Catalog DA 21.1 • 2006

simoreg
DC MASTER

SIEMENS

Digital
Chassis Converters

Catalogs for “Large Drives”

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

Order No.:
German: E86060-K5511-A101-A3
English: E86060-K5511-A101-A3-7600

SINAMICS GM150/SM150
Medium-Voltage Converters
0.8 MVA to 28 MVA
D 12

Order No.:
German: E86060-K5512-A101-A1
English: E86060-K5512-A101-A1-7600

SINAMICS S120
Vector Control Drive System
D 21.1

Order No.:
German: E86060-K5521-A111-A1
English: E86060-K5521-A111-A1-7600

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

Order No.:
German: E86060-K5521-A131-A1
English: E86060-K5521-A131-A1-7600

DC Motors
Sizes 100 to 630
0.45 kW to 1610 kW
DA 12

Order No.:
German: E86060-K5312-A101-A1
English: E86060-K5312-A101-A1-7600

Engineering Information
for Catalog DA 12
DC Motors
DA 12 T

Order No.:
German: E86060-T5312-A101-A1
English: E86060-T5312-A101-A1-7600

SIMOREG DC-MASTER 6RA70
Digital Chassis Converters
DA 21.1

Order No.:
German: E86060-K5321-A111-A1
English: E86060-K5321-A111-A2-7600
French: E86060-K5321-A111-A1-7700

Spare Parts for SIMOREG
Converters (Chassis Units)
DA 21.1 E

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SIMOREG K 6RA22
Analog Chassis Converters
DA 21.2

Order No.:
German: E86060-K5121-A121-A1
English: E86060-K5121-A121-A1-7600

SIMOREG DC MASTER 6RM70
Digital Converter Cabinet Units
DA 22

Order No.:
German: E86060-K5122-A101-A1
English: E86060-K5122-A101-A1-7600

Components for Automation
CA 01

Order No.:
German: E86060-D4001-A100-C5 (CD-ROM)
E86060-D4001-A500-C5 (DVD)
English: E86060-D4001-A110-C5-7600 (CD-ROM)
E86060-D4001-A510-C5-7600 (DVD)

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SIMOREG
DC MASTER 6RA70
Digital
Chassis Converters

Catalog DA 21.1 · 2006

Supersedes:
Catalog DA 21.1 · 2002

The products contained in this catalog can also be found in the e-Catalog CA 01
Order No.:
E86060-D4001-A110-C5-7600 (CD-ROM)
E86060-D4001-A510-C5-7600 (DVD)

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SIEMENS

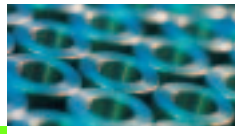
Siemens Automation and Drives. Welcome

More than 60,000 people aiming for the same goal: increasing your competitiveness. That's Siemens Automation and Drives.

We offer you a comprehensive portfolio for sustained success in your sector, whether you're talking automation engineering, drives or electrical installation systems. Totally Integrated Automation (TIA) and Totally Integrated Power (TIP) form the core of our offering. TIA and TIP are the basis of our integrated range of products and systems for the manufacturing and process industries as well as building automation. This portfolio is rounded off by innovative services over the entire life cycle of your plants.

Learn for yourself the potential our products and systems offer. And discover how you can permanently increase your productivity with us.

Your regional Siemens contact can provide more information. He or she will be glad to help.



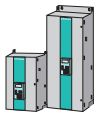
Notes

SIMOREG 6RA70 DC MASTER

Overview

SIMOREG® 6RA70 DC MASTER

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:

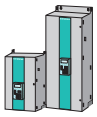
- Main drives for printing machines
- Rubber and plastics industry
- Traversing and lifting drives in the lifting gear industry
- Elevator and cable car drives
- Applications in paper manufacturing
- Cross-cutter drives in the steel industry
- Rolling mill drives
- Winding drives
- Loading machines for 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.



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.

At your side worldwide

SIMOREG DC MASTER converters 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 pro-cessing 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.

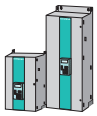
Motors, the muscles of the DC system

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.

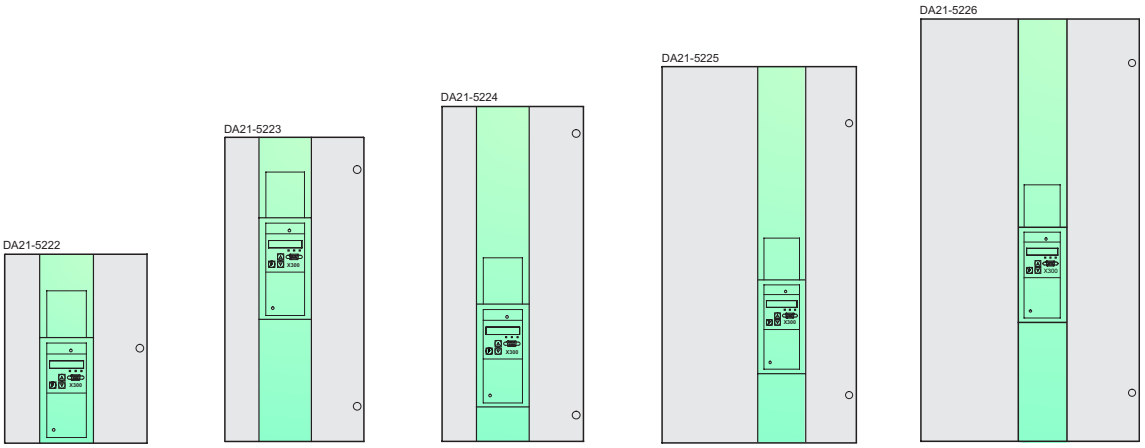
SIMOREG 6RA70 DC MASTER

Overview

Type overview · Guide



Overview of types



Rated supply voltage	3-ph. AC 400/460/575 V	3-ph. AC 400/460/575 V	3-ph. AC 400/460/575 V	3-ph. AC 400/460/575/690 V	3-ph. AC 400/460/575/690/ 830 V/950 V
Rated DC current armature	15 A – 280 A	400 A – 600 A	720 A – 850 A	900 A – 1200 A	1500 A – 3000 A
Rated DC current field	5 A – 15 A	25 A	30 A	30 A	40 A/85 A
Dimensions (H x W x D mm x mm x mm)	385 x 265 x 239-313	625 x 268 x 318	700 x 268 x 362	780 x 410 x 362	880 x 450 x 500

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

Retrofitting 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 CCP limits the unper-missible 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

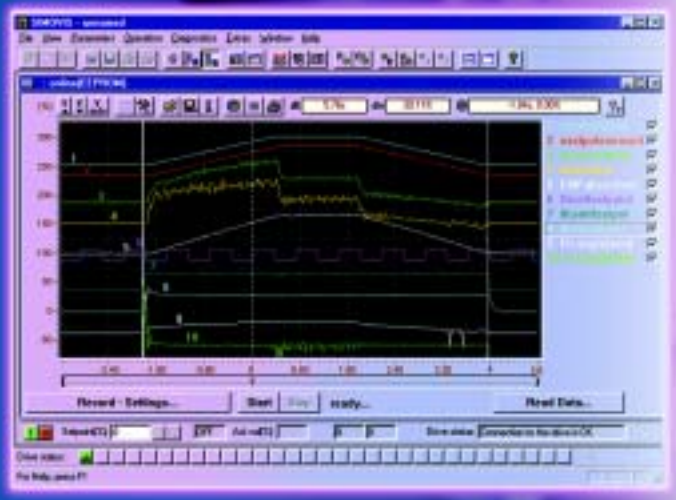
When you have found the right converter, you will certainly want to install it in a system. You will find the necessary instructions in *Section 9, Dimension Drawings*.

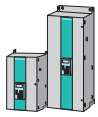
Section 10

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*.

SIMOREG 6RA70 DC MASTER

System Overview





Overview

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).

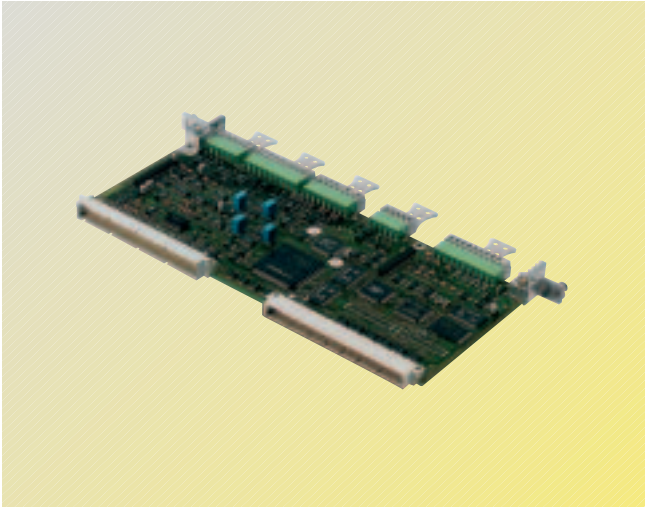


Fig. 2/1
Basic electronics board

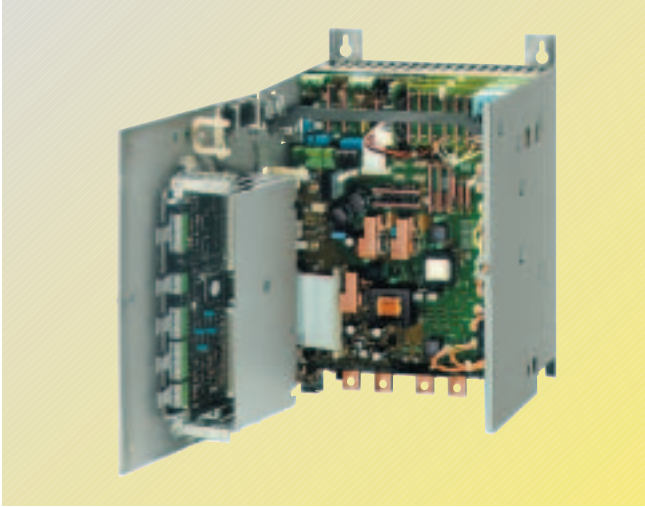


Fig. 2/2
SIMOREG 6RA70, 15 A/30 A

Fig. 2/3
SIMOREG 6RA70, 2000 A

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.

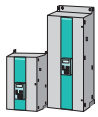
The OP1S features an LCD with 4 x 16 characters for displaying parameter names in plain text. English, German, French, Spanish and Italian can be selected as the display languages. The OP1S can store parameter sets for easy downloading to other devices.

- Keys on OP1S:
- Select key (P)
- UP key [1])
- DOWN key
- Reversing key [1])
- ON key [1])
- OFF key [1])
- Inching key (Jog) [1])
- 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])

Fig. 2/4
PMU operation and parameterization unit

Fig. 2/5
OP1S user-friendly operator control panel

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



Parameterization devices

Parameterization via PC

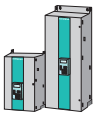
To allow start-up and trouble-shooting using a PC, the Drive-Monitor software is supplied with the converters.

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).

Fig. 2/6



Software structure

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 quantities are available via connectors:

- Analog inputs and outputs
- Inputs of actual-value sensing circuit
- Inputs and outputs of ramp-function generator, limitations, gating unit, controllers, freely available software modules
- Digital fixed setpoints
- General quantities such as operating status, motor temperature, thyristor temperature, alarm memory, fault memory, operating hours meter, processor capacity utilization.

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.

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.

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

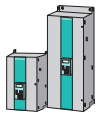
The BICO data set can be switched over by the control word (binector input). It is possible to select which connector or binector quantity must be applied at the intervention point. The control structure or control quantities can therefore be flexibly adapted.

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 setpoint" 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.



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. control 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

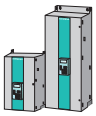
The ramp-function generator converts the specified setpoint after a step change into a setpoint signal that changes constantly over time. Ramp-up and ramp-down times can be set independently of one another. The ramp-function generator also features a lower and upper transition rounding (jerk limitation) 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 zero are 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_p (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 binector 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 far. 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 Φ 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 binector 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^2t 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 transferred speedily to the gating unit in both intermittent and continuous DC operation or when the torque direction is reversed.

Auto-reversing module

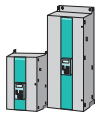
The auto-reversing module (only on converters for four-quadrant drives) acts in conjunction with the current control loop to define the logical sequence of all processes required to reverse the torque direction. One torque direction can be disabled by a parameter setting if necessary.

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.



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_p 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

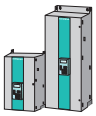
The operating status of the converter is displayed via parameter r000. Approximately 50 parameters are provided for displaying measured values. An additional 300 signals from the closed-loop control can be selected in the software (connectors) for output on the display unit. Examples of displayable measured 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 to between 3 and 300 ms.

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

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 lockout" status. "Starting lockout" 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 (I^2t 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): Monitoring of brush length, bearing condition, air flow, motor temperature has responded
- External faults via binary assignable-function terminals.

Fault messages can be deactivated individually. The default setting for some fault messages is "deactivated" so they need to be activated in the appropriate parameter.

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 I^2t 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

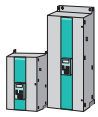
Analog selectable inputs

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.



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 up to operating speed. With an L signal at terminal 37, the drive is decelerated along the deceleration ramp down to speed $n < n_{min}$ and when the brake control delay has expired, the controllers are disabled and the main contactor is de-energized when $I = 0$. The field current is then reduced to its standstill value (parameterizable) after a parameterizable delay following main contactor dropout has expired.
- *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, 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 $n < n_{min}$ 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 37, an H 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 $n < n_{min}$; 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.

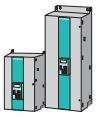
Examples of binary output functions:

- Fault: An L signal is output when a fault message is active.
- Alarm: An L signal is output when an alarm is active.
- $n < n_{min}$: An H signal is output at speeds of less than n_{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 $n < n_{min}$ 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 $n < n_{min}$ 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_{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.
- PROFIBUS-DP on a supplementary card (option).
- SIMOLINK® on a supplementary card (optional) with fiber-optic 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

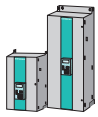
The peer-to-peer protocol is used to link one converter to another. With this mode, data are exchanged between converters, e.g. to build a setpoint cascade, via a serial interface. Since a serial interface is employed as a four-wire line, it is possible to receive data from the upstream converter, condition 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.



Design and mode of operation

2

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 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.

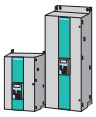
A temperature switch can also be evaluated via the optional terminal expansion board. A parameterizable alarm or fault message is output when the monitor responds (binary switching signal. Signals are evaluated via the binary selectable input (Terminal 214) on the optional terminal expansion board.

