# SINAMICS DCM
# Converter Units

## Catalog D 23.1 · 2010

SINAMICS Drives

Answers for industry.

SIEMENS

# Related catalogs

**SINAMICS G110, SINAMICS G120** D 11.1
Standard Inverters
**SINAMICS G110D, 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-A4-7600

**SINAMICS GM150, SINAMICS SM150** D 12
Medium-Voltage Converters

E86060-K5512-A101-A2-7600

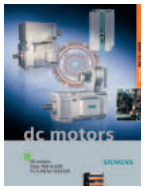
**SINAMICS S120** D 21.3
Chassis Format Units and Cabinet Modules
**SINAMICS S150**
Converter Cabinet Units
E86060-K5521-A131-A2-7600

**SIMOREG DC-MASTER** DA 21.1
Digital Chassis Converters

E86060-K5321-A111-A2-7600

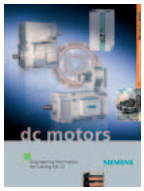

**DC motors** DA 12
Sizes 160 to 630
31.5 kW to 1610 kW

E86060-K5312-A101-A2-7600




**DC motors** DA 12 T
Engineering information for Catalog DA 12

E86060-T5312-A101-A2-7600




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

E86060-K4921-A101-A1-7600
News: E86060-K4921-E101-A1-7600

**SINAMICS S110** PM 22
The Basic Positioning Drive

E86060-K4922-A101-A1-7600

**SITRAIN** ITC
Training for Automation and Industrial Solutions
Language: German

E86060-K6850-A101-B9

**Interactive Catalog** CA 01
Products for Automation and Drives

E86060-D4001-A510-C8-7600

**Industry Mall**
Information and ordering platform in the Internet:
**www.siemens.com/industrymall**

## DVD-ROM included with Catalog D 23.1 · 2010

**On the DVD-ROM included with Catalog D 23.1 · 2010, you will find:**

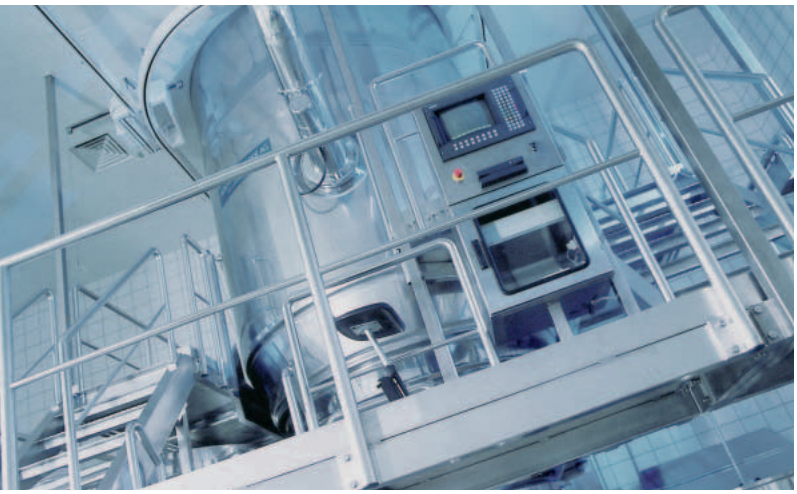
- Manuals, SINAMICS DCM and SICROWBAR AC/DC
- GSD files
- Function block diagrams in the VSD format
- Dimension drawings of the DC Converter and Control Module in the DXF and PDF formats
- STARTER commissioning tool
- Spare parts list in the XLS format
- Catalog D 23.1 · 2010 in the PDF format
- Information about service and support

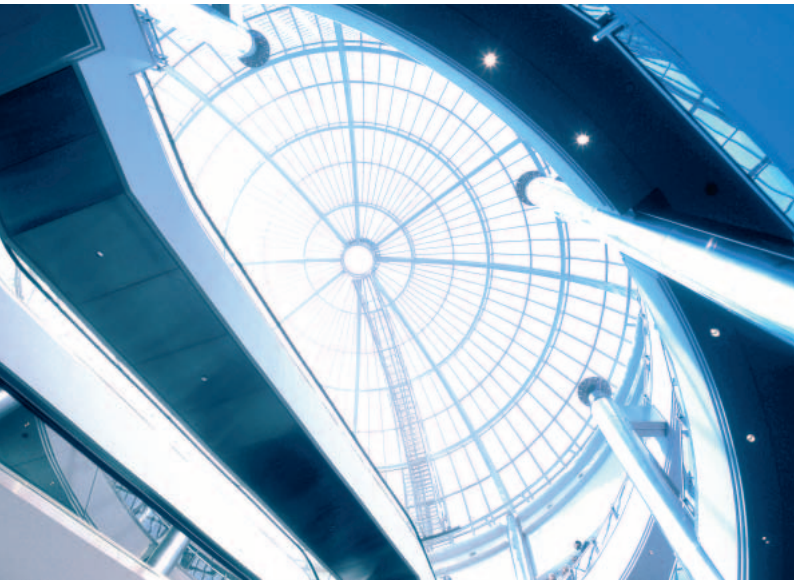
# SINAMICS Drives
# SINAMICS DCM Converter Units

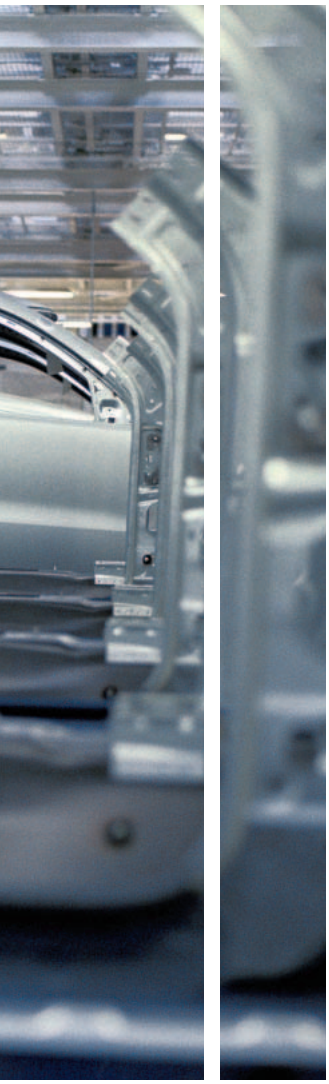
## Catalog D 23.1 · 2010


The products and systems described in this catalog are manufactured and marketed using a certified quality management system in accordance with ISO 9001/ISO 14001 (Certificate Registration No. AT-00257/1 and AT-00355/1). The certificates are recognized in all IQNet countries.

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







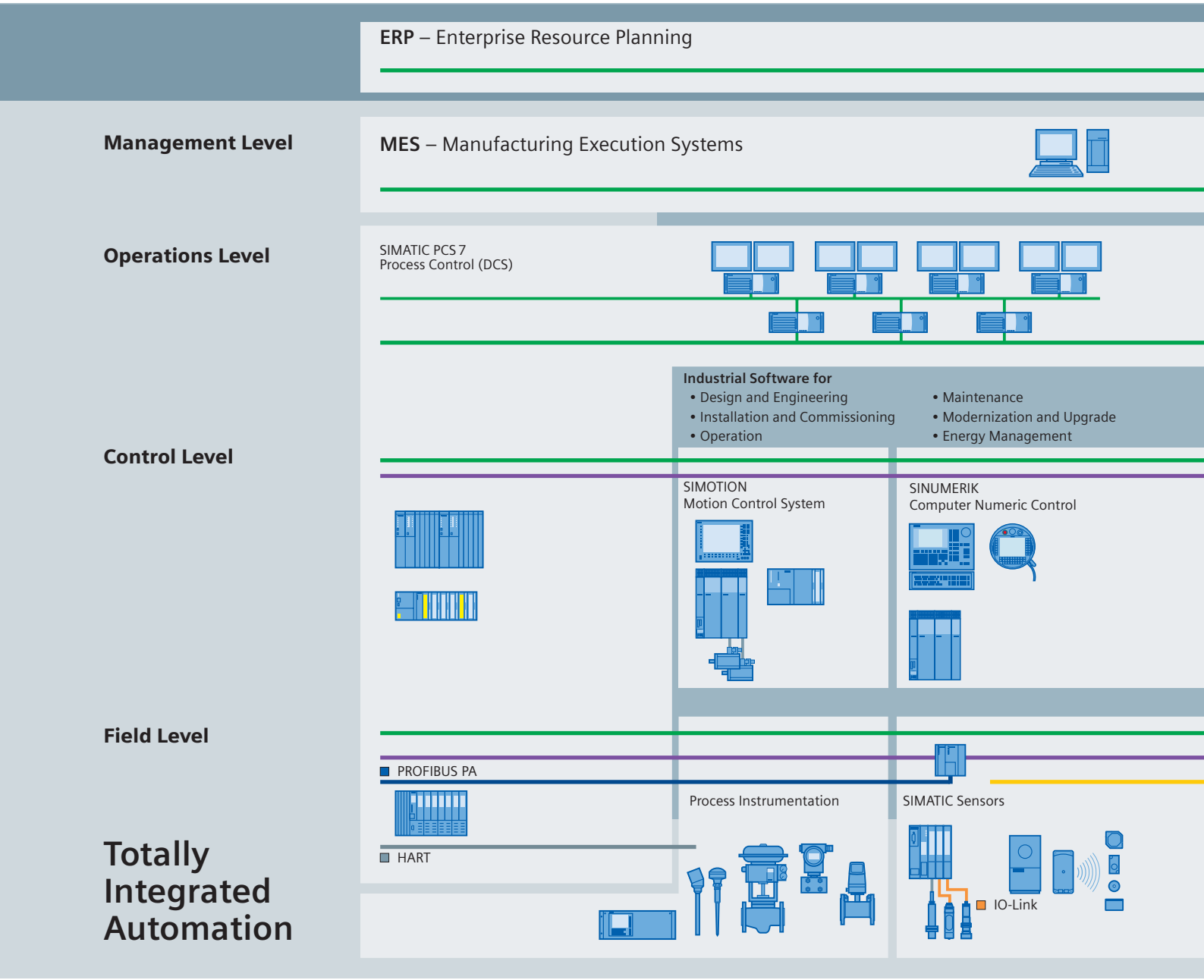
# Answers for industry.

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

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

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

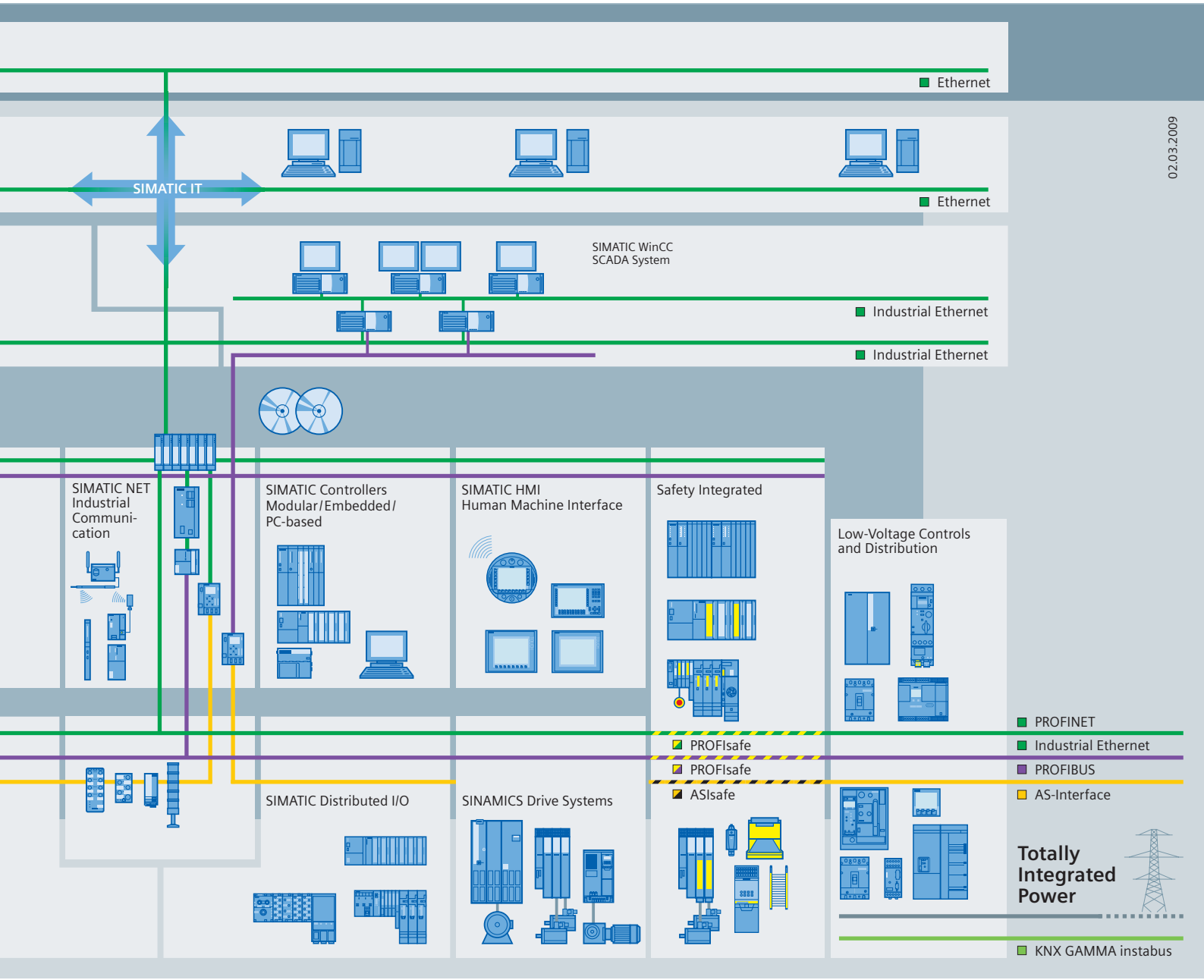
Check out the opportunities our automation and drive solutions provide. And discover how you can sustainably enhance your competitive edge with us.




# Setting standards in productivity and competitiveness.

**Totally Integrated Automation.**

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




**TIA is characterized by its unique continuity.**

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

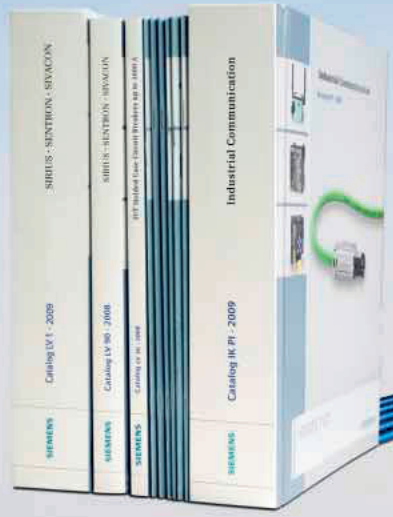
**The unique continuity is already a defined characteristic at the development stage of our products and systems.**

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

# 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

## The SINAMICS drive family

1


SINAMICS range applications

### *Area of application*

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

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

### *Variants*

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

- SINAMICS G is designed for standard applications with induction motors. These applications have less stringent requirements regarding the dynamic performance of the motor speed.
- SINAMICS S handles complex drive tasks with synchronous/induction motors and fulfills stringent requirements regarding
  - the dynamic performance and accuracy
  - the integration of extensive technological functions in the drive control system
- SINAMICS DC MASTER is the DC drive belonging to the SINAMICS family. As a result of its standard expandability, it fulfills both basic as well as demanding requirements relating to drive technology and complementary markets.

### *Platform concept and Totally Integrated Automation*

All SINAMICS versions are based on a platform concept. Common hardware and software components, as well as standardized tools for design, configuration and commissioning tasks, ensure high-level integration across all components. SINAMICS handles a wide variety of drive tasks without system gaps. The different SINAMICS versions can be easily combined with each other.

SINAMICS is a part of the Siemens “Totally Integrated Automation” concept. Integrated SINAMICS systems covering engineering, data management and communication at the automation level, result in extremely cost-effective solutions based on SIMOTION, SINUMERIK and SIMATIC control systems.


SINAMICS as part of the Siemens modular automation system

### *Quality according to DIN EN ISO 9001*

SINAMICS is able to meet the highest requirements in terms of quality. Comprehensive quality assurance measures in all development and production processes ensure a consistently high level of quality.

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

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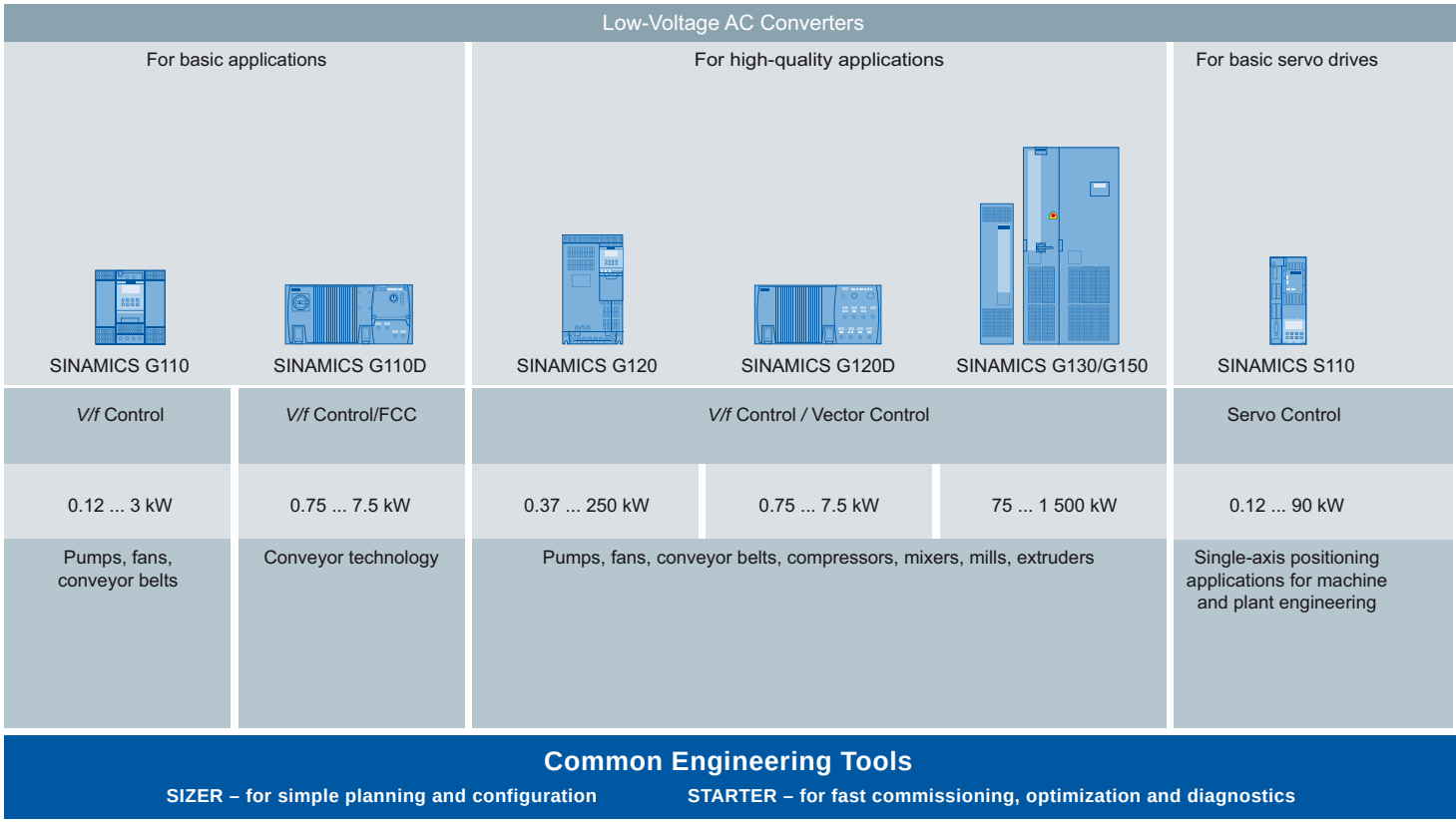
## The SINAMICS drive family




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

DC converters (line supply voltage < 1 000 V)

- **SINAMICS DC MASTER** – the scalable drive system for basic and demanding applications

AC low-voltage converters (line supply voltage < 1 000 V)

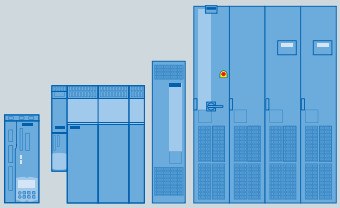
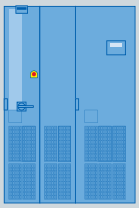
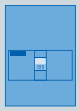
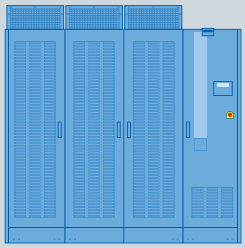
- **SINAMICS G110** – the versatile drive for low power ratings
- **SINAMICS G120** – the modular single-motor drive for low to medium power ratings
- **SINAMICS G110D** – the distributed, compact single-motor drive in a high degree of protection for basic applications
- **SINAMICS G120D** – the distributed, modular single-motor drive in a high degree of protection for sophisticated applications
- **SINAMICS G130** and **SINAMICS G150** – the universal drive solution for high-performance single-motor drives
- **SINAMICS S110** – the basic positioning drive for single-axis applications
- **SINAMICS S120** – the flexible, modular drive system for demanding drive tasks
- **SINAMICS S150** – the drive solution for demanding high-performance single-motor drives

Medium-voltage converters (line supply voltage > 1 000 V)

- **SINAMICS GM150** – the universal drive solution for single-motor drives
- **SINAMICS SM150** – the drive solution for demanding single-motor and multi-motor drives
- **SINAMICS GL150** – the drive solution for synchronous motors up to 120 MW
- **SINAMICS SL150** – the drive solution for slow speed motors with the highest torques and overloads

The SINAMICS range is characterized by the following system properties:

- Uniform functionality based on a platform concept
- Standardized engineering
- High degree of flexibility and combination capability
- Wide range of performance
- Designed for global use
- SINAMICS Safety Integrated
- Increased economic efficiency and effectiveness
- Versatile interfacing facilities to higher-level controllers
- Totally Integrated Automation

| Low-Voltage AC Converters | | DC Converters | Medium-Voltage AC Converters |
|---|---|---|---|
| For demanding applications | | For basic and demanding applications | For high-power applications |
|  SINAMICS S120 |  SINAMICS S150 |  SINAMICS DCM |  SINAMICS GM150/SM150/GL150/SL150 |
| *V/f* Control / Vector Control / Servo Control | | Closed-loop speed control / torque control | *V/f* Control / Vector Control |
| 0.12 ... 4 500 kW | 75 ... 1 200 kW | 6 kW ... 30 MW | 0.8 ... 120 MW |
| Motion Control applications in production machines (packaging, textile, printing, paper, plastic), machine tools, plants and process lines | Test stands, cross cutters, centrifuges | Rolling mills, cross cutters and shears, wire-drawing machines, extruders and kneaders, presses, elevator and crane installations, cableways and lifts, mining hoists, test stand drives | Pumps, fans, compressors, mixers, extruders, mills, rolling mills, mining hoist drives, excavators, test stands |

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**Common Engineering Tools**

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

## The members of the SINAMICS drive family

1

**SINAMICS DC converters**

**SINAMICS DCM**

*The scalable drive system for basic and demanding applications*

**Main applications**

- Machines and plants in the industrial environment (steel/aluminum, plastics, printing, paper, cranes, mining, oil and gas, excitation equipment) in the new plant and retrofit businesses

**Application examples**

- Rolling mills
- Cross cutters and shears
- Wire-drawing machines
- Extruders and kneaders
- Presses
- Elevators and cranes
- Cableways and lifts
- Mine hoists
- Test stand drives

**Highlights**

- PROFIBUS as standard, PROFINET optional
- Variance of the Control Units
- Field power supply in line with requirements
- Electronics power supply for connection to 24 V DC
- Power section isolated with respect to ground
- Free function blocks and Drive Control Chart
- Expandable functionality using SINAMICS components
- Single-phase connection possible
- Coated PCBs and nickel-plated copper busbars
- Wide temperature range

**Catalog D 23.1**

## SINAMICS low-voltage converters

| SINAMICS G110 | SINAMICS G120 | SINAMICS G110D | SINAMICS G120D |
|---|---|---|---|
|  |  |  |  |
| *The versatile drive for low power ratings* | *The modular single-motor drive for low to medium power ratings* | *The distributed, compact single-motor drive in a high degree of protection for basic applications* | *The distributed, modular single-motor drive in a high degree of protection for sophisticated applications* |
| **Main applications** | | | |
| • Machines and plants for industrial and commercial applications | • Machines and plants for industrial and commercial applications (machinery construction, automobile, textiles, chemical industry, printing, steel) | • Horizontal conveyor applications in the industrial environment, with the main focus on distribution and logistics in airports; generally suitable for basic conveyor-related tasks with local control or connected to a bus via AS-Interface | • Conveyor drive applications in industrial environments, main focus on the automotive industry; also suitable for high-performance applications e.g. at airports and in the food, beverage and tobacco industry (without tenside) |
| **Application examples** | | | |
| • Pumps and fans<br>• Auxiliary drives<br>• Conveyor systems<br>• Billboards<br>• Door/gate operating mechanisms<br>• Centrifuges | • Pumps and fans<br>• Compressors<br>• Conveyor systems | • Conveyor systems<br>• Airports<br>• Distribution logistics | • Conveyor systems<br>• Electric monorail system in distribution logistics |
| **Highlights** | | | |
| • Compact<br>• Can be flexibly adapted to different applications<br>• Simple and fast commissioning<br>• Clear terminal layout<br>• Optimum interaction with SIMATIC and LOGO! | • Modular<br>• Can be flexibly expanded<br>• Simple and fast commissioning<br>• Regenerative feedback<br>• Innovative cooling concept<br>• Optimum interaction with SIMOTION and SIMATIC<br>• SINAMICS Safety Integrated | • Low profile design with standard drilling dimensions (standard footprint) in IP65 degree of protection<br>• Simple and fast commissioning<br>• Versions with and without a maintenance switch<br>• Optional key-operated switch<br>• AS-Interface with bus parameterization<br>• Quick stop function<br>• Integrated brake control, 180 V DC<br>• Optimum interaction with SIMATIC and LOGO! | • Low profile design with standard drilling dimensions (standard footprint) in IP65 degree of protection<br>• Modular<br>• Can be flexibly expanded<br>• Simple and fast commissioning<br>• Regenerative feedback<br>• Optimum interaction with SIMOTION and SIMATIC<br>• SINAMICS Safety Integrated |
| **Catalog D 11.1** | **Catalog D 11.1** | **Catalog D 11.1** | **Catalog D 11.1** |

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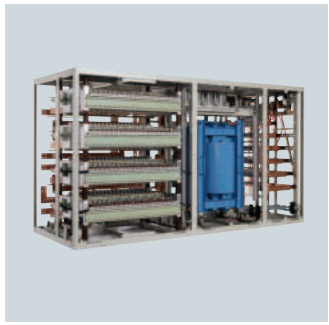
## The members of the SINAMICS drive family

**SINAMICS low-voltage converters**

| SINAMICS G130, SINAMICS G150 | SINAMICS S110 | SINAMICS S120 | SINAMICS S150 |
|---|---|---|---|
|  |  |  |  |
| *The universal drive solution for high-performance single-motor drives* | *The basic positioning drive for single-axis applications* | *The flexible, modular drive system for demanding drive tasks* | *The drive solution for demanding high-performance single-motor drives* |
| **Main applications** | | | |
| • Machines and plants in the process and production industry, water/waste, power stations, oil and gas, petrochemicals, chemical raw materials, paper, cement, stone, steel | • Machines and plants in the industrial environment, where machine axes should be quickly and precisely positioned in the simplest possible way | • Machines and plants for industrial applications (packaging, plastics, textile, printing, wood, glass, ceramics, presses, paper, lifting equipment, semiconductors, automated assembly and testing equipment, handling, machine tools) | • Machines and plants in the process and production industry, food, beverages and tobacco, automotive and steel industry, mining/open-cast mining, shipbuilding, lifting equipment, conveyors |
| **Application examples** | | | |
| • Pumps and fans<br>• Compressors<br>• Extruders and mixers<br>• Crushers | • Handling equipment<br>• Feed and withdrawal devices<br>• Stacking units<br>• Automatic assembly machines<br>• Laboratory automation<br>• Metalworking<br>• Woodworking, glass and ceramic industries<br>• Printing machines<br>• Plastics processing machines | • Motion Control applications (positioning, synchronous operation)<br>• Numerical control, interpolating motion control<br>• Converting<br>• Technological applications | • Test stand drives<br>• Centrifuges<br>• Elevators and cranes<br>• Cross cutters and shears<br>• Conveyor belts<br>• Presses<br>• Cable winches |
| **Highlights** | | | |
| • Space-saving<br>• Low noise<br>• Simple and fast commissioning<br>• SINAMICS G130: Modular components<br>• SINAMICS G150: Ready-to-connect cabinet unit<br>• Optimum interaction with SIMATIC | • Can be universally used<br>• Flexible and modular<br>• Scalable in terms of power, functionality, number of axes, performance<br>• Simple and fast commissioning, auto-configuration<br>• Innovative, system architecture fit for the future<br>• (graded infeed / regenerative feedback concepts)<br>• Wide range of motors<br>• (Optimum interaction with SIMOTION, SIMATIC and SINUMERIK)<br>• SINAMICS Safety Integrated | • Can be universally used<br>• Flexible and modular<br>• Scalable in terms of power, functionality, number of axes, performance<br>• Simple and fast commissioning, auto-configuration<br>• Innovative, system architecture fit for the future<br>• Graded infeed / regenerative feedback concepts<br>• Wide range of motors<br>• Optimum interaction with SIMOTION, SIMATIC and SINUMERIK<br>• SINAMICS Safety Integrated | • Four-quadrant operation as standard<br>• High control accuracy and dynamic response<br>• Minimum harmonic effects on the supply system, considerably lower than the limits specified in IEEE 519 THD<br>• Tolerant to line voltage fluctuations<br>• Reactive power compensation option<br>• Simple and fast commissioning<br>• Ready-to-connect cabinet unit<br>• Optimum interaction with SIMATIC |
| **Catalog D 11** | **Catalog PM 22** | **Catalogs PM 21, D 11.1 and D 21.3** | **Catalog D 21.3** |

## SINAMICS medium-voltage converters

| SINAMICS GM150 | SINAMICS SM150 | SINAMICS GL150 | SINAMICS SL150 |
|---|---|---|---|
|  |  |  |  |
| *The universal drive solution for single-motor drives* | *The drive solution for demanding single-motor and multi-motor drives* | *The drive solution for synchronous motors up to 120 MW* | *The drive solution for slow speed motors with the highest torques and overloads* |
| **Main applications** | | | |
| • Machines and plants in the process industry | • Machines and plants in the steel industry sector (rolling mills) and mining industry | • Machines and plants in the process industry, especially in the oil, gas and petrochemicals sectors | • Machines and plants in the basic materials industry, especially in the steel and mining sectors |
| **Application examples** | | | |
| • Pumps and fans<br>• Compressors<br>• Extruders and mixers<br>• Crushers<br>• Marine drives | • Hot and cold rolling mill stands<br>• Mining hoists<br>• Test stand drives<br>• Ore conveyor belts | • Compressors<br>• Pumps and fans<br>• Extruders and kneaders<br>• Marine drives<br>• Blast furnace blowers | • Hot rolling mill roughing stands<br>• Mine hoists<br>• Ore and cement mills<br>• Excavators |
| **Highlights** | | | |
| • Space-saving<br>• Simple and fast commissioning<br>• Ready-to-connect cabinet unit<br>• Optimum interaction with SIMATIC | • Four-quadrant operation as standard<br>• High degree of efficiency and operation that reduces the stress on the motor<br>• High control accuracy and dynamic response<br>• Almost no line harmonics<br>• Reactive power compensation option<br>• Simple and fast commissioning<br>• Ready-to-connect cabinet unit<br>• Optimum interaction with SIMATIC | • Compact design and high power density<br>• Simple operator control and monitoring<br>• Extremely rugged, reliable in operation and almost maintenance-free<br>• Two directions of rotation by reversing the rotating field<br>• Can be seamlessly integrated into higher-level automation systems | • Low output frequency/motor speed<br>• High short-time overload capability<br>• Four-quadrant operation as standard<br>• Extremely rugged, reliable in operation and almost maintenance-free<br>• High efficiency<br>• Can be seamlessly integrated into higher-level automation systems |
| **Catalog D 12** | **Catalog D 12** | **–** | **–** |

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## SINAMICS DCM series of converters

### Overview

SINAMICS DC MASTER is the new generation of DC converters from Siemens. The name SINAMICS DC MASTER – briefly: SINAMICS DCM – embodies the strengths of this new generation. It combines the advantages of its predecessor SIMOREG DC-MASTER, with the advantages of the SINAMICS family.

When it comes to quality, reliability and functionality, SINAMICS DC MASTER is not only on par with its predecessor – but especially in the area of functionality – offers new features and includes useful functions from its predecessor as standard.

SINAMICS DC MASTER is the new member of the SINAMICS family that now makes many of the SINAMICS tools and components known from AC technology available to DC technology.

As scalable drive system, the SINAMICS DC MASTER series of converters is convincing both for basic as well as demanding applications. The DC Converter is equipped with a standard Control Unit (Standard CUD) for standard closed-loop control. The option of combining Standard CUD and Advanced CUD is used to address applications demanding a higher computational performance and more interfaces.

The DC Converter of the SINAMICS DC MASTER series combines the open-loop and closed-loop control and power sections in one device. It especially sets itself apart as a result of the compact, space-saving design.

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

The interfaces of the CUD and the number of digital inputs and outputs can be supplemented using additional modules – such as the TM15 and TM31 Terminal Modules.

The components of a DC drive system and how these are logically interlinked are shown in the following diagram. A flow diagram on pages 1/12 and 1/13 provides support when selecting and dimensioning the required components.

## Overview

**Motors** (see Catalog DA 12)

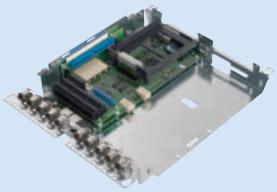
**Motor-side components** (see Catalogs D 23.1, LV 60, ET B1-BETA)

Fuses
SICROWBAR DC
Smoothing reactors
(for retrofit for motors with solid yoke and single-phase operation)

**SINAMICS DC MASTER components**

SINAMICS DC MASTER


Advanced CUD



SINAMICS accessories
For example:
Terminal Modules,
Sensor Module,
Advanced
Operator Panel,
PROFINET Board

SIMOREG CCP

Connection system

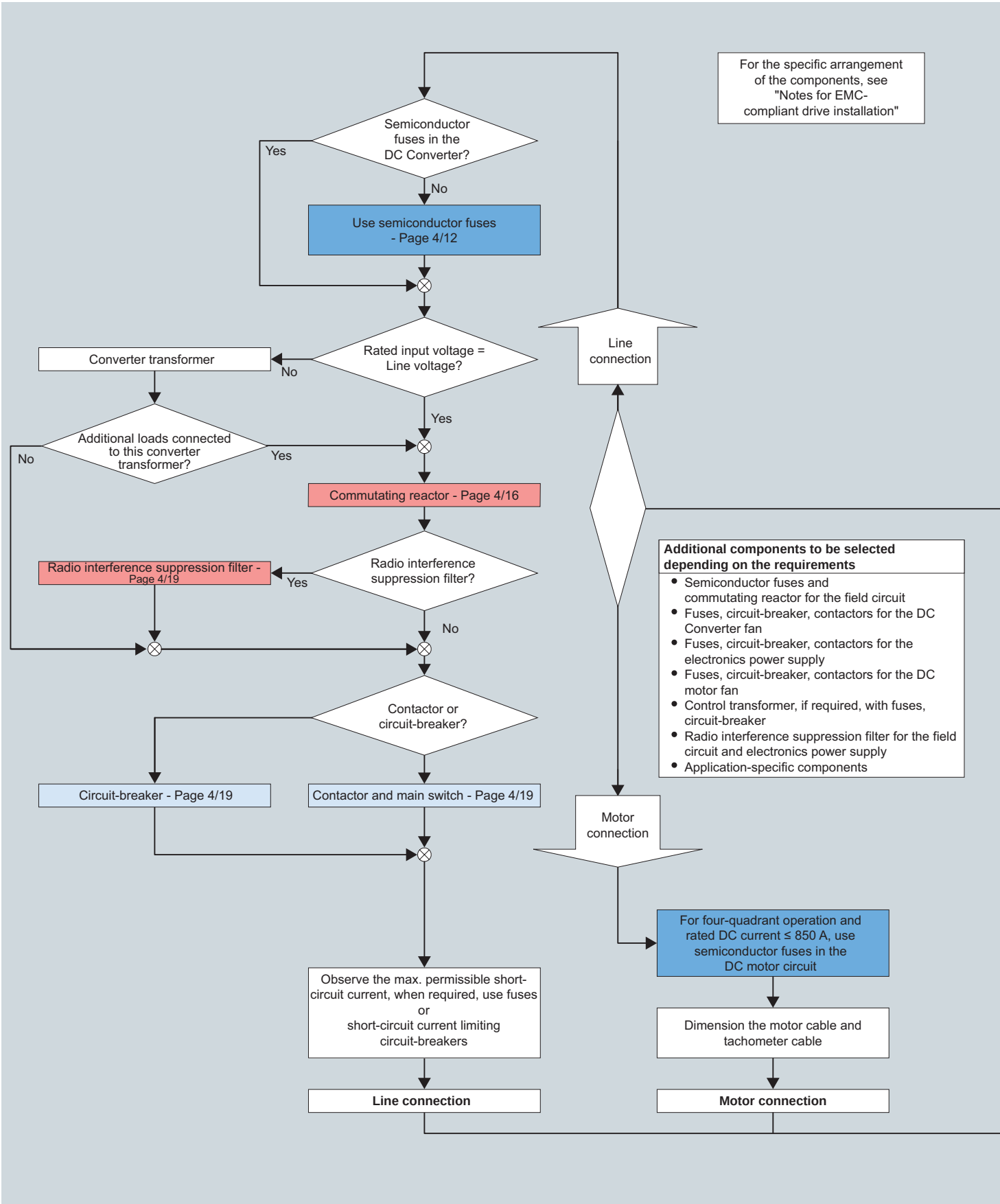
**Line-side components** (see Catalogs D 23.1, LV 1, LV 60, ET B1-BETA)

For example:
Commutating reactor
Line fuses
Circuit breaker or contactor
Radio interference
suppression filter
SICROWBAR AC

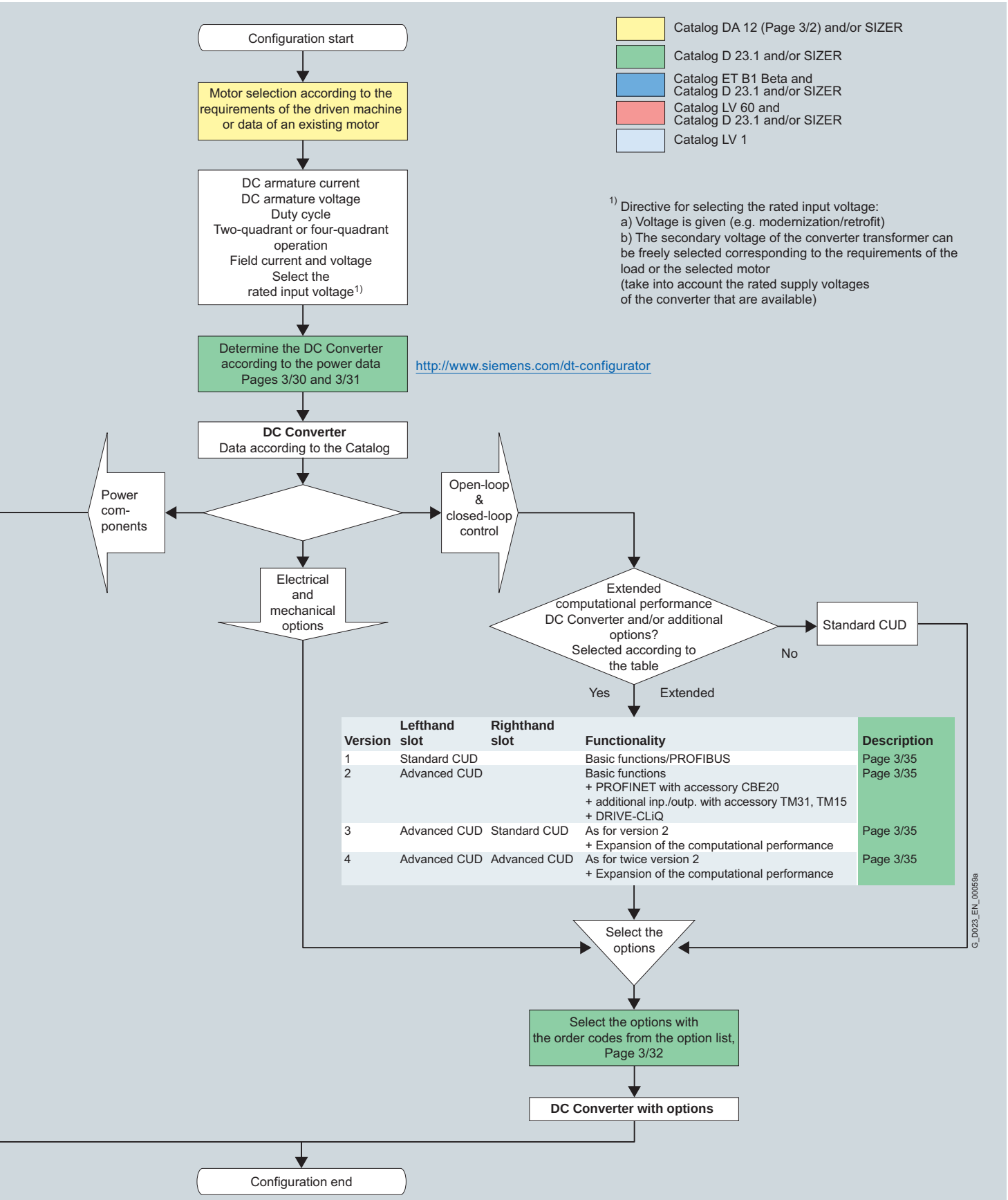
**3 AC line supply**

G_D023_EN_00070

## Configuration



## Configuration (continued)




| Version | Lefthand slot | Righthand slot | Functionality | Description |
|---|---|---|---|---|
| 1 | Standard CUD | | Basic functions/PROFIBUS | Page 3/35 |
| 2 | Advanced CUD | | Basic functions<br>+ PROFINET with accessory CBE20<br>+ additional inp./outp. with accessory TM31, TM15<br>+ DRIVE-CLiQ | Page 3/35 |
| 3 | Advanced CUD | Standard CUD | As for version 2<br>+ Expansion of the computational performance | Page 3/35 |
| 4 | Advanced CUD | Advanced CUD | As for twice version 2<br>+ Expansion of the computational performance | Page 3/35 |

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## Notes

# Highlights



## Overview

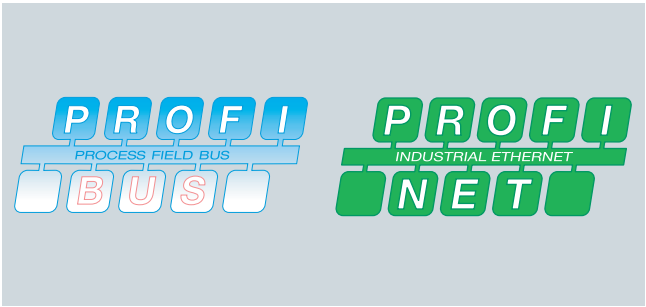
SINAMICS DC MASTER is the drive system for basic applications and demanding DC applications. The use in a wide range of different sectors and complementary markets demands a high degree of scalability and the ability to expand the converter series over a wide range.

In order to be able to guarantee this versatile use, SINAMICS DC MASTER has a whole raft of new features:

### *The SINAMICS drive family*

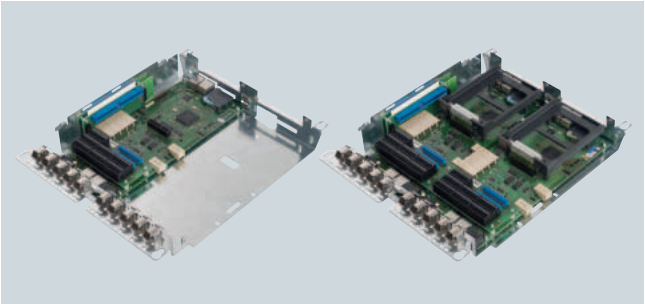
SINAMICS DC MASTER is a member of the SINAMICS drive family. The individual SINAMICS versions are based on a common platform, especially in the area of interfaces, tools and operator control & monitoring.
All of the SINAMICS drives support the TIA philosophy and share common ways of engineering, communication and data management with the SIMATIC, SIMOTION and SINUMERIK automation systems from Siemens. When using these systems, automation solutions can be very simply generated using SINAMICS. As a result of the standard and seamless integration into the automation environment of Siemens, customers also profit from faster engineering and commissioning of the complete machine automation and drive technology. Further, training-related costs are reduced and support, service & maintenance and spare parts stocking are simplified.

### *PROFIBUS as standard, PROFINET optional*



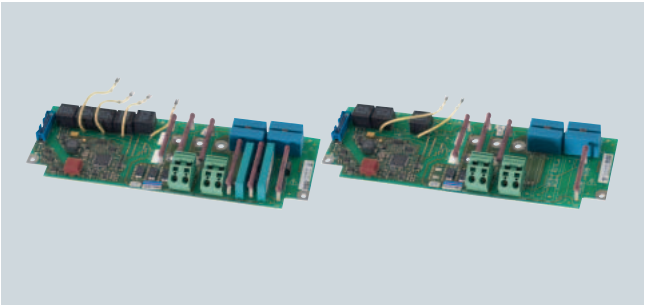

The units are equipped as standard with PROFIBUS – the industry standard. PROFINET is available as option. Communication to other fieldbus systems can be realized using external adapters.

### *Variance of the Control Units*



In order to optimally fulfill the requirements relating to interfaces and computational performance for technology functions, a Standard or Advanced CUD or a combination can be selected. It is also possible to use two CUDs to increase the performance for technological open-loop and closed-loop control tasks. This allows optimum adaptation to the wide range of requirements relating to drive technology and complementary markets – both technically and economically.

### *Field power supply in line with requirements*



With the introduction of SINAMICS DC MASTER, you have the option of selecting the optimum field power supply for your particular requirements.
SINAMICS DC MASTER is always the optimum choice:

- For units without field (from a rated DC current of 60 A and higher)
- For units with a 1Q field (with integrated free-wheeling circuit)
- For units with a 2Q field to actively reduce the current for high-speed field current changes and integrated field overvoltage protection (from a rated DC current of 60 A and higher)

For units from 1 500 A and higher, it is also possible to select a version with 85 A rated field current in a 1Q or 2Q version instead of the 40 A field power supply.
It goes without saying that an external field power supply unit can also be connected – if the application demands it.

## Overview (continued)

### *24 V DC electronics power supply*


The electronics power supply of the DC Converter will be available in two versions:

- For connection to 230 V/400 V AC or
- For connection to 24 V DC (protected against polarity reversal).

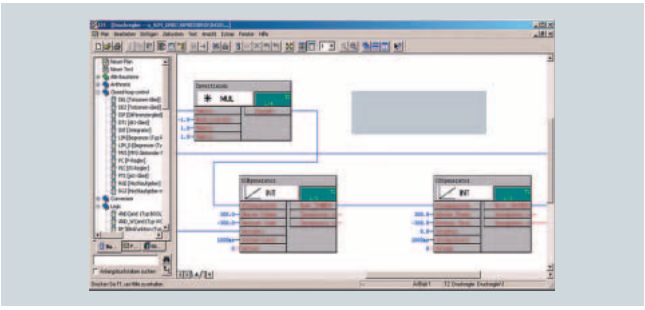
Using a 24 V supply, a UPS function can be simply implemented – and therefore the availability of the plant or system increased.

The figure above shows a 24 V DC power supply SITOP smart.

### *Power section isolated with respect to ground*

The power section voltage sensing inside the unit is floating with respect to the electronics (electrically isolated).
This is the reason that in the future it will not be necessary to disconnect/connect the motor cable to measure the insulation resistance of DC motors. In order to secure the availability of the plant or system and to avoid severe damage to the motor, it is absolutely mandatory that the insulation resistance of DC motors is regularly checked.

### *Free function blocks and Drive Control Chart*

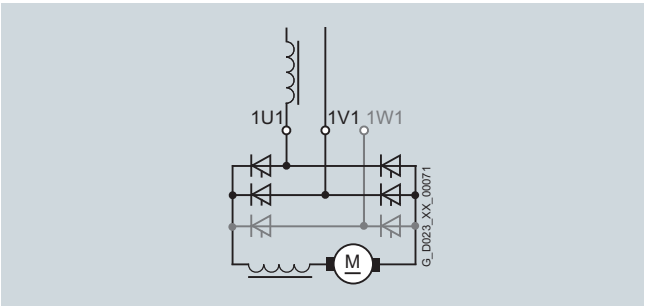


A sufficient number of free function blocks for various applications is included as standard. Optionally, the functional scope can be subsequently extended using free function blocks from Drive Control Chart (DCC). This allows the drive to be optimally adapted to the particular application – both technically and economically.

### *Expandable functionality using SINAMICS components*

Additional inputs and outputs are available by coupling supplementary modules from the SINAMICS range to the DRIVE-CLiQ interface (Advanced CUD). As a consequence, the flexibility when engineering the plant or system is increased and at the same time costs are optimized.

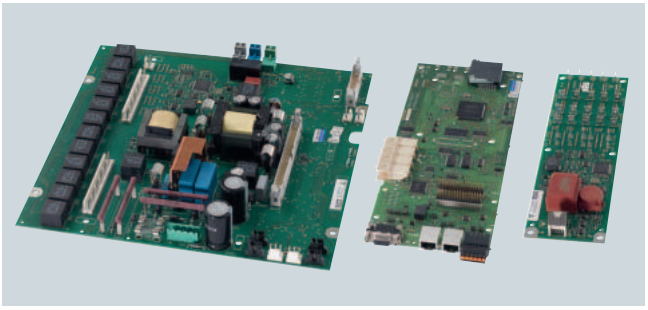
### *Single-phase connection is possible*




For units up to 125 A and up to 575 V AC, the full functionality is available even when supplied through just two conductors. This means, for example, that when retrofitting a converter with single-phase connection, it is not necessary to make any changes to the existing machine or plant – and the retrofitted drive system can be integrated into state-of-the-art communication concepts (TIA).

**Overview** (continued)

***Coated PCBs and nickel-plated copper busbars***



PCBs coated on both sides and nickel-plated copper busbars are two options to improve the reliability for increased degrees of pollution and climatic stressing – as well as for increased environmental stressing (e.g. for aggressive atmospheres).

***Wide temperature range***

Use in regions with high climatic stressing is made simpler as a result of the –40 °C to +70 °C temperature range for storage and transport.

# DC Converter and Control Module

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## General information

### Overview

SINAMICS DC MASTER converter

The SINAMICS DC MASTER series of converters includes the DC Converter and Control Module product versions.

The DC Converter includes built-in units for connection to a three-phase supply. These are used to supply the armature and field of variable-speed DC drives. The rated DC current range of the units extends from 15 to 3 000 A and can be increased by connecting DC Converters in parallel.

Depending on the application, there are units for two-quadrant and four-quadrant operation. The units are autonomous as a result of the integrated parameterization device and do not require any additional equipment for parameterization. All functions associated with open-loop and closed-loop control, as well as all monitoring and auxiliary functions, are handled by a microprocessor system. Setpoints and actual values can either be entered as analog or digital values.

The SINAMICS DC MASTER Control Module is the successor of the SIMOREG CM and is mainly used to retrofit and modernize DC drives.

SINAMICS DC MASTER converters are available in the following sizes (self-ventilated up to 125 A):


| DC Converter | | | | | | Control Module |
|---|---|---|---|---|---|---|
| Rated DC current<br>A | | | | | | |
| ≤ 30 | ≤ 280 | ≤ 600 | ≤ 850 | ≤ 1 200 | ≤ 3 000 | – |
| Dimensions<br>(W × H × D)<br>mm | | | | | | |
| 268 × 385 × 221 | 268 × 385 × 252 | 268 × 625 × 275 | 268 × 700 × 311 | 268 × 785 × 435 | 453 × 883 × 505 | 271 × 388 × 253 |

Detailed dimension drawings in the PDF and DXF formats are available on the DVD-ROM supplied with this catalog and in the Internet under www.siemens.com/sinamics-dcm (information material).

## Benefits

- Less training time and costs and maximum number of identical parts through the extensive product range of the SINAMICS DC MASTER.
  The standard and seamless series of SINAMICS DC MASTER units addresses a wide current and voltage range. The series of units is designed for connection to three-phase line supplies. Furthermore, the units can also be connected to single-phase line supplies up to and including a rated DC current of 125 A.
- Flexible expandability regarding functionality and performance.
  The extensive product range and the many options allow the DC Converter to be optimally adapted to customer requirements – both technically and economically. Different customer requirements, the type and number of interfaces as well as the computational performance and speed can be precisely fulfilled by selecting between either a Standard CUD, an Advanced CUD or a combination of both.
- Plant and system availability are increased by being able to quickly and simply replace components.
  Replaceable components have been designed so that they can be quickly and simply replaced. The spare parts that are available can be viewed at any time, assigned to the serial number of the unit.
- Easy commissioning and parameterization using interactive menus on the AOP30 Advanced Operator Panel with graphic LCD and plain-text display, or PC-supported using the STARTER commissioning tool (see “Tools and engineering”).
- During the complete production process, all of the components are subject to comprehensive tests and checks. This guarantees a high functional safety.
- Can be easily integrated into automation solutions, e.g. using a standard PROFIBUS communication interface and various analog and digital interfaces.

## Application

***DC drive technology: Dynamic, rugged and cost effective***

Depending on the application, DC drives are frequently the most favorably-priced drive solution. They have many advantages when it comes to reliability, operator friendliness and operating characteristics. Just as before, there are some good technical and economic reasons for still using DC drives in many industrial areas:

- Favorably-priced four-quadrant operation
- Continuous operation at a low speed
- Full torque even at low speeds
- High starting torque
- Wide speed control range with constant power
- Low space requirement and low weight
- Reliability

Main applications for DC drives include:

- Rolling mill drives
- Wire-drawing machines
- Extruders and kneaders
- Presses
- Elevators and cranes
- Cableways and lifts
- Mine hoists
- Test stand drives

## General information

### Function

| Function | Description |
|---|---|
| **Functions of the closed-loop control in the armature circuit** | |
| Speed setpoint | The source of the speed setpoint and additional setpoints can be freely selected by making the appropriate parameter settings:<br>• Entered using analog values 0 to ± 10 V, 0 to ± 20 mA, 4 to 20 mA<br>• Using the integrated motorized potentiometer<br>• Using binectors with the functions: Fixed setpoint, jogging, crawl<br>• Entered via serial interfaces of the SINAMICS DC MASTER<br>• Entered via supplementary modules<br>The scaling is realized so that 100 % setpoint (formed from the main setpoint and supplementary setpoints) corresponds to the maximum motor speed.<br>The setpoint can be limited to a minimum and maximum value via a parameter or connector. Further, additional points are provided in the software e.g. in order to be able to enter supplementary setpoints before or after the ramp-function generator. The "setpoint enable function" can be selected using a binector. After a parameterizable filter function (PT1 element), the summed setpoint is transferred to the setpoint input of the speed controller. In this case, the ramp-function generator is also active. |
| Actual speed | One of four sources can be selected as signal for the speed actual value.<br>• *Analog tachometer*<br>The voltage of the tachogenerator at maximum speed can be between 8 and 270 V. Adaptation to the voltage is realized using parameters.<br>• *Pulse encoder*<br>The pulse encoder type, the number of pulses per revolution and the maximum speed are set using parameters. Encoder signals (symmetrical: with additional inverted track, unsymmetrical: referred to ground) up to a maximum differential voltage of 27 V can be processed by the evaluation electronics.<br>The rated voltage range (5 or 15 V) for the encoder is selected via parameter. The power supply for the pulse encoder can be taken from the DC Converter for a rated voltage of 15 V.<br>5 V encoders require an external power supply. The pulse encoder is evaluated across the three tracks: Track 1, track 2 and zero mark. However, pulse encoders without zero mark can also be used. A position actual value can be sensed using the zero mark. The maximum frequency of the encoder pulses can be 300 kHz. It is recommended that pulse encoders with at least 1 024 pulses per revolution are used (due to the smooth running operation at low speeds).<br>• *Operation without tachometer with EMF control*<br>A speed actual value encoder is not required for closed-loop EMF control. In this case, the output voltage of the device is measured in the DC Converter. The measured armature voltage is compensated by the internal voltage drop across the motor (IR compensation). The level of compensation is automatically determined during the current controller optimization run. The accuracy of this control method, which is defined by the temperature-dependent change in the motor armature circuit resistance, is approximately 5 %. We recommend that the current controller optimization run is repeated when the motor is in the warm operating condition to achieve a higher degree of precision. The closed-loop EMF control can be used if the requirements on the precision are not so high, if it is not possible to mount an encoder and the motor is operated in the armature voltage control range.<br>Notice: In this mode, EMF-dependent field weakening is not possible.<br>• *Freely selectable speed actual value signal*<br>For this mode, any connector number can be selected as speed actual value signal. This setting is especially selected if the speed actual value sensing is implemented on a supplementary technology module.<br>Before the speed actual value is transferred to the speed controller, it can be smoothed using a parameterizable smoothing element (PT1 element) and two adjustable bandstop filters. Bandstop filters are used primarily for the purpose of filtering out resonant frequencies caused by mechanical resonance. The resonant frequency and the filter quality factor can be set. |
| Ramp-function generator | When there is a step change in the setpoint applied at its input, the ramp-function generator converts the setpoint into a signal with a steady rate of rise. Ramp-up time and ramp-down time can be selected independently of one another. In addition, the ramp-function generator has initial and final rounding-off (jerk limiting) that are effective at the beginning and end of the ramp-up time.<br>All of the times for the ramp-function generator can be set independently of one another.<br>Three parameter sets are available for the ramp-function generator times; these can be selected via binary select inputs or a serial interface (via binectors). The ramp-up function generator parameters can be switched over in operation. In addition, a multiplication factor can be applied to the value of parameter set 1 via a connector (to change the ramp-function generator data via a connector). When entering ramp-function generator times with the value zero, the speed setpoint is directly input into the speed controller. |

## Function (continued)

| Function | Description |
|---|---|
| **Functions of the closed-loop control in the armature circuit** (continued) | |
| Speed controller | The speed controller compares the setpoint and actual value of the speed and if there is a deviation, enters an appropriate current setpoint into the current controller (principle: Speed control with lower-level current controller). The speed controller is implemented as PI controller with additional D component that can be selected. Further, a switchable droop function can be parameterized. All of the controller parameters can be adjusted independently of one another. The value for $K_p$ (gain) can be adapted depending on a connector signal (external or internal).<br>In this case, the P gain of the speed controller can be adapted depending on the speed actual value, current actual value, setpoint-actual value distance or the wound roll diameter. This can be precontrolled in order to achieve a high dynamic performance in the speed control loop. For this purpose, e.g. depending on the friction and the moment of inertia of the drive, a torque setpoint signal can be added after the speed controller. The friction and moment of inertia compensation are determined using an automatic optimization run.<br>The output quantity of the speed controller can be directly adjusted via parameter after the controller has been enabled.<br>Depending on the parameterization, the speed controller can be bypassed and the converter controlled either with closed-loop torque or current control. In addition, it is also possible to switch between speed control/torque control in operation using the "leading/following switchover" selection function. The function can be selected as binector using a binary user-assignable terminal or a serial interface. The torque setpoint is input via a selectable connector and can therefore come from an analog user-assignable terminal or via a serial interface.<br>A limiting controller is active in the following drive state (torque or current controlled operation). In this case, depending on a speed limit that can be selected using parameters, the limiting controller can intervene in order to prevent the drive accelerating in an uncontrolled fashion. In this case, the drive is limited to an adjustable speed deviation. |
| Torque limiting | The speed controller output represents the torque setpoint or current setpoint depending on what has been parameterized. In torque-controlled operation, the speed controller output is weighted with the machine flux $\Phi$ and transferred to a current limiting stage as a current setpoint. Torque control is applied primarily in field weakening operation in order to limit the maximum motor torque independent of the speed.<br>The following functions are available:<br>• Independent setting of positive and negative torque limits using parameters.<br>• Switchover of the torque limit using a binector as a function of a parameterizable switchover speed.<br>• Free input of a torque limit by means of a connector signal, e.g. via an analog input or via serial interface.<br>The lowest specified quantity should always be effective as the actual torque limit. Additional torque setpoints can be added after the torque limit. |
| Current limiting | The current limit that can be adjusted after the torque limit is used to protect the converter and the motor. The lowest specified quantity is always effective as the actual current limit.<br>The following current limit values can be set:<br>• Independent setting of positive and negative current limits using parameters (maximum motor current setting).<br>• Free input of a current limit using a connector, e.g. from an analog input or via a serial interface.<br>• Separate setting of current limit using parameters for stopping and quick stop.<br>• Speed-dependent current limiting: An automatically initiated, speed-dependent reduction of the current limit at high speeds can be parameterized (commutation limit curve of the motor).<br>$I^2t$ monitoring of the power section: The thermal state of the thyristors is calculated for all current values. When the thyristor limit temperature is reached, the unit responds as a function of parameter settings, i.e. the converter current is reduced to the rated DC current or the unit is shut down with a fault message. This function is used to protect the thyristors. |
| Current controller | The current controller is implemented as PI controller with P gain and integral time that can be set independently from one another. The P and I components can also be deactivated (pure P controller or pure I controller). The current actual value is sensed using a current transformer on the three-phase side and is fed to the current controller via a load resistor and rectification after analog-digital conversion. The resolution is 10 bits for the converter related current. The current limit output is used as current setpoint.<br>The current controller output transfers the firing angle to the gating unit – the precontrol function is effective in parallel. |
| Precontrol | The precontrol in the current control loop improves the dynamic performance of the closed-loop control. This allows rise times of between 6 and 9 ms in the current control loop. The precontrol is effective dependent on the current setpoint and EMF of the motor and ensures – for intermittent and continuous current or when the torque direction is reversed – that the required firing angle is quickly transferred as setpoint to the gating unit. |
| Auto-reversing module | In conjunction with the current control loop, the auto-reversing module (only for units with four-quadrant drives) ensures the logical sequence of all of the operations and processes required to change the torque direction. The torque direction can also be disabled when required via parameter. |
| Gating unit | The gating unit generates the firing pulses for the power section thyristors in synchronism with the line supply voltage. The synchronization is independent of the speed and the electronics supply and is sensed at the power section. The timing of the firing pulses is defined by the output values of the current controller and the precontrol. The firing angle limit can be set using parameters.<br>In a frequency range from 45 to 65 Hz, the gating unit automatically adapts itself to the actual line frequency. |

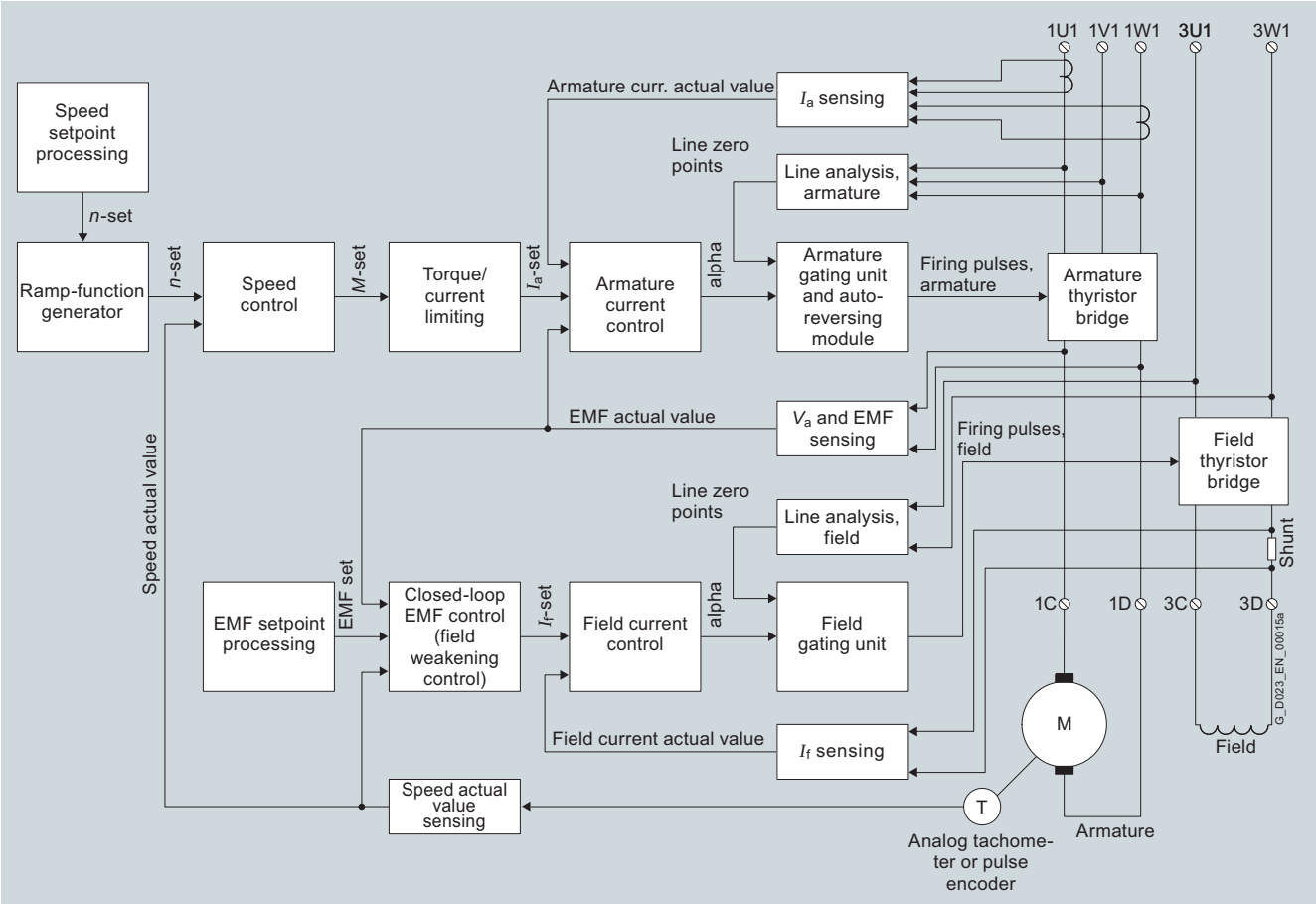
## General information

### Function (continued)

| Function | Description |
|---|---|
| **Functions of the closed-loop control in the field circuit** | |
| EMF controller | The EMF controller compares setpoint and actual value of the EMF (induced motor voltage) and enters the setpoint for the field current controller. This therefore permits field weakening control that is dependent on the EMF.<br>The EMF controller operates as PI controller; P and I components can be adjusted independently of one another and/or the controller can be operated as pure P controller or pure I controller. A precontrol function operates in parallel to the EMF controller. Depending on the speed, it precontrols the field current setpoint using an automatically recorded field characteristic (refer to the optimization runs). There is an adding point after the EMF controller, where the supplementary field current setpoints can be entered either via a connector, via an analog input or a serial interface. The limit is then effective for the field current setpoint. In this case, the field current setpoint can be limited to a minimum and a maximum value that can be set independently from one another. The limit is realized using a parameter or a connector. The minimum for the upper limit or the maximum for the lower limit is effective. |
| Field current controller | The field current controller is a PI controller – where $K_p$ and $T_n$ can be independently set. It can also be operated as pure P and I controller. A precontrol function operates in parallel to the field current controller. This calculates and sets the firing angle for the field circuit as a function of current setpoint and line supply voltage. The precontrol supports the current controller and ensures that the field circuit has the appropriate dynamic performance. |
| Gating unit | The gating unit generates the firing pulses for the power section thyristors in synchronism with the line supply voltage in the field circuit. The synchronization is detected in the power section and is therefore independent of the electronics power supply. The timing of the firing pulses is defined by the output values of the current controller and the precontrol. The firing angle limit can be set using parameters. In a frequency range from 45 to 65 Hz, the gating unit automatically adapts itself to the actual line supply voltage. |
| **Communication between drive components** | |
| DRIVE-CLiQ | Communication between SINAMICS components is realized using the standard internal SINAMICS interface DRIVE-CLiQ (this is an abbreviation for Drive Component Link with IQ). This couples the Control Unit with the connected drive components (e.g. DC Converter, Terminal Modules etc.).<br>DRIVE-CLiQ provides standard digital interfaces for all SINAMICS drives. This permits modularization of the drive functions and thus increased flexibility for customized solutions (allows power and intelligence to be separated).<br>The DRIVE-CLiQ hardware is based on the Industrial Ethernet standard and uses twisted-pair cables. The DRIVE-CLiQ line provides the transmit and receive signals and also the 24 V power supply.<br>Setpoints and actual values, control commands, status feedback signals and electronic rating plate data of the drive components are transferred via DRIVE-CLiQ. Only original Siemens cables must be used for DRIVE-CLiQ cables. As a result of the special transfer and damping properties, only these cables can guarantee that the system functions perfectly. |
| SINAMICS Link | SINAMICS Link allows data to be directly exchanged between several (2 to 64) Control Units. A higher-level master is not required.<br>The following Control Units support SINAMICS Link:<br>• CU320-2<br>• Advanced CUD<br>For use of SINAMICS Link, all of the Control Units must be equipped with the CBE20 Communication Board (option G20).<br>In addition, a memory card (options S01, S02) is required for the Advanced CUD. Communication can either be synchronous (only CU320-2) or non-synchronous or a combination of both. Each participant can send and receive up to 16 process data words.<br>For instance, SINAMICS Link can be used for the following applications:<br>• Torque distribution for n drives<br>• Setpoint cascading for n drives<br>• Load distribution of drives coupled through a material web<br>• Master/slave function for infeed units<br>• Couplings between SINAMICS units |

## Function (continued)

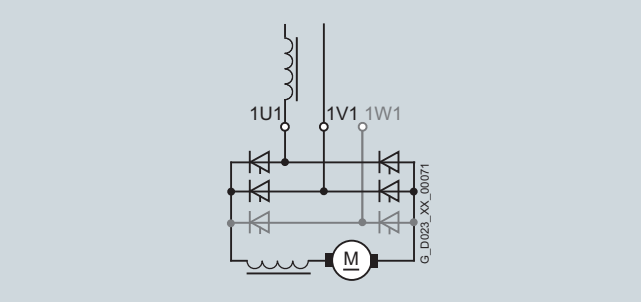
Overview, closed-loop control structure



**Function** (continued)

### *Single-phase operation*

For DC Converters up to 125 A and up to 575 V AC, the full functionality of the devices is available even when supplied through only two conductors.




