<table>
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<th>Catalogs for “Large Drives”</th>
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| **SINAMICS G130/G150**  
Drive Converter Chassis Units  
Drive Converter Cabinet Units  
Order No.:  
German: E86060-K5511-A101-A3  
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| D 11 |
| **SIMOREG K 6RA22**  
Analog Chassis Converters  
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German: E86060-K5121-A121-A1  
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| **SINAMICS GM150/SM150**  
Medium-Voltage Converters  
0.8 MVA to 28 MVA  
Order No.:  
German: E86060-K5512-A101-A1  
| D 12 |
| **SIMOREG DC MASTER 6RM70**  
Digital Converter Cabinet Units  
Order No.:  
German: E86060-K5122-A101-A1  
| DA 22 |
| **SINAMICS S120**  
Vector Control Drive System  
Order No.:  
German: E86060-K5521-A111-A1  
| D 21.1 |
| **Components for Automation**  
CA 01  
Order No.:  
German: E86060-D4001-A100-C5 (CD-ROM)  
English: E86060-D4001-A500-C5 (DVD) |
| DA 21.1 |
| **DC Motors**  
Sizes 100 to 630  
0.45 kW to 1610 kW  
Order No.:  
German: E86060-K5312-A101-A1  
| DA 12 |
| **SIMOREG DC-MASTER 6RA70**  
Digital Chassis Converters  
Order No.:  
German: E86060-K5321-A111-A1  
| DA 21.1 |
| **Spare Parts for SIMOREG Converters (Chassis Units)**  
Order No.:  
German: E86060-K5521-A131-A1  
| DA 21.3 |
| **A&D Mall**  
Internet:  
www.siemens.com/automation/mall |
| DA 21.1 E |
| **Engineering Information for Catalog DA 12 DC Motors**  
Order No.:  
German: E86060-T5312-A101-A1  
| DA 12 T |
| **SIMOREG K 6RA22 Analog Chassis Converters**  
Order No.:  
German: E86060-K5121-A121-A1  
English: E86060-K5121-A121-A1-7600 |
| DA 21.2 |
| **SINAMICS S150 Drive Converter Cabinet Units**  
75 kW to 1200 kW  
Order No.:  
German: E86060-K5521-A131-A1  
| D 21.3 |
| **SIMOREG K 6RA22 Analog Chassis Converters**  
Order No.:  
German: E86060-K5121-A121-A1  
English: E86060-K5121-A121-A1-7600 |
| DA 21.2 |
| **SINAMICS S120 Vector Control Drive System**  
Order No.:  
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The products contained in this catalog can also be found in the e-Catalog CA 01
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E86060-D4001-A510-C5-7600 (DVD)

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Your regional Siemens contact can provide more information. He or she will be glad to help.
SIMOREG 6RA70 DC MASTER

Overview

Application
Overview of types
Guide
Overview

Application

Well-proven drive technology: Rugged, dynamic and low-priced

Depending on the application, DC drives are often the most economical drive solution. They also have many advantages in terms of reliability, user-friendliness and operational response. A number of technical and commercial factors are as important now as they have been in the past for deployment of DC drives in many sectors of industry:
- Low-cost 4-quadrant operation
- Continuous duty at low speed
- Full torque even at low speeds
- High starting torque
- Wide speed range for constant power
- Minimal space requirements
- Reliability

Perfect for all requirements

In DC technology, anyone who is looking for optimal economy should start with the SIMOREG DC MASTER family – converters with top performance as well as integrated intelligence. They are known for maximum operational reliability and availability – world wide in a wide range of different fields:
- Main drives for printing machines
- Rubber and plastics industry
- Traversing and lifting drives in the lifting gear industry
- Elevator and cable car drives
- Applications in paper manufacturing
- Cross-cutter drives in the steel industry
- Rolling mill drives
- Winding drives
- Loading machines for motor, turbine and gearbox test beds.

One complete family: SIMOREG DC MASTER

The SIMOREG DC MASTER family is available in every possible variation – for a power range from 6.3 kW to 2508 kW, for armature and field supply and for single/two or four-quadrant operation. And the SIMOREG DC MASTERs feature a highly dynamic response: Their current or torque rise time is significantly below 10 ms. You will always find the right variant for your application. And these are their most important characteristics:
- For total integration into every automation environment
- Modular expansion capability throughout
- From standard applications to high-performance solutions
- Redundant drive configurations up to 12,000 A thanks to intelligent parallel connection
- Rated input voltage from 400 V to 950 V
- Quick and easy start-up thanks to the fully electronic parameterization of all settings
- Uniform operating philosophy

SIMOREG DC MASTERs naturally also feature the unique characteristic of Siemens products: TIA – Totally Integrated Automation. You profit from the totally integrated Siemens world during project engineering and programming as well as with the common database and system-wide communication.

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Application

Motors, the muscles of the DC system

SIMOREG DC MASTER converters in combination with the DC motor range are the winning team. The compact DC motors from Siemens have proved themselves worldwide wherever low-cost drive technology and maximum availability are required. They are rugged and have a long service life over a power range from 0.45 kW to 1610 kW. Whether self-cooled or externally-cooled, with or without a fan, to the IP 23, IP 54 or IP 55 degree of protection: The modular design permits any combination. And what is more: Our DC motors can be integrated into the world of automation via the motor interface designed for the SIMOREG DC MASTER – for continuous monitoring, accurate diagnosis and effective maintenance.

At your side worldwide

Internationally approved products are not only global players in terms of their compliance with international standards. Within the context of the worldwide Siemens service network, service does not end with the finely-tuned logistics concept for short delivery times, fast order-processing and prompt service. With over 180 service centers in more than 110 countries, we are accessible round the clock to overcome breakdowns and to offer individually tailored business services for all aspects of products and systems. As a professional service provider, our OnCall service provides technical expertise and logistics as well as all the other components necessary to ensure an efficient service visit.

Retrofit to make your existing systems fit again

You can also benefit from these advantages in existing systems. With the SIMOREG CM converter, you can inject new life into an old system. The Control Module provides you with a low-cost and efficient retrofit solution – whether for re-equipping or upgrading.

International standards from Siemens

Internationally approved products are taken for granted at Siemens. SIMOREG products comply with all the most important standards – ranging from the EN European standard to IEC/VDE. CE marking, UL, cUL and CSA approvals make the SIMOREG DC MASTER a genuinely global player.

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Overview

Type overview · Guide

Overview of types

<table>
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<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>Rated DC current armature</td>
<td>15 A – 280 A</td>
<td>400 A – 600 A</td>
<td>720 A – 850 A</td>
<td>900 A – 1200 A</td>
<td>1500 A – 3000 A</td>
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<tr>
<td>Rated DC current field</td>
<td>5 A – 15 A</td>
<td>25 A</td>
<td>30 A</td>
<td>30 A</td>
<td>40 A/85 A</td>
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<td>Dimensions (H x W x D mm x mm x mm)</td>
<td>385 x 265 x 239-313</td>
<td>625 x 268 x 318</td>
<td>700 x 268 x 362</td>
<td>780 x 410 x 362</td>
<td>880 x 450 x 500</td>
</tr>
</tbody>
</table>

Guide

Section 2
You will find an overview of the performance and characteristics of the SIMOREG DC MASTER converters in Section 2 of the system description. Everything that you always wanted to know about the market leader in DC drive technology or perhaps have forgotten again is presented here.

Section 3
Selecting a DC converter is easy. Make a note of the following data:
- Rated supply voltage or
- Rated DC voltage (armature voltage)
- Rated armature current
- Operating mode (1Q or 4Q)
Then select the appropriate converter from the tables in Section 3, Technical Data. For voltages that differ from the standard ratings simply select the next higher voltage class. The converters can be adjusted within the range 85 V to 1000 V to any supply voltage by setting the appropriate parameters.

The reduction factors that apply in the case of climatic conditions that differ from the standard (installation altitude above 1000 m and/or ambient temperature higher than 45 °C/40 °C) are also specified there. These tables also contain the complete set of technical data for the individual converter types.

Section 4
Everything that is necessary for expanding the functional scope or for integration in a drive system is described in Section 4, Options. From a simple operator panel through communications and technology modules as far as rectifier modules for series connection, the expansion possibilities are almost endless.

Section 5
If you want to utilize the dynamic overload characteristics of the converters, you will find all the necessary information in Section 5, Planning Guide. There are also notes and selection guidelines concerning the commutating reactors required as well as filters and other EMC topics.

Whether you want parallel connection, 12-pulse operation or redundant drive configurations – it is easy with the SIMOREG DC MASTER.

Section 6
Retooling existing systems is becoming more and more interesting in the field of DC drives. For high power ratings in particular, it can prove sensible not to replace the power section in the system. But the customer still wants all the advantages of a modern DC drive. Our solution to this dilemma is described in Section 6, SIMOREG CM.

Section 7
The SIMOREG CCP (Converter Commutation Protector) is used to protect line-commutated converters SIMOREG DC MASTER operating in inverter mode. In this mode line faults can cause inverter commutation failures ("conduction-through"). The OCP limits the unpermissible large current created in this case and thus avoids destruction of fuses and thyristors.

Section 8
The data provided in Section 8, Selection and Ordering Data is probably sufficient to enable an experienced DC engineer to plan a complete converter solution. All the necessary data is summarized in this section.

Section 9
When you have found the right converter, you will certainly want to install it in a system. You will find the necessary instructions in Section 9, Dimension Drawings.

Section 10
For all those who want to refresh their knowledge or who do not yet have any experience with DC drives, help is of course available. Whether at home with a training briefcase or in one of our training centers: The appropriate training aids or course structures are described in Section 10, Documentation and Training.
Overview

Power section and cooling
Parameterization devices

Design and mode of operation

Software structure
Closed-loop functions in armature circuit
Closed-loop functions in field circuit
Optimization run
Monitoring and diagnosis
Functions of inputs and outputs
Safety shutdown (E-STOP)
Serial interfaces
Control terminal block
Interface to motor

Terminal assignments

Terminal assignments for basic units

Open-loop and closed-loop control section

Block diagram of CUD1
Terminal assignments for CUD1

Block diagram

SIMOREG DC Master without fan
SIMOREG DC Master with fan
### Power section and cooling

SIMOREG 6RA70 converters are fully digital, compact units for connection to a three-phase AC supply. They in turn supply the armature and field of variable-speed DC drives. The range of rated DC currents extends from 15 A to 3000 A, but can be expanded by connecting SIMOREG converters in parallel.

Converters for single-quadrant or four quadrant operation are available to suit individual applications. As the converters feature an integrated parameterization panel, they are autonomous and do not require any additional parameterization equipment. All open-loop and closed-loop control tasks as well as monitoring and auxiliary functions are performed by a microprocessor system. Setpoints and actual values can be applied in either analog or digital form.

SIMOREG 6RA70 converters are characterized by their compact, space-saving design. An electronics box containing the closed-loop control board is mounted in the converter door. This box also has space to hold additional boards for process-related expansion functions and serial interfaces. This design makes them especially easy to service since individual components are easily accessible.

External signals (binary inputs/output), analog inputs/outputs, pulse encoders, etc.) are connected by way of plug-in terminals. The converter software is stored in a flash EPROM. Software upgrades can easily be loaded via the serial interface of the basic unit.

#### Power section: Armature and field circuit

The armature circuit is a three-phase bridge connection:

- As a fully controlled B6C three-phase connection in converters for single-quadrant drives.
- As two fully controlled (B6) A (B6) C three-phase connections in converters for four-quadrant drives.

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

For converters with 15 to 1200 A rated DC current, the power section for armature and field is constructed with isolated thyristor modules. The heat sink is therefore at floating potential.

For converters with rated currents ≥ 1500 A, the power section for armature and field is constructed with disc-type thyristors and heat sinks at voltage potential. All connecting terminals for the power section are accessible from the front.

#### Cooling

Converters with rated DC currents up to 125 A are self-cooled, while converters with rated DC currents of 210 A and higher have forced-air cooling (fan assembly).
Parameterization devices

**PMU simple operator panel**

All units feature a PMU panel mounted in the converter door. The PMU consists of a five-digit, seven-segment display, three LEDs as status indicators and three parameterization keys.

The PMU is also equipped with connector X300 with a USS interface in compliance with the RS232 or RS485 standard.

The panel provides all the facilities required during start-up for making adjustments or settings and displaying measured values. The following functions are assigned to the three panel keys:

- **P (select) key**
  Switches over between parameter number and parameter value and vice versa, acknowledges fault messages.

- **UP key**
  Selects a higher parameter number in parameter mode or raises the set and displayed parameter value in value mode. Also selects a higher index on indexed parameters.

- **DOWN key**
  Selects a lower parameter number in parameter mode or reduces the set and displayed parameter value in value mode. Also selects a lower index on indexed parameters.

- **LED functions**
  - Ready: Ready to operate, lights up in the “Wait for operation enable” state.
  - Run: In operation, lights up when operation is enabled.
  - Fault: Disturbance, lights up in “Active fault” status, flashes when alarm is active.

The quantities output on the five-digit, seven-segment display are easy to understand, e.g.:
- Percentage of rated value
- Servo gain factor
- Seconds
- Amperes or Volts

**OP1S converter operator panel**

The OP1S optional converter operator panel can be mounted either in the converter door or externally, e.g. in the cubicle door. For this purpose, it can be connected up by means of a 5 m long cable. Cables of up to 200 m in length can be used if a separate 5 V supply is available.

The OP1S is connected to the SIMOREG via connector X300.

The OP1S can be installed as an economic alternative to control cubicle measuring instruments which display physical measured quantities.

The OP1S features an LCD with 4 x 16 characters for displaying parameter names in plain text. English, German, French, Spanish and Italian can be selected as the display languages. The OP1S can store parameter sets for easy downloading to other devices.

- **Keys on OP1S:**
  - Select key (P)
  - UP key
  - DOWN key
  - Reversing key
  - ON key
  - OFF key
  - Inching key (Jog)
  - Numeric keys (0 to 9)
  - LEDs on OP1S:
    - Green: Lights up in “Run”, flashes in “Ready”
    - Red: Lights up with “Fault”, flashes with “Alarm”
  - RESET key

---

1) This function must be activated with parameters and is freely selectable.
Parameterization devices

Parameterization via PC

To allow start-up and troubleshooting using a PC, the Drive-Monitor software is supplied with the converters.

The PC is linked to the SIMOREG via the USS interface on the basic unit.

The software provides the following functions:

- Menu-assisted access to parameters.
- Reading and writing of parameter sets.
- Copying of existing parameter sets to other converters of the same type.
- Output of parameter sets to a printer.

- Operation via control words (binary commands such as ON/OFF instructions, etc.) and specification of setpoints.
- Monitoring via status words (checkback information about converter status) and readout of actual values.
- Reading of fault messages and alarms.
- Readout of trace buffer contents (oscilloscope function integrated in SIMOREG).
Software structure

Two powerful microprocessors (C163 and C167) perform all closed-loop and drive control functions for the armature and field circuits. Closed-loop control functions are implemented in the software as program modules that are “wired up” via parameters.

Connectors

All important quantities in the closed-loop control system can be accessed via connectors. They correspond to measuring points and can be accessed as digital values. 14 bits (16,384 steps) correspond to 100% in the standard normalization. These values can be used for other purposes in the converters, e.g. to control a setpoint or change a limit. They can also be output via the operator panel, analog outputs and serial interfaces.

The following states can be accessed via binectors:
- Status of binary inputs
- Fixed control bits
- Status of controllers, limitations, faults, ramp-function generator, control words, status words.

Intervention points

The inputs of software modules are defined at intervention points using the associated parameters. At the intervention point for connector signals, the connector number of the desired signal is entered in the relevant parameter so as to define which signal must act as the input quantity. It is therefore possible to use both analog inputs and signals from interfaces as well as internal variables to specify setpoints, additional setpoints, limitations, etc.

The number of the binector to act as the input quantity is entered at the intervention point for binector signals. A control function can therefore be executed or a control bit output by means of either binary inputs, control bits of the serial interfaces or control bits generated in the closed-loop control.

Binectors

Binectors are digital control signals which can assume a value of “0” or “1”. They are employed, for example, to inject a setpoint or execute a control function. Binectors can also be output via the operator panel, binary outputs or via serial interfaces.

The following states can be accessed via binectors:
- Status of binary inputs
- Fixed control bits
- Status of controllers, limitations, faults, ramp-function generator, control words, status words.

Switchover of parameter sets

Four copies of parameters with numbers ranging from P100 to P599 as well as some others are stored in the memory. Binectors can be used to select the active parameter set. This function allows, for example, up to four different motors to be operated alternately or four different gear changes to be implemented on one converter. The setting values for the following functions can be switched over:
- Definition of motor and pulse encoder
- Optimization of closed-loop control
- Current and torque limitation
- Conditioning of speed controller actual value
- Speed controller
- Closed-loop field current control
- Closed-loop e.m.f. control
- Ramp-function generator
- Speed limitation
- Monitors and limit values
- Digital setpoints
- Technology controller
- Motorized potentiometer
- Friction compensation
- Flywheel effect compensation
- Speed controller adaptation.

Switchover of BICO data sets

The BICO data set can be switched over by the control word (binector input). It is possible to select which connector or binector quantity must be applied at the intervention point. The control structure or control quantities can therefore be flexibly adapted.

Motorized potentiometer

The motorized potentiometer features control functions “Raise”, “Lower”, “Clockwise/Counterclockwise” and “Manual/Auto” and has its own ramp-function generator with mutually independent ramp time settings and a selectable rounding factor. The setting range (minimum and maximum output quantities) can be set by means of parameters. Control functions are specified via binectors.

In Automatic mode (“Auto” setting), the motorized potentiometer input is determined by a freely selectable quantity (connector number). It is possible to select whether the ramping times are effective or whether the output is switched directly through to the output.

In the “Manual” setting, the setpoint is adjusted with the “Raise” and “Lower” setpoint functions. It is also possible to define whether the output must be set to zero or the last value stored in the event of a power failure. The output quantity is freely available at a connector, e.g. for use at a main setpoint, additional setpoint or limitation.
**System Overview**

**Design and mode of operation**

### Closed-loop functions in armature circuit

#### Speed setpoint

The source for the speed setpoint and additional setpoints can be freely selected through parameter settings, i.e., the setpoint source can be programmed as:

- Analog values: 0 to ±10 V, 0 to ±20 mA, 4 to 20 mA
- Integrated motorized potentiometer
- Binectors with functions: Fixed setpoint, inch, crawl
- Serial interfaces on basic unit
- Supplementary boards

The normalization is such that 100% setpoint (product of main setpoint and additional setpoints) corresponds to the maximum motor speed. The speed setpoint can be limited to a minimum or maximum value by means of a parameter setting or connector. Furthermore, “adding points” are included in the software to allow, for example, additional setpoints to be injected before or after the ramp-function generator. The “setpoint enable” function can be selected with a binector. After smoothing by a parameterizable filter (PT1 element), the total setpoint is transferred to the setpoint input of the speed controller. The ramp-function generator is effective at the same time.

#### Actual speed value

One of four sources can be selected as the actual speed signal.

- Analog tachometer

The voltage of the tacho-generator at maximum speed can be between 8 and 250 V. The voltage maximum speed normalization is set in a parameter.

- Pulse encoder

The type of pulse encoder, the number of marks per revolution and the maximum speed are set via parameters. The evaluation electronics are capable of processing encoder signals (symmetrical: With additional inverted track or asymmetrical: Referred to ground) up to a maximum differential voltage of 27 V. The rated voltage range (5 V or 15 V) for the encoder is set in a parameter. With a rated voltage of 15 V, the SIMOREG converter can supply the voltage for the pulse encoder. 5 V encoders require an external supply. The pulse encoder is evaluated on the basis of three tracks: track 1, track 2 and zero marker. Pulse encoders without a zero marker may also be installed. The zero marker allows an actual position to be acquired. The maximum frequency of the encoder signals must not exceed 300 kHz. Pulse encoders with at least 1024 pulses per revolution are recommended (to ensure smooth running at low speeds).

- Operation without tachometer and with closed-loop e.m.f. control

No actual value sensor is needed if the closed-loop e.m.f. control function is employed. Instead, the converter output voltage is measured in the SIMOREG. The measured armature voltage is compensated by the internal voltage drop in the motor (I*R compensation). The degree of compensation is automatically determined during the current controller optimization run. The accuracy of this control method is determined by the temperature-dependent change in resistance in the motor armature circuit and equals approximately 5%. In order to achieve greater accuracy, it is advisable to repeat the current controller optimization run when the motor is warm. Closed-loop e.m.f. controller can be employed if the accuracy requirements are not particularly high, if there is no possibility of installing an encoder and if the motor is operated in the armature voltage control range.

Important: The drive cannot be operated in e.m.f.-dependent field-weakening mode when this control method is employed.

- Freely selectable actual speed signal

Any connector number can be selected as the actual speed signal for this operating mode. This setting is selected in most cases if the actual speed sensor is implemented on a technological supplementary board.

Before the actual speed value is transferred to the speed controller, it can be smoothed by means of a parameterizable smoothing (PT1 element) and two adjustable band filters. The band filters are used mainly to filter out resonant frequencies caused by mechanical resonance. The resonant frequency and the filter quality can be selected.

#### Ramp-function generator

The ramp-function generator converts the specified setpoint to a step change into a setpoint signal that changes constantly over time. Ramp-up and ramp-down times can be set independently of one another. The ramp-function generator also features a lower and upper transition rounding (jerk limitation) which take effect at the beginning and end of the ramp time respectively.

All time settings for the ramp-function generator are mutually independent.

Three parameter sets are provided for the ramp-function generator times. These can be selected via binary selectable inputs or a serial interface (via binectors). The generator parameters can be switched over while the drive is in operation.

The value of parameter set 1 can also be weighted multiplicatively via a connector (to change generator data by means of a connector). When ramp-function generator time settings of parameter entered, the speed setpoint is applied directly to the speed controller.

#### Speed controller

The speed controller compares the speed setpoint and actual value and if these two quantities deviate, it applies a corresponding current setpoint to the current controller (operating principle: Closed-loop speed control with subordinate current controller). The speed controller is a PI controller with an additional selectable D component. A switchable speed droop can also be parameterized. All controller characteristics can be set independently of one another. The value of $K_c$ (gain) can be adapted as the function of a connector signal (external or internal).
Closed-loop functions in armature circuit

The P gain of the speed controller can be adapted as a function of actual speed, actual current, setpoint/actual value deviation or winding diameter. To achieve a better dynamic response in the speed control loop, a feedforward control function can be applied. For this purpose, a torque setpoint quantity can be added after the speed controller as a function of friction or drive moment of inertia. The friction and moment of inertia compensation values can be calculated in an automatic optimization run.

The output quantity of the speed controller directly after enabling can be set via a parameter. Depending on how parameters are set, the speed controller can be bypassed and the converter can be operated under torque or current control. Furthermore, it is possible to switch between closed-loop speed control and closed-loop torque control in operation by means of the selection function “Master/Slave switchover”. The function can be selected as a binecator via a binary assignable-function terminal or a serial interface. The torque setpoint is applied by means of a selectable connector and can thus be supplied by an analog assignable-function terminal or a serial interface.

In “slave drive” operation (under torque or current control), a limiting controller is operating. It can intervene on the basis of an adjustable, parameterized speed limit in order to prevent the drive from accelerating too fast. In this case, the drive is limited to an adjustable speed deviation.

Torque limitation
Depending on parameterization, the speed controller output acts as either the torque setpoint or current setpoint. In closed-loop torque control mode, the speed controller output is weighted with machine flux and then transferred as a current setpoint to the current limitation. Torque-control mode is usually used in conjunction with field weakening so that the maximum motor torque can be limited independently of speed.

The following functions are available:
- Independent setting of positive and negative torque limits via parameters.
- Switchover of torque limit via a binecator as a function of a parameterizable changeover speed.
- Free input of torque limit by means of a connector, e.g. via an analog input or serial interface.

The lowest input quantity is always applied as the current torque limit. Additional torque setpoints can be added after the torque limit.

Current limitation
The purpose of the current limitation set after the torque limit is to protect the converter and motor. The lowest input quantity is always applied as the current limit.

The following current limit values can be set:
- Independent setting of positive and negative current limits via parameters (setting of maximum motor current).
- Free input of current limit by means of a connector, e.g. via an analog input or serial interface.
- Separate setting of current limit via parameters for shutdown and fast stop.
- Speed-dependent current limitation: Parameters can be set to implement an automatically triggered speed-dependent reduction in the current limitation at high speeds (commutation limit curve of motor).
- $I_t$ monitoring of the power section: The temperature of the thyristors is calculated for all current values. When the thyristor limit temperature is reached, the converter current is either reduced to rated DC current or the converter is shut down with a fault message, depending on how the appropriate response parameter is set. This function is provided to protect the thyristors.

Current controller
The current controller is a PI controller with mutually independent P gain and reset time settings. The P or I component can also be deactivated (to obtain a pure P controller or a pure I controller). The actual current is acquired on the three-phase AC side by means of current transformers and applied to the current controller after A/D conversion via a resistive load and a rectifying circuit. The resolution is 10 bits for converter rated current. The current limiting output is applied as the current setpoint.

The current controller output transfers the firing angle to the gating unit, the feedforward control function acts in parallel.

Feedforward control
The feedforward control function in the current control loop improves the dynamic response of the control. This allows rise times of between 6 and 9 ms to be achieved in the current control loop. The feedforward control operates as a function of the current setpoint and motor e.m.f. and ensures that the necessary firing angle is translated speedily to the gating unit in both intermittent and continuous DC operation or when the torque direction is reversed.

Auto-reversing module
The auto-reversing module (only on converters for four-quadrant drives) acts in conjunction with the current control loop to define the logical sequence of all processes required to reverse the torque direction. One torque direction can be disabled by a parameter setting if necessary.

Gating unit
The gating unit generates the gate pulses for the power section thyristors in synchronism with the line voltage. Synchronization is implemented independently of the rotating field and electronics supply and is measured on the power section. The gating pulse position timing is determined by the output values of the current controller and feedforward control. The firing angle setting limit can be set in a parameter.

The gating unit is automatically adjusted to the connected line frequency within a frequency range of 45 Hz to 65 Hz. Adaptation to the line frequency within a frequency range of 23 Hz to 110 Hz via separate parameterization is available on request.
**System Overview**

### Design and mode of operation

**Closed-loop functions in field circuit**

**E.m.f. controller**

The e.m.f. controller compares the e.m.f. (induced motor voltage) setpoint and the actual value and specifies the setpoint for the field current controller. This provides e.m.f.-dependent closed-loop field-weakening control.

The e.m.f. controller operates as a PI controller, the P and I components can be set independently of one another. The controller can also be operated as a pure P or pure I controller. A feedforward control also operates in parallel with the e.m.f. controller. This applies feedforward control as a function of speed to the field current setpoint by means of an automatically recorded field characteristic (see optimization runs). An adding point is located after the e.m.f. controller at which additional field current setpoints can be entered via a connector, e.g. analog input or serial interface. The limitation for the field current setpoint is then applied. The maximum and minimum setpoint limits can be set independently of one another. The limitation is implemented via a parameter or connector. The minimum is applied as the upper limit and the maximum is applied for the lower limit.

**Field current controller**

The current controller for the field is a PI controller with independent settings for \(K_C\) and \(T_n\). It can also be operated as a pure P or pure I controller. A feedforward control operates in parallel with the field current controller. This calculates and sets the firing angle for the field circuit as a function of current setpoint and line voltage. The feedforward control supports the current controller and ensures a dynamic response in the field circuit.

**Gating unit**

The gating unit generates the gate pulses for the power section thyristors in synchronism with the line voltage in the field circuit. Synchronization is measured on the power section and is not therefore dependent on the electronics supply. The gating pulse position timing is determined by the output values of the current controller and feedforward control. The firing angle setting limit can be set in a parameter. The gating unit is automatically adjusted to the connected line frequency within a frequency range of 45 Hz to 65 Hz.

**Optimization run**

6RA70 converters are supplied with parameters set to the factory settings. Automatic optimization runs can be selected by means of special key numbers to support setting of the controllers.

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

- Current controller optimization run for setting current controllers and feedforward controls (armature and field circuit).
- Speed controller optimization run for setting characteristic data for the speed controller.
- Automatic recording of friction and moment of inertia compensation for feedforward control of speed controller.
- Automatic recording of the field characteristic for an e.m.f.-dependent closed-loop field-weakening control and automatic optimization of the e.m.f. controller in field-weakening operation.

Furthermore, all parameters set automatically during optimization runs can be altered afterwards on the operator panel.

**Monitoring and diagnosis**

**Display of operational data**

The operating status of the converter is displayed via parameter r000. Approximately 50 parameters are provided for displaying measured values. An additional 300 signals from the closed-loop control can be selected in the software (connectors) for output on the display unit. Examples of displayable measured values: Setpoints, actual values, status of binary inputs/outputs, line voltage, line frequency, firing angle, inputs/outputs of analog terminals, input/output of controllers, display of limitations.

**Trace function**

The trace function can be selected to store up to 8 measured quantities with 128 measuring points each. A measured quantity or the activation of a fault message can be parameterized as a trigger condition. It is possible to record the pre-event and post-event history by programming a trigger delay. The sampling time for the measured value memory can be parameterized between 3 and 300 ms.

Measured values can be output via the operator panels or serial interfaces.

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Fig. 2/7
SIMOREG converter family
Monitoring and diagnosis

Fault messages
A number is allocated to each fault message. The time at which the event occurred is also stored with the fault message. This allows the cause of the fault to be pinpointed promptly. The most recent eight fault messages are stored with fault number, fault value and hours count for diagnostic purposes.

When a fault occurs:
- The binary output function “Fault” is set to LOW (selectable function).
- The drive is switched off (controller disable and current I = 0, pulse disable, relay “Line contactor CLOSED” drops out) and
- An “F” with a fault number appears on the display, the “Fault” LED lights up.

Fault messages can be acknowledged on the operator panel, via a binary assignable-function terminal or a serial interface. When a fault has been acknowledged, the system switches to the “Starting lock-out” status. “Starting lock-out” is cancelled by OFF (L signal at terminal 37).

Automatic restart: The system can be restarted automatically within a parameterizable time period of 0 to 2 s. If this time is set to zero, a fault message is activated immediately (on power failure) without a restart.

Automatic restart can be parameterized in connection with the following fault messages:
- Phase failure (field or armature), undervoltage, overvoltage, failure of electronics power supply, undervoltage on parallel SIMOREG unit.

Fault/error messages are divided into the following categories:
- Line fault: Phase failure, fault in field circuit, undervoltage, overvoltage, line frequency < 45 or > 65 Hz
- Interface fault: Basic unit interfaces to supplementary boards are malfunctioning
- Drive fault: Monitor for speed controller, current controller, e.m.f. controller, field current controller has responded, drive blocked, no armature current
- Electronic motor overload protection (t1 monitor for motor) has responded
- Tacho-generator monitor and overspeed signal
- Start-up error
- Fault on electronics board
- Fault message from thyristor check: This fault message will only occur if the thyristor check is activated via the appropriate parameter. The check function ascertains whether the thyristors are capable of blocking and firing
- Fault messages from motor sensors (with terminal expansion option only): Monitoring of brush length, bearing condition, air flow, motor temperature has responded
- External faults via binary assignable-function terminals
- Fault messages from motor sensors (with terminal expansion option): Monitoring of brush length, bearing condition, air flow, motor temperature has responded
- External alarms via binary assignable-function terminals
- Alarms from supplementary boards.

Alarms
Special states that do not lead to drive shutdown are indicated by alarms. Alarms do not need to be acknowledged, but are automatically reset when the cause of the problem has been eliminated.

When one or several alarms occur:
- The binary output function “Alarm” is set to LOW (selectable function) and
- The alarm is indicated by a flashing “Fault” LED.

Alarms are divided into the following categories:
- Motor overtemperature: The calculated I2t value of the motor has reached 100 %
- Alarms from motor sensors (with terminal expansion option only): Monitoring of bearing condition, motor fan, motor temperature has responded
- Drive alarms: Drive blocked, no armature current
- External alarms via binary assignable-function terminals
- Alarms from supplementary boards.

Functions of inputs and outputs

Analog selectable inputs
After conversion to a digital value, the quantity at the analog inputs can be flexibly adjusted in terms of normalization, filtering, sign selection and offset via parameters. Since these values are available as connectors, the analog inputs can also act as a main setpoint or an additional setpoint or limitation.

Analog outputs
The actual current is output as a real-time quantity at terminal 12. The output can be parameterized as a bipolar quantity or absolute value, with selectable polarity.

Selectable analog outputs are provided for the output of other analog signals. They can be output in the form of a bipolar signal or absolute value. The normalization, offset, polarity and a filtering time can also be parameterized. The required output quantities are selected by means of connector numbers specified at intervention points. Possible outputs are, for example, actual speed, ramp function generator output, current setpoint, line voltage, etc.
System Overview

Design and mode of operation

Functions of inputs and outputs

**Binary inputs**

- **Switch-on/Shutdown (OFF1)** via terminal 37: This terminal function is ANDed with the control bit of the serial interface. With an H signal applied to terminal 37, the main contactor (terminal 109/110) is energized via an internal sequence control. If an H signal is applied to terminal 38 (enable operation), then the controllers are enabled. The drive accelerates at the speed setpoint to operating speed. With an L signal at terminal 37, the drive is decelerated along the deceleration ramp down to speed $n < n_{\text{min}}$ and when the brake control delay has expired, the controllers are disabled and the main contactor is de-energized. The drive coasts down to standstill.

- **Enable operation via terminal 38**: This function is ANDed with the control bit of the serial interface. The controllers are enabled with an H signal applied to terminal 38. With an L signal at terminal 38, the controllers are disabled and, at $I = 0$, the pulses are disabled too. The “Enable operation” signal has high priority, i.e. if it changes to “L” during operation, the effect is always $I = 0$, causing the drive to coast to a standstill.

  **Binary selectable inputs**: Further binary input terminals are provided for optional function selections. A binector number is assigned to each assignable function terminal for use for control functions. Examples of binary input functions:

  - Voltage disconnect (OFF 2): With an OFF 2 (L signal), the controllers are disabled instantaneously, and the armature circuit current is reduced and when $I = 0$, the main contactor is de-energized. The drive coasts down in an uncontrolled manner.
  - Fast stop (OFF 3): With a fast stop (low) signal, the speed setpoint at the speed controller input is set to zero and the drive is braked along the current limit (separate current limit can be parameterized for fast stop). When $n < n_{\text{min}}$ is input, on expiry of the brake control delay time, $I = 0$ is input and the main contactor is deactivated.
  - INCH: The inching function is available with an L signal at terminal 38 and activation of inching mode. In active inching mode, the main contactor is energized and the drive is accelerated to a parameterized inching setpoint. When the inching signal is cancelled, the drive is braked down to $n < n_{\text{min}}$; the controllers are then disabled and the main contactor is de-energized after a parameterizable delay (0 to 60 s) has elapsed. It is also possible to select whether the ramp function generator must be active in inching mode or whether a ramp-up time = ramp-down time = 0 should be applied.

**Binary outputs**

Selectable signaling functions are available at binary output terminals (open-emitter output). Any binector quantity, chosen by the appropriate selection parameter, can be output at each terminal. The polarity of the output signal and a settable delay (0 to 15 s) can also be parameterized.

Examples of binary output functions:

  - Fault: An L signal is output when a fault message is active.
  - Alarm: An L signal is output when an alarm is active.
  - $n < n_{\text{min}}$: An H signal is output at speeds of less than $n_{\text{min}}$. This signal is used, for example, to activate a “zero speed” message.
  - Switch-on command for a mechanical brake: A motor brake can be activated via this signal.

When the drive is switched on with the “Drive ON” function and “Enable operation” signal, an H signal is output to release the brake; output of the internal controller enable signal is delayed for a parameterizable period (corresponding to mechanical release time). When the drive is stopped via the “Shutdown” or “Fast stop” function, an L signal to close the brake is output when a speed of $n < n_{\text{min}}$ is reached. At the same time, the internal controller enable signal remains active for a parameterizable time period (corresponding to mechanical brake closing time). $I = 0$ is then input, the pulses are disabled and the main contactor is de-energized.

A further operating mode can be selected for the “Close brake” signal (L signal at binary selectable output). With this option, there is no delay until $n < n_{\text{min}}$ is reached when “Internal controller disable” is applied (drive is at zero current), but instead, the (operating) brake is activated at speeds greater than $n_{\text{min}}$.

An internal controller disable signal is output in response to fault messages, voltage disconnection or cancellation of the “Enable operation” signal at terminal 38 during operation.
**Safety shutdown (E-STOP)**

The task of the E-STOP function is to open the relay contacts (terminals 109/110) for energizing the main contactor within about 15 ms, independently of semiconductor components and the functional status of the microprocessor board (basic electronics). If the basic electronics are operating correctly, the closed-loop control outputs an \( I = 0 \) command to de-energize the main contactor. When an E-STOP command is given, the drive coasts to a standstill.

The E-STOP function can be triggered by one of the following methods:

- **Switch operation:** E-STOP is activated when the switch between terminals 105 and 106 opens.
- **Pushbutton operation:** Opening an NC contact between terminals 106 and 107 triggers the E-STOP function and stores the shutdown operation. Closing an NO contact between terminals 106 and 108 resets the function.

When the E-STOP function is reset, the drive switches to the “Starting lockout” state. This status needs to be acknowledged through activation of the “Shutdown” function, e.g. by opening terminal 37.

Note: The E-STOP function is not an EMERGENCY STOP function according to EN 60204-1.

**Serial interfaces**

The following serial interfaces are available:

- One serial interface on connector X300 on the PMU for a USS protocol to the RS 232 or RS 485 standard. For connection of optional OP1S operator panel or for PC-based DriveMonitor.
- One serial interface at terminals of the basic electronics board, two-wire or four-wire RS485 for USS protocol or peer-to-peer connection.
- One serial interface at terminals of the terminal expansion board (option), two-wire or four-wire RS485 for USS protocol or peer-to-peer connection.

**Physical characteristics of interfaces**

- **RS 232:** ± 12 V interface for point-to-point operation.
- **RS 485:** 5 V normal mode interface, noise-proof, for an additional bus connection with a maximum of 31 bus nodes.

**USS protocol**

Disclosed SIEMENS protocol, easy to program on external systems, e.g. on a PC, any master interfaces can be used. The drives operate as slaves on a master. The drives are selected via a slave number.

The following data can be exchanged via the USS protocol:

- PKW data for writing and reading parameters.
- PZD data (process data) such as control words, setpoints, status words, actual values.

Connector numbers are entered in parameters to select the transmit data (actual values), the receive data (setpoints) represent connector numbers that can be programmed to act at any intervention points.

**Peer-to-peer protocol**

The peer-to-peer protocol is used to link one converter to another. With this mode, data are exchanged between converters, e.g. to build a setpoint cascade, via a serial interface. Since a serial interface is employed as a four-wire line, it is possible to receive data from the upstream converter, condition them (e.g. through multiplicative weighting) and then send them to the downstream converter. Only one serial interface is used for the whole operation.

The following data can be exchanged between converters:

- Transmission of control words and actual values.
- Receipt of status words and setpoints.

Up to five data words are transmitted in each direction. Data are exchanged on the basis of connector numbers and intervention points.

The serial interfaces can be operated simultaneously. For example, the first interface can be used as an automation link (USS protocol) for open-loop control, diagnostics and specification of the master setpoint. A second interface operates in conjunction with the peer-to-peer protocol to act as a setpoint cascade.
**SIMOREG 6RA70 DC MASTER**

**System Overview**

### Design and mode of operation

#### Control terminal block

**Terminals on microprocessor board (basic electronics)**

- P10 reference voltage, 10 mA load rating
- N10 reference voltage, 10 mA load rating
- 2 analog inputs via differential amplifiers, resolution can be set between 10 and ±14 bits, 0 to ±10 V, 0 to ±20 mA, 4 to 20 mA
- 1 analog input for motor temperature sensor using PTC or KTY84
- Realtime analog output to ground for actual current value, 5 V for rated converter current, max. 2 mA
- 2 analog outputs to ground, 0 to ±10 V, ±11 bit resolution, max. 2 mA
- Pulse encoder evaluation for 5 or 24 V encoder, 2 tracks and zero mark, maximum frequency 300 kHz
- P15 power supply, 200 mA for pulse encoder
- 4 binary inputs to ground, 2 with selectable function
- 2 binary inputs to ground, open emitter P24, 100 mA load rating
- One serial interface, two-wire or four-wire RS 485, max. 187.5 kbd
- P24 power supply for driving binary inputs
- 9 terminals for converter ground

**Connectors on PMU simple operator panel**

- Connector X300 for connection of OP1S, two-wire RS 232 or RS 485, max. 187.5 kbd USS interface
- Terminals on gating board
- Analog tachometer 8 to 250 V for maximum speed
- E-STOP

**Terminals on optional terminal expansion board**

- 4 binary selectable inputs via optocouplers, can also be used as interface to motor
- 4 binary selectable inputs to ground
- 2 analog inputs to ground, ±10 V, ±11 bit resolution
- 1 analog input for evaluation of motor temperature via PTC or KTY84
- 2 P24 binary inputs to ground, open emitter, 100 mA load rating
- 2 analog outputs to ground, ±10 V, 2 mA load rating, ±11-bit resolution
- 1 serial interface, two-wire and four-wire RS 485, max. 187.5 kbd
- 1 parallel interface (2 connectors) for parallel connection of SIMOREG
- P24 power supply for driving binary inputs
- 8 terminals for converter ground

#### Interface to motor

**Monitoring of motor temperature**

The motor temperature can be monitored by either PTC thermistors or linear temperature sensors (KTY84-130). These can be connected via an input on the basic converter electronics board and an input on the optional terminal expansion board. An alarm or fault message can be parameterized for PTC thermistors. Two thresholds, one for alarm and one for shutdown, can be entered for a KTY84-130. Limit values are input and displayed in °C.

**Monitoring of brush length**

The brush length is monitored via floating microswitches; the shortest brush in each case is evaluated. If the brush has worn out, the microswitch opens, causing an alarm or fault message (parameterizable) to be output. Signals are evaluated via the binary selectable input (Terminal 211) on the optional terminal expansion board.