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

Type	Terminal design	Function	Terminal	Connection values/comments
Power section:	Converters with • 15 and 30 A: KDS10 PCB feed-through (screw-type terminal max. cross-section 10 mm^2, stranded)	Armature line input Protective conductor PE	1U1 1V1 1W1 ⏚	See technical data
	• 60 to 280 A: 1U1, 1V1, 1W1: Through-hole for M8 (3 x 20 copper bus) 1C1, 1D1: Through-hole for M8 (5 x 20 copper bus)	Armature circuit/ motor connection	1C1 (1D1) 1D1 (1C1)	
	• 400 to 600 A: 1U1, 1V1, 1W1: Through-hole for M10 (5 x 30 copper bus) 1C1, 1D1: Through-hole for M10 (5 x 35 copper bus)			
	• 710 to 850 A: Through-hole for M12 (5 x 60 copper bus)			
	• 900 to 1200 A: Through-hole for M12 (10 x 60 copper bus)			
	• 1500 to 2200 A: 1U1, 1V1, 1W1: Through-hole for M12 (10 x 80 copper bus) 1C1, 1D1: Through-hole for M12 (10 x 50 copper bus)			
	• 2200 to 3000 A: 1U1, 1V1, 1W1: Through-hole for M12 (2 x copper bus 10 x 100) 1C1, 1D1: Through-hole for M12 (2 x copper bus 10 x 80)			
	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 mm^2			
	The conductor cross-sections must be determined according to the applicable regulations, e.g. DIN VDE 100 Part 523, DIN VDE 0276 Part 1000).			
Field circuit	• 15 to 850 A: MKDS PCB terminal block (screw-type terminal) max. cross-section 4 mm^2 stranded	Mains connection Field winding connection	XF1-2/3U1 XF1-1/3W1 XF2-2/3C XF2-1/3D	2-ph. AC 400 to 460 V (+15%/–20%) 325 V rated DC voltage with 2-ph. AC 400 V mains connection
	• 900 to 2000 A: G10/4 converter terminal (screw-type terminal) max. cross-section 10 mm^2 stranded			
	• 2200 to 3000 A: UK16N converter terminal (screw-type terminal) max. cross-section 16 mm^2 stranded			
Electronics power supply [1]	• Plug-in terminal max. cross-section 1.5 mm^2 stranded	Incoming supply XP/5W1 XP/5N1	XP/5U1	2-ph. AC 380 to 460 V (+15%/–25%); I_n = 1 A (–35% for 1 min) or 1-ph. AC 190 to 230 V (+15%/–25%; I_n = 2 A
Fan [2]	Plug-in terminal (screw-type terminal) Max. cross-section 4 mm^2 stranded	Incoming supply Protective conductor PE	4U1 4V1 4W ⏚	3-ph. AC 400 V (±15%) For further information, see technical data
Analog inputs, tacho inputs	Plug-in terminal Max. cross-section 2.5 mm^2	Tacho connection 8 to 270 V Analog ground M	 XT/103 XT/104	 ±270 V; > 143 kΩ Signs can be reversed and signals switched through by means of binary input functions.
Safety shutdown (E-STOP)	MSTB2.5 plug-in terminal Max. cross-section 2.5 mm^2	Supply for safety shutdown Safety shutdown – Switch – Pushbutton – Reset	XS/106 XS/105 [3] XS/107 [3] XS/108 [3]	24 V DC, max. load 50 mA, short-circuit-proof, evaluation via fault message F018 I_e = 20 mA NC contact I_e = 30 mA NO contact I_e = 10 mA

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.

Block diagram of CUD1

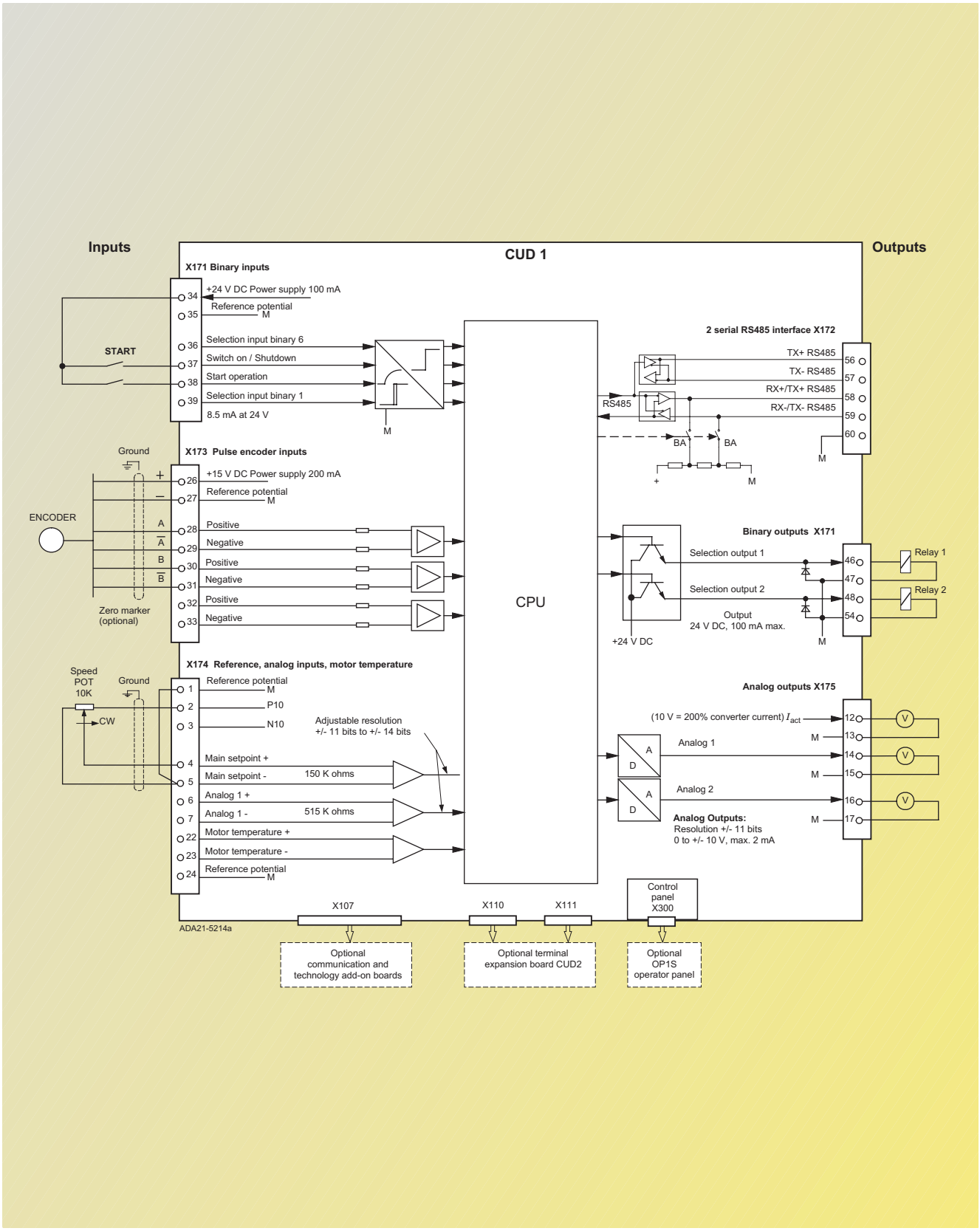
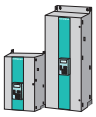


Fig. 2/8
Block diagram of CUD1 with customized connections



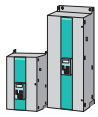
Terminal assignments for CUD1

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

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.



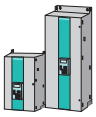
Open-loop and closed-loop control section

Terminal assignments for CUD1

Type	Terminal design	Function	Terminal	Connection values/comments
Analog outputs	Plug-in (screw-type) terminal Max. cross-section 1.5 mm^2	Actual current Analog ground M	X175/12 X175/13	0 ±10 V corresponds to 0 ±200% converter rated DC current Max. load 2 mA, short-circuit-proof
		Analog selectable output 1 Analog mass M	X175/14 X175/15	0 ±10 V, max. 2 mA, short-circuit-proof Resolution ± 11 bits
		Analog selectable output 2 Analog mass M	X175/16 X175/17	0 ±10 V, max. 2 mA, short-circuit-proof Resolution ± 11 bits
Binary control inputs	Plug-in (screw-type) terminal Max. cross-section 1,5 mm^2	Supply	X171/34	24 V DC, max. load 100 mA, internal supply referred to internal ground
		Digital ground M	X171/35	
		Switch-on/shutdown	X171/37	• H signal: Switch-on [1]) Line contactor CLOSED + (with H signal at terminal 38) acceleration along ramp-function generator ramp to operating speed • L signal: Shutdown [1]) Deceleration along ramp-function generator ramp to $n < n_{min}$ (P370) + controller disable + line contactor OPEN.
		Enable operation	X171/38	• H signal: Controller enabled [1]) • L signal: Controller disabled [1]) The L signal also acts at a higher level on “Inch” and “Crawl”.
		Binary selectable input 1	X171/39	[1])
		Binary selectable input 6 (fault acknowledgement)	X171/36	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])

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

Type	Terminal design	Function	Terminal	Connection values/comments
Binary control outputs	Plug-in (screw-type) terminal Max. cross-section 1.5 mm^2	Ground M: – Binary selectable outputs – Binary selectable outputs	 X171/47 X171/54	
		Selectable output "$\overline{\text{Fault}}$"	X171/46	• H signal: No fault [1]) • L signal: Fault [1]) Short-circuit-proof 100 mA [1])
		Binary selectable output 2	X171/48	Short-circuit-proof 100 mA [1])
		Relay for line contactor: – Common potential – NO contact	 XR/109 XR/110	Load rating: ≤ 250 V AC, 4 A; cos φ = 1 ≤ 250 V AC, 2 A; cos φ = 0.4 ≤ 30 V DC, 2 A
Serial interface 1 RS 232/X300 [2]) [3]) [4])		Housing earth	X300/1 [5])	
		Receive cable RS 232 standard (V.24)	X300/2 [5])	
		Send and receive cable two-wire RS 485, pos. diff. input/output	X300/4 [5])	
		$\overline{\text{BOOT}}$, control signal for software update	X300/4 [5]) [8])	
		Ground	X300/5 [5])	
		5 V voltage supply for OP1S	X300/6 [5])	
		Send cable RS 232 standard (V.24)	X300/7 [5])	
		Send and receive cable two-wire RS 485, neg. diff. input/output	X300/8 [5])	
		Ground	X300/9 [5])	
Serial interface 2 RS 485 [6]) [7])	Plug-in (screw-type) terminal Max. cross-section 1.5 mm^2	TX+	X172/56	RS 485, 4-wire send cable, positive differential input
		TX-	X172/57	RS 485, 4-wire send cable, negative differential input
		RX+/TX+	X172/58	RS 485, 4-wire receive cable, positive differential input, 2-wire send/receive cable, positive differential input
		RX-/TX-	X172/59	RS 485, 4-wire receive cable, negative differential input, 2-wire send/receive cable, negative differential input
		M	X172/60	Ground

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)

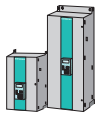
4) A serial connection to a PLC or PC can be made using connector X300 on the PMU. This allows the converter to be controlled and operated from a central control center or room.

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, 15 A to 125 A without fan

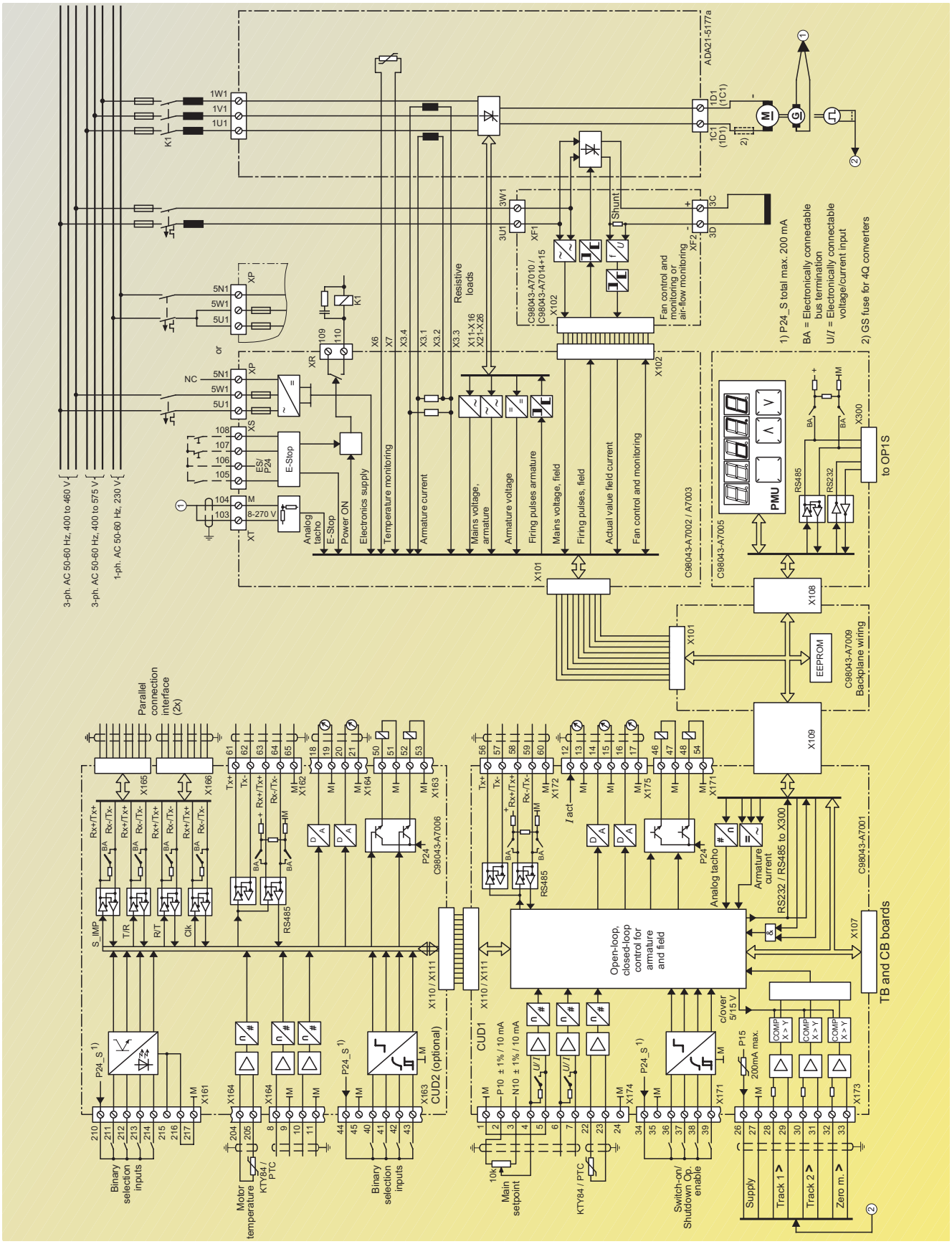


Fig. 2/9

SIMOREG 6RA70 with fan

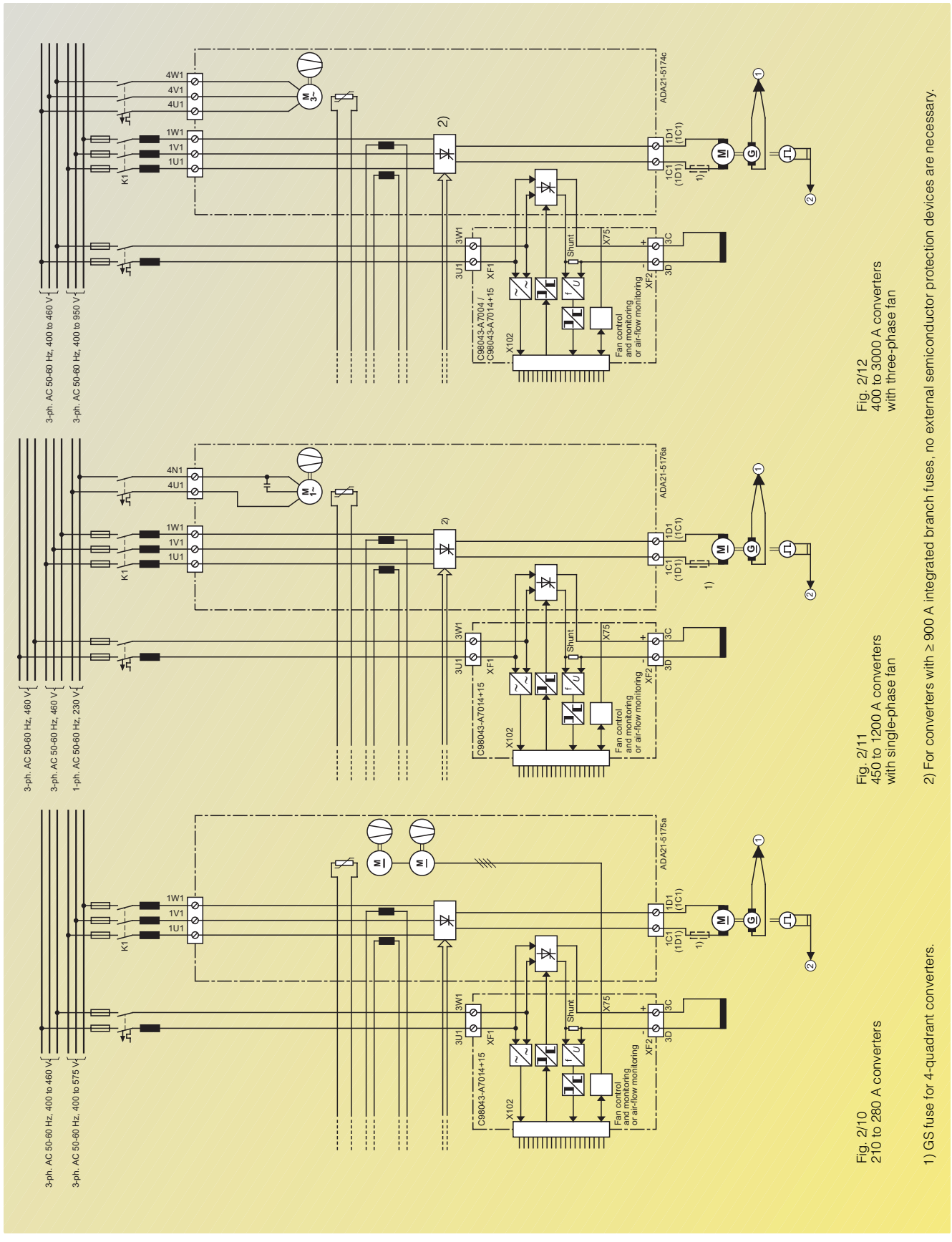


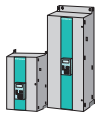
Fig. 2/12
400 to 3000 A converters
with three-phase fan

Fig. 2/11
450 to 1200 A converters
with single-phase fan

Fig. 2/10
210 to 280 A converters

1) GS fuse for 4-quadrant converters.