This means, that in a retrofit project for example, a converter with a single-phase connection can be integrated into state-of-the-art communication concepts (TIA) without requiring any changes to the existing machine or plant.

The unit is connected to the line supply via terminals 1U1 and 1W1. It is mandatory that a single-phase commutating reactor or a transformer with 4 % $u_k$ is provided, which only supplies the DC Converter involved.
Commutating reactor and transformer should be selected according to the rated motor current of the armature circuit.

In this B2 circuit, the line current is equal to the DC current in the armature circuit. All of the other line-side drive components should be dimensioned according to this.

Further, due to the higher current ripple when compared to six-pulse operation, a smoothing reactor must be provided in the DC circuit. Please contact the motor manufacturer when dimensioning the smoothing reactor.

The associated technical data of the three-phase converter in single-phase operation is provided in section “Technical specifications” under DC Converter. (Compared to three-phase operation, a derating factor 0.7 must be taken into account for the rated DC current.)

Rated output voltage for single-phase operation

| Line supply | Rated output voltage for single-phase operation | |
|---|---|---|
| | Two-quadrant operation | Four-quadrant operation |
| V | V | V |
| 230 | 180 | 160 |
| 400 | 320 | 280 |
| 480 | 385 | 335 |
| 575 | 460 | 400 |

### *Coolant temperature and installation altitude*

Current derating

The permissible coolant temperatures and installation altitudes for SINAMICS DC MASTER as well as the associated maximum permissible load of the DC Converters in continuous operation can be taken from the following table (the load is specified as a % of the rated DC current).

| Ambient or coolant temperature | **Maximum permissible load of the DC Converter in continuous operation** (the load is specified as a % of the rated DC current) Installation altitude above sea level (The derating factors for values in between can be determined using linear interpolation.) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 1 000 m | | 2 000 m | | 3 000 m | | 4 000 m | | 5 000 m | |
| | Units up to 125 A | Units from 210 A and higher | Units up to 125 A | Units from 210 A and higher | Units up to 125 A | Units from 210 A and higher | Units up to 125 A | Units from 210 A and higher | Units up to 125 A | Units from 210 A and higher |
| 30 °C | 100 % | | | 98 % | 96 % | 88 % | 86 % | 78 % | 78 % | 70 % |
| 35 °C | | | | 93 % | 90 % | 83 % | 80 % | 73 % | | |
| 40 °C | | | 94 % | 88 % | 84 % | 78 % | | | | |
| 45 °C | | 95 % | 88 % | 83 % | | | | | | |
| 50 °C | 94 % | 90 % | 82 % | 78 % | | | | | | |
| 55 °C | 88 % | | | | | | | | | |

Voltage derating

The units can be operated up to an installation altitude of 4 000 m above sea level with the specified rated supply voltages. The line supply voltages may have overvoltage category III with respect to ground. For installation altitudes above 4 000 m, in some cases, it will be necessary to reduce the supply voltage or ensure that overvoltage category II is maintained. Detailed information is provided in the Operating Instructions.

## More information

### *Documentation*

The technical documentation includes the following manuals:

- SINAMICS DC MASTER DC Converter Operating Instructions
- SINAMICS DC MASTER Control Module Operating Instructions
- List Manual (parameter lists and function diagrams)
- Function Manual SINAMICS Free function blocks

Documentation is provided on a DVD when the converter is supplied. German, English, French, Spanish, Italian and Russian are the standard languages. The documentation can be separately ordered as hard copy in the languages specified above.

The manuals include all of the data relevant to SINAMICS DC MASTER units:

- Description
- Technical data
- Installation instructions
- Commissioning guide
- Maintenance information
- Function diagrams
- Description of faults and alarms
- Parameter list
- List of connectors and binectors
- Dimension drawings

Documentation on DVD

The product DVD contains all of the operating instructions, both for DC Converters as well as the Control Module in electronic form as PDF files.

The DVD also includes application documents about the use and application of DC drives, on topics such as

- Axial winders
- 12-pulse applications
- Leading-following switchover (MASTER slave operation)
- SINAMICS DC MASTER as field supply unit
- Engineering tips

These documents are being continually supplemented and expanded.

Additional information and ordering data for the various documents are provided in the catalog section “Services and documentation”.

## DC Converter

### Overview


The series of SINAMICS DC MASTER DC Converters includes:

- The electronics module with the Control Unit (CUD) and the slot for expansion using another CUD (in a cradle that can be swiveled out),
- The power section with thyristors in a fully-controlled three-phase bridge circuit configuration (two-quadrant drive: B6C or four-quadrant drive: (B6) A (B6) C),
- A fan (up to 125 A: self-ventilated),
- A single-quadrant field power section with integrated free-wheeling circuit (optionally, also without field or as two-quadrant field with integrated field overvoltage protection),
- The electronics power supply,
- A standard BOP20 operator panel (AOP30 Advanced Operator Panel as accessory).

3

### Technical specifications

| General technical data | |
|---|---|
| **Relevant standards** | |
| EN 50178 | Electronic equipment for use in power installations |
| EN 50274 | Low-voltage switchgear and controlgear assemblies: Protection against electric shock – Protection against unintentional direct contact with hazardous live parts |
| EN 60146-1-1 | Semiconductor converters: General requirements and line-commutated converters; specification of basic requirements |
| EN 61800-1 | Adjustable speed electrical power drive systems, Part 1 – (DC drives) General requirements – Rating specifications for low-voltage DC power drive systems |
| EN 61800-3 | Adjustable speed electrical power drive systems, Part 3 – EMC product standard including specific test methods |
| EN 61800-5-1 | Adjustable speed electrical power drive systems – Part 5-1: Requirements regarding safety – electrical, thermal, and energy requirements |
| IEC 62103 (identical to EN 50178) | Electronic equipment for use in power installations |
| UBC 97 | Uniform Building Code |
| **Electrical specifications** | |
| Overvoltage category | Category II acc. to EN 61800-5-1 within the line supply circuits<br>Category III acc. to EN 61800-5-1 for line supply circuits with respect to the environment (other line supply circuits, housing, electronics) |
| Overvoltage strength | Class 1 acc. to EN 50178 |
| Radio interference suppression | No radio interference suppression according to EN 61800-3 |
| **Mechanical data** | |
| Degree of protection | IP00 acc. to EN 60529; IP20 with accessories “Mounting kit to upgrade to IP20” for units up to 850 A |
| Protection class | Class 1 acc. to EN 61140 |
| Cooling method | |
| • Units ≤ 125 A rated DC current:<br>Permissible ambient temperature in operation | Self-ventilated<br>0 ... 45 °C – for higher ambient temperature, refer to current derating on page 3/8 |
| • Units ≥ 210 A rated DC current:<br>Permissible ambient temperature in operation | Forced-air cooling with integrated fan<br>0 ... 40 °C – for higher ambient temperature, refer to current derating on page 3/8 |
| Closed-loop control stability | |
| • for pulse encoder operation and digital setpoint | $\Delta_n$ = 0.006 % of the rated motor speed |
| • for analog tachometer and analog setpoint [1] | $\Delta_n$ = 0.1 % of the rated motor speed |
| MTBF | > 170 000 h |

[1] Conditions:
The closed-loop control (PI control) stability is referred to the rated motor speed and applies when the SINAMICS DC MASTER is in the warm operating condition. This is based on the following preconditions:
- Temperature changes of ±10 °C
- Line supply voltage changes of +10 % / -5 % of the rated input voltage
- Temperature coefficient of the tachometer generator with temperature compensation 0.15 ‰ every 10 °C (for analog tachometer generators only)
- Constant setpoint

## Technical specifications (continued)

| General technical data | | | |
|---|---|---|---|
| **Environmental conditions** | | | |
| Permissible ambient temperature during storage and transport | –40 ... +70 °C | | |
| Permissible humidity | Relative humidity ≤ 95 % (75 % at 17 °C average annual value, 95 % at 24 °C max., condensation not permissible) | | |
| Climate class | 3K3 acc. to EN 60721-3-3 | | |
| Insulation | Pollution degree 2 according to EN 61800-5-1<br>Condensation not permissible | | |
| Installation altitude | ≤ 1 000 m above sea level (100 % load capability)<br>> 1 000 ... 5 000 m above sea level (see under “Coolant temperature and installation altitude” on page 3/8) | | |
| **Mechanical strength** | **Storage** | **Transport** | **Operation** |
| Vibratory load | 1M2 acc. to EN 60721-3-1 (dropping not permissible) | 2M2 acc. to EN 60721-3-2 (dropping not permissible) | Constant deflection: 0.075 mm at 10 to 58 Hz<br>Constant acceleration: 10 $m/s^2$ at > 58 to 200 Hz<br>(testing and measuring techniques acc. to EN 60068-2-6, Fc) |
| Shock load | | | 100 $m/s^2$ at 11 ms<br>(testing and measuring techniques acc. to EN 60068-2-27, Ea) |
| **Approvals** | | | |
| UL/cUL | UL file No.: E203250 | | |
| UL 508 C<br>(UL Standard for Power Conversion Equipment) | Certification of the units up to and including 575 V | | |
| GOST | | | |
| Lloyd´s Register | In order to maintain the important limit values for marine certification, radio interference suppression filters should be used (see “Accessories and supplementary components”) and option M08 should be selected (coated PCBs). | | |
| Det Norske Veritas | | | |
| American Bureau of Shipping | | | |
| Germanische Lloyd | | | |

## Technical specifications (continued)

### *SINAMICS DC MASTER converters for 400 V 3 AC, 60 to 280 A, two-quadrant operation*

| | | Type | | | | |
|---|---|---|---|---|---|---|
| | | 6RA8025-6DS22-0AA0 | 6RA8028-6DS22-0AA0 | 6RA8031-6DS22-0AA0 | 6RA8075-6DS22-0AA0 | 6RA8078-6DS22-0AA0 |
| Rated armature supply voltage [1] | V | 400 V 3 AC (+15/–20 %) | | | | |
| Rated armature input current | A | 50 | 75 | 104 | 174 | 232 |
| Rated supply voltage, electronics power supply | V | 380 (–25 %) … 480 V (+10 %) 2 AC; $I_n$ = 1 A or 190 (–25 %) … 240 V (+10 %) 2 AC; $I_n$ = 2 A | | | | |
| Rated fan supply voltage | V | Self-ventilated | | | 24 V DC internal | |
| Rated fan current | A | | | | Internal supply | |
| Air flow | $m^3/h$ | | | | 300 | |
| Sound pressure level [2] | dB (A) | | | | 52.4 | |
| Rated field supply voltage [1] | V | 400 V 2 AC (+15/–20 %) | | | | |
| Rated frequency | Hz | 45 … 65 | | | | |
| Rated DC voltage [1] | V | 485 | | | | |
| Rated DC current | A | **60** | **90** | **125** | **210** | **280** |
| Overload capability | x × $I_n$ | 1.8 | | | | |
| Rated power | kW | 29 | 44 | 61 | 102 | 136 |
| Power loss at rated DC current | kW | 0.25 | 0.36 | 0.41 | 0.69 | 0.81 |
| Rated DC field voltage [1] | V | max. 325 | | | | |
| Rated DC field current | A | **10** | | | **15** | |
| Normal ambient temperature in operation [3] | °C | 0 … +45 | | | 0 … +40 | |
| Storage and transport temperature | °C | –40 … +70 | | | | |
| Installation altitude above sea level [3] | | ≤ 1 000 m for rated DC current | | | | |
| Dimensions | | | | | | |
| • Width | mm | 268 | | | | |
| • Height | mm | 385 | | | | |
| • Depth | mm | 252 | | | | |
| Weight, approx. | kg | 10 | 14 | | | 15 |

Note:
Detailed dimension drawings in the PDF and DXF formats are available on the DVD-ROM supplied with this catalog and in the Internet under www.siemens.com/sinamics-dcm (information material).

Data for single-phase operation

| | | Type | | |
|---|---|---|---|---|
| | | 6RA8025-6DS22-0AA0 | 6RA8028-6DS22-0AA0 | 6RA8031-6DS22-0AA0 |
| Rated DC voltage | V | 320 | | |
| Rated DC current | A | 42.0 | 63.0 | 87.5 |

[1] The armature/field supply voltage may be lower than the rated armature/field voltage (set via parameter; in the case of units with a 400 V rated voltage, an input voltage of up to 85 V is permitted). The output voltage decreases accordingly. The specified DC output voltage can be maintained up to an undervoltage of 5 % of the line supply voltage (rated armature/field supply voltage).

[2] Fan noise for a unit installed in an IP20 electrical cabinet (door closed, 50 Hz operation or operation at 24 V DC for units with an internal supply).

[3] Derating factors for higher temperatures and installation altitudes, see page 3/8.

## Technical specifications (continued)

### *SINAMICS DC MASTER converters for 400 V 3 AC, 400 to 1 200 A, two-quadrant operation*

| | | Type | | | |
|---|---|---|---|---|---|
| | | 6RA8081-6DS22-0AA0 | 6RA8085-6DS22-0AA0 | 6RA8087-6DS22-0AA0 | 6RA8091-6DS22-0AA0 |
| Rated armature supply voltage [1] | V | 400 V 3 AC (+15/–20 %) | | | |
| Rated armature input current | A | 332 | 498 | 706 | 996 |
| Rated supply voltage, electronics power supply | V | 380 (–25 %) … 480 V (+10 %) 2 AC; $I_n$ = 1 A or 190 (–25 %) … 240 V (+10 %) 2 AC; $I_n$ = 2 A | | | |
| Rated fan supply voltage | V | 400 V 3 AC ± 10 % (50 Hz) 460 V 3 AC ± 10 % (60 Hz) | | | |
| Rated fan current | A | 0.23 [3] | | | 0.3 [3] |
| Air flow | $m^3/h$ | 600 | | | 1 000 |
| Sound pressure level [2] | dB (A) | 64.5 | | | |
| Rated field supply voltage [1] | V | 400 V 2 AC (+15/–20 %) | | | 480 V 2 AC (+10/–20 %) |
| Rated frequency | Hz | 45 … 65 | | | |
| Rated DC voltage [1] | V | 485 | | | |
| Rated DC current | A | **400** | **600** | **850** | **1 200** |
| Overload capability | x × $I_n$ | 1.8 | | | |
| Rated power | kW | 194 | 291 | 412 | 582 |
| Power loss at rated DC current | kW | 1.37 | 1.84 | 2.47 | 4.11 |
| Rated DC field voltage [1] | V | max. 325 | | | max. 390 |
| Rated DC field current | A | **25** | | **30** | **40** |
| Normal ambient temperature in operation [4] | °C | 0 … +40 | | | |
| Storage and transport temperature | °C | –40 … +70 | | | |
| Installation altitude above sea level [4] | | ≤ 1 000 m for rated DC current | | | |
| Dimensions | | | | | |
| • Width | mm | 268 | | | |
| • Height | mm | 625 | | 700 | 783 |
| • Depth | mm | 275 | | 311 | 435 |
| Weight, approx. | kg | 26 | 28 | 38 | 78 |

Note:
Detailed dimension drawings in the PDF and DXF formats are available on the DVD-ROM supplied with this catalog and in the Internet under www.siemens.com/sinamics-dcm (information material).

[1] The armature/field supply voltage may be lower than the rated armature/field voltage (set via parameter; in the case of units with a 400 V rated voltage, an input voltage of up to 85 V is permitted). The output voltage decreases accordingly. The specified DC output voltage can be maintained up to an undervoltage of 5 % of the line supply voltage (rated armature/field supply voltage).

[2] Fan noise for a unit installed in an IP20 electrical cabinet (door closed, 50 Hz operation or operation at 24 V DC for units with an internal supply).

[3] For fan motor type R2D220-AB02-19 in units 6RA8081, 6RA8085, and 6RA8087 with a rated voltage of 400 V or 575 V, UL systems require a Siemens motor circuit-breaker of type 3RV1011-0DA1 or 3RV1011-0EA1, set to 0.3 A.

[4] Derating factors for higher temperatures and installation altitudes, see page 3/8.

## Technical specifications (continued)

### *SINAMICS DC MASTER converters for 400 V 3 AC, 1 600 to 3 000 A, two-quadrant operation*

| | | Type | | |
|---|---|---|---|---|
| | | 6RA8093-4DS22-0AA0 | 6RA8095-4DS22-0AA0 | 6RA8098-4DS22-0AA0 |
| Rated armature supply voltage [1] | V | 400 V 3 AC (+15/–20 %) | | 400 V 3 AC (+10/–20 %) |
| Rated armature input current | A | 1 328 | 1 660 | 2 490 |
| Rated supply voltage, electronics power supply | V | 380 (–25 %) … 480 V (+10 %) 2 AC; $I_n$ = 1 A or 190 (–25 %) … 240 V (+10 %) 2 AC; $I_n$ = 2 A | | |
| Rated fan supply voltage | V | 400 V 3 AC ± 10 % (50 Hz) 460 V 3 AC ± 10 % (60 Hz) | | |
| Rated fan current | A | 1 [3] | | |
| Air flow | $m^3/h$ | 2 400 | | |
| Sound pressure level [2] | dB (A) | 75.6 | | |
| Rated field supply voltage [1] | V | 480 V 2 AC (+10/–20 %) | | |
| Rated frequency | Hz | 45 … 65 | | |
| Rated DC voltage [1] | V | 485 | | |
| Rated DC current | A | **1 600** | **2 000** | **3 000** |
| Overload capability | x × $I_n$ | 1.8 | | |
| Rated power | kW | 776 | 970 | 1 455 |
| Power loss at rated DC current | kW | 5.68 | 6.78 | 10.64 |
| Rated DC field voltage [1] | V | max. 390 | | |
| Rated DC field current | A | **40** | | |
| Normal ambient temperature in operation [4] | °C | 0 … +40 | | |
| Storage and transport temperature | °C | –40 … +70 | | |
| Installation altitude above sea level [4] | | ≤ 1 000 m for rated DC current | | |
| Dimensions | | | | |
| • Width | mm | 453 | | |
| • Height | mm | 883 | | |
| • Depth | mm | 505 | | |
| Weight, approx. | kg | 135 | | 165 |

Note:
Detailed dimension drawings in the PDF and DXF formats are available on the DVD-ROM supplied with this catalog and in the Internet under www.siemens.com/sinamics-dcm (information material).

[1] The armature/field supply voltage may be lower than the rated armature/field voltage (set via parameter; in the case of units with a 400 V rated voltage, an input voltage of up to 85 V is permitted). The output voltage decreases accordingly. The specified DC output voltage can be maintained up to an undervoltage of 5 % of the line supply voltage (rated armature/field supply voltage).

[2] Fan noise for a unit installed in an IP20 electrical cabinet (door closed, 50 Hz operation or operation at 24 V DC for units with an internal supply).

[3] For fan motor type RH28M-2DK.3F.1R in units 6RA8090, 6RA8091, 6RA8093, and 6RA8095 with a rated voltage of 400 V or 575 V, UL systems require a Siemens motor circuit-breaker of type 3RV1011-0KA1 or 3RV1011-1AA1, set to 1.25 A.

[4] Derating factors for higher temperatures and installation altitudes, see page 3/8.

## Technical specifications (continued)

### *SINAMICS DC MASTER converters for 480 V 3 AC, 60 to 280 A, two-quadrant operation*

| | | Type | | | | |
|---|---|---|---|---|---|---|
| | | 6RA8025-6FS22-0AA0 | 6RA8028-6FS22-0AA0 | 6RA8031-6FS22-0AA0 | 6RA8075-6FS22-0AA0 | 6RA8078-6FS22-0AA0 |
| Rated armature supply voltage [1] | V | 480 V 3 AC (+10/–20 %) | | | | |
| Rated armature input current | A | 50 | 75 | 104 | 174 | 232 |
| Rated supply voltage, electronics power supply | V | 380 (–25 %) … 480 V (+10 %) 2 AC; $I_n$ = 1 A or 190 (–25 %) … 240 V (+10 %) 2 AC; $I_n$ = 2 A | | | | |
| Rated fan supply voltage | V | Self-ventilated | | | 24 V DC internal | |
| Rated fan current | A | | | | Internal supply | |
| Air flow | $m^3/h$ | | | | 300 | |
| Sound pressure level [2] | dB (A) | | | | 52.4 | |
| Rated field supply voltage [1] | V | 480 V 2 AC (+10/–20 %) | | | | |
| Rated frequency | Hz | 45 … 65 | | | | |
| Rated DC voltage [1] | V | 575 | | | | |
| Rated DC current | A | **60** | **90** | **125** | **210** | **280** |
| Overload capability | x × $I_n$ | 1.8 | | | | |
| Rated power | kW | 35 | 52 | 72 | 121 | 161 |
| Power loss at rated DC current | kW | 0.30 | 0.38 | 0.43 | 0.72 | 0.81 |
| Rated DC field voltage [1] | V | max. 390 | | | | |
| Rated DC field current | A | **10** | | | **15** | |
| Normal ambient temperature in operation [3] | °C | 0 … +45 | | | 0 … +40 | |
| Storage and transport temperature | °C | –40 … +70 | | | | |
| Installation altitude above sea level [3] | | ≤ 1 000 m for rated DC current | | | | |
| Dimensions | | | | | | |
| • Width | mm | 268 | | | | |
| • Height | mm | 385 | | | | |
| • Depth | mm | 252 | | | | |
| Weight, approx. | kg | 11 | 14 | | | 15 |

Note:
Detailed dimension drawings in the PDF and DXF formats are available on the DVD-ROM supplied with this catalog and in the Internet under www.siemens.com/sinamics-dcm (information material).

Data for single-phase operation

| | | Type | | |
|---|---|---|---|---|
| | | 6RA8025-6FS22-0AA0 | 6RA8028-6FS22-0AA0 | 6RA8031-6FS22-0AA0 |
| Rated DC voltage | V | 385 | | |
| Rated DC current | A | 42.0 | 63.0 | 87.5 |

[1] The armature/field supply voltage may be lower than the rated armature/field voltage (set via parameter; in the case of units with a 400 V rated voltage, an input voltage of up to 85 V is permitted). The output voltage decreases accordingly. The specified DC output voltage can be maintained up to an undervoltage of 5 % of the line supply voltage (rated armature/field supply voltage).

[2] Fan noise for a unit installed in an IP20 electrical cabinet (door closed, 50 Hz operation or operation at 24 V DC for units with an internal supply).

[3] Derating factors for higher temperatures and installation altitudes, see page 3/8.

## Technical specifications (continued)

### *SINAMICS DC MASTER converters for 480 V 3 AC, 450 to 1 200 A, two-quadrant operation*

| | | Type | | | |
|---|---|---|---|---|---|
| | | 6RA8082-6FS22-0AA0 | 6RA8085-6FS22-0AA0 | 6RA8087-6FS22-0AA0 | 6RA8091-6FS22-0AA0 |
| Rated armature supply voltage [1] | V | 480 V 3 AC (+10/–20 %) | | | |
| Rated armature input current | A | 374 | 498 | 706 | 996 |
| Rated supply voltage, electronics power supply | V | 380 (–25 %) … 480 V (+10 %) 2 AC; $I_n$ = 1 A or 190 (–25 %) … 240 V (+10 %) 2 AC; $I_n$ = 2 A | | | |
| Rated fan supply voltage | V | 400 V 3 AC ± 10 % (50 Hz) 460 V 3 AC ± 10 % (60 Hz) | | | |
| Rated fan current | A | 0.23 [3] | | | 0.3 [3] |
| Air flow | $m^3/h$ | 600 | | | 1 000 |
| Sound pressure level [2] | dB (A) | 64.5 | | | |
| Rated field supply voltage [1] | V | 480 V 2 AC (+10/–20 %) | | | |
| Rated frequency | Hz | 45 … 65 | | | |
| Rated DC voltage [1] | V | 575 | | | |
| Rated DC current | A | **450** | **600** | **850** | **1 200** |
| Overload capability | x × $I_n$ | 1.8 | | | |
| Rated power | kW | 259 | 345 | 489 | 690 |
| Power loss at rated DC current | kW | 1.58 | 1.91 | 2.60 | 4.24 |
| Rated DC field voltage [1] | V | max. 390 | | | |
| Rated DC field current | A | **25** | | **30** | |
| Normal ambient temperature in operation [4] | °C | 0 … +40 | | | |
| Storage and transport temperature | °C | –40 … +70 | | | |
| Installation altitude above sea level [4] | | ≤ 1 000 m for rated DC current | | | |
| Dimensions | | | | | |
| • Width | mm | 268 | | | |
| • Height | mm | 625 | | 700 | 783 |
| • Depth | mm | 275 | | 311 | 435 |
| Weight, approx. | kg | 28 | | 38 | 78 |

Note:
Detailed dimension drawings in the PDF and DXF formats are available on the DVD-ROM supplied with this catalog and in the Internet under www.siemens.com/sinamics-dcm (information material).

[1] The armature/field supply voltage may be lower than the rated armature/field voltage (set via parameter; in the case of units with a 400 V rated voltage, an input voltage of up to 85 V is permitted). The output voltage decreases accordingly. The specified DC output voltage can be maintained up to an undervoltage of 5 % of the line supply voltage (rated armature/field supply voltage).

[2] Fan noise for a unit installed in an IP20 electrical cabinet (door closed, 50 Hz operation or operation at 24 V DC for units with an internal supply).

[3] For fan motor type R2D220-AB02-19 in units 6RA8081, 6RA8085, and 6RA8087 with a rated voltage of 400 V or 575 V, UL systems require a Siemens motor circuit-breaker of type 3RV1011-0DA1 or 3RV1011-0EA1, set to 0.3 A.

[4] Derating factors for higher temperatures and installation altitudes, see page 3/8.

## Technical specifications (continued)

### *SINAMICS DC MASTER converters for 575 V 3 AC, 60 to 800 A, two-quadrant operation*

| | | Type | | | | | |
|---|---|---|---|---|---|---|---|
| | | 6RA8025-6GS22-0AA0 | 6RA8031-6GS22-0AA0 | 6RA8075-6GS22-0AA0 | 6RA8081-6GS22-0AA0 | 6RA8085-6GS22-0AA0 | 6RA8087-6GS22-0AA0 |
| Rated armature supply voltage [1] | V | 575 V 3 AC (+10/–20 %) | | | | | |
| Rated armature input current | A | 50 | 104 | 174 | 332 | 498 | 664 |
| Rated supply voltage, electronics power supply | V | 380 (–25 %) … 480 V (+10 %) 2 AC; $I_n$ = 1 A or 190 (–25 %) … 240 V (+10 %) 2 AC; $I_n$ = 2 A | | | | | |
| Rated fan supply voltage | V | Self-ventilated | | 24 V DC internal | 400 V 3 AC ± 10 % (50 Hz) 460 V 3 AC ± 10 % (60 Hz) | | |
| Rated fan current | A | | | Internal supply | 0.23 [3] | | |
| Air flow | $m^3/h$ | | | 300 | 600 | | |
| Sound pressure level [2] | dB (A) | | | 52.4 | 64.5 | | |
| Rated field supply voltage [1] | V | 480 V 2 AC (+10/–20 %) | | | | | |
| Rated frequency | Hz | 45 … 65 | | | | | |
| Rated DC voltage [1] | V | 690 | | | | | |
| Rated DC current | A | **60** | **125** | **210** | **400** | **600** | **800** |
| Overload capability | x × $I_n$ | 1.8 | | | | | |
| Rated power | kW | 41 | 86 | 145 | 276 | 414 | 552 |
| Power loss at rated DC current | kW | 0.27 | 0.46 | 0.74 | 1.60 | 2.00 | 2.69 |
| Rated DC field voltage [1] | V | max. 390 | | | | | |
| Rated DC field current | A | **10** | | **15** | **25** | | **30** |
| Normal ambient temperature in operation [4] | °C | 0 … +45 | | 0 … +40 | | | |
| Storage and transport temperature | °C | –40 … +70 | | | | | |
| Installation altitude above sea level [4] | | ≤ 1 000 m for rated DC current | | | | | |
| Dimensions | | | | | | | |
| • Width | mm | 268 | | | | | |
| • Height | mm | 385 | | | 625 | | 700 |
| • Depth | mm | 252 | | | 275 | | 311 |
| Weight, approx. | kg | 11 | 14 | | 26 | 28 | 38 |

Note:
Detailed dimension drawings in the PDF and DXF formats are available on the DVD-ROM supplied with this catalog and in the Internet under www.siemens.com/sinamics-dcm (information material).

Data for single-phase operation

| | | Type | |
|---|---|---|---|
| | | 6RA8025-6GS22-0AA0 | 6RA8031-6GS22-0AA0 |
| Rated DC voltage | V | 460 | |
| Rated DC current | A | 42.0 | 87.5 |

[1] The armature/field supply voltage may be lower than the rated armature/field voltage (set via parameter; in the case of units with a 400 V rated voltage, an input voltage of up to 85 V is permitted). The output voltage decreases accordingly. The specified DC output voltage can be maintained up to an undervoltage of 5 % of the line supply voltage (rated armature/field supply voltage).

[2] Fan noise for a unit installed in an IP20 electrical cabinet (door closed, 50 Hz operation or operation at 24 V DC for units with an internal supply).

[3] For fan motor type R2D220-AB02-19 in units 6RA8081, 6RA8085, and 6RA8087 with a rated voltage of 400 V or 575 V, UL systems require a Siemens motor circuit-breaker of type 3RV1011-0DA1 or 3RV1011-0EA1, set to 0.3 A.

[4] Derating factors for higher temperatures and installation altitudes, see page 3/8.

## Technical specifications (continued)

### *SINAMICS DC MASTER converters for 575 V 3 AC, 1 100 to 2 800 A, two-quadrant operation*

| | | Type | | | | |
|---|---|---|---|---|---|---|
| | | 6RA8090-6GS22-0AA0 | 6RA8093-4GS22-0AA0 | 6RA8095-4GS22-0AA0 | 6RA8096-4GS22-0AA0 | 6RA8097-4GS22-0AA0 |
| Rated armature supply voltage [1] | V | 575 V 3 AC (+10/–20 %) | | | | |
| Rated armature input current | A | 913 | 1 328 | 1 660 | 1 826 | 2 324 |
| Rated supply voltage, electronics power supply | V | 380 (–25 %) … 480 V (+10 %) 2 AC; $I_n$ = 1 A or 190 (–25 %) … 240 V (+10 %) 2 AC; $I_n$ = 2 A | | | | |
| Rated fan supply voltage | V | 400 V 3 AC ± 10 % (50 Hz) 460 V 3 AC ± 10 % (60 Hz) | | | | |
| Rated fan current | A | 0.3 [3] | 1 [4] | | | |
| Air flow | $m^3/h$ | 1 000 | 2 400 | | | |
| Sound pressure level [2] | dB (A) | 64.5 | 75.6 | | | |
| Rated field supply voltage [1] | V | 480 V 2 AC (+10/–20 %) | | | | |
| Rated frequency | Hz | 45 … 65 | | | | |
| Rated DC voltage [1] | V | 690 | | | | |
| Rated DC current | A | **1 100** | **1 600** | **2 000** | **2 200** | **2 800** |
| Overload capability | x × $I_n$ | 1.8 | | | | |
| Rated power | kW | 759 | 1 104 | 1 380 | 1 518 | 1 932 |
| Power loss at rated DC current | kW | 4.02 | 6.04 | 7.07 | 7.39 | 10.53 |
| Rated DC field voltage [1] | V | max. 390 | | | | |
| Rated DC field current | A | **40** | | | | |
| Normal ambient temperature in operation [5] | °C | 0 … +40 | | | | |
| Storage and transport temperature | °C | –40 … +70 | | | | |
| Installation altitude above sea level [5] | | ≤ 1 000 m for rated DC current | | | | |
| Dimensions | | | | | | |
| • Width | mm | 268 | 453 | | | |
| • Height | mm | 785 | 883 | | | |
| • Depth | mm | 435 | 505 | | | |
| Weight, approx. | kg | 78 | 135 | | 165 | |

Note:
Detailed dimension drawings in the PDF and DXF formats are available on the DVD-ROM supplied with this catalog and in the Internet under www.siemens.com/sinamics-dcm (information material).

[1] The armature/field supply voltage may be lower than the rated armature/field voltage (set via parameter; in the case of units with a 400 V rated voltage, an input voltage of up to 85 V is permitted). The output voltage decreases accordingly. The specified DC output voltage can be maintained up to an undervoltage of 5 % of the line supply voltage (rated armature/field supply voltage).

[2] Fan noise for a unit installed in an IP20 electrical cabinet (door closed, 50 Hz operation or operation at 24 V DC for units with an internal supply).

[3] For fan motor type R2D220-AB02-19 in units 6RA8081, 6RA8085, and 6RA8087 with a rated voltage of 400 V or 575 V, UL systems require a Siemens motor circuit-breaker of type 3RV1011-0DA1 or 3RV1011-0EA1, set to 0.3 A.

[4] For fan motor type RH28M-2DK.3F.1R in units 6RA8090, 6RA8091, 6RA8093, and 6RA8095 with a rated voltage of 400 V or 575 V, UL systems require a Siemens motor circuit-breaker of type 3RV1011-0KA1 or 3RV1011-1AA1, set to 1.25 A.

[5] Derating factors for higher temperatures and installation altitudes, see page 3/8.

## Technical specifications (continued)

### *SINAMICS DC MASTER converters for 690 V 3 AC, 720 to 2 600 A, two-quadrant operation*

| | | Type | | | | |
|---|---|---|---|---|---|---|
| | | 6RA8086-6KS22-0AA0 | 6RA8090-6KS22-0AA0 | 6RA8093-4KS22-0AA0 | 6RA8095-4KS22-0AA0 | 6RA8097-4KS22-0AA0 |
| Rated armature supply voltage [1] | V | 690 V 3 AC (+10/–20 %) | | | | |
| Rated armature input current | A | 598 | 830 | 1 245 | 1 660 | 2 158 |
| Rated supply voltage, electronics power supply | V | 380 (–25 %) … 480 V (+10 %) 2 AC; $I_n$ = 1 A or 190 (–25 %) … 240 V (+10 %) 2 AC; $I_n$ = 2 A | | | | |
| Rated fan supply voltage | V | 400 V 3 AC ± 10 % (50 Hz) 460 V 3 AC ± 10 % (60 Hz) | | | | |
| Rated fan current | A | 0.23 [3] | 0.3 [3] | 1 [4] | | |
| Air flow | $m^3/h$ | 600 | 1 000 | 2 400 | | |
| Sound pressure level [2] | dB (A) | 64.5 | | 75.6 | | |
| Rated field supply voltage [1] | V | 480 V 2 AC (+10/–20 %) | | | | |
| Rated frequency | Hz | 45 … 65 | | | | |
| Rated DC voltage [1] | V | 830 | | | | |
| Rated DC current | A | **720** | **1 000** | **1 500** | **2 000** | **2 600** |
| Overload capability | x × $I_n$ | 1.8 | | | | |
| Rated power | kW | 598 | 830 | 1 245 | 1 660 | 2 158 |
| Power loss at rated DC current | kW | 2.77 | 3.96 | 6.67 | 8.16 | 10.30 |
| Rated DC field voltage [1] | V | max. 390 | | | | |
| Rated DC field current | A | **30** | **40** | | | |
| Normal ambient temperature in operation [5] | °C | 0 … +40 | | | | |
| Storage and transport temperature | °C | –40 … +70 | | | | |
| Installation altitude above sea level [5] | | ≤ 1 000 m for rated DC current | | | | |
| Dimensions | | | | | | |
| • Width | mm | 268 | | 453 | | |
| • Height | mm | 700 | 785 | 883 | | |
| • Depth | mm | 311 | 435 | 505 | | |
| Weight, approx. | kg | 38 | 78 | 135 | | 165 |

Note:
Detailed dimension drawings in the PDF and DXF formats are available on the DVD-ROM supplied with this catalog and in the Internet under www.siemens.com/sinamics-dcm (information material).

[1] The armature/field supply voltage may be lower than the rated armature/field voltage (set via parameter; in the case of units with a 400 V rated voltage, an input voltage of up to 85 V is permitted). The output voltage decreases accordingly. The specified DC output voltage can be maintained up to an undervoltage of 5 % of the line supply voltage (rated armature/field supply voltage).

[2] Fan noise for a unit installed in an IP20 electrical cabinet (door closed, 50 Hz operation or operation at 24 V DC for units with an internal supply).

[3] For fan motor type R2D220-AB02-19 in units 6RA8081, 6RA8085, and 6RA8087 with a rated voltage of 400 V or 575 V, UL systems require a Siemens motor circuit-breaker of type 3RV1011-0DA1 or 3RV1011-0EA1, set to 0.3 A.

[4] For fan motor type RH28M-2DK.3F.1R in units 6RA8090, 6RA8091, 6RA8093, and 6RA8095 with a rated voltage of 400 V or 575 V, UL systems require a Siemens motor circuit-breaker of type 3RV1011-0KA1 or 3RV1011-1AA1, set to 1.25 A.

[5] Derating factors for higher temperatures and installation altitudes, see page 3/8.

## Technical specifications (continued)

### *SINAMICS DC MASTER converters for 830 V 3 AC, 950 to 1 900 A and 950 V 3 AC, 2 200 A, two-quadrant operation*

| | | Type | | | |
|---|---|---|---|---|---|
| | | 6RA8088-6LS22-0AA0 | 6RA8093-4LS22-0AA0 | 6RA8095-4LS22-0AA0 | 6RA8096-4MS22-0AA0 |
| Rated armature supply voltage [1] | V | 830 V 3 AC (+10/–20 %) | | | 950 V 3 AC (+15/–20 %) |
| Rated armature input current | A | 789 | 1 245 | 1 577 | 1 826 |
| Rated supply voltage, electronics power supply | V | 380 (–25 %) … 480 V (+10 %) 2 AC; $I_n$ = 1 A or 190 (–25 %) … 240 V (+10 %) 2 AC; $I_n$ = 2 A | | | |
| Rated fan supply voltage | V | 400 V 3 AC ± 10 % (50 Hz) 460 V 3 AC ± 10 % (60 Hz) | | | |
| Rated fan current | A | 0.3 [3] | 1 [4] | | |
| Air flow | $m^3/h$ | 1 000 | 2 400 | | |
| Sound pressure level [2] | dB (A) | 64.5 | 75.6 | | |
| Rated field supply voltage [1] | V | 480 V 2 AC (+10/–20 %) | | | |
| Rated frequency | Hz | 45 … 65 | | | |
| Rated DC voltage [1] | V | 1 000 | | | 1 140 |
| Rated DC current | A | **950** | **1 500** | **1 900** | **2 200** |
| Overload capability | x × $I_n$ | 1.8 | | | |
| Rated power | kW | 950 | 1 500 | 1 900 | 2 508 |
| Power loss at rated DC current | kW | 4.22 | 7.12 | 8.67 | 11.34 |
| Rated DC field voltage [1] | V | max. 390 | | | |
| Rated DC field current | A | **40** | | | |
| Normal ambient temperature in operation [5] | °C | 0 … +40 | | | |
| Storage and transport temperature | °C | –40 … +70 | | | |
| Installation altitude above sea level [5] | | ≤ 1 000 m for rated DC current | | | |
| Dimensions | | | | | |
| • Width | mm | 268 | 453 | | |
| • Height | mm | 785 | 883 | | |
| • Depth | mm | 435 | 505 | | |
| Weight, approx. | kg | 78 | 135 | | 165 |

Note:
Detailed dimension drawings in the PDF and DXF formats are available on the DVD-ROM supplied with this catalog and in the Internet under www.siemens.com/sinamics-dcm (information material).

[1] The armature/field supply voltage may be lower than the rated armature/field voltage (set via parameter; in the case of units with a 400 V rated voltage, an input voltage of up to 85 V is permitted). The output voltage decreases accordingly. The specified DC output voltage can be maintained up to an undervoltage of 5 % of the line supply voltage (rated armature/field supply voltage).

[2] Fan noise for a unit installed in an IP20 electrical cabinet (door closed, 50 Hz operation or operation at 24 V DC for units with an internal supply).

[3] For fan motor type R2D220-AB02-19 in units 6RA8081, 6RA8085, and 6RA8087 with a rated voltage of 400 V or 575 V, UL systems require a Siemens motor circuit-breaker of type 3RV1011-0DA1 or 3RV1011-0EA1, set to 0.3 A.

[4] For fan motor type RH28M-2DK.3F.1R in units 6RA8090, 6RA8091, 6RA8093, and 6RA8095 with a rated voltage of 400 V or 575 V, UL systems require a Siemens motor circuit-breaker of type 3RV1011-0KA1 or 3RV1011-1AA1, set to 1.25 A.

[5] Derating factors for higher temperatures and installation altitudes, see page 3/8.

## Technical specifications (continued)

### *SINAMICS DC MASTER converters for 400 V 3 AC, 15 to 125 A, four-quadrant operation*

| | | Type | | | | |
|---|---|---|---|---|---|---|
| | | 6RA8013-6DV62-0AA0 | 6RA8018-6DV62-0AA0 | 6RA8025-6DV62-0AA0 | 6RA8028-6DV62-0AA0 | 6RA8031-6DV62-0AA0 |
| Rated armature supply voltage [1] | V | 400 V 3 AC (+15/–20 %) | | | | |
| Rated armature input current | A | 12 | 25 | 50 | 75 | 104 |
| Rated supply voltage, electronics power supply | V | 380 (–25 %) … 480 V (+10 %) 2 AC; $I_n$ = 1 A or 190 (–25 %) … 240 V (+10 %) 2 AC; $I_n$ = 2 A | | | | |
| Rated fan supply voltage | V | Self-ventilated | | | | |
| Rated fan current | A | | | | | |
| Air flow | $m^3/h$ | | | | | |
| Sound pressure level [2] | dB (A) | | | | | |
| Rated field supply voltage [1] | V | 400 V 2 AC (+15/–20 %) | | | | |
| Rated frequency | Hz | 45 … 65 | | | | |
| Rated DC voltage [1] | V | 420 | | | | |
| Rated DC current | A | **15** | **30** | **60** | **90** | **125** |
| Overload capability | x × $I_n$ | 1.8 | | | | |
| Rated power | kW | 6.3 | 12.6 | 25 | 38 | 53 |
| Power loss at rated DC current | kW | 0.13 | 0.18 | 0.25 | 0.32 | 0.41 |
| Rated DC field voltage [1] | V | max. 325 | | | | |
| Rated DC field current | A | **3** | **5** | **10** | | |
| Normal ambient temperature in operation [3] | °C | 0 … +45 | | | | |
| Storage and transport temperature | °C | –40 … +70 | | | | |
| Installation altitude above sea level [3] | | ≤ 1 000 m for rated DC current | | | | |
| Dimensions | | | | | | |
| • Width | mm | 268 | | | | |
| • Height | mm | 385 | | | | |
| • Depth | mm | 221 | | 252 | | |
| Weight, approx. | kg | 11 | | | 14 | |

Note:
Detailed dimension drawings in the PDF and DXF formats are available on the DVD-ROM supplied with this catalog and in the Internet under www.siemens.com/sinamics-dcm (information material).

Data for single-phase operation

| | | Type | | | | |
|---|---|---|---|---|---|---|
| | | 6RA8013-6DV62-0AA0 | 6RA8018-6DV62-0AA0 | 6RA8025-6DV62-0AA0 | 6RA8028-6DV62-0AA0 | 6RA8031-6DV62-0AA0 |
| Rated DC voltage | V | 280 | | | | |
| Rated DC current | A | 10.5 | 21.0 | 42.0 | 63.0 | 87.5 |

[1] The armature/field supply voltage may be lower than the rated armature/field voltage (set via parameter; in the case of units with a 400 V rated voltage, an input voltage of up to 85 V is permitted). The output voltage decreases accordingly. The specified DC output voltage can be maintained up to an undervoltage of 5 % of the line supply voltage (rated armature/field supply voltage).

[2] Fan noise for a unit installed in an IP20 electrical cabinet (door closed, 50 Hz operation or operation at 24 V DC for units with an internal supply).

[3] Derating factors for higher temperatures and installation altitudes, see page 3/8.

## Technical specifications (continued)

### *SINAMICS DC MASTER converters for 400 V 3 AC, 210 to 850 A, four-quadrant operation*

| | | Type | | | | |
|---|---|---|---|---|---|---|
| | | 6RA8075-6DV62-0AA0 | 6RA8078-6DV62-0AA0 | 6RA8081-6DV62-0AA0 | 6RA8085-6DV62-0AA0 | 6RA8087-6DV62-0AA0 |
| Rated armature supply voltage [1] | V | 400 V 3 AC (+15/–20 %) | | | | |
| Rated armature input current | A | 174 | 232 | 332 | 498 | 706 |
| Rated supply voltage, electronics power supply | V | 380 (–25 %) … 480 V (+10 %) 2 AC; $I_n$ = 1 A or 190 (–25 %) … 240 V (+10 %) 2 AC; $I_n$ = 2 A | | | | |
| Rated fan supply voltage | V | 24 V DC internal | | 400 V 3 AC ± 10 % (50 Hz) 460 V 3 AC ± 10 % (60 Hz) | | |
| Rated fan current | A | Internal supply | | 0.23 [3] | | |
| Air flow | $m^3/h$ | 300 | | 600 | | |
| Sound pressure level [2] | dB (A) | 52.4 | | 64.5 | | |
| Rated field supply voltage [1] | V | 400 V 2 AC (+15/–20 %) | | | | |
| Rated frequency | Hz | 45 … 65 | | | | |
| Rated DC voltage [1] | V | 420 | | | | |
| Rated DC current | A | **210** | **280** | **400** | **600** | **850** |
| Overload capability | x × $I_n$ | 1.8 | | | | |
| Rated power | kW | 88 | 118 | 168 | 252 | 357 |
| Power loss at rated DC current | kW | 0.69 | 0.81 | 1.37 | 1.84 | 2.47 |
| Rated DC field voltage [1] | V | max. 325 | | | | |
| Rated DC field current | A | **15** | | **25** | | **30** |
| Normal ambient temperature in operation [4] | °C | 0 … +40 | | | | |
| Storage and transport temperature | °C | –40 … +70 | | | | |
| Installation altitude above sea level [4] | | ≤ 1 000 m for rated DC current | | | | |
| Dimensions | | | | | | |
| • Width | mm | 268 | | | | |
| • Height | mm | 385 | | 625 | | 700 |
| • Depth | mm | 252 | | 275 | | 311 |
| Weight, approx. | kg | 15 | | 26 | 31 | 42 |

Note:
Detailed dimension drawings in the PDF and DXF formats are available on the DVD-ROM supplied with this catalog and in the Internet under www.siemens.com/sinamics-dcm (information material).

[1] The armature/field supply voltage may be lower than the rated armature/field voltage (set via parameter; in the case of units with a 400 V rated voltage, an input voltage of up to 85 V is permitted). The output voltage decreases accordingly. The specified DC output voltage can be maintained up to an undervoltage of 5 % of the line supply voltage (rated armature/field supply voltage).

[2] Fan noise for a unit installed in an IP20 electrical cabinet (door closed, 50 Hz operation or operation at 24 V DC for units with an internal supply).

[3] For fan motor type R2D220-AB02-19 in units 6RA8081, 6RA8085, and 6RA8087 with a rated voltage of 400 V or 575 V, UL systems require a Siemens motor circuit-breaker of type 3RV1011-0DA1 or 3RV1011-0EA1, set to 0.3 A.

[4] Derating factors for higher temperatures and installation altitudes, see page 3/8.

## Technical specifications (continued)

### *SINAMICS DC MASTER converters for 400 V 3 AC, 1 200 to 3 000 A, four-quadrant operation*

| | | Type | | | |
|---|---|---|---|---|---|
| | | 6RA8091-6DV62-0AA0 | 6RA8093-4DV62-0AA0 | 6RA8095-4DV62-0AA0 | 6RA8098-4DV62-0AA0 |
| Rated armature supply voltage [1] | V | 400 V 3 AC (+15/–20 %) | | | 400 V 3 AC (+10/–20 %) |
| Rated armature input current | A | 996 | 1 328 | 1 660 | 2 490 |
| Rated supply voltage, electronics power supply | V | 380 (–25 %) … 480 V (+10 %) 2 AC; $I_n$ = 1 A or 190 (–25 %) … 240 V (+10 %) 2 AC; $I_n$ = 2 A | | | |
| Rated fan supply voltage | V | 400 V 3 AC ± 10 % (50 Hz) 460 V 3 AC ± 10 % (60 Hz) | | | |
| Rated fan current | A | 0.3 [3] | 1 [4] | | |
| Air flow | $m^3/h$ | 1 000 | 2 400 | | |
| Sound pressure level [2] | dB (A) | 64.5 | 75.6 | | |
| Rated field supply voltage [1] | V | 480 V 2 AC (+10/–20 %) | | | |
| Rated frequency | Hz | 45 … 65 | | | |
| Rated DC voltage [1] | V | 420 | | | |
| Rated DC current | A | **1 200** | **1 600** | **2 000** | **3 000** |
| Overload capability | x × $I_n$ | 1.8 | | | |
| Rated power | kW | 504 | 672 | 840 | 1 260 |
| Power loss at rated DC current | kW | 4.11 | 5.68 | 6.78 | 10.64 |
| Rated DC field voltage [1] | V | max. 390 | | | |
| Rated DC field current | A | **40** | | | |
| Normal ambient temperature in operation [4] | °C | 0 … +40 | | | |
| Storage and transport temperature | °C | –40 … +70 | | | |
| Installation altitude above sea level [4] | | ≤ 1 000 m for rated DC current | | | |
| Dimensions | | | | | |
| • Width | mm | 268 | 453 | | |
| • Height | mm | 785 | 883 | | |
| • Depth | mm | 435 | 505 | | |
| Weight, approx. | kg | 78 | 155 | | 185 |

Note:
Detailed dimension drawings in the PDF and DXF formats are available on the DVD-ROM supplied with this catalog and in the Internet under www.siemens.com/sinamics-dcm (information material).

[1] The armature/field supply voltage may be lower than the rated armature/field voltage (set via parameter; in the case of units with a 400 V rated voltage, an input voltage of up to 85 V is permitted). The output voltage decreases accordingly. The specified DC output voltage can be maintained up to an undervoltage of 5 % of the line supply voltage (rated armature/field supply voltage).

[2] Fan noise for a unit installed in an IP20 electrical cabinet (door closed, 50 Hz operation or operation at 24 V DC for units with an internal supply).

[3] For fan motor type R2D220-AB02-19 in units 6RA8081, 6RA8085, and 6RA8087 with a rated voltage of 400 V or 575 V, UL systems require a Siemens motor circuit-breaker of type 3RV1011-0DA1 or 3RV1011-0EA1, set to 0.3 A.

[4] Derating factors for higher temperatures and installation altitudes, see page 3/8.

## Technical specifications (continued)

### *SINAMICS DC MASTER converters for 480 V 3 AC, 15 to 210 A, four-quadrant operation*

| | | Type | | | | | |
|---|---|---|---|---|---|---|---|
| | | 6RA8013-6FV62-0AA0 | 6RA8018-6FV62-0AA0 | 6RA8025-6FV62-0AA0 | 6RA8028-6FV62-0AA0 | 6RA8031-6FV62-0AA0 | 6RA8075-6FV62-0AA0 |
| Rated armature supply voltage [1] | V | 480 V 3 AC (+15/–20 %) | 480 V 3 AC (+10/–20 %) | | | | |
| Rated armature input current | A | 12 | 25 | 50 | 75 | 104 | 174 |
| Rated supply voltage, electronics power supply | V | 380 (–25 %) … 480 V (+10 %) 2 AC; $I_n$ = 1 A or 190 (–25 %) … 240 V (+10 %) 2 AC; $I_n$ = 2 A | | | | | |
| Rated fan supply voltage | V | Self-ventilated | | | | | 24 V DC internal |
| Rated fan current | A | | | | | | Internal supply |
| Air flow | $m^3/h$ | | | | | | 300 |
| Sound pressure level [2] | dB (A) | | | | | | 52.4 |
| Rated field supply voltage [1] | V | 480 V 2 AC (+10/–20 %) | | | | | |
| Rated frequency | Hz | 45 … 65 | | | | | |
| Rated DC voltage [1] | V | 500 | | | | | |
| Rated DC current | A | **15** | **30** | **60** | **90** | **125** | **210** |
| Overload capability | x × $I_n$ | 1.8 | | | | | |
| Rated power | kW | 6 | 15 | 30 | 45 | 63 | 105 |
| Power loss at rated DC current | kW | 0.13 | 0.19 | 0.30 | 0.34 | 0.43 | 0.72 |
| Rated DC field voltage [1] | V | max. 390 | | | | | |
| Rated DC field current | A | **3** | **5** | **10** | **10** | **10** | **15** |
| Normal ambient temperature in operation [3] | °C | 0 … +45 | | | | | 0 … +40 |
| Storage and transport temperature | °C | –40 … +70 | | | | | |
| Installation altitude above sea level [3] | | ≤ 1 000 m for rated DC current | | | | | |
| Dimensions | | | | | | | |
| • Width | mm | 268 | | | | | |
| • Height | mm | 385 | | | | | |
| • Depth | mm | 221 | | 252 | | | |
| Weight, approx. | kg | 11 | | | 14 | | 15 |

Note:
Detailed dimension drawings in the PDF and DXF formats are available on the DVD-ROM supplied with this catalog and in the Internet under www.siemens.com/sinamics-dcm (information material).

Data for single-phase operation

| | | Type | | | | |
|---|---|---|---|---|---|---|
| | | 6RA8013-6FV62-0AA0 | 6RA8018-6FV62-0AA0 | 6RA8025-6FV62-0AA0 | 6RA8028-6FV62-0AA0 | 6RA8031-6FV62-0AA0 |
| Rated DC voltage | V | 335 | | | | |
| Rated DC current | A | 10.5 | 21.0 | 42.0 | 63.0 | 87.5 |

[1] The armature/field supply voltage may be lower than the rated armature/field voltage (set via parameter; in the case of units with a 400 V rated voltage, an input voltage of up to 85 V is permitted). The output voltage decreases accordingly. The specified DC output voltage can be maintained up to an undervoltage of 5 % of the line supply voltage (rated armature/field supply voltage).

[2] Fan noise for a unit installed in an IP20 electrical cabinet (door closed, 50 Hz operation or operation at 24 V DC for units with an internal supply).

[3] Derating factors for higher temperatures and installation altitudes, see page 3/8.

## Technical specifications (continued)

### *SINAMICS DC MASTER converters for 480 V 3 AC, 280 to 1 200 A, four-quadrant operation*

| | | Type | | | | |
|---|---|---|---|---|---|---|
| | | 6RA8078-6FV62-0AA0 | 6RA8082-6FV62-0AA0 | 6RA8085-6FV62-0AA0 | 6RA8087-6FV62-0AA0 | 6RA8091-6FV62-0AA0 |
| Rated armature supply voltage [1] | V | 480 V 3 AC (+10/–20 %) | | | | |
| Rated armature input current | A | 232 | 374 | 498 | 706 | 996 |
| Rated supply voltage, electronics power supply | V | 380 (–25 %) … 480 V (+10 %) 2 AC; $I_n$ = 1 A or 190 (–25 %) … 240 V (+10 %) 2 AC; $I_n$ = 2 A | | | | |
| Rated fan supply voltage | V | 24 V DC internal | 400 V 3 AC ± 10 % (50 Hz) 460 V 3 AC ± 10 % (60 Hz) | | | |
| Rated fan current | A | Internal supply | 0.23 [3] | | | 0.3 [3] |
| Air flow | $m^3/h$ | 300 | 600 | | | 1 000 |
| Sound pressure level [2] | dB (A) | 52.4 | 64.5 | | | |
| Rated field supply voltage [1] | V | 480 V 2 AC (+10/–20 %) | | | | |
| Rated frequency | Hz | 45 … 65 | | | | |
| Rated DC voltage [1] | V | 500 | | | | |
| Rated DC current | A | **280** | **450** | **600** | **850** | **1 200** |
| Overload capability | x × $I_n$ | 1.8 | | | | |
| Rated power | kW | 140 | 225 | 300 | 425 | 600 |
| Power loss at rated DC current | kW | 0.81 | 1.58 | 1.91 | 2.60 | 4.24 |
| Rated DC field voltage [1] | V | max. 390 | | | | |
| Rated DC field current | A | **15** | **25** | **25** | **30** | **40** |
| Normal ambient temperature in operation [4] | °C | 0 … +40 | | | | |
| Storage and transport temperature | °C | –40 … +70 | | | | |
| Installation altitude above sea level [4] | | ≤ 1 000 m for rated DC current | | | | |
| Dimensions | | | | | | |
| • Width | mm | 268 | | | | |
| • Height | mm | 385 | 625 | | 700 | 785 |
| • Depth | mm | 252 | 275 | | 311 | 435 |
| Weight, approx. | kg | 15 | 31 | | 42 | 78 |

Note:
Detailed dimension drawings in the PDF and DXF formats are available on the DVD-ROM supplied with this catalog and in the Internet under www.siemens.com/sinamics-dcm (information material).

[1] The armature/field supply voltage may be lower than the rated armature/field voltage (set via parameter; in the case of units with a 400 V rated voltage, an input voltage of up to 85 V is permitted). The output voltage decreases accordingly. The specified DC output voltage can be maintained up to an undervoltage of 5 % of the line supply voltage (rated armature/field supply voltage).

[2] Fan noise for a unit installed in an IP20 electrical cabinet (door closed, 50 Hz operation or operation at 24 V DC for units with an internal supply).

[3] For fan motor type R2D220-AB02-19 in units 6RA8081, 6RA8085, and 6RA8087 with a rated voltage of 400 V or 575 V, UL systems require a Siemens motor circuit-breaker of type 3RV1011-0DA1 or 3RV1011-0EA1, set to 0.3 A.

[4] Derating factors for higher temperatures and installation altitudes, see page 3/8.

## Technical specifications (continued)

### *SINAMICS DC MASTER converters for 575 V 3 AC, 60 to 850 A, four-quadrant operation*

| | | Type | | | | | |
|---|---|---|---|---|---|---|---|
| | | 6RA8025-6GV62-0AA0 | 6RA8031-6GV62-0AA0 | 6RA8075-6GV62-0AA0 | 6RA8081-6GV62-0AA0 | 6RA8085-6GV62-0AA0 | 6RA8087-6GV62-0AA0 |
| Rated armature supply voltage [1] | V | 575 V 3 AC (+10/–20 %) | | | | | |
| Rated armature input current | A | 50 | 104 | 174 | 332 | 498 | 706 |
| Rated supply voltage, electronics power supply | V | 380 (–25 %) … 480 V (+10 %) 2 AC; $I_n$ = 1 A or 190 (–25 %) … 240 V (+10 %) 2 AC; $I_n$ = 2 A | | | | | |
| Rated fan supply voltage | V | Self-ventilated | | 24 V DC internal | 400 V 3 AC ± 10 % (50 Hz) 460 V 3 AC ± 10 % (60 Hz) | | |
| Rated fan current | A | | | Internal supply | 0.23 [3] | | |
| Air flow | $m^3/h$ | | | 300 | 600 | | |
| Sound pressure level [2] | dB (A) | | | 52.4 | 64.5 | | |
| Rated field supply voltage [1] | V | 480 V 2 AC (+10/–20 %) | | | | | |
| Rated frequency | Hz | 45 … 65 | | | | | |
| Rated DC voltage [1] | V | 600 | | | | | |
| Rated DC current | A | **60** | **125** | **210** | **400** | **600** | **850** |
| Overload capability | x × $I_n$ | 1.8 | | | | | |
| Rated power | kW | 36 | 75 | 126 | 240 | 360 | 510 |
| Power loss at rated DC current | kW | 0.27 | 0.46 | 0.74 | 1.60 | 2.00 | 2.83 |
| Rated DC field voltage [1] | V | max. 390 | | | | | |
| Rated DC field current | A | **10** | **10** | **15** | **25** | **25** | **30** |
| Normal ambient temperature in operation [4] | °C | 0 … +45 | | 0 … +40 | | | |
| Storage and transport temperature | °C | –40 … +70 | | | | | |
| Installation altitude above sea level [4] | | ≤ 1 000 m for rated DC current | | | | | |
| Dimensions | | | | | | | |
| • Width | mm | 268 | | | | | |
| • Height | mm | 385 | | | 65 | | 700 |
| • Depth | mm | 252 | | | 275 | | 311 |
| Weight, approx. | kg | 11 | 14 | 15 | 26 | 31 | 42 |

Note:
Detailed dimension drawings in the PDF and DXF formats are available on the DVD-ROM supplied with this catalog and in the Internet under www.siemens.com/sinamics-dcm (information material).

Data for single-phase operation

| | | Type | |
|---|---|---|---|
| | | 6RA8025-6GV62-0AA0 | 6RA8031-6GV62-0AA0 |
| Rated DC voltage | V | 400 | |
| Rated DC current | A | 42.0 | 87.5 |

[1] The armature/field supply voltage may be lower than the rated armature/field voltage (set via parameter; in the case of units with a 400 V rated voltage, an input voltage of up to 85 V is permitted). The output voltage decreases accordingly. The specified DC output voltage can be maintained up to an undervoltage of 5 % of the line supply voltage (rated armature/field supply voltage).

[2] Fan noise for a unit installed in an IP20 electrical cabinet (door closed, 50 Hz operation or operation at 24 V DC for units with an internal supply).

[3] For fan motor type R2D220-AB02-19 in units 6RA8081, 6RA8085, and 6RA8087 with a rated voltage of 400 V or 575 V, UL systems require a Siemens motor circuit-breaker of type 3RV1011-0DA1 or 3RV1011-0EA1, set to 0.3 A.

[4] Derating factors for higher temperatures and installation altitudes, see page 3/8.