**Monitoring of air flow in motor fan**

A ventcaptor (type 3201.03) is installed in the ventilation circuit of the motor fan for this purpose. An alarm or fault message is output when the monitor responds. Signals are evaluated via the binary selectable input (Terminal 213) on the optional terminal expansion board.
Terminal assignments for basic units

<table>
<thead>
<tr>
<th>Type</th>
<th>Terminal design</th>
<th>Function</th>
<th>Terminal</th>
<th>Connection values/comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power section:</td>
<td></td>
<td>Armatrue line input</td>
<td>1U1, 1V1</td>
<td>See technical data</td>
</tr>
<tr>
<td>• 15 and 30 A:</td>
<td></td>
<td>Protective conductor PE</td>
<td>1W1</td>
<td></td>
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<tr>
<td>• 60 to 280 A:</td>
<td>1U1, 1V1, 1W1: Through-hole for</td>
<td>Armature circuit/motor connection</td>
<td>1C1 (1D1)</td>
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<tr>
<td></td>
<td>M8 (5 x 20 copper bus)</td>
<td></td>
<td>1D1 (1C1)</td>
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</tr>
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<td></td>
<td>1C1, 1D1: Through-hole for M8</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(5 x 35 copper bus)</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>• 400 to 600 A:</td>
<td>1U1, 1V1, 1W1: Through-hole for</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>M10 (5 x 30 copper bus)</td>
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<tr>
<td></td>
<td>1C1, 1D1: Through-hole for M10</td>
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<tr>
<td></td>
<td>(5 x 35 copper bus)</td>
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<tr>
<td>• 710 to 850 A:</td>
<td>Through-hole for M12</td>
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<tr>
<td></td>
<td>(5 x 60 copper bus)</td>
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<td>• 900 to 1200 A:</td>
<td>Through-hole for M12</td>
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<tr>
<td></td>
<td>(10 x 60 copper bus)</td>
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<td></td>
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<tr>
<td>• 1500 to 2200 A:</td>
<td>1U1, 1V1, 1W1: Through-hole for</td>
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<tr>
<td></td>
<td>M12 (2 x 20 copper bus 10 x 100)</td>
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<td></td>
<td>1C1, 1D1: Through-hole for M12</td>
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<td></td>
<td></td>
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<tr>
<td></td>
<td>(10 x 90 copper bus)</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>• 2200 to 3000 A:</td>
<td>Through-hole for M12</td>
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<td></td>
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<tr>
<td></td>
<td>(2 x copper bus 10 x 80)</td>
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<td></td>
</tr>
<tr>
<td>The converters are designed for a permanent power supply connection according to DIN VDE 0160 Section 6.5.2.1. PE conductor connection: Minimum cross-section 10 mm². The conductor cross-sections must be determined according to the applicable regulations, e.g. DIN VDE 100 Part 523, DIN VDE 0276 Part 1000.</td>
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<tr>
<td>Field circuit:</td>
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<td>Mains connection</td>
<td>XF1-2/3U1</td>
<td>2-ph. AC 400 to 460 V (+/-20%)</td>
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<td>• 15 to 850 A:</td>
<td>MKDS PCB terminal block</td>
<td>Field winding connection</td>
<td>XF1-1/3W1</td>
<td>325 V rated DC voltage</td>
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<td>(screw-type terminal) max. cross-section 4 mm² stranded</td>
<td></td>
<td>XF2-2/3D</td>
<td>with 2-ph. AC 400 V mains connection</td>
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<td>• 900 to 2000 A:</td>
<td>G10/4 converter terminal</td>
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<td></td>
<td></td>
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<td></td>
<td>(screw-type terminal) max. cross-section 10 mm² stranded</td>
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<td></td>
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</tr>
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<td>• 2200 to 3000 A:</td>
<td>UK16N converter terminal</td>
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<td></td>
<td>(screw-type terminal) max. cross-section 16 mm² stranded</td>
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<td>Electronics power supply 1)</td>
<td>Plug-in terminal max. cross-section 1.5 mm² stranded</td>
<td>Incoming supply</td>
<td>XP/5W1</td>
<td>2-ph. AC 380 to 460 V (+/-25%);</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>XP/5N1</td>
<td></td>
</tr>
<tr>
<td>Fan *)</td>
<td>Plug-in terminal (screw-type terminal)</td>
<td>Max. cross-section 4 mm² stranded</td>
<td>4U1, 4V1</td>
<td>3-ph. AC 400 V (+15%);</td>
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<td></td>
<td></td>
<td>4W</td>
<td>For further information,</td>
</tr>
<tr>
<td>Analog inputs, tacho inputs</td>
<td>Plug-in terminal Max. cross-section 2.5 mm²</td>
<td>Tacho connection</td>
<td>XT/103</td>
<td>see technical data</td>
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<td></td>
<td></td>
<td></td>
<td>XT/104</td>
<td></td>
</tr>
<tr>
<td>Safety shutdown (E-STOP)</td>
<td>MSTRB.2.5 plug-in terminal Max. cross-section 2.5 mm²</td>
<td>Supply for safety shutdown</td>
<td>XS/106</td>
<td>24 V DC, max. load 50 mA, short-circuit-proof, evaluation via fault message F018</td>
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<td></td>
<td></td>
<td>Safety shutdown</td>
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</tr>
<tr>
<td></td>
<td></td>
<td>– Switch</td>
<td>XS/105 2)</td>
<td>30 mA, short-circuit-proof</td>
</tr>
<tr>
<td></td>
<td></td>
<td>– Pushbutton</td>
<td>XS/107 2)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>– Reset</td>
<td>XS/108 2)</td>
<td></td>
</tr>
</tbody>
</table>

1) Note: For converters with a power section supply voltage that lies outside the tolerance range (note max. permissible power section supply voltage), the electronics power supply, field circuit mains connection and fan connection must be adapted to AC 400 V via a transformer. An autotransformer is recommended for power section supply voltages up to 500 V. An isolating transformer must be used for power section supply voltages over 500 V. This isolating transformer must have a center tap that is connected to protective earth PE. 2) On forced-ventilated converters ≥ 400 A 3) Note: Either terminal 105 or terminals 107 and 108 may be used. Terminal 105 is connected to terminal 106 in the delivery state.
Open-loop and closed-loop control section

Block diagram of CUD1

![Block diagram of CUD1 with customized connections]
## Terminal assignments for CUD1

<table>
<thead>
<tr>
<th>Type</th>
<th>Terminal design</th>
<th>Function</th>
<th>Terminal</th>
<th>Connection values/comments</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Analog inputs, reference voltage</strong></td>
<td>Plug-in (screw-type) terminal</td>
<td>Reference</td>
<td>X174/1</td>
<td>±1% at 25°C (stability 0.1% per 10 °K); 10 mA short-circuit-proof</td>
</tr>
<tr>
<td></td>
<td>Max. cross-section 1.5 mm²</td>
<td>− M</td>
<td>X174/2</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>− P10</td>
<td>X174/3</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>− N10</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Selectable input:</td>
<td>X174/4</td>
<td>Differential input Parameter settings:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>− Main setpoint +</td>
<td></td>
<td>±10 V; 150 kΩ 1) Resolution can be parameterized up to approx. 555 µV (±14 bits)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>− Main setpoint -</td>
<td>X174/5</td>
<td>0 to 20 mA; 300 Ω; 4 to 20 mA; 300 Ω</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Selectable input:</td>
<td>X174/6</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>− Analog 1+</td>
<td>X174/7</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>− Analog 1-</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Differential input Parameter settings:</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>− ±10 V; 150 kΩ 1) Resolution can be parameterized up to approx. 555 µV (±14 bits)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Selectable input:</td>
<td>X173/26</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>− Analog 1+</td>
<td>X173/27</td>
<td>Load: ≤ 5.25 mA at 15 V (w/o switching losses, see &quot;Cable, cable length, shield connection&quot;) 2)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>− Analog 1-</td>
<td></td>
<td>Switching hysteresis: 3) Pulse/pause ratio: 1:1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Pulse encoder ground M</td>
<td>X173/28</td>
<td>Level of input pulses: 2) Track offset: See Page 5/21, Table 5 2)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>− Positive terminal</td>
<td>X173/29</td>
<td>Pulse frequency: See Page 5/21, Table 6 2)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>− Negative terminal</td>
<td>X173/30</td>
<td>Cable length: 3)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>− Track 2:</td>
<td>X173/31</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>− Positive terminal</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>− Negative terminal</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>− Zero marker</td>
<td>X173/32</td>
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<td></td>
<td></td>
<td>− Positive terminal</td>
<td>X173/33</td>
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</tr>
<tr>
<td></td>
<td></td>
<td>− Negative terminal</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Pulse encoder input</strong></td>
<td>Plug-in (screw-type) terminal</td>
<td>Supply (±13.7 V to ±15.2 V)</td>
<td>X173/26</td>
<td>200 mA; short-circuit-proof (electronic protection)</td>
</tr>
<tr>
<td></td>
<td>Max. cross-section 1.5 mm²</td>
<td>Pulse encoder ground M</td>
<td>X173/27</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>− Positive terminal</td>
<td>X173/28</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>− Negative terminal</td>
<td>X173/29</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>− Track 2:</td>
<td>X173/30</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>− Positive terminal</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>− Negative terminal</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>− Zero marker</td>
<td>X173/32</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>− Positive terminal</td>
<td>X173/33</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>− Negative terminal</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Sensor acc. to P146, index 1</td>
<td>X174/22</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Sensor acc. to P146, index 1</td>
<td>X174/23</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Motor temperature:</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>− Positive terminal</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>− Negative terminal</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Analog ground M</td>
<td>X174/24</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>− PTC or KTY84-130</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1) Resolution can be parameterized up to approx. 555 µV (±14 bits)  
2) See Section “Characteristic data of pulse tacho evaluation electronics”  
3) See page 5/21.
## Terminal assignments for CUD1

<table>
<thead>
<tr>
<th>Type</th>
<th>Terminal design</th>
<th>Function</th>
<th>Terminal</th>
<th>Connection values/comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Analog outputs</td>
<td>Plug-in (screw-type) terminal</td>
<td>Actual current</td>
<td>X175/12</td>
<td>0 ±10 V corresponds to 0 ±200% converter rated DC current</td>
</tr>
<tr>
<td></td>
<td>Max. cross-section 1.5 mm²</td>
<td>Analog ground M</td>
<td>X175/13</td>
<td>Max. load 2 mA, short-circuit-proof</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Analog selectable output 1</td>
<td>X175/14</td>
<td>0 ±10 V, max. 2 mA, short-circuit-proof</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Analog mass M</td>
<td>X175/15</td>
<td>Resolution ± 11 bits</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Analog selectable output 2</td>
<td>X175/16</td>
<td>0 ±10 V, max. 2 mA, short-circuit-proof</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Analog mass M</td>
<td>X175/17</td>
<td>Resolution ± 11 bits</td>
</tr>
<tr>
<td>Binary control inputs</td>
<td>Plug-in (screw-type) terminal</td>
<td>Supply</td>
<td>X171/34</td>
<td>24 V DC, max. load 100 mA, internal supply referred to internal ground</td>
</tr>
<tr>
<td></td>
<td>Max. cross-section 1.5 mm²</td>
<td>Digital ground M</td>
<td>X171/35</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Switch-on/shutdown</td>
<td>X171/37</td>
<td>• H signal: Switch-on ¹)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Line contactor CLOSED + (with H signal at terminal 38) acceleration along ramp-function generator ramp to operating speed</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Enable operation</td>
<td>X171/38</td>
<td>• L signal: Shutdown ¹)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Deceleration along ramp-function generator ramp to ( n &lt; n_{\text{min}} ) (P370) + controller disable + line contactor OPEN.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Binary selectable input 1</td>
<td>X171/39</td>
<td>• H signal: Controller enabled ¹)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• L signal: Controller disabled ¹)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>The L signal also acts at a higher level on “Inch” and “Crawl”.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Binary selectable input 6</td>
<td>X171/36</td>
<td>¹)</td>
</tr>
<tr>
<td></td>
<td>(fault acknowledgement)</td>
<td></td>
<td></td>
<td>The group message is acknowledged on a positive edge. The converter remains in the fault state until the fault has been eliminated and acknowledged and then switches to the “Starting lockout” state. The “Starting lockout” state can be reset by applying an L signal to terminal 37. ¹)</td>
</tr>
</tbody>
</table>

---

¹) H signal: +13 to +33 V  *
L signal: -33 to +3 V  *
or terminal open  *

* for binary control inputs
8.5 mA at 24 V
### Terminal assignments for CUD1

<table>
<thead>
<tr>
<th>Type</th>
<th>Terminal design</th>
<th>Function</th>
<th>Terminal</th>
<th>Connection values/comments</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Binary control outputs</strong></td>
<td>Plug-in (screw-type) terminal Max. cross-section 1.5 mm²</td>
<td>Ground M: – Binary selectable outputs – Binary selectable outputs Selectable output &quot;Fault&quot;</td>
<td>X171/47  X171/54  X171/46</td>
<td>• H signal: No fault ¹) • L signal: Fault ¹) Short-circuit-proof 100 mA ¹)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Binary selectable output 2 Relay for line contactor: – Common potential – NO contact</td>
<td>X171/48  XR/109  XR/110</td>
<td>Load rating: ≤ 250 V AC, 4 A; cos φ = 1 ≤ 250 V AC, 2 A; cos φ = 0.4 ≤ 30 V DC, 2 A</td>
</tr>
<tr>
<td><strong>Serial interface 1</strong></td>
<td></td>
<td>Housing earth</td>
<td>X300/1</td>
<td>2) 3) 4)</td>
</tr>
<tr>
<td>RS 232/X300</td>
<td></td>
<td>Receive cable RS 232 standard (V.24)</td>
<td>X300/2</td>
<td>5)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Send and receive cable two-wire RS 485, pos. diff. input/output</td>
<td>X300/4</td>
<td>5)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Boot, control signal for software update</td>
<td>X300/4</td>
<td>5) 6)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ground</td>
<td>X300/5</td>
<td>5)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5 V voltage supply for OP15</td>
<td>X300/6</td>
<td>5)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Send cable RS 232 standard (V.24)</td>
<td>X300/7</td>
<td>5)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Send and receive cable two-wire RS 485, neg. diff. input/output</td>
<td>X300/8</td>
<td>5)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ground</td>
<td>X300/9</td>
<td>5)</td>
</tr>
<tr>
<td><strong>Serial interface 2</strong></td>
<td>Plug-in (screw-type) terminal Max. cross-section 1.5 mm²</td>
<td>TX+</td>
<td>X172/56</td>
<td>RS 485, 4-wire send cable, positive differential input</td>
</tr>
<tr>
<td>RS 485</td>
<td></td>
<td>TX-</td>
<td>X172/57</td>
<td>RS 485, 4-wire send cable, negative differential input</td>
</tr>
<tr>
<td></td>
<td></td>
<td>RX+/TX+</td>
<td>X172/58</td>
<td>RS 485, 4-wire receive cable, positive differential input, 2-wire send/receive cable, positive differential input</td>
</tr>
<tr>
<td></td>
<td></td>
<td>RX-/TX-</td>
<td>X172/59</td>
<td>RS 485, 4-wire receive cable, negative differential input</td>
</tr>
<tr>
<td></td>
<td></td>
<td>M X172/60</td>
<td></td>
<td>Ground</td>
</tr>
</tbody>
</table>

1) H signal: +16 to +30 V
L signal: 0 to +2 V
2) 9-pin SUBMIN D socket
3) Cable length: – Up to 15 m acc. to EIA RS 232-C standard – Up to 30 m capacitive load max. 2.5 nF (cable and receiver)
4) A serial connection to a PLC or PC can be made using connector X300 on the PMU. This allows the converter to be controlled and operated from a central control center or room.
5) Connector pin
6) Cable length: – For baud rate of = 187.5 kbd: 600 m – For baud rate of ≤ 93.75 kbd: 1200 m
7) Please observe DIN 19245 Part 1. In particular, the potential difference between the data reference potentials M of all interfaces must not exceed -7 V/+12 V. If this cannot be guaranteed, then equipotential bonding must be provided.
8) For SIMOREG 6RA70, no function.
SIMOREG 6RA70 DC MASTER
System Overview

1) GS fuse for 4-quadrant converters.

2) For converters with > 200 A integrated branch fuses, no external semiconductor protection devices are necessary.
## Technical Data

### General technical data

**Converters for single-quadrant operation**
- 3-ph. AC 400 V, 30 A to 125 A
- 3-ph. AC 400 V, 210 A to 600 A
- 3-ph. AC 400 V, 850 A to 3000 A
- 3-ph. AC 460 V, 30 A to 125 A
- 3-ph. AC 460 V, 210 A to 600 A
- 3-ph. AC 460 V, 850 A to 1200 A
- 3-ph. AC 575 V, 60 A to 600 A
- 3-ph. AC 575 V, 800 A to 2800 A
- 3-ph. AC 690 V, 720 A to 2600 A
- 3-ph. AC 830 V, 900 A to 1900 A
- 3-ph. AC 950 V, 2200 A

**Converters for four-quadrant operation**
- 3-ph. AC 400 V, 15 A to 125 A
- 3-ph. AC 400 V, 210 A to 600 A
- 3-ph. AC 400 V, 850 A to 3000 A
- 3-ph. AC 460 V, 30 A to 125 A
- 3-ph. AC 460 V, 210 A to 600 A
- 3-ph. AC 460 V, 850 A to 1200 A
- 3-ph. AC 575 V, 60 A to 600 A
- 3-ph. AC 575 V, 850 A to 2800 A
- 3-ph. AC 690 V, 760 A to 2600 A
- 3-ph. AC 830 V, 950 A to 1900 A
- 3-ph. AC 950 V, 2200 A
### General technical data

<table>
<thead>
<tr>
<th>Type of cooling</th>
<th>Self-ventilated</th>
</tr>
</thead>
<tbody>
<tr>
<td>Converters ≤ 125 A rated armature current</td>
<td>Permissible ambient air temperature during operation 0 °C to 45 °C (reduction curves apply for +45 °C &lt; T &lt; +60 °C, Page 3/3 onwards)</td>
</tr>
<tr>
<td>Converters ≥ 210 A rated armature current</td>
<td>Permissible ambient air temperature during operation Enhanced air cooling with installed fan 0 °C to 40 °C (reduction curves apply for +40 °C &lt; T &lt; +50 °C, Page 3/3 onwards)</td>
</tr>
<tr>
<td>Permissible ambient air temperature during storage and transport</td>
<td>–25 °C to +70 °C</td>
</tr>
<tr>
<td>Installation altitude</td>
<td>≤ 1000 m above sea level (100 % load rating) &gt; 1000 m to 5000 m above sea level (reduction curves: see detailed data for converters)</td>
</tr>
<tr>
<td>Control stability</td>
<td>( \Delta_n = 0.006 % ) of the rated motor speed, valid for pulse encoder operation and digital setpoint ( \Delta_n = 0.1 % ) of the rated motor speed, valid for analog tacho and analog setpoint 2)</td>
</tr>
<tr>
<td>Humidity class</td>
<td>Relative air humidity ≤ 95 %, dewing not permissible 1)</td>
</tr>
<tr>
<td>Climate class</td>
<td>Class 3K3 acc. to DIN IEC 60 721-3-3</td>
</tr>
<tr>
<td>Insulation</td>
<td>Pollution severity 2 acc. to DIN VDE 0110-1 (HD 625.1 S: 1996) Dewing not permissible</td>
</tr>
<tr>
<td>Overvoltage category</td>
<td>Category III acc. to DIN VDE 0110-1 for power section and power supply Category II acc. to DIN VDE 0110-1 for electronics</td>
</tr>
<tr>
<td>Overvoltage resistance</td>
<td>Class 1 acc. to DIN VDE 0160</td>
</tr>
<tr>
<td>Degree of protection</td>
<td>IP 03 acc. to EN 60 529</td>
</tr>
<tr>
<td>Safety class</td>
<td>Class I acc. to DIN VDE 0106, Part 1</td>
</tr>
<tr>
<td>Shock-hazard protection</td>
<td>Acc. to DIN VDE 0106 Part 100 (VBG4) and DIN VDE 0113 Part 5</td>
</tr>
<tr>
<td>RI suppression</td>
<td>No RI suppression acc. to EN 61 800-3</td>
</tr>
<tr>
<td>MTBF</td>
<td>&gt; 200,000 h acc. to SN 29600</td>
</tr>
<tr>
<td>Mechanical rigidity</td>
<td>Acc. to DIN IEC 60 068-2-6</td>
</tr>
<tr>
<td>For stationary use</td>
<td>Constant amplitude:</td>
</tr>
<tr>
<td>• of acceleration</td>
<td>0.075 mm in frequency range 10 Hz to 58 Hz</td>
</tr>
<tr>
<td>• of displacement</td>
<td>9.8 ms –2 (1 x g) in frequency range &gt; 58 Hz to 500 Hz</td>
</tr>
<tr>
<td>For transport</td>
<td>Constant amplitude:</td>
</tr>
<tr>
<td>• of displacement</td>
<td>3.5 mm in frequency range 5 Hz to 9 Hz</td>
</tr>
<tr>
<td>• of acceleration</td>
<td>9.8 ms –2 (1 x g) in frequency range &gt; 9 Hz to 500 Hz</td>
</tr>
<tr>
<td>Approvals</td>
<td>UL File No.: E203250</td>
</tr>
<tr>
<td>Applicable standards</td>
<td>UL-UL 3)</td>
</tr>
<tr>
<td>DIN VDE 0106 Part 100</td>
<td>Arrangement of operator control elements in the vicinity of components/parts at hazardous voltage levels.</td>
</tr>
<tr>
<td>DIN VDE 0110 Part 1</td>
<td>Insulation coordination for electrical equipment in low-voltage installations.</td>
</tr>
<tr>
<td>EN 60146-1-1 / DIN VDE 0558 T11</td>
<td>Semiconductor converters General requirements and line-commutated converters</td>
</tr>
<tr>
<td>EN 50178 / DIN VDE 0160</td>
<td>Regulations for the equipment of electrical power installations with electronic equipment.</td>
</tr>
<tr>
<td>EN 61800-3</td>
<td>Variable-speed drives, Part 3, EMC product standard including special test procedures</td>
</tr>
<tr>
<td>EN 60068-2-6 acc. to degree of severity 12 (SN29010 Part 1)</td>
<td>Mechanical stress</td>
</tr>
</tbody>
</table>

---

1) 75 % at 17 °C annual mean
2) 95 % at 24 °C max.

1) 75 % at 17 °C annual mean
2) Conditions:
   - The control stability (PI control) is referred to the rated motor speed and applies when the SIMOREG converter is warm. The following conditions are applicable:
     - Temperature changes of ±10 °K
     - Line voltage changes corresponding to +10% / -5% of the rated input voltage
     - Temperature coefficient of temperature-compensated tacho-generators 0.15 % per 10 °K (applies only to analog tacho-generator)
     - Constant setpoint (14-bit resolution)

3) Not for converters with 690 V and 950 V rated voltage.
3-ph. AC 400 V, 30 A to 125 A, 1Q

<table>
<thead>
<tr>
<th>Type</th>
<th>6RA70-6DS22-0</th>
</tr>
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<tbody>
<tr>
<td>Rated supply voltage armature 1)</td>
<td>V 3-ph. AC 400 (+15% / -20%)</td>
</tr>
<tr>
<td>Rated input current armature 2)</td>
<td>A 25 50 75 104</td>
</tr>
<tr>
<td>Rated supply voltage electronics supply</td>
<td>V 2-ph. AC 380 (-25%) to 460 (+15%); ( I_a = 1 \text{A or 1-ph. AC 190 (-25%) to 230 (+15%); } I_a = 2 \text{A} ) (-35% for 1 min)</td>
</tr>
<tr>
<td>Rated supply voltage field 1)</td>
<td>V 2-ph. AC 400 (+15% / -0%)</td>
</tr>
<tr>
<td>Rated frequency</td>
<td>Hz 45 to 65 7)</td>
</tr>
<tr>
<td>Rated DC voltage 1)</td>
<td>V 485</td>
</tr>
<tr>
<td>Rated DC current 1)</td>
<td>A 30 60 90 125</td>
</tr>
<tr>
<td>Overload capability 5)</td>
<td>Max. 1.8 times rated DC current</td>
</tr>
<tr>
<td>Rated output kW</td>
<td>14.5 29 44 61</td>
</tr>
<tr>
<td>Power loss at rated DC current (approx.) W</td>
<td>163 240 347 400</td>
</tr>
<tr>
<td>Rated DC voltage field 1)</td>
<td>V Max. 325</td>
</tr>
<tr>
<td>Rated DC current field A</td>
<td>5 10</td>
</tr>
<tr>
<td>Operational ambient temperature °C</td>
<td>0 to 45 at ( I_{\text{rated}} ) self-cooled</td>
</tr>
<tr>
<td>Storage and transport temperature °C</td>
<td>-25 to +70</td>
</tr>
<tr>
<td>Installation altitude above sea level mm</td>
<td>≤ 1000 m at rated DC current 4)</td>
</tr>
<tr>
<td>Dimensions (H x W x D)</td>
<td>385 x 265 x 239 385 x 265 x 283</td>
</tr>
<tr>
<td>See dimension drawing on Page</td>
<td>9/2</td>
</tr>
<tr>
<td>Weight (approx.) kg</td>
<td>11 14 16 16</td>
</tr>
</tbody>
</table>

1) The armature/field supply voltage can be less than the rated supply voltage armature/field (set with Parameter P078; for converters with 400 V rated voltage, input voltages of up to 85 V are permissible). The output voltage is reduced accordingly. The specified output DC voltage can be guaranteed up to undervoltages 5 % below the supply voltage (rated supply voltage armature/field).

2) Values apply to output rated DC current.

3) Load factor K1 (DC current) as a function of the coolant temperature (see P077 Operating Instructions, Section 11).

4) Load values K2 as a function of installation altitude (see P077 Operating Instructions, Section 11); overall reduction factor \( K = K_1 \cdot K_2 \) (for K1 see Footnote 3).

5) See Section 5.

6) In spite of derating, converters of ≥ 400 A with enhanced cooling may be operated at an ambient or coolant temperature of 50 °C only if the rated supply voltage of the converter or fan is safely within the limited tolerance range of 400 V +10% -15%.

7) Load values K2 as a function of installation altitude (see P077 Operating Instructions, Section 11); overall reduction factor \( K = K_1 \cdot K_2 \) (for K1 see Footnote 3).

<table>
<thead>
<tr>
<th>Ambient or coolant temperature °C</th>
<th>Load factor K1 In devices with self-cooling</th>
<th>Load factor K1 In devices with enhanced cooling</th>
</tr>
</thead>
<tbody>
<tr>
<td>≤ +30 °C</td>
<td>1.18</td>
<td>1.10</td>
</tr>
<tr>
<td>+35 °C</td>
<td>1.12</td>
<td>1.05</td>
</tr>
<tr>
<td>+40 °C</td>
<td>1.06</td>
<td>1.00</td>
</tr>
<tr>
<td>+45 °C</td>
<td>1.00</td>
<td>0.95</td>
</tr>
<tr>
<td>+50 °C</td>
<td>0.94</td>
<td>0.90 4)</td>
</tr>
<tr>
<td>+55 °C</td>
<td>0.88</td>
<td></td>
</tr>
<tr>
<td>+60 °C</td>
<td>0.82 5)</td>
<td></td>
</tr>
</tbody>
</table>

a) Not permissible when T400 or OP1S are used.

b) Load values K2 as a function of installation altitude (see P077 Operating Instructions, Section 11); overall reduction factor \( K = K_1 \cdot K_2 \) (for K1 see Footnote 3).

The supply voltages for all electric circuits apply for site altitudes up to 5000 m for basic insulation, with the exception of converters for rated supply voltages:

<table>
<thead>
<tr>
<th>Installation altitude m</th>
<th>Rated supply voltage V</th>
</tr>
</thead>
<tbody>
<tr>
<td>up to 4000 m</td>
<td>max. 830 V</td>
</tr>
<tr>
<td>up to 4500 m</td>
<td>max. 795 V</td>
</tr>
<tr>
<td>up to 5000 m</td>
<td>max. 727 V</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Installation altitude m</th>
<th>Reduced factor K2</th>
</tr>
</thead>
<tbody>
<tr>
<td>max. 830 V</td>
<td>1.0</td>
</tr>
<tr>
<td>max. 795 V</td>
<td>0.835</td>
</tr>
<tr>
<td>max. 727 V</td>
<td>0.74</td>
</tr>
<tr>
<td>max. 950 V</td>
<td>0.71</td>
</tr>
<tr>
<td>max. 933 V</td>
<td>0.67</td>
</tr>
</tbody>
</table>

5) See Section 5.

6) 2-ph. AC 460 (+15% / -20%) is also permissible.

7) Operation in the extended frequency range of 23 Hz to 110 Hz is possible on request.

Curve b1: Reduction factor of load values (DC current) at installation altitudes above 1000 m.
### SIMOREG 6RA70 DC MASTER

#### Technical Data

**Converters for single-quadrant operation**

<table>
<thead>
<tr>
<th>3-ph. AC 400 V, 210 A to 600 A, 1Q</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Type</strong></td>
</tr>
<tr>
<td><strong>Rated supply voltage armature</strong></td>
</tr>
<tr>
<td><strong>Rated input current armature</strong></td>
</tr>
<tr>
<td><strong>Rated supply voltage electronics supply</strong></td>
</tr>
<tr>
<td><strong>Rated supply voltage fan</strong></td>
</tr>
<tr>
<td><strong>Rated supply voltage field</strong></td>
</tr>
<tr>
<td><strong>Nominal fan current</strong></td>
</tr>
<tr>
<td><strong>Air flow rate</strong></td>
</tr>
<tr>
<td><strong>Fan noise level</strong></td>
</tr>
<tr>
<td><strong>Rated supply voltage field</strong></td>
</tr>
<tr>
<td><strong>Rated frequency</strong></td>
</tr>
<tr>
<td><strong>Rated DC voltage</strong></td>
</tr>
<tr>
<td><strong>Rated DC current</strong></td>
</tr>
<tr>
<td><strong>Rated DC voltage field</strong></td>
</tr>
<tr>
<td><strong>Rated DC current field</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Load factor K1</strong> (DC current)</th>
<th>3-ph. AC 400 (+15%) 50 Hz</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Overload capability</strong></td>
<td>Max. 1.8 times rated DC current</td>
</tr>
<tr>
<td><strong>Rated output</strong></td>
<td>kW 102</td>
</tr>
<tr>
<td><strong>Power loss at rated DC current</strong></td>
<td>W 676</td>
</tr>
<tr>
<td><strong>Rated DC voltage (approx.)</strong></td>
<td>V Max. 325</td>
</tr>
<tr>
<td><strong>Rated DC current</strong></td>
<td>A 15</td>
</tr>
</tbody>
</table>

| **Operational ambient temperature** | °C 0 to 40 at $f_{max}$ |
| **Storage and transport temperature** | °C -25 to +70 |
| **Installation altitude above sea level** | ≤ 1000 m at rated DC current |

| **Dimensions (H x W x D)** | mm 385 x 265 x 283 |
| **See dimension drawing on Page** | 9/2 |

| **Weight (approx.)** | kg 16 |

---

1) The armature/field supply voltage can be less than the rated supply voltage armature/field (set with Parameter P078; for converters with 400 V rated voltage, input voltages of up to 85 V are permissible). The output voltage is reduced accordingly. The specified output DC voltage can be guaranteed up to undervoltages 5 % below the supply voltage (rated supply voltage armature/field).

2) Values apply to output rated DC current.

3) Load factor K1 (DC current) as a function of the coolant temperature (see P077 Operating Instructions, Section 11).

a) In spite of derating, converters of ≥ 400 A with enhanced cooling may be operated at an ambient or coolant temperature of 50 °C only if the rated supply voltage of the converter fan is safely within the limited tolerance range of 400 V +10% –15%.

b) Not permissible when T400 or OP1S are used.

---

<table>
<thead>
<tr>
<th>Ambient or coolant temperature</th>
<th>Load factor K1</th>
</tr>
</thead>
<tbody>
<tr>
<td>In devices with self-cooling</td>
<td>In devices with enhanced cooling</td>
</tr>
<tr>
<td>≤ +30 °C</td>
<td>1.18</td>
</tr>
<tr>
<td>+35 °C</td>
<td>1.12</td>
</tr>
<tr>
<td>+40 °C</td>
<td>1.06</td>
</tr>
<tr>
<td>+45 °C</td>
<td>1.00</td>
</tr>
<tr>
<td>+50 °C</td>
<td>0.94</td>
</tr>
<tr>
<td>+55 °C</td>
<td>0.88</td>
</tr>
<tr>
<td>+60 °C</td>
<td>0.82 b)</td>
</tr>
</tbody>
</table>
3-ph. AC 400 V, 850 A to 3000 A, 1Q

<table>
<thead>
<tr>
<th>Type</th>
<th>6RA7087-6DS22-0</th>
<th>6RA7085-4DS22-0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated input current armature (^1)</td>
<td>A</td>
<td>705</td>
</tr>
<tr>
<td>Rated supply voltage armature (^2)</td>
<td>V</td>
<td>3-ph. AC 400 (+15% / –20%)</td>
</tr>
<tr>
<td>Rated supply voltage electronics supply</td>
<td>V</td>
<td>2-ph. AC 380 (~25%) to 460 (+15%); I_{2n}=1 A or 1-ph. AC 190 (~25%) to 230 (+15%); I_{2n}=2 A (~35% for 1 min)</td>
</tr>
<tr>
<td>Rated supply voltage fan</td>
<td>V</td>
<td>3-ph. AC 400 (+15%) 50 Hz</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3-ph. AC 400 (+10%) 50 Hz</td>
</tr>
<tr>
<td>Nominal fan current</td>
<td>A</td>
<td>0.3 (^7)</td>
</tr>
<tr>
<td>Air flow rate (\text{m}^3/\text{h})</td>
<td>570</td>
<td>1300</td>
</tr>
<tr>
<td>Fan noise level (\text{dB(A)})</td>
<td>73</td>
<td>83</td>
</tr>
<tr>
<td>Rated supply voltage field (^1)</td>
<td>V</td>
<td>2-ph. AC 400 (+15 % / –20%)</td>
</tr>
<tr>
<td>Rated frequency</td>
<td>Hz</td>
<td>45 to 65 (^5)</td>
</tr>
<tr>
<td>Rated DC voltage (^1)</td>
<td>V</td>
<td>485</td>
</tr>
<tr>
<td>Rated DC current</td>
<td>A</td>
<td>850</td>
</tr>
<tr>
<td>Overload capability (^5)</td>
<td></td>
<td>Max. 1.8 times rated DC current</td>
</tr>
<tr>
<td>Rated output</td>
<td>kW</td>
<td>412</td>
</tr>
<tr>
<td>Power loss at rated DC current (approx.)</td>
<td>W</td>
<td>2420</td>
</tr>
<tr>
<td>Rated DC voltage field (^1)</td>
<td>V</td>
<td>Max. 325</td>
</tr>
<tr>
<td>Rated DC current field</td>
<td>A</td>
<td>30</td>
</tr>
<tr>
<td>Operational ambient temperature</td>
<td>°C</td>
<td>0 to 40 at (T_{\text{ambient}}) separately cooled</td>
</tr>
<tr>
<td>Storage and transport temperature</td>
<td>°C</td>
<td>–25 to +70</td>
</tr>
<tr>
<td>Installation altitude above sea level</td>
<td>m</td>
<td>≤1000 m at rated DC current (^5)</td>
</tr>
<tr>
<td>Dimensions (H x W x D)</td>
<td>mm</td>
<td>700 x 268 x 362</td>
</tr>
<tr>
<td>Weight (approx.)</td>
<td>kg</td>
<td>40</td>
</tr>
</tbody>
</table>

4) Load values K2 as a function of installation altitude (see P077 Operating Instructions, Section 11); Overall reduction factor K = K1 * K2 (for K1 see Footnote 3).

5) See Section 5.

6) 2-ph. AC 460 (+15% / –20%) is also permissible.

7) For UL systems, a Siemens motor protection circuit-breaker Type 3RV1011-0DA1 or 3RV1011-0EA1, adjusted to 0.3 A for the fan motor Type R2D220-AB02-19 must be installed in 6RA7081, 6RA7085 and 6RA7087 converters with a rated voltage of 400 V or 575 V.

8) For UL systems, a Siemens motor protection circuit-breaker Type 3RV1011-0KA1 or 3RV1011-1AA1, adjusted to 1.25 A for the fan motor Type RH28M-2DK.3F .1R must be installed in 6RA7090, 6RA7091, 6RA7093 and 6RA7095 converters with a rated voltage of 400 V or 575 V.

9) Operation in the extended frequency range of 23 Hz to 110 Hz is possible on request.

Curve b1: Reduction factor of load values (DC current) at installation altitudes above 1000 m.

<table>
<thead>
<tr>
<th>Installation altitude m</th>
<th>1000</th>
<th>2000</th>
<th>3000</th>
<th>4000</th>
<th>5000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reduction factor K2</td>
<td>1.0</td>
<td>0.835</td>
<td>0.74</td>
<td>0.71</td>
<td>0.67</td>
</tr>
</tbody>
</table>

The supply voltages for all electric circuits are possible for site altitudes up to 5000 m with basic insulation with the exception of converters for rated supply voltages:

<table>
<thead>
<tr>
<th>Installation altitude</th>
<th>Rated supply voltage</th>
<th>830 V</th>
<th>950 V</th>
</tr>
</thead>
<tbody>
<tr>
<td>up to 4000 m</td>
<td>max. 830 V</td>
<td>950 V</td>
<td></td>
</tr>
<tr>
<td>up to 4500 m</td>
<td>max. 795 V</td>
<td>933 V</td>
<td></td>
</tr>
<tr>
<td>up to 5000 m</td>
<td>max. 727 V</td>
<td>881 V</td>
<td></td>
</tr>
</tbody>
</table>

For UL systems, a Siemens motor protection circuit-breaker Type 3RV1011-0KA1 or 3RV1011-1AA1, adjusted to 1.25 A for the fan motor Type RH28M-2DK.3F .1R must be installed in 6RA7090, 6RA7091, 6RA7093 and 6RA7095 converters with a rated voltage of 400 V or 575 V.

For UL systems, a Siemens motor protection circuit-breaker Type 3RV1011-0DA1 or 3RV1011-0EA1, adjusted to 0.3 A for the fan motor Type R2D220-AB02-19 must be installed in 6RA7081, 6RA7085 and 6RA7087 converters with a rated voltage of 400 V or 575 V.
### SIMOREG 6RA70 DC MASTER

#### Technical Data

#### Converters for single-quadrant operation

**3-ph. AC 460 V, 30 A to 125 A, 1Q**

<table>
<thead>
<tr>
<th>Type</th>
<th>6RA70-6FS22-0</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Rated supply voltage</strong></td>
<td>25</td>
</tr>
<tr>
<td>armature (1)</td>
<td>V</td>
</tr>
<tr>
<td><strong>Rated input current armature</strong></td>
<td>50</td>
</tr>
<tr>
<td><strong>Rated supply voltage</strong></td>
<td>25</td>
</tr>
<tr>
<td>electronics supply</td>
<td>V</td>
</tr>
<tr>
<td><strong>Rated supply voltage field</strong></td>
<td>25</td>
</tr>
<tr>
<td>(1)</td>
<td>V</td>
</tr>
<tr>
<td><strong>Rated frequency</strong></td>
<td>Hz</td>
</tr>
<tr>
<td><strong>Rated DC voltage</strong></td>
<td>550</td>
</tr>
<tr>
<td><strong>Rated DC current</strong></td>
<td>30</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Overload capability (5)</th>
<th>Max. 1.8 times rated DC current</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Rated output</strong></td>
<td>kW</td>
</tr>
<tr>
<td><strong>Power loss at rated DC current</strong></td>
<td>W</td>
</tr>
<tr>
<td>(approx.)</td>
<td></td>
</tr>
<tr>
<td><strong>Rated DC voltage field</strong> (1)</td>
<td>V</td>
</tr>
<tr>
<td><strong>Rated DC current field</strong></td>
<td>A</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Operational ambient temperature</th>
<th>°C</th>
<th>0 to 45 at f_{cool} (2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>self-cooled</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Storage and transport temperature</th>
<th>°C</th>
<th>-25 to +70</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Installation altitude above sea level</th>
<th>m</th>
<th>≤ 1000 m at rated DC current (4)</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Dimensions (H x W x D)</th>
<th>mm</th>
<th>385 x 265 x 239</th>
<th>385 x 265 x 313</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>See dimension drawing on Page</th>
<th>9/2</th>
<th>9/11</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Weight (approx.)</th>
<th>kg</th>
<th>11</th>
<th>15</th>
<th>17</th>
<th>17</th>
</tr>
</thead>
</table>

1) The armature/field supply voltage can be less than the rated supply voltage armature/field (set with Parameter P078; for converters with 400 V rated voltage, input voltages of up to 85 V are permissible). The output voltage is reduced accordingly. The specified output DC voltage can be guaranteed up to undervoltages 5% below the supply voltage (rated supply voltage armature/field).

2) Values apply to output rated DC current.

3) Load factor K1 (DC current) as a function of the coolant temperature (see P077 Operating Instructions, Section 11). K1 > 1 only permissible where K1 \* K2 ≤ 1st. overall reduction factor K = K1 \* K2 (for K2 see Footnote 4).

4) a) In spite of derating, converters of ≥ 400 A with enhanced cooling may be operated at an ambient or coolant temperature of 50 °C only if the rated supply voltage of the converter fan is safely within the limited tolerance range of 400 V +10% –15%.

b) Not permissible when T400 or OP1S are used.

5) a) Ambient or coolant temperature

<table>
<thead>
<tr>
<th>Ambient or coolant temperature</th>
<th>Load factor K1</th>
</tr>
</thead>
<tbody>
<tr>
<td>≤ +30 °C</td>
<td>1.18</td>
</tr>
<tr>
<td>+35 °C</td>
<td>1.12</td>
</tr>
<tr>
<td>+40 °C</td>
<td>1.06</td>
</tr>
<tr>
<td>+45 °C</td>
<td>1.00</td>
</tr>
<tr>
<td>+50 °C</td>
<td>0.94</td>
</tr>
<tr>
<td>+55 °C</td>
<td>0.88</td>
</tr>
<tr>
<td>+60 °C</td>
<td>0.82 (4)</td>
</tr>
</tbody>
</table>

b) In devices with self-cooling

<table>
<thead>
<tr>
<th>Ambient or coolant temperature</th>
<th>Load factor K1</th>
</tr>
</thead>
<tbody>
<tr>
<td>≤ +30 °C</td>
<td>1.10</td>
</tr>
<tr>
<td>+35 °C</td>
<td>1.05</td>
</tr>
<tr>
<td>+40 °C</td>
<td>1.00</td>
</tr>
<tr>
<td>+45 °C</td>
<td>0.95</td>
</tr>
<tr>
<td>+50 °C</td>
<td>0.90 (4)</td>
</tr>
<tr>
<td>+55 °C</td>
<td>0.88</td>
</tr>
<tr>
<td>+60 °C</td>
<td>0.82 (4)</td>
</tr>
</tbody>
</table>

In devices with enhanced cooling
# SIMOREG 6RA70 DC MASTER

## Technical Data

### Converters for single-quadrant operation

<table>
<thead>
<tr>
<th>Type</th>
<th>6RA70□□□-6FS22-0</th>
</tr>
</thead>
<tbody>
<tr>
<td>3-ph. AC 460 V, 210 A to 600 A, 1Q</td>
<td></td>
</tr>
</tbody>
</table>

### Rated supply voltage

- Rated supply voltage armature \(^1\) V 3-ph. AC 460 (+15% / -20%)
- Rated input current armature \(^2\) A 175 233 374 498
- Rated supply voltage electronics supply V 2-ph. AC 380 (-25%) to 460 (+15%); \(I_a=1\) A or 1-ph. AC 190 (-25%) to 230 (+15%); \(I_a=2\) A (-35% for 1 min)
- Rated supply voltage fan V 24 V DC internal 1-ph. AC 230 (+10%)
- Rated supply voltage fan 1) V 24 V DC internal 1-ph. AC 230 (+10%)
- Nominal fan current A 0.55 0.55
- Air flow rate m³/h 100 570 570
- Fan noise level dBA 40 73 76
- Rated supply voltage field \(^1\) V 2-ph. AC 460 (+15% / -20%) 1-ph. AC 230 (+10%)
- Rated frequency Hz 45 to 65 \(^5\)

### Rated DC voltage

- Rated DC voltage \(^1\) V 550
- Rated DC current A 210 280 450 600
- Overload capability \(^5\) Max. 1.8 times rated DC current
- Rated output kW 115 154 247 330
- Power loss at rated DC current (approx.) W 700 792 1519 1845
- Rated DC voltage field \(^1\) V Max. 375
- Rated DC current field A 15 25

### Operational ambient temperature

- Operational ambient temperature °C 0 to 40 at \(I_{\max} \) separately cooled
- Storage and transport temperature °C -25 to +70

### Installation altitude above sea level

- Installation altitude above sea level \(\leq 1000 \text{ m at rated DC current} \) \(^7\)

### Dimensions (H x W x D)

- Dimensions (H x W x D) mm 385 x 265 x 313 625 x 268 x 318

### Weight (approx.)

- Weight (approx.) kg 17 18 32

---

4) Load values \(K_2\) as a function of installation altitude (see P077 Operating Instructions, Section 11); Overall reduction factor \(K = K_1 \cdot K_2\) (for \(K_1\) see Footnote 3).

5) See Section 5.

9) Operation in the extended frequency range of 23 Hz to 110 Hz is possible on request.

---

**Curve b1:** Reduction factor of load values (DC current) at installation altitudes above 1000 m.

**Table:**

<table>
<thead>
<tr>
<th>Installation altitude (m)</th>
<th>Rated supply voltage</th>
</tr>
</thead>
<tbody>
<tr>
<td>up to 4000 m</td>
<td>max. 830 V</td>
</tr>
<tr>
<td>up to 4500 m</td>
<td>max. 795 V</td>
</tr>
<tr>
<td>up to 5000 m</td>
<td>max. 727 V</td>
</tr>
</tbody>
</table>

**Diagram:**

- **Installation- altitude:** 1000 2000 3000 4000 5000
- **Rated supply voltage:** 830 V 950 V

---

**Installation- altitude:**

<table>
<thead>
<tr>
<th>Reduction factor (K_2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0 0.835 0.74 0.71 0.67</td>
</tr>
</tbody>
</table>

---

The supply voltages for all electric circuits are possible for site altitudes up to 5000 m with basic insulation, with the exception of converters for rated supply voltages:
SIMOREG 6RA70 DC MASTER

Technical Data

Converters for single-quadrant operation

<table>
<thead>
<tr>
<th>Type</th>
<th>6RA70□□□□-6FS22-0</th>
<th>91</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated supply voltage armature</td>
<td>V</td>
<td>3-ph. AC 460 (+15 % / -20 %)</td>
</tr>
<tr>
<td>Rated input current armature</td>
<td>A</td>
<td>705</td>
</tr>
<tr>
<td>Rated supply voltage electronics supply</td>
<td>V</td>
<td>2-ph. AC 380 (-25%) to 460 (+15%); I_a=1 A or 1-ph. AC 190 (-25%) to 230 (+15%); I_a=2 A (-35% for 1 min)</td>
</tr>
<tr>
<td>Rated supply voltage fan</td>
<td>V</td>
<td>1-ph. AC 230 (+10%)</td>
</tr>
<tr>
<td>Nominal fan current</td>
<td>A</td>
<td>0.55</td>
</tr>
<tr>
<td>Air flow rate</td>
<td>m³/h</td>
<td>570</td>
</tr>
<tr>
<td>Fan noise level</td>
<td>dBA</td>
<td>73</td>
</tr>
<tr>
<td>Rated supply voltage field</td>
<td>V</td>
<td>2-ph. AC 460 (+15 % / -20 %)</td>
</tr>
<tr>
<td>Rated frequency</td>
<td>Hz</td>
<td>45 to 65</td>
</tr>
<tr>
<td>Rated DC voltage</td>
<td>V</td>
<td>550</td>
</tr>
<tr>
<td>Rated DC current</td>
<td>A</td>
<td>850</td>
</tr>
<tr>
<td>Overload capability</td>
<td>Max. 1.8 times rated DC current</td>
<td></td>
</tr>
<tr>
<td>Rated output</td>
<td>kW</td>
<td>467</td>
</tr>
<tr>
<td>Power loss at rated DC current</td>
<td>W</td>
<td>2514</td>
</tr>
<tr>
<td>Rated DC voltage field</td>
<td>V</td>
<td>Max. 375</td>
</tr>
<tr>
<td>Rated DC current field</td>
<td>A</td>
<td>30</td>
</tr>
</tbody>
</table>

| Operational ambient temperature | °C | 0 to 40 at I_f rated |
| Storage and transport temperature | °C | -25 to +70 |
| Installation altitude above sea level | m | ≤ 1000 m at rated DC current |
| Dimensions (H x W x D) | mm | 700 x 268 x 362 |
| Weight (approx.) | kg | 42 |

1) The armature/field supply voltage can be less than the rated supply voltage armature/field (set with Parameter P078; for converters with 400 V rated voltage, input voltages of up to 85 V are permissible). The output voltage is reduced accordingly. The specified output DC voltage can be guaranteed up to undervoltages 5 % below the supply voltage (rated supply voltage armature/field).

2) Values apply to output rated DC current.

3) Load factor K1 (DC current) as a function of the coolant temperature (see P077 Operating Instructions, Section 11). K1 > 1 only permissible where K1 * K2 ≤ 1st. overall reduction factor K = K1 * K2 (for K2 see Footnote 4).

a) In spite of derating, converters of ≥ 400 A with enhanced cooling may be operated at an ambient or coolant temperature of 80 °C only if the rated supply voltage of the converter fan is safely within the limited tolerance range of 400 V +10% –15%.

b) Not permissible when T400 or OP1S are used.

<table>
<thead>
<tr>
<th>Ambient or coolant temperature</th>
<th>Load factor K1 in devices with self-cooling</th>
<th>Load factor K1 in devices with exhauster cooling</th>
</tr>
</thead>
<tbody>
<tr>
<td>≤ +30 °C</td>
<td>1.18</td>
<td>1.10</td>
</tr>
<tr>
<td>+35 °C</td>
<td>1.12</td>
<td>1.05</td>
</tr>
<tr>
<td>+40 °C</td>
<td>1.06</td>
<td>1.00</td>
</tr>
<tr>
<td>+45 °C</td>
<td>1.00</td>
<td>0.95</td>
</tr>
<tr>
<td>+50 °C</td>
<td>0.94</td>
<td>0.90</td>
</tr>
<tr>
<td>+55 °C</td>
<td>0.88</td>
<td></td>
</tr>
<tr>
<td>+60 °C</td>
<td>0.82</td>
<td>2)</td>
</tr>
</tbody>
</table>
## SIMOREG 6RA70 DC MASTER
### Technical Data

#### Converters for single-quadrant operation

**3-ph. AC 575 V, 60 A to 600 A, 1Q**

<table>
<thead>
<tr>
<th>Type</th>
<th>6RA70-6GS22-0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated supply voltage armature</td>
<td>V 3-ph. AC 575 (+10% / -20%)</td>
</tr>
<tr>
<td>Rated input current armature</td>
<td>A 50</td>
</tr>
<tr>
<td>Rated supply voltage electronics supply</td>
<td>V 2-ph. AC 380 (~25%) to 460 (+15%); ( I_n = 1 ) A or 1-ph. AC 190 (~25%) to 230 (+15%); ( I_n = 2 ) A (~35% for 1 min)</td>
</tr>
<tr>
<td>Rated supply voltage fan</td>
<td>V 24 V DC internal</td>
</tr>
<tr>
<td>Nominal fan current</td>
<td>A 0.3</td>
</tr>
<tr>
<td>Air flow rate</td>
<td>m³/h 100</td>
</tr>
<tr>
<td>Fan noise level</td>
<td>dBA 40</td>
</tr>
<tr>
<td>Rated supply voltage fan field</td>
<td>V 2-ph. AC 460 (+15 % / -20 %)</td>
</tr>
<tr>
<td>Rated frequency</td>
<td>Hz 45 to 65 ³)</td>
</tr>
<tr>
<td>Rated DC voltage</td>
<td>V 690</td>
</tr>
<tr>
<td>Rated DC current</td>
<td>A 60</td>
</tr>
<tr>
<td>Rated DC current field</td>
<td>A 10</td>
</tr>
<tr>
<td>Overload capability</td>
<td>Max. 1.8 times rated DC current</td>
</tr>
<tr>
<td>Rated output</td>
<td>kW 41</td>
</tr>
<tr>
<td>Power loss at rated DC current (approx.)</td>
<td>W 265</td>
</tr>
<tr>
<td>Rated DC voltage field</td>
<td>V Max. 375</td>
</tr>
<tr>
<td>Rated DC current field</td>
<td>A 15</td>
</tr>
<tr>
<td>Operational ambient temperature</td>
<td>°C 0 to 45 at ( I_{rad} )³</td>
</tr>
<tr>
<td>Storage and transport temperature</td>
<td>°C ~25 to 70</td>
</tr>
<tr>
<td>Installation altitude above sea level</td>
<td>≤ 1000 m at rated DC current ³)</td>
</tr>
<tr>
<td>Dimensions (H x W x D)</td>
<td>mm 385 x 265 x 283</td>
</tr>
<tr>
<td>Weight (approx.)</td>
<td>kg 14</td>
</tr>
</tbody>
</table>

### Footnotes:

1) The supply voltages for all electric circuits are possible for site altitudes up to 5000 m with basic insulation with the exception of converters for rated supply voltages:

<table>
<thead>
<tr>
<th>Installation altitude</th>
<th>Rated supply voltage</th>
</tr>
</thead>
<tbody>
<tr>
<td>830 V</td>
<td>≤ 4000 m max. 830 V</td>
</tr>
<tr>
<td>950 V</td>
<td>≤ 4000 m max. 950 V</td>
</tr>
<tr>
<td>830 V</td>
<td>≤ 4500 m max. 795 V</td>
</tr>
<tr>
<td>933 V</td>
<td>≤ 4500 m max. 933 V</td>
</tr>
<tr>
<td>727 V</td>
<td>≤ 5000 m max. 727 V</td>
</tr>
</tbody>
</table>

5) See Section 5.

8) For UL systems, a Siemens motor protection circuit-breaker Type 3RV1011-0DA1 or 3RV1011-0EA1, adjusted to 0.3 A for the fan motor Type R2D220-AB02-19 must be installed in 6RA7081, 6RA7085 and 6RA7087 converters with a rated voltage of 400 V or 575 V.

9) Operation in the extended frequency range of 23 Hz to 110 Hz is possible on request.

---

4) Load values K2 as a function of the installation altitude (see P077 Operating Instructions, Section 11); Overall reduction factor \( K = K1 \times K2 \) (for K1 see Footnote 3)

5) See Section 5.

8) For UL systems, a Siemens motor protection circuit-breaker Type 3RV1011-0DA1 or 3RV1011-0EA1, adjusted to 0.3 A for the fan motor Type R2D220-AB02-19 must be installed in 6RA7081, 6RA7085 and 6RA7087 converters with a rated voltage of 400 V or 575 V.

9) Operation in the extended frequency range of 23 Hz to 110 Hz is possible on request.

