available immediately from stock, i.e. are dispatched within 24 hours.
A	2 work days	In exceptional cases the actual delivery time may differ from that specified
B	1 week	The transport times depend on the destination and type of shipping. The standard transport time for Germany is 1 day.
C	3 weeks	The delivery times shown represent the state of 10/2011.
D	6 weeks	
X	on request	

STEP 7 Safety Advanced V11

Overview



- For creating safety-related programs in the STEP 7 operator interface
- For seamless and easy to use integration of safety-related functions into the standard automation
- All the required configuration and programming tools are integrated into the STEP7 operator interface and utilize a common project structure

Benefits

STEP 7 Safety Advanced also makes the advantages of the TIA Portal available for fail-safe automation:

- Intuitive operation and the uniform operating concept (as with standard programming) enable a fast introduction to the creation of fail-safe programs.
- The F system is configured in the same way as standard automation.
- Ready-to-start: The F runtime group is set up automatically on insertion of the F-CPU.
- In connection with special signatures for the device parameters, the library concept supports in-house standardization and simplifies the validation of safety-oriented applications.
- The Safety Administrator Editor provides central support for the administration, display and modification of safety-related parameters.
- Uniform and integrated identification of all safety-related objects provides an instant overview.

Application

The STEP 7 Safety Advanced engineering tool allows the implementation of safety-related automation applications in the TIA Portal.

The languages LAD and FBD, as well as ready-made certified blocks, are used for programming the safety programs.

Function

STEP 7 Safety Advanced provides extensive functions for the generation of safety-related automation applications in the F system SIMATIC Safety.

SIMATIC Safety is certified for use in safety mode to:

- Safety class SIL3 (Safety Integrity Level) in compliance with IEC 61508: 2010
- Performance Level (PL) e according to ISO 13849-1: 2006 or according to EN ISO 13849-1: 2008

The documentation of the safety application is part of the acceptance documentation in accordance with the Machinery Directive or IEC 61508 and corresponding applicable standards. STEP 7 Safety Advanced supports validation of the safety program with standard-compliant program documentation that is generated automatically at the press of a button.

Further functions:

- Library with a host of fail-safe logic and application blocks
- Separation of time-critical and non-time-critical tasks by 2 runtime groups
- Interconnection to modules by dragging and dropping from the program editor
- Inheritance of module parameters by reusing via project library
- Unambiguous marking of fail-safe components, parameters, blocks, etc.
- Safety Administration Editor for support in the following tasks:
  - Display of Status and signature of the safety program
  - Display of safety mode status
  - Creation/organization of F runtime groups
  - Display of information about F blocks
  - Definition/modification of access protection
  - Definition/modification of general settings for the safety program

Projects created with Distributed Safety V5.4 SP5 can continue to be used with STEP 7 Safety Advanced V11.

System prerequisites

STEP 7 Safety Advanced V11 can run under STEP 7 Professional V11 SP1.

Ordering data

Ordering data	Order No.
STEP 7 Safety Advanced V11 Task: Engineering tool for configuring fail-safe user programs for SIMATIC S7-300F, S7-400F, WinAC RTX F, ET 200S, ET 200M, ET 200iSP, ET 200pro, ET 200eco Requirement: STEP 7 Professional V11 SP1	
Floating license for 1 user	**6ES7 833-1FA11-0YA5**
Software Update Service (requires current software version)	**6ES7 833-1FC00-0YX2**
STEP 7 Safety Advanced Upgrade Distributed Safety V5.4 SP5 and STEP 7 Safety Advanced V11 for parallel use; incl. software on CD; Combo License for 1 user	**6ES7 833-1FA11-0YE5**

Overview

- Digital inputs for fail-safe SIMATIC S7 systems
- Can be used in the distributed ET 200iSP I/O device with IM 152-1

The digital electronic module 8 F-DI Ex NAMUR has the following features:

- Suitable for the connection of encoders from the hazardous area
- 8 inputs 1-channel (SIL2/Category 3/PLe) or 4 inputs 2-channel (SIL3/Category 4/PLe)
- Isolated from the power bus/backplane bus
- Suitable for the following sensors:
  - According to IEC 60947-5-6 or NAMUR (with diagnostic evaluation)
  - Wired mechanical contacts (with diagnostic evaluation)
  - Unwired mechanical contacts (with deactivated diagnostics)
- Programmable diagnostic interrupt
- Diagnostic buffer integrated in module
- Firmware update
- Identification data I&M
- Channel-selective passivation
- Supports time stamping
- Can only be used in safety mode

Application

The module is used decentrally in the ET 200iSP I/O device together with SIMATIC IM151-7 F-CPU, S7-31xF-2 DP, S7-416F-2, and S7-400F/FH.

Encoders according to NAMUR and wired mechanical contacts, also for signals from the hazardous area, can be connected.

Design

The fail-safe digital input module has the following features:

- 8 short-circuit-proof encoder supplies (8 V DC) for 1 channel each, electrically isolated from the power bus/backplane bus
- Group error display (SF LED; red)
- Safety mode display (SAFE LED; green)
- Status/channel fault display per channel (green/red LED)
- Simple installation;
  the installation is the same as for the other I/O modules of the ET 200iSP
- User-friendly, permanent wiring.

Function

Fail-safe digital input modules convert the levels of the external digital signals from the process to the internal signal level of the fail-safe SIMATIC S7 CPUs.

The safety functions required for fail-safe operation are integrated in the modules.

Technical specifications

	6ES7 138-7FN00-0AB0
FH technology	
Module for failsafe applications	Yes
Input current	
from supply voltage L+, max.	150 mA; (int. power bus)
Encoder supply	
Number of outputs	8
Output voltage	8 V DC
Power losses	
Power loss, typ.	1.4 W
Address area	
Occupied address area	
• Outputs	4 byte
• Inputs	6 byte
Digital inputs	
Number/binary inputs	8
Number of NAMUR inputs	8
Input voltage	
• Type of input voltage	DC
Input current	
• for signal "1", typ.	9.5 mA
Input delay (for rated value of input voltage)	
• for standard inputs	
- at "0" to "1", min.	0.7 ms
- at "0" to "1", max.	16 ms; Parameterizable
- at "1" to "0", min.	0.7 ms
- at "1" to "0", max.	16 ms; Parameterizable
Cable length	
• Cable length, shielded, max.	500 m
• Cable length unshielded, max.	200 m
Encoder	
Number of connectable encoders, max.	8
Connectable encoders	
• NAMUR encoder	Yes

F Digital input module

Technical specifications (continued)

	6ES7 138-7FN00-0AB0
NAMUR encoder	
• Input current, for signal "0", max.	1.2 mA
• Input current, for signal "1", min.	2.1 mA
Interrupts/diagnostics/status information	
Status indicator	Yes
Alarms	
• Diagnostic alarm	Yes; Parameterizable
• Hardware interrupt	No
Diagnoses	
• Diagnostic functions	Yes
• Diagnostic information readable	Yes
• Wire break	Yes; NAMUR encoders or single contact with 10 kOhm parallel resistor
• Short circuit	Yes; R load < 150 ohms with NAMUR sensor/sensor and NAMUR changeover contact/sensor to DIN 19234
Diagnostics indication LED	
• Group error SF (red)	Yes
Parameter	
Diagnosis: wire break	channel by channel
Diagnosis: short circuit	channel by channel
Galvanic isolation	
between the channels and backplane bus	Yes
Galvanic isolation digital inputs	
• between the channels	No
• between the channels and the backplane bus	Yes
Permissible potential difference	
between different circuits	60 V DC/30 V AC
Isolation	
Isolation checked with	350 V AC/1 min between the shield and backplane bus connection 350 V AC/1 min between the shield and I/O 2830 V AC/1 min between backplane bus connection and I/O
Standards, approvals, certificates	
CE mark	Yes
Highest safety class achievable in safety mode	
• Performance Level in accordance with EN ISO 13849-1	PLe
• acc. to EN 954	Cat. 3 (single-channel), Cat. 4 (two-channel)
• acc. to IEC 61508	SIL 3
Use in hazardous areas	
• Type of protection acc. to EN 50020 (CENELEC)	II 2 G (1) GD Ex ib[ia Ga] [ia IIIC Da] IIC T4 GB and I M2 Ex ib[ia Ma] I Mb
• Type of protection acc. to KEMA	10 ATEX 0056
Dimensions	
Width	30 mm
Height	129 mm
Depth	136.5 mm
Weight	
Weight, approx.	288 g

Ordering data

	Order No.
F digital input modules	
8 F-DI Ex NAMUR	**6ES7 138-7FN00-0AB0**
Terminal modules	
TM-EM/EM60S Terminal module E60S (screw-type terminal)	**6ES7 193-7CA00-0AA0**
TM-EM/EM60C Terminal module E60C (spring-loaded terminal)	**6ES7 193-7CA10-0AA0**
Accessories	
ET 200iSP Manual	
• German	**6ES7 152-1AA00-8AA0**
• English	**6ES7 152-1AA00-8BA0**
Cable connector PROFIBUS cable connector with active terminating resistor For RS 485-IS electric circuit; 1.5 Mbit/s	**6ES7 972-0DA60-0XA0**
RS 485-IS coupler Isolating transformer for connection of PROFIBUS DP and PROFIBUS RS 485-IS	**6ES7 972-0AC80-0XA0**
Labeling sheet DIN A4, perforated, each consisting of 10 sheets of 30 strips each, can be used for electronic modules, and 20 strips each, can be used for IM 151	
• petrol	**6ES7 193-7BH00-0AA0**
• red	**6ES7 193-7BD00-0AA0**
• yellow	**6ES7 193-7BB00-0AA0**
• light beige	**6ES7 193-7BA00-0AA0**
Labels, inscribed Ordering unit: 1 set with 200 items each for slot numbering	
• 10 x slots 1 to 2	**8WA8 861-0AB**
• 5 x slots 1 to 40	**8WA8 861-0AC**
Labels, not inscribed Ordering unit: 1 set with 200 items each for slot numbering	**8WA8 848-2AY**
Distributed Safety V5.4 programming tool Task: Software for configuring fail-safe user programs for SIMATIC S7-300F, S7-400F, ET 200S Requirement: STEP 7 V5.3 SP3 and higher	
Floating License	**6ES7 833-1FC02-0YA5**
S7 F Systems RT License For processing safety-related user programs, for one AS 412F/FH, AS 414F/FH or AS 417F/FH	**6ES7 833-1CC00-6YX0**

Ordering data	Order No.
S7 F Systems V6.1 Programming and configuring environment for creating and operating safety-related STEP 7 programs for an S7 400H-based target system, Floating License for 1 user, executable under Windows XP Prof SP2/SP3, Windows Server 2003 SP2 2 languages (German, English) Type of delivery: Certificate of License as well as software and electronic documentation on CD	**6ES7 833-1CC02-0YA5**
SIMATIC Safety Matrix Tool V6.2 Creation, configuration, compilation, loading and online monitoring of the Safety Matrix in a SIMATIC PCS 7 environment Including SIMATIC Safety Matrix Viewer for SIMATIC PCS 7, for operation and monitoring of the Safety Matrix in a SIMATIC PCS 7 environment with several operator control levels 1 language (English), executes with Windows XP Professional, Type of delivery: Certificate of License and authorization diskette for Safety Matrix Tool and Safety Matrix Viewer; software and electronic documentation on CD	
Floating License for 1 installation	**6ES7 833-1SM02-0YA5**
Floating License upgrade from V5.x/V6.x to V6.2	**6ES7 833-1SM02-0YE5**
SIMATIC Safety Matrix Editor V6.2 Creation and checking of the Safety Matrix logic on an external computer without a SIMATIC PCS 7 or STEP 7 environment 1 language (English), executes with Windows 2000 Professional or Windows XP Professional, single license for 1 installation Type of delivery: Certificate of License and authorization diskette; software and electronic documentation on CD	**6ES7 833-1SM42-0YA5**
SIMATIC Safety Matrix Viewer V6.2 for SIMATIC PCS 7 Operation and monitoring of the Safety Matrix in the SIMATIC PCS 7 environment with several operator control levels 2 languages (English/German), runs under Windows 2000 Professional, Windows XP Professional, Windows 2003 Server Type of delivery: Certificate of License and authorization diskette; software and electronic documentation on CD	
Floating License for 1 installation	**6ES7 833-1SM62-0YA5**
Floating License upgrade from V6.x to V6.2	**6ES7 833-1SM62-0YE5**

SIMATIC ET 200iSP fail-safe distributed I/O

F Digital output module

Overview

- Digital outputs for fail-safe SIMATIC S7 systems
- Can be used in the distributed ET 200iSP I/O device with IM 152-1

The digital electronic module 4 F-DO Ex 17.4 V/40 mA has the following properties:

- Suitable for the connection of actuators from the hazardous area
- 4 outputs, PP-switching (SIL3/Category 4/PLe)
- Isolated from the power bus/backplane bus
- Max. output current 40 mA
- Rated load voltage 17.4 V DC
- Short-circuit, overload and wire-break monitoring
- Suitable for Ex i solenoid valves, DC current relays and actuators
- To increase the power rating, two digital outputs can be connected in parallel for one actuator
- Programmable diagnostics
- Programmable diagnostic interrupt
- Diagnostic buffer integrated in module
- Firmware update
- Identification data I&M
- Channel-selective passivation
- Can only be used in safety mode

Application

The module is used decentrally in the ET 200iSP I/O device together with SIMATIC IM151-7 F-CPU, S7-31xF-2 DP, S7-416F-2, and S7-400F/FH.

The modules are, for example, suitable for connecting solenoid valves, DC contactors and indicator lights.

Design

The fail-safe digital output module has the following features:

- Group error display (SF LED; red)
- Safety mode display (SAFE LED; green)
- Status/channel fault display per output (green/red LED)
- Simple installation;
  the installation is the same as for the other I/O modules of the ET 200iSP.
- User-friendly, permanent wiring.

Function

Fail-safe digital output modules convert the internal signal level of the fail-safe SIMATIC S7-CPUs to the external signal level required by the process. The safety functions required for fail-safe operation are integrated in the modules.

Technical specifications

	6ES7 138-7FD00-0AB0
Input current	
from load voltage L+ (without load), max.	510 mA; (int. power bus)
Power losses	
Power loss, typ.	5.3 W; max.
Digital outputs	
Number/binary outputs	4
Functionality/short-circuit strength	Yes
• Response threshold, typ.	Depending on the "short-circuit level" parameter
Controlling a digital input	No
No-load voltage Uao (DC)	17.4 V
Internal resistor Ri	167 Ω
Load resistance range	
• lower limit	270 Ω
• upper limit	18 kΩ
Trend key points E	
• Voltage Ue (DC)	10 V
• Current Ie	40 mA
Output voltage	
• for signal "1", min.	max. 17.4 V
Output current	
• for signal "0" residual current, max.	10 µA
Parallel switching of 2 outputs	
• for increased power	Yes
• for redundant control of a load	No
Switching frequency	
• with resistive load, max.	30 Hz
• with inductive load, max.	2 Hz
Cable length	
• Cable length, shielded, max.	500 m
• Cable length unshielded, max.	500 m
Interrupts/diagnostics/status information	
Status indicator	Yes
Substitute values connectable	Yes

Technical specifications (continued)

	6ES7 138-7FD00-0AB0
Alarms	
• Diagnostic alarm	Yes; Parameterizable
Diagnoses	
• Diagnostic information readable	Yes
• Wire break	Yes
• Short circuit	Yes
Diagnostics indication LED	
• Group error SF (red)	Yes
• Status indicator digital output (green)	Yes
Parameter	
Diagnosis: wire break	Yes
Diagnosis: short circuit	Yes
Galvanic isolation	
Galvanic isolation digital outputs	
• between the channels	No
• between the channels and the backplane bus	Yes
• between the channels and the load voltage L+	Yes
Permissible potential difference	
between different circuits	60V DC/30V AC
Isolation	
Isolation checked with	370 V for 1 min
Standards, approvals, certificates	
CE mark	Yes
Highest safety class achievable in safety mode	
• Performance Level in accordance with EN ISO 13849-1	PLe
• acc. to EN 954	Up to Cat. 4
• acc. to IEC 61508	SIL 3
Use in hazardous areas	
• Type of protection acc. to EN 50020 (CENELEC)	II 2 G (1) GD Ex ib[ia Ga] [ia IIIC Da] IIC T4 GB and I M2 Ex ib[ia Ma] I Mb
• Type of protection acc. to KEMA	10 ATEX 0057
Dimensions	
Width	30 mm
Height	129 mm
Depth	136.5 mm
Weight	
Weight, approx.	285 g

Ordering data

	Order No.
Digital output module	
4 F-DO Ex 17.4 V/40 mA	**6ES7 138-7FD00-0AB0**
Terminal modules	
TM-EM/EM60S	**6ES7 193-7CA00-0AA0**
Terminal module E60S (screw-type terminal)	
TM-EM/EM60C	**6ES7 193-7CA10-0AA0**
Terminal module E60C (spring-loaded terminal)	
Accessories	
ET 200iSP Manual	
• German	**6ES7 152-1AA00-8AA0**
• English	**6ES7 152-1AA00-8BA0**
Cable connector	
PROFIBUS cable connector with active terminating resistor	**6ES7 972-0DA60-0XA0**
For RS 485-IS electric circuit; 1.5 Mbit/s	
RS 485-IS coupler	**6ES7 972-0AC80-0XA0**
Isolating transformer for connection of PROFIBUS DP and PROFIBUS RS 485-IS	
Labeling sheet	
DIN A4, perforated, each consisting of 10 sheets of 30 strips each, can be used for electronic modules, and 20 strips each, can be used for IM 151	
• petrol	**6ES7 193-7BH00-0AA0**
• red	**6ES7 193-7BD00-0AA0**
• yellow	**6ES7 193-7BB00-0AA0**
• light beige	**6ES7 193-7BA00-0AA0**
Labels, inscribed	
Ordering unit: 1 set with 200 items each for slot numbering	
• 10 x slots 1 to 2	**8WA8 861-0AB**
• 5 x slots 1 to 40	**8WA8 861-0AC**
Labels, not inscribed	**8WA8 848-2AY**
Ordering unit: 1 set with 200 items each for slot numbering	
Distributed Safety V5.4 programming tool	
Task: Software for configuring fail-safe user programs for SIMATIC S7-300F, S7-400F, ET 200S Requirement: STEP 7 V5.3 SP3 and higher	
Floating License	**6ES7 833-1FC02-0YA5**

F Digital output module

Ordering data	Order No.
S7 F Systems RT License For processing safety-related user programs, for one AS 412F/FH, AS 414F/FH or AS 417F/FH	**6ES7 833-1CC00-6YX0**
S7 F Systems V6.1 Programming and configuring environment for creating and operating safety-related STEP 7 programs for an S7 400H-based target system, Floating License for 1 user, executable under Windows XP Prof SP2/SP3, Windows Server 2003 SP2 2 languages (German, English) Type of delivery: Certificate of License as well as software and electronic documentation on CD	**6ES7 833-1CC02-0YA5**
SIMATIC Safety Matrix Tool V6.2 Creation, configuration, compilation, loading and online monitoring of the Safety Matrix in a SIMATIC PCS 7 environment Including SIMATIC Safety Matrix Viewer for SIMATIC PCS 7, for operation and monitoring of the Safety Matrix in a SIMATIC PCS 7 environment with several operator control levels 1 language (English), executes with Windows XP Professional, Type of delivery: Certificate of License and authorization diskette for Safety Matrix Tool and Safety Matrix Viewer; software and electronic documentation on CD	
Floating License for 1 installation	**6ES7 833-1SM02-0YA5**
Floating License upgrade from V5.x/V6.x to V6.2	**6ES7 833-1SM02-0YE5**
SIMATIC Safety Matrix Editor V6.2 Creation and checking of the Safety Matrix logic on an external computer without a SIMATIC PCS 7 or STEP 7 environment 1 language (English), executes with Windows 2000 Professional or Windows XP Professional, single license for 1 installation Type of delivery: Certificate of License and authorization diskette; software and electronic documentation on CD	**6ES7 833-1SM42-0YA5**
SIMATIC Safety Matrix Viewer V6.2 for SIMATIC PCS 7 Operation and monitoring of the Safety Matrix in the SIMATIC PCS 7 environment with several operator control levels 2 languages (English/German), runs under Windows 2000 Professional, Windows XP Professional, Windows 2003 Server Type of delivery: Certificate of License and authorization diskette; software and electronic documentation on CD	
Floating License for 1 installation	**6ES7 833-1SM62-0YA5**
Floating License upgrade from V6.x to V6.2	**6ES7 833-1SM62-0YE5**

Overview

- Analog inputs for fail-safe SIMATIC S7 systems
- Can be used in the distributed ET 200iSP I/O device with IM 152-1

The analog electronic module 4 F-AI Ex HART has the following properties:

- Suitable for the connection of encoders from the hazardous area
- 4 analog inputs 1-channel (SIL2/Cat.3/PLe) or 4 inputs 2-channel (SIL3/Category 4/PLe, with two 4 F-AI Ex HART modules)
- Electrical isolation between channels and the backplane bus
- Input ranges:
  - 0 to 20 mA
  - 4 to 20 mA
- Suitable for the following sensors:
  - 2-wire transducers
  - HART field devices
- Programmable diagnostics
- Programmable diagnostic interrupt
- Diagnostic buffer integrated in module
- HART communication (HART protocol versions 5, 6, 7)
- Firmware update
- Identification data I&M
- Can only be used in safety mode

Application

The module is used decentrally in the ET 200iSP I/O device together with SIMATIC IM 151-7 F-CPU, S7-31xF-2 DP, S7-416F-2, and S7-400F/FH.

Current sensors 0 ... 20 mA and 4 ... 20 mA (also HART) can be connected as encoders.

Design

- 4 short-circuit-proof encoder supplies (min. 12 V DC/ max. 26 V DC) for 1 channel each, electrically isolated from the backplane bus
- Group error display (SF LED; red)
- Safety mode display (SAFE LED; green)
- Channel fault display per channel (red LED)
- Display for HART status per channel (green LED)
  (If HART communication is activated for a channel and HART communication is running, the green HART status display lights up.)
- Simple installation;
  the installation is the same as for the other I/O modules of the ET 200iSP
- User-friendly, permanent wiring.

Function

The analog input module converts analog signals from the process to digital signals for internal processing within the fail-safe SIMATIC S7 CPUs.

The safety functions required for fail-safe operation are integrated in the module.

The following functions are available:

- Resolution 15 bits + sign.
- Different measuring ranges:
  - 0 to 20 mA or
  - 4 to 20 mA or
  - 4 to 20 mA (HART)
- Interrupt capability;
  the module sends diagnostic interrupts to the CPU of the controller.
- Diagnostics;
  the module sends extensive diagnostic information to the CPU.

Technical specifications

	6ES7 138-7FA00-0AB0
Input current	
from supply voltage L+, max.	490 mA; (int. power bus)
Output voltage	
Power supply to the transmitters	
• short-circuit proof	Yes
• Supply current, max.	25 mA; Plus 4 mA per channel
Power losses	
Power loss, typ.	5.4 W; max.
Address area	
Address space per module	
• Address space per module, max.	16 byte; 12 bytes in the I area / 4 bytes in the O area
Analog inputs	
Number of analog inputs	4
Cycle time (all channels) max.	See data in manual
Input ranges	
• Voltage	No
• Current	Yes
• Thermocouple	No
• Resistance thermometer	No
• Resistance	No

F Analog input module

Technical specifications (continued)

	6ES7 138-7FA00-0AB0
Input ranges (rated values), currents	
• 4 to 20 mA	Yes; and 0 to 20 mA
Cable length	
• Cable length, shielded, max.	500 m
Analog value creation	
Measurement principle	integrating (Sigma-Delta)
Integrations and conversion time/ resolution per channel	
• Resolution with overrange (bit including sign), max.	16 bit
• Integration time, parameterizable	Yes
• Interference voltage suppression for interference frequency f1 in Hz	50 / 60 Hz
Smoothing of measured values	
• Parameterizable	Yes; in 4 stages
• Step: None	Yes; 1 x cycle time
• Step: low	Yes; 4 x cycle time
• Step: Medium	Yes; 32 x cycle time
• Step: High	Yes; 64 x cycle time
Encoder	
Connection of signal encoders	
• for current measurement as 2-wire transducer	Yes
• Burden of 2-wire transmitter, max.	750 Ω
Errors/accuracies	
Linearity error (relative to input area)	+/- 0.015 %
Temperature error (relative to input area)	+/- 0.005 %/K
Crosstalk between the inputs, min.	-50 dB
Repeat accuracy in settled status at 25 °C (relative to input area)	+/- 0.015%
Operational limit in overall temperature range	
• Current, relative to input area	+/- 0.35%
Basic error limit (operational limit at 25 °C)	
• Current, relative to input area	+/- 0.1 %

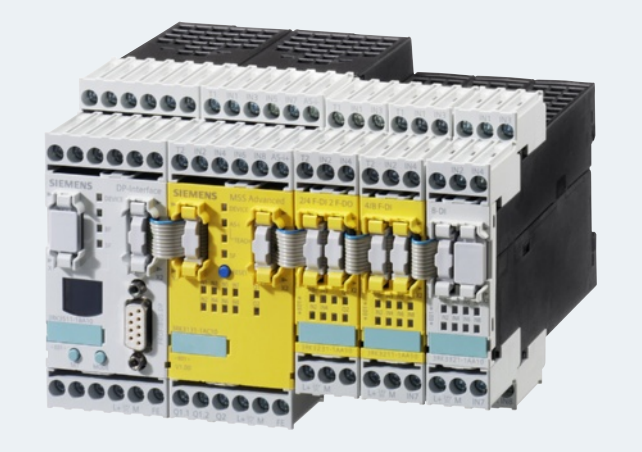
	6ES7 138-7FA00-0AB0
Interference voltage suppression for f = n x (fl +/- 1%), fl = interference frequency	
• Series mode interference (peak value of interference < rated value of input range), min.	40 dB
• Common mode interference, min.	50 dB
Interrupts/diagnostics/status information	
Alarms	
• Diagnostic alarm	Yes; Parameterizable
Diagnoses	
• Diagnostic information readable	Yes
• Wire break	Yes
• Short circuit	Yes
Diagnostics indication LED	
• Group error SF (red)	Yes
Galvanic isolation	
Galvanic isolation analog inputs	
• between the channels	No
• between the channels and the backplane bus	Yes
• between the channels and the load voltage L+	Yes; Power bus
Permissible potential difference	
between the inputs (UCM)	60 V DC/30 V AC
Standards, approvals, certificates	
CE mark	Yes
Highest safety class achievable in safety mode	
• Performance Level in accordance with EN ISO 13849-1	PLe
• acc. to EN 954	Cat. 3 (single-channel), Cat. 4 (two-channel)
• acc. to IEC 61508	SIL 3
Use in hazardous areas	
• Type of protection acc. to EN 50020 (CENELEC)	II 2 G (1) GD Ex ib[ia Ga] [ia IIIC Da] IIC T4 GB and I M2 Ex ib[ia Ma] I Mb
• Type of protection acc. to KEMA	10 ATEX 0058
Dimensions	
Width	30 mm
Height	129 mm
Depth	136.5 mm
Weight	
Weight, approx.	299 g

Ordering data	Order No.
F analog input module	
4 F-AI Ex HART	**6ES7 138-7FA00-0AB0**
Terminal modules	
TM-EM/EM60S	**6ES7 193-7CA00-0AA0**
Terminal module E60S (screw-type terminal)	
TM-EM/EM60C	**6ES7 193-7CA10-0AA0**
Terminal module E60C (spring-loaded terminal)	
Accessories	
ET 200iSP Manual	
• German	**6ES7 152-1AA00-8AA0**
• English	**6ES7 152-1AA00-8BA0**
Cable connector	
PROFIBUS cable connector with active terminating resistor	**6ES7 972-0DA60-0XA0**
For RS 485-IS electric circuit; 1.5 Mbit/s	
RS 485-IS coupler	**6ES7 972-0AC80-0XA0**
Isolating transformer for connection of PROFIBUS DP and PROFIBUS RS 485-IS	
Labeling sheet	
DIN A4, perforated, each consisting of 10 sheets of 30 strips each, can be used for electronic modules, and 20 strips each, can be used for IM 151	
• petrol	**6ES7 193-7BH00-0AA0**
• red	**6ES7 193-7BD00-0AA0**
• yellow	**6ES7 193-7BB00-0AA0**
• light beige	**6ES7 193-7BA00-0AA0**
Labels, inscribed	
Ordering unit: 1 set with 200 items each for slot numbering	
• 10 x slots 1 to 2	**8WA8 861-0AB**
• 5 x slots 1 to 40	**8WA8 861-0AC**
Labels, not inscribed	**8WA8 848-2AY**
Ordering unit: 1 set with 200 items each for slot numbering	
Distributed Safety V5.4 programming tool	
Task: Software for configuring fail-safe user programs for SIMATIC S7-300F, S7-400F, ET 200S Requirement: STEP 7 V5.3 SP3 and higher	
Floating License	**6ES7 833-1FC02-0YA5**
S7 F Systems RT License	**6ES7 833-1CC00-6YX0**
For processing safety-related user programs, for one AS 412F/FH, AS 414F/FH or AS 417F/FH	

	Order No.
S7 F Systems V6.1	**6ES7 833-1CC02-0YA5**
Programming and configuring environment for creating and operating safety-related STEP 7 programs for an S7 400H-based target system, Floating License for 1 user, executable under Windows XP Prof SP2/SP3, Windows Server 2003 SP2	
2 languages (German, English)	
Type of delivery: Certificate of License as well as software and electronic documentation on CD	
SIMATIC Safety Matrix Tool V6.2	
Creation, configuration, compilation, loading and online monitoring of the Safety Matrix in a SIMATIC PCS 7 environment	
Including SIMATIC Safety Matrix Viewer for SIMATIC PCS 7, for operation and monitoring of the Safety Matrix in a SIMATIC PCS 7 environment with several operator control levels	
1 language (English), executes with Windows XP Professional,	
Type of delivery: Certificate of License and authorization diskette for Safety Matrix Tool and Safety Matrix Viewer; software and electronic documentation on CD	
Floating License for 1 installation	**6ES7 833-1SM02-0YA5**
Floating License upgrade from V5.x/V6.x to V6.2	**6ES7 833-1SM02-0YE5**
SIMATIC Safety Matrix Editor V6.2	**6ES7 833-1SM42-0YA5**
Creation and checking of the Safety Matrix logic on an external computer without a SIMATIC PCS 7 or STEP 7 environment 1 language (English), executes with Windows 2000 Professional or Windows XP Professional, single license for 1 installation Type of delivery: Certificate of License and authorization diskette; software and electronic documentation on CD	
SIMATIC Safety Matrix Viewer V6.2 for SIMATIC PCS 7	
Operation and monitoring of the Safety Matrix in the SIMATIC PCS 7 environment with several operator control levels 2 languages (English/German), runs under Windows 2000 Professional, Windows XP Professional, Windows 2003 Server Type of delivery: Certificate of License and authorization diskette; software and electronic documentation on CD	
Floating License for 1 installation	**6ES7 833-1SM62-0YA5**
Floating License upgrade from V6.x to V6.2	**6ES7 833-1SM62-0YE5**

General data

Overview



SIRIUS 3RK3 modular safety system

The 3RK3 modular safety system (MSS) is a freely parameterizable modular safety relay. Depending on the external circuit version, safety-oriented applications up Performance Level e according to ISO 13849-1 or SIL3 according to IEC 62061 can be realized.

The modular safety relay enables the interconnection of several safety applications.

The comprehensive error and status diagnostics provides the possibility of finding errors in the system and localizing signals from sensors. Plant downtimes can be reduced as the result.

The MSS comprises the following system components:

- Central modules
- Expansion modules
- Interface modules
- Diagnostics modules
- Parameterization software
- Accessories

Central modules

MSS Basic

The 3RK3 Basic central module is used wherever more than three safety functions need to be evaluated and the wiring parameterization of safety relays would involve great cost and effort. It reads in inputs, controls outputs and communicates through an interface module with higher-level control systems. An application's entire safety program is processed in the central module. The 3RK3 Basic central module is the lowest expansion level and fully functional on its own, without the optional expansion modules.

MSS Advanced

The 3RK3 Advanced central module is the consistent expansion of the Basic central module with the functionality of an AS-i safety monitor. In addition to having a larger volume of project data and scope of functionality it can be integrated in AS-Interface and therefore make use of the many different possibilities offered by this bus system. The function can be optionally activated in the central module.

The service-proven insulation piercing method of AS-Interface enables not only the distributed expansion of the project data volume using safe AS-i outputs, safe AS-i sensors and other MSS Advanced or safety monitors (F cross traffic) but also a highly flexible adaptation of the application, e.g. very fast connection of AS-i outputs such as LV HRC command devices, position switches with and without interlock, or light curtains.

Safety-orientated central disconnection using MSS or by distributed means using safe AS-i outputs and the formation of switch-off groups can be realized very easily. The same applies for any subsequent modifications. They are now easily possible by re-addressing, i.e. re-wiring is no longer necessary.

The AS-i bus is connected directly to the central module.

Expansion modules

With the optional expansion modules, both safety-related and standard, the system is flexibly adapted to the required safety applications.

Interface modules

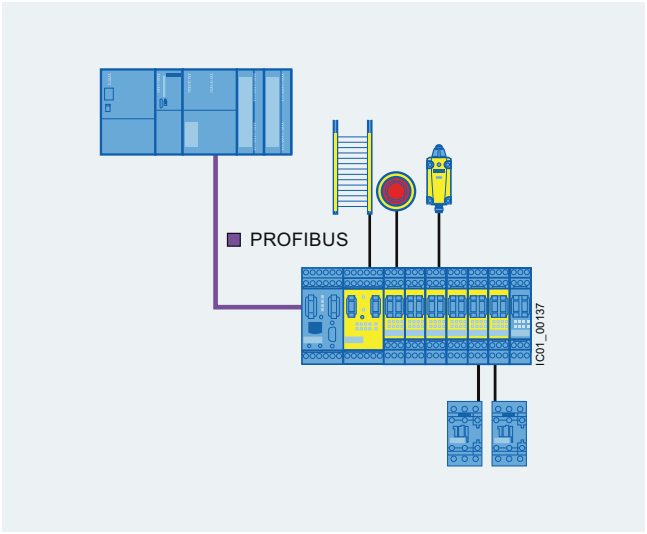
The DP interface module is used for transferring diagnostics data and device status data to a higher-level PROFIBUS network, e.g. for purposes of visualization using HMI. When using the Basic central module, 32-bit cyclic data can be exchanged with the control system. If the Advanced central module is used, the number is doubled to 64-bit cycle data. The acyclic calling of diagnostics data is possible with both central modules.

Diagnostics modules

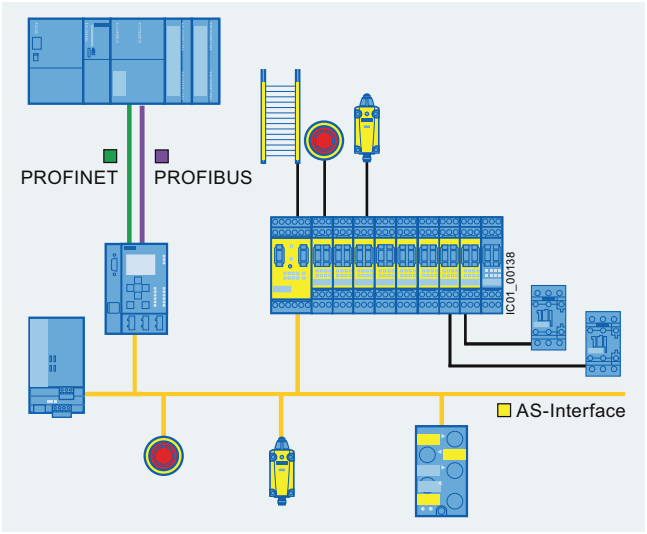
Faults, e.g. crossover, are indicated directly on the diagnostics display. The fault is diagnosed directly in plain text by the detailed alarm message. The device is fully functional upon delivery. No programming is required.

Parameterization software

Using the MSS ES graphical parameterization tool it is very easy to create the safety functions as well as their logical links on the PC. For example disconnection ranges, ON-delays, OFF-delays and other dependencies can be defined. In addition comprehensive commissioning, diagnostic and documentation functions are available.



System configuration with the Basic central module



System configuration with the Advanced central module

Order No. scheme

Digit of the Order No.	1st - 4th	5th	6th	7th		8th	9th	10th	11th	12th
	□□□□	□	□	□	–	□	□	□	□	□
Modular safety system	**3 R K 3**									
Device type		□								
Device type			□	□						
Connection type						□				
Communications							□	□	□	
Version										□
Example	**3 R K 3**	**1**	**1**	**1**	**–**	**1**	**A**	**A**	**1**	**0**

Note:

The Order No. scheme is presented here merely for information purposes and for better understanding of the logic behind the order numbers.