## Technical specifications (continued)

### *SINAMICS DC MASTER converters for 575 V 3 AC, 1 100 to 2 800 A, four-quadrant operation*

| | | Type | | | | |
|---|---|---|---|---|---|---|
| | | 6RA8090-6GV62-0AA0 | 6RA8093-4GV62-0AA0 | 6RA8095-4GV62-0AA0 | 6RA8096-4GV62-0AA0 | 6RA8097-4GV62-0AA0 |
| Rated armature supply voltage [1] | V | 575 V 3 AC (+10/–20 %) | | | | |
| Rated armature input current | A | 913 | 1 328 | 1 660 | 1 826 | 2 324 |
| Rated supply voltage, electronics power supply | V | 380 (–25 %) … 480 V (+10 %) 2 AC; $I_n$ = 1 A or 190 (–25 %) … 240 V (+10 %) 2 AC; $I_n$ = 2 A | | | | |
| Rated fan supply voltage | V | 400 V 3 AC ± 10 % (50 Hz) 460 V 3 AC ± 10 % (60 Hz) | | | | |
| Rated fan current | A | 0.3 [3] | 1 [4] | | | |
| Air flow | $m^3/h$ | 1 000 | 2 400 | | | |
| Sound pressure level [2] | dB (A) | 64.5 | 75.6 | | | |
| Rated field supply voltage [1] | V | 480 V 2 AC (+10/–20 %) | | | | |
| Rated frequency | Hz | 45 … 65 | | | | |
| Rated DC voltage [1] | V | 600 | | | | |
| Rated DC current | A | **1 100** | **1 600** | **2 000** | **2 200** | **2 800** |
| Overload capability | x × $I_n$ | 1.8 | | | | |
| Rated power | kW | 660 | 960 | 1 200 | 1 320 | 1 680 |
| Power loss at rated DC current | kW | 4.02 | 6.04 | 7.07 | 7.39 | 10.53 |
| Rated DC field voltage [1] | V | max. 390 | | | | |
| Rated DC field current | A | **40** | | | | |
| Normal ambient temperature in operation [5] | °C | 0 … +40 | | | | |
| Storage and transport temperature | °C | –40 … +70 | | | | |
| Installation altitude above sea level [5] | | ≤ 1 000 m for rated DC current | | | | |
| Dimensions | | | | | | |
| • Width | mm | 268 | 453 | | | |
| • Height | mm | 785 | 883 | | | |
| • Depth | mm | 435 | 505 | | | |
| Weight, approx. | kg | 78 | 155 | | 185 | |

Note:
Detailed dimension drawings in the PDF and DXF formats are available on the DVD-ROM supplied with this catalog and in the Internet under www.siemens.com/sinamics-dcm (information material).

[1] The armature/field supply voltage may be lower than the rated armature/field voltage (set via parameter; in the case of units with a 400 V rated voltage, an input voltage of up to 85 V is permitted). The output voltage decreases accordingly. The specified DC output voltage can be maintained up to an undervoltage of 5 % of the line supply voltage (rated armature/field supply voltage).

[2] Fan noise for a unit installed in an IP20 electrical cabinet (door closed, 50 Hz operation or operation at 24 V DC for units with an internal supply).

[3] For fan motor type R2D220-AB02-19 in units 6RA8081, 6RA8085, and 6RA8087 with a rated voltage of 400 V or 575 V, UL systems require a Siemens motor circuit-breaker of type 3RV1011-0DA1 or 3RV1011-0EA1, set to 0.3 A.

[4] For fan motor type RH28M-2DK.3F.1R in units 6RA8090, 6RA8091, 6RA8093, and 6RA8095 with a rated voltage of 400 V or 575 V, UL systems require a Siemens motor circuit-breaker of type 3RV1011-0KA1 or 3RV1011-1AA1, set to 1.25 A.

[5] Derating factors for higher temperatures and installation altitudes, see page 3/8.

## Technical specifications (continued)

### *SINAMICS DC MASTER converters for 690 V 3 AC, 760 to 2 600 A, four-quadrant operation*

| | | Type | | | | |
|---|---|---|---|---|---|---|
| | | 6RA8086-6KV62-0AA0 | 6RA8090-6KV62-0AA0 | 6RA8093-4KV62-0AA0 | 6RA8095-4KV62-0AA0 | 6RA8097-4KV62-0AA0 |
| Rated armature supply voltage [1] | V | 690 V 3 AC (+10/–20 %) | | | | |
| Rated armature input current | A | 631 | 830 | 1 245 | 1 660 | 2 158 |
| Rated supply voltage, electronics power supply | V | 380 (–25 %) … 480 V (+10 %) 2 AC; $I_n$ = 1 A or 190 (–25 %) … 240 V (+10 %) 2 AC; $I_n$ = 2 A | | | | |
| Rated fan supply voltage | V | 400 V 3 AC ± 10 % (50 Hz) 460 V 3 AC ± 10 % (60 Hz) | | | | |
| Rated fan current | A | 0.23 [3] | 0.3 [3] | 1 [4] | | |
| Air flow | $m^3/h$ | 600 | 1 000 | 2 400 | | |
| Sound pressure level [2] | dB (A) | 64.5 | | 75.6 | | |
| Rated field supply voltage [1] | V | 480 V 2 AC (+10/–20 %) | | | | |
| Rated frequency | Hz | 45 … 65 | | | | |
| Rated DC voltage [1] | V | 725 | | | | |
| Rated DC current | A | **760** | **1 000** | **1 500** | **2 000** | **2 600** |
| Overload capability | x × $I_n$ | 1.8 | | | | |
| Rated power | kW | 551 | 725 | 1 088 | 1 450 | 1 885 |
| Power loss at rated DC current | kW | 2.90 | 3.96 | 6.67 | 8.16 | 10.30 |
| Rated DC field voltage [1] | V | max. 390 | | | | |
| Rated DC field current | A | **30** | **40** | | | |
| Normal ambient temperature in operation [5] | °C | 0 … +40 | | | | |
| Storage and transport temperature | °C | –40 … +70 | | | | |
| Installation altitude above sea level [5] | | ≤ 1 000 m for rated DC current | | | | |
| Dimensions | | | | | | |
| • Width | mm | 268 | | 453 | | |
| • Height | mm | 700 | 785 | 883 | | |
| • Depth | mm | 311 | 435 | 505 | | |
| Weight, approx. | kg | 42 | 78 | 155 | | 185 |

Note:
Detailed dimension drawings in the PDF and DXF formats are available on the DVD-ROM supplied with this catalog and in the Internet under www.siemens.com/sinamics-dcm (information material).

[1] The armature/field supply voltage may be lower than the rated armature/field voltage (set via parameter; in the case of units with a 400 V rated voltage, an input voltage of up to 85 V is permitted). The output voltage decreases accordingly. The specified DC output voltage can be maintained up to an undervoltage of 5 % of the line supply voltage (rated armature/field supply voltage).

[2] Fan noise for a unit installed in an IP20 electrical cabinet (door closed, 50 Hz operation or operation at 24 V DC for units with an internal supply).

[3] For fan motor type R2D220-AB02-19 in units 6RA8081, 6RA8085, and 6RA8087 with a rated voltage of 400 V or 575 V, UL systems require a Siemens motor circuit-breaker of type 3RV1011-0DA1 or 3RV1011-0EA1, set to 0.3 A.

[4] For fan motor type RH28M-2DK.3F.1R in units 6RA8090, 6RA8091, 6RA8093, and 6RA8095 with a rated voltage of 400 V or 575 V, UL systems require a Siemens motor circuit-breaker of type 3RV1011-0KA1 or 3RV1011-1AA1, set to 1.25 A.

[5] Derating factors for higher temperatures and installation altitudes, see page 3/8.

## Technical specifications (continued)

### *SINAMICS DC MASTER converters for 830 V 3 AC, 950 to 1 900 A and 950 V 3 AC, 2 200 A, four-quadrant operation*

| | | Type | | | |
|---|---|---|---|---|---|
| | | 6RA8088-6LV62-0AA0 | 6RA8093-4LV62-0AA0 | 6RA8095-4LV62-0AA0 | 6RA8096-4MV62-0AA0 |
| Rated armature supply voltage [1] | V | 830 V 3 AC (+10/–20 %) | | | 950 V 3 AC (+15/–20 %) |
| Rated armature input current | A | 789 | 1 245 | 1 577 | 1 826 |
| Rated supply voltage, electronics power supply | V | 380 (–25 %) … 480 V (+10 %) 2 AC; $I_n$ = 1 A or 190 (–25 %) … 240 V (+10 %) 2 AC; $I_n$ = 2 A | | | |
| Rated fan supply voltage | V | 400 V 3 AC ± 10 % (50 Hz) 460 V 3 AC ± 10 % (60 Hz) | | | |
| Rated fan current | A | 0.3 [3] | 1 [4] | | |
| Air flow | $m^3/h$ | 1 000 | 2 400 | | |
| Sound pressure level [2] | dB (A) | 64.5 | 75.6 | | |
| Rated field supply voltage [1] | V | 480 V 2 AC (+10/–20 %) | | | |
| Rated frequency | Hz | 45 … 65 | | | |
| Rated DC voltage [1] | V | 875 | | | 1 000 |
| Rated DC current | A | **950** | **1 500** | **1 900** | **2 200** |
| Overload capability | x × $I_n$ | 1.8 | | | |
| Rated power | kW | 831 | 1 313 | 1 663 | 2 200 |
| Power loss at rated DC current | kW | 4.22 | 7.12 | 8.67 | 11.34 |
| Rated DC field voltage [1] | V | max. 390 | | | |
| Rated DC field current | A | **40** | | | |
| Normal ambient temperature in operation [5] | °C | 0 … +40 | | | |
| Storage and transport temperature | °C | –40 … +70 | | | |
| Installation altitude above sea level [5] | | ≤ 1 000 m for rated DC current | | | |
| Dimensions | | | | | |
| • Width | mm | 268 | 453 | | |
| • Height | mm | 785 | 883 | | |
| • Depth | mm | 435 | 505 | | |
| Weight, approx. | kg | 78 | 155 | | 185 |

Note:
Detailed dimension drawings in the PDF and DXF formats are available on the DVD-ROM supplied with this catalog and in the Internet under www.siemens.com/sinamics-dcm (information material).

[1] The armature/field supply voltage may be lower than the rated armature/field voltage (set via parameter; in the case of units with a 400 V rated voltage, an input voltage of up to 85 V is permitted). The output voltage decreases accordingly. The specified DC output voltage can be maintained up to an undervoltage of 5 % of the line supply voltage (rated armature/field supply voltage).

[2] Fan noise for a unit installed in an IP20 electrical cabinet (door closed, 50 Hz operation or operation at 24 V DC for units with an internal supply).

[3] For fan motor type R2D220-AB02-19 in units 6RA8081, 6RA8085, and 6RA8087 with a rated voltage of 400 V or 575 V, UL systems require a Siemens motor circuit-breaker of type 3RV1011-0DA1 or 3RV1011-0EA1, set to 0.3 A.

[4] For fan motor type RH28M-2DK.3F.1R in units 6RA8090, 6RA8091, 6RA8093, and 6RA8095 with a rated voltage of 400 V or 575 V, UL systems require a Siemens motor circuit-breaker of type 3RV1011-0KA1 or 3RV1011-1AA1, set to 1.25 A.

[5] Derating factors for higher temperatures and installation altitudes, see page 3/8.

## Selection and ordering data

### *DC Converters for two-quadrant operation*

| Rated data | | | | | | DC Converter | Fuses | | |
|---|---|---|---|---|---|---|---|---|---|
| Armature circuit | | | | Field circuit | | | Armature circuit | | Field circuit |
| Rated supply voltage [1] | Rated DC voltage | Rated DC current | Rated power | Rated supply voltage [1] | Rated DC current | Order No. | Phase | DC current | 2 each |
| V | V | A | kW | V | A | | Type | Type | Type |
| 400 V 3 AC | 485 | 60 | 29 | 400 V 2 AC | 10 | **6RA8025-6DS22-0AA0** | 3NE1817-0 | – | 5SD420 |
| | | 90 | 44 | | 10 | **6RA8028-6DS22-0AA0** | 3NE1820-0 | – | 5SD420 |
| | | 125 | 61 | | 10 | **6RA8031-6DS22-0AA0** | 3NE1021-0 | – | 5SD420 |
| | | 210 | 102 | | 15 | **6RA8075-6DS22-0AA0** | 3NE3227 | – | 5SD440 |
| | | 280 | 136 | | 15 | **6RA8078-6DS22-0AA0** | 3NE3231 | – | 5SD440 |
| | | 400 | 194 | | 25 | **6RA8081-6DS22-0AA0** | 3NE3233 | – | 5SD440 |
| | | 600 | 291 | | 25 | **6RA8085-6DS22-0AA0** | 3NE3336 | – | 5SD440 |
| | | 850 | 412 | | 30 | **6RA8087-6DS22-0AA0** | 3NE3338-8 | – | 5SD480 |
| | | 1 200 | 582 | 480 V 2 AC | 40 | **6RA8091-6DS22-0AA0** | – [2] | – | 3NE1802-0 [3] |
| | | 1 600 | 776 | | 40 | **6RA8093-4DS22-0AA0** | – [2] | – | 3NE1802-0 [3] |
| | | 2 000 | 970 | | 40 | **6RA8095-4DS22-0AA0** | – [2] | – | 3NE1802-0 [3] |
| | | 3 000 | 1 455 | | 40 | **6RA8098-4DS22-0AA0** | – [2] | – | 3NE1802-0 [3] |
| 480 V 3 AC | 575 | 60 | 35 | 480 V 2 AC | 10 | **6RA8025-6FS22-0AA0** | 3NE1817-0 | – | 5SD420 |
| | | 90 | 52 | | 10 | **6RA8028-6FS22-0AA0** | 3NE1820-0 | – | 5SD420 |
| | | 125 | 72 | | 10 | **6RA8031-6FS22-0AA0** | 3NE1021-0 | – | 5SD420 |
| | | 210 | 121 | | 15 | **6RA8075-6FS22-0AA0** | 3NE3227 | – | 5SD440 |
| | | 280 | 161 | | 15 | **6RA8078-6FS22-0AA0** | 3NE3231 | – | 5SD440 |
| | | 450 | 259 | | 25 | **6RA8082-6FS22-0AA0** | 3NE3233 | – | 5SD440 |
| | | 600 | 345 | | 25 | **6RA8085-6FS22-0AA0** | 3NE3336 | – | 5SD440 |
| | | 850 | 489 | | 30 | **6RA8087-6FS22-0AA0** | 3NE3338-8 | – | 5SD480 |
| | | 1 200 | 690 | | 40 | **6RA8091-6FS22-0AA0** | – [2] | – | 3NE1802-0 [3] |
| 575 V 3 AC | 690 | 60 | 41 | 480 V 2 AC | 10 | **6RA8025-6GS22-0AA0** | 3NE1817-0 | – | 5SD420 |
| | | 125 | 86 | | 10 | **6RA8031-6GS22-0AA0** | 3NE1021-0 | – | 5SD420 |
| | | 210 | 145 | | 15 | **6RA8075-6GS22-0AA0** | 3NE3227 | – | 5SD440 |
| | | 400 | 276 | | 25 | **6RA8081-6GS22-0AA0** | 3NE3233 | – | 5SD440 |
| | | 600 | 414 | | 25 | **6RA8085-6GS22-0AA0** | 3NE3336 | – | 5SD440 |
| | | 800 | 552 | | 30 | **6RA8087-6GS22-0AA0** | 3NE3338-8 | – | 5SD480 |
| | | 1 100 | 759 | | 40 | **6RA8090-6GS22-0AA0** | – [2] | – | 3NE1802-0 [3] |
| | | 1 600 | 1 104 | | 40 | **6RA8093-4GS22-0AA0** | – [2] | – | 3NE1802-0 [3] |
| | | 2 000 | 1 380 | | 40 | **6RA8095-4GS22-0AA0** | – [2] | – | 3NE1802-0 [3] |
| | | 2 200 | 1 518 | | 40 | **6RA8096-4GS22-0AA0** | – [2] | – | 3NE1802-0 [3] |
| | | 2 800 | 1 932 | | 40 | **6RA8097-4GS22-0AA0** | – [2] | – | 3NE1802-0 [3] |
| 690 V 3 AC | 830 | 720 | 598 | 480 V 2 AC | 30 | **6RA8086-6KS22-0AA0** | 3NE3337-8 | – | 5SD480 |
| | | 1 000 | 830 | | 40 | **6RA8090-6KS22-0AA0** | – [2] | – | 3NE1802-0 [3] |
| | | 1 500 | 1 245 | | 40 | **6RA8093-4KS22-0AA0** | – [2] | – | 3NE1802-0 [3] |
| | | 2 000 | 1 660 | | 40 | **6RA8095-4KS22-0AA0** | – [2] | – | 3NE1802-0 [3] |
| | | 2 600 | 2 158 | | 40 | **6RA8097-4KS22-0AA0** | – [2] | – | 3NE1802-0 [3] |
| 830 V 3 AC | 1 000 | 950 | 950 | 480 V 2 AC | 40 | **6RA8088-6LS22-0AA0** | – [2] | – | 3NE1802-0 [3] |
| | | 1 500 | 1 500 | | 40 | **6RA8093-4LS22-0AA0** | – [2] | – | 3NE1802-0 [3] |
| | | 1 900 | 1 900 | | 40 | **6RA8095-4LS22-0AA0** | – [2] | – | 3NE1802-0 [3] |
| 950 V 3 AC | 1 140 | 2 200 | 2 508 | 480 V 2 AC | 40 | **6RA8096-4MS22-0AA0** | – [2] | – | 3NE1802-0 [3] |

[1] 50/60 Hz

[2] Arm fuses included in the unit, external semiconductor fuses not required.

[3] UL-recognized

## Selection and ordering data (continued)

### *DC Converters for four-quadrant operation*

| Rated data | | | | | | DC Converter | Fuses | | |
|---|---|---|---|---|---|---|---|---|---|
| Armature circuit | | | | Field circuit | | | Armature circuit | | Field circuit |
| Rated supply voltage [1] | Rated DC voltage | Rated DC current | Rated power | Rated supply voltage [1] | Rated DC current | Order No. | Phase | DC current | 2 each |
| V | V | A | kW | V | A | | Type | Type | Type |
| 400 V 3 AC | 420 | 15 | 6.3 | 400 V 2 AC | 3 | **6RA8013-6DV62-0AA0** | 3NE1814-0 | 3NE1814-0 | 5SD420 |
| | | 30 | 12.6 | | 5 | **6RA8018-6DV62-0AA0** | 3NE8003-1 | 3NE4102 | 5SD420 |
| | | 60 | 25 | | 10 | **6RA8025-6DV62-0AA0** | 3NE1817-0 | 3NE4120 | 5SD420 |
| | | 90 | 38 | | 10 | **6RA8028-6DV62-0AA0** | 3NE1820-0 | 3NE4122 | 5SD420 |
| | | 125 | 53 | | 10 | **6RA8031-6DV62-0AA0** | 3NE1021-0 | 3NE4124 | 5SD420 |
| | | 210 | 88 | | 15 | **6RA8075-6DV62-0AA0** | 3NE3227 | 3NE3227 | 5SD440 |
| | | 280 | 118 | | 15 | **6RA8078-6DV62-0AA0** | 3NE3231 | 3NE3231 | 5SD440 |
| | | 400 | 168 | | 25 | **6RA8081-6DV62-0AA0** | 3NE3233 | 3NE3233 | 5SD440 |
| | | 600 | 252 | | 25 | **6RA8085-6DV62-0AA0** | 3NE3336 | 3NE3336 | 5SD440 |
| | | 850 | 357 | | 30 | **6RA8087-6DV62-0AA0** | 3NE3338-8 | 3NE3334-0B [3] | 5SD480 |
| | | 1 200 | 504 | 480 V 2 AC | 40 | **6RA8091-6DV62-0AA0** | – [2] | – [2] | 3NE1802-0 [4] |
| | | 1 600 | 672 | | 40 | **6RA8093-4DV62-0AA0** | – [2] | – [2] | 3NE1802-0 [4] |
| | | 2 000 | 840 | | 40 | **6RA8095-4DV62-0AA0** | – [2] | – [2] | 3NE1802-0 [4] |
| | | 3 000 | 1 260 | | 40 | **6RA8098-4DV62-0AA0** | – [2] | – [2] | 3NE1802-0 [4] |
| 480 V 3 AC | 500 | 15 | 6 | 480 V 2 AC | 3 | **6RA8013-6FV62-0AA0** | 3NE1814-0 | 3NE1814-0 | 5SD420 |
| | | 30 | 15 | | 5 | **6RA8018-6FV62-0AA0** | 3NE1815-0 | 3NE4102 | 5SD420 |
| | | 60 | 30 | | 10 | **6RA8025-6FV62-0AA0** | 3NE1817-0 | 3NE4120 | 5SD420 |
| | | 90 | 45 | | 10 | **6RA8028-6FV62-0AA0** | 3NE1820-0 | 3NE4122 | 5SD420 |
| | | 125 | 63 | | 10 | **6RA8031-6FV62-0AA0** | 3NE1021-0 | 3NE4124 | 5SD420 |
| | | 210 | 105 | | 15 | **6RA8075-6FV62-0AA0** | 3NE3227 | 3NE3227 | 5SD440 |
| | | 280 | 140 | | 15 | **6RA8078-6FV62-0AA0** | 3NE3231 | 3NE3231 | 5SD440 |
| | | 450 | 225 | | 25 | **6RA8082-6FV62-0AA0** | 3NE3233 | 3NE3334-0B | 5SD440 |
| | | 600 | 300 | | 25 | **6RA8085-6FV62-0AA0** | 3NE3336 | 3NE3336 | 5SD440 |
| | | 850 | 425 | | 30 | **6RA8087-6FV62-0AA0** | 3NE3338-8 | 3NE3334-0B [3] | 5SD480 |
| | | 1 200 | 600 | | 40 | **6RA8091-6FV62-0AA0** | – [2] | – [2] | 3NE1802-0 [4] |
| 575 V 3 AC | 600 | 60 | 36 | 480 V 2 AC | 10 | **6RA8025-6GV62-0AA0** | 3NE1817-0 | 3NE4120 | 5SD420 |
| | | 125 | 75 | | 10 | **6RA8031-6GV62-0AA0** | 3NE1021-0 | 3NE4124 | 5SD420 |
| | | 210 | 126 | | 15 | **6RA8075-6GV62-0AA0** | 3NE3227 | 3NE3227 | 5SD440 |
| | | 400 | 240 | | 25 | **6RA8081-6GV62-0AA0** | 3NE3233 | 3NE3233 | 5SD440 |
| | | 600 | 360 | | 25 | **6RA8085-6GV62-0AA0** | 3NE3336 | 3NE3336 | 5SD440 |
| | | 850 | 510 | | 30 | **6RA8087-6GV62-0AA0** | 3NE3338-8 | 3NE3334-0B [3] | 5SD480 |
| | | 1 100 | 660 | | 40 | **6RA8090-6GV62-0AA0** | – [2] | – [2] | 3NE1802-0 [4] |
| | | 1 600 | 960 | | 40 | **6RA8093-4GV62-0AA0** | – [2] | – [2] | 3NE1802-0 [4] |
| | | 2 000 | 1 200 | | 40 | **6RA8095-4GV62-0AA0** | – [2] | – [2] | 3NE1802-0 [4] |
| | | 2 200 | 1 320 | | 40 | **6RA8096-4GV62-0AA0** | – [2] | – [2] | 3NE1802-0 [4] |
| | | 2 800 | 1 680 | | 40 | **6RA8097-4GV62-0AA0** | – [2] | – [2] | 3NE1802-0 [4] |
| 690 V 3 AC | 725 | 760 | 551 | 480 V 2 AC | 30 | **6RA8086-6KV62-0AA0** | 3NE3337-8 | 3NE3334-0B [3] | 5SD420 |
| | | 1 000 | 725 | | 40 | **6RA8090-6KV62-0AA0** | – [2] | – [2] | 3NE1802-0 [4] |
| | | 1 500 | 1 088 | | 40 | **6RA8093-4KV62-0AA0** | – [2] | – [2] | 3NE1802-0 [4] |
| | | 2 000 | 1 450 | | 40 | **6RA8095-4KV62-0AA0** | – [2] | – [2] | 3NE1802-0 [4] |
| | | 2 600 | 1 885 | | 40 | **6RA8097-4KV62-0AA0** | – [2] | – [2] | 3NE1802-0 [4] |
| 830 V 3 AC | 875 | 950 | 831 | 480 V 2 AC | 40 | **6RA8088-6LV62-0AA0** | – [2] | – [2] | 3NE1802-0 [4] |
| | | 1 500 | 1 313 | | 40 | **6RA8093-4LV62-0AA0** | – [2] | – [2] | 3NE1802-0 [4] |
| | | 1 900 | 1 663 | | 40 | **6RA8095-4LV62-0AA0** | – [2] | – [2] | 3NE1802-0 [4] |
| 950 V 3 AC | 1 000 | 2 200 | 2 200 | 480 V 2 AC | 40 | **6RA8096-4MV62-0AA0** | – [2] | – [2] | 3NE1802-0 [4] |

[1] 50/60 Hz

[2] Arm fuses included in the unit, external semiconductor fuses not required.

[3] Two fuses connected in parallel.

[4] UL-recognized

## Options

Note:

When ordering a unit with options, add the suffix **"-Z"** after the Order No. and then state the order code(s) for the desired option(s) after the suffix.

*Example:*
*6RA8075-6GV62-0AA0-Z*
*G00+G20+L85+...*

*See also ordering examples.*

### *Available options*

The following table provides an overview of the available options. Detailed descriptions of the options are provided in the section "Description of options".

| Designation | Order code | Notes | Order No. for separate order | |
|---|---|---|---|---|
| | | | not coated | coated |
| **CUD** | | | | |
| Standard CUD left | (Standard) | – | **6RY1803-0AA00** | **6RY1803-0AA20** |
| Advanced CUD left | **G00** | – | **6RY1803-0AA05** | **6RY1803-0AA25** |
| Standard CUD right | **G10** | This option requires an Advanced CUD left – order code **G00** | **6RY1803-0AA00 + 6RY1803-0GA00** | **6RY1803-0AA20 + 6RY1803-0GA20** |
| Advanced CUD right | **G11** | This option requires an Advanced CUD left – order code **G00** | **6RY1803-0AA05 + 6RY1803-0GA00** | **6RY1803-0AA25 + 6RY1803-0GA20** |
| Communication Board CBE20 left | **G20** | This option requires an Advanced CUD left – order code **G00** | **–** | **6SL3055-0AA00-2EB0** |
| Communication Board CBE20 right | **G21** | This option requires an Advanced CUD right – order code **G11** | **–** | **6SL3055-0AA00-2EB0** |
| Memory card left | **S01** | – | **6RX1800-0AS01** | **–** |
| Memory card right | **S02** | This option requires a Standard CUD right – order code **G10** – or an Advanced CUD right – order code **G11** | **6RX1800-0AS01** | **–** |
| **Field** | | | | |
| Field power section 1Q | (Standard) | – | – [1] | – [1] |
| Field power section 2Q | **L11** | Only applicable for units from 60 to 3 000 A | – [1] | – [1] |
| Without field power section | **L10** | Only applicable for units from 60 to 3 000 A | – | – |
| 85 A field power section | **L85** | Only applicable for units from 1 500 to 3 000 A | – [1] | – [1] |
| **Fans** | | | | |
| Standard fan | (Standard) | Self-ventilated units do not have a fan | – [1] | – |
| Fan for single-phase connection | **L21** | Only applicable for units from 400 to 1 200 A | – [1] | – |
| **Additional options** | | | | |
| Electronics power supply for connection to 24 V DC | **L05** | Standard for Control Module, input voltage range 18 to 30 V, current consumption 5 A at 24 V | – [1] | – [1] |
| Armature supply with extra-low voltage 10 to 50 V | **L04** | Only applicable for units up to ≤ 575 V rated supply voltage | – [1] | – [1] |
| Coated PCBs | **M08** | – | – | – |
| Nickel-plated copper busbars | **M10** | Only applicable for units from 60 to 3 000 A | – | – |
| External sensor for ambient or inlet temperature | **L15** | Only applicable for units from 1 500 to 3 000 A | – [1] | – |

[1] Available as spare part.

## Options (continued)

*Option selection matrix*

| | G00 | G10 | G11 | G20 | G21 | L04 | L05 | L10 | L11 | L15 | L21 | L85 | M08 | M10 | S01 | S02 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| G00 | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| G10 | ✓ | | – | ✓ | – | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| G11 | ✓ | – | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| G20 | ✓ | ✓ | ✓ | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| G21 | ✓ | – | ✓ | ✓ | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| L04 | ✓ | ✓ | ✓ | ✓ | ✓ | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| L05 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| L10 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | – | ✓ | ✓ | – | ✓ | ✓ | ✓ | ✓ |
| L11 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | – | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| L15 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| L21 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | ✓ | ✓ | ✓ | ✓ | ✓ |
| L85 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | – | ✓ | ✓ | ✓ | | ✓ | ✓ | ✓ | ✓ |
| M08 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | ✓ | ✓ | ✓ |
| M10 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | ✓ | ✓ |
| S01 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | ✓ |
| S02 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | |

✓ Option can be combined without any restrictions

– Option cannot be combined

**Options** (continued)

***Ordering examples***

Example 1

*Application:*

A DC drive system is required for a cableway. A SINAMICS DC MASTER is to handle the closed-loop control of the selected 560 kW DC motor with a rated armature voltage of 420 V and a rated armature current of 1 306 A. Due to the overdimensioning of 25 % specified by the acceptance authorities, and due to the maximum ambient temperature of 45 °C that can occur, the rated current of the converter had to be further reduced by 5 %. This is the reason that a unit with a rated supply current of 2 000 A was selected. The converter capable of energy recovery is to be connected to a 400 V line supply. A PROFINET connection is required for the higher-level control.

*Solution:*

A four-quadrant converter with 2 000 A and 400 V AC should be selected for this application. The incremental encoder to sense the speed – mounted on the motor – is directly evaluated in the CUD of the SINAMICS DC MASTER, without requiring any additional option.

The following options must be selected in order to permit the PROFINET connection:
**G00** (Advanced CUD left)
**G20** (PROFINET Communication Board CBE20 left)

The ordering data are as follows:
**6RA8095-4DV62-0AA0-Z**
**G00+G20**

Example 2

*Application:*

An unwinder for paper in a reeler-slitter is to be modernized – but the existing motor is to be kept. The power section is to be supplied from the existing 690 V supply. The technological control is to be implemented in the higher-level PCS7 system. The client specified PROFIBUS as the control and setpoint interface. The following measured values and status displays are to be visualized in the cabinet doors of the drive cabinet to facilitate fast and simple diagnostics for the service and maintenance personnel: Armature current, armature voltage, speed, field current, status messages – operation and fault.

The customer explained that he repeatedly had problems with the existing converter relating to overvoltage in the motor armature circuit – and as a consequence, this resulted in tension fluctuations in the paper web when the motor went into the field-weakening range. As a result of instability in the control voltage supply, in the past, there were repeatedly failures that had a negative impact on the availability.

*Solution:*

As a result of the data of the existing motor and the customer specifications relating to acceleration and braking ramps, tambour roll weight and maximum diameter, a four-quadrant converter was selected with a rated supply voltage of 690 V and a rated current of 1 500 A. The dynamic overload capability of the units is utilized to brake the drive when the paper web breaks.

The technological control with current setpoint interface is realized in the higher-level control. This is the reason that for this particular application, the Standard CUD is sufficient, which already has an integrated Profibus interface.

The problem with armature overvoltages when entering the field weakening range has now been resolved by selecting the two-quadrant field power section option. By actively reducing the current using a counter-voltage, the field current actual value can now follow the field current setpoint – even for steep acceleration ramps – and therefore overvoltages are avoided in the armature circuit. The tension fluctuations in the paper web are consequentially eliminated.

Selecting the option “Electronics power supply for connection to 24 V DC” means that the drive system can be intergrated into a favorably-priced and low-maintenance DC UPS system comprising SITOP components.

The requirements regarding actual value and status displays were addressed by installing the AOP30 Advanced Operator Panel in the doors of the drive cabinet.

Coated PCBs and nickel-plated copper busbars were selected as a result of the aggressive atmosphere with a high percentage of $H_2S$.

The availability of equipment is extremely important in the paper industry. This is the reason that the option “memory card left” was selected to allow service and maintenance personnel short repair times in the case of faults. Software and additional languages of the AOP text are saved on this card. Further, parameter values can be additionally saved there and there is a reserved memory range for offline long-time trace records.

The following options must be selected for this particular application:
**L05** (electronics power supply for connection to 24 V DC)
**L11** (2Q field power section)
**M08** (coated PCBs)
**M10** (nickel-plated copper busbars)
**S01** (memory card left)

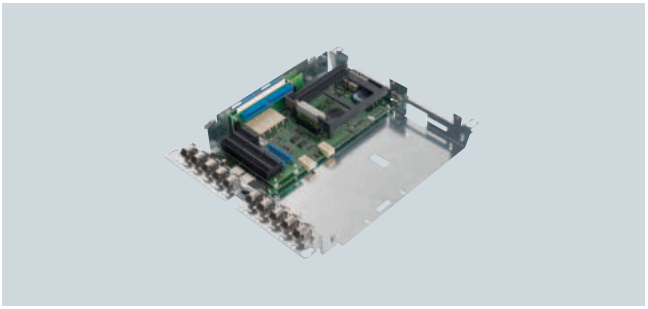
Further, the following accessories are required:
Advanced Operator Panel AOP30 (6SL3055-0AA00-4CA)
RS485 cable, 3 m long

The ordering data are as follows:
**6RA8093-4KV62-0AA0-Z**
**L05+L11+M08+M10+S01**
and
**6SL3055-0AA00-4CA**
as well as
**6RY1807-0AP00**

## Options (continued)

### *Description of options*

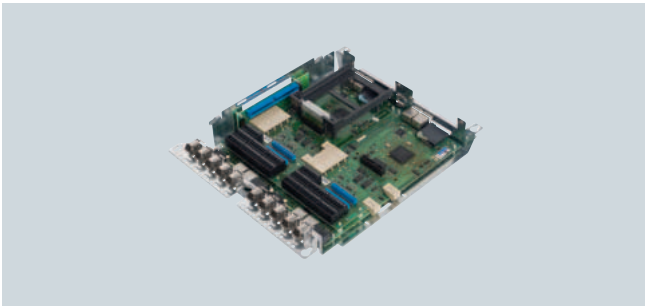
**G00**
Advanced CUD left



In addition to the connections and functions of the Standard CUD, the Advanced CUD has two DRIVE-CLiQ connections and one option slot. The use of an Advanced CUD also provides the opportunity of inserting an additional CUD (Standard or Advanced) to increase the computational performance and the number of terminals. This can be used, e.g. to implement additional technological functions.

By using an Advanced CUD, which is located in the lefthand slot instead of the Standard CUD, the SINAMICS SMC30, TM15, TM31 and CBE20 components can be connected to the SINAMICS DC MASTER. More detailed information on the SINAMICS components is available in the catalog section "Accessories and supplementary components".

**G10**
Standard CUD right

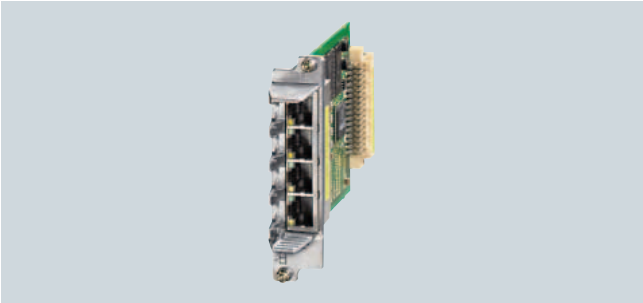


Selecting option **G10** provides the possibility of further increasing the performance of technology functions for the SINAMICS DC MASTER. As a result of the additional Standard CUD that is inserted in the righthand slot of the electronics tray, users have additional computational performance at their fingertips in order to fulfill even the highest demands when it comes to closed-loop control performance. Option **G00** is required when selecting option G10. An extension to include two Control Units is only possible when the Advanced CUD is inserted in the lefthand slot.

**G11**
Advanced CUD right

With option **G11**, users can address the highest demands regarding the closed-loop control performance and use the wide range of interfaces. With this option, in addition to the Advanced CUD located in the lefthand slot, an additional Advanced CUD can be mounted in the righthand slot. This therefore doubles the number of interfaces of the SINAMICS DC MASTER. Option **G00** is required when selecting option **G11**. An extension to include two Control Units is only possible when the Advanced CUD is inserted in the lefthand slot.

**G20**
Communication Board CBE20 left



The CBE20 Communication Board can be used to connect to a PROFINET IO network via the Advanced CUD.

The SINAMICS DC MASTER then assumes the function of a PROFINET IO device in the sense of PROFINET and offers the following functions:

- PROFINET IO device
- 100 Mbits/s full duplex
- Supports real-time classes of PROFINET IO:
- RT (Real-Time)
- Connection to control systems as PROFINET IO devices in accordance with PROFIdrive, Specification V4.1.
- In addition to PROFIBUS (standard), PROFINET can also be used for engineering with the STARTER commissioning tool.
- Integrated 4-port switch with four RJ45 sockets based on the PROFINET ASIC ERTEC400. The optimum topology (line, star, tree) can therefore be configured without additional external switches.
- The SINAMICS Link function can be used in conjunction with option S01 or S02.

The CBE20 is inserted in the option slot of the Advanced CUD, which is inserted in the lefthand slot. An Advanced CUD must be located in the lefthand slot in order to be able to use option G20. This can be selected with option G00.

| Technical data | |
|---|---|
| Permissible ambient temperature | |
| • Storage and transport | –40 ... +70 °C |
| • Operation | 0 ... 55 °C |
| Approvals | cULus (File No.: E164110) |

| Accessories for CBE20 | Type |
|---|---|
| Industrial Ethernet FC | |
| • RJ45 Plug 145 (1 plug) | 6GK1901-1BB30-0AA0 |
| • RJ45 Plug 145 (10 plugs) | 6GK1901-1BB30-0AB0 |
| • Stripping tool | 6GK1901-1GA00 |
| • Standard cable GP 2x2 | 6XV1840-2AH10 |
| • Flexible cable GP 2x2 | 6XV1870-2B |
| • Trailing cable GP 2x2 | 6XV1870-2D |
| • Trailing cable 2x2 | 6XV1840-3AH10 |
| • Marine cable 2x2 | 6XV1840-4AH10 |

The cables are sold by the meter.

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

**Options** (continued)

**G21**
Communication Board CBE20 right

With option G21, an Advanced CUD inserted in the righthand slot (refer to option G11) can be extended by the CBE20. More detailed information on the functionality, selection and ordering data of the CBE20 is available under option G20.

**L04**
Armature supply with extra-low voltage 10 to 50 V

With option L04, the SINAMICS DC MASTER is re-equipped for operation with 10 to 50 V AC. This is frequently required especially for electrochemical applications, when controlling solenoids, when using the converter to supply the fields of special motors or Ward-Leonard converters (MG sets).

This option can only be selected for units with rated supply voltages of up to 575 V.

**L05**
Electronics power supply for connection to 24 V DC

With option L05, users have the possibility of equipping SINAMICS DC MASTER with an electronics power supply for connection to 24 V DC instead of the standard electronics power supply. This option allows users to connect the units to a favorably-priced 24 V UPS system.

This option cannot be selected for Control Modules as the Control Module is supplied as standard with an electronics power supply for connection to 24 V DC.
Input voltage range: 18 to 30 V,
current consumption: 5 A at 24 V

**L10**
Without field power section

In some applications it may be necessary to individually adapt the field power section. For this particular case, users can order option L10 where SINAMICS DC MASTER is not equipped with the standard integrated field power section. This then allows them to implement their own individual solutions for the field power section.

This option cannot be ordered for units with rated DC currents from 15 to 30 A.

**L11**
2Q field power section

For applications that demand high speed field current changes, by specifying option L11, the SINAMICS DC MASTER can be equipped with a two-quadrant field with active current reduction. Further, this field power section has an integrated field overvoltage protection.

This option cannot be ordered for units with rated DC currents from 15 to 30 A.

**L15**
External sensor for ambient or inlet temperature

Option L15 is a sensor located outside the unit to measure the ambient or inlet temperature. For example, this can be used to simply monitor the cabinet temperature and/or identify when the air intake filter is blocked.

This option is only available for units with rated DC currents from 1 500 to 3 000 A.

**L21**
Fan for single-phase connection

A fan can be optionally supplied with a single-phase connection for units with rated DC currents between 400 and 1 200 A. This allows fans to be more quickly replaced than three-phase fans – especially as the direction of rotation does not have to be checked.

Units smaller than 400 A are self-ventilated or have an integrated 24 V DC fan. Units with ratings of greater than 1 200 A require a three-phase connection for the fan due to the higher power consumption. Rated supply voltage: 230 V 1 AC ± 10 % (50 and 60 Hz).

**L85**
85 A field power section

With option L85, users can have the SINAMICS DC MASTER equipped with a rated DC field current of 85 A.

This option can only be ordered for units with rated DC currents from 1 500 to 3 000 A.

**M08**
Coated PCBs

In order to improve the reliability for increased degrees of pollution and climatic stressing, it is possible to order PCBs of the SINAMICS DC MASTER that are coated on both sides by specifying option M08.

**M10**
Nickel-plated copper busbars

When ordered with Option M10, the SINAMICS DC MASTER is equipped with nickel-plated copper busbars. The degree of availability can be increased for aggressive atmospheres.

This option is not available for units with rated DC currents from 15 to 30 A.

**S01**
Memory card left

With option S01, users receive a memory card for one Standard CUD or one Advanced CUD, which is inserted in the lefthand slot.

This memory card offers the following options:

- Additional languages can be downloaded to the Advanced Operator Panel AOP30. When using two CUDs, option S01 and option S02 must be ordered.
- Perform an offline long-time trace.
- Download the DCC block library into the drive.
- Update the software.

The SINAMICS Link function requires that the memory card is always inserted.

**S02**
Memory card right

With option S02, users receive a memory card for one Standard CUD or one Advanced CUD, which is inserted in the righthand slot.

This memory card offers the following options:

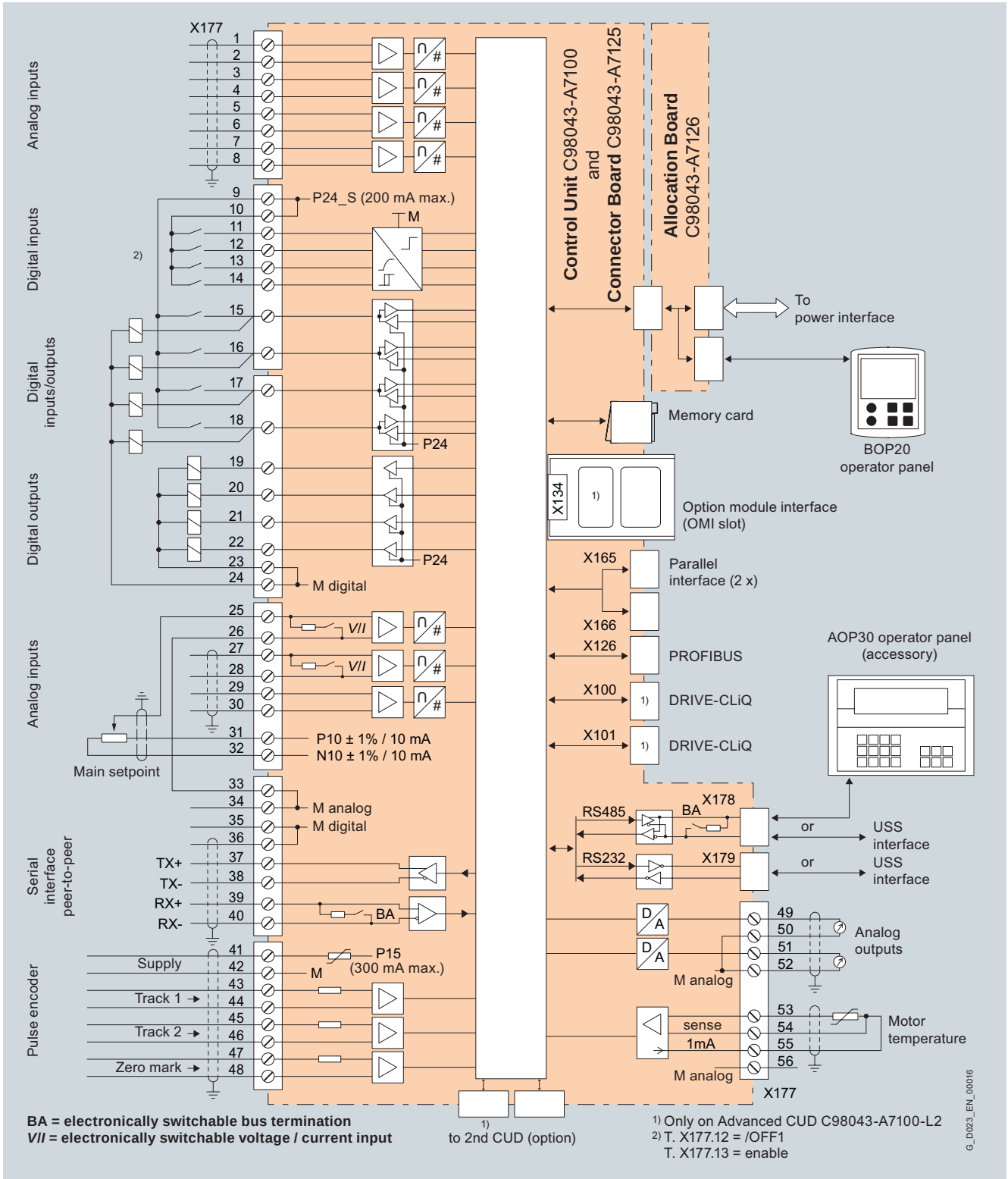
- Additional languages can be downloaded to the Advanced Operator Panel AOP30. When using two CUDs, option S01 and option S02 must be ordered.
- Perform an offline long-time trace.
- Download the DCC block library into the drive.
- Update the software.

The SINAMICS Link function requires that the memory card is always inserted.

In order to be able to use option S02, a Standard CUD right (option G10) or an Advanced CUD right (option G11) is required.

## Schematics

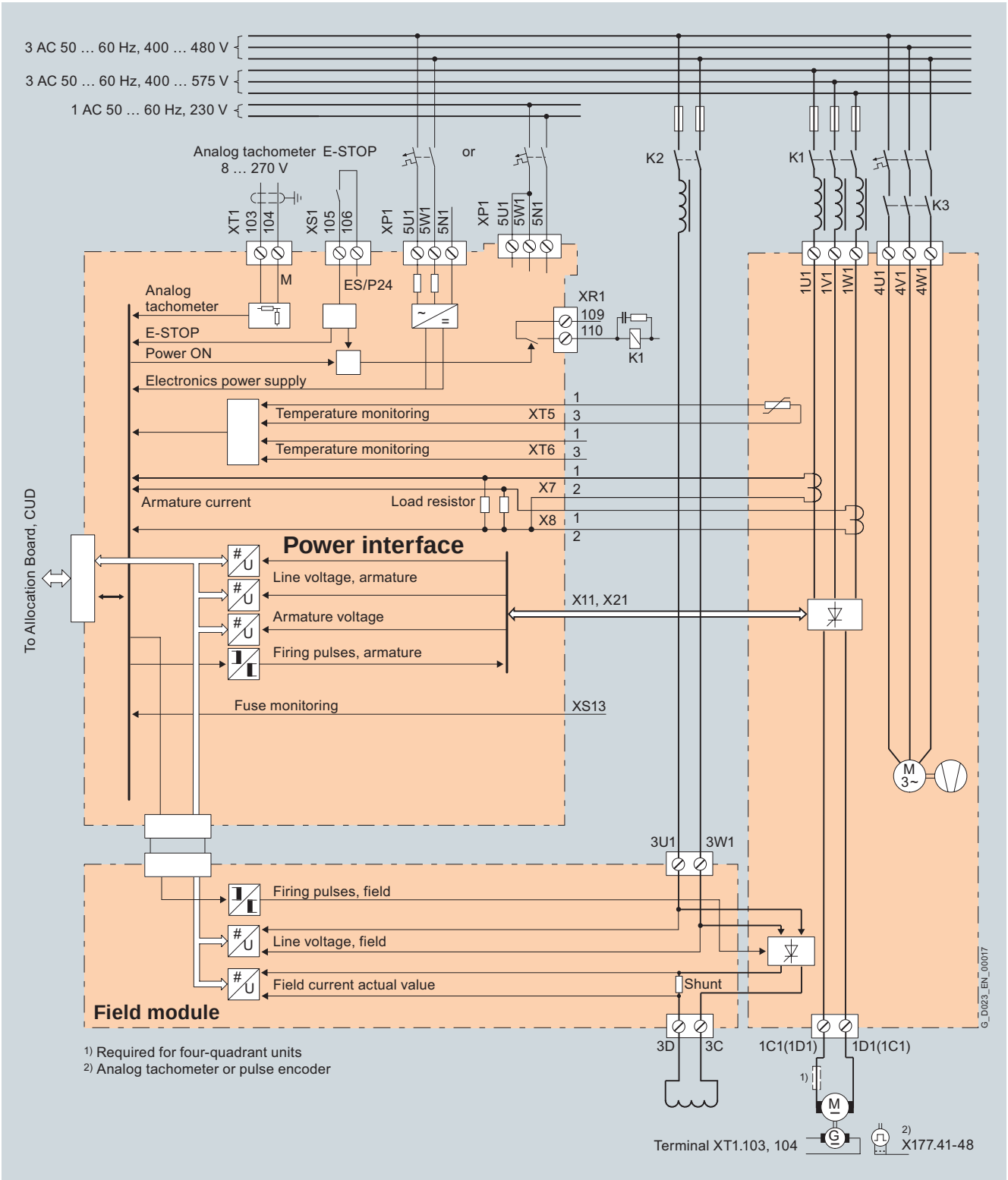
### *Control Units*




Connection diagram, Standard CUD/Advanced CUD with typical connections

## Schematics (continued)

### DC Converters




1) Required for four-quadrant units
2) Analog tachometer or pulse encoder

Connection diagram, DC Converters, 400 to 3 000 A, electronics power supply 400 V or 230 V, with fan

## Schematics (continued)

### *Assignment of terminals and connectors*

Overview

*Overview of terminals and connectors*

| | |
|---|---|
| 1U1, 1V1, 1W1, 1C1, 1D1 | Power section |
| 3U1, 3W1, 3C, 3D | Field circuit |
| 4U1, 4V1, 4W1, 4N1 | Fan |
| 5U1, 5W1, 5N1 | Electronics power supply |
| X100, X101 | DRIVE-CLiQ |
| X126 | PROFIBUS |
| X165, X166 | Parallel connection interface |
| X177 | Analog inputs, digital inputs, digital outputs, setpoints, reference voltage (P10/N10), serial interface (peer-to-peer), pulse encoder, analog outputs, temperature sensor |
| X178 | RS485 interface for connection of the AOP30, alternatively USS interface; generally only one of the interfaces X178 or X179 can be used |
| X179 | RS232 interface can be used as USS interface; generally only one of the interfaces X178 or X179 can be used |
| XR1, XS1, XT1 | Relay output for line contactor, safety shutdown (E-STOP), analog tachometer |

Power section

*Terminal type, power connections for 15 A and 30 A units*

| Type | KDS 10 PC board terminal |
|---|---|
| Conductor size | • Rigid: 0.5 … 16 $mm^2$<br>• Flexible with end sleeve with/without plastic sleeve: 0.5 … 10 $mm^2$<br>• Conductor sizes: AWG 20 … 6 |
| Stripped length | 12 mm |
| Tightening torque | 1.2 … 1.5 Nm |

*Terminal type, power connections for units of 60 A and higher*

| Units | Data |
|---|---|
| 60 … 210 A | 1U1, 1V1, 1W1: 3 × 20 mm aluminum busbar, through hole for M8<br>1C1, 1D1: 5 × 20 mm aluminum busbar, through hole for M8 |
| | Max. conductor cross-section for cables with cable lug in acc. with DIN 46234:<br>1U1, 1V1, 1W1, 1C1, 1D1: 2 × 95 $mm^2$ |
| | Tightening torque for 1U1, 1V1, 1W1, 1C1, 1D1: 13 Nm<br>Tightening torque for protective conductor: 25 Nm |
| 280 A | 1U1, 1V1, 1W1: 3 × 20 mm copper busbar, through hole for M8<br>1C1, 1D1: 5 × 20 mm copper busbar, through hole for M8 |
| | Max. conductor cross-section for cables with cable lug in acc. with DIN 46234:<br>1U1, 1V1, 1W1, 1C1, 1D1: 2 × 95 $mm^2$ |
| | Tightening torque for 1U1, 1V1, 1W1, 1C1, 1D1: 13 Nm<br>Tightening torque for protective conductor: 25 Nm |
| 400 … 450 A | 1U1, 1V1, 1W1: 5 × 30 mm aluminum busbar, through hole for M10<br>1C1, 1D1: 5 × 35 mm aluminum busbar, through hole for M10 |
| | Max. conductor cross-section for cables with cable lug in acc. with DIN 46234:<br>1U1, 1V1, 1W1: 2 × 150 $mm^2$<br>1C1, 1D1: 2 × 185 $mm^2$ |
| | Tightening torque for 1U1, 1V1, 1W1, 1C1, 1D1: 25 Nm<br>Tightening torque for protective conductor: 50 Nm |
| 600 A | 1U1, 1V1, 1W1: 5 × 30 mm copper busbar, through hole for M10<br>1C1, 1D1: 5 × 35 mm copper busbar, through hole for M10 |
| | Max. conductor cross-section for cables with cable lug in acc. with DIN 46234:<br>1U1, 1V1, 1W1: 2 × 150 $mm^2$<br>1C1, 1D1: 2 × 185 $mm^2$ |
| | Tightening torque for 1U1, 1V1, 1W1, 1C1, 1D1: 25 Nm<br>Tightening torque for protective conductor: 50 Nm |
| 720 … 850 A | 1U1, 1V1, 1W1, 1C1, 1D1: 5 × 60 mm copper busbar, through hole for M12 |
| | Max. conductor cross-section for cables with cable lug in acc. with DIN 46234:<br>1U1, 1V1, 1W1, 1C1, 1D1: 4 × 150 $mm^2$ |
| | Tightening torque for 1U1, 1V1, 1W1, 1C1, 1D1: 44 Nm<br>Tightening torque for protective conductor: 50 Nm |

Protective conductor:
Minimum cross-section 10 $mm^2$, for connection options, see dimension drawings.

## Schematics (continued)

*Terminal type, power connections for units of 60 A and higher (continued)*

| Units | Data |
|---|---|
| 900 … 1 200 A | 1U1, 1V1, 1W1, 1C1, 1D1: 10 × 80 mm copper busbar, through hole for M12 |
| | Max. conductor cross-section for cables with cable lug in acc. with DIN 46234:<br>1U1, 1V1, 1W1, 1C1, 1D1: 4 × 150 $mm^2$ |
| | Tightening torque for 1U1, 1V1, 1W1, 1C1, 1D1: 44 Nm<br>Tightening torque for protective conductor: 60 Nm |
| 1 500 … 2 000 A and<br>2 200 A/575 V | 1U1, 1V1, 1W1: 10 × 80 mm aluminum busbar, through hole for M12<br>1C1, 1D1: 10 × 50 mm aluminum busbar, through hole for M12 |
| | Max. conductor cross-section for cables with cable lug in acc. with DIN 46234:<br>1U1, 1V1, 1W1: 4 × 240 $mm^2$<br>1C1, 1D1: 8 × 240 $mm^2$ |
| | Tightening torque for 1U1, 1V1, 1W1, 1C1, 1D1: 44 Nm<br>Tightening torque for protective conductor: 60 Nm |
| 2 200 A (> 575 V) … 3 000 A | 1U1, 1V1, 1W1: 2x 10 × 100 mm copper busbar, through hole for M12<br>1C1, 1D1: 2x 10 × 80 mm copper busbar, through hole for M12 |
| | Tightening torque for 1U1, 1V1, 1W1, 1C1, 1D1: 44 Nm<br>Tightening torque for protective conductor: 60 Nm |

Protective conductor:
Minimum cross-section 10 $mm^2$, for connection options, see dimension drawings.

The units are designed for a permanent line supply connection in accordance with DIN VDE 0160-106, Section 6.5.2.1.

The conductor cross-sections must be determined in accordance with the regulations that apply in each case – e.g. DIN VDE 0276-1000.

*Assignment of power connections*

| Terminal | Function | Technical data |
|---|---|---|
| 1U1<br>1V1<br>1W1 | Line input armature power section | See under “Technical specifications” (Rated armature supply voltage) |
| ⏚ | Protective conductor PE | |
| 1C1 (1D1)<br>1D1 (1C1) | Motor connection armature circuit | See under “Technical specifications” (Rated DC voltage) |

Field circuit

*Terminal type, field circuit connections*

| | |
|---|---|
| **Units with power section C98043-A7111 (15 and 30 A units) and units with field module C98043-A7115 (the terminals are located on the module):** | |
| Type | ZFKDS 4-10 PC board terminal |
| Conductor size | • Rigid: 0.2 … 6 $mm^2$<br>• Flexible: 0.2 … 4 $mm^2$<br>• Conductor sizes: AWG 24 … 10<br>• Flexible with end sleeve with/without plastic sleeve: 0.25 … 4 $mm^2$ |
| Stripped length | 10 mm |
| **Units with field module C98043-A7116 with rated armature DC current 900 … 1 200 A:** | |
| Type | 20E/4DS terminal strip |
| Conductor size | • Rigid: 6 … 16 $mm^2$<br>• Flexible: 6 … 10 $mm^2$ |
| Stripped length | 8 mm |
| **Units with field module C98043-A7116 with rated armature DC current 1 500 … 3 000 A:** | |
| Type | UK16N terminal block |
| Conductor size | • Rigid: 2.5 … 25 $mm^2$, AWG 14 … 4<br>• Flexible: 4 … 16 $mm^2$, AWG 12 … 6 |
| Stripped length | 11 mm |
| Tightening torque | 1.5 … 1.8 Nm |

## Schematics (continued)

*Terminal type, field circuit connections (continued)*

| Units with option L85 (with rated field DC current 85 A): | |
|---|---|
| Type | UK35 terminal block |
| Conductor size | • Rigid: 0.75 … 50 $mm^2$<br>• Flexible: 0.75 … 35 $mm^2$<br>• Conductor sizes: AWG 18 … 0/1<br>• Flexible with end sleeve with/without plastic sleeve: 0.75 … 35 $mm^2$ |
| Stripped length | 16 mm |
| Tightening torque | 3.2 … 3.7 Nm |

*Assignment of connections for the field circuit*

| Terminal | Function | Technical data |
|---|---|---|
| XF1:<br>3U1, 3W1 | Line input armature power section field circuit | See under “Technical specifications” (Rated field supply voltage) |
| XF2-1: 3D<br>XF2-2: 3C | Motor connection field circuit | See under “Technical specifications” (Rated field DC voltage) |

Electronics power supply

*Terminal type, electronics power supply*

| Type | MSTB 2.5 / CIF plug-in terminal |
|---|---|
| Conductor size | • Rigid: 0.2 … 2.5 $mm^2$<br>• Flexible: 0.2 … 2.5 $mm^2$<br>• Conductor sizes: AWG 24 … 12<br>• Flexible with end sleeve with/without plastic sleeve: 0.25 … 2.5 $mm^2$ |
| | Multi-conductor connection (2 conductors of the same type and with same cross-section):<br>• Rigid: 0.2 … 1 $mm^2$<br>• Flexible: 0.2 … 1.5 $mm^2$<br>• Flexible with end sleeve without plastic sleeve: 0.25 … 1 $mm^2$<br>• Flexible with end sleeve with plastic sleeve: 0.5 … 1.5 $mm^2$ |
| Stripped length | 7 mm |
| Tightening torque | 0.5 … 0.6 Nm |

*Assignment of terminals for the electronics power supply*

| Terminal XP1 | Connection | Function | Technical data |
|---|---|---|---|
| 5U1<br>5W1<br>5N1 | ——<br>——<br>NC | 400 V supply | 380 V (–25 %) … 480 V (+10 %) 2 AC; $I_n$ = 1 A (–35 % for 1 min)<br>Internal fuse with F200, F201 on module C98043-A7105 or -A7106<br>External protection max. 6 A, characteristic C recommended |
| or | | | |
| 5U1<br>5W1<br>5N1 |  | 230 V supply | 190 V (–25 %) … 240 V (+10 %) 1 AC; $I_n$ = 2 A (–35 % for 1 min)<br>Internal fuse with F200, F201 on module C98043-A7105 or -A7106<br>External protection max. 6 A, characteristic C recommended |

Module C98043-A7105 Power Interface 400 … 600 V or C98043-A7106 Power Interface 690 … 950 V

Note:

In the case of line supply voltages that fall outside the tolerance range, the electronics supply voltage, field circuit line supply connection, and the unit fan connection must be adapted to the permissible value using transformers. It is absolutely essential that you use an isolation transformer for rated line supply voltages above 480 V.
The rated supply voltage for the armature circuit (index i00) and for the field circuit (index i01) must be set at p50078.

**Schematics** (continued)

Fans

*Terminal type, fan connections for units ≥ 400 A with forced ventilation*

| Type | DFK-PC4 plug-in terminal |
|---|---|
| Conductor size | • Rigid: 0.2 … 4 $mm^2$<br>• Flexible: 0.2 … 4 $mm^2$<br>• Conductor sizes: AWG 24 … 10 |

The connecting leads must be insulated up to the point where they meet the terminal enclosure.

*Terminal assignment for fan connection*

| Terminal | Function | Technical data |
|---|---|---|
| 4U1<br>4V1<br>4W1 | 400 … 460 V supply | 400 … 460 V 3 AC<br>for additional data, refer under “Technical specifications” |
| ⏚ | Protective conductor PE | |
| or | | |
| 4U1<br>4N1 | 230 V supply | 230 V 1 AC<br>for additional data, refer under “Technical specifications” |

Open-loop and closed-loop control section

*Terminal type, open-loop and closed-loop control section*

| | |
|---|---|
| **X177:** | |
| Type | SPT 1.5 spring-loaded terminal |
| Conductor size | • Rigid: 0.2 … 1.5 $mm^2$<br>• Flexible: 0.2 … 1.5 $mm^2$<br>• Conductor sizes: AWG 24 … 16<br>• Flexible with end sleeve without plastic sleeve: 0.25 … 1.5 $mm^2$ (stripped length 8 mm)<br>• Flexible with end sleeve with plastic sleeve: 0.25 … 0.75 $mm^2$ (stripped length 8 mm) |
| Stripped length | 10 mm |
| **X178, X179:** | |
| Type | FMC 1.5 plug-in terminal |
| Conductor size | • Rigid: 0.2 … 1.5 $mm^2$<br>• Flexible: 0.2 … 1.5 $mm^2$<br>• Conductor sizes: AWG 24 … 16<br>• Flexible with end sleeve without plastic sleeve: 0.25 … 1.5 $mm^2$<br>• Flexible with end sleeve with plastic sleeve: 0.25 … 0.75 $mm^2$ |
| Stripped length | 10 mm |
| **XR1, XS1, XT1:** | |
| Type | MSTB 2.5 / CIF plug-in terminal |
| Conductor size | • Rigid: 0.2 … 2.5 $mm^2$<br>• Flexible: 0.2 … 2.5 $mm^2$<br>• Conductor sizes: AWG 24 … 12<br>Flexible with end sleeve with/without plastic sleeve: 0.25 … 2.5 $mm^2$ |
| Stripped length | 7 mm |
| Tightening torque | 0.5 … 0.6 Nm |
| **X126:** | |
| Type | Submin D, 9-pin |
| **X100, X101:** | |
| Type | Western socket 8 / 4 (RJ45) |

## Schematics (continued)

Terminals on Connector Board C98043-A7125

*Assignment, terminal X177*

| Terminal X177 | Function | | Technical data |
|---|---|---|---|
| **Analog inputs (user-assignable inputs)** | | | |
| 1<br>2 | AI3 +<br>AI3 - | Analog input 3 | Input type (signal type):<br>Differential input ± 10 V; 150 kΩ<br>Resolution approx. 5.4 mV (± 11 bits)<br>Common-mode controllability: ± 15 V |
| 3<br>4 | AI4 +<br>AI4 - | Analog input 4 | |
| 5<br>6 | AI5 +<br>AI5 - | Analog input 5 | |
| 7<br>8 | AI6 +<br>AI6 - | Analog input 6 | |
| **Digital inputs (user-assignable inputs)** | | | |
| 9<br>10 | 24 V DC | 24 V supply (output) | 24 V DC, short-circuit proof<br>Max. load 200 mA (terminals 9 and 10 together),<br>internal supply referred to internal ground |
| 11 | DI0 | Digital input 0 | H signal: +15 … +30 V<br>L signal: –30 … +5 V or terminal open<br>8.5 mA at 24 V |
| 12 | DI1 | Digital input 1 | |
| 13 | DI2 | Digital input 2 | |
| 14 | DI3 | Digital input 3 | |
| **Digital inputs/outputs (user-assignable inputs/outputs)** | | | |
| 15 | DI/<br>DO4 | Digital input/<br>output 4 | Type, input/output parameterizable<br>Properties of inputs:<br>H signal: +15 … +30 V<br>L signal: 0 … +5 V or terminal open<br>8.5 mA at 24 V<br>Properties of outputs:<br>H signal: +20 … +26 V<br>L signal: 0 … +2 V<br>Short-circuit proof, 100 mA<br>Internal protective circuit (free wheeling diode)<br>For overload: Alarm A60018 |
| 16 | DI/<br>DO5 | Digital input/<br>output 5 | |
| 17 | DI/<br>DO6 | Digital input/<br>output 6 | |
| 18 | DI/<br>DO7 | Digital input/<br>output 7 | |
| 19 | DO0 | Digital output 0 | H signal: +20 … +26 V<br>L signal: 0 … +2 V<br>Short-circuit proof, 100 mA<br>Internal protective circuit (free wheeling diode)<br>For overload: Alarm A60018 |
| 20 | DO1 | Digital output 1 | |
| 21 | DO2 | Digital output 2 | |
| 22 | DO3 | Digital output 3 | |
| 23, 24 | M | Ground, digital | |
| **Analog inputs, setpoint inputs (user-assignable inputs)** | | | |
| 25<br>26 | AI0 +<br>AI0 - | Analog input 0<br>Main setpoint | Input type (signal type), parameterizable:<br>- Differential input ± 10 V; 150 kΩ<br>- Current input 0 … 20 mA; 300 Ω or 4 … 20 mA; 300 Ω<br>Resolution approx. 0.66 mV (± 14 bits)<br>Common-mode controllability: ± 15 V |
| 27<br>28 | AI1 +<br>AI1 - | Analog input 1 | |
| 29<br>30 | AI2 +<br>AI2 - | Analog input 2 | Input type (signal type):<br>- Differential input ± 10 V; 150 kΩ<br>Resolution approx. 0.66 mV (± 14 bits)<br>Common-mode controllability: ± 15 V |
| **Reference voltage** | | | |
| 31<br>32 | P10<br>N10 | Reference voltage ± 10 V<br>(output) | Tolerance ± 1 % at 25 °C<br>Stability 0.1 % per 10 K<br>10 mA short-circuit proof |
| 33, 34 | M | Ground, analog | |
| **Serial interface, peer-to-peer RS485** | | | |
| 35, 36 | M | Ground, digital | |
| 37 | TX+ | Send cable + | 4-wire send cable, positive differential output |
| 38 | TX- | Send cable - | 4-wire send cable, negative differential output |
| 39 | RX+ | Receive cable + | 4-wire receive cable, positive differential input |
| 40 | RX- | Receive cable - | 4-wire receive cable, negative differential input |

## Schematics (continued)

*Assignment, terminal X177 (continued)*

| Terminal X177 | Function | | Technical data |
|---|---|---|---|
| **Pulse encoder input** | | | |
| 41 | Pulse encoder supply | | +13.7 … +15.2 V, 300 mA short-circuit proof (electronically protected)<br>For overload: Alarm A60018 |
| 42 | Pulse encoder ground | | |
| 43 | Track 1 positive connection | | Load: ≤ 5.25 mA at 15 V (without switching losses)<br>Pulse duty factor: 1:1<br>See below for data relating to cables, cable length, shield connection, input pulse levels, hysteresis, track displacement, and pulse frequency. |
| 44 | Track 1 negative connection | | |
| 45 | Track 2 positive connection | | |
| 46 | Track 2 negative connection | | |
| 47 | Zero mark positive connection | | |
| 48 | Zero mark negative connection | | |
| **Analog outputs (user-assignable outputs)** | | | |
| 49 | AO0 | Analog output 0 | ± 10 V, max. 2 mA short-circuit proof, resolution ± 15 bits |
| 50 | M | Ground, analog | |
| 51 | AO1 | Analog output 1 | |
| 52 | M | Ground, analog | |
| **Connections for temperature sensor (motor interface 1)** | | | |
| 53 | Temp 1 | | Sensor acc. to p50490<br>The cable to the temperature sensor on the motor must be shielded and connected to ground at both ends.<br>The cables for the Temp 1 and Temp 3 connections to the temperature sensor must have approximately the same length.<br>The sense cable (Temp 2) is used for compensating the cable resistances. If you are not using a sense cable, terminals 54 and 55 must be connected. |
| 54 | Temp 2 (sense cable) | | |
| 55 | Temp 3 | | |
| 56 | M | Ground, analog | |

Module C98043-A7125 Connector Board

## More information

### *Free function blocks*

Application, properties

Logic operations, which link several states (e.g. access control, plant status) to a control signal (e.g. ON command), is required for controlling the drive system in a wide variety of applications. Along with logic operations, a number of arithmetic operations and storing elements are becoming increasingly important in drive systems.