---

Curve b1: Reduction factor of load values (DC current) at installation altitudes above 1000 m.
### Technical Data

**SIMOREG 6RA70 DC MASTER**

#### Converters for single-quadrant operation

<table>
<thead>
<tr>
<th>Type</th>
<th>6RA70-6GS22-0</th>
<th>6RA70-4GS22-0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated supply voltage armature</td>
<td>V</td>
<td>3-ph. AC 575 (+10% / -20%)</td>
</tr>
<tr>
<td>Rated input current armature</td>
<td>A</td>
<td>663</td>
</tr>
<tr>
<td>Rated supply voltage electronics supply</td>
<td>V</td>
<td>2-ph. AC 380 (~25%) to 460 (+15%); Iₒ = 1 A or 1-ph. AC 190 (~25%) to 230 (+15%); Iₒ = 2 A (~35% for 1 min)</td>
</tr>
<tr>
<td>Rated supply voltage fan</td>
<td>V</td>
<td>3-ph. AC 400 (+15%) 50 Hz</td>
</tr>
<tr>
<td>Nominal fan current</td>
<td>A</td>
<td>0.3 7)</td>
</tr>
<tr>
<td>Air flow rate</td>
<td>m³/h</td>
<td>570</td>
</tr>
<tr>
<td>Fan noise level</td>
<td>dBA</td>
<td>73</td>
</tr>
<tr>
<td>Rated supply voltage field</td>
<td>V</td>
<td>2-ph. AC 460 (+15 % / -20 %)</td>
</tr>
<tr>
<td>Rated frequency</td>
<td>Hz</td>
<td>45 to 65 5)</td>
</tr>
<tr>
<td>Rated DC voltage</td>
<td>V</td>
<td>690</td>
</tr>
<tr>
<td>Rated DC current</td>
<td>A</td>
<td>800</td>
</tr>
<tr>
<td>Overload capability</td>
<td>Max. 1.8 times rated DC current</td>
<td></td>
</tr>
<tr>
<td>Rated output</td>
<td>kW</td>
<td>552</td>
</tr>
<tr>
<td>Power loss at rated DC current (approx.)</td>
<td>W</td>
<td>2638</td>
</tr>
<tr>
<td>Rated DC voltage field</td>
<td>V</td>
<td>Max. 375</td>
</tr>
<tr>
<td>Rated DC current field</td>
<td>A</td>
<td>30</td>
</tr>
<tr>
<td>Operational ambient temperature</td>
<td>°C</td>
<td>0 to 40 at fmax 3) separately cooled</td>
</tr>
<tr>
<td>Storage and transport temperature</td>
<td>°C</td>
<td>-25 to +70</td>
</tr>
<tr>
<td>Installation altitude above sea level</td>
<td>≤ 1000 m at rated DC current 7)</td>
<td></td>
</tr>
<tr>
<td>Dimensions (H x W x D)</td>
<td>mm</td>
<td>700 x 268 x 362</td>
</tr>
<tr>
<td>See dimension drawing on Page</td>
<td>9/4</td>
<td>9/5</td>
</tr>
<tr>
<td>Weight (approx.)</td>
<td>kg</td>
<td>40</td>
</tr>
</tbody>
</table>

1. The armature/field supply voltage can be less than the rated supply voltage armature/field (set with Parameter P078; for converters with 400 V rated voltage, input voltages of up to 85 V are permissible). The output voltage is reduced accordingly. The specified output DC voltage can be guaranteed up to undervoltages 5 % below the supply voltage (rated supply voltage armature/field).
2. Values apply to output rated DC current.
3. Load factor K1 (DC current) as a function of the coolant temperature (see P077 Operating Instructions, Section 11).
   K1 > 1 only permissible where K1 * K2 ≤ 1st. overall reduction factor K = K1 * K2 (for K2 see Footnote 4).
   a) In spite of derating, converters of ≥ 400 A with enhanced cooling may be operated at an ambient or coolant temperature of 50 °C only if the rated supply voltage of the converter fan is safely within the limited tolerance range of 400 V +10% -15%.
   b) Not permissible when T400 or OP1S are used.

#### Footnotes
1. The armature/field supply voltage can be less than the rated supply voltage armature/field (set with Parameter P078; for converters with 400 V rated voltage, input voltages of up to 85 V are permissible). The output voltage is reduced accordingly. The specified output DC voltage can be guaranteed up to undervoltages 5 % below the supply voltage (rated supply voltage armature/field).
2. Values apply to output rated DC current.
3. Load factor K1 (DC current) as a function of the coolant temperature (see P077 Operating Instructions, Section 11).
   K1 > 1 only permissible where K1 * K2 ≤ 1st. overall reduction factor K = K1 * K2 (for K2 see Footnote 4).
   a) In spite of derating, converters of ≥ 400 A with enhanced cooling may be operated at an ambient or coolant temperature of 50 °C only if the rated supply voltage of the converter fan is safely within the limited tolerance range of 400 V +10% -15%.
   b) Not permissible when T400 or OP1S are used.

![](image)

<table>
<thead>
<tr>
<th>Ambient or coolant temperature</th>
<th>Load factor K1</th>
<th>Load factor K1</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>In devices with self-cooling</td>
<td>In devices with enhanced cooling</td>
</tr>
<tr>
<td>≤ +30 °C</td>
<td>1.18</td>
<td>1.10</td>
</tr>
<tr>
<td>+35 °C</td>
<td>1.12</td>
<td>1.05</td>
</tr>
<tr>
<td>+40 °C</td>
<td>1.06</td>
<td>1.00</td>
</tr>
<tr>
<td>+45 °C</td>
<td>1.00</td>
<td>0.95</td>
</tr>
<tr>
<td>+50 °C</td>
<td>0.94</td>
<td>0.90 9)</td>
</tr>
<tr>
<td>+55 °C</td>
<td>0.88</td>
<td></td>
</tr>
<tr>
<td>+60 °C</td>
<td>0.82 9)</td>
<td></td>
</tr>
</tbody>
</table>
### SIMOREG 6RA70 DC MASTER Technical Data

#### Converters for single-quadrant operation

<table>
<thead>
<tr>
<th>Type</th>
<th>6RA70□□□-6KS22-0</th>
<th>6RA70□□□-4KS22-0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated supply voltage armature</td>
<td>V</td>
<td>3-ph. AC 690 (+10% / −20%)</td>
</tr>
<tr>
<td>Rated input current armature</td>
<td>A</td>
<td>597</td>
</tr>
<tr>
<td>Rated supply voltage electronics supply</td>
<td>V</td>
<td>2-ph. AC 380 (−25%) to 460 (+15%); ( I_n = A ) or 1-ph. AC 190 (−25%) to 230 (−15%); ( I_n = 2 A ) (−35% for 1 min)</td>
</tr>
<tr>
<td>Rated supply voltage fan</td>
<td>V</td>
<td>3-ph. AC 400 (±15%) 50 Hz</td>
</tr>
<tr>
<td>Nominal fan current</td>
<td>A</td>
<td>0.3 7)</td>
</tr>
<tr>
<td>Air flow rate</td>
<td>m³/h</td>
<td>570</td>
</tr>
<tr>
<td>Fan noise level</td>
<td>dBA</td>
<td>73</td>
</tr>
<tr>
<td>Rated supply voltage field 1)</td>
<td>V</td>
<td>2-ph. AC 460 (±15% / −20%)</td>
</tr>
<tr>
<td>Rated frequency</td>
<td>Hz</td>
<td>45 to 65 5)</td>
</tr>
<tr>
<td>Rated DC voltage 1)</td>
<td>V</td>
<td>830</td>
</tr>
<tr>
<td>Rated DC current</td>
<td>A</td>
<td>720</td>
</tr>
<tr>
<td>Overload capability 5)</td>
<td>Max. 1.8 times rated DC current</td>
<td></td>
</tr>
<tr>
<td>Rated output</td>
<td>kW</td>
<td>598</td>
</tr>
<tr>
<td>Power loss at rated DC current (approx.)</td>
<td>W</td>
<td>2720</td>
</tr>
<tr>
<td>Rated DC voltage field 1)</td>
<td>V</td>
<td>Max. 375</td>
</tr>
<tr>
<td>Rated DC current field</td>
<td>A</td>
<td>30</td>
</tr>
</tbody>
</table>
| Operational ambient temperature | °C | 0 to 40 at 
| Storage and transport temperature | °C | −25 to +70 |
| Installation altitude above sea level | ≤ 1000 m at rated DC current 7) |
| Dimensions (H x W x D) | mm | 700 x 268 x 362 |
| See dimension drawing on Page | 9/4 |
| Weight (approx.) | kg | 40 |

**4)** Load values K2 as a function of the installation altitude (see P077 Operating Instructions, Section 11); Overall reduction factor K = K1 * K2 (for K1 see Footnote 3).

**5)** See Section 5.

**6)** 2-ph. AC 460 (+15% / −20%) is also permissible.

**7)** For UL systems, a Siemens motor protection circuit-breaker Type 3RV1011-0DA1 or 3RV1011-0EA1, adjusted to 0.3 A for the fan motor Type R2D220-AB02-19 must be installed in 6RA7081, 6RA7085 and 6RA7087 converters with a rated voltage of 400 V or 575 V.

**8)** For UL systems, a Siemens motor protection circuit-breaker Type 3RV1011-0KA1 or 3RV1011-1AA1, adjusted to 1.25 A for the fan motor Type RH28M-2DK.3F .1R must be installed in 6RA7090, 6RA7091, 6RA7093 and 6RA7095 converters with a rated voltage of 400 V or 575 V.

**9)** Operation in the extended frequency range of 23 Hz to 110 Hz is possible on request.

---

**Curve b1:** Reduction factor of load values (DC current) at installation altitudes above 1000 m.
### SIMOREG 6RA70 DC MASTER

#### Technical Data

**Converters for single-quadrant operation**

**3-ph. AC 830 V, 900 A to 1900 A, 1Q and 3-ph. AC 950 V, 2200 A, 1Q**

<table>
<thead>
<tr>
<th>Type</th>
<th>6RA70-6LS22-0</th>
<th>6RA70-4LS22-0</th>
<th>6RA70-4MS22-0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated supply voltage armature</td>
<td>3-ph. AC 830 (+10% / -20%)</td>
<td>3 Ac 950 (+15%/-20%)</td>
<td></td>
</tr>
<tr>
<td>Rated input current armature</td>
<td>746</td>
<td>1244</td>
<td>1575</td>
</tr>
<tr>
<td>Rated supply voltage electronics supply</td>
<td>2-ph. AC 380 (~25%) to 460 (~15%); ( I_0 = 1 ) A or 1-ph. AC 190 (~25%) to 230 (~15%); ( I_0 = 2 ) A (~35% for 1 min)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rated supply voltage fan</td>
<td>3-ph. AC 400 (+10%) 50 Hz</td>
<td>3-ph. AC 460 (+10%) 60 Hz</td>
<td>3-ph. AC 460 (+10%) 60 Hz</td>
</tr>
<tr>
<td>Nominal fan current</td>
<td>1.0</td>
<td>1.25</td>
<td>1.0</td>
</tr>
<tr>
<td>Air flow rate</td>
<td>1300</td>
<td>1300</td>
<td>2400</td>
</tr>
<tr>
<td>Fan noise level</td>
<td>83</td>
<td>87</td>
<td>83</td>
</tr>
<tr>
<td>Rated supply voltage field</td>
<td>2-ph. AC 460 (+15% / -20%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rated frequency</td>
<td>45 to 65</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rated DC voltage</td>
<td>1000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rated DC current</td>
<td>900</td>
<td>1500</td>
<td>1900</td>
</tr>
<tr>
<td>Overload capability</td>
<td>Max. 1.8 times rated DC current</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rated output</td>
<td>kW</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Power loss at rated DC current (approx.)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rated DC voltage field</td>
<td>Max. 375</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rated DC current field</td>
<td>A</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Operational ambient temperature</td>
<td>°C</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Storage and transport temperature</td>
<td>°C</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Installation altitude above sea level</td>
<td>m</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dimensions (H x W x D)</td>
<td>mm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>See dimension drawing on Page</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weight (approx.)</td>
<td>kg</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1) The armature/field supply voltage can be less than the rated supply voltage armature/field (set with Parameter P078; for converters with 400 V rated voltage, input voltages of up to 85 V are permissible). The output voltage is reduced accordingly. The specified output DC voltage can be guaranteed up to undervoltages 5% below the supply voltage (rated supply voltage armature/field).  

2) Values apply to output rated DC current.

3) Load factor K1 (DC current) as a function of the coolant temperature (see P077 Operating Instructions, Section 11). 

K1 > 1 only permissible where K1 * K2 ≤ 1st. overall reduction factor K = K1 * K2 (for K2 see Footnote 4).  

<table>
<thead>
<tr>
<th>Ambient or coolant temperature</th>
<th>Load factor K1 In devices with self-cooling</th>
<th>Load factor K1 In devices with enhanced cooling</th>
</tr>
</thead>
<tbody>
<tr>
<td>≤ +30 °C</td>
<td>1.18</td>
<td>1.10</td>
</tr>
<tr>
<td>+35 °C</td>
<td>1.12</td>
<td>1.05</td>
</tr>
<tr>
<td>+40 °C</td>
<td>1.06</td>
<td>1.00</td>
</tr>
<tr>
<td>+45 °C</td>
<td>1.00</td>
<td>0.95</td>
</tr>
<tr>
<td>+50 °C</td>
<td>0.94</td>
<td>0.90</td>
</tr>
<tr>
<td>+55 °C</td>
<td>0.88</td>
<td></td>
</tr>
<tr>
<td>+60 °C</td>
<td>0.82</td>
<td></td>
</tr>
</tbody>
</table>

a) In spite of derating, converters of ≥ 400 A with enhanced cooling may be operated at an ambient or coolant temperature of 50 °C only if the rated supply voltage of the converter fan is safely within the limited tolerance range of 400 V +10% –15%.  
b) Not permissible when T400 or OP1S are used.
### SIMOREG 6RA70 DC MASTER

#### Technical Data

**Converters for four-quadrant operation**

<table>
<thead>
<tr>
<th>Type</th>
<th>6RA70-6DV62-0</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>3-ph. AC 400 V, 15 A to 125 A, 4Q</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Rated supply voltage armature</strong></td>
<td>13</td>
</tr>
<tr>
<td><strong>Rated input current armature</strong></td>
<td>A</td>
</tr>
<tr>
<td><strong>Rated supply voltage electronics supply</strong></td>
<td>V</td>
</tr>
<tr>
<td><strong>Rated supply voltage field</strong></td>
<td>V</td>
</tr>
<tr>
<td><strong>Rated frequency</strong></td>
<td>Hz</td>
</tr>
<tr>
<td><strong>Rated DC voltage</strong></td>
<td>V</td>
</tr>
<tr>
<td><strong>Rated DC current</strong></td>
<td>A</td>
</tr>
<tr>
<td><strong>Overload capability</strong></td>
<td>Max. 1.8 times rated DC current</td>
</tr>
<tr>
<td><strong>Rated output</strong></td>
<td>kW</td>
</tr>
<tr>
<td><strong>Power loss at rated DC current</strong></td>
<td>W</td>
</tr>
<tr>
<td><strong>Rated DC voltage field</strong></td>
<td>V</td>
</tr>
<tr>
<td><strong>Rated DC current field</strong></td>
<td>A</td>
</tr>
<tr>
<td><strong>Operational ambient temperature</strong></td>
<td>°C</td>
</tr>
<tr>
<td><strong>Storage and transport temperature</strong></td>
<td>°C</td>
</tr>
<tr>
<td><strong>Installation altitude above sea level</strong></td>
<td>mm</td>
</tr>
<tr>
<td><strong>Dimensions (H x W x D)</strong></td>
<td>mm</td>
</tr>
<tr>
<td><strong>Weight (approx.)</strong></td>
<td>kg</td>
</tr>
</tbody>
</table>

4) Load values K2 as a function of installation altitude (see P077 Operating Instructions, Section 11); Overall reduction factor \( K = K_1 \times K_2 \) (for K1 see Footnote 3).

---

**Curve b1:** Reduction factor of load values (DC current) at installation altitudes above 1000 m.

---

<table>
<thead>
<tr>
<th>Installation altitude m</th>
<th>1000</th>
<th>2000</th>
<th>3000</th>
<th>4000</th>
<th>5000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reduction factor K2</td>
<td>1.0</td>
<td>0.835</td>
<td>0.74</td>
<td>0.71</td>
<td>0.67</td>
</tr>
</tbody>
</table>

The supply voltages for all electric circuits are possible for site altitudes up to 5000 m with basic insulation, with the exception of converters for rated supply voltages:

<table>
<thead>
<tr>
<th>Installation altitude</th>
<th>Rated supply voltage</th>
</tr>
</thead>
<tbody>
<tr>
<td>up to 4000 m</td>
<td>max. 830 V</td>
</tr>
<tr>
<td>up to 4500 m</td>
<td>max. 795 V</td>
</tr>
<tr>
<td>up to 5000 m</td>
<td>max. 727 V</td>
</tr>
</tbody>
</table>

5) See Section 5.
6) 2-ph. AC 460 (+15% / -20%) is also permissible.
8) For UL systems, a Siemens motor protection circuit-breaker Type 3RV1011-0KA1 or 3RV1011-1AA1, adjusted to 1.25 A for the fan motor Type RH28M-2DK.3F must be installed in 6RA7090, 6RA7091, 6RA7093 and 6RA7095 converters with a rated voltage of 400 V or 575 V.
9) Operation in the extended frequency range of 23 Hz to 110 Hz is possible on request.
### Technical Data

#### 3-ph. AC 400 V, 210 A to 600 A, 4Q

<table>
<thead>
<tr>
<th>Type</th>
<th>6RA70□□□-6DV62-0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated supply voltage armature 1)</td>
<td>75, 78, 81, 85 V</td>
</tr>
<tr>
<td>Rated input current armature 2)</td>
<td>A</td>
</tr>
<tr>
<td>Rated supply voltage electronics supply</td>
<td>V</td>
</tr>
<tr>
<td>Rated supply voltage fan</td>
<td>V</td>
</tr>
<tr>
<td>Nominal fan current</td>
<td>A</td>
</tr>
<tr>
<td>Air flow rate</td>
<td>m³/h</td>
</tr>
<tr>
<td>Fan noise level</td>
<td>dBA</td>
</tr>
<tr>
<td>Rated frequency</td>
<td>Hz</td>
</tr>
<tr>
<td>Rated DC voltage 1)</td>
<td>V</td>
</tr>
<tr>
<td>Rated DC current</td>
<td>A</td>
</tr>
<tr>
<td>Overload capability 3)</td>
<td>Max. 1.8 times rated DC current</td>
</tr>
<tr>
<td>Rated output</td>
<td>kW</td>
</tr>
<tr>
<td>Power loss at rated DC current (approx.)</td>
<td>W</td>
</tr>
<tr>
<td>Rated DC voltage field 1)</td>
<td>V</td>
</tr>
<tr>
<td>Rated DC current field</td>
<td>A</td>
</tr>
<tr>
<td>Operational ambient temperature</td>
<td>°C</td>
</tr>
<tr>
<td>Storage and transport temperature</td>
<td>°C</td>
</tr>
<tr>
<td>Installation altitude above sea level</td>
<td>≤ 1000 m at rated DC current 4)</td>
</tr>
<tr>
<td>Dimensions (H x W x D)</td>
<td>mm</td>
</tr>
<tr>
<td>See dimension drawing on Page</td>
<td>9/7, 9/8</td>
</tr>
<tr>
<td>Weight (approx.)</td>
<td>kg</td>
</tr>
</tbody>
</table>

**Footnotes:**

1) The armature/field supply voltage can be less than the rated supply voltage armature/field (set with Parameter P078; for converters with 400 V rated voltage, input voltages of up to 85 V are permissible). The output voltage is reduced accordingly. The specified output DC voltage can be guaranteed up to undervoltages 5 % below the supply voltage (rated supply voltage armature/field).

2) Values apply to output rated DC current.

3) Load factor K1 (DC current) as a function of the coolant temperature (see P077 Operating Instructions, Section 11). K1 > 1 only permissible where K1 * K2 ≤ 1st. overall reduction factor K = K1 * K2 (for K2 see Footnote 4).

4) In spite of derating, converters of ≥ 400 A with enhanced cooling may be operated at an ambient or coolant temperature of 50 °C only if the rated supply voltage of the converter fan is safely within the limited tolerance range of 400 V +10% –15%.

5) Not permissible when T400 or OP1S are used.
### SIMOREG 6RA70 DC MASTER
#### Technical Data

**Converters for four-quadrant operation**

<table>
<thead>
<tr>
<th>Type</th>
<th>6RA70-6DV62-0</th>
<th>6RA70-4DV62-0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated supply voltage armature</td>
<td>V</td>
<td>3-ph. AC 400 (±15 % / –20 %)</td>
</tr>
<tr>
<td>Rated input current armature</td>
<td>A</td>
<td>705</td>
</tr>
<tr>
<td>Rated supply voltage electronics supply</td>
<td>V</td>
<td>2-ph. AC 380 (–25%) to 460 (+15%); (I_n=1) A or 1-ph. AC 190 (–25%) to 230 (+15%); (I_n=2) A (–35% for 1 min)</td>
</tr>
<tr>
<td>Rated supply voltage fan</td>
<td>V</td>
<td>3-ph. AC 400 (±15%)/50 Hz</td>
</tr>
<tr>
<td>Nominal fan current</td>
<td>A</td>
<td>0.3 ((^7))</td>
</tr>
<tr>
<td>Air flow rate</td>
<td>m(^3)/h</td>
<td>570</td>
</tr>
<tr>
<td>Fan noise level</td>
<td>dBA</td>
<td>73</td>
</tr>
<tr>
<td>Rated supply voltage field</td>
<td>V</td>
<td>2-ph. AC 400 (±15 % / –20%) ((^5))</td>
</tr>
<tr>
<td>Rated frequency</td>
<td>Hz</td>
<td>45 to 65 ((^3))</td>
</tr>
<tr>
<td>Rated DC voltage</td>
<td>V</td>
<td>420</td>
</tr>
<tr>
<td>Rated DC current</td>
<td>A</td>
<td>850</td>
</tr>
<tr>
<td>Overload capability</td>
<td>(^5)</td>
<td>Max. 1.8 times rated DC current</td>
</tr>
<tr>
<td>Rated output</td>
<td>kW</td>
<td>357</td>
</tr>
<tr>
<td>Power loss at rated DC current (approx.)</td>
<td>W</td>
<td>2420</td>
</tr>
<tr>
<td>Rated DC voltage field</td>
<td>V</td>
<td>Max. 325</td>
</tr>
<tr>
<td>Rated DC current field</td>
<td>A</td>
<td>30</td>
</tr>
<tr>
<td>Operational ambient temperature</td>
<td>°C</td>
<td>0 to 40 at / separately cooled</td>
</tr>
<tr>
<td>Storage and transport temperature</td>
<td>°C</td>
<td>–25 to +70</td>
</tr>
<tr>
<td>Installation altitude above sea level</td>
<td>m</td>
<td>≤ 1000 m at rated DC current (^7)</td>
</tr>
<tr>
<td>Dimensions (H x W x D)</td>
<td>mm</td>
<td>700 x 268 x 362</td>
</tr>
<tr>
<td>See dimension drawing on Page</td>
<td>9/8</td>
<td>9/9</td>
</tr>
<tr>
<td>Weight (approx.)</td>
<td>kg</td>
<td>45</td>
</tr>
</tbody>
</table>

4) Load values K2 as a function of the installation altitude (see P077 Operating Instructions, Section 11): Overall reduction factor \(K = K_1 \cdot K_2\) for \(K_1\) see Footnote 3.

5) See Section 5.

6) 2-ph. AC 460 (+15% / –20%) is also permissible.

7) For UL systems, a Siemens motor protection circuit-breaker Type 3RV1011-0DA1 or 3RV1011-0EA1, adjusted to 0.3 A for the fan motor Type RH22M-2DK.3F.1R must be installed in 6RA7090, 6RA7091, 6RA7093 and 6RA7095 converters with a rated voltage of 400 V or 575 V.

8) For UL systems, a Siemens motor protection circuit-breaker Type 3RV1011-0KA1 or 3RV1011-1AA1, adjusted to 1.25 A for the fan motor Type RH28M-2DK.3F.1R must be installed in 6RA7081, 6RA7085 and 6RA7087 converters with a rated voltage of 400 V or 575 V.

9) Operation in the extended frequency range of 23 Hz to 110 Hz is possible on request.

---

4) Load values K2 as a function of the installation altitude (see P077 Operating Instructions, Section 11): Overall reduction factor \(K = K_1 \cdot K_2\) for \(K_1\) see Footnote 3.

5) See Section 5.

6) 2-ph. AC 460 (+15% / –20%) is also permissible.

7) For UL systems, a Siemens motor protection circuit-breaker Type 3RV1011-0DA1 or 3RV1011-0EA1, adjusted to 0.3 A for the fan motor Type RH22M-2DK.19 must be installed in 6RA7081, 6RA7085 and 6RA7087 converters with a rated voltage of 400 V or 575 V.

8) For UL systems, a Siemens motor protection circuit-breaker Type 3RV1011-0KA1 or 3RV1011-1AA1, adjusted to 1.25 A for the fan motor Type RH28M-2DK.3F.1R must be installed in 6RA7090, 6RA7091, 6RA7093 and 6RA7095 converters with a rated voltage of 400 V or 575 V.

9) Operation in the extended frequency range of 23 Hz to 110 Hz is possible on request.
### SIMOREG 6RA70 DC MASTER

#### Technical Data

**Convertisers for four-quadrant operation**

<table>
<thead>
<tr>
<th>Type</th>
<th>6RA70-6FV62-0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated supply voltage armature ¹)</td>
<td>3-ph. AC 460 (+15 % / –20 %)</td>
</tr>
<tr>
<td>Rated input current armature ²)</td>
<td>A 25 50 75 104</td>
</tr>
<tr>
<td>Rated supply voltage electronics supply</td>
<td>V 2-ph. AC 380 (–25 %) to 460 (+15 %); ( I_n = 1 \text{ A} ) or 1-ph. AC 190 (–25 %) to 230 (+15 %); ( I_n = 2 \text{ A} ) (–35 % for 1 min)</td>
</tr>
<tr>
<td>Rated supply voltage field ¹)</td>
<td>V 2-ph. AC 460 (+15 % / –20 %)</td>
</tr>
<tr>
<td>Rated frequency</td>
<td>Hz 45 to 65 ³)</td>
</tr>
<tr>
<td>Rated DC voltage ¹)</td>
<td>V 480</td>
</tr>
<tr>
<td>Rated DC current</td>
<td>A 30 60 90 125</td>
</tr>
<tr>
<td>Overload capability ⁴)</td>
<td>Max. 1.8 times rated DC current</td>
</tr>
<tr>
<td>Rated output</td>
<td>kW 14.4 28.8 43 60</td>
</tr>
<tr>
<td>Power loss at rated DC current (approx.)</td>
<td>W 172 248 328 417</td>
</tr>
<tr>
<td>Rated DC voltage field ¹)</td>
<td>V Max. 375</td>
</tr>
<tr>
<td>Rated DC current field</td>
<td>A 5 10</td>
</tr>
<tr>
<td>Operational ambient temperature</td>
<td>°C 0 to 45 at ( I_{\text{rated}} ) self-cooled</td>
</tr>
<tr>
<td>Storage and transport temperature</td>
<td>°C –25 to +70</td>
</tr>
<tr>
<td>Installation altitude above sea level</td>
<td>≤ 1000 m at rated DC current ⁴)</td>
</tr>
<tr>
<td>Dimensions (H x W x D)</td>
<td>mm 385 x 265 x 239 385 x 265 x 313</td>
</tr>
<tr>
<td>See dimension drawing on Page</td>
<td>9/7 9/13</td>
</tr>
<tr>
<td>Weight (approx.)</td>
<td>kg 11 15 15 17</td>
</tr>
</tbody>
</table>

---

1) The armature/field supply voltage can be less than the rated supply voltage armature/field set with Parameter P078; for converters with 400 V rated voltage, input voltages of up to 85 V are permissible). The output voltage is reduced accordingly. The specified output DC voltage can be guaranteed up to undervoltages 5 % below the supply voltage (rated supply voltage armature/field).

2) Values apply to output rated DC current.

3) Load factor K1 (DC current) as a function of the coolant temperature (see P077 Operating Instructions, Section 11). K1 > 1 only permissible where K1 * K2 ≤ 1st. overall reduction factor K = K1 * K2 (for K2 see Footnote 4).

4) In spite of derating, converters of ≥ 400 A with enhanced cooling may be operated at an ambient or coolant temperature of 50 °C only if the rated supply voltage of the converter fan is safely within the limited tolerance range of 400 V +10% –15%.

5) Not permissible when T400 or OP1S are used.

---

### 3-ph. AC 460 V, 30 A to 125 A, 4Q

<table>
<thead>
<tr>
<th>Type</th>
<th>6RA70-6FV62-0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated supply voltage armature ¹)</td>
<td>3-ph. AC 460 (+15 % / –20 %)</td>
</tr>
<tr>
<td>Rated input current armature ²)</td>
<td>A 25 50 75 104</td>
</tr>
<tr>
<td>Rated supply voltage electronics supply</td>
<td>V 2-ph. AC 380 (–25 %) to 460 (+15 %); ( I_n = 1 \text{ A} ) or 1-ph. AC 190 (–25 %) to 230 (+15 %); ( I_n = 2 \text{ A} ) (–35 % for 1 min)</td>
</tr>
<tr>
<td>Rated supply voltage field ¹)</td>
<td>V 2-ph. AC 460 (+15 % / –20 %)</td>
</tr>
<tr>
<td>Rated frequency</td>
<td>Hz 45 to 65 ³)</td>
</tr>
<tr>
<td>Rated DC voltage ¹)</td>
<td>V 480</td>
</tr>
<tr>
<td>Rated DC current</td>
<td>A 30 60 90 125</td>
</tr>
<tr>
<td>Overload capability ⁴)</td>
<td>Max. 1.8 times rated DC current</td>
</tr>
<tr>
<td>Rated output</td>
<td>kW 14.4 28.8 43 60</td>
</tr>
<tr>
<td>Power loss at rated DC current (approx.)</td>
<td>W 172 248 328 417</td>
</tr>
<tr>
<td>Rated DC voltage field ¹)</td>
<td>V Max. 375</td>
</tr>
<tr>
<td>Rated DC current field</td>
<td>A 5 10</td>
</tr>
<tr>
<td>Operational ambient temperature</td>
<td>°C 0 to 45 at ( I_{\text{rated}} ) self-cooled</td>
</tr>
<tr>
<td>Storage and transport temperature</td>
<td>°C –25 to +70</td>
</tr>
<tr>
<td>Installation altitude above sea level</td>
<td>≤ 1000 m at rated DC current ⁴)</td>
</tr>
<tr>
<td>Dimensions (H x W x D)</td>
<td>mm 385 x 265 x 239 385 x 265 x 313</td>
</tr>
<tr>
<td>See dimension drawing on Page</td>
<td>9/7 9/13</td>
</tr>
<tr>
<td>Weight (approx.)</td>
<td>kg 11 15 15 17</td>
</tr>
</tbody>
</table>

---

1) The armature/field supply voltage can be less than the rated supply voltage armature/field set with Parameter P078; for converters with 400 V rated voltage, input voltages of up to 85 V are permissible). The output voltage is reduced accordingly. The specified output DC voltage can be guaranteed up to undervoltages 5 % below the supply voltage (rated supply voltage armature/field).

2) Values apply to output rated DC current.

3) Load factor K1 (DC current) as a function of the coolant temperature (see P077 Operating Instructions, Section 11). K1 > 1 only permissible where K1 * K2 ≤ 1st. overall reduction factor K = K1 * K2

4) In spite of derating, converters of ≥ 400 A with enhanced cooling may be operated at an ambient or coolant temperature of 50 °C only if the rated supply voltage of the converter fan is safely within the limited tolerance range of 400 V +10% –15%.

5) Not permissible when T400 or OP1S are used.
### SIMOREG 6RA70 DC MASTER
#### Technical Data

<table>
<thead>
<tr>
<th>3-ph. AC 460 V, 210 A to 600 A, 4Q</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Type</strong></td>
<td>6RA70-6FV62-0</td>
</tr>
<tr>
<td><strong>Rated supply voltage armature</strong></td>
<td>V 3-ph. AC 460 (+15 % / -20 %)</td>
</tr>
<tr>
<td><strong>Rated input current armature</strong></td>
<td>A 175</td>
</tr>
<tr>
<td><strong>Rated supply voltage electronics supply</strong></td>
<td>V 2-ph. AC 380 (-25%) to 460 (+15%); ( I_n=1 ) A or 1-ph. AC 190 (-25%) to 230 (+15%); ( I_n=2 ) A (-35% for 1 min)</td>
</tr>
<tr>
<td><strong>Rated supply voltage fan</strong></td>
<td>V 24 V DC internal</td>
</tr>
<tr>
<td><strong>Nominal fan current</strong></td>
<td>A 0.55</td>
</tr>
<tr>
<td><strong>Air flow rate</strong></td>
<td>m³/h 100</td>
</tr>
<tr>
<td><strong>Fan noise level</strong></td>
<td>dBA 40</td>
</tr>
<tr>
<td><strong>Rated supply voltage field</strong></td>
<td>V 2-ph. AC 460 (+15 % / -20 %)</td>
</tr>
<tr>
<td><strong>Rated frequency</strong></td>
<td>Hz 45 to 65</td>
</tr>
<tr>
<td><strong>Rated DC voltage</strong></td>
<td>V 480</td>
</tr>
<tr>
<td><strong>Rated DC current</strong></td>
<td>A 210</td>
</tr>
<tr>
<td><strong>Overload capability</strong></td>
<td>Max. 1.8 times rated DC current</td>
</tr>
<tr>
<td><strong>Rated output</strong></td>
<td>kW 100</td>
</tr>
<tr>
<td><strong>Power loss at rated DC current</strong></td>
<td>W 700</td>
</tr>
<tr>
<td><strong>Rated DC voltage field</strong></td>
<td>V Max. 375</td>
</tr>
<tr>
<td><strong>Rated DC current field</strong></td>
<td>A 15</td>
</tr>
<tr>
<td><strong>Operational ambient temperature</strong></td>
<td>°C 0 to 40 at ( f_{\text{supply}} )</td>
</tr>
<tr>
<td><strong>Storage and transport temperature</strong></td>
<td>°C -25 to +70</td>
</tr>
<tr>
<td><strong>Installation altitude above sea level</strong></td>
<td>≤ 1000 m at rated DC current</td>
</tr>
<tr>
<td><strong>Dimensions (H x W x D)</strong></td>
<td>mm 385 x 265 x 313</td>
</tr>
<tr>
<td><strong>See dimension drawing on Page</strong></td>
<td>9/13</td>
</tr>
<tr>
<td><strong>Weight (approx.)</strong></td>
<td>kg 17</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Installation altitude (m)</strong></th>
<th>1000</th>
<th>2000</th>
<th>3000</th>
<th>4000</th>
<th>5000</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Reduction factor K2</strong></td>
<td>1.0</td>
<td>0.835</td>
<td>0.74</td>
<td>0.71</td>
<td>0.67</td>
</tr>
</tbody>
</table>

4) Load values K2 as a function of the installation altitude (see P077 Operating Instructions, Section 11); Overall reduction factor K = K1 * K2 (for K1 see Footnote 3).

The supply voltages for all electric circuits are possible for site altitudes up to 5000 m with basic insulation, with the exception of converters for rated supply voltages:

| Installation altitude (m) | Rated supply voltage |
|---------------------------|--|---|
| up to 4000 m              | max. 830 V         | 950 V |
| up to 4500 m              | max. 795 V         | 933 V |
| up to 5000 m              | max. 727 V         | 881 V |

5) See Section 5.

9) Operation in the extended frequency range of 23 Hz to 110 Hz is possible on request.
### SIMOREG 6RA70 DC MASTER

#### Technical Data

**Converters for four-quadrant operation**

<table>
<thead>
<tr>
<th>3-ph. AC 460 V, 850 A to 1200 A, 4Q</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Type</strong></td>
</tr>
<tr>
<td>6RA70-0-6FV62-0</td>
</tr>
<tr>
<td><strong>Rated supply voltage armature</strong></td>
</tr>
<tr>
<td>V 3-ph. AC 460 (+15% / -20%)</td>
</tr>
<tr>
<td><strong>Rated input current armature</strong> 2)</td>
</tr>
<tr>
<td>A 705</td>
</tr>
<tr>
<td><strong>Rated supply voltage electronics supply</strong></td>
</tr>
<tr>
<td>V 2-ph. AC 380 (-25%) to 460 (+15%); I_n=1 A or 1-ph. AC 190 (-25%) to 230 (+15%); I_n=2 A (-35% for 1 min)</td>
</tr>
<tr>
<td><strong>Rated supply voltage fan</strong></td>
</tr>
<tr>
<td>V 1-ph. AC 230 (±10%)</td>
</tr>
<tr>
<td>Nominal fan current A</td>
</tr>
<tr>
<td>0.55</td>
</tr>
<tr>
<td>Air flow rate m³/h</td>
</tr>
<tr>
<td>570</td>
</tr>
<tr>
<td>Fan noise level dBA</td>
</tr>
<tr>
<td>73</td>
</tr>
<tr>
<td><strong>Rated supply voltage field</strong> 1)</td>
</tr>
<tr>
<td>V 2-ph. AC 460 (+15% / -20%)</td>
</tr>
<tr>
<td><strong>Rated frequency</strong> Hz</td>
</tr>
<tr>
<td>45 to 65 3)</td>
</tr>
<tr>
<td><strong>Rated DC voltage</strong> 1)</td>
</tr>
<tr>
<td>V 480</td>
</tr>
<tr>
<td><strong>Rated DC current</strong> A</td>
</tr>
<tr>
<td>850</td>
</tr>
<tr>
<td><strong>Overload capability</strong> 3)</td>
</tr>
<tr>
<td>Max. 1.8 times rated DC current</td>
</tr>
<tr>
<td><strong>Rated output</strong> kW</td>
</tr>
<tr>
<td>408</td>
</tr>
<tr>
<td><strong>Power loss at rated DC current (approx.)</strong> W</td>
</tr>
<tr>
<td>2514</td>
</tr>
<tr>
<td><strong>Rated DC voltage field</strong> 1)</td>
</tr>
<tr>
<td>V Max. 375</td>
</tr>
<tr>
<td><strong>Rated DC current field</strong> A</td>
</tr>
<tr>
<td>30</td>
</tr>
<tr>
<td><strong>Operational ambient temperature °C</strong></td>
</tr>
<tr>
<td>0 to 40 at f_rated 3)</td>
</tr>
<tr>
<td><strong>Storage and transport temperature °C</strong></td>
</tr>
<tr>
<td>-25 to +70</td>
</tr>
<tr>
<td><strong>Installation altitude above sea level</strong> m</td>
</tr>
<tr>
<td>≤ 1000 m at rated DC current 4)</td>
</tr>
<tr>
<td><strong>Dimensions (H x W x D) mm</strong></td>
</tr>
<tr>
<td>700 x 268 x 362</td>
</tr>
<tr>
<td><strong>Weight (approx.) kg</strong></td>
</tr>
<tr>
<td>47</td>
</tr>
</tbody>
</table>

---

1) The armature/field supply voltage can be less than the rated supply voltage armature/field (set with Parameter P078; for converters with 400 V rated voltage, input voltages of up to 85 V are permissible). The output voltage is reduced accordingly. The specified output DC voltage can be guaranteed up to undervoltages 5% below the supply voltage (rated supply voltage armature/field).

2) Values apply to output rated DC current.

3) Load factor K1 (DC current) as a function of the coolant temperature (see P077 Operating Instructions, Section 11). K1 > 1 only permissible where K1 * K2 ≤ 1st. overall reduction factor K = K1 * K2 (for K2 see Footnote 4).

---

### Footnotes:

- In spite of derating, converters of ≥ 400 A with enhanced cooling may be operated at an ambient or coolant temperature of 50 °C only if the rated supply voltage of the converter fan is safely within the limited tolerance range of 400 V +10% –15%.
- Not permissible when T400 or OP1S are used.

---

<table>
<thead>
<tr>
<th>Ambient or coolant temperature</th>
<th>Load factor K1 in devices with self-cooling</th>
<th>Load factor K1 in devices with enhanced cooling</th>
</tr>
</thead>
<tbody>
<tr>
<td>≤ +30 °C</td>
<td>1.18</td>
<td>1.10</td>
</tr>
<tr>
<td>+35 °C</td>
<td>1.12</td>
<td>1.05</td>
</tr>
<tr>
<td>+40 °C</td>
<td>1.06</td>
<td>1.00</td>
</tr>
<tr>
<td>+45 °C</td>
<td>1.00</td>
<td>0.95</td>
</tr>
<tr>
<td>+50 °C</td>
<td>0.94</td>
<td>0.90 2)</td>
</tr>
<tr>
<td>+55 °C</td>
<td>0.88</td>
<td></td>
</tr>
<tr>
<td>+60 °C</td>
<td>0.82 2)</td>
<td></td>
</tr>
</tbody>
</table>
### SIMOREG 6RA70 DC MASTER

#### Technical Data

**3-ph. AC 575 V, 60 A to 600 A, 4Q**

<table>
<thead>
<tr>
<th>Type</th>
<th>6RA70-6GV62-0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated supply voltage armature</td>
<td>3-ph. AC 575 (+10% / -20%)</td>
</tr>
<tr>
<td>Rated input current armature</td>
<td>50 A 104 A 175 A 332 A 498 A</td>
</tr>
<tr>
<td>Rated supply voltage electronics supply</td>
<td>2-ph. AC 380 (-25%) to 460 (+15%): ( I_n = 1 ) A or 1-ph. AC 190 (-25%) to 230 (+15%): ( I_n = 2 ) A (~35% for 1 min)</td>
</tr>
<tr>
<td>Rated supply voltage fan</td>
<td>24 V DC internal 3-ph. AC 400 (+15%) 50 Hz 3-ph. AC 460 (+10%) 60 Hz</td>
</tr>
<tr>
<td>Nominal fan current</td>
<td>0.3 A</td>
</tr>
<tr>
<td>Air flow rate</td>
<td>100 m³/h 570 m³/h</td>
</tr>
<tr>
<td>Fan noise level</td>
<td>40 dBA 73 dBA</td>
</tr>
<tr>
<td>Rated supply voltage field</td>
<td>2-ph. AC 460 (+15 % / -20 %)</td>
</tr>
<tr>
<td>Rated frequency</td>
<td>45 to 65 Hz</td>
</tr>
<tr>
<td>Rated DC voltage</td>
<td>600 V</td>
</tr>
<tr>
<td>Rated DC current</td>
<td>60 A 125 A 210 A 400 A 600 A</td>
</tr>
<tr>
<td>Overload capability</td>
<td>Max. 1.8 times rated DC current</td>
</tr>
<tr>
<td>Rated output</td>
<td>kW 36 75 126 240 360</td>
</tr>
<tr>
<td>Power loss at rated DC current (approx.)</td>
<td>W 265 455 730 1550 1955</td>
</tr>
<tr>
<td>Rated DC voltage field</td>
<td>V Max. 375</td>
</tr>
<tr>
<td>Rated DC current field</td>
<td>A 10 15 25</td>
</tr>
<tr>
<td>Operational ambient temperature</td>
<td>°C 0 to 45 at ( f_{\text{rated}} ) 0 to 40 at ( f_{\text{rated}} ) self-cooled separately cooled</td>
</tr>
<tr>
<td>Storage and transport temperature</td>
<td>°C -25 to +70</td>
</tr>
<tr>
<td>Installation altitude above sea level</td>
<td>≤ 1000 m at rated DC current</td>
</tr>
<tr>
<td>Dimensions (H x W x D)</td>
<td>mm 385 x 265 x 283 625 x 268 x 318</td>
</tr>
<tr>
<td>See dimension drawing on Page</td>
<td>9/7 9/8</td>
</tr>
<tr>
<td>Weight (approx.)</td>
<td>kg 14 16 30</td>
</tr>
</tbody>
</table>

4) Load values \( K_2 \) as a function of the installation altitude (see P077 Operating Instructions, Section 11);

Overall reduction factor \( K = K_1 \times K_2 \) (for \( K_1 \) see Footnote 3).

![Curve b1: Reduction factor of load values (DC current) at installation altitudes above 1000 m.](image)

5) See Section 5.

7) For UL systems, a Siemens motor protection circuit-breaker Type 3RV1011-0DA1 or 3RV1011-0EA1, adjusted to 0.3 A for the fan motor Type R2D220-AB02-19 must be installed in 6RA7081, 6RA7085 and 6RA7087 converters with a rated voltage of 400 V or 575 V.

9) Operation in the extended frequency range of 23 Hz to 110 Hz is possible on request.
### SIMOREG 6RA70 DC MASTER

#### Technical Data

**Converters for four-quadrant operation**

<table>
<thead>
<tr>
<th>3-ph. AC 575 V, 850 A to 2800 A, 4Q</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Type</strong></td>
</tr>
<tr>
<td><strong>Rated supply voltage armature</strong></td>
</tr>
<tr>
<td><strong>Rated input current armature</strong></td>
</tr>
<tr>
<td><strong>Rated supply voltage electronics supply</strong></td>
</tr>
<tr>
<td><strong>Rated supply voltage fan</strong></td>
</tr>
<tr>
<td><strong>Rated supply voltage field</strong></td>
</tr>
<tr>
<td><strong>Nominal fan current</strong></td>
</tr>
<tr>
<td><strong>Air flow rate</strong></td>
</tr>
<tr>
<td><strong>Fan noise level</strong></td>
</tr>
<tr>
<td><strong>Rated frequency</strong></td>
</tr>
<tr>
<td><strong>Rated DC voltage</strong></td>
</tr>
<tr>
<td><strong>Rated DC current</strong></td>
</tr>
<tr>
<td><strong>Overload capability</strong></td>
</tr>
<tr>
<td><strong>Rated output</strong></td>
</tr>
<tr>
<td><strong>Power loss at rated DC current (approx.)</strong></td>
</tr>
<tr>
<td><strong>Rated DC voltage field</strong></td>
</tr>
<tr>
<td><strong>Rated DC current field</strong></td>
</tr>
<tr>
<td><strong>Operational ambient temperature</strong></td>
</tr>
<tr>
<td><strong>Storage and transport temperature</strong></td>
</tr>
<tr>
<td><strong>Installation altitude above sea level</strong></td>
</tr>
<tr>
<td><strong>Dimensions (H x W x D)</strong></td>
</tr>
<tr>
<td><strong>See dimension drawing on Page</strong></td>
</tr>
<tr>
<td><strong>Weight (approx.)</strong></td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

1) The armature/field supply voltage can be less than the rated supply voltage armature/field (set with Parameter P078; for converters with 400 V rated voltage, input voltages of up to 85 V are permissible). The output voltage is reduced accordingly. The specified output DC voltage can be guaranteed up to undervoltages 5 % below the supply voltage (rated supply voltage armature/field).

2) Values apply to output rated DC current.

3) Load factor K1 (DC current) as a function of the coolant temperature (see P077 Operating Instructions, Section 11). K1 > 1 only permissible where K1 * K2 ≤ 1st. overall reduction factor K = K1 * K2 (for K2 see Footnote 4).

a) In spite of derating, converters of ≥ 400 A with enhanced cooling may be operated at an ambient or coolant temperature of 50 °C only if the rated supply voltage of the converter fan is safely within the limited tolerance range of 400 V +10% –15%.

b) Not permissible when T400 or OP1S are used.

### Footnotes:

- **1)** The armature/field supply voltage can be less than the rated supply voltage armature/field (set with Parameter P078; for converters with 400 V rated voltage, input voltages of up to 85 V are permissible). The output voltage is reduced accordingly. The specified output DC voltage can be guaranteed up to undervoltages 5 % below the supply voltage (rated supply voltage armature/field).

- **2)** Values apply to output rated DC current.

- **3)** Load factor K1 (DC current) as a function of the coolant temperature (see P077 Operating Instructions, Section 11). K1 > 1 only permissible where K1 * K2 ≤ 1st. overall reduction factor K = K1 * K2 (for K2 see Footnote 4).

### Conversion Table:

<table>
<thead>
<tr>
<th>Ambient or coolant temperature</th>
<th>Load factor K1 In devices with self-cooling</th>
<th>Load factor K1 In devices with enhanced cooling</th>
</tr>
</thead>
<tbody>
<tr>
<td>≤ +30 °C</td>
<td>1.18</td>
<td>1.10</td>
</tr>
<tr>
<td>+35 °C</td>
<td>1.12</td>
<td>1.05</td>
</tr>
<tr>
<td>+40 °C</td>
<td>1.06</td>
<td>1.00</td>
</tr>
<tr>
<td>+45 °C</td>
<td>1.00</td>
<td>0.95</td>
</tr>
<tr>
<td>+50 °C</td>
<td>0.94</td>
<td>0.90</td>
</tr>
<tr>
<td>+55 °C</td>
<td>0.88</td>
<td></td>
</tr>
<tr>
<td>+60 °C</td>
<td>0.82</td>
<td></td>
</tr>
</tbody>
</table>
3-ph. AC 690 V, 760 A to 2600 A, 4Q

<table>
<thead>
<tr>
<th>Type</th>
<th>6RA70□□-6KV62-0</th>
<th>6RA70□□-4KV62-0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated supply voltage armature (^1)</td>
<td>V</td>
<td>3-ph. AC 690 (+10% / –20%)</td>
</tr>
<tr>
<td>Rated input current armature (^2)</td>
<td>A</td>
<td>630</td>
</tr>
<tr>
<td>Rated supply voltage electronics supply</td>
<td>V</td>
<td>2-ph. AC 380 (~25%) to 460 (+15%); (I_n=1) A or 1-ph. AC 190 (~25%) to 230 (+15%); (I_n=2) A (–35% for 1 min)</td>
</tr>
<tr>
<td>Rated supply voltage fan</td>
<td>V</td>
<td>3-ph. AC 460 (+10%) 50 Hz 3-ph. AC 460 (+10%) 60 Hz</td>
</tr>
<tr>
<td>Nominal fan current</td>
<td>A</td>
<td>0.3 (^7)</td>
</tr>
<tr>
<td>Air flow rate</td>
<td>m³/h</td>
<td>570</td>
</tr>
<tr>
<td>Fan noise level</td>
<td>dBA</td>
<td>73</td>
</tr>
<tr>
<td>Rated supply voltage field (^1)</td>
<td>V</td>
<td>2-ph. AC 460 (+15 % / –20 %)</td>
</tr>
<tr>
<td>Rated frequency</td>
<td>Hz</td>
<td>45 to 65 (^5)</td>
</tr>
<tr>
<td>Rated DC voltage (^1)</td>
<td>V</td>
<td>725</td>
</tr>
<tr>
<td>Rated DC current</td>
<td>A</td>
<td>760</td>
</tr>
<tr>
<td>Overload capability (^5)</td>
<td>Max. 1.8 times rated DC current</td>
<td></td>
</tr>
<tr>
<td>Rated output</td>
<td>kW</td>
<td>551</td>
</tr>
<tr>
<td>Power loss at rated DC current (approx.)</td>
<td>W</td>
<td>2850</td>
</tr>
<tr>
<td>Rated DC voltage field (^1)</td>
<td>V</td>
<td>Max. 375</td>
</tr>
<tr>
<td>Rated DC current field</td>
<td>A</td>
<td>30</td>
</tr>
<tr>
<td>Operational ambient temperature</td>
<td>°C</td>
<td>0 to 40 at (I_{	ext{max}}) (^3) separately cooled</td>
</tr>
<tr>
<td>Storage and transport temperature</td>
<td>°C</td>
<td>–25 to +70</td>
</tr>
<tr>
<td>Installation altitude above sea level</td>
<td>m</td>
<td>≤ 1000 m at rated DC current (^7)</td>
</tr>
<tr>
<td>Dimensions (H x W x D)</td>
<td>mm</td>
<td>700 x 268 x 362</td>
</tr>
<tr>
<td>See dimension drawing on Page</td>
<td>9/8</td>
<td></td>
</tr>
<tr>
<td>Weight (approx.)</td>
<td>kg</td>
<td>45</td>
</tr>
</tbody>
</table>

4) Load values \(K_2\) as a function of the installation altitude (see P077 Operating Instructions, Section 11); Overall reduction factor \(K = K_1 \times K_2\) (for \(K_1\) see Footnote 3).