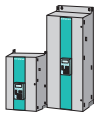
2) For converters with ≥ 900 A integrated branch fuses, no external semiconductor protection devices are necessary.



Notes

SIMOREG 6RA70 DC MASTER

Technical Data



Converters

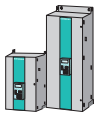
General technical data

Type of cooling	
Converters ≤ 125 A rated armature current: Permissible ambient air temperature during operation	Self-ventilated 0 °C to 45 °C (reduction curves apply for +45 °C < *T* < +60 °C, Page 3/3 onwards)
Converters ≥ 210 A rated armature current: Permissible ambient air temperature during operation	Enhanced air cooling with installed fan 0 °C to 40 °C (reduction curves apply for +40 °C < *T* < +50 °C, Page 3/3 onwards)
Permissible ambient air temperature during storage and transport	–25 °C to +70 °C
Installation altitude	≤ 1000 m above sea level (100 % load rating) > 1000 m to 5000 m above sea level (reduction curves: see detailed data for converters)
Control stability	Δ_n = 0.006 % of the rated motor speed, valid for pulse encoder operation and digital setpoint Δ_n = 0.1 % of the rated motor speed, valid for analog tacho and analog setpoint [2])
Humidity class	Relative air humidity ≤ 95 %, dewing not permissible [1])
Climate class	Class 3K3 acc. to DIN IEC 60 721-3-3
Insulation	Pollution severity 2 acc. to DIN VDE 0110-1 (HD 625.1 S: 1996) Dewing not permissible
Overvoltage category	Category III acc. to DIN VDE 0110-1 for power section and power supply Category II acc. to DIN VDE 0110-1 for electronics
Overvoltage resistance	Class 1 acc. to DIN VDE 0160
Degree of protection	IP 00 acc. to EN 60 529
Safety class	Class I acc. to DIN VDE 0106, Part 1
Shock-hazard protection	Acc. to DIN VDE 0106 Part 100 (VBG4) and DIN VDE 0113 Part 5
RI suppression	No RI suppression acc. to EN 61 800-3
MTBF	> 200,000 h acc. to SN 29500
Mechanical rigidity	Acc. to DIN IEC 60 068-2-6
For stationary use constant amplitude:	
• of acceleration	0.075 mm in frequency range 10 Hz to 58 Hz
• of displacement	9.8 ms –2 (1 x *g*) in frequency range > 58 Hz to 500 Hz
For transport constant amplitude:	
• of displacement	3.5 mm in frequency range 5 Hz to 9 Hz
• of acceleration	9.8 ms –2 (1 x *g*) in frequency range > 9 Hz to 500 Hz
Approvals	
UL/$_C$UL [3])	UL File No.: E203250
Applicable standards	
DIN VDE 0106 Part 100	Arrangement of operator control elements in the vicinity of components/parts at hazardous voltage levels.
DIN VDE 0110 Part 1	Insulation coordination for electrical equipment in low-voltage installations.
EN 60146-1-1 / DIN VDE 0558 T11	Semiconductor converters General requirements and line-commutated converters
EN 50178 / DIN VDE 0160	Regulations for the equipment of electrical power installations with electronic equipment.
EN 61800-3	Variable-speed drives, Part 3, EMC product standard including special test procedures
EN 60068-2-6 acc. to degree of severity 12 (SN29010 Part 1)	Mechanical stress

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

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

Type		6RA70□□-6DS22-0			
		18	25	28	31
Rated supply voltage armature [1]	V	3-ph. AC 400 (+15 % / –20 %)			
Rated input current armature [2]	A	25	50	75	104
Rated supply voltage electronics supply	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)			
Rated supply voltage field [1]	V	2-ph. AC 400 (+15 % / – 0%) [6]			
Rated frequency	Hz	45 to 65 [7]			
Rated DC voltage [1]	V	485			
Rated DC current	A	**30**	**60**	**90**	**125**
Overload capability [5]		Max. 1.8 times rated DC current			
Rated output	kW	14.5	29	44	61
Power loss at rated DC current (approx.)	W	163	240	347	400
Rated DC voltage field [1]	V	Max. 325			
Rated DC current field	A	**5**	**10**		
Operational ambient temperature	°C	0 to 45 at I_{rated} [3] self-cooled			
Storage and transport temperature	°C	–25 to +70			
Installation altitude above sea level		≤ 1000 m at rated DC current [4]			
Dimensions (H x W x D)	mm	385 x 265 x 239	385 x 265 x 283		
See dimension drawing on Page		9/2			
Weight (approx.)	kg	11	14	16	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.

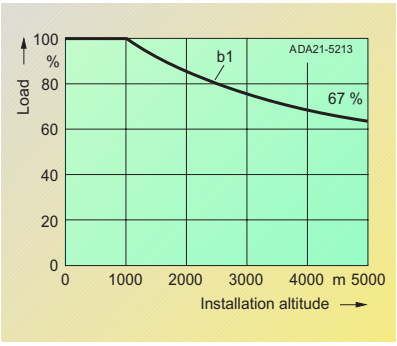
3) Load factor K1 (DC current) as a function of the coolant temperature (see P077 Operating Instructions, Section 11).
K1 > 1 only permissible where K1 * K2 ≤ 1st. overall reduction factor K = K1 * K2
(for K2 see Footnote 4).

Ambient or coolant temperature	Load factor K1	
	In devices with self-cooling	In devices with enhanced cooling
≤ +30 °C	1.18	1.10
+35 °C	1.12	1.05
+40 °C	1.06	1.00
+45 °C	1.00	0.95
+50 °C	0.94	0.90 [a]
+55 °C	0.88	
+60 °C	0.82 [b]	

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.

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).



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

Installation altitude m	1000	2000	3000	4000	5000
Reduction factor K2	1.0	0.835	0.74	0.71	0.67

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:

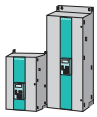
Installation-altitude	Rated supply voltage 830 V	950 V
up to 4000 m	max. 830 V	950 V
up to 4500 m	max. 795 V	933 V
up to 5000 m	max. 727 V	881 V

5) See Section 5.

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.

Converters for single-quadrant operation



3-ph. AC 400 V, 210 A to 600 A, 1Q

Type		6RA70□□-6DS22-0			
		75	78	81	85
Rated supply voltage armature [1]	V	3-ph. AC 400 (+15 % / –20 %)			
Rated input current armature [2]	A	175	233	332	498
Rated supply voltage electronics supply	V	2-ph. AC 380 (–25%) to 460 (+15%); I_n=1 A or 1-ph. AC 190 (–5%) to 230 (+15%); I_n=2 A (–35% for 1 min)			
Rated supply voltage fan	V	24 V DC internal		3-ph. AC 400 (±15%) 50 Hz 3-ph. AC 460 (±10%) 60 Hz	
Nominal fan current	A			0.3 [7]	
Air flow rate	m³/h	100		570	
Fan noise level	dBA	40		73	
Rated supply voltage field [1]	V	2-ph. AC 400 (+15 % / –20%) [6]			
Rated frequency	Hz	45 to 65 [9]			
Rated DC voltage [1]	V	485			
Rated DC current	A	**210**	**280**	**400**	**600**
Overload capability [5]		Max. 1.8 times rated DC current			
Rated output	kW	102	136	194	291
Power loss at rated DC current (approx.)	W	676	800	1328	1798
Rated DC voltage field [1]	V	Max. 325			
Rated DC current field	A	**15**		**25**	
Operational ambient temperature	°C	0 to 40 at I_{rated} [3] separately cooled			
Storage and transport temperature	°C	–25 to +70			
Installation altitude above sea level		≤ 1000 m at rated DC current [4]			
Dimensions (H x W x D)	mm	385 x 265 x 283		625 x 268 x 318	
See dimension drawing on Page		9/2		9/3	
Weight (approx.)	kg	16	17	30	

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).

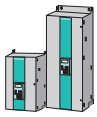
2) Values apply to output rated DC current.

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).

Ambient or coolant temperature	Load factor K1	
	In devices with self-cooling	In devices with enhanced cooling
≤ +30 °C	1.18	1.10
+35 °C	1.12	1.05
+40 °C	1.06	1.00
+45 °C	1.00	0.95
+50 °C	0.94	0.90 [a]
+55 °C	0.88	
+60 °C	0.82 [b]	

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%.

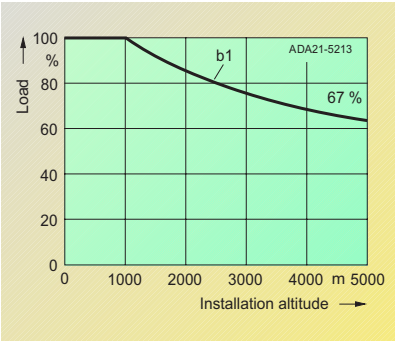
b) Not permissible when T400 or OP1S are used.



3-ph. AC 400 V, 850 A to 3000 A, 1Q

Type		6RA70□□-6DS22-0			6RA70□□-4DS22-0		
		87	91		93	95	98
Rated supply voltage armature [1]	V	3-ph. AC 400 (+15% / –20%)					(+10% / -20%)
Rated input current armature [2]	A	705	995		1326	1658	2487
Rated supply voltage electronics supply	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)					
Rated supply voltage fan	V	3-ph. AC 400 (±15%) 50 Hz 3-ph. AC 460 (±10%) 60 Hz	3-ph. AC 400 (±10%) 50 Hz 3-ph. AC 460 (±10%) 60 Hz		3-ph. AC 400 (±10%) 50 Hz 3-ph. AC 460 (±10%) 60 Hz		
			50 Hz	60 Hz	50 Hz	60 Hz	
Nominal fan current	A	0.3 [7]	1.0 [8]	1.25 [8]	1.0 [8]	1.25 [8]	
Air flow rate	m^3/h	570	1300	1300	2400	2400	
Fan noise level	dBA	73	83	87	83	87	
Rated supply voltage field [1]	V	2-ph. AC 400 (+15 % / –20%) [6]					
Rated frequency	Hz	45 to 65 [9]					
Rated DC voltage [1]	V	485					
Rated DC current	A	**850**	**1200**		**1600**	**2000**	**3000**
Overload capability [5]		Max. 1.8 times rated DC current					
Rated output	kW	412	582		776	970	1455
Power loss at rated DC current (approx.)	W	2420	4525		5710	6810	10660
Rated DC voltage field [1]	V	Max. 325					
Rated DC current field	A	**30**			**40**		**85**
Operational ambient temperature	°C	0 to 40 at I_{rated} [3] separately cooled					
Storage and transport temperature	°C	–25 to +70					
Installation altitude above sea level		≤ 1000 m at rated DC current [4]					
Dimensions (H x W x D)	mm	700 x 268 x 362	780 x 410 x 362		880 x 450 x 500		
See dimension drawing on Page		9/4			9/5		9/6
Weight (approx.)	kg	40	80		125		

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).



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

Installation altitude m	1000	2000	3000	4000	5000
Reduction factor K2	1.0	0.835	0.74	0.71	0.67

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 830 V	950 V
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.

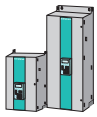
6) 2-ph. AC 460 (+15% / –20%) is also permissible.

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.

Converters for single-quadrant operation



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

Type		6RA70□□-6FS22-0			
		18	25	28	31
Rated supply voltage armature [1]	V	3-ph. AC 460 (+15 % / –20 %)			
Rated input current armature [2]	A	25	50	75	104
Rated supply voltage electronics supply	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)			
Rated supply voltage field [1]	V	2-ph. AC 460 (+15 % / –20 %)			
Rated frequency	Hz	45 to 65 [9]			
Rated DC voltage [1]	V	550			
Rated DC current	A	30	60	90	125
Overload capability [5]		Max. 1.8 times rated DC current			
Rated output	kW	16.5	33	49.5	68.7
Power loss at rated DC current (approx.)	W	172	248	363	417
Rated DC voltage field [1]	V	Max. 375			
Rated DC current field	A	5	10		
Operational ambient temperature	°C	0 to 45 at I_{rated} [3] self-cooled			
Storage and transport temperature	°C	–25 to +70			
Installation altitude above sea level		≤ 1000 m at rated DC current [4]			
Dimensions (H x W x D)	mm	385 x 265 x 239	385 x 265 x 313		
See dimension drawing on Page		9/2	9/11		
Weight (approx.)	kg	11	15	17	17

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).

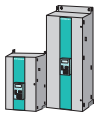
2) Values apply to output rated DC current.

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).

Ambient or coolant temperature	Load factor K1	
	In devices with self-cooling	In devices with enhanced cooling
≤ +30 °C	1.18	1.10
+35 °C	1.12	1.05
+40 °C	1.06	1.00
+45 °C	1.00	0.95
+50 °C	0.94	0.90 [a]
+55 °C	0.88	
+60 °C	0.82 [b]	

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%.

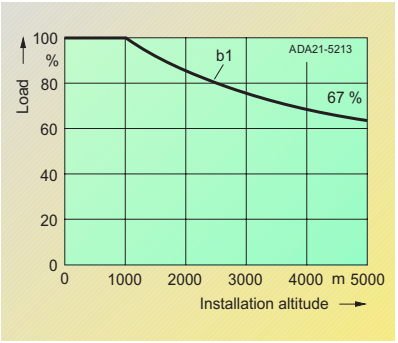
b) Not permissible when T400 or OP1S are used.



3-ph. AC 460 V, 210 A to 600 A, 1Q

Type		6RA70□□-6FS22-0			
		75	78	82	85
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_n=1 A or 1-ph. AC 190 (–25%) to 230 (+15%); I_n=2 A (–35% for 1 min)			
Rated supply voltage fan	V	24 V DC internal		1-ph. AC 230 (±10%)	
				50 Hz	60 Hz
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 %)			
Rated frequency	Hz	45 to 65 [9]			
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	°C	0 to 40 at I_{rated} [3] separately cooled			
Storage and transport temperature	°C	–25 to +70			
Installation altitude above sea level		≤ 1000 m at rated DC current [4]			
Dimensions (H x W x D)	mm	385 x 265 x 313		625 x 268 x 318	
See dimension drawing on Page		9/11		9/12	
Weight (approx.)	kg	17	18	32	

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).



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

Installation altitude m	1000	2000	3000	4000	5000
Reduction factor K2	1.0	0.835	0.74	0.71	0.67

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:

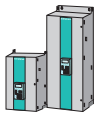
Installation-altitude	Rated supply voltage 830 V	950 V
up to 4000 m	max. 830 V	950 V
up to 4500 m	max. 795 V	933 V
up to 5000 m	max. 727 V	881 V

5) See Section 5.