This functionality is available as function module “Free function blocks” (FBLOCKS) for SINAMICS DC MASTER and can be activated in the Control Unit (CUD). A detailed description is provided in the Function Manual “Free function blocks” (see catalog section “Services and documentation”).

Configuring and use

The free function blocks are configured at the parameter level.

The following parameters are required for this:

- Input parameters (e.g. inputs I0 ... I3 for the AND function block)
- Output parameters (e.g. output Y for the numeric change-over switch)
- Adjustable parameters (e.g. pulse duration for pulse generator MFP)
- Runtime group (this includes the sampling time; the free function blocks are not computed in the factory setting)
- Run sequence within the runtime group

A parameter is assigned to each input, output, and setting variable. These can be accessed by means of the Advanced Operator Panel AOP30 or STARTER commissioning software. The free function blocks can be interconnected at the BICO level. The free function blocks do not support data set dependency.

**More information** (continued)

Range of blocks

The table below shows the range of free function blocks available. The special technical properties of the individual function blocks can be taken from the function block diagrams in Chapter 3 of the Function Manual.

| Short name | Name of function block | Data type | Count per drive object |
|---|---|---|---|
| AND | AND function block | BOOL | 4 |
| OR | OR function block | BOOL | 4 |
| XOR | XOR function block | BOOL | 4 |
| NOT | Inverter | BOOL | 4 |
| ADD | Adder | REAL | 2 |
| SUB | Subtracter | REAL | 2 |
| MUL | Multiplier | REAL | 2 |
| DIV | Divider | REAL | 2 |
| AVA | Absolute value generator with sign evaluation | REAL | 2 |
| MFP | Pulse generator | BOOL | 2 |
| PCL | Pulse shortener | BOOL | 2 |
| PDE | ON delay | BOOL | 2 |
| PDF | OFF delay | BOOL | 2 |
| PST | Pulse stretcher | BOOL | 2 |
| RSR | RS flip-flop, reset dominant | BOOL | 2 |
| DFR | D flip-flop, reset dominant | BOOL | 2 |
| BSW | Binary change-over switch | BOOL | 2 |
| NSW | Numeric change-over switch | REAL | 2 |
| LIM | Limiter | REAL | 2 |
| PT1 | Smoothing element | REAL | 2 |
| INT | Integrator | REAL | 1 |
| DIF | Derivative-action element | REAL | 1 |
| LVM | Double-sided limit monitor with hysteresis | BOOL | 2 |

### *Drive Control Chart (DCC)*

The “Drive Control Chart” function (DCC) is available for more complex applications.

DCC allows you to graphically configure the required functionality and then download it to the drive. It provides a significantly extended range of block types available.

In online operation, the signal values can be monitored in STARTER/SCOUT in the DCC chart.

### *Power section and cooling*

SINAMICS DC MASTER converters distinguish themselves as a result of the compact, space-saving design. The electronics module (available in various customer-specific combinations with options) is installed in a cradle that can be swiveled out. The easy access to individual components makes this technology very service-friendly.

Plug-in terminals are used to connect external signals (binary inputs/outputs, analog inputs/outputs, pulse generators etc.). The device software is saved in a flash EPROM and can be easily exchanged by loading via the serial interface of the SINAMICS DC MASTER.

Power section: Armature and field circuit

The armature circuit is implemented as a three-phase bridge circuit:

- For units for two-quadrant operation, in a fully-controlled three-phase bridge circuit B6C
- For units for four-quadrant operation in two fully-controlled three-phase bridge circuits (B6) A (B6) C.

The field circuit is implemented in a half-controlled single-phase bridge circuit B2HZ.

In the case of units with a 15 A to 1 200 A rated DC current, the power sections for the armature and field include electrically isolated thyristor modules, which means that the heat sink is floating. For units up to 30 A, the armature and field power sections are implemented in the form of a printed circuit board with compact modules that are soldered on.

For units with rated currents ≥ 1 500 A, the power section for the armature circuit uses disc-type thyristors and heat sinks at voltage potential. For units from 1 500 to 3 000 A, the thyristor phases are implemented as plug-in modules and can therefore be quickly replaced.

Checking the motor insulation has been significantly simplified due to the fact that the line supply voltage sensing for the armature and the field sections is electrically isolated.

Cooling

Units with a rated DC current up to 125 A are designed for natural air cooling, units with a rated current above 210 A are designed for forced air cooling (fan). The fans are always horizontally mounted at the top so that they can be quickly replaced without having to disconnect the power connections.

### *Parameterizing devices*

BOP20 Basic Operator Panel


BOP20 Basic Operator Panel

As standard, all of the units are equipped with a BOP20 Basic Operator Panel from the SINAMICS family.

The basic operator panel offers customers a basic functionality for commissioning as well as operator control and monitoring.

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

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

The BOP20 power supply and communication with the CUD Control Unit are established via the connector integrated at the rear of the BOP20.

**More information** (continued)

AOP30 Advanced Operator Panel


The AOP30 Advanced Operator Panel is an optional input/output device for SINAMICS DC MASTER converters. It can be separately ordered. Additional information on the AOP30 is available in the catalog section “Accessories and supplementary components”.

PC based parameterization

The STARTER tool is available for PC-based commissioning and diagnostics. More detailed information is provided in catalog section 5 “Tools and engineering”.

### *Closed-loop control and open-loop drive control*

The closed-loop and open-loop drive control is essentially designed for supplying the armature and field of variable-speed DC drives.

Using BICO technology permits the closed-loop and open-loop drive control structure to be simply adapted to the application-specific requirements as well as the use in alternative applications (e.g. as excitation equipment for synchronous motors).

The most important functions of the closed-loop control include:

- Setpoint processing (including digital setpoints, jogging, motorized potentiometer)
- Ramp-function generator
- Speed controller actual value processing
- Speed controller
- Torque and armature current control
- Closed-loop armature current control
- Armature gating unit
- Closed-loop EMF control
- Closed-loop field current control
- Field gating unit

BICO technology

BICO technology (Binector Connector Technology) allows signal paths to be defined (and therefore the controller structure) using parameters.

Mode of operation:
All important points of the closed-loop control are accessible via connectors.
Connectors are measuring points that are mapped to display parameters.

Important connectors include:

- Analog inputs and outputs
- Interface inputs (e.g. PROFIBUS)
- Actual value sensing inputs (e.g. speed, armature current, armature voltage)
- Inputs and outputs of the ramp-function generator, speed controller, armature current controller, armature gating unit, EMF controller, field current controller, field gating unit
- General quantities such as operating state, motor temperature rise, thyristor temperature rise

All important binary signals of the closed-loop and open-loop control are accessible via binectors.
Binectors are measuring points for binary signals, which are mapped to display parameters.

Important binectors include:

- Status of binary inputs
- Control words, status words
- Status of controllers, limits, faults

All of the important inputs of the open-loop and closed-loop control can be interconnected using BICO selection parameters. This means that by setting the corresponding BICO selection parameter, a connection can be established between any connector or binector.

Important inputs include:

- Setpoint input, supplementary setpoint input
- Ramp-function generator input
- Speed controller input
- Armature current controller input
- Armature gating unit input
- Speed setpoint limiting (before and after the ramp-function generator)
- Torque limiting
- Armature current limiting
- Signal source for binary and analog outputs

**More information** (continued)

Data sets

Many open-loop and closed-loop control parameters depend on the particular data set. This means that they have several indices where various values can be set. All data set dependent parameters can be simultaneously switched over to another data set using binary control signals.

There are two groups of data set-dependent parameters:

- DDS parameters:
  Parameters that are associated with the drive data set (DDS). The drive data set contains various adjustable parameters that are relevant for open-loop and closed-loop drive control.
- CDS parameters:
  Parameters that are associated with the command data set (CDS). Many BICO selection parameters are combined in the command data set. These parameters are used to interconnect the signal sources of a drive.

By parameterizing several command data sets and switching between them, the drive can be operated with different pre-configured signal sources.

### *Optimization run*

The SINAMICS DC MASTER converter units are supplied with the factory settings. Controller setting is supported by selecting automatic optimization runs. The selection is made using special key numbers.

The following controller functions can be set using an automatic optimization run:

- Current controller optimization run to set the current controller and pre-controls (armature and field circuit).
- Speed controller optimization run to set the speed controller characteristics; the friction and moment of inertia compensation for the speed controller pre-control is automatically recorded.
- Automatic recording of the field characteristic for an EMF-dependent field-weakening control and automatic optimization of the EMF controller for field-weakening operation.
- In addition, all of the parameters set during the automatic optimization runs can be changed via the operator panel.

### *Monitoring and diagnostics*

Displaying operating values

The operating state of the converter is displayed using a parameter. Several hundred signals can be displayed via parameter or selected for output on the display unit. Examples of measured values that can be displayed: Setpoints, actual values, status of binary inputs/outputs, line supply voltage, line frequency, firing angle, inputs/outputs of the analog terminals, controller input and output, limits.

Trace function

Up to eight measured quantities can be saved by selecting the trace function. A measured quantity or the occurrence of a fault message can be parameterized as trigger condition. By selecting a trigger delay, it is also possible to record (trace) the pre-history and post-history of events. The sampling time of the measured value storage can be parameterized.

The measured values can be output via the serial interfaces using the STARTER commissioning tool.

Fault messages

A number is assigned to each fault message. In addition, the operating hour of the event is saved together with the fault message. This allows the cause of the fault to be quickly pinpointed. By using the optional AOP30 Advanced Operator Panel, fault messages can be stamped in real time. Then, instead of the operating hour of the event, the day and the time of day of the event are displayed in the AOP30 fault list. For diagnostic purposes, the last eight fault messages are saved with fault number, fault value and the operating hours.

When a fault occurs

- the binary output function “Fault” is set to LOW (user-assignable function),
- the drive is switched-off (controller inhibit, current $I = 0$ is entered, pulses are inhibited, the relay “line contactor CLOSE” drops out) and
- an F is displayed with fault number, LED “Fault” is lit.

Fault messages should either be acknowledged via the operator panel, a binary user-assignable terminal or a serial interface. The “switch-on inhibit” state is reached after the fault has been acknowledged. “Switch-on inhibit” is canceled by an OFF command.

Automatic restart: An automatic restart is possible within a time that can be parameterized between 0 and 10 s. If the time is set to zero, a fault message is immediately output (for power failure) without a restart. A restart can be selected for the following fault messages: Phase failure (field or armature), undervoltage, overvoltage, electronics power supply failure, undervoltage condition at the parallel SINAMICS DC MASTER.

A distinction is made between the following groups of fault messages:

- Power system faults: Phase failure, fault in the field circuit, undervoltage, overvoltage, line frequency < 45 or > 65 Hz
- Interface faults: CUD interfaces or interfaces to the supplementary modules faulted
- Drive faults:
  Controller monitoring for speed controller,
  Current controller, EMF controller,
  Field current controller has responded,
  Drive stalled,
  No armature current possible
- Electronic motor overload protection
  ($I^2t$ monitoring of the motor has responded)
- Tachometer monitoring and overspeed signal
- Commissioning fault
- Fault on the electronics module
- Fault message from the thyristor check: This fault message can only occur if the thyristor check has been activated using the appropriate parameter. In this case, a check is made as to whether the thyristors can be blocked and whether they can be fired.
- Fault messages from the motor sensor system:
  Monitoring of brush length, bearing condition, air flow, motor temperature
- External faults via binary user-assignable terminals

The fault messages can be individually deactivated using a parameter. Some fault messages are already deactivated in the factory and can be activated using this parameter.

**More information** (continued)

Alarms

Alarm messages display special states; however, they do not cause the drive to be switched-off. Alarms that occur do not have to be acknowledged, but rather they are automatically reset as soon as the cause of the alarm is no longer present.

When one or several alarms occur

- the binary output function “Alarm” must be set to LOW (user-assignable function) and
- the alarm is displayed by the flashing “Fault” LED.

A distinction is made between the following groups of alarms:

- Motor overtemperature: The calculated $I^2t$ value of the motor has reached 100 %.
- Alarms from the motor sensor system: Monitoring of brush length, bearing condition, motor fan, motor temperature
- Drive alarms: Drive has stalled, no armature current possible
- External alarms via binary user-assignable terminals
- Alarms from supplementary modules

### *Functions of the inputs and outputs*

Analog user-assignable inputs

After converting to a digital value, the quantity of the analog inputs can be flexibly adapted via parameters for scaling, filter, sign selection and offset input. The values are available as connector. This is the reason that the analog inputs can be effective as main setpoint and also as quantity for a supplementary setpoint or a limit.

Analog outputs

Selectable analog outputs are available to output analog signals. Analog signals can be output as bipolar signal or as absolute value. In this case, scaling, an offset, polarity and a filter time can be parameterized. The required output quantities are selected at the intervention points by entering connector numbers. For instance, speed actual value, ramp-function generator output, current setpoint, line supply voltage etc. can be output.

Binary inputs

- *Switch-on/shutdown (OFF 1)*
  This terminal function is ANDed with the control bit of the serial interface. For an H signal at terminal *switch-on/shutdown*, the main contactor closes via an internal sequence control. The controllers are enabled if there is an H signal at the operating enable terminal. The drive accelerates up to the operating speed with the speed setpoint. For an L signal at the terminal *switch-on/shutdown*, the drive is ramp-down to speed $n < n_{min}$ via the ramp-function generator; after the brake control delay time, the controllers are inhibited and at $I = 0$, the main contactor is opened. After this, after an adjustable time after the main contactor has dropped-out, the field current is reduced to the standstill field current (this can be parameterized). The standstill field can e.g. be used as anti-condensation heating for the motor; to do this, approximately 30 % of the rated field current must be entered as standstill field. The motor fan must be operational for a field current of 100 % of the rated field current. Otherwise, the field winding will be overloaded.
- *Operating enable*
  This function is ANDed with the control bit of the serial interface. The controllers are enabled with an H signal at the *operating enable* terminal. For an L signal, the controllers are inhibited and at $I = 0$, the pulses are inhibited. The signal *operating enable* has a high priority; this means that if the signal (L signal) is withdrawn in operation, then this always results in $I = 0$ and therefore the drive coasts down.

Binary user-assignable inputs:
Additional binary input terminals are available for user-assignable functions. In this case, a binector number is assigned to every user-assignable terminal, which can be used for control functions.

Examples of binary input functions:

- Voltage disconnect (OFF 2): For OFF 2 (L signal), the controllers are instantaneously inhibited, the current in the armature circuit is reduced and at $I = 0$, the main contactor is opened. The drive coasts down uncontrolled.
- Fast stop (OFF 3): For a fast stop (L signal), the speed setpoint at the speed controller input is set to zero and the drive is braked along the current limit for the fast stop which can be parameterized. At $n < n_{min}$ after the brake control delay time $I = 0$ is entered and the main contactor is opened.
- Jogging: The jogging function is available for an L signal at terminal *switch-on/shutdown*, for an H signal at terminal *operating enable* and when the jogging function is controlled. In this case, the main contactor is closed and the drive accelerates up to the jogging setpoint defined in a parameter. When the jogging signal is withdrawn, the drive is braked to $n < n_{min}$; after this, the controllers are inhibited and the main contactor is opened after a parameterizable time (0 to 60 s). Further, it can be selected as to whether the ramp-function generator is active or ramp-up time=ramp-down time=0 is used.

Binary outputs

User-assignable signaling functions are available at the binary output terminals (open emitter output). Any binector quantity, which can be selected via the associated user-assignable parameter, can be output for each terminal. The polarity of the output signal and an adjustable delay time (0 to 10 s) can be selected using parameters.

Examples of binary output functions:

- Fault: An L signal is output when a fault message is present.
- $n < n_{min}$: An H signal is output for speeds less than $n_{min}$. This signal is used, for instance, as a zero speed signal.
- Switch-on command for a mechanical brake: A motor brake can be controlled using this signal.

When switching on the drive using the “switch-on” function and entering “operating enable”, an H signal is output to open the brake, in this case, the internal controller enable is delayed by a parameterizable time (wait for the mechanical brake opening time to expire). When shutting down the drive using the “shutdown” function or “fast stop”, an L signal is output to close the brake when speed $n < n_{min}$ is reached. At the same time, the internal controller enable is present for a parameterizable time (wait for the mechanical brake closing time to expire): When $I = 0$ is entered, the pulses are inhibited and the main contactor is opened.

An additional operating mode can be selected using the “close brake” signal (L signal at the binary user-assignable output). As a consequence, when the “internal controller inhibit” is present (the drive is in a no-current condition), the drive does not wait for the status $n < n_{min}$, but the brake is already controlled (operating brake) at speeds greater than $n_{min}$.

Internal control inhibit is present when a fault message occurs, when the voltage is disconnected or the operating enable – terminal *operating enable* – is withdrawn in operation.

**More information** (continued)

### *Safety shutdown (E-STOP)*

The E-STOP function is used to open the relay contact for the main contactor control within approximately 15 ms independent of semiconductor components and the correct functioning of the CUD. If the CUD is operating correctly, entering *I* = 0 via the control ensures that the main contactor is switched in a no-current condition. The drive coasts down once E-STOP has been entered.

After the E-STOP has been reset, the drive goes into the "switch-on inhibit" operating state. This must be acknowledged by activating the "shutdown" function e.g. by opening terminal *switch-on/shutdown*.

Note:
The E-STOP function is not an EMERGENCY OFF function in the sense of EN 60204-1.

### *Serial interfaces*

The following serial interfaces are available for each CUD:

- A serial interface on the Standard CUD and Advanced CUD for the USS protocol according to RS232 or RS485 to connect the optional AOP30 Advanced Operator Panel or for STARTER via a PC
- A serial interface at the terminals of the Standard CUD and Advanced CUD, RS485 two-wire or four-wire for a peer-to-peer connection
- PROFIBUS-DP as standard on the Standard CUD and Advanced CUD
- PROFINET via the CBE20 Communication Board on the Advanced CUD (option)
- DRIVE-CLiQ on Advanced CUD (option) to connect optional SINAMICS components SMC30, TM15 and TM31

Physics of the interfaces

- RS232: ± 5 V interface for the point-to-point connection
- RS485: 3.3 V common mode interface, interference-proof, additionally for one bus connection with a maximum of 31 participants connected to the bus

USS protocol

Open Siemens protocol, can be simply programmed e.g. on the PC in third-party systems, any master interfaces can be used. The drives operate as slaves connected to a master. The drives are selected using a slave number.

The following data exchange is possible via the USS protocol:

- PKW data to read and write parameters
- PZD data (process data) such as control words, setpoints, status words, actual values

The send data (actual values) are selected by entering connector numbers in the parameters, the receive data (setpoints) represent the connector numbers, that can act at any intervention points.

Peer-to-peer protocol

The peer-to-peer protocol is used to connect devices with one another. For this operating mode, data is exchanged between converters via a serial interface, e.g. to establish a setpoint cascade. By using a serial interface as four-conductor cable, data can be received from the previous unit that is then processed (e.g. by being multiplied) and then transferred to the following unit. Only one serial interface is used for this purpose.

The following data can be exchanged between converters:

- Sending control words and actual values.
- Receiving status words and setpoints.

In this case, up to five data words are transferred in both the send and receive directions. Data is exchanged via connector numbers and intervention points.

The serial interfaces can be simultaneously operated. A connection to the automation (USS protocol) can be established via the first interface for control, diagnostics and to enter the main setpoint. A second interface is used to realize a setpoint cascade function via the peer-to-peer protocol.

### *Control terminal block*

| Terminals on the CUD |
|---|
| • Reference voltage P10, 10 mA load rating,<br>Reference voltage N10, 10 mA load rating |
| • 2 analog inputs via differential amplifier,<br>resolution ± 14 bits<br>0 ... ± 10 V, 0 ... ± 20 mA, 4 ... 20 mA |
| • 1 analog input via differential amplifier,<br>resolution ± 14 bits<br>0 ... ± 10 V |
| • 4 analog inputs via differential amplifier,<br>resolution ± 11 bits<br>0 ... ± 10 V |
| • One analog input for motor temperature sensor via PT100,<br>PTC or KTY84 |
| • 2 analog outputs, referred to ground, 0 ... ± 10 V, ± 15-bit resolution,<br>max. 2 mA |
| • Pulse encoder evaluation for 5 or 24 V encoder, 2 tracks and<br>zero mark, maximum frequency 300 kHz |
| • P15 power supply, 200 mA for a pulse encoder |
| • 4 binary inputs, referred to ground, 2 with selectable function |
| • 4 binary inputs/outputs, referred to ground, outputs with<br>open emitter P24, 100 mA load rating |
| • 4 binary outputs, referred to ground, open emitter P24,<br>100 mA load rating |
| • One serial interface, RS485 two-wire or four-wire,<br>max. 187.5 kBaud |
| • P24 power supply to control the binary inputs |
| • Terminals for equipment ground "digital"<br>(e.g.: to connect the loads of the binary outputs) |
| • Terminals for equipment ground "analog "<br>(e.g.: to connect the reference potentials of analog inputs) |
| • Connector to connect an AOP30 |
| • Connector to connect a serial RS232 interface and a<br>5 V power supply, 300 mA (e.g.: for a pulse encoder) |
| **Terminals on the gating module** |
| • Analog tachometer 8 to 270 V for maximum speed |
| • E-STOP |

**More information** (continued)

### *Interface to the motor*

Motor temperature monitoring

Either PTC thermistors or linear temperature sensors (KTY84-130) can be connected. One input is provided on the Standard CUD and one input on the Advanced CUD option for this purpose. An alarm or fault message can be parameterized for PTC thermistors. When using a KTY84-130, one threshold can be entered for an alarm and one threshold for shutdown (trip). The limit values are displayed and entered in °C.

In addition, a thermo switch can be evaluated by the Advanced CUD (option). A parameterizable alarm or fault message can be output when the thermo switch responds (this is a binary switching signal). The evaluation is realized via a binary user-assignable input.

Brush length monitoring

The brush length is monitored using a floating microswitch; the shortest brush is evaluated. If the useful brush life has expired, then the microswitch opens; an alarm or fault message can be parameterized. The evaluation is realized via a binary user-assignable input.

Monitoring the motor fan airflow

An airflow monitor is integrated in the airflow of the motor fan. When this responds, an alarm or fault message is issued. The evaluation is realized via a binary user-assignable input.

### *Siemens DC motors*

Although the end of DC technology has been forecast now for many years, we will keep hold of our DC technology and it will remain in our portfolio. When all is said and done, DC motors have proven themselves in daily use for decades now and they are essentially indispensable.

In conjunction with the SINAMICS DC MASTER converters, they always form the ideal team – wherever favorably-priced drive technology and the highest degree of availability are demanded.

These motors can also be used where space is restricted thanks to their compact and modular design.

Further, an extensive range of equipment and devices for mounting on the motor is available. A wide range of monitoring and diagnostic options facilitate reliable and disturbance-free operation.

Detailed specifications regarding quality assurance and improvement are integrated in all of the various operations and processes – from motor development through to production and service. Quality management coordinates the interaction between all of the company processes to ensure error-free and smooth processes.

It goes without saying that our stringent quality requirements also apply to our suppliers. All of the suppliers must seamlessly integrate themselves into our quality management system.

The result: Only fault-free and high quality materials are released for use in our motor production.


Customer benefits:

- High power density with low envelope dimensions
- High degree of operational reliability and availability through a wide range of diagnostic features, in conjunction with the SINAMICS DC MASTER converter
- High thermal reserves for continuous and overload conditions as a result of the DURIGNIT 2000® insulation system
- Low losses through a very good efficiency
- Long brush lifetimes through an optimized current commutation system

| **Technical data** | |
|---|---|
| Power range | 31.5 … 1 610 kW |
| Rated armature voltage | 420 … 810 V DC |
| Field | Separately excited |
| Shaft heights | 160 … 630 mm |
| Number of poles | 4- and 6-pole |
| Speed | Up to 4 500 rpm |
| Degree of protection | IP23 and IP54 |
| Type of construction | IM B3, IM B35, IM V1 and others |
| Cooling method | IC06/IC17/IC37/IC A06 A66/IC W37 A86 |
| Stator version | Fully laminated |
| Standards | IEC, EN, DIN, VDE |
| Operation | Converter operation, 2Q and 4Q, S1 – S9 |

Typical applications:

- Lift and cableway drives
- Rolling mill drives and winders
- Hoisting and travel gear drives for cranes
- Extruders in the plastics industry
- Drives for printing machines
- Drives for paper machines

Additional information on Siemens DC motors is available in the Internet under:
http://www.automation.siemens.com/ld/dc-motor

## Application

The SINAMICS DC MASTER Control Module is mainly used for retrofitting and modernizing DC drives in existing plants and systems. In DC technology, there are many anterior plants and systems that cannot be connected to modern automation systems.

When such plants and systems are retrofitted or upgraded, the motor, mechanical system and power section are retained and only the closed-loop control section is replaced by a Control Module. As a consequence, an extremely favorably-priced modern DC drive is obtained with the full functional scope of the well-proven, fully digital units from the SINAMICS DC MASTER series.

The new system is adapted to the configuration of the existing components using simple parameterization.

The SINAMICS DC MASTER Control Module contains a power section for the field supply with a rated current of 40 A.

## Design

The SINAMICS DC MASTER Control Module sets itself apart as a result of its compact, space-saving design. The compact design where all of the individual components are easily accessible offers a high degree of service friendliness.

In order to be able to optimally use the mounting and installation possibilities in the plant or system, the SINAMICS DC MASTER Control Module can be split depthwise. In addition, the PC boards for generating and distributing the firing pulses as well as for the fuse monitoring and voltage sensing can be implemented so that they can be mounted outside the unit close to the power section.

Alternatively, when commissioning the drive system with STARTER, the adaptations, settings and measured value displays required can be made using the Basic Operator Panel BOP20 or the Advanced Operator Panel AOP30.

The AOP30 offers a favorably-priced alternative to measuring equipment installed in the electrical cabinet.

The field is supplied from a single-phase, half-controlled bridge circuit B2HZ. The field power section is implemented using electrically insulated thyristor modules, which means that the heatsink is floating.

## Control Module

### Technical specifications

For general technical data, see section "DC Converters"

| | | Type<br>6RA8000-0MV62-0AA0 |
|---|---|---|
| Rated armature supply voltage that can be sensed | V | 50/125/250/575/1 000 |
| Rated supply voltage, electronics power supply | V | 24 DC (18 … 30 V DC); $I_n$ = 5 A |
| Rated field supply voltage [1] | V | 480 V 2 AC (+10/–20 %) |
| Rated frequency | Hz | 45 … 65 |
| Rated DC field voltage [1] | V | Max. 390 |
| Rated DC field current | A | 40 |
| Normal ambient temperature in operation | °C | 0 … +55 |
| Dimensions | | |
| • Width | mm | 271 |
| • Height | mm | 388 |
| • Depth | mm | 253 |
| Weight, approx. | kg | 12 |



### Selection and ordering data

| Rated data<br>Armature circuit<br>Rated supply voltage [2]<br>V | Field circuit<br>Rated supply voltage [2]<br>V | Rated current<br>A | **Control Module**<br>Order No. | Fuses<br>Field circuit<br>Type<br>1 each |
|---|---|---|---|---|
| 50/125/250/575/1 000 V 3 AC | 480 V (+10/–20 %) 2 AC | 40 | **6RA8000-0MV62-0AA0** | 3NE1802-0 [3] |

### Options

Note:
When ordering a unit with options, add the suffix "**-Z**" after the Order No. and then state the order code(s) for the desired option(s) after the suffix.

*Examle:*
*6RA8000-0MV62-0AA0-Z*
*G00+G20+L10+...*

#### *Available options*

The following table provides an overview of the available options. Detailed descriptions of the options are provided in the section "Description of options".

| Designation | Order code | Notes | Order No. for separate order<br>not coated | <br>coated |
|---|---|---|---|---|
| **CUD** | | | | |
| Standard CUD left | (Standard) | – | **6RY1803-0AA00** | **6RY1803-0AA20** |
| Advanced CUD left | **G00** | – | **6RY1803-0AA05** | **6RY1803-0AA25** |
| Standard CUD right | **G10** | This option requires an Advanced CUD left – order code **G00** | **6RY1803-0AA00** | **6RY1803-0AA20** |
| Advanced CUD right | **G11** | This option requires an Advanced CUD left – order code **G00** | **6RY1803-0AA05** | **6RY1803-0AA25** |
| Communication Board CBE20 left | **G20** | This option requires an Advanced CUD left – order code **G00** | **–** | **6SL3055-0AA00-2EB0** |
| Communication Board CBE20 right | **G21** | This option requires an Advanced CUD right – order code **G11** | **–** | **6SL3055-0AA00-2EB0** |
| Memory card left | **S01** | – | **6RX1800-0AS01** | **–** |
| Memory card right | **S02** | This option requires a Standard CUD right – order code **G10** – or an Advanced CUD right – order code **G11** | **6RX1800-0AS01** | **–** |
| **Field** | | | | |
| Field power section 1Q | (Standard) | – | **–** [4] | **–** [4] |
| Field power section 2Q | **L11** | – | **–** [4] | **–** [4] |
| Without field power section | **L10** | – | **–** | **–** |
| **Additional options** | | | | |
| Coated PCBs | **M08** | – | **–** | **–** |
| Nickel-plated copper busbars | **M10** | – | **–** | **–** |

[1] The field supply voltage can lie below the rated field voltage (set using a parameter, input voltages of up to 85 V are permissible). The output voltage decreases accordingly. The specified DC output voltage can be reliably provided up to a 5 % undervoltage of the line supply voltage (rated field supply voltage).

[2] 50/60 Hz

[3] UL-recognized

[4] Available as spare part.

## Accessories

The SINAMICS DC MASTER Control Module can be split up into several individual modules. These can be mounted separately from one another.

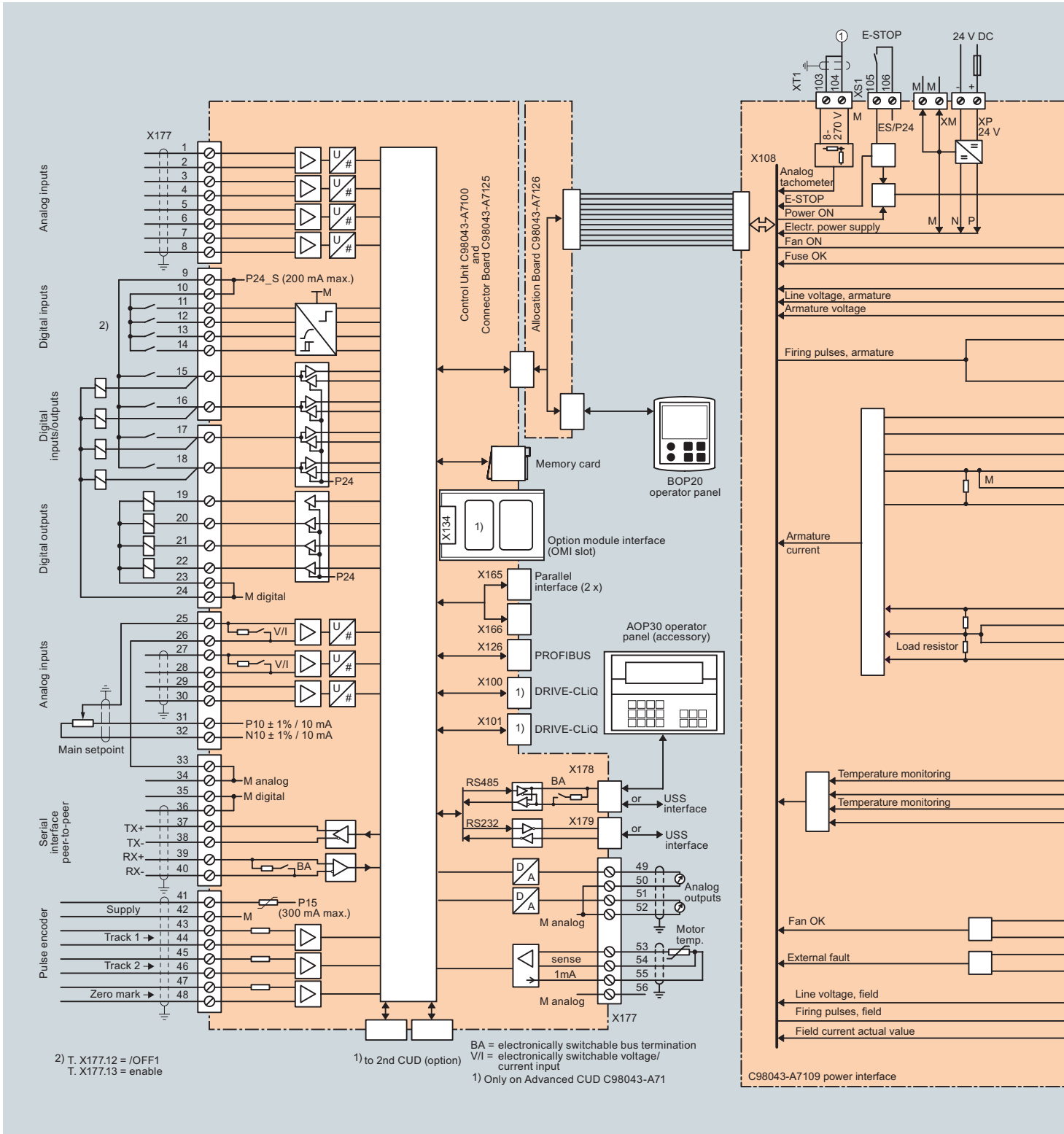
Optional, pre-fabricated cable sets are available to connect the individual modules. This means that the drive system can be quickly but also flexibly adapted to the plant or system configuration.

| Description | Content | Connection | Order No. |
|---|---|---|---|
| Rear enclosure part including accessories for mounting the firing pulse transformer module and/or fuse monitoring module for a parallel connection | Set of loose parts | | **6RY1805-0CM00** |
| Screws, stud bolts, and snap-on parts to externally mount module parts | Set of loose parts | | **6RY1807-0CM00** |
| Pre-fabricated connection set ribbon cable:<br>To connect the two cradles when separately mounted | 2 x 26-core ribbon cable shielded (3 m long)<br>1 x 10-core ribbon cable shielded (3 m long)<br>1 x 20-core ribbon cable shielded (3 m long)<br>1 x RJ45 patch cable shielded (3 m long) | from X21A, X22A on PC board -A7109- to X21A, X22A on PC board -A7043-<br>from X23B on PC board -A7109- to X23B on PC board -A7118-<br>from XF1 on PC board -A7109- to XF1 on PC board -A7116-<br>from X45 on PC board -A7109- to X45 on PC board -A7117- | **6RY1707-0CM01** |
| Pre-fabricated connection set ribbon cable:<br>To connect the two cradles when separately mounted | 2 x 26-core ribbon cable shielded (10 m long)<br>1 x 10-core ribbon cable shielded (10 m long)<br>1 x 20-core ribbon cable shielded (10 m long)<br>1 x RJ45 patch cable shielded (10 m long) | from X21A, X22A on PC board -A7109- to X21A, X22A on PC board -A7043-<br>from X23B on PC board -A7109- to X23B on PC board -A7118-<br>from XF1 on PC board -A7109- to XF1 on PC board -A7116-<br>from X45 on PC board -A7109- to X45 on PC board -A7117- | **6RY1807-0CM02** |
| Pre-fabricated connection set for current transformer | 2 x 2-core twisted cable (2 m long) | from XB on PC board -A7109- to the current transformers | **6RY1707-0CM03** [1] |
| Pre-fabricated connection set for current transformer | 2 x 2-core cable shielded (10 m long) | from XB on PC board -A7109- to the current transformers | **6RY1707-0CM04** [1] |
| Pre-fabricated connection set for heatsink temperature sensing | 1 x 2-core cable shielded (10 m long) | from XT6 on PC board -A7109- to temperature sensor on the heat sink | **6RY1707-0CM05** |
| Pre-fabricated connection set for firing pulse cables | Connection set for 12 x 2-core twisted cable (3 m long) | from XIMP11, XIMP12, XIMP13, XIMP14, XIMP15, XIMP16, XIMP21, XIMP22, XIMP23, XIMP24, XIMP25, XIMP26 to the thyristors | **6RY1707-0CM06** [1] |
| Pre-fabricated connection set for fuse monitoring | 6 x 2-core twisted cable (10 m long) | from XS1_5, XS2_5, XS3_5, XS4_5, XS5_5, XS6_5, XS7_5, XS8_5, XS9_5, XS10_5, XS11_5, XS12_5 or XS1_4, XS2_4, XS3_4, XS4_4, XS5_4, XS6_4, XS7_4, XS8_4, XS9_4, XS10_4, XS11_4, XS12_4 or XS1_3, XS2_3, XS3_3, XS4_3, XS5_3, XS6_3, XS7_3, XS8_3, XS9_3, XS10_3 | **6RY1807-0CM07** |
| Pre-fabricated connection set for voltage sensing | 1 x 3-core twisted cable U-V-W (3 m long)<br>1 x 2-core twisted cable C-D (3 m long) | from XU6, XV6, XW6 or XU5, XV5, XW5 or XU4, XV4, XW4 or XU3, XV3, XW3 or XU2, XV2, XW2 or XU1, XV1, XW1 depending on the voltage (5.6 V, 50 V, 125 V, 250 V, 575 V or 1000 V) to supply XC6, XD6 or XC5, XD5 or XC4, XD4 or XC3, XD3 or XC2, XD2 | **6RY1807-0CM08** |
| Pre-fabricated connection set for controlling the firing pulse transformers | 12 x 2-core twisted cable (1 m long) | from XIMP1, XIMP4 or XIMP2, XIMP5 or XIMP3, XIMP6 on PC board -A7043- (side parts) on the firing pulse transformer modules (single boards) with the terminals X11, X12, X13, X14, X15, X16, X21, X22, X23, X24, X25, X26 | **6RY1707-0CM13** [1] |
| Pre-fabricated connection set for controlling the firing pulse transformers | 2 x 12-core cable shielded (10 m long) | from XIMP1, XIMP4 and/or XIMP2, XIMP5 and/or XIMP3, XIMP6 on PC board -A7043- to the external firing pulse transformers | **6RY1707-0CM10** [1] |
| Pre-fabricated connection set for mounting cradles next to each other | 2 x 26-core ribbon cable shielded (10 m long)<br>1 x 10-core ribbon cable shielded (10 m long)<br>1 x 20-core ribbon cable shielded (10 m long)<br>1 x RJ45 patch cable shielded (10 m long) | from X21A, X22A on PC board -A7109- to X21A, X22A on PC board -A7043-<br>from X23B on PC board -A7109- to X23B on PC board -A7118-<br>from XF1 on PC board -A7109- to XF1 on PC board -A7116-<br>from X45 on PC board -A7109- to X45 on PC board -A7117- | **6RY1807-0CM11** |

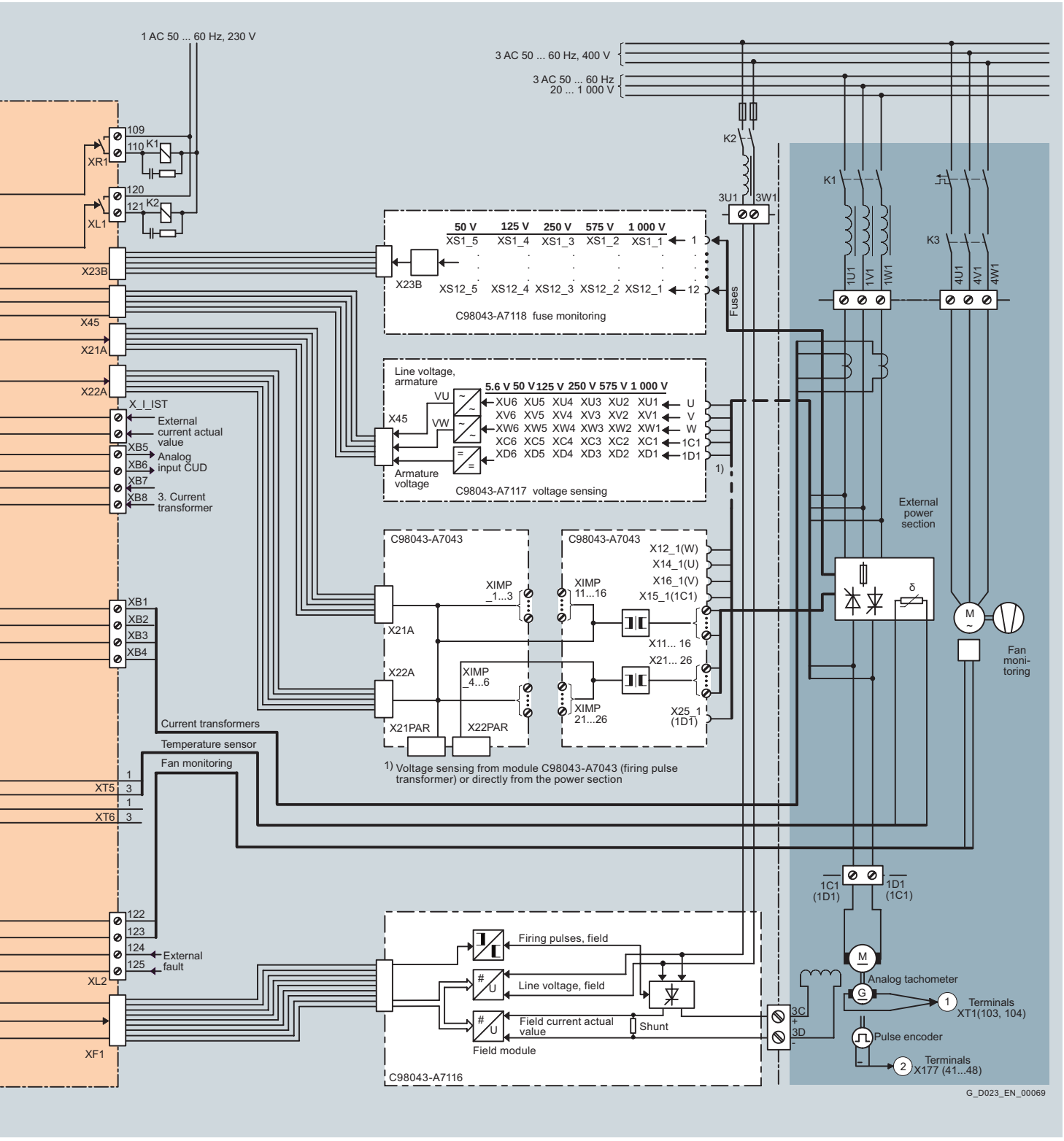
[1] Unchanged when compared to the SIMOREG DC-MASTER Control Modules.

## Control Module

### Schematics



## Schematics (continued)



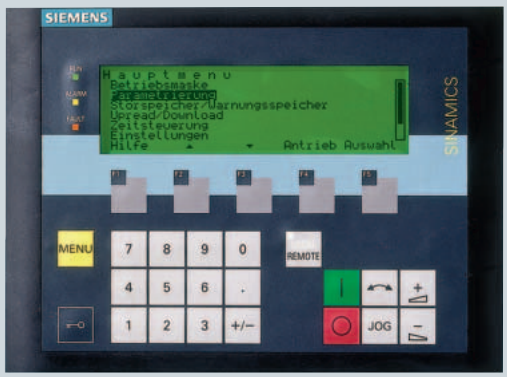
## Notes

# Accessories and supplementary components

4

## AOP30 Advanced Operator Panel

### Overview




The AOP30 Advanced Operator Panel is an optional input/output device for SINAMICS DC MASTER converters. It can be separately ordered. The operator panel is only designed for installation outside the converter (e.g. in a cabinet door up to 4 mm thick), installation cut-out 141.5 × 197.5 mm.

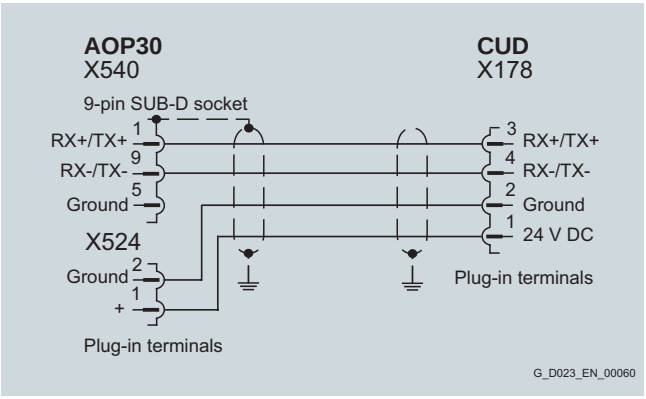
It sets itself apart as a result of the following properties:

- Graphic LCD display (240 × 64 pixels) with backlighting for plain-text display and a bar-type display for process variables
- LEDs for displaying the operating states
  - RUN green
  - ALARM yellow
  - FAULT red
- Help function describing the causes of faults and alarms and how to resolve them
- Time and date memory with internal battery backup
- 26-key membrane keyboard
  - Keypad for operational control of a drive
  - Local/remote switchover for selecting the operator control location (operator panel or customer terminal strip/communications channel has the control authority)
  - Numeric keypad for entering setpoints or parameter values
  - Function keys for prompted navigation in the menu
- RS232 and RS485 interface
- Connection for a 24 V power supply
- The converter can be controlled using the AOP30 up to distances of 200 m. A cable with integrated 24 V power supply in standard lengths can be ordered as accessory.
- Two-stage safety strategy to protect against accidental or unauthorized changes to settings.
  - Operation of the drive from the operator panel can be disabled using the control inhibit function so that only parameter values and process variables can be displayed on the operating panel.
  - A password can be used to prevent converter parameters being changed by unauthorized personnel.
- Front panel with degree of protection IP55, rear IP20

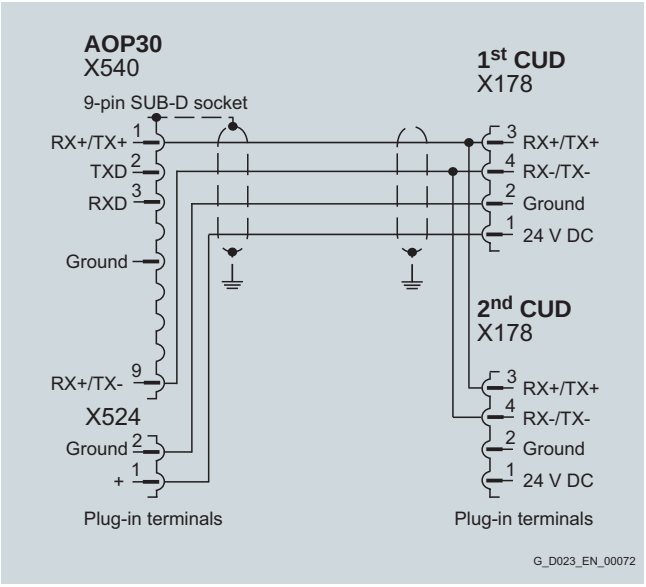
The AOP30 communicates with the SINAMICS DC MASTER drive via the serial RS485 interface.

The AOP30 can communicate with the Standard CUD as well as with the Advanced CUD of the SINAMICS DC MASTER.

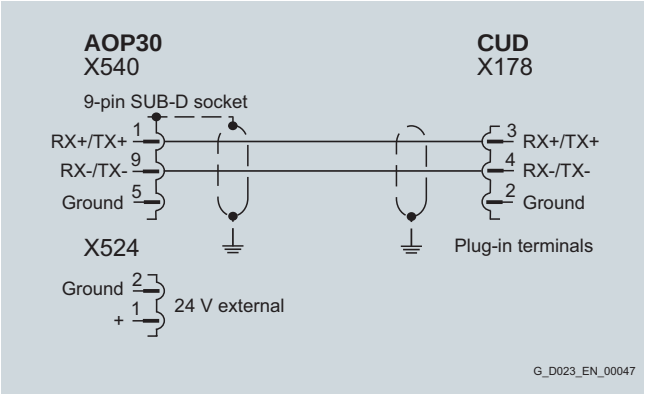
A 24 V power supply is required to operate the AOP30. For a maximum cable length of 50 m, this can be taken from the CUD of the SINAMICS DC MASTER. An external power supply must be used for cable lengths greater than 50 m.




Assignment of the RS485 cable with a 24 V power supply from the CUD – max. cable length 50 m

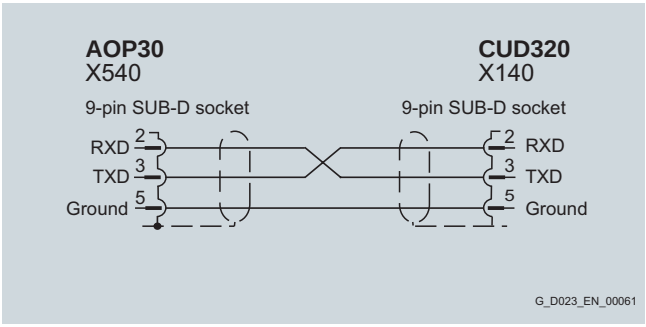



Assignment of the RS485 cable when using two CUDs (24 V power supply from one CUD) – max. cable length 50 m




Assignment of the RS485 cable when supplying the AOP30 from an external 24 V DC source – max. cable length 200 m

## Overview (continued)




Assignment of the RS232 cable for connecting to an AC SINAMICS unit (not for SINAMICS DC MASTER!)

## Function

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

German and English are integrated in the SINAMICS DC MASTER as standard. Additional languages, if the memory card with a corresponding language package is inserted in every CUD.

Note:
Only operator panels with Order No. 6SL3055-0AA00-4CA4 have a second RS485 interface. Preliminary models are not suitable for SINAMICS DC MASTER.

## Selection and ordering data

| Description | Order No. |
|---|---|
| **AOP30 Advanced Operator Panel** | **6SL3055-0AA00-4CA4** |

A connecting cable with integrated 24 V power supply is available to connect the AOP via RS485.

| **RS485 cable** to connect the AOP | Length m | Order No. |
|---|---|---|
| to a CUD | 3 | **6RY1807-0AP00** |
| to two CUDs | 3 | **6RY1807-0AP10** |

Other cable lengths can be ordered by specifying the following options.

| Cable length | Order code |
|---|---|
| 5 m | **K05** |
| 10 m | **K10** |
| 15 m | **K15** |
| 20 m | **K20** |
| 25 m | **K25** |
| 30 m | **K30** |
| 35 m | **K35** |
| 40 m | **K40** |
| 45 m | **K45** |
| 50 m | **K50** |

Note:

When ordering the RS485 cable with options, add the suffix "**-Z**" after the Order No. and then state the order code for the desired option after the suffix.

Ordering example for 35 m cable length: **6RY1807-0AP00-Z K35**

## SMC30 Sensor Module Cabinet-Mounted

### Overview

Every CUD (both Standard CUD as well as also Advanced CUD) can evaluate the signals of an incremental encoder. For applications where more than one encoder must be evaluated, either a second CUD and/or the SMC30 Sensor Module Cabinet-Mounted can be used.
The SMC30 can be used to evaluate SSI encoders with incremental signals, which for instance, are used for positioning functions.

Encoders, which have a DRIVE-CLiQ interface, cannot be evaluated at the SINAMICS DC MASTER or at the SMC30. These encoders are usually not used in the DC drive technology.

The following encoder signals can be evaluated:

- Incremental encoders TTL/HTL with and without broken cable detection (broken cable detection is only available with bipolar signals)
- SSI encoder with TTL/HTL incremental signals
- SSI encoder without incremental signals

The motor temperature input, available on the SMC30, is not evaluated for SINAMICS DC MASTER. A motor temperature sensor can be evaluated using the temperature measurement input provided on each CUD.

### Design

The SMC30 Sensor Module Cabinet-Mounted features the following interfaces as standard:

- 1 DRIVE-CLiQ interface
- 1 encoder connection via Sub-D connector or terminals
- 1 connection for the electronics power supply via the 24 V DC power supply connector
- 1 PE/protective conductor connection

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

The SMC30 Sensor Module Cabinet-Mounted can be snapped on a TH mounting rail in accordance with EN 60715 (IEC 60715).

The maximum encoder cable length between SMC30 modules and encoders is 100 m. For HTL encoders, this length can be increased to 300 m if the A+/A- and B+/B- signals are evaluated and the power supply cable has a minimum cross section of 0.5 $mm^2$.

The signal cable shield can be connected to the SMC30 Sensor Module Cabinet-Mounted via a shield connection terminal, e.g. Phoenix Contact type SK8 or Weidmüller type KLBÜ CO 1.

### Integration

The SMC30 Sensor Module Cabinet-Mounted communicates with the Advanced CUD via DRIVE-CLiQ.
One SMC30 can be connected to each Advanced CUD.

### Technical specifications

| SMC30 Sensor Module Cabinet-Mounted | |
|---|---|
| **Current consumption, max.**<br>at 24 V DC, not taking the encoder into account | 0.2 A |
| • Conductor cross-section, max. | 2.5 $mm^2$ |
| • Fuse protection, max. | 20 A |
| **Power loss** | < 10 W |
| **Encoders that can be evaluated** | • Incremental encoder TTL/HTL<br>• SSI encoder with TTL/HTL incremental signals<br>• SSI encoder without incremental signals |
| • Encoder supply | 24 V DC/0.35 A or<br>5 V DC/0.35 A |
| • Encoder frequency, max. | 300 kHz |
| • SSI baud rate | 100 … 250 kBaud |
| • Limiting frequency | 300 kHz |
| • Resolution absolute position SSI | 30 bits |
| • Cable length, max. | |
| - TTL encoder | 100 m (only bipolar signals permitted)[1] |
| - HTL encoder | 100 m for unipolar signals<br>300 m for bipolar signals[1] |
| - SSI encoder | 100 m |
| **PE connection** | M4 screw |
| **Dimensions** | |
| • Width | 30 mm |
| • Height | 150 mm |
| • Depth | 111 mm |
| **Weight, approx.** | 0.45 kg |
| **Approvals** | cULus (File No.: E164110) |

### Selection and ordering data

| Description | Order No. |
|---|---|
| **SMC30 Sensor Module Cabinet-Mounted**<br>(without DRIVE-CLiQ cable) | **6SL3055-0AA00-5CA2** |

Note:
The maximum permissible encoder currents should be carefully observed. The capacitive recharging currents increase in the connecting cable between the encoder and converter due to long cable lengths and high output frequencies. This can cause the output driver of the encoder to be overloaded and/or result in incorrect evaluation of the encoder signals. This is the reason that the encoder manufacturer's instructions must be carefully observed.

[1] Twisted pair and shielded signal cables.

## SMC30 Sensor Module Cabinet-Mounted

### Selection and ordering data (continued)

*DRIVE-CLiQ cables*

| Description | Length m | Order No. |
|---|---|---|
| **Pre-fabricated DRIVE-CLiQ cable** Degree of protection of connector IP20/IP20 | 0.11 | **6SL3060-4AB00-0AA0** |
| | 0.16 | **6SL3060-4AD00-0AA0** |
| | 0.21 | **6SL3060-4AF00-0AA0** |
| | 0.26 | **6SL3060-4AH00-0AA0** |
| | 0.36 | **6SL3060-4AM00-0AA0** |
| | 0.60 | **6SL3060-4AU00-0AA0** |
| | 0.95 | **6SL3060-4AA10-0AA0** |
| | 1.20 | **6SL3060-4AW00-0AA0** |
| | 1.45 | **6SL3060-4AF10-0AA0** |
| | 2.80 | **6SL3060-4AJ20-0AA0** |
| | 5.00 | **6SL3060-4AA50-0AA0** |

## TM15 Terminal Module

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### Overview

The number of available digital inputs and outputs within a drive system can be expanded with the TM15 Terminal Module.

### Design

The following are located on the TM15 Terminal Module:

- 24 bidirectional digital inputs/outputs (isolation in 3 groups with 8 channels each)
- 24 green status LEDs for indicating the logical signal status of the relevant terminal
- 2 DRIVE-CLiQ sockets
- 1 connection for the electronics power supply via the 24 V DC power supply connector
- 1 PE/protective conductor connection

The TM15 Terminal Module can be snapped on a TH 35 mounting rail in accordance with EN 60715 (IEC 60715).

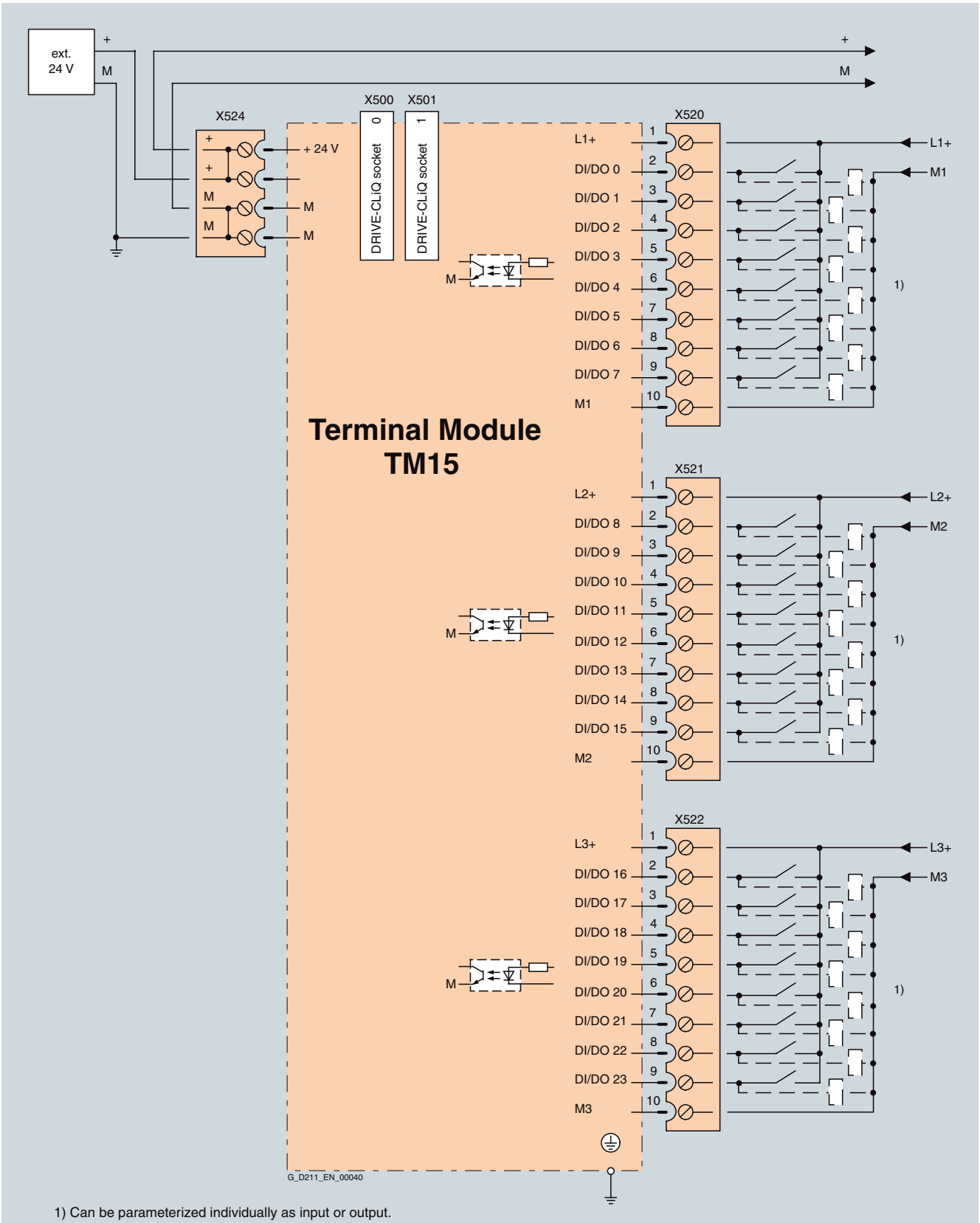
The signal cable shield can be connected to the TM15 Terminal Module via a shield connection terminal, e.g. Phoenix Contact type SK8 or Weidmüller type KLBÜ CO 1. The shield connection terminal must not be used for strain relief.

The status of the TM15 Terminal Module is indicated via a multicolor LED.

## TM15 Terminal Module

### Integration

The TM15 Terminal Module communicates with the Advanced CUD via DRIVE-CLiQ. Further, TM15 can also be used with the CU310 and CU320 Control Units and a SIMOTION D Control Unit.




1) Can be parameterized individually as input or output.

Connection example of a TM15 Terminal Module

## Technical specifications

| TM15 Terminal Module | |
|---|---|
| **Current consumption, max.** with 24 V DC without load | 0.15 A |
| • Conductor cross-section, max. | 2.5 $mm^2$ |
| • Fuse protection, max. | 20 A |
| **Number of DRIVE-CLiQ sockets** | 2 |
| **I/O** | |
| • Digital inputs/outputs | Channelwise parameterizable as DI or DO |
| • Number of digital inputs/outputs | 24 |
| • Electrical isolation | Yes, in groups of 8 |
| • Connection system | Plug-in screw-type terminals |
| • Conductor cross-section, max. | 1.5 $mm^2$ |
| **Digital inputs** | |
| • Voltage | –30 … +30 V |
| • Low level (an open digital input is interpreted as “low”) | –30 … +5 V |
| • High level | 15 … 30 V |
| • Current consumption at 24 V DC | 5 … 11 mA |
| • Delay times of digital inputs, typ.[1)] | |
| - L → H | 50 µs |
| - H → L | 100 µs |
| **Digital outputs** (continuously short-circuit-proof) | |
| • Voltage | 24 V DC |
| • Load current per digital output, max. | 0.5 A |
| • Delay times (ohmic load) [1)] | |
| - L → H, typ.<br>L → H, max. | 50 µs<br>100 µs |
| - H → L, typ.<br>H → L, max. | 150 µs<br>225 µs |
| • Total current of outputs (per group), max. | |
| - Up to 60 °C | 2 A |
| - Up to 50 °C | 3 A |
| - Up to 40 °C | 4 A |
| **Power loss** | < 3 W |
| **PE connection** | M4 screw |
| **Dimensions** | |
| • Width | 50 mm |
| • Height | 150 mm |
| • Depth | 111 mm |
| **Weight, approx.** | 0.86 kg |
| **Approvals** | cULus (File No.: E164110) |

## Selection and ordering data

### *TM15 Terminal Module*

| Description | Order No. |
|---|---|
| **TM15 Terminal Module** (without DRIVE-CLiQ cable) | **6SL3055-0AA00-3FA0** |

### *DRIVE-CLiQ cables*

| Description | Length m | Order No. |
|---|---|---|
| **Pre-fabricated DRIVE-CLiQ cable** Degree of protection of connector IP20/IP20 | 0.11 | **6SL3060-4AB00-0AA0** |
| | 0.16 | **6SL3060-4AD00-0AA0** |
| | 0.21 | **6SL3060-4AF00-0AA0** |
| | 0.26 | **6SL3060-4AH00-0AA0** |
| | 0.36 | **6SL3060-4AM00-0AA0** |
| | 0.60 | **6SL3060-4AU00-0AA0** |
| | 0.95 | **6SL3060-4AA10-0AA0** |
| | 1.20 | **6SL3060-4AW00-0AA0** |
| | 1.45 | **6SL3060-4AF10-0AA0** |
| | 2.80 | **6SL3060-4AJ20-0AA0** |
| | 5.00 | **6SL3060-4AA50-0AA0** |

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

## TM31 Terminal Module

### Overview

Using the TM31 Terminal Module, the number of available digital inputs and outputs and the number of analog inputs and outputs within a drive system can be expanded.

The TM31 Terminal Module also features relay outputs with changeover contact and a temperature sensor input.