Curve b1: Reduction factor of load values (DC current) at installation altitudes above 1000 m.

5) See Section 5.
7) For UL systems, a Siemens motor protection circuit-breaker Type 3RV1011-0DA1 or 3RV1011-0EA1, adjusted to 0.3 A for the fan motor Type R2D220-AB02-19 must be installed in 6RA7081, 6RA7085 and 6RA7087 converters with a rated voltage of 400 V or 575 V.
8) For UL systems, a Siemens motor protection circuit-breaker Type 3RV1011-0KA1 or 3RV1011-1AA1, adjusted to 1.25 A for the fan motor Type RH28M-2DK.3F .1R must be installed in 6RA7090, 6RA7091, 6RA7093 and 6RA7095 converters with a rated voltage of 400 V or 575 V.
9) Operation in the extended frequency range of 23 Hz to 110 Hz is possible on request.
SIMOREG 6RA70 DC MASTER
Technical Data

Converters for four-quadrant operation

3-ph. AC 830 V, 950 A to 1900 A, 4Q and 3-ph. AC 950 V, 2200 A, 4Q

<table>
<thead>
<tr>
<th>Type</th>
<th>6RA70□□-6LV62-0</th>
<th>6RA70□□-4LV62-0</th>
<th>6RA70□□-4MV62-0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated supply voltage armature</td>
<td>V</td>
<td>3-ph. AC 830 (+10% / -20%)</td>
<td>3-ph. AC 950 (+15% / -20%)</td>
</tr>
<tr>
<td>Rated input current armature</td>
<td>A</td>
<td>788</td>
<td>1244</td>
</tr>
<tr>
<td>Rated supply voltage electronics supply</td>
<td>V</td>
<td>2-ph. AC 380 (–25%) to 460 (+15%), ( n=1 )</td>
<td>1-ph. AC 190 (–25%) to 230 (+15%), ( n=2 )</td>
</tr>
<tr>
<td>Rated supply voltage fan</td>
<td>V</td>
<td>3-ph. AC 400 (±10%) 50 Hz</td>
<td>3-ph. AC 400 (±10%) 50 Hz</td>
</tr>
<tr>
<td>Nominal fan current</td>
<td>A</td>
<td>1.0 ( ^{8} )</td>
<td>1.0 ( ^{8} )</td>
</tr>
<tr>
<td>Rated supply voltage field</td>
<td>V</td>
<td>2-ph. AC 460 (+15 % / –20 %)</td>
<td>3-ph. AC 460 (±10%) 50 Hz</td>
</tr>
<tr>
<td>Rated frequency</td>
<td>Hz</td>
<td>45 to 65 ( ^{5} )</td>
<td>50 Hz</td>
</tr>
<tr>
<td>Rated DC voltage</td>
<td>V</td>
<td>875</td>
<td>1500</td>
</tr>
<tr>
<td>Rated DC current</td>
<td>A</td>
<td>950</td>
<td>1900</td>
</tr>
<tr>
<td>Overload capability</td>
<td>kW</td>
<td>831</td>
<td>1663</td>
</tr>
<tr>
<td>Power loss at rated DC current (approx.)</td>
<td>W</td>
<td>4870</td>
<td>7153</td>
</tr>
<tr>
<td>Rated DC voltage field</td>
<td>V</td>
<td>Max. 375</td>
<td>83</td>
</tr>
<tr>
<td>Rated DC current field</td>
<td>A</td>
<td>30</td>
<td>85</td>
</tr>
<tr>
<td>Operational ambient temperature</td>
<td>°C</td>
<td>0 to 40 at ( \gamma_{\text{rad}} )</td>
<td>0 to 40 at ( \gamma_{\text{rad}} )</td>
</tr>
<tr>
<td>Storage and transport temperature</td>
<td>°C</td>
<td>–25 to +70</td>
<td>–25 to +70</td>
</tr>
<tr>
<td>Installation altitude above sea level</td>
<td>m</td>
<td>up to 1000 m at rated DC current ( ^{7} )</td>
<td>up to 4000 m max. up to 4000 m max. up to 4500 m max. up to 5000 m max.</td>
</tr>
<tr>
<td>Dimensions (H x W x D) mm</td>
<td>780 x 410 x 362</td>
<td>880 x 450 x 500</td>
<td></td>
</tr>
<tr>
<td>See dimension drawing on Page</td>
<td>9/9</td>
<td>9/10</td>
<td></td>
</tr>
<tr>
<td>Weight (approx.)</td>
<td>kg</td>
<td>85</td>
<td>145</td>
</tr>
</tbody>
</table>

1) The armature/field supply voltage can be less than the rated supply voltage armature/field (set with Parameter P078; for converters with 400 V rated voltage, input voltages of up to 85 V are permissible). The output voltage is reduced accordingly. The specified output DC voltage can be guaranteed up to undervoltages 5 % below the supply voltage (rated supply voltage armature/field).

2) Values apply to output rated DC current.

3) Load factor K1 (DC current) as a function of the coolant temperature (see P077 Operating Instructions, Section 11).

K1 > 1 only permissible where K1 \* K2 \( ^{1st} \) overall reduction factor K = K1 \* K2 (for K1 see Footnote 3).

b) Not permissible when T400 or OP1S is used.

4) Load values K2 as a function of the installation altitude (see P077 Operating Instructions, Section 11). Overall reduction factor K = K1 \* K2 (for K1 see Footnote 3).

a) In spite of derating, converters of ≥ 400 A with enhanced cooling may be operated at an ambient or coolant temperature of 50 °C only if the rated supply voltage of the converter fan is safely within the limited tolerance range of 400 V +10% -15%.

Installation altitude m

<table>
<thead>
<tr>
<th>1000</th>
<th>2000</th>
<th>3000</th>
<th>4000</th>
<th>5000</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0</td>
<td>0.835</td>
<td>0.74</td>
<td>0.71</td>
<td>0.67</td>
</tr>
</tbody>
</table>

The supply voltages for all electric circuits are possible for site altitudes up to 5000 m with basic insulation, with the exception of converters for rated supply voltages:

Installation-altitude | Rated supply voltage
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>up to 4000 m</td>
<td>max. 830 V</td>
</tr>
<tr>
<td>up to 4500 m</td>
<td>max. 795 V</td>
</tr>
<tr>
<td>up to 5000 m</td>
<td>max. 727 V</td>
</tr>
</tbody>
</table>

5) See Section 5.

8) For UL systems, a Siemens motor protection circuit-breaker Type 3RV1011-0KA1 or 3RV1011-1AA1, adjusted to 1.25 A for the fan motor Type RH28M-2DK.3F.1R must be installed in 6RA7090, 6RA7091, 6RA7093 and 6RA7095 converters with a rated voltage of 400 V or 575 V.

9) Operation in the extended frequency range of 23 Hz to 110 Hz is possible on request.

![Curves b1: Reduction factor of load values (DC current) at installation altitudes above 1000 m.](image)
# SIMOREG 6RA70 DC MASTER Options

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<th>Section</th>
<th>Description</th>
</tr>
</thead>
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<td>Technology software in the basic unit</td>
</tr>
<tr>
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<td>Options in the basic unit</td>
<td>Terminal expansion board CUD2</td>
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<tr>
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</tr>
<tr>
<td>4/13</td>
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</tr>
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<tr>
<td>4/19</td>
<td>Technology boards</td>
<td>Technology board T400</td>
</tr>
<tr>
<td>4/24</td>
<td>Technology boards</td>
<td>Technology board T100</td>
</tr>
<tr>
<td>4/26</td>
<td>Technology boards</td>
<td>T300 technology board</td>
</tr>
<tr>
<td>4/27</td>
<td>Communication</td>
<td>Overview</td>
</tr>
<tr>
<td>4/28</td>
<td>Communication</td>
<td>SIMOLINK communication board SLB</td>
</tr>
<tr>
<td>4/32</td>
<td>Communication</td>
<td>CAN communication board CBC</td>
</tr>
<tr>
<td>4/34</td>
<td>Communication</td>
<td>Communication board CBD DeviceNet</td>
</tr>
<tr>
<td>4/35</td>
<td>Communication</td>
<td>SCB1 interface board</td>
</tr>
<tr>
<td>4/36</td>
<td>Operating and monitoring</td>
<td>OP1S operator panel</td>
</tr>
<tr>
<td>4/38</td>
<td>Operating and monitoring</td>
<td>DriveMonitor</td>
</tr>
<tr>
<td>4/39</td>
<td>Operating and monitoring</td>
<td>Drive ES engineering package</td>
</tr>
<tr>
<td>4/42</td>
<td>Performance options</td>
<td>SIMOREG 6RL70 rectifier module</td>
</tr>
</tbody>
</table>
SIMOREG 6RA70 DC MASTER

Options

Options in the basic unit

“Technology software” in the basic unit

The software option “Technology software” in the basic unit is released for use by means of a PIN number.

If the converter is ordered with the appropriate short code, it will be supplied with the software option enabled. The PIN number is supplied with the unit.

If this option is ordered subsequently, the PIN number will be sent to the customer who must enable the option as described in the operating instructions.

Software modules

The following software modules are available:

- Fixed values
- 32 fault message trigger signals
- 8 warning message trigger signals
- 3 connector/binector converters
- 3 binector/connector converters
- 15 adders/subtractors
- 4 sign inverters
- 2 switchable sign inverters
- 12 multipliers
- 6 dividers
- 3 high-resolution multipliers/dividers
- 4 absolute-value generators with filter
- 3 limiters
- 3 limit-value monitors with filter
- 7 limit-value monitors without filter
- 4 mean-value generators
- 4 maximum selections
- 4 minimum selections
- 2 tracking/storage elements
- 2 connector memories
- 10 connector selector switches
- 2 limit-value monitors (for dual connectors)
- 2 connector-type converters
- 2 adders/subtractors (for dual connectors)
- 3 integrators
- 3 DT1 elements
- 10 derivative action/delay elements
- 9 characteristic blocks
- 3 dead zones
- 1 setpoint shift
- 1 simple ramp-function generator
- 1 technology controller
- 10 PI controllers
- 1 velocity/speed/calculator
- 1 speed/velocity calculator
- 1 calculation of variable torque
- 3 multiplexers
- 1 software counter, 16-bit
- 2 decoders/demultiplexers binary, 1 from 8
- 28 AND elements
- 20 OR elements
- 4 EXCLUSIVE OR elements
- 16 inverters
- 12 NAND elements
- 14 RS flipflops
- 4 D flipflops
- 6 timers (0,00 s to 60,000 s)
- 4 timers (0,00 s to 600,00 s)
- 5 binary signal selector switches
- Technology controller

The technology controller can be used for higher-level closed-loop controls, such as tension, position or pressure controllers. The output can be wired as required and can act, for example, as a main setpoint, additional setpoint or current limit.

The technology controller is a PID controller with separate settings for the closed-loop control characteristics. A droop setting is also available.

Connector numbers can be entered freely to select the source for setpoint and actual value. A filter (PT1 element) can be parameterized at the setpoint and actual value inputs.

The technology controller output can be limited by mutually independent, positive and negative values, which can be parameterized or input via freely selectable connectors. The output signal can be weighted multiplicatively (parameterized or via connector signal) after the limiting stage.

Selection and ordering data

<table>
<thead>
<tr>
<th>Description</th>
<th>Code</th>
<th>Order No.:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Technology software in the basic unit</td>
<td>S00</td>
<td>6RX1700-0AS00</td>
</tr>
</tbody>
</table>
Terminal expansion board CUD2

The terminal expansion board CUD2 is mounted on the basic electronics assembly CUD1 and does not require any additional built-in components. This board provides a range of additional inputs and outputs.

Apart from these additional inputs and outputs, terminal expansion board CUD2 provides an additional RS 485 serial interface as well as a parallel interface for connecting up to 5 power supply modules in parallel.

Terminals on terminal expansion board CUD2

- 4 binary selectable inputs via optocouplers, can also be used as interface to motor
- 4 binary selectable inputs to ground
- 2 analog inputs to ground, ±10 bit resolution
- 1 analog input for evaluation of motor temperature via PTC or KTY84
- 2 P24 binary inputs to ground, open emitter, 100 mA load rating
- 2 analog outputs to ground, ±10 V, 2 mA load rating, ±11 bit resolution
- 1 serial interface, two-wire and four-wire RS 485, max. 187.5 kbd
- 1 parallel interface (2 connectors) for parallel connection of SIMOREG
- P24 power supply for driving binary inputs
- 8 terminals for converter ground

Selection and ordering data

<table>
<thead>
<tr>
<th>Description</th>
<th>Code</th>
<th>Order No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>CUD2 Terminal expansion board</td>
<td>K00</td>
<td>6RX1700-0AK00</td>
</tr>
</tbody>
</table>
Options in the basic unit

Terminal expansion board CUD2 · Terminal assignments

Fig. 4/3
Block diagram of the terminal expansion board CUD2
## Terminal expansion board CUD2 - Terminal assignments

<table>
<thead>
<tr>
<th>Type</th>
<th>Terminal design</th>
<th>Function</th>
<th>Terminal</th>
<th>Connection values/comments</th>
</tr>
</thead>
</table>
| Motors interface          | Plug-in terminal (screw terminal) Max. cross-section 1.5 mm² | Motor temperature:  
- Positive terminal  
- Negative terminal  
Supply for binary inputs | X164/204  
X164/205  
X164/210 | Sensor according to P146 Index 2  
Sensor according to P146 Index 2  
24 V DC, max. load  
Internal supply referred to internal ground, effective when ground M_GT is connected to internal ground (i.e. jumper is connected between Terminal 216 and 217)  
Evaluation of motor data |
|                           |                 |                                               | X164/211  
X164/212  
X164/213 | Can be isolated from internal ground  
Remove jumper between terminals 216 and 217. |
|                           |                 |                                               | X164/214 | Remove jumper between terminals 216 and 217. |
|                           |                 | Ground M_GT:  
- Binary inputs  
- Binary inputs | X164/215  
X164/216 | Can be isolated from internal ground  
Remove jumper between terminals 216 and 217. |
|                           |                 |                                               | X164/217 | Remove jumper between terminals 216 and 217. |
| Analog inputs             | Plug-in terminal (screw terminal) Max. cross-section 1.5 mm² | Selectable input analog 2  
Analog ground  
Selectable input analog 3  
Analog ground | X164/8  
X164/9  
X164/10  
X164/11 | ±10 V, 52 kΩ  
Resolution: ±10 bit  
Signs can be reversed and signals switched through by means of binary input functions. |
|                           |                 |                                               | X164/18 | 0 to ±10 V, max. 2 mA  
short-circuit-proof, resolution ±11 bits |
|                           |                 |                                               | X164/19 | 0 to ±10 V, max. 2 mA  
short-circuit-proof, resolution ±11 bits |
|                           |                 |                                               | X164/20 | 0 to ±10 V, max. 2 mA  
short-circuit-proof, resolution ±11 bits |
|                           |                 |                                               | X164/21 | 0 to ±10 V, max. 2 mA  
short-circuit-proof, resolution ±11 bits |
| Binary control inputs     | Plug-in terminal (screw terminal) Max. cross-section 1.5 mm² | Supply  
Digital ground M | X163/44 | 24 V DC, max. load 100 mA, internal supply referred to internal ground |
|                           |                 |                                               | X163/45 | 24 V DC, max. load 100 mA, internal supply referred to internal ground |
|                           |                 |                                               | X163/40 | 1) |
|                           |                 |                                               | X163/41 | 1) |
|                           |                 |                                               | X163/42 | 1) |
|                           |                 |                                               | X163/43 | 1) |
| Binary control outputs    | Plug-in terminal (screw terminal) Max. cross-section 1.5 mm² | Ground M:  
- Binary selectable outputs  
- Binary selectable outputs | X163/51  
X163/53 | 2) Short-circuit-proof 100 mA |
|                           |                 |                                               | X163/50 | 2) Short-circuit-proof 100 mA |
|                           |                 |                                               | X163/52 | 2) Short-circuit-proof 100 mA |
| Serial interface 3 RS 485 | Plug-in terminal (screw terminal) Max. cross-section 1.5 mm² | TX+  
TX–  
RX+/TX+  
RX-/TX– | X172/61  
X172/61  
X172/63  
X172/64 | RS 485, 4-wire send cable, positive differential input  
RS 485, 4-wire send cable, negative differential input  
RS 485, 4-wire receive cable, positive differential input  
RS 485, 4-wire receive cable, negative differential input |
|                           |                 |                                               | M X172/65 | Ground |

1) H signal: +13 to +33 V*  
L signal: –33 to +3 V  
or unconnected terminals*  
* For binary control inputs  
8.5 mA at 24 V

2) H signal: +13 to +30 V  
L signal: 0 to +2 V

3) Cable length:  
- For baud rate of 187.5 kbd: 600 m  
- For transmission rate of  
  ≤ 93.75 kbd: 1200 m

4) Please observe DIN 19 245 Part 1. In particular, the potential difference between the data reference potentials M of all interfaces must not exceed ~ 7 V / +12 V. If this cannot be guaranteed, then equipotential bonding must be provided.
In the electronics box of the SIMOREG 6RA70 converter, up to four slots are available for fitting optional boards. The slots are identified by characters D to G.

If slots D to G are required, the LBA (Local Bus Adapter) must be installed first.

One adapter board is required for slot D and slot E and one for slots F and G when half-size optional boards are used.

**Fig. 4/4**
Integration/fitting of the optional boards
### Installation of the electronics options

The optional boards are installed in the slots of the electronics box. The LBA (Local Bus Adapter, backplane wiring) must be installed before additional optional boards can be fitted. The designations of the mounting locations and the slots are shown in the adjacent Figure.

Optional boards can be inserted into any slots; the only rule is that location 2 must be occupied before location 3.

**Note**
- A technology board must always be inserted in location 2 of the electronics box.
- If a technology board is used in conjunction with a communication board, the communication board must be installed in slot G. In this configuration, the communication data is exchanged directly between the communication board and technology board T400.
- Boards EB1, EB2, SLB and SBP cannot be used in conjunction with a technology board.
- Data from large-format boards are always output from slot E or slot G. The software version of a technology board is indicated, for example, in r060.003.
- In addition to the Local Bus Adapter, an adapter board (ADB) is required for the mini boards (CBP2, SLB, EB1 etc.) because the mini boards have to be inserted in the adapter board before they can be installed in the electronics box due to their extremely small size.
- It is not possible to install two optional boards of the same type in a converter (e.g. 2 x EB1).

![Diagram](image)

**Fig. 4/6** Possible locations and slots for supplementary boards as well as their possible combinations

### Installation possibilities in the electronics box

<table>
<thead>
<tr>
<th>Board</th>
<th>LBA required</th>
<th>ADB required</th>
<th>Location 1</th>
<th>Location 2</th>
<th>Location 3</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>D E F G</td>
<td></td>
<td></td>
<td>D E</td>
<td>F G</td>
</tr>
<tr>
<td>CUD1</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>CUD2</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>CBP2</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>CBC</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>CBD</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>SLB</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>SBP</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>SCB1</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>T300</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>T400</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>EB1</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>EB2</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>
Options

Integration of the electronics options

■ Backplane bus adapter LBA

The electronics box can be equipped with the backplane bus adapter LBA (Local Bus Adapter) in order to utilize locations 2 and 3. Two supplementary boards or the optional boards plugged into the adapter boards can be combined with the CUD1 in the electronics box. The CUD1 must be moved if the backplane bus adapter is used.

Fig. 4/7
Backplane bus adapter

■ Selection and ordering data

<table>
<thead>
<tr>
<th>Description</th>
<th>Short code</th>
<th>Supplied unassembled Order No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>LBA Backplane bus adapter</td>
<td></td>
<td>6SE7090-0XX84-4HA0</td>
</tr>
<tr>
<td>LBA installed in the electronics box (prerequisite for the installation of optional boards)</td>
<td></td>
<td>K11</td>
</tr>
</tbody>
</table>

■ Adapter board ADB

The ADB (Adapter Board) is used to install the supplementary boards CBD, CBC, CBP, EB1, EB2, SBP and SLB in locations 2 and 3 of the electronics box. Two supplementary boards can be installed on the adapter board. The backplane bus adapter is required if the adapter board is used.

Fig. 4/8
Adapter board ADB

■ Selection and ordering data

<table>
<thead>
<tr>
<th>Description</th>
<th>Short code</th>
<th>Installation kit and spare part, supplied unassembled Order No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>ADB Adapter board</td>
<td></td>
<td>6SE7090-0XX84-0KA0</td>
</tr>
<tr>
<td>Board installed in location</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 (Slot D and E)</td>
<td>K01</td>
<td></td>
</tr>
<tr>
<td>3 (Slot F and G)</td>
<td>K02</td>
<td></td>
</tr>
</tbody>
</table>
Optional board SBP for pulse encoder

The optional board SBP (Sensor Board Pulse) allows a second pulse encoder to be connected to the converter.

Suitable pulse encoders

All commercially available pulse encoders can be connected to this optional board. Their pulses can be processed as either bipolar or unipolar TTL or HTL level signals.

Encoder signals up to a pulse frequency of 410 kHz are possible (4096 pulses per rev. at 6000 rpm). Encoder monitoring can also be implemented through evaluation of the check track.

The supply voltage for the connected encoder can be set to 5 V or 15 V.

Temperature sensor

The temperature sensor connection on the board is not evaluated in the SIMOREG system.

Connections

Signal cables are connected to terminal strips X400 and X401. Connectable cross-section: 2.5 mm² (AWG12)

Maximum connectable encoder cable length with shielding as specified 1):
- 100 m (TTL signals)
- 150 m with Tracks A and B (HTL signals)
- 300 m with Track A+/A– and B+/B– (HTL signals).

1) See electromagnetically compatible installation on page 5/22.

Terminal assignments on terminal strip X400

<table>
<thead>
<tr>
<th>Terminal</th>
<th>Designation</th>
<th>Meaning</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>60</td>
<td>+VSS</td>
<td>Power supply for pulse encoder</td>
<td>5/15 V</td>
</tr>
<tr>
<td>61</td>
<td>–VSS</td>
<td>Power supply ground</td>
<td>–</td>
</tr>
<tr>
<td>62</td>
<td>–Temp</td>
<td>Negative (–) terminal KTY84/PTC100</td>
<td></td>
</tr>
<tr>
<td>63</td>
<td>+Temp</td>
<td>Positive (+) terminal KTY84/PTC100</td>
<td></td>
</tr>
<tr>
<td>64</td>
<td>Coarse/fine ground</td>
<td>Ground</td>
<td></td>
</tr>
<tr>
<td>65</td>
<td>Coarse pulse 1</td>
<td>Digital input coarse pulse 1</td>
<td></td>
</tr>
<tr>
<td>66</td>
<td>Coarse pulse 2</td>
<td>Digital input coarse pulse 2</td>
<td></td>
</tr>
<tr>
<td>67</td>
<td>Fine pulse 2</td>
<td>Digital input fine pulse 2</td>
<td></td>
</tr>
</tbody>
</table>

Connectable cross-section: 0.14 mm² to 1.5 mm² (AWG 16)
Terminal 60 is on the top in the installed state.

Terminal assignments on terminal strip X401

<table>
<thead>
<tr>
<th>Terminal</th>
<th>Designation</th>
<th>Meaning</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>68</td>
<td>Track A+</td>
<td>Positive (+) terminal Track A</td>
<td>TTL,HTL,HTL unipolar</td>
</tr>
<tr>
<td>69</td>
<td>Track A–</td>
<td>Negative (–) terminal Track A</td>
<td>TTL,HTL,HTL unipolar</td>
</tr>
<tr>
<td>70</td>
<td>Track B+</td>
<td>Positive (+) terminal Track B</td>
<td>TTL,HTL,HTL unipolar</td>
</tr>
<tr>
<td>71</td>
<td>Track B–</td>
<td>Negative (–) terminal Track A</td>
<td>TTL,HTL,HTL unipolar</td>
</tr>
<tr>
<td>72</td>
<td>Zero pulse+</td>
<td>Positive (+) terminal Zero track</td>
<td>TTL,HTL,HTL unipolar</td>
</tr>
<tr>
<td>73</td>
<td>Zero pulse–</td>
<td>Negative (–) terminal Zero track</td>
<td>TTL,HTL,HTL unipolar</td>
</tr>
<tr>
<td>74</td>
<td>CTRL+</td>
<td>Positive (+) terminal Check track</td>
<td>TTL,HTL,HTL unipolar</td>
</tr>
<tr>
<td>75</td>
<td>CTRL– = M</td>
<td>Negative (–) terminal Check track = ground</td>
<td>TTL,HTL,HTL unipolar</td>
</tr>
</tbody>
</table>

Connectable cross-section: 0.14 mm² to 1.5 mm² (AWG 16)
Terminal 68 is on the top in the installed state.
## Optional board SBP for pulse encoder

### Voltage range of encoder inputs

See adjacent tables.

**Note**

When unipolar signals are connected, one ground connection for all signals on the CTRL– terminal is sufficient. Due to the possibility of interference, it is recommended in the case of cables longer than 50 m that the four terminals A–, B–, zero pulse – and CTRL – are bridged and connected with the encoder ground.

### Voltage range of digital inputs

**Note**

The inputs are not floating. Coarse pulses are smoothed with 0.7 ms and fine pulses are smoothed with approximately 200 ns.

<table>
<thead>
<tr>
<th>Voltage range</th>
<th>RS 422 (TTL)</th>
<th>HTL bipolar</th>
<th>HTL unipolar</th>
</tr>
</thead>
<tbody>
<tr>
<td>Voltage range – Input</td>
<td>Max. 33 V; min. –33 V</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Voltage range + Input</td>
<td>Max. 33 V; min. –33 V</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Switching level – LOW</td>
<td>Min. –150 mV</td>
<td>Min. –2 V</td>
<td>Min. 4 V</td>
</tr>
<tr>
<td>Switching level – HIGH</td>
<td>Max. 150 mV</td>
<td>Max. 2 V</td>
<td>Max. 8 V</td>
</tr>
</tbody>
</table>

### Selection and ordering data

<table>
<thead>
<tr>
<th>Description</th>
<th>Short code</th>
<th>Installation kit for retrofitting, supplied unassembled</th>
<th>Spare part</th>
</tr>
</thead>
<tbody>
<tr>
<td>SBP Pulse encoder evaluation board</td>
<td></td>
<td>Order No.</td>
<td>Order No.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SBP Pulse encoder evaluation board</td>
<td>1)2)</td>
<td>6SX7010-0FA00</td>
<td>6SE7090-0XX84-0FA0</td>
</tr>
<tr>
<td>Board installed in slot</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>D</td>
<td>C14</td>
<td></td>
<td></td>
</tr>
<tr>
<td>E</td>
<td>C15</td>
<td></td>
<td></td>
</tr>
<tr>
<td>F</td>
<td>C16</td>
<td></td>
<td></td>
</tr>
<tr>
<td>G</td>
<td>C17</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1) For the installation of the SBP board in the SIMOREG unit, the Local Bus Adapter ADB and the adapter board ADB are additionally required. These must be ordered separately.

2) The SBP board is only necessary if a second pulse encoder is to be evaluated as the SIMOREG unit is already equipped with a pulse encoder evaluation in the basic unit.
Terminal expansion board EB1

The number of digital and analog inputs and outputs can be expanded with terminal expansion board EB1 (Expansion Board 1).

On terminal expansion board EB1, there are:
- 3 digital inputs
- 4 bidirectional digital inputs/outputs
- 1 analog input with differential signal, for use as current or voltage input
- 2 analog inputs (single-ended), that can also be used as digital inputs
- 2 analog outputs
- 1 input for the external 24 V supply for the digital outputs.

Terminal expansion board EB1 is installed in a slot in the electronics box. Boards LBA and ADB must be moved to allow installation.

Fig. 4/10 Terminal expansion board EB1

Fig. 4/11 Circuit diagram of the terminal expansion board EB1
## Terminal expansion board EB1

### Terminal X480

The terminal strip has the following terminals:

- 3 digital inputs
- 4 bidirectional digital inputs/outputs

The ground cables are protected with a reactor. In the installed state, Terminal 46 is on the top.

**Note**

The external 24 V supply is necessary and must be designed for the currents of the digital outputs.

### Terminal X481

The terminal strip has the following terminals:

- 1 analog input with differential signal, for use as current or voltage input
- 2 analog inputs (single ended), that can also be used as digital inputs
- 2 analog outputs

The ground cables are protected with a reactor. In the installed state, Terminal 47 is on the top.

### Technical Data

<table>
<thead>
<tr>
<th>Designation</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Digital inputs</td>
<td>D11, D12, D13</td>
</tr>
<tr>
<td>Voltage range LOW</td>
<td>0 V (-33 V to +5 V)</td>
</tr>
<tr>
<td>Voltage range HIGH</td>
<td>+24 V (13 V to 33 V)</td>
</tr>
<tr>
<td>Input resistance</td>
<td>4 kΩ</td>
</tr>
<tr>
<td>Smoothing</td>
<td>250 µs</td>
</tr>
<tr>
<td>Isolation</td>
<td>None</td>
</tr>
<tr>
<td>Bidirectional digital inputs/outputs</td>
<td>D1O1, D1O2, D1O3, D1O4</td>
</tr>
<tr>
<td>As input</td>
<td>Voltage range LOW</td>
</tr>
<tr>
<td>Voltage range HIGH</td>
<td>+24 V (13 V to 33 V)</td>
</tr>
<tr>
<td>Input resistance</td>
<td>4 kΩ</td>
</tr>
<tr>
<td>As output</td>
<td>Voltage range LOW</td>
</tr>
<tr>
<td>Voltage range HIGH</td>
<td>&gt; P24 ext. –2.5 V</td>
</tr>
<tr>
<td>Analog input (differential input)</td>
<td>A11P, A11N</td>
</tr>
<tr>
<td>Input range</td>
<td>Voltage</td>
</tr>
<tr>
<td>Current</td>
<td>±20 mA</td>
</tr>
<tr>
<td>Input resistance</td>
<td>40 kΩ relative to frame</td>
</tr>
<tr>
<td>Hardware smoothing</td>
<td>220 µs</td>
</tr>
<tr>
<td>Resolution</td>
<td>13 bits + sign bit</td>
</tr>
<tr>
<td>Analog input (single ended)</td>
<td>A12, A13, A1M</td>
</tr>
<tr>
<td>Input range</td>
<td>Voltage</td>
</tr>
<tr>
<td>Input resistance</td>
<td>40 kΩ relative to frame</td>
</tr>
<tr>
<td>Hardware smoothing</td>
<td>220 µs</td>
</tr>
<tr>
<td>Resolution</td>
<td>13 bits + sign bit</td>
</tr>
<tr>
<td>Analog output</td>
<td>A01, A02, A0M</td>
</tr>
<tr>
<td>Voltage range</td>
<td>±10 V</td>
</tr>
<tr>
<td>Input resistance</td>
<td>40 kΩ relative to frame</td>
</tr>
<tr>
<td>Hardware smoothing</td>
<td>10 µs</td>
</tr>
<tr>
<td>Resolution</td>
<td>11 bits + sign bit</td>
</tr>
</tbody>
</table>

### Selection and ordering data

<table>
<thead>
<tr>
<th>Description</th>
<th>Short code</th>
<th>Installation kit, supplied unassembled</th>
<th>Spare part</th>
</tr>
</thead>
<tbody>
<tr>
<td>Terminal expansion board</td>
<td>EB1</td>
<td>6SX7010-0KB00 6SE7090-0XX84-0KB0</td>
<td></td>
</tr>
</tbody>
</table>

**Module, installed in slot**

- D G64
- E G65
- F G66
- G G67

---

1) For the installation of the EB1 board in the SIMOREG unit, the Local Bus Adapter ADB and the adapter board ADB are additionally required. These must be ordered separately.
Terminal expansion board EB2

The number of digital and analog inputs and outputs can be expanded with terminal expansion board EB2 (Expansion Board 2).

On terminal expansion board EB2, there are:

- 2 digital inputs
- 1 relay output with changeover contacts
- 3 relay outputs with NO contacts
- 1 analog input with differential signal, for use as current or voltage input
- 1 analog output
- 24 V supply for the digital outputs.

Terminal expansion board EB2 is installed in a slot in the electronics box. Boards LBA and ADB must be moved to allow installation.
Options

Terminal expansions

Terminal expansion board EB2

Terminal X490

Load rating on the relay contacts

<table>
<thead>
<tr>
<th>Contact type</th>
<th>Changeover</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max. operational voltage</td>
<td>60 V AC, 60 V DC</td>
</tr>
<tr>
<td>Max. switching power</td>
<td>16 VA at 60 V AC (\cos \varphi = 0.4)</td>
</tr>
<tr>
<td></td>
<td>60 VA at 60 V AC (\cos \varphi = 1.0)</td>
</tr>
<tr>
<td></td>
<td>3 W at 60 V DC</td>
</tr>
</tbody>
</table>

Terminal Designation Meaning

<table>
<thead>
<tr>
<th>Terminal</th>
<th>Designation</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>38</td>
<td>DO13</td>
<td>Relay output 1, NC</td>
</tr>
<tr>
<td>39</td>
<td>DO12</td>
<td>Relay output 1, NO</td>
</tr>
<tr>
<td>40</td>
<td>DO11</td>
<td>Relay output 1, reference contact</td>
</tr>
<tr>
<td>41</td>
<td>DO22</td>
<td>Relay output 2, NO</td>
</tr>
<tr>
<td>42</td>
<td>DO21</td>
<td>Relay output 2, reference contact</td>
</tr>
<tr>
<td>43</td>
<td>DO32</td>
<td>Relay output 3, NO</td>
</tr>
<tr>
<td>44</td>
<td>DO31</td>
<td>Relay output 3, reference contact</td>
</tr>
<tr>
<td>45</td>
<td>DO42</td>
<td>Relay output 4, NO</td>
</tr>
<tr>
<td>46</td>
<td>DO41</td>
<td>Relay output 4, reference contact</td>
</tr>
</tbody>
</table>

Connectable cross-section: 0.14 - 1.5 mm² (AWG 16)

Terminal X491

The ground cables are protected with a reactor.

Note

The analog input can be used as a voltage or current input. This is set using a jumper.

Terminal Designation Meaning

<table>
<thead>
<tr>
<th>Terminal</th>
<th>Designation</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>47</td>
<td>AO</td>
<td>Analog output</td>
</tr>
<tr>
<td>48</td>
<td>AOM</td>
<td>Analog output ground</td>
</tr>
<tr>
<td>49</td>
<td>A11P</td>
<td>Analog input +</td>
</tr>
<tr>
<td>50</td>
<td>A11N</td>
<td>Analog input –</td>
</tr>
<tr>
<td>51</td>
<td>DIM</td>
<td>Digital input ground</td>
</tr>
<tr>
<td>52</td>
<td>P24AUX</td>
<td>24 V supply</td>
</tr>
<tr>
<td>53</td>
<td>DI1</td>
<td>Digital input 1</td>
</tr>
<tr>
<td>54</td>
<td>DI2</td>
<td>Digital input 2</td>
</tr>
</tbody>
</table>

Connectable cross-section: 0.14 - 1.5 mm² (AWG 16)

Technical Data

<table>
<thead>
<tr>
<th>Designation</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Digital inputs</td>
<td>DI1, DI2, DIM</td>
</tr>
<tr>
<td>• Voltage range LOW</td>
<td>0 V ((-33) V to +5 V)</td>
</tr>
<tr>
<td>• Voltage range HIGH</td>
<td>+24 V ((13 ) V to 33 V)</td>
</tr>
<tr>
<td>• Input resistance</td>
<td>4 kΩ</td>
</tr>
<tr>
<td>• Smoothing</td>
<td>None</td>
</tr>
<tr>
<td>Digital outputs (relay)</td>
<td>DO1., DO2., DO3., DO4.</td>
</tr>
<tr>
<td>• Contact type</td>
<td>Changeover</td>
</tr>
<tr>
<td>• Max. operational voltage</td>
<td>60 V AC, 60 V DC</td>
</tr>
<tr>
<td>• Max. switching power</td>
<td>16 VA (\cos \varphi = 0.4)</td>
</tr>
<tr>
<td></td>
<td>60 VA (\cos \varphi = 1.0)</td>
</tr>
<tr>
<td></td>
<td>3 W</td>
</tr>
<tr>
<td></td>
<td>24 W</td>
</tr>
<tr>
<td>• Permissible minimum capacity</td>
<td>1 mA, 1 V</td>
</tr>
<tr>
<td>Analog input (differential input)</td>
<td>AI1P, AI1N</td>
</tr>
<tr>
<td>• Input range</td>
<td>±11 V</td>
</tr>
<tr>
<td>• Input resistance</td>
<td>±20 mA</td>
</tr>
<tr>
<td>Voltage</td>
<td>40 kΩ relative to frame</td>
</tr>
<tr>
<td>Current</td>
<td>250 Ω relative to frame</td>
</tr>
<tr>
<td>Hardware smoothing</td>
<td>220 μs</td>
</tr>
<tr>
<td>Resolution</td>
<td>11 bits + sign bit</td>
</tr>
<tr>
<td>Analog output</td>
<td>AO, AOM</td>
</tr>
<tr>
<td>• Voltage range</td>
<td>±10 V, ±0 –20 mA</td>
</tr>
<tr>
<td>• Input resistance</td>
<td>40 kΩ relative to frame</td>
</tr>
<tr>
<td>Hardware smoothing</td>
<td>10 μs</td>
</tr>
<tr>
<td>Resolution</td>
<td>9 bits + sign bit</td>
</tr>
</tbody>
</table>

Selection and ordering data

<table>
<thead>
<tr>
<th>Description</th>
<th>Short code</th>
<th>Installation kit, supplied unassembled</th>
<th>Spare part</th>
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</thead>
<tbody>
<tr>
<td>Module, installed in slot</td>
<td>D</td>
<td>G74</td>
<td></td>
</tr>
<tr>
<td></td>
<td>E</td>
<td>G75</td>
<td></td>
</tr>
<tr>
<td></td>
<td>F</td>
<td>G76</td>
<td></td>
</tr>
<tr>
<td></td>
<td>G</td>
<td>G77</td>
<td></td>
</tr>
</tbody>
</table>

1) For the installation of the EB2 board into the SIMOREG unit, the Local Bus Adapter ADB and the adapter board ADB are additionally required. These must be ordered separately.
Interface boards SCI1 and SCI2

Interface boards SCI1 or SCI2 (Serial Communication Interface 1 or 2) and interface board SCB1 can be used to assemble a serial I/O system with a fiber-optic conductor that can expand the binary and analog inputs and outputs considerably. In addition, the fiber-optic conductor reliably decouples the devices according to DIN VDE 0100 and DIN VDE 0160 (PELV function, e.g. for NAMUR).

The fiber-optic conductor of between 0.3 m and 10 m in length connects the modules in a ring. Both the SCI1 and the SCI2 require an external 24 V supply (1 A each).

All inputs and outputs of the interface boards can be parameterized.

Interface boards SCI1 and SCI2 can be snapped onto a mounting rail at a suitable location in the switchgear cabinet.

![Fig. 4/14 Interface board SCI1](image)

![Fig. 4/15 Interface board SCI2](image)

### Inputs and outputs

<table>
<thead>
<tr>
<th>Functions</th>
<th>SCI1</th>
<th>SCI2</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Binary inputs</td>
<td>10</td>
<td>16</td>
<td>Isolated optocoupler inputs in 2 circuits</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>24 V DC, 10 mA</td>
</tr>
<tr>
<td>Binary outputs</td>
<td>8</td>
<td>12</td>
<td>Load rating:</td>
</tr>
<tr>
<td>of which</td>
<td></td>
<td></td>
<td>Voltage signals: 0 to ± 10 V</td>
</tr>
<tr>
<td>Relay changeover</td>
<td>4</td>
<td>4</td>
<td>Current signals: 0 to ± 20 mA</td>
</tr>
<tr>
<td>Relay NO</td>
<td>3</td>
<td>3</td>
<td>250 V AC, 2000 VA (cos φ = 1)</td>
</tr>
<tr>
<td>Transistor outputs</td>
<td>1</td>
<td>5</td>
<td>100 V DC, 240 W</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>240 V DC, max. 100 mA, short-circuit-proof, open emitter</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>for controlling optocouplers or relay</td>
</tr>
<tr>
<td>Analog inputs</td>
<td>3</td>
<td>–</td>
<td>Output signals: 0 to ± 10 V</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Current signals: 0 to ± 20 mA</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>4 to 20 mA, 250 Ω resistive load</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Non-floating inputs</td>
</tr>
<tr>
<td>Analog outputs</td>
<td>3</td>
<td>–</td>
<td>Load rating 5 mA short-circuit proof</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>24 V DC, max. 100 m with shielded cable</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Max. resistive load 500 Ω</td>
</tr>
<tr>
<td>Supply voltage:</td>
<td></td>
<td></td>
<td>Load rating 5 mA short-circuit proof</td>
</tr>
<tr>
<td>Reference voltage</td>
<td></td>
<td></td>
<td>24 V DC, max. 100 m with shielded cable</td>
</tr>
<tr>
<td>+10 V</td>
<td>1</td>
<td>–</td>
<td>Load rating 5 mA short-circuit proof</td>
</tr>
<tr>
<td>-10 V</td>
<td>1</td>
<td>–</td>
<td>Non-floating inputs</td>
</tr>
<tr>
<td>24 V DC</td>
<td>2</td>
<td>2</td>
<td>Short-circuit proof output for binary inputs or outputs, load rating 280 mA</td>
</tr>
</tbody>
</table>

### Technical Data

<table>
<thead>
<tr>
<th>Fixing</th>
<th>Standard mounting rail</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated input voltage, external</td>
<td>24 V DC (-17 %, +25 %), 1 A</td>
</tr>
<tr>
<td>Degree of protection</td>
<td>IP 00</td>
</tr>
<tr>
<td>Dimensions H x W x D</td>
<td>SCI1: 95 mm x 300 mm x 80 mm</td>
</tr>
<tr>
<td></td>
<td>SCI2: 95 mm x 250 mm x 80 mm</td>
</tr>
</tbody>
</table>
### Control terminal strip on interface board SCI1

<table>
<thead>
<tr>
<th>Terminal</th>
<th>No.:</th>
<th>Internal Circuit</th>
<th>Function, Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>X427</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A1</td>
<td></td>
<td></td>
<td>Auxiliary voltage P 24 V DC, 200 mA for binary inputs</td>
</tr>
<tr>
<td>A2</td>
<td></td>
<td></td>
<td>Auxiliary voltage M for binary inputs</td>
</tr>
<tr>
<td>A3</td>
<td></td>
<td></td>
<td>Binary input 6</td>
</tr>
<tr>
<td>A4</td>
<td></td>
<td></td>
<td>Binary input 7</td>
</tr>
<tr>
<td>A5</td>
<td></td>
<td></td>
<td>Binary input 8</td>
</tr>
<tr>
<td>A6</td>
<td></td>
<td></td>
<td>Binary input 9</td>
</tr>
<tr>
<td>A7</td>
<td></td>
<td></td>
<td>Binary input 10</td>
</tr>
<tr>
<td>A8</td>
<td></td>
<td></td>
<td>Reference point for binary inputs 6 to 10</td>
</tr>
<tr>
<td>A9</td>
<td></td>
<td></td>
<td>Auxiliary voltage M for binary inputs</td>
</tr>
<tr>
<td>A10</td>
<td></td>
<td></td>
<td>Power supply M (connection of external supply)</td>
</tr>
<tr>
<td>A11</td>
<td></td>
<td></td>
<td>Power supply M (connection of external supply)</td>
</tr>
<tr>
<td>B1</td>
<td></td>
<td></td>
<td>Binary output 8, driver P 24 V DC</td>
</tr>
<tr>
<td>B2</td>
<td></td>
<td></td>
<td>Binary output 8, driver 100 mA external, short-circuit proof</td>
</tr>
<tr>
<td>B3</td>
<td></td>
<td></td>
<td>Binary input 1</td>
</tr>
<tr>
<td>B4</td>
<td></td>
<td></td>
<td>Binary input 2</td>
</tr>
<tr>
<td>B5</td>
<td></td>
<td></td>
<td>Binary input 3</td>
</tr>
<tr>
<td>B6</td>
<td></td>
<td></td>
<td>Binary input 4</td>
</tr>
<tr>
<td>B7</td>
<td></td>
<td></td>
<td>Binary input 5</td>
</tr>
<tr>
<td>B8</td>
<td></td>
<td></td>
<td>Reference point for binary inputs 1 to 5</td>
</tr>
<tr>
<td>B9</td>
<td></td>
<td></td>
<td>Auxiliary voltage P 24 V DC for binary inputs</td>
</tr>
<tr>
<td>B10</td>
<td></td>
<td></td>
<td>Power supply P 24 V DC (connection of external supply)</td>
</tr>
<tr>
<td>B11</td>
<td></td>
<td></td>
<td>Power supply P 24 V DC (connection of external supply)</td>
</tr>
</tbody>
</table>

| **X428**|      |                  |                |
| 1       |      |                  | +10 V / 5 mA for potentiometer; short-circuit proof |
| 2       |      |                  | –10 V / 5 mA for potentiometer; short-circuit proof |
| 3       |      |                  | Analog input 1: Voltage (0 to +/-10 V) |
| 4       |      |                  | Ground |
| 5       |      |                  | Current (0/4 to 20 mA, resistive load 250 Ω) |
| 6       |      |                  | Analog input 2: Voltage (0 to +/-10 V) |
| 7       |      |                  | Ground |
| 8       |      |                  | Current (0/4 to 20 mA, resistive load 250 Ω) |
| 9       |      |                  | Analog input 3: Voltage (0 to +/-10 V) |
| 10      |      |                  | Ground |
| 11      |      |                  | Current (0/4 to 20 mA, resistive load 250 Ω) |
| 12      |      |                  | Analog output 1: Voltage (±10 V, max. 5 mA) |
| 13      |      |                  | Ground |
| 14      |      |                  | Current (0/4 to +/-20 mA, max. 500 Ω) |
| 15      |      |                  | Analog output 2: Voltage (±10 V, max. 5 mA) |
| 16      |      |                  | Ground |
| 17      |      |                  | Current (0/4 to +/-20 mA, max. 500 Ω) |
| 18      |      |                  | Analog output 3: Current voltage (±10 V, max. 5 mA) |
| 19      |      |                  | Ground |
| 20      |      |                  | Current (0/4 to +/-20 mA, max. 500 Ω) |
### Control terminal strip on interface board SCI1

<table>
<thead>
<tr>
<th>Terminal No.</th>
<th>Internal Circuit</th>
<th>Function, Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>X429 1</td>
<td></td>
<td>Binary output 1: NO 100 V DC / 250 V AC; 240 W / 2000 VA; min.: 24 V, 10 mA</td>
</tr>
<tr>
<td>X429 2</td>
<td></td>
<td>Binary output 2: NO 100 V DC / 250 V AC; 240 W / 2000 VA; min.: 24 V, 10 mA</td>
</tr>
<tr>
<td>X429 3</td>
<td></td>
<td>Binary output 3: NO 100 V DC / 250 V AC; 240 W / 2000 VA; min.: 24 V, 10 mA</td>
</tr>
<tr>
<td>X429 4</td>
<td></td>
<td>Binary output 4: changeover</td>
</tr>
<tr>
<td>X429 5</td>
<td></td>
<td>Binary output 5: changeover</td>
</tr>
<tr>
<td>X429 6</td>
<td></td>
<td>Binary output 6: changeover</td>
</tr>
<tr>
<td>X429 7</td>
<td></td>
<td>Binary output 7: changeover</td>
</tr>
</tbody>
</table>