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

Technical Data

Converters for single-quadrant operation



3-ph. AC 460 V, 850 A to 1200 A, 1Q

Type		6RA70□□-6FS22-0			
		87		91	
Rated supply voltage armature [1]	V	3-ph. AC 460 (+15 % / –20 %)			
Rated input current armature [2]	A	705		995	
Rated supply voltage electronics supply	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)			
Rated supply voltage fan	V	1-ph. AC 230 (±10%)		1-ph. AC 230 (±10%)	
		50 Hz	60 Hz	50 Hz	60 Hz
Nominal fan current	A	0.55	0.75	2.6	3.3
Air flow rate	m³/h	570	570	1300	1300
Fan noise level	dBA	73	76	82	85
Rated supply voltage field [1]	V	2-ph. AC 460 (+15 % / –20 %)			
Rated frequency	Hz	45 to 65 [9]			
Rated DC voltage [1]	V	550			
Rated DC current	A	**850**		**1200**	
Overload capability [5]		Max. 1.8 times rated DC current			
Rated output	kW	467		660	
Power loss at rated DC current (approx.)	W	2514		4620	
Rated DC voltage field [1]	V	Max. 375			
Rated DC current field	A	**30**			
Operational ambient temperature	°C	0 to 40 at I_{rated} [3]			
Storage and transport temperature	°C	–25 to +70			
Installation altitude above sea level		≤ 1000 m at rated DC current [4]			
Dimensions (H x W x D)	mm	700 x 268 x 362		780 x 410 x 362	
See dimension drawing on Page		9/12		9/4	
Weight (approx.)	kg	42		80	

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).

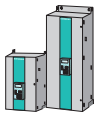
2) Values apply to output rated DC current.

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).

Ambient or coolant temperature	Load factor K1	
	In devices with self-cooling	In devices with enhanced cooling
≤ +30 °C	1.18	1.10
+35 °C	1.12	1.05
+40 °C	1.06	1.00
+45 °C	1.00	0.95
+50 °C	0.94	0.90 [a]
+55 °C	0.88	
+60 °C	0.82 [b]	

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%.

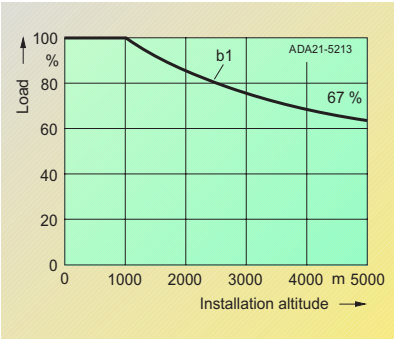
b) Not permissible when T400 or OP1S are used.



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

Type		6RA70□□-6GS22-0				
		25	31	75	81	85
Rated supply voltage armature [1]	V	3-ph. AC 575 (+10% / –20%)				
Rated input current armature [2]	A	50	104	175	332	498
Rated supply voltage electronics supply	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)				
Rated supply voltage fan	V			24 V DC internal	3-ph. AC 400 (±15%) 50 Hz 3-ph. AC 460 (±10%) 60 Hz	
Nominal fan current	A				0.3 [8]	
Air flow rate	m^3/h			100	570	
Fan noise level	dBA			40	73	
Rated supply voltage field [1]	V	2-ph. AC 460 (+15 % / –20 %)				
Rated frequency	Hz	45 to 65 [9]				
Rated DC voltage [1]	V	690				
Rated DC current	A	60	125	210	400	600
Overload capability [5]		Max. 1.8 times rated DC current				
Rated output	kW	41	86	145	276	414
Power loss at rated DC current (approx.)	W	265	454	730	1550	1955
Rated DC voltage field [1]	V	Max. 375				
Rated DC current field	A	10		15	25	
Operational ambient temperature	°C	0 to 45 at I_{rated} [3] self-cooled		0 to 40 at I_{rated} [3] separately cooled		
Storage and transport temperature	°C	–25 to +70				
Installation altitude above sea level		≤ 1000 m at rated DC current [4]				
Dimensions (H x W x D)	mm	385 x 265 x 283			625 x 268 x 318	
See dimension drawing on Page		9/2			9/3	
Weight (approx.)	kg	14	16		30	

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)



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

Installation altitude m	1000	2000	3000	4000	5000
Reduction factor K2	1.0	0.835	0.74	0.71	0.67

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:

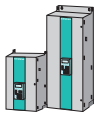
Installation-altitude	Rated supply voltage 830 V	950 V
up to 4000 m	max. 830 V	950 V
up to 4500 m	max. 795 V	933 V
up to 5000 m	max. 727 V	881 V

5) See Section 5.

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.

Converters for single-quadrant operation



3-ph. AC 575 V, 800 A to 2800 A, 1Q

Type		6RA70□□-6GS22-0			6RA70□□-4GS22-0			
		87	90		93	95	96	97
Rated supply voltage armature [1]	V	3-ph. AC 575 (+10% / –20%)						
Rated input current armature [2]	A	663	829		1326	1658	1823	2321
Rated supply voltage electronics supply	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)						
Rated supply voltage fan	V	3-ph. AC 400 (±15%) 50 Hz 3-ph. AC 460 (±10%) 60 Hz	3-ph. AC 400 (±10%) 50 Hz 3-ph. AC 460 (±10%) 60 Hz		3-ph. AC 400 (±10%) 50 Hz 3-ph. AC 460 (±10%) 60 Hz			
			50 Hz	60 Hz	50 Hz	60 Hz		
Nominal fan current	A	0.3 [7]	1.0 [8]	1.25 [8]	1.0 [8]	1.25 [8]		
Air flow rate	m^3/h	570	1300	1300	2400	2400		
Fan noise level	dBA	73	83	87	83	87		
Rated supply voltage field [1]	V	2-ph. AC 460 (+15 % / –20 %)						
Rated frequency	Hz	45 to 65 [9]						
Rated DC voltage [1]	V	690						
Rated DC current	A	**800**	**1000**		**1600**	**2000**	**2200**	**2800**
Overload capability [5]		Max. 1.8 times rated DC current						
Rated output	kW	552	690		1104	1380	1518	1932
Power loss at rated DC current (approx.)	W	2638	4130		5942	7349	7400	10560
Rated DC voltage field [1]	V	Max. 375						
Rated DC current field	A	**30**			**40**		**85**	
Operational ambient temperature	°C	0 to 40 at I_{rated} [3] separately cooled						
Storage and transport temperature	°C	–25 to +70						
Installation altitude above sea level		≤ 1000 m at rated DC current [4]						
Dimensions (H x W x D)	mm	700 x 268 x 362	780 x 410 x 362		880 x 450 x 500			
See dimension drawing on Page		9/4			9/5			9/6
Weight (approx.)	kg	40	80		125			

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).

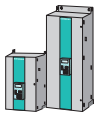
2) Values apply to output rated DC current.

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).

Ambient or coolant temperature	Load factor K1	
	In devices with self-cooling	In devices with enhanced cooling
≤ +30 °C	1.18	1.10
+35 °C	1.12	1.05
+40 °C	1.06	1.00
+45 °C	1.00	0.95
+50 °C	0.94	0.90 [a]
+55 °C	0.88	
+60 °C	0.82 [b]	

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%.

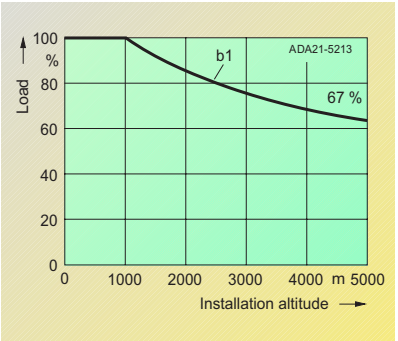
b) Not permissible when T400 or OP1S are used.



3-ph. AC 690 V, 720 A to 2600 A, 1Q

Type		6RA70□□-6KS22-0			6RA70□□-4KS22-0		
		86	88		93	95	97
Rated supply voltage armature [1]	V	3-ph. AC 690 (+10% / –20%)					
Rated input current armature [2]	A	597	788		1244	1658	2155
Rated supply voltage electronics supply	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)					
Rated supply voltage fan	V	3-ph. AC 400 (±15%) 50 Hz 3-ph. AC 460 (±10%) 60 Hz	3-ph. AC 400 (±10%) 50 Hz 3-ph. AC 460 (±10%) 60 Hz		3-ph. AC 400 (±10%) 50 Hz 3-ph. AC 460 (±10%) 60 Hz		
			50 Hz	60 Hz	50 Hz	60 Hz	
Nominal fan current	A	0.3 [7]	1.0 [8]	1.25 [8]	1.0 [8]	1.25 [8]	
Air flow rate	m^3/h	570	1300	1300	2400	2400	
Fan noise level	dBA	73	83	87	83	87	
Rated supply voltage field [1]	V	2-ph. AC 460 (+15 % / –20 %)					
Rated frequency	Hz	45 to 65 [9]					
Rated DC voltage [1]	V	830					
Rated DC current	A	**720**	**950**		**1500**	**2000**	**2600**
Overload capability [5]		Max. 1.8 times rated DC current					
Rated output	kW	598	789		1245	1660	2158
Power loss at rated DC current (approx.)	W	2720	4380		6706	8190	10330
Rated DC voltage field [1]	V	Max. 375					
Rated DC current field	A	**30**			**40**		**85**
Operational ambient temperature	°C	0 to 40 at I_{rated} [3] separately cooled					
Storage and transport temperature	°C	–25 to +70					
Installation altitude above sea level		≤ 1000 m at rated DC current [4]					
Dimensions (H x W x D)	mm	700 x 268 x 362	780 x 410 x 362		880 x 450 x 500		
See dimension drawing on Page		9/4			9/5		9/6
Weight (approx.)	kg	40	80		125		

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).



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

Installation altitude m	1000	2000	3000	4000	5000
Reduction factor K2	1.0	0.835	0.74	0.71	0.67

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 830 V	950 V
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.

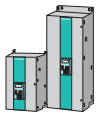
6) 2-ph. AC 460 (+15% / –20%) is also permissible.

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.

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

Type		6RA70□□-6LS22-0		6RA70□□-4LS22-0		6RA70□□-4MS22-0
		88		93	95	96
Rated supply voltage armature [1]	V	3-ph. AC 830 (+10% / –20%)				3 AC 950 (+15%/-20%)
Rated input current armature [2]	A	746		1244	1575	1824
Rated supply voltage electronics supply	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)				
Rated supply voltage fan	V	3-ph. AC 400 (±10%) 50 Hz 3-ph. AC 460 (±10%) 60 Hz		3-ph. AC 400 (±10%) 50 Hz 3-ph. AC 460 (±10%) 60 Hz		
		50 Hz	60 Hz	50 Hz	60 Hz	
Nominal fan current	A	1.0 [8]	1.25 [8]	1.0 [8]	1.25 [8]	
Air flow rate	m^3/h	1300	1300	2400	2400	
Fan noise level	dBA	83	87	83	87	
Rated supply voltage field [1]	V	2-ph. AC 460 (+15 % / –20 %)				
Rated frequency	Hz	45 to 65 [9]				
Rated DC voltage [1]	V	1000				1140
Rated DC current	A	**900**		**1500**	**1900**	**2200**
Overload capability [5]		Max. 1.8 times rated DC current				
Rated output	kW	900		1500	1900	2508
Power loss at rated DC current (approx.)	W	4638		6778	8700	11370
Rated DC voltage field [1]	V	Max. 375				
Rated DC current field	A	**30**		**40**		**85**
Operational ambient temperature	°C	0 to 40 at I_{rated} [3] separately cooled				
Storage and transport temperature	°C	–25 to +70				
Installation altitude above sea level		≤ 1000 m at rated DC current [4]				
Dimensions (H x W x D)	mm	780 x 410 x 362		880 x 450 x 500		
See dimension drawing on Page		9/4		9/5		9/6
Weight (approx.)	kg	80		125		

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).

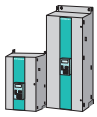
2) Values apply to output rated DC current.

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).

Ambient or coolant temperature	Load factor K1	
	In devices with self-cooling	In devices with enhanced cooling
≤ +30 °C	1.18	1.10
+35 °C	1.12	1.05
+40 °C	1.06	1.00
+45 °C	1.00	0.95
+50 °C	0.94	0.90 [a]
+55 °C	0.88	
+60 °C	0.82 [b]	

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%.

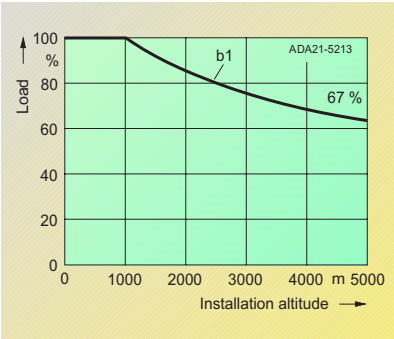
b) Not permissible when T400 or OP1S are used.



3-ph. AC 400 V, 15 A to 125 A, 4Q

Type		6RA70□□-6DV62-0				
		13	18	25	28	31
Rated supply voltage armature [1]	V	3-ph. AC 400 (+15 % / –20 %)				
Rated input current armature [2]	A	13	25	50	75	104
Rated supply voltage electronics supply	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)				
Rated supply voltage field [1]	V	2-ph. AC 400 (+15 % / –20%) [6]				
Rated frequency	Hz	45 to 65 [9]				
Rated DC voltage [1]	V	420				
Rated DC current	A	**15**	**30**	**60**	**90**	**125**
Overload capability [5]		Max. 1.8 times rated DC current				
Rated output	kW	6.3	12.6	25	38	52.5
Power loss at rated DC current (approx.)	W	117	163	240	312	400
Rated DC voltage field [1]	V	Max. 325				
Rated DC current field	A	**3**	**5**	**10**		
Operational ambient temperature	°C	0 to 45 at I_{rated} [3] self-cooled				
Storage and transport temperature	°C	–25 to +70				
Installation altitude above sea level		≤ 1000 m at rated DC current [4]				
Dimensions (H x W x D)	mm	385 x 265 x 239		385 x 265 x 283		
See dimension drawing on Page		9/7				
Weight (approx.)	kg	11	11	14	14	16

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).



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

Installation altitude m	1000	2000	3000	4000	5000
Reduction factor K2	1.0	0.835	0.74	0.71	0.67

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 830 V	950 V
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

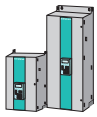
5) See Section 5.

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.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.

Converters for four-quadrant operation



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

Type		6RA70□□-6DV62-0			
		75	78	81	85
Rated supply voltage armature [1]	V	3-ph. AC 400 (+15 % / –20 %)			
Rated input current armature [2]	A	175	233	332	498
Rated supply voltage electronics supply	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)			
Rated supply voltage fan	V	24 V DC internal		3-ph. AC 400 (±15%) 50 Hz 3-ph. AC 460 (±10%) 60 Hz	
Nominal fan current	A			0.3 [7]	
Air flow rate	m³/h	100		570	
Fan noise level	dBA	40		73	
Rated supply voltage field [1]	V	2-ph. AC 400 (+15 % / –20%) [6]			
Rated frequency	Hz	45 to 65 [9]			
Rated DC voltage [1]	V	420			
Rated DC current	A	**210**	**280**	**400**	**600**
Overload capability [5]		Max. 1.8 times rated DC current			
Rated output	kW	88	118	168	252
Power loss at rated DC current (approx.)	W	676	800	1328	1800
Rated DC voltage field [1]	V	Max. 325			
Rated DC current field	A	**15**		**25**	
Operational ambient temperature	°C	0 to 40 at I_{rated} [3] separately cooled			
Storage and transport temperature	°C	–25 to +70			
Installation altitude above sea level		≤ 1000 m at rated DC current [4]			
Dimensions (H x W x D)	mm	385 x 265 x 283		625 x 268 x 318	
See dimension drawing on Page		9/7		9/8	
Weight (approx.)	kg	16	17	30	

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).

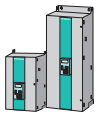
2) Values apply to output rated DC current.

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).

Ambient or coolant temperature	Load factor K1	
	In devices with self-cooling	In devices with enhanced cooling
≤ +30 °C	1.18	1.10
+35 °C	1.12	1.05
+40 °C	1.06	1.00
+45 °C	1.00	0.95
+50 °C	0.94	0.90 [a]
+55 °C	0.88	
+60 °C	0.82 [b]	

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%.