For your orders, please use the order numbers quoted in the catalog in the Selection and ordering data.

Benefits

- More functionality and flexibility through freely configurable safety logic
- Suitable for all safety applications thanks to compliance with the highest safety standards in production automation
- For use all over the world through compliance with all product-relevant, globally established certifications
- Modular hardware configuration
- Parameterization by means of software instead of wiring
- Removable terminals for greater plant availability
- Distributed collection from sensors and disconnection of actuators through AS-Interface
- All MSS ES logic functions can also be used for AS-Interface, e.g. muting, protective door with interlock
- Up to 12 independent safe switch-off groups on the AS-i bus
- Volume of project data can be greatly increased by means of AS-Interface
- Up to 50 two-channel enabling circuits per system

Communication through PROFIBUS

The 3RK3 modular safety system can be connected to PROFIBUS through the DP interface and exchange data with higher-level control systems.

The MSS supports among other things:

- Baud rates up to 12 Mbit/s
- Automatic baud rate detection
- Cyclic services (DPV0) and acyclic services (DPV1)
- Exchange of 32-bit cyclic data with MSS Basic or 64-bit cyclic data with MSS Advanced
- Diagnostics using data record invocations

AS-Interface communication

Using the Advanced central module, the 3RK3 modular safety system can be integrated in AS-Interface.

- MSS can read in up to 31 AS-i sensors
- Up to 12 prepared signals per MSS can be placed on the AS-i bus, e.g. for F cross traffic or for disconnecting safe AS-i outputs
- Safe cross traffic among Advanced systems or between Advanced systems and safety monitors
- Standard signals, e.g. for acknowledgment, can also be placed on the bus

MSS with communication function see Catalog IC 10, page 3/17 onwards.

Accessories see Catalog IC 10, page 3/18 onwards.

More information see also Catalog IC 10, Chapter 14 "Planning, Configuration and Visualizing for SIRIUS".

General data

Application

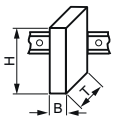
The 3RK3 modular safety system can be used for all safety-oriented requirements in the manufacturing industry and offers the following safety functions:

	Symbol	MSS Basic	MSS Advanced
Monitoring functions			
Universal monitoring Evaluation of binary signals from single-channel and two-channel sensors		--	✓
EMERGENCY-STOP Evaluation of EMERGENCY-STOP devices with positive-opening contacts		✓	✓
Switching mats Evaluation of switching mats with NC contacts and/or crossover monitoring		✓	✓
Protective door monitoring Evaluation of protective door signals and/or protective flap signals		✓	✓
Protective door interlocking Evaluation of protective doors with interlock and of the actuation/release of this interlock		--	✓
Approval switches Evaluation of OK buttons with NO contact		✓	✓
Two-hand operator controls Evaluation of two-hand operator controls		✓	✓
BWS monitoring Evaluation of non-contact protective devices, e.g. light curtains and laser scanners		✓	✓
Muting Temporary bridging of non-contact protective devices, 2/4 sensors in parallel, 4 sensors in sequence		--	✓
Operating mode selector switches Evaluation of operating mode selector switches with NO contacts		✓	✓
Monitoring of AS-i (AS-i 2F-DI) Logic element for monitoring of AS-i input slaves		--	✓
Logic operation functions			
AND		✓	✓
OR		✓	✓
XOR		✓	✓
NAND		✓	✓

	Symbol	MSS Basic	MSS Advanced
Logic Operation Functions (continued)			
NOR		✓	✓
Negation		✓	✓
Flip-flop		✓	✓
Counting functions			
Counter 0 -> 1		✓	✓
Counter 1 -> 0		✓	✓
Counter 0 -> 1/1 -> 0		✓	✓
Time functions			
With ON-delay		✓	✓
Passing make contact		✓	✓
With OFF-delay		✓	✓
Clock-pulsing		✓	✓
Start functions			
Monitored start		✓	✓
Manual start		✓	✓
Output functions			
Standard output		✓	✓
F output		✓	✓
AS-i output function		--	✓
Status functions			
Element status		--	✓

✓ Available -- Not available

Technical specifications

Type		Central modules	Expansion modules						Interface modules	Diagnostics modules
			4/8F-DI	2/4 F-DI 1/2 F-RO	2/4 F-DI 2F-DO	4/8 F-RO	4 F-DO	8 DI	8 DO		
Dimensions (W x H x D)											
											
• Screw terminals	mm	45 x 111 x 124	22.5 x 111 x 124			45 x 111 x 124	22.5 x 111 x 124			45 x 111 x 124	96 x 60 x 44
• Spring-type terminals	mm	45 x 113 x 124	22.5 x 113 x 124			45 x 113 x 124	22.5 x 113 x 124			45 x 113 x 124	--
Device data											
Shock resistance (sine pulse)	*g*/ms	15/11									
Touch protection acc. to VDE 0106 Part 100 or EN 60529		IP20									
Permissible mounting position		Vertical mounting surface (+10°/-10°), deviating mounting positions are permitted for reduced ambient temperature									
Minimum distances		For heat dissipation through convection from the devices 25 mm to the ventilation openings (top and bottom)									
Permissible ambient temperature											
• During operation	°C	-20 ... +60									
• During storage and transport	°C	-40 ... +85									
Number of sensor inputs (1-channel)		8	8	4	4	--	--	8	8	--	--
Number of test outputs		2	2	2	2	--	--	--	--	--	--
Number of outputs											
• Relay outputs											
- Single channel		--	--	2	--	8	--	--	--	--	--
- Two-channel		1	--	--	--	--	--	--	--	--	--
• Solid-state outputs											
- Single channel		--	--	--	--	--	--	--	8	--	--
- Two-channel		1	--	--	2	--	4	--	--	--	--
Weight	g	300	160	160	160	400	135	125	160	270	90
Installation altitude above sea level	m	2000									
Environmental data											
EMC interference immunity		IEC 60947-5-1									
Vibrations											
• Frequency	Hz	5 ... 500									
• Amplitude	mm	0.75									
Climatic withstand capability		EN 60068-2-78									

General data

Type		Central modules	Expansion modules						Interface modules	Diagnostics modules
			4/8F-DI	2/4 F-DI 1/2 F-RO	2/4 F-DI 2F-DO	4/8 F-RO	4 F-DO	8 DI	8 DO		
Electrical specifications											
Rated control supply voltage U_s According to IEC 61131-2	V	24 DC ±15 %[1]	24 DC ±15 %	24 DC ±15 %	24 DC ±15 %	24 DC ±15 %	24 DC ±15 %	24 DC ±15 %	24 DC ±15 %	24 DC ±15 %	24 DC ±15 %[2]
Operating range		0.85 ... 1.15 x U_s									
Rated insulation voltage U_i	V	300	50	300	50	300	50	50	50	50	50
Rated impulse voltage U_{imp}	kV	4	500	4	500	4	500	500	500	500	500
Total current input	mA	185	60	85	85	140	8	78	60	--	24
Rated power at U_s	W	4.5	1.5	2	2	3	4.8	1.9	1.5	--	0.6
Utilization category according to EN 60947-5-1 (relay outputs)											
• AC-15 at 230 V	A	2	--	2	--	3	--	--	--	--	--
• DC-13 at 24 V	A	1	--	1	--	3	--	--	--	--	--
(semiconductor outputs)											
• DC-13 at 24 V	A	1.5	--	--	1	--	2	--	0.5	--	--
Mechanical endurance during rated operation	Operating cycles (relay)	10×10^6	--	10×10^6	--	10×10^6	--	--	--	--	--
Switching frequency z at rated operational current	1/h	1000	--	1000	1000	360	1000	--	1000	--	--
Conventional thermal current I_{th}	A	2/1.5	--	1	1	3	2	--	0.5	--	--
Protection for output contacts Fuse links LV HRC Type 3NA, DIAZED Type 5SB, NEOZED Type 5SE											
• gG operational class	A	4	--	4	--	4	--	--	--	--	--
• Operational class quick	A	6	--	6	--	6	--	--	--	--	--
Safety specifications											
Probability of a dangerous failure											
• Per hour (PFH_d)	1/h	Basic: 5.14×10^{-9} Advanced: 2.8×10^{-9} AS-i (incl. AS-i): 3.8×10^{-9}	1.89×10^{-9}	3.79×10^{-9}	2.7×10^{-9}	7.15×10^{-9}	3.18×10^{-9}	--	--	--	--
• On demand (PFD)	1/h	Basic: 1.28×10^{-5} Advanced: 1.7×10^{-4} AS-i (incl. AS-i): 1.7×10^{-4}	4.29×10^{-6}	5.85×10^{-6}	8.34×10^{-6}	4.36×10^{-5}	2.2×10^{-5}	--	--	--	--
Parameters for cables											
Line resistance	Ω	100	100	100	100	--	--	100	--	--	--
Cable length from terminal to terminal											
With Cu 1.5 mm^2 and 150 nF/km	m	1000	1000	1000	1000	--	--	1000	--	--	--
Conductor capacity	nF	330	330	330	330	--	--	330	--	--	--

[1] Device current supply through a power supply unit acc. to IEC 60 536 protection class III (SELV or PELV).

[2] Via connecting cable to the central module.

Selection and ordering data


3RK3 111-1AA10


3RK3 131-1AC10


3RK3 211-1AA10
3RK3 221-1AA10
3RK3 231-1AA10
3RK3 242-1AA10


3RK3 251-1AA10


3RK3 311-1AA10
3RK3 321-1AA10


3RK3 511-1BA10


3RK3 611-3AA00

Version	DT	Screw terminals ⊕	DT	Spring-type terminals ⊞
		Order No.		Order No.
Central modules				
3RK3 Basic Central module with safety-orientated inputs and outputs • 8 inputs • 1 two-channel relay output • 1 two-channel solid-state output Max. 7 expansion modules can be connected *Note:* *Memory module 3RK3 931-0AA00 is included in the scope of supply.*	A	**3RK3 111-1AA10**	A	**3RK3 111-2AA10**
3RK3 Advanced Central modules for connecting to AS-Interface with safety-orientated inputs and outputs and extended scope of functions • 8 inputs • 1 two-channel relay output • 1 two-channel solid-state output Max. 9 expansion modules can be connected *Note:* *Memory module 3RK3 931-0AA00 is included in the scope of supply.*	A	**3RK3 131-1AC10**	A	**3RK3 131-2AC10**
Expansion modules				
4/8 F-DI Safety-related input modules • 8 inputs	A	**3RK3 211-1AA10**	A	**3RK3 211-2AA10**
2/4 F-DI 1/2 F-RO Safety-related input/output modules • 4 inputs • 2 single-channel relay outputs	A	**3RK3 221-1AA10**	A	**3RK3 221-2AA10**
2/4 F-DI 2F-DO Safety-related input/output modules • 4 inputs • 2 two-channel solid-state outputs	A	**3RK3 231-1AA10**	A	**3RK3 231-2AA10**
4/8 F-RO Safety-related output modules • 8 single-channel relay outputs	A	**3RK3 251-1AA10**	A	**3RK3 251-2AA10**
4 F-DO Safety-related output modules • 4 two-channel solid-state outputs	A	**3RK3 242-1AA10**	A	**3RK3 242-2AA10**
8 DI Standard input module • 8 inputs	A	**3RK3 321-1AA10**	A	**3RK3 321-2AA10**
8 DO Standard output module • 8 solid-state outputs	A	**3RK3 311-1AA10**	A	**3RK3 311-2AA10**
Interface modules				
DP interface PROFIBUS DP interface, 12 Mbit/s, RS 485, 32-bit cyclic data exchange with Basic central module or 64-bit with Advanced central module, acyclic exchange of diagnostics data	A	**3RK3 511-1BA10**	A	**3RK3 511-2BA10**
Operating and monitoring modules				
Diagnostics modules	A	**3RK3 611-3AA00**		**--**

Note:

Connection cable required, see Catalog IC 10, page 3/18.

More information see Cat. IC 10, Chapter 2 "Industrial Communication" and on the Internet at www.siemens.com/sirius-mss

Accessories

Selection and ordering data

	Version			DT	Order No.
Connection cables (essential accessory)					
 3UF7 932-0AA00-0	For connection of				
	Central modules with expansion modules or interface module	Diagnostics modules with central module or interface module			
	✓	✓	• Length 0.025 m (flat)	►	**3UF7 930-0AA00-0**
	--	✓	• Length 0.1 m (flat)	►	**3UF7 931-0AA00-0**
	--	✓	• Length 0.3 m (flat)	►	**3UF7 935-0AA00-0**
	--	✓	• Length 0.5 m (flat)	►	**3UF7 932-0AA00-0**
	--	✓	• Length 0.5 m (round)	►	**3UF7 932-0BA00-0**
	--	✓	• Length 1.0 m (round)	►	**3UF7 937-0BA00-0**
	--	✓	• Length 2.5 m (round)	►	**3UF7 933-0BA00-0**
PC cables and adapters					
 3UF7 940-0AA00-0	**PC cable for PC/PG communication with 3RK3 modular safety system** Through the system interface, for connecting to the serial interface of the PC/PG			►	**3UF7 940-0AA00-0**
	USB/serial adapters To connect a RS 232 PC cable to the USB port of a PC, recommended for use in conjunction with 3RK3			B	**3UF7 946-0AA00-0**
Interface covers					
 3UF7 950-0AA00-0	For system interface			►	**3UF7 950-0AA00-0**
Memory modules					
 3RK3 931-0AA00	For parameterizing the 3RK3 Modular Safety System without a PC/PG through the system interface			A	**3RK3 931-0AA00**
Door adapters					
 3UF7 920-0AA00-0	For external connection of the system interface, e.g. outside a control cabinet			►	**3UF7 920-0AA00-0**
Push-in lugs					
 3RP19 03	For screw fixing e.g. on mounting plate, 2 units required per device				
	Can be used for 3RK3			B	**3RP19 03**
Manuals					
	Manual for 3RK3 modular safety system (MSS)				
	• English			C	**3ZX1 012-0RK31-1AC1**
	• German			C	**3ZX1 012-0RK31-1AB1**

✓ Available
-- Not available

More accessories see Catalog IC 10, Chapter 2 "Industrial Communication".

Parameterization, start-up and diagnostics software for 3RK3

- Runs under Windows XP Professional (Service Pack 2), Windows 7 32 bit Professional/Ultimate/Business
- Delivered without PC cable

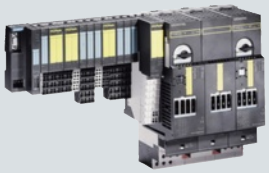
	Version	DT	Order No.
Modular Safety System ES 2008 Basic incl. SP2			
 3ZS1 314-4CC10-0YA5	**Floating license for one user** Engineering software in limited-function version for diagnostics purposes, software and documentation on CD, 3 languages (German/English/French), communication through the system interface		
	• License key on USB stick, Class A	►	**3ZS1 314-4CC10-0YA5**
	• License key download, Class A	►	**3ZS1 314-4CE10-0YB5**
Modular Safety System ES 2008 Standard incl. SP2			
 3ZS1 314-5CC10-0YA5	**Floating license for one user** Engineering software, software and documentation on CD, 3 languages (German/English/French), communication through system interface		
	• License key on USB stick, Class A	B	**3ZS1 314-5CC10-0YA5**
	• License key download, Class A	►	**3ZS1 314-5CE10-0YB5**
	Powerpack for MSS ES 2008 Basic to Standard Floating license for one user, engineering software, license key on USB stick, Class A, 3 languages (German/English/French), communication through the system interface	►	**3ZS1 314-5CC10-0YD5**
	Software Update Service For 1 year with automatic extension, assuming the current software version is in use, engineering software, software and documentation on CD, communication through the system interface	►	**3ZS1 314-5CC10-0YL5**
Modular Safety System ES 2008 Premium incl. SP2			
 3ZS1 314-6CC10-0YA5	**Floating license for one user** Engineering software, software and documentation on CD, 3 languages (German/English/French), communication through PROFIBUS or the system interface, creating, importing and exporting macros		
	• License key on USB stick, Class A	B	**3ZS1 314-6CC10-0YA5**
	• License key download, Class A	►	**3ZS1 314-6CE10-0YB5**
	Powerpack for MSS ES 2008 Standard to Premium Floating license for one user, engineering software, license key on USB stick, Class A, 3 languages (German/English/French), communication through the system interface	►	**3ZS1 314-6CC10-0YD5**
	Software Update Service For 1 year with automatic extension, assuming the current software version is in use, engineering software, software and documentation on CD, communication through PROFIBUS or the system interface, creating, importing and exporting macros	►	**3ZS1 314-6CC10-0YL5**

Note:

Description of the software versions see Catalog IC 10, Chapter 14 "Planning, Configuration and Visualizing for SIRIUS".

Reacting

4



Delivery time classes (DT)

►	Preferred type	Preferred types are available immediately from stock, i.e. are dispatched within 24 hours.
A	2 work days	In exceptional cases the actual delivery time may differ from that specified
B	1 week	The transport times depend on the destination and type of shipping. The standard transport time for Germany is 1 day.
C	3 weeks	The delivery times shown represent the state of 10/2011.
D	6 weeks	
X	on request	

High-Feature motor starters

Overview

Functionality of the High-Feature motor starters

- Basic functionality see catalog IC 10, "General Data" →"Overview" on page 8/84.
- Direct-on-line, reversing or soft starter up to 7.5 kW
- With wide range in 3 setting ranges, with 0.3 to 3 A, 2.4 up to 8 A, 2.4 to 16 A available
- With combination of starter circuit breaker, electronic overload protection (parameterizable), and contactor or soft starter
- Power bus up to 50 A
- Upper and lower current limits for plant and process monitoring
- Motor stall protection, zero current detection and asymmetry detection integrated
- The actual motor current is measured and transmitted for diagnostics in the cyclic process image
- Control of the motor starter from the control system and extensive diagnostics status via the cyclic process image
- Optional digital inputs available in the cyclic process image and flexibly assignable with functions for adaptation to all applications
- Detection of the switching state of the starter circuit breaker via aux. switches and of the contactor via current evaluation
- Integrated isolating function using starter circuit breakers
- **Local safety engineering up to SIL 3 according to EN 62061 and PL e according to ISO 13849-1** (without failsafe kit in the case of the HF starter, because the function of the failsafe kit is already integrated)
- Front-mounting 2DI LC COM control module for 2 more parameterizable digital inputs
- Optional "Motor Starter ES" software for easy commissioning and diagnostics - from 11/2011 also for the new .-.AB4 -Starter available (see catalog IC 10, Chapter 14 "Planning, Configuration and Visualizing for SIRIUS")
- PROFIenergy capable (only with the new .-.AB4 -starters)
- Supplying the motor current in PROFIenergy format
  - Switching off during dead times
- All acyclic services DPV1 supported by PROFIBUS and PROFINET (only with the new .-.AB4 -starters)
  - Changing of parameters during operation, e.g. the rated operational current
  - Reading and writing acyclic data for exact diagnostics of the unit or process and for analysis of the plant status

Selective protection concept for ET 200S High-Feature motor starters

As a result of the selective protection concept (separate tripping of short circuit and overload) with solid-state overload evaluation, additional advantages are realized on the High-Feature motor starters – advantages which soon make themselves positively felt particularly in manufacturing processes with high plant stoppage costs:

- Only two versions up to 7.5 kW – hence little order variance and stock keeping
- All settings can be parameterized by bus – hence full TIA capability
- Separate signaling of overload and short circuit – enables selective diagnostics
- Overload can be acknowledged by remote reset – ideal for highly automated plants
- Current asymmetry monitoring – complete monitoring of the motor
- Stall protection – complete monitoring of the motor
- Emergency start function in case of overload – operation is possible in an emergency
- Current value transmission via bus – monitoring of the application
- Current limit monitoring
- Trip class can be parameterized – overload trip can be adapted to the application
- Type of coordination "2" – still functional after short circuit with magnitude of 50 kA
- Very high contact endurance

ET 200S High-Feature motor starter: DS1e-x direct-on-line starter (innovated .-.AB4 starters)

ET 200S High-Feature motor starter: DS1e-x direct-on-line soft starter (innovated .-.AB4 starter)

ET 200S High-Feature motor starter: Reversing starter (reversing starter) RS1e-x (innovated .-.AB4 -Starter)

PROFIenergy for ET 200S High-Feature motor starters[1)]

Increasing energy prices, far-reaching ecological problems worldwide and the threat of climate change make it necessary for you to be more conscious about your use of energy.

Active and effective energy management is possible with PROFIenergy.

PROFIenergy is a manufacturer-independent profile on PROFINET, which can be used by all manufacturers, has been standardized by PNO[1)] and supports the shut-down of electrical devices during dead times and the read-out of measured values.

The ET 200S HF motor starter supplies the motor current in PROFIenergy format and switches off during dead times.

All acyclic services DPV1 supported by PROFIBUS and PROFINET (only with the new .-.AB4 -starters)

Thanks to the acyclic services, the ET 200S HF motor starters now offer plenty of diagnostics data via data records. There are extensive new options for reading out data from the motor starter for device, system or process monitoring. The motor starter is equipped internally with three logbooks for device faults, motor starter trips and events, which are issued with a time stamp. These logbooks can be read out of the motor starter on demand at any time and provide the plant operator with plenty of information about the state of his plant and process which he can use to carry out improvements.

With the slave pointer and statistical data functions it is possible to read out, for example, the maximum internal current values or the number of motor starter connection operations. This enables process deviations to be monitored or commissioning to be optimized.

Statistical data or measured values make plant monitoring easy for the user.

The device diagnostics data record contains details of all the states of the motor starter, the device configuration and the communication as a basis for central device and plant monitoring.

The Installation and Maintenance Functions (I&M) store, firstly, information (I&M) about the modules used in the motor starter and, secondly, data (I&M) that can be defined during configuration, e.g. location designations. I&M functions are used for for troubleshooting faults and localizing changes in hardware at a plant or checking the system configuration.

Supported data records:

- DS 0 S7-V1 system diagnostics (S7 diagnostics alarm)
- DS 72, 73, 75 logbooks, device faults, trips, events
- DS 92 device diagnostics
- DS 93 command
- DS 94 measured values
- DS 95 statistics
- DS 96 slave pointer
- DS 100 device identification
- DS 131 device parameters
- DS 134 maintenance
- DS 165 comment
- DS 226 PROFIenergy technology function
- DS 231 I&M 0 (= device identification)
- DS 232 I&M 1 (= equipment identifier)
- DS 233 I&M 2 (= installation)
- DS 234 I&M 3 (= description)

Device functions (firmware features)

See catalog IC 10, page 8/86 and 8/87.

1) In the PNO (PROFIBUS Nutzerorganisation e. V. - PROFIBUS User Organization), manufacturers and users have come together to agree on the standardized communication technologies PROFIBUS and PROFINET.

Technical specifications

See catalog IC 10, page 8/89.

High-Feature motor starters

Selection and ordering data

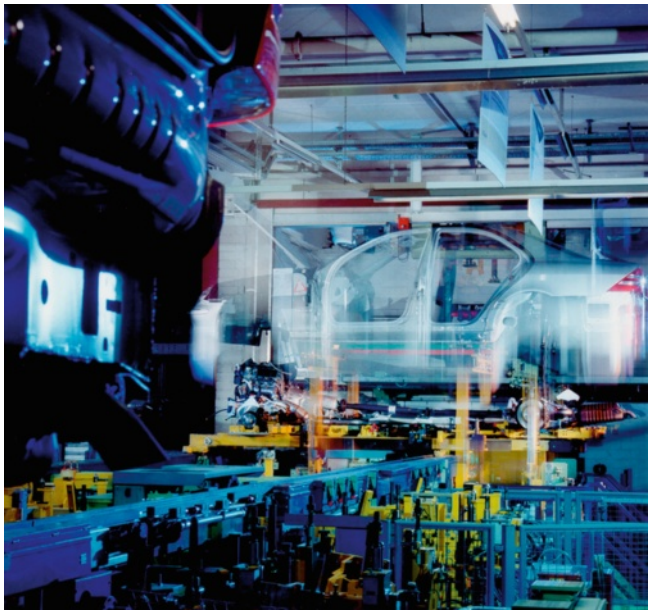
High-Feature motor starters in fully innovated design (".-.AB4 starters") [1)]

	Setting range of the electronic release	DT	Order No.
	A		
High-Feature motor starters, with diagnostics, solid-state overload protection, fuseless, expandable with brake control module			
 DS1e-x	***DS1e-x direct-on-line starters***		
	0.3 ... 3	A	**3RK1 301-0AB10-0AB4**
	2.4 ... 8	A	**3RK1 301-0BB10-0AB4**
	2.4 ... 16	A	**3RK1 301-0CB10-0AB4**
	RS1e-x reversing starters		
	0.3 ... 3	A	**3RK1 301-0AB10-1AB4**
	2.4 ... 8	A	**3RK1 301-0BB10-1AB4**
	2.4 ... 16	A	**3RK1 301-0CB10-1AB4**
	Direct-on-line soft starter DSS1e-x		
	0.3 ... 3	A	**3RK1 301-0AB20-0AB4**
	2.4 ... 8	A	**3RK1 301-0BB20-0AB4**
	2.4 ... 16	A	**3RK1 301-0CB20-0AB4**

[1)] When a device is replaced, the innovated motor starter will behave like the previous motor starter, i.e. it will run in DPV0 mode.

	Version	DT	Order No.
Accessories for Standard / High-Feature motor starters			
 3RK1 903-0CB00	• **xB5 for motor starters** 400 V AC without digital input	A	**3RK1 903-0CJ00**
	• **xB6 for motor starters** 400 V AC with two digital inputs	A	**3RK1 903-0CK00**
	Terminal modules for brake control modules		
	• **TM-xB15 S24-01** for xB1, xB2 or xB5	A	**3RK1 903-0AG00**
	• **TM-xB215 S24-01** for xB3, xB4 or xB6	A	**3RK1 903-0AG01**

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.
EN ISO 12100 and EN 1050, for example, are concerned with the construction and risk assessment of machines. EN 62061 (only applicable for electrical and electronic control systems) and EN ISO 13849-1, which will replace the previously used EN 954-1 as of 2012, define the functional and safety-related requirements of control systems with relevance to safety.

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

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

Trend toward integrated safety systems

The trend toward more encompassing and increasing modularity of machines has seen a shift in safety functions away from the classical central safety functions (for example, shutdown of all drives by a line contactor) and into the machine control system and the drives. One advantage of this development is that some safety-related circuitry involving extensive hardware is now no longer necessary.

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. This significantly reduces the motivation to consciously bypass safety functions.

Function

Safety functions integral to the SINAMICS G120, SINAMICS G120D, SINAMICS S110 and SINAMICS S120 drive systems

SINAMICS G120, SINAMICS G120D, SINAMICS S110 and SINAMICS S120 are characterized by a full range of integrated safety functions.

The drives fulfill the following equipment requirements of

- Category 3 according to EN 954-1
- Safety Integrity Level (SIL) 2 according to EN 61508
- PL d according to EN ISO 13849-1

The Safety Integrated functions provided by SINAMICS G120, SINAMICS G120D, SINAMICS S110 and SINAMICS S120 have been certified by independent institutes. You can obtain the corresponding external test certificates and manufacturer's declarations from your Siemens contact person.

The most important integrated safety functions available for Siemens drives are described in the following. 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 integrated drive safety functions can be roughly divided into two categories:

- Functions for safely stopping a drive:
  - **Safe Torque Off (STO)**
    This function ensures that torque is no longer output at the motor shaft.
  - **Safe Stop 1 (SS1)**
    This function actively brakes a drive before the STO function is activated. In the event of danger, drives with a high kinetic energy can be brought to a standstill extremely quickly using this function.
  - **Safe Stop 2 (SS2)**
    Like the SS1 function, the SS2 function actively brakes the drive. At standstill, however, the SOS function is used instead of STO. Just as with SS1, drives with a high kinetic energy can be brought to a standstill extremely quickly in a hazardous situation.
  - **Safe Operating Stop (SOS)**
    The SOS function can be used as an alternative to STO. In contrast to STO, the motor is not released from all torque. Instead, the drive remains in position control, holds its position, and it is monitored to detect zero speed.
  - **Safe Brake Control (SBC)**
    This function safely applies a holding brake after STO has been activated, meaning that the drive can no longer move, e.g. due to gravity.
- Functions for safely monitoring the speed of a drive:
  - **Safely Limited Speed (SLS)**
    The SLS function ensures that the drive does not exceed a preset speed limit.
  - **Safe Speed Monitor (SSM)**
    This function signals if the speed falls below a specified value. No drive-integrated response occurs.
  - **Safe Direction (SDI)**
    This function monitors whether the selected direction of rotation is being adhered to.

Function

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.

Applications

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.

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 has a shorter switching time than the electromechanical components in a conventional solution.

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

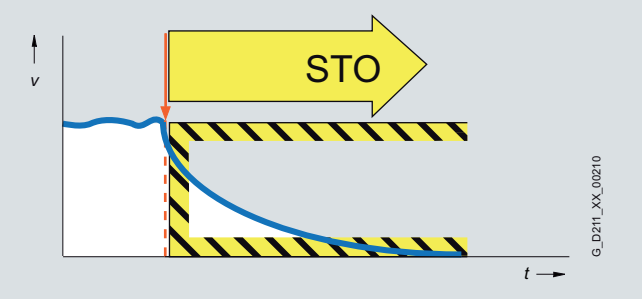
The Safe Stop 1 function can safely stop the drive in accordance with EN 60204-1, Stop Category 1. When the SS1 function is selected, the drive brakes autonomously along a quick stop ramp. The Safe Torque Off and Safe Brake Control functions (if activated) are then activated automatically depending on the setting – either after a delay time has elapsed or after the frequency drops below a minimum value (monitored brake ramp).

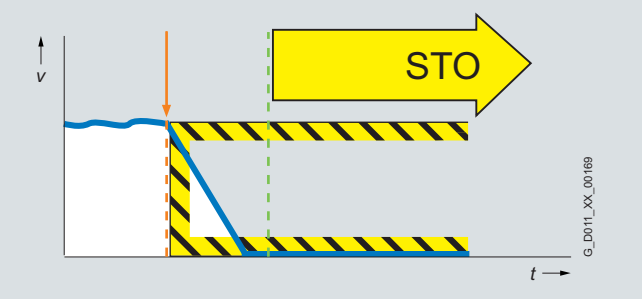
Applications

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





Function

Safe Operating Stop (SOS)

With the SOS function, the stopped motor is brought into position and monitored by the drive.

Activation

The Safe Operating Stop 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.

Applications

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 machining steps, but where 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.

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 position 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 Stop 2 (SS2)

The SS2 function brings the motor to a standstill quickly and safely and then monitors the standstill position.

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).

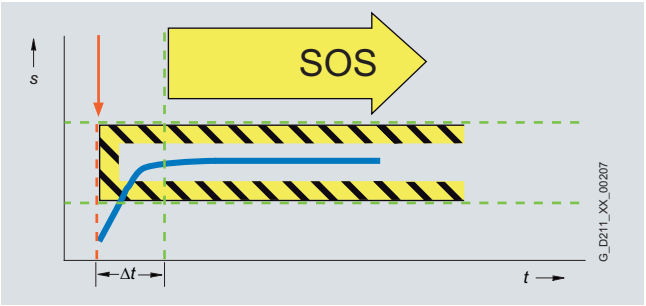
Applications

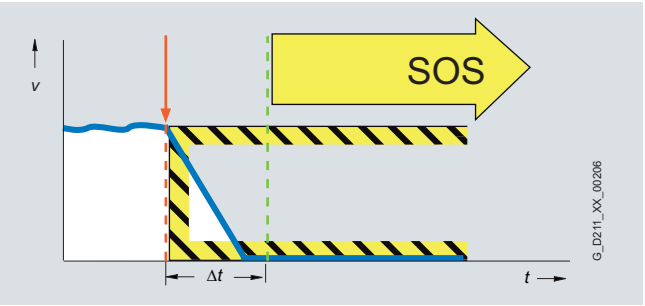
As with SS1, the SS2 function ensures the quickest possible deceleration of the motor. However, the motor power is not switched off. Instead, a control system prevents it from leaving the standstill position – even if it is affected by external forces

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

4





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.

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.

Safely Limited Speed (SLS)

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

Activation

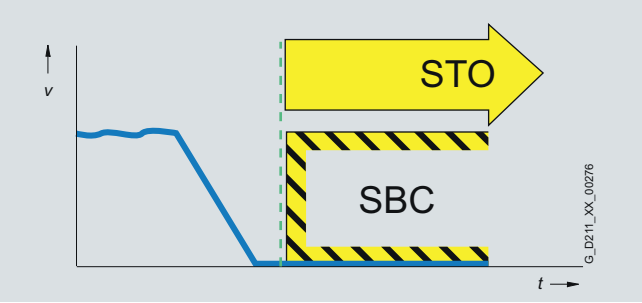
If the preset speed limit is exceeded, this is detected reliably. If the limit is exceeded, a customizable drive-integrated fault reaction occurs.

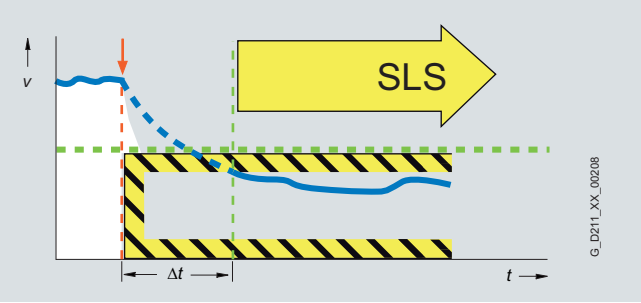
Application

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. First, therefore, the speed is reduced, then safe monitoring is activated using the SLS function so that accidental exceeding of the set speed limit is prevented. Typical examples are cases in which an operator must enter the danger zone of the machine for maintenance or setup. A typical use of SLS is 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 condition exists where 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

Safe Speed Monitor (SSM)

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

Activation

If a speed/velocity value drops below a parameterized level, 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.

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 motor can only rotate in the selected direction.

Activation

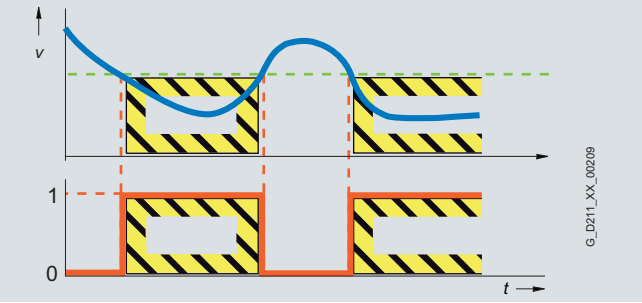
Deviation from the direction of rotation currently being monitored is detected reliably and the configured drive-integrated fault reaction is initiated. It is possible to select which direction of rotation is to be monitored.

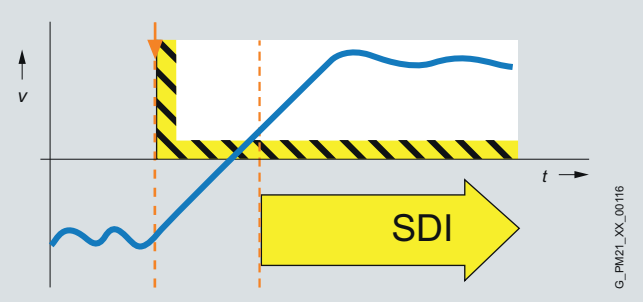
Application

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 e.g. 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.





Function

SINAMICS G120, SINAMICS G120C and SINAMICS G120D

The Safety Integrated functions do not require a license.

The availability of Safety Integrated functions depends on the type of Control Unit, i.e. whether it is a standard Control Unit or a fail-safe Control Unit.

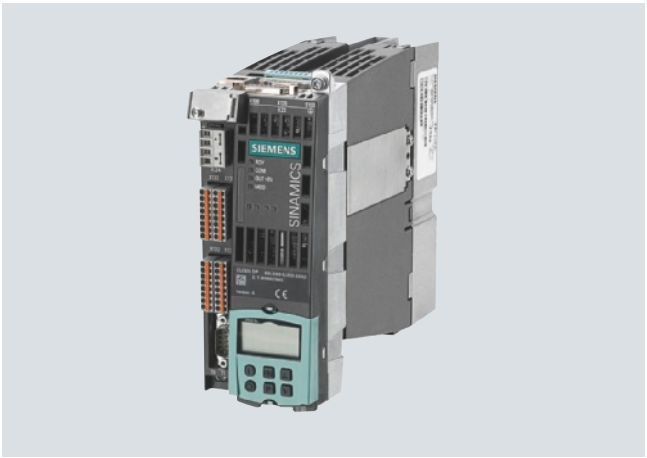
An overview of the Safety Integrated functions of SINAMICS G120 and SINAMICS G120D plus their boundary conditions is shown in the following table:

Function	Activation	Underlying function	Reaction to limit overshoot	External setpoint input effective	Encoder required	License required	Available in
STO	• F-DI [1)] • PROFIsafe	–	–	No	No	No	G120 - CU240E-2 - CU240E-2 DP - CU240E-2 F - CU240E-2 DP-F G120C G120D - CU240D DP-F - CU240D PN-F
SS1	• F-DI [1)] • PROFIsafe	STO, following expiry of the parameterized delay time or if the speed falls below the minimum speed limit	Activation of STO	No	No	No	G120 - CU240E-2 F - CU240E-2 DP-F G120D - CU240D DP-F - CU240D PN-F
SLS	• F-DI [1)] • PROFIsafe	–	Activation of STO or SS1	Yes	No	No	G120 - CU240E-2 F - CU240E-2 DP-F G120D - CU240D DP-F - CU240D PN-F
SDI	• F-DI [1)] • PROFIsafe	–	Activation of STO or SS1	Yes	No	No	G120 - CU240E-2 F - CU240E-2 DP-F
SSM	Always active	–	Signals that the speed has fallen below a specified value	–	No	No	G120 - CU240E-2 DP-F

[1)] Not for SINAMICS G120D.