### Control terminal strip on interface board SCI2

<table>
<thead>
<tr>
<th>Terminal No.</th>
<th>Internal Circuit</th>
<th>Function, Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>X437 A1</td>
<td></td>
<td>Binary input 9</td>
</tr>
<tr>
<td>X437 A2</td>
<td></td>
<td>Binary input 10</td>
</tr>
<tr>
<td>X437 A3</td>
<td></td>
<td>Binary input 11</td>
</tr>
<tr>
<td>X437 A4</td>
<td></td>
<td>Binary input 12</td>
</tr>
<tr>
<td>X437 A5</td>
<td></td>
<td>Binary input 13</td>
</tr>
<tr>
<td>X437 A6</td>
<td></td>
<td>Binary input 14</td>
</tr>
<tr>
<td>X437 A7</td>
<td></td>
<td>Binary input 15</td>
</tr>
<tr>
<td>X437 A8</td>
<td></td>
<td>Binary input 16</td>
</tr>
<tr>
<td>X437 A9</td>
<td></td>
<td>Reference point for binary inputs 9 to 16</td>
</tr>
<tr>
<td>X437 A10</td>
<td></td>
<td>Auxiliary voltage M for binary inputs</td>
</tr>
<tr>
<td>X437 A11</td>
<td></td>
<td>Power supply M (connection of external supply)</td>
</tr>
<tr>
<td>X437 A12</td>
<td></td>
<td>Power supply M (connection of external supply)</td>
</tr>
<tr>
<td>X437 B1</td>
<td></td>
<td>Binary input 1</td>
</tr>
<tr>
<td>X437 B2</td>
<td></td>
<td>Binary input 2</td>
</tr>
<tr>
<td>X437 B3</td>
<td></td>
<td>Binary input 3</td>
</tr>
<tr>
<td>X437 B4</td>
<td></td>
<td>Binary input 4</td>
</tr>
<tr>
<td>X437 B5</td>
<td></td>
<td>Binary input 5</td>
</tr>
<tr>
<td>X437 B6</td>
<td></td>
<td>Binary input 6</td>
</tr>
<tr>
<td>X437 B7</td>
<td></td>
<td>Binary input 7</td>
</tr>
<tr>
<td>X437 B8</td>
<td></td>
<td>Binary input 8</td>
</tr>
<tr>
<td>X437 B9</td>
<td></td>
<td>Reference point for binary inputs 1 to 8</td>
</tr>
<tr>
<td>X437 B10</td>
<td></td>
<td>Aux. volt. P 24 V DC, 280 mA/0 to 40 °C, 400 mA/20 °C, 200 mA/55 °C in combination with X438/A5 for binary inputs</td>
</tr>
<tr>
<td>X437 B11</td>
<td></td>
<td>Power supply P 24 V DC (connection of external supply)</td>
</tr>
<tr>
<td>X437 B12</td>
<td></td>
<td>Power supply P 24 V DC (connection of external supply)</td>
</tr>
</tbody>
</table>
Control terminal strip on interface board SCI2

<table>
<thead>
<tr>
<th>Terminal No.</th>
<th>Internal Circuit</th>
<th>Function, Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>X438</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A1</td>
<td></td>
<td>Binary output 11, driver 24 V DC</td>
</tr>
<tr>
<td>A2</td>
<td></td>
<td>Binary output 11, driver 100 mA external, short-circuit proof</td>
</tr>
<tr>
<td>A3</td>
<td></td>
<td>Binary output 12, driver 24 V DC</td>
</tr>
<tr>
<td>A4</td>
<td></td>
<td>Binary output 13, driver 100 mA external, short-circuit proof</td>
</tr>
<tr>
<td>A5</td>
<td></td>
<td>Aux. volt. P 24 V DC, 280 mA/0 to 40 °C, 400 mA/20 °C, 200 mA/55 °C in combination with X437/B10 for binary outputs</td>
</tr>
<tr>
<td>A6</td>
<td></td>
<td>Auxiliary voltage M for binary outputs</td>
</tr>
<tr>
<td>B1</td>
<td></td>
<td>Binary output 8, driver 24 V DC</td>
</tr>
<tr>
<td>B2</td>
<td></td>
<td>Binary output 8, driver 100 mA external, short-circuit proof</td>
</tr>
<tr>
<td>B3</td>
<td></td>
<td>Binary output 9, driver 24 V DC</td>
</tr>
<tr>
<td>B4</td>
<td></td>
<td>Binary output 9, driver 100 mA external, short-circuit proof</td>
</tr>
<tr>
<td>B5</td>
<td></td>
<td>Binary output 10, driver 24 V DC</td>
</tr>
<tr>
<td>B6</td>
<td></td>
<td>Binary output 10, driver 100 mA external, short-circuit proof</td>
</tr>
<tr>
<td>X439</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td></td>
<td>Binary output 1: NO 100 V DC / 250 V AC; 240 W / 2000 VA; min.: 24 V, 10 mA</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>Binary output 2: NO 100 V DC / 250 V AC; 240 W / 2000 VA; min.: 24 V, 10 mA</td>
</tr>
<tr>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td></td>
<td>Binary output 3: NO 100 V DC / 250 V AC; 240 W / 2000 VA; min.: 24 V, 10 mA</td>
</tr>
<tr>
<td>6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td></td>
<td>Binary output 4: changeover</td>
</tr>
<tr>
<td>8</td>
<td></td>
<td>100 V DC / 250 V AC; 240 W / 2000 VA; Minimum load: 24 V, 10 mA</td>
</tr>
<tr>
<td>9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td></td>
<td>Binary output 5: changeover</td>
</tr>
<tr>
<td>11</td>
<td></td>
<td>100 V DC / 250 V AC; 240 W / 2000 VA; Minimum load: 24 V, 10 mA</td>
</tr>
<tr>
<td>12</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td></td>
<td>Binary output 6: changeover</td>
</tr>
<tr>
<td>14</td>
<td></td>
<td>100 V DC / 250 V AC; 240 W / 2000 VA; Minimum load: 24 V, 10 mA</td>
</tr>
<tr>
<td>15</td>
<td></td>
<td></td>
</tr>
<tr>
<td>16</td>
<td></td>
<td>Binary output 7: changeover</td>
</tr>
<tr>
<td>17</td>
<td></td>
<td>100 V DC / 250 V AC; 240 W / 2000 VA; Minimum load: 24 V, 10 mA</td>
</tr>
<tr>
<td>18</td>
<td></td>
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</table>

Selection and ordering data

<table>
<thead>
<tr>
<th>Description</th>
<th>Order No.:</th>
</tr>
</thead>
<tbody>
<tr>
<td>SCI1 Interface board</td>
<td>6SE7090-0XX84-3EA0</td>
</tr>
<tr>
<td>Binary and analog inputs/outputs</td>
<td></td>
</tr>
<tr>
<td>Supplied unassembled incl. 10 m fiber-optic cable</td>
<td></td>
</tr>
<tr>
<td>SCI2 Interface board</td>
<td>6SE7090-0XX84-3EF0</td>
</tr>
<tr>
<td>Binary inputs and outputs</td>
<td></td>
</tr>
<tr>
<td>Supplied unassembled incl. 10 m fiber-optic cable</td>
<td></td>
</tr>
</tbody>
</table>
Technology board T400

The T400 is used to implement supplementary process-specific functions (e.g. for tension and position controls, winders, reels, synchronous and positioning controls, hoisting gear and drive-related open-loop control functions. Frequently used supplementary process-specific functions are available as pre-programmed standard configurations.

End users who wish to implement specialist applications or who want to market their own technological know-how can create their own process solution on the T400 using CFC configuring language that is familiar from SIMATIC® STEP® 7.

Process-specific functions are configured with CFC. The processor then executes these functions cyclically. The closed-loop control sampling time is about 1 ms.

A virtually instantaneous parallel interface (dual-port RAM) allows data to be exchanged between the basic unit and T400. All signals can be directly connected to terminals on the T400. A 15 V/100 mA pulse power supply is available.

An external 24 V DC supply must be available to drive the binary inputs and outputs. This voltage can be supplied by the basic unit provided the total current at the terminals does not exceed 150 mA.

The configuration is parameterized by means of:
- The PMU operation and parameterization unit
- The OP1S operator control panel
- A PC with DriveMonitor\(^1\)) on the basic unit
- An interface board
- Altered parameter settings can be stored permanently in the EEPROM.

The T400 board can be installed in the electronics box of SIMOREG converters. The LBA bus adapter is needed for this purpose.

Fig. 4/16
Technology board T400

---

1) The DriveMonitor service program enables the entire parameter set of a standard configuration to be read or written via a PC or programming device.
Technology board T400

Features (inputs/outputs)
- 2 analog outputs
- 5 analog inputs
- 2 binary outputs
- 8 binary inputs
- 4 bidirectional binary inputs or outputs
- 2 incremental encoder inputs with zero pulse
  - Encoder 1 for HTL (15 V) encoder.
  - Encoder 2 for HTL (15 V) or TTL/RS 422 encoder (5 V)
- For each incremental encoder: One coarse pulse input for suppression of zero pulse, coarse pulse inputs (simultaneous) also available as binary inputs
- No isolation of inputs/outputs.
- Serial interface 1 with RS 232 and RS 485 transmission format; protocol can be selected via switch on board:
  - Service protocol DUST1 with 19.2 Kbits/s and RS 232 transmission format
  - USS protocol, 2-wire with selectable RS 232 or RS 485 transmission format, max. 38.4 Kbits/s, configurable as slave for parameterization with OP1S, Drive ES Basic or SIMOVIS or as master for OP2 operator panel connection
- Serial interface 2 with RS 485 transmission format and protocol that is selectable through configuring of the appropriate function block:
  - Peer-to-peer for high-speed process link, 4-wire.
  - USS protocol configurable as slave for parameterization with OP1S, Drive ES Basic or DriveMonitor (2-wire or 4-wire), baud rates [Kbits/s]: 9.6/19.2/38.4/93.75/187.5.

Note
If serial interface 2 (peer-to-peer, USS) is used, the second absolute encoder cannot be operated since both applications utilize the same terminals.
- Absolute encoder 1 with SSI or EnDat protocol (RS 485) for positioning applications.
- Absolute encoder 2 with SSI or EnDat protocol (RS 485) for positioning applications.

Note
If the second absolute encoder is used, serial interface 2 (peer-to-peer, USS) cannot be used since both applications utilize the same terminals.
- Wide variety of synchronizing options:
  - Synchronization of T400 with MASTERDRIVES (CUx, CBx) or second T400
  - T400 supplies synchronizing signals for MASTERDRIVES (CUx, CBx) or second T400.
- Operation without a fan
- 3 LEDs for operational status displays.
- Hardlock PAL: Plug-in base for 28-pin EPLD submodule as copy protection for user program (as on 32-bit CPU boards).
- Soldered-in flash memory (2 MB) for downloadable program code (no MS5x memory module needed).
- 4 MB DRAM as main memory for program and data.
- 32 KB permanent modification memory.
- 128 byte NOVRAM for data storage during power off.
- Cache: 4 KB program, 4 KB data.
- Clock cycle (external/internal): 32/32 MHz.

Fig. 4/17 Technology board T400
# Technology board T400

<table>
<thead>
<tr>
<th>Type</th>
<th>Features</th>
</tr>
</thead>
<tbody>
<tr>
<td>General</td>
<td>Isolation of inputs/outputs. No</td>
</tr>
<tr>
<td></td>
<td>Space required 1 slot</td>
</tr>
<tr>
<td></td>
<td>Dimensions (W x H x D) in mm 267 x 140 x 14</td>
</tr>
<tr>
<td></td>
<td>Weight 0.4 kg</td>
</tr>
<tr>
<td>Power supply</td>
<td>Voltage supply/typ. + 5 V ± 5 %: 1.1 A +15 V ± 4 %: 140 mA + max. 100 mA encoder supply −15 V ± 3 %: 140 mA</td>
</tr>
<tr>
<td>Analog outputs</td>
<td>Number 2</td>
</tr>
<tr>
<td></td>
<td>Output range ± 10 V</td>
</tr>
<tr>
<td></td>
<td>Short-circuit protection Yes</td>
</tr>
<tr>
<td></td>
<td>Short-circuit current ± 10 mA</td>
</tr>
<tr>
<td></td>
<td>Resolution 12 bits (4.88 mV)</td>
</tr>
<tr>
<td></td>
<td>Accuracy, absolute ± 3 bits</td>
</tr>
<tr>
<td></td>
<td>Linearity error &lt; 1 bit</td>
</tr>
<tr>
<td></td>
<td>Voltage rise time 4.2 V/μs</td>
</tr>
<tr>
<td></td>
<td>Delay time 3.5 μs</td>
</tr>
<tr>
<td>Analog inputs</td>
<td>Number 2 differential inputs, 3 unipolar</td>
</tr>
<tr>
<td></td>
<td>Input range ± 10 V</td>
</tr>
<tr>
<td></td>
<td>Measuring principle Sampling</td>
</tr>
<tr>
<td></td>
<td>Conversion time 12 μs</td>
</tr>
<tr>
<td></td>
<td>Input impedance 20 kΩ</td>
</tr>
<tr>
<td></td>
<td>Input filter (-3 dB limit frequency) 1.5 kHz</td>
</tr>
<tr>
<td></td>
<td>Resolution 12 bits (4.88 mV)</td>
</tr>
<tr>
<td></td>
<td>Accuracy, absolute ± 3 bits</td>
</tr>
<tr>
<td></td>
<td>Linearity error &lt; 1 bit</td>
</tr>
<tr>
<td>Binary outputs</td>
<td>Number 2 + max. 4 (bidirect.)</td>
</tr>
<tr>
<td></td>
<td>Ext. Supply voltage: 24 V DC</td>
</tr>
<tr>
<td></td>
<td>Rated value 24 V DC</td>
</tr>
<tr>
<td></td>
<td>Permissible range 15 to 33 V DC</td>
</tr>
<tr>
<td></td>
<td>For “0” signal Max. 0.1 V Ext. supply voltage –0.3 V</td>
</tr>
<tr>
<td></td>
<td>For “1” signal Ext. supply voltage 50 mA + output currents</td>
</tr>
<tr>
<td></td>
<td>Output current Max. 50 mA</td>
</tr>
<tr>
<td></td>
<td>Output current, ext. Retransmission of encoder values</td>
</tr>
<tr>
<td>Supply voltage</td>
<td>Switching frequency/ohmic load 5 kHz</td>
</tr>
<tr>
<td></td>
<td>Overload protection Yes (limited to 100 mA)</td>
</tr>
<tr>
<td></td>
<td>Max. switching delay 70 μs</td>
</tr>
<tr>
<td>Binary inputs and coarse signals</td>
<td>Number 8 + max. 4 (bidirect.) + max. 2 (coarse pulse)</td>
</tr>
<tr>
<td></td>
<td>Input voltage: 24 V DC</td>
</tr>
<tr>
<td></td>
<td>Rated value 24 V DC</td>
</tr>
<tr>
<td></td>
<td>For “0” signal −1 to +6 V or input open</td>
</tr>
<tr>
<td></td>
<td>For “1” signal +13 to +33 V</td>
</tr>
<tr>
<td>Input current</td>
<td>Input current: 8 mA typ.</td>
</tr>
<tr>
<td></td>
<td>For “0” signal</td>
</tr>
<tr>
<td></td>
<td>For “1” signal</td>
</tr>
<tr>
<td></td>
<td>Input smoothing (time constant) 0.1 ms</td>
</tr>
<tr>
<td>5 V, 15 V incremental encoder</td>
<td>Number 2</td>
</tr>
<tr>
<td></td>
<td>Signal voltage (rated value): 15 V (HTL only) unipolar</td>
</tr>
<tr>
<td></td>
<td>&quot;Encoder 1&quot; 5 V or 15 V unipolar or differential</td>
</tr>
<tr>
<td></td>
<td>&quot;Encoder 2&quot; 1.5 MHz</td>
</tr>
<tr>
<td></td>
<td>Max. pulse frequency Configurable on function block (NAV)</td>
</tr>
<tr>
<td></td>
<td>Input filter</td>
</tr>
<tr>
<td>5 V incremental encoder</td>
<td>Signal voltage for differential inputs (RS 422 encoder): −0.2 V</td>
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<tr>
<td></td>
<td>For “0” signal 0.2 V</td>
</tr>
<tr>
<td></td>
<td>For “1” signal</td>
</tr>
<tr>
<td></td>
<td>Signal voltage for unipolar inputs (TTL encoder): 0.8 V</td>
</tr>
<tr>
<td></td>
<td>For “0” signal 2.3 V</td>
</tr>
<tr>
<td></td>
<td>For “1” signal 15 mA (limited)</td>
</tr>
<tr>
<td>15 V incremental encoder</td>
<td>Signal voltage for differential inputs −30 V to 4 V</td>
</tr>
<tr>
<td></td>
<td>For “0” signal 8 V to 30 V</td>
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<tr>
<td></td>
<td>For “1” signal</td>
</tr>
<tr>
<td></td>
<td>Signal voltage for unipolar inputs: 5 V</td>
</tr>
<tr>
<td></td>
<td>For “0” signal 8 V</td>
</tr>
<tr>
<td></td>
<td>For “1” signal 15 mA (limited)</td>
</tr>
<tr>
<td>Absolute encoder</td>
<td>Number Max. 2</td>
</tr>
<tr>
<td></td>
<td>of connectable encoders Single-turn or multi-turn encoder</td>
</tr>
<tr>
<td></td>
<td>With SSI (synchronous-serial) or EnDat interface</td>
</tr>
<tr>
<td></td>
<td>Signal voltage 5 V to RS 422</td>
</tr>
<tr>
<td></td>
<td>Data transfer rate 100 kHz to 2 MHz</td>
</tr>
<tr>
<td></td>
<td>Data display Dual, Gray, Gray Excess Code</td>
</tr>
</tbody>
</table>
Technology board T400

Standard configurations

Standard configurations for commonly used application types are available as pre-installed configurations. The standard configuration can be adapted to suit a specific plant by means of parameterization.

Components and features of standard configuration

- Peer-to-peer communication (digital setpoint cascade)
- The T400 with standard configuration can be operated with and without a communication board (e.g. CBP)
- A communication board can be used to
  1. Specify T400 control commands and set points via a bus system (e.g. PROFIBUS-DP) or a point-to-point connection
  2. Read actual values and status words and to read and write technology parameters
- Inputs, outputs and process data can be "wired up" to the DRAM to provide access to all important SIMOREG data, thereby ensuring highly flexible configuring
- Non-volatile storage of all important operating data
- All parameters can be reset to IPL status
- Parameters can be set via PC with DriveMonitor linked to the basic unit interface

Available standard configurations

- Standard configuration for axial winders
- Standard configuration for angular synchronism controls

Standard configuration for axis winder with T400

Scope of applications:
- Foil plants
- Paper machines
- Paper finishing machines
- Coating machines
- Printing presses of all types (foil, paper)
- Wire-drawing machines
- Reels in metalworking (e.g. straightening machines, treatment plants, etc.)

Features
- Suitable for wind-on and wind-off coils, with and without on-the-fly roller change
- Suitable for direct and indirect tension control
- Compensating roller or tension capsule-type dyanometer can be connected
- Diameter calculation with "Set diameter" and "Stop" plus non-volatile storage of diameter measurement
- Adaptation of tension and speed controllers as a function of diameter
- Polygon-based friction compensation, speed-dependent
- Acceleration as a function of diameter, material width and gear stage
- Ramp-function generator for acceleration on-on-the-fly roller change followed by shutdown
- Pulse encoder for path velocity measurement can be connected
- Initial diameter can be measured via contact pulse encoder
- Tension controller can be applied either to the speed controller or directly to the torque control
- \( v = \) constant control can be implemented
- Winder-specific open-loop control with alarm and fault evaluation
- Inching and crawling operation
- Two motorized potentiometers for optional use
- Smooth, overshoot-free shutdown via braking characteristic

Standard configuration for angular synchronism control with T400

Scope of applications:
- Substitute for mechanical and electrical shafts, e.g. on gantry traversing mechanisms, feed and discharge machines on furnaces or looms
- Substitute for gear units with fixed or variable gear ratio, e.g. change-gear units, installed at transition points on conveyer belts or at transition point between one machine section and the next, such as on packaging machines or book spine gluing machines
- Phase-locked synchronism, also applicable for mutual engagement of two machine parts. Also suitable for printing or folding of bags, round stock, etc.

Features
- Angular synchronism with gear ratio adjustable within wide limits
- Offset angle setting between drives as a function of coarse and fine pulse markers for angle sensing (synchronization)
- Synchronization signals can be supplied by proximity-type switches (e.g. BERO®s) or pulse encoders (zero pulse)
- Modification of angle setting by setpoint input
- Different offset angles can be specified for both directions of rotation (automatic switchover on direction reversal). This option must be applied for synchronization if the switching positions of the fine pulse marker are different for clockwise and anti-clockwise rotation of the drive (or machine part acting as the synchronization partner) and need to be compensated. Another example is a crane runway on which the fine pulse marker is two-dimensional.
- Backstop function
- Overspeed and blocking protection
- inching operation
- Adaptation of position controller based on gear ratio

- Setpoint (speed setpoint) can be supplied by pulse encoder, for example, in cases where the speed setpoint is not available via a terminal or interface
- A maximum of ten slave drives can be connected if pulse encoder cable length < 100 m, \( n < 3 \, 000 \, \text{min}^{-1} \)

Closed-loop cross-cutter/ shears control

Scope of applications:
- Flying saw/knife
- Rotating cross-cutter (drum shears)

Features
- Local control modes
  - Inch 1/2
  - Calibrate
  - Approach start position
  - Parameterizable angular ranges for synchronization
- Cutter control modes
  - Single cut to separate the material
  - Head cut to separate defective length at start of material
  - End cut to separate defective length at end of material
  - Continuous lengthwise cuts for chopping or panel cutting
  - Trial cut for cutting a panel
  - Cutting program with entry of number and length of cuts
- Referencing
- Error monitoring
- Overspeed for setting the lead
- Format changeover from one cut to the next
- Gentle traversing curves (sin/ cos) to enhance the cutting accuracy and protect the mechanical components
- Closed-loop format control to optimize the cutting precision
- Cutting curve to optimize the cutting accuracy
- KP-adaption speed control for enhancing the cutting accuracy
- Compensation of variable inertia (pendulum torque), e.g. for pendulum shears
- Friction compensation
- Torque precontrol for acceleration
- Cutting torque application
## Technology board T400

### T400 terminal assignments

<table>
<thead>
<tr>
<th>Connector</th>
<th>Connector pin</th>
<th>Terminal</th>
</tr>
</thead>
<tbody>
<tr>
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<td>6DD1842-0AA0</td>
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<td>–</td>
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<tr>
<td>Axle winder software including User’s Guide</td>
<td>6DD1843-0AA0</td>
<td>–</td>
<td>–</td>
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<tr>
<td>User’s Guide for axle winder</td>
<td>–</td>
<td>–</td>
<td>6DD1903-0AB0</td>
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<td>T400 with angular synchronism without User’s Guide</td>
<td>6DD1842-0AB0</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Angular synchronism software including User’s Guide</td>
<td>6DD1843-0AB0</td>
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<tr>
<td>User’s Guide for angular synchronism</td>
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<td>6DD1903-0BB0</td>
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<td>6DD1606-0AD0</td>
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<tr>
<td>User’s Guide</td>
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<td>6DD1903-0EA0</td>
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<tr>
<td>T400 with closed-loop cross-cutter/shears control</td>
<td>6DD1842-0AD0</td>
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<td>User’s Guide</td>
<td>–</td>
<td>–</td>
<td>6DD1903-0DB0</td>
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</table>
Higher-level PID controller for functions such as:

- Many drive-related technologies.

**T100 board.**

**Options**

**Technology board T100**

- **5 analog inputs** 24 V DC
- **8 binary inputs** (input resistance: 4.4 K  typ)
- **2 differential inputs** (terminals 50 to 53)
- **3 inputs to ground** (terminals 54 to 59)

**Communication board**

- **Dual-port RAM**
- **1/2 LBA**

**Microcontroller CPU:**

- Siemens SAB 90C166
- 10 bits + sign

**Serial interface 1** (USI protocol)

- **Serial interface 2** (peer-to-peer)

- **2 analog outputs** ±10 V / 5 mA max or ±20 mA / 500 max or ±40 mA / 500 max

**5 binary outputs** 24 V DC / 90 mA max

**Connections diagram for T100**

**T100 technology board**

The T100 board can be installed in the electronics box of SIMOREG converters. The LBA bus adapter is needed for this purpose.

- The T100 board extends the basic converter functionality by many drive-related technological functions such as:
  - Higher-level PID controller for use, for example, as a tension, compensating roller position, flow or pressure controller.
  - Comfort ramp-function generator with rounding, parameter set selection via control command, dv/dt output and cut-out function.
  - Comfort motorized potentiometer with non-volatile storage of output value.
  - Wobble generator with triangular wobble pattern, adjustable P steps and synchronizing input or output for reciprocating drives.
  - Drive-specific control functions, e.g. starting/shutdown controller.
  - Terminals with 5 binary inputs, 5 binary outputs, 5 analog inputs and 2 analog outputs. All external signals are connected directly to screw-type plug-in terminals 50 to 52 on the T100 board.
  - 2 serial interfaces that can operate in mutual independence:
    - High-speed peer-to-peer link with a transfer rate of up to 187.5 kbd, for which a digital setpoint cascade can be created.
    - USI interface with a transfer rate of up to 187.5 kbd, for implementing a simple fieldbus connection to the SIMATIC PLC or an external system.
## Technology board T100

**Technical data**

In addition to the functions listed above, the T100 contains a series of freely interconnectable closed-loop control, arithmetic and logic blocks:

- 5 adders with 3 inputs each
- 3 subtractors
- 4 sign inverters
- 3 dividers
- 4 multipliers
- 3 high-resolution multipliers/dividers with 3 inputs
- 4 absolute-value generators with filter
- 2 limiters
- 2 limit-value monitors with filter
- 1 minimum selection with 3 inputs
- 1 maximum selection with 3 inputs
- 2 analog signal tracking/storage elements with non-volatile storage on power failure
- 2 analog signal storage elements
- 10 analog signal selector switches
- 1 simple ramp-function generator
- 1 dead band
- 3 characteristic blocks
- 16 AND elements with 3 inputs each
- 8 OR elements with 3 inputs each
- 8 inverters
- 3 EXCLUSIVE OR elements
- 6 NAND elements with 3 inputs each
- 7 RS flipflops
- 2 D storage elements
- 5 timers
- 4 binary signal selector switches
- 1 parameter set switchover

### Communications functions

It is possible to access important internal signals and parameters of both the basic converter and T100 via the USS interface on the basic unit or the T100 board.

The access method and reactions of the T100 are identical to those of the SIMOREG basic unit.

The T100 has its own parameter memory and can be parameterized via the PMU operator control and parameterization panel, the OP1S operator panel or a PC with SIMOVIS installed.

The PC with SIMOVIS is connected to the USS interface on the SIMOREG unit.

All important internal signals of the T100 can be monitored by means of display parameters (multimeter function).

The T100 features three diagnostic LEDs which indicate the following operating states:

1. T100 is operating correctly in cyclical mode.
2. Data exchange between T100 and SIMOREG is OK.
3. Data exchange between T100 and the communication board is OK.

Note

All the software functions described here are contained in the MS100 "Universal Drive" software module. The module is a 40-pin EPROM submodule that must be ordered separately and inserted in the specially provided receptacle on the T100 board.

### Terminal Features

<table>
<thead>
<tr>
<th>Terminal</th>
<th>Features</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 analog inputs</td>
<td>- Possible input level/input impedance -10 V ... 10 V/24 kΩ typ&lt;br&gt;- 0 ... ± 20 mA/250 Ω typ&lt;br&gt;- 4 ... 20 mA/250 Ω typ&lt;br&gt;- 2 differential inputs&lt;br&gt;- 3 inputs to ground&lt;br&gt;- Non-floating&lt;br&gt;- Resolution 10 bits + sign</td>
</tr>
<tr>
<td>2 analog outputs</td>
<td>- Possible output level/driver capability -10 V to +10 V/5 mA max.&lt;br&gt;- 0 to 20 mA/500 Ω max.&lt;br&gt;- 4 to 20 mA/500 Ω max.&lt;br&gt;- Non-floating&lt;br&gt;- Resolution 9 bits + sign</td>
</tr>
<tr>
<td>8 binary inputs</td>
<td>- Input level: 24 V DC, compatible with SIMATIC:&lt;br&gt;LOW = -33 V to +5 V, HIGH = ±13 V to +33 V&lt;br&gt;- Non-floating&lt;br&gt;- Input resistance: 4.4 kΩ typ&lt;br&gt;- Signal status display on PMU and OP1S</td>
</tr>
<tr>
<td>5 binary outputs</td>
<td>- Transistor switch, switched in relation to 24 V DC, &quot;open emitter&quot;&lt;br&gt;- Output level compatible with SIMATIC:&lt;br&gt;LOW &lt; +2 V, HIGH +17.5 to +33 V&lt;br&gt;- Switching capacity: 90 mA max. (resistant to sustained short circuits)&lt;br&gt;- Signal status display on PMU and OP1S</td>
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<tr>
<td>24 V DC load power supply for binary inputs and outputs</td>
<td>- From SIMOREG converter: A short-circuit-proof 24 V DC supply is available at terminals 76 and 85 which has a total load rating of 90 mA.&lt;br&gt;- External 24 V DC supply: Permissible voltage range +20 to +30 V&lt;br&gt;- For other baud rates 1000 m</td>
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<tr>
<td>1 peer-to-peer interface</td>
<td>- RS 485 transmission method, 4-wire full duplex&lt;br&gt;- Non-floating&lt;br&gt;- Terminating resistances can be activated by jumpers&lt;br&gt;- Settable baud rate up to 187.5 kbd&lt;br&gt;- Receive and send signals can be freely interconnected by parameters&lt;br&gt;- Max. cable length for 187.5 kbd: 500 m&lt;br&gt;- For other baud rates 1000 m</td>
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<tr>
<td>1 serial USS interface</td>
<td>- RS 485 transmission method, 2-wire half duplex&lt;br&gt;- Non-floating&lt;br&gt;- Terminating resistances can be activated by jumpers&lt;br&gt;- Settable baud rate up to 187.5 kbd&lt;br&gt;- Max. cable length for 187.5 kbd: 500 m&lt;br&gt;- For other baud rates 1000 m</td>
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### Selection and ordering data

**Description**

- Technology board T100 for drive-based technological functions.

**Order No.:** 6SE7090-0XX87-0BB0

**Weight (approx.)**

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**Dimensions**

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For further details, integration of the T100 board and accessories, see Catalog DA 65.10 SIMOVERT MASTERDRIVES Vector Control. Supplied unassembled without software modules.
SIMOREG 6RA70 DC MASTER

Options

Technology boards

**T300 technology board**

This board allows additional technological functions to be implemented. For a comprehensive description of the functional scope of this board, see Catalog DA 65.10 SIMOVERT MASTERDRIVES Vector Control.

- 16 binary inputs and 8 binary outputs
- 7 analog inputs and 4 analog outputs
- 2 serial interfaces
- Customized configuration using STRUC®.

![T300 board with memory submodule](image)

**Selection and ordering data**

<table>
<thead>
<tr>
<th>Description</th>
<th>Order No.</th>
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<th>Dimensions W x H x D mm</th>
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<td>6SE7090-0XX87-4AH0</td>
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<td>6SE7090-0XX84-0AH2</td>
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6SE7090-0XX87-4AH0 supplied unassembled and not configured.
Overview

One of the most important advantages of the SIMOREG 6RA70 is that it is equipped with serial interfaces and another is that the SIMOREG converters can be easily integrated into the world of automation. This also applies to the AC drive product range from Siemens that utilizes many identical communication boards, simplifying implementation and reducing your spare parts inventories on site.

Optimized integration of the drives in the world of automation

The addition of easily installed communication boards allows a wide range of communications possibilities to be configured. The SIMOREG 6RA70 is therefore able to communicate using many different protocols.

- SIMOLINK fiber-optic network with peer-to-peer functionality for extremely high-speed data exchange (11 Mbaud)
- PROFIBUS-DP communication
- Communication by means of CAN protocol
- DeviceNet communication

All SIMOREG 6RA70 converters are equipped with two serial interfaces as standard that are not only USS-capable but which also feature peer-to-peer functionality for baudrates of up to 187.5 Kbaud. There is a choice of RS 232 and RS 485 transfer format for the first serial interface.

The interface is located on the front of the unit and an OP1S or PC (with DriveMonitor or Drive ES) can be easily connected to it. The second interface is a dedicated RS 485 interface that is located on the terminal strip of the CUD1.

An additional RS 485 interface is available on the optional terminal expansion board CUD2.

The USS protocol is a proprietary Siemens protocol for drive systems. It enables up to 31 stations to be connected via the bus on the basis of RS 485 transmission. The data are exchanged in accordance with the host/slave access mechanism. The host can be a higher-level system such as a SIMATIC S5 or S7, a PC or a non-Siemens automation system.
The SLB optional board (SIMOLINK Board) acts as the interface between SIMOREG drives and the SIMOLINK system.

The SLB is mounted on the ADB adapter board. An LBA bus adapter is needed for this purpose.

Every SLB optional board is a node in the SIMOLINK system. The maximum number of nodes is restricted to 201.

The SIMOLINK drive interface is used to exchange data rapidly between different drives and to synchronize them with a common system clock cycle. SIMOLINK is a closed circuit into which all nodes are connected.

Data are exchanged between the individual nodes by way of fiber-optic cables. Optical fibers made of glass or plastic can be used as transmission lines.

The SLB optional board has a 24 V voltage input for connecting an external voltage supply. This ensures that data can still be exchanged within the SIMOLINK circuit when the converter is switched off.

The board features three LEDs for displaying the current operational status.

### Operating principle

The SLB optional board acts as the interface between the SIMOLINK system and converters and/or inverters. It can operate as either a SIMOLINK Dispatcher or a SIMOLINK Transceiver. Its functionality is selected by means of parameter settings.

### Voltage supply

The optional board can be supplied with the necessary operating voltage, both internally from the SIMOREG converter and from an external source. The external power source has priority. Switchover between the sources takes place automatically on the board.

### Note

The external voltage supply must not be switched over while the bus is operating. When the supply is switched over automatically, a reset signal is generated on the board which would otherwise cause some message frames to be lost.
**SIMOLINK communication board SLB**

**Features**

- The transfer medium is a fiber-optic conductor. Either glass or plastic optical fibers can be used.
- The structure of the SIMOLINK is an optical fiber ring, whereby every station in the ring acts as a signal amplifier.
- The following distances are possible depending on the selected medium:
  - Max. 40 m between each station with plastic optical fibers or
  - Max. 300 m between each station with glass optical fibers.
- Up to 201 stations can be interconnected on SIMOLINK.
- Extremely fast (11 Mbits/s; 100 32-bit data elements in 0.63 ms).
- No dial, i.e. every SIMOREG 6RA70 unit can send or receive process data to or from every other SIMOREG 6RA70 unit.

**Selection and ordering data**

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<td>G</td>
<td>G47</td>
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<tr>
<td>Plastic fiber-optic cable; 100 m, 20 X470 connectors, 40 FOC connectors</td>
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<td>Plastic fiber-optic cable; 1 X470 connector, 2 FOC connectors</td>
<td>6SY7000-0CAD15</td>
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</table>

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1) For the installation of the SLB board in the SIMOREG unit, the Local Bus Adapter ADB and the adapter board ADB are additionally required. These must be ordered separately.
2) Including 5 m plastic fiber-optic cable and connector
**PROFIBUS-DP communication board CBP2**

The optional CBP2 (Communication Board PROFIBUS) is used to link drives to higher-level automation systems via PROFIBUS-DP.

The CBP2 is mounted in the ADB adapter board for installation in the converter. An LBA bus adapter is needed for this purpose.

The optional board features three LEDs (green, yellow, red) for displaying the current operational status.

The board is supplied with power via the basic unit.

Baudrates of 9.6 Kbits/s to 12 Mbits/s are possible.

**Data exchange via PROFIBUS-DP**

The bus system allows data to be exchanged very rapidly between the drives and higher-level systems (e.g. SIMATIC). The drives are accessed in the bus system according to the master/slave principle. The drives are always slaves. Each slave is uniquely identified by a slave address.

---

**Fig. 4/23**
Communication board CBP2

**Fig. 4/24**
PROFIBUS-DP connections
**PROFIBUS-DP communication board CBP2**

**PROFIBUS-DP message frame**

Data are exchanged in message frames. Each message frame contains useful data which are divided into two groups:

1. Parameters (parameter ID value, PKW)
2. Process data (PZD)

The PKW area contains all transfer data which are needed to read or write parameter values or read parameter properties.

The PZD area contains all the information needed to control a variable-speed drive. Control information (control words) and setpoints are passed to the slaves by the PROFIBUS-DP master. Information about the status of slaves (status words) as well as actual values are transferred in the opposite direction.

The length of the PKW and PZD components in the message frame as well as the baudrate, are determined by the master. Only the bus address and, if necessary, the message frame failure time are set on the slaves.

**Connections**

The optional CBP2 board features a 9-pin Sub D connector (X448) for connection to the PROFIBUS-DP system. The connections are short-circuit proof and floating.

---

**Pin assignments on X448 connector**

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<th>Designation</th>
<th>Meaning</th>
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<td>4</td>
<td>CNTR-P</td>
<td>Control signal</td>
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<td>5</td>
<td>DGND</td>
<td>PROFIBUS-DP data reference potential (C/C')</td>
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<td>VP</td>
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<td>8</td>
<td>RxD/TxD-N</td>
<td>Receive/Send data N (A/A')</td>
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**Selection and ordering data**

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<tr>
<td>PROFIBUS-DP cable (per meter; min. 20 m/max. 100 m)</td>
<td>6XY1830-0AH10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PROFIBUS-DP connector plug</td>
<td>6ES7972-0BB40-0XA0</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

---

1) For the installation of the CBP2 board in the SIMOREG unit, the Local Bus Adapter ADB and the adapter board ADB are additionally required. These must be ordered separately.
### CAN communication board CBC

The CAN protocol (Controller Area Network) is specified in the proposed international standard ISO DIS 11 898 whereby only the electrical parts of the Physical Layer and the Data Link Layer (Layers 1 and 2 in the ISO/OSI Layer reference model). The CiA (CAN in Automation, an international user’s and manufacturer’s association) has defined implementation as an industrial fieldbus with the DS 102-1 recommendations for bus coupling and the bus medium.

- The CBC board complied with the definitions in ISO-DIS 11 898 and in DS 102-1.
- The CBC board only supports CAN Layers 1 and 2. Higher-level additional communication definitions of the various user organizations, such as CAN open of the CiA are not currently supported (CAN open on request).

The CBC (Communication Board CAN) facilitates communication between SIMOREG converters and a higher-level automation system, between SIMOREG converters and between SIMOREG converters and other field devices by means of the CAN protocol. The board is supplied with power via the basic unit.

The CBC board is limited to the main specifications of CAN and is therefore free of the dependent specifications of the user organizations. Data is exchanged with SIMOREG in accordance with the useful data definition for drive technology with PROFIBUS-DP.

The useful data structure is subdivided into two areas
- Process data (control words, setpoints, status words and actual values)
- Parameter area (mechanism for reading and writing parameter values, e.g. setting values, warnings, fault numbers or fault values

The useful data are transferred in the form of communication objects (identifiers).

Individual communication objects are defined for the process data to and from the drive as well as for the "write" and "read" parameter tasks.

### Functional scope

<table>
<thead>
<tr>
<th>Feature</th>
<th>Max. 16 words</th>
<th>Cable length up to 1000 m</th>
</tr>
</thead>
<tbody>
<tr>
<td>Process data</td>
<td>10, 20, 50 Kbits/s</td>
<td>Cable length up to 750 m</td>
</tr>
<tr>
<td>Data transfer rate</td>
<td>125 Kbits/s</td>
<td>Cable length 530 m</td>
</tr>
<tr>
<td></td>
<td>250 Kbits/s</td>
<td>Cable length 270 m</td>
</tr>
<tr>
<td></td>
<td>500 Kbits/s</td>
<td>Cable length 100 m</td>
</tr>
<tr>
<td></td>
<td>1 Mbits/s</td>
<td>Cable length 9 m</td>
</tr>
</tbody>
</table>

Max. number of bus nodes: ≤ 124

### Data exchange with CAN

**Data exchange between CBC boards with bus interruption**

**Data exchange between CBC boards without bus interruption**
CAN communication board CBC

The CAN protocol supports high-speed data transfer between bus stations. In the case of useful data transfer, a distinction is made between the parameter ID value (PKW) and the process data (PZD).

A CAN data message frame comprises the protocol header, the CAN identifier (up to 8 bytes of useful data) and the protocol trailer. The CAN identifier serves to uniquely identify the data message frame. In Standard Message Format, up to 2048 different CAN identifiers are possible; in Extended Message Format, 2^29 CAN identifiers are possible. Extended Message Format is tolerated by the CBC board but not evaluated. The CAN identifier specifies the priority of the data message frame. The lower the number of the CAN identifier, the higher the priority of the message frame.

Up to 8 bytes of useful data can be transferred in a CAN data message frame. The PKW area always comprises 4 words or 8 bytes i.e. the data can be transferred in a single data message frame. In the case of SIMOREG 6RA70, for example, the process data area comprises 16 words, so 4 data message frames are required in total to transfer all the process data.

**X458 and X459 connectors on the CBC board**

The CBC communication board has one 9-pin Sub-D plug (X458) and one 9-pin Sub-D socket (X459) for connection to CAN.

The pin assignments and internal connections of the connectors are identical. The connector interface is short-circuit proof and floating.

**Fitting the CBC board**

One LBA and one ADB are needed for installing the board.

**Selection and ordering data**

<table>
<thead>
<tr>
<th>Description</th>
<th>Short code</th>
<th>Installation kit for retrofitting, supplied unassembled</th>
<th>Spare Part</th>
</tr>
</thead>
<tbody>
<tr>
<td>CBC communication board^1^ (CAN bus)</td>
<td>6SX7010-0FG00</td>
<td>6SE7090-0XX84-0FG0</td>
<td></td>
</tr>
<tr>
<td>Board, installed in slot</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>D</td>
<td>G24</td>
<td></td>
<td></td>
</tr>
<tr>
<td>E</td>
<td>G25</td>
<td></td>
<td></td>
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<td>F</td>
<td>G26</td>
<td></td>
<td></td>
</tr>
<tr>
<td>G</td>
<td>G27</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

^1^ For the installation of the CBC board in the SIMOREG unit, the Local Bus Adapter ADB and the adapter board ADB are additionally required. These must be ordered separately.
The CBD (Communication Board DeviceNet) facilitates communication between SIMOREG converters and higher-level programmable controllers or other field devices by means of the DeviceNet protocol. The CBD board is inserted in the electronics box of the SIMOREG 6RA70 unit using the LBA and ADB adapter boards.

The CBD board supports the transfer of process data and parameter data using “DeviceNet Explicit Messages” and “DeviceNet I/O Messages”.

With DeviceNet, Explicit Messages Connections provide generic, multi-use communication paths between two units. This allows typical requirements-oriented or response-oriented functions (e.g. board configuration) to be implemented.

In contrast, DeviceNet I/O Messages Connections provide communication paths for special purposes between the transmitting and receiving units. Application-specific I/O data are transferred via an I/O connection. The significance of the data within an “I/O message” is determined by the associated “Connection ID”.

The DeviceNet alarms can be subdivided into three main groups:

- DeviceNet configuration data, e.g. channel assignment, timeouts and I/O configurations, whereby “Explicit messages” are used.
- Process data, e.g. control words, setpoint/reference values, status information and actual values, whereby “I/O messages” are used.
- Parameter data for reading/writing drive parameter data, whereby manufacturer-specific PKW objects and “Explicit messages” are used.

The drive is controlled by process data (e.g. activation/deactivation and setpoint input). The number of process data words (4, 8 or 16) is either determined on switch-on by the value of certain CB parameters or dynamically by DeviceNet. The purpose for which the individual process data words are used is determined in the drive and differs in accordance with the actual function of each individual drive. The process data are processed with the highest priority and shortest time segments.

The master uses the manufacturer-specific PKW object for the purpose of reading drive parameters with DeviceNet or modifying them, whereby the Explicit Messaging Channel is used. The user therefore has access to all parameters in the basic unit (CU) and any existing technology board (TB) via DeviceNet. Examples for this include read-out of detailed diagnostic information, error messages, etc. In this manner, additional information for drive monitoring could be requested from a higher-level system (e.g. a PC) without affecting the transmission of process data.

Control and operation of SIMOREG 6RA70 converters over DeviceNet

In the process data area, all the information is transferred that is necessary for controlling a drive within a specific technical process. The control information (control words) and setpoints are sent to the drive from the DeviceNet master. Information about the status of the drive (status words) as well as actual values are transferred in the opposite direction.

The CBD communication board saves the received process data in the Dual-Port RAM in the order in which they were transferred in the message frame. An address is assigned to each word in the Dual-Port RAM. The content of the Dual-Port RAM in the drive (CU and, if necessary, TB) can be freely assigned by setting parameters. It can, for example, be specified that the second word in the process data area of the message frame should be used as a speed setpoint for the ramp-function generator follow-up. The same mechanism also applies for other setpoints and for each individual control word bit. This mechanism also applies for data exchange in the opposite direction when actual values and status words are transferred to the master. Diagnostic LEDs provide the user with information quickly about the current status of the CBD. More detailed diagnostic information can be read directly out of the diagnostics memory of the CBD with the help of a diagnostic parameter.

The CBD board operates with the “Predefined master/slave connection set”, that is defined in the DeviceNet specification. Both “Poll” and “Bit strobe” I/O messages are supported.

The CBD complies with the “DeviceNet Device Profile for Communication Adapters” (Device Type 12). This profile was selected to ensure that all features and extended functions of the SIMOREG 6RA70 converter can be used by the DeviceNet master. For the same reason, the CBD board has not implemented the “DeviceNet DC Drives” profile.

### Options

#### Communication

**Communication board CBD DeviceNet**

The CBD (Communication Board DeviceNet) facilitates communication between SIMOREG converters and higher-level programmable controllers or other field devices by means of the DeviceNet protocol. The CBD board is inserted in the electronics box of the SIMOREG 6RA70 unit using the LBA and ADB adapter boards.

The CBD board supports the transfer of process data and parameter data using “DeviceNet Explicit Messages” and “DeviceNet I/O Messages”.

With DeviceNet, Explicit Messages Connections provide generic, multi-use communication paths between two units. This allows typical requirements-oriented or response-oriented functions (e.g. board configuration) to be implemented.

In contrast, DeviceNet I/O Messages Connections provide communication paths for special purposes between the transmitting and receiving units. Application-specific I/O data are transferred via an I/O connection. The significance of the data within an “I/O message” is determined by the associated “Connection ID”.

The DeviceNet alarms can be subdivided into three main groups:

- DeviceNet configuration data, e.g. channel assignment, timeouts and I/O configurations, whereby “Explicit messages” are used.
- Process data, e.g. control words, setpoint/reference values, status information and actual values, whereby “I/O messages” are used.
- Parameter data for reading/writing drive parameter data, whereby manufacturer-specific PKW objects and “Explicit messages” are used.

The drive is controlled by process data (e.g. activation/deactivation and setpoint input). The number of process data words (4, 8 or 16) is either determined on switch-on by the value of certain CB parameters or dynamically by DeviceNet. The purpose for which the individual process data words are used is determined in the drive and differs in accordance with the actual function of each individual drive. The process data are processed with the highest priority and shortest time segments.

The master uses the manufacturer-specific PKW object for the purpose of reading drive parameters with DeviceNet or modifying them, whereby the Explicit Messaging Channel is used. The user therefore has access to all parameters in the basic unit (CU) and any existing technology board (TB) via DeviceNet. Examples for this include read-out of detailed diagnostic information, error messages, etc. In this manner, additional information for drive monitoring could be requested from a higher-level system (e.g. a PC) without affecting the transmission of process data.

Control and operation of SIMOREG 6RA70 converters over DeviceNet

In the process data area, all the information is transferred that is necessary for controlling a drive within a specific technical process. The control information (control words) and setpoints are sent to the drive from the DeviceNet master. Information about the status of the drive (status words) as well as actual values are transferred in the opposite direction.

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The device is controlled by process data (e.g. activation/deactivation and setpoint input). The number of process data words (4, 8 or 16) is either determined on switch-on by the value of certain CB parameters or dynamically by DeviceNet. The purpose for which the individual process data words are used is determined in the drive and differs in accordance with the actual function of each individual drive. The process data are processed with the highest priority and shortest time segments.

The master uses the manufacturer-specific PKW object for the purpose of reading drive parameters with DeviceNet or modifying them, whereby the Explicit Messaging Channel is used. The user therefore has access to all parameters in the basic unit (CU) and any existing technology board (TB) via DeviceNet. Examples for this include read-out of detailed diagnostic information, error messages, etc. In this manner, additional information for drive monitoring could be requested from a higher-level system (e.g. a PC) without affecting the transmission of process data.