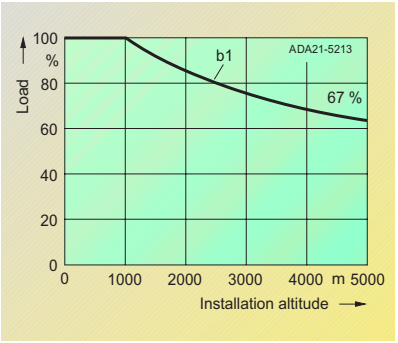
b) Not permissible when T400 or OP1S are used.



3-ph. AC 400 V, 850 A to 3000 A, 4Q

Type		6RA70□□-6DV62-0			6RA70□□-4DV62-0		
		87	91		93	95	98
Rated supply voltage armature [1]	V	3-ph. AC 400 (+15 % / –20 %)					(+10 % / –20 %)
Rated input current armature [2]	A	705	995		1326	1658	2487
Rated supply voltage electronics supply	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)					
Rated supply voltage fan	V	3-ph. AC 400 (±15%) 50 Hz 3-ph. AC 460 (±10%) 60 Hz	3-ph. AC 400 (±10%) 50 Hz 3-ph. AC 460 (±10%) 60 Hz		3-ph. AC 400 (±10%) 50 Hz 3-ph. AC 460 (±10%) 60 Hz		
			50 Hz	60 Hz	50 Hz	60 Hz	
Nominal fan current	A	0.3 [7]	1.0 [8]	1.25 [8]	1.0 [8]	1.25 [8]	
Air flow rate	m³/h	570	1300	1300	2400	2400	
Fan noise level	dBA	73	83	87	83	87	
Rated supply voltage field [1]	V	2-ph. AC 400 (+15 % / –20%) [6]					
Rated frequency	Hz	45 to 65 [9]					
Rated DC voltage [1]	V	420					
Rated DC current	A	**850**	**1200**		**1600**	**2000**	**3000**
Overload capability [5]		Max. 1.8 times rated DC current					
Rated output	kW	357	504		672	840	1260
Power loss at rated DC current (approx.)	W	2420	4525		5708	6810	10660
Rated DC voltage field [1]	V	Max. 325					
Rated DC current field	A	**30**			**40**		**85**
Operational ambient temperature	°C	0 to 40 at I_{rated} [3] separately cooled					
Storage and transport temperature	°C	–25 to +70					
Installation altitude above sea level		≤ 1000 m at rated DC current [4]					
Dimensions (H x W x D)	mm	700 x 268 x 362	780 x 410 x 362		880 x 450 x 500		
See dimension drawing on Page		9/8	9/9				9/10
Weight (approx.)	kg	45	85		145		

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).



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

Installation altitude m	1000	2000	3000	4000	5000
Reduction factor K2	1.0	0.835	0.74	0.71	0.67

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 830 V	950 V
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.

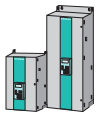
6) 2-ph. AC 460 (+15% / –20%) is also permissible.

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.

Converters for four-quadrant operation



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

Type		6RA70□□-6FV62-0			
		18	25	28	31
Rated supply voltage armature [1]	V	3-ph. AC 460 (+15 % / –20 %)			
Rated input current armature [2]	A	25	50	75	104
Rated supply voltage electronics supply	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)			
Rated supply voltage field [1]	V	2-ph. AC 460 (+15 % / –20 %)			
Rated frequency	Hz	45 to 65 [9]			
Rated DC voltage [1]	V	480			
Rated DC current	A	**30**	**60**	**90**	**125**
Overload capability [5]		Max. 1.8 times rated DC current			
Rated output	kW	14.4	28.8	43	60
Power loss at rated DC current (approx.)	W	172	248	328	417
Rated DC voltage field [1]	V	Max. 375			
Rated DC current field	A	**5**	**10**		
Operational ambient temperature	°C	0 to 45 at I_{rated} [3] self-cooled			
Storage and transport temperature	°C	–25 to +70			
Installation altitude above sea level		≤ 1000 m at rated DC current [4]			
Dimensions (H x W x D)	mm	385 x 265 x 239	385 x 265 x 313		
See dimension drawing on Page		9/7	9/13		
Weight (approx.)	kg	11	15	15	17

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).

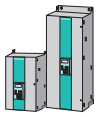
2) Values apply to output rated DC current.

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).

Ambient or coolant temperature	Load factor K1	
	In devices with self-cooling	In devices with enhanced cooling
≤ +30 °C	1.18	1.10
+35 °C	1.12	1.05
+40 °C	1.06	1.00
+45 °C	1.00	0.95
+50 °C	0.94	0.90 [a]
+55 °C	0.88	
+60 °C	0.82 [b]	

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%.

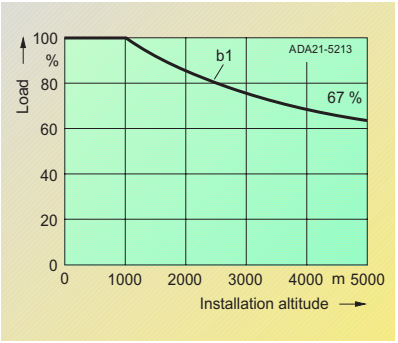
b) Not permissible when T400 or OP1S are used.



3-ph. AC 460 V, 210 A to 600 A, 4Q

Type		6RA70□□-6FV62-0			
		75	78	82	85
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_n=1 A or 1-ph. AC 190 (–25%) to 230 (+15%); I_n=2 A (–35% for 1 min)			
Rated supply voltage fan	V	24 V DC internal		1-ph. AC 230 (±10%)	
				50 Hz	60 Hz
Nominal fan current	A			0.55	0.75
Air flow rate	m^3/h	100		570	570
Fan noise level	dBA	40		73	76
Rated supply voltage field [1]	V	2-ph. AC 460 (+15 % / –20 %)			
Rated frequency	Hz	45 to 65 [9]			
Rated DC voltage [1]	V	480			
Rated DC current	A	**210**	**280**	**450**	**600**
Overload capability [5]		Max. 1.8 times rated DC current			
Rated output	kW	100	134	216	288
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	°C	0 to 40 at I_{rated} [3] separately cooled			
Storage and transport temperature	°C	–25 to +70			
Installation altitude above sea level		≤ 1000 m at rated DC current [4]			
Dimensions (H x W x D)	mm	385 x 265 x 313		625 x 268 x 318	
See dimension drawing on Page		9/13		9/14	
Weight (approx.)	kg	17	18	32	

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).



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

Installation altitude m	1000	2000	3000	4000	5000
Reduction factor K2	1.0	0.835	0.74	0.71	0.67

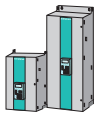
The supply voltages for all electric circuits are possible for site altitudes up to 5000 m with basic insulation,
with the exception of converters for rated supply voltages:

Installation-altitude	Rated supply voltage 830 V	950 V
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.

Converters for four-quadrant operation



3-ph. AC 460 V, 850 A to 1200 A, 4Q

Type		6RA70□□-6FV62-0			
		87		91	
Rated supply voltage armature [1]	V	3-ph. AC 460 (+15 % / –20 %)			
Rated input current armature [2]	A	705		995	
Rated supply voltage electronics supply	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)			
Rated supply voltage fan	V	1-ph. AC 230 (±10%)		1-ph. AC 230 (±10%)	
		50 Hz	60 Hz	50 Hz	60 Hz
Nominal fan current	A	0.55	0.75	2.6	3.3
Air flow rate	m^3/h	570	570	1300	1300
Fan noise level	dBA	73	76	82	85
Rated supply voltage field [1]	V	2-ph. AC 460 (+15 % / –20 %)			
Rated frequency	Hz	45 to 65 [9]			
Rated DC voltage [1]	V	480			
Rated DC current	A	**850**		**1200**	
Overload capability [5]		Max. 1.8 times rated DC current			
Rated output	kW	408		576	
Power loss at rated DC current (approx.)	W	2514		4620	
Rated DC voltage field [1]	V	Max. 375			
Rated DC current field	A	**30**			
Operational ambient temperature	°C	0 to 40 at I_{rated} [3] separately cooled			
Storage and transport temperature	°C	–25 to +70			
Installation altitude above sea level		≤ 1000 m at rated DC current [4]			
Dimensions (H x W x D)	mm	700 x 268 x 362		780 x 410 x 362	
See dimension drawing on Page		9/14		9/9	
Weight (approx.)	kg	47		85	

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).

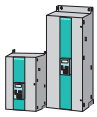
2) Values apply to output rated DC current.

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).

Ambient or coolant temperature	Load factor K1	
	In devices with self-cooling	In devices with enhanced cooling
≤ +30 °C	1.18	1.10
+35 °C	1.12	1.05
+40 °C	1.06	1.00
+45 °C	1.00	0.95
+50 °C	0.94	0.90 [a]
+55 °C	0.88	
+60 °C	0.82 [b]	

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%.

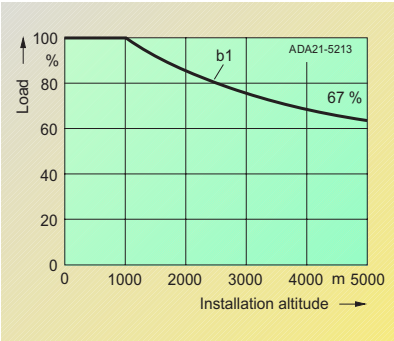
b) Not permissible when T400 or OP1S are used.



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

Type		6RA70□□-6GV62-0				
		25	31	75	81	85
Rated supply voltage armature [1]	V	3-ph. AC 575 (+10% / –20%)				
Rated input current armature [2]	A	50	104	175	332	498
Rated supply voltage electronics supply	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)				
Rated supply voltage fan	V			24 V DC internal	3-ph. AC 400 (±15%) 50 Hz 3-ph. AC 460 (±10%) 60 Hz	
Nominal fan current	A				0.3 [7]	
Air flow rate	m^3/h			100	570	
Fan noise level	dBA			40	73	
Rated supply voltage field [1]	V	2-ph. AC 460 (+15 % / –20 %)				
Rated frequency	Hz	45 to 65 [9]				
Rated DC voltage [1]	V	600				
Rated DC current	A	60	125	210	400	600
Overload capability [5]		Max. 1.8 times rated DC current				
Rated output	kW	36	75	126	240	360
Power loss at rated DC current (approx.)	W	265	455	730	1550	1955
Rated DC voltage field [1]	V	Max. 375				
Rated DC current field	A	10		15	25	
Operational ambient temperature	°C	0 to 45 at I_{rated} [3] self-cooled		0 to 40 at I_{rated} [3] separately cooled		
Storage and transport temperature	°C	–25 to +70				
Installation altitude above sea level		≤ 1000 m at rated DC current [4]				
Dimensions (H x W x D)	mm	385 x 265 x 283			625 x 268 x 318	
See dimension drawing on Page		9/7			9/8	
Weight (approx.)	kg	14	16		30	

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).



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

Installation altitude m	1000	2000	3000	4000	5000
Reduction factor K2	1.0	0.835	0.74	0.71	0.67

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:

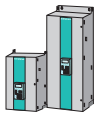
Installation-altitude	Rated supply voltage 830 V	950 V
up to 4000 m	max. 830 V	950 V
up to 4500 m	max. 795 V	933 V
up to 5000 m	max. 727 V	881 V

5) See Section 5.

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.

Converters for four-quadrant operation



3-ph. AC 575 V, 850 A to 2800 A, 4Q

Type		6RA70□□-6GV62-0			6RA70□□-4GV62-0			
		87	90		93	95	96	97
Rated supply voltage armature [1]	V	3-ph. AC 575 (+10% / –20%)						
Rated input current armature [2]	A	705	912		1326	1658	1823	2321
Rated supply voltage electronics supply	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)						
Rated supply voltage fan	V	3-ph. AC 400 (±15%) 50 Hz 3-ph. AC 460 (±10%) 60 Hz	3-ph. AC 400 (±10%) 50 Hz 3-ph. AC 460 (±10%) 60 Hz		3-ph. AC 400 (±10%) 50 Hz 3-ph. AC 460 (±10%) 60 Hz			
			50 Hz	60 Hz	50 Hz	60 Hz		
Nominal fan current	A	0.3 [7]	1.0 [8]	1.25 [8]	1.0 [8]	1.25 [8]		
Air flow rate	m^3/h	570	1300	1300	2400	2400		
Fan noise level	dBA	73	83	87	83	87		
Rated supply voltage field [1]	V	2-ph. AC 460 (+15 % / –20 %)						
Rated frequency	Hz	45 to 65 [9]						
Rated DC voltage [1]	V	600						
Rated DC current	A	**850**	**1100**		**1600**	**2000**	**2200**	**2800**
Overload capability [5]		Max. 1.8 times rated DC current						
Rated output	kW	510	660		960	1200	1320	1680
Power loss at rated DC current (approx.)	W	2780	4515		5942	7349	7400	10560
Rated DC voltage field [1]	V	Max. 375						
Rated DC current field	A	**30**			**40**		**85**	
Operational ambient temperature	°C	0 to 40 at I_{rated} [3] separately cooled						
Storage and transport temperature	°C	–25 to +70						
Installation altitude above sea level		≤ 1000 m at rated DC current [4]						
Dimensions (H x W x D)	mm	700 x 268 x 362	780 x 410 x 362		880 x 450 x 500			
See dimension drawing on Page		9/8	9/9					9/10
Weight (approx.)	kg	45	85		145			

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).

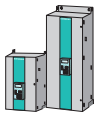
2) Values apply to output rated DC current.

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).

Ambient or coolant temperature	Load factor K1	
	In devices with self-cooling	In devices with enhanced cooling
≤ +30 °C	1.18	1.10
+35 °C	1.12	1.05
+40 °C	1.06	1.00
+45 °C	1.00	0.95
+50 °C	0.94	0.90 [a]
+55 °C	0.88	
+60 °C	0.82 [b]	

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%.

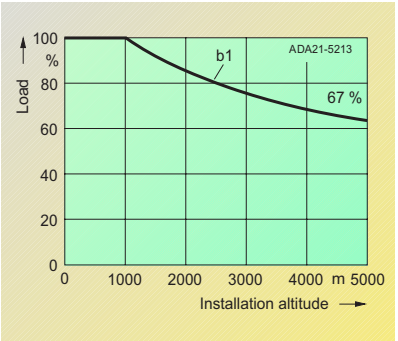
b) Not permissible when T400 or OP1S are used.



3-ph. AC 690 V, 760 A to 2600 A, 4Q

Type		6RA70□□-6KV62-0			6RA70□□-4KV62-0		
		86	90		93	95	97
Rated supply voltage armature [1]	V	3-ph. AC 690 (+10% / –20%)					
Rated input current armature [2]	A	630	829		1244	1658	2155
Rated supply voltage electronics supply	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)					
Rated supply voltage fan	V	3-ph. AC 400 (±15%) 50 Hz 3-ph. AC 460 (±10%) 60 Hz	3-ph. AC 400 (±10%) 50 Hz 3-ph. AC 460 (±10%) 60 Hz		3-ph. AC 400 (±10%) 50 Hz 3-ph. AC 460 (±10%) 60 Hz		
			50 Hz	60 Hz	50 Hz	60 Hz	
Nominal fan current	A	0.3 [7]	1.0 [8]	1.25 [8]	1.0 [8]	1.25 [8]	
Air flow rate	m^3/h	570	1300	1300	2400	2400	
Fan noise level	dBA	73	83	87	83	87	
Rated supply voltage field [1]	V	2-ph. AC 460 (+15 % / –20 %)					
Rated frequency	Hz	45 to 65 [9]					
Rated DC voltage [1]	V	725					
Rated DC current	A	**760**	**1000**		**1500**	**2000**	**2600**
Overload capability [5]		Max. 1.8 times rated DC current					
Rated output	kW	551	725		1088	1450	1885
Power loss at rated DC current (approx.)	W	2850	4605		6706	8190	10330
Rated DC voltage field [1]	V	Max. 375					
Rated DC current field	A	**30**			**40**		**85**
Operational ambient temperature	°C	0 to 40 at I_{rated} [3] separately cooled					
Storage and transport temperature	°C	–25 to +70					
Installation altitude above sea level		≤ 1000 m at rated DC current [4]					
Dimensions (H x W x D)	mm	700 x 268 x 362	780 x 410 x 362		880 x 450 x 500		
See dimension drawing on Page		9/8	9/9				9/10
Weight (approx.)	kg	45	85		145		

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).