Function

SINAMICS S110



The Safety Integrated Basic Functions do not require a license.

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

The license can be ordered separately or as an option with the memory card (order no. of the memory card plus order code F01). For memory card order numbers, please refer to catalog D 31, selection and ordering data.

An overview of the Safety Integrated functions of SINAMICS S110 plus their boundary conditions is shown in the following table:

Function	Activation	Underlying function	Reaction to limit overshoot	External setpoint input effective	Encoder required	License required
Basic Functions						
STO	• F-DI0 on CU305 • PROFIsafe	SBC (if activated)	–	No	No	No
SBC	• With STO (immediately or following expiry of the delay time with SS1)	–	–	–	No	No
SS1	• F-DI0 on CU305	STO following expiry of the parameterized delay time, followed by SBC (if activated)	–	No	No	No
Extended Functions						
SS1 with SBR	• F-DI0-2 on CU305 • PROFIsafe	Safe acceleration monitoring (SBR) during braking. STO and SBC (if activated) following expiry of the parameterized delay time or if the speed falls below the minimum speed limit	STO	No	No	Yes
SS2 with SBR	• F-DI0-2 on CU305 • PROFIsafe	Safe acceleration monitoring during braking. Following expiry of the parameterized delay time SOS	STO	No	Yes	Yes
SOS	• F-DI0-2 on CU305 • PROFIsafe	–	SS1	Yes	Yes	Yes
SLS	• F-DI0-2 on CU305 • PROFIsafe	–	SS1, STO, or SOS (parameterizable)	Yes	No	Yes
SSM	Always active	–	Message only	Yes	No	Yes
SDI	• F-DI0-2 on CU305 • PROFIsafe	–	SS1, STO, or SOS (parameterizable)	Yes	No	Yes

Function

SINAMICS S120

The Safety Integrated Basic Functions do not require a license.

A license is, however, required for each axis with safety functions in the case of Safety Integrated Extended Functions. It is irrelevant which safety functions are used and how many.

The required licenses can be ordered separately or as an option with the CompactFlash card (order no. of the memory card plus order code F01).
For the order numbers of the CompactFlash cards, see catalog D 31, chapter SINAMICS S120 drive system.

The CU310-2 Control Units are intended for the control of single axes only. This means only one license is required for the Extended safety functions.

An overview of the Safety Integrated functions of SINAMICS S120 plus their boundary conditions is shown in the following table:

Function	Activation	Underlying function	Reaction to limit overshoot	External setpoint input effective	Encoder required	License required
Basic Functions						
STO	• EP terminals on the device and on the CU3xx • Terminals on the TM54F • PROFIsafe	SBC (if activated)	–	No	No [1]	No [2]
SBC	• With STO (immediately or following expiry of the delay time with SS1)	–	–	–	No	No [2]
SS1	• EP terminals on the device and on the CU3xx • PROFIsafe	STO following expiry of the parameterized delay time, SBC (if activated)	–	No	No	No [2]
Extended Functions						
SS1 with SBR	• Terminals on the TM54F • PROFIsafe	Safe acceleration monitoring (SBR) during braking. STO and SBC (if activated) following expiry of the parameterized delay time or if the speed falls below the minimum speed limit	STO	No	No [3]	Yes
SS2	• Terminals on the TM54F • PROFIsafe	Safe acceleration monitoring (SBR) during braking. Following expiry of the parameterized delay time SOS	STO	No	Yes	Yes
SLS	• Terminals on the TM54F • PROFIsafe	–	SS1, STO or SOS (parameterizable)	Yes	No [3]	Yes
SOS	• Terminals on the TM54F • PROFIsafe	–	SS1/STO	Yes	Yes	Yes
SSM	Always active	–	Display only	Yes	Yes	Yes
SDI	• Terminals on the TM54F • PROFIsafe	–	SS1, STO or SOS (parameterizable)	Yes	No [3]	Yes

[1] Activation using terminals on the TM54F currently requires an encoder.
[2] Activation using terminals on the TM54F currently requires a license.
[3] Not available for CU310 (SINAMICS Firmware V2.x)

SINAMICS drives with integrated safety functions

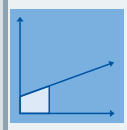
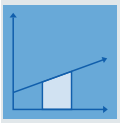
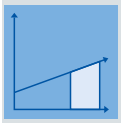
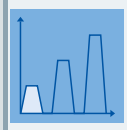
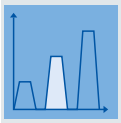
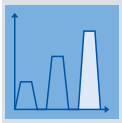
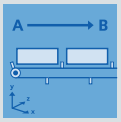
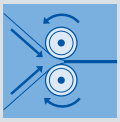
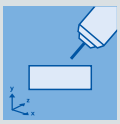
	Drive applications with variable speed		
	SINAMICS G120/G120C	SINAMICS G120D	SINAMICS G130/G150
			
	Modular/compact frequency inverter for variable-speed single drives	Modular, distributed frequency inverter for variable-speed single drives	Frequency converter for variable-speed single drives
Main applications	Machines and plants for industrial and commercial applications (mechanical engineering, automotive, textiles, chemicals, printing, steel)	Machines and plants for industrial applications, particularly automotive, but also in airports (wet area without tensides), the food, beverages and tobacco industry, and distribution logistics (e.g. overhead monorail conveyors)	Machines and plants for industrial applications, wherever solid, liquid, or gas substances must be moved, transported, pumped, or compressed
Application examples	• Pumps and fans • Compressors • Conveyor systems in production and process industries	• Conveyor technology, above all for high-performance solutions	• Pumps and fans • Compressors • Extruders and mixers • Mills
Power range	0.37 – 250 kW/0.55 – 18.5 kW 0.50 – 340 HP/0,75 – 25 hp	0.75 – 7.5 kW 1.02 – 10.2 HP	75 – 800 kW / 75 – 1500 kW 102 – 1088 HP / 102 – 2040 HP
Degree of protection	IP20	IP65	IP20 / optional up to IP54 for SINAMICS G150
Regenerative feedback	Yes, optional	Yes	No
Control method			
- *V/f* control	Yes	Yes	Yes
- Vector control with/ without encoder	Yes	Yes	Yes
- Servo control	-	-	-
Motors	Induction motors	Induction motors	Induction and Synchronous motors
Further information	Catalog D 31	Catalog D 31	Catalog D 11

	High-performance and motion control applications		
	SINAMICS S110	**SINAMICS S120**	**SINAMICS S150**
			
	Single-axis positioning drive	Modular drive system for demanding single or multiple-axis applications	Frequency converter for complex variable-speed single drives
Main applications	Simple positioning tasks with synchronous servo motors and induction motors	Continuous motion control, motion control tasks (including highly dynamic and coordinated positioning tasks) in multi-axis drives with a common, central power supply and intermediate DC circuit	Machines and plants for industrial applications with the most stringent requirements for processes with dynamic and reproducible procedures
Application examples	• Handling devices • Feed/extraction equipment • Assembly machines • Positioning axes • Tool changers	• Production machines: Machinery, equipment, and process lines in the packaging, textile, printing, paper, wood, glass, ceramics, and plastics industries • Presses • Converting applications • Handling devices • Paper machines, rolling mills, marine applications	• Test bay drives • Centrifuges • Elevators and cranes • Cross cutters and shears • Conveyor belts • Presses • Cable winches
Power range	0.12 – 90 kW 0.16 – 122 HP	1.6 – 4500 kW 2 – 6035 HP	75 – 1200 kW 100 – 1609 HP
Degree of protection	IP20	IP20 / optional up to IP54 For cabinet modules	IP20 / optional up to IP54
Regenerative feedback	No	Yes, optional	Yes
Control method			
- *V/f* control	No	Yes	Yes
- Vector control with/ without encoder	No	Yes	Yes
- Servo control	Yes	Yes	Yes
Motors	Induction and synchronous motors	Induction, synchronous, torque, linear motors	Induction, synchronous, torque, linear motors
Further information	Catalog D 31	Catalogs D 31, PM 21	Catalog D 21.3

SINAMICS G120C compact inverters 0.55 kW to 18.5 kW (0.75 hp to 25 hp)

Introduction

Application

Application	Continuous motion			Non-continuous motion		
	Requirements for torque accuracy / speed accuracy / position accuracy / coordination of axes / functionality			Requirements for torque accuracy / speed accuracy / position accuracy / coordination of axes / functionality		
	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
	G110, G120C (G130, G150, GM150, GL150)	**G120P, G120C, G120** (G130, G150, GM150, GL150)	**S120**	**S110**	**S110, S120**	**S120** (GM150)
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 Robotics Pick & place Rotary indexing tables Cross cutters Roll feeds Engagers/ disengagers
	G110, G110D, G120C (G130, G150, GM150)	**G120D, G120C, G120, S120** (G130, G150, S150, GM150, GL150, SM150, DCM, SIMATIC ET200S, SIMATIC ET200pro)	**S120** (S150, SM150, SL150, GM150, DCM)	**S110**	**S110, S120** (DCM)	**S120** (GM150)
Processing 	Mills Mixers Kneaders Crushers Agitators Centrifuges	Mills Mixers Kneaders Crushers Agitators Centrifuges Extruders Rotary furnaces	Extruders Winders and unwinders Lead/follower drives Calenders Main press drives Printing machines	Tubular bagging machines Single-axis motion control such as • Position profile • Path profile	Tubular bagging machines Single-axis motion control such as • Position profile • Path profile	Servo presses Rolling mill drives Multi-axis motion control such as • Multi-axis positioning • Cams • Interpolations
	G120C (G130, G150, GM150)	**G120C, G120** (G130, G150, S150, GM150, GL150, DCM)	**S120** (S150, DCM)	**S110**	**S110, S120**	**S120** (SM150, SL150, DCM)
Machining 	Main drives for • Turning • Drilling • Milling	Main drives for • Drilling • Sawing	Main drives for • Turning • Drilling • Milling • Gear cutting • Grinding	Axle drives for • Turning • Drilling • Milling	Axle drives for • Drilling • Sawing	Axle drives for • Turning • Drilling • Milling • Lasering • Gear cutting • Grinding • Nibbling and punching
	S110	**S110, S120**	**S120**	**S110**	**S110, S120**	**S120**

(Devices in brackets are not included in Catalog D 31)

SINAMICS G120C compact inverters continuously control the speed of three-phase asynchronous (induction) motors and can be used in a wide range of industrial areas. They are generally suitable for applications involving conveyor belts, mixers, extruders, pumps, fans, compressors and basic handling machines.

More information

You may also be interested in these inverters:

- More performance in the control cabinet in IP20 degree of protection ⇒ SINAMICS G120 (catalog D 31, chapter 6)
- Higher degree of protection for power ratings up to 7.5 kW ⇒ SINAMICS G120D (catalog D 31, chapter 8)
- With positioning function in the control cabinet in IP20 degree of protection ⇒ SINAMICS S110 (catalog D 31, chapter 9)

SINAMICS G120C compact inverters 0.55 kW to 18.5 kW (0.75 hp to 25 hp)

Overview

SINAMICS G120C frame sizes FSA, FSB and FSC with mounted blanking cover

SINAMICS G120C compact inverters offer a well-balanced combination of features to address a wide range of applications. SINAMICS G120C inverters are compact, rugged devices that are easy to operate and can be optionally equipped with a basic or advanced operator panel.

SINAMICS G120C inverters are especially suitable when it comes to meeting the requirements of system integrators, OEMs and distributors regarding high productivity and tailored performance.

Benefits

- Compact design
- Side-by-side design
- High power density, low envelope dimensions
- Simple installation in the tightest space
- Low space requirement
- Use in small control cabinets, close to the machine
- Optimized parameter set
- Optimized commissioning
- Getting Started document
- BOP-2 or IOP operator panels can be used
- Integrated USB connection
- Simple and fast software parameter assignment
- Simple to use during commissioning and in operation
- Minimized training costs, existing SINAMICS know-how can be used
- High degree of service friendliness, simple maintenance
- Plug-in terminals
- Cloning function using BOP-2 or SD card
- Operating hours counter for "drive on" and "motor on"
- Fast mechanical installation
- Intuitive standard commissioning
- Integrated component of Totally Integrated Automation
- Energy-efficient, sensorless vector control
- Automatic flux reduction with *V/f* ECO
- Integrated energy saving computer
- Safety Integrated (STO)
- Integrated communication interfaces PROFIBUS DP, CAN, USS, Modbus RTU
- Coated modules
- Operation up to an ambient temperature of 60° C (140 °F)

Design

SINAMICS G120C is a compact inverter in IP20 degree of protection where the Control Unit (CU) and Power Module (PM) function units are combined in one device.

The compact mechanical design and the high power density allow these devices to be installed in machine control enclosures and control cabinets for maximum space utilization. SINAMICS G120C compact inverters can be lined up next to one another without requiring any derating.

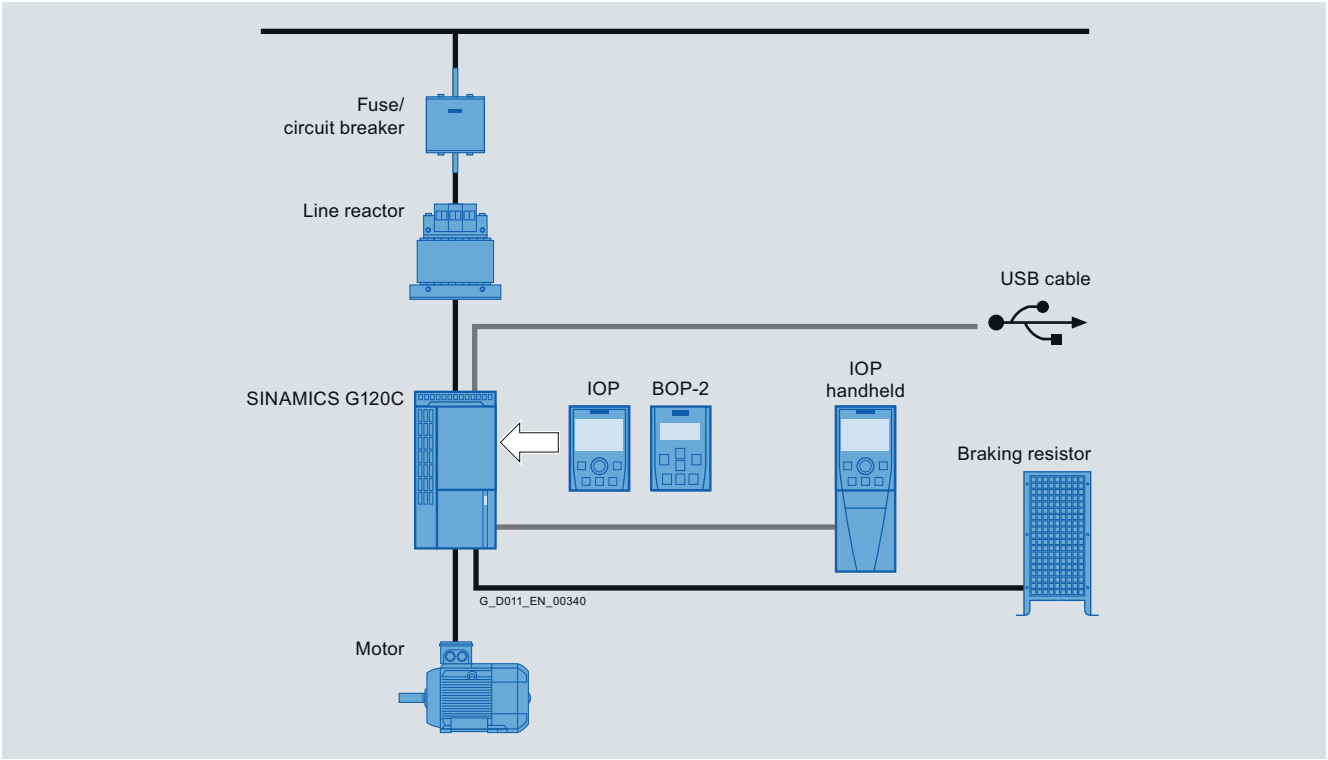
SINAMICS G120C, frame size FSB, with BOP-2

SINAMICS G120C can be integrated into the widest range of applications, either using the integrated digital and analog inputs or via the integrated fieldbus interface (available in the USS/Modbus RTU, PROFIBUS DP, CANopen versions). Especially the product versions with integrated PROFIBUS-DP interface make full integration into the Siemens TIA family possible, therefore allowing the advantages of the seamless TIA product family to be fully utilized. SINAMICS G120C devices are preset in the factory so that they can be immediately connected to PROFIBUS DP and CANopen fieldbuses and used without parameterization.

SINAMICS G120C is also equipped with the safety function STO (Safe Torque Off) as standard, which is used to safely stop drives. As a consequence, machine manufacturers can simply comply with current machinery directives with minimum associated costs.

SINAMICS G120C can control asynchronous (induction) motors in the power range from 0.37 kW up to 18.5 kW (0.5 hp up to 25 hp). Reliable and efficient motor operation is achieved by using state-of-the-art IGBT technology combined with vector control. The extensive range of functions integrated in the SINAMICS G120C also offers a high degree of protection for the inverter and motor.

Design



Line-side components

Line reactors

A line reactor is used to smooth voltage peaks (inverter protection) and to reduce commutating dips (line harmonic distortion).

Recommended line-side power components

Standard fuses can be used for the SINAMICS G120C. These must be dimensioned to comply with local regulations. In this chapter, you will find recommended components such as fuses and circuit breakers in compliance with IEC and UL regulations.

DC link components

Braking resistors

The excess energy of the DC link is dissipated using the braking resistor. The braking resistors are designed for use with the SINAMICS G120C. This has an integrated brake chopper (electronic switch).

Supplementary system components

Intelligent Operator Panel IOP

Graphics-based, user-friendly and powerful operator panel for commissioning and diagnostics as well as local operator control and monitoring of SINAMICS G120C.

Basic Operator Panel BOP-2

A 2-line display to provide support when commissioning and troubleshooting the drive. The drive can be locally controlled.

Memory cards

The parameter settings for an inverter can be stored on the SINAMICS micro memory card (MMC) or SIMATIC memory card (SD card). When service is required, e.g. after the inverter has been replaced and the data have been downloaded from the memory card the drive system is immediately ready for use again. The associated memory card holder is integrated in the inverter.

PC inverter connection kit 2

For controlling and commissioning an inverter directly from a PC, if the STARTER commissioning tool V4.2 and higher has been installed on the PC.

Spare parts

Shield plates

A set of shield plates can be ordered for the motor and signal lines corresponding to the frame size of the SINAMICS G120C inverter.

Spare Parts Kit

This kit comprises 5 sets of I/O terminals, 1 RS485 terminal, 2 Control Unit doors and 1 blanking cover.

Set of connectors

A set of connectors for the line feeder cable, braking resistor and motor cable can be ordered corresponding to the frame size of the SINAMICS G120C inverter.

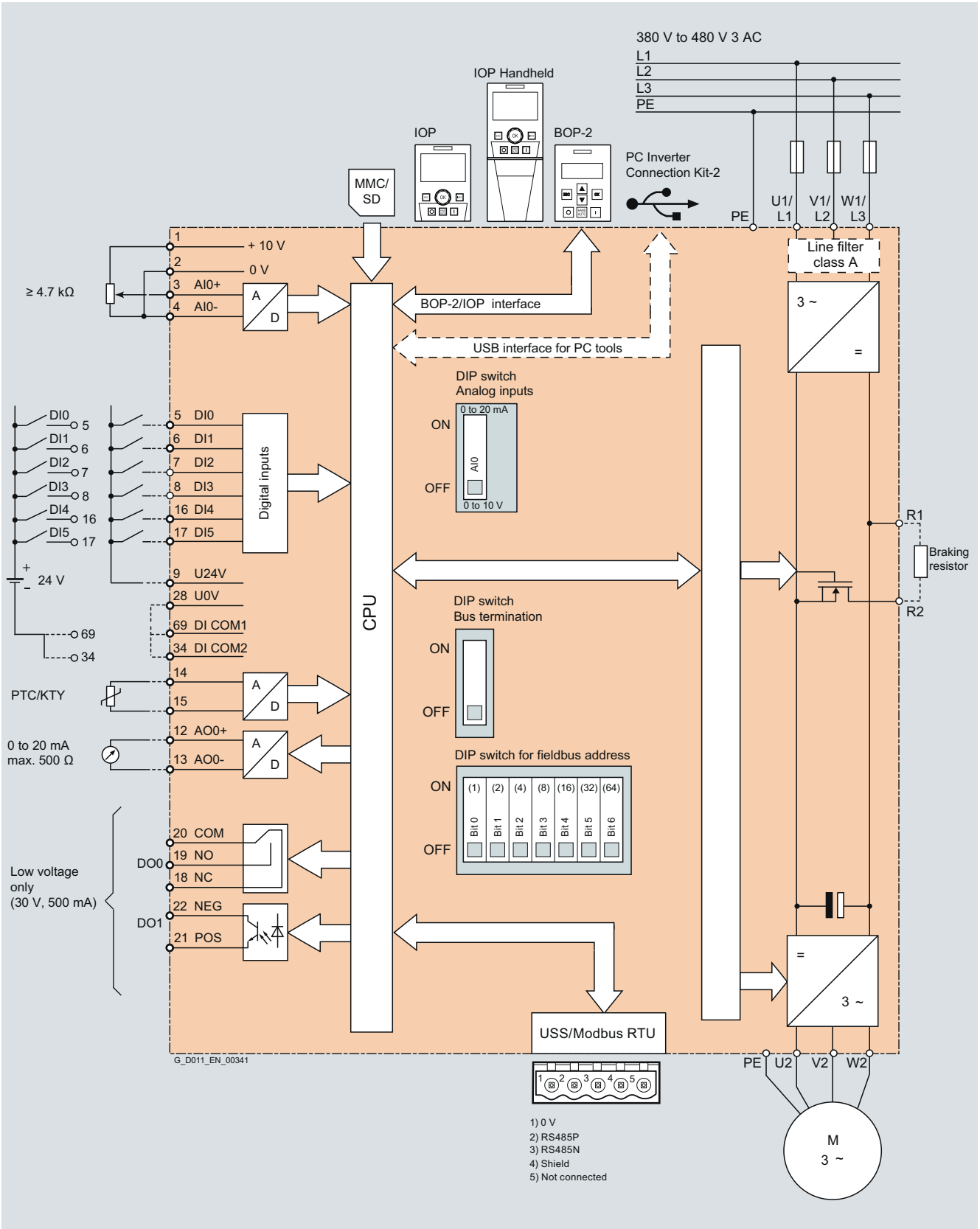
Roof-mounted fan

A roof-mounted fan (at the top of the device) comprising a pre-assembled unit with holder and fan can be ordered corresponding to the frame size of the SINAMICS G120C.

Fan unit

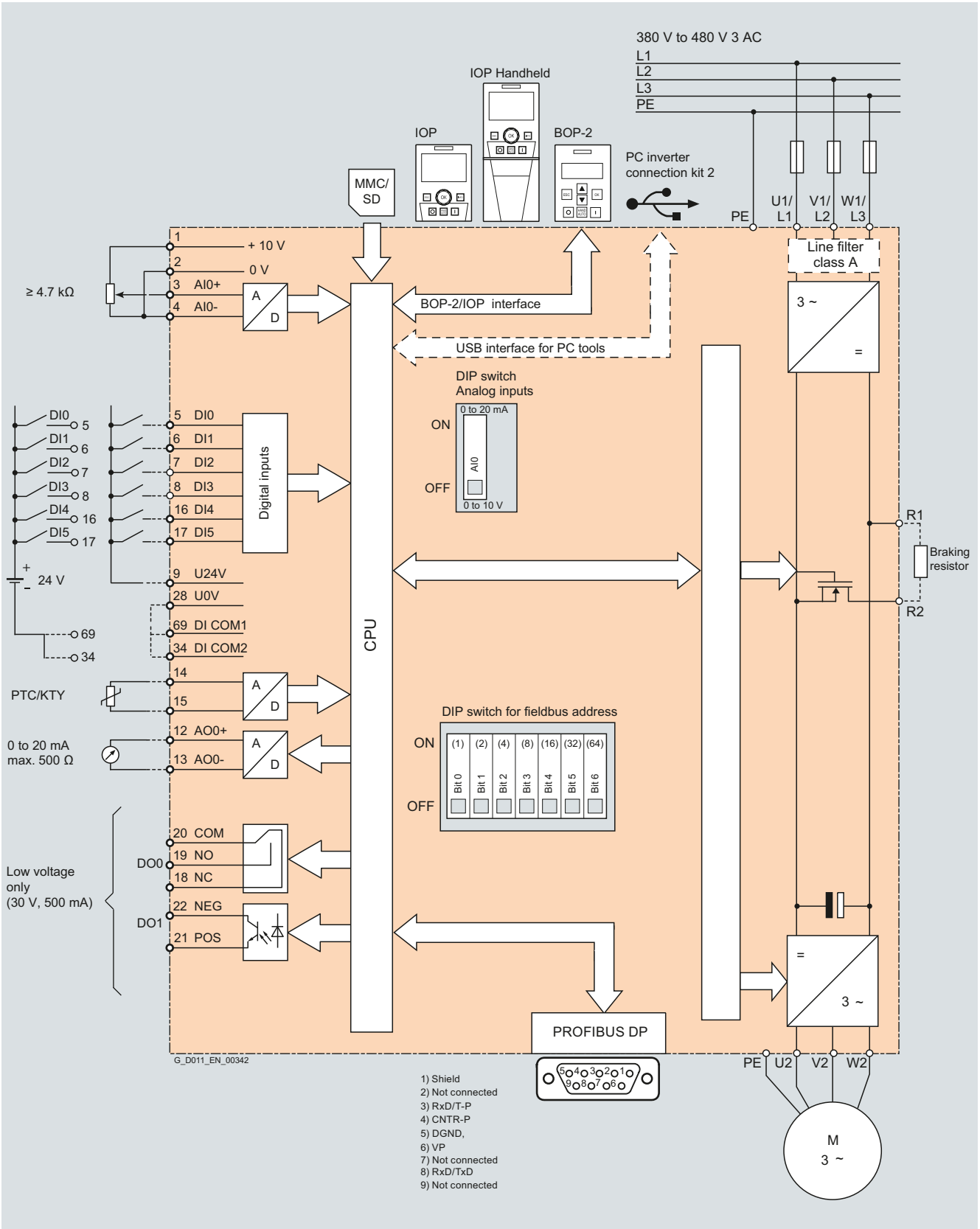
A replacement fan (at the rear of the device; heat sink) comprising a pre-assembled unit with holder and fan can be ordered corresponding to the frame size of the SINAMICS G120C.

Integration



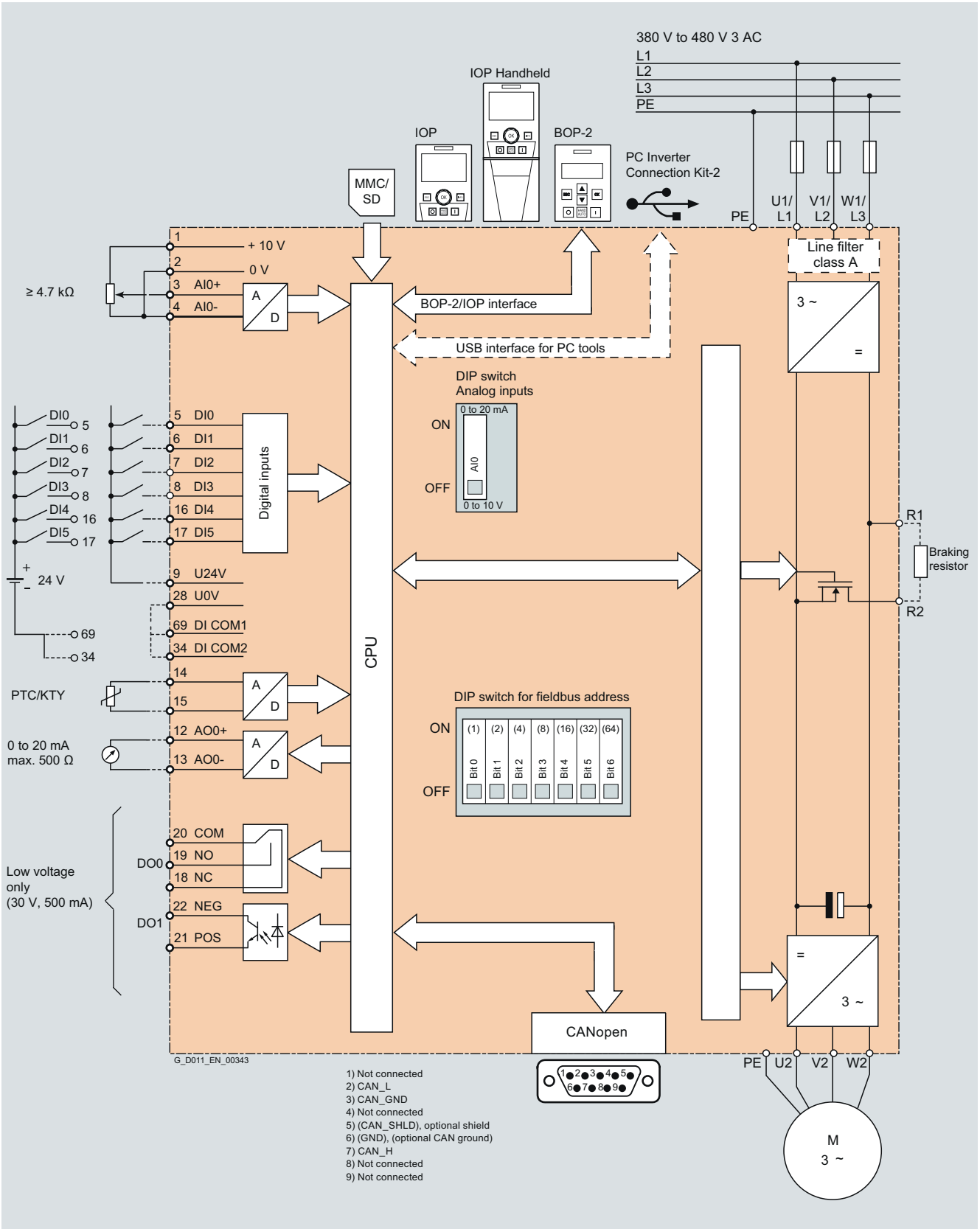
Connection example SINAMICS G120C, USS/Modbus RTU version

Integration



Connection example SINAMICS G120C, PROFIBUS DP version

Integration



Connection example SINAMICS G120C, CANopen version

Configuration

The following electronic configuring guides and engineering tools are available for SINAMICS G120C compact inverters:

Selection guide DT Configurator within the CA 01

The interactive catalog CA 01 – the offline mall of Siemens Industry Automation & Drive Technologies – contains over 100000 products with approximately 5 million possible drive system product variants. The DT Configurator has been developed to facilitate selection of the optimum motor and/or inverter from the wide spectrum of drives. The configurator is integrated as a "selection guide" in this catalog on the DVD-ROM with the selection and configuration tools.

Online DT Configurator

In addition, the DT Configurator can be used in the Internet without requiring any installation. The DT Configurator can be found in the Siemens Industry Mall at the following address: www.siemens.com/dt-configurator

SIZER for Siemens Drives engineering tool

The SIZER for Siemens Drives engineering tool makes it easy to engineer the SINAMICS and MICROMASTER 4 drive families. It provides support when selecting the hardware and firmware components necessary to implement a drive task. SIZER for Siemens Drives covers the full range of operations required to configure a complete drive system, from basic single drives to demanding multi-axis applications.

Additional information on the SIZER for Siemens Drives engineering tool is provided in the chapter Engineering tools.

STARTER commissioning tool

The STARTER commissioning tool allows menu-prompted commissioning, optimization and diagnostics.
In addition to SINAMICS drives, STARTER is also suitable for MICROMASTER 4 units and the frequency converters for the distributed I/O SIMATIC ET 200S FC and SIMATIC ET 200pro FC. For SINAMICS G120D from STARTER version 4.1, SP1 and higher.

Additional information on the STARTER commissioning tool is provided in the chapter Engineering tools.

Drive ES engineering system

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. The STEP 7 Manager user interface provides the ideal basis for this. A variety of software packages are available for SINAMICS – Drive ES Basic, Drive ES SIMATIC and Drive ES PCS 7.1.

Additional information on the Drive ES engineering system is provided in the chapter Engineering tools.

Selection and ordering data

The order number is selected corresponding to

- the required motor power or the motor current required and the overload requirements of the application,
- the necessary EMC classification and
- the required integrated fieldbus interface

Rated power[1]		Base load current I_L[2]	Base load current I_H[3]	Frame size	Version	SINAMICS G120C without filter	SINAMICS G120C with integrated filter class A
kW	hp	A	A			Order No.	Order No.
0.55	0.75	1.7	1.3	FSA	USS/Modbus RTU	6SL3 210-1KE11-8UB0	6SL3 210-1KE11-8AB0
					PROFIBUS DP	6SL3 210-1KE11-8UP0	6SL3 210-1KE11-8AP0
					CANopen	6SL3 210-1KE11-8UC0	6SL3 210-1KE11-8AC0
0.75	1.0	2.2	1.7	FSA	USS/Modbus RTU	6SL3 210-1KE12-3UB0	6SL3 210-1KE12-3AB0
					PROFIBUS DP	6SL3 210-1KE12-3UP0	6SL3 210-1KE12-3AP0
					CANopen	6SL3 210-1KE12-3UC0	6SL3 210-1KE12-3AC0
1.1	1.5	3.1	2.2	FSA	USS/Modbus RTU	6SL3 210-1KE13-2UB0	6SL3 210-1KE13-2AB0
					PROFIBUS DP	6SL3 210-1KE13-2UP0	6SL3 210-1KE13-2AP0
					CANopen	6SL3 210-1KE13-2UC0	6SL3 210-1KE13-2AC0
1.5	2.0	4.1	3.1	FSA	USS/Modbus RTU	6SL3 210-1KE14-3UB0	6SL3 210-1KE14-3AB0
					PROFIBUS DP	6SL3 210-1KE14-3UP0	6SL3 210-1KE14-3AP0
					CANopen	6SL3 210-1KE14-3UC0	6SL3 210-1KE14-3AC0
2.2	3.0	5.6	4.1	FSA	USS/Modbus RTU	6SL3 210-1KE15-8UB0	6SL3 210-1KE15-8AB0
					PROFIBUS DP	6SL3 210-1KE15-8UP0	6SL3 210-1KE15-8AP0
					CANopen	6SL3 210-1KE15-8UC0	6SL3 210-1KE15-8AC0
3.0	4.0	7.3	5.6	FSA	USS/Modbus RTU	6SL3 210-1KE17-5UB0	6SL3 210-1KE17-5AB0
					PROFIBUS DP	6SL3 210-1KE17-5UP0	6SL3 210-1KE17-5AP0
					CANopen	6SL3 210-1KE17-5UC0	6SL3 210-1KE17-5AC0
4.0	5.0	8.8	7.3	FSA	USS/Modbus RTU	6SL3 210-1KE18-8UB0	6SL3 210-1KE18-8AB0
					PROFIBUS DP	6SL3 210-1KE18-8UP0	6SL3 210-1KE18-8AP0
					CANopen	6SL3 210-1KE18-8UC0	6SL3 210-1KE18-8AC0
5.5	7.5	12.5	8.8	FSB	USS/Modbus RTU	6SL3 210-1KE21-3UB0	6SL3 210-1KE21-3AB0
					PROFIBUS DP	6SL3 210-1KE21-3UP0	6SL3 210-1KE21-3AP0
					CANopen	6SL3 210-1KE21-3UC0	6SL3 210-1KE21-3AC0
7.5	10	16.5	12.5	FSB	USS/Modbus RTU	6SL3 210-1KE21-7UB0	6SL3 210-1KE21-7AB0
					PROFIBUS DP	6SL3 210-1KE21-7UP0	6SL3 210-1KE21-7AP0
					CANopen	6SL3 210-1KE21-7UC0	6SL3 210-1KE21-7AC0
11	15	25	16.5	FSC	USS/Modbus RTU	6SL3 210-1KE22-6UB0	6SL3 210-1KE22-6AB0
					PROFIBUS DP	6SL3 210-1KE22-6UP0	6SL3 210-1KE22-6AP0
					CANopen	6SL3 210-1KE22-6UC0	6SL3 210-1KE22-6AC0
15	20	31	25	FSC	USS/Modbus RTU	6SL3 210-1KE23-2UB0	6SL3 210-1KE23-2AB0
					PROFIBUS DP	6SL3 210-1KE23-2UP0	6SL3 210-1KE23-2AP0
					CANopen	6SL3 210-1KE23-2UC0	6SL3 210-1KE23-2AC0
18.5	25	37	31	FSC	USS/Modbus RTU	6SL3 210-1KE23-8UB0	6SL3 210-1KE23-8AB0
					PROFIBUS DP	6SL3 210-1KE23-8UP0	6SL3 210-1KE23-8AP0
					CANopen	6SL3 210-1KE23-8UC0	6SL3 210-1KE23-8AC0

[1] The rated power of the device based on the rated output current I_{LO} and a rated input voltage of 400 V 3 AC. The rated power is specified on the device rating plate.