### Selection and ordering data

<table>
<thead>
<tr>
<th>Description</th>
<th>Short code</th>
<th>Supplier unassembled Order No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>CBD DeviceNet communication board</td>
<td>G54</td>
<td>6SX7010-0FK00</td>
</tr>
<tr>
<td>Board, installed in slot</td>
<td>G55</td>
<td></td>
</tr>
<tr>
<td>Operating instructions</td>
<td>G56</td>
<td></td>
</tr>
<tr>
<td></td>
<td>G57</td>
<td></td>
</tr>
</tbody>
</table>

1) For the installation of the CBD board in the SIMOREG unit, the Local Bus Adapter ADB and the adapter board ADB are additionally required. These must be ordered separately.
SCB1 interface board

The SCB1 (Serial Communication Board 1) has one fiber-optic connection and can be used to establish:

- A peer-to-peer connection between several devices with a max. transfer rate of 38.4 Kbits/s
- A serial I/O system (see Figure 4/30) in conjunction with the serial interface boards SCI1 and SCI2 (see Page 4/15).

This can be implemented to:

1. Expand the binary and analog inputs and outputs of the basic units
2. Assign the terminals of the inputs and outputs customer-specifically (e.g. NAMUR).

The following board combinations are possible:

- SCB1 with one SCI1 or SCI2 each
- SCB1 with two SCI1s or SCI2s each
- SCB1 with one SCI1 and SCI2 each

The SCB1 interface board is plugged into location 2 or 3 of the electronics box (see the description on Page 4/6).

Selection and ordering data

<table>
<thead>
<tr>
<th>Description</th>
<th>Order No.:</th>
<th>Weight (approx.)</th>
<th>Dimensions W x H x D</th>
</tr>
</thead>
<tbody>
<tr>
<td>SCB1 Interface board with fiber-optic cable connection, supplied unassembled incl. 10 m FO cable</td>
<td>6SE7090-0XX84-0BC0</td>
<td>0.5 kg</td>
<td>25 x 235 x 125</td>
</tr>
</tbody>
</table>

Fig. 4/30
Example to show connection of a serial I/O system comprising an SCB1, SCI1
OP1S operator panel

The OP1S (Operator Panel) is an optional input/output unit that can be used to parameterize the converters. Parameterization is menu driven; the parameter number is selected and the parameter value is entered. The displays are in plain text.

The descriptions of the parameters and parameter values as well as the text displays are included in English, German, French, Spanish and Italian as standard. The OP1S is equipped with non-volatile memory and is able to save complete parameter sets permanently. It can therefore be used to archive parameter settings and to transfer parameter sets from one unit to another. The memory capacity is sufficient to store, for example, 5 data sets from CUMC boards. It is not possible to save data sets from technology boards (e.g. T100, T300).

There is a 9-pin Sub-D connector on the rear of the OP1S. This is used for connection of the power supply as well as for communication with the connected units.

The OP1S operator panel is directly plugged into the Sub-D socket of the PMU operator control and parameterization panel and screwed into the front cover. The OP1S operator panel can also be used as a remote operation device. The cable between the PMU and the OP1S can be up to 200 m in length. In the case of distances greater than 5 m, a generally available 5 V power supply unit with a current of at least 400 mA (Fig. 4/33) must be connected at the OP1S end.

## OP1S connections with RS 485

<table>
<thead>
<tr>
<th>Pin</th>
<th>Designation</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>2</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>3</td>
<td>RS 485 P</td>
<td>Data via RS 485 interface</td>
</tr>
<tr>
<td>4</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>5</td>
<td>NSV</td>
<td>Ground</td>
</tr>
<tr>
<td>6</td>
<td>PSV</td>
<td>5 V auxiliary voltage supply</td>
</tr>
<tr>
<td>7</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>8</td>
<td>PS485 N</td>
<td>Data via RS 485 interface</td>
</tr>
<tr>
<td>9</td>
<td>–</td>
<td>Reference potential</td>
</tr>
</tbody>
</table>

Fig. 4/31
View of the OP1S

Fig. 4/32
OP1S with point-to-point link
OP1S operator panel

The communication between the OP1S and the converter to be operated takes place via a serial interface (RS 485) with USS protocol (see Figure 4/31). In this communication, the OP1S assumes the role of the master. The connected converters operate as slaves. The OP1S can be operated at transmission rates of 9.6 kbit/s and 19.2 kbit/s.

It can communicate with up to 31 slaves (addresses 1 to 31). It can therefore be used either with a point-to-point connection (for operating one converter) or in a bus configuration (for operating several converters).

Fig. 4/33
OP1S with point-to-point connection, up to 200 m cable length

Selection and ordering data

<table>
<thead>
<tr>
<th>Description</th>
<th>Order No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>OP1S operator panel</td>
<td>6SE7090-0XX84-2FK0</td>
</tr>
<tr>
<td>Adapter AOP1S for cabinet door mounting</td>
<td>6SX7010-0AA00</td>
</tr>
<tr>
<td>including 5 m connecting cable</td>
<td></td>
</tr>
<tr>
<td>Connecting cable PMU OP1S 3 m</td>
<td>6SX7010-0AB03</td>
</tr>
<tr>
<td>Connecting cable PMU OP1S 5 m</td>
<td>6SX7010-0AB05</td>
</tr>
</tbody>
</table>
**DriveMonitor**

**Features**

The current version of the DriveMonitor is part of the standard scope of supply on CD-ROM.

- All basic unit parameters can be set and monitored by means of tables that can be created as required
- Reading, writing, printing and comparison of parameter sets
- Process data operation (control signals, setpoints)
- Diagnosis (fault, warning, fault memory)
- Offline and online operation.
- Parameterization of technology boards T100, T300 and T400
- Graphical presentation of the trace memory function for analysis
- Guided graphical parameterization during start-up.

**PC configuration (hardware and software equipment)**

- PC with Pentium II or comparable processor
- Operating systems
  - Windows 98/ME or
  - Windows NT/2000/XP Professional
- Main memory of at least 32 MB RAM with Windows 98/ME, 64 MB RAM with Windows NT/2000/XP Professional
- CD-ROM drive (24 x)
- Screen resolution 800 x 600 or higher
- Free hard-disk memory of 200 MB for minimum requirements
- Recommended system requirements
  - Pentium II/500 MHz or higher
  - Main memory of 256 MB RAM
  - Windows 98/ME/NT/2000/XP Professional
  - CD-ROM drive (24 x)
  - Screen resolution 800 x 600 or higher
  - Free hard-disk memory of 500 MB

For stand-alone operation (USS)

- RS232 serial interface (for one unit, point-to-point)
- RS485 serial interface (for several units, bus operation), e.g. with the RS232/RS485 interface converter, SU1.

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**Fig. 4/34**

DriveMonitor: Trace function for converter diagnosis

**Fig. 4/35**

DriveMonitor: Guided start-up
Drive ES engineering package

With Drive ES (Drive Engineering System), drives from the SIMOREG range can be totally integrated into the SIMATIC automation world with regard to communication, configuration and data management.

Drive ES comprises four software packages that can be ordered separately: Drive ES Basic, Drive ES Graphic, Drive ES SIMATIC and Drive ES PCS7.

- Drive ES Basic is the basic software that is used to parameterize all drives online and offline as well being the prerequisite for the Drive ES Graphic software.
- Drive ES Graphic is the software that is used for graphical online and offline configuration of the BICO function blocks. The prerequisites are an installed version of Drive ES Basic and an installed version of SIMATIC *CFC*/G152 V 5.1 (graphical programming tool, see Catalog ST 70, “Products for Totally Integrated Automation and Micro Automation”).
- Drive ES SIMATIC requires an installed version of STEP 7. It contains a SIMATIC function block library and therefore supports easy and reliable programming of the PROFIBUS-DP interface in the SIMATIC CPU for the drives.
- Drive ES PCS7 requires prior installation of SIMATIC PCS7, Version V 5.0 upwards. Drive ES PCS7 provides a function block library complete with function blocks for the drives and the associated faceplates for the operator station. This enables operation of the drives from the PCS7 process control system.

![Fig. 4/36](image-url) Structure of the Drive ES product

![Fig. 4/37](image-url) Task distribution for the Drive ES packages
SIMOREG 6RA70 DC MASTER

Options

Operating and monitoring

Drive ES Basic
- Drive ES is based on the SIMATIC Manager user interface.
- The parameters and diagrams of drives are available in SIMATIC Manager (integrated data management).
- Drive ES ensures that parameters and diagrams are uniquely assigned to a drive.
- A SIMATIC project complete with drive data can be archived.

Drive ES Teleservice (V5) can be used.
- It communicates with the drive over PROFIBUS-DP or USS.
- Parameter sets can be freely combined and processed.
- Script files can be used.
- Guided start-up for SIMOREG DC MASTER.

Installation with STEP 7
Drive ES Basic can be installed as an option for STEP 7 (≥ V 5.0) and integrates itself homogeneously in the SIMATIC environment.

Installation without STEP 7
Drive ES Basic can also be installed without STEP 7 and uses its own Drive Manager (similar to the SIMATIC Manager).

Drive ES Graphic
- Function diagrams are stored in SIMATIC CFC format drive-oriented.
- The drive functions are configured in BICO technology with SIMATIC CFC.
- Offline functionality.
- Test mode (online functionality) complete with “Modify connection”, “Modify value” and “Activate function block”.

Read out and feedback documentation.

Drive ES SIMATIC
- This provides SIMATIC CPU function blocks and sample projects that process the communication with Siemens drives over PROFIBUS-DP or USS.
- The communication functions are parameterized and not programmed.

Features
- Function blocks in STEP 7 design; symbolic addressing; function blocks with instance data; online help.
- For use in all SIMATIC programming and configuration environments, such as LAD, FDB, STL, SCL and CFC.

New function block structure: Individual modular functions for runtime-optimized program generation.

Function block types
- Read and write process data of freely configurable length and consistency.
- Exchange parameters cyclically and non-cyclically, monitor communication, read out fault memory from SIMOREG DC MASTER.
- Download parameters into the drive via the CPU.
- Complete reparameterization after converter exchange at the push of a button from the CPU.

Drive ES PCS7
- Integrates drives with a PROFIBUS-DP interface into PCS7.
- Can be used with STEP 7 or PCS7 V 5 upwards.

Function block types
- Display blocks and control blocks for the integration of drives into PCS7.
Integration of drives into SIMATIC S7 with Drive ES

Drive ES Basic supports the user with commissioning, servicing and diagnosing all Siemens drives. It can be integrated as an option into STEP 7 or it can be installed without STEP 7 as a stand-alone tool on a PC or programming device. In the case of stand-alone installation, the Drive Manager of Drive ES Basic will be installed instead of the SIMATIC Managers with the same Look & Feel. When it is integrated as an option for STEP 7, the Version of STEP 7 must correspond to that listed in the ordering data.

Drive ES Graphic is an option for Drive ES Basic and is used in conjunction with the SIMATIC tool CFC (Continuous Function Chart) for graphical configuration of the functions available with the SIMOREG DC MASTER (basic unit functions, process-specific functions and freely-definable function blocks). Precondition: Drive ES Basic V 5 and CFC V 5.1 upwards must have been installed on the computer beforehand.

Drive ES SIMATIC provides function block libraries complete with SIMATIC function blocks which reduces the configuration of the communication functions between SIMATIC S7 CPUs and Siemens drives (e.g. SIMOREG DC MASTER) to simple parameter settings. Drive ES SIMATIC supersedes the DVA_S7 software package for all versions of STEP 7 ≥ V 5.0 and can also be installed and implemented stand-alone, i.e. without Drive ES Basic.

Drive ES PCS7 provides a function block library complete with display and control function blocks that can be used to integrate Siemens drives (e.g. SIMOREG DC MASTER) on the basis of a speed interface into the SIMATIC PCS7 process control system. Operation and monitoring of the drive is then possible from the Operator Station (OS).

The PCS7 library can be used stand-alone, i.e. even without Drive ES Basic, with PCS7 versions V 5.0 and V 5.1.

### Scope of supply

<table>
<thead>
<tr>
<th>Scope of supply</th>
<th>Order No.:</th>
<th>Type of delivery</th>
<th>Documentation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drive ES software packages · For installation as an integral option of STEP 7 Versions ≥ V 5.3, SP 3</td>
<td>Drive ES Basic V 5.4</td>
<td>6SW1700-5JA00-4AA0</td>
<td>CD-ROM, 1 unit</td>
</tr>
<tr>
<td></td>
<td>Drive ES Graphic V 6.0</td>
<td>6SW1700-6JB00-0AA0</td>
<td>CD-ROM, 1 unit</td>
</tr>
<tr>
<td></td>
<td>Drive ES SIMATIC V 5.4</td>
<td>6SW1700-5JC00-4AA0</td>
<td>CD-ROM, 1 unit</td>
</tr>
<tr>
<td></td>
<td>Drive ES PCS7 V 6.1</td>
<td>6SW1700-5JD00-1AA0</td>
<td>CD-ROM, 1 unit</td>
</tr>
<tr>
<td>Drive ES software packages · For installation as an integral option of STEP 7 Versions ≥ V 5.1</td>
<td>Drive ES Basic V 5.4</td>
<td>6SW1700-5JA00-4AA0</td>
<td>CD-ROM, 1 unit</td>
</tr>
<tr>
<td></td>
<td>Drive ES Basic Upgrade V 5 V → V 5.4</td>
<td>6SW1700-5JA00-4AA4</td>
<td>CD-ROM, 1 unit</td>
</tr>
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<td>Drive ES Basic V 5.1</td>
<td>6SW1700-5JA00-1AA1</td>
<td>CD-ROM, 1 unit</td>
</tr>
<tr>
<td></td>
<td>Drive ES Graphic V 6.0</td>
<td>6SW1700-6JB00-0AA0</td>
<td>CD-ROM, 1 unit</td>
</tr>
<tr>
<td></td>
<td>Drive ES Graphic Upgrade V 5 V → V 6.0</td>
<td>6SW1700-6JB00-0AA4</td>
<td>CD-ROM, 1 unit</td>
</tr>
<tr>
<td></td>
<td>Drive ES SIMATIC V 5.4</td>
<td>6SW1700-5JC00-4AA0</td>
<td>CD-ROM, 1 unit</td>
</tr>
<tr>
<td></td>
<td>Drive ES SIMATIC Upgrade V 5 V → V 5.4</td>
<td>6SW1700-5JC00-4AA4</td>
<td>CD-ROM, 1 unit</td>
</tr>
<tr>
<td></td>
<td>Drive ES PCS7 V 5.1</td>
<td>6SW1700-5JC00-1AC0</td>
<td>Only product certificate (without software and documentation)</td>
</tr>
<tr>
<td></td>
<td>Drive ES PCS7 V 5.1</td>
<td>6SW1700-5JD00-1AC0</td>
<td>Only product certificate (without software and documentation)</td>
</tr>
</tbody>
</table>

### Contents of the Drive ES SIMATIC package

- **Communication software “PROFIBUS-DP”** for S7-300 with CPUs with integrated DP interface (function block libraries DRVDPS7, POSMO)
- S7-400 with CPUs with integrated DP interface or with CP443-5 (function block library DRVDPS7, POSMO)
- S7-300 with CP342-5 (function block library DRVDPS7)
- **Communication software “USS protocol”** for S7-200 with CPU 214/215/216/217 (DRVUS32/27/26/25 driver program for STEP 7 Micro programming tool) S7-300 with CP 343/341 and S7-400 with CP 441 (function block library DRVUS32)
- **STEP 7 slave object manager** supports easy configuration of drives and non-cyclic PROFIBUS-DP communication with the drives, support for DVA_S7 conversion to Drive ES (only V 5.1 upwards)
- **SETUP program** for installing the software in the STEP 7 environment

### Contents of the Drive ES PCS7 package (the PCS7 package can be used with PCS7 versions V 5.0 and V 5.1)

- **Function block library for SIMATIC PCS7** Display and control function blocks for SIMOREG DC-MASTER
- **STEP 7 slave object manager** supports easy configuration of drives and non-cyclic PROFIBUS-DP communication with the drives
- **SETUP program** for installing the software in the PCS7 environment

### Software update service for Drive ES

A software update service can be ordered for the Drive ES software. For one year following the initial order, the customer automatically receives all the latest software, Service Packs and full versions without the need for any action.

Duration of the update service: 1 year

6 weeks before expiry, the customer and his Siemens contact will be informed about the serve service which automatically be extended by another year if it is not cancelled on the part of the customer.

The update service can only be ordered to customers who have previously purchased a complete version.

### Scope of supply

<table>
<thead>
<tr>
<th>Scope of supply</th>
<th>Order No.:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Software update service</td>
<td>Drive ES Basic Update service for single license</td>
</tr>
<tr>
<td></td>
<td>for copy license</td>
</tr>
<tr>
<td>Drive ES SIMATIC Update service for single license</td>
<td>6SW1700-5JC00-0AB2</td>
</tr>
<tr>
<td>Drive ES PCS7 Update service for single license</td>
<td>6SW1700-5JD00-0AB2</td>
</tr>
</tbody>
</table>

1) Drive ES Basic can also be installed stand-alone w/o STEP 7 (for further information, see adjacent text).
**SIMOREG 6RL70 rectifier module**

**Design**

The SIMOREG uncontrolled rectifiers of Series 6RL70 were developed from the 6RA70 single-quadrant converters. Diodes are installed instead of thyristors and the units do not contain any electronic modules. The fan voltage is 230 V (single-phase).

A KTY 84 temperature sensor for sensing the heat-sink temperature is wired to terminals to allow external evaluation of the signal. Semiconductor – cell fuses are integrated into the unit.

The units feature overload capability (60 s overload 1.36 % – 240 s previous load 0.91 %).

**Application**

In older installations, 12-pulse series circuits with rectifiers and thyristor converters are used. For retrofit projects, therefore, diode bridges can be required as partial converters in conjunction with standard converter units for supplying DC motors. Another (retrofit) application is for subsynchronous converter cascades.

The SIMOREG 6RL70 rectifier module is also suitable for supplying general DC loads that tolerate the use of an uncontrolled rectifier, e.g. DC links for converters in combination with a preloading unit, field supplies and galvanic applications.

**Standards**

<table>
<thead>
<tr>
<th>Standard</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>DIN VDE 0106 Part 10</td>
<td>Protection against electric shock; location of actuators near live parts.</td>
</tr>
<tr>
<td>DIN VDE 0110 Part 1</td>
<td>Insulation coordination for electrical equipment in low-voltage installations. Requirements for safe isolation → Pollution severity 2 for boards and the power section. Only non-conductive pollution is permissible. Temporary conductivity must however be accepted due to condensation. “Dewing is not permitted because the components are only approved for Humidity Class F”.</td>
</tr>
<tr>
<td>DIN VDE 0113 Part 1</td>
<td>Electrical equipment of industrial machines (where applicable).</td>
</tr>
<tr>
<td>DIN EN 50 178/DIN VDE 0160</td>
<td>Regulations for the equipment of electrical power installations with electronic equipment.</td>
</tr>
<tr>
<td>EN 61 000-4-2 and EN 61 000-4-4</td>
<td>Interference immunity</td>
</tr>
<tr>
<td>DIN IEC 60 068-2-6 acc. to degree of severity 12 (SN29 010 Part 1)</td>
<td>Mechanical stress</td>
</tr>
</tbody>
</table>
### SIMOREG 6RL70 rectifier module · 3-ph. AC 690 V, 1000 A and 2000 A

<table>
<thead>
<tr>
<th>Type</th>
<th>6RL70□□□KS00-0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated supply voltage</td>
<td>91-6 V 3-ph. AC 690 (+10% / -20%)</td>
</tr>
<tr>
<td>Rated input current</td>
<td>A 865</td>
</tr>
<tr>
<td>Rated supply voltage fan</td>
<td>V 1-ph. AC 230 (±10%)</td>
</tr>
<tr>
<td>Nominal fan current</td>
<td>A 2.6 / 3</td>
</tr>
<tr>
<td>Fan noise level</td>
<td>dBA 85 / 87</td>
</tr>
<tr>
<td>Air flow rate</td>
<td>m³/h 1400</td>
</tr>
<tr>
<td>Rated DC voltage</td>
<td>V 930</td>
</tr>
<tr>
<td>Rated DC current</td>
<td>A 1000</td>
</tr>
</tbody>
</table>

**Rated output current** mean value A 910

**Base-load duty period** s 240

**Output overcurrent mean value** A 1365

**Overcurrent duration** s 60

**Rated output** kW 930

**Power loss at rated DC current** (approx.) W 3.12

**Operational ambient temperature** °C 0 to 40 at $I_{\text{rated}}$ separately cooled

**Storage and transport temperature** °C –25 to +70

**Installation altitude above sea level** ≤ 1000 m at rated DC current

**Environment class** DIN IEC 721-3-3 3K3

**Degree of protection** DIN 40 050 IEC 60 144 IP 00

**See dimension drawing on Page** mm 9/13

**Weight (approx.)** kg 82

---

1) Duty cycle

2) Load factor $K_1$ (DC current) as a function of the coolant temperature. $K_1 > 1$ only permissible where $K_1 * K_2 \leq 1$. Overall reduction factor $K = K_1 * K_2$ (for $K_2$ see Footnote 4).

<table>
<thead>
<tr>
<th>Ambient or coolant temperature</th>
<th>Load factor $K_1$</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>°C</td>
<td>In devices with self-cooling</td>
<td>In devices with enhanced cooling</td>
<td></td>
<td></td>
</tr>
<tr>
<td>≤ +30 °C</td>
<td>1.18</td>
<td>1.10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>+35 °C</td>
<td>1.12</td>
<td>1.05</td>
<td></td>
<td></td>
</tr>
<tr>
<td>+40 °C</td>
<td>1.06</td>
<td>1.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>+45 °C</td>
<td>1.00</td>
<td>0.95</td>
<td></td>
<td></td>
</tr>
<tr>
<td>+50 °C</td>
<td>0.94</td>
<td>0.90</td>
<td></td>
<td></td>
</tr>
<tr>
<td>+55 °C</td>
<td>0.88</td>
<td>0.82</td>
<td></td>
<td></td>
</tr>
<tr>
<td>+60 °C</td>
<td>0.82</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

3) The rectifier can be operated with voltages up to the rated supply voltage (with a corresponding output voltage).

4) Load values $K_2$ as a function of the installation altitude. Overall reduction factor $K = K_1 * K_2$ (for $K_1$ see Footnote 2).

<table>
<thead>
<tr>
<th>Installation altitude m</th>
<th>1000</th>
<th>2000</th>
<th>3000</th>
<th>4000</th>
<th>5000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reduction factor $K_2$</td>
<td>1.0</td>
<td>0.835</td>
<td>0.74</td>
<td>0.71</td>
<td>0.67</td>
</tr>
</tbody>
</table>

The supply voltages for all electric circuits are possible for site altitudes up to 5000 m with basic insulation.

---

Curve b1: Reduction factor of load values (DC current) at installation altitudes above 1000 m.
SIMOREG 6RA70 DC MASTER
Planning guide

Dynamic overload capability
Calculation of dynamic overload capability
Rating classes
Load cycles for single-quadrant applications
Load cycles for four-quadrant applications

Parallel connection
Parallel connection of SIMOREG DC MASTER converters
Redundancy mode
Terminal connections for parallel connection

12-pulse operation
Supplying high inductances
Condensation protection

Characteristic data of pulse evaluation electronics
Level of input pulses
Switching frequency
Cable, cable length, shield connection

Instructions for the electromagnetically compatible installation of drives
Fundamentals of EMC
Electromagnetically compatible installation
Cabinet arrangement and shielding

Components
Components for converters
Single-phase commutating reactors
Three-phase commutating reactors
Radio interference suppression filters

Harmonics
Calculation of dynamic overload capability

Overview of function

The dynamic overload capability is made possible by a thermal monitoring function (\(I^2t\) monitor) in the power section. This \(I^2t\) monitor uses the time characteristic of the actual load current to calculate the time characteristic of an equivalent value for the thyristor junction temperature over ambient temperature. Converter-specific characteristics (e.g. thermal resistance and time constants) are included in the calculation. When the converter is switched on, the calculation commences with the initial values that were calculated before the converter power supply was last switched off or last failed. Allowance for ambient conditions (ambient temperature and installation altitude) can be made via a parameter setting.

The \(I^2t\) monitor responds if the calculated equivalent junction temperature exceeds the permitted value. Two alternative reactions can be parameterized:

- Alarm with reduction of armature current setpoint to rated DC current
- Fault with shutdown of converter.

The \(I^2t\) monitor can be switched off. In this case, the armature current is limited to the rated DC current.

Planning of dynamic overload capability

The planning sheets contain the following information:

- The maximum overload period \(t_{an}\) for starting with cold power section and specified constant overload
- The maximum current interval \(t_{ab}\) (maximum cooling time) until the power section reaches the “cold” state
- Limit characteristic fields for calculating overload capability in thermally settled, intermittent overload operation (periodic load cycles).

Note: The power section is in the “cold” state when the calculated equivalent junction temperature corresponds to less than 5% of its maximum permissible value. This state can be scanned via a binary selectable output.

Structure of limit characteristic fields for intermittent overload operation

Each characteristic field refers to a load cycle of intermittent overload operation with a total period of 300 s. This type of load cycle consists of two periods, i.e. the base-load duty period (actual armature current ≤ rated DC current) and the overload duty period (actual armature current > rated DC current).

Each limit characteristic represents the maximum base-load current specified as a percentage of rated DC current for a certain overload factor over the minimum base-load duty period (limit base-load duty period) for a specific unit. For the remainder of the load cycle, the maximum permissible current then corresponds to the overload current determined by the overload factor. If no limit characteristic is specified for the desired overload factor, then the characteristic for the next higher overload factor is applicable.

The families of limit characteristics are valid for a load cycle period of 300 s. However, simple rules of calculation can be applied to configure load cycles that are longer or shorter than 300 s. These are illustrated below by two basic planning tasks.
Calculation of dynamic overload capability

Basic task 1

- Known quantities:
  - Converter, cycle time, overload factor, overload period
- Quantities to be found:
  - (min.) base-load duty period
  - max. base-load current
- Solution:
  - See Table 2

Example for basic task 1

- Known quantities:
  - 30 A converter
  - Cycle time 113.2 s
  - Overload factor 1.45
  - Overload period 20 s
- Quantities to be found:
  - (min.) base-load duty period
  - max. base-load current
- Solution:
  - Limit characteristic for 30 A converter
  - Overload factor 1.5
  - Overload period \(300 = \frac{300 \text{ s}}{113.2 \text{ s}} \times 20 \text{ s} = 53 \text{ s}\)
  - Max. base-load current = 44% \(I_{\text{rated}} = 13.2 \text{ A}\)

Basic task 2

- Known quantities:
  - Converter, cycle time, overload factor, base-load current
- Quantities to be found:
  - Maximum overload period
  - minimum base-load period
- Solution: See Table 3

Example for basic task 2

- Known quantities:
  - 30 A converter
  - Cycle time 140 s
  - Overload factor 1.15
  - Base-load current = 0.6 \(I_{\text{rated}} = 18 \text{ A}\)
- Quantities to be found:
  - Max. overload period
  - Min. base-load period
- Solution:
  - Limit characteristic for 30 A converter
  - Overload factor 1.2
  - Base-load current = 60% \(I_{\text{rated}} \rightarrow\)
  - Overload period \(127 = \frac{127 \text{ s}}{140 \text{ s/300 s}} \times 140 \text{ s} = 59 \text{ s}\)
  - Min. base-load duty period
  = 140 s – 59 s = 81 s

Table 1

<table>
<thead>
<tr>
<th>Cycle time</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>(&lt; 300 \text{ s})</td>
<td>Selection of limit characteristic for specific converter and overload factor (see Fig. 5/1)</td>
</tr>
<tr>
<td>(\geq 300 \text{ s})</td>
<td>(f_{\text{on}}(s))</td>
</tr>
</tbody>
</table>

Table 2

<table>
<thead>
<tr>
<th>Steps to solve basic task 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Determine curve</td>
</tr>
<tr>
<td>2. Overload period(300 = \frac{300 \text{ s}}{\text{cycle time x overload period}} \times \text{ overload period(300)}</td>
</tr>
<tr>
<td>3. Base-load duty period(300 = \frac{300 \text{ s}}{\text{overload period(300)}} \times \text{ overload period(300)}</td>
</tr>
</tbody>
</table>
| 4. Base-load duty period\(300 = \frac{300 \text{ s}}{\text{base-load duty period\(300\)}} \times \text{ max. base-load current} = 0 | Yes: Required cycle time not configurable
No: Read off max. base-load current for overload period\(300\) from limit characteristic |
| 5. Determine percentage for base-load current | Read of percentage for base-load current from diagram |

Table 3

<table>
<thead>
<tr>
<th>Steps to solve basic task 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Determine curve</td>
</tr>
<tr>
<td>2. Max. overload period (= (\text{cycle time/300 s}) \times \text{ overload period(300)} \times \text{ base-load duty period(300)}</td>
</tr>
<tr>
<td>3. Min. base-load period (= \text{ cycle time - max. overload period} \times \text{ cycle time - max. overload period}</td>
</tr>
</tbody>
</table>

Fig. 5/1

Characteristics for example calculations for basic tasks 1 and 2
Calculation of dynamic overload capability

Fig. 5/2
6RA7013-6DV62 15 A/4Q/400 V

Fig. 5/3
6RA7018-6DS22 30 A/1Q/400 V, 6RA7018-6FS22 30 A/1Q/460 V, 6RA7018-6DV62 30 A/4Q/400 V, 6RA7018-6FV62 30 A/4Q/460 V

Fig. 5/4
6RA7025-6DS22 60 A/1Q/400 V, 6RA7025-6FS22 60 A/1Q/460 V, 6RA7025-6GS22 60 A/1Q/575 V
**Calculation of dynamic overload capability**

<table>
<thead>
<tr>
<th>Overloading with x times rated DC current</th>
<th>( t_{on}(s) )</th>
</tr>
</thead>
<tbody>
<tr>
<td>( x=1.1 )</td>
<td>2535</td>
</tr>
<tr>
<td>( x=1.2 )</td>
<td>1446</td>
</tr>
<tr>
<td>( x=1.3 )</td>
<td>1016</td>
</tr>
<tr>
<td>( x=1.4 )</td>
<td>761</td>
</tr>
<tr>
<td>( x=1.5 )</td>
<td>587</td>
</tr>
<tr>
<td>( x=1.8 )</td>
<td>283</td>
</tr>
</tbody>
</table>

---

Fig. 5/5
6RA7025-6DV62 60 A/4Q/400 V, 6RA7025-6FV62 60 A/4Q/460 V, 6RA7025-6GV62 60 A/4Q/575 V

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Fig. 5/6
6RA7028-6DS22 90 A/1Q/400 V, 6RA7028-6FS22 90 A/1Q/460 V

---

Fig. 5/7
6RA7028-6DS22 90 A/1Q/400 V, 6RA7028-6FS22 90 A/1Q/460 V
Calculation of dynamic overload capability

Fig. 5/8
6RA7031-6DS22 125 A/1Q/400 V, 6RA7031-6FS22 125 A/1Q/460 V, 6RA7031-6GS22 125 A/1Q/575 V

Fig. 5/9
6RA7031-6DV62 125 A/4Q/400 V, 6RA7031-6FV62 125 A/4Q/460 V, 6RA7031-6GV62 125 A/4Q/575 V

Fig. 5/10
6RA7075-6DS22 210 A/1Q/400 V, 6RA7075-6FS22 210 A/1Q/460 V, 6RA7075-6GS22 210 A/1Q/575 V, 6RA7075-6DV62 210 A/4Q/400 V, 6RA7075-6FV62 210 A/4Q/460 V, 6RA7075-6GV62 210 A/4Q/575 V
**Calculation of dynamic overload capability**

![Fig. 5/11](image1)

6RA7078-6DS22 280 A/1Q/400 V, 6RA7078-6FS22 280 A/1Q/460 V, 6RA7078-6DV62 280 A/4Q/400 V, 6RA7078-6FV62 280 A/4Q/460 V

![Fig. 5/12](image2)

6RA7081-6DS22 400 A/1Q/400 V, 6RA7081-6GS22 400 A/1Q/575 V

![Fig. 5/13](image3)

6RA7081-6DV62 400 A/4Q/400 V, 6RA7081-6GV62 400 A/4Q/575 V

Overloading with x times rated DC current:

- $x=1.1$: 729 s
- $x=1.2$: 381 s
- $x=1.3$: 237 s
- $x=1.4$: 155 s
- $x=1.5$: 103 s
- $x=1.8$: 24 s

Overloading time $t_{on}$ in seconds.

Dynamic overload capability
Calculation of dynamic overload capability

![Graph showing dynamic overload capability](image)

Fig. 5/14
6RA7082-6FS22 450 A/1Q/460 V, 6RA7082-6FV62 450 A/4Q/460 V

![Graph showing dynamic overload capability](image)

Fig. 5/15
6RA7085-6DS22 600 A/1Q/400 V, 6RA7085-6FS22 600 A/1Q/460 V, 6RA7085-6GS22 600 A/1Q/575 V

![Graph showing dynamic overload capability](image)

Fig. 5/16
6RA7085-6DV62 600 A/4Q/400 V, 6RA7085-6FV62 600 A/4Q/460 V, 6RA7085-6GV62 600 A/4Q/575 V
**Calculation of dynamic overload capability**

![Diagram](image1)

**Fig. 5/17**
6RA7087-6DS22 850 A/1Q/460 V, 6RA7087-6FS22 850 A/1Q/460 V, 6RA7087-6GS22 800 A/1Q/575 V, 6RA7086-6KS22 720 A/1Q/690 V

![Diagram](image2)

**Fig. 5/18**
6RA7087-6DV62 850 A/4Q/460 V, 6RA7087-6FV62 850 A/4Q/460 V, 6RA7087-6GV62 850 A/4Q/575 V, 6RA7086-6KV62 760 A/4Q/690 V

![Diagram](image3)

**Fig. 5/19**
6RA7090-6GS22 1000 A/1Q/575 V, 6RA7088-6KS22 950 A/1Q/690 V, 6RA7088-6LS22 900 A/1Q/830 V

Dynamic overload capability
Calculation of dynamic overload capability

Overloading with x times rated DC current

<table>
<thead>
<tr>
<th>x</th>
<th>( t_{\text{on}} ) (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1</td>
<td>218.0</td>
</tr>
<tr>
<td>1.2</td>
<td>99.0</td>
</tr>
<tr>
<td>1.3</td>
<td>50.0</td>
</tr>
<tr>
<td>1.4</td>
<td>25.0</td>
</tr>
<tr>
<td>1.5</td>
<td>13.0</td>
</tr>
<tr>
<td>1.8</td>
<td>3.6</td>
</tr>
</tbody>
</table>

\( t_{\text{on}}(s) = 373 \)

Fig. 5/20
6RA7090-6KV62 1000 A/4Q/690 V, 6RA7088-6LV62 950 A/4Q/830 V

Overloading with x times rated DC current

<table>
<thead>
<tr>
<th>x</th>
<th>( t_{\text{on}} ) (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1</td>
<td>208.0</td>
</tr>
<tr>
<td>1.2</td>
<td>91.0</td>
</tr>
<tr>
<td>1.3</td>
<td>45.6</td>
</tr>
<tr>
<td>1.4</td>
<td>20.5</td>
</tr>
<tr>
<td>1.5</td>
<td>10.5</td>
</tr>
<tr>
<td>1.8</td>
<td>2.9</td>
</tr>
</tbody>
</table>

\( t_{\text{on}}(s) = 366 \)

Fig. 5/21
6RA7090-6GV62 1100 A/4Q/575 V

Overloading with x times rated DC current

<table>
<thead>
<tr>
<th>x</th>
<th>( t_{\text{on}} ) (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1</td>
<td>160</td>
</tr>
<tr>
<td>1.2</td>
<td>88</td>
</tr>
<tr>
<td>1.3</td>
<td>49</td>
</tr>
<tr>
<td>1.4</td>
<td>30</td>
</tr>
<tr>
<td>1.5</td>
<td>19</td>
</tr>
<tr>
<td>1.8</td>
<td>6</td>
</tr>
</tbody>
</table>

\( t_{\text{on}}(s) = 312 \)

Fig. 5/22
6RA7091-6DS22 1200 A/1Q/400 V, 6RA7091-6FS22 1200 A/1Q/460 V
**Calculation of dynamic overload capability**

Fig. 5/23
6RA7091-6DV62 1200 A/4Q/400 V, 6RA7091-6FV62 1200 A/4Q/460 V

Fig. 5/24
6RA7093-4KS22 1500 A/1Q/690 V, 6RA7093-4LS22 1500 A/1Q/830 V

Fig. 5/25
6RA7093-4KV62 1500 A/4Q/690 V, 6RA7093-4LV62 1500 A/4Q/830 V
Calculation of dynamic overload capability

Overloading with x times rated DC current  \( t_{\text{in}}(\%) \)
\[
\begin{array}{c|c}
  x & t_{\text{in}}(\%) \\
  \hline
  1.1 & 548.0 \\
  1.2 & 219.0 \\
  1.3 & 122.0 \\
  1.4 & 73.0 \\
  1.5 & 45.0 \\
  1.8 & 14.5 \\
\end{array}
\]

Overloading with x times rated DC current  \( t_{\text{in}}(\%) \)
\[
\begin{array}{c|c}
  x & t_{\text{in}}(\%) \\
  \hline
  1.1 & 513.0 \\
  1.2 & 259.0 \\
  1.3 & 160.0 \\
  1.4 & 108.0 \\
  1.5 & 76.0 \\
  1.8 & 38.0 \\
\end{array}
\]

Overloading with x times rated DC current  \( t_{\text{in}}(\%) \)
\[
\begin{array}{c|c}
  x & t_{\text{in}}(\%) \\
  \hline
  1.1 & 321.0 \\
  1.2 & 164.0 \\
  1.3 & 96.0 \\
  1.4 & 59.0 \\
  1.5 & 38.0 \\
  1.8 & 13.7 \\
\end{array}
\]
**Calculation of dynamic overload capability**

- **Fig. 5/29**
  6RA7095-4KS22 2000 A/1Q/690 V

- **Fig. 5/30**
  6RA7095-4GS22 2000 A/1Q/575 V, 6RA7095-4GV62 2000 A/4Q/575 V

- **Fig. 5/31**
  6RA7095-4DV62 2000 A/4Q/400 V, 6RA7095-4KV62 2000 A/4Q/575 V

- **Overloading with x times rated DC current**
  - $x=1.1$: $I_{dc}(s) = 663$
  - $x=1.2$: $I_{dc}(s) = 1064$
  - $x=1.3$: $I_{dc}(s) = 1247.5$
  - $x=1.4$: $I_{dc}(s) = 241.9$
  - $x=1.5$: $I_{dc}(s) = 119.2$
  - $x=1.6$: $I_{dc}(s) = 56.8$
  - $x=1.8$: $I_{dc}(s) = 37$

- **Overloading with x times rated DC current**
  - $x=1.1$: $I_{dc}(s) = 274$
  - $x=1.2$: $I_{dc}(s) = 128$
  - $x=1.3$: $I_{dc}(s) = 65$
  - $x=1.4$: $I_{dc}(s) = 23$
  - $x=1.8$: $I_{dc}(s) = 8$
Calculation of dynamic overload capability

Fig. 5/32
6RA7096-4GS22 2200 A/1Q/575 V, 6RA7096-4GV62 2200 A/4Q/575 V

Fig. 5/33
6RA7096-4MS22 2200 A/1Q/950 V, 6RA7096-4MV62 2200 A/4Q/950 V

Fig. 5/34
6RA7097-4KS22 2600 A/1Q/690 V, 6RA7097-4KV62 2600 A/4Q/690 V
Calculation of dynamic overload capability

Overloading with \( x \) times rated DC current

\[
\begin{array}{c|c}
\text{ rated DC current} & \text{ } t_{\text{om}} \text{(s)} \\\n\hline
x=1.1 & 284 \\
x=1.2 & 162 \\
x=1.3 & 105 \\
x=1.4 & 72 \\
x=1.5 & 51 \\
x=1.8 & 22 \\
\end{array}
\]

Overload period in s for cycle time of 300 s

Base-load current in % of rated DC current

Fig. 5/35
6RA7097-4GS22 2800 A/1Q/575 V, 6RA7097-4GV62 2800 A/4Q/575 V

Fig. 5/36
6RA7098-4DS22 3000 A/1Q/400 V, 6RA7098-4DV62 3000 A/4Q/400 V
## Rating classes

To enable the SIMOREG DC MASTER converters to be adapted to the loading profile of the machine as easily as possible, they can – in addition to individual dimensioning on the basis of the limit curves for dynamic overload capability – also be dimensioned using preset and easily parameterized load cycles.

The adjustment is made on the SIMOREG DC MASTER using Parameter P067.

**Note**
The SIMOREG DC MASTER does not monitor compliance with the rating class set using parameter P067. If the power section permits it, longer overload periods than specified by the rating class can also be used. In this case, however, there is no protection for the driven machine or the mechanical system against overloading!

The overload duration actually permitted for the specific power section is always larger than the overload duration corresponding to the rating class. Compliance with the overload duration actually permitted for the power section is monitored by the SIMOREG DC MASTER.

### Rating class (Parameter) | Load for converter | Load cycle
---|---|---
DC I (P067=1) | $I_{\text{DC I}}$ continuous ($I_{\text{EN}}$) | ![Diagram](image1.png)
DC II (P067=2) | $I_{\text{DC II}}$ for 15 min and $1.5 \times I_{\text{DC II}}$ for 60 s | ![Diagram](image2.png)
DC III (P067=3) | $I_{\text{DC III}}$ for 15 min and $1.5 \times I_{\text{DC III}}$ for 120 s | ![Diagram](image3.png)
DC IV (P067=4) | $I_{\text{DC IV}}$ for 15 min and $2 \times I_{\text{DC IV}}$ for 10 s | ![Diagram](image4.png)
US Rating (P067=5) | $I_{\text{US}}$ for 15 min and $1.5 \times I_{\text{US}}$ for 60 s | ![Diagram](image5.png)

**Note**
With this setting, an ambient temperature or coolant temperature of 46 °C is permitted for all converter types.
### Load cycles for single-quadrant applications

<table>
<thead>
<tr>
<th>Type</th>
<th>°C</th>
<th>A</th>
<th>A</th>
<th>A</th>
<th>A</th>
<th>A</th>
<th>A</th>
<th>A</th>
</tr>
</thead>
<tbody>
<tr>
<td>400 V, 1Q</td>
<td>45</td>
<td>30</td>
<td>24.9</td>
<td>37.4</td>
<td>24.2</td>
<td>36.3</td>
<td>22.4</td>
<td>44.8</td>
</tr>
<tr>
<td>460 V, 1Q</td>
<td>45</td>
<td>60</td>
<td>51.4</td>
<td>77.1</td>
<td>50.2</td>
<td>75.3</td>
<td>46.4</td>
<td>92.8</td>
</tr>
<tr>
<td>575 V, 1Q</td>
<td>45</td>
<td>60</td>
<td>71.4</td>
<td>111.6</td>
<td>72.8</td>
<td>109.2</td>
<td>65.4</td>
<td>130.8</td>
</tr>
<tr>
<td>690 V, 1Q</td>
<td>45</td>
<td>60</td>
<td>71.4</td>
<td>111.6</td>
<td>72.8</td>
<td>109.2</td>
<td>65.4</td>
<td>130.8</td>
</tr>
<tr>
<td>830 V, 1Q</td>
<td>45</td>
<td>60</td>
<td>71.4</td>
<td>111.6</td>
<td>72.8</td>
<td>109.2</td>
<td>65.4</td>
<td>130.8</td>
</tr>
<tr>
<td>950 V, 1Q</td>
<td>45</td>
<td>60</td>
<td>71.4</td>
<td>111.6</td>
<td>72.8</td>
<td>109.2</td>
<td>65.4</td>
<td>130.8</td>
</tr>
</tbody>
</table>

**Load cycles**

- **DC I**: 15 min 100% 60 s 150%
- **DC II**: 15 min 100% 60 s 150%
- **DC III**: 15 min 100% 60 s 150%
- **DC IV**: 10 s 200% 15 min 100% 60 s 150%
## Load cycles for four-quadrant applications

<table>
<thead>
<tr>
<th>Type</th>
<th>°C</th>
<th>A</th>
<th>A</th>
<th>A</th>
<th>A</th>
<th>A</th>
<th>A</th>
<th>A</th>
<th>A</th>
<th>A</th>
</tr>
</thead>
<tbody>
<tr>
<td>400 V, 4Q</td>
<td>45</td>
<td>15</td>
<td>13.9</td>
<td>20.9</td>
<td>13.5</td>
<td>20.3</td>
<td>12.6</td>
<td>25.2</td>
<td>13.9</td>
<td>20.9</td>
</tr>
<tr>
<td>460 V, 4Q</td>
<td>45</td>
<td>30</td>
<td>24.9</td>
<td>37.4</td>
<td>24.2</td>
<td>36.3</td>
<td>22.4</td>
<td>44.8</td>
<td>24.9</td>
<td>37.4</td>
</tr>
<tr>
<td>575 V, 4Q</td>
<td>45</td>
<td>60</td>
<td>53.1</td>
<td>79.7</td>
<td>51.8</td>
<td>77.7</td>
<td>47.2</td>
<td>94.4</td>
<td>53.1</td>
<td>79.7</td>
</tr>
<tr>
<td>690 V, 4Q</td>
<td>45</td>
<td>90</td>
<td>78.2</td>
<td>117.3</td>
<td>76.0</td>
<td>114.0</td>
<td>72.2</td>
<td>144.4</td>
<td>78.2</td>
<td>117.3</td>
</tr>
<tr>
<td>830 V, 4Q</td>
<td>45</td>
<td>125</td>
<td>126.1</td>
<td>189.2</td>
<td>123.6</td>
<td>186.0</td>
<td>121.9</td>
<td>243.8</td>
<td>126.4</td>
<td>189.2</td>
</tr>
<tr>
<td>950 V, 4Q</td>
<td>45</td>
<td>160</td>
<td>177.6</td>
<td>263.4</td>
<td>174.3</td>
<td>259.5</td>
<td>172.6</td>
<td>317.4</td>
<td>177.6</td>
<td>263.4</td>
</tr>
</tbody>
</table>

### Load cycles

<table>
<thead>
<tr>
<th>DC I</th>
<th>DC II</th>
<th>DC III</th>
<th>DC IV</th>
<th>US Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>15 min 100%</td>
<td>60 s 150%</td>
<td>15 min 100%</td>
<td>120 s 150%</td>
<td>15 min 100%</td>
</tr>
<tr>
<td>15 min 100%</td>
<td>60 s 150%</td>
<td>15 min 100%</td>
<td>120 s 150%</td>
<td>15 min 100%</td>
</tr>
<tr>
<td>15 min 100%</td>
<td>60 s 150%</td>
<td>15 min 100%</td>
<td>120 s 150%</td>
<td>15 min 100%</td>
</tr>
<tr>
<td>15 min 100%</td>
<td>60 s 150%</td>
<td>15 min 100%</td>
<td>120 s 150%</td>
<td>15 min 100%</td>
</tr>
<tr>
<td>15 min 100%</td>
<td>60 s 150%</td>
<td>15 min 100%</td>
<td>120 s 150%</td>
<td>15 min 100%</td>
</tr>
</tbody>
</table>

### Dynamic overload capability

- **Type**: 6RA7013-6DV62
- **°C**: 45
- **A**: 15
- **A**: 13.9
- **A**: 20.9
- **A**: 13.5
- **A**: 20.3
- **A**: 12.6
- **A**: 25.2
- **A**: 13.9
- **A**: 20.9

### US Rating

- **TU**: 10°C
- **10°C**: 15 min 100%
- **10°C**: 60 s 150%
- **10°C**: 120 s 150%
- **10°C**: 15 min 100%
- **10°C**: 10 s 200%
- **10°C**: 15 min 100%
- **10°C**: 60 s 150%
Parallel connection of SIMOREG DC MASTER converters

SIMOREG DC MASTER converters can be connected in parallel to increase their power output. The following boundary conditions must be met:

- The terminal expansion option (CUD2) is required for each converter in the case of parallel connection. The terminal expansion contains the hardware and plug-in connectors required for transferring the firing pulses and the higher-level communication.

- Up to 6 converters can be connected in parallel. When several converters are connected in parallel, the master unit must be located in the middle to reduce signal runtime. The maximum cable length for the parallel interface cable between the master and slave units at one end of the bus is 15 m.

- Separate commutating reactors (\(u_n \leq 2\%\)) for the SIMOREG converters are needed for correct current distribution. The difference in tolerance between the reactors determines the current distribution. To avoid derating, a tolerance of 5% or more is recommended.

Redundancy mode ("n+1 duty")

Redundancy mode can be implemented as a special duty type for parallel connection of the SIMOREG DC MASTER converters. In this mode, if one converter fails (e.g. due to fuse rupture in the power section), operation can be maintained by means of the remaining SIMOREG units.

The fully functional SIMOREG units continue to operate without interruption when one unit has failed. At the planning stage, it must be ensured that the power output from only \(n\) units (instead of \(n+1\) units) must be sufficient for the application.