### Design

The following are located on the TM31 Terminal Module:

- 8 digital inputs
- 4 bidirectional digital inputs/outputs
- 2 relay outputs with changeover contact
- 2 analog inputs
- 2 analog outputs
- 1 temperature sensor input (KTY84-130 or PTC)
- 2 DRIVE-CLiQ sockets
- 1 connection for the electronics power supply via the 24 V DC power supply connector
- 1 PE/protective conductor connection

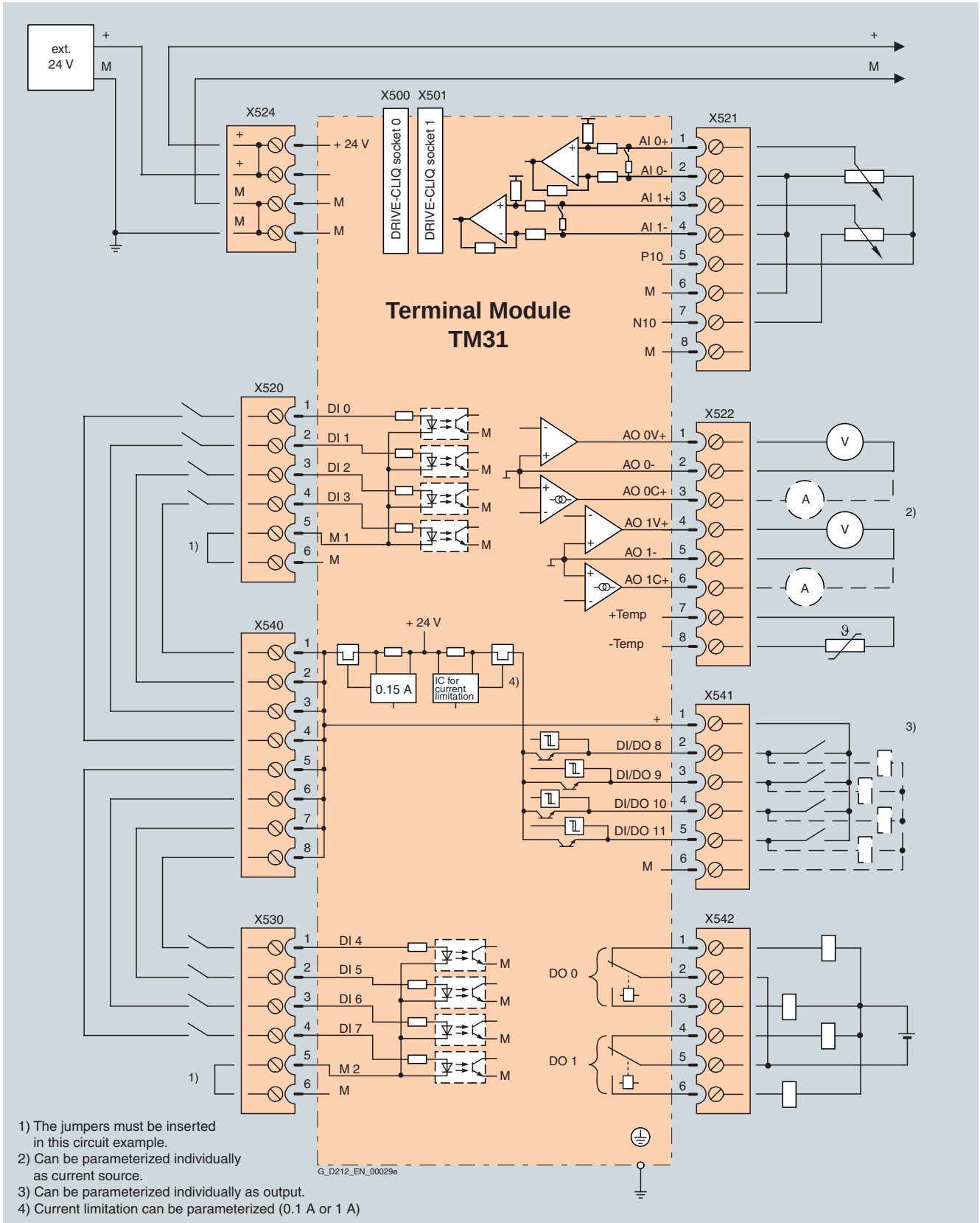
The TM31 Terminal Module can be snapped on a TH 35 mounting rail in accordance with EN 60715 (IEC 60715).

The signal cable shield can be connected to the TM31 Terminal Module via a shield connection terminal, e.g. Phoenix Contact type SK8 or Weidmüller type KLBÜ CO 1. The shield connection terminal must not be used for strain relief.

The status of the TM31 Terminal Module is indicated via a multicolor LED.

## Integration

The TM31 Terminal Module communicates with the Advanced CUD via DRIVE-CLiQ.




1) The jumpers must be inserted in this circuit example.
2) Can be parameterized individually as current source.
3) Can be parameterized individually as output.
4) Current limitation can be parameterized (0.1 A or 1 A)

Connection example of a TM31 Terminal Module

## TM31 Terminal Module

### Technical specifications

| TM31 Terminal Module | |
|---|---|
| **Current consumption, max.** At 24 V DC without taking into account the digital outputs and DRIVE-CLiQ supply | 0.2 A |
| • Conductor cross-section, max. | 2.5 mm$^2$ |
| • Fuse protection, max. | 20 A |
| **Digital inputs** | |
| • Voltage | –3 … +30 V |
| • Low level (an open digital input is interpreted as "low") | –3 … +5 V |
| • High level | 15 … 30 V |
| • Current consumption at 24 V DC, typ. | 10 mA |
| • Delay times of digital inputs [1], approx. | |
| - L → H | 50 µs |
| - H → L | 100 µs |
| • Conductor cross-section, max. | 1.5 mm$^2$ |
| **Digital outputs** (continuously short-circuit-proof) | |
| • Voltage | 24 V DC |
| • Total current of digital outputs, max. | 1 000 mA |
| • Delay times of digital outputs [1] | |
| - typ. | 150 µs with 0.5 A resistive load |
| - max. | 500 µs |
| • Conductor cross-section, max. | 1.5 mm$^2$ |
| **Analog inputs** | |
| • As voltage input | |
| - Voltage range | -10 … +10 V |
| - Internal resistance $R_i$ | 100 kΩ |
| • As current input | |
| - Current range | 4 … 20 mA, –20 … +20 mA, 0 … 20 mA |
| - Internal resistance $R_i$ | 250 Ω |
| - Resolution [2] | 11 bits + sign |
| • Conductor cross-section, max. | 1.5 mm$^2$ |

| TM31 Terminal Module | |
|---|---|
| **Analog outputs** (continuously short-circuit-proof) | |
| • Voltage range | -10 … +10 V |
| • Load current, max. | –3 … +3 mA |
| • Current range | 4 … 20 mA, –20 … +20 mA, 0 … 20 mA |
| • Load resistance, max. | 500 Ω for outputs in the range –20 … +20 mA |
| • Resolution | 11 bits + sign |
| • Conductor cross-section, max. | 1.5 mm$^2$ |
| **Relay outputs** (changeover contacts) | |
| • Load current, max. | 8 A |
| • Switching voltage, max. | 250 V AC, 30 V DC |
| • Switching capacity, max. | |
| - At 250 V AC | 2 000 VA (cos φ = 1)<br>750 VA (cos φ = 0.4) |
| - At 30 V DC | 240 W (resistive load) |
| • Required minimum current | 100 mA |
| • Conductor cross-section, max. | 2.5 mm$^2$ |
| **Power loss** | < 10 W |
| **PE connection** | M4 screw |
| **Dimensions** | |
| • Width | 50 mm |
| • Height | 150 mm |
| • Depth | 111 mm |
| **Weight, approx.** | 0.87 kg |
| **Approvals** | cULus (File No.: 164110) |

### Selection and ordering data

| Description | Order No. |
|---|---|
| **TM31 Terminal Module** (without DRIVE-CLiQ cable) | **6SL3055-0AA00-3AA1** |

*DRIVE-CLiQ cables*

| Description | Length m | Order No. |
|---|---|---|
| **Pre-fabricated DRIVE-CLiQ cable** Degree of protection of connector IP20/IP20 | 0.11 | **6SL3060-4AB00-0AA0** |
| | 0.16 | **6SL3060-4AD00-0AA0** |
| | 0.21 | **6SL3060-4AF00-0AA0** |
| | 0.26 | **6SL3060-4AH00-0AA0** |
| | 0.36 | **6SL3060-4AM00-0AA0** |
| | 0.60 | **6SL3060-4AU00-0AA0** |
| | 0.95 | **6SL3060-4AA10-0AA0** |
| | 1.20 | **6SL3060-4AW00-0AA0** |
| | 1.45 | **6SL3060-4AF10-0AA0** |
| | 2.80 | **6SL3060-4AJ20-0AA0** |
| | 5.00 | **6SL3060-4AA50-0AA0** |

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

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

## Overview

With a mounting kit, it is possible to increase the degree of protection of SINAMICS DC MASTER from IP00 up to IP20.

## Selection and ordering data

For units up to 850 A, there is a suitable mounting kit to increase the degree of protection; this can be ordered using the following order numbers.

| **Mounting kit to upgrade to IP20** | |
|---|---|
| Description | Order No. |
| for units from 15 to 30 A | **6RX1800-0MA00** |
| for units from 60 to 280 A | **6RX1800-0MA01** |
| for units from 400 to 600 A | **6RX1800-0MA02** |
| for units from 720 to 850 A | **6RX1800-0MA03** |

## Line fuses

### Overview

3NE1 SITOR double protection fuses allow the cable and semiconductor protection to be implemented with just one fuse. This results in significant cost savings and shorter assembly times.

An overview of the fuses required for the armature and field circuits is provided in the following table.

| Fuse | Armature circuit | | | | Field circuit |
|---|---|---|---|---|---|
| | < 900 A | | ≥ 900A | | |
| | Two-quadrant operation | Four-quadrant operation | Two-quadrant operation | Four-quadrant operation | |
| Phase fuse | Required | Required | – | – | Required |
| Arm fuse | – | – | Integrated in the unit | Integrated in the unit | – |
| DC fuse | – | Required | – | – | – |

### Selection and ordering data

For technical data, engineering data as well as dimension drawings for Siemens fuses, please refer to Catalog ET B1 “BETA Low-Voltage Switchgear and Controlgear” catalog section 4.

In order to ensure UL-compliant protection of units, it is essential that you use “UL-listed” or “UL-recognized” fuses.

#### *Fuses for the field circuit*

Recommended fuses for the field circuit

| Rated DC current for converter unit | Max. field current | **2 Siemens fuses** | | 2 Bussmann fuses FWP 700V | |
|---|---|---|---|---|---|
| | | Order No. | | Order No. | |
| A | A | per unit | A | per unit | A |
| 15 | 3 | **5SD420** | 16 | FWP-5B | 5 |
| 30 | 5 | **5SD420** | 16 | FWP-5B | 5 |
| 60 … 125 | 10 | **5SD420** | 16 | FWP-15B | 15 |
| 210 … 280 | 15 | **5SD440** | 25 | FWP-20B | 20 |
| 400 … 600 | 25 | **5SD440** | 25 | FWP-30B | 30 |
| 710 … 850 | 30 | **5SD480** | 30 | FWP-35B | 35 |
| 900 … 3 000 | 40 | **3NE1802-0** [1] | 40 | FWP-50B | 50 |
| 1 500 … 3 000 with option L85 | 85 | **3NE8021-1** [1] | 100 | FWP-100B | 100 |

#### *Fuses for the armature circuit*

Units, two-quadrant operation: 400 V, 575 V, 690 V, 830 V and 950 V

*Phase fuses*

| Unit | | **3 phase fuses Siemens** | |
|---|---|---|---|
| Type | *I*/*V* | Order No. | *I*/*V* |
| | A/V | per unit | A/V |
| 6RA8025-6DS22 | 60/400 | **3NE1817-0** | 50/690 |
| 6RA8025-6GS22 | 60/575 | **3NE1817-0** | 50/690 |
| 6RA8028-6DS22 | 90/400 | **3NE1820-0** | 80/690 |
| 6RA8031-6DS22 | 125/400 | **3NE1021-0** | 100/690 |
| 6RA8031-6GS22 | 125/575 | **3NE1021-0** | 100/690 |
| 6RA8075-6DS22 | 210/400 | **3NE3227** | 250/1 000 |
| 6RA8075-6GS22 | 210/575 | **3NE3227** | 250/1 000 |
| 6RA8078-6DS22 | 280/400 | **3NE3231** | 350/1 000 |
| 6RA8081-6DS22 | 400/400 | **3NE3233** | 450/1 000 |
| 6RA8081-6GS22 | 400/575 | **3NE3233** | 450/1 000 |
| 6RA8085-6DS22 | 600/400 | **3NE3336** | 630/1 000 |
| 6RA8085-6GS22 | 600/575 | **3NE3336** | 630/1 000 |
| 6RA8087-6DS22 | 850/400 | **3NE3338-8** | 800/800 |
| 6RA8087-6GS22 | 800/575 | **3NE3338-8** | 800/800 |
| 6RA8086-6KS22 | 720/690 | **3NE3337-8** | 710/900 |

[1] UL-recognized

## Selection and ordering data (continued)

*Arm fuses*

Note:
The arm fuses are included in the unit. No external semiconductor fuses are required.

| Unit | | Arm fuses Siemens | | |
|---|---|---|---|---|
| Type | *I*/*V* | Fuses | Order No. | *I*/*V* |
| | A/V | | per unit | A/V |
| 6RA8091-6DS22 | 1 200/400 | 6 | **3NE3338-8** | 800/800 |
| 6RA8090-6GS22 | 1 100/575 | 6 | **3NE3338-8** | 800/800 |
| 6RA8090-6KS22 | 1 000/690 | 6 | **3NE3337-8** | 710/900 |
| 6RA8088-6LS22 | 950/830 | 6 | **3NE3337-8** | 710/900 |
| 6RA8093-4DS22 | 1 600/400 | 6 | **6RY1702-0BA02** | 1 000/660 |
| 6RA8093-4GS22 | 1 600/575 | 6 | **6RY1702-0BA02** | 1 000/660 |
| 6RA8093-4KS22 | 1 500/690 | 6 | **6RY1702-0BA03** | 1 000/1 000 |
| 6RA8093-4LS22 | 1 500/830 | 6 | **6RY1702-0BA03** | 1 000/1 000 |
| 6RA8095-4DS22 | 2 000/400 | 6 | **6RY1702-0BA01** | 1 250/660 |
| 6RA8095-4GS22 | 2 000/575 | 6 | **6RY1702-0BA01** | 1 250/660 |
| 6RA8095-4KS22 | 2 000/690 | 12 | **6RY1702-0BA04** | 630/1 000 |
| 6RA8095-4LS22 | 1 900/830 | 12 | **6RY1702-0BA04** | 630/1 000 |
| 6RA8096-4GS22 | 2 200/575 | 6 | **6RY1702-0BA05** | 1 500/660 |
| 6RA8096-4MS22 | 2 200/950 | 12 | **6RY1702-0BA07** | 800/1 250 |
| 6RA8097-4KS22 | 2 600/690 | 12 | **6RY1702-0BA08** | 1 000/1 000 |
| 6RA8097-4GS22 | 2 800/575 | 12 | **6RY1702-0BA08** | 1 000/1 000 |
| 6RA8098-4DS22 | 3 000/400 | 12 | **6RY1702-0BA08** | 1 000/1 000 |

Units, two-quadrant operation: 480 V

*Phase fuses*

| Unit | | 3 phase fuses Siemens | | 3 phase fuses Bussmann | | 3 phase fuses Bussmann [1] | |
|---|---|---|---|---|---|---|---|
| Type | *I*/*V* | Order No. | *I*/*V* | Order No. | *I*/*V* | Order No. | *I*/*V* |
| | A/V | per unit | A/V | per unit | A/V | per unit | A/V |
| 6RA8025-6FS22 | 60/480 | **3NE1817-0** | 50/690 | 170M1565 | 63/660 | FWH-60B | 60/500 |
| 6RA8028-6FS22 | 90/480 | **3NE1820-0** | 80/690 | 170M1567 | 100/660 | FWH-100B | 100/500 |
| 6RA8031-6FS22 | 125/480 | **3NE1021-0** | 100/690 | 170M1568 | 125/660 | FWH-125B | 125/500 |
| 6RA8075-6FS22 | 210/480 | **3NE3227** | 250/1 000 | 170M3166 | 250/660 | FWH-225A | 225/500 |
| 6RA8078-6FS22 | 280/480 | **3NE3231** | 350/1 000 | 170M3167 | 315/660 | FWH-275A | 275/500 |
| 6RA8082-6FS22 | 450/480 | **3NE3233** | 450/1 000 | 170M3170 | 450/660 | FWH-450A | 450/500 |
| 6RA8085-6FS22 | 600/480 | **3NE3336** | 630/1 000 | 170M4167 | 700/660 | FWH-600A | 600/500 |
| 6RA8087-6FS22 | 850/480 | **3NE3338-8** | 800/800 | 170M5165 | 900/660 | FWH-800A | 800/500 |

*Arm fuses*

Note:
The arm fuses are included in the unit. No external semiconductor fuses are required.

| Unit | | Arm fuses Siemens | | |
|---|---|---|---|---|
| Type | *I*/*V* | Fuses | Order No. | *I*/*V* |
| | A/V | | per unit | A/V |
| 6RA8091-6FS22 | 1 200/480 | 6 | **3NE3338-8** | 800/800 |

[1] FWH-... fuses are not mechanically compatible with 3NE or 170M fuses.

## Line fuses

### Selection and ordering data (continued)

Units, four-quadrant operation: 400 V, 575 V, 690 V, 830 V and 950 V

*Phase fuses, DC fuse*

| Unit | | 3 phase fuses Siemens | | 1 DC fuse Siemens | |
|---|---|---|---|---|---|
| Type | *I*/*V* | Order No. | *I*/*V* | Order No. | *I*/*V* |
| | A/V | per unit | A/V | per unit | A/V |
| 6RA8013-6DV62 | 15/400 | **3NE1814-0** | 20/690 | **3NE1814-0** | 20/690 |
| 6RA8018-6DV62 | 30/400 | **3NE8003-1** | 35/690 | **3NE4102** | 40/1 000 |
| 6RA8025-6DV62 | 60/400 | **3NE1817-0** | 50/690 | **3NE4120** | 80/1 000 |
| 6RA8025-6GV62 | 60/575 | **3NE1817-0** | 50/690 | **3NE4120** | 80/1 000 |
| 6RA8028-6DV62 | 90/400 | **3NE1820-0** | 80/690 | **3NE4122** | 125/1 000 |
| 6RA8031-6DV62 | 125/400 | **3NE1021-0** | 100/690 | **3NE4124** | 160/1 000 |
| 6RA8031-6GV62 | 125/575 | **3NE1021-0** | 100/690 | **3NE4124** | 160/1 000 |
| 6RA8075-6DV62 | 210/400 | **3NE3227** | 250/1 000 | **3NE3227** | 250/1 000 |
| 6RA8075-6GV62 | 210/575 | **3NE3227** | 250/1 000 | **3NE3227** | 250/1 000 |
| 6RA8078-6DV62 | 280/400 | **3NE3231** | 350/1 000 | **3NE3231** | 350/1 000 |
| 6RA8081-6DV62 | 400/400 | **3NE3233** | 450/1 000 | **3NE3233** | 450/1 000 |
| 6RA8081-6GV62 | 400/575 | **3NE3233** | 450/1 000 | **3NE3233** | 450/1 000 |
| 6RA8085-6DV62 | 600/400 | **3NE3336** | 630/1 000 | **3NE3336** | 630/1 000 |
| 6RA8085-6GV62 | 600/575 | **3NE3336** | 630/1 000 | **3NE3336** | 630/1 000 |
| 6RA8087-6DV62 | 850/400 | **3NE3338-8** | 800/800 | **3NE3334-0B** [1] | 500/1 000 |
| 6RA8087-6GV62 | 850/575 | **3NE3338-8** | 800/800 | **3NE3334-0B** [1] | 500/1 000 |
| 6RA8086-6KV62 | 760/690 | **3NE3337-8** | 710/900 | **3NE3334-0B** [1] | 500/1 000 |

*Arm fuses*

Note:
The arm fuses are included in the unit. No external semiconductor fuses are required.

| Unit | | Arm fuses Siemens | | |
|---|---|---|---|---|
| Type | *I*/*V* | Fuses | Order No. | *I*/*V* |
| | A/V | | per unit | A/V |
| 6RA8091-6DV62 | 1 200/400 | 6 | **3NE3338-8** | 800/800 |
| 6RA8090-6GV62 | 1 100/575 | 6 | **3NE3338-8** | 800/800 |
| 6RA8090-6KV62 | 1 000/690 | 6 | **3NE3337-8** | 710/900 |
| 6RA8088-6LV62 | 950/830 | 6 | **3NE3337-8** | 710/900 |
| 6RA8093-4DV62 | 1 600/400 | 6 | **6RY1702-0BA02** | 1 000/660 |
| 6RA8093-4GV62 | 1 600/575 | 6 | **6RY1702-0BA02** | 1 000/660 |
| 6RA8093-4KV62 | 1 500/690 | 6 | **6RY1702-0BA03** | 1 000/1 000 |
| 6RA8093-4LV62 | 1 500/830 | 6 | **6RY1702-0BA03** | 1 000/1 000 |
| 6RA8095-4DV62 | 2 000/400 | 6 | **6RY1702-0BA01** | 1 250/660 |
| 6RA8095-4GV62 | 2 000/575 | 6 | **6RY1702-0BA01** | 1 250/660 |
| 6RA8095-4KV62 | 2 000/690 | 12 | **6RY1702-0BA04** | 630/1 000 |
| 6RA8095-4LV62 | 1 900/830 | 12 | **6RY1702-0BA04** | 630/1 000 |
| 6RA8096-4GV62 | 2 200/575 | 6 | **6RY1702-0BA05** | 1 500/660 |
| 6RA8096-4MV62 | 2 200/950 | 12 | **6RY1702-0BA07** | 800/1 250 |
| 6RA8097-4KV62 | 2 600/690 | 12 | **6RY1702-0BA08** | 1 000/1 000 |
| 6RA8097-4GV62 | 2 800/575 | 12 | **6RY1702-0BA08** | 1 000/1 000 |
| 6RA8098-4DV62 | 3 000/400 | 12 | **6RY1702-0BA08** | 1 000/1 000 |

[1] Two fuses connected in parallel.

## Selection and ordering data (continued)

Units, four-quadrant operation: 480 V

*Phase fuses*

| Unit | | 3 phase fuses Siemens | | 3 phase fuses Bussmann | | 3 phases fuses Bussmann [2] | |
|---|---|---|---|---|---|---|---|
| Type | *I*/*V* A/V | Order No. per unit | *I*/*V* A/V | Order No. per unit | *I*/*V* A/V | Order No. per unit | *I*/*V* A/V |
| 6RA8013-6FV62 | 15/480 | **3NE1814-0** | 20/690 | 170M1562 | 32/660 | FWH-35B | 35/500 |
| 6RA8018-6FV62 | 30/480 | **3NE1815-0** | 25/690 | 170M1562 | 32/660 | FWH-35B | 35/500 |
| 6RA8025-6FV62 | 60/480 | **3NE1817-0** | 50/690 | 170M1565 | 63/660 | FWH-60B | 60/500 |
| 6RA8028-6FV62 | 90/480 | **3NE1820-0** | 80/690 | 170M1567 | 100/660 | FWH-100B | 100/500 |
| 6RA8031-6FV62 | 125/480 | **3NE1021-0** | 100/690 | 170M1568 | 125/660 | FWH-125B | 125/500 |
| 6RA8075-6FV62 | 210/480 | **3NE3227** | 250/1 000 | 170M3166 | 250/660 | FWH-225A | 225/500 |
| 6RA8078-6FV62 | 280/480 | **3NE3231** | 350/1 000 | 170M3167 | 315/660 | FWH-275A | 275/500 |
| 6RA8082-6FV62 | 450/480 | **3NE3233** | 450/1 000 | 170M3170 | 450/660 | FWH-450A | 450/500 |
| 6RA8085-6FV62 | 600/480 | **3NE3336** | 630/1 000 | 170M4167 | 700/660 | FWH-600A | 600/500 |
| 6RA8087-6FV62 | 850/480 | **3NE3338-8** | 800/800 | 170M5165 | 900/660 | FWH-800A | 800/500 |

*DC fuse*

| | | 1 DC fuse Siemens | | 1 DC fuse Bussmann [2] | |
|---|---|---|---|---|---|
| Type | *I*/*V* A/V | Order No. per unit | *I*/*V* A/V | Order No. per unit | *I*/*V* A/V |
| 6RA8013-6FV62 | 15/480 | **3NE1814-0** | 20/690 | FWP-35B | 35/660 |
| 6RA8018-6FV62 | 30/480 | **3NE4102** | 40/1 000 | FWP-35B | 35/660 |
| 6RA8025-6FV62 | 60/480 | **3NE4120** | 80/1 000 | FWP-70B | 70/660 |
| 6RA8028-6FV62 | 90/480 | **3NE4122** | 125/1 000 | FWP-125A | 125/660 |
| 6RA8031-6FV62 | 125/480 | **3NE4124** | 160/1 000 | FWP-150A | 150/660 |
| 6RA8075-6FV62 | 210/480 | **3NE3227** | 250/1 000 | FWP-250A | 250/660 |
| 6RA8078-6FV62 | 280/480 | **3NE3231** | 350/1 000 | FWP-350A | 350/660 |
| 6RA8082-6FV62 | 450/480 | **3NE3334-0B** | 500/1 000 | FWP-500A | 500/660 |
| 6RA8085-6FV62 | 600/480 | **3NE3336** | 630/1 000 | FWP-700A | 700/660 |
| 6RA8087-6FV62 | 850/480 | **3NE3334-0B** [1] | 500/1 000 | FWP-1000A | 1 000/660 |

*Arm fuses*

Note:
The arm fuses are included in the unit. No external semiconductor fuses are required.

| Unit | | Arm fuses Siemens | | |
|---|---|---|---|---|
| Type | *I*/*V* A/V | Fuses | Order No. per unit | *I*/*V* A/V |
| 6RA8091-6FV62 | 1 200/480 | 6 | **3NE3338-8** | 800/800 |

[1] Two fuses connected in parallel.

[2] FWH-... and FWP-... fuses are not mechanically compatible with 3NE or 170M fuses.

## Overview

### *Commutating reactors*

A converter must always be connected to the line supply through a commutation inductance. This must have at least 4 % $u_K$! The commutation inductance can be in the form of a converter transformer or, for the appropriate line supply, in the form of a commutating reactor.

A line supply can be considered to be "stiff" if the power ratio $P_s/S_k$ is ≤ 0.01. Even for stiff line supplies, the commutation inductance must have a $u_K$ of at least 4 %!

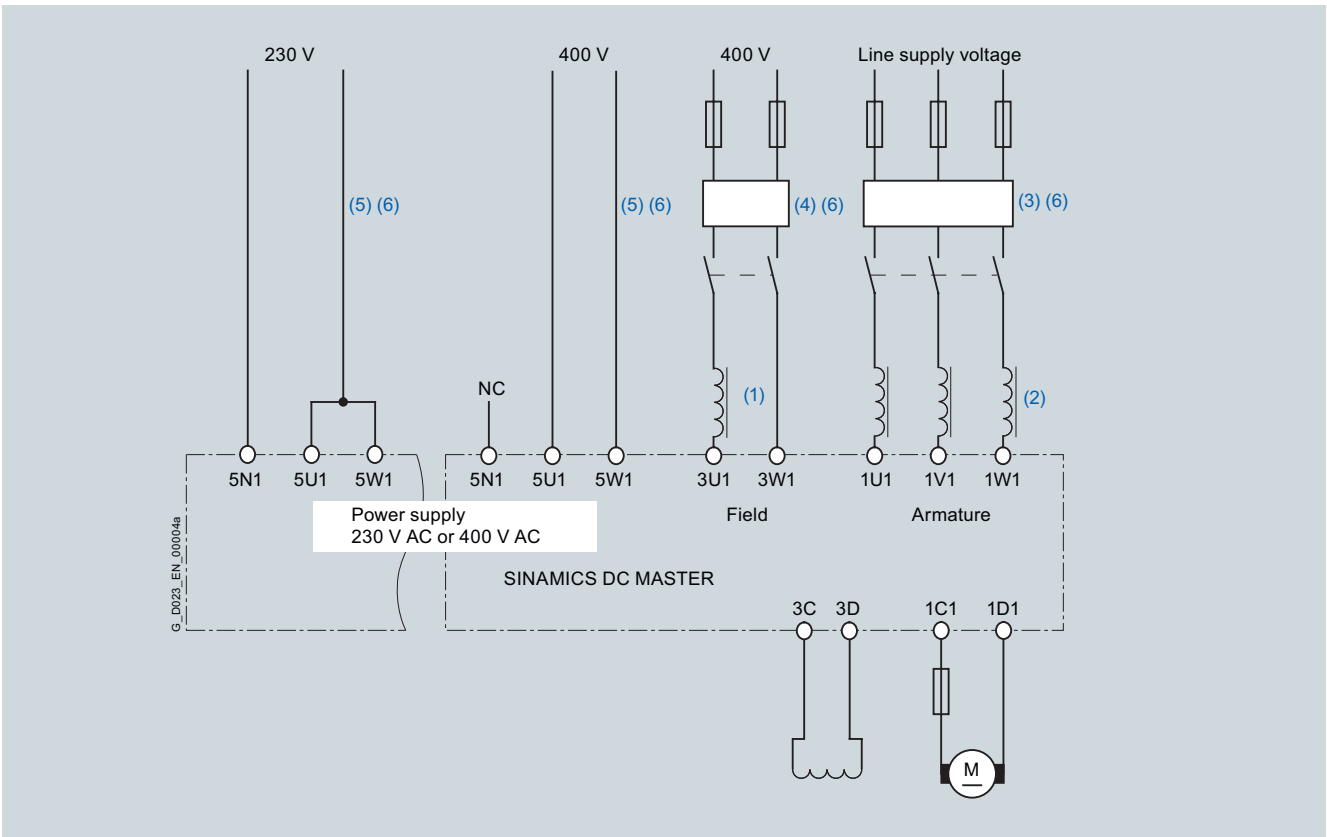
For high-rating converters, the line reactance, i.e. the finite fault level (short-circuit power) of the line supply must be taken into account; this also results in higher $u_K$ values. Recommendation for the ratio of the line supply fault level (short-circuit power) to the apparent drive power > 33:1.

The commutating reactors are dimensioned according to the rated motor current in the armature or field circuit.

Operation with line frequencies of 50 Hz and 60 Hz

The rated currents $I_{Ln}$ of the reactors, specified in the table, apply for operation with a line frequency $f$ = 50 Hz. It is permissible to operate the reactors with a line frequency $f$ = 60 Hz. In this case, a 10 % larger reactor should be used.

At the same time, the voltage drop $\Delta V$ increases by 8 %.




Arrangement of reactors and radio interference suppression filters

(1) The commutating reactor in the field circuit is dimensioned for the rated motor field current.

(2) The commutating reactor in the armature circuit is dimensioned for the rated motor armature current.
The line current is 0.82 times the DC current.

(3) The radio interference suppression filter for the armature circuit is dimensioned for the rated motor armature current.
The line current is 0.82 times the DC current.

(4) The radio interference suppression filter for the field circuit is dimensioned for the rated motor field current.

(5) Radio interference suppression filters are not required for the electronics power supply alone. Current consumption at 400 V 1 A, at 230 V 2 A.

(6) If the power supply voltages for the armature circuit, field circuit and electronics power supply are the same, then the voltage for the field and electronics power supply can also be taken after the radio interference suppression filter for the armature circuit.

## Selection and ordering data

CE cULus [1)]

Note:
The commutating reactors are dimensioned according to the rated motor current in the armature and field circuits. For single-phase operation, single-phase commutating reactors should be used in the armature circuit.
The following table provides an overview and can be a guide for selection. Please find detailed information in Catalog LV 60.

| Thermal continuous current [2)] | Maximum AC current | Continuous permissible DC current [3)] | **Commutating reactor** | | | |
|---|---|---|---|---|---|---|
| | | | 4 % per unit voltage drop $u_D$ of the reactor at $I_{th\ max}$ and $V_N$ | | | |
| $I_{th\ max}$ | $I_{L\ max}$ | $I_{dn}$ | 400 V | 500 V | 690 V | 750 V |
| A | A | A | Order No. | Order No. | Order No. | Order No. |
| **Single-phase commutating reactor $I_{th\ max} = I_{L\ max}$ with inductive load** | | | | | | |
| 8 | 8 | 9.8 | **4EM4807-1CB00** | – | – | – |
| 10 | 10 | 12.3 | **4EM4911-7CB00** | – | – | – |
| 11.2 | 11.2 | 13.7 | **4EM4911-8CB00** | – | – | – |
| 12.5 | 12.5 | 15.3 | **4EM4912-0CB00** | – | – | – |
| 14 | 14 | 17.2 | **4EM4912-1CB00** | – | – | – |
| 15 | 15 | 18.4 | **4EM5000-2CB00** | – | – | – |
| 18 | 18 | 22 | **4EM5005-6CB00** | – | – | – |
| 20 | 20 | 24.5 | **4EM5005-7CB00** | – | – | – |
| 22.4 | 22.4 | 27.4 | **4EM5005-8CB00** | – | – | – |
| 24 | 24 | 29.4 | **4EM5100-2CB00** | – | – | – |
| 28 | 28 | 34 | **4EM6100-2CB00** | – | – | – |
| 31.5 | 31.5 | 39 | **4EM6100-3CB00** | – | – | – |
| 35.5 | 35.5 | 43 | **4EM5212-8CB00** | – | – | – |
| 40 | 40 | 49 | **4EM5200-1CB00** | – | – | – |
| 45 | 45 | 55 | **4EM6200-3CB00** | – | – | – |
| 50 | 50 | 61 | **4EM5316-6CB00** | – | – | – |
| **Three-phase commutating reactor $I_{th\ max} = 0.8 \times I_{L\ max}$ with inductive load, 50 Hz 3 AC** | | | | | | |
| 16 | 20 | 19.6 | **4EP3601-3DS00** | **4EP3601-8DS00** | – | – |
| 18 | 22.4 | 22 | **4EP3601-4DS00** | **4EP3602-0DS00** | – | – |
| 20 | 25 | 24.5 | **4EP3601-5DS00** | **4EP3702-0DS00** | – | – |
| 22.4 | 28 | 27.4 | – | **4EP3702-1DS00** | – | – |
| 25 | 31.5 | 31 | **4EP3701-5DS00** | **4EP3702-2DS00** | – | – |
| 28 | 35.5 | 34 | **4EP3701-6DS00** | **4EP3801-7DS00** | – | – |
| 31.5 | 40 | 39 | **4EP3701-7DS00** | **4EP3801-8DS00** | – | – |
| 35.5 | 45 | 43 | **4EP3701-8DS00** | **4EP3802-0DS00** | – | – |
| 40 | 50 | 49 | **4EP3800-2DS00** | **4EP3800-4DS00** | – | – |
| 45 | 56 | 55 | **4EP3801-6DS00** | **4EP3901-5DS00** | – | – |
| 50 | 63 | 61 | **4EP3800-3DS00** | **4EP3900-3DS00** | – | – |
| 56 | 71 | 69 | **4EP3901-4DS00** | **4EP4003-1DS00** | – | – |
| 63 | 80 | 77 | **4EP3900-2DS00** | **4EP4000-4DS00** | – | – |
| 71 | 91 | 87 | **4EP4002-7DS00** | **4EP4003-2DS00** | – | – |
| 80 | 100 | 98 | **4EP4000-3DS00** | **4EU2422-8AA00-0AA0** | – | – |
| 91 | 112 | 112 | **4EP4002-8DS00** | **4EU2422-0BA00-0AA0** | – | – |

Note:
Commutating reactors for 830 and 950 V on request.

[1)] All reactors with $V_N \leq 600$ V acc. to UL
[2)] Rated current $I_{Ln} = 0.9 \times I_{th\ max}$
[3)] For a downstream six-pulse bridge circuit

## Commutating reactors

### Selection and ordering data (continued)

CE cULus [1]

| Thermal continuous current [2] | Maximum AC current | Continuous permissible DC current [3] | Commutating reactor | | | |
|---|---|---|---|---|---|---|
| | | | 4 % per unit voltage drop $u_D$ of the reactor at $I_{th\ max}$ and $V_N$ | | | |
| $I_{th\ max}$ | $I_{L\ max}$ | $I_{dn}$ | 400 V | 500 V | 690 V | 750 V |
| A | A | A | Order No. | Order No. | Order No. | Order No. |
| **Three-phase commutating reactor $I_{th\ max} = 0.8 \times I_{L\ max}$ with inductive load, 50 Hz 3 AC** (continued) | | | | | | |
| 100 | 125 | 123 | **4EP4003-0DS00** | **4EU2522-6BA00-0AA0** | **–** | **–** |
| 112 | 140 | 137 | **4EU2422-6AA00-0AA0** | **4EU2522-7BA00-0AA0** | **–** | **–** |
| 125 | 160 | 153 | **4EU2422-7AA00-0AA0** | **4EU2522-8BA00-0AA0** | **–** | **–** |
| 140 | 180 | 172 | **4EU2522-2BA00-0AA0** | **4EU2522-0CA00-0AA0** | **–** | **–** |
| 160 | 200 | 196 | **4EU2522-3BA00-0AA0** | **4EU2722-0CA00-0AA0** | **–** | **–** |
| 180 | 224 | 221 | **4EU2522-4BA00-0AA0** | **4EU2722-1CA00-0AA0** | **–** | **–** |
| 200 | 250 | 245 | **4EU2522-5BA00-0AA0** | **4EU2722-2CA00-0AA0** | **4EU2722-0DA00-1BA0** | **–** |
| 224 | 280 | 275 | **4EU2722-5BA00-0AA0** | **4EU2722-3CA00-0AA0** | **4EU3022-8BA00-0AA0** | **–** |
| 250 | 315 | 306 | **4EU2722-6BA00-0AA0** | **4EU2722-4CA00-0AA0** | **4EU3022-0CA00-0AA0** | **4EU3022-2CA00-0AA0** |
| 280 | 355 | 343 | **4EU2722-7BA00-0AA0** | **4EU3022-5BA00-0AA0** | **4EU3022-1CA00-0AA0** | **4EU3622-5DA00-0AA0** |
| 315 | 400 | 386 | **4EU2722-8BA00-0AA0** | **4EU3022-6BA00-0AA0** | **4EU3622-0DA00-0AA0** | **4EU3622-6DA00-0AA0** |
| 355 | 450 | 435 | **4EU3022-1BA00-0AA0** | **4EU3022-7BA00-0AA0** | **4EU3622-1DA00-0AA0** | **4EU3622-7DA00-0AA0** |
| 400 | 500 | 490 | **4EU3022-2BA00-0AA0** | **4EU3622-4CA00-0AA0** | **4EU3622-2DA00-0AA0** | **4EU3622-8DA00-1BA0** |
| 450 | 560 | 551 | **4EU3022-3BA00-0AA0** | **4EU3622-5CA00-0AA0** | **4EU3622-3DA00-0AA0** | **4EU3622-0EA00-1BA0** |
| 500 | 630 | 613 | **4EU3022-4BA00-0AA0** | **4EU3622-6CA00-0AA0** | **4EU3622-4DA00-0AA0** | **4EU3921-1CA00-0A** |
| 560 | 710 | 686 | **4EU3622-0CA00-0AA0** | **4EU3622-7CA00-0AA0** | **4EU3921-8BA00-0A** | **4EU3921-2CA00-0A** |
| 630 | 800 | 772 | **4EU3622-1CA00-0AA0** | **4EU3622-8CA00-1BA0** | **4EU3921-0CA00-0A** | **4EU4321-4DA00-0A** |
| 710 | 910 | 870 | **4EU3622-2CA00-1BA0** | **4EU3921-6BA00-0A** | **4EU4321-0DA00-0A** | **4EU4321-5DA00-0A** |
| 800 | 1 000 | 980 | **4EU3622-3CA00-1BA0** | **4EU3921-7BA00-0A** | **4EU4321-1DA00-0A** | **4EU4321-6DA00-0A** |
| 910 | 1 120 | 1 115 | **4EU3921-2BA00-0A** | **4EU4321-4CA00-0A** | **4EU4321-2DA00-0A** | **4EU4521-4BA00** |
| 980 | 1 230 | 1 200 | **–** | **–** | **4EU4321-0AY00-0A** | **–** |
| 1 000 | 1 250 | 1 225 | **4EU3921-3BA00-0A** | **4EU4321-5CA00-0A** | **4EU4321-3DA00-0A** | **4EU4521-5BA00** |
| 1 040 | 1 300 | 1 280 | **4EU3921-0AL00-0A** | **4EU4321-0AX00-0A** [4] | **–** | **–** |
| 1 310 | 1 640 | 1 600 | **4EU4321-0AW00-0A** | **4EU4521-0AK00** [4] | **4EU4521-0AP00** | **–** |
| 1 600 | 2 000 | 1 951 | **4EU4321-0CH10-0A** | **4EU4521-0CP10-0C** | **4EU5121-0BD10-0C** | **4EU5021-0AM10-0C** |
| 1 800 | 2 250 | 2 195 | **4EU4321-0CK10-0C** | **4EU4521-0CQ10-0C** | **4EU5121-0BE10-0C** | **4EU5221-0BF10-0C** |
| 2 000 | 2 500 | 2 439 | **4EU9921-0BG10-0B** | **4EU5121-0BA10-0C** | **4EU5121-0BF10-0C** | **4EU5221-0BG10-0C** |
| 2 250 | 2 812.5 | 2 744 | **4EU5021-0AL10-0C** | **4EU5121-0BB10-0C** | **4EU5121-0BG10-0C** | **4EU5221-0BH10-0C** |
| 2 500 | 3 125 | 3 049 | **4EU5021-0AK10-0B** | **4EU5121-0BC10-0C** | **4EU5421-0AV10-0C** | **4EU5621-0AW10-0C** |

Note:
Commutating reactors for 830 and 950 V on request.

[1] All reactors with $V_N \leq 600$ V acc. to UL
[2] Rated current $I_{Ln} = 0.9 \times I_{th\ max}$
[3] For a downstream six-pulse bridge circuit
[4] Per unit voltage drop of the reactor $u_D \cong 4$ % at $I_{Ln}$ and $V_N = 575$ V

## Circuit-breakers and contactors

### Overview

The main contactor or the circuit-breaker in front of the three-phase armature supply of the converter is used to switch-on the power section in a correct manner when the electronics and the voltage for the thyristor modules is enabled if the unit is still not operational. This is the reason that the contactor or the circuit-breaker must always be energized via terminals XR1-109-110. When a circuit-breaker is used, a motor-operated mechanism must be used to close the circuit-breaker and an undervoltage release to open the circuit-breaker.

#### *Selection criteria*

The internal control sequence guarantees that the switching operations are always made in a no-current condition. When selecting the main contactor, the utilization category AC-1 or for a circuit-breaker, the maximum rated current $I_{n\,max}$ should be used as basis. If the current and voltage quantities permit it, then generally, the more cost-effective solution using a contactor is preferred over a circuit-breaker.

## Radio interference suppression filters

### Overview

SINAMICS DC MASTER applications are in compliance with the EMC product standard EN 61800-3 for electric drives when taking into account that the units are integrated into the plant or system in compliance with EMC rules.

However, EMC legislation does stipulate that the plant or system as a whole must be electromagnetically compatible with its environment.

If radio interference suppression level “A1” according to EN 55011 is to be achieved, then in addition to the commutating reactors, a radio interference suppression filter is also required. Radio interference suppression filters reduce radio interference voltages of the converter that occur in conjunction with the commutating reactor. It is only possible to use radio interference suppression filters for grounded line supplies.

Radio interference suppression filters generate leakage currents. In accordance with DIN VDE 0160, a PE connection with a cross-section of 10 mm$^2$ is required. For the filters to have optimum effect, it is absolutely essential that they and the unit are installed on a single metal plate.

For converter units with 3-phase connection, the minimum rated filter current is equal to the DC output current of the unit times 0.82. For a two-phase connection (field power section or single-phase operation of the armature power section) only two phases are connected to the three-phase radio interference suppression filter. In this case, the line current is equal to the DC field current.

#### *List of the recommended radio interference suppression filters from EPCOS*

| Rated current<br>Radio interference suppression filter | Radio interference suppression filter | Terminal cross-section (mm$^2$) or threaded hole | Weight, approx. | Dimensions (W × H × D) |
|---|---|---|---|---|
| A | Type | | kg | mm × mm × mm |
| 8 | B84143-G8 -R 1 1 ■ | 4 mm$^2$ | 1.3 | 80 × 230 × 50 |
| 20 | B84143-G20 -R 1 1 ■ | 4 mm$^2$ | 1.3 | 80 × 230 × 50 |
| 36 | B84143-G36 -R 1 1 ■ | 6 mm$^2$ | 2.8 | 150 × 280 × 60 |
| 50 | B84143-G50 -R 1 1 ■ | 16 mm$^2$ | 3.3 | 150 × 60 × 330 |
| 66 | B84143-G66 -R 1 1 ■ | 25 mm$^2$ | 4.4 | 150 × 330 × 80 |
| 90 | B84143-G90 -R 1 1 ■ | 25 mm$^2$ | 4.9 | 150 × 330 × 80 |
| 120 | B84143-G120 -R 1 1 ■ | 50 mm$^2$ | 7.5 | 200 × 380 × 90 |
| 150 | B84143-G150 -R 1 1 ■ | 50 mm$^2$ | 8.0 | 200 × 380 × 90 |
| 220 | B84143-G220 -R 1 1 ■ | 95 mm$^2$ | 11.5 | 220 × 430 × 110 |
| 150 | B84143-B150 -S ■■ | M10 | 13 | 140 × 310 × 170 |
| 180 | B84143-B180 -S ■■ | M10 | 13 | 140 × 310 × 170 |
| 250 | B84143-B250 -S ■■ | M10 | 15 | 115 × 360 × 190 |
| 320 | B84143-B320 -S ■■ | M10 | 21 | 115 × 360 × 260 |
| 400 | B84143-B400 -S ■■ | M10 | 21 | 115 × 360 × 260 |
| 600 | B84143-B600 -S ■■ | M10 | 22 | 115 × 410 × 260 |
| 1 000 | B84143-B1000-S ■■ | M12 | 28 | 165 × 420 × 300 |
| 1 600 | B84143-B1600-S ■■ | 2 × M12 | 34 | 165 × 420 × 300 |
| 2 500 | B84143-B2500-S ■■ | 4 × M12 | 105 | 200 × 810 × 385 |

| | | |
|---|---|---|
| 500 V | 2 0 | |
| 760 V | 2 1 | |
| 690 V | 2 4 | |
| 480 V | | 0 |
| 530 V | | 2 |

## Overview (continued)

***List of the recommended radio interference suppression filters from Siemens***

| Rated current<br>Radio interference suppression filter | Radio interference suppression filter | Terminal cross-section | Ground stud | Weight, approx. | Dimensions (W × H × D) |
|---|---|---|---|---|---|
| A | Type | $mm^2$ | | kg | mm × mm × mm |
| 12 | 6SE7021-0ES87-0FB1 | 4 | M6 | 2.5 | 215 x 90 × 81 |
| 18 | 6SE7021-8ES87-0FB1 | 4 | M6 | 2.5 | 215 x 90 × 81 |
| 36 | 6SE7023-4ES87-0FB1 | 16 | M6 | 4 | 231 × 101 × 86 |
| 80 | 6SE7027-2ES87-0FB1 | 50 | M10 | 9 | 308 × 141 × 141 |
| 120 | 6SE7031-2ES87-0FA1 | 50 | M10 | 10 | 348 × 171 × 141 |
| 190 | 6SE7031-8ES87-0FA1 | 95 | M10 | 10 | 404 × 171 × 141 |
| 320 | 6SE7033-2ES87-0FA1 | Connecting lug | M10 × 30 | 21 | 300 × 260 × 116 |
| 600 | 6SE7036-0ES87-0FA1 | Connecting lug | M10 × 30 | 22 | 350 × 260 × 116 |
| 1 000 | 6SE7041-0ES87-0FA1 | Connecting lug | M10 × 30 | 28 | 350 × 300 × 166 |
| 1 600 | 6SE7041-6ES87-0FB1 | Connecting lug | M12 × 30 | 34 | 400 × 300 × 166 |

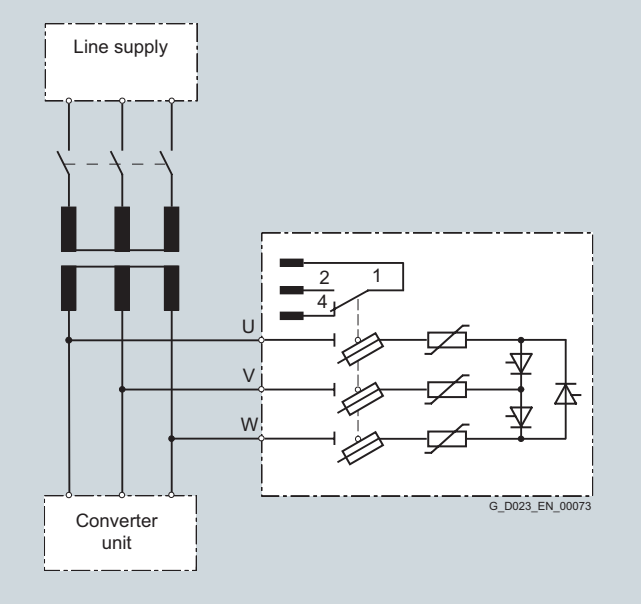
## Technical specifications

| **Radio interference suppression filter** | |
|---|---|
| Rated supply voltage | 380 ... 460 V (± 15 %) 3 AC |
| Rated frequency | 50/60 Hz (± 6 %) |
| Ambient temperature during operation | 0 ... +40 °C |
| Degree of protection in accordance with EN 60529 | IP20<br>IP00 from 500 A |

## Application


**SICROWBAR AC** overvoltage protection is used to protect power semiconductors (thyristors and diodes) in converters against overvoltages between the phases of a three-phase line supply. The range of applications is not restricted to protecting DC drive converters, but can also be used for infeed/regenerative feedback units of AC drive systems that are equipped with thyristors. Overvoltages that occur on the AC side of converters are mainly caused by switching operations when disconnecting from the line supply at the transformer primary. This applies both to operational switching operations (shutdown under no-load conditions) as well as in the case of a fault (shutdown under load).

Overvoltage protection is normally used in the following configuration:




## Design

There are three device versions depending on the rated voltage:

| Version | Rated voltage | Design, installation |
|---|---|---|
| A | Up to 580 V | Mounted in an enclosure.<br>For mounting in an upright position on panels in cabinets or machine frames. |
| B | Up to 725 V | Mounted on a baseplate.<br>For installation in 600 mm wide cabinets. |
| C | Up to 1 150 V | Mounted on a baseplate.<br>For installation in 600 mm wide cabinets. |

The power section of the overvoltage protection device has a P3C connection, 3-pulse fully controlled polygon connection. The feeders to the polygon connection have metaloxide varistors that absorb overvoltage energy.

Semiconductor fuses included in the devices are accommodated in a fused disconnector with integrated fuse monitoring.

The break-over diodes (BOD) and RC snubbers for the thyristors and varistors are mounted on a printed circuit board as are also the gate series resistors and diodes that transfer the line voltage to the break-over diodes.

## Mode of operation

If an overvoltage occurs, which reaches the response voltage of the integrated firing module, then the break-over diodes trigger and in turn trigger their associated thyristors. As a consequence, the varistors are switched to the line supply. The varistors absorb the overvoltage energy. An RC snubber circuit protects the thyristors against an excessively steep voltage gradient when the current is interrupted.

## Configuration

### *Notes on selection*

The following conditions should be maintained when selecting the overvoltage protection:

- The limit voltage of the overvoltage protection $V_{RRM55}$ must not exceed the highest periodic and permissible peak blocking voltage of the power semiconductor to be protected.
- The rated supply voltage of the overvoltage protection must not be exceeded.
- Commutation overvoltages of the converter that periodically occur must remain below the response voltage of the overvoltage protection. The energy absorption capability of the selected overvoltage protection should be checked. A distinction must be made between two operating cases:
  - A transformer is shut down under no-load conditions
  - A transformer is shut down under load

Detailed notes on configuration, standards and connection of the overvoltage protection are provided in the Operating Instructions, on the DVD-ROM supplied with this catalog or in the Internet under
http://support.automation.siemens.com/WW/view/en/18260008/130000.

## SICROWBAR AC overvoltage protection

### Technical specifications

| General technical data | SICROWBAR AC overvoltage protection |
|---|---|
| Degree of protection | IP00 acc. to EN 60529 |
| Protection class | I according to EN 50178 |
| Overvoltage category | III, corresponding to EN 60664 |
| Dimensioning creepages and clearances | Pollution degree 2 acc. to EN 50178 |
| Rated insulation voltage<br>(for installation altitudes up to 2 000 m above sea level) [1] | 725 V AC for rated supply voltages of 400 ... 725 V<br>1 200 V AC for rated supply voltages of 850 ... 1 150 V |
| Installation altitude | ≤ 2 000 m above sea level |
| Permissible ambient temperature | |
| • In operation | +5 ... +55 °C |
| • In storage | –40 ... +70 °C |
| Climate class | 3K3 acc. to EN 60721-3-3 |
| Fuse monitoring (microswitch at the fused disconnector, 1 changeover contact) | Flat connector 6.3 mm × 0.8 mm |
| • Disconnector closed, all fuse links OK | 1/2 closed, 1/4 opened |
| • Disconnector closed, one or several fuse links defective | 1/4 closed, 1/2 opened |
| • Disconnector open | 1/4 closed, 1/2 opened |
| • Maximum switching capacity | 50 Hz 250 V AC, 3 A<br>30 V DC, 3 A |

| | | SICROWBAR AC overvoltage protection | | | |
|---|---|---|---|---|---|
| | | 7VV3002-3CD20 | 7VV3002-3AD20 | 7VV3002-3BD20 | 7VV3002-3GD20 |
| Max. permissible rated supply voltage $V_N$ | V | 460 | | 550 | |
| Nominal response voltage of the BOD element $V_{AN}$ | V | 1 000 | 1 200 | 1 400 | 1 600 |
| Min. limit voltage of BOD element at 5 °C $V_{RRM\_05}$ | V | 864 | 1 056 | 1 248 | 1 440 |
| Max. limit voltage of BOD element at 55 °C $V_{RRM\_55}$ | V | 1 166 | 1 378 | 1 590 | 1 802 |
| Max. permissible peak current, $I_{max}$ | A | 200 | 1 000 | | 2 000 |
| Rated insulation voltage (the insulation voltage is determined by the highest rated supply voltage of the relevant construction type) $V_{ISO}$ | V | 550 | | | |
| Varistor voltage (breakdown voltage) at $T_A$ = 25 °C, 1 mA (data sheet value × 2 for 2 series-connected varistors) $V_V$ | V | 720 | | 860 | |
| Max. energy (for 2 ms) at $T_A$ = 85 °C (data sheet value × 2 for 2 series-connected varistors) $W_0$ | Ws | 600 | | 720 | |
| Energy that can be absorbed 100 times (determined from the derating data) $W_2$ | Ws | 350 | | 419 | |
| Energy that can be absorbed 10 000 times (determined from the derating data) $W_4$ | Ws | 42 | | 50 | |
| Version | | A | | | |
| Dimensions | | | | | |
| • Width | mm | 265 | | | |
| • Height | mm | 385 | | | |
| • Depth | mm | 237 | | | |
| Weight, approx. | kg | 7 | | | |

[1] Installation altitudes above 2 000 m on request.

## Technical specifications (continued)

| | | SICROWBAR AC overvoltage protection | | | | |
|---|---|---|---|---|---|---|
| | | 7VV3002-3DD20 | 7VV3002-3ED20 | 7VV3002-3JD20 | 7VV3002-3KD20 | 7VV3002-3LD20 |
| Max. permissible rated supply voltage $V_N$ | V | 770 | 920 | | 1 100 | |
| Nominal response voltage of the BOD element $V_{AN}$ | V | 1 900 | 2 400 | 2 600 | 2 800 | 3 000 |
| Min. limit voltage of BOD element at 5 °C $V_{RRM\_05}$ | V | 1 728 | 2 208 | 2 400 | 2 592 | 2 784 |
| Max. limit voltage of BOD element at 55 °C $V_{RRM\_55}$ | V | 2 120 | 2 650 | 2 862 | 3 074 | 3 286 |
| Max. permissible peak current, $I_{max}$ | A | 300 | 800 | 1 000 | 400 | 1 000 |
| Rated insulation voltage (the insulation voltage is determined by the highest rated supply voltage of the relevant construction type) $V_{ISO}$ | V | 770 | 1 100 | | | |
| Varistor voltage (breakdown voltage) at $T_A$ = 25 °C, 1 mA (data sheet value × 2 for 2 series-connected varistors) $V_V$ | V | 1 240 | 1 500 | | 1 820 | |
| Max. energy (for 2 ms) at $T_A$ = 85 °C (data sheet value × 2 for 2 series-connected varistors) $W_0$ | Ws | 2 400 | 3 300 | | 3 000 | |
| Energy that can be absorbed 100 times (determined from the derating data) $W_2$ | Ws | 986 | 1 196 | | 1 027 | |
| Energy that can be absorbed 10 000 times (determined from the derating data) $W_4$ | Ws | 145 | 176 | | 214 | |
| Version | | B | C | | | |
| Dimensions | | | | | | |
| • Width | mm | 580 | | | | |
| • Height | mm | 305 | | | | |
| • Depth | mm | 205 | 245 | | | |
| Weight, approx. | kg | 11 | 12 | | | |

## Selection and ordering data

| Rated supply voltage | Limit voltage | **SICROWBAR AC overvoltage protection** |
|---|---|---|
| V | V | Order No. |
| 460 | 1 166 | **7VV3002-3CD20** |
| 460 | 1 378 | **7VV3002-3AD20** |
| 550 | 1 590 | **7VV3002-3BD20** |
| 550 | 1 802 | **7VV3002-3GD20** |
| 770 | 2 120 | **7VV3002-3DD20** |
| 920 | 2 650 | **7VV3002-3ED20** |
| 920 | 2 862 | **7VV3002-3JD20** |
| 1 100 | 3 074 | **7VV3002-3KD20** |
| 1 100 | 3 286 | **7VV3002-3LD20** |

## Accessories

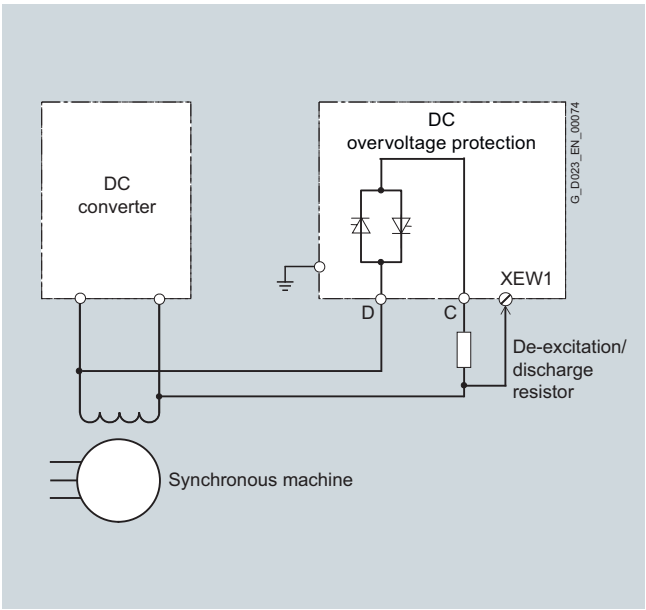
Spare parts, see in the Internet under http://workplace.automation.siemens.de/sparesonweb.

## SICROWBAR DC overvoltage protection

### Application


**SICROWBAR DC** overvoltage protection protects windings and converters against overvoltage when supplying large inductances, e.g. field windings of synchronous machines, DC machines or hoisting solenoids.

Further, it is optionally possible to initiate fast de-excitation – triggered by a higher-level signal. An appropriate de-excitation/discharge resistor must be provided.




### Design

The most important components of the device are:

- Two disk-type thyristors in an anti-parallel connection
- A firing circuit, which, depending on the version, triggers a thyristor in the blocking direction at a defined voltage
- A module to detect the voltage at the de-excitation/discharge resistor, detect the current being conducted, identify when the overvoltage protection device triggers and signal the status using binary outputs.
- The power connections C, D (copper bars)
- Terminal XEW1 to connect the sensor cable from the de-excitation/discharge resistor.
- An “Optional fast de-excitation” module (Option G11). The module allows the thyristors to be fired at any time by controlling three fast relays that are independent of one another.

### Mode of operation

The two thyristors connected in an anti-parallel connection, located between connections C and D, can briefly (approx. 5 s) conduct the pulse current. The overvoltage triggers a break-over diode (BOD) on the trigger circuit which in turn triggers the blocking thyristor and conducts the firing current past the blocking thyristor through a diode connected in an anti-parallel configuration to its gate/cathode. Independent of the polarity of the overvoltage, the break-over diode is always operated in the same direction using a bridge rectifier and the firing current is limited to between 6 and 8 A using series resistors. The thyristor fires within just a microseconds and the voltage decreases quickly down to the forward voltage (1 to 1.5 V). The load current increases the temperature of the disk-type thyristor within just a few seconds and the thyristor and the stack construction absorb the thermal energy. As a consequence, the load cycle can only be repeated after a cooling time has elapsed (see Technical specifications).

The fast de-excitation option (G11) is connected to the firing circuit in such a way that the thyristors can be triggered at any time by controlling at least one of the three fast relays – that are independent of one another. This assumes that there is sufficient voltage. Generally, this is approximately 5 % of the trigger voltage. Each of the three relays can be controlled with 24 V DC, 110 V to 125 V DC or 220 V to 240 V DC.

The voltage detection for the de-excitation/discharge resistor is connected to the external de-excitation/discharge resistor. When the voltage detection responds, the supplying converter must be blocked or the current controlled down to zero. The voltage detection module requires an external 24 V DC power supply with min. 100 mA.

The de-excitation/discharge resistor is an external device and is not included in the scope of delivery of the SICROWBAR DC overvoltage protection. Its resistance must be so low that even at the highest load current, the voltage is still under the destruction limit of the supplying converter and/or the winding to be protected. The lowest possible resistance is defined by the supply voltage and the maximum load current of the converter (dimensioning the fuses). The required de-excitation time must also be taken into account when dimensioning the value of the resistance.

## Configuration

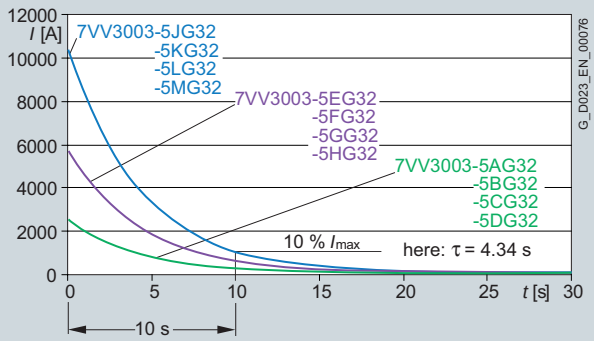
The complete arrangement comprises a SICROWBAR DC overvoltage protection and de-excitation/discharge resistor.

The following device parameters that are used to select the device must be determined:

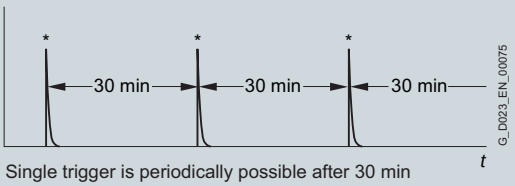
1. The firing voltage – if this is reached, then the thyristors of the SICROWBAR DC are turned-on.
2. The maximum current that flows or the maximum $I^2t$ value that occurs.

Detailed notes on the configuration, the standards that apply and the connection of the overvoltage protection are provided in the Operating Instructions, on the DVD-ROM supplied with this catalog or in the Internet under http://support.automation.siemens.com/WW/view/en/21690222/130000

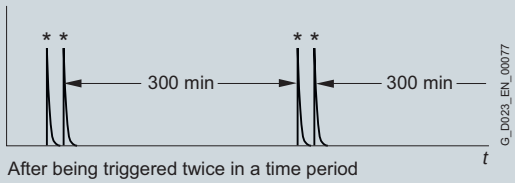
Typical load current characteristic for the three device power stages




Cooling-down time




Single trigger is periodically possible after 30 min cooling-down time.




After being triggered twice in a time period < 30 min, a cooling-down time of 300 min is required.

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## SICROWBAR DC overvoltage protection

### Technical specifications

| General technical data | SICROWBAR DC overvoltage protection |
|---|---|
| Degree of protection | IP00 acc. to EN 60529 |
| Protection class | I acc. to EN 50178 |
| Overvoltage category | III acc. to EN 60664 |
| Dimensioning creepages and clearances | Pollution degree 2 acc. to EN 50178 |
| Installation altitude | ≤ 2 000 m above sea level |
| Insulation test voltage of the power section (first test) with respect to the housing, voltage detection (signal part) and fast de-excitation (control) | 5.5 kV 50 Hz 1 minute corresponding to EN 60034-1 for rated exciting voltages up to 750 V DC |
| Climate class | 3K3 acc. to EN 60721-3-3 |
| Permissible ambient temperature | |
| • In operation | 0 ... +40 °C |
| • In storage | –25 ... +70 °C |
| Power supply required for the voltage detection | 24 V DC, +10 % , –20 %, 100 mA |

| | | SICROWBAR DC overvoltage protection | | | |
|---|---|---|---|---|---|
| | | 7VV3003-5AG32 | 7VV3003-5BG32 | 7VV3003-5CG32 | 7VV3003-5DG32 |
| Trigger voltage | V | 800 ± 100 | 1 200 ± 100 | 1 600 ± 100 | 2 200 ± 150 |
| Max. pulse current | kA | 2.5 | | | |
| Critical voltage gradient | V/µs | 1 000 | | | |
| Critical current gradient | A/µs | 80 | | | |
| $I^2t$ | $A^2s$ | $13.6 \times 10^6$ | | | |
| Dimensions | | | | | |
| • Width | mm | 265 | | | |
| • Height | mm | 350 | | | |
| • Depth | mm | 285 | | | |
| Weight, approx. | kg | 17 | | | |

| | | SICROWBAR DC overvoltage protection | | | |
|---|---|---|---|---|---|
| | | 7VV3003-5EG32 | 7VV3003-5FG32 | 7VV3003-5GG32 | 7VV3003-5HG32 |
| Trigger voltage | V | 1 600 ± 100 | 2 200 ± 150 | 2 600 ± 150 | 3 000 ± 150 |
| Max. pulse current | kA | 5.8 | | | |
| Critical voltage gradient | V/µs | 1 000 | | | |
| Critical current gradient | A/µs | 300 | | | |
| $I^2t$ | $A^2s$ | $73 \times 10^6$ | | | |
| Dimensions | | | | | |
| • Width | mm | 265 | | | |
| • Height | mm | 350 | | | |
| • Depth | mm | 285 | | | |
| Weight, approx. | kg | 18 | | | |

| | | SICROWBAR DC overvoltage protection | | | |
|---|---|---|---|---|---|
| | | 7VV3003-5JG32 | 7VV3003-5KG32 | 7VV3003-5LG32 | 7VV3003-5MG32 |
| Trigger voltage | V | 1 600 ± 100 | 2 200 ± 150 | 2 600 ± 150 | 3 000 ± 150 |
| Max. pulse current | kA | 10.5 | | | |
| Critical voltage gradient | V/µs | 1 000 | | | |
| Critical current gradient | A/µs | 300 | | | |
| $I^2t$ | $A^2s$ | $239 \times 10^6$ | | | |
| Dimensions | | | | | |
| • Width | mm | 265 | | | |
| • Height | mm | 350 | | | |
| • Depth | mm | 285 | | | |
| Weight, approx. | kg | 20 | | | |

## Selection and ordering data

| Pulse current, max. | Trigger voltage, typ. | **SICROWBAR DC overvoltage protection** |
|---|---|---|
| kA | V | Order No. |
| 2.5 | 800 | **7VV3003-5AG32** |
| 2.5 | 1 200 | **7VV3003-5BG32** |
| 2.5 | 1 600 | **7VV3003-5CG32** |
| 2.5 | 2 200 | **7VV3003-5DG32** |
| 5.8 | 1 600 | **7VV3003-5EG32** |
| 5.8 | 2 200 | **7VV3003-5FG32** |
| 5.8 | 2 600 | **7VV3003-5GG32** |
| 5.8 | 3 000 | **7VV3003-5HG32** |
| 10.5 | 1 600 | **7VV3003-5JG32** |
| 10.5 | 2 200 | **7VV3003-5KG32** |
| 10.5 | 2 600 | **7VV3003-5LG32** |
| 10.5 | 3 000 | **7VV3003-5MG32** |

## Accessories

Spare parts, see in the Internet under http://workplace.automation.siemens.de/sparesonweb.