[2] The base load current I_L is based on the duty cycle for low overload (LO). The current value is specified on the device rating plate.

[3] The base load current I_H is based on the duty cycle for high overload (HO). The current value is not specified on the device rating plate.

SINAMICS G120C compact inverters 0.55 kW to 18.5 kW (0.75 hp to 25 hp)

Technical specifications

Unless explicitly specified otherwise, the following technical specifications are valid for all SINAMICS G120C compact inverters.

Mechanical specifications	
Vibratory load According to EN 60068-2-6	
• Transport in the transport packaging	5 ... 9 Hz: Constant deflection 3.1 mm 9 … 200 Hz: Constant acceleration = 9.81 m/s^2 (1 × *g*)
• Operation	2 ... 9 Hz: Constant deflection 7 mm 9 … 200 Hz: Constant acceleration = 19.62 m/s^2 (2 × *g*)
Shock load According to EN 60068-2-27	
• Transport in the transport packaging	147.15 m/s^2 (15 × *g*)/11 ms 3 shocks in each axis and direction
• Operation	147.15 m/s^2 (15 × *g*)/11 ms 3 shocks in each axis and direction
Degree of protection	IP20/ UL open type
Permissible mounting position	Horizontal panel mounting
Ambient conditions	
Protection class According to EN 61800-5-1	Class III (PELV1)
Touch protection According to EN 61800-5-1	Class I (with protective conductor system)
Humidity, max.	95 % at 40 °C (104 °F), condensation and icing not permissible
Ambient temperature	
• Storage [1] acc. to EN 60068-2-1	-40 … +70 °C (-40 ... +158 °F)
• Transport [1] acc. to EN 60068-2-1	-40 … +70 °C (-40 ... +158 °F)
• Operation acc. to EN 60068-2-2	0 … 40 °C (32 … 104 °F) without derating >40 … 60 °C (104 … 140 °F) see derating characteristics
Environmental class in operation	
• Harmful chemical substances	Class 3C2 to EN 60721-3-3
• Organic/biological pollutants	Class 3B1 to EN 60721-3-3
• Degree of pollution	2 acc. to EN 61800
Standards	
Compliance with standards	CE, cULus, c-tick
Fail-safe certification	Function: Safe Torque Off (STO) SIL 2 according to IEC 61508, Parts 1 to 7 (1998 ... 2001) PL d according to EN ISO 13849 Part 1 (2008) Category 3 according to EN 60204 (2007) PFH_D: 5 × 10E-8 / T1: 10 years
CE marking, according to	EMC Directive 2004/108/EC Low-Voltage Directive 2006/95/EC
EMC behavior According to EN 61800-3	The EMC product standard EN 61800-3 does not apply directly to a frequency inverter but to a PDS (Power Drive System), which comprises the complete circuitry, motor and cables in addition to the inverter.
• Frame sizes FSA to FSB with integrated line filter class A	Category C2 with max. 25 m (82 ft) shielded motor cable
• Frame size FSC with integrated line filter class A	Category C3 with max. 25 m (82 ft) shielded motor cable

[1] In transport packaging.

Technical specifications

Control Unit	USS/Modbus RTU version	PROFIBUS DP version	CANopen version
	6SL3210-0KE..-..B0	6SL3210-0KE..-..P0	6SL3210-0KE..-..C0
I/O interfaces			
Signal cable cross-section	0.15 mm^2 ... 1.5 mm^2 (AWG28 ... AWG16)		
Digital inputs – Standard	6 isolated inputs Optically isolated; Free reference potential (own potential group) NPN/PNP logic can be selected using the wiring		
• Switching level: 0 → 1	11 V		
• Switching level: 1 → 0	5 V		
• Input current, max.	15 mA		
Fail-safe input	1 safety input When using the standard digital inputs (DI4+DI5) Safety function: Safe Torque OFF (STO)		
Digital outputs	1 relay changeover contact 30 V DC, 0.5 A (ohmic load) 1 transistor 30 V DC, 0.5 A (ohmic load)		
Analog inputs	1 analog input Differential input Switchable between voltage (-10 ... +10 V) and current (0/4 ... 20 mA) using a DIP switch 10-bit resolution Can be used as additional digital input Analog inputs are protected in a voltage range of ± 30 V and have a common-mode voltage in the ± 15 V range.		
• Switching threshold: 0 → 1	4 V		
• Switching threshold: 1 → 0	1.6 V		
Analog outputs	1 analog output Non-isolated output Switchable between voltage (0 ... 10 V) and current (0/4 ... 20 mA) using a parameter Voltage mode: 10 V, min. burden 10 kΩ Current mode: 20 mA, max. burden 500 Ω The analog outputs have short circuit protection		
PTC/KTY interface	1 motor temperature sensor input sensors that can be connected: PTC, KTY and Thermo-Click, Accuracy ±5 °C		
Integrated bus interface			
Type	**RS485**	**PROFIBUS DP**	**CANopen**
Protocols	USS Modbus RTU (switchable using a parameter)	PROFIdrive Profile V4.1	CANopen
Hardware	Plug-in terminal, insulated, USS: max. 187.5 kbaud Modbus RTU: 19.2 kbaud, Bus terminating resistors that can be switched in	9-pin SUB-D connector, insulated, Max. 12 Mbit/s Slave address can be set using DIP switches	9-pin SUB-D socket, insulated, Max. 1 Mbit/s
Tool interfaces			
Memory cards	Optional 1 SINAMICS micro memory card (MMC) or 1 SIMATIC memory card (SD card)		
Operator panels	Optional Basic Operator Panel BOP-2 or Intelligent Operator Panel IOP		
PC interface	USB		

Technical specifications

Control Unit	USS/Modbus RTU version	PROFIBUS DP version	CANopen version
	6SL3210-0KE..-..B0	6SL3210-0KE..-..P0	6SL3210-0KE..-..C0
Open-loop/closed-loop control techniques			
***V/f* linear/square/ parameterizable**	✓		
***V/f* with flux current control (FCC)**	✓		
***V/f* ECO linear/square**	✓		
Vector control, sensorless	✓		
Vector control, with sensor	–		
Torque control, sensorless	–		
Torque control, with sensor	–		
Software functions			
Setpoint input	✓		
Fixed frequencies	16, parameterizable		
JOG	✓		
Digital motorized potentiometer (MOP)	✓		
Ramp smoothing	✓		
Extended ramp-function generator (with ramp smoothing Off3)	✓		
Positioning down ramp	–		
Slip compensation	✓		
Signal interconnection with BICO technology	✓		
Free function blocks (FFB) for logical and arithmetic operations	–		
Switchable drive data sets (DDS)	–		
Switchable command data sets (CDS)	✓ (2)		
Flying restart	✓		
Automatic restart after line supply failure or operating fault (AR)	✓		
Technology controller (internal PID)	✓		
Energy consumption counter	✓		
Energy saving computer	✓		
Thermal motor protection	✓ (I^2t, sensor: PTC/KTY/Thermo-Click)		
Thermal inverter protection	✓		
Motor identification	✓		
Motor holding brake	✓		
Auto-ramping (V_{dcmax} controller)	✓		
Kinetic buffering (V_{dcmin} controller)	✓		
Braking functions			
• DC braking	✓		
• Compound braking	✓		
• Dynamic braking with integrated brake chopper	✓		

Technical specifications

General technical specifications of the power electronics	
System operating voltage	380 … 480 V 3 AC +10 % -20 %
Line supply requirements **Line short circuit voltage u_K**	No restriction
Input frequency	47 … 63 Hz
Output frequency	
• Control type *V/f*	0 … 650 Hz
• Control type Vector	0 … 240 Hz
Pulse frequency	4 kHz for higher pulse frequencies up to 16 kHz, see derating data
Power factor λ	0.7 ... 0.85
Offset factor cos φ	≥0.95
Output voltage, max.	0 ... 95 % of input voltage
Overload capability	
• Low overload (LO)	150 % base load current I_L for 3 s, followed by 110 % base load current I_L for 57 s followed by 100 % base load current I_L for 240 s in a 300 s cycle time
• High overload (HO)	200 % base load current I_H for 3 s, followed by 150 % base load current I_H for 57 s followed by 100 % base load current I_L for 240 s in a 300 s cycle time
Electromagnetic compatibility	With integrated line filter Category C2/C3 according to EN 61800-3
Cooling	Air cooling using an integrated fan
Installation altitude	Up to 1000 m (3281 ft) above sea level without derating, > 1000 m (3281 ft) see derating characteristics
Standard SCCR (Short Circuit Current Rating) [1]	65 kA
Protection functions	• Undervoltage • Overvoltage • Overcontrol/overload • Ground fault • Short-circuit • Stall protection • Motor blocking protection • Motor overtemperature • Inverter overtemperature

[1] Applies to industrial control cabinet installations to NEC article 409/UL 508A.

SINAMICS G120C compact inverters 0.55 kW to 18.5 kW (0.75 hp to 25 hp)

Technical specifications

Line voltage 380 ... 480 V 3 AC		SINAMICS G120C power electronics			
		6SL3210-1KE11-8..0	6SL3210-1KE12-3..0	6SL3210-1KE13-2..0	6SL3210-1KE14-3..0
Output current at 400 V 3 AC					
• Rated current I_{rated} [1]	A	1.8	2.3	3.2	4.3
• Base load current I_L [2]	A	1.7	2.2	3.1	4.1
• Base load current I_H [3]	A	1.3	1.7	2.2	3.1
• I_{max}	A	2.6	3.4	4.4	6.2
Rated power					
• Based on I_L	kW (hp)	0.55 (0.75)	0.75 (1.0)	1.1 (1.5)	1.5 (2.0)
• Based on I_H	kW (hp)	0.37 (0.5)	0.55 (0.75)	0.75 (1.0)	1.1 (1.5)
Rated pulse frequency	kHz	4	4	4	4
Efficiency η		0.97	0.97	0.97	0.97
Power loss at rated current	kW	0.04	0.05	0.05	0.07
Cooling air requirement	m^3/s (ft^3/s)	0.005 (0.18)	0.005 (0.18)	0.005 (0.18)	0.005 (0.18)
Sound pressure level L_{pA} (1 m)	dB	<52	<52	<52	<52
Rated input current [4]					
• Based on I_L	A	2.3	2.9	4.1	5.5
• Based on I_H	A	1.9	2.5	3.2	4.5
Length of cable to braking resistor, max.	m (ft)	15 (49)	15 (49)	15 (49)	15 (49)
Line supply connection U1/L1, V1/L2, W1/L3		Plug-in screw terminals	Plug-in screw terminals	Plug-in screw terminals	Plug-in screw terminals
• Conductor cross-section	mm^2	1 … 2.5 (16 ... 14 AWG)	1 … 2.5 (16 ... 14 AWG)	1 … 2.5 (16 ... 14 AWG)	1 … 2.5 (16 ... 14 AWG)
Motor connection U2, V2, W2		Plug-in screw terminals	Plug-in screw terminals	Plug-in screw terminals	Plug-in screw terminals
• Conductor cross-section	mm^2	1 … 2.5 (16 ... 14 AWG)	1 … 2.5 (16 ... 14 AWG)	1 … 2.5 (16 ... 14 AWG)	1 … 2.5 (16 ... 14 AWG)
Connection for braking resistor R1, R2		Plug-in screw terminals	Plug-in screw terminals	Plug-in screw terminals	Plug-in screw terminals
• Conductor cross-section	mm^2	1 … 2.5 (16 ... 14 AWG)	1 … 2.5 (16 ... 14 AWG)	1 … 2.5 (16 ... 14 AWG)	1 … 2.5 (16 ... 14 AWG)
PE connection		On housing with M4 screw	On housing with M4 screw	On housing with M4 screw	On housing with M4 screw
Motor cable length, max. [5]					
• Shielded	m (ft)	50 (164)	50 (164)	50 (164)	50 (164)
• Unshielded	m (ft)	100 (328)	100 (328)	100 (328)	100 (328)
Dimensions					
• Width	mm (in)	73 (2.87)	73 (2.87)	73 (2.87)	73 (2.87)
• Height	mm (in)	196 (7.72)	196 (7.72)	196 (7.72)	196 (7.72)
• Depth					
- Without operator panel	mm (in)	203 (7.99)	203 (7.99)	203 (7.99)	203 (7.99)
- With operator panel	mm (in)	224 (8.82)	224 (8.82)	224 (8.82)	224 (8.82)
Frame size		FSA	FSA	FSA	FSA
Weight, approx.	kg (lb)	1.7 (3.75)	1.7 (3.75)	1.7 (3.75)	1.7 (3.75)

[1] The rated output current I_{rated} can be used up to 100 %; however, without overload.

[2] The base load current I_L is based on the duty cycle for low overload (LO).

[3] The base load current I_H is based on the duty cycle for high overload (HO).

[4] The rated input currents are valid for an input voltage of 400 V 3 AC and a line impedance corresponding to u_K = 1 % (without line reactor). The rated input current based on I_L is stamped on the inverter rating plate. In the particular application, the input current depends on the motor load and line impedance. The input current is reduced when using a line reactor.

[5] The maximum motor cable lengths are valid for an input voltage of 400 V 3 AC and operation with a 4 kHz pulse frequency. To maintain limit values according to EN 61800-3 Category C2, a maximum motor cable length of 25 m (82 ft) (shielded) is permissible.

Technical specifications

Line voltage 380 ... 480 V 3 AC		SINAMICS G120C power electronics			
		6SL3210-1KE15-8..0	6SL3210-1KE17-5..0	6SL3210-1KE18-8..0	6SL3210-1KE21-3..0
Output current at 400 V 3 AC					
• Rated current I_{rated} [1]	A	5.8	7.5	9.0	13.0
• Base load current I_L [2]	A	5.6	7.3	8.8	12.5
• Base load current I_H [3]	A	4.1	5.6	7.3	8.8
• I_{max}	A	8.2	11.2	14.6	17.6
Rated power					
• Based on I_L	kW (hp)	2.2 (3.0)	3.0 (4.0)	4.0 (5.0)	5.5 (7.5)
• Based on I_H	kW (hp)	1.5 (2.0)	2.2 (3.0)	3.0 (4.0)	4.0 (5.0)
Rated pulse frequency	kHz	4	4	4	4
Efficiency η		0.97	0.97	0.97	0.97
Power loss at rated current	kW	0.09	0.14	0.15	0.18
Cooling air requirement	m^3/s (ft^3/s)	0.005 (0.18)	0.005 (0.18)	0.005 (0.18)	0.009 (0.32)
Sound pressure level L_{pA} (1 m)	dB	<52	<52	<52	<63
Rated input current [4]					
• Based on I_L	A	7.4	9.5	11.4	16.5
• Based on I_H	A	6.0	8.2	10.6	12.8
Length of cable to braking resistor, max.	m (ft)	15 (49)	15 (49)	15 (49)	15 (49)
Line supply connection U1/L1, V1/L2, W1/L3		Plug-in screw terminals	Plug-in screw terminals	Plug-in screw terminals	Plug-in screw terminals
• Conductor cross-section	mm^2	1 … 2.5 (16 ... 14 AWG)	1 … 2.5 (16 ... 14 AWG)	1 … 2.5 (16 ... 14 AWG)	4 … 6 (12 ... 10 AWG)
Motor connection U2, V2, W2		Plug-in screw terminals	Plug-in screw terminals	Plug-in screw terminals	Plug-in screw terminals
• Conductor cross-section	mm^2	1 … 2.5 (16 ... 14 AWG)	1 … 2.5 (16 ... 14 AWG)	1 … 2.5 (16 ... 14 AWG)	4 … 6 (12 ... 10 AWG)
Connection for braking resistor R1, R2		Plug-in screw terminals	Plug-in screw terminals	Plug-in screw terminals	Plug-in screw terminals
• Conductor cross-section	mm^2	1 … 2.5 (16 ... 14 AWG)	1 … 2.5 (16 ... 14 AWG)	1 … 2.5 (16 ... 14 AWG)	4 … 6 (12 ... 10 AWG)
PE connection		On housing with M4 screw	On housing with M4 screw	On housing with M4 screw	On housing with M4 screw
Motor cable length, max. [5]					
• Shielded	m (ft)	50 (164)	50 (164)	50 (164)	50 (164)
• Unshielded	m (ft)	100 (328)	100 (328)	100 (328)	100 (328)
Dimensions					
• Width	mm (in)	73 (2.87)	73 (2.87)	73 (2.87)	100 (3.94)
• Height	mm (in)	196 (7.72)	196 (7.72)	196 (7.72)	196 (7.72)
• Depth					
- Without operator panel	mm (in)	203 (7.99)	203 (7.99)	203 (7.99)	203 (7.99)
- With operator panel	mm (in)	224 (8.82)	224 (8.82)	224 (8.82)	224 (8.82)
Frame size		FSA	FSA	FSA	FSB
Weight, approx.	kg (lb)	1.7 (3.75)	1.7 (3.75)	1.7 (3.75)	2.3 (5)

[1] The rated output current I_{rated} can be used up to 100 %; however, without overload.

[2] The base load current I_L is based on the duty cycle for low overload (LO).

[3] The base load current I_H is based on the duty cycle for high overload (HO).

[4] The rated input currents are valid for an input voltage of 400 V 3 AC and a line impedance corresponding to u_K = 1 % (without line reactor). The rated input current based on I_L is stamped on the inverter rating plate. In the particular application, the input current depends on the motor load and line impedance. The input current is reduced when using a line reactor.

[5] The maximum motor cable lengths are valid for an input voltage of 400 V 3 AC and operation with a 4 kHz pulse frequency. To maintain limit values according to EN 61800-3 Category C2, a maximum motor cable length of 25 m (82 ft) (shielded) is permissible.

SINAMICS G120C compact inverters 0.55 kW to 18.5 kW (0.75 hp to 25 hp)

Technical specifications

Line voltage 380 ... 480 V 3 AC		SINAMICS G120C power electronics			
		6SL3210-1KE21-7..0	6SL3210-1KE22-6..0	6SL3210-1KE23-2..0	6SL3210-1KE23-8..0
Output current at 400 V 3 AC					
• Rated current I_{rated} [1]	A	17.0	26.0	32.0	38.0
• Base load current I_L [2]	A	16.5	25.0	31.0	37.0
• Base load current I_H [3]	A	12.5	16.5	25.0	31.0
• I_{max}	A	25.0	33.0	50.0	62.0
Rated power					
• Based on I_L	kW (hp)	7.5 (10)	11.0 (15)	15.0 (20)	18.5 (25)
• Based on I_H	kW (hp)	5.5 (7.5)	7.5 (10)	11.0 (15)	15.0 (20)
Rated pulse frequency	kHz	4	4	4	4
Efficiency η		0.97	0.97	0.97	0.97
Power loss at rated current	kW	0.24	0.35	0.43	0.50
Cooling air requirement	m^3/s (ft^3/s)	0.009 (0.32)	0.018 (0.64)	0.018 (0.64)	0.018 (0.64)
Sound pressure level L_{pA} (1 m)	dB	<63	<66	<66	<66
Rated input current [4]					
• Based on I_L	A	21.5	33.0	40.6	48.2
• Based on I_H	A	18.2	24.1	36.4	45.2
Length of cable to braking resistor, max.	m (ft)	15 (49)	15 (49)	15 (49)	15 (49)
Line supply connection U1/L1, V1/L2, W1/L3		Plug-in screw terminals	Plug-in screw terminals	Plug-in screw terminals	Plug-in screw terminals
• Conductor cross-section	mm^2	4 … 6 (12 ... 10 AWG)	6 … 16 (10 ... 5 AWG)	6 … 16 (10 ... 5 AWG)	6 … 16 (10 ... 5 AWG)
Motor connection U2, V2, W2		Plug-in screw terminals	Plug-in screw terminals	Plug-in screw terminals	Plug-in screw terminals
• Conductor cross-section	mm^2	4 … 6 (12 ... 10 AWG)	6 … 16 (10 ... 5 AWG)	6 … 16 (10 ... 5 AWG)	6 … 16 (10 ... 5 AWG)
Connection for braking resistor R1, R2		Plug-in screw terminals	Plug-in screw terminals	Plug-in screw terminals	Plug-in screw terminals
• Conductor cross-section	mm^2	4 … 6 (12 ... 10 AWG)	6 … 16 (10 ... 5 AWG)	6 … 16 (10 ... 5 AWG)	6 … 16 (10 ... 5 AWG)
PE connection		On housing with M4 screw	On housing with M4 screw	On housing with M4 screw	On housing with M4 screw
Motor cable length, max. [5]					
• Shielded	m (ft)	50 (164)	50 (164)	50 (164)	50 (164)
• Unshielded	m (ft)	100 (328)	100 (328)	100 (328)	100 (328)
Dimensions					
• Width	mm (in)	100 (3.94)	140 (5.51)	140 (5.51)	140 (5.51)
• Height	mm (in)	196 (7.72)	295 (11.61)	295 (11.61)	295 (11.61)
• Depth					
- Without operator panel	mm (in)	203 (7.99)	203 (7.99)	203 (7.99)	203 (7.99)
- With operator panel	mm (in)	224 (8.82)	224 (8.82)	224 (8.82)	224 (8.82)
Frame size		FSB	FSC	FSC	FSC
Weight, approx.	kg (lb)	2.3 (5)	4.5 (10)	4.5 (10)	4.5 (10)

[1] The rated output current I_{rated} can be used up to 100 %; however, without overload.

[2] The base load current I_L is based on the duty cycle for low overload (LO).

[3] The base load current I_H is based on the duty cycle for high overload (HO).

[4] The rated input currents are valid for an input voltage of 400 V 3 AC and a line impedance corresponding to u_K = 1 % (without line reactor). The rated input current based on I_L is stamped on the inverter rating plate. In the particular application, the input current depends on the motor load and line impedance. The input current is reduced when using a line reactor.

[5] The maximum motor cable lengths are valid for an input voltage of 400 V 3 AC and operation with a 4 kHz pulse frequency. To maintain limit values according to EN 61800-3 Category C2, a maximum motor cable length of 25 m (82 ft) (shielded) is permissible.

Overview

Operator panel	Intelligent Operator Panel IOP and IOP Handheld	Basic Operator Panel BOP-2
		
Description	Thanks to the large plain text display, menu-based operation and the application wizards, commissioning of the standard drives is easy. Integrated application wizards guide the user interactively through the commissioning process for important applications such as pumps, fans, compressors and conveyor systems.	Commissioning of standard drives is easy with the menu-prompted dialog on a 2-line display. Simultaneous display of the parameter and parameter value, as well as parameter filtering, means that basic commissioning of a drive can be performed easily and, in most cases, without a printed parameter list.
Possible applications	• Directly mounted on SINAMICS G120C • Can be mounted in the control cabinet door using a door mounting kit (achievable degree of protection is IP54/UL Type 12) • Available as handheld version • 5 languages available	• Directly mounted on SINAMICS G120C • Can be mounted in the control cabinet door using a door mounting kit (achievable degree of protection is IP55/UL Type 12)
Quick commissioning without expert knowledge	• Standard commissioning using the clone function • User-defined parameter list with a reduced number of self-selected parameters • Simple commissioning of standard applications using application-specific wizards; it is not necessary to know the parameter structure • Simple local commissioning using the handheld version • Commissioning largely without documentation	• Standard commissioning using the clone function
High degree of operator friendliness and intuitive operation	• Direct manual operation of the drive – you can simply toggle between the automatic and manual modes • Intuitive navigation using a rotary knob – just like in everyday applications • Graphic display to show status values such as pressure or flow in bar-type diagrams • Status display with freely selectable units to specify physical values	• Direct manual operation of the drive – you can simply toggle between the automatic and manual modes – • 2-line display for showing up to 2 process values with text • Status display of predefined units
Minimization of maintenance times	• Diagnostics using plain text display, can be used locally on-site without documentation • Simple update of languages, wizards and firmware via USB	• Diagnostics with menu prompting with 7-segment display

Supplementary system components Memory cards

Overview

SINAMICS micro memory card (MMC)/SIMATIC memory card (SD card)

The parameter settings for an inverter can be stored on the SINAMICS micro memory card (MMC) or SIMATIC memory card (SD card). When service is required, e.g. after the inverter has been replaced and the data have been downloaded from the memory card the drive system is immediately ready for use again.

- Parameter settings can be written from the memory card to the inverter or saved from the inverter to the memory card.
- Up to 100 parameter sets can be stored.
- The memory card supports standard commissioning without the use of an operator panel such as the BOP-2 or the STARTER commissioning tool.

Note:

The memory card is not required for operation and does not have to remain inserted.

Selection and ordering data

Description	Order No.
SINAMICS micro memory card (MMC)	**6SL3 254-0AM00-0AA0**
SIMATIC memory card (SD card) (for SINAMICS G120C and the SINAMICS G120 CU2 . 0 . -2 Control Units)	**6ES7 954-8LB01-0AA0**

Supplementary system components PC inverter connection kit 2

Overview

For controlling and commissioning an inverter directly from a PC, if the STARTER commissioning tool has been installed on the PC. With this, the inverter can be

- parameterized (commissioned, optimized),
- monitored (diagnostics)
- controlled (master control via the STARTER commissioning tool for test purposes).

A USB cable (3 m/9.84 ft) and the STARTER commissioning tool on DVD-ROM are included in the scope of delivery.

Selection and ordering data

Description	Order No.
PC inverter connection kit 2 for SINAMICS G120C and SINAMICS G120 Control Units CU2 . 0 . -2 Including USB cable (3 m/9.84 ft) and STARTER commissioning tool on DVD-ROM [1]	**6SL3 255-0AA00-2CA0**

[1] The STARTER commissioning tool is also available on the Internet at http://support.automation.siemens.com/WW/view/en/10804985/133100

Overview

The following spare parts are available for SINAMICS G120C for service and maintenance work.

SINAMICS G120C shield plates

A set of shield plates can be ordered for the motor and signal cables corresponding to the frame size of the SINAMICS G120C compact inverter.

SINAMICS G120C Spare Parts Kit

This kit comprises 5 sets of I/O terminals, 1 RS485 terminal, 2 Control Unit doors and 1 blanking cover.

SINAMICS G120, SINAMICS G120C connectors

A set of connectors for the line feeder cable, braking resistor and motor cable can be ordered corresponding to the frame size of the SINAMICS G120C compact inverter.

SINAMICS G120C roof-mounted fan

A roof-mounted fan (at the top of the device) comprising a pre-assembled unit with holder and fan can be ordered corresponding to the frame size of the SINAMICS G120C compact inverter.

SINAMICS G120C, frame size FSB, with integrated roof-mounted fan

SINAMICS G120, SINAMICS G120C fan unit

A replacement fan (at the rear of the device; heat sink) comprising a pre-assembled unit with holder and fan can be ordered corresponding to the frame size of the SINAMICS G120C compact inverter.

SINAMICS G120C, frame size FSB, with fan unit (rear view of rotated inverter)

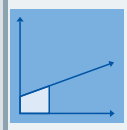
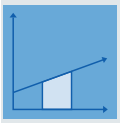
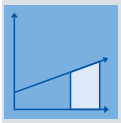
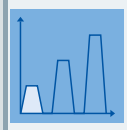
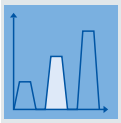
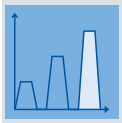
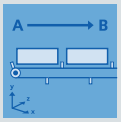
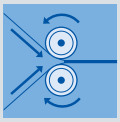
Selection and ordering data

Description	Order No.
SINAMICS G120C shield plate	
• Frame size FSA	**6SL3 266-1EA00-0KA0**
• Frame size FSB	**6SL3 266-1EB00-0KA0**
• Frame size FSC	**6SL3 266-1EC00-0KA0**
SINAMICS G120C Spare Parts Kit	**6SL3 200-0SK40-0AA0**
SINAMICS G120, SINAMICS G120C connectors	
• Frame size FSA	**6SL3 200-0ST05-0AA0**
• Frame size FSB	**6SL3 200-0ST06-0AA0**
• Frame size FSC	**6SL3 200-0ST07-0AA0**
SINAMICS G120C roof-mounted fan	
• Frame size FSA	**6SL3 200-0SF40-0AA0**
• Frame size FSB	**6SL3 200-0SF41-0AA0**
• Frame size FSC	**6SL3 200-0SF42-0AA0**
SINAMICS G120, SINAMICS G120C fan unit	
• Frame size FSA	**6SL3 200-0SF12-0AA0**
• Frame size FSB	**6SL3 200-0SF13-0AA0**
• Frame size FSC	**6SL3 200-0SF14-0AA0**

SINAMICS G120 standard inverters 0.37 kW to 250 kW (0.5 hp to 400 hp)

Introduction

Application

Application	Continuous motion			Non-continuous motion		
	Requirements for torque accuracy / speed accuracy / position accuracy / coordination of axes / functionality			Requirements for torque accuracy / speed accuracy / position accuracy / coordination of axes / functionality		
	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
	G110, G120C (G130, G150, GM150, GL150)	**G120P, G120C, G120** (G130, G150, GM150, GL150)	**S120**	**S110**	**S110, S120**	**S120** (GM150)
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 Robotics Pick & place Rotary indexing tables Cross cutters Roll feeds Engagers/ disengagers
	G110, G110D, G120C (G130, G150, GM150)	**G120D, G120C, G120, S120** (G130, G150, S150, GM150, GL150, SM150, DCM, SIMATIC ET200S, SIMATIC ET200pro)	**S120** (S150, SM150, SL150, GM150, DCM)	**S110**	**S110, S120** (DCM)	**S120** (GM150)
Processing 	Mills Mixers Kneaders Crushers Agitators Centrifuges	Mills Mixers Kneaders Crushers Agitators Centrifuges Extruders Rotary furnaces	Extruders Winders and unwinders Lead/follower drives Calenders Main press drives Printing machines	Tubular bagging machines Single-axis motion control such as • Position profile • Path profile	Tubular bagging machines Single-axis motion control such as • Position profile • Path profile	Servo presses Rolling mill drives Multi-axis motion control such as • Multi-axis positioning • Cams • Interpolations
	G120C (G130, G150, GM150)	**G120C, G120** (G130, G150, S150, GM150, GL150, DCM)	**S120** (S150, DCM)	**S110**	**S110, S120**	**S120** (SM150, SL150, DCM)
Machining 	Main drives for • Turning • Drilling • Milling	Main drives for • Drilling • Sawing	Main drives for • Turning • Drilling • Milling • Gear cutting • Grinding	Axle drives for • Turning • Drilling • Milling	Axle drives for • Drilling • Sawing	Axle drives for • Turning • Drilling • Milling • Lasering • Gear cutting • Grinding • Nibbling and punching
	S110	**S110, S120**	**S120**	**S110**	**S110, S120**	**S120**

(Devices in brackets are not included in Catalog D 31)

The standard SINAMICS G120 inverter is especially well-suited

- as a universal drive in all industrial and commercial applications
- e.g. in the automotive, textile, printing and chemical industries
- for higher-level applications, e.g. in conveyor systems

More information

You may also be interested in these inverters/converters:

- Increased functional scope ⇒ SINAMICS S110 (catalog D 31, chapter 9)
- Higher degree of protection ⇒ SINAMICS G120D (catalog D 31, chapter 8)

SINAMICS G120 standard inverters 0.37 kW to 250 kW (0.5 hp to 400 hp)

Overview

The SINAMICS G120 inverter is designed to provide precise and cost-effective speed/torque control of three-phase motors.

With different device versions (frame sizes FSA to FSGX) in an output range of 0.37 kW to 250 kW (0.5 hp to 400 hp), it is suitable for a wide variety of drive solutions.

SINAMICS G120, frame sizes FSA, FSB and FSC; each with Power Module, CU240E-2 F Control Unit and Basic Operator Panel BOP-2

SINAMICS G120, frame sizes FSD, FSE and FSF; each with Power Module, CU240E-2 F Control Unit and Basic Operator Panel BOP-2

SINAMICS G120 standard inverters 0.37 kW to 250 kW (0.5 hp to 400 hp)

SINAMICS G120 standard inverters

Overview

SINAMICS G120, frame size FSGX; with Power Module, CU240E-2 F Control Unit and Basic Operator Panel BOP-2

Operator-friendly design

SINAMICS G120 is a modular inverter system that essentially comprises two function units:

- Control Unit (CU)
- Power Module (PM)

The Control Unit controls and monitors the Power Module and the connected motor in several different modes. It supports communication with a local or central controller and monitoring devices.

The Power Module supplies the motor in the power range 0.37 kW to 250 kW (0.5 hp to 400 hp). It features state-of-the-art IGBT technology with pulse-width-modulated motor voltage and selectable pulse frequency. It also features a range of functions offering a high degree of protection for the Power Module and motor.

Safety Integrated

SINAMICS G120 standard inverters are available in different versions for safety-related applications. The PM240, PM250 and PM260 Power Modules are prepared for Safety Integrated. In conjunction with a fail-safe Control Unit, the drive can be turned into a Safety Integrated Drive.

The SINAMICS G120 fail-safe inverter provides 5 safety functions, certified in accordance with EN 954-1, Category 3 and IEC 61508 SIL 2 as well as ISO 13849-1 PLD:

- Safe Torque Off (STO)
  to protect against active movement of the drive
- Safe Stop 1 (SS1)
  for continuous monitoring of a safe braking ramp
- Safely Limited Speed (SLS)
  for protection against dangerous movements on exceeding a speed limit
- Safe direction (SDI)
  This function ensures that the drive can only rotate in the selected direction
- Safe speed monitoring (SSM)
  This function signals if a drive operates below a specific speed/feed velocity.

The Safe Stop 1 (SS1) and Safely Limited Speed functions can both be implemented without having to use a motor encoder; the implementation cost is minimal. Existing plants in particular can be updated with safety technology without the need to change the motor or mechanical system.

The Safe Torque Off (STO) function can be used without restriction for all applications. The SS1, SLS, SSM and SDI functions are only permissible for applications where the load can never accelerate when the inverter is switched off. They are therefore not permitted for applications involving pull-through loads such as hoisting gear and unwinders.

Additional information is provided in catalog D 31, chapter Highlights, section Safety Integrated.

Overview

Efficient Infeed Technology

The advanced Efficient Infeed Technology is employed in PM250 and PM260 Power Modules. This technology allows the energy produced by motors operating in generator mode connected to standard inverters to be fed back into the supply system. For control cabinets, an additional temperature rise can be avoided and the amount of space required can be reduced due to the fact that components such as braking resistors, braking choppers and line reactors can be eliminated. Further, wiring and engineering costs are significantly reduced. At the same time, energy consumption can be reduced and ongoing operating costs noticeably reduced.

Additional information is included in catalog D 31,chapter Highlights, section Efficient Infeed Technology.

Innovative cooling concept and varnishing of electronic modules

The new cooling system and varnishing of the electronic modules significantly increases the service life or useful life of the device.