This mode is possible in the event of slave unit failure as well as master unit failure.

Diagram showing the terminal connections for the parallel connection of SIMOREG units

- It is essential that 1U1, 1V1 and 1W1 are in-phase.
- It is essential that 1C1 and 1D1 are in-phase.
- The units are interconnected using (8-core) shielded patch cable UTP CAT5 acc. to ANSI/ EIA/TIA 568 as used in PC network technology. A standard cable of 5 m in length can be ordered directly from Siemens (Order No.: 6RY1707-0AA08).
- These fuses are only to be inserted for units up to 850 A.
- Only for units up to 850 A in 4Q mode.

Important

- Only converters with the same DC current rating may be connected in parallel.

Permissible output current for parallel connection on compliance with the boundary conditions:

\[I_{\text{max}} = n \times I_{\text{N(SIMOREG)}}\]

\(n\) = number of SIMOREG units
SIMOREG converters for 12-pulse operation

In 12-pulse operation, two SIMOREG converters are supplied with voltages displaced by 30 degrees, resulting in a reduction in harmonics. Each SIMOREG receives half the total current. One unit operates under speed control and the other operates under current control. Current setpoints are transferred from the first converter to the second via the peer-to-peer connection.

Smoothing reactors must be installed in the DC circuit for 12-pulse operation. Calculation of smoothing reactor:

- One smoothing reactor is needed for each of the two converters. This is a twin-value reactor, i.e., the reactor inductance is defined for two current values.
- The reactor is dimensioned thermally according to the rms value of the reactor DC current.

Calculation of required inductance: See Fig. 5/38.

Calculation of required inductance:
1. Inductance of reactor at $0.2 \times I_{\text{dN}}$ ($L_{D1}$)
2. Inductance of reactor at $I_{\text{dmax}}$ ($L_{D2}$)

Inductance for 50 Hz line frequency:

$L_{D1} = 0.296 \times 10^{-3} \times \frac{U_{\text{di}}}{0.2 \times I_{\text{dN}}}$
$L_{D2} = 0.296 \times 10^{-3} \times \frac{U_{\text{di}}}{0.33 \times I_{\text{dmax}}}$

Inductance for 60 Hz line frequency:

$L_{D1} = 0.24 \times 10^{-3} \times \frac{U_{\text{di}}}{0.2 \times I_{\text{dN}}}$
$L_{D2} = 0.24 \times 10^{-3} \times \frac{U_{\text{di}}}{0.33 \times I_{\text{dmax}}}$

Legend:
- $L$: Inductance in henry
- $I_{\text{dN}}$: 50% of rated DC current of DC motor
- $I_{\text{dmax}}$: 50% of maximum current of DC motor
- $U_{\text{di}}$: 1.35 x $U_N$
- $U_N$: Rated voltage of supply system

SIMOREG for supplying high inductances

For supplying high inductances such as the fields of large DC or synchronous motors or solenoids, the gating unit is switched to long pulses via a parameter setting. Long pulses ensure reliable triggering of thyristors for high-inductance equipment. In such cases, the converter armature circuit (terminals 1C1/1D1) is not used to supply DC motors, but large-scale field windings.

Condensation protection

SIMOREG converters are designed to comply with humidity class F without condensation. Where converters are installed in tropical climates, it is advisable to install converter cubicle heating.

Note
An external snubber circuit (e.g., resistor or block varistor) must be provided at the DC voltage output of the converter.
### Level of input pulses

The evaluation electronics are capable of processing encoder signals (both symmetrical and asymmetrical) up to a maximum of 27 V differential voltage. The evaluation electronics are electronically adapted (in Parameter P140) to the encoder signal voltage. The parameter setting selects one of two possible rated input voltages (see Table 4).

If the pulse encoder does not supply symmetrical encoder signals, then its grounding lead must be routed with each signal cable as a twisted pair and connected to the negative terminals of Track 1, Track 2 and the zero marker.

<table>
<thead>
<tr>
<th>Rated input voltage range</th>
<th>5 V $P140 = 0x$</th>
<th>15 V $P140 = 1x$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low level</td>
<td>Differential voltage $&lt; 0.8$ V</td>
<td>Differential voltage $&lt; 5$ V</td>
</tr>
<tr>
<td>High level</td>
<td>Differential voltage $&gt; 2$ V</td>
<td>Differential voltage $&gt; 8$ V $^{1)}$</td>
</tr>
<tr>
<td>Hysteresis</td>
<td>$&gt; 0.2$ V</td>
<td>$&lt; 1$ V</td>
</tr>
<tr>
<td>Common mode</td>
<td>$\pm 10$ V</td>
<td>$\pm 10$ V</td>
</tr>
</tbody>
</table>

Table 4  
Explanation of terms

### Switching frequency

The maximum frequency of the encoder pulses is 300 kHz. To ensure correct evaluation of the encoder pulses, the minimum distance $T_{\text{min}}$ between two encoder signal edges (Tracks 1 and 2) specified in the table must be observed (see Table 5).

If the pulse encoder is incorrectly matched to the encoder cable, disturbing cable reflections will be produced at the receive end. These reflections must be damped so that the encoder pulses can be correctly evaluated. The limit values specified in Table 6 must be maintained to ensure that the resultant power loss in the adapting element of the evaluation electronics is not exceeded.

<table>
<thead>
<tr>
<th>Differential voltage $^2)$</th>
<th>2 V</th>
<th>$&gt; 2.5$ V</th>
<th>8 V</th>
<th>10 V</th>
<th>$&gt; 14$ V</th>
</tr>
</thead>
<tbody>
<tr>
<td>$T_{\text{min}} , ^3)$</td>
<td>630 ns</td>
<td>380 ns</td>
<td>630 ns</td>
<td>430 ns</td>
<td>380 ns</td>
</tr>
</tbody>
</table>

Table 5  
Minimum distance between edges

<table>
<thead>
<tr>
<th>Differential voltage $^4)$</th>
<th>50 kHz</th>
<th>100 kHz</th>
<th>150 kHz</th>
<th>200 kHz</th>
<th>300 kHz</th>
</tr>
</thead>
<tbody>
<tr>
<td>$f_{\text{max}}$</td>
<td>to 27 V</td>
<td>to 22 V</td>
<td>to 18 V</td>
<td>to 16 V</td>
<td>to 14 V</td>
</tr>
</tbody>
</table>

Table 6  
Maximum input frequency as a function of supply voltage

### 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 specified by the encoder manufacturer. A suitable cable as recommended by the encoder manufacturer must be used and the maximum cable length must not be exceeded.

Generally, a twisted-pair cable with a common pair shield is sufficient for each track. Crosstalk between the cables is thus reduced. The shielding of all pairs protects against noise pulses. The shield must be connected to the shield bar of the SIMOREG converter over the largest possible surface area.

---

1) Restriction: See switching frequency  
2) Differential voltage at evaluation electronics terminals  
3) The phase error $L_G$ (deviation from 90°), which may occur as the result of encoder and cable, can be calculated from $T_{\text{min}}$:  
   
   \[ L_G \, [\text{°}] = + \left( 90° - f_p \times T_{\text{min}} \times 360° \times 10^{-6} \right) \]
   
   \[ f_p \, [\text{kHz}] = \text{Pulse frequency} \]
   
   \[ T_{\text{min}} \, [\text{ns}] = \text{Minimum distance between edges} \]

4) Differential voltage of encoder pulses without load (approximate encoder current supply voltage)
Fundamentals of EMC

What is EMC

EMC stands for “electromagnetic compatibility”. It describes the capability of a device to operate satisfactorily in the electromagnetic environment, without causing electromagnetic interference which is unacceptable for other devices in this environment. In other words, the different devices must not interfere with each other.

Emitted Interference and Interference Immunity

EMC depends on two characteristics of the devices involved: emitted interference and interference immunity. Electrical devices can be interference sources (transmitters) and/or interference sinks (receivers).

Electromagnetic compatibility exists when the interference sources do not affect functioning of the interference sinks.

A device can be simultaneously an interference source and sink. For example, the power section of a converter can be considered as an interference source and the control section as an interference sink.

Limit values

Product standard EN 61800-3 (IEC 61800-3, DIN VDE 160 Part 100) covers electrical drives. According to this product standard, not all EMC measures are essential for industrial supply systems; a solution must be defined which is adapted to the actual environment. This may be economically more advantageous to increase the interference immunity of a sensitive device rather than implement interference suppression on the converter. The choice of solution, therefore, also depends on economic factors.

To some extent, adherence to EN 55011 is required. This defines the limit values for emitted interference in industry and in residential buildings. Conducted interference at the supply connection is measured under standardized conditions as a radio interference voltage and electromagnetically emitted interference is measured as interference emission. The standard defines limit values “A1” and “B1” which apply to radio interference voltage over the range 150 kHz and 30 MHz and to interference emission over the range 30 MHz to 2 GHz. Since the SIMOREG K converters are used in industry, limit value “A1” applies. To achieve limit value “A1”, the SIMOREG K units must be provided with external RFI filters.

Interference immunity describes the behavior of a device under the influence of electromagnetic interference. Standard EN 50082-2 governs the requirements and assessment criteria for the behavior of the devices in industry. This standard is met by the converters listed in the following Section.

Application in industry

In industry, the interference immunity of the devices must be very high, whilst lower demands are made on emitted interference.

The SIMOREG converters are components of an electrical drive, as are contactors and switches. Skilled personnel must integrate them in a drive system comprising at least the converter, motor cables and the motor. Commutating reactors and fuses are usually also needed.

Proper installation thus also determines whether or not a limit value will be met. To limit the emitted interference according to limit value “A1”, at least the corresponding radio interference suppression filter and the commutating reactor are also needed in addition to the converter. Without a radio interference suppression filter, the emitted interference of the SIMOREG converters exceeds limit value “A1” of EN 55011.

If the drive is part of an installation, it need not initially meet requirements relating to emitted interference. However, the EMC legislation requires that the entire installation be electromagnetically compatible with the environment.

If all the control components of the installation, such as automation equipment, exhibit industrial grade interference immunity, there is no need for each drive to satisfy limit value “A1”.

Ungrounded supply systems

In some branches of industry, ungrounded supply systems (IT systems) are used to increase availability of the plant. In the event of a ground fault, there is no ground current and the plant can continue with production. In conjunction with radio interference suppression filters, however, there is a fault current in the event of a ground fault which can result in a shutdown of the drives or even the destruction of the filter. The product standard therefore does not specify limit values for these systems. For economic reasons, interference suppression, if required, should be implemented on the grounded primary side of the supply transformer.

EMC planning

If two devices are electromagnetically incompatible, you can reduce the emitted interference of the source or increase the interference immunity of the sink. Interference sources are usually power electronics devices with a high current consumption. To reduce their emitted interference, elaborate filters are required. Interference sinks are, in particular, control units and sensors including their evaluation circuits. Enhancing the interference immunity of low-power devices is less involved. For economical reasons in industry, therefore, it is often more favorable to increase the interference immunity than to reduce emitted interference. To satisfy limit value class A1 of EN 55011, for example, the radio interference voltage at the supply terminals must not exceed 79 dB (µV) between 150 and 500 kHz, and 73 dB (µV) (9 mV or 4.5 mV) between 500 kHz and 30 MHz.

In industry, the EMC of equipment should be based on a judicious balance between emitted interference and interference immunity.

The least expensive suppression method is to separate the interference sources and sinks, provided that this is taken into account during the planning of a machine/plant. For each device, the first question is whether it is a potential interference source or sink. Examples of interference sources in this context are converters and contactors. Examples of interference sinks are programmable controllers, encoders and sensors.

The components in the cabinet (interference sources and sinks) should be separated, if necessary with partition plates or by installing them in metal housings. Fig. 5/40 shows a possible arrangement of components in the cabinet.
Electromagnetically compatible installation of drives

**General notes**

Since the drives are operated in very different environments and additional electrical components (controllers, switched-mode power supplies, etc.) can differ greatly with regard to interference immunity and emitted interference, each installation guideline can only be a sensible compromise. In individual cases, therefore, after examination, deviation from the rules is possible.

To ensure electromagnetic compatibility (EMC) in your cabinets in an electrically harsh environment and to be able to meet the legal standards, the following EMC rules should be observed during design and installation.

Rules 1 to 10 are generally applicable. Rules 11 to 15 are necessary to meet the emitted interference standards.

**Rules for electromagnetically compatible installation**

**Rule 1**
All metal parts of the cabinet must be joined to each other with good electrical contact (not paintwork on paintwork!). Contact or toothed washers should be used where necessary. The cabinet door should be connected to the cabinet via ground straps (at top, middle and bottom) with as short a path as possible.

**Rule 2**
Contactors, relays, solenoid valves, electromagnetic operating hours counters, etc. in the cabinet and if necessary in adjacent cabinets, should be provided with suppression combinations, such as RC networks, varistors or diodes. The examination, deviation from the rules is possible.

**Rule 3**
Signal lines should be routed into the cabinet from one level if possible. The definition of ground, in general, encompasses all metallic conductive parts which can be connected to a protective conductor, e.g. a cabinet housing, motor housing, foundations earth, etc.

**Rule 4**
Unshielded conductors of the same circuit (outgoing and return conductors) should be twisted together if possible, i.e. the surface between outgoing and return conductors should be kept as small as possible to prevent the creating of unnecessary frame antennas.

**Rule 5**
Spare cores should be connected to the cabinet ground. This achieves additional shielding.

**Rule 6**
Unnecessary line lengths should be avoided. Coupling capacitances and inductances are thus kept low.

**Rule 7**
In general, crosstalk is reduced when conductors are placed close to the cabinet ground. Wiring should, therefore, not be placed in free space in the cabinet but, wherever possible, routed closely along the cabinet housing or installation plates. This also applies to spare cables.

**Rule 8**
Signal lines and power cables should be laid separately from each other (to avoid coupling paths). A minimum clearance of 20 cm is desirable. If segregation between sensor cables and motor cables is not possible, the sensor cable should be decoupled by a partition plate or by installing it in a metal conduit. The partition plate or metal conduit should be grounded at several points.

**Rule 9**
The shields of digital signal cables should have good large-area electrical grounding at each end (source and destination). In the event of poor equipotential bonding between the shield connections, an additional equalizing conductor of at least 10 mm² should be laid in parallel with the shield to reduce the shield current. In general, shields may be connected to the cabinet housing (ground) at several points. Even outside the cabinet, the shields may be connected in several places. Foil shields are not satisfactory. Compared to braid shields, their shielding effect is inferior by a factor of at least 5.

**Rule 10**
With good equipotential bonding, the shields of analog signal lines may be grounded at both ends (with good large-area contact!). Good equipotential bonding can be assumed if all metal parts make good contact and the electronic components involved are powered from the same power supply.

Single-ended shield grounding prevents low-frequency capacitive interference pickup such as 50 Hz hum. The shield connection should be made in the cabinet; a sheath wire may be used to connect the shield.

**Rule 11**
Positioning the radio interference suppression filter in the vicinity of the suspected interference source: The filter should be mounted with its surface on the cabinet housing, mounting plate, etc. Input and output leads should be separated.

**Rule 12**
The use of radio interference suppression filters is mandatory for compliance with limit value class A1. Additional loads should be connected ahead of the filter (supply system side).

The need to install an additional line filter depends on the controller in use and on the type of wiring of the rest of the cabinet.

**Rule 13**
With a regulated field current supply, a commutating reactor is needed in the field circuit.

**Rule 14**
A commutating reactor is needed in the armature circuit of the controller.

**Rule 15**
With SIMOREG drives, the motor cables may be unshielded. The supply cable must have a clearance of at least 20 cm from the motor cables (field, armature). A partition plate should be used if necessary.

---

**Notes:**

1) Signal lines are defined as:
   - Digital signal line
   - Lines for pulse generators
   - Serial interfaces, e.g. PROFIBUS-DP or analog signal line (e.g. ±10 V setpoint line).

2) The definition of ground, in general, encompasses all metallic conductive parts which can be connected to a protective conductor, e.g. a cabinet housing, motor housing, foundations earth, etc.
Cabinet arrangement and shielding

The cabinet arrangement of Fig. 5/40 is intended to draw the user’s attention to the EMC-critical parts. The example does not necessarily show all possible cabinet components or arrangements.

Details affecting the interference immunity and emitted interference of the cabinet and which do not clearly appear in the block diagram are shown in Figs. 5/41 and 5/42.
Components for the converters

The arrangement of radio interference suppression filters and commutating reactors for SIMOREG DC MASTER converters is shown in the Figure below. The reactors and filters must be installed in the specified order.

Caution

When filters are used, commutating reactors are always needed between the filter and the input of the unit to decouple the RC circuit.

For selection of the commutating reactors, see Page 5/26. For selection of the radio interference suppression filters, see Catalog LV 60.

Line fuses

The SITOR dual protection fuse 3NE1 provides both lead and semiconductor protection in a single fuse. This reduces costs considerably and also reduces the installation time.

For the Order No. and assignments, see Section 8.

- The commutating reactor in the field circuit is designed for the rated current of the motor field.
- The commutating reactor in the armature circuit is designed for the rated motor current in the armature. The supply current is equal to the DC multiplied by 0.82.
- The radio interference suppression filter for the electronics power supply alone at 400 V is designed for ≥ 1 A. The filter for the field circuit and the electronics power supply at 400 V is designed for the rated current of the motor field plus 1 A.
- The filter for the armature circuit is designed for the rated motor current in the armature. The supply current is equal to the DC multiplied by 0.82.
- The radio interference suppression filter for the electronics power supply at 230 V is designed for ≥ 2 A.

Line commutating reactors

A converter must always be connected to the supply via a commutating inductance. This must be at least 4% \( \omega_k \). The commutating inductance can be implemented as a converter transformer or, with appropriate mains voltage, as a commutating reactor.

A supply can be regarded as “constant” when the output ratio \( P_s/S_k \leq 0.01 \). Even in the case of a constant supply, the commutating reactor must have a \( \omega_k \) of at least 4% !

For high-power converters, the supply reactance, i.e. the total short-circuit power of the supply must be taken into account, which also results in a larger \( \omega_k \) value. The recommended ratio of supply short-circuit power to apparent drive power is > 33:1. The commutating reactors are dimensioned for the rated motor current in the armature or field circuit.

For the recommended commutating reactors, see Page 5/26.

Operation on a 50 Hz and 60 Hz supply

The rated currents \( I_{n} \) specified in the Table for the reactors apply for operation at a supply frequency \( f = 50 \text{ Hz} \). Operation of the reactors at a supply frequency \( f = 60 \text{ Hz} \) is permissible. In this case, the permissible rated current \( I_{n} \) is reduced to 90%.

\[ I_{n} (60 \text{ Hz}) = 0.9 \cdot I_{n} (50 \text{ Hz}) \]

At the same time, the voltage drop \( \Delta U \) increases by 8%.

![Arrangement of the reactors and radio interference suppression filters](image-url)
### Components

#### Commutating reactors

<table>
<thead>
<tr>
<th>Thermal permissible continuous current</th>
<th>Max. AC current</th>
<th>Permissible continuous DC current</th>
<th>Referred voltage drop $U_D$ of the reactor at $I_{L\text{max}}$ and $U_N$</th>
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<tbody>
<tr>
<td>$I_{\text{th max}}$ A</td>
<td>$I_{\text{Lmax}}$ A</td>
<td>$I_{\text{Pmax}}$ A</td>
<td>Order No.: 400 V</td>
</tr>
<tr>
<td>8</td>
<td>8</td>
<td>9.8</td>
<td>4EM48 07-1CB00</td>
</tr>
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<td>10</td>
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<td>4EM49 11-7CB00</td>
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<td>15.3</td>
<td>4EM48 12-6CB00</td>
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<td>17.2</td>
<td>4EM48 12-1CB00</td>
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<td>15</td>
<td>15</td>
<td>18.4</td>
<td>4EM50 00-2CB00</td>
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<td>18</td>
<td>22</td>
<td>4EM50 05-6CB00</td>
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<td>39</td>
<td>4EM51 00-3CB00</td>
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<td>35.5</td>
<td>35.5</td>
<td>43</td>
<td>4EM52 12-8CB00</td>
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<td>50</td>
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<td>61</td>
<td>4EM53 16-6CB00</td>
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**Single-phase commutating reactors $I_{\text{th max}} = I_{\text{Lmax}}$ with inductive load**

<table>
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<tr>
<th>Voltage (V)</th>
<th>Current (A)</th>
<th>Order No.: 4EM48</th>
<th>Order No.: 4EM49</th>
<th>Order No.: 4EM50</th>
<th>Order No.: 4EM51</th>
<th>Order No.: 4EM52</th>
<th>Order No.: 4EM53</th>
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</thead>
<tbody>
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<td>400 V</td>
<td>8</td>
<td>8</td>
<td>9.8</td>
<td>4EM48 07-1CB00</td>
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<td>–</td>
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<tr>
<td>500 V</td>
<td>10</td>
<td>10</td>
<td>12.3</td>
<td>4EM49 11-7CB00</td>
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<td>–</td>
<td>–</td>
</tr>
<tr>
<td>690 V</td>
<td>12.5</td>
<td>12.5</td>
<td>15.3</td>
<td>4EM48 12-6CB00</td>
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<td>–</td>
<td>–</td>
</tr>
<tr>
<td>750 V</td>
<td>14</td>
<td>14</td>
<td>17.2</td>
<td>4EM48 12-1CB00</td>
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<td>–</td>
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</table>

**Three phase commutating reactors $I_{\text{th max}} = 0.8 \cdot I_{\text{Lmax}}$ with inductive load 3-ph. AC 50 Hz**

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
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<th></th>
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<tbody>
<tr>
<td>400 V</td>
<td>16</td>
<td>20</td>
<td>19.6</td>
<td>4EP36 01-3DS50</td>
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<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>500 V</td>
<td>18</td>
<td>22</td>
<td>22</td>
<td>4EP36 01-4DS50</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>690 V</td>
<td>20</td>
<td>25</td>
<td>24.5</td>
<td>4EP36 01-5DS50</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>750 V</td>
<td>22.4</td>
<td>27.4</td>
<td>–</td>
<td>4EP37 02-1DS50</td>
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<td>–</td>
<td>–</td>
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<tr>
<td>800 V</td>
<td>25</td>
<td>31</td>
<td>31</td>
<td>4EP37 01-5DS50</td>
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<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
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<tr>
<td>900 V</td>
<td>28</td>
<td>35.5</td>
<td>35.5</td>
<td>4EP37 01-6DS50</td>
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<td>–</td>
<td>–</td>
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<td>–</td>
</tr>
<tr>
<td>1000 V</td>
<td>31.5</td>
<td>40</td>
<td>40</td>
<td>4EP37 01-7DS50</td>
<td>–</td>
<td>–</td>
<td>–</td>
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<tr>
<td>1100 V</td>
<td>35.5</td>
<td>45</td>
<td>45</td>
<td>4EP37 01-8DS50</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>1200 V</td>
<td>40</td>
<td>50</td>
<td>50</td>
<td>4EP38 00-2DS50</td>
<td>–</td>
<td>–</td>
<td>–</td>
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<td>1300 V</td>
<td>45</td>
<td>56</td>
<td>56</td>
<td>4EP38 01-5DS50</td>
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<td>–</td>
<td>–</td>
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<td>–</td>
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</tr>
<tr>
<td>1500 V</td>
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<td>71</td>
<td>71</td>
<td>4EP39 01-4DS50</td>
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<td>–</td>
<td>–</td>
<td>–</td>
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</tr>
</tbody>
</table>

1) All reactors with $U_N \leq 600$ V acc. to UL
2) Referred voltage drop of the reactor $U_D \approx 4\%$ at $I_{\text{Lmax}}$ and $U_N = 575$ V
3) With series-connected 6-pulse bridge circuit
4) Rated current $I_{\text{L}} = 0.9 \cdot I_{\text{th max}}$.
Radio interference suppression filters

SIMOREG DC MASTER applications comply with the EMC product standard EN 61 800-3 for electrical drives provided that the rules for electromagnetically compatible installation of the converters in the plant are observed.

However, the EMC legislation requires that the entire installation be electromagnetically compatible with the environment.

If the system is to comply with the “A1” degree of radio interference suppression according to EN 55011, RI suppression filters must be installed in addition to commutating reactors. In conjunction with the commutating reactors, the RI suppression filters reduce the radio interference voltages that arise due to the converters. RI suppression filters can only be installed in grounded-neutral systems.

The RI suppression filters generate discharge currents. In accordance with DIN VDE 0160, a PE connection with a cross-sectional area of 10 mm² is necessary. To ensure the best possible action of the filter it must be mounted with the converter on a common metal plate.

For converters with a three-phase system, the minimum rated current of the filter is equal to the output DC current multiplied by 0.82. For units with a two-phase system (field supply and electronics power supply), only two phases are connected to the three-phase RI suppression filter. The line current is equal to the field DC current (plus 1 A for the electronics power supply).

List of suggested RI suppression filters from EPCOS

*) In place of *, the identification number for the design type must be inserted:
- 0 = 480 V
- 2 = 530 V

*) In place of **, the identification number for the design type must be inserted:
- 20 = 500 V
- 21 = 760 V
- 24 = 690 V

<table>
<thead>
<tr>
<th>Rated current</th>
<th>Radio interference suppression filters</th>
<th>Terminal cross-section</th>
<th>Weight approx.</th>
<th>Dimensions H x W x D mm x mm x mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Type</td>
<td>Holes for M . .</td>
<td>kg</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>B84143-G8-R11*</td>
<td>4 mm²</td>
<td>1.3</td>
<td>80 x 230 x 50</td>
</tr>
<tr>
<td>20</td>
<td>B84143-G20-R11*</td>
<td>4 mm²</td>
<td>1.3</td>
<td>80 x 230 x 50</td>
</tr>
<tr>
<td>36</td>
<td>B84143-G36-R11*</td>
<td>6 mm²</td>
<td>2.8</td>
<td>150 x 280 x 60</td>
</tr>
<tr>
<td>50</td>
<td>B84143-G50-R11*</td>
<td>16 mm²</td>
<td>3.3</td>
<td>150 x 330 x 80</td>
</tr>
<tr>
<td>66</td>
<td>B84143-G66-R11*</td>
<td>25 mm²</td>
<td>4.4</td>
<td>150 x 330 x 80</td>
</tr>
<tr>
<td>90</td>
<td>B84143-G90-R11*</td>
<td>25 mm²</td>
<td>4.9</td>
<td>150 x 330 x 80</td>
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<tr>
<td>120</td>
<td>B84143-G120-R11*</td>
<td>50 mm²</td>
<td>7.5</td>
<td>200 x 380 x 90</td>
</tr>
<tr>
<td>150</td>
<td>B84143-G150-R11*</td>
<td>50 mm²</td>
<td>8.0</td>
<td>200 x 380 x 90</td>
</tr>
<tr>
<td>220</td>
<td>B84143-G220-R11*</td>
<td>95 mm²</td>
<td>11.5</td>
<td>220 x 430 x 110</td>
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<tr>
<td>150</td>
<td>B84143-B150-S**</td>
<td>M10</td>
<td>13</td>
<td>140 x 310 x 170</td>
</tr>
<tr>
<td>180</td>
<td>B84143-B180-S**</td>
<td>M10</td>
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<tr>
<td>250</td>
<td>B84143-B250-S**</td>
<td>M10</td>
<td>15</td>
<td>115 x 360 x 190</td>
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<tr>
<td>320</td>
<td>B84143-B320-S**</td>
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<tr>
<td>400</td>
<td>B84143-B400-S**</td>
<td>M10</td>
<td>21</td>
<td>115 x 360 x 260</td>
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<tr>
<td>600</td>
<td>B84143-B600-S**</td>
<td>M10</td>
<td>22</td>
<td>115 x 410 x 260</td>
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<tr>
<td>1000</td>
<td>B84143-B1000-S**</td>
<td>M12</td>
<td>28</td>
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<tr>
<td>1600</td>
<td>B84143-B1600-S**</td>
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<tr>
<td>2500</td>
<td>B84143-B2500-S**</td>
<td>4 x M12</td>
<td>105</td>
<td>200 x 810 x 365</td>
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<table>
<thead>
<tr>
<th>Rated current</th>
<th>Radio interference suppression filters</th>
<th>Terminal cross-section</th>
<th>Ground bolt</th>
<th>Weight approx.</th>
<th>Dimensions H x W x D mm x mm x mm</th>
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<tbody>
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<td>A</td>
<td>Type</td>
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<td>1600</td>
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<td>Terminal link</td>
<td>M10 x 30</td>
<td>34</td>
<td>400 x 300 x 166</td>
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</table>

Technical Data

- Rated supply voltage: 3-ph. AC 380-460 V (±15%)
- Rated frequency: 50/60 Hz (±6%)
- Operating temperature: 0 to +40°C
- Degree of protection: IP 20 (EN 60529); IP 00 from 500 A
The harmonic currents calculated from the above tables apply only to short-circuit power $S_K$ at the connection point of the converter:

$$S_K = \frac{U_{\text{V0}}^2}{X_N} \text{(VA)}$$

where

$$X_N = X_K - X_0 = 0.03536 \frac{U_{\text{V0}}}{I_d} - 2\pi f_N \times L_d \text{(Ω)}$$

$$U_{\text{V0}}$$ No-load voltage at the connection point of the converter in V

$$I_d$$ DC current for the examined operating point in A

$$f_N$$ Line frequency in Hz

$$L_d$$ Inductance of the commutating choke in H.

This is accompanied by formulas with which, depending on the operating data in the specific case, supply voltage (no-load voltage $U_{\text{V0}}$), line frequency $f_N$, and DC current $I_d$, the short-circuit power $S_K$ and armature inductance $L_a$ of the motor are determined, and to which the specified harmonic spectrum applies.

If the actual system short-circuit power and/or the actual armature inductance deviate from the values thus calculated, an individual calculation is necessary.

The given drive has the following data:

- $U_{\text{V0}} = 400$ V
- $I_d = 150$ A
- $f_N = 50$ Hz
- $L_d = 0.169$ mH (4EU2421-7AA10 with $I_{\text{IN}} = 125$ A)

If the actual values of short-circuit power $S_K$ and/or armature inductance $L_a$ differ from the values calculated using the above formulas, a separate calculation is necessary.

Example:

$$X_N = 0.03536 \times \frac{400}{150} \times 2\pi \times 0.169 \times 10^{-3} = 0.0412 \text{ Ω}$$

resulting in the following required short-circuit power of the system at the connection point of the converter:

$$S_K = 400^2 = 3.88 \text{ MVA}$$

and the following required armature inductance of the motor:

$$L_a = 0.0488 \times \frac{400}{50 \times 150} = 2.0 \text{ mH}$$

The harmonic currents listed in the tables apply only to the values $S_K$ and $L_a$, if the values differ, a separate calculation is necessary.
An important application for the SIMOREG CM converter is in the retrofitting and modernization of DC drives in existing systems.

In the field of DC drives, many systems exist that are older than 5 or 10 years and that still use analog technology.

On retrofitting or updating these systems, the motor, mechanical components and power section are retained and only the closed-loop control section is replaced by a 6RA70 Control Module. This is an extremely economical way to obtain a modern DC drive with the complete functional scope of the well-proven, fully digital converters of the SIMOREG DC MASTER series.

It is easily adapted to the configuration of the existing components by setting parameters. The 6RA70 Control Module contains a power section for supplying the field with a rated current of up to 40 A.

The converter can also be parameterized via the serial interface of the basic unit by means of a generally available PC and appropriate software. This PC interface is used for start-up, for maintenance during shutdown and for diagnosis during operation and is, therefore, a service interface. Upgrades of the converter software that is stored in Flash memory can also be loaded via this interface.

The field is supplied by a single-phase, semi-controlled dual pulse bridge connection B2HZ. The power section for the field is constructed with galvanically isolated thyristor modules; the heat sink is therefore at floating potential.

The optional OP1S converter operator panel can be mounted either in the converter door or externally, e.g. in the cubicle door. For this purpose, it can be connected up by means of a 5 m long cable. Cables of up to 200 m in length can be used if a separate 5 V supply is available. The OP1S is connected to the SIMOREG CM unit via connector X300.

The OP1S can be installed as an economic alternative to control cubicle measuring instruments which display physical measured quantities.

The OP1S features an LCD with 4 x 16 characters for displaying parameter names in plain text. English, German, French, Spanish and Italian can be selected as the display languages.

The OP1S can store parameter sets for easy downloading to other devices.

Design

The 6RA70 Control Module is characterized by its compact, space-saving design. The compact construction makes it especially easy to service since individual components are easily accessible. The electronics box contains the basic electronics as well as any supplementary boards.

To support optimum utilization of the installation possibilities in the system, the 6RA70 Control Module can be separated in its depth. Furthermore, the PCBs for firing pulse generation and distribution as well as for fuse monitoring and voltage measurement are designed to be removed and mounted either partially or completely outside the unit directly on the power section and connected to the basic unit via cables.

All 6RA70 Control Modules are equipped with a PMU simple operator panel in the door of the unit. The PMU consists of a five-digit, seven-segment display, three LEDs as status indicators and three parameterization keys. The PMU also features connector X300 with a USS interface in compliance with the RS232 or RS485 standard.

The panel provides all the facilities required during start-up for making adjustments or settings and displaying measured values.

Fig. 6/1
SIMOREG CM
## Technical data

### Type 6RA7000-0MV62-0

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measurable rated supply voltage armature</td>
<td>V 85 / 250 / 575 / 1000</td>
</tr>
<tr>
<td>Rated supply voltage electronics supply</td>
<td>V 2-ph. AC 380 (~25%) to 460 (+15%); I_a = 1 A or 1-ph. AC 190 (~25%) to 230 (+15%); I_a = 2 A (~35% for 1 min)</td>
</tr>
<tr>
<td>Rated supply voltage field ¹</td>
<td>V 2-ph. AC 400 (+15% / -20%)</td>
</tr>
<tr>
<td>Rated frequency</td>
<td>Hz The converters automatically adjust to the connected line frequency within a frequency range of 45 to 65 Hz ²</td>
</tr>
<tr>
<td>Rated DC voltage field ¹</td>
<td>V Max. 325 / 373</td>
</tr>
<tr>
<td>Rated DC current field</td>
<td>A 40</td>
</tr>
<tr>
<td>Operational ambient temperature</td>
<td>°C 0 to +60</td>
</tr>
<tr>
<td>Storage and transport temperature</td>
<td>°C -25 to +70</td>
</tr>
<tr>
<td>Control stability</td>
<td>α_a = 0.006 % of the rated motor speed, valid for pulse encoder operation and digital setpoint</td>
</tr>
<tr>
<td>Environmental class</td>
<td>EN 60721-3-3</td>
</tr>
<tr>
<td>Degree of protection</td>
<td>EN 60529</td>
</tr>
<tr>
<td>See dimension drawing on Page</td>
<td>9/16</td>
</tr>
<tr>
<td>Weight approx.</td>
<td>kg 15</td>
</tr>
</tbody>
</table>

### Standards

- **DIN VDE 0106 Part 100**: Protection against electric shock; location of actuators near live parts.
- **DIN VDE 0110 Part 1**: Insulation coordination for electrical equipment in low-voltage installations. Pollution Severity 2 for boards and power section. Only non-conductive pollution is permissible. Temporary conductivity must however be accepted due to condensation. "Dewing is not permitted because the components are only approved for Humidity Class F".
- **EN 60146 T1-1 / DIN VDE 0558 T11**: Semiconductor converters General requirements and line-commutated converters.
- **EN 61800-3**: Variable-speed drives, Part 3, EMC product standard including special test procedures.
- **DIN EN 50178 / DIN VDE 0160**: Regulations for the equipment of electrical power installations with electronic equipment.
- **DIN IEC 60 068-2-6 acc. to degree of severity 12 (SN29010 Part 1)**: Mechanical stress.

¹ The field supply voltage can be less than the rated supply voltage field (set with Parameter P078.002; input voltages of up to 85 V are permissible). The output voltage is reduced accordingly. The specified output DC voltage can be guaranteed up to under-voltages 5 % below the supply voltage (rated supply voltage field).

² Adaptation to the line frequency within a frequency range of 23 Hz to 110 Hz via separate parameterization is available on request.

³ Conditions:

- Temperature changes of ±10 °C
- Line voltage changes corresponding to +10% / 5% of the rated input voltage
- Temperature coefficient of temperature-compensated tacho-generators 0.15 % per 10 °C (applies only to analog tacho-generator)
- Constant setpoint (14-bit resolution)
SIMOREG CM

Block diagram

Fig. 6/2

1) P24_5 total max. 200 mA
BA = Electronically connectable bus termination
U/T = Electronically connectable voltage/current input

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The SIMOREG CM can be subdivided into several modules. These modules can be mounted separately. Sets of preassembled cables are available as options for interconnecting the separate modules of the CM unit. This allows fast, flexible adaptation to system requirements.

### Options

<table>
<thead>
<tr>
<th>Description</th>
<th>Connection</th>
<th>Cable length</th>
<th>Order No.:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supplementary housing</td>
<td>Rear housing part including accessories for the mounting of the firing pulse transfer module and/or fuse monitoring module in a parallel connection</td>
<td>–</td>
<td>6RY1705-0CM00</td>
</tr>
<tr>
<td>Set of unassembled parts</td>
<td>Screws, dowel pins and snap-on devices for the external mounting of module parts</td>
<td>–</td>
<td>6RY1707-0CM00</td>
</tr>
<tr>
<td>Preassembled ribbon cable set</td>
<td>2 off 26-core ribbon cable, shielded</td>
<td>3 m</td>
<td>6RY1707-0CM01</td>
</tr>
<tr>
<td>Preassembled ribbon cable set</td>
<td>2 off 10-core ribbon cable, shielded</td>
<td>10 m</td>
<td>6RY1707-0CM02</td>
</tr>
<tr>
<td>Preassembled cable set for current transformer</td>
<td>2 off 2-core twisted-pair cable</td>
<td>2 m</td>
<td>6RY1707-0CM03</td>
</tr>
<tr>
<td>Preassembled cable set for heat sink temperature sensing</td>
<td>1 off 2-core shielded cable</td>
<td>10 m</td>
<td>6RY1707-0CM04</td>
</tr>
<tr>
<td>Preassembled cable set for firing pulse cables</td>
<td>Bridging set for 12 off 2-core twisted-pair cable</td>
<td>3 m</td>
<td>6RY1707-0CM05</td>
</tr>
<tr>
<td>Preassembled cable set for the fuse monitoring system</td>
<td>6 off 2-core twisted-pair cable</td>
<td>10 m</td>
<td>6RY1707-0CM06</td>
</tr>
<tr>
<td>Preassembled cable set for voltage measurement</td>
<td>1 off 3-core twisted-pair cable U-V-W</td>
<td>3 m</td>
<td>6RY1707-0CM07</td>
</tr>
<tr>
<td>Preassembled cable set for activation of the firing pulse transfer devices</td>
<td>12 off 2-core twisted-pair cable</td>
<td>1 m</td>
<td>6RY1707-0CM08</td>
</tr>
<tr>
<td>Preassembled cable set for cradle in-line mounting</td>
<td>2 off 26-core ribbon cable</td>
<td>10 m</td>
<td>6RY1707-0CM09</td>
</tr>
<tr>
<td>Preassembled cable set for voltage measurement</td>
<td>1 off 2-core twisted-pair cable C-D</td>
<td>–</td>
<td>6RY1707-0CM10</td>
</tr>
<tr>
<td>Preassembled cable set for activation of the firing pulse transfer devices</td>
<td>12 off 2-core shielded cable</td>
<td>–</td>
<td>6RY1707-0CM11</td>
</tr>
<tr>
<td>Preassembled cable set for cradle in-line mounting</td>
<td>2 off 10-core ribbon cable</td>
<td>–</td>
<td>6RY1707-0CM12</td>
</tr>
</tbody>
</table>

---

6RY1705-0CM00
6RY1707-0CM01
6RY1707-0CM02
6RY1707-0CM03
6RY1707-0CM04
6RY1707-0CM05
6RY1707-0CM06
6RY1707-0CM07
6RY1707-0CM08
6RY1707-0CM13
6RY1707-0CM10
6RY1707-0CM11
The SIMOREG CCP (Converter Commutation Protector) is used to protect a line-commutated SIMOREG 6RA70 DC MASTER from the effects of inverter commutation failures.

For line-commutated converters in order to commutate the current between the individual power semiconductors, an appropriate line-side counter voltage is required. As a result of uncontrolled switching operations caused by line supply interruptions/dips (e.g. weak line supplies, thunderstorms, etc.), the completion of commutation can be prevented (inverter commutation failures). A large current is created in the regenerating direction via the power system or a crossover current is created in the power converter. This can result, in turn, to ruptured fuses or under certain circumstances, to destroyed power semiconductors.

By expanding the basic software of the SIMOREG DC MASTER, an inverter commutation failure is quickly detected and a command is then issued to the SIMOREG CCP to turn-off the power semiconductors in the basic unit. The SIMOREG CCP turns-off the power semiconductors, ensures that the right conditions are available to reduce the current in the motor and absorbs the magnetic energy, stored in the motor, as electrical energy.

The SIMOREG CCP limits the current created with inverter commutation fault to a harmless level so that thyristors and the associated super-fast fuses are protected. As a result, time-consuming and expensive replacement of the fuses is no longer necessary.

The inverter commutation failure cannot be prevented but its effects can.

- Any gear units used are protected against inadmissibly high torque surges in the event of a fault by de-energizing the current in good time before the maximum current value is reached.

- Up till now high-speed DC circuit-breakers have already been used to protect against blown fuses in the event of high system rated currents. The use of the CCP now provides cost-effective protection even in the case of smaller rated currents; the SIMOREG CCP offers the following advantages compared to high-speed DC circuit-breakers:
  - Protection even in the case of circulating current
  - Lower system costs
  - Lower space requirement
  - No additional air reactors necessary to reduce current gradients in the event of a fault
  - Lower operating costs due to being maintenance-free
  - Higher availability

Fig. 7/1
SIMOREG CCP

Overview

Benefits

- Protection even in the case of circulating current
- Lower system costs
- Lower space requirement
- No additional air reactors necessary to reduce current gradients in the event of a fault
- Lower operating costs due to being maintenance-free
- Higher availability
SIMOREG CCP is distinguished by its compact and space-saving design.

The line voltage, the line current, and the armature voltage are recorded in the basic unit. These quantities are used to determine whether a commutation failure has occurred ("conduction-through").

If this is the case, the following happens:

1. The firing pulses in the SIMOREG DC MASTER are blocked immediately.
2. The SIMOREG DC MASTER transmits (via serial interface) an "extinguish command" to the SIMOREG CCP.

3. The SIMOREG CCP extinguishes the thyristors by connecting precharged extinguishing capacitors anti-parallel to all thyristors. Consequently, the current commutates from the converter into the SIMOREG CCP. The surge absorbing capacitors will initially be discharged by the accepted current and then charged reversed. Once the voltage of the surge absorbing capacitors has reached the value of the motor EMF, the armature current begins to extinguish itself. The armature voltage, however, continues to increase. As soon as it has attained the limiting value, resistors will be added that accept the energy fed back from the motor during the remaining time of the current reduction.

4. Fault indication F030 is triggered in the SIMOREG DC MASTER.

5. The SIMOREG CCP recharges the commutation capacitors again in reverse direction so that a new extinguishing process is possible.

Each time the line voltage is switched on (e.g. by means of a line contactor), the SIMOREG CCP needs approx. 3 s until it is ready for use again because the commutation capacitors first have to be charged.

After one extinguishing process, the SIMOREG CCP requires some time before it becomes operational again. This duration depends on the actions during the extinguishing process and immediately afterwards. Firstly, the surge absorbing capacitors in the SIMOREG CCP must be recharged to the required value (approximately 10 s). Secondly, the chopper resistors that during the armature current reduction convert the energy to heat need a cooling time which is calculated by a software algorithm. Depending on the energy to be extinguished, this time can be as long as approximately 20 minutes.

The SIMOREG DC MASTER contains setting and display parameters for the commissioning, operation, monitoring and diagnostics of the SIMOREG CCP. The status of the SIMOREG CCP is signaled via connectors and triggering of the SIMOREG CCP or faulty statuses are signaled via fault and alarm messages.

The necessary data transfer between the SIMOREG DC MASTER and SIMOREG CCP takes place via the serial interface.
The following table contains the types of SIMOREG CCP suitable for SIMOREG DC MASTER.

The basis for the selection is not only the device rated data (considering the associated limit values) for the SIMOREG DC MASTER and SIMOREG CCP components, but also typical rated data for Siemens direct current motors from the DA 12 2004 product catalog.

**Note:** For plant configurations with reduced rated values (e.g. DC Rating, US Rating, voltage derating), in some circumstances suitable device combinations can be found that are not listed in the above table.

If required the specialist support group will help you with the detailed engineering and selection of the CCP. Please contact your Siemens representative and specify the following plant/system data:

- Line supply voltages and power sections
- Undervoltage range of the power section that will be required
- Rated motor armature voltage
- Rated motor current
- Information regarding the overcurrent capability required (magnitude, duty cycle)
- Load inductance (motor, cable and, where relevant, smoothing reactor)

### Table: SIMOREG DC MASTER – SIMOREG CCP

<table>
<thead>
<tr>
<th>SIMOREG DC MASTER</th>
<th>Converter Commutation Protector SIMOREG CCP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type</td>
<td>Rated DC voltage/DC current</td>
</tr>
<tr>
<td>6RA7013-6DV62-0</td>
<td>420 V / 15 A</td>
</tr>
<tr>
<td>6RA7018-6DV62-0</td>
<td>420 V / 30 A</td>
</tr>
<tr>
<td>6RA7025-6DV62-0</td>
<td>420 V / 60 A</td>
</tr>
<tr>
<td>6RA7029-6DV62-0</td>
<td>420 V / 90 A</td>
</tr>
<tr>
<td>6RA7031-6DV62-0</td>
<td>420 V / 125 A</td>
</tr>
<tr>
<td>6RA7075-6DV62-0</td>
<td>420 V / 210 A</td>
</tr>
<tr>
<td>6RA7078-6DV62-0</td>
<td>420 V / 280 A</td>
</tr>
<tr>
<td>6RA7081-6DV62-0</td>
<td>420 V / 400 A</td>
</tr>
<tr>
<td>6RA7085-6DV62-0</td>
<td>420 V / 600 A</td>
</tr>
<tr>
<td>6RA7087-6DV62-0</td>
<td>420 V / 850 A</td>
</tr>
<tr>
<td>6RA7091-6DV62-0</td>
<td>420 V / 1200 A</td>
</tr>
<tr>
<td>6RA7093-6DV62-0</td>
<td>420 V / 1600 A</td>
</tr>
<tr>
<td>6RA7095-6DV62-0</td>
<td>420 V / 2000 A</td>
</tr>
<tr>
<td>6RA7098-6DV62-0</td>
<td>420 V / 3000 A</td>
</tr>
<tr>
<td>6RA7018-6DV62-0</td>
<td>480 V / 30 A</td>
</tr>
<tr>
<td>6RA7025-6DV62-0</td>
<td>480 V / 60 A</td>
</tr>
<tr>
<td>6RA7028-6DV62-0</td>
<td>480 V / 90 A</td>
</tr>
<tr>
<td>6RA7031-6DV62-0</td>
<td>480 V / 125 A</td>
</tr>
<tr>
<td>6RA7075-6DV62-0</td>
<td>480 V / 210 A</td>
</tr>
<tr>
<td>6RA7078-6DV62-0</td>
<td>480 V / 280 A</td>
</tr>
<tr>
<td>6RA7082-6DV62-0</td>
<td>480 V / 450 A</td>
</tr>
<tr>
<td>6RA7085-6DV62-0</td>
<td>480 V / 600 A</td>
</tr>
<tr>
<td>6RA7087-6DV62-0</td>
<td>480 V / 850 A</td>
</tr>
<tr>
<td>6RA7091-6DV62-0</td>
<td>480 V / 1200 A</td>
</tr>
<tr>
<td>6RA7095-6DV62-0</td>
<td>600 V / 60 A</td>
</tr>
<tr>
<td>6RA7091-6FV62-0</td>
<td>600 V / 125 A</td>
</tr>
<tr>
<td>6RA7097-6FV62-0</td>
<td>600 V / 210 A</td>
</tr>
<tr>
<td>6RA7081-6G62-0</td>
<td>600 V / 400 A</td>
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<td>600 V / 600 A</td>
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<td>600 V / 850 A</td>
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<tr>
<td>6RA7090-6G62-0</td>
<td>600 V / 1100 A</td>
</tr>
<tr>
<td>6RA7093-4G62-0</td>
<td>600 V / 1600 A</td>
</tr>
<tr>
<td>6RA7095-4G62-0</td>
<td>600 V / 2000 A</td>
</tr>
<tr>
<td>6RA7096-4G62-0</td>
<td>600 V / 2200 A</td>
</tr>
<tr>
<td>6RA7097-4G62-0</td>
<td>600 V / 2800 A</td>
</tr>
<tr>
<td>6RA7086-6KV62-0</td>
<td>725 V / 760 A</td>
</tr>
<tr>
<td>6RA7090-6KV62-0</td>
<td>725 V / 1000 A</td>
</tr>
<tr>
<td>6RA7093-4KV62-0</td>
<td>725 V / 1500 A</td>
</tr>
<tr>
<td>6RA7095-4KV62-0</td>
<td>725 V / 2000 A</td>
</tr>
<tr>
<td>6RA7097-4KV62-0</td>
<td>725 V / 2600 A</td>
</tr>
<tr>
<td>6RA7086-6LV62-0</td>
<td>875 V / 950 A</td>
</tr>
<tr>
<td>6RA7093-4LV62-0</td>
<td>875 V / 1500 A</td>
</tr>
<tr>
<td>6RA7095-4LV62-0</td>
<td>875 V / 1900 A</td>
</tr>
<tr>
<td>6RA7096-4MV62-0</td>
<td>1000 V / 2200 A</td>
</tr>
</tbody>
</table>

x = suitable  
- = Not suitable (see note)
### Technical data

**Type**

<table>
<thead>
<tr>
<th>Type</th>
<th>6RA70&lt;sup&gt;DC&lt;/sup&gt;-6FC00-0</th>
<th>6RA70&lt;sup&gt;DC&lt;/sup&gt;-6KC00-0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated voltage</td>
<td>85 V (460 (+15 % / –20 %))</td>
<td>91 V (690 (+10% / –20%))</td>
</tr>
<tr>
<td>Rated current</td>
<td>600 A</td>
<td>1200 A</td>
</tr>
<tr>
<td>Rated frequency</td>
<td>45 to 65 Hz</td>
<td>100 W</td>
</tr>
<tr>
<td>Rated supply voltage electronics</td>
<td>2 AC 380 (-20 %) to 460 (+15 %)</td>
<td>0 to 55 °C</td>
</tr>
<tr>
<td>Power loss</td>
<td>1 fuse per conn.</td>
<td>3K3 accord. to DIN IEC 60 721-3-3</td>
</tr>
<tr>
<td>Storage and transport temperature</td>
<td>1 fuse in parall. per conn.</td>
<td>Degree of pollution 2 accord. to EN 60178 2)</td>
</tr>
<tr>
<td>Operational ambient temperature</td>
<td>3NA3 365-6</td>
<td></td>
</tr>
<tr>
<td>Installation altitude above sea level</td>
<td>1 fuse per conn.</td>
<td></td>
</tr>
<tr>
<td>Degree of protection</td>
<td>&lt;= 1000 m</td>
<td>3NA3 365-6</td>
</tr>
<tr>
<td>Environmental class</td>
<td>3 NA3 365-6</td>
<td></td>
</tr>
<tr>
<td>Degree of pollution</td>
<td>2 fuse in parall. per conn.</td>
<td>Degree of protection IP00 accord. to DIN EN 60529</td>
</tr>
<tr>
<td>Degree of protection</td>
<td>1 fuse per conn.</td>
<td></td>
</tr>
<tr>
<td>See dimension drawings on Page</td>
<td>1 fuse in parall. per conn.</td>
<td></td>
</tr>
<tr>
<td>Weight (approx.)</td>
<td>35 kg</td>
<td>9/17</td>
</tr>
<tr>
<td>Fuses for connections 1U1, 1V1, 1W1 and 1C1, 1D1</td>
<td>35 kg</td>
<td></td>
</tr>
<tr>
<td>Fuses for connections 2U1, 2V1, 2W1 (10 A line protection)</td>
<td>35 kg</td>
<td></td>
</tr>
</tbody>
</table>

1) The current range that can be covered corresponds to the actual rated current of the 6RA70 SIMOREG DC MASTER (display parameter I072.02). If the rated current is reduced by parameter P076.01 and/or P067 the resulting lower value is valid. Thus the CCP can then be used for a SIMOREG DC MASTER with a rated current higher than 2000 A according to its rating plate (necessary, for example, to obtain partly longer required overload times). If the actual rated current that has been parameterized does not exceed 2000 A. The possible overload capability with 1.8 times the actual rated current can be additionally utilized in the process.