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

Installation altitude m	1000	2000	3000	4000	5000
Reduction factor K2	1.0	0.835	0.74	0.71	0.67

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 830 V	950 V
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

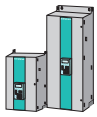
5) See Section 5.

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.

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

Type		6RA70□□-6LV62-0		6RA70□□-4LV62-0		6RA70□□-4MV62-0
		88		93	95	96
Rated supply voltage armature [1]	V	3-ph. AC 830 (+10% / –20%)				3-ph. AC 950 (+15% / –20%)
Rated input current armature [2]	A	788		1244	1575	1824
Rated supply voltage electronics supply	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)				
Rated supply voltage fan	V	3-ph. AC 400 (±10%) 50 Hz 3-ph. AC 460 (±10%) 60 Hz		3-ph. AC 400 (±10%) 50 Hz 3-ph. AC 460 (±10%) 60 Hz		
		50 Hz	60 Hz	50 Hz	60 Hz	
Nominal fan current	A	1.0 [8]	1.25 [8]	1.0 [8]	1.25 [8]	
Air flow rate	m³/h	1300	1300	2400	2400	
Fan noise level	dBA	83	87	83	87	
Rated supply voltage field [1]	V	2-ph. AC 460 (+15 % / –20 %)				
Rated frequency	Hz	45 to 65 [9]				
Rated DC voltage [1]	V	875				1000
Rated DC current	A	**950**		**1500**	**1900**	**2200**
Overload capability [5]		Max. 1.8 times rated DC current				
Rated output	kW	831		1313	1663	2200
Power loss at rated DC current (approx.)	W	4870		7153	8700	11370
Rated DC voltage field [1]	V	Max. 375				
Rated DC current field	A	**30**		**40**		**85**
Operational ambient temperature	°C	0 to 40 at I_{rated} [3] separately cooled				
Storage and transport temperature	°C	–25 to +70				
Installation altitude above sea level		≤ 1000 m at rated DC current [4]				
Dimensions (H x W x D)	mm	780 x 410 x 362		880 x 450 x 500		
See dimension drawing on Page		9/9				9/10
Weight (approx.)	kg	85		145		

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.

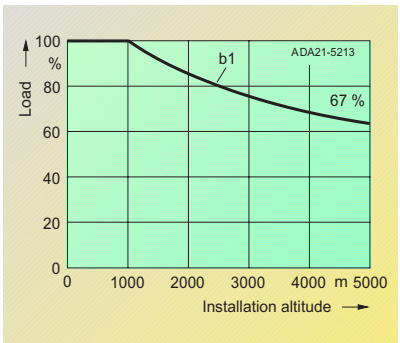
3) Load factor K1 (DC current) as a function of the coolant temperature (see P077 Operating Instructions, Section 11).
K1 > 1 only permissible where K1 * K2 ≤ 1st. overall reduction factor K = K1 * K2
(for K2 see Footnote 4).

Ambient or coolant temperature	Load factor K1	
	In devices with self-cooling	In devices with enhanced cooling
≤ +30 °C	1.18	1.10
+35 °C	1.12	1.05
+40 °C	1.06	1.00
+45 °C	1.00	0.95
+50 °C	0.94	0.90 [a]
+55 °C	0.88	
+60 °C	0.82 [b]	

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.

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).



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

Installation altitude m	1000	2000	3000	4000	5000
Reduction factor K2	1.0	0.835	0.74	0.71	0.67

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 830 V	950 V
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.

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.

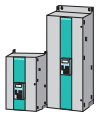
9) Operation in the extended frequency range of 23 Hz to 110 Hz is possible on request.

SIMOREG 6RA70 DC MASTER

Options

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 (0,000 to 60,000 s)
- 4 timers (0,00 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

Description	Code	Order No.:
Technology software in the basic unit	**S00**	**6RX1700-0AS00**

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

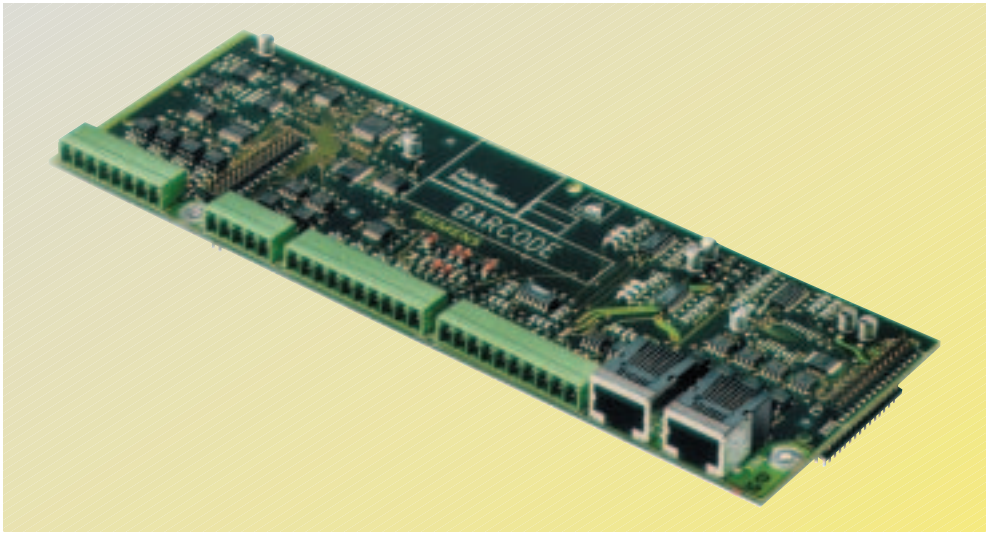


Fig. 4/1
Terminal expansion board CUD2

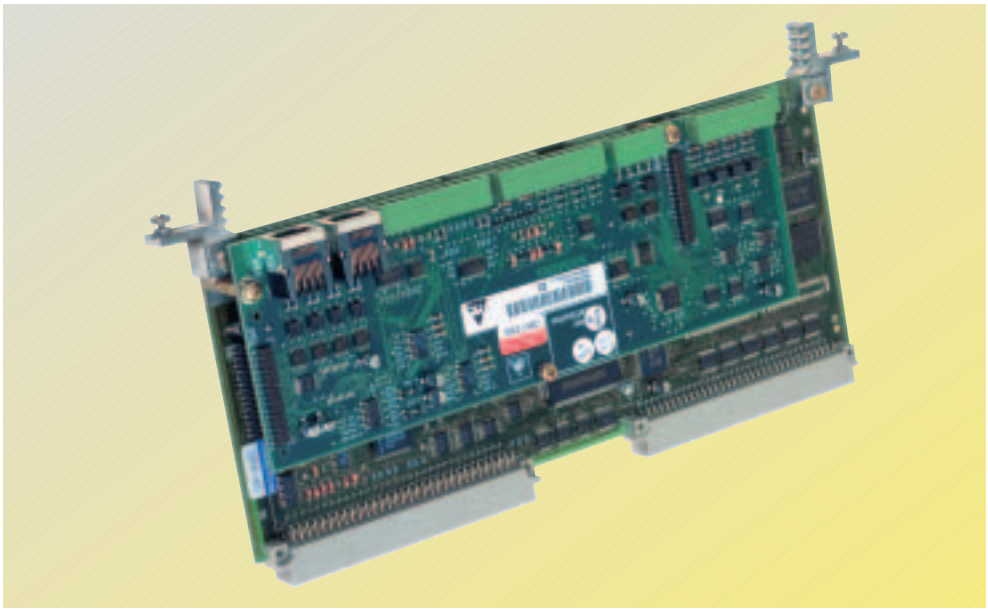
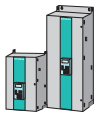


Fig. 4/2
Terminal expansion board CUD2 plugged into the basic board CUD1

Selection and ordering data

Description		Code	Order No.:
CUD2	Terminal expansion board	**K00**	**6RX1700-0AK00**



Options in the basic unit

Terminal expansion board CUD2 · Terminal assignments

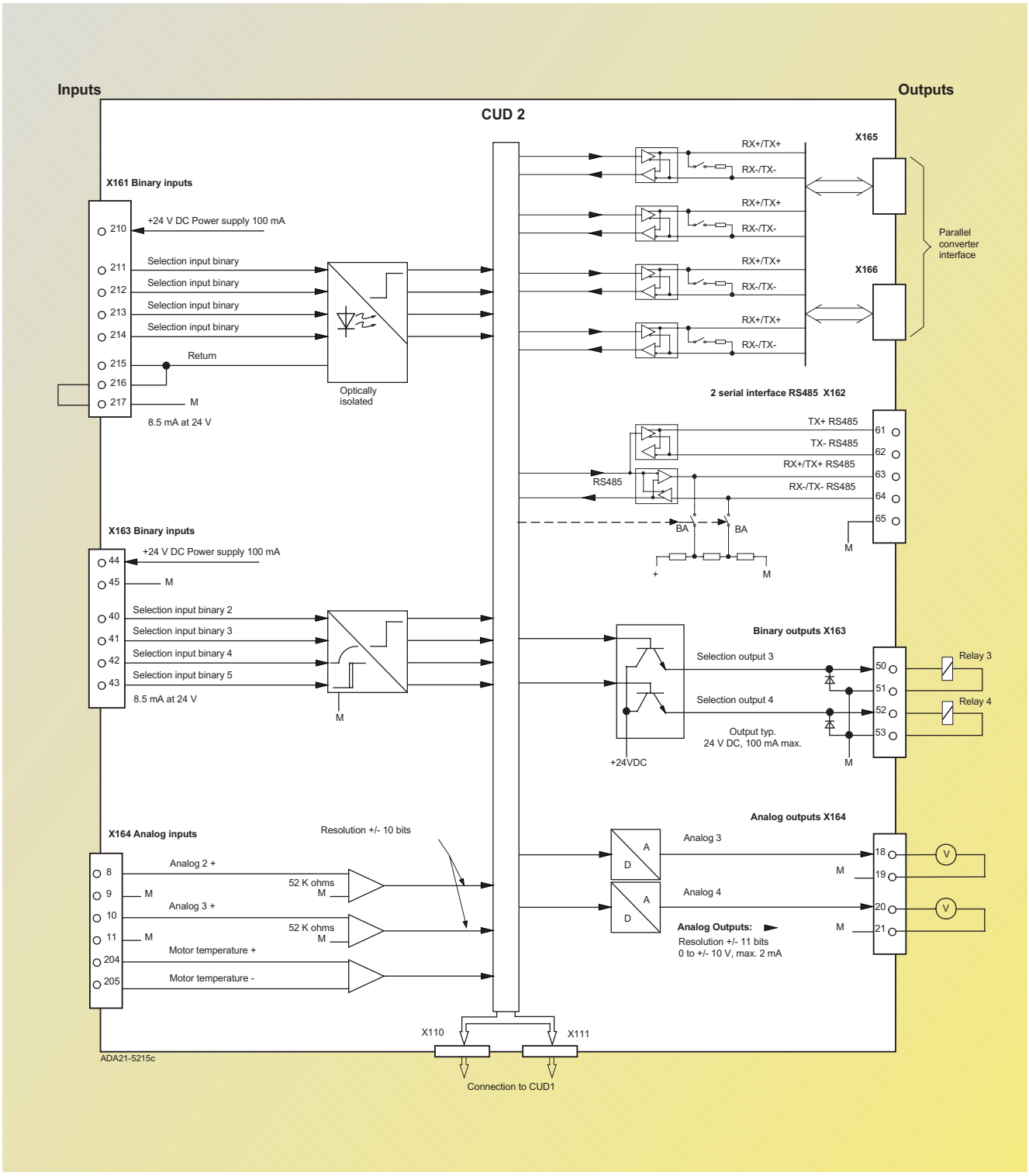
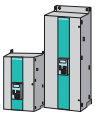


Fig. 4/3
Block diagram of the terminal expansion board CUD2



Terminal expansion board CUD2 · Terminal assignments

Type	Terminal design	Function	Terminal	Connection values/comments
Motors interface	Plug-in terminal (screw terminal) Max. cross-section 1.5 mm^2	Motor temperature:		
		– Positive terminal	X164/204	Sensor according to P146 Index 2
		– Negative terminal	X164/205	Sensor according to P146 Index 2
		Supply for binary inputs	X164/210	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)
		Binary input	X164/211	Evaluation of motor data
		Binary input	X164/212	
		Binary input	X164/213	
		Binary input	X164/214	
		Ground M_GT:		
		– Binary inputs	X164/215	Can be isolated from internal ground
		– Binary inputs	X164/216	Remove jumper between terminals 216 and 217.
		M	X164/217	Remove jumper between terminals 216 and 217.
Analog inputs	Plug-in terminal (screw terminal) Max. cross-section 1.5 mm^2	Selectable input analog 2	X164/8	±10 V, 52 kΩ
		Analog ground	X164/9	Resolution: ±10 bit
		Selectable input analog 3	X164/10	Signs can be reversed and signals switched through by means of binary input functions.
		Analog ground	X164/11	
Analog outputs	Plug-in terminal (screw terminal) Max. cross-section 1.5 mm^2	Selectable output analog 3	X164/18	0 to ±10 V, max. 2 mA short-circuit-proof, resolution ±11 bits
		Analog ground	X164/19	
		Selectable output analog 4	X164/20	
		Analog ground M	X164/21	
Binary control inputs	Plug-in terminal (screw terminal) Max. cross-section 1.5 mm^2	Supply	X163/44	24 V DC, max. load 100 mA, internal supply referred to internal ground
		Digital ground M	X163/45	[1]
		Selectable input:		
		– Binary 2	X163/40	[1]
		– Binary 3	X163/41	[1]
		– Binary 4	X163/42	[1]
		– Binary 5	X163/43	[1]
Binary control outputs	Plug-in terminal (screw terminal) Max. cross-section 1.5 mm^2	Ground M:		
		– Binary selectable outputs	X163/51	
		– Binary selectable outputs	X163/53	
		Selectable output:		
		– Binary 3	X163/50	[2] Short-circuit-proof 100 mA
		– Binary 4	X163/52	
Serial interface 3 RS 485 [3] [4]	Plug-in terminal (screw terminal) Max. cross-section 1.5 mm^2	TX+	X172/61	RS 485, 4-wire send cable, positive differential input
		TX–	X172/61	RS 485, 4-wire send cable, negative differential input
		RX+/TX+	X172/63	RS 485, 4-wire receive cable, positive differential input, 2-wire send/receive cable, positive differential input
		RX–/TX–	X172/64	RS 485, 4-wire receive cable, negative differential input, 2-wire send/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.