- Disposal of all heat losses via an external heat sink
- Consequential convection cooling of the Control Unit, electronic modules are not located in the air duct
- All cooling air from the fan is directed through the heat sink

Energy efficiency

Integrated technologies help when optimizing the energy usage of the plant or system referred to the particular application:

- Energy-efficient, sensorless vector control
- Automatic flux reduction with *V/f* ECO mode
- Integrated energy saving computer

Benefits

- Modularity ensures flexibility for a drive concept that is fit for the future
  - Module replacement under voltage (hot swapping)
  - Pluggable terminals
  - The modules can be easily replaced, which makes the system extremely service friendly
- The integrated safety functions significantly reduce the costs when integrating drives into safety-oriented machines or systems
- Communications-capable via PROFINET or PROFIBUS with PROFIdrive Profile 4.0
  - Reduced number of interfaces
  - Plant-wide engineering
  - Easy to handle
- The innovative circuit design (bidirectional input rectifier with "pared-down" DC link) allows the kinetic energy of a load to be fed back into the supply system when PM250 and PM260 Power Modules are used. This feedback capability provides enormous potential for savings because generated energy no longer has to be converted into heat in a braking resistor
- Integrated USB interface for simplified, local commissioning and diagnostics
- Application-specific modules for pumps, fans and compressors are integrated, e.g.:
  - 4 freely-programmable PID controllers
  - Application-specific wizards
  - Ni1000/Pt1000 temperature sensor interface
  - 230 V relay
  - 3 freely-programmable digital time switches
- Integrated control functionality by using Bico technology
- Innovative SiC semiconductor technology ensures that when a PM260 Power Module is used, the inverter is more compact than a comparable standard inverter with an optional sine-wave filter for the same power rating
- An innovative cooling concept and coated electronic modules increase robustness and service life
  - External heat sink
  - Electronic components are not located in air duct
  - Control Unit that is completely cooled by convection
  - Additional coating of the most important components
- Simple unit replacement and quick copying of parameters using the optional Basic Operator Panel or the optional MMC memory card
- Quiet motor operation as a result of the high pulse frequency
- Compact, space-saving design
- Software parameters for simple adaptation to 50 Hz or 60 Hz motors (IEC or NEMA motors)
- 2/3-wire control for static/pulsed signals for universal control via digital inputs
- Fast engineering and commissioning by using standard engineering tools such as SIZER for Siemens Drives, STARTER and Drive ES – STARTER is integrated into STEP 7 using Drive ES Basic, with all of the benefits of central data management and totally integrated communication
- Certified worldwide for compliance with CE, UL, cUL, c-tick and Safety Integrated IEC 61508 SIL 2

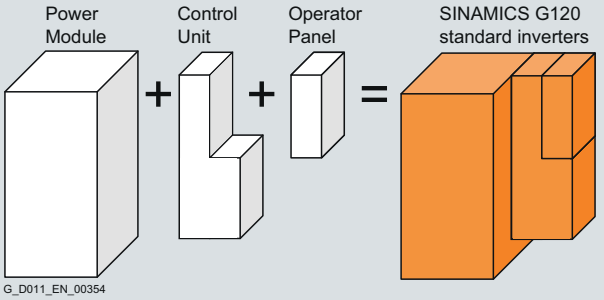
SINAMICS G120 standard inverters 0.37 kW to 250 kW (0.5 hp to 400 hp)

SINAMICS G120 standard inverters

Design

Application-orientated design of SINAMICS G120

SINAMICS G120 standard inverters are modular inverters for standard drives. Selection of the SINAMICS G120 is reduced to two or three steps thanks to the modular system used.

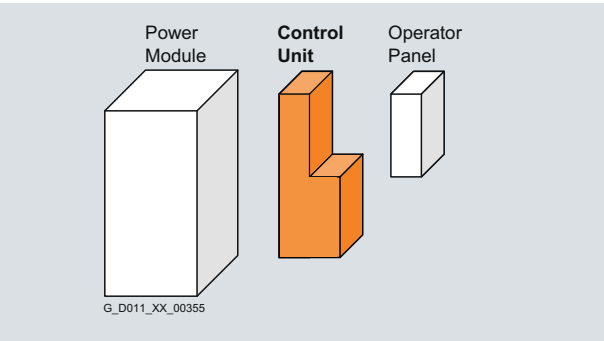


Selecting the Control Unit

The optimum Control Unit is selected first, based on the number of I/Os and any additional functions required such as Safety Integrated or HVAC. The communication options are already integrated and do not have to be additionally ordered or plugged in. Two product series are available corresponding to the particular application.

CU240 Control Units

The CU240 Control Units are suitable for a wide range of applications in general machine construction, such as conveyor belts, mixers and extruders.



Technology functions (selection)	Inputs	Outputs	Integrated safety technology	Digital inputs, fail-safe	Communication	Designation	**Control Unit** Order No.
CU240 series – for basic applications with variable-speed drives							
• Free function blocks (FFB) • 1 x PID controller • Motor holding brake	4 digital 1 analog	1 digital 1 analog	–	–	RS485/USS / Modbus RTU	CU240B-2	**6SL3 244-0BB00-1BA1**
					PROFIBUS DP	CU240B-2 DP	**6SL3 244-0BB00-1PA1**
CU240 series – for standard applications in general machinery construction, such as conveyor belts, mixers and extruders							
• Free function blocks (FFB) • 1 x PID controller • Motor holding brake	6 digital 2 analog	3 digital 2 analog	STO	1 F-DI (opt. for each 2 DI)	RS485/USS / Modbus RTU	CU240E-2	**6SL3 244-0BB12-1BA1**
					PROFIBUS DP PROFIsafe	CU240E-2 DP	**6SL3 244-0BB12-1PA1**
			STO, SS1, SLS, SSM, SDI	3 F-DI (opt. for each 2 DI)	RS485/USS / Modbus RTU	CU240E-2 -F	**6SL3 244-0BB13-1BA1**
					PROFIBUS DP PROFIsafe	CU240E-2 DP-F	**6SL3 244-0BB13-1PA1**

Design

Selecting the Power Module

The optimum power unit can be quickly selected based on the required motor power, the supply voltage and the braking cycles to be expected.

PM240 Power Modules – degree of protection IP20

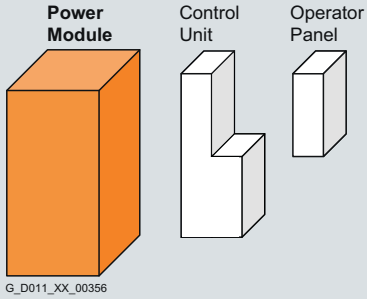
PM240 Power Modules have a braking chopper (four-quadrant applications) and are suitable for a large number of applications in general machinery construction.

PM250 Power Modules – degree of protection IP20

PM250 Power Modules are suitable for the same applications as the PM240. Any braking energy is directly fed back into the line supply (four-quadrant applications – a braking chopper is not required).

PM260 Power Modules – degree of protection IP20

PM260 Power Modules are designed for applications from 500 V to 690 V, are capable of energy recovery and include a sine-wave filter to reduce the stress on the motor and for long cable lengths.



		380 ... 480 V 3 AC			500 ... 690 V 3 AC	
Rated power [1]		Rated output current I_{rated} [2]	**SINAMICS G120 PM240 Power Module degree of protection IP20, all CUs pluggable**	**SINAMICS G120 PM250 Power Module degree of protection IP20, all CUs pluggable**	Rated output current I_{rated} [2]	**SINAMICS G120 PM260 Power Module degree of protection IP20, all CUs pluggable**
kW	hp	A	Order No.	Order No.	A	Order No.
0.37	0.50	1.3	**6SL3 224-0BE13-7UA0**	–		–
0.55	0.75	1.7	**6SL3 224-0BE15-5UA0**	–		–
0.75	1.0	2.2	**6SL3 224-0BE17-5UA0**	–		–
1.1	1.5	3.1	**6SL3 224-0BE21-1UA0**	–		–
1.5	2.0	4.1	**6SL3 224-0BE21-5UA0**	–		–
2.2	3.0	5.9	**6SL3 224-0BE22-2■A0**	–		–
3.0	4.0	7.7	**6SL3 224-0BE23-0■A0**	–		–
4.0	5.0	10.2	**6SL3 224-0BE24-0■A0**	–		–
5.5	7.5	13.2	–	–		–
7.5	10	18	**6SL3 224-0BE25-5■A0**	**6SL3 225-0BE25-5AA1**		–
11.0	15	25	**6SL3 224-0BE27-5■A0**	**6SL3 225-0BE27-5AA1**	14	**6SL3 225-0BH27-5■A1**
15.0	20	32	**6SL3 224-0BE31-1■A0**	**6SL3 225-0BE31-1AA1**	19	**6SL3 225-0BH31-1■A1**
18.5	25	38	**6SL3 224-0BE31-5■A0**	**6SL3 225-0BE31-5■A0**	23	**6SL3 225-0BH31-5■A1**
22	30	45	**6SL3 224-0BE31-8■A0**	**6SL3 225-0BE31-8■A0**	–	–
30	40	60	**6SL3 224-0BE32-2■A0**	**6SL3 225-0BE32-2■A0**	35	**6SL3 225-0BH32-2■A1**
37	50	75	**6SL3 224-0BE33-0■A0**	**6SL3 225-0BE33-0■A0**	42	**6SL 3225-0BH33-0■A1**
45	60	90	**6SL3 224-0BE33-7■A0**	**6SL3 225-0BE33-7■A0**	–	–
55	75	110	**6SL3 224-0BE34-5■A0**	**6SL3 225-0BE34-5■A0**	62	**6SL3 225-0BH33-7■A1**
75	100	145	**6SL3 224-0BE35-5■A0**	**6SL3 225-0BE35-5■A0**		–
90	125	178	**6SL3 224-0BE37-5■A0**	**6SL3 225-0BE37-5■A0**		–
110	150	205	**6SL3 224-0BE38-8UA0**	–		–
132	200	250	**6SL3 224-0BE41-1UA0**	–		–
160	250	302	**6SL3 224-0XE41-3UA0**	–		–
200	300	370	**6SL3 224-0XE41-6UA0**	–		–
250	400	477	**6SL3 224-0XE42-0UA0**	–		–
Integrated line filter			↑	↑		↑
Without (for IT systems)			**U**	**U**		**U**
Class A (for TN systems)			**A**	**A**		**A**
Class B (for TN systems)			Are not available integrated	Are not available integrated		Not supported

Data based on a duty cycle with low overload (LO).
High overload (HO) see Power Modules, catalog D31 from page 6/32 on.

[1] The LO duty cycle is generally used for applications with square torque characteristic such as for pumps, fans and compressors; the HO duty cycle for constant torque characteristics, for example conveyor belts.

[2] These current values are applicable for 400 V (for PM230, PM240 and PM250 Power Modules) and for 690 V (for PM260 Power Modules).

Design

Selecting optional system components

Intelligent Operator Panel IOP

Graphic display with bar-type diagrams, e.g. for status values such as pressure or flowrate.

User-friendly commissioning, diagnostics and local operator control using a large plain text display, clear menu navigation and integrated application wizards.

Intelligent Operator Panel IOP Handheld

A handheld version of the IOP can be ordered for mobile use. In addition to the IOP, this includes a housing with rechargeable batteries, charging unit and RS232 connecting cable.

Basic Operator Panel BOP-2

Menu navigation and 2-line display permit fast and user-friendly commissioning of the inverter.

Simple basic commissioning by simultaneously displaying parameter and parameter value, as well as the option of filtering parameters.

Door mounting kit for IOP/BOP-2

Using the optionally available door mounting kit, the IOP/BOP-2 can be mounted in a control cabinet door with just a few manual operations (IP54/UL Type 12 degree of protection is achieved).

Memory cards

The parameter settings for an inverter can be stored on the SINAMICS micro memory card (MMC) or SIMATIC memory card (SD card). When service is required, e.g. after the inverter has been replaced, the drive system is immediately ready for use again.

Brake Relay

The Brake Relay allows the Power Module to be connected to an electromechanical motor brake, thereby allowing the motor brake to be driven directly by the Control Unit.

Adapter for mounting on DIN rails

The adapter for DIN rail mounting can be used to mount inverters, frame sizes FSA and FSB, on DIN mounting rails (2 units with a center-to-center distance of 100 mm/3.94 in).

PC inverter connection kit 2

For controlling and commissioning an inverter directly from a PC if the appropriate software (STARTER commissioning tool) has been installed.

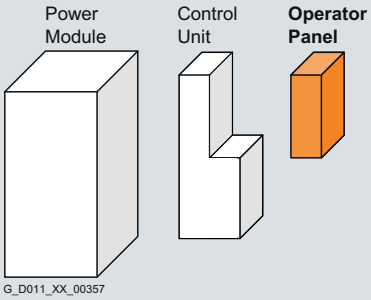
The STARTER commissioning tool on DVD-ROM is included in the scope of delivery of the PC inverter connection kit 2.

Shield connection kit for Power Modules

The shield connection kit makes it easier to connect the shields of supply and control cables, provides mechanical strain relief and thus ensures optimum EMC performance.

Shield connection kit for Control Units

The shield connection kit offers optimum shield connection and strain relief for all signal and communication cables. It includes a matching shield bonding plate and all of the necessary connecting and retaining elements for mounting.



Description	Order No.
Operator Panel IOP	**6SL3 255-0AA00-4JA0**
Operator Panel IOP Handheld [1]	**6SL3 255-0AA00-4HA0**
Operator Panel BOP-2	**6SL3 255-0AA00-4CA1**
Door mounting kit [1] **for IOP/BOP-2**	**6SL3 256-0AP00-0JA0**
Memory cards [2]	
• SINAMICS micro memory card (MMC)	**6SL3 254-0AM00-0AA0**
• SIMATIC memory card (SD card)	**6ES7 954-8LB01-0AA0**
Brake Relay [1]	**6SL3 252-0BB00-0AA0**
Adapter for mounting on DIN rails	
• For Power Modules, frame size FSA	**6SL3 262-1BA00-0BA0**
• For Power Modules, frame size FSB	**6SL3 262-1BB00-0BA0**
PC inverter connection kit 2	**6SL3 255-0AA00-2CA0**
Shield connection kits for PM240 and PM250 Power Modules	
• Frame size FSA	**6SL3 262-1AA00-0BA0**
• Frame size FSB	**6SL3 262-1AB00-0DA0**
• Frame size FSC	**6SL3 262-1AC00-0DA0**
• Frame sizes FSD and FSE	**6SL3 262-1AD00-0DA0**
• Frame size FSF	**6SL3 262-1AF00-0DA0**
Shield connection kits for PM260 Power Modules	
• Frame size FSD	**6SL3 262-1FD00-0CA0**
• Frame size FSF	**6SL3 262-1FF00-0CA0**
Shield connection kits for Control Units	
• For CU240 . -2	**6SL3 264-1EA00-0HA0**
STARTER commissioning tool on DVD-ROM	**6SL3 072-0AA00-0AG0**

[1] Not possible in conjunction with the PM230 Power Module.

[2] Alternatively, an MMC or an SD card can be used.

Design

Line-side power components

The following line-side power components are available for SINAMICS G120 standard inverters:

Line filters

With one of the additional line filters, the Power Module reaches a higher radio interference class.

Line reactors
(for PM240 Power Modules only)

Line reactors are used to smooth voltage peaks or to bridge commutating dips.

Line reactors also reduce the effects of harmonics on the inverter and the line supply.

If the ratio of the rated inverter power to the line supply short-circuit power is less than 1 %, then it is recommended to use a line reactor to reduce the current peaks.

Recommended line-side power components

This is a recommendation for additional line-side components, such as fuses and circuit breakers (line-side components must be dimensioned in accordance with IEC standards).

Additional information about the listed fuses and circuit breakers can be found in Catalogs LV 1 AO, LV 10.1 and IC 10.

DC link components

The following DC link components are available for the SINAMICS G120 standard inverters:

Braking Modules
(only for PM240 Power Modules, frame size FSGX)

A Braking Module and the matching external braking resistor are required to bring drives with a PM240 Power Module, frame size FSGX, to a controlled standstill in the event of a power failure (e.g. emergency retraction or EMERGENCY STOP Category 1) or to limit the DC link voltage during a short period of generator operation. The Braking Module includes the power electronics and the associated control circuit.

Braking resistors
(for PM240 Power Modules only)

Excess energy in the DC link is dissipated in the braking resistor. The braking resistors are designed for use with PM240 Power Modules. They are equipped with an integrated braking chopper (electronic switch). There is an optional plug-in Braking Module for frame size FSGX.

Load-side power components

The following load-side power components are available for the SINAMICS G120 standard inverters. This means that during operation with output reactors or sine-wave filters, longer, shielded motor cables are possible and the motor service life can be extended:

Output reactors
(for PM240 and PM250 Power Modules only)

Output reactors reduce the voltage stress on the motor windings. At the same time, the capacitive charging/discharging currents, which place an additional load on the power unit when long motor cables are used, are reduced.

Sine-wave filters
(not for PM260 Power Modules)

The sine-wave filter limits the rate of rise of voltage and the capacitive charging/discharging currents that usually occur with inverter operation. An output reactor is not required.

Spare parts

Terminal cover kit

The kit includes a replacement cover for the terminals. The kit can be ordered for PM240/PM250 Power Modules, frame sizes FSD, FSE and FSF, as well as for the PM260, frame size FSF.

PM260 replacement connector

This spare part includes a connector for the input and output sides of the PM260 Power Module, frame size FSD.

SINAMICS G120 PM240 FSGX replacement door

A complete replacement door can be ordered for the PM240 Power Module, frame size FSGX.

Replacement fan

The Power Module fans are designed for extra long service life. Replacement fans can be ordered for special applications.

Configuration

The following electronic configuring aids and engineering tools are available for the SINAMICS G120 standard inverters:

Selection guide DT Configurator

The interactive catalog CA 01 – the offline mall of Siemens Industry Automation & Drive Technologies – contains over 100000 products with approximately 5 million possible drive system product variants. The DT Configurator has been developed to facilitate selection of the optimum motor and/or inverter from the wide spectrum of drives. It is provided on a DVD-ROM.

Online DT Configurator

In addition, the DT Configurator can be used in the Internet without requiring any installation
www.siemens.com/dt-configurator

SIZER for Siemens Drives engineering tool

The PC-based SIZER for Siemens Drives engineering tool makes it easy to engineer the SINAMICS and MICROMASTER 4 drive families. It provides support when selecting the hardware and firmware components necessary to implement a drive task. SIZER for Siemens Drives covers the full range of operations required to configure a complete drive system, from basic single drives to demanding multi-axis applications.

STARTER commissioning tool

The STARTER commissioning tool allows menu-prompted commissioning, optimization and diagnostics. In addition to SINAMICS drives, STARTER is also suitable for MICROMASTER 4 units and the drive converters for the distributed I/O SIMATIC ET 200S FC and SIMATIC ET 200pro FC.

SINAMICS StartDrive commissioning tool

SINAMICS StartDrive is a tool for configuring, commissioning, and diagnosing the SINAMICS family of drives and is integrated into the TIA Portal. The engineering tool has been optimized with regard to user friendliness and consistent use of the TIA Portal technologies. The two Control Units CU240B-2 DP and CU240E-2 DP of the SINAMICS G120 standard inverter are supported in the SINAMICS StartDrive V11 version.

Drive ES engineering system

Drive ES is the engineering system that can be used to integrate the communication, configuration and data management functions of Siemens drive technology into the SIMATIC automation world easily, efficiently and cost-effectively. The STEP 7 Manager user interface provides the ideal basis for this. A variety of software packages are available for SINAMICS – Drive ES Basic, Drive ES SIMATIC and Drive ES PCS 7.1.

Technical specifications

Unless explicitly specified otherwise, the following technical specifications are valid for all the following components of the SINAMICS G120 standard inverters.

Mechanical specifications	
Vibratory load	
• Transport [1] acc. to EN 60721-3-2	
- All units and components with the exception of frame size FSGX	Class 2M3
- Units, frame size FSGX	Class 2M2
• Operation Test values acc. to EN 60068-2-6	Test Fc: 10 … 58 Hz: Constant deflection 0.075 mm 58 … 200 Hz: Constant acceleration = 9.81 m/s^2 (1 × *g*)
Shock load	
• Transport [1] acc. to EN 60721-3-2	
- All units and components with the exception of frame size FSGX	Class 2M3
- Units, frame size FSGX	Class 2M2
• Operation Test values acc. to EN 60068-2-27	Test Ea:
- Frame sizes FSA to FSC	147 m/s^2 (15 × *g*)/11 ms
- Frame sizes FSD to FSF	49 m/s^2 (5 × *g*)/30 ms
- Frame size FSGX	98 m/s^2 (10 × *g*)/20 ms
Ambient conditions	
Protection class acc. to EN 61800-5-1	Class I (with protective conductor system) and class III (PELV)
Touch protection acc. to EN 61800-5-1	For the intended purpose
Permissible ambient and coolant temperature (air) during operation for line-side power components and Power Modules	
• Low overload (LO)	0 … 40 °C (32 … 104 °F) without derating >40 … 60 °C (>104 … 140 °F) see derating characteristics
• High overload (HO)	0 … 50 °C (32 … 122 °F) without derating (for PM240 frame size FSGX: 0 … 40 °C, 32 … 104 °F), >50 … 60 °C (>104 … 140 °F) see derating characteristics
Permissible ambient and coolant temperature (air) during operation for Control Units, additional system components and DC-link components	0 ... 50 °C (32 ... 122 °F) Exception: CU230P-2: 0 ... 60 °C (32 ... 140 °F) Up to 2000 m (6562 ft) above sea level
Climatic ambient conditions	
• Storage [1] acc. to EN 60721-3-1	Class 1K3 Temperature -25 … +55 °C (-13 ... +131 °F)
• Transport [1] acc. to EN 60721-3-2	Class 2K4 Temperature -40 … +70 °C (-40 ... +158 °F) Max. air humidity 95 % at 40 °C (104 °F)
• Operation acc. to EN 60721-3-3	Class 3K5 [2] Condensation, splashwater, and ice formation not permitted (EN 60204, Part 1)
Environmental class/harmful chemical substances	
• Storage [1] acc. to EN 60721-3-1	Class 1C2
• Transport [1] acc. to EN 60721-3-2	Class 2C2
• Operation acc. to EN 60721-3-3	Class 3C2
Organic/biological influences	
• Storage [1] acc. to EN 60721-3-1	Class 1B1
• Transport [1] acc. to EN 60721-3-2	Class 2B1
• Operation acc. to EN 60721-3-3	Class 3B1
Degree of pollution acc. to EN 61800-5-1	2

[1] In transport packaging.

[2] For Intelligent Operator Panel IOP, class 3K3

Technical specifications

Standards	
Compliance with standards	UL [1], cUL [2], CE, c-tick
CE marking	According to Low-Voltage Directive 2006/95/EC
EMC Directive acc. to EN 61800-3	
• Frame sizes FSA to FSGX without integrated line filter class A	Category C3 [3]
• Frame sizes FSB to FSF with integrated line filter class A	Category C2 [4] (corresponds to class A acc. to EN 55011 for conducted interference emission)
• Frame size FSA without integrated line filter and with additional line filter class A	Category C2 [4] (corresponds to class A acc. to EN 55011 for conducted interference emission)
• Frame size FSA with additional line filter class A and with additional line filter class B	Category C2 [4] (corresponds to class B acc. to EN 55011 for conducted interference emission)
• Frame sizes FSB and FSC with additional line filter class A and with additional line filter class B	Category C2 [4] (corresponds to class B acc. to EN 55011 for conducted interference emission)

Note:

The EMC product standard EN 61800-3 does not apply directly to a frequency inverter but to a PDS (Power Drive System), which comprises the complete circuitry, motor and cables in addition to the inverter. The frequency inverters on their own do not generally require identification according to the EMC Directive.

[1] UL approval for frame sizes FSD to FSF will be available soon.

[2] Applies to PM240 and PM250 Power Modules.

[3] Unfiltered inverters can be used in industrial environments as long as they are part of a system that contains line filters on the higher-level infeed side. As a consequence, a PDS (Power Drive System) can be installed according to category C3.

[4] With shielded motor cable up to 25 m (82 ft).

Technical specifications

Compliance with standards

CE marking

The SINAMICS G120 inverters meet the requirements of the Low-Voltage Directive 2006/95/EC.

Low-Voltage Directive

The inverters comply with the following standards listed in the official journal of the EU:

- EN 60204-1
  Safety of machinery, electrical equipment of machines
- EN 61800-5-1
  Electrical power drive systems with variable speed – Part 5-1: Requirements regarding safety – electrical, thermal, and energy requirements

UL listing

Inverter devices in UL category NMMS certified to UL and cUL, in compliance with UL508C. UL list numbers E121068 and E192450. This data is applicable for the PM240 and PM250 Power Modules.

For use in environments with pollution degree 2.

On the Internet at www.ul.com

Machinery Directive

The inverters are suitable for installation in machines. Compliance with the Machinery Directive 2006/42/EC requires a separate certificate of conformity. This must be provided by the plant construction company or the organization marketing the machine.

EMC Directive

- EN 61800-3
  Variable-speed electric drives
  Part 3: EMC product standard including specific test methods

The EMC product standard EN 61800-3 for electric drive systems has been valid since July 1, 2005. The transition period for the predecessor standard EN 61800-3/A11 dated February 2001 ended on October 1, 2007. The following information applies to the Siemens SINAMICS G120 inverters:

- The EMC product standard EN 61800-3 does not apply directly to a frequency inverter but to a PDS (Power Drive System), which comprises the complete circuitry, motor and cables in addition to the inverter.
- Frequency inverters are normally only supplied to experts for installation in machines or systems. A frequency inverter must, therefore, only be considered as a component which, on its own, is not subject to the EMC product standard EN 61800-3. The inverter's operating instructions, however, specifies the conditions regarding compliance with the product standard if the frequency inverter is expanded to become a PDS. For a PDS, the EMC Directive in the EU is complied with by observing the product standard EN 61800-3 for variable-speed electric drive systems. The frequency inverters on their own do not generally require identification according to the EMC Directive.
- In the Standard EN 61800-3 of July 2005, a distinction is no longer made between "general availability" and "restricted availability". Instead, different categories C1 to C4 have been defined in accordance with the environment of the PDS at the operating location:
  - **Category C1:** Drive systems for rated voltages < 1000 V for use in the first environment
  - **Category C2:** Stationary drive systems not connected by means of a plug connector for rated voltages < 1000 V. When used in the first environment, the system must be installed and commissioned by personnel familiar with EMC requirements. A warning note is required.
  - **Category C3:** Drive systems for rated voltages < 1000 V for exclusive use in the second environment. A warning note is required.
  - **Category C4:** Drive systems for rated voltages ≥ 1000 V or for rated currents ≥ 400 A or for use in complex systems in the second environment. An EMC plan must be created.
- The EMC product standard EN 61800-3 also defines limit values for conducted interference and radiated interference for the "second environment" (= industrial power supply systems that do not supply households). These limit values are below the limit values of filter class A to EN 55011. Unfiltered inverters can be used in industrial environments as long as they are part of a system that contains line filters on the higher-level infeed side.
- With SINAMICS G120, Power Drive Systems (PDS) that fulfill the EMC product standard EN 61800-3 can be configured when observing the installation instructions in the product documentation.
- A differentiation must be made between the product standards for electrical drive systems (PDS) of the range of standards EN 61800 (of which Part 3 covers EMC topics) and the product standards for the devices/systems/machines, etc. This will probably not result in any changes in the practical use of frequency inverters. Since frequency inverters are always part of a PDS and these are part of a machine, the machine manufacturer must observe various standards depending on their type and environment (e.g. EN 61000-3-2 for line harmonics and EN 55011 for radio interference). The product standard for PDS on its own is, therefore, either insufficient or irrelevant.
- With respect to the compliance with limits for line supply harmonics, the EMC product standard EN 61800-3 for PDS refers to compliance with the EN 61000-3-2 and EN 61000-3-12 standards.
- Regardless of the configuration with SINAMICS G120 and its components, the machine construction company (OEM) can also apply other measures to ensure that the machine complies with the EU EMC Directive. The EU EMC Directive is generally fulfilled when the relevant EMC product standards are observed. If they are not available, the generic standards (e.g. DIN EN 61000-x-x) can be used instead. It is important that the conducted and emitted interference at the line connection point and outside the machine remain below the relevant limit values. Any suitable technical measures can be applied to ensure this.

SEMI F47

SEMI F47 is an industry standard relating to the immunity to voltage dips. This includes the requirement that industrial equipment must be able to tolerate defined dips or drops of the line supply voltage. As a result, industrial equipment that fulfills this standard is more reliable and productive. In the SINAMICS G120 product family, the PM240 and PM250 Power Modules fulfill the latest SEMI F47-0706 standard. In the case of a voltage dip defined in accordance with SEMI F47-0607, these drives either continue to supply a defined output current, or automatically restart and continue to operate as expected.

Overview

CU240B-2 and CU240E-2 Control Units

CU240E-2 DP-F Control Unit

The Control Unit performs closed-loop control functions for the inverter.

The CU240B-2 and CU240E-2 Control Units are designed as standard Control Units for all of the usual applications involving *V/f* or vector control.

- CU240B-2 series with basic I/O quantity structure, ideal for a large number of applications
- CU240E-2 series with standard I/O quantity structure and integrated safety technology

The CU240B-2 and CU240E-2 Control Units can be operated with the following Power Modules:

- PM240
- PM250
- PM260

Safety Integrated functions

The Safety function "Safe Torque Off" (STO) (certified according to EN 954-1, Category 3 and IEC 61508 SIL 2 – as well as ISO 13849-1 PLd) is already integrated into the basic versions of the CU240E-2 series (CU240E-2 and CU240E-2 DP). The following extended Safety Integrated functions have been integrated into the CU240E-2 F and CU240E-2 DP-F Control Units.

- Safe Torque Off (STO)
  to protect against active movement of the drive
- Safe Stop 1 (SS1)
  for continuous monitoring of a safe braking ramp
- Safely Limited Speed (SLS)
  for protection against dangerous movements when a speed limit is exceeded (CU240E-2 DP-F Control Unit has up to 4 selectable SLS limit values)
- Safe direction (SDI)
  This function ensures that the drive can only rotate in the selected direction.
- Safe speed monitoring (SSM)
  This function signals if a drive operates below a specific speed/feed velocity (only CU240E-2 DP-F with PROFIsafe).

All integrated Safety functions can be implemented without having to use a motor encoder or encoder; implementation costs are minimal. Existing systems in particular can be simply updated with safety technology without the need to change the motor or mechanical system.

The STO function can be used without restriction for all applications. The SS1, SLS, SDI and SSM functions are only permissible for applications where the load can never accelerate when the inverter is switched off. They are therefore not permitted for applications involving pull-through loads such as hoisting gear and unwinders.

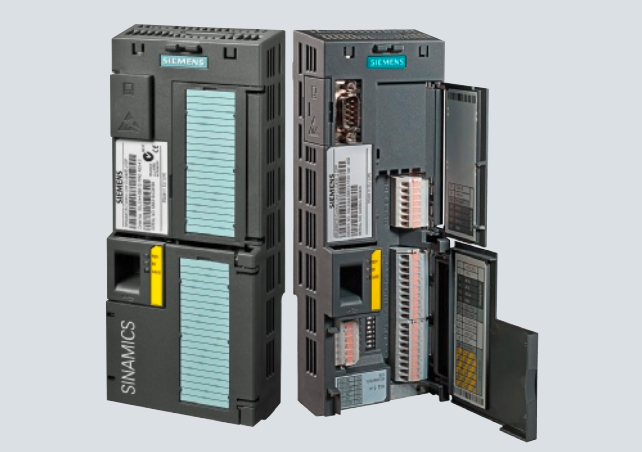
Additional information is provided in catalog D 31, chapter Highlights, section Safety Integrated.

Selection and ordering data

Technology functions (selection)	Inputs	Outputs	Integrated safety technology	Digital inputs, fail-safe	Communication	Designation	**Control Unit** Order No.
CU240 series – for standard applications in general machinery construction, such as conveyor belts, mixers and extruders							
• Free function blocks (FFB) • 1 x PID controller • Motor holding brake	6 digital 2 analog	3 digital 2 analog	STO	1 F-DI (opt. for each 2 DI)	RS485/USS / Modbus RTU	CU240E-2	**6SL3 244-0BB12-1BA1**
					PROFIBUS DP PROFIsafe	CU240E-2 DP	**6SL3 244-0BB12-1PA1**
			STO, SS1, SLS, SSM, SDI	3 F-DI (opt. for each 2 DI)	RS485/USS / Modbus RTU	CU240E-2 -F	**6SL3 244-0BB13-1BA1**
					PROFIBUS DP PROFIsafe	CU240E-2 DP-F	**6SL3 244-0BB13-1PA1**

Design

CU240E-2, CU240E-2 DP, CU240E-2-F and CU240E-2 DP-F Control Units



CU240E-2 Control Unit with open and closed terminal covers

Terminal No.	Signal	Features
Digital inputs (DI) – Standard		
5 … 8, 16, 17	DI0 … DI5	Freely programmable (isolated) 5.5 mA/24 V
69	DI COM1	Reference potential for digital inputs 0, 2, 4, 6
34	DI COM2	Reference potential for digital inputs 1, 3, 5, 7
Digital inputs (DI) – Fail-safe (formed from two standard inputs using the appropriate parameter setting)		
16, 17	F-DI0	Fail-safe digital inputs, 2 channels (redundant), freely programmable (isolated) 5.5 mA / 24 V
The following are only available for CU240E-2 F and CU240E-2 DP-F		
5, 6	F-DI1	Fail-safe digital inputs, 2 channels (redundant), freely programmable (isolated) 5.5 mA / 24 V
7, 8	F-DI2	Fail-safe digital inputs, 2 channels (redundant), freely programmable (isolated) 5.5 mA / 24 V
Digital outputs (DO)		
18	DO0, NC	Relay output DO0 NC contact (0.5 A, 30 V DC)
19	DO0, NO	Relay output DO0 NO contact (0.5 A, 30 V DC)
20	DO0, COM	Relay output DO0 Common contact (0.5 A, 30 V DC)
21	DO1+	Transistor output DO1 Positive (0.5 A, 30 V DC)
22	DO1-	Transistor output DO1 Negative (0.5 A, 30 V DC)
23	DO2, NC	Relay output DO2 NC contact (0.5 A, 30 V DC)
24	DO2, NO	Relay output DO2 NO contact (0.5 A, 30 V DC)
25	DO2, COM	Relay output DO2 Common contact (0.5 A, 30 V DC)

Terminal No.	Signal	Features
Analog inputs (AI)		
3	AI0+	Differential input, switchable between current, voltage Value range: 0 ... 10 V, -10 ... +10 V, 0/2 ... 10 V, 0/4 ... 20 mA
4	AI0-	
10	AI1+	Differential input, switchable between current, voltage Value range: 0 ... 10 V, -10 ... +10 V, 0/2 ... 10 V, 0/4 ... 20 mA
11	AI1-	
Analog outputs (AO)		
12	AO0+	Non-isolated output Freely programmable Value range: 0 ... 10 V; 0/4 ... 20 mA
13	AO0-	Reference potential of the AO0/internal electronics ground
26	AO1+	Non-isolated output Freely programmable Value range: 0 ... 10 V; 0/4 ... 20 mA
27	AO1-	Reference potential of the AO1/internal electronics ground
Motor temperature sensor interface		
14	T1 motor	Positive input for motor temperature sensor Type: PTC, KTY sensor, Thermo-Click
15	T2 motor	Negative input for motor temperature sensor
Power supply		
9	+24 V OUT	Power supply output 24 V DC, max. 200 mA
28	GND	Reference potential of the power supply/internal electronics ground
1	+10 V OUT	Power supply output 10 V DC ±0.5 V, max. 10 mA
2	GND	Reference potential of the power supply/internal electronics ground
31	+24 V IN	Power supply input 18 ... 30 V DC, max. 1500 mA
32	GND IN	Reference potential of the power supply input

SINAMICS G120 standard inverters 0.37 kW to 250 kW (0.5 hp to 400 hp)

Control Units

Technical specifications

Control Unit	CU240E-2 series 6SL3244-0BB1 . -1 . A1
Electrical specifications	
Operating voltage	24 V DC via the Power Module or by connecting to an external 18 ... 30 V DC power supply
Current consumption, max.	0.5 A
Protective insulation	PELV according to EN 50178 Protective separation from the line supply using double/reinforced insulation
Power loss	<5.5 W
Interfaces	
Digital inputs – Standard	6 isolated inputs Optically isolated, free reference potential (own potential group), max. input current 15 mA NPN/PNP logic can be selected using the wiring Switching level: 0 → 1: 11 V Switching level: 1 → 0: 5 V
Digital inputs – Fail-safe	1 (use of 2 × DI standard) Max. 3 (use of 6 × DI standard) for CU240E-2 F and CU240E-2 DP-F
Digital outputs	1 transistor 30 V DC, 0.5 A (ohmic load) 2 relay change-over contacts 30 V DC, 0.5 A (ohmic load)
Analog inputs – Standard	2 differential inputs Switchable using DIP switch between voltage and current: -10 ... +10 V, 0/4 ... 20 mA, 10-bit resolution The differential analog inputs can be configured as additional digital inputs. Switching thresholds: 0 → 1: Rated voltage 4 V 1 → 0: Rated voltage 1.6 V Analog inputs are protected against inputs in a voltage range of ± 30 V and have a common-mode voltage in the ± 15 V range
Analog inputs – Expanded	–
Analog outputs	2 non-isolated outputs Switchable between voltage and current using parameter setting: 0 ... 10 V, 0/4 ... 20 mA Voltage mode: 10 V, min. burden 10 kΩ Current mode: 20 mA, max. burden 500 Ω The analog outputs have short circuit protection
PTC/KTY interface	1 motor temperature sensor input, sensors that can be connected: PTC, KTY and Thermo-Click, accuracy ±5 °C
Removable terminal connector for I/O interface	✓

Control Unit	CU240E-2 series 6SL3244-0BB1 . -1 . A1
Integrated bus interface	
USS/Modbus RTU RS485 connected at a terminal, isolated, bus terminating resistors can be switched in, slave address can be set using DIP switches USS: max. 187.5 kBaud Modbus RTU:19.2 kBaud	CU240E-2 6SL3244-0BB12-1BA1 CU240E-2 F 6SL3244-0BB13-1BA1
PROFIBUS DP 9-pin SUB-D connector, isolated, PROFIdrive profile V4.1, slave address can be set using DIP switches Max. 12 Mbit/s	CU240E-2 DP 6SL3244-0BB12-1PA1 CU240E-2 DP-F 6SL3244-0BB13-1PA1
Tool interfaces	
Memory card	1 SINAMICS micro memory card (MMC) or 1 SIMATIC memory card (SD card)
Operator panels	• IOP Supported connection options between CU230P-2 and IOP: can be directly plugged on, door mounting or handheld (IOP Handheld not possible in combination with PM230) • BOP-2 Supported connection options between CU230P-2 and BOP-2: can be directly plugged on or door-mounted
PC interface	USB (connection via PC inverter connection kit 2)
Open-loop/closed-loop control techniques	
***V/f* linear/square/ parameterizable**	✓
***V/f* with flux current control (FCC)**	✓
***V/f* ECO linear/square**	✓
Vector control, sensorless	✓
Vector control, with sensor	–
Torque control, sensorless	✓
Torque control, with sensor	–

Technical specifications

Control Unit	CU240E-2 series 6SL3244-0BB1 . -1 . A1
Software functions	
Application macro	✓
Setpoint input, can be parameterized	✓
Fixed frequencies	16, parameterizable
JOG	✓
Digital motorized potentiometer (MOP)	✓
Ramp smoothing	✓
Extended ramp-function generator (with ramp smoothing Off3)	✓
Slip compensation	✓
Signal interconnection with BICO technology	✓
Trace	✓
Energy saving display	✓
Switchable drive data sets (DDS)	✓ (4)
Switchable command data sets (CDS)	✓ (4)
Free function blocks (FFB) for logical and arithmetic operations	✓
Technology controller (internal PID)	✓
Flying restart	✓
Automatic restart after line supply failure or operating fault (AR)	✓
Thermal motor protection	✓ (I^2t, sensor: PTC/KTY/Thermo-Click)

Control Unit	CU240E-2 series 6SL3244-0BB1 . -1 . A1
Software functions	
Thermal inverter protection	✓
Motor identification	✓
Motor holding brake	✓
Auto-ramping (V_{dcmax} controller)	✓
Kinetic buffering (V_{dcmin} controller)	✓
Braking functions for PM240 • DC braking • Compound braking • Dynamic braking with integrated braking chopper	✓
Braking functions for PM250/PM250-2 Regenerative feedback	✓
Mechanical specifications and ambient conditions	
Degree of protection	IP20
Signal cable cross-section	
• Min.	0.05 mm^2 (AWG30)
• Max.	1.5 mm^2 (AWG16)
Operating temperature	0 ... 50 °C (32 ... 122 °F)
Storage temperature	-40 ... +70 °C (-40 ... +158 °F)
Relative humidity	<95 % RH, condensation not permissible
Dimensions	
• Width	73 mm (2.87 in)
• Height	199 mm (7.83 in)
• Depth	46 mm (1.81 in)
Weight, approx.	0.49 kg (1.08 lb)

SINAMICS G120 standard inverters 0.37 kW to 250 kW (0.5 hp to 400 hp)

Power Modules

Overview

PM240 Power Modules – 0.37 kW to 250 kW (0.5 hp to 400 hp), IP20 degree of protection

PM240 Power Modules, frame sizes FSA to FSGX

PM240 Power Modules have a braking chopper (four-quadrant applications) and are suitable for a large number of applications in general machinery construction.