2) Definition of degree of pollution 2: Under normal conditions, only non-conductive pollution occurs. Occasionally, pollution may become conductive for a short period of time when the electronic equipment is not in operation.

**Derating as a function of installation altitude**

Units can operate at altitudes of up to 4500 m when the electronics is supplied with voltages of 460 VAC line-to-line (maximum 300 VAC to earth). The maximum permissible voltage up to 5000 m is 400 VAC line-to-line (maximum 230 VAC to earth).

At higher altitudes, or at higher voltages, only basic insulation is afforded rather than "Protection by electrical separation".

### Standards

- **EN 50178**: Electronic equipment for use in power installations
- **EN 60068**: Part 2 A93; Basic environmental testing procedures; Tests
- **EN 61800**: Part 1; Adjustable speed electrical power drive systems: General requirements. Rating specifications for low voltage adjustable speed d.c. power drive systems
- **EN 60146**: Part 1; Semiconductor converters; general requirements and line commutated converters
- **EN 60204**: Machine directive
- **EN 60529**: Part 4-2 A12.01; Degrees of protection provided by enclosures (EN 60529: 1991)
- **EN 60721**: Classification of environmental conditions
- **EN 61140**: Part 1 A08.03; Protection against electric shock
- **EN 61800**: Part 3; Adjustable speed electrical power drive systems – Part 3: EMC product standard including specific test methods
- **DIN VDE 0110**: Part 1 and 2 A01.89; Insulation coordination for equipment within low-voltage systems – Coordination of high-frequency voltage stress
- **SN 36350**: Environmentally compatible product design (Siemens Standard)
- **UL 508 C**: Power conversion equipment
<1> CAUTION!
Operation without main contactor is not permitted.
The control voltage for the main contactor (or the circuit-breaker) must always be led via the XR terminal (connections 109 and 110) of the SIMOREG device and the X_SCHÜTZ terminal (connections 4 and 5) of the SIMOREG CCP.

For parallel connection, all SIMOREG devices must be included in this interlock chain.
In applications with SIMOREG CCP, if a fault occurs, the basic unit or the SIMOREG CCP must be able to reliably separate the arrangement from the supply line voltage.

Also note that the total of the delay times for all switching elements contained in the control loop must not exceed the time set on the P089 parameter.

For converter devices SIMOREG DC MASTER connected in parallel one SIMOREG CCP is connected directly parallel to each (see overview diagram page 7/7).
1) The same phase sequence is required between 1U1 / 1V1 / 1W1.
2) The same phase sequence is required between 1C1 / 1D1.
3) Connecting cables:
   3.1) Connection of the SIMOREG devices in parallel
   3.2) Serial connection of SIMOREG device - SIMOREG CCP
   3.3) Extinction pulse interface
   3.4) Group firing pulse interface
4) These fuses may only be used on converters up to 850 A
5) For converters up to 850 A in 4Q operation only

Warning:
The triggering of the main contactors is not shown here.
Please refer to the connection suggestion on page before.

For further connections for the SIMOREG devices, see operating instructions for the SIMOREG DC-MASTER 6RA70.
## Options

<table>
<thead>
<tr>
<th>Description</th>
<th>Order No.:</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Description</strong></td>
<td></td>
</tr>
<tr>
<td>Operating instructions in printed form for Converter Commutation Protector SIMOREG CCP in German / English French / Italian / Spanish</td>
<td>6RX1700-0DD74 6RX1700-0DD83</td>
</tr>
<tr>
<td><strong>Operating instructions</strong> for SIMOREG DC Master 6RA70 and SIMOREG CCP and Drive Monitor in German / English / French / Italian / Spanish on CD-ROM</td>
<td>6RX1700-0AD64</td>
</tr>
<tr>
<td><strong>UTP CAT5 patch cable</strong></td>
<td></td>
</tr>
<tr>
<td>in accordance with ANSI/EIA/TIA 568 Parallel switch cable for SIMOREG 6RA70 and SIMOREG CCP approx. 5 m Connecting cable for the extinction-pulse interface for connecting SIMOREG CCPs in parallel connecting cable for the group firing-pulse interface to the SIMOREG (CUD2)</td>
<td>6RY1707-0AA08</td>
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# SIMOREG 6RA70 DC MASTER

## Selection and Ordering Data

<table>
<thead>
<tr>
<th>Section</th>
<th>Description</th>
</tr>
</thead>
</table>
| 8/2     | Chassis converters  
          | Single-quadrant operation  
          | Four-quadrant operation |
| 8/3     | SIMOREG CM Control Module  
          | Electronics options  
          | Ordering information  
          | Options for the basic unit  
          | Options for which an LBA or LBA + ADB are necessary  
          | Interface boards SCI1 and SCI2  
          | Options for the SIMOREG CM unit |
| 8/4     | SIMOREG CCP  
          | Miscellaneous options  
          | Operating and monitoring  
          | SIMOREG 6RL70 rectifier  
          | Documentation |
### Chassis and Ordering Data

#### Field Circuit

<table>
<thead>
<tr>
<th>V</th>
<th>V</th>
<th>A</th>
<th>Rated output</th>
<th>Rated supply voltage</th>
<th>Rated DC current</th>
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<tbody>
<tr>
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<td>5</td>
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<tr>
<td>60</td>
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<tr>
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<td>125</td>
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<tr>
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#### Converter

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<tr>
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#### Fuses

<table>
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<th>Order No.:</th>
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</table>

1) 50/60 Hz
2) Integrated branch fuses, no external semiconductor protection devices are necessary
3) UL recognized
## SIMOREG 6RA70 DC MASTER
### Selection and Ordering Data

Chassis converters for four-quadrant operation

### Rated data

<table>
<thead>
<tr>
<th>Armature circuit</th>
<th>Rated data</th>
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<td>Rated supply voltage</td>
<td>Rated DC voltage</td>
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<tr>
<td>V</td>
<td>V</td>
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<tr>
<td>3-ph. AC 400</td>
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<td>2200</td>
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<tr>
<td>2800</td>
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<td>3-ph. AC 830</td>
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<table>
<thead>
<tr>
<th>Armature circuit</th>
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<tbody>
<tr>
<td>Rated supply voltage</td>
<td>Rated DC voltage</td>
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<tr>
<td>V</td>
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<tr>
<td>3AC 85/25V</td>
<td>575/1000</td>
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---

1) 50/60 Hz

2) Integrated branch fuses, no external semiconductor protection devices are necessary

3) Parallel connection

4) UL recognized

---

SIMOREG CM Control Module 6RA70
## Ordering information

When a SIMOREG converter is ordered with an additional option, the suffix "-Z" plus the appropriate short code must be added to the converter order number.

The options ordered with the short code are supplied installed by the factory.

| Order No. of the SIMOREG unit short codes (several order codes can be added in sequence) |

### Options for the basic unit

<table>
<thead>
<tr>
<th>Board</th>
<th>Description</th>
<th>Short code</th>
<th>Order No.:</th>
</tr>
</thead>
<tbody>
<tr>
<td>CUD2</td>
<td>Terminal expansion board for basic unit</td>
<td>K00</td>
<td>6RX1700-0AK00</td>
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<tr>
<td></td>
<td>Parallel connection cable</td>
<td></td>
<td>6RY1707-0AA08</td>
</tr>
<tr>
<td></td>
<td>Option extra-low voltage for 400 V / 460 V / 575 V units</td>
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</table>

### Options for which an LBA or LBA + ADB are necessary

<table>
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<tr>
<th>Board</th>
<th>Description</th>
<th>Short code</th>
<th>Installed in slot</th>
<th>Order No.:</th>
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<tbody>
<tr>
<td>LBA</td>
<td>Local Bus Adapter for the electronics box</td>
<td>K11</td>
<td>D E F G</td>
<td>6SE7090-0XX84-0HA0</td>
</tr>
<tr>
<td>ADB</td>
<td>Adapter board 1) Prequisite for installing optional supplementary boards</td>
<td>Location 2</td>
<td>K01 K01 K02 K02</td>
<td>6SE7090-0XX84-0KA0</td>
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<tr>
<td></td>
<td>SBP 2)</td>
<td>Location 3</td>
<td>- - - -</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Pulse encoder evaluation board 3)</td>
<td>-</td>
<td>- - - -</td>
<td>-</td>
</tr>
<tr>
<td>EB1</td>
<td>Terminal expansion board 1)</td>
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<td>G64 G65 G66 G67</td>
<td>6SX7010-0KB00</td>
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<tr>
<td>EB2</td>
<td>Terminal expansion board 1)</td>
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<td>G74 G75 G76 G77</td>
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<td>SLB</td>
<td>SIMOLINK board 1)</td>
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<td>6SX7010-0FJ00</td>
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<td>CBP2</td>
<td>Communication board with interface for SINEC L2 DP, PROFIBUS-DP 1)</td>
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<td>G94 G95 G96 G97</td>
<td>6SX7010-0FF05</td>
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<tr>
<td>CBC</td>
<td>Communication board with interface for CAN protocol 1)</td>
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<td>G24 G25 G26 G27</td>
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<tr>
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<td>Communication board with interface for DeviceNet protocol 1)</td>
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<td>G54 G55 G56 G57</td>
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<tr>
<td>SCB1</td>
<td>Interface board with fiber-optic cable connection</td>
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<tr>
<td>T100</td>
<td>Technology board incl. hardware manual without software module 3)</td>
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<tr>
<td>MS100</td>
<td>Software module “Universal drive” for T100 (EPROM) without manual</td>
<td>-</td>
<td>- - - -</td>
<td>-</td>
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</table>
|       | Manual for software module MS100 “Universal drive”:  
  • German  
  • English  
  • French  
  • Spanish  
  • Italian | -         | - - - -            | -          |
| T300  | Technology board with 2 connecting cables SC58 and SC60, terminal strip SE300 and hardware manual 3) | -         | - - - -            | -          |
| T400  | Technology board (incl. Brief Description) 3) | -         | - - - -            | -          |

1) These supplementary boards are supplied as a retrofit kit (with connector and Brief Description).
   The boards can be ordered as spare parts with the following order numbers:

<table>
<thead>
<tr>
<th>Board</th>
<th>Spare part (no accessories)</th>
<th>Order No.:</th>
</tr>
</thead>
<tbody>
<tr>
<td>SBP</td>
<td>6SE7090-0XX84-0FA0</td>
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<td>EB1</td>
<td>6SE7090-0XX84-0B0</td>
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<td>SLB</td>
<td>6SE7090-0XX84-0F00</td>
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<td>CBP2</td>
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</tr>
<tr>
<td>CBD</td>
<td>6SE7090-0XX84-0FK0</td>
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</tr>
</tbody>
</table>

2) The SIMOREG unit is already equipped with a pulse encoder evaluation board in the basic unit, so the SBP is only necessary when a second pulse encoder is to be evaluated.

3) For installation of the board in the SIMOREG unit, the Local Bus Adapter LBA is also required. This must be ordered separately.
**Interface boards SCI1 and SCI2**

Interface boards SCI1 and SCI2 and interface board SCB1 can be used to assemble a serial I/O system with a fiber-optic conductor that can expand the binary and analog inputs and outputs considerably.

<table>
<thead>
<tr>
<th>Board</th>
<th>Description</th>
<th>Order No.:</th>
</tr>
</thead>
<tbody>
<tr>
<td>SCI1</td>
<td>Interface board binary and analog inputs/outputs supplied with 10 m fiber-optic cable</td>
<td>6SE7090-0XX84-3EA0</td>
</tr>
<tr>
<td>SCI2</td>
<td>Interface board binary inputs/outputs supplied with 10 m fiber-optic cable</td>
<td>6SE7090-0XX84-3EF0</td>
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</table>

**Options for the SIMOREG CM unit**

<table>
<thead>
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<th>Description</th>
<th>Length</th>
<th>Order No.:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supplementary housing</td>
<td>–</td>
<td>6RY1705-0CM00</td>
</tr>
<tr>
<td>Rear housing part including accessories for the mounting of the firing pulse transfer module and/or fuse monitoring module in a parallel connection.</td>
<td>–</td>
<td>6RY1707-0CM00</td>
</tr>
<tr>
<td>Set of unassembled parts</td>
<td>–</td>
<td>6RY1707-0CM00</td>
</tr>
<tr>
<td>Screws, dowel pins and snap-on devices for the external mounting of module parts</td>
<td>–</td>
<td>6RY1707-0CM00</td>
</tr>
<tr>
<td>Preassembled ribbon cable set</td>
<td>3 m</td>
<td>6RY1707-0CM01</td>
</tr>
<tr>
<td>2 off 26-core ribbon cable, shielded</td>
<td>10 m</td>
<td>6RY1707-0CM02</td>
</tr>
<tr>
<td>2 off 10-core ribbon cable, shielded</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Preassembled cable set for current transformer</td>
<td>2 m</td>
<td>6RY1707-0CM03</td>
</tr>
<tr>
<td>2 off 2-core twisted-pair cable, shielded</td>
<td>10 m</td>
<td>6RY1707-0CM04</td>
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<tr>
<td>Preassembled cable set for heat-sink temperature sensing</td>
<td>10 m</td>
<td>6RY1707-0CM05</td>
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<tr>
<td>1 off 2-core shielded cable</td>
<td></td>
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</tr>
<tr>
<td>Preassembled cable set for firing pulse leads</td>
<td>3 m</td>
<td>6RY1707-0CM06</td>
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<tr>
<td>Bridging kit for 12 off 2-core twisted-pair cable</td>
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<td>6RY1707-0CM06</td>
</tr>
<tr>
<td>Preassembled cable set for fuse monitoring</td>
<td>10 m</td>
<td>6RY1707-0CM07</td>
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<tr>
<td>6 off 2-core twisted-pair cable, shielded</td>
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<tr>
<td>Preassembled cable set for voltage sensing</td>
<td>3 m</td>
<td>6RY1707-0CM08</td>
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<tr>
<td>1 off 3-core twisted-pair cable U-V-W</td>
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<td>1 off 2-core twisted-pair cable</td>
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<tr>
<td>Preassembled cable set for activation of the firing pulse transfer elements</td>
<td>1 m</td>
<td>6RY1707-0CM13</td>
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<tr>
<td>2 off 2-core shielded cable</td>
<td>10 m</td>
<td>6RY1707-0CM10</td>
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<tr>
<td>Preassembled cable set for cradle mounting side by side</td>
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<td>6RY1707-0CM11</td>
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<tr>
<td>2 off 26-core ribbon cable</td>
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<tr>
<td>2 off 10-core ribbon cable</td>
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<tr>
<td>1 off 20-core ribbon cable</td>
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</table>

**Rated voltage**

<table>
<thead>
<tr>
<th>Rated voltage</th>
<th>Rated current</th>
<th>Live area that can be covered (*)</th>
<th>SIMOREG CCP</th>
<th>Order No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>460 V</td>
<td>600 A</td>
<td>up to 600 A</td>
<td>600 A/460 V</td>
<td>6RA7085-4FC00-0</td>
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<tr>
<td>460 V</td>
<td>1200 A</td>
<td>up to 1200 A</td>
<td>1200 A/460 V</td>
<td>6RA7091-4FC00-0</td>
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<tr>
<td>460 V</td>
<td>2000 A</td>
<td>up to 2000 A</td>
<td>2000 A/460 V</td>
<td>6RA7095-4FC00-0</td>
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<tr>
<td>690 V</td>
<td>1000 A</td>
<td>up to 1000 A</td>
<td>1000 A/690 V</td>
<td>6RA7090-6KC00-0</td>
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<tr>
<td>690 V</td>
<td>2000 A</td>
<td>up to 2000 A</td>
<td>2000 A/690 V</td>
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(*) see “Technical Data”

**Options for the SIMOREG CCP Converter Commutation Protector**

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<th>Description</th>
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<tr>
<td>UTP CAT5 patch cable in accordance with ANSI/EIA/TIA 568</td>
<td>6RX1707-0AA08</td>
<td>6RX1707-0AA08</td>
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<tr>
<td>Connecting cable for the extinction-pulse interface for connecting SIMOREG CCPs in parallel</td>
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<td>Connecting cable for the group firing-pulse interface to the SIMOREG (CUD2)</td>
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### Operating and monitoring

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<tr>
<td>Connecting cable DriveMonitor PC – PMU (RS232)</td>
<td>3 m</td>
<td>6SX7005-0AB00</td>
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<tr>
<td>Interface converter SU1 RS232 - RS485, including mounting accessories, connection to power supply: 1 CA 115 V / 230 V</td>
<td>–</td>
<td>6SX7005-0AA00</td>
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<tr>
<td>OP15 operator panel</td>
<td>–</td>
<td>6SE7090-0XX94-2FK0</td>
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<tr>
<td>Adapter AOP1 for cabinet door mounting of OP15</td>
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<td>6SX7010-0AA00</td>
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<td>6SX7010-0AB03</td>
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### SIMOREG 6RL70 rectifier module

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<th>Armature circuit</th>
<th>Rated supply voltage 1)</th>
<th>Rated DC voltage</th>
<th>Rated DC current</th>
<th>Rated power</th>
<th>Order No.:</th>
<th>Fuses armature circuit</th>
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<tr>
<td></td>
<td>3-ph. AC 690</td>
<td>930</td>
<td>1000</td>
<td>930</td>
<td>6RL7091-6KS00-0</td>
<td>Phase 3)</td>
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<td>3-ph. AC 690</td>
<td>930</td>
<td>2000</td>
<td>1860</td>
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### Documentation

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<td>SIMOREG DC MASTER operating instructions</td>
<td>D00</td>
<td>6RX1700-0AD00</td>
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<td>The units are supplied with a Brief Description, Operating Instructions must be ordered.</td>
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<tr>
<td>• German</td>
<td>D72</td>
<td>6RX1700-0AD72</td>
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<td>• Italian</td>
<td>D76</td>
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<td>• French</td>
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<td>• Spanish</td>
<td>D78</td>
<td>6RX1700-0AD78</td>
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<tr>
<td>Operating Instructions and DriveMonitor</td>
<td>D64</td>
<td>6RX1700-0AD64</td>
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<td>in all the languages listed above on CD-ROM</td>
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<tr>
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| SIMOREG CM operating instructions                                 | D72        | 6RX1700-0BD72     |
| The units are supplied with German Operating Instructions as standard, other language versions must be ordered with short code. |            |                   |
| • German                                                         | D76        | 6RX1700-0BD76     |
| • Italian                                                       | D77        | 6RX1700-0BD77     |
| • French                                                        | D78        | 6RX1700-0BD78     |
| Operating Instructions and DriveMonitor                          | D64        | 6RX1700-0AD64     |
| in all the languages listed above on CD-ROM                     |            |                   |

| SIMOREG 6RL70 operating instructions                              | D74        | 6RX1700-0DD74     |
| The units are supplied with Operating Instructions in five languages. |            |                   |
| • German / English                                               | D83        | 6RX1700-0DD83     |
| • French / Italian / Spanish                                     |            |                   |
| Operating Instructions and DriveMonitor                          | D64        | 6RX1700-0AD64     |
| in all the languages listed above on CD-ROM                     |            |                   |

1) 50/60 Hz
2) Integrated branch fuses, no external semiconductor protection devices are necessary
3) UL recognized
### Converters for single-quadrant operation

<table>
<thead>
<tr>
<th>Page</th>
<th>Description</th>
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<tr>
<td>9/2</td>
<td>3-ph. AC 400 V and 460 V, 30 A</td>
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<tr>
<td>9/2</td>
<td>3-ph. AC 400 V and 575 V, 60 A to 280 A</td>
</tr>
<tr>
<td>9/3</td>
<td>3-ph. AC 400 V and 575 V, 400 A</td>
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<tr>
<td>9/3</td>
<td>3-ph. AC 400 V and 575 V, 600 A</td>
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<tr>
<td>9/4</td>
<td>3-ph. AC 400 V, 575 V and 690 V, 720 A to 850 A</td>
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<tr>
<td>9/4</td>
<td>3-ph. AC 400 V, 460 V, 575 V, 690 V and 830 V, 900 A to 1200 A</td>
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<td>9/5</td>
<td>3-ph. AC 400 V, 575 V, 690 V and 830 V, 1500 A to 2200 A</td>
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<tr>
<td>9/6</td>
<td>3-ph. AC 400 V, 575 V, 690 V and 950 V, 2200 A to 3000 A</td>
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### Converters for four-quadrant operation

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<td>3-ph. AC 400 V and 575 V, 60 A to 280 A</td>
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<tr>
<td>9/8</td>
<td>3-ph. AC 400 V and 575 V, 400 A to 600 A</td>
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<td>9/8</td>
<td>3-ph. AC 400 V, 575 V and 690 V, 760 A to 850 A</td>
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<td>3-ph. AC 400 V, 460 V, 575 V, 690 V and 830 V, 950 A to 1200 A</td>
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<td>3-ph. AC 400 V, 575 V, 690 V and 830 V, 1500 A to 2200 A</td>
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<td>9/10</td>
<td>3-ph. AC 400 V, 575 V, 690 V and 950 V, 2200 A to 3000 A</td>
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### Converters with additional power circuit terminals on their top panel

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<th>Page</th>
<th>Description</th>
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<tr>
<td>9/12</td>
<td>3-ph. AC 460 V, 450 A to 600 A, 1Q</td>
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<td>9/13</td>
<td>3-ph. AC 460 V, 60 A to 125 A, 4Q</td>
</tr>
<tr>
<td>9/13</td>
<td>3-ph. AC 460 V, 210 A to 280 A, 4Q</td>
</tr>
<tr>
<td>9/14</td>
<td>3-ph. AC 460 V, 450 A to 600 A, 4Q</td>
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<tr>
<td>9/14</td>
<td>3-ph. AC 460 V, 850 A, 4Q</td>
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### 6RL70 rectifier module

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</tr>
<tr>
<td>9/15</td>
<td>3-ph. AC 690 V, 2000 A</td>
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### SIMOREG CM
- Device components assembled
- Device components alongside each other

### SIMOREG CCP
- 600 A, 1000 A, 1200 A
- 2000 A
3-ph. AC 400 V and 460 V, 30 A

Fig. 9/1

3-ph. AC 400 V and 575 V, 60 A to 280 A

Fig. 9/2

1) Minimum free space for air circulation; it is necessary to ensure that the cooling air intake is sufficient.
3-ph. AC 400 V and 575 V, 400 A

3-ph. AC 400 V and 575 V, 600 A

1) Minimum free space for air circulation; it is necessary to ensure that the cooling air intake is sufficient.
3-ph. AC 400 V, 575 V and 690 V, 720 A to 850 A

3-ph. AC 400 V, 460 V, 575 V, 690 V and 830 V, 900 A to 1200 A

1) Minimum free space for air circulation; it is necessary to ensure that the cooling air intake is sufficient.
3-ph. AC 400 V, 575 V, 690 V and 830 V, 1500 A to 2000 A; 575 V, 2200 A

Converters for single-quadrant operation

Fig. 9/7

1) Minimum free space for air circulation; it is necessary to ensure that the cooling air intake is sufficient.
SIMOREG 6RA70 DC MASTER
Dimension Drawings

Converters for single-quadrant operation

3-ph. AC 400 V, 3000 A; 575 V, 2800 A; 690 V, 2600 A; 950 V, 2200 A

---

1) Minimum free space for air circulation; it is necessary to ensure that the cooling air intake is sufficient.
3-ph. AC 400 V and 460 V, 15 A to 30 A

Converters for four-quadrant operation

Fig. 9/8

3-ph. AC 400 V and 575 V, 60 A to 280 A

1) Minimum free space for air circulation; it is necessary to ensure that the cooling air intake is sufficient.
SIMOREG 6RA70 DC MASTER

Dimension Drawings

Conerters for four-quadrant operation

3-ph. AC 400 V and 575 V, 400 A to 600 A

![Diagram of SIMOREG 6RA70 DC MASTER 3-ph. AC 400 V and 575 V, 400 A to 600 A]

Fig. 9/10

3-ph. AC 400 V, 575 V and 690 V, 760 A to 850 A

![Diagram of SIMOREG 6RA70 DC MASTER 3-ph. AC 400 V, 575 V and 690 V, 760 A to 850 A]

Fig. 9/11

1) Minimum free space for air circulation; it is necessary to ensure that the cooling air intake is sufficient.
3-ph. AC 400 V, 460 V, 575 V, 690 V and 830 V, 950 A to 1200 A

3-ph. AC 400 V, 575 V, 690 V and 830 V, 1500 A to 2000 A; 575 V, 2200 A

Fig. 9/12

Fig. 9/13

1) Minimum free space for air circulation; it is necessary to ensure that the cooling air intake is sufficient.
Converters for single-quadrant operation

- 3-ph. AC 400 V, 3000 A; 575 V, 2800 A; 690 V, 2600 A; 950 V, 2200 A

Fig. 9/13a

1) Minimum free space for air circulation; it is necessary to ensure that the cooling air intake is sufficient.
3-ph. AC 460 V, 60 A to 125 A, 1Q

- 3-ph. AC 460 V, 210 A to 280 A, 1Q

Fig. 9/14

Fig. 9/15

1) Minimum free space for air circulation; it is necessary to ensure that the cooling air intake is sufficient.
SIMOREG 6RA70 DC MASTER
Dimension Drawings

Converters with additional power circuit terminals on their top panel

3-ph. AC 460 V, 450 A to 600 A, 1Q

Fig. 9/16

3-ph. AC 460 V, 850 A, 1Q

Fig. 9/17

1) Minimum free space for air circulation; it is necessary to ensure that the cooling air intake is sufficient.
SIMOREG 6RA70 DC MASTER
Dimension Drawings

Converters with additional power circuit terminals on their top panel

3-ph. AC 460 V, 60 A to 125 A, 4Q

<table>
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<tr>
<th>Dimensions of Converters</th>
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<tbody>
<tr>
<td>3-ph. AC 460 V, 60 A</td>
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<tr>
<td>3-ph. AC 460 V, 125 A</td>
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Fig. 9/18

3-ph. AC 460 V, 210 A to 280 A, 4Q

<table>
<thead>
<tr>
<th>Dimensions of Converters</th>
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<tbody>
<tr>
<td>3-ph. AC 460 V, 210 A</td>
</tr>
<tr>
<td>3-ph. AC 460 V, 280 A</td>
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</table>

Fig. 9/19

1) Minimum free space for air circulation; it is necessary to ensure that the cooling air intake is sufficient.
3-ph. AC 460 V, 450 A to 600 A, 4Q

Fig. 9/20

3-ph. AC 460 V, 850 A, 4Q

Fig. 9/21

1) Minimum free space for air circulation; it is necessary to ensure that the cooling air intake is sufficient.
Siemens DA 21.1 · 2006

3-ph. AC 690 V, 1000 A

for M10

3-ph. AC 690 V, 1000 A

for M12

Front view without door

View of rear thyristor level

Fig. 9/22

1) Minimum free space for air circulation; it is necessary to ensure that the cooling air intake is sufficient.
Device components assembled (as-supplied state)

Fig. 9/24

Device components alongside each other

Fig. 9/25
600 A, 1000 A, 1200 A

Fig. 9/26

2000 A

Fig. 9/27
SIMOREG
6RA70 DC MASTER
Documentation and Training

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<th>Training</th>
<th>Demonstration model</th>
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<td>10/3 Documentation for electronics options</td>
<td>10/5 SIMOREG 6RA70 DC MASTER Commissioning (SD-GMP5)</td>
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Documentation overview

The documentation for the SIMOREG DC MASTER converters is available at three different levels:

- Description
- Operating instructions
- Documentation on CD-ROM

These types of documentation differ with regard to their content and medium (printed or on CD-ROM).

Description

The Description is supplied with every unit as a manual with the exception of the SIMOREG CM unit. The content is an excerpt from the Operating Instructions and contains the same Sections with the exception of Sections 9 (function descriptions), 11 (parameter list) and 12 (list of connectors and binectors). The Description contains the information in English and German. Versions in other languages are not available.

The Description provides the necessary product documentation (such as dimension drawings, technical data, function diagrams and descriptions of the errors and warnings). The commissioning instructions it contains supports commissioning of a unit and in addition – for the experienced user of SIMOREG DC MASTER converters – project engineering on the basis of function diagrams is possible.

Operating instructions

The Operating Instructions contain all the relevant data for the SIMOREG DC MASTER converters. In addition to the information provided in the Description, the Operating Instructions contain the detailed function description, the extensive parameter description and the complete list of connectors and binectors. The Operating Instructions are available in five languages: English, German, French, Spanish and Italian and must be ordered separately. German Operating Instructions are supplied with the SIMOREG CM unit, other language versions must be ordered with a “Z” option.

The Operating Instructions are required when:

- Access to the parameter list is necessary
- Complex project engineering requires functions over and above the factory settings or the standard drive functions
- The dynamic overload capability of the units is to be individually utilized.

Documentation on CD-ROM

The product CD-ROM contains all the Operating Instructions for the converters and for the SIMOREG CM unit in electronic form. The files are provided in Acrobat and Winword file format.

On the CD-ROM, there are articles about DC drive applications and implementation, on topics such as:

- Axle winders
- 12-pulse applications
- Control sequence changeover (Master Slave operation)
- SIMOREG as field supply unit
- Tips for project engineering and more. These articles are continuously reviewed and updated.

The CD-ROM also contains the DriveMonitor for commissioning, parameter setting and diagnosis via the PC. The DriveMonitor supersedes SIMOVIS and is a component of the Drive Engineering System “Drive ES”.

On the CD-ROM, there are articles about DC drive applications and implementation, on topics such as:
## Documentation for SIMOREG units

<table>
<thead>
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<th>Language</th>
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## Documentation for electronics options

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<td>Communication board CBC</td>
<td>6SE708-0NX84-0GF0</td>
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<td>Communication board SBP</td>
<td>6SE708-0NX84-0FA0</td>
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<td>Terminal expansion board EB1</td>
<td>6SE708-0NX84-0KB0</td>
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<td>T400 technology board, User's Guide for T400 hardware and project engineering</td>
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<td>6DD1903-0EA0</td>
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<td>MS320 software module</td>
<td>German</td>
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Training center

Siemens Training for A&D and I&S has branches throughout the world and offers the full range of courses presented in the training program for SIMOREG DC MASTER converters. Courses are also offered for the complete spectrum of the world of automation and drives. Individual tailoring of the course content and training at the customer site is possible.

With the innovative concept for imparting knowledge at all levels, SITRAIN offers a comprehensive service for qualification of personnel. From the standard course through to individually tailored training courses and workshops, know-how to suit all requirements can be acquired:

- Technical know-how for automation, drive technology, power engineering, instrumentation, industrial IT, electronics and mechanical engineering
- Method know-how for systematic fault diagnosis, project management and maintenance management
- Process know-how for sector-specific automation processes.

Contact:
Siemens AG
Training Center
Course Office
Werner-von-Siemens-Str. 65
D-91052 Erlangen
Tel.: +49 (0)9131-7-29262
Fax: +49 (0)9131-7-28172
e-mail: info@sitrain.com
Current Information about our wide range of Training:
www.siemens.com/sitrain

SIMOREG learning path SD4

Programmers, Configuration engineers, Commissioning engineers, Service personnel, Maintenance personnel

<table>
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<tr>
<th>Basics of Drive Technology</th>
<th>SIMOREG K 6RA24 (MP) Commissioning</th>
<th>SIMOREG 6RA70 DC Master Commissioning</th>
<th>Mastering Faults in a Drive – DC-Drives</th>
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<tr>
<td>D-GAT 5 days</td>
<td>D-GMP3 5 days</td>
<td>D-GMP5 5 days</td>
<td>D-IHD02 3 days</td>
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</table>
Training courses SIMOREG 6RA70 DC Master – Commissioning (SD-GMP5)

Course description

The target is to learn the principle of operation of the converter equipment and the serial interfaces and to be able to start up the converter. The participants learn to adapt the parameters to the requirements of the drive and record them, to diagnose faults, alarms and to solve problems.

Target group
- Programmer
- Commissioning engineers, Configuration engineers
- Service personnel

Duration 5 days

Content
- Presentation of the concept of the series SIMOREG DC MASTER
- Explanation of the principle of operation
- Commissioning of the drive, parametrization and verifying of the controller-optimization
- Structure of the function diagrams
- Operating conditions, faults and alarms
- Function of the binary and analog in- and outputs
- Reading and loading parameters with DriveMonitor and OP1S
- Trace-buffer
- Peer-to-peer and SIMOLINK-function
- Practical training, based on selected applications
- Selected examples of the free functions
- Introduction of Retrofit with SIMOREG CM (Control module)
- Troubleshooting

SIMOREG DC MASTER demonstration model

Portable demonstration models are available for SIMOREG 6RA70 DC MASTER converters.

Field of application
- Presentation of Siemens DC drives to customers
- Familiarization of Siemens personnel in the Regional Offices and National Companies
- Training of customers
- Test set-ups with PROFIBUS-DP

Design
The SIMOREG DC MASTER demonstration model comprises 2 cases.

Mains connection
The equipment is connected to the mains via a 16 A CECON plug (5UR5076-3) with a cable of approximately 3 m in length.

The supply voltage for the selected SIMOREG unit is 3-ph. AC 400 V (+15% / -20%) and the rated frequency is 45 to 65 Hz.

Selection and ordering data

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<td>SIMOREG DC MASTER 6RA70 demonstration case</td>
<td>6RX1700-0SV00</td>
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<td>Demonstration case containing 1GA51...DC motor</td>
<td>6RX1240-0MW00</td>
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<td>Mobile trolley for both demonstration cases</td>
<td>6SX7000-0AE01</td>
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A/9 Customer Support
A/10 Conditions of Sale and Delivery, export regulations
Siemens AG has committed itself to protecting the environment and conserving valuable natural resources. This applies both to production and to the products we sell.

As early as the development phase, the possible impact of future products and systems on the environment is taken into consideration. Our aim is to prevent environmental pollution or, at least, reduce it to a minimum and, in doing so, look beyond existing regulations and legislation.

**Environmental aspects of development**

The use of dangerous substances (such as arsenic, asbestos, beryllium and many others in accordance with the internal standard SN 36350 and the EU directives) has already been avoided in the development stage.

Flame resistant materials containing halogen and insulation materials containing silicon have been replaced by components with neutral materials.

Easily dismantled joints have been designed and attention has been paid to increased uniformity of types and grades of materials.

Furthermore, recyclable materials have been given priority, or materials which can be disposed of without any problems.

The number of components has been significantly reduced by using large-scale integrated components and due to the modular design of the complete converter range. In addition attention has also been paid to low power losses and to high efficiency of the devices.

Particular attention is paid to reducing the volume, mass and range of types of the metal and plastic components.

Environmental aspects were an important criteria in selecting the supplied components.

**Environmental aspects of manufacturing**

The supplied components are mainly transported in reusable packaging. The PCBs are produced on modern, energy-saving production equipment.

When selecting the used auxiliary materials attention is paid to their environmental compatibility in accordance with internal standard SN 36350.

The end devices are produced taking ergonomic aspects into account. The waste products arising during production are recycled to a large extent.

**Despatch**

The packaging material of the final product can be recycled and mainly comprises cardboard.

**Environmental aspects of disposal**

The unit can be disassembled into recyclable mechanical components by means of easily removed screw and snap-on fixings.

The PCBs can be recycled on account of their high quality components.

The entire documentation is printed on chlorine-free bleached paper.
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Certificates
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SIMOREG 6RA70 DC MASTER
Simonreg 6 Ra70 DC Master

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<th>Carrier for small-format supplementary boards (Adapter Board)</th>
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<td>CAN</td>
<td>Fieldbus specification for the CiA user organization (CAN in Automation) (Controller Area Network)</td>
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<td>CAL</td>
<td>CAN Application Layer</td>
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<td>CBC</td>
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<td>Supplementary board for DeviceNet interfacing (Communication Board DeviceNet)</td>
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<td>CBP2</td>
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<td>COB</td>
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<td>DeviceNet</td>
<td>Fieldbus specification of ODVA (Open DeviceNet Vendor Association)</td>
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<td>DP</td>
<td>Dezentrale Peripherie</td>
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<td>Supplementary board with additional inputs/outputs (Expansion Board 1)</td>
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<td>EB2</td>
<td>Supplementary board with additional inputs/outputs (Expansion Board 2)</td>
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<td>Identifier for CAN bus communication</td>
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<td>IND</td>
<td>Parameter Index</td>
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<td>Backplane wiring for the installation of supplementary modules (Local Bus Adapter)</td>
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<td>MSCY_C1</td>
<td>Designation of a transmission channel for PROFIBUS-DP (Master Slave Cyclic / Class 1)</td>
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<td>OP1S</td>
<td>Optional control panel with plain text display and internal memory for parameter sets (Operator Panel 1 / Store)</td>
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<td>PDO</td>
<td>Process Data Object (CAN bus)</td>
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<td>PKE</td>
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<td>PKW</td>
<td>Related to a parameter (Parameter-Kennung Wert)</td>
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<td>PMU</td>
<td>Simple control panel for the SIMOREG DC MASTERS (Parameterization Unit)</td>
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<td>PNU</td>
<td>ParameterN NUMBER</td>
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<td>PPO</td>
<td>Definition of number of parameter and process data words for PROFIBUS-DP communication (Parameter Process data Object)</td>
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<td>Prozessdaten</td>
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<td>S</td>
<td>SBP</td>
<td>Supplementary board for tacho interfacing (Sensor Board Pulse)</td>
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<td>SCB1</td>
<td>Supplementary board for interfacing from SCI1 or SCI2 via fiber-optic cable (Serial Communication Board 1)</td>
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<td>SCI1</td>
<td>Supplementary board with additional inputs/outputs; I/O slave module on SCI1 (Serial Communication Interface 1)</td>
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<td>SCI2</td>
<td>Supplementary board with additional inputs/outputs; I/O slave module on SCB1 (Serial Communication Interface 2)</td>
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<td>S</td>
<td>SDO</td>
<td>Service Data Object (CAN bus)</td>
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<td>SIMOLINK</td>
<td>Fieldbus specification for fiber-optic ring bus (Siemens Motion Link)</td>
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<td>Steuerwort</td>
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<td>U</td>
<td>USS</td>
<td>Universele serielle Schnittstelle</td>
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<td>Z</td>
<td>ZSW</td>
<td>Zustandswort (status word)</td>
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At
www.siemens.com/automation/partner
you can find details of Siemens contact partners worldwide responsible for particular technologies.

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

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

By further specifying the remaining criteria you will find exactly the right contact partner with his/her respective expertise.
A detailed knowledge of the range of products and services available is essential when planning and configuring automation systems. It goes without saying that this information must always be fully up-to-date.

The Siemens Automation and Drives Group (A&D) has therefore built up a comprehensive range of information in the World Wide Web, which offers quick and easy access to all data required.

Under the address
http://www.siemens.com/automation
you will find everything you need to know about products, systems and services.

Product Selection Using the Offline Mail of Automation and Drives

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

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

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

Information on the interactive catalog CA 01 can be found in the Internet under
http://www.siemens.com/automation/ca01
or on CD-ROM or DVD.

Easy Shopping with the A&D Mall

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

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

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

Please visit the A&D Mall on the Internet under:
http://www.siemens.com/automation/mall
In the face of harsh competition you need optimum conditions to keep ahead all the time:
A strong starting position. A sophisticated strategy and team for the necessary support - in every phase.
Service & Support from Siemens provides this support with a complete range of different services for automation and drives.
In every phase: from planning and startup to maintenance and upgrading.
Our specialists know when and where to act to keep the productivity and cost-effectiveness of your system running in top form.

### Online Support
The comprehensive information system available round the clock via Internet ranging from Product Support and Service & Support services to Support Tools in the Shop.
http://www.siemens.com/automation/service&support

### Technical Support
Competent consulting in technical questions covering a wide range of customer-oriented services for all our products and systems.
Tel.: +49 (0)180 50 50 222
Fax: +49 (0)180 50 50 223
E-Mail: 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. ¹)

### Configuration and Software Engineering
Support in configuring and developing with customer-oriented services from actual configuration to implementation of the automation project. ¹)

### Service On Site
With Service On Site we offer services for startup and maintenance, essential for ensuring system availability.
In Germany
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### Repairs and Spare Parts
In the operating phase of a machine or automation system we provide a comprehensive repair and spare parts service ensuring the highest degree of operating safety and reliability.
In Germany
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### Optimization and Upgrading
To enhance productivity and save costs in your project we offer high-quality services in optimization and upgrading. ¹)

¹) For country-specific telephone numbers go to our Internet site at:
http://www.siemens.com/automation/service&support
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By using this catalog you can acquire hardware and software products described therein from Siemens AG subject to the following terms. Please note! The scope, the quality and the conditions for supplies and services, including software products, by any Siemens entity having a registered office outside of Germany, shall be subject exclusively to the General Terms and Conditions of the respective Siemens entity. The following terms apply exclusively for orders placed with Siemens AG.

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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.

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

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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.

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

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<thead>
<tr>
<th>AL</th>
<th>Number of the German Export List</th>
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<tbody>
<tr>
<td>Products marked other than &quot;N&quot; require an export license.</td>
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<tr>
<td>In the case of software products, the export designations of the relevant data medium must also be generally adhered to.</td>
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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.

<table>
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<tr>
<th>ECCN</th>
<th>Export Control Classification Number</th>
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<tr>
<td>Products marked other than &quot;N&quot; are subject to a reexport license to specific countries.</td>
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<tr>
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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.

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Automation & Drives
Large Drives
Postfach 4743
90025 NÜRNBERG
GERMANY
### Automation and Drives

Interactive catalog on CD-ROM and on DVD

- The Offline Mall of Automation and Drives

**Catalog**: CA 01

### Automation Systems for Machine Tools

SINUMERIK & SIMODRIVE

SINUMERIK & SINAMICS

**Catalogs**: NC 60, NC 61

### Drive Systems

Variable-Speed Drives

- SINAMICS G130 Drive Converter Chassis Units, SINAMICS G130 Drive Converter Cabinet Units
- SINAMICS G110 Inverter Chassis Units
- SINAMICS GM150/SINAMICS SM150 Medium-Voltage Converter 0.6 MVA to 28 MVA
- SINAMICS S120 Vector Control Drive System
- SINAMICS S120 Servo Control Drive System
- SINAMICS S150 Drive Converter Cabinet Units
- Asynchronous Motors Standardline DC Motors
- SIMOREG K 6RA22 Analog Chassis Converters
- SIMOREG DC MASTER 6RA70 Digital Chassis Converters
- SIMOREG DC MASTER 6RM70 Digital Converter Cabinet Units
- SIMOVERT PM Modular Converter Systems
- SIEMOSYN Motors
- MICROMASTER 410/420/430/440 Inverters
- MICROMASTER 411/COMBIMASTER 411
- SIMOVERT MASTERDRIVES Vector Control
- SIMOVERT MASTERDRIVES Motion Control
- Synchronous and asynchronous servomotors for SIMOVERT MASTERDRIVES
- SIMODRIVE 611 universal and POSMO


Low-Voltage Three-Phase-Motors

- Squirrel-Cage Motors, Totally Enclosed, Fan-Cooled
- Automation Systems for Machine Tools SIMODRIVE
  - Main Spindle/Feed Motors
  - Converter Systems SIMODRIVE 611/POSMO
  - Automation Systems for Machine Tools SIMANICS
  - Main Spindle/Feed Motors
  - Drive System SINAMICS S120
- Drive and Control Components for Hoisting Equipment

**Catalogs**: M 11, NC 60, NC 61, HE 1

### Electrical Installation Technology

- ALPHA Small Distribution Boards and Distribution Boards
- ALPHA 8HP Molded-Plastic Distribution System
- ALPHA FIX Terminal Blocks
- BETA Modular Installation Devices
- DELTA Switches and Socket Outlets
- GAMMA Building Management Systems

**Catalogs**: ET A1, ET A3, ET A5, ET B1, ET D1, ET G1

### Human Machine Interface Systems SIMATIC HMI

**Catalog**: ST 80

### Industrial Communication for Automation and Drives

**Catalog**: IK PI

### Low-Voltage

- Controls and Distribution – SIRIUS, SENTRON, SIVACON
- Controls and Distribution – Technical Information
- SIDIAC Reactors and Filters
- SIVENT Fans
- SIVACON 8PS Busbar Trunking Systems

**Catalogs**: LV 1, LV 1 T, LV 60, LV 65, LV 70

### Motion Control System SIMOTION

**Catalog**: PM 10

### Process Instrumentation and Analytics

- Field Instruments for Process Automation
  - Measuring Instruments for Pressure, Differential Pressure, Flow, Level and Temperature, Positioners and Liquid Meters
- SIREC Recorders and Accessories
- SIPART, Controllers and Software
- SIWAREX Weighing Systems
- Continuous Weighing and Process Protection
- Process Analytical Instruments

**Catalogs**: FI 01, MP 12, MP 20, MP 31, WT 01, WT 02, PA 01, PA 11

### SIMATIC Industrial Automation Systems

- SIMATIC PCS Process Control System
  - Products for Totally Integrated Automation and Micro Automation
- SIMATIC PCS 7 Process Control System
  - Add-ons for the SIMATIC PCS 7
  - Process Control System
- Migration solutions with the SIMATIC PCS 7
- Process Control System
- pc-based Automation
- SIMATIC Control Systems

**Catalogs**: ST 45, ST 70, ST PCS 7, ST PCS 7.1, ST PCS 7.2, ST PC, ST DA

### SIMATIC Sensors

**Catalog**: FS 10

### SIPOS Electric Actuators

- Electric Rotary, Linear and Part-turn Actuators
- Electric Rotary Actuators for Nuclear Plants

**Catalogs**: MP 35, MP 3S 1/2

### Systems Engineering

- Power supplies SITOP power
- System cabling SIMATIC TOP connect

**Catalogs**: KT 10.1, KT 10.2

### System Solutions

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

### TELEPERM M Process Control System

**Catalog**: PLT 112

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