## Options

| Option | Order code | Notes | Order No. for separate order |
|---|---|---|---|
| Fast de-excitation | **G11** | Initiation of fast de-excitation using one of the three relays, of which each has the following control voltages:<br>• 220 ... 240 V DC, +10 % –20 %<br>• 110 ... 125 V DC, +10 % –20 %<br>• 24 V DC, +10 % –20 % | **7VV3003-7FG00** |

4

## SIMOREG CCP

### Overview

SIMOREG CCP

The Converter Commutation Protector SIMOREG CCP is used to protect line-commutated SINAMICS DC MASTER converters in inverter operation against inverter commutation faults.

For line-commutated inverters, an appropriate line-side counter voltage is required in order to commutate the current between the individual power semiconductors. Commutation can be prevented from being completed (commutation fault) as a result of uncontrolled switching operations, line supply dips (weak line supplies, thunderstorms, etc.). As a result, in the regenerative feedback direction, a high current flows through the line supply or a cross-current in the converter. This can result in fuses blowing or under certain circumstances can destroy the semiconductors.

The software of the SINAMICS DC MASTER identifies if inverter commutation faults are pending and then issues the command to turn off the power semiconductors in the converter to the SIMOREG CCP. SIMOREG CCP then turns off the power semiconductors, ensures that the conditions to reduce the current in the motor are present and absorbs the magnetic energy stored in the motor as electric energy.

### Benefits

SIMOREG CCP limits the current that flows when inverter commutation faults occur to a non-hazardous value so that the thyristors and the associated super-fast fuses are protected. This eliminates the complex and time consuming replacement of fuses after inverter commutation faults.

Although inverter commutation faults cannot be prevented, their effects can be.

- Gear units and the driven machine are protected by shutting off the current in time before it reaches its possible maximum value in the case of a fault therefore protecting them against inadmissibly high torque surges.
- For high rated system currents, up until now, high-speed DC circuit-breakers were used to protect the fuses against rupture. By using the CCP, protection is now cost-effectively possible even for lower line currents, whereby SIMOREG CCP has the following advantages when compared to high-speed DC circuit-breakers even at high current levels:
  - Protection also for circulating currents
  - Lower system costs
  - Lower space requirements
  - No additional air reactor to reduce the current rate-of-rise when a fault occurs
  - Lower operating costs, as it requires no maintenance
  - High degree of availability

### Design

SIMOREG CCP distinguishes itself as a result of the compact and space-saving design.

### Function

The line supply voltage, line current as well as the armature voltage are continually sensed in the SINAMICS DC MASTER.

A possible commutation fault (inverter commutation fault – inverter shoot-through) is detected from these quantities, which results in the following measures being initiated:

1. The firing pulses are immediately disabled in the SINAMICS DC MASTER

2. The converter sends a “turn-off command” to SIMOREG CCP (via the serial interface).

3. SIMOREG CCP turns off the thyristors by connecting the precharged quenching capacitors anti-parallel to all thyristors. As a consequence, the current commutates from the converter into SIMOREG CCP. The quenching capacitors are initially discharged by the currents that they accept and they are then charged with the reverse polarity. The armature current starts to decrease as soon as the voltage of the quenching capacitors has reached the value of the motor EMF. However, the armature voltage continues to increase. As soon as it has reached the limit value, resistors are switched-in, which absorb the energy fed back from the motor during the remaining time of the current reduction phase.

4. A fault message is initiated in the SINAMICS DC MASTER.

5. The SIMOREG CCP re-charges the quenching capacitors with the reverse polarity so that a new quenching operation is possible.

Each time that the line supply voltage is switched in (e.g. via a line contactor), SIMOREG CCP requires approximately 3 s until it is ready for use as the quenching capacitors must first be charged up.

After a quenching operation, SIMOREG CCP requires a certain time until it is ready for use again. The duration depends on the operations during the quenching process and immediately afterwards. On one hand, the quenching capacitors in SIMOREG CCP must be charged to the required value with the reverse polarity (approx. 10 s). On the other hand, the chopper resistors, that convert the energy into heat when the armature current is reduced, require a cooling time calculated using a algorithm in the software. Depending on the amount of energy that was dissipated, this can take up to approx. 20 min.

SINAMICS DC MASTER has setting and monitoring parameters for commissioning, operation, monitoring and diagnostics of the SIMOREG CCP. The state of the SIMOREG CCP is signaled via connectors and the triggering of the SIMOREG CCP or erroneous states are signaled using fault and alarm messages.

Data is exchanged between the SINAMICS DC MASTER and SIMOREG CCP via the serial interface.

## Integration

### *SINAMICS DC MASTER – SIMOREG CCP*

The following table lists the SIMOREG CCP units that are suitable for the particular SINAMICS DC MASTER.

This information is based on the rated unit data (taking into consideration the particular limit values) of the components and on the other hand, typical rated data for Siemens DC motors from Catalog DA 12 · 2008.

Note:
For plant and system configurations with reduced rated values (e.g. DC rating, US rating, voltage derating), under certain circumstances, suitable combinations of units can be found that are not listed in the table.

For detailed engineering and when selecting the appropriate CCP, our technical support personnel can provide you with help through the local Siemens office. Please specify the following plant or system data:

- Line supply voltages and power sections
- Required undervoltage range of the power section
- Rated motor armature voltage
- Rated motor current
- Details on the required overcurrent where necessary (magnitude, cycle duration)
- Inductance of the load (motor, cable plus if required a smoothing reactor)

| **SINAMICS DC MASTER** | | | **SIMOREG CCP** | | |
|---|---|---|---|---|---|
| Type | Rated DC voltage | Rated DC current | Type | Rated voltage | Rated current |
| | V | A | | V | A |
| 6RA8078-6DV62-0AA0 | 420 | 280 | 6RA7085-6FC00-0 | 460 V 3 AC | DC 600 |
| 6RA8081-6DV62-0AA0 | | 400 | | | |
| 6RA8085-6DV62-0AA0 | | 600 | | | |
| 6RA8078-6FV62-0AA0 | 480 | 280 | | | |
| 6RA8082-6FV62-0AA0 | | 450 | | | |
| 6RA8085-6FV62-0AA0 | | 600 | | | |
| 6RA8085-6DV62-0AA0 | 420 | 600 | 6RA7091-6FC00-0 | | DC 1 200 |
| 6RA8087-6DV62-0AA0 | | 850 | | | |
| 6RA8091-6DV62-0AA0 | | 1 200 | | | |
| 6RA8085-6FV62-0AA0 | 480 | 600 | | | |
| 6RA8087-6FV62-0AA0 | | 850 | | | |
| 6RA8091-6FV62-0AA0 | | 1 200 | | | |
| 6RA8091-6DV62-0AA0 | 420 | 1 200 | 6RA7095-6FC00-0 | | DC 2 000 |
| 6RA8093-4DV62-0AA0 | | 1 600 | | | |
| 6RA8095-4DV62-0AA0 | | 2 000 | | | |
| 6RA8081-6GV62-0AA0 | 600 | 400 | 6RA7090-6KC00-0 | 690 V 3 AC | DC 1 000 |
| 6RA8085-6GV62-0AA0 | | 600 | | | |
| 6RA8087-6GV62-0AA0 | | 850 | | | |
| 6RA8086-6KV62-0AA0 | 725 | 760 | | | |
| 6RA8090-6KV62-0AA0 | | 1 000 | | | |
| 6RA8090-6GV62-0AA0 | 600 | 1 100 | 6RA7095-6KC00-0 | | DC 2 000 |
| 6RA8093-4GV62-0AA0 | | 1 600 | | | |
| 6RA8095-4GV62-0AA0 | | 2 000 | | | |
| 6RA8090-6KV62-0AA0 | 725 | 1 000 | | | |
| 6RA8093-4KV62-0AA0 | | 1 500 | | | |
| 6RA8095-4KV62-0AA0 | | 2 000 | | | |

## SIMOREG CCP

### Technical specifications

| | | SIMOREG CCP | | | | |
|---|---|---|---|---|---|---|
| | | Type | | | | |
| | | 6RA7085-6FC00-0 | 6RA7091-6FC00-0 | 6RA7095-6FC00-0 | 6RA7090-6KC00-0 | 6RA7095-6KC00-0 |
| Rated voltage | V | 460 (+15 %/–20 %) | | | 690 (+10 %/–20 %) | |
| Rated current | A | 600 | 1 200 | 2 000 | 1 000 | 2 000 |
| Current range that can be covered [1] | A | up to 600 | up to 1 200 | up to 2 000 | up to 1 000 | up to 2 000 |
| Rated supply voltage, electronics power supply | V | 380 (–20 %) … 60 V (+15 %) 2 AC; $I_n$ = 1 A or<br>190 (–20 %) … 230 V (+15 %) 1 AC; $I_n$ = 2 A | | | | |
| Rated frequency | Hz | 45 ... 65 | | | | |
| Power loss | W | 100 | | | | |
| Ambient temperature | | | | | | |
| • Operation | °C | 0 ... 55 | | | | |
| • Storage and transport | °C | –25 ... +70 | | | | |
| Installation altitude above sea level | m | ≤ 1 000 m | | | | |
| Climate class | | 3K3 acc. to EN 60721-3-3 | | | | |
| Degree of pollution | | 2 acc. to EN 50178 [2] | | | | |
| Degree of protection | | IP00 acc. to EN 60529 | | | | |
| Dimensions | | | | | | |
| • Width | mm | 406 | | | | |
| • Height | mm | 780 | | | | |
| • Depth | mm | 500 | | | | |
| Weight, approx. | kg | 35 | 35 | 55 | 45 | 75 |
| Fuse for connections 1U1, 1V1, 1W1 and 1D1 | | 3NA3365-6<br>1 each | 3NA3365-6<br>1 each | 3NA3365-6<br>2 each in parallel | 3NA3365-6<br>1 each | 3NA3365-6<br>2 each in parallel |
| Fuse for connections 2U1, 2V1, 2W1 (10 A cable protection) | | DIAZED 5SD604 | | | | |

[1] The current range that can be covered corresponds to the actual rated current of the SINAMICS DC MASTER. When the rated current is reduced (via parameter) then the lower value obtained applies. This means that for a SINAMICS DC MASTER with (according to the type plate) a rated current higher than 2 000 A (necessary e.g. to maintain longer specified overload times), it is possible to use the CCP if the actual rated current, specified by the parameterization, does not exceed 2 000 A. The possible overload capability of 1.8x the actual rated current can be additionally utilized.

[2] Definition of pollution degree 2:
Generally only non-conductive pollution occurs. However, occasionally conductive pollution can be expected for a short period of time if the electronic equipment is not operational.

## Technical specifications (continued)

| General technical data | | | |
|---|---|---|---|
| **Relevant standards** | | | |
| EN 50178 | Electronic equipment for use in power installations | | |
| EN 50274 | Low-voltage switchgear and controlgear assemblies: Protection against electric shock – Protection against unintentional direct contact with hazardous live parts | | |
| EN 60146-1-1 | Semiconductor converters: General requirements and line-commutated converters; specification of basic requirements | | |
| EN 61800-1 | Adjustable speed electrical power drive systems, Part 1 – (DC drives) General requirements – Rating specifications for low-voltage DC power drive systems | | |
| EN 61800-3 | Adjustable speed electrical power drive systems, Part 3 – EMC product standard including specific test methods | | |
| EN 61800-5-1 | Adjustable speed electrical power drive systems – Part 5-1: Requirements regarding safety – electrical, thermal, and energy requirements | | |
| IEC 62103 (identical to EN 50178) | Electronic equipment for use in power installations | | |
| UBC 97 | Uniform Building Code | | |
| **Mechanical strength** | **Storage** | **Transport** | **Operation** |
| Vibratory load | 1M2 acc. to EN 60721-3-1 (dropping not permissible) | 2M2 acc. to EN 60721-3-2 (dropping not permissible) | Constant deflection: 0.075 mm at 10 to 58 Hz Constant acceleration: 10 $m/s^2$ at > 58 to 200 Hz (testing and measuring techniques acc. to EN 60068-2-6, Fc) |
| Shock load | | | 100 $m/s^2$ at 11 ms (testing and measuring techniques acc. to EN 60068-2-27, Ea) |
| **Approvals** | | | |
| UL/cUL | UL file No.: E145153 | | |
| UL 508 C (UL Standard for Power Conversion Equipment) | Certification of the units up to and including 575 V | | |
| GOST | | | |

## Selection and ordering data

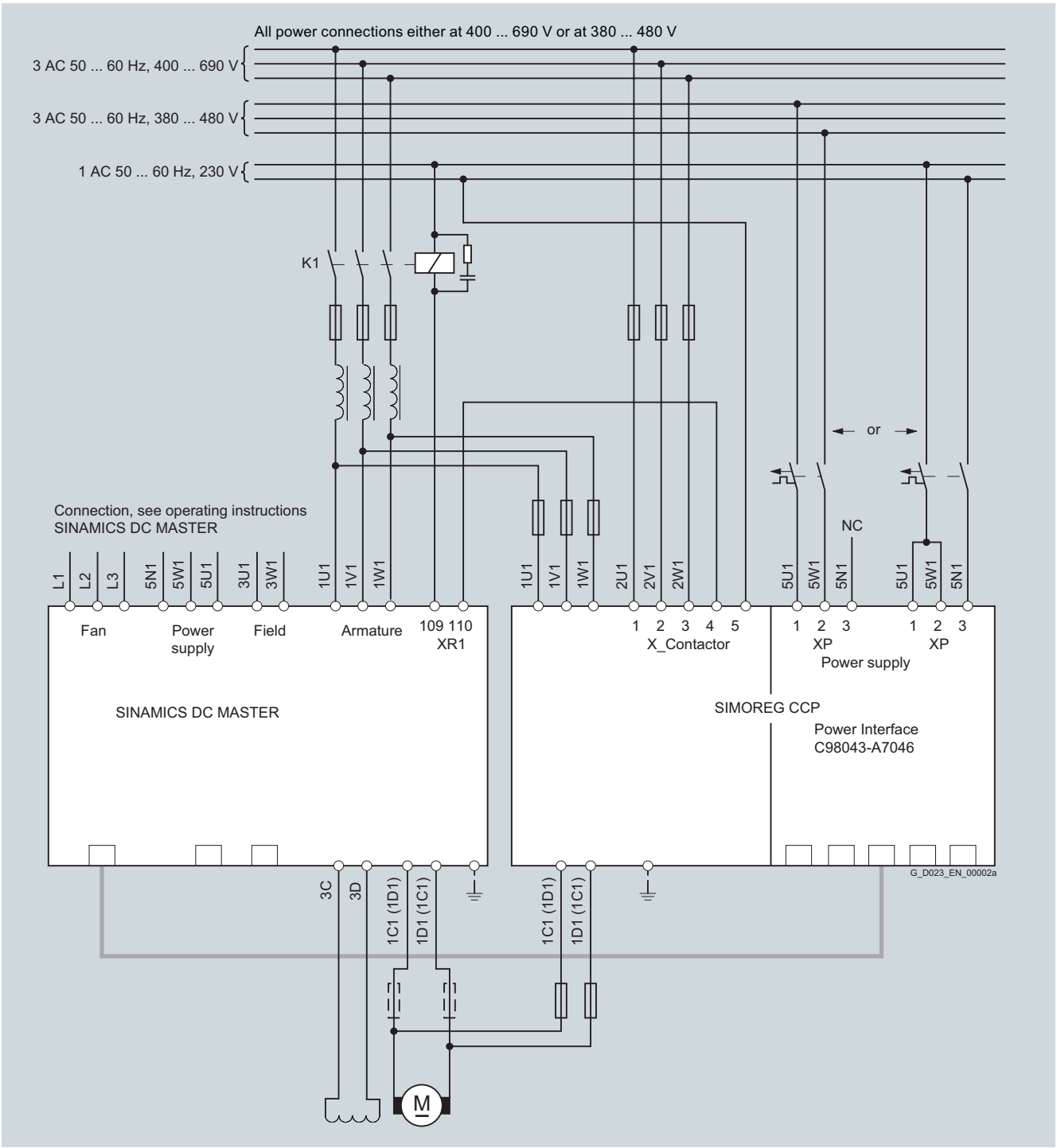
| Rated voltage | Rated current | **SIMOREG CCP** |
|---|---|---|
| V | A | Order No. |
| 460 | 600 | **6RA7085-6FC00-0** |
| | 1 200 | **6RA7091-6FC00-0** |
| | 2 000 | **6RA7095-6FC00-0** |
| 690 | 1 000 | **6RA7090-6KC00-0** |
| | 2 000 | **6RA7095-6KC00-0** |

## Accessories

| Description | Order No. |
|---|---|
| **Operating Instructions** for SIMOREG CCP in printed form | |
| • English, German | **6RX1700-0DD74** (from Edition 04) |
| • French, Italian, Spanish | **6RX1700-0DD83** (from Edition 04) |
| **Operating Instructions** for SINAMICS DC MASTER and SIMOREG CCP on DVD English, French, German, Italian, Spanish, Russian [1] | **6RX1800-0AD64** (for SIMOREG CCP from Edition 04) |
| **Patch cable UTP CAT5** according to ANSI/EIA/TIA 568 Parallel patch cable for SINAMICS DC MASTER and SIMOREG CCP, approx. 5 m, connecting cable, pulse blocking interface to connected SIMOREG CCPs in parallel, connecting cable, pulse blocking interface to the SINAMICS DC MASTER | **6RY1707-0AA08** |
| **FiringUnitTrigger Board** Printed circuit board to inhibit the firing pulses for a parallel connection | **6RY1803-0CP00** |

[1] However Russian not for SIMOREG CCP.

## Schematics

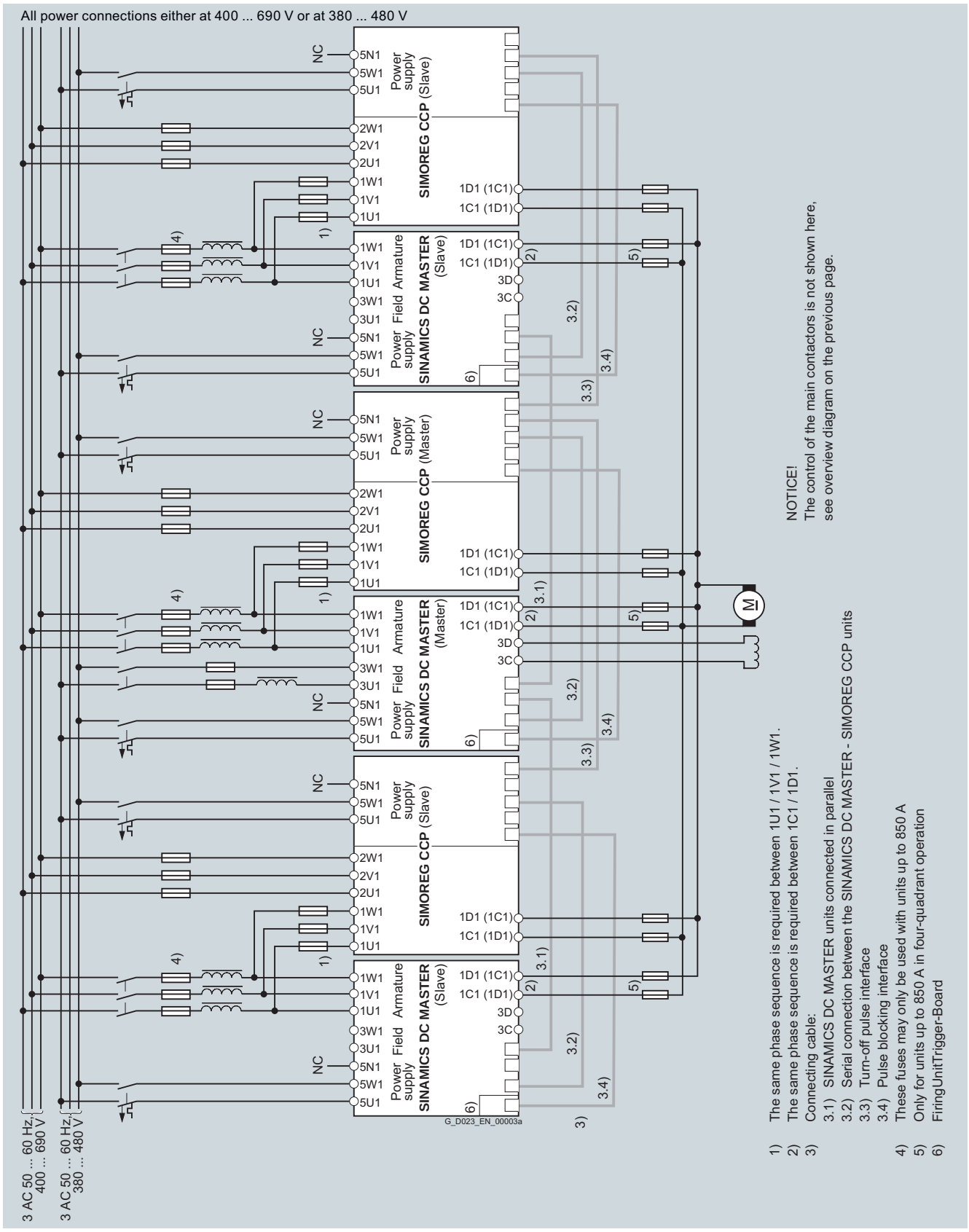



Block diagram

Operation without a main contactor is not permissible.
The control voltage for the main contactor (or the circuit-breaker) must always be routed via terminal XR (connection 109 and 110) of the SINAMICS DC MASTER unit and via terminal X_Contactor (connections 4 and 5) of the SIMOREG CCP.

For applications with SIMOREG CCP, in the case of a fault, the converter or SIMOREG CCP must be able to disconnect safely the arrangement from the line supply. Further, it must be ensured that the total of the delay times of all of the switching elements in the control circuit must not exceed the time set using the corresponding parameters. When SINAMICS DC MASTER units are connected in parallel, each unit is directly connected to a SIMOREG CCP in parallel (refer to the block diagram for the parallel connection).

## Schematics (continued)




Block diagram for the parallel connection

## Notes

# Engineering information

5

## Dynamic overload capability

### Overview

*Determining the dynamic overload capability*

**Function overview**

The rated DC current specified on the unit rating plate (maximum permissible continuous DC current) may be exceeded in operation. The extent to which this value is exceeded and how long this lasts are subject to certain limits, which are explained in more detail in the following.

The absolute upper limit for the value of the overload currents is 1.8x the rated DC current. The maximum overload duration depends on the time characteristic of the overload current as well as on the load history of the unit and also depends on the specific unit.

Each overload must be preceded by an underload (load phase with load current < rated DC current). Once the maximum permissible overload duration has elapsed, the load current must return to at least an absolute value ≤ the rated DC current.

The dynamic overload duration is made possible by thermally monitoring the power section ($I^2t$ monitoring). $I^2t$ monitoring uses the time characteristic of the actual load current to calculate the time characteristic of a substitute value for the increase of the depletion layer temperature of the thyristors above the ambient temperature. In this case, unit-specific properties (e.g. thermal resistances and time constants) are incorporated in the calculation. When the converter unit is switched on, the calculation process starts with the initial values that were determined before the shutdown/line supply failure. The environmental conditions (ambient temperature and installation altitude) must be taken into account when setting a parameter.

$I^2t$ monitoring responds when the calculated substitute depletion layer temperature rise exceeds the permissible value. Two alternatives can be parameterized as response:

- Alarm with a reduction of the armature current setpoint to the rated DC current or
- Fault with unit shutdown

$I^2t$ monitoring can be disabled. In this case, the armature current is limited to the rated DC current.

**Configuring for the dynamic overload capability**

The configuring sheets contain the following information:

- The maximum overload duration $t_{an}$ when starting with a cold power section and specified, constant overload,
- The maximum zero current interval $t_{ab}$ (maximum cooling down time) until the “cold” thermal state of the power section is reached, and
- Fields of limiting characteristics for determining the overload capability during thermally stabilized, intermittent operation with overload (periodic duty cycles)

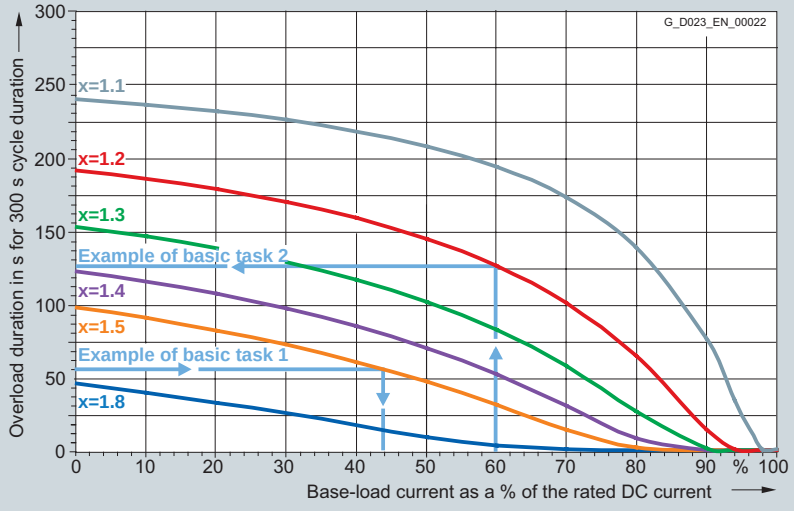
Remark: The power section is considered to be “cold” if the calculated substitute depletion layer temperature rise is less than 5% of its maximum permissible value. This state can be queried using a binary assignable output.

Structure of the fields of limiting characteristics for intermittent operation with overload

The fields of limiting characteristics refer to a duty cycle of the intermittent overload operation with a total duration (time period) of 300 s. Such a duty cycle comprises two time sections – the base-load duration (armature current actual value ≤ rated DC current) and the overload duration (armature current actual value ≥ rated DC current).

Each limiting characteristic represents a unit-specific maximum base-load current for a specific overload factor (limiting base-load current, specified as a % of the rated DC current) over the minimum base-load duration (limiting base-load duration). For the remaining duration of the duty cycle, the maximum permissible overload current is determined by the overload factor. If no limiting characteristic has been specified for the required overload factor, then it will be subject to the limiting characteristic for the next highest overload factor.

The fields of limiting characteristics are valid for a duty cycle of 300 s. Using basic calculation algorithms, duty cycles can be configured with duty cycle durations of longer than or shorter than 300 s. This will now be shown using two basic tasks.




| Overload with x-times rated DC current | $t_{an}$ (s) |
|---|---|
| x=1.1 | 1438 |
| x=1.2 | 906 |
| x=1.3 | 631 |
| x=1.4 | 455 |
| x=1.5 | 333 |
| x=1.8 | 123 |

$t_{ab}$ (s) = 2193

Characteristic example for basic tasks 1 and 2

## Overview (continued)

Basic task 1

- Given:
  Unit, cycle duration, overload factor, overload duration
- To be found:
  (Min.) base-load duration and max. base-load current
- Solution:

| | Cycle duration | |
|---|---|---|
| | < 300 s | ≥ 300 s |
| 1. Determine the characteristic | Select the limiting characteristic for the specific unit and the specific overload factor | |
| 2. Overload duration$_{300}$ = | 300 s/cycle duration × overload duration | Overload duration$_{300}$ |
| 3. Base-load duration$_{300}$ = | 300 s – overload duration$_{300}$ | |
| 4. Base-load duration$_{300}$ < base-load duration$_{300}$ for max. base-load current = 0 | Yes: Required duty cycle cannot be configured<br>No: Read the max. base-load current for overload duration$_{300}$ from the limiting characteristic | |
| 5. Determine the percentage for the base-load current | Read the percentage for the base-load currents from the diagram | |

Example for basic task 1

- Given:
  - Unit with 30 A
  - Cycle duration 113.2 s
  - Overload factor 1.45
  - Overload duration 20 s
- To be found:
  - (Min.) base-load duration
  - Max. base-load current
- Solution:
  - Limiting characteristic for a unit with 30 A
  - Overload factor 1.5
  - Overload duration$_{300}$ = 300 s/113.2 s × 20 s = 53 s →
  - Max. base-load current = 44 % $I_{rated}$ = 13.2 A

Basic task 2

- Given:
  Unit, cycle duration, overload factor, base-load current
- To be found:
  Maximum overload duration, minimum base-load duration
- Solution:

| | Cycle duration | |
|---|---|---|
| | < 300 s | ≥ 300 s |
| 1. Determine the characteristic | Select the limiting characteristic for the specific unit and the specific overload factor | |
| 2. Max. overload duration = | (Cycle duration/300 s) × overload duration$_{300}$ | 300 s – base-load duration$_{300}$ |
| 3. Min. base-load duration = | Cycle duration – max. overload duration | Cycle duration – max. overload duration |

Example for basic task 2

- Given:
  - Unit with 30 A
  - Cycle duration 140 s
  - Overload factor 1.15
  - Base load current = 0.6 × $I_{rated}$ = 18 A
- To be found:
  - Maximum overload duration
  - Minimum base-load duration

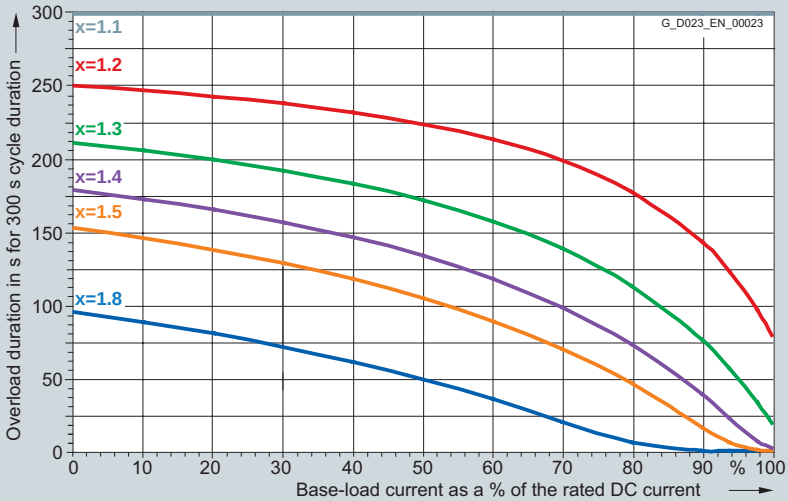
Solution:
- Limiting characteristic for a unit with 30 A
- Overload factor 1.2
- Base-load current = 60 % $I_{rated}$ →
- Overload duration$_{300}$ = 127 s
- Max. overload duration = 140 s/300 s × 127 s = 59 s
- Min. base-load duration = 140 s - 59 s = 81 s

Base-load duration$_{300}$ = min. base-load duration for 300 s cycle duration (300 s overload duration)

Overload duration$_{300}$ = max. overload duration for 300 s cycle duration

## Dynamic overload capability

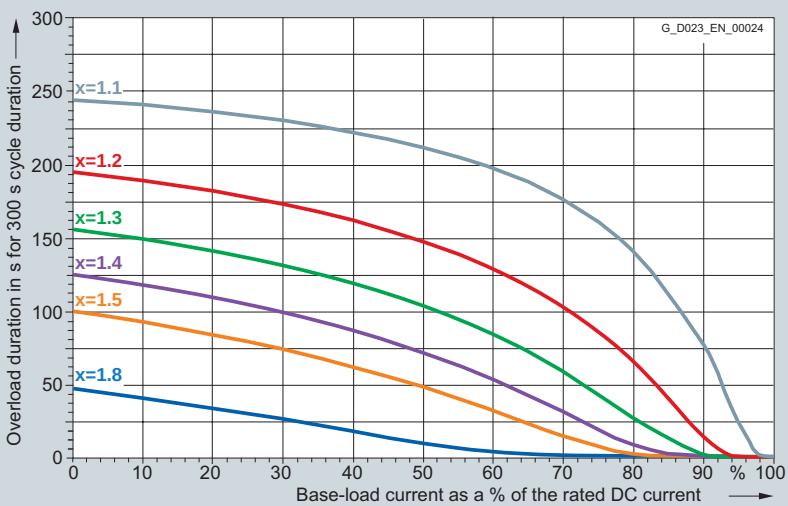
### Overview (continued)




| Overload with x-times rated DC current | $t_{an}$ (s) |
|---|---|
| x=1.1 | 9227 |
| x=1.2 | 1633 |
| x=1.3 | 1112 |
| x=1.4 | 833 |
| x=1.5 | 651 |
| x=1.8 | 342 |

$t_{ab}$ (s) = 2303

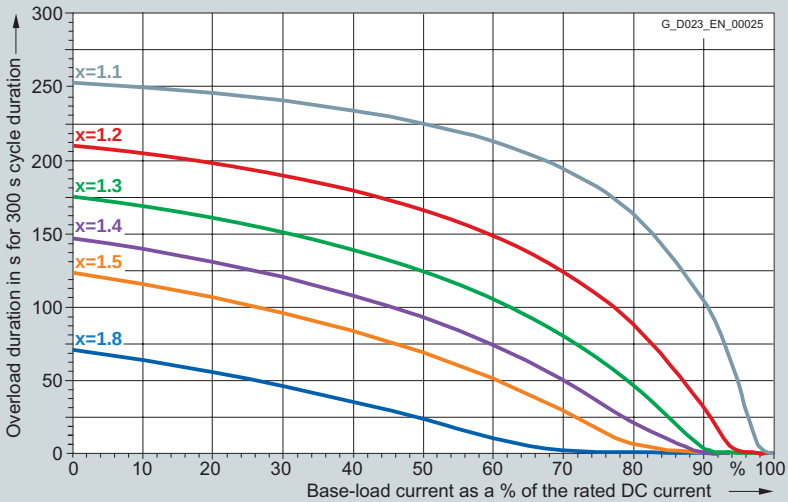
6RA8013-6DV62-0AA0 15 A/four-quadrant operation 400 V, 6RA8013-6FV62-0AA0 15 A/four-quadrant operation 480 V




| Overload with x-times rated DC current | $t_{an}$ (s) |
|---|---|
| x=1.1 | 1438 |
| x=1.2 | 906 |
| x=1.3 | 631 |
| x=1.4 | 455 |
| x=1.5 | 333 |
| x=1.8 | 123 |

$t_{ab}$ (s) = 2193

6RA8018-6DV62-0AA0 30 A/four-quadrant operation 400 V, 6RA8018-6FV62-0AA0 30 A/four-quadrant operation 480 V

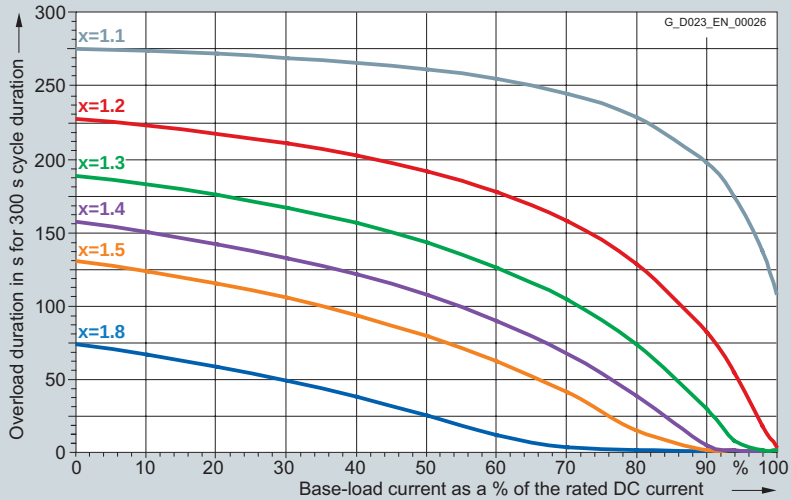



| Overload with x-times rated DC current | $t_{an}$ (s) |
|---|---|
| x=1.1 | 2081 |
| x=1.2 | 1356 |
| x=1.3 | 990 |
| x=1.4 | 758 |
| x=1.5 | 593 |
| x=1.8 | 296 |

$t_{ab}$ (s) = 2902

6RA8025-6DS22-0AA0 60 A/two-quadrant operation 400 V, 6RA8025-6FS22-0AA0 60 A/two-quadrant operation 480 V, 6RA8025-6GS22-0AA0 60 A/two-quadrant operation 575 V

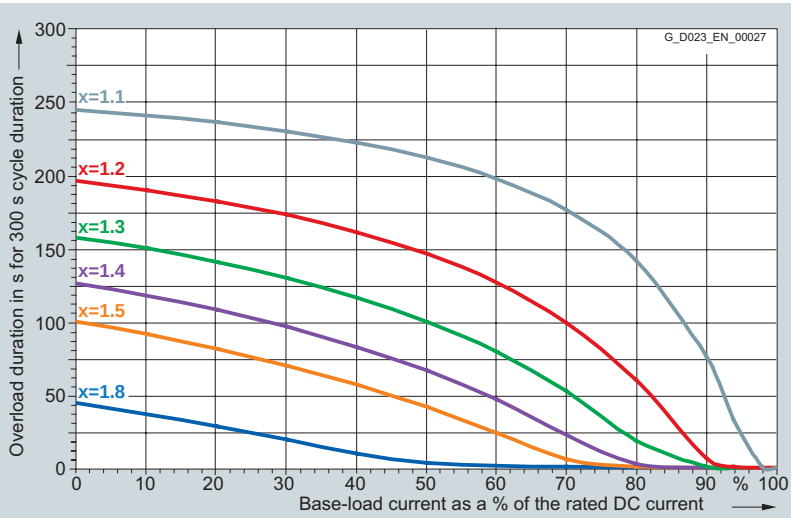
## Overview (continued)




| Overload with x-times rated DC current | $t_{an}$ (s) |
|---|---|
| x=1.1 | 2536 |
| x=1.2 | 1447 |
| x=1.3 | 1017 |
| x=1.4 | 762 |
| x=1.5 | 588 |
| x=1.8 | 283 |

$t_{ab}$ (s) = 2571

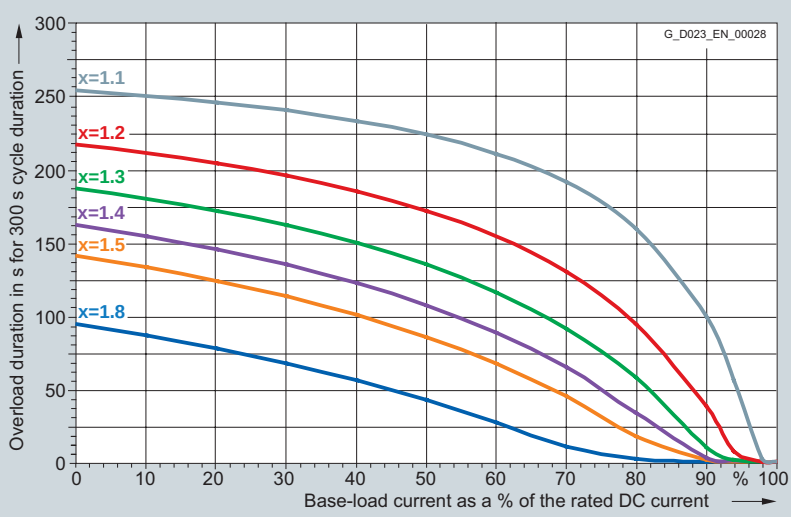
6RA8025-6DV62-0AA0 60 A/four-quadrant operation 400 V, 6RA8025-6FV62-0AA0 60 A/four-quadrant operation 480 V, 6RA8025-6GV62-0AA0 60 A/four-quadrant operation 575 V




| Overload with x-times rated DC current | $t_{an}$ (s) |
|---|---|
| x=1.1 | 1877 |
| x=1.2 | 1184 |
| x=1.3 | 830 |
| x=1.4 | 603 |
| x=1.5 | 442 |
| x=1.8 | 150 |

$t_{ab}$ (s) = 2725

6RA8028-6DS22-0AA0 90 A/two-quadrant operation 400 V, 6RA8028-6FS22-0AA0 90 A/two-quadrant operation 480 V



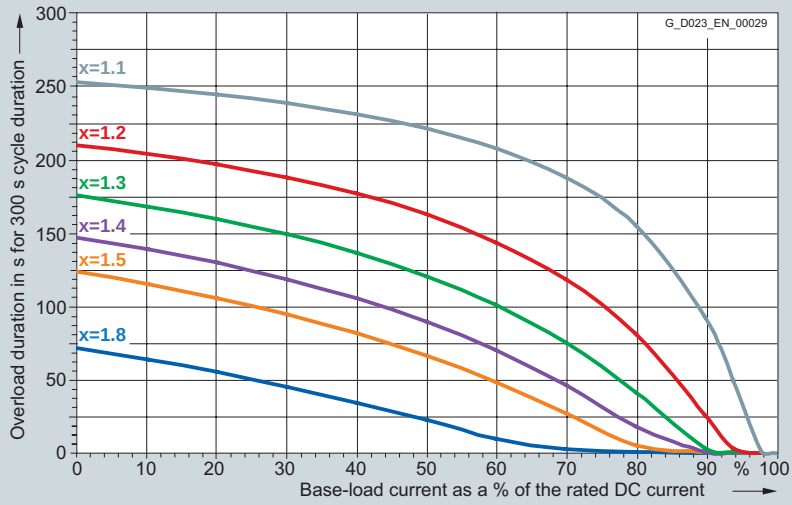

| Overload with x-times rated DC current | $t_{an}$ (s) |
|---|---|
| x=1.1 | 1911 |
| x=1.2 | 1320 |
| x=1.3 | 1007 |
| x=1.4 | 804 |
| x=1.5 | 659 |
| x=1.8 | 391 |

$t_{ab}$ (s) = 2683

6RA8028-6DV62-0AA0 90 A/four-quadrant operation 400 V, 6RA8028-6FV62-0AA0 90 A/four-quadrant operation 480 V

## Dynamic overload capability

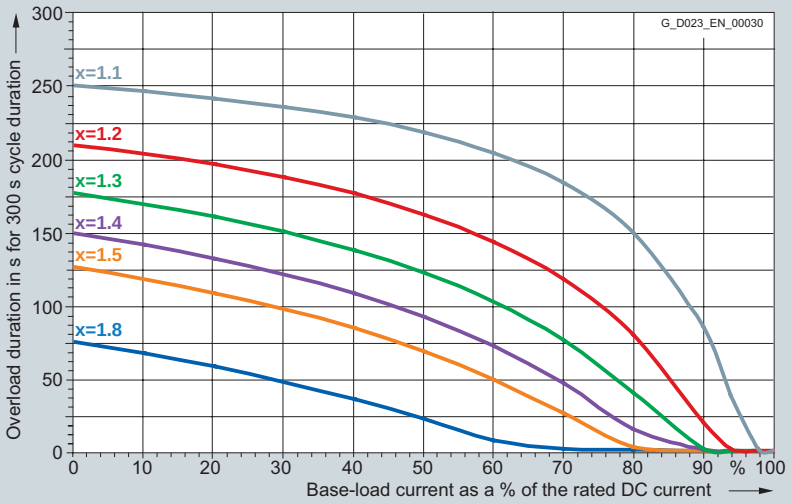
### Overview (continued)




| Overload with x-times rated DC current | $t_{an}$ (s) |
|---|---|
| x=1.1 | 1994 |
| x=1.2 | 1319 |
| x=1.3 | 968 |
| x=1.4 | 743 |
| x=1.5 | 583 |
| x=1.8 | 289 |

$t_{ab}$ (s) = 2828

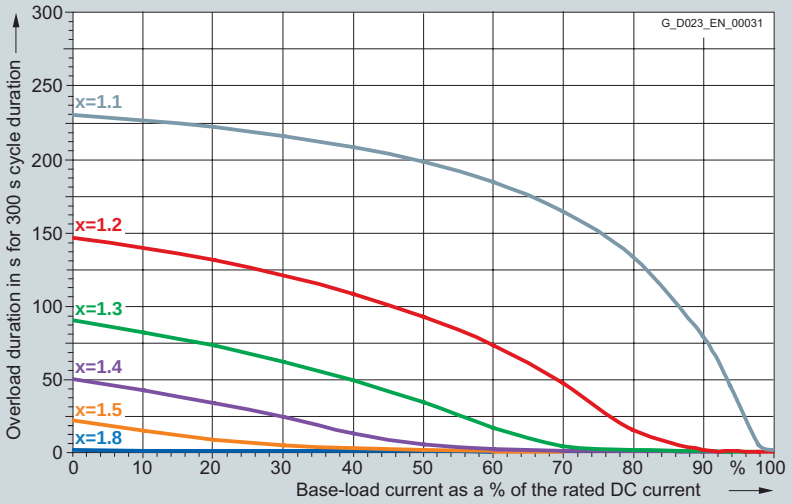
6RA8031-6DS22-0AA0 125 A/two-quadrant operation 400 V, 6RA8031-6FS22-0AA0 125 A/two-quadrant operation 480 V,
6RA8031-6GS22-0AA0 125 A/two-quadrant operation 575 V




| Overload with x-times rated DC current | $t_{an}$ (s) |
|---|---|
| x=1.1 | 2159 |
| x=1.2 | 1452 |
| x=1.3 | 1078 |
| x=1.4 | 835 |
| x=1.5 | 662 |
| x=1.8 | 343 |

$t_{ab}$ (s) = 3158

6RA8031-6DV62-0AA0 125 A/four-quadrant operation 400 V, 6RA8031-6FV62-0AA0 125 A/four-quadrant operation 480 V,
6RA8031-6GV62-0AA0 125 A/four-quadrant operation 575 V

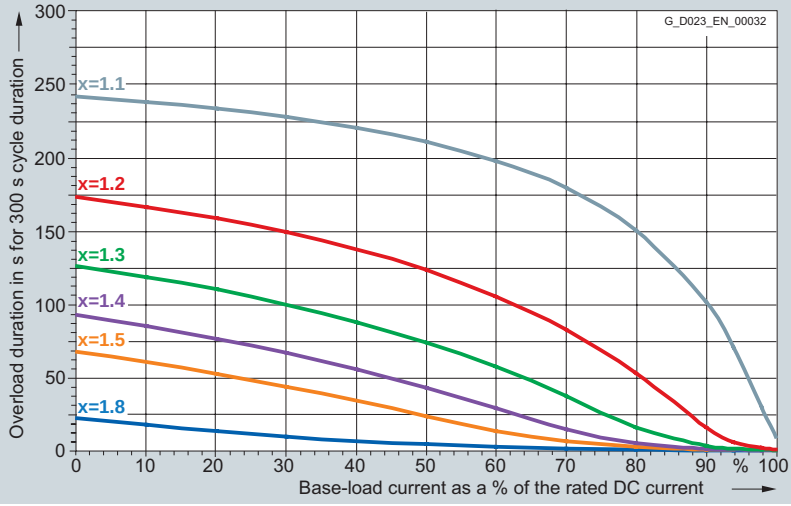



| Overload with x-times rated DC current | $t_{an}$ (s) |
|---|---|
| x=1.1 | 680 |
| x=1.2 | 318 |
| x=1.3 | 167 |
| x=1.4 | 79 |
| x=1.5 | 25 |
| x=1.8 | 1 |

$t_{ab}$ (s) = 813

6RA8075-6DS22-0AA0 210 A/two-quadrant operation 400 V, 6RA8075-6DV62-0AA0 210 A/four-quadrant operation 400 V,
6RA8075-6FS22-0AA0 210 A/two-quadrant operation 480 V, 6RA8075-6FV62-0AA0 210 A/four-quadrant operation 480 V,
6RA8075-6GS22-0AA0 210 A/two-quadrant operation 575 V, 6RA8075-6GV62-0AA0 210 A/four-quadrant operation 575 V

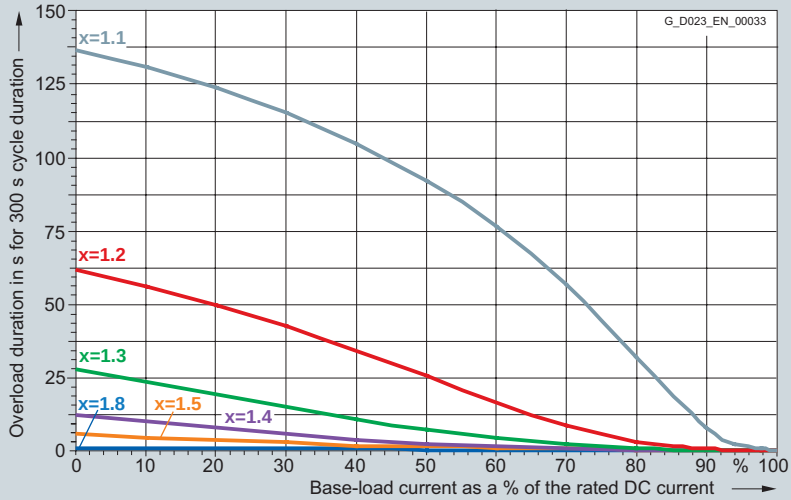
## Overview (continued)




| Overload with x-times rated DC current | $t_{an}$ (s) |
|---|---|
| x=1.1 | 729 |
| x=1.2 | 381 |
| x=1.3 | 238 |
| x=1.4 | 156 |
| x=1.5 | 103 |
| x=1.8 | 26 |

$t_{ab}$ (s) = 863

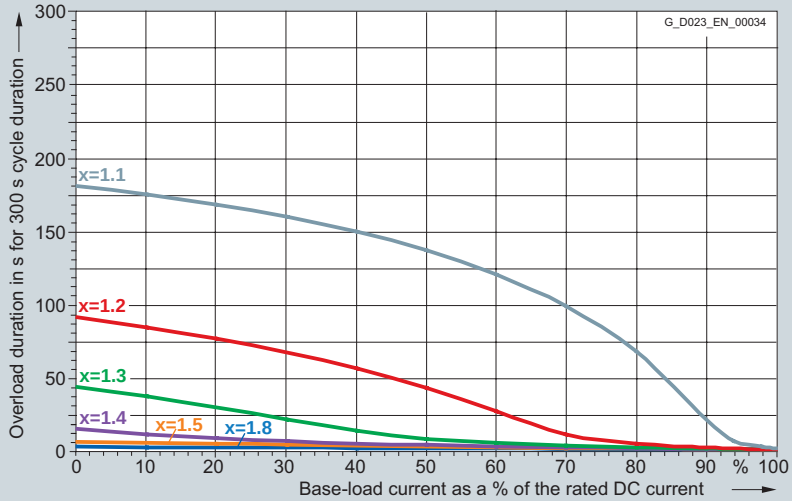
6RA8078-6DS22-0AA0 280 A/two-quadrant operation 400 V, 6RA8078-6DV62-0AA0 280 A/four-quadrant operation 400 V,
6RA8078-6FS22-0AA0 280 A/two-quadrant operation 480 V, 6RA8078-6FV62-0AA0 280 A/four-quadrant operation 480 V




| Overload with x-times rated DC current | $t_{an}$ (s) |
|---|---|
| x=1.1 | 132 |
| x=1.2 | 55 |
| x=1.3 | 23 |
| x=1.4 | 9 |
| x=1.5 | 4 |
| x=1.8 | 1 |

$t_{ab}$ (s) = 203

6RA8081-6DS22-0AA0 400 A/two-quadrant operation 400 V, 6RA8081-6GS22-0AA0 400 A/two-quadrant operation 575 V



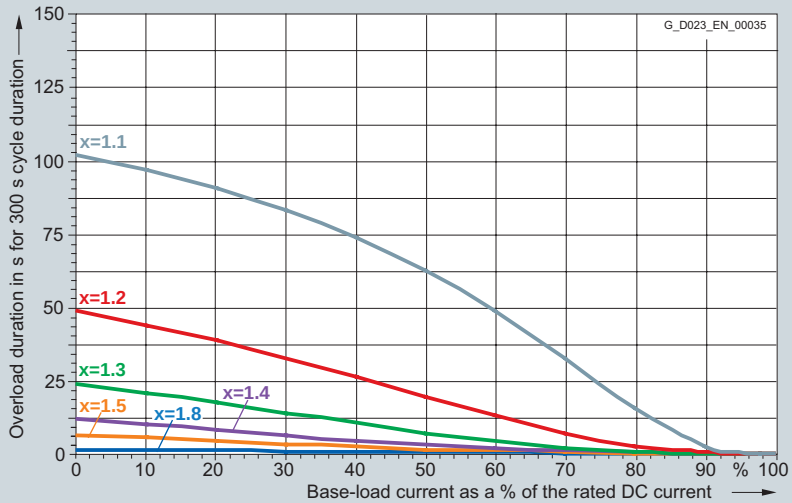

| Overload with x-times rated DC current | $t_{an}$ (s) |
|---|---|
| x=1.1 | 265 |
| x=1.2 | 108 |
| x=1.3 | 45 |
| x=1.4 | 12 |
| x=1.5 | 5 |
| x=1.8 | 1 |

$t_{ab}$ (s) = 367

6RA8081-6DV62-0AA0 400 A/four-quadrant operation 400 V, 6RA8081-6GV62-0AA0 400 A/four-quadrant operation 575 V

## Dynamic overload capability

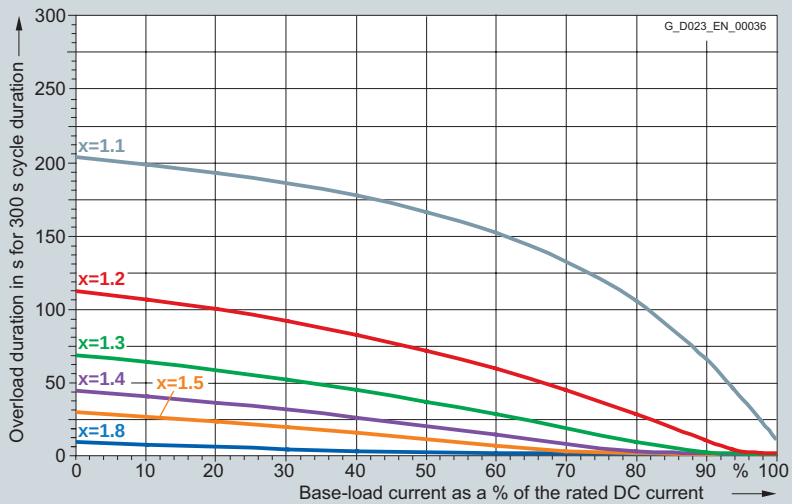
### Overview (continued)




| Overload with x-times rated DC current | $t_{an}$ (s) |
|---|---|
| x=1.1 | 110 |
| x=1.2 | 49 |
| x=1.3 | 22 |
| x=1.4 | 11 |
| x=1.5 | 6 |
| x=1.8 | 1 |

$t_{ab}$ (s) = 210

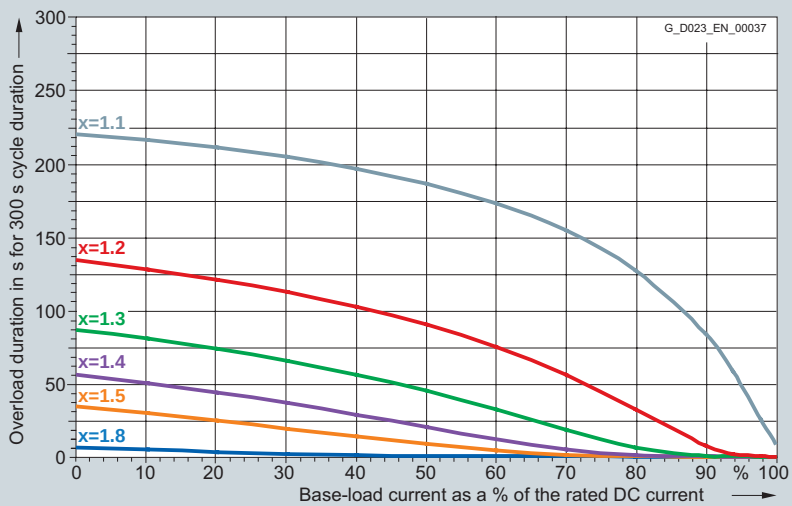
6RA8082-6FS22-0AA0 450 A/two-quadrant operation 480 V, 6RA8082-6FV62-0AA0 450 A/four-quadrant operation 480 V




| Overload with x-times rated DC current | $t_{an}$ (s) |
|---|---|
| x=1.1 | 331 |
| x=1.2 | 137 |
| x=1.3 | 75 |
| x=1.4 | 45 |
| x=1.5 | 29 |
| x=1.8 | 7 |

$t_{ab}$ (s) = 408

6RA8085-6DS22-0AA0 600 A/two-quadrant operation 400 V, 6RA8085-6FS22-0AA0 600 A/two-quadrant operation 480 V,
6RA8085-6GS22-0AA0 600 A/two-quadrant operation 575 V

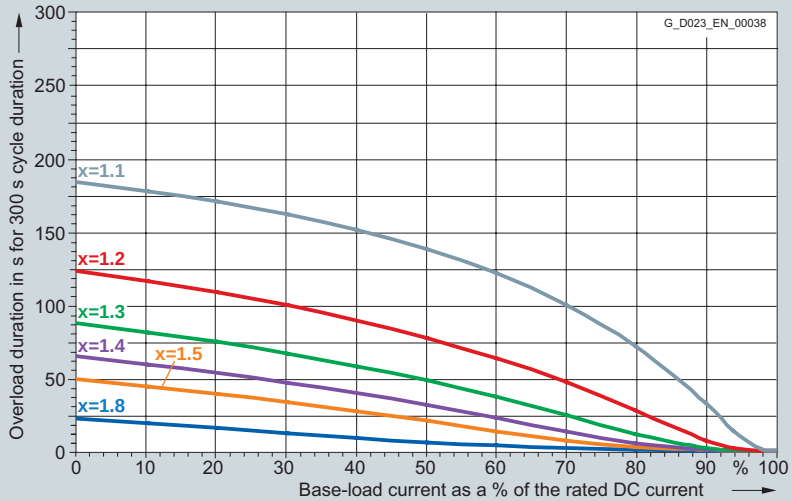



| Overload with x-times rated DC current | $t_{an}$ (s) |
|---|---|
| x=1.1 | 426 |
| x=1.2 | 184 |
| x=1.3 | 107 |
| x=1.4 | 64 |
| x=1.5 | 37 |
| x=1.8 | 5 |

$t_{ab}$ (s) = 519

6RA8085-6DV62-0AA0 600 A/four-quadrant operation 400 V, 6RA8085-6FV62-0AA0 600 A/four-quadrant operation 480 V,
6RA8085-6GV62-0AA0 600 A/four-quadrant operation 575 V

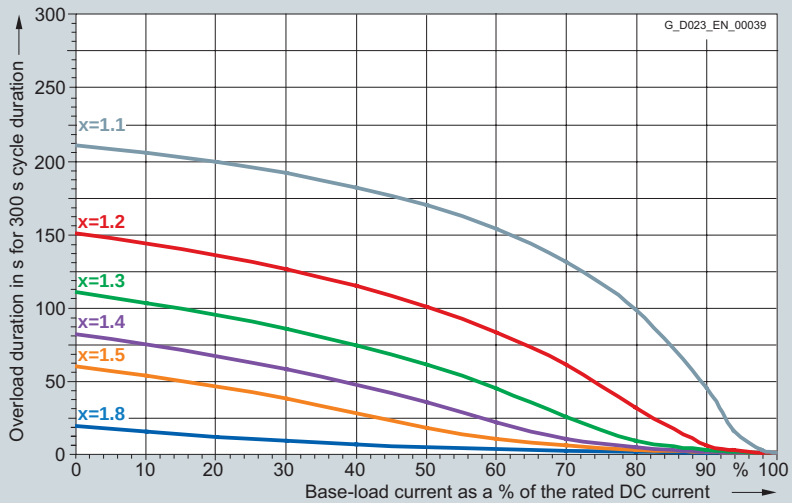
## Overview (continued)




| Overload with x-times rated DC current | $t_{an}$ (s) |
|---|---|
| x=1.1 | 312 |
| x=1.2 | 170 |
| x=1.3 | 109 |
| x=1.4 | 75 |
| x=1.5 | 55 |
| x=1.8 | 22 |

$t_{ab}$ (s) = 542

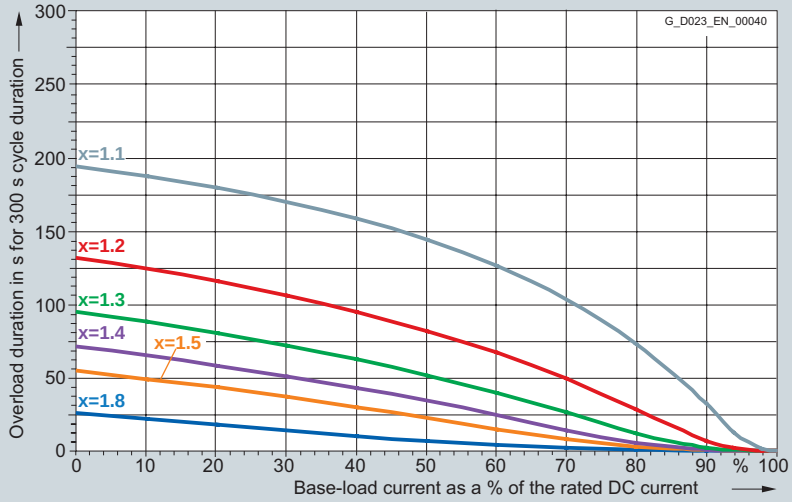
6RA8086-6KS22-0AA0 720 A/two-quadrant operation 690 V




| Overload with x-times rated DC current | $t_{an}$ (s) |
|---|---|
| x=1.1 | 411 |
| x=1.2 | 245 |
| x=1.3 | 164 |
| x=1.4 | 113 |
| x=1.5 | 79 |
| x=1.8 | 20 |

$t_{ab}$ (s) = 606

6RA8086-6KV62-0AA0 760 A/four-quadrant operation 690 V



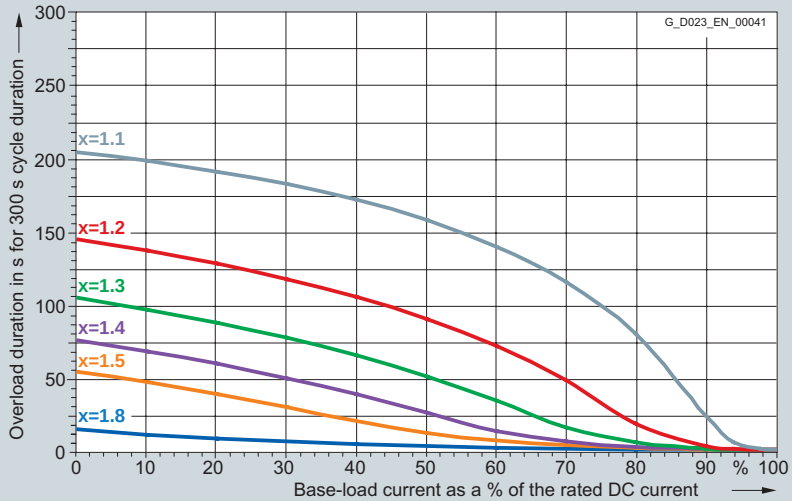

| Overload with x-times rated DC current | $t_{an}$ (s) |
|---|---|
| x=1.1 | 316 |
| x=1.2 | 175 |
| x=1.3 | 114 |
| x=1.4 | 80 |
| x=1.5 | 58 |
| x=1.8 | 25 |

$t_{ab}$ (s) = 542

6RA8087-6DS22-0AA0 850 A/two-quadrant operation 400 V, 6RA8087-6FS22-0AA0 850 A/two-quadrant operation 480 V

## Dynamic overload capability

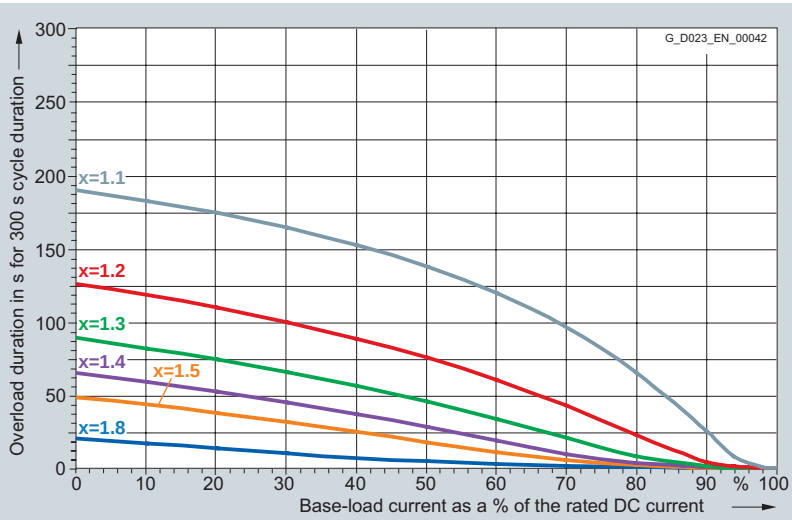
### Overview (continued)




| Overload with x-times rated DC current | $t_{an}$ (s) |
|---|---|
| x=1.1 | 382 |
| x=1.2 | 228 |
| x=1.3 | 151 |
| x=1.4 | 102 |
| x=1.5 | 68 |
| x=1.8 | 13 |