The braking chopper is already integrated in frame sizes FSA up to FSF. For frame size FSGX, an optional pluggable Braking Module can be ordered (see DC link components).

The permissible cable lengths between inverter and motor are limited. Longer cables can be used if output reactors are connected (see load-side power components).

Line reactors are available to minimize line harmonics as well as voltage and current peaks (see line-side components).

Frame size FSA of the PM240 Power Module is available only without integrated line filter class A. A base filter is therefore available so that class A can be achieved. A class B base filter is also available so that class B can be achieved (see line-side components).

Frame sizes FSB and FSC of the PM240 Power Module are available both with and without integrated line filter to class A. To achieve class B, PM240 Power Modules with integrated line filter class A must be additionally equipped with a base filter class B (see line-side components).

The PM240 Power Module is suitable for safety-oriented applications. In conjunction with a fail-safe Control Unit, the drive can be transformed into a Safety Integrated drive (see Control Units).

Power Modules with integrated line filter class A are suitable for connection to TN systems. Power Modules without integrated line filter can be connected to grounded TN/TT systems and non-grounded IT systems.

Overview

PM250 Power Modules – 7.5 kW to 75 kW (10 hp to 100 hp), IP20 degree of protection

PM250 Power Modules, frame sizes FSC to FSF

PM250 Power Modules are suitable for many applications in general machinery construction, the same as for the PM240. Any braking energy is directly fed back into the line supply (four quadrant applications – a braking chopper is not required).

The PM250 Power Module features an absolutely unique technology – Efficient Infeed Technology. This feature provides the ability to feed energy back into the supply system in the generator mode (electronic braking) so that the energy is not wasted in a braking resistor. This saves space in the control cabinet. The time-consuming process of dimensioning the braking resistor and the expense of the extra wiring are eliminated. Furthermore, heat losses in the control cabinet are reduced.

Additional information is included in catalog D 31, chapter Highlights, section Efficient Infeed Technology.

Further, the innovative circuit design reduces the line harmonics. There is no need to use an optional line reactor at the supply infeed. This saves space and costs for engineering and procurement.

The permissible cable lengths between inverter and motor are limited. Longer cables can be used if output reactors are connected (see load-side power components).

Frame sizes FSD to FSF of the PM250 Power Modules are available both with as well as without integrated line filter class A.

For frame size FSC of the PM250 Power Module with an integrated line filter class A, an additional base filter class B is available for achieving class B (see line-side components).

The PM250 Power Module is also designed for safety-oriented applications. In conjunction with a fail-safe Control Unit, the drive can be transformed into a Safety Integrated drive (see Control Units).

The PM250 Power Modules with integrated line filter class A are suitable for connection to TN supply systems. Power Modules without integrated line filter can be connected to grounded TN/TT systems and non-grounded IT systems.

Overview

PM260 Power Modules – 11 kW to 55 kW (15 hp to 75 hp), IP20 degree of protection

PM260 Power Module, frame size FSD

PM260 Power Modules have been designed for applications from 500 V to 690 V. They are capable of energy recovery and include a sine-wave filter to reduce the stress on the motor and for long cable lengths.

The PM260 Power Module features an absolutely unique technology – Efficient Infeed Technology. This feature provides the ability to feed energy back into the supply system in the generator mode (electronic braking) so that the energy is not wasted in a braking resistor. This saves space in the control cabinet. The time-consuming process of dimensioning the braking resistor and the expense of the extra wiring are eliminated. Furthermore, heat losses in the control cabinet are reduced.

Additional information is included in catalog D 31, chapter Highlights, section Efficient Infeed Technology.

The innovative circuit design used in Efficient Infeed Technology reduces the line harmonics. There is no need to use an optional line reactor at the supply infeed. This saves space and costs for engineering and procurement.

The PM260 Power Modules are also characterized by a higher rated pulse frequency combined with a high efficiency and an integrated sine-wave filter. The integrated sine-wave filter ensures that the inverter output current is sinusoidal and supports cable lengths of up to 200 m (656 ft) shielded and 300 m (984 ft) unshielded. An output reactor is therefore not required. Furthermore, lower bearing currents flow and there is a lower voltage stress that reduces the overall stress on the motor.

The use of SiC free-wheeling diodes – an absolutely unique innovation – makes the PM260 Power Module extremely compact. It is also highly resistant to thermal loading and operates very quietly as a result of the high clock frequencies.

Standard motors can be used in conjunction with the PM260 Power Module. The winding system insulation strength does not have to be increased.

The PM260 Power Module is suitable for safety-oriented applications. In conjunction with a fail-safe Control Unit, the drive can be transformed into a Safety Integrated drive (see Control Units).

The PM260 Power Modules with integrated line filter class A are suitable for connection to TN supply systems. Power Modules without integrated line filter can be connected to grounded TN/TT systems and non-grounded IT systems.

Customer benefits

- Low switching losses at high fundamental frequency
- High speeds possible
- Quiet operation thanks to the 16 kHz pulse frequency
- High thermal load capacity (small heat sinks)
- Very compact units
- Increased ruggedness
- High efficiency
- Low forward losses
- Integrated sine-wave filter, so that long unshielded cables can be used
- Can be used with motors without a special insulation
- Very low bearing currents, no bearing insulation requiredg

Selection and ordering data

To ensure that a suitable Power Module is selected, the following currents should be used for applications:

- **Rated output current for applications with low overload (LO)**
- **Base load current for applications with high overload (HO)**

With reference to the rated output current, the modules support at least 2-pole to 6-pole low-voltage motors, e.g. the new 1LE1 motor series. The rated power is merely a guide value. For a description of the overload performance, please refer to the general technical specifications of the Power Modules.

PM250 Power Modules

Rated power [1]		Rated output current I_{rated} [2]	Power based on the base load current [3]		Base load current I_H [3]	Frame size	**PM250 Power Module without integrated line filter**	**PM250 Power Module with integrated line filter class A**
kW	hp	A	**kW**	hp	A		Order No.	Order No.
380 … 480 V 3 AC								
7.5	10	18	**5.5**	7.5	13.2	FSC	–	**6SL3 225-0BE25-5AA1**
11.0	15	25	**7.5**	10	19	FSC	–	**6SL3 225-0BE27-5AA1**
15.0	20	32	**11.0**	15	26	FSC	–	**6SL3 225-0BE31-1AA1**
18.5	25	38	**15.0**	20	32	FSD	**6SL3 225-0BE31-5UA0**	**6SL3 225-0BE31-5AA0**
22	30	45	**18.5**	25	38	FSD	**6SL3 225-0BE31-8UA0**	**6SL3 225-0BE31-8AA0**
30	40	60	**22**	30	45	FSD	**6SL3 225-0BE32-2UA0**	**6SL3 225-0BE32-2AA0**
37	50	75	**30**	40	60	FSE	**6SL3 225-0BE33-0UA0**	**6SL3 225-0BE33-0AA0**
45	60	90	**37**	50	75	FSE	**6SL3 225-0BE33-7UA0**	**6SL3 225-0BE33-7AA0**
55	75	110	**45**	60	90	FSF	**6SL3 225-0BE34-5UA0**	**6SL3 225-0BE34-5AA0**
75	100	145	**55**	75	110	FSF	**6SL3 225-0BE35-5UA0**	**6SL3 225-0BE35-5AA0**
90	125	178	**75**	100	145	FSF	**6SL3 225-0BE37-5UA0**	**6SL3 225-0BE37-5AA0**

[1] Rated power based on the rated output current I_{rated}. The rated output current I_{rated} is based on the duty cycle for low overload (LO).

[2] The rated output current I_{rated} is based on the duty cycle for low overload (LO). These current values are valid for 400 V and are specified on the rating plate of the Power Module.

[3] The base load current I_H is based on the duty cycle for high overload (HO).

SINAMICS G120 standard inverters 0.37 kW to 250 kW (0.5 hp to 400 hp)

Power Modules

Selection and ordering data

PM240 Power Modules

Rated power [1]		Rated output current I_{rated} [2]	Power based on the base load current [3]		Base load current I_H [3]	Frame size	PM240 Power Module without integrated line filter	PM240 Power Module with integrated line filter class A
kW	hp	A	kW	hp	A		Order No.	Order No.
380 … 480 V 3 AC								
0.37	0.50	1.3	**0.37**	0.50	1.3	FSA	**6SL3 224-0BE13-7UA0**	–
0.55	0.75	1.7	**0.55**	0.75	1.7	FSA	**6SL3 224-0BE15-5UA0**	–
0.75	1.0	2.2	**0.75**	1.0	2.2	FSA	**6SL3 224-0BE17-5UA0**	–
1.1	1.5	3.1	**1.1**	1.5	3.1	FSA	**6SL3 224-0BE21-1UA0**	–
1.5	2.0	4.1	**1.5**	2.0	4.1	FSA	**6SL3 224-0BE21-5UA0**	–
2.2	3.0	5.9	**2.2**	3.0	5.9	FSB	**6SL3 224-0BE22-2UA0**	**6SL3 224-0BE22-2AA0**
3.0	4.0	7.7	**3.0**	4.0	7.7	FSB	**6SL3 224-0BE23-0UA0**	**6SL3 224-0BE23-0AA0**
4.0	5.0	10.2	**4.0**	5.0	10.2	FSB	**6SL3 224-0BE24-0UA0**	**6SL3 224-0BE24-0AA0**
7.5	10	18	**5.5**	7.5	13.2	FSC	**6SL3 224-0BE25-5UA0**	**6SL3 224-0BE25-5AA0**
11.0	15	25	**7.5**	10	19	FSC	**6SL3 224-0BE27-5UA0**	**6SL3 224-0BE27-5AA0**
15.0	20	32	**11.0**	15	26	FSC	**6SL3 224-0BE31-1UA0**	**6SL3 224-0BE31-1AA0**
18.5	25	38	**15.0**	20	32	FSD	**6SL3 224-0BE31-5UA0**	**6SL3 224-0BE31-5AA0**
22	30	45	**18.5**	25	38	FSD	**6SL3 224-0BE31-8UA0**	**6SL3 224-0BE31-8AA0**
30	40	60	**22**	30	45	FSD	**6SL3 224-0BE32-2UA0**	**6SL3 224-0BE32-2AA0**
37	50	75	**30**	40	60	FSE	**6SL3 224-0BE33-0UA0**	**6SL3 224-0BE33-0AA0**
45	60	90	**37**	50	75	FSE	**6SL3 224-0BE33-7UA0**	**6SL3 224-0BE33-7AA0**
55	75	110	**45**	60	90	FSF	**6SL3 224-0BE34-5UA0**	**6SL3 224-0BE34-5AA0**
75	100	145	**55**	75	110	FSF	**6SL3 224-0BE35-5UA0**	**6SL3 224-0BE35-5AA0**
90	125	178	**75**	100	145	FSF	**6SL3 224-0BE37-5UA0**	**6SL3 224-0BE37-5AA0**
110	150	205	**90**	125	178	FSF	**6SL3 224-0BE38-8UA0**	–
132	200	250	**110**	150	205	FSF	**6SL3 224-0BE41-1UA0**	–
160	250	302	**132**	200	250	FSGX	**6SL3 224-0XE41-3UA0**	–
200	300	370	**160**	250	302	FSGX	**6SL3 224-0XE41-6UA0**	–
250	400	477	**200**	300	370	FSGX	**6SL3 224-0XE42-0UA0**	–

PM260 Power Modules

Rated power [1]		Rated output current I_{rated} [4]	Power based on the base load current [3]		Base load current I_H [3]	Frame size	PM260 Power Module without integrated line filter	PM260 Power Module with integrated line filter class A
kW	hp	A	kW	hp	A		Order No.	Order No.
500 … 690 V 3 AC								
11.0	15	14	**7.5**	10	10	FSD	**6SL3 225-0BH27-5UA1**	**6SL3 225-0BH27-5AA1**
15.0	20	19	**11**	15	14	FSD	**6SL3 225-0BH31-1UA1**	**6SL3 225-0BH31-1AA1**
18.5	25	23	**15**	20	19	FSD	**6SL3 225-0BH31-5UA1**	**6SL3 225-0BH31-5AA1**
30	40	35	**22**	30	26	FSF	**6SL3 225-0BH32-2UA1**	**6SL3 225-0BH32-2AA1**
37	50	42	**30**	40	35	FSF	**6SL3 225-0BH33-0UA1**	**6SL3 225-0BH33-0AA1**
55	75	62	**37**	50	42	FSF	**6SL3 225-0BH33-7UA1**	**6SL3 225-0BH33-7AA1**

[1] Rated power based on the rated output current I_{rated}. The rated output current I_{rated} is based on the duty cycle for low overload (LO).

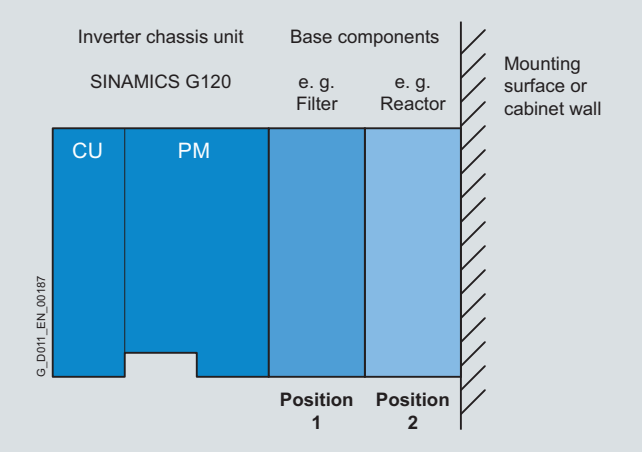
[2] The rated output current I_{rated} is based on the duty cycle for low overload (LO). These current values are valid for 400 V and are specified on the rating plate of the Power Module.

[3] The base load current I_H is based on the duty cycle for high overload (HO).

[4] The rated output current I_{rated} is based on the duty cycle for low overload (LO). These current values are valid for 690 V and are specified on the rating plate of the Power Module.

Integration

General design information



Inverter comprising a Power Module (PM) and a Control Unit (CU) and two base components at position 1 and position 2 (side view)

- A maximum of two base components plus inverter are possible.
- If at all possible, the line filter should be mounted directly below the inverter (position 1).
- With lateral mounting, the line-side components have to be mounted on the left side of the inverter, and the load-side components on the right side.
- Braking resistors have to be mounted directly on the control cabinet wall due to heating issues.
- This mounting type is always used for the PM240 and PM250 built-in units.

Recommended installation combinations of the inverter and optional power and DC link components

Power Module	**Base**		**Lateral mounting**	
Frame size	**Position 1**	**Position 2**	Left of the inverter (for line-side power components)	Right of the inverter (for load-side power components and DC link components)
FSA	Line filter	Line reactor	–	Output reactor or sine-wave filter and/or braking resistor
	Line filter or line reactor	Output reactor or sine-wave filter	–	Braking resistor
	Line filter or line reactor	Braking resistor	–	–
	Line filter or line reactor or braking resistor	–	–	–
FSA and FSB	Line filter	Line reactor	–	Output reactor or sine-wave filter and/or braking resistor
	Line filter or line reactor	Output reactor	–	Braking resistor
	Line filter or line reactor	Braking resistor	–	–
	Line filter or line reactor or braking resistor or sine-wave filter	–	–	–
FSC	Line filter	Line reactor	–	Output reactor or sine-wave filter and/or braking resistor
	Line filter or line reactor	Output reactor	–	Braking resistor
FSD and FSE	Line reactor	–	Line filter	Output reactor or sine-wave filter and/or braking resistor
FSF	–	–	Line filter and/or line reactor	Output reactor or sine-wave filter and/or braking resistor
FSGX	–	–	Line filter and/or line reactor	Output reactor or sine-wave filter and/or braking resistor

SINAMICS G120 standard inverters 0.37 kW to 250 kW (0.5 hp to 400 hp)

Power Modules

Integration

Maximum permissible cable lengths from the motor to the inverter when using output reactors or sine-wave filters depending on the voltage range and the Power Module being used

The following load-side power components in the appropriate frame sizes are optionally available for the Power Modules and result in the following maximum cable lengths:

	Maximum permissible motor cable lengths (shielded/unshielded) in m (ft)						
Frame size	FSA	FSB	FSC	FSD	FSE	FSF	FSGX
PM240 Power Module with integrated braking chopper							**without integrated braking chopper**
Available frame sizes	✓	✓	✓	✓	✓	✓	✓
Without output reactor/sine-wave filter	50/100 (164/328)	50/100 (164/328)	50/100 (164/328)	50/100 (164/328)	100/100 (328/328)	150/150 (492/492)	300/450 (984/1476)
With optional output reactor							
• At 380 -10 % ... 400 V 3 AC	150/225 (492/738)	150/225 (492/738)	150/225 (492/738)	200/300 (656/984)	200/300 (656/984)	200/300 (656/984)	300/340 (984/1116)
• At 401 ... 480 V 3 AC +10 %	100/150 (328/492)	100/150 (328/492)	100/150 (328/492)	200/300 (656/984)	200/300 (656/984)	200/300 (656/984)	300/340 (984/1116)
With optional sine-wave filter							
• At 380 -10 % ... 400 V 3 AC	200/300 (656/984)	200/300 (656/984)	200/300 (656/984)	200/300 (656/984)	200/300 (656/984)	200/300 (656/984)	300/340 (984/1116)
• At 401 ... 480 V 3 AC +10 %	200/300 (656/984)	200/300 (656/984)	200/300 (656/984)	200/300 (656/984)	200/300 (656/984)	200/300 (656/984)	300/340 (984/1116)
PM250 Power Module with line-commutated energy recovery							
Available frame sizes	–	–	✓	✓	✓	✓	–
Without output reactor/sine-wave filter	–	–	50/100 (164/328)	50/100 (164/328)	50/100 (164/328)	50/100 (164/328)	–
With optional output reactor							
• At 380 -10 % ... 400 V 3 AC	–	–	150/225 (492/738)	200/300 (656/984)	200/300 (656/984)	200/300 (656/984)	–
• At 401 ... 480 V 3 AC +10 %	–	–	100/150 (328/492)	200/300 (656/984)	200/300 (656/984)	200/300 (656/984)	–
With optional sine-wave filter							
• At 380 -10 % ... 400 V 3 AC	–	–	200/300 (656/984)	200/300 (656/984)	200/300 (656/984)	200/300 (656/984)	–
• At 401 ... 480 V 3 AC +10 %	–	–	200/300 (656/984)	200/300 (656/984)	200/300 (656/984)	200/300 (656/984)	–
PM260 Power Module with line-commutated energy recovery and integrated sine-wave filter							
Available frame sizes	–	–	–	✓	–	✓	–
With integrated sine-wave filter							
• At 500 ... 690 V 3 AC ±10 %	–	–	–	200/300 (656/984)	–	200/300 (656/984)	–

Technical specifications

General technical specifications

Power Modules	PM240	PM250	PM260
System operating voltage	380 ... 480 V 3 AC ±10 %	380 ... 480 V 3 AC ±10 %	500 … 690 V 3 AC ±10 % For operation with 500 V -10 % linearly reduced – see derating characteristics
Line supply requirements **Line short circuit voltage u_K**	For u_K < 1 %, a line reactor is recommended	u_K < 1 %	u_K < 1 %
Input frequency	47 … 63 Hz	47 … 63 Hz	47 … 63 Hz
Output frequency			
• Control type *V/f*	0 … 650 Hz	0 … 650 Hz	0 … 200 Hz
• Control type Vector	0 … 200 Hz	0 … 200 Hz	0 … 200 Hz
Pulse frequency	Up to 75 kW HO: 4 kHz From 90 kW HO: 2 kHz Higher pulse frequencies up to 16 kHz, see derating data	4 kHz (standard) Higher pulse frequencies up to 16 kHz, see derating data	16 kHz (standard)
Power factor	0.7 ... 0.85	0.9	0.95
cos φ	0.95	1.05	1.05
Inverter efficiency	95 ... 98 %	95 ... 97 %	95 ... 97 %
Output voltage, max.	0 ... 95 % of input voltage	0 ... 87 % of input voltage	0 ... 87 % of input voltage
Overload capability			
• Low overload (LO)	1.1 × rated output current (i.e. 110 % overload) for 57 s with a cycle time of 300 s 1.5 × rated output current (i.e. 150 % overload) for 3 s with a cycle time of 300 s	1.1 × rated output current (i.e. 110 % overload) for 57 s with a cycle time of 300 s 1.5 × rated output current (i.e. 150 % overload) for 3 s with a cycle time of 300 s	1.1 x rated output current (i.e. 110 % overload) for 57 s with a cycle time of 300 s 1.4 × rated output current (i.e. 140 % overload) for 3 s with a cycle time of 300 s
• High overload (HO)	Up to 75 kW (HO): 1.5 x rated output current (i.e. 150 % overload) for 57 s with a cycle time of 300 s 2 × rated output current (i.e. 200 % overload) for 3 s with a cycle time of 300 s From 90 kW (HO): 1.36 x rated output current (i.e. 136 % overload) for 57 s with a cycle time of 300 s 1.6 × rated output current (i.e. 160 % overload) for 3 s with a cycle time of 300 s	1.5 x rated output current (i.e. 150 % overload) for 57 s with a cycle time of 300 s 2 × rated output current (i.e. 200 % overload) for 3 s with a cycle time of 300 s	1.5 x rated output current (i.e. 150 % overload) for 57 s with a cycle time of 300 s 2 × rated output current (i.e. 200 % overload) for 3 s with a cycle time of 300 s
Electromagnetic compatibility	Optional line filter class A or B acc. to EN 55011 is available	Optional line filter class A or B acc. to EN 55011 is available	Optional line filter class A acc. to EN 55011 is available
Possible braking methods	DC braking Compound braking Dynamic braking with integrated braking chopper (optional for frame size FSGX)	Regenerative feedback in generator mode	Regenerative feedback in generator mode
Degree of protection	IP20	IP20	IP20

SINAMICS G120 standard inverters 0.37 kW to 250 kW (0.5 hp to 400 hp)

Power Modules

Technical specifications

General technical specifications

Power Modules	PM240	PM250	PM260
Operating temperature			
• Low overload (LO)	Frame sizes FSA to FSF: 0 … 40 °C (32 … 104 °F) without derating >40 … 60 °C (>104 … 140 °F) see derating characteristics Frame size FSGX: 0 … 40 °C (32 … 104 °F) without derating >40 … 55 °C (>104 … 131 °F) see derating characteristics	0 … 40 °C (32 … 104 °F) without derating >40 … 60 °C (>104 … 140 °F) see derating characteristics	0 … 40 °C (32 … 104 °F) without derating >40 … 60 °C (>104 … 140 °F) see derating characteristics
• High overload (HO)	Frame sizes FSA to FSF: 0 … 50 °C (32 … 122 °F) without derating >50 … 60 °C (>122 … 140 °F) see derating characteristics Frame size FSGX: 0 … 40 °C (32 … 104 °F) without derating >40 … 55 °C (>104 … 131 °F) see derating characteristics	0 … 50 °C (32 … 122 °F) without derating >50 … 60 °C (>122 … 140 °F) see derating characteristics	0 … 50 °C (32 … 122 °F) without derating >50 … 60 °C (>122 … 140 °F) see derating characteristics
Storage temperature	-40 … +70 °C (-40 … +158 °F)		
Relative humidity	<95 % RH, condensation not permissible		
Cooling	Internal ventilation, power units with increased air cooling by built-in fans	Internal ventilation, power units with increased air cooling by built-in fans	Internal ventilation, power units with increased air cooling by built-in fans
Installation altitude	Up to 1000 m (3281 ft) above sea level without power reduction, > 1000 m (3281 ft) see derating characteristics		
Protection functions	• Undervoltage • Overvoltage • Overcontrol/overload • Ground fault • Short circuit • Stall protection • Motor blocking protection • Motor overtemperature • Inverter overtemperature • Parameter locking		
Standard SCCR (Short Circuit Current Rating) [1]	65 kA	Frame size FSC 10 kA Frame sizes FSD up to FSF 42 kA	42 kA
Compliance with standards	UL, cUL, CE, c-tick, SEMI F47	UL, cUL, CE, c-tick	CE
CE marking	According to Low-Voltage Directive 2006/95/EC		

[1] Applies to industrial control cabinet installations to NEC article 409/UL 508A.

[2] UL approval for frame sizes FSD to FSF will be available soon.

Technical specifications

PM240 Power Modules

Line voltage 380 … 480 V 3 AC		PM240 Power Modules 6SL3 224-				
Without integrated line filter		0BE13-7UA0	0BE15-5UA0	0BE17-5UA0	0BE21-1UA0	0BE21-5UA0
Output current at 50 Hz 400 V 3 AC						
• Rated current I_{rated} [1]	A	1.3	1.7	2.2	3.1	4.1
• Base load current I_L [1]	A	1.3	1.7	2.2	3.1	4.1
• Base load current I_H [2]	A	1.3	1.7	2.2	3.1	4.1
• I_{max}	A	2.6	3.4	4.4	6.2	8.2
Rated power						
• Based on I_L	kW (hp)	0.37 (0.5)	0.55 (0.75)	0.75 (1.0)	1.1 (1.5)	1.5 (2.0)
• Based on I_H	kW (hp)	0.37 (0.5)	0.55 (0.75)	0.75 (1.0)	1.1 (1.5)	1.5 (2.0)
Rated pulse frequency	kHz	4	4	4	4	4
Efficiency η		0.97	0.97	0.97	0.97	0.97
Power loss at rated current	kW	0.09	0.1	0.1	0.1	0.11
Cooling air requirement	m^3/s (ft^3/s)	0.005 (0.18)	0.005 (0.18)	0.005 (0.18)	0.005 (0.18)	0.005 (0.18)
Sound pressure level L_{pA} (1 m)	dB	<45	<45	<45	<45	<45
24 V DC power supply for the Control Unit	A	1	1	1	1	1
Rated input current [3]						
• With line reactor	A	1.4	1.8	2.3	3.2	4.3
• Without line reactor	A	1.7	2.1	2.6	3.9	4.9
Length of cable to braking resistor, max.	m (ft)	15 (49)	15 (49)	15 (49)	15 (49)	15 (49)
Line supply connection U1/L1, V1/L2, W1/L3		Screw terminals	Screw terminals	Screw terminals	Screw terminals	Screw terminals
• Conductor cross-section	mm^2	1 … 2.5	1 … 2.5	1 … 2.5	1 … 2.5	1 … 2.5
Motor connection U2, V2, W2		Screw terminals	Screw terminals	Screw terminals	Screw terminals	Screw terminals
• Conductor cross-section	mm^2	1 … 2.5	1 … 2.5	1 … 2.5	1 … 2.5	1 … 2.5
DC link connection, connection for the braking resistor DCP/R1, DCN, R2		Screw terminals	Screw terminals	Screw terminals	Screw terminals	Screw terminals
• Conductor cross-section	mm^2	1 … 2.5	1 … 2.5	1 … 2.5	1 … 2.5	1 … 2.5
PE connection		On housing with M4 screw	On housing with M4 screw	On housing with M4 screw	On housing with M4 screw	On housing with M4 screw
Motor cable length [4], **max.**						
• Shielded	m (ft)	50 (164)	50 (164)	50 (164)	50 (164)	50 (164)
• Unshielded	m (ft)	100 (328)	100 (328)	100 (328)	100 (328)	100 (328)
Degree of protection		IP20	IP20	IP20	IP20	IP20
Dimensions						
• Width	mm (in)	73 (2.87)	73 (2.87)	73 (2.87)	73 (2.87)	73 (2.87)
• Height	mm (in)	173 (6.81)	173 (6.81)	173 (6.81)	173 (6.81)	173 (6.81)
• Depth						
- Without Control Unit	mm (in)	145 (5.71)	145 (5.71)	145 (5.71)	145 (5.71)	145 (5.71)
- With Control Unit	mm (in)	210 (8.27)	210 (8.27)	210 (8.27)	210 (8.27)	210 (8.27)
Frame size		FSA	FSA	FSA	FSA	FSA
Weight, approx.	kg (lb)	1.1 (2.43)	1.1 (2.43)	1.1 (2.43)	1.1 (2.43)	1.1 (2.43)

[1] The rated output current I_{rated} and the base load current I_L are based on the duty cycle for low overload (LO).

[2] The base load current I_H is based on the duty cycle for high overload (HO).

[3] The input current depends on the motor load and line impedance. The input currents apply for rated power loading (based on I_{rated}) for a line impedance corresponding to u_K = 1 %. These current values without line reactor are specified on the rating plate of the Power Module.

[4] Max. motor cable length 25 m (82 ft) (shielded) for PM240 Power Modules with integrated line filter to maintain the limit values acc. to EN 61800-3 Category C2.

SINAMICS G120 standard inverters 0.37 kW to 250 kW (0.5 hp to 400 hp)

Power Modules

Technical specifications

Line voltage 380 … 480 V 3 AC		PM240 Power Modules 6SL3 224-...				
Without integrated line filter		0BE22-2UA0	0BE23-0UA0	0BE24-0UA0	0BE25-5UA0	0BE27-5UA0
With integrated line filter		0BE22-2AA0	0BE23-0AA0	0BE24-0AA0	0BE25-5AA0	0BE27-5AA0
Output current at 50 Hz 400 V 3 AC						
• Rated current I_{rated} [1]	A	5.9	7.7	10.2	18	25
• Base load current I_L [1]	A	5.9	7.7	10.2	18	25
• Base load current I_H [2]	A	5.9	7.7	10.2	13.2	19
• I_{max}	A	11.8	15.4	20.4	26.4	38
Rated power						
• Based on I_L	kW (hp)	2.2 (3.0)	3 (4)	4 (5)	7.5 (10)	11 (15)
• Based on I_H	kW (hp)	2.2 (3.0)	3 (4)	4 (5)	5.5 (7.5)	7.5 (10)
Rated pulse frequency	kHz	4	4	4	4	4
Efficiency η		0.95	0.95	0.95	0.95	0.95
Power loss at rated current	kW	0.14	0.16	0.18	0.24	0.30
Cooling air requirement	m^3/s (ft^3/s)	0.024 (0.85)	0.024 (0.85)	0.024 (0.85)	0.055 (1.94)	0.055 (1.94)
Sound pressure level L_{pA} (1 m)	dB	<50	<50	<50	<60	<60
24 V DC power supply for the Control Unit	A	1	1	1	1	1
Rated input current [3]						
• With line reactor	A	6.1	8	10.4	18.7	26
• Without line reactor	A	7.6	10.2	13.4	21.9	31.5
Length of cable to braking resistor, max.	m (ft)	15 (49)	15 (49)	15 (49)	15 (49)	15 (49)
Line supply connection U1/L1, V1/L2, W1/L3		Screw terminals	Screw terminals	Screw terminals	Screw terminals	Screw terminals
• Conductor cross-section	mm^2	1 … 6	1 … 6	1 … 6	2.5 … 10	2.5 … 10
Motor connection U2, V2, W2		Screw terminals	Screw terminals	Screw terminals	Screw terminals	Screw terminals
• Conductor cross-section	mm^2	1 … 6	1 … 6	1 … 6	2.5 … 10	2.5 … 10
DC link connection, connection for the braking resistor DCP/R1, DCN, R2		Screw terminals	Screw terminals	Screw terminals	Screw terminals	Screw terminals
• Conductor cross-section	mm^2	1 … 6	1 … 6	1 … 6	2.5 … 10	2.5 … 10
PE connection		On housing with M5 screw	On housing with M5 screw	On housing with M5 screw	On housing with M5 screw	On housing with M5 screw
Motor cable length [4], **max.**						
• Shielded	m (ft)	50 (164)	50 (164)	50 (164)	50 (164)	50 (164)
• Unshielded	m (ft)	100 (328)	100 (328)	100 (328)	100 (328)	100 (328)
Degree of protection		IP20	IP20	IP20	IP20	IP20
Dimensions						
• Width	mm (in)	153 (6.02)	153 (6.02)	153 (6.02)	189 (7.44)	189 (7.44)
• Height	mm (in)	270 (10.63)	270 (10.63)	270 (10.63)	334 (13.15)	334 (13.15)
• Depth						
- Without Control Unit	mm (in)	165 (6.50)	165 (6.50)	165 (6.50)	185 (7.28)	185 (7.28)
- With Control Unit	mm (in)	230 (9.06)	230 (9.06)	230 (9.06)	250 (9.84)	250 (9.84)
Frame size		FSB	FSB	FSB	FSC	FSC
Weight, approx.	kg (lb)	4 (8.8)	4 (8.8)	4 (8.8)	7 (15.4)	7 (15.4)

[1] The rated output current I_{rated} and the base load current I_L are based on the duty cycle for low overload (LO).

[2] The base load current I_H is based on the duty cycle for high overload (HO).

[3] The input current depends on the motor load and line impedance. The input currents apply for rated power loading (based on I_{rated}) for a line impedance corresponding to u_K = 1 %. These current values without line reactor are specified on the rating plate of the Power Module.