Integration of the electronics options

Overview

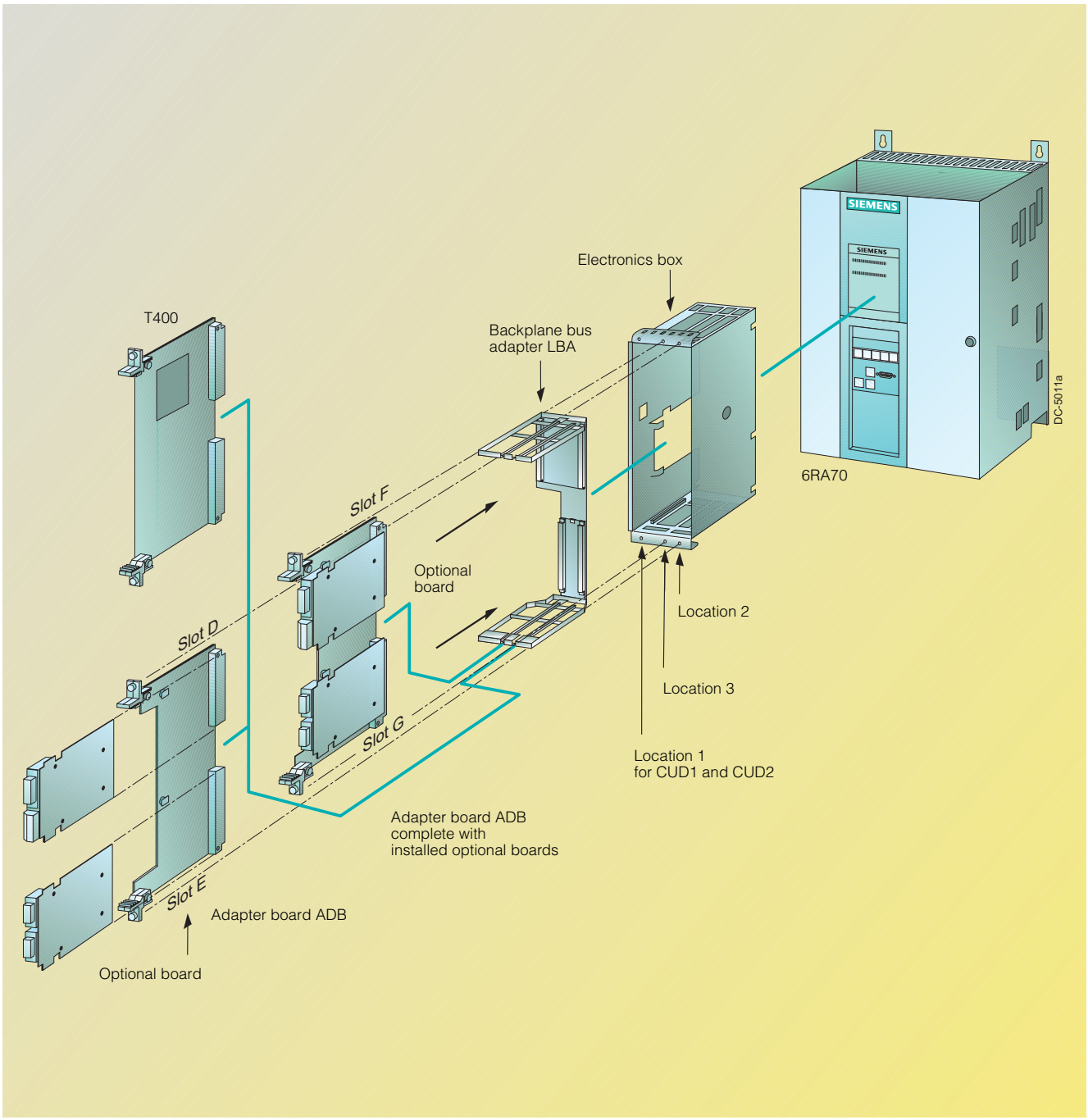
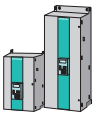


Fig. 4/4
Integration/fitting of the optional boards

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 (**L**ocal **B**us **A**dapter) 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.



Installation of the electronics options

The optional boards are installed in the slots of the electronics box. The LBA (**L**ocal **B**us **A**dapter, 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).

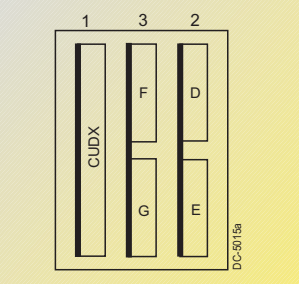


Fig. 4/5
Position of mounting locations 1 to 3 and slots D to G in the electronics

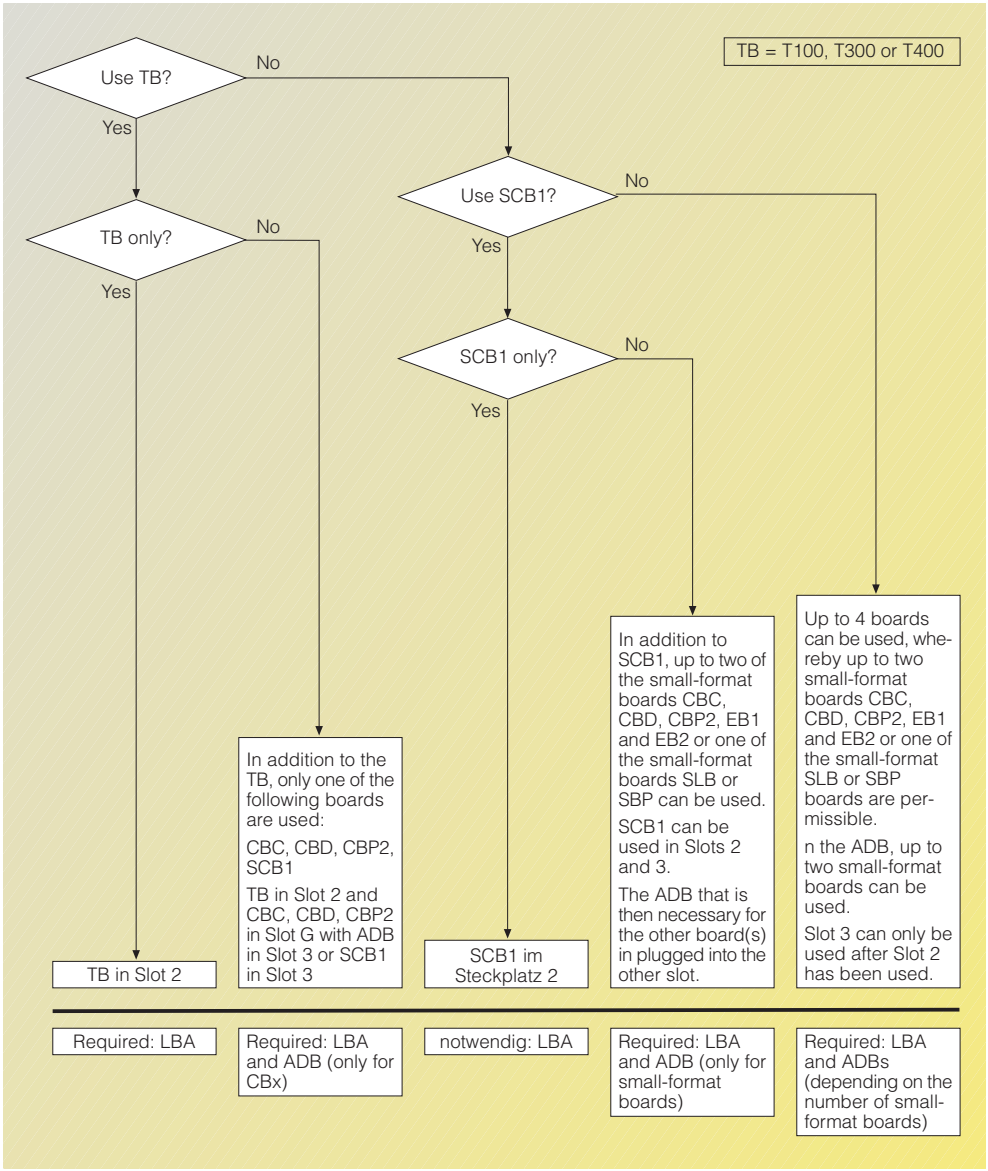
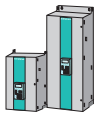


Fig. 4/6
Possible locations and slots for supplementary boards as well as their possible combinations

Installation possibilities in the electronics box

Board	LBA required	ADB required	Location 1	Location 2		Location 3	
				D	E	F	G
CUD1	No	No	Yes	No	No	No	No
CUD2	No	No	Yes	No	No	No	No
CBP2	Yes	Yes	No	Yes	Yes	Yes	Yes
CBC	Yes	Yes	No	Yes	Yes	Yes	Yes
CBD	Yes	Yes	No	Yes	Yes	Yes	Yes
SLB	Yes	Yes	No	Yes	Yes	Yes	Yes
SBP	Yes	Yes	No	Yes	Yes	Yes	Yes
SCB1	Yes	No	No		Yes		Yes
T100	Yes	No	No		Yes		No
T300	Yes	No	No		Yes		No
T400	Yes	No	No		Yes		No
EB1	Yes	Yes	No	Yes	Yes	Yes	Yes
EB2	Yes	Yes	No	Yes	Yes	Yes	Yes



Integration of the electronics options

Backplane bus adapter LBA

The electronics box can be equipped with the backplane bus adapter LBA (**L**ocal **B**us **A**dapter) 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.

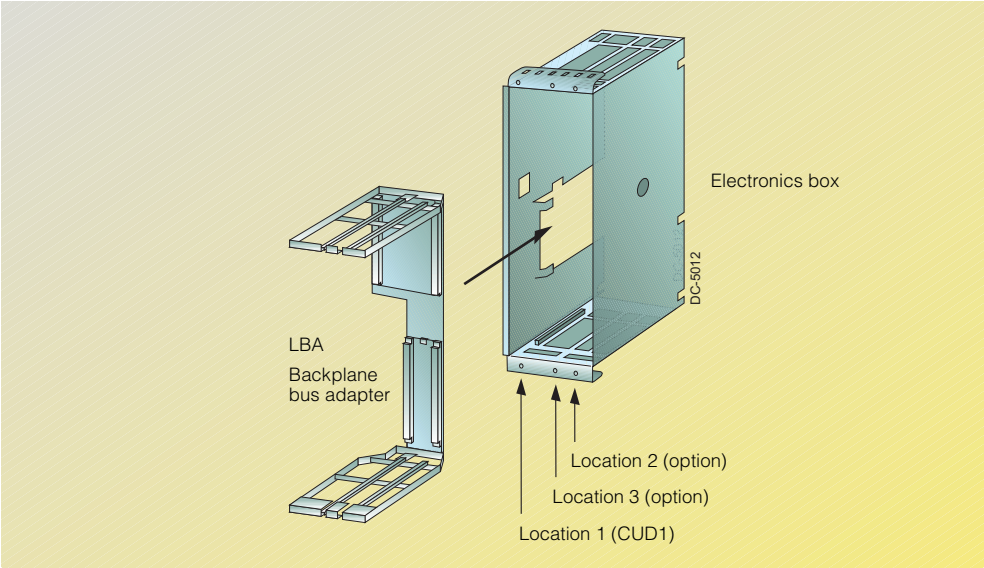


Fig. 4/7
Backplane bus adapter

Selection and ordering data

Description		Short code	Supplied unassembled Order No.
LBA	Backplane bus adapter		**6SE7090-0XX84-4HA0**
LBA installed in the electronics box (prerequisite for the installation of optional boards)		**K11**	

Adapter board ADB

The ADB (**A**dapter **B**oard) 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.

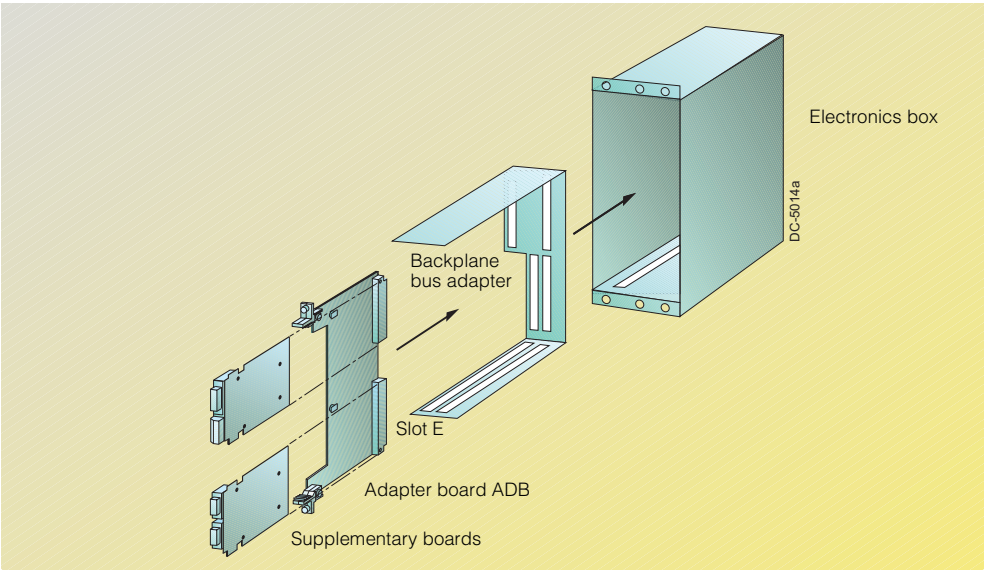
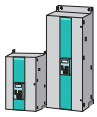


Fig. 4/8
Adapter board ADB

Selection and ordering data

Description			Short code	Installation kit and spare part, supplied unassembled Order No.
ADB	Adapter board			**6SE7090-0XX84-0KA0**
Board installed in location		2 (Slot D and E)	**K01**	
		3 (Slot F and G)	**K02**	



Optional board SBP for pulse encoder

The optional board SBP (**S**ensor **B**oard **P**ulse) 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 6 000 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 mm^2 (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).

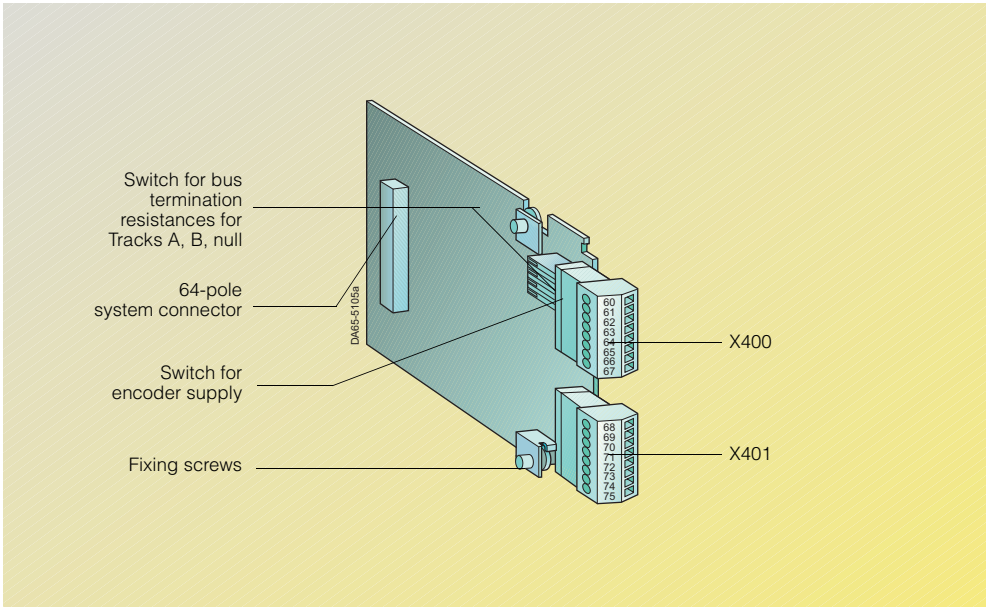


Fig. 4/9
Optional module SBP

Terminal assignments on terminal strip X400

Terminal	Designation	Meaning	Range
60	$+V_{SS}$	Power supply for pulse encoder	5/15 V I_{max} = 250 mA
61	$-V_{SS}$	Power supply ground	–
62	–Temp	Negative (–) terminal KTY84/PTC100	
63	+Temp	Positive (+) terminal KTY84/PTC100	
64	Coarse/fine ground	Ground	
65	Coarse pulse 1	Digital input coarse pulse 1	
66	Coarse pulse 2	Digital input coarse pulse 2	
67	Fine pulse 2	Digital input fine pulse 2	

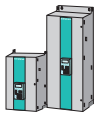
Connectable cross-section: 0.14 mm^2 to 1.5 mm^2 (AWG 16)
Terminal 60 is on the top in the installed state.

Terminal assignments on terminal strip X401

Terminal	Designation	Meaning	Range
68	Track A+	Positive (+) terminal Track A	TTL/HTL/HTL unipolar
69	Track A–	Negative (–) terminal Track A	TTL/HTL/HTL unipolar
70	Track B+	Positive (+) terminal Track B	TTL/HTL/HTL unipolar
71	Track B–	Negative (–) terminal Track B	TTL/HTL/HTL unipolar
72	Zero pulse+	Positive (+) terminal Zero track	TTL/HTL/HTL unipolar
73	Zero pulse–	Negative (–) terminal Zero track	TTL/HTL/HTL unipolar
74	CTRL+	Positive (+) terminal Check track	TTL/HTL/HTL unipolar
75	CTRL– = M	Negative (–) terminal Check track = ground	TTL/HTL/HTL unipolar

Connectable cross-section: 0.14 mm^2 to 1.5 mm^2 (AWG 16)
Terminal 68 is on the top in the installed state.

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



Terminal expansions

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.