$t_{ab}$ (s) = 593

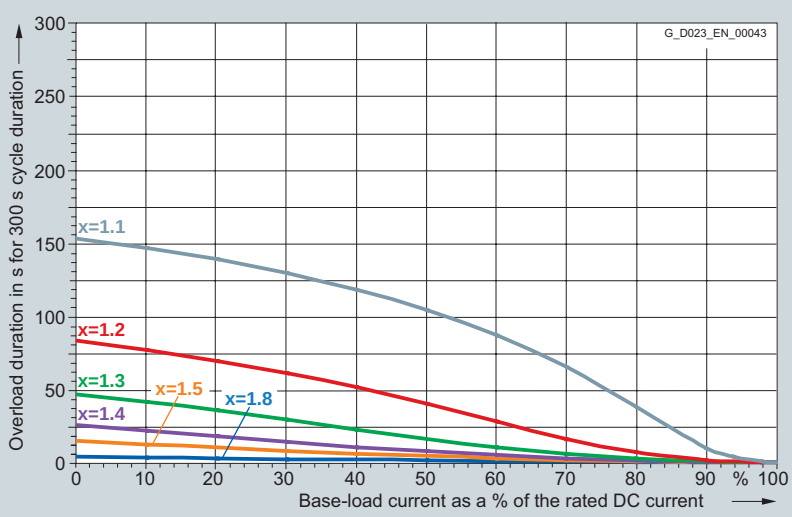
6RA8087-6DV62-0AA0 850 A/four-quadrant operation 400 V, 6RA8087-6FV62-0AA0 850 A/four-quadrant operation 480 V, 6RA8087-6GV62-0AA0 850 A/four-quadrant operation 575 V




| Overload with x-times rated DC current | $t_{an}$ (s) |
|---|---|
| x=1.1 | 296 |
| x=1.2 | 161 |
| x=1.3 | 102 |
| x=1.4 | 70 |
| x=1.5 | 50 |
| x=1.8 | 19 |

$t_{ab}$ (s) = 527

6RA8087-6GS22-0AA0 800 A/two-quadrant operation 575 V

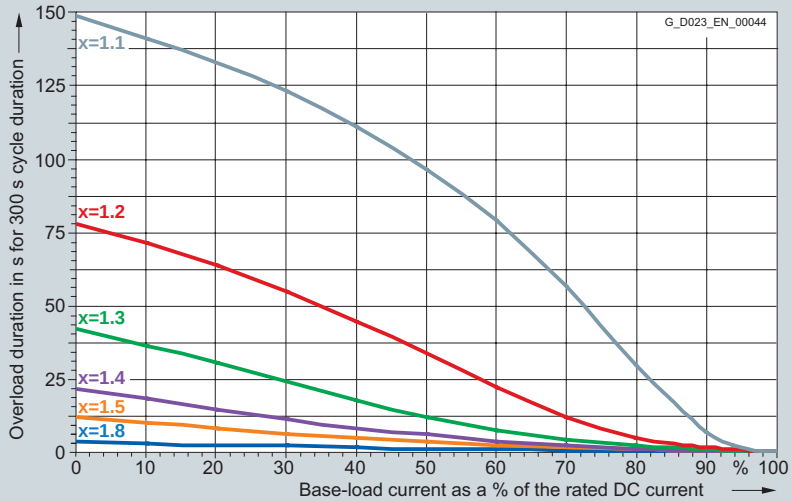



| Overload with x-times rated DC current | $t_{an}$ (s) |
|---|---|
| x=1.1 | 220 |
| x=1.2 | 99 |
| x=1.3 | 50 |
| x=1.4 | 25 |
| x=1.5 | 13 |
| x=1.8 | 4 |

$t_{ab}$ (s) = 395

6RA8088-6LS22-0AA0 950 A/two-quadrant operation 830 V, 6RA8088-6LV62-0AA0 950 A/four-quadrant operation 830 V

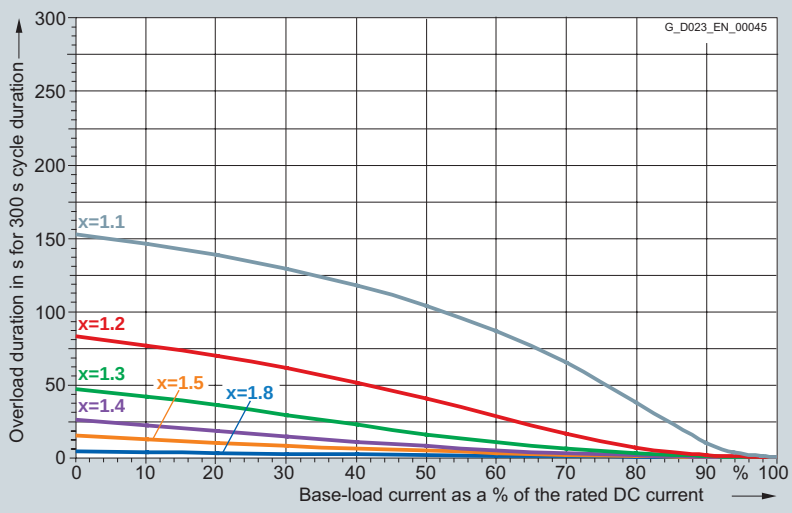
## Overview (continued)




| Overload with x-times rated DC current | $t_{an}$ (s) |
|---|---|
| x=1.1 | 208 |
| x=1.2 | 91 |
| x=1.3 | 43 |
| x=1.4 | 20 |
| x=1.5 | 10 |
| x=1.8 | 3 |

$t_{ab}$ (s) = 380

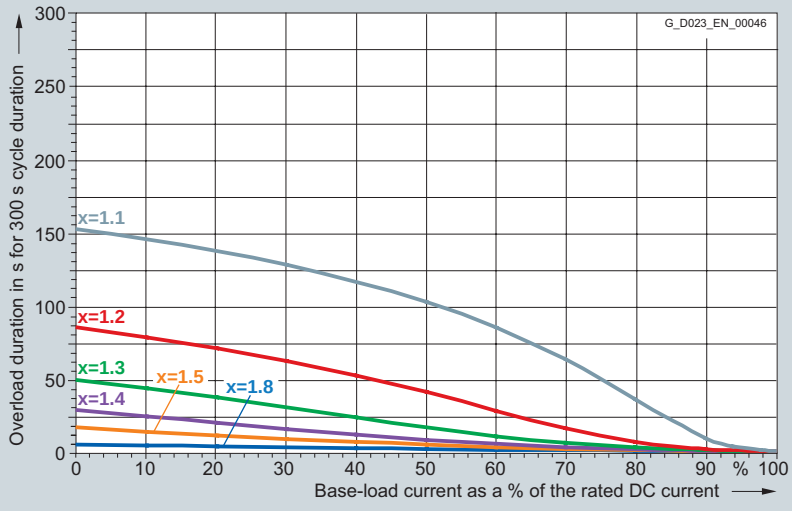
6RA8090-6GS22-0AA0 1 100 A/two-quadrant operation 575 V, 6RA8090-6GV62-0AA0 1 100 A/four-quadrant operation 575 V




| Overload with x-times rated DC current | $t_{an}$ (s) |
|---|---|
| x=1.1 | 219 |
| x=1.2 | 99 |
| x=1.3 | 50 |
| x=1.4 | 25 |
| x=1.5 | 13 |
| x=1.8 | 4 |

$t_{ab}$ (s) = 395

6RA8090-6KS22-0AA0 1 000 A/two-quadrant operation 690 V, 6RA8090-6KV62-0AA0 1 000 A/four-quadrant operation 690 V



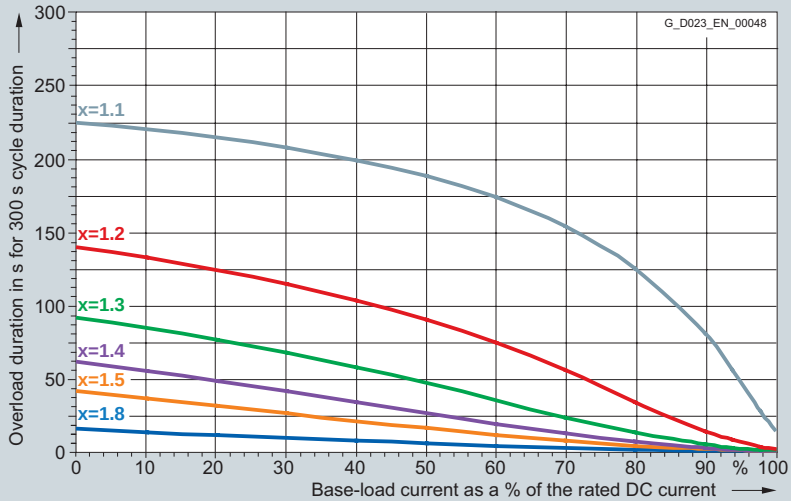

| Overload with x-times rated DC current | $t_{an}$ (s) |
|---|---|
| x=1.1 | 223 |
| x=1.2 | 104 |
| x=1.3 | 54 |
| x=1.4 | 28 |
| x=1.5 | 15 |
| x=1.8 | 4 |

$t_{ab}$ (s) = 395

6RA8091-6DS22-0AA0 1 200 A/two-quadrant operation 400 V, 6RA8091-6FS22-0AA0 1 200 A/two-quadrant operation 480 V, 6RA8091-6FV62-0AA0 1 200 A/four-quadrant operation 480 V, 6RA8091-6DV62-0AA0 1 200 A/four-quadrant operation 400 V

## Dynamic overload capability

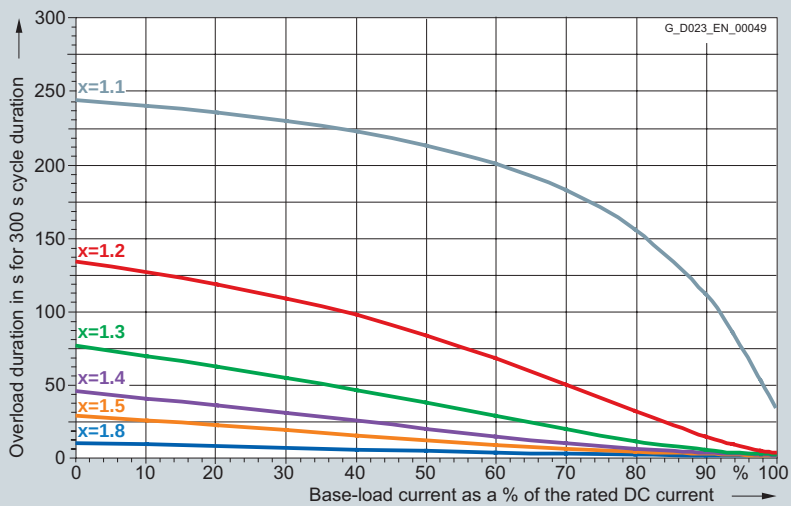
### Overview (continued)




| Overload with x-times rated DC current | $t_{an}$ (s) |
|---|---|
| x=1.1 | 519 |
| x=1.2 | 221 |
| x=1.3 | 123 |
| x=1.4 | 74 |
| x=1.5 | 46 |
| x=1.8 | 15 |

$t_{ab}$ (s) = 591

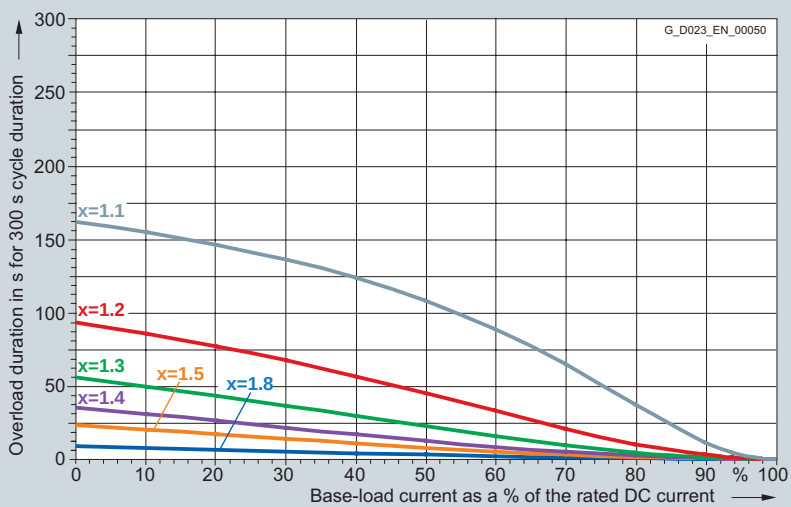
6RA8093-4DS22-0AA0 1 600 A/two-quadrant operation 400 V, 6RA8093-4DV62-0AA0 1 600 A/four-quadrant operation 400 V,
6RA8093-4GS22-0AA0 1 600 A/two-quadrant operation 575 V, 6RA8093-4GV62-0AA0 1 600 A/four-quadrant operation 575 V




| Overload with x-times rated DC current | $t_{an}$ (s) |
|---|---|
| x=1.1 | 546 |
| x=1.2 | 196 |
| x=1.3 | 92 |
| x=1.4 | 47 |
| x=1.5 | 27 |
| x=1.8 | 8 |

$t_{ab}$ (s) = 499

6RA8093-4KS22-0AA0 1 500 A/two-quadrant operation 690 V, 6RA8093-4KV62-0AA0 1 500 A/four-quadrant operation 690 V,
6RA8093-4LS22-0AA0 1 500 A/two-quadrant operation 830 V, 6RA8093-4LV62-0AA0 1 500 A/four-quadrant operation 830 V

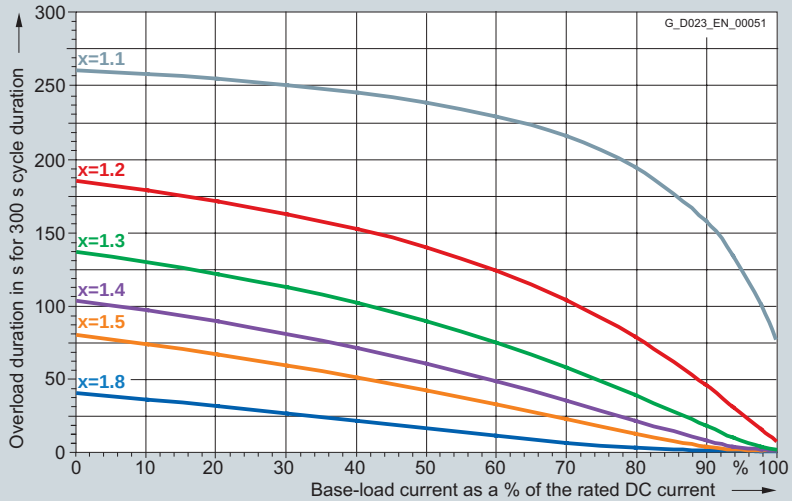



| Overload with x-times rated DC current | $t_{an}$ (s) |
|---|---|
| x=1.1 | 274 |
| x=1.2 | 129 |
| x=1.3 | 66 |
| x=1.4 | 37 |
| x=1.5 | 24 |
| x=1.8 | 8 |

$t_{ab}$ (s) = 517

6RA8095-4DS22-0AA0 2 000 A/two-quadrant operation 400 V, 6RA8095-4DV62-0AA0 2 000 A/four-quadrant operation 400 V

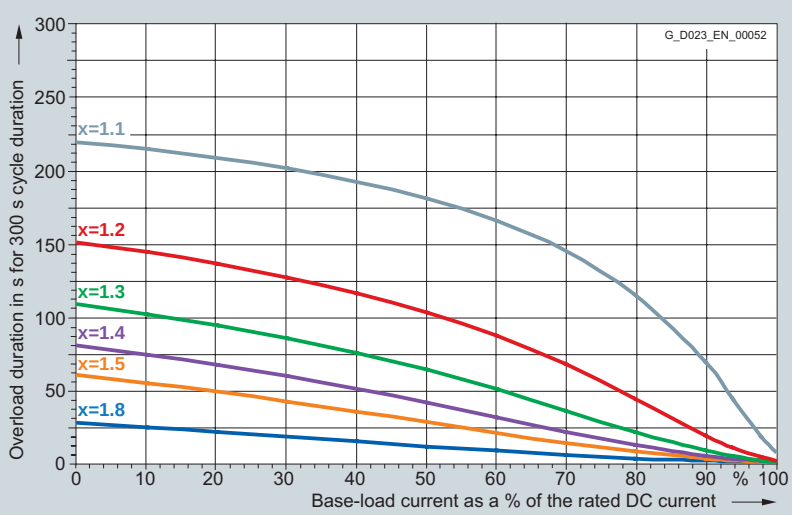
## Overview (continued)




| Overload with x-times rated DC current | $t_{an}$ (s) |
|---|---|
| x=1.1 | 1247 |
| x=1.2 | 421 |
| x=1.3 | 242 |
| x=1.4 | 159 |
| x=1.5 | 112 |
| x=1.8 | 47 |

$t_{ab}$ (s) = 1099

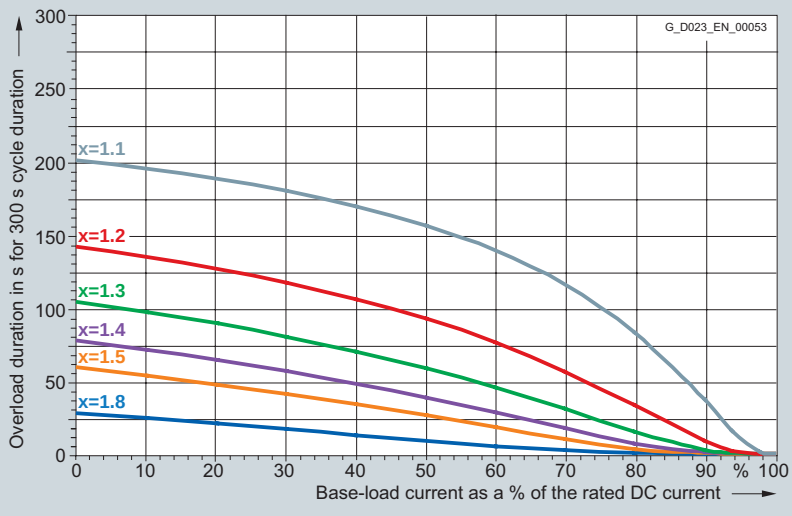
6RA8095-4GS22-0AA0 2 000 A/two-quadrant operation 575 V, 6RA8095-4GV62-0AA0 2 000 A/four-quadrant operation 575 V




| Overload with x-times rated DC current | $t_{an}$ (s) |
|---|---|
| x=1.1 | 480 |
| x=1.2 | 248 |
| x=1.3 | 156 |
| x=1.4 | 105 |
| x=1.5 | 73 |
| x=1.8 | 29 |

$t_{ab}$ (s) = 676

6RA8095-4KS22-0AA0 2 000 A/two-quadrant operation 690 V, 6RA8095-4KV62-0AA0 2 000 A/four-quadrant operation 690 V



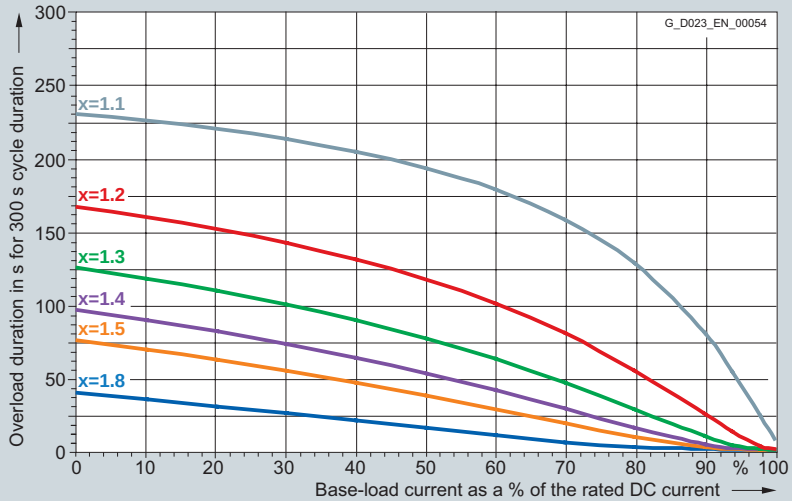

| Overload with x-times rated DC current | $t_{an}$ (s) |
|---|---|
| x=1.1 | 514 |
| x=1.2 | 259 |
| x=1.3 | 161 |
| x=1.4 | 108 |
| x=1.5 | 76 |
| x=1.8 | 31 |

$t_{ab}$ (s) = 1099

6RA8095-4LS22-0AA0 1 900 A/two-quadrant operation 830 V, 6RA8095-4LV62-0AA0 1 900 A/four-quadrant operation 830 V

## Dynamic overload capability

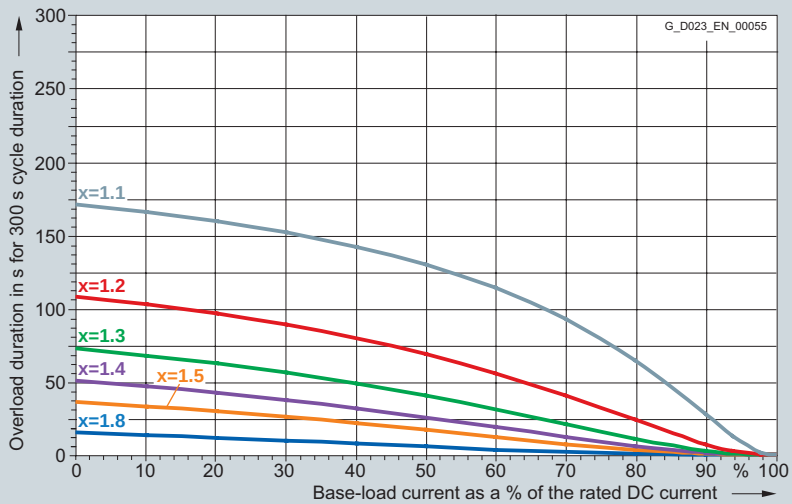
### Overview (continued)




| Overload with x-times rated DC current | $t_{an}$ (s) |
|---|---|
| x=1.1 | 754 |
| x=1.2 | 343 |
| x=1.3 | 211 |
| x=1.4 | 144 |
| x=1.5 | 104 |
| x=1.8 | 46 |

$t_{ab}$ (s) = 1118

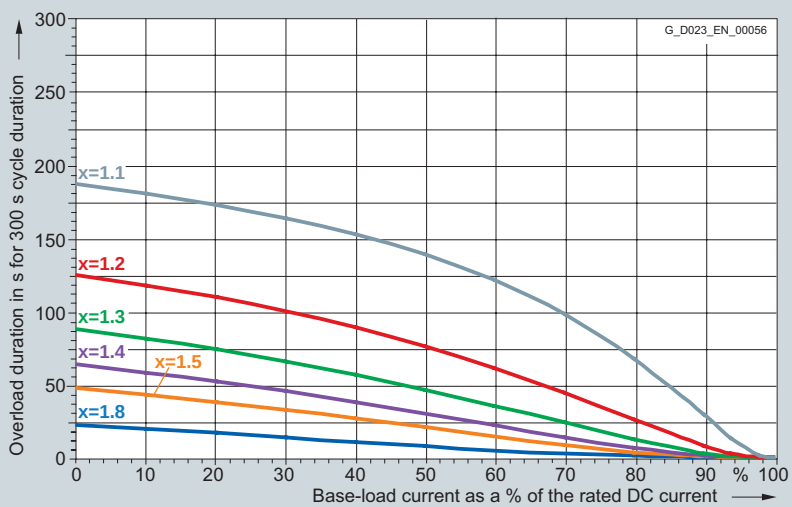
6RA8096-4GS22-0AA0 2 200 A/two-quadrant operation 575 V, 6RA8096-4GV62-0AA0 2 200 A/four-quadrant operation 575 V




| Overload with x-times rated DC current | $t_{an}$ (s) |
|---|---|
| x=1.1 | 259 |
| x=1.2 | 140 |
| x=1.3 | 86 |
| x=1.4 | 56 |
| x=1.5 | 38 |
| x=1.8 | 15 |

$t_{ab}$ (s) = 465

6RA8096-4MS22-0AA0 2 200 A/two-quadrant operation 950 V, 6RA8096-4MV62-0AA0 2 200 A/four-quadrant operation 950 V

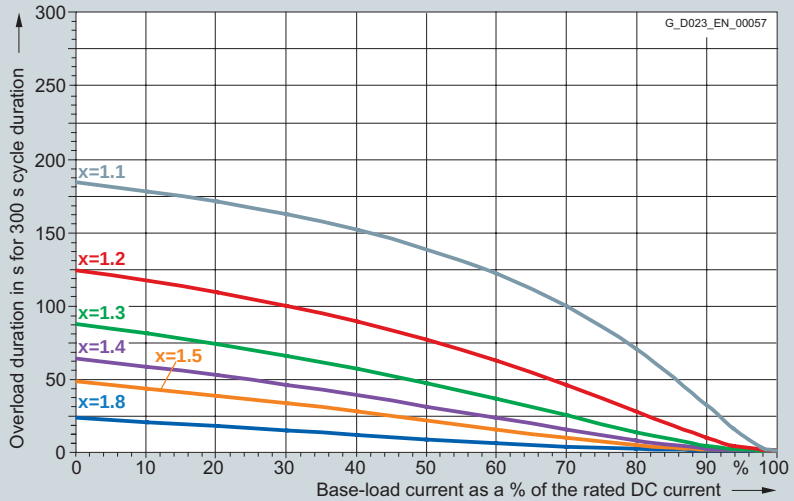



| Overload with x-times rated DC current | $t_{an}$ (s) |
|---|---|
| x=1.1 | 285 |
| x=1.2 | 162 |
| x=1.3 | 105 |
| x=1.4 | 72 |
| x=1.5 | 51 |
| x=1.8 | 22 |

$t_{ab}$ (s) = 465

6RA8097-4GS22-0AA0 2 800 A/two-quadrant operation 575 V, 6RA8097-4GV62-0AA0 2 800 A/four-quadrant operation 575 V

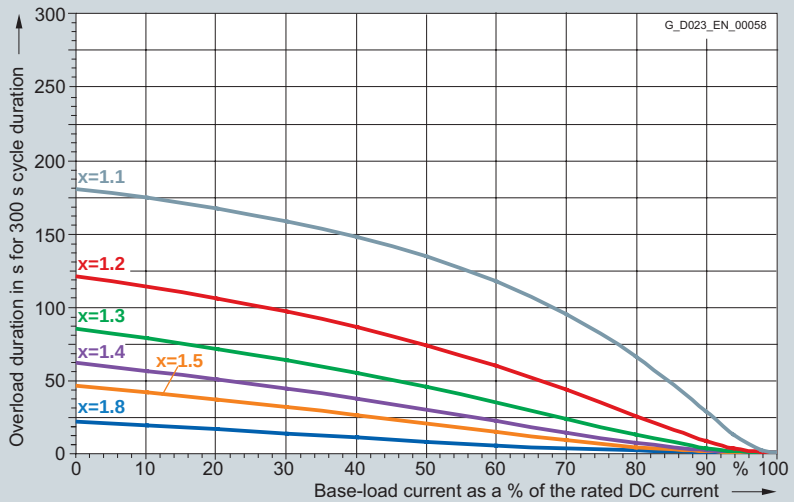
## Overview (continued)




| Overload with x-times rated DC current | $t_{an}$ (s) |
|---|---|
| x=1.1 | 296 |
| x=1.2 | 168 |
| x=1.3 | 109 |
| x=1.4 | 74 |
| x=1.5 | 53 |
| x=1.8 | 23 |

$t_{ab}$ (s) = 465

6RA8097-4KS22-0AA0 2 600 A/two-quadrant operation 690 V, 6RA8097-4KV62-0AA0 2 600 A/four-quadrant operation 690 V




| Overload with x-times rated DC current | $t_{an}$ (s) |
|---|---|
| x=1.1 | 282 |
| x=1.2 | 160 |
| x=1.3 | 103 |
| x=1.4 | 70 |
| x=1.5 | 50 |
| x=1.8 | 21 |

$t_{ab}$ (s) = 465

6RA8098-4DS22-0AA0 3 000 A/two-quadrant operation 400 V, 6RA8098-4DV62-0AA0 3 000 A/four-quadrant operation 400 V

### *Load classes*

In order to be able to adapt the SINAMICS DC MASTER as simply as possible to the load profile of the driven machine, in addition to the individual dimensioning using the limiting characteristics of the dynamic overload capability, these can also be dimensioned using pre-selected load cycles that are simple to parameterize.

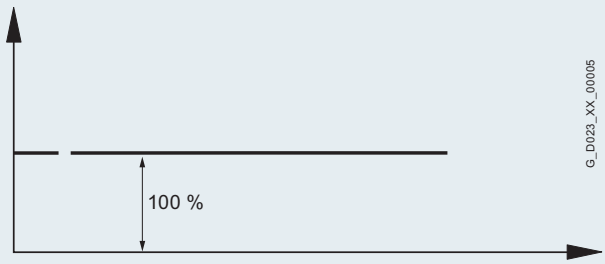
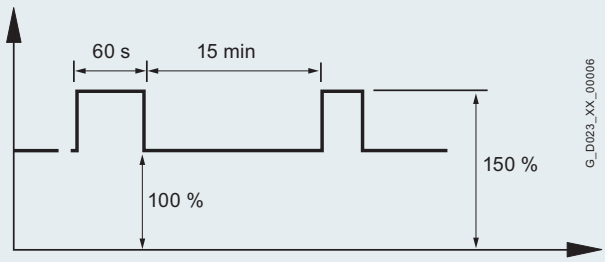
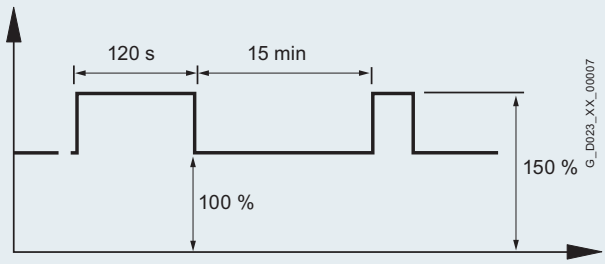
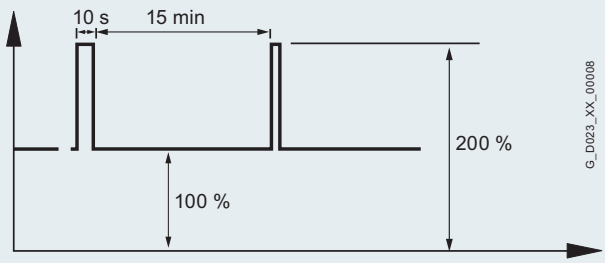
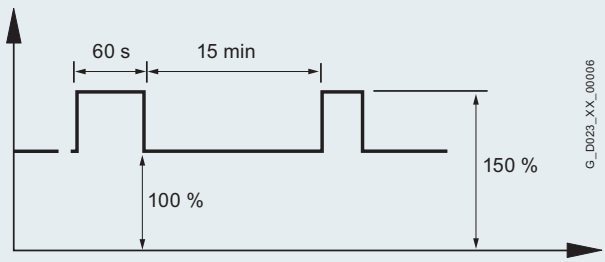
Note:

SINAMICS DC MASTER does not monitor whether the load class – set using parameters – is maintained. If the power section permits it, the unit can operate for overload durations in excess of those defined by the load class. This means that the driven machine of the mechanical system is not protected against overload!

The overload duration that is actually permitted for the power section in question is always longer than the duration defined by the load class. SINAMICS DC MASTER monitors whether the overload duration that is actually permitted for the power section is being maintained.

## Dynamic overload capability

### Overview (continued)

| Load class (parameter) | Load for the converter | Load cycle |
|---|---|---|
| DC I | $I_{DC\ I}$ continuous ($I_{dN}$) |  |
| DC II | $I_{DC\ II}$ for 15 min and 1.5 × $I_{DC\ II}$ for 60 s |  |
| DC III | $I_{DC\ III}$ for 15 min and 1.5 × $I_{DC\ III}$ for 120 s |  |
| DC IV | $I_{DC\ IV}$ for 15 min and 2 × $I_{DC\ IV}$ for 10 s |  |
| US rating | $I_{US}$ for 15 min and 1.5 × $I_{US}$ for 60 s<br>Note:<br>With this setting, for all unit types, an ambient and/or cooling medium temperature of 45 °C is permissible. |  |

## Overview (continued)

### *Duty cycles for two-quadrant operation*

| Supply voltage | SINAMICS DC MASTER converter | $T_u$ | Duty cycles | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | DC I | DC II | | DC III | | DC IV | | US rating $T_u$ = 45 °C | |
| | | | Continu-ous | 15 min 100 % | 60 s 150 % | 15 min 100 % | 120 s 150 % | 15 min 100 % | 10 s 200 % | 15 min 100 % | 60 s 150 % |
| V | Type | °C | A | A | A | A | A | A | A | A | A |
| **400 V 3 AC** | 6RA8025-6DS22-0AA0 | 45 | 60 | 51.4 | 77.1 | 50.2 | 75.3 | 46.4 | 92.8 | 51.4 | 77.1 |
| | 6RA8028-6DS22-0AA0 | 45 | 90 | 74.4 | 111 | 72.8 | 109 | 65.4 | 130 | 74.4 | 111 |
| | 6RA8031-6DS22-0AA0 | 45 | 125 | 106 | 159 | 103 | 155 | 96.3 | 192 | 106 | 159 |
| | 6RA8075-6DS22-0AA0 | 40 | 210 | 164 | 247 | 161 | 242 | 136 | 273 | 157 | 236 |
| | 6RA8078-6DS22-0AA0 | 40 | 280 | 226 | 340 | 219 | 328 | 201 | 402 | 215 | 323 |
| | 6RA8081-6DS22-0AA0 | 40 | 400 | 290 | 435 | 282 | 423 | 244 | 488 | 278 | 417 |
| | 6RA8085-6DS22-0AA0 | 40 | 600 | 462 | 693 | 446 | 669 | 413 | 826 | 443 | 665 |
| | 6RA8087-6DS22-0AA0 | 40 | 850 | 652 | 978 | 622 | 933 | 609 | 1 219 | 619 | 929 |
| | 6RA8091-6DS22-0AA0 | 40 | 1 200 | 884 | 1 326 | 857 | 1 286 | 768 | 1 537 | 842 | 1 263 |
| | 6RA8093-4DS22-0AA0 | 40 | 1 600 | 1 255 | 1 883 | 1 213 | 1 819 | 1 139 | 2 279 | 1 190 | 1 785 |
| | 6RA8095-4DS22-0AA0 | 40 | 2 000 | 1 477 | 2 216 | 1 435 | 2 152 | 1 326 | 2 653 | 1 404 | 2 106 |
| | 6RA8098-4DS22-0AA0 | 40 | 3 000 | 2 288 | 3 432 | 2 189 | 3 283 | 2 164 | 4 328 | 2 178 | 3 267 |
| **480 V 3 AC** | 6RA8025-6FS22-0AA0 | 45 | 60 | 51.4 | 77.1 | 50.2 | 75.3 | 46.4 | 92.8 | 51.4 | 77.1 |
| | 6RA8028-6FS22-0AA0 | 45 | 90 | 74.4 | 111 | 72.8 | 109 | 65.4 | 130 | 74.4 | 111 |
| | 6RA8031-6FS22-0AA0 | 45 | 125 | 106 | 159 | 103 | 155 | 96.3 | 192 | 106 | 159 |
| | 6RA8075-6FS22-0AA0 | 40 | 210 | 164 | 247 | 161 | 242 | 136 | 273 | 157 | 236 |
| | 6RA8078-6FS22-0AA0 | 40 | 280 | 226 | 340 | 219 | 328 | 201 | 402 | 215 | 323 |
| | 6RA8082-6FS22-0AA0 | 40 | 450 | 320 | 480 | 311 | 466 | 274 | 548 | 306 | 460 |
| | 6RA8085-6FS22-0AA0 | 40 | 600 | 462 | 693 | 446 | 669 | 413 | 826 | 443 | 665 |
| | 6RA8087-6FS22-0AA0 | 40 | 850 | 652 | 978 | 622 | 933 | 609 | 1 219 | 619 | 929 |
| | 6RA8091-6FS22-0AA0 | 40 | 1 200 | 884 | 1 326 | 857 | 1 286 | 768 | 1 537 | 842 | 1 263 |
| **575 V 3 AC** | 6RA8025-6GS22-0AA0 | 45 | 60 | 51.4 | 77.1 | 50.2 | 75.3 | 46.4 | 92.8 | 51.4 | 77.1 |
| | 6RA8031-6GS22-0AA0 | 45 | 125 | 106 | 159 | 103 | 155 | 96.3 | 192 | 106 | 159 |
| | 6RA8075-6GS22-0AA0 | 40 | 210 | 164 | 247 | 161 | 242 | 136 | 273 | 157 | 236 |
| | 6RA8081-6GS22-0AA0 | 40 | 400 | 290 | 435 | 282 | 423 | 244 | 488 | 278 | 417 |
| | 6RA8085-6GS22-0AA0 | 40 | 600 | 462 | 693 | 446 | 669 | 413 | 826 | 443 | 665 |
| | 6RA8087-6GS22-0AA0 | 40 | 800 | 607 | 911 | 581 | 872 | 559 | 1 118 | 578 | 867 |
| | 6RA8090-6GS22-0AA0 | 40 | 1 100 | 804 | 1 207 | 782 | 1 173 | 689 | 1 379 | 766 | 1 150 |
| | 6RA8093-4GS22-0AA0 | 40 | 1 600 | 1 255 | 1 883 | 1 213 | 1 819 | 1 139 | 2 279 | 1 190 | 1 785 |
| | 6RA8095-4GS22-0AA0 | 40 | 2 000 | 1 663 | 2 494 | 1 591 | 2 386 | 1 568 | 3 136 | 1 569 | 2 354 |
| | 6RA8096-4GS22-0AA0 | 40 | 2 200 | 1 779 | 2 669 | 1 699 | 2 549 | 1 697 | 3 394 | 1 678 | 2 517 |
| | 6RA8097-4GS22-0AA0 | 40 | 2 800 | 2 136 | 3 204 | 2 044 | 3 066 | 2 022 | 4 044 | 2 024 | 3 036 |
| **690 V 3 AC** | 6RA8086-6KS22-0AA0 | 40 | 720 | 553 | 829 | 527 | 791 | 515 | 1 031 | 525 | 788 |
| | 6RA8090-6KS22-0AA0 | 40 | 1 000 | 737 | 1 105 | 715 | 1 072 | 639 | 1 279 | 702 | 1 053 |
| | 6RA8093-4KS22-0AA0 | 40 | 1 500 | 1 171 | 1 757 | 1 140 | 1 710 | 1 036 | 2 073 | 1 116 | 1 674 |
| | 6RA8095-4KS22-0AA0 | 40 | 2 000 | 1 589 | 2 383 | 1 522 | 2 283 | 1 505 | 3 011 | 1 503 | 2 255 |
| | 6RA8097-4KS22-0AA0 | 40 | 2 600 | 1 992 | 2 989 | 1 906 | 2 859 | 1 887 | 3 774 | 1 876 | 2 815 |
| **830 V 3 AC** | 6RA8088-6LS22-0AA0 | 40 | 950 | 700 | 1 051 | 679 | 1 019 | 607 | 1 215 | 667 | 1 001 |
| | 6RA8093-4LS22-0AA0 | 40 | 1 500 | 1 171 | 1 757 | 1 140 | 1 710 | 1 036 | 2 073 | 1 116 | 1 674 |
| | 6RA8095-4LS22-0AA0 | 40 | 1 900 | 1 485 | 2 228 | 1 421 | 2 132 | 1 396 | 2 793 | 1 414 | 2 121 |
| **950 V 3 AC** | 6RA8096-4MS22-0AA0 | 40 | 2 200 | 1 674 | 2 511 | 1 603 | 2 404 | 1 570 | 3 141 | 1 588 | 2 382 |

## Dynamic overload capability

### Overview (continued)

*Duty cycles for four-quadrant operation*

| Supply voltage | SINAMICS DC MASTER converter | $T_u$ | Duty cycles | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | DC I | DC II | | DC III | | DC IV | | US rating $T_u$ = 45 °C | |
| | | | Continu-ous | 15 min 100 % | 60 s 150 % | 15 min 100 % | 120 s 150 % | 15 min 100 % | 10 s 200 % | 15 min 100 % | 60 s 150 % |
| V | Type | °C | A | A | A | A | A | A | A | A | A |
| **400 V 3 AC** | 6RA8013-6DV62-0AA0 | 45 | 15 | 13.9 | 20.8 | 13.5 | 20.2 | 12.6 | 25.2 | 13.9 | 20.8 |
| | 6RA8018-6DV62-0AA0 | 45 | 30 | 24.9 | 37.3 | 24.2 | 36.3 | 22.4 | 44.8 | 24.9 | 37.3 |
| | 6RA8025-6DV62-0AA0 | 45 | 60 | 53.1 | 79.6 | 51.8 | 77.7 | 47.2 | 94.4 | 53.1 | 79.6 |
| | 6RA8028-6DV62-0AA0 | 45 | 90 | 78.2 | 117 | 76 | 114 | 72.2 | 144 | 78.2 | 117 |
| | 6RA8031-6DV62-0AA0 | 45 | 125 | 106 | 159 | 103 | 155 | 95.4 | 190 | 106 | 159 |
| | 6RA8075-6DV62-0AA0 | 40 | 210 | 164 | 247 | 161 | 242 | 136 | 273 | 157 | 236 |
| | 6RA8078-6DV62-0AA0 | 40 | 280 | 226 | 340 | 219 | 328 | 201 | 402 | 215 | 323 |
| | 6RA8081-6DV62-0AA0 | 40 | 400 | 300 | 450 | 292 | 438 | 247 | 494 | 285 | 428 |
| | 6RA8085-6DV62-0AA0 | 40 | 600 | 470 | 706 | 453 | 680 | 410 | 820 | 450 | 675 |
| | 6RA8087-6DV62-0AA0 | 40 | 850 | 658 | 987 | 634 | 951 | 579 | 1 159 | 626 | 939 |
| | 6RA8091-6DV62-0AA0 | 40 | 1 200 | 884 | 1 326 | 857 | 1 286 | 768 | 1 537 | 842 | 1 263 |
| | 6RA8093-4DV62-0AA0 | 40 | 1 600 | 1 255 | 1 883 | 1 213 | 1 819 | 1 139 | 2 279 | 1 190 | 1 785 |
| | 6RA8095-4DV62-0AA0 | 40 | 2 000 | 1 477 | 2 216 | 1 435 | 2 152 | 1 326 | 2 653 | 1 404 | 2 106 |
| | 6RA8098-4DV62-0AA0 | 40 | 3 000 | 2 288 | 3 432 | 2 189 | 3 283 | 2 164 | 4 328 | 2 178 | 3 267 |
| **480 V 3 AC** | 6RA8013-6FV62-0AA0 | 45 | 15 | 13.9 | 20.8 | 13.5 | 20.2 | 12.6 | 25.2 | 13.9 | 20.8 |
| | 6RA8018-6FV62-0AA0 | 45 | 30 | 24.9 | 37.3 | 24.2 | 36.3 | 22.4 | 44.8 | 24.9 | 37.3 |
| | 6RA8025-6FV62-0AA0 | 45 | 60 | 53.1 | 79.6 | 51.8 | 77.7 | 47.2 | 94.4 | 53.1 | 79.6 |
| | 6RA8028-6FV62-0AA0 | 45 | 90 | 78.2 | 117 | 76 | 114 | 72.2 | 144 | 78.2 | 117 |
| | 6RA8031-6FV62-0AA0 | 45 | 125 | 106 | 159 | 103 | 155 | 95.4 | 190 | 106 | 159 |
| | 6RA8075-6FV62-0AA0 | 40 | 210 | 164 | 247 | 161 | 242 | 136 | 273 | 157 | 236 |
| | 6RA8078-6FV62-0AA0 | 40 | 280 | 226 | 340 | 219 | 328 | 201 | 402 | 215 | 323 |
| | 6RA8082-6FV62-0AA0 | 40 | 450 | 320 | 480 | 311 | 466 | 274 | 548 | 306 | 460 |
| | 6RA8085-6FV62-0AA0 | 40 | 600 | 470 | 706 | 453 | 680 | 410 | 820 | 450 | 675 |
| | 6RA8087-6FV62-0AA0 | 40 | 850 | 658 | 987 | 634 | 951 | 579 | 1 159 | 626 | 939 |
| | 6RA8091-6FV62-0AA0 | 40 | 1 200 | 884 | 1 326 | 857 | 1 286 | 768 | 1 537 | 842 | 1 263 |
| **575 V 3 AC** | 6RA8025-6GV62-0AA0 | 45 | 60 | 53.1 | 79.6 | 51.8 | 77.7 | 47.2 | 94.4 | 53.1 | 79.6 |
| | 6RA8031-6GV62-0AA0 | 45 | 125 | 106 | 159 | 103 | 155 | 95.4 | 190 | 106 | 159 |
| | 6RA8075-6GV62-0AA0 | 40 | 210 | 164 | 247 | 161 | 242 | 136 | 273 | 157 | 236 |
| | 6RA8081-6GV62-0AA0 | 40 | 400 | 300 | 450 | 292 | 438 | 247 | 494 | 285 | 428 |
| | 6RA8085-6GV62-0AA0 | 40 | 600 | 470 | 706 | 453 | 680 | 410 | 820 | 450 | 675 |
| | 6RA8087-6GV62-0AA0 | 40 | 850 | 658 | 987 | 634 | 951 | 579 | 1 159 | 626 | 939 |
| | 6RA8090-6GV62-0AA0 | 40 | 1 100 | 804 | 1 207 | 782 | 1 173 | 689 | 1 379 | 766 | 1 150 |
| | 6RA8093-4GV62-0AA0 | 40 | 1 600 | 1 255 | 1 883 | 1 213 | 1 819 | 1 139 | 2 279 | 1 190 | 1 785 |
| | 6RA8095-4GV62-0AA0 | 40 | 2 000 | 1 663 | 2 494 | 1 591 | 2 386 | 1 568 | 3 136 | 1 569 | 2 354 |
| | 6RA8096-4GV62-0AA0 | 40 | 2 200 | 1 779 | 2 669 | 1 699 | 2 549 | 1 697 | 3 394 | 1 678 | 2 517 |
| | 6RA8097-4GV62-0AA0 | 40 | 2 800 | 2 136 | 3 204 | 2 044 | 3 066 | 2 022 | 4 044 | 2 024 | 3 036 |
| **690 V 3 AC** | 6RA8086-6KV62-0AA0 | 40 | 760 | 598 | 898 | 575 | 863 | 532 | 1 065 | 569 | 853 |
| | 6RA8090-6KV62-0AA0 | 40 | 1 000 | 737 | 1 105 | 715 | 1 072 | 639 | 1 279 | 702 | 1 053 |
| | 6RA8093-4KV62-0AA0 | 40 | 1 500 | 1 171 | 1 757 | 1 140 | 1 710 | 1 036 | 2 073 | 1 116 | 1 674 |
| | 6RA8095-4KV62-0AA0 | 40 | 2 000 | 1 589 | 2 383 | 1 522 | 2 283 | 1 505 | 3 011 | 1 503 | 2 255 |
| | 6RA8097-4KV62-0AA0 | 40 | 2 600 | 1 992 | 2 989 | 1 906 | 2 859 | 1 887 | 3 774 | 1 876 | 2 815 |
| **830 V 3 AC** | 6RA8088-6LV62-0AA0 | 40 | 950 | 700 | 1 051 | 679 | 1 019 | 607 | 1 215 | 667 | 1 001 |
| | 6RA8093-4LV62-0AA0 | 40 | 1 500 | 1 171 | 1 757 | 1 140 | 1 710 | 1 036 | 2 073 | 1 116 | 1 674 |
| | 6RA8095-4LV62-0AA0 | 40 | 1 900 | 1 485 | 2 228 | 1 421 | 2 132 | 1 396 | 2 793 | 1 414 | 2 121 |
| **950 V 3 AC** | 6RA8096-4MV62-0AA0 | 40 | 2 200 | 1 674 | 2 511 | 1 603 | 2 404 | 1 570 | 3 141 | 1 588 | 2 382 |

## Overview

### *Parallel connection of SINAMICS DC MASTER units*

SINAMICS DC MASTER units can be connected in parallel to increase the power rating.
The following secondary conditions must be fulfilled:

The hardware and plug connectors necessary to transmit the firing pulses and to establish the higher-level communication are provided on the CUD.

A maximum of 6 units can be connected in parallel. When connecting several units in parallel, the master unit should be positioned centrally due to the signal runtimes. Maximum cable length of the parallel-connection interface cable between master and slave units at each end of the bus: 15 m.

Identical, separate commutating reactors ($u_K$ min. 2 %) are required for each SINAMICS DC MASTER unit in order to evenly distribute the current. The difference in reactor tolerances determines the current distribution. For operation without derating (current reduction), a tolerance of 5 % or better is recommended.

Only units with the same DC current ratings are permitted to be connected in parallel.
The permissible output current when connecting units in parallel is, when maintaining the secondary conditions:

$I_{max} = n \times I_{N(SINAMICS\ DC\ MASTER)}$

$n$ = number of SINAMICS DC MASTER units

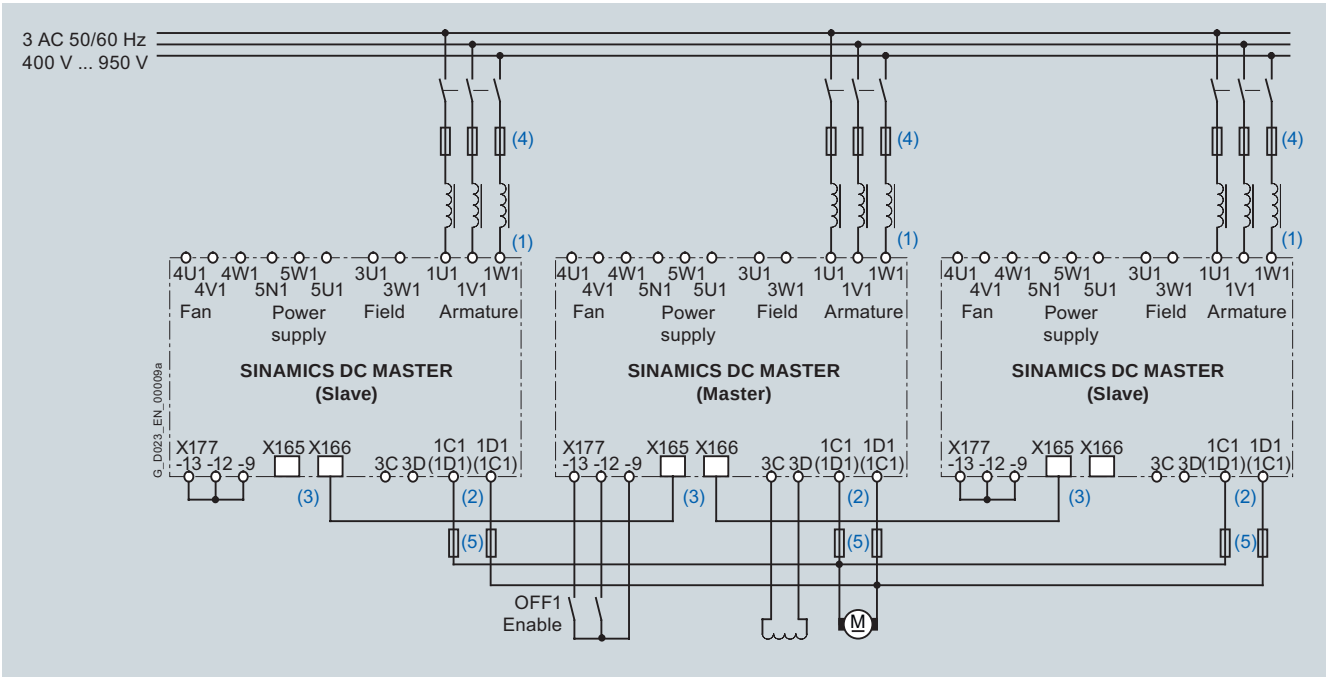
Redundant operation (mode “(n+m) operation”)

SINAMICS DC MASTER units can also be used in a redundant configuration as a special operating mode of the parallel connection. In this operating mode, it is possible to maintain operation with the remaining SINAMICS DC MASTER units if one unit fails (e.g. if a fuse fails in the power section). When appropriately configured and interconnected, both the armature circuit as well as the field circuit can be redundantly operated.

SINAMICS DC MASTER units that can still function, continue to operate without any interruption when a unit fails. When configuring the system, it is important to note that in redundant applications, the power rating of only n units (instead of n+m units) must be sufficient.

In the case of a fault, the master functionality is automatically transferred. As a consequence, this operating mode is possible both when the power section of the slave units fails and when the power section of the master unit fails. (MTBF data in redundant operation are available on request.)

Connection schematic of the armature circuit when connecting SINAMICS DC MASTER units in parallel




(1) The same phase sequence is required between 1U1/1V1/1W1.

(2) The same phase sequence is required between 1C1/1D1.

(3) The units are connected using (8-pin) shielded patch cables of type UTP CAT5 in acc. with ANSI/EIA/TIA 568, such as those that are used in PC network technology. A standard 5 m long cable can be directly purchased from Siemens (Order No.: 6RY1707-0AA08). (n-1) cables are required to connect n units in parallel. The bus termination must be activated at the units/devices connected at the start of the bus and at the end of the bus.

(4) These fuses may only be used with units up to 850 A.

(5) Only for units up to 850 A in four-quadrant operation.

## 12-pulse operation

### Overview

***SINAMICS DC MASTER for 12-pulse operation***

For 12-pulse operation, two SINAMICS DC MASTER converters are supplied with voltages displaced by 30 degrees. This configuration reduces the harmonics. Each SINAMICS DC MASTER conducts half of the total current. One of the SINAMICS DC MASTER units is operated with closed-loop speed control, and the second with closed-loop current control. A peer-to-peer connection is used to transfer the current setpoint from the first to the second SINAMICS DC MASTER.

Smoothing reactors are required in the DC circuit for 12-pulse operation.

Calculating the smoothing reactor

- A smoothing reactor is used for each of the two partial converters. The reactor comprises a 2-value reactor; this means that the inductance of the reactor is defined for two current values.
- The reactor is thermally dimensioned according to the rms value of the DC reactor current.

Calculating the required inductance

1. Inductance of the reactor at $0.2 \times I_{dN}$ ($L_{D1}$)
2. Inductance of the reactor for $I_{dmax}$ ($L_{D2}$)

- Inductance for 50 Hz line frequency

$L_{D1} = 0.296 \times 10^{-3} \times V_{di}/(0.2 \times I_{dN})$

$L_{D2} = 0.296 \times 10^{-3} \times V_{di}/(0.33 \times I_{dmax})$

- Inductance for 60 Hz line frequency

$L_{D1} = 0.24 \times 10^{-3} \times V_{di}/(0.2 \times I_{dN})$

$L_{D2} = 0.24 \times 10^{-3} \times V_{di}/(0.33 \times I_{dmax})$

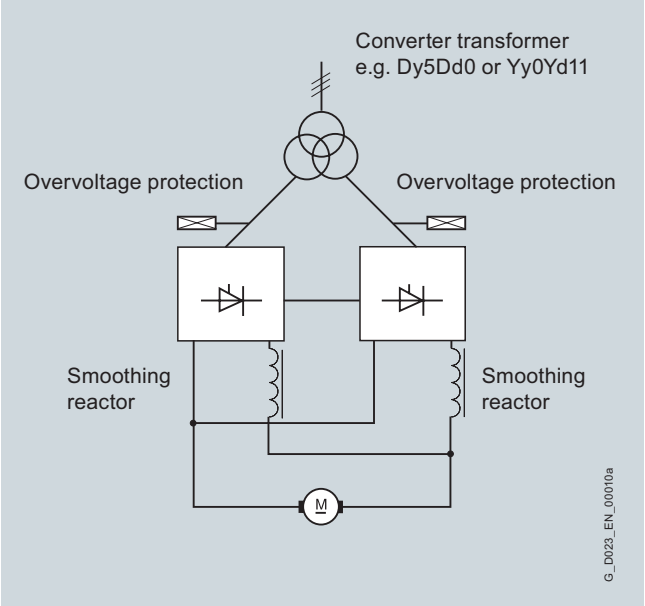
$L =$ Inductance in H

$I_{dN}$ half the rated DC current of the DC motor

$I_{dmax}$ half the maximum current of the DC motor

$V_{di} = 1.35 \times V_N$

$V_N$ rated line supply voltage




12-pulse operation

## Supply of high inductances

### Overview

***SINAMICS DC MASTER to supply high inductances***

To supply high inductances – such as the fields of large DC or synchronous motors or lifting solenoids – the gating unit is changed over to long pulses using the appropriate parameter settings. At high levels of inductance, the long pulses ensure that the thyristors are reliably triggered. In this case, the armature circuit of the units is not used to supply the armature of DC motors, but to supply large field windings.

Note:
An external overvoltage protective circuit must be provided at the DC voltage output of the SINAMICS DC MASTER (e.g. SICROWBAR DC overvoltage protection).

## Protection against condensation

### Overview

***Protection against condensation***

SINAMICS DC MASTER are designed in compliance with climate class 3K3 (EN 60721-3-3) without condensation.

When supplied to tropical countries, we recommend that the electrical cabinets are equipped with cabinet heating elements.

Units with coated PCBs are optionally available (option M08); these are insensitive to unfavorable environmental conditions. In order to guarantee safe and reliable operation, under all circumstances, it should be avoided that the units are commissioned with PC boards with moisture condensation.

## Overview

### *Input pulse levels*

The evaluation electronics can process encoder signals (symmetrical as well as asymmetrical) up to a maximum differential voltage of 27 V. The encoder type is selected via parameter. The evaluation electronics are electronically adjusted to the encoder signal voltage. With the parameter setting, a sub-division is made into two rated input voltage ranges.

| | Rated input voltage range | |
|---|---|---|
| | 5 V | 15 V |
| Low level | Differential voltage < 0.8 V | Differential voltage < 5 V |
| High level | Differential voltage > 2 V | Differential voltage > 8 V [1] |
| Hysteresis | > 0.2 V | > 1 V |
| Common-mode controllability | ± 10 V | ± 10 V |

If the pulse encoder does not supply any symmetrical encoder signals, it must be grounded with each signal cable twisted in pairs and connected to the negative connections of track 1, track 2, and zero mark.

### *Maximum frequency that can be evaluated*

The maximum frequency of the encoder pulses that can be evaluated is 300 kHz. To ensure that the encoder pulses are evaluated correctly, the minimum edge clearance $T_{min}$ between two encoder signal edges (track 1, track 2), as listed in the table, must be adhered to.

| | Rated input voltage range | | | | |
|---|---|---|---|---|---|
| | 5 V | | 15 V | | |
| Differential voltage [2] | 2 V | > 2.5 V | 8 V | 10 V | > 14 V |
| $T_{min}$ [3] | 630 ns | 380 ns | 630 ns | 430 ns | 380 ns |

If the pulse encoder is incorrectly matched to the encoder cable, disturbing cable reflections will occur at the receiving end. To ensure that encoder pulses of this type can be evaluated without errors, these reflections need to be damped. The limit values listed in the table below must be maintained in order to prevent the resulting power losses in the evaluation electronics adaptor from being exceeded.

| | $F_{max}$ | | | | |
|---|---|---|---|---|---|
| | 50 kHz | 100 kHz | 150 kHz | 200 kHz | 300 kHz |
| Differential voltage [4] | Up to 27 V | Up to 22 V | Up to 18 V | Up to 16 V | Up to 14 V |

### *Cable, cable length, shield connection*

The encoder cable capacitance must be recharged at each encoder edge change. The rms value of this current is proportional to the cable length and pulse frequency, and must not exceed the current permitted by the encoder manufacturer. A suitable cable that meets the recommendations of the encoder manufacturer must be used, and the maximum cable length must not be exceeded.

Generally speaking, a twisted cable pair with a single pair shield is sufficient for each track. This reduces crosstalk between the cables. Shielding all the pairs provides protection against interference pulses. The shield should be connected to the SINAMICS DC MASTER shield bar through a large surface area.

[1] Restriction: See "Maximum frequency that can be evaluated"

[2] Differential voltage at the terminals of the evaluation electronics

[3] The phase error $L_G$ (deviation of 90°), caused by the encoder and cable and which may occur, can be calculated from $T_{min}$:

$L_G = +(90° - f_p \times T_{min} \times 360° \times 10^{-6})$

$L_G$ Phase error in °

$f_p$ Pulse frequency in kHz

$T_{min}$ Minimum edge clearance in ns

[4] Differential voltage of the encoder pulses without load (approximate encoder power supply voltage)

## Notes for EMC-compliant drive installation

### Overview

#### *Notes for EMC-compliant installation*

These installation instructions do not claim to contain all details and versions of units, or to take into account all conceivable operational cases and applications.

Contact partners of the Siemens regional offices are available for additional information or for specific problems, that have not been handled in sufficient detail for your particular application.

The contents of these installation instructions neither form part of nor modify any prior or existing contract, agreement, or legal relationship. The particular contract of sale represents the overall obligations of SIEMENS AG. The warranty specified in the contract between the parties is the only warranty accepted by the SIEMENS AG. Any statements contained in these installation instructions neither create new warranty conditions nor modify the existing warranty conditions.

#### *Basic information about EMC*

What is EMC?

EMC stands for “ElectroMagnetic Compatibility” and describes the capability of a device to function satisfactorily in an electromagnetic environment without itself causing interference unacceptable for other devices in the environment. Therefore, the various units should not mutually interfere with one another.

Within the context of the EMC Directive, the SINAMICS DC MASTER units described in this document are not “units” at all, but are instead “components” that are intended to be installed in an overall system or overall plant. For reasons of clarity, however, the generic term “units” is used in many cases.

Interference emissions and interference immunity

EMC is dependent upon two properties demonstrated by the units involved in the system: interference emissions and interference immunity. Electrical units can be sources of interference (senders) and/or potentially susceptible equipment (receivers).

Electromagnetic compatibility is ensured when the existing sources of interference do not impair the function of potentially susceptible equipment.

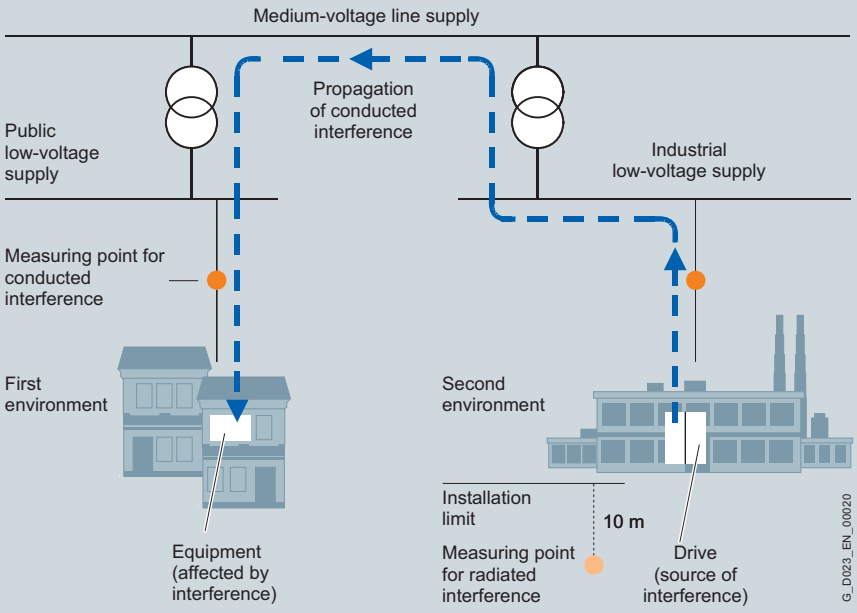
A unit may even be a source of interference and potentially susceptible equipment at the same time: For example, the power section of a converter unit should be viewed as a source of interference and the control unit as potentially susceptible equipment.

Product standard EN 61800-3

The EMC requirements for “Variable-speed drive systems” are described in the product standard EN 61800-3. A variable-speed drive system (or Power Drive System PDS) consists of the drive converter and the electric motor including cables. The driven machine is not part of the drive system.
EN 61800-3 defines different limit values depending on the location of the drive system, referred to as the first and second environments.

Residential buildings or locations at which the drive system is directly connected to a public low-voltage supply without intermediate transformer are defined as the **first environment**.

The term **second environment** refers to all locations outside residential areas. These are basically industrial areas which are supplied from the medium-voltage line supply via their own transformers.




Definition of the first and second environments

## Overview (continued)

Four different categories are defined in EN 61800-3 Ed.2 depending on the location and the power of the drive:

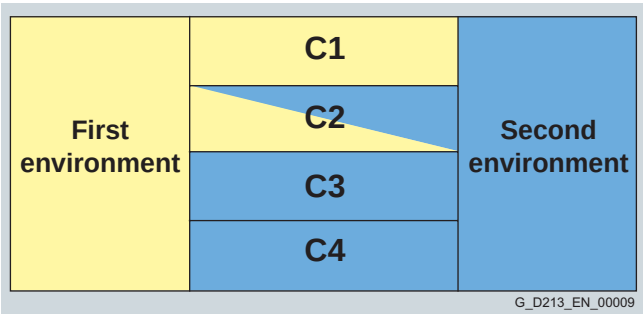
**Category C1:** Drive systems for rated voltages < 1 000 V for unlimited use in the first environment.

**Category C2:** Stationary drive systems for rated voltages < 1 000 V for use in the second environment. Use in the first environment is possible if the drive system is marketed and installed by qualified personnel. The warning information and installation instructions supplied by the manufacturer must be observed.

**Category C3:** Drive systems for rated voltages < 1 000 V for exclusive use in the second environment.

**Category C4:** Drive systems for rated voltages ≥ 1 000 V or for rated currents ≥ 400 A for use in complex systems in the second environment.

The following diagram shows how the four categories are assigned to the first and second environments:




Definition of categories C1 to C4

SINAMICS DC MASTER units are nearly always used in the second environment (Categories C3 and C4).

Radio interference suppression filters and commutating reactors are required whenever they are to be used in Category C2.

SINAMICS DC MASTER units conform to the interference immunity requirements defined in EN 61800-3 for the second environment, and thus also to the lower requirements in the first environment.

Standard EN 55011

Some situations require compliance with standard EN 55011. This defines limit values for interference emissions in industrial and residential environments. The values that are measured are conducted interference at the line supply connection as interference voltage, and electromagnetically radiated interference as radio interference, under standardized conditions.

The standard defines limit values “A1” and “B1” which, for interference voltage, apply to the 150 kHz – 30 MHz range and, for radio interference, the 30 MHz – 2 GHz range. Since SINAMICS DC MASTER converter units are used in industrial applications, they are subject to the limit value “A1”. In order to achieve limit value “A1”, the SINAMICS DC MASTER units must be provided with external radio interference suppression filters and commutating reactors.