[4] Max. motor cable length 25 m (82 ft) (shielded) for PM240 Power Modules with integrated line filter to maintain the limit values acc. to EN 61800-3 Category C2.

Technical specifications

Line voltage 380 … 480 V 3 AC		PM240 Power Modules 6SL3 224-...				
Without integrated line filter		0BE31-1UA0	0BE31-5UA0	0BE31-8UA0	0BE32-2UA0	0BE33-0UA0
With integrated line filter		0BE31-1AA0	0BE31-5AA0	0BE31-8AA0	0BE32-2AA0	0BE33-0AA0
Output current at 50 Hz 400 V 3 AC						
• Rated current I_{rated} [1]	A	32	38	45	60	75
• Base load current I_L [1]	A	32	38	45	60	75
• Base load current I_H [2]	A	26	32	38	45	60
• I_{max}	A	52	64	76	90	124
Rated power						
• Based on I_L	kW (hp)	15 (20)	18.5 (25)	22 (30)	30 (40)	37 (50)
• Based on I_H	kW (hp)	11 (15)	15 (20)	18.5 (25)	22 (30)	30 (40)
Rated pulse frequency	kHz	4	4	4	4	4
Efficiency η		>0.97	>0.97	>0.97	>0.97	>0.97
Power loss at rated current	kW	0.4	0.42	0.52	0.69	0.99
Cooling air requirement	m^3/s (ft^3/s)	0.055 (1.94)	0.055 (1.94)	0.055 (1.94)	0.055 (1.94)	0.055 (1.94)
Sound pressure level L_{pA} (1 m)	dB	<60	<60	<60	<61	<60
24 V DC power supply for the Control Unit	A	1	1	1	1	1
Rated input current [3]						
• With line reactor	A	33	40	47	63	78
• Without line reactor	A	39	46	53	72	88
Length of cable to braking resistor, max.	m (ft)	15 (49)	15 (49)	15 (49)	15 (49)	15 (49)
Line supply connection U1/L1, V1/L2, W1/L3		Screw terminals	M6 screw stud	M6 screw stud	M6 screw stud	M6 screw stud
• Conductor cross-section	mm^2	2.5 … 10	10 … 50	10 … 50	10 … 50	10 … 50
Motor connection U2, V2, W2		Screw terminals	M6 screw stud	M6 screw stud	M6 screw stud	M6 screw stud
• Conductor cross-section	mm^2	2.5 … 10	10 … 50	10 … 50	10 … 50	10 … 50
DC link connection, connection for the braking resistor DCP/R1, DCN, R2		Screw terminals	M6 screw stud	M6 screw stud	M6 screw stud	M6 screw stud
• Conductor cross-section	mm^2	2.5 … 10	10 … 50	10 … 50	10 … 50	10 … 50
PE connection		On housing with M5 screw	On housing with M6 screw	On housing with M6 screw	On housing with M6 screw	On housing with M6 screw
Motor cable length [4], max.						
• Shielded	m (ft)	50 (164)	50 (164)	50 (164)	50 (164)	100 (328)
• Unshielded	m (ft)	100 (328)	100 (328)	100 (328)	100 (328)	100 (328)
Degree of protection		IP20	IP20	IP20	IP20	IP20
Dimensions						
• Width	mm (in)	189 (7.44)	275 (10.83)	275 (10.83)	275 (10.83)	275 (10.83)
• Height						
- Without integrated line filter	mm (in)	334 (13.15)	419 (16.50)	419 (16.50)	419 (16.50)	499 (19.65)
- With integrated line filter	mm (in)	334 (13.15)	512 (20.16)	512 (20.16)	512 (20.16)	635 (25.0)
• Depth						
- Without Control Unit	mm (in)	185 (7.28)	204 (8.03)	204 (8.03)	204 (8.03)	204 (8.03)
- With Control Unit	mm (in)	250 (9.84)	260 (10.24)	260 (10.24)	260 (10.24)	260 (10.24)
Frame size		FSC	FSD	FSD	FSD	FSE
Weight, approx.						
• Without integrated line filter	kg (lb)	7 (15.4)	13 (28.7)	13 (28.7)	13 (28.7)	16 (35.3)
• With integrated line filter	kg (lb)	7 (15.4)	16 (35.3)	16 (35.3)	16 (35.3)	23 (50.7)

[1] The rated output current I_{rated} and the base load current I_L are based on the duty cycle for low overload (LO).

[2] The base load current I_H is based on the duty cycle for high overload (HO).

[3] The input current depends on the motor load and line impedance. The input currents apply for rated power loading (based on I_{rated}) for a line impedance corresponding to u_K = 1 %. These current values without line reactor are specified on the rating plate of the Power Module.

[4] Max. motor cable length 25 m (82 ft) (shielded) for PM240 Power Modules with integrated line filter to maintain the limit values acc. to EN 61800-3 Category C2.

SINAMICS G120 standard inverters 0.37 kW to 250 kW (0.5 hp to 400 hp)

Power Modules

Technical specifications

Line voltage 380 … 480 V 3 AC		**PM240 Power Modules** 6SL3 224-...					
Without integrated line filter		0BE33-7UA0	0BE34-5UA0	0BE35-5UA0	0BE37-5UA0	0BE38-8UA0	0BE41-1UA0
With integrated line filter		0BE33-7AA0	0BE34-5AA0	0BE35-5AA0	0BE37-5AA0	–	–
Output current at 50 Hz 400 V 3 AC							
• Rated current I_{rated} [1]	A	90	110	145	178	205	250
• Base load current I_L [1]	A	90	110	145	178	205	250
• Base load current I_H [2]	A	75	90	110	145	178	205
• I_{max}	A	150	180	220	290	308	375
Rated power							
• Based on I_L	kW (hp)	45 (60)	55 (75)	75 (100)	90 (125)	110 (150)	132 (200)
• Based on I_H	kW (hp)	37 (50)	45 (60)	55 (75)	75 (100)	90 (125)	110 (150)
Rated pulse frequency	kHz	4	4	4	4	2	2
Efficiency η		>0.97	>0.97	>0.97	>0.97	>0.97	>0.97
Power loss at rated current	kW	1.21	1.42	1.93	2.31	2.43	2.53
Cooling air requirement	m^3/s (ft^3/s)	2 × 0.055 (1.94)	0.15 (5.3)	0.15 (5.3)	0.15 (5.3)	0.15 (5.3)	0.15 (5.3)
Sound pressure level L_{pA} (1 m)	dB	<62	<60	<60	<65	<65	<65
24 V DC power supply for the Control Unit	A	1	1	1	1	1	1
Rated input current [3]							
• With line reactor	A	94	115	151	186	210	250
• Without line reactor	A	105	129	168	204	245	299
Length of cable to braking resistor, max.	m (ft)	15 (49)	15 (49)	15 (49)	15 (49)	15 (49)	15 (49)
Line supply connection U1/L1, V1/L2, W1/L3		M6 screw stud	M8 screw stud	M8 screw stud	M8 screw stud	M8 screw stud	M8 screw stud
• Conductor cross-section	mm^2	10 … 50	25 … 120	25 … 120	25 … 120	25 … 120	25 … 120
Motor connection U2, V2, W2		M6 screw stud	M8 screw stud	M8 screw stud	M8 screw stud	M8 screw stud	M8 screw stud
• Conductor cross-section	mm^2	10 … 50	25 … 120	25 … 120	25 … 120	25 … 120	25 … 120
DC link connection, connection for the braking resistor DCP/R1, DCN, R2		M6 screw stud	M8 screw stud	M8 screw stud	M8 screw stud	M8 screw stud	M8 screw stud
• Conductor cross-section	mm^2	10 … 50	25 … 120	25 … 120	25 … 120	25 … 120	25 … 120
PE connection		On housing with M6 screw	On housing with M8 screw	On housing with M8 screw	On housing with M8 screw	On housing with M8 screw	On housing with M8 screw
Motor cable length [4], max.							
• Shielded	m (ft)	50 (164)	50 (164)	50 (164)	50 (164)	50 (164)	50 (164)
• Unshielded	m (ft)	100 (328)	100 (328)	100 (328)	100 (328)	100 (328)	100 (328)
Degree of protection		IP20	IP20	IP20	IP20	IP20	IP20
Dimensions							
• Width	mm (in)	275 (10.83)	350 (13.78)	350 (13.78)	350 (13.78)	350 (13.78)	350 (13.78)
• Height							
- Without integrated line filter	mm (in)	499 (19.65)	634 (24.96)	634 (24.96)	634 (24.96)	634 (24.96)	634 (24.96)
- With integrated line filter	mm (in)	635 (25.0)	934 (36.77)	934 (36.77)	934 (36.77)	–	–
• Depth							
- Without Control Unit	mm (in)	204 (8.03)	316 (12.44)	316 (12.44)	316 (12.44)	316 (12.44)	316 (12.44)
- With Control Unit	mm (in)	260 (10.24)	372 (14.65)	372 (14.65)	372 (14.65)	372 (14.65)	372 (14.65)
Frame size		FSE	FSF	FSF	FSF	FSF	FSF
Weight, approx.							
• Without integrated line filter	kg (lb)	16 (35.3)	36 (79.4)	36 (79.4)	36 (79.4)	39 (86)	39 (86)
• With integrated line filter	kg (lb)	23 (50.7)	52 (115)	52 (115)	52 (115)	–	–

[1] The rated output current I_{rated} and the base load current I_L are based on the duty cycle for low overload (LO).

[2] The base load current I_H is based on the duty cycle for high overload (HO).

[3] The input current depends on the motor load and line impedance. The input currents apply for rated power loading (based on I_{rated}) for a line impedance corresponding to u_K = 1 %. These current values without line reactor are specified on the rating plate of the Power Module.

[4] Max. motor cable length 25 m (82 ft) (shielded) for PM240 Power Modules with integrated line filter to maintain the limit values acc. to EN 61800-3 Category C2.

Technical specifications

Line voltage 380 … 480 V 3 AC		**PM240 Power Modules** 6SL3 224-...		
Without integrated line filter		0XE41-3UA0	0XE41-6UA0	0XE42-0UA0
Output current at 50 Hz 400 V 3 AC				
• Rated current I_{rated} [1]	A	302	370	477
• Base load current I_L [1]	A	302	370	477
• Base load current I_H [2]	A	250	302	370
• I_{max}	A	400	483	592
Rated power				
• Based on I_L	kW (hp)	160 (250)	200 (300)	250 (400)
• Based on I_H	kW (hp)	132 (200)	160 (215)	200 (300)
Rated pulse frequency	kHz	2	2	2
Efficiency η		>0.98	>0.98	>0.98
Power loss at rated current	kW	3.9	4.4	5.5
Cooling air requirement	m^3/s (ft^3/s)	0.36 (12.7)	0.36 (12.7)	0.36 (12.7)
Sound pressure level L_{pA} (1 m)	dB	<69	<69	<69
24 V DC power supply for the Control Unit	A	1	1	1
Rated input current [3]				
• With line reactor	A	245	297	354
• Without line reactor	A	297	354	442
Length of cable to braking resistor, max.	m (ft)	50 (164)	50 (164)	50 (164)
Line supply connection U1/L1, V1/L2, W1/L3		M10 screw stud	M10 screw stud	M10 screw stud
• Conductor cross-section	mm^2	2 × 240	2 × 240	2 × 240
Motor connection U2, V2, W2		M10 screw stud	M10 screw stud	M10 screw stud
• Conductor cross-section	mm^2	2 × 240	2 × 240	2 × 240
PE connection		On housing with M10 screw	On housing with M10 screw	On housing with M10 screw
Motor cable length [4], **max.**				
• Shielded	m (ft)	300 (984)	300 (984)	300 (984)
• Unshielded	m (ft)	450 (1476)	450 (1476)	450 (1476)
Degree of protection		IP20	IP20	IP20
Dimensions				
• Width	mm (in)	326 (12.83)	326 (12.83)	326 (12.83)
• Height	mm (in)	1533 (60.35)	1533 (60.35)	1533 (60.35)
• Depth	mm (in)	547 (21.54)	547 (21.54)	547 (21.54)
Frame size		FSGX	FSGX	FSGX
Weight, approx.	kg (lb)	174 (384)	174 (384)	174 (384)

[1] The rated output current I_{rated} and the base load current I_L are based on the duty cycle for low overload (LO).

[2] The base load current I_H is based on the duty cycle for high overload (HO).

[3] The input current depends on the motor load and line impedance. The input currents apply for rated power loading (based on I_{rated}) for a line impedance corresponding to u_K = 1 %. These current values without line reactor are specified on the rating plate of the Power Module.

[4] Max. motor cable length 25 m (82 ft) (shielded) for PM240 Power Modules with integrated line filter to maintain the limit values acc. to EN 61800-3 Category C2.

Technical specifications

PM250 Power Modules

Line voltage 380 … 480 V 3 AC		**PM250 Power Modules** 6SL3 225-...		
With integrated line filter		0BE25-5AA1	0BE27-5AA1	0BE31-1AA1
Output current at 50 Hz 400 V 3 AC				
• Rated current I_{rated} [1]	A	18	25	32
• Base load current I_L [1]	A	18	25	32
• Base load current I_H [2]	A	13.2	19	26
• I_{max}	A	26.4	38	52
Rated power				
• Based on I_L	kW (hp)	7.5 (10)	11 (15)	15 (20)
• Based on I_H	kW (hp)	5.5 (7.5)	7.5 (10)	11 (15)
Rated pulse frequency	kHz	4	4	4
Efficiency η		0.95	0.95	0.95
Power loss at rated current	kW	0.26	0.28	0.31
Cooling air requirement	m^3/s (ft^3/s)	0.038 (1.34)	0.038 (1.34)	0.038 (1.34)
Sound pressure level L_{pA} (1 m)	dB	<60	<60	<60
24 V DC power supply for the Control Unit	A	1	1	1
Input current [3]				
• Rated current	A	18	25	32
• Current based on I_H	A	13.2	19	26
Line supply connection U1/L1, V1/L2, W1/L3		Screw terminals	Screw terminals	Screw terminals
• Conductor cross-section	mm^2	2.5 … 10	2.5 … 10	2.5 … 10
Motor connection U2, V2, W2		Screw terminals	Screw terminals	Screw terminals
• Conductor cross-section	mm^2	2.5 … 10	2.5 … 10	2.5 … 10
PE connection		On housing with M5 screw	On housing with M5 screw	On housing with M5 screw
Motor cable length, max.				
• Shielded	m (ft)	25 (82)	25 (82)	25 (82)
• Unshielded	m (ft)	100 (328)	100 (328)	100 (328)
Degree of protection		IP20	IP20	IP20
Dimensions				
• Width	mm (in)	189 (7.44)	189 (7.44)	189 (7.44)
• Height	mm (in)	334 (13.15)	334 (13.15)	334 (13.15)
• Depth				
- Without Control Unit	mm (in)	185 (7.28)	185 (7.28)	185 (7.28)
- With Control Unit	mm (in)	250 (9.84)	250 (9.84)	250 (9.84)
Frame size		FSC	FSC	FSC
Weight, approx.	kg (lb)	7.5 (16.5)	7.5 (16.5)	7.5 (16.5)

[1] The rated output current I_{rated} and the base load current I_L are based on the duty cycle for low overload (LO).

[2] The base load current I_H is based on the duty cycle for high overload (HO).

[3] The input current depends on the motor load and line impedance and applies for a line impedance corresponding to u_K = 1 %. The rated input currents apply for a load at rated power (based on I_{rated}) – these current values are specified on the rating plate.

Technical specifications

Line voltage 380 … 480 V 3 AC		PM250 Power Modules 6SL3 225-...		
Without integrated line filter		0BE31-5UA0	0BE31-8UA0	0BE32-2UA0
With integrated line filter		0BE31-5AA0	0BE31-8AA0	0BE32-2AA0
Output current at 50 Hz 400 V 3 AC				
• Rated current I_{rated} [1]	A	38	45	60
• Base load current I_L [1]	A	38	45	60
• Base load current I_H [2]	A	32	38	45
• I_{max}	A	64	76	90
Rated power				
• Based on I_L	kW (hp)	18.5 (25)	22 (30)	30 (40)
• Based on I_H	kW (hp)	15 (20)	18.5 (25)	22 (30)
Rated pulse frequency	kHz	4	4	4
Efficiency η		>0.97	>0.97	>0.97
Power loss at rated current	kW	0.42	0.52	0.68
Cooling air requirement	m^3/s (ft^3/s)	0.022 (0.78)	0.022 (0.78)	0.039 (1.38)
Sound pressure level L_{pA} (1 m)	dB	<60	<60	<61
24 V DC power supply for the Control Unit	A	1	1	1
Input current [3]				
• Rated current	A	36	42	56
• Based on I_H	A	30	36	42
Line supply connection U1/L1, V1/L2, W1/L3		M6 screw stud	M6 screw stud	M6 screw stud
• Conductor cross-section	mm^2	10 … 35	10 … 35	10 … 35
Motor connection U2, V2, W2		M6 screw stud	M6 screw stud	M6 screw stud
• Conductor cross-section	mm^2	10 … 35	10 … 35	10 … 35
PE connection		On housing with M6 screw	On housing with M6 screw	On housing with M6 screw
Motor cable length [4], **max.**				
• Shielded	m (ft)	50 (164)	50 (164)	50 (164)
• Unshielded	m (ft)	100 (328)	100 (328)	100 (328)
Degree of protection		IP20	IP20	IP20
Dimensions				
• Width	mm (in)	275 (10.83)	275 (10.83)	275 (10.83)
• Height				
- Without integrated line filter	mm (in)	419 (16.50)	419 (16.50)	419 (16.50)
- With integrated line filter	mm (in)	512 (20.16)	512 (20.16)	512 (20.16)
• Depth				
- Without Control Unit	mm (in)	204 (8.03)	204 (8.03)	204 (8.03)
- With Control Unit	mm (in)	260 (10.24)	260 (10.24)	260 (10.24)
Frame size		FSD	FSD	FSD
Weight, approx.				
• Without integrated line filter	kg (lb)	13 (28.7)	13 (28.7)	13 (28.7)
• With integrated line filter	kg (lb)	15 (33.1)	15 (33.1)	16 (35.3)

[1] The rated output current I_{rated} and the base load current I_L are based on the duty cycle for low overload (LO).

[2] The base load current I_H is based on the duty cycle for high overload (HO).

[3] The input current depends on the motor load and line impedance and applies for a line impedance corresponding to u_K = 1 %. The rated input currents apply for a load at rated power (based on I_{rated}) – these current values are specified on the rating plate.

[4] Max. motor cable length 25 m (82 ft) (shielded) for PM250 Power Modules with integrated line filter to maintain the limit values of EN 61800-3 Category C2.

SINAMICS G120 standard inverters 0.37 kW to 250 kW (0.5 hp to 400 hp)

Power Modules

Technical specifications

Line voltage 380 … 480 V 3 AC		PM250 Power Modules 6SL3 225-...				
Without integrated line filter		0BE33-0UA0	0BE33-7UA0	0BE34-5UA0	0BE35-5UA0	0BE37-5UA0
With integrated line filter		0BE33-0AA0	0BE33-7AA0	0BE34-5AA0	0BE35-5AA0	0BE37-5AA0
Output current at 50 Hz 400 V 3 AC						
• Rated current I_{rated} [1]	A	75	90	110	145	178
• Base load current I_L [1]	A	75	90	110	145	178
• Base load current I_H [2]	A	60	75	90	110	145
• I_{max}	A	120	150	180	220	290
Rated power						
• Based on I_L	kW (hp)	37 (50)	45 (60)	55 (75)	75 (100)	90 (125)
• Based on I_H	kW (hp)	30 (40)	37 (50)	45 (60)	55 (75)	75 (100)
Rated pulse frequency	kHz	4	4	4	4	4
Efficiency η		>0.97	>0.97	>0.97	>0.97	>0.97
Power loss at rated current	kW	0.99	1.21	1.42	1.93	2.31
Cooling air requirement	m^3/s (ft^3/s)	0.022 (0.78)	0.039 (1.38)	0.094 (3.32)	0.094 (3.32)	0.117 (4.13)
Sound pressure level L_{pA} (1 m)	dB	<60	<62	<60	<60	<65
24 V DC power supply for the Control Unit	A	1	1	1	1	1
Input current [3]						
• Rated current	A	70	84	102	135	166
• Based on I_H	A	56	70	84	102	135
Line supply connection U1/L1, V1/L2, W1/L3		M6 screw stud	M6 screw stud	M8 screw stud	M8 screw stud	M8 screw stud
• Conductor cross-section, max.	mm^2	10 … 50	10 … 50	25 … 120	25 … 120	25 … 120
Motor connection U2, V2, W2		M6 screw stud	M6 screw stud	M8 screw stud	M8 screw stud	M8 screw stud
• Conductor cross-section, max.	mm^2	10 … 50	10 … 50	25 … 120	25 … 120	25 … 120
PE connection		On housing with M6 screw	On housing with M6 screw	On housing with M8 screw	On housing with M8 screw	On housing with M8 screw
Motor cable length [4], **max.**						
• Shielded	m (ft)	50 (164)	50 (164)	50 (164)	50 (164)	50 (164)
• Unshielded	m (ft)	100 (328)	100 (328)	100 (328)	100 (328)	100 (328)
Degree of protection		IP20	IP20	IP20	IP20	IP20
Dimensions						
• Width	mm (in)	275 (10.83)	275 (10.83)	350 (13.78)	350 (13.78)	350 (13.78)
• Height						
- Without integrated line filter	mm (in)	499 (19.65)	499 (19.65)	634 (24.96)	634 (24.96)	634 (24.96)
- With integrated line filter	mm (in)	635 (25.0)	635 (25.0)	934 (36.77)	934 (36.77)	934 (36.77)
• Depth						
- Without Control Unit	mm (in)	204 (8.03)	204 (8.03)	316 (12.44)	316 (12.44)	316 (12.44)
- With Control Unit	mm (in)	260 (10.24)	260 (10.24)	372 (14.65)	372 (14.65)	372 (14.65)
Frame size		FSE	FSE	FSF	FSF	FSF
Weight, approx.						
• Without integrated line filter	kg (lb)	14 (30.9)	14 (30.9)	35 (77.2)	35 (77.2)	35 (77.2)
• With integrated line filter	kg (lb)	21 (46.3)	21 (46.3)	51 (112)	51 (112)	51 (112)

[1] The rated output current I_{rated} and the base load current I_L are based on the duty cycle for low overload (LO).

[2] The base load current I_H is based on the duty cycle for high overload (HO).

[3] The input current depends on the motor load and line impedance and applies for a line impedance corresponding to u_K = 1 %. The rated input currents apply for a load at rated power (based on I_{rated}) – these current values are specified on the rating plate.

[4] Max. motor cable length 25 m (82 ft) (shielded) for PM250 Power Modules with integrated line filter to maintain the limit values of EN 61800-3 Category C2.

Technical specifications

PM260 Power Modules

Line voltage 500 … 690 V 3 AC		**PM260 Power Modules** 6SL3 225-...		
Without integrated line filter		0BH27-5UA1	0BH31-1UA1	0BH31-5UA1
With integrated line filter		0BH27-5AA1	0BH31-1AA1	0BH31-5AA1
Output current at 50 Hz 690 V 3 AC				
• Rated current I_{rated} [1]	A	14	19	23
• Base load current I_L [1]	A	14	19	23
• Base load current I_H [2]	A	10	14	19
• I_{max}	A	20	28	38
Rated power				
• Based on I_L	kW (hp)	11 (15)	15 (20)	18.5 (25)
• Based on I_H	kW (hp)	7.5 (10)	11 (15)	15 (20)
Rated pulse frequency	kHz	16	16	16
Efficiency η		0.95	0.95	0.95
Power loss at rated current	kW	0.58	0.72	0.82
Cooling air requirement	m^3/s (ft^3/s)	0.044 (1.55)	0.044 (1.55)	0.044 (1.55)
Sound pressure level L_{pA} (1 m)	dB	<64	<64	<64
24 V DC power supply for the Control Unit	A	1	1	1
Input current [3]				
• Rated current	A	13	18	22
• Based on I_H	A	10	13	18
Line supply connection U1/L1, V1/L2, W1/L3		Terminal strip	Terminal strip	Terminal strip
• Conductor cross-section	mm^2	2.5 … 16	2.5 … 16	2.5 … 16
Motor connection U2, V2, W2		Terminal strip	Terminal strip	Terminal strip
• Conductor cross-section	mm^2	2.5 … 16	2.5 … 16	2.5 … 16
PE connection		On housing with M6 screw	On housing with M6 screw	On housing with M6 screw
Motor cable length, max. [4]				
• Shielded	m (ft)	200 (656)	200 (656)	200 (656)
• Unshielded	m (ft)	300 (984)	300 (984)	300 (984)
Degree of protection		IP20	IP20	IP20
Dimensions				
• Width	mm (in)	275 (10.83)	275 (10.83)	275 (10.83)
• Height	mm (in)	512 (20.16)	512 (20.16)	512 (20.16)
• Depth				
- Without Control Unit	mm (in)	204 (8.03)	204 (8.03)	204 (8.03)
- With Control Unit	mm (in)	260 (10.24)	260 (10.24)	260 (10.24)
Frame size		FSD	FSD	FSD
Weight, approx.				
• Without integrated line filter	kg (lb)	22 (48.5)	22 (48.5))	22 (48.5))
• With integrated line filter	kg (lb)	23 (50.7)	23 (50.7)	23 (50.7)

[1] The rated output current I_{rated} and the base load current I_L are based on the duty cycle for low overload (LO).

[2] The base load current I_H is based on the duty cycle for high overload (HO).

[3] The input current depends on the motor load and line impedance and applies for a line impedance corresponding to u_K = 1 %. The rated input currents apply for a load at rated power (based on I_{rated}) – these current values are specified on the rating plate.

[4] Shielded motor cables must be used in order to maintain the limit values for field-conducted disturbances according to EN 61800-3 Class C2.

SINAMICS G120 standard inverters 0.37 kW to 250 kW (0.5 hp to 400 hp)

Technical specifications

Line voltage 500 … 690 V 3 AC		**PM260 Power Modules** 6SL3 225-...		
Without integrated line filter		0BH32-2UA1	0BH33-0UA1	0BH33-7UA1
With integrated line filter		0BH32-2AA1	0BH33-0AA1	0BH33-7AA1
Output current at 50 Hz 690 V 3 AC				
• Rated current I_{rated} [1]	A	35	42	62
• Base load current I_L [1]	A	35	42	62
• Base load current I_H [2]	A	26	35	42
• I_{max}	A	52	70	84
Rated power				
• Based on I_L	kW (hp)	30 (40)	37 (50)	55 (75)
• Based on I_H	kW (hp)	22 (30)	30 (40)	37 (50)
Rated pulse frequency	kHz	16	16	16
Efficiency η		0.95	0.95	0.95
Power loss at rated current	kW	1.13	1.29	1.73
Cooling air requirement	m^3/s (ft^3/s)	0.131 (4.63)	0.131 (4.63)	0.131 (4.63)
Sound pressure level L_{pA} (1 m)	dB	<70	<70	<70
24 V DC power supply for the Control Unit	A	1	1	1
Input current [3]				
• Rated current	A	34	41	60
• Based on I_H	A	26	34	41
Line supply connection U1/L1, V1/L2, W1/L3		M6 screw stud	M6 screw stud	M6 screw stud
• Conductor cross-section	mm^2	10 … 50	10 … 50	10 … 50
Motor connection U2, V2, W2		M6 screw stud	M6 screw stud	M6 screw stud
• Conductor cross-section	mm^2	10 … 50	10 … 50	10 … 50
PE connection		On housing with M6 screw	On housing with M6 screw	On housing with M6 screw
Motor cable length, max. [4]				
• Shielded	m (ft)	200 (656)	200 (656)	200 (656)
• Unshielded	m (ft)	300 (984)	300 (984)	300 (984)
Degree of protection		IP20	IP20	IP20
Dimensions				
• Width	mm (in)	350 (13.78)	350 (13.78)	350 (13.78)
• Height	mm (in)	634 (24.96)	634 (24.96)	634 (24.96)
• Depth				
- Without Control Unit	mm (in)	316 (12.44)	316 (12.44)	316 (12.44)
- With Control Unit	mm (in)	372 (14.65)	372 (14.65)	372 (14.65)
Frame size		FSF	FSF	FSF
Weight, approx.				
• Without integrated line filter	kg (lb)	56 (123)	56 (123)	56 (123)
• With integrated line filter	kg (lb)	58 (128)	58 (128)	58 (128)

[1] The rated output current I_{rated} and the base load current I_L are based on the duty cycle for low overload (LO).

[2] The base load current I_H is based on the duty cycle for high overload (HO).

[3] The input current depends on the motor load and line impedance and applies for a line impedance corresponding to u_K = 1 %. The rated input currents apply for a load at rated power (based on I_{rated}) – these current values are specified on the rating plate.

[4] Shielded motor cables must be used in order to maintain the limit values for field-conducted disturbances according to EN 61800-3 Class C2.

Integration

Frame size FSA of the PM240 Power Module is available only without integrated line filter class A. A base filter is therefore available so that class A can be achieved. A base filter class B is also available so that class B can be achieved.

Frame sizes FSB and FSC of the PM240 Power Module are available both with and without integrated line filter class A. For compliance with class B, PM240 Power Modules with integrated line filter class A must be fitted additionally with a base filter class B.

An external line filter class A is available for frame size FSGX of the PM240 Power Module.

Frame sizes FSC of the PM250 Power Module are available only with integrated line filter class A. To achieve class B, PM250 Power Modules must be additionally fitted with a base filter class B.

No additional line filters class B are available for the PM260 Power Module.

Line filters that are optionally available depending on the Power Module used

	Frame size						
	FSA	**FSB**	**FSC**	**FSD**	**FSE**	**FSF**	**FSGX**
PM240 Power Module with integrated braking chopper							**without integrated braking chopper**
Available frame sizes	✓	✓	✓	✓	✓	✓	✓
Line-side power components							
Line filter class A	U	F	F	F	F	F/S [1]	S [1]
Line filter class B	U	U	U	–	–	–	–
PM250 Power Module with line-commutated energy recovery							
Available frame sizes	–	–	✓	✓	✓	✓	–
Line-side power components							
Line filter class A	–	–	I	F	F	F	–
Line filter class B	–	–	U	–	–	–	–
PM260 Power Module with line-commutated energy recovery and integrated sine-wave filter							
Available frame sizes	–	–	–	✓	–	✓	–
Line-side power components							
Line filter class A	–	–	–	F	–	F	–
Line filter class B	–	–	–	–	–	–	–

U = Base component
S = Lateral mounting
I = Integrated
– = Not possible
F = Power Modules available with and without integrated filter class A

[1] PM240 FSF Power Modules from 110 kW and higher and FSGX, are available only without an integrated filter class A. An optional line filter class A for lateral mounting is available instead.

SINAMICS G120 standard inverters 0.37 kW to 250 kW (0.5 hp to 400 hp)

Supplementary system components
Operator panels

Overview

Operator panel	Intelligent Operator Panel IOP and IOP Handheld	Basic Operator Panel BOP-2
	 	
Description	Thanks to the large plain text display, menu-based operation and the application wizards, commissioning of the standard drives is easy. Integrated application wizards guide the user interactively through the commissioning process for important applications such as pumps, fans, compressors and conveyor systems.	Commissioning of standard drives is easy with the menu-prompted dialog on a 2-line display. Simultaneous display of the parameter and parameter value, as well as parameter filtering, means that basic commissioning of a drive can be performed easily and, in most cases, without a printed parameter list.
Possible applications	• Directly mounted on SINAMICS G120 • Can be mounted in the control cabinet door using a door mounting kit (achievable degree of protection is IP54/ UL Type 12) • Available as handheld version • 5 languages available	• Directly mounted on SINAMICS G120 • Can be mounted in the control cabinet door using a door mounting kit (achievable degree of protection is IP55/UL Type 12)
Quick commissioning without expert knowledge	• Standard commissioning using the clone function • User-defined parameter list with a reduced number of self-selected parameters • Simple commissioning of standard applications using application-specific wizards, it is not necessary to know the parameter structure • Simple local commissioning using the handheld version • Commissioning largely without documentation	• Standard commissioning using the clone function
High degree of operator friendliness and intuitive operation	• Direct manual operation of the drive – you can simply toggle between the automatic and manual modes • Intuitive navigation using a rotary knob – just like in everyday applications • Graphic display to show status values such as pressure or flow in bar-type diagrams • Status display with freely selectable units to specify physical values	• Direct manual operation of the drive – you can simply toggle between the automatic and manual modes – • 2-line display for showing up to 2 process values with text • Status display of predefined units
Minimization of maintenance times	• Diagnostics using plain text display, can be used locally on-site without documentation • Simple update of languages, wizards and firmware via USB	• Diagnostics with menu prompting with 7-segment display

Overview

Intelligent Operator Panel IOP

The Intelligent Operator Panel IOP is a very user-friendly and powerful operator panel for the SINAMICS G120, SINAMICS G120C, SINAMICS G120D, SINAMICS G120P standard drives and SIMATIC ET 200 frequency converters.

The IOP supports both entry-level personnel and drive experts. Thanks to the large plain text display, the menu-based operation and the application wizards, it is easy to commission standard drives.
A drive can be essentially commissioned without having to use a printed parameter list – as the parameters are displayed in plain text, and explanatory help texts and the parameter filtering function are provided.

Application wizards interactively guide you when commissioning important applications such as conveyor technology, pumps, fans and compressors. There are quick commissioning wizards for general commissioning.

The drives are easily controlled manually using directly assigned buttons and the navigation wheel. The IOP has a dedicated switchover button to switch from automatic to manual mode.

The inverter can be diagnosed in a user-friendly fashion using the plain text display of faults and alarms. Help texts can be obtained by pressing the INFO button.

Up to 2 process values can be displayed graphically or numerically on the status screen/status display. Process values can also be displayed in technological units.

The IOP supports standard commissioning of identical drives. For this purpose, a parameter list can be copied from an inverter into the IOP and downloaded into other drive units of the same type as required.

The IOP includes the following language packages: English, French, German, Italian and Spanish.

The IOP can be installed in control cabinet doors using the optionally available door mounting kit (not possible in conjunction with the PM230 Power Module).

The operating temperature of the IOP is 0 ... 50 °C (32 ... 122 °F).

IOP Handheld

A handheld version of the IOP can be ordered for mobile use. In addition to the IOP, this includes a housing with rechargeable batteries, charging unit and RS232 connecting cable. The charging unit is supplied with connector adapters for Europe, the US and UK. When the batteries are fully charged, the operating time is up to 8 hours.

To connect the IOP Handheld to SINAMICS G110D and SINAMICS G120D, the RS232 connecting cable with optical interface is required in addition.

The IOP Handheld cannot be used in conjunction with the PM230 Power Module.

Updating the IOP

The IOP can be updated and expanded using the integrated USB interface.

Data to support future drive systems can be transferred from the PC to the IOP via drag & drop. Further, the USB interface allows user languages and wizards that become available in the future to be subsequently downloaded and the firmware to be updated for the IOP.

The IOP is supplied with power via the USB interface during an update.

SINAMICS G120 standard inverters 0.37 kW to 250 kW (0.5 hp to 400 hp)

Supplementary system components
Intelligent Operator Panel IOP

Selection and ordering data

Description	Order No.
Intelligent Operator Panel IOP	**6SL3 255-0AA00-4JA0**
IOP Handheld For use with SINAMICS G120, SINAMICS G110D, SINAMICS G120D, SIMATIC ET 200S FC or SIMATIC ET 200pro FC Included in the scope of delivery: • IOP • Handheld housing • Rechargeable batteries (4 × AA) • Charging unit (international) • RS232 connecting cable (3 m/9.84 ft long, can only be used for SINAMICS G120 and SIMATIC ET 200S FC) • USB cable (1 m/3.28 ft long)	**6SL3 255-0AA00-4HA0**
Accessories	
Door mounting kit IP54 degree of protection for mounting an operator panel in control cabinet doors with sheet steel thicknesses of 1 … 3 mm (0.04 ...0.12 in) IP54 degree of protection for IOP IP55 degree of protection for BOP-2 Included in the scope of delivery: • Seal • Mounting material • Connecting cable (5 m/16.41 ft long)	**6SL3 256-0AP00-0JA0**
RS232 connecting cable With optical interface to connect the SINAMICS G110D, SINAMICS G120D or SIMATIC ET 200pro FC inverters to the IOP Handheld (2.5 m/8.2 ft long)	**3RK1 922-2BP00**

Benefits

- Simple commissioning of standard applications using wizards, it is not necessary to know the parameter structure
- Diagnostics using plain text display; can be used locally on-site without documentation
- Direct manual operation of the drive; you can toggle between the automatic and manual modes
- Status display with freely selectable units; display of real physical values
- Intuitive navigation using a wheel – just like in everyday applications
- Graphic display with bar charts e.g. for status values such as pressure or flowrate
- Quickly and simply mounted in the door – mechanically and electrically
- Simple local commissioning on-site using the handheld version
- Commissioning without documentation using the integrated help function
- Standard commissioning using the clone function (parameter set data is saved for fast replacement)
- User-defined parameter list with a reduced number of self-selected parameters (to generate your own commissioning screens)
- 5 integrated languages
- Simple update of languages, wizards and firmware updates via USB

Overview

Basic Operator Panel BOP-2

The Basic Operator Panel BOP-2 can be used to commission drives, monitor drives in operation and input individual parameter settings.

Commissioning of standard drives is easy with the menu-prompted dialog on a 2-line display. Simultaneous display of the parameter and parameter value, as well as parameter filtering, means that basic commissioning of a drive can be performed easily and, in most cases, without a printed parameter list.

The drives are easily controlled manually using directly assigned navigation buttons. The BOP-2 has a dedicated switchover button to switch from automatic to manual mode.

Diagnostics can easily be performed on the connected inverter by following the menus.

Up to two process values can be numerically visualized simultaneously.

BOP-2 supports standard commissioning of identical drives. For this purpose, a parameter list can be copied from an inverter into the BOP-2 and when required, downloaded into other drive units of the same type.

The operating temperature of the BOP-2 is 0 ... 50 °C (32 ... 122 °F).

Selection and ordering data

Description	Order No.
Basic Operator Panel BOP-2	**6SL3 255-0AA00-4CA1**
Accessories	
Door mounting kit For mounting an operator panel in control cabinet doors with sheet steel thicknesses of 1 … 3 mm (0.04 ...0.12 in) IP54 degree of protection for IOP IP55 degree of protection for BOP-2 Included in the scope of delivery: • Seal • Mounting material • Connecting cable (5 m/16.41 ft long)	**6SL3 256-0AP00-0JA0**

Benefits

- Shorten commissioning times – Easy commissioning of standard drives using basic commissioning wizards (setup)
- Minimize standstill times – Fast detection and rectification of errors (Diagnostics)
- Greater transparency in the process – The status display of the BOP-2 makes process variable monitoring easy (Monitoring)
- Direct mounting on the inverter (also see IOP)
- User-friendly user interface:
  - Easy navigation using clear menu structure and clearly assigned control keys
  - Two-line display

SINAMICS G120 standard inverters 0.37 kW to 250 kW (0.5 hp to 400 hp)

Supplementary system components Memory cards

Overview

SINAMICS micro memory card (MMC)/SIMATIC memory card (SD card)

The parameter settings for an inverter can be stored on the SINAMICS micro memory card (MMC) or SIMATIC memory card (SD card). When service is required, e.g. after the converter has been replaced and the data has been downloaded from the memory card, the drive system is immediately ready for use once more.

- Parameter settings can be written from the memory card to the inverter or saved from the inverter to the memory card.
- Up to 100 parameter sets can be stored.
- The memory card supports standard commissioning without the use of an operator panel such as the BOP-2 or the STARTER commissioning tool.

Note:

The memory card is not required for operation and does not have to remain inserted.

Selection and ordering data

Description	Order No
SINAMICS micro memory card (MMC)	**6SL3 254-0AM00-0AA0**
SIMATIC memory card (SD card) For SINAMICS G120C and the SINAMICS G120 CU2 . 0 . -2 Control Units	**6ES7 954-8LB01-0AA0**

Supplementary system components Brake Relay

Overview

The Brake Relay allows the Power Module to be connected to an electromechanical motor brake, thereby allowing the motor brake to be driven directly by the Control Unit.

Selection and ordering data

Description	Order No
Brake Relay Including cable harness for connection with the Power Module	**6SL3 252-0BB00-0AA0**

Technical specifications

	Brake Relay
	6SL3252-0BB00-0AA0
Switching capability of the NO contact, max.	440 V AC / 3.5 A 30 V DC / 12 A
Conductor cross-section, max.	2.5 mm^2
Degree of protection	IP20
Dimensions	
• Width	68 mm (2.68 in)
• Height	63 mm (2.48 in)
• Depth	33 mm (1.30 in)
Weight, approx.	0.17 kg (0.37 lb)

Integration

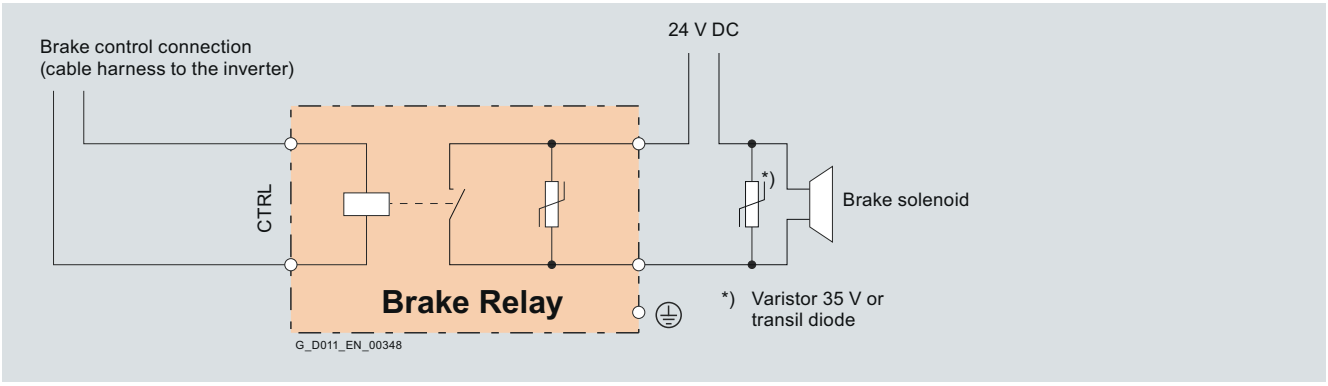
The Brake Relay has the following interfaces:

- A switch contact (NO contact) to control the motor brake solenoid
- A connection for the cable harness (CTRL) for connection to the Power Module

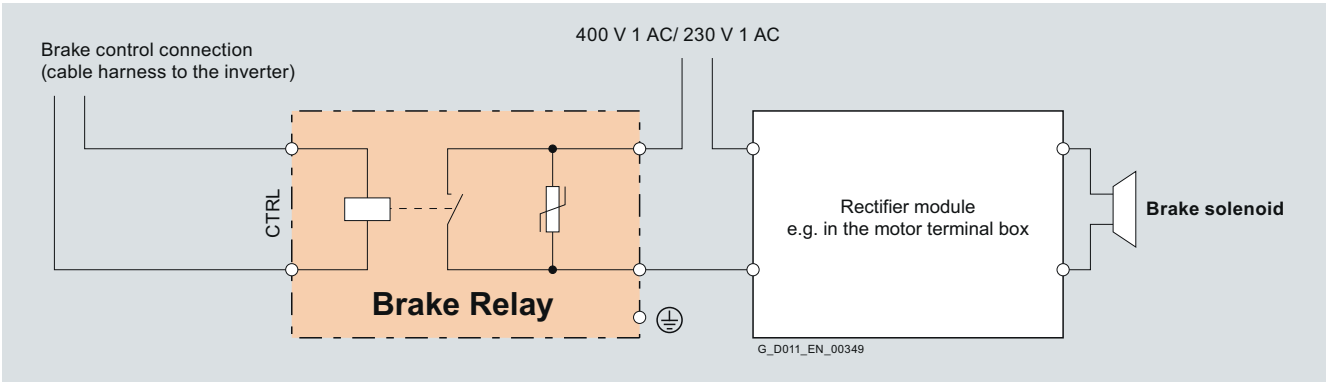
The Brake Relay can be installed on the shield bonding plate near the power terminals of the Power Module.

The supplied Brake Relay includes the cable harness for connection with the Power Module.

The 24 V DC solenoid of the motor brake is connected via an external power supply. For 24 V DC, external surge arrestors are required (e.g. varistor, transil diode).



Connection example of 24 V DC Brake Relay



Connection example of 230 ... 400 V 1 AC Brake Relay

Safe Brake Adapter SBA

Overview

For SINAMICS S120, S150, G130 and G150 units, the Safe Brake Adapter SBA is required to safely control a motor holding brake via the Safe Brake Control (SBC) safety function according to IEC 61800-5-2.

The Safe Brake Adapter is available for 24 V DC and 230 V AC brake control voltages.

It can be ordered as supplementary component for SINAMICS S120 Chassis Format Units as well as for SINAMICS G130 Chassis Units.
It is available as option (**K88, K89**) for SINAMICS S120 Cabinet Modules and SINAMICS S150 or G150 Cabinet Units.

Note: The SBA approval is currently only valid for IEC regions (still open for UL regions).

Selection and ordering data

Description	Order No.
Safe Brake Adapter	
• 230 V AC/2 A	**6SL3 355-2DX00-1AA0**
• 24 V DC/5 A	**6SL3 355-2DX01-1AA0**
Accessories	
Pre-assembled interface cables to connect the SBA to the electronics module	**6SL3 060-4DX04-0AA0**

Technical data

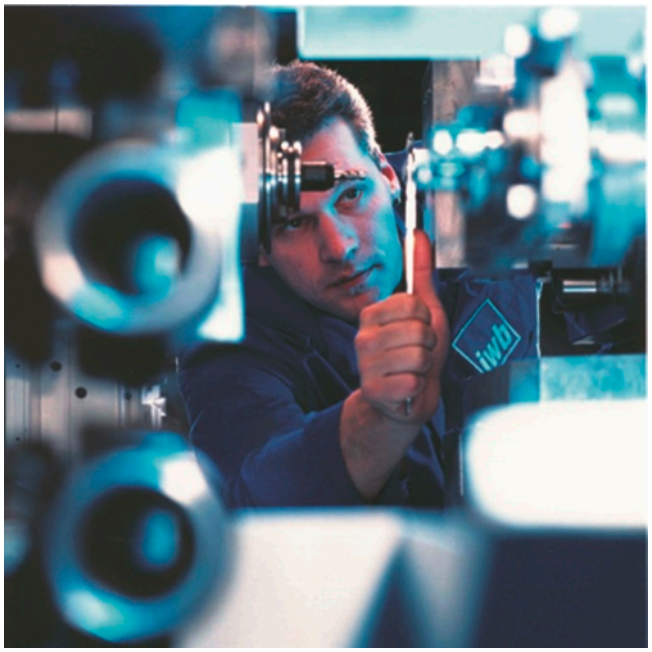
Safe Brake Adapter	6SL3355-2DX00-1AA0	6SL3355-2DX01-1AA0
Electronics power supply		
• Supply voltage (via the Control Interface Module)	24 V DC (20.4 ... 28.8 V)	24 V DC (20.4 ... 28.8 V)
Supply voltage of the motor holding brake	230 V AC	24 V DC
Max. permissible current consumption of the		
• Motor holding brake	2 A	5 A
• Fast de-energization	2 A	–
Max. permissible cable lengths		
• to the Control Interface Module	10 m	10 m
• to the brake	300 m	30 m
Max. conductor cross section	2.5 mm^2	2.5 mm^2
Dimensions		
• Width	75 mm	75 mm
• Height	111 mm	111 mm
• Depth	89 mm	89 mm
Weight, approx.	0.25 kg	0.25 kg
Safety integrated	Safety Integrity Level 2 (SIL2) acc. to IEC 61508, Performance Level d (PLd) acc. to ISO 13849-1 and Control Category 3 acc. to EN ISO 13849-1 (previously EN 954-1)	

Integration

The SBC function is controlled and monitored by the SINAMICS Drives firmware. The control and feedback signal regarding the switching state of the SBA relay is realized via terminals of the Control Interface Module (CIM). The excitation coil of the holding brake is connected directly at the SBA.

For SINAMICS G130 chassis units and SINAMICS S120 units the chassis format, the brake supply voltage must be connected externally at the SBA.

Overview



Drive Based Safety Integrated provides integrated safety functions that support the implementation of highly effective personnel and machine protection. The safety functions comply with the requirements of Category 3 as well as Performance Level PL d according to EN ISO 13849-1 and safety integrity level SIL 2 according to EN 61508. Consequently, important functional safety requirements can be implemented easily and economically. The range of functions includes, for example:

- Functions for safe monitoring of standstill
- Functions for safe monitoring of speed

Benefits

- High level of safety:
  Full implementation of the safety functions in Category 3/SIL 2/PL d
- High level of flexibility:
  Practical safety and operating concepts can be implemented
- Faster commissioning using integrated safety functions

Function

The safety functions are available in all modes and can communicate with the process using safety-oriented input/output signals. These can be implemented individually for each axis and spindle. The following Safety Integrated functions are available (terms in accordance with IEC 61800-5-2):

Safety Integrated basic functions

- Safe Torque Off (STO)
  Prevention of unexpected startup by internal cancellation of the drive pulses.
- Safe Brake Control (SBC)
  Safe brake control of holding brakes which are operative at zero current, e.g. motor holding brakes.
- Safe Stop 1 (SS1)
  Safe stopping of the drive with subsequent prevention of unexpected startup (STO).

Function (continued)

Extended Safety Integrated functions

- Safe Operating Stop (SOS)
  Monitors drives for standstill. The drives remain fully functional for position control.
- Safe Stop 2 (SS2)
  Safe stopping of the drive with subsequent monitoring for standstill (SOS).
- Safely Limited Speed (SLS)
  Monitoring of configurable velocity limit values, e.g. during setup.
- Safe Speed Monitor (SSM)
  Safe checkback signal when a value falls below a settable speed limit, e.g. for enabling a protective door.
- Safe Acceleration Monitor (SAM)
  Prompt detection of a new axis acceleration during braking (SS1 and SS2).

The Safety Integrated basic functions are license-free. The Extended Safety Integrated functions require a software license in the form of a CNC option per axis with Safety functions.

The Safety Integrated basic functions are controlled via existing terminals on the SINAMICS S120 Combi Power Modules or the SINAMICS S120 Motor Modules in booksize compact format and the SINUMERIK 828D BASIC T/BASIC M. A TM54F Terminal Module is required to control the Extended Safety Integrated functions.

For the formation of the safe control logic, fail-safe 3TK28 or 3RK3 safety relays are recommended. See catalog SI 10 or the Siemens Industry Mall:
www.siemens.com/industrymall

Integration

SINUMERIK 828D BASIC T

- SINUMERIK 828D BASIC M
- SINUMERIK 828D
- SINAMICS S120 Combi Power Module or SINAMICS S120 Motor Module in booksize compact format
- Motors with encoders which comply with the Safety Integrated specification: 1PH8 or 1FK7 motors
- Encoder systems
  For information on suitable encoder systems for SINUMERIK Safety Integrated, please contact your local Siemens branch.
- Signal cables which comply with the SINAMICS S120 specification: MOTION-CONNECT
- Control of the Extended Safety Integrated functions:
  TM54F Terminal Module
- CNC software license required per axis for the Extended Safety functions see SINUMERIK 828D BASIC
- 3TK28 or 3RK3 safety relays

Selection and ordering data

Description	Order No
SINUMERIK Safety Integrated for SINUMERIK 828D Safety Integrated Extended Functions for one CNC axis	**6FC5 800-0AC50-0YB0**

Appendix

5

Standard B10 values of electrical and mechanical components

Safety characteristics

Overview

In the following standards, the so-called B10 values for calculating the safety integrity or safety integrity level (SIL) in functional safety at a high or continuous demand rate are required also for electromechanical switchgear:

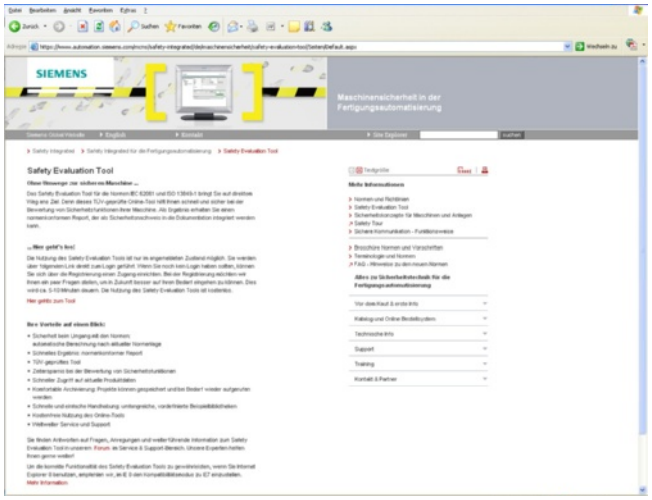
- IEC 62061 "Safety of machines - Functional safety of safety-related electrical, electronic and programmable electronic control systems",
- ISO 13849-1 "Safety of machines - Safety-related components of controls - Part 1: General principles".

Failure rates of electromechanical components are required for calculating the safety integrity or safety integrity level (SIL) in functional safety:
- in the manufacturing industry at a high demand rate
- in the process industry at a low demand rate

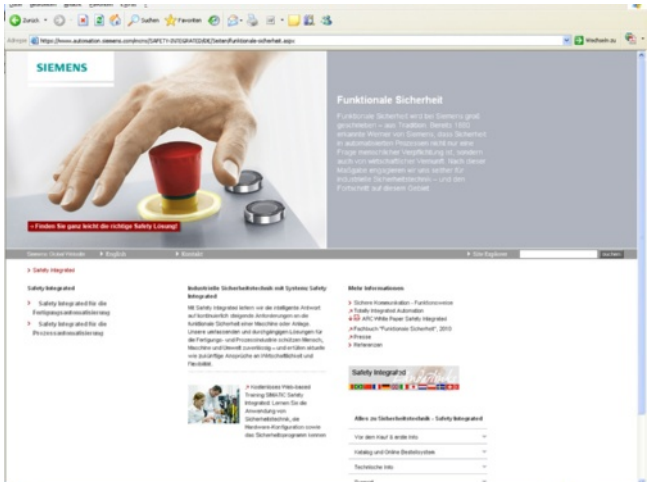
Further requirements are laid down in IEC 61511-1 "Functional safety - Safety instrumented systems for the process industry sector - Part 1: Framework, definitions, system, hardware and software requirements".

The TÜV-tested Safety Evaluation Tool assists in calculating the safety function as verification for the machine documentation. It is available on the Internet at

www.siemens.com/safety-evaluation-tool.



At www.siemens.com/safety-integrated you will also find functional examples with calculations according to the current standards.



Definitions

λ (t) dt is the probability that a unit which has not failed by a certain time *t* will fail in the following interval (*t; t + dt*).
Failure rates have the dimension 1/time unit, e.g. 1/h.
Failure rates for components are often specified in FIT (failures in time unit): 1 FIT equals 10^{-9}/h.
From the failure rate it is possible to derive a (mathematical) distribution function of the failure probability:

$F(t) = 1 - \exp(-\lambda t)$, with λ as constant failure rate

- The mean value of this exponential distribution is also referred to as:
  - Mean Time To Failure (MTTF) in the case of irreparable components; 63.2 % of components fail by the MTTF.
  - Mean Operating Time Between Failures (MTBF) in the case of reparable components.
- MTTF = 1/λ
  (MTTF is a statistical mean value but no guarantee for endurance)

Electromechanical components are often irreparable components. In general, the failure rate of monitored units changes with age.

The B10 value for devices subject to wear is expressed in number of operating cycles:

- it is the number of operating cycles after which 10 % of the test specimens fail in the course of an endurance test (or: the number of operating cycles after which 10 % of the devices have failed).

For low demand rates (mainly in the process industry), the failure rate and not the B10 value is used to determine the failure probability.

Overview (continued)

Standard B10 values at a high demand rate

With the help of the B10 value and a simplified formula (see section 6.7.8.2.1 of EN 62061), the user can then calculate the total failure rate of an electromechanical component:

$\lambda = (0.1 \times C) / B10$

with C = operating cycles per hour. C is specified by the user.

The failure rate is made up of safe (λ_S) and dangerous (λ_D) failures:

$\lambda = \lambda_S + \lambda_D$

or

λ_D = [share of dangerous failures in %] x λ

λ_S = [share of safe failures in %] x λ

The failure rate of the dangerous failures λ_D of the components used is needed for further calculations.

Listed in the following table are the standard B10 values and the share of dangerous failures for SIRIUS product groups at a high demand rate. The standard B10 values listed in the current SN 31920 shall apply. In cases where no load is specified there, the B10 values refer to a maximum load of 2/3 of the rated value, such as required in safety standards.

Standard B10 values at a high demand rate

SIRIUS product group (electromechanical components)	Contact load, utilization category	Standard B10 value (operating cycles)	Share of hazardous failures
Control devices, detecting devices (only devices with positive-opening contacts permissible)			
EMERGENCY-OFF/EMERGENCY-STOP control devices	[1]	100 000	20 %
- Rotate-to-unlatch (also with lock)	[1]	30 000	
- Pull-to-unlatch			
Cable-operated switches for EMERGENCY-OFF/EMERGENCY-STOP function	[1]	1 000 000	20 %
Hinge switches	[1]	1 000 000	20 %
Pushbuttons (non-latching)	[2]	10 000 000	20 % [4]
Position switches			
- Standard position switches	[2]	10 000 000	20 % [4]
- With separate actuator	[1]	1 000 000	20 % [4]
- With tumbler, interlocking with spring force	[1]	1 000 000	20 % [4]
Controls – contactors and contactor assemblies (only devices with positive-opening contacts or mirror contacts permissible)			
SIRIUS contactor relays and auxiliary switches			50 %
- Basic units, auxiliary coupling relays, 4-pole	[3]	30 000 000	
- Basic units with mounted auxiliary switches	[3]	10 000 000	
- Solid-state compatible auxiliary switches, latched contactor relays	[3]	5 000 000	
	AC-15/-14; 230 V DC-13; 24 V ($<0.3 \times I_e$)	1 000 000	73 %
	AC-15/-14; 230 V ($<0.66 \times I_e$)	200 000	73 %
	DC-13; 24 V ($<0.66 \times I_e$)	300 000	73 %
Contactors/motor starters			
- For switching motors (incl. TF68, 3TF69, 3TF2, 3TB)	[3] AC-3	10 000 000 1 000 000	50 % 73 %
Load feeders			
3RA1, 2 fuseless load feeders	AC-3	1 000 000	73 %
3RA6 compact starters	AC-3		50 %
3RA61/62/64 compact starters			
- 12 A		3 000 000	
- 32 A		2 000 000	
3RA65 compact starter			
- 12 A		1500 000	
- 32 A		1 500 000	

[1] Limited primarily by mechanical wear

[2] Limited primarily by contact wear

[3] Maximum achievable B10 values at current load up to a maximum of approx. 1% of the rated value

[4] Share of dangerous failures: 50% when using the NO contact (you have to additionally always use a positive-opening contact in a redundant architecture. Using the NO contact on its own is not permitted).

The $B10_d$ value used in EN ISO 13849-1:2008 is determined as follows:

$$B10_d = \frac{B10}{\text{Share of dangerous failures}}$$

5

Standard B10 values of electrical and mechanical components

Safety characteristics

Overview (continued)

Calculation example

A protective door is monitored by a position switch with a separate actuator.

The protective door is opened 4 times an hour.

The overall failure rate of the position switch is:

$\lambda = (0.1 \cdot C) / B10$ [failures/h]
$\lambda = 0.1 \cdot 4/1\,000\,000 = 4 \cdot 10^{-7}$ [failures/h]

The dangerous failure rate is calculated with:

$\lambda_D = 20\ \%$ of $\lambda = 0.2 \cdot 4 \cdot 10^{-7}$ [failures/h]
$\lambda_D = 8 \cdot 10^{-8}$ [failures/h]

Standard failure rates (at a low demand rate)

On the basis of the failure rates it is possible to calculate the average probability of failure on demand (PFD_{avg}) of a PLT protective device.

A so-called low demand rate is assumed, meaning the rate of demand on the safety-related system amounts to no more than once a year and is not greater than double the frequency of the repeat test.

A repeat test once a year is recommended for electromechanical components in order to reveal passive faults.

For special applications it is possible, in agreement with the inspecting institution (e.g. a technical inspectorate, government agency or the like) to extend the test intervals by using suitable solutions (e.g. a multi-channel version etc.).

Under the above conditions and in compliance with the requirements laid down in IEC 61511 it is possible to achieve SIL 2 with a single-channel design and SIL 3 with a two-channel design.

Listed in the following table are the standard failure rates and the share of dangerous failures for SIRIUS product groups at a low demand rate.

Standard failure rates at a low demand rate

SIRIUS product group (electromechanical components)	Standard failure rates (in FIT)[1]	Share of dangerous failures[2]
EMERGENCY-STOP control devices (with positive-opening contacts)	100	20 %
Cable-operated switches for EMERGENCY-STOP function (with positive-opening contacts)	100	20 %
Standard position switches (with positive-opening contacts)	100	20 %
Position switches with separate actuator (with positive-opening contacts)	100	20 %
Position switches with solenoid interlock (with positive-opening contacts)	100	20 %
Hinge switches (with positive-opening contacts)	100	20 %
Pushbuttons (non-latching) (with positive-opening contacts)	100	20 %
Contactors / motor starters (with positively driven contacts in the case of 3RH/3TH and mirror contacts in the case of 3RT/3TF)	100	< 40 %

[1] The failure rates specified in the table were limited to 100 FIT.
[2] Valid only under the previously mentioned conditions.

Siemens standard SN 31920 contains more detailed explanations.

Faster and more applicable know-how: Hands-on training from the manufacturer

SITRAIN® – the Siemens Training for Industry – provides you with comprehensive support in solving your tasks.

Training by the market leader in automation and plant engineering enables you to make independent decisions with confidence. Especially where the optimum and efficient use of products and plants are concerned. You can eliminate deficiencies in existing plants, and exclude expensive faulty planning right from the beginning.

First-class know-how directly pays for itself: In shorter startup times, high-quality end products, faster troubleshooting and reduced downtimes. In other words, increased profits and lower costs.

Achieve more with SITRAIN

- Shorter times for startup, maintenance and servicing
- Optimized production operations
- Reliable configuration and startup
- Minimization of plant downtimes
- Flexible plant adaptation to market requirements
- Compliance with quality standards in production
- Increased employee satisfaction and motivation
- Shorter familiarization times following changes in technology and staff

Contact

Visit our site on the Internet at:

http://www.siemens.com/sitrain

or let us advise you personally.

SITRAIN Customer Support Germany:

Phone: +49 (911) 895-7575

Fax: +49 (911) 895-7576

E-Mail: info@sitrain.com

SITRAIN highlights

Top trainers

Our trainers are skilled teachers with direct practical experience. Course developers have close contact with product development, and directly pass on their knowledge to the trainers.

Practical experience

The practical experience of our trainers enables them to teach theory effectively. But since theory can be pretty drab, we attach great importance to practical exercises which can comprise up to half of of the course time. You can therefore immediately implement your new knowledge in practice. We train you on state-of-the-art methodically/didactically designed training equipment. This training approach will give you all the confidence you need.

Wide variety

With a total of about 300 local attendance courses, we train the complete range of Siemens Industry products as well as interaction of the products in systems.

Tailor-made training

We are only a short distance away. You can find us at more than 50 locations in Germany, and in 62 countries worldwide. You wish to have individual training instead of one of our 300 courses? Our solution: We will provide a program tailored exactly to your personal requirements. Training can be carried out in our Training Centers or at your company.

The right mixture: Blended learning

"Blended learning" means a combination of various training media and sequences. For example, a local attendance course in a Training Center can be optimally supplemented by a teach-yourself program as preparation or follow-up. Additional effect: Reduced traveling costs and periods of absence.

SITRAIN training courses

SITRAIN course offer for "Safety Integrated"

Title	Decision makers, sales personnel	Project managers, project team members	Programmers	Commissioning engineers, configuration	Service personnel	Operators, users	Maintenance personnel	Duration	Short title
	Target group								
Factory automation									
European safety standards for functional safety in practice	✓	✓	✓	✓				1 day	ST-NSSTPRX
Current European directives and CE standards in machinery and plant environments	✓	✓	✓	✓		✓		1 day	ST-CEKEN
Risk Assessment Management – methods for the norm conforming risk evaluation		✓		✓				1 day	ST-RAM
Process automation									
SIMATIC PCS 7 Process Safety	✓	✓	✓	✓				3 days	ST-PCS7SAF
IEC 61511 Functional safety in the process industry	✓	✓		✓				2 days	ST-NRM
IEC 61511 Practical use	✓	✓		✓				1 day	ST-NRMPRX
Drives (AC-Converter)									
SINAMICS S120 Safety Integrated			✓	✓	✓		✓	2 days	DR-SNS-SAF
Industry automation systems SIMATIC (SIMATIC S7 H/F-Safety Integrated									
Programming of safety related SIMATIC S7 controller via Distributed Safety			✓	✓				3 days	ST-PPDS
Projecting of the fault tolerance SIMATIC S7-400H controller			✓	✓				3 days	ST-7H400H
Projecting of fault tolerance/failsafe SIMATIC S7-400H controller with the software F-Systems			✓	✓				3 days	ST-PPFS
CNC automation system SINUMERIK									
SINUMERIK 840D, Safety Integrated Maintenance Course					✓		✓	3 days	NC-84DSIS
SINUMERIK 840D, Safety Integrated Configuring and Start-Up				✓	✓			5 days	NC-84DSIW
SINUMERIK 840D sl, Safety Integrated Maintenance Course					✓		✓	3 days	NC-84SLSIS
SINUMERIK 840D sl Safety Integrated Configuring and Start-up				✓	✓			5 days	NC-84SLSIW

For more detailed information on these and other courses on "Safety Integrated" please go to

www.siemens.com/sitrain-safetyintegrated

Order No. Index

Notes

Notes

Notes

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! The scope, the quality and the conditions for supplies and services, including software products, by any Siemens entity having a registered office outside of Germany, shall be subject exclusively to the General Terms and Conditions of the respective Siemens entity. The following 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 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/or 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 of Germany

For customers with a seat or registered office outside Germany the following applies subordinate to 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, Automation and Drives for Customers with a Seat or registered Office outside of Germany"[1)].

2. Prices

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

The sales tax (value added tax) is not included in the prices.

It shall be debited separately at the respective rate according to the applicable legal regulations.

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

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

The surcharge will be calculated on the basis of the official price on the day prior to receipt of the order or prior to the release order.

The metal factor determines the official price as of which the metal surcharges are charged and the calculation method used. The metal factor, provided it is relevant, is included with the price information of the respective products. An exact explanation of the metal factor can be downloaded at:

www.siemens.com/automation/salesmaterial-as/catalog/en/terms_of_trade_en.pdf

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 only apply to devices for export.

Illustrations are not binding.

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

4. Export regulations

We shall not be obligated to fulfill this agreement if such fulfillment is prevented by any impediments arising out of national or international foreign trade or customs requirements or any embargoes or other sanctions.

Export of goods listed in this catalog may be subject to license. We shall indicate in the delivery details whether licenses are required under German, European and US export lists. Goods labeled with "AL" not equal to "N" are subject to European or German export authorization when being exported out of the EU. Goods labeled with "ECCN" not equal to "N" are subject to US re-export authorization.

The export label is made available with the information of the respective goods on Industry Mall, our online-catalog-system, additionally. The deciding factors are the export label "AL" or "ECCN" indicated on order confirmations, delivery notes and invoices.

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

If you transfer goods (hardware and/or software and/or technology as well as corresponding documentation, regardless of the mode of provision) delivered by us or works and services (including all kinds of technical support) performed by us to a third party worldwide, you shall comply with all applicable national and international (re-) export control regulations.

If required to conduct export control checks, you, upon request by us, shall promptly provide us with all information pertaining to particular end customer, destination and intended use of goods, works and services provided by us, as well as any export control restrictions existing.

Errors excepted and subject to change without prior notice.

1) The text of the Comprehensive Terms and Conditions of Sale and Delivery can be downloaded at: www.siemens.com/automation/salesmaterial-as/catalog/en/terms_of_trade_en.pdf

Catalogs

Industry Automation, Drive Technologies and Low-Voltage Power Distribution

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

Interactive Catalog on DVD

	Catalog
for Industry Automation, Drive Technologies and Low Voltage Distribution	**CA 01**

Drive Systems

Variable-Speed Drives	
SINAMICS G130 Drive Converter Chassis Units SINAMICS G150 Drive Converter Cabinet Units	D 11
SINAMICS GM150, SINAMICS SM150 Medium-Voltage Converters	D 12
SINAMICS S120 Chassis Format Units and Cabinet Modules SINAMICS S150 Converter Cabinet Units	D 21.3
SINAMICS DCM Converter Units	D 23.1
SINAMICS and Motors for Single-Axis Drives	D 31
Three-phase Induction Motors • H-compact • H-compact PLUS	D 84.1
Asynchronous Motors Standardline	D 86.1
Synchronous Motors with Permanent-Magnet Technology, HT-direct	D 86.2
DC Motors	DA 12
SIMOREG DC MASTER 6RA70 Digital Chassis Converters	DA 21.1
SIMOREG K 6RA22 Analog Chassis Converters	DA 21.2
PDF: *SIMOREG DC MASTER 6RM70 Digital Converter Cabinet Units*	*DA 22*
SIMOVERT PM Modular Converter Systems	DA 45
SIEMOSYN Motors	DA 48
MICROMASTER 420/430/440 Inverters	DA 51.2
MICROMASTER 411/COMBIMASTER 411	DA 51.3
SIMOVERT MASTERDRIVES Vector Control	DA 65.10
SIMOVERT MASTERDRIVES Motion Control	DA 65.11
Synchronous and asynchronous servomotors for SIMOVERT MASTERDRIVES	DA 65.3
SIMODRIVE 611 universal and POSMO	DA 65.4
SIMOTION, SINAMICS S120 and Motors for Production Machines	PM 21
SINUMERIK, SIMODRIVE and Motors for Machine Tools	NC 60
SINUMERIK, SINAMICS S120 and Motors for Machine Tools	NC 61
Low-Voltage Three-Phase-Motors	
IEC Squirrel-Cage Motors	D 81.1
MOTOX Geared Motors	D 87.1
Mechanical Driving Machines	
FLENDER Standard Couplings	MD 10.1
FLENDER SIG Standard industrial gear unit	MD 30.1

Low-Voltage Power Distribution and Electrical Installation Technology

SENTRON Protection, Switching, Measuring and Monitoring Devices	LV 10.1
SIVACON · ALPHA Switchboards and Distribution Systems	LV 10.2
SIVACON 8PS Busbar Trunking Systems	LV 70
GAMMA Building Control	ET G1
PDF: *DELTA Switches and Socket Outlets*	*ET D1*

Motion Control

	Catalog
SINAMICS and Motors for Single-Axis Drives	D 31
SINUMERIK & SIMODRIVE Automation Systems for Machine Tools	NC 60
SINUMERIK & SINAMICS Equipment for Machine Tools	NC 61
SINUMERIK 828D BASIC T/BASIC M, SINAMICS S120 Combi and 1FK7/1PH8 motors	NC 82
SIMOTION, SINAMICS S120 and Motors for Production Machines	PM 21
Drive and Control Components for Cranes	CR 1

Power Supply and System Cabling

Power supply SITOP	KT 10.1
System cabling SIMATIC TOP connect	KT 10.2

Process Instrumentation and Analytics

Field Instruments for Process Automation	FI 01
SIREC Recorders and Accessories	MP 20
SIPART, Controllers and Software	MP 31
Products for Weighing Technology	WT 10
PDF: *Process Analytical Instruments*	*PA 01*
PDF: *Process Analytics, Components for the System Integration*	*PA 11*

Safety Integrated

Safety Technology for Factory Automation	SI 10

SIMATIC HMI/PC-based Automation

Human Machine Interface Systems/ PC-based Automation	ST 80/ ST PC

SIMATIC Ident

Industrial Identification Systems	ID 10

SIMATIC Industrial Automation Systems

Products for Totally Integrated Automation and Micro Automation	ST 70
SIMATIC PCS 7 Process Control System	ST PCS 7
Add-ons for the SIMATIC PCS 7 Process Control System	ST PCS 7.1
PDF: *Migration solutions with the SIMATIC PCS 7 Process Control System*	*ST PCS 7.2*

SIMATIC NET

Industrial Communication	IK PI

SINVERT Photovoltaics

Inverters and Components for Photovoltaic Installations	RE 10

SIRIUS Industrial Controls

SIRIUS Industrial Controls	IC 10
SIRIUS Industrial Controls (selected content from catalog IC 10)	IC 90

System Solutions

Applications and Products for Industry are part of the interactive catalog CA 01

PDF: *These catalogs are only available as pdf files.*

Download-Center

PDF versions of the catalogs are available on the Internet at: www.siemens.com/automation/infocenter

Siemens AG
Industry Sector
Industry Automation and
Drive Technologies
Postfach 48 48
90026 NÜRNBERG
GERMANY

Subject to change without prior notice
Oder No. E86060-K7010-A121-A1-7600
MP.R1.CE.MKKG.87.2.03 / Dispo 27610
KG 0212 5. S 144 En
Printed in Germany

www.siemens.de/safety-integrated