	RS 422 (TTL)	HTL bipolar	HTL unipolar
Voltage range – Input	Max. 33 V; min. –33 V		
Voltage range + Input	Max. 33 V; min. –33 V		
Switching level Differential voltage – LOW	Min. –150 mV	Min. –2 V	Min. 4 V
Switching level Differential voltage – HIGH	Max. 150 mV	Max. 2 V	Max. 8 V

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.

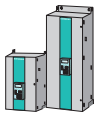
	Rated value	Min.	Max.
Voltage range LOW	0 V	–0.6 V	3 V
Voltage range HIGH	24 V	24 V	33 V
Input current LOW	≤ 2 mA		
Input current HIGH	10 mA	8 mA	12 mA

Selection and ordering data

Description		Short code	Installation kit for retrofitting, supplied unassembled Order No.	Spare part Order No.
SBP	Pulse encoder evaluation board [1)2)]		**6SX7010-0FA00**	**6SE7090-0XX84-0FA0**
Board installed in slot	D	**C14**		
	E	**C15**		
	F	**C16**		
	G	**C17**		

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 (**E**xpansion-**B**oard 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.

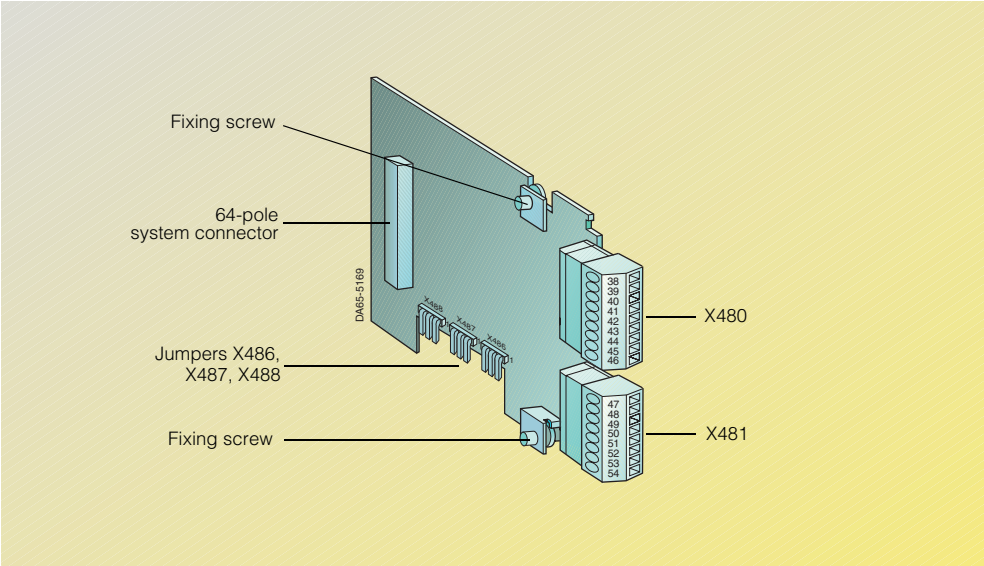


Fig. 4/10
Terminal expansion board EB1

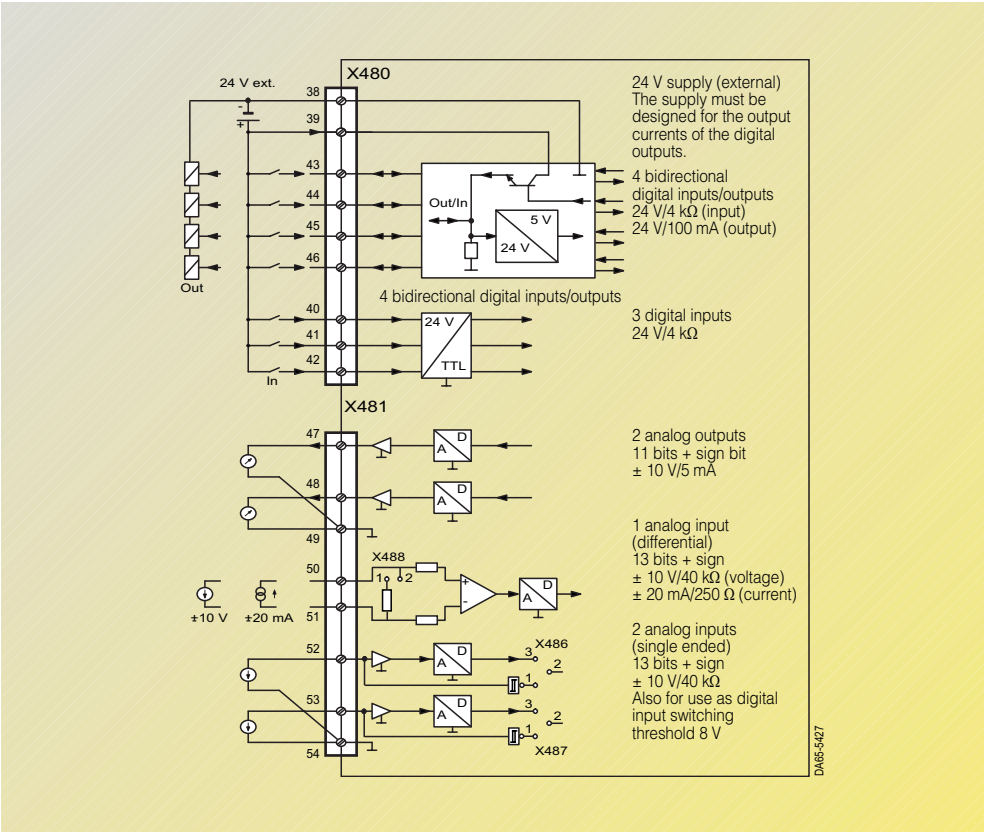
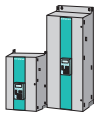


Fig. 4/11
Circuit diagram of the terminal expansion board EB1



Terminal expansions

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	Designation	Meaning	Range
38	M	Digital ground	0 V
39	P24 ext.	Ext. 24 V supply	20 V to 33 V
40	DI1	Digital input 1	24 V, R_i = 4 kΩ
41	DI2	Digital input 2	24 V, R_i = 4 kΩ
42	DI3	Digital input 3	24 V, R_i = 4 kΩ
43	DIO1	Digital input/output 1	As input: 24 V, 4 kΩ As output: Output voltage P24 ext. 100 mA
44	DIO2	Digital input/output 2	
45	DIO3	Digital input/output 3	
46	DIO4	Digital input/output 4	

Connectable cross-section: 0.14 - 1.5 mm^2 (AWG 16)

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.

Terminal	Designation	Meaning	Range
47	AO1	Analog output 1	±10 V, 5 mA
48	AO2	Analog output 2	±10 V, 5 mA
49	AOM	Analog output ground	0 V
50	AI1P	Analog input 1 +	Voltage: ±10 V, 40 kΩ Current: ± 20 mA, 250 Ω
51	AI1N	Analog input 1 –	
52	AI2	Analog input 2	±10 V, 40 kΩ
53	AI3	Analog input 3	±10 V, 40 kΩ
54	AIM	Analog input ground	0 V

Connectable cross-section: 0.14 - 1.5 mm^2 (AWG 16)

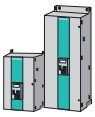
Technical Data

Designation	Value
Digital inputs	DI1, DI2, DI3
• Voltage range LOW • Voltage range HIGH • Input resistance • Smoothing • Isolation	0 V (–33 V to +5 V) +24 V (13 V to 33 V) 4 kΩ 250 µs None
Bidirectional digital inputs/outputs	DIO1, DIO2, DIO3, DIO4
As input • Voltage range LOW • Voltage range HIGH • Input resistance As output • Voltage range LOW • Voltage range HIGH	 0 V (–33 V to +5 V) +24 V (13 V to 33 V) 4 kΩ < 2 V > P24 ext. –2.5 V
Analog input (differential input)	AI1P, AI1N
• Input range Voltage Current • Input resistance Voltage Current • Hardware smoothing • Resolution	 ±11 V ±20 mA 40 kΩ relative to frame 250 Ω relative to frame 220 µs 13 bits + sign bit
Analog input (single ended)	AI2, AI3, AIM
• Input range • Input resistance • Hardware smoothing • Resolution	±11 V 40 kΩ relative to frame 220 µs 13 bits + sign bit
Analog output	AO1, AO2, AOM
• Voltage range • Input resistance • Hardware smoothing • Resolution	±10 V 40 kΩ relative to frame 10 µs 11 bits + sign bit

Selection and ordering data

Description		Short code	Installation kit, supplied unassembled Order No.	Spare part Order No.
EB1	Terminal expansion board [1]		**6SX7010-0KB00**	**6SE7090-0XX84-0KB0**
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 (**E**xpansion-**B**oard 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.

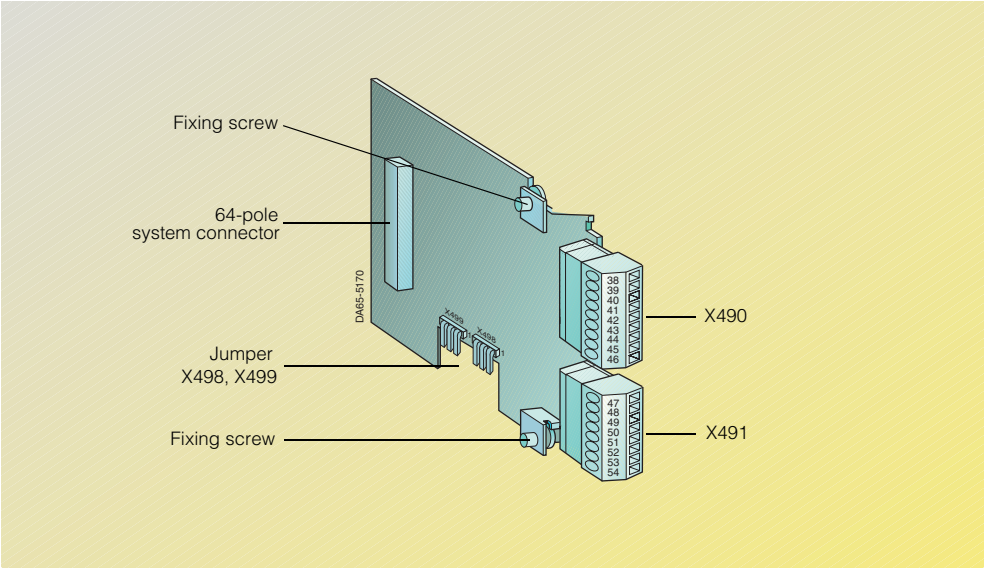


Fig. 4/12
Terminal expansion board EB2

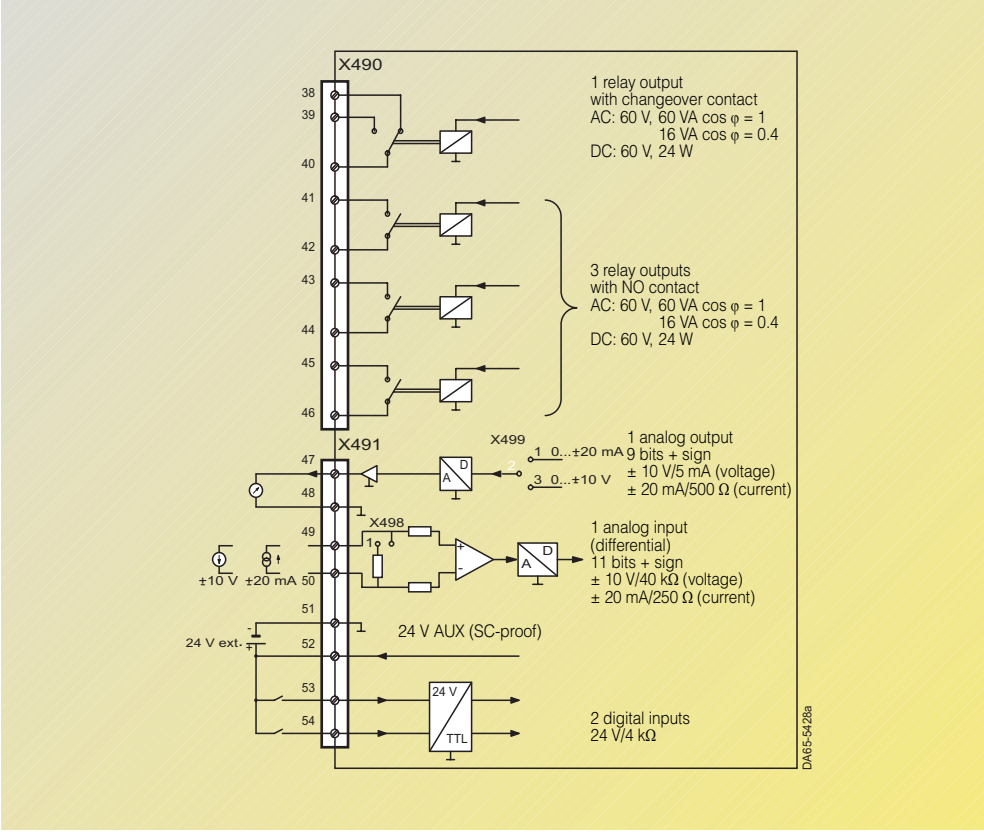
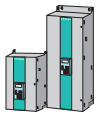


Fig. 4/13
Circuit diagram of the terminal expansion board EB2

Options

Terminal expansions



Terminal expansion board EB2

Terminal X490

Load rating on the relay contacts	
Contact type	Changeover
Max. operational voltage	60 V AC, 60 V DC
Max. switching power	16 VA at 60 V AC (cos φ = 0.4) 60 VA at 60 V AC (cos φ = 1.0) 3 W at 60 V DC 24 W at 60 V DC

Terminal	Designation	Meaning
38	DO13	Relay output 1, NC
39	DO12	Relay output 1, NO
40	DO11	Relay output 1, reference contact
41	DO22	Relay output 2, NO
42	DO21	Relay output 2, reference contact
43	DO32	Relay output 3, NO
44	DO31	Relay output 3, reference contact
45	DO42	Relay output 4, NO
46	DO41	Relay output 4, reference contact

Connectable cross-section: 0.14 - 1.5 mm^2 (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	Range
47	AO	Analog output	±10 V, 5 mA ±20 mA, 500 Ω
48	AOM	Analog output ground	
49	AI1P	Analog input +	±10 V, 40 kΩ ±20 mA, 250 Ω
50	AI1N	Analog input –	
51	DIM	Digital input ground	0 V
52	P24AUX	24 V supply	24 V
53	DI1	Digital input 1	24 V, R_i = 4 kΩ
54	DI2	Digital input 2	24 V, R_i = 4 kΩ

Connectable cross-section: 0.14 - 1.5 mm^2 (AWG 16)

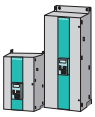
Technical Data

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

Selection and ordering data

Description		Short code	Installation kit, supplied unassembled Order No.	Spare part Order No.
EB2	Terminal expansion board [1]		**6SX7010-0KC00**	**6SE7090-0XX84-0KC0**
Module, installed in slot	D	**G74**		
	E	**G75**		
	F	**G76**		
	G	**G77**		

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 (**S**erial **C**ommunication **I**nterface 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.

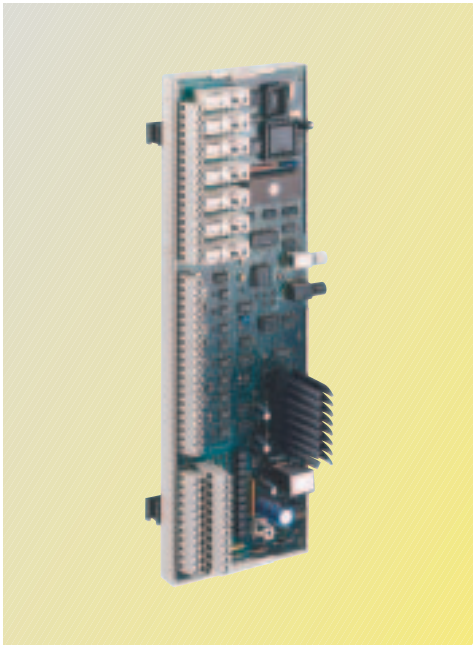


Fig. 4/14
Interface board SCI1