SINAMICS DC MASTER, industrial applications

Industrial applications demand that units demonstrate an extremely high level of interference immunity, but by contrast place very low requirements on them in terms of interference emission levels.

SINAMICS DC MASTER converter units are components of an electrical drive, such as contactors and switches. Qualified personnel must integrate them into a drive system which, as an absolute minimum, consists of the converter unit, motor cables, and motor. Commutating reactors and fuses are also required in most cases. Therefore, whether or not a limit value is adhered to is determined by the components being installed correctly. Limiting interference emission levels in line with limit value “A1” requires not only the converter unit itself, but also the radio interference suppression filter assigned to it and the commutating reactor, at the very least. Without a radio interference suppression filter, the interference emission level of SINAMICS DC MASTER converter units exceeds limit value “A1” of EN 55011.

If the drive forms part of a plant or system, it does not initially need to fulfill any interference emission requirements. However, EMC legislation does stipulate that the plant or system as a whole must be electromagnetically compatible with its environment.

If all the control components in the plant or system (such as PLCs) demonstrate a level of interference immunity that is suitable for industrial applications, then it is not necessary for every drive to adhere to limit value “A1”.

Non-grounded line supplies

Non-grounded line supplies (IT line supplies) are used in some branches of industry in order to increase the availability of the plant. In the event of a ground fault, no fault current flows and the plant can continue with production. However, in conjunction with radio interference suppression filters, in the case of a fault, a fault current flows, which can cause the drives to shut down or possibly even destroy the radio interference suppression filter. This is the reason that the product standard does not define any limit values for these types of line supplies. From an economics perspective, any necessary EMC conformance measures should be taken on the grounded primary side of the supply transformer.

EMC planning

If two units are not electromagnetically compatible, you can reduce the interference emission level of the source of interference or increase the interference immunity of the potentially susceptible equipment.

Sources of interference are generally power electronics units with high power consumption. Reducing their interference emission levels requires complex filters. Potentially susceptible equipment usually refers to controlgear and sensors, including their evaluation circuit. Lower costs are involved with increasing the interference immunity of units with lower power ratings. This means, that from an economics perspective, increasing the interference immunity is generally a more favorable option for industrial applications than reducing the interference emission level. For example, to maintain limit value class A1 of EN 55011, the radio interference voltage at the line supply connection point between 150 and 500 kHz can be a maximum of 79 dB (µV) and between 500 kHz and 30 MHz, a maximum of 73 dB (µV) (9 or 4.5 mV).

In industrial applications, EMC between units should be based on a carefully-balanced combination of the interference emission and interference immunity levels.

The most cost-effective measure that can be put in place to achieve EMC conformance is to physically separate sources of interference and potentially susceptible equipment – provided that you have taken this option into account during the planning stage of your machine/plant. In the first instance, it is necessary to determine whether each unit used is a potential source of interference or potentially susceptible equipment. Within this context, converter units and contactors, for example, can be counted as sources of interference. While examples of potentially susceptible equipment include PLCs, encoders and sensors.

The components in the control cabinet (sources of interference and potentially susceptible equipment) must be physically separated, by means of partition plates if necessary, or by installing them in metal enclosures.

## Overview (continued)

### *EMC-compliant drive installation (installation instructions)*

General information

Not only are drives operated in a wide variety of environments, but the electrical components used (controls and switched mode power supplies, and so on) can also differ widely with respect to interference immunity and interference emission levels, meaning that all installation guidelines of any kind can offer is a practical compromise. This is the reason that it is possible to deviate from the EMC rules on a case-for-case basis provided that individual measures are tested.

In order to ensure electromagnetic compatibility (EMC) in your control cabinets in rugged electrical environments and adhere to the standards required by the relevant legislating body, the EMC rules listed below should be followed during the construction and design stages.

Rules 1 to 10 are generally valid. Rules 11 to 15 must be followed in order to fulfill interference emission standards.

Rules for EMC-compliant installation

*Rule 1*
All metal parts of the control cabinet are connected with one another through a large surface area with a good electrical connection (not paint on paint!). If required, contact or serrated washers should be used. The cabinet door must be connected to the cabinet using the shortest possible grounding straps (at the top, center, and bottom).

*Rule 2*
Contactors, relays, solenoid valves, electromechanical operating hours counters, etc., in the cabinet and – where applicable – in neighboring cabinets – must be provided with quenching combination, e.g. RC elements, varistors, and diodes. The protective circuit must be directly connected to the particular coil.

*Rule 3*
Signal cables [1] if at all possible, should only be routed at just one level in the cabinet.

*Rule 4*
Unshielded cables in the same circuit (outgoing/incoming conductors) must be twisted wherever possible, or the area between them minimized, to prevent the unnecessary formation of frame antennae.

*Rule 5*
Connect spare wires at both ends to the cabinet ground (ground [2]). This achieves an additional shielding effect.

*Rule 6*
Avoid unnecessary cable lengths. This keeps coupling capacitances and inductances low.

*Rule 7*
Crosstalk is generally reduced, if cables are routed close to the control cabinet ground. Therefore, do not route cables freely around the cabinet, but route them as close as possible to the cabinet enclosure or to the mounting plates. This also applies to spare cables.

*Rule 8*
Signal and power cables must be physically separated (to prevent coupling paths!). A minimum distance of 20 cm must be observed.

If it is not possible to physically separate the encoder and motor cables, the encoder cable must be decoupled either using a partition or by routing it in a metal conduit. The partition or metal conduit must be grounded at several points.

*Rule 9*
Ground the shields of digital signal cables at both ends (source and destination), ensuring maximum contact area and good conductivity. In the event of poor equipotential bonding between the shield connections, run an additional equipotential bonding conductor with a cross-section of at least 10 $mm^2$ parallel to the shield for the purpose of reducing the shield current. Generally speaking, the shields may also be connected to the cabinet enclosure (ground) at several points. The shields can be connected several times even outside the control cabinet.

Foil-type shields should be avoided, as they are at least 5 times less effective than braided shields.

*Rule 10*
Shields for analog signal cables may be connected to ground at both ends if the equipotential bonding is good (this must be done through a large surface area with good conductivity!). It can be assumed that equipotential bonding is good if all of the metal parts are interconnected with one another through a good electrical connection and the electronics components are supplied from a single source.

Connecting shields at one end prevents low-frequency, capacitive interference from being coupled in (e.g. 50 Hz hum). In this case, the shield should be connected in the control cabinet; whereby the shield can also be connected using a separate wire.

*Rule 11*
Ensure that the radio interference suppression filter is located close to the suspected source of interference. The filter must be attached to the cabinet enclosure, mounting plate, etc., through a large surface area. Incoming and outgoing cables must be physically separated.

*Rule 12*
Radio interference suppression filters must be used in order to conform to limit value class A1. Additional loads must be connected upstream of the filter (line side).

The control used and the manner in which the rest of the control cabinet is wired will determine whether an additional line filter needs to be installed.

*Rule 13*
A commutating reactor must be included in the field circuit for controlled field power supplies.

*Rule 14*
A commutating reactor must be included in the armature circuit of the converter.

*Rule 15*
The motor cables do not have to be shielded. There must be a clearance of at least 20 cm between the line supply feeder cable and the motor cables (field, armature). If necessary, a separating metal partition should be used.

The cabinet design shown in the following diagram is intended to help the user become familiar with EMC-critical parts. This example does not claim to show all possible cabinet components or design options.

Additional diagrams show details that are not immediately clear in the overview diagram and which may also have an effect on the resistance to interference/interference emission levels of the cabinet as well as different shield connection techniques.

[1] Signal cables are defined as:
Digital signal cable:
Cables for pulse encoders,
serial interfaces, e.g. PROFIBUS-DP or
analog signal cable, e.g. ± 10 V setpoint cable.

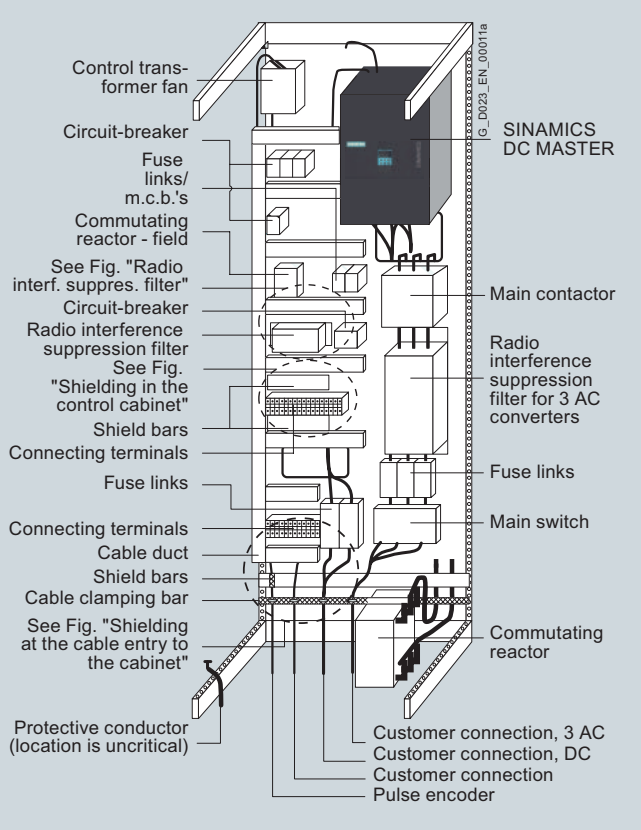
[2] Generally speaking, "ground" refers to all metallic conductive parts that can be connected to a protective conductor, such as the cabinet enclosure, motor enclosure, or foundation ground etc..

## Overview (continued)

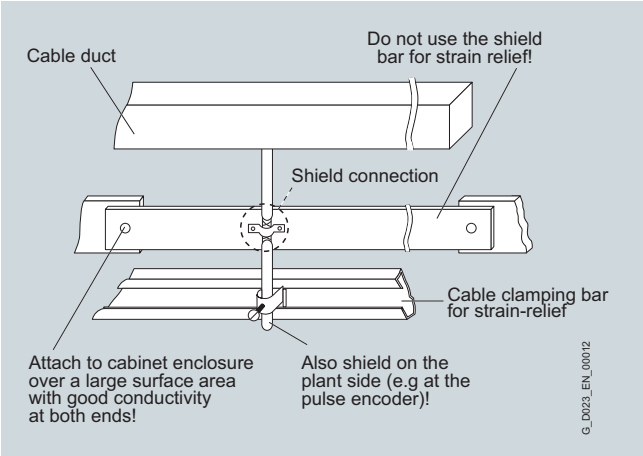
Arrangement of radio interference suppression filters and commutating reactors

Another section shows how the radio interference suppression filters and commutating reactors are arranged in a SINAMICS DC MASTER. The order in which the reactors and filters are installed must be adhered to. The filter cables on the line side and unit side must be physically separated.

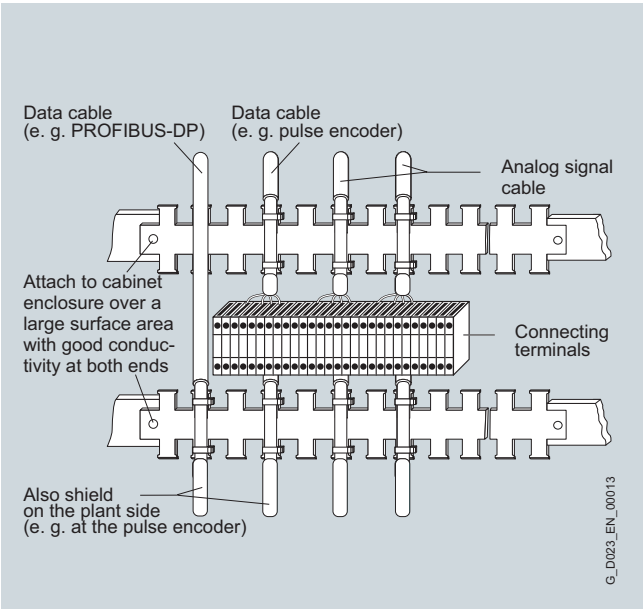
For information on selecting fuses for semiconductor protection, please refer to the section titled “Line fuses”.




Example of a cabinet design with a SINAMICS DC MASTER of up to 850 A




Shielding at the cable entry to the cabinet

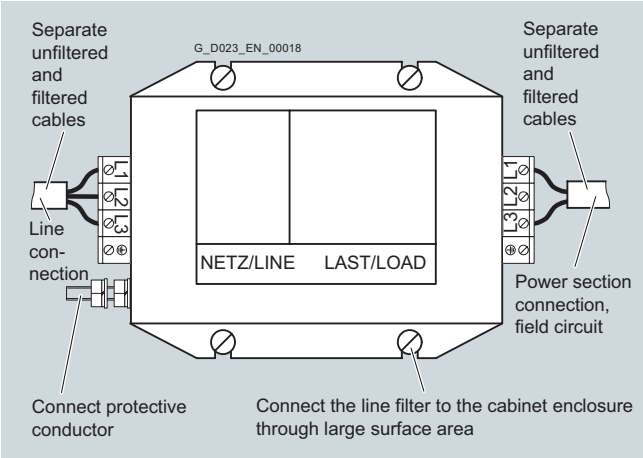



Shielding in the control cabinet

## Notes for EMC-compliant drive installation

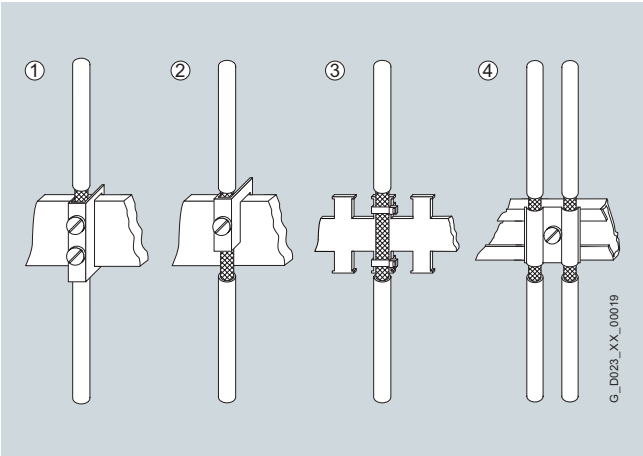
**Overview** (continued)

Radio interference suppression filter for the SINAMICS DC MASTER field power section




Radio interference suppression filter

Shield connection




Shield connection

① Connecting terminal on a copper bar, max. cable diameter 15 mm

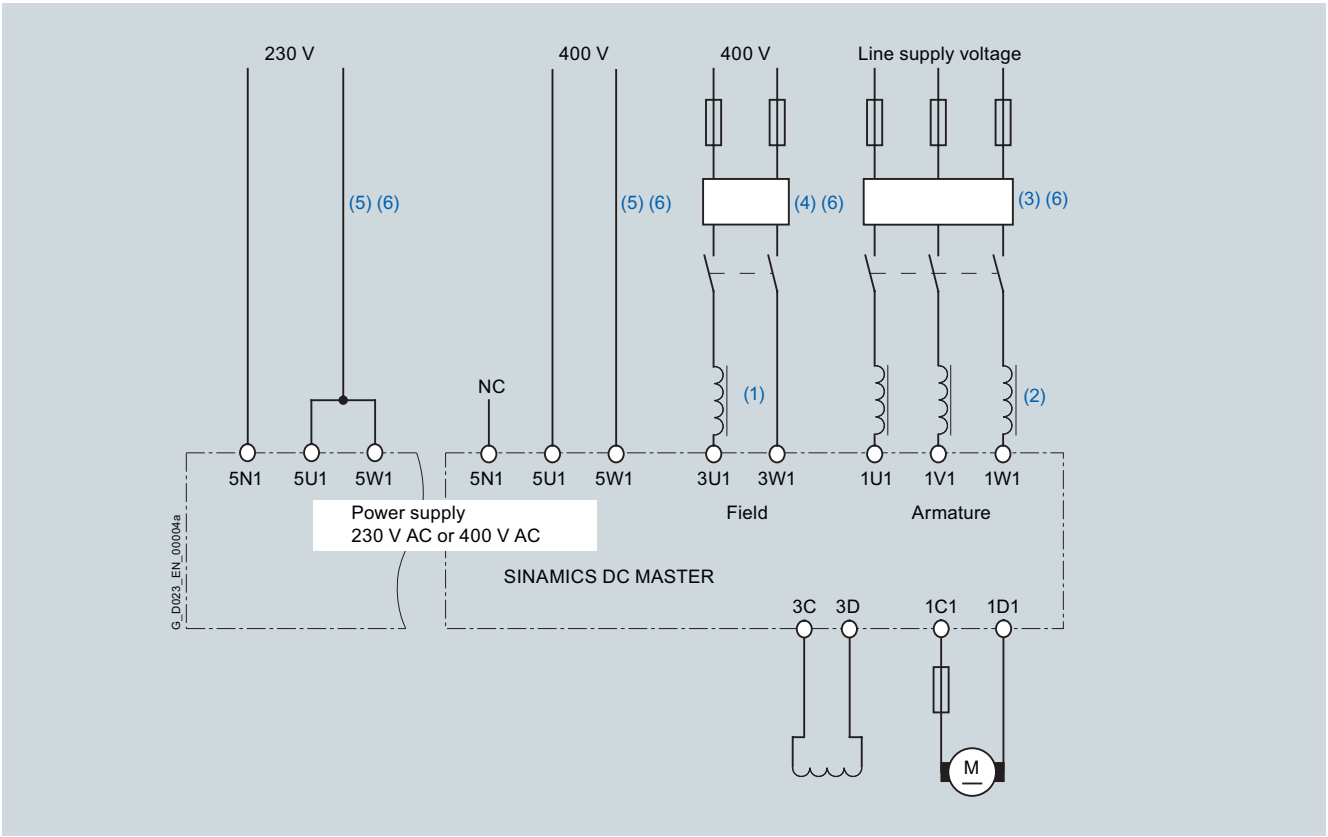
② Bar-mounting terminal on a copper bar, max. cable diameter 10 mm

③ Metal tube or cable tie on a bare-metal comb-type/toothed bar

④ Clamp with metal backing plate on a cable support rail

## Overview (continued)

Arrangement of the components for converter units




Arrangement of reactors and radio interference suppression filters

(1) The commutating reactor in the field circuit is dimensioned for the rated motor field current.

(2) The commutating reactor in the armature circuit is dimensioned for the rated motor armature current.
The line current is 0.82 times the DC current.

(3) The radio interference suppression filter for the armature circuit is dimensioned for the rated motor armature current.
The line current is 0.82 times the DC current.

(4) The radio interference suppression filter for the field circuit is dimensioned for the rated motor field current.

(5) Radio interference suppression filters are not required for the electronics power supply alone. Current consumption at 400 V 1 A, at 230 V 2 A.

(6) If the power supply voltages for the armature circuit, field circuit and electronics power supply are the same, then the voltage for the field and electronics power supply can also be taken after the radio interference suppression filter for the armature circuit.

## Overview

### *Line-side harmonics produced by converter units in a fully-controlled three-phase bridge circuit B6C and (B6)A(B6)C*

The majority of converter units for medium-power applications have a fully-controlled three-phase bridge circuit. Below is an example of the harmonics that can be found in a typical system configuration for two firing angles ($\alpha$ = 20° and $\alpha$ = 60°).

The values have been taken from a previous publication, "Oberschwingungen im netzseitigen Strom sechspulsiger netzgeführter Stromrichter (Harmonics in the Line-Side Current of Six-Pulse, Line-Commutated Converters)" by H. Arremann and G. Möltgen, Siemens Research and Development Division, Volume 7 (1978) No. 2, © Springer-Verlag 1978.

In addition, the formulas are specified which, depending on the actual operating data in use, line supply voltage (no-load voltage $V_{V0}$), line frequency $f_N$ and DC current $I_d$, can be used to calculate the short-circuit power $S_K$ and armature inductance $L_a$ for the motor to which the specified harmonics spectrum applies.

If the actual line short-circuit power and/or actual armature inductance deviate from the values calculated in this way, then they will need to be calculated on a case-by-case basis.

The harmonics spectrum shown below is obtained if the values for the short-circuit power $S_K$ at the point where the unit is connected and the armature inductance $L_a$ of the motor, calculated using the following formulas, match the actual values of the plant or system. If the values do not match, the harmonics will have to be separately calculated.

| $\nu$ | $I_\nu/I_1$ | |
|---|---|---|
| | at $\alpha$ = 20° fundamental factor $g$ = 0.962 | at $\alpha$ = 60° fundamental factor $g$ = 0.953 |
| 5 | 0.235 | 0.283 |
| 7 | 0.100 | 0.050 |
| 11 | 0.083 | 0.089 |
| 13 | 0.056 | 0.038 |
| 17 | 0.046 | 0.050 |
| 19 | 0.035 | 0.029 |
| 23 | 0.028 | 0.034 |
| 25 | 0.024 | 0.023 |
| 29 | 0.018 | 0.026 |
| 31 | 0.016 | 0.019 |
| 35 | 0.011 | 0.020 |
| 37 | 0.010 | 0.016 |
| 41 | 0.006 | 0.016 |
| 43 | 0.006 | 0.013 |
| 47 | 0.003 | 0.013 |
| 49 | 0.003 | 0.011 |

The fundamental component of current $I_1$ as a reference variable is calculated using the following formula:

$I_1 = g \times 0.817 \times I_d$

$I_d$ DC current of the operating point being investigated
$g$ Basic fundamental content

The harmonics currents calculated according to the table only apply for:

**a) Short-circuit power $S_K$ at the point where the converter unit is connected**

$S_K = V_{V0}^2/X_N$ (VA)

where

$X_N = X_K - X_D = 0.03536 \times V_{V0}/I_d - 2\pi \times f_N \times L_D$ (Ω)

$V_{V0}$ No-load voltage at the point where the converter unit is connected in V

$I_d$ DC current of the operating point being investigated in A

$f_N$ Line frequency in Hz

$L_D$ Inductance of the commutating reactor being used in H

**b) Armature inductance $L_a$**

$L_a = 0.0488 \times V_{V0}/(f_N \times I_d)$ (H)

If the actual values for the short-circuit power $S_K$ and/or armature inductance $L_a$ deviate from the values calculated using the formulas above, a separate calculation will need to be made.

Example:

Let us assume a drive with the following data:

$V_{V0}$ = 400 V

$I_d$ = 150 A

$f_N$ = 50 Hz

$L_D$ = 0.169 mH (4EU2421-7AA10) with $I_{LN}$ = 125 A

where

$X_N = 0.03536 \times 400/150 - 2\pi \times 0.169 \times 10^{-3} = 0.0412\ \Omega$

The following short-circuit power of the line supply required at the point where the converter is connected:

$S_K = 400^2/0.0412 = 3.88$ MVA

and the following armature inductance of the motor required:

$L_a = 0.0488 \times 400/(50 \times 150) = 2.0$ mH

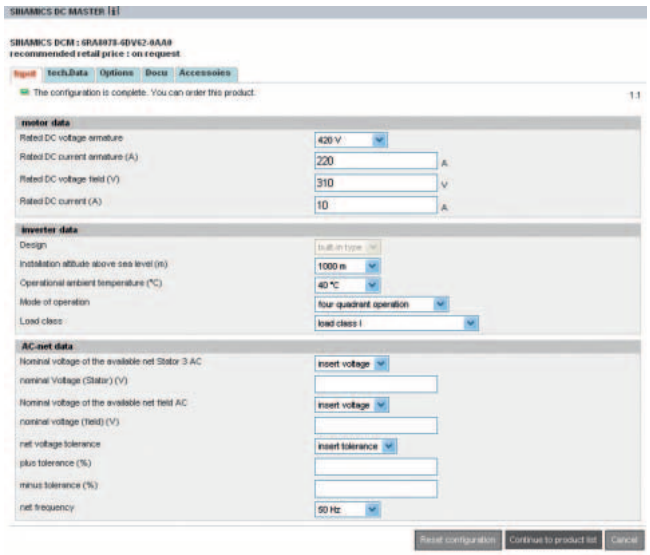
The harmonics currents $I_\nu$ (with $I_1 = g \times 0.817 \times I_d$ for firing angles $\alpha$ = 20° and $\alpha$ = 60°) that can be taken from the tables, only apply for the values $S_K$ and $L_a$ that have been calculated in this way. If the actual values deviate from these, a separate calculation will have to be made.

For the purpose of dimensioning filters and compensation equipment with reactors, it is only possible to draw on the information provided by the harmonic values calculated in this way if the calculated values $S_K$ and $L_a$ match the actual drive values. In all other cases, a separate calculation will have to be made (this particularly applies when using compensated motors as they have very low armature inductance levels).

# 6 Tools and engineering

## SIZER LD web engineering tool

### Overview




SIZER LD web is used when engineering SINAMICS DC MASTER. It provides supply when selecting and dimensioning the converter, associated options and accessories required for the particular application. SIZER LD web is implemented as web-based application (Internet): http://www.siemens.com/sizer-ld.

SIZER LD web supports all of the engineering stages of a converter in just one workflow:

- Enter the motor data, converter data and AC line supply data
- Select the SINAMICS DC MASTER options
- Compile the required documentation and accessories

The SIZER LD web user interface is in German and English.

The engineered drive is saved in a project. From the general idea and the structure, the “Projects” and “Project items” set up in the system correspond to quotations. These are all saved on one server and can be recalled at any time.

Results of the engineering process include:

- Data sheet with the technical data of the engineered converter and where relevant, the accessories
- Dimension drawing of the converter

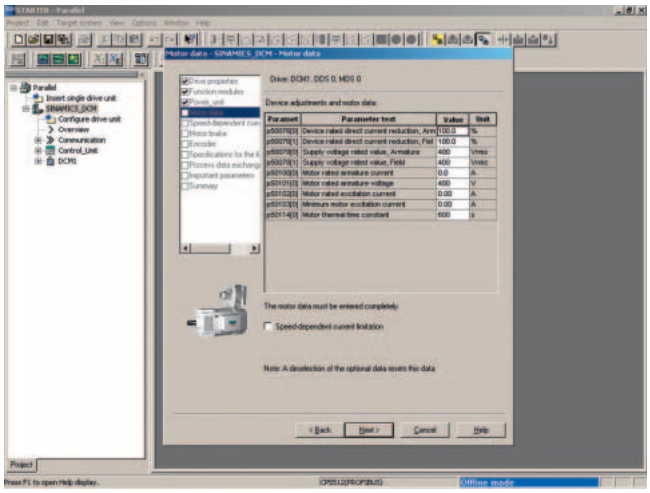
The results and dimension drawings can be saved or exported to technical quotation documentation.

SIZER LD web requires the following preconditions for its use:

- Internet connection
- Login for SSO (Single-Sign-On) through http://www.siemens.com/sizer-ld
- SIZER LD web Version 1 has been designed for Internet Explorer 6 or higher. Mozilla Firefox, Safari (Mac OS) and Opera are also supported from Version 2 and higher.

However, in the future, SINAMICS DC MASTER will not only be able to be engineered in SIZER LD web. It is also possible to engineer the unit in the Industry Mall (https://mall.automation.siemens.com/) directly via the configurator list. Almost the whole of the Industry product catalog can be called-up in the Industry Mall – including Configurators for a wide range of products – without having to enter a Login. After logging on to the Mall, users can view the prices and add the products that have been selected into the Mall shopping cart and then enter an order.

## Overview



The user-friendly STARTER commissioning tool can be used for:

- Commissioning
- Optimization and
- Diagnostics

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

In addition to the SINAMICS DC MASTER, the current version of STARTER also supports all of the SINAMICS AC drives – including MICROMASTER 4 and the frequency converters for the SIMATIC ET 200S FC distributed I/O.

SINAMICS DC MASTER is supported from STARTER 4.1.5; it is not possible to use older STARTER versions.

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

Entry level personnel are interactivelly supported in a solution-oriented way.

First commissioning is guided by a wizard which makes all of the basic settings in the drive. Therefore, getting a motor up and running is merely a question of setting a few of the drive parameters as part of the drive configuration process.

Examples of individual settings that can be made include:

- Terminals
- Bus interface
- BICO interconnections
- Diagnostics

Experts can quickly access all of the parameters via the Expert List and do not have to navigate through dialogs.

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

- Trace (depending on drive)

Diagnostic functions provide information about:

- Control/status words
- Parameter status
- Operating conditions
- Communication states

**Performance features**

- Easy to use: Only a small number of settings need to be made to successfully commission the drive for the first time: Motor rotates
- Solution-based user navigation simplifies commissioning
- The built-in trace function provides optimum support during commissioning, optimization and troubleshooting

Minimum hardware and software requirements

PG or PC with Pentium III 1 GHz

512 MB RAM (1 GB RAM recommended)

Screen resolution 1 024 × 768 pixels, 16 bit color depth

Free hard disk memory: 2 GB

Windows 2000 SP4, Windows 2003 Server SP1, SP2

Windows XP Professional SP2 or SP3

Windows Vista Business SP1, Windows Vista Ultimate SP1

Microsoft Internet Explorer 6.0

## Integration

Communication between the Control Unit of the drive and the programming device (PG) or PC can be established via a serial interface, via PROFIBUS or PROFINET.

The following accessories are available for the particular drive system:

### *SINAMICS DC MASTER*

A PROFIBUS communication module and a connecting cable are required to establish communication between a PG/PC and a CUD.

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

and a **connecting cable** between CP 5512 and PROFIBUS
Order No.: 6ES7901-4BD00-0XA0

## Selection and ordering data

| | Order No. |
|---|---|
| **STARTER commissioning tool for SINAMICS and MICROMASTER**<br>English/French/German/Italian/Spanish | **6SL3072-0AA00-0AG0** |

STARTER version 4.1 with Service Pack 5, Hotfix 1 is required for SINAMICS DC MASTER.

If new converter units are launched into the market or if the functionality of a converter is extended by new software, then it is not necessary to install new STARTER software. STARTER can be updated by installing an SSP (SINAMICS Support Package). The actual STARTER version as well as updates can be downloaded from the Internet under
http://support.automation.siemens.com/WW/view/en/10804985/133100
and are provided in the product DVD supplied with each unit.

## STARTER commissioning tool

### Accessories

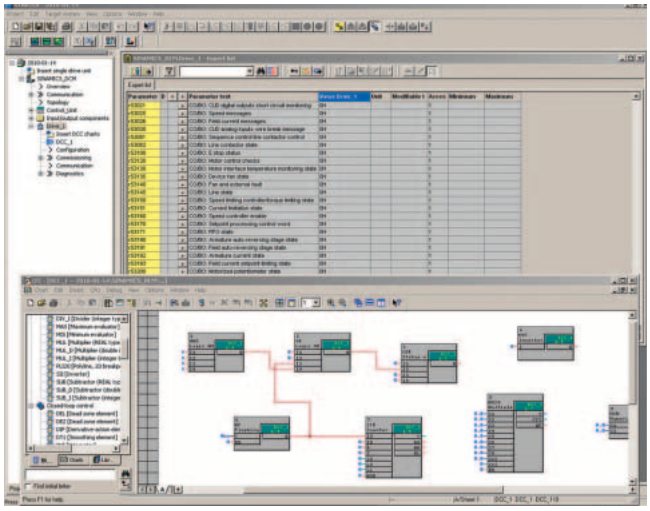
#### *Connection*

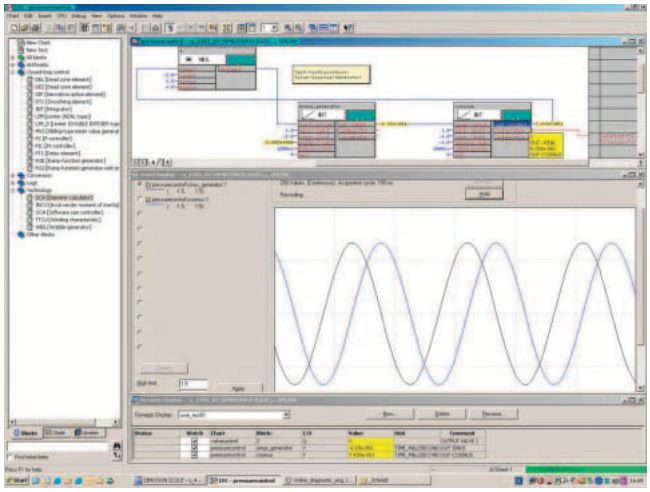
Depending on the version of the Control Unit, the Control Unit (CU) of the drive unit can communicate with the programming device (PG) or PC via a serial interface, PROFIBUS, or Ethernet/PROFINET. The following accessories are available for the particular drive system as listed in the following table.

| | Order No. |
|---|---|
| **PROFIBUS communication module CP 5512**<br>PCMCIA type 2 card + adapter with 9-pin SUB-D socket for connection to PROFIBUS. For MS Windows 2000/XP Professional and PCMCIA 32 | **6GK1551-2AA00** |
| **Connecting cable between CP 5512 and PROFIBUS** | **6ES7901-4BD00-0XA0** |

## Overview

Graphically configuring and expanding the device functionality using the freely available closed-loop control, arithmetic, and logic blocks





Drive Control Chart (DCC) extends the possibility of very simply configuring technological functions – both for the SIMOTION motion control system as well as for the SINAMICS DC MASTER drive system. For users, this opens up a new dimension regarding the adaptability of the systems mentioned to the specific functions of their machines. DCC has no restrictions with regard to the number of usable functions; this is only limited by the performance capability of the target platform.

The user-friendly DCC editor enables easy graphics-based configuration, allows control loop structures to be clearly represented and provides a high degree of reusability of diagrams that have already been created.

The open-loop and closed-loop control functions are defined by using multi-instance-capable blocks (Drive Control Blocks (DCBs)) from a pre-defined library (DCB library) that are selected and graphically linked with one another by dragging and dropping. Test and diagnostic functions allow the program behavior to be verified and in the case of a fault, the cause identified.

The block library encompasses a large selection of closed-loop, arithmetic and logic blocks, as well as comprehensive open-loop and closed-loop control functions.

For logically combining, evaluating and acquiring binary signals, all commonly used logic functions are available for selection (AND, XOR, on/off delay, RS flipflop, counter, etc.). A wide range of arithmetic functions, such as absolute value generation, dividers and minimum/maximum evaluation are available to monitor and evaluate numerical quantities. In addition to the closed-loop drive control, axial winder functions, closed-loop PI controller, ramp function generator or wobble generator can be configured simply and easily.

Closed-loop control structures can be programmed with almost no restrictions in conjunction with the SIMOTION motion control system. These can then be combined with other program sections to form an overall program.

Further, Drive Control Chart for SINAMICS DC MASTER provides a user-friendly basis to handle drive-related open-loop and closed-loop control tasks directly in the converter. This further extends the possibility of adapting SINAMICS to the particular application. Local data processing in the drive supports the implementation of modular machine concepts and results in an increase in the overall machine performance.

Minimum hardware and software requirements

See the SCOUT or STARTER engineering software, since DCC is installed in addition to this.

Note:
In order to download the DCB library into the drive, it is necessary to use a memory card for the first time (option S01 or option S02 when using a Standard CUD right (option G10) or an Advanced CUD right (option G11)).

## Selection and ordering data

DCC comprises the graphic configuring tool (DCC Editor) and the block library (DCB Library).

DCC is installed in addition to the SCOUT or STARTER engineering software.

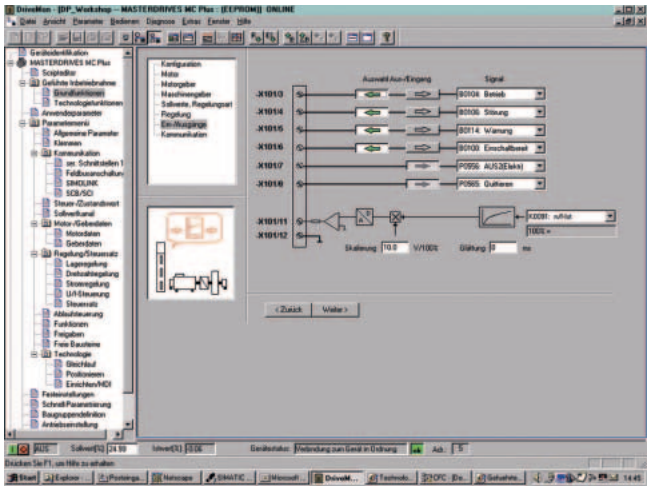
The necessary engineering license for each PC (floating) for DCC is acquired at the same time the order is placed; additional run time licenses are not required.

DCC can be ordered in two versions: The version for SIMOTION and SINAMICS applications, or the version for SINAMICS applications only.

| | Order No. |
|---|---|
| **DCC-SIMOTION/-SINAMICS V2.0 SP1 for SCOUT/STARTER V4.1 SP1**<br>(single-user engineering license, with DCC data carrier)<br>DCC editor + DCB libraries for use on SIMOTION V4.1 SP1 and SINAMICS S120 V2.5 SP1<br>German/English/French/Italian (SIMOTION)<br>German/English/French/Italian/Spanish (SINAMICS) | **6AU1810-1JA20-1XA0** |
| **DCC-SINAMICS V2.0 SP1 for STARTER V4.1 SP1**<br>(single-user engineering license, with DCC data carrier)<br>DCC editor + DCB library for use on SINAMICS S120 V2.5 SP1<br>German/English/French/Italian/Spanish | **6AU1810-1HA20-1XA0** |

## Drive ES engineering software

### Overview



Drive ES is the engineering system used to integrate Siemens drive technology into the SIMATIC automation world easily, efficiently and cost-effectively in terms of communication, configuration and data management.

It is based on the operator interface of the STEP 7 Manager, the essential element when it comes to engineering.

Various software packages are available for selection:

- Drive ES Basic –
  for entry into the world of Totally Integrated Automation and the capability of routing beyond network boundaries and the use of the SIMATIC teleservice.
- Drive ES SIMATIC –
  to simply parameterize the STEP 7 communication program instead of programming.
- Drive ES PCS7 –
  integrates drives with PROFIBUS interface into the SIMATIC PCS7 process control system.

### Application

The Drive ES (*D*rive *E*ngineering *S*oftware) engineering software fully integrates drives from Siemens into the world of Totally Integrated Automation.

The table provides a general overview of the Drive ES software packages available for each drive.

| Drive | Drive ES Basic V5.4 and higher | Drive ES SIMATIC V5.4 and higher | Drive ES PCS7 V6.0 and higher |
|---|---|---|---|
| SIMOVERT MASTERDRIVES | • | • | • |
| SIMOREG DC-MASTER | • | • | • |
| SIMODRIVE 611 universal HRS | • | • | |
| SIMODRIVE POSMO A/SI/CD/CA | • | • | |
| MICROMASTER/ MIDIMASTER/ COMBIMASTER Third generation | • | • | • |
| MICROMASTER 4 Fourth generation | • | • | • |
| SINAMICS S110 | • | • | |
| SINAMICS S120 | • | • | • 1) |
| SINAMICS S150 | • | • | • 1) |
| SINAMICS G120 | • | • | • 1) |
| SINAMICS G120D | • | • | • 1) |
| SINAMICS G130 | • | • | • 1) |
| SINAMICS G150 | • | • | • 1) |
| SINAMICS GL150 | • | • | • 1) |
| SINAMICS GM150 | • | • | • 1) |
| SINAMICS SM150 | • | • | • 1) |
| SINAMICS DC MASTER | • 2) | • 3) | on request |

### Design

- **Drive ES Basic** is the basic software to parameterize all of the drives online and offline. Using the Drive ES Basic basic software, the automation and the drives can be handled with the SIMATIC Manager software. Drive ES Basic is the starting point for common data archiving for complete projects and for extending the use of routing and the SIMATIC teleservice to drives. Drive ES Basic provides the engineering tools for the new motion control functions, slave-to-slave communication, equidistance mode and clock cycle synchronization with PROFIBUS DP and ensures that drives with PROFINET IO are simply integrated into the SIMATIC environment.
- **Drive ES SIMATIC** requires that STEP 7 has first been installed. It features a SIMATIC function block library, thereby making the programming of the PROFIBUS and/or PROFINET IO interface in the SIMATIC CPU for the drives easy and secure.
  There is no need for separate, time-consuming programming of the data exchange between the SIMATIC CPU and the drive.
  All Drive ES users need to remember is:
  Copy – Modify – Load – Finished.
  Customized, fully-developed function blocks are copied from the library into user-specific projects.
  Frequently-used functions are set to run in program format:
  - The complete diagnostics memory is automatically read-out of the drive
  - Download complete parameter set automatically from the SIMATIC CPU to the drive, e.g. when a device has to be replaced
  - Automatically download partial parameter sets (e.g. for recipe or product change) from the SIMATIC CPU to the drive
  - Upload the complete parameter assignment or partial parameter sets from the drive to the SIMATIC CPU, that means update.

1) Drive ES PCS7 V6.0 SP2 and higher
2) Drive ES Basic V5.4 SP5 and higher
3) Drive ES SIMATIC V5.4 SP3 and higher

## Design (continued)

Detailed contents of the Drive ES SIMATIC package:

- **"PROFIBUS DP" communications software** for S7-300 with CPUs with integrated DP interface (DRVDPS7, POSMO function block libraries), S7-400 with CPUs with integrated DP interface or with CP443-5 (DRVDPS7, POSMO function block libraries) and S7-300 with CP342-5 (DRVDPS7C function block library)
- **"USS protocol" communications software** for S7-300 with integrated PtP interfaces or with CP 340/341 and S7-400 with CP 441 (DRVUSSS7 function block library)
- **STEP 7 slave object manager** for the easy configuration of drives as well as for non-cyclic PROFIBUS DP communication with the drives; supports the conversion of DVA_S7 to Drive ES projects (V5.1 and higher)
- **STEP 7 device object manager** for convenient configuration of drives with PROFINET IO interfaces (V5.4 and higher)
- **SETUP program** for installing the software in the STEP 7 environment
- **"PROFINET IO" communications software** for S7-300 with CPUs with integrated PN interface, S7-400 with CPUs with integrated PN interface or with CP (DRVDPS7 function block library, respectively). PROFINET IO and PROFIBUS DP use the same blocks from the DRVDPS7 library, i.e. the blocks are able to serve both buses with a common block (only for V5.4 and higher)

- **Drive ES PCS7** requires that SIMATIC PCS7 (version 5.2 and higher) has first been installed. Drive ES PCS7 provides a function block library with function blocks for the drives and the corresponding faceplates for the operator station which enables the drives to be operated from the PCS7 process control system. From version V6.1 and higher, drives will also be able to be represented in the PCS7 Maintenance Station.

Detailed contents of the Drive ES PCS7 package:

- **Block library for SIMATIC PCS7** Faceplates and control blocks for SIMOVERT MASTERDRIVES VC and MC, as well as MICRO-/MIDIMASTER of the third and fourth generation and SIMOREG DC-MASTER and SINAMICS
- **STEP 7 slave object manager** for convenient configuration of drives and acyclic PROFIBUS DP communications with the drives
- **SETUP program** for installing the software in the PCS7 environment

## Selection and ordering data

| | Order No. |
|---|---|
| **Drive ES Basic V5.4 SPx** [1] | |
| • Configuration software for the integration of drives into Totally Integrated Automation<br>• Precondition: STEP 7 V5.3 and higher, SP 3<br>• Supply as: DVD English/French/German/Italian/Spanish with electronic documentation | |
| Floating license, 1 user | **6SW1700-5JA00-4AA0** |
| Floating license, (copy license), 60 users | **6SW1700-5JA00-4AA1** |
| Update service for single-user license | **6SW1700-0JA00-0AB2** |
| Update service for copy license, 60 users | **6SW1700-0JA00-1AB2** |
| Upgrade from V5.x to V5.4 SPx [1] | **6SW1700-5JA00-4AA4** |
| **Drive ES SIMATIC V5.4 SPx** [1] | |
| • Function block library for SIMATIC for the parameterization of communication with the drives<br>• Precondition: STEP 7, V5.3 and higher, SP 3<br>• Supply as: CD-ROM English/French/German/Italian/Spanish with electronic documentation | |
| Single-user license incl. 1x runtime license | **6SW1700-5JC00-4AA0** |
| Runtime license (without data carrier) | **6SW1700-5JC00-1AC0** |
| Update service for single-user license | **6SW1700-0JC00-0AB2** |
| Upgrade from V5.x to V5.4 SPx [1] | **6SW1700-5JC00-4AA4** |
| **Drive ES PCS7 V6.1 SPx** [1] | |
| • Block library for PCS7 for the integration of drives<br>• Precondition: PCS7, V6.1 and higher<br>• Supply as: CD-ROM English/French/German/Italian/Spanish with electronic documentation | |
| Single-user license incl. 1x runtime license | **6SW1700-6JD00-1AA0** |
| Runtime license (without data carrier) | **6SW1700-5JD00-1AC0** |
| Update service for single-user license | **6SW1700-0JD00-0AB2** |
| Upgrade from V5.x to V6.1 SPx [1] | **6SW1700-6JD00-1AA4** |
| **Drive ES PCS7 V7.0 SPx** [1] | |
| • Block library for PCS7 for the integration of drives<br>• Precondition: PCS7, V7.0 and higher<br>• Supply as: CD-ROM English/French/German/Italian/Spanish with electronic documentation | |
| Single-user license, incl. 1x runtime license | **6SW1700-7JD00-0AA0** |
| Runtime license (without data carrier) | **6SW1700-5JD00-1AC0** |
| Update service for single-user license | **6SW1700-0JD00-0AB2** |
| Upgrade from V5.x to V7.0 SPx [1] | **6SW1700-7JD00-0AA4** |

[1] Orders are always automatically supplied with the latest SP.

## Drive ES engineering software

### Options

#### *Drive ES software update service*

A software update service can also be purchased for the Drive ES software. The user will automatically receive the latest software, service packs and full versions for one year after ordering.

The update service can only be ordered in addition to an existing (i.e. previously ordered) full version.

- Period of update service: 1 year

The update service is automatically extended by 1 further year unless canceled up to 6 weeks prior to expiration.

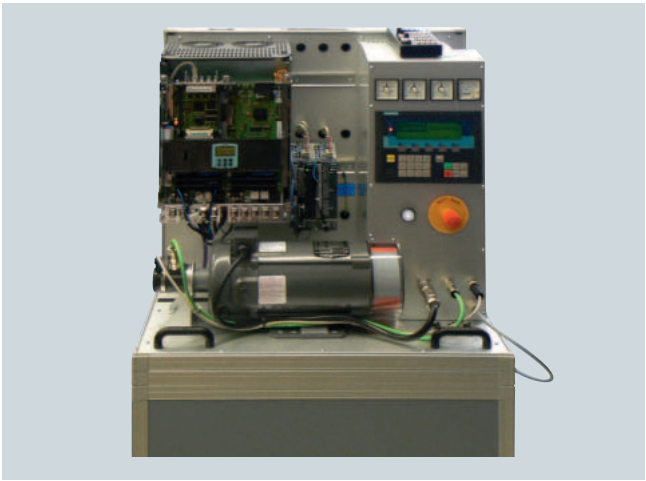
| | Order No. |
|---|---|
| **Drive ES Basic** | |
| Update service for single-user license | **6SW1700-0JA00-0AB2** |
| Update service for copy license | **6SW1700-0JA00-1AB2** |
| **Drive ES SIMATIC** | |
| Update service for single-user license | **6SW1700-0JC00-0AB2** |
| **Drive ES PCS7** | |
| Update service for single-user license | **6SW1700-0JD00-0AB2** |

# Services and documentation



# SINAMICS DCM demonstration case

## Overview



Demonstration case, opened

The SINAMICS DC MASTER demonstration model is installed ready to be connected-up in a rugged transport case and is immediately ready for operation. It comprises a DC converter 480 V 3 AC, DC 30 A, a 1 kW DC motor as well as numerous options and accessories. The case has two integrated transport wheels and a hinged handle.

### *Scope of delivery*

The following main components are included in the SINAMICS DC MASTER demonstration case, including all of the required wiring, connection and signal cables:

- DC converter 6RA8018-6FV62-0AA0-Z;
  Z=G00+G10+G20+S01
  G00 = Advanced CUD left
  G10 = Standard CUD right
  G20 = Communication Board CBE20 left
  S01 = Memory card left
- TM31 Terminal Module
- TM15 Terminal Module
- AOP30 Advanced Operator Panel
- Radio interference suppression filter
- Three-phase commutating reactor for the armature circuit
- Single-phase commutating reactor for the field circuit
- DC motor 1 kW, 1 750 rpm
- Pulse encoder OG 60 DN 2040 CI
- Analog tachometer GT 5.05 L/410, $V_o$ = 10 V/1 000 rpm
- Commissioning box for SINAMICS DC MASTER to control analog and digital inputs and outputs

Free function blocks and Drive Control Chart can be used without any restrictions.

The demonstration case is also available without integrated DC motor to operate an externally mounted DC motor. (The rated converter data must be observed.)

## Application

- Demonstrating DC drives to customers
- Training Siemens employees and customers
- Test configurations

An automation group using a SIMATIC demonstration case together with one or several SINAMICS DC MASTER demonstration cases can be implemented.

## Function

### *Operation*

The converter can be operated from:

- the commissioning box, which is connected to the terminals of the unit or the TM15 and TM31
- the AOP30 operator panel
- the PROFIBUS interface
- the PROFINET interface

A description is provided with the demonstration case. This clearly shows the principle operator panel design and the possible functions of the operator controls.

To use the STARTER commissioning tool users require a programming device or PC. The system requirements are described in section STARTER.

## Technical specifications

| SINAMICS DCM demonstration case | |
|---|---|
| **Line supply connection** | |
| Supply voltage | 400 V 3 AC (+15 %/-20 %) |
| Rated frequency | 45 … 65 Hz |
| Connecting cable with 16-A-CECON connector (5UR5076-3), length | approx. 4 m |
| Line connection fusing required | 16 A |
| **Dimensions and weights** | |
| • Width | approx. 680 mm |
| • Height | approx. 700 mm |
| • Depth | approx. 430 mm |
| Weight with integrated DC motor | approx. 70 kg |
| Weight without motor | approx. 55 kg |

## Selection and ordering data

| SINAMICS DCM demonstration case | |
|---|---|
| Description | Order No. |
| With integrated DC motor | **6RX1800-0SM00** |
| Without motor | **6RX1800-0SV00** |

The demonstration case with integrated DC motor is also available for rental.
Please contact your regional Siemens sales person.

## Overview

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

SITRAIN® – Siemens Training for Automation and Industrial Solutions – provides you with comprehensive support in solving your tasks.

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http://www.siemens.com/sitrain or let us advise you personally. You can request our latest training catalog from:

SITRAIN Customer Support Germany:

Tel.:+49 (0)1805 / 23 56 11

Fax:+49 (0)1805 / 23 56 12

(0.14 €/min. from German landlines, mobile call charges may differ)

E-Mail: info@sitrain.com

### *SITRAIN highlights*

Top trainers

Our trainers have a wealth of practical and didactic experience. Course developers have direct contact to 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 it is known that all theory is drab, we attach great importance to practical exercises which can comprise up to half of the course time. You can therefore immediately implement your new knowledge in practice. We train you on state-of-the-art equipment that has been designed both from the methodology and didactic perspectives. You feel absolutely certain when trained in this environment.

Wide variety

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

Customized training

We are never far 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 combination: Blended learning

Blended learning is the combination of various training media and sequences. For example, attending a course in a local training center can be optimally supplemented by a teach-yourself program as preparation or follow-up. Spin-off: Lower travel costs and shorter times away from work.

## Range of training courses

### Overview

***Commissioning SINAMICS DCM***

Description/learning objective

This training course explains how you adapt the parameter settings of the converter to the application and the DC motor. You expand your theoretical knowledge in the form of exercises carried out on special training equipment. After participating in the course, you know the functions of a converter and the interfaces. You are in a position to safely and quickly commission the unit. Through routine fault diagnostics and troubleshooting, you save time and optimize the availability of your plant or system.

Target group

Commissioning engineers, project engineers, service personnel

Preconditions

Basic knowledge of electrical engineering

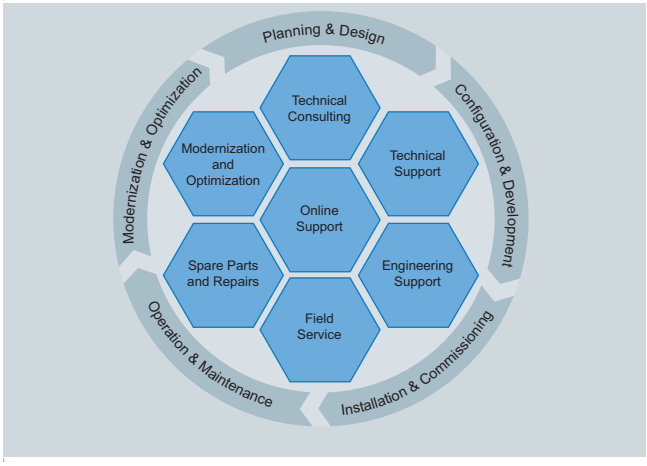
Content

- Design and function of the SINAMICS DC MASTER converter:
  - Control module CUD
  - Power section
  - Field circuit
  - Interfaces
  - Circuit diagrams
- Commissioning and parameterizing using the BOP20 and AOP30 operator panels and the STARTER PC program
- Using the memory card: Structure and data backup
- Procedure when commissioning, checking functions
- Optimizing the closed-loop current and speed control, automatic optimization
- Function diagrams: Setpoint channel, inputs and outputs, free function blocks
- Information on Drive Control Chart DCC
- Drive interface to PROFIBUS / PROFINET
- Expanding the system using Terminal Modules and Sensor Modules via DRIVE-CLiQ
- Parallel circuit configuration and peer-to-peer coupling
- Operating states, alarms and fault messages
- Service functions: Trace, measuring functions, diagnostics memory
- Practical exercises using AOP30 and STARTER on training equipment

Note:

This course is subject to export regulations
AL: N, ECCN: EAR99T

| ***Duration*** | 5 days | ***Order code:*** | DR-DCM |
|---|---|---|---|




Our Service & Support accompanies you worlwide in all concerns related to the automation and drive technology of Siemens. In more than 100 countries directly on site and covering all phases of the life cycle of your machines and plants. Round the clock.

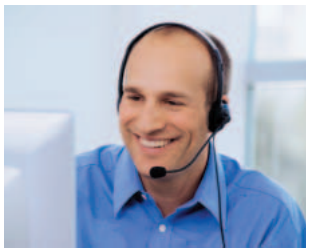
An experienced team of specialists with their combined know-how is ready to assist you. Regular training courses and a close contact of our employees among each other – also across continents – assure a reliable service for multifaceted scopes.

## Online Support

The comprehensive information system available round the clock via Internet ranging from Product Support and Service & Support services to Support Tools in the Shop.

http://www.siemens.com/automation/service&support

## Technical Support



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

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

## Technical Consulting

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

## Engineering Support

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

## Field Service

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

## Spare Parts and Repairs

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

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After startup or during the operating phase, additional potential for inceasing the productiviy or for reducing costs often arises. For this purpose, we offer you high-quality services in optimization and upgrading.

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The DVD also includes a full-text search and our Knowledge Manager for targeted searches for solutions. The DVD will be updated every 4 months.

Just the same as our online offer in the Internet, the Service & Support Knowledge Base on DVD comes complete in 5 languages (German, English, French, Italian, Spanish).

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Order No. **6ZB5310-0EP30-0BA2**

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The Automation Value Card is an integral component of the comprehensive service concept with which Siemens Automation and Drives will accompany you in each phase of your automation project.

It doesn't matter whether you want just specific services from our Technical Support or want to purchase something on our Online portal, you can always pay with your Automation Value Card. No invoicing, transparent and safe. With your personal card number and associated PIN you can view the state of your account and all transactions at any time.

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Card number and PIN are on the back of the Automation Value Card. When delivered, the PIN is covered by a scratch field, guaranteeing that the full credit is on the card.

By entering the card number and PIN you have full access to the Service & Support services being offered. The charge for the services procured is debited from the credits on your Automation Value Card.

All the services offered are marked in currency-neutral credits, so you can use the Automation Value Card worldwide.

Order your Automation Value Card easily and comfortably like a product with your sales contact.

| **Automation Value Card order numbers** | |
|---|---|
| Credits | Order No. |
| 200 | **6ES7 997-0BA00-0XA0** |
| 500 | **6ES7 997-0BB00-0XA0** |
| 1 000 | **6ES7 997-0BC00-0XA0** |
| 10 000 | **6ES7 997-0BG00-0XA0** |

Detailed information on the services offered is available on our Internet site at:

http://www.siemens.com/automation/service&support

Service & Support à la Card: Examples

| **Technical Support** | |
|---|---|
| "Priority" | Priority processing for urgent cases |
| "24 h" | Availability round the clock |
| "Extended" | Technical consulting for complex questions |
| "Mature Products" | Consulting service for products that are not available any more |
| **Support Tools in the Support Shop** | |
| | Tools that can be used directly for configuration, analysis and testing |

## Overview

Documentation is supplied as standard on DVD together with the converter. German, English, French, Spanish, Italian and Russian are the standard languages. The documentation can be additionally ordered as hard copy in the languages specified below.

## Selection and ordering data

### *Documentation for SINAMICS DC MASTER*

| Documentation | Language | Order No. |
|---|---|---|
| Operating Instructions **DC Converters** | German | **6RX1800-0AD00** |
| | English | **6RX1800-0AD76** |
| | French | **6RX1800-0AD77** |
| | Spanish | **6RX1800-0AD78** |
| | Italian | **6RX1800-0AD72** |
| | Russian | **6RX1800-0AD56** |
| Operating Instructions **Control Module** | German | **6RX1800-0BD00** |
| | English | **6RX1800-0BD76** |
| | French | **6RX1800-0BD77** |
| | Spanish | **6RX1800-0BD78** |
| | Italian | **6RX1800-0BD72** |
| | Russian | **6RX1800-0BD56** |
| List Manual | German | **6RX1800-0ED00** |
| | English | **6RX1800-0ED76** |
| | French | **6RX1800-0ED77** |
| | Spanish | **6RX1800-0ED78** |
| | Italian | **6RX1800-0ED72** |
| | Russian | **6RX1800-0ED56** |
| Function Manual **SINAMICS** Free function blocks | German | **6RX1800-0FD00** |
| | English | **6RX1800-0FD76** |
| Set of manuals **DC Converters and Control Module** includes the Operating Instructions, List Manual and Function Manual Free function blocks [1] | German | **6RX1800-0GD00** |
| | English | **6RX1800-0GD76** |
| | French | **6RX1800-0GD77** |
| | Spanish | **6RX1800-0GD78** |
| | Italian | **6RX1800-0GD72** |
| | Russian | **6RX1800-0GD56** |

### *Documentation on DVD*

| Documentation | Language | Order No. |
|---|---|---|
| All documentation in all languages on DVD [1] | German, English, French, Spanish, Italian and Russian | **6RX1800-0AD64** |

[1] Function Manual Free function blocks only in German and English.

## Notes

# Appendix

## Subject index

## Subject index

## Subject index

## Order number index

## List of abbreviations

| Abbreviation | Meaning |
|---|---|
| ***AC*** | Alternating Current |
| ***AOP30*** | Advanced Operator Panel |
| ***AWG*** | American Wire Gauge |
| ***BICO*** | Binector/Connector Technology |
| ***BOD*** | Break-Over Diode |
| ***BOP20*** | Basic Operator Panel |
| ***CBE*** | Communication Board |
| ***CDS*** | Command Data Set |
| ***CM*** | Control Module |
| ***CU*** | Control Unit |
| ***CUD*** | Control Unit DC |
| ***DC*** | Direct Current |
| ***DCB*** | Drive Control Block |
| ***DCC*** | Drive Control Chart |
| ***DCM*** | DC MASTER |
| ***DDS*** | Drive Data Set |
| ***DIN*** | German Institute for Standardization (Deutsches Institut für Normung e.V.) |
| ***DRIVE-CLiQ*** | Drive Component Link with IQ |
| ***EMC*** | Electromagnetic Compatibility |
| ***EMF*** | Electromotive Force |
| ***EN*** | European standard (Europäische Norm) |
| ***EPROM*** | Erasable Programmable Read Only Memory |
| ***E-STOP*** | Emergency Stop |
| ***ES*** | Engineering System |
| ***HTL*** | High-level Transistor Logic |
| ***IEC*** | International Electrotechnical Commission |
| ***IP*** | International Protection |

| Abbreviation | Meaning |
|---|---|
| ***LCD*** | Liquid Crystal Display |
| ***LED*** | Light Emitting Diode |
| ***MTBF*** | Mean Time Between Failure |
| ***PC*** | Personal Computer |
| ***PCB*** | Printed Circuit Board |
| ***PCS*** | Process Control System |
| ***PDS*** | Power Drive System |
| ***PE*** | Protective Earth |
| ***PG*** | Programming device (Programmiergerät) |
| ***PKW*** | Parameter identifier value (Parameter Kennung Wert) |
| ***PTC*** | Positive Temperature Coefficient |
| ***PZD*** | Process data (Prozessdaten) |
| ***RAM*** | Random Access Memory |
| ***SMC30*** | Sensor Module |
| ***SSO*** | Single Sign-On |
| ***TIA*** | Totally Integrated Automation |
| ***TIP*** | Totally Integrated Power |
| ***TM15, TM31*** | Terminal Module |
| ***TTL*** | Transistor-Transistor Logic |
| ***UL*** | Underwriters Laboratories Inc. |
| ***UPS*** | Uninterruptible Power Supply |
| ***USS*** | Universal serial interface (Universelle Serielle Schnittstelle) |
| ***VDE*** | Association of Electrical Engineering, Electronics and Information Technology (Germany) (Verband der Elektrotechnik Elektronik Informationstechnik e.V.) |

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You start by selecting a

- Product group,
- Country,
- City,
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## Product Selection Using the Offline Mall of Industry


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

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

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

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

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

or on DVD.

## Easy Shopping with the Industry Mall


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

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

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

### *For customers with a seat or registered office outside of Germany*

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

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

### *General*

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

Illustrations are not binding.

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

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

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

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

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

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

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

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

or download them from the Internet
www.siemens.com/industrymall
(Germany: Industry Mall Online-Help System)

## Export regulations

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

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

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

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

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

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

Errors excepted and subject to change without prior notice.

I IA/DT /VuL_ohne MZ/En 16.03.10

## DVD-ROM included with Catalog D 23.1 · 2010

***On the DVD-ROM included with Catalog D 23.1 · 2010, you will find:***

- Manuals, SINAMICS DCM and SICROWBAR AC/DC
- GSD files
- Function block diagrams in the VSD format
- Dimension drawings of the DC Converter and Control Module in the DXF and PDF formats
- STARTER commissioning tool
- Spare parts list in the XLS format
- Catalog D 23.1 · 2010 in the PDF format
- Information about service and support

The contents of the DVD correspond to the catalog edition. Current versions are provided in the Internet and on every DVD supplied with the equipment.

***Hardware and software requirements***

- DVD-ROM drive
- Windows from XP
- Adobe Reader from 7.0
- MS Internet Explorer from V6.0 (SP2)

***Start***

Insert the DVD-ROM into your DVD-ROM drive.
Run the “start.htm” file from the DVD-ROM in your Windows Explorer.

Note:
No software has to be installed to view the information on this DVD-ROM. The only exception is when using the dimension drawings in the DXF format.

# Catalogs

# Industry Automation, Drive Technologies and Low Voltage Distribution

**Further information can be obtained from our branch offices listed in the appendix or 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 G110, SINAMICS G120 Standard Inverters<br>SINAMICS G110D, SINAMICS G120D Distributed Inverters | D 11.1 |
| SINAMICS G130 Drive Converter Chassis Units<br>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<br>SINAMICS S150 Converter Cabinet Units | D 21.3 |
| SINAMICS DCM Converter Units | D 23.1 |
| Three-phase Induction Motors<br>• H-compact<br>• 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 |
| SINAMICS S110 The Basic Positioning Drive | PM 22 |
| Low-Voltage Three-Phase-Motors | |
| IEC Squirrel-Cage Motors | D 81.1 |
| MOTOX Geared Motors | D 87.1 |
| Automation Systems for Machine Tools SIMODRIVE<br>• Motors<br>• Converter Systems SIMODRIVE 611/POSMO | NC 60 |
| Automation Systems for Machine Tools SINAMICS<br>• Motors<br>• Drive System SINAMICS S120 | NC 61 |
| Drive and Control Components for Hoisting Equipment | HE 1 |
| Mechanical Driving Machines | |
| Flender Standard Couplings | MD 10.1 |

## Electrical Installation Technology

| | |
|---|---|
| *PDF: ALPHA Distribution Boards and Terminal Blocks* | *ET A1* |
| *PDF: ALPHA 8HP Molded-Plastic Distribution System* | *ET A3* |
| *PDF: BETA Low-Voltage Circuit Protection* | *ET B1* |
| *PDF: DELTA Switches and Socket Outlets* | *ET D1* |
| *PDF: GAMMA Building Management Systems* | *ET G1* |

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

## Motion Control

| | Catalog |
|---|---|
| SINUMERIK & SIMODRIVE Automation Systems for Machine Tools | NC 60 |
| SINUMERIK & SINAMICS Equipment for Machine Tools | NC 61 |
| SIMOTION, SINAMICS S120 and Motors for Production Machines | PM 21 |
| SINAMICS S110 The Basic Positioning Drive | PM 22 |

## Low-Voltage

| | |
|---|---|
| Controls and Distribution – SIRIUS, SENTRON, SIVACON | LV 1 |
| SICUBE System Cubicles and Cubicle Air-Conditioning | LV 50 |
| *PDF: SIDAC Reactors and Filters* | *LV 60* |
| *PDF: SIVACON 8PS Busbar Trunking Systems* | *LV 70* |
| Low-Voltage Controls and Distribution – SIRIUS, SENTRON, SIVACON | LV 90 |

## 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 |
| *PDF: Indicators for panel mounting* | *MP 12* |
| SIREC Recorders and Accessories | MP 20 |
| SIPART, Controllers and Software | MP 31 |
| *PDF: Products for Weighing Technology* | *WT 10* |
| Process Analytical Instruments | PA 01 |
| *PDF: Process Analytics, Components for the System Integration* | *PA 11* |

## Safety Integrated

| | |
|---|---|
| Safety Technology for Factory Automation | SI I0 |

## SIMATIC HMI

| | |
|---|---|
| Human Machine Interface Systems | ST 80 |

## 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* |
| pc-based Automation | ST PC |

## SIMATIC NET

| | |
|---|---|
| Industrial Communication | IK PI |

## SIMATIC Sensors

| | |
|---|---|
| Sensor Technology for Factory Automation | FS 10 |
| Industrial Identification Systems | ID 10 |

## System Solutions

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

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Large Drives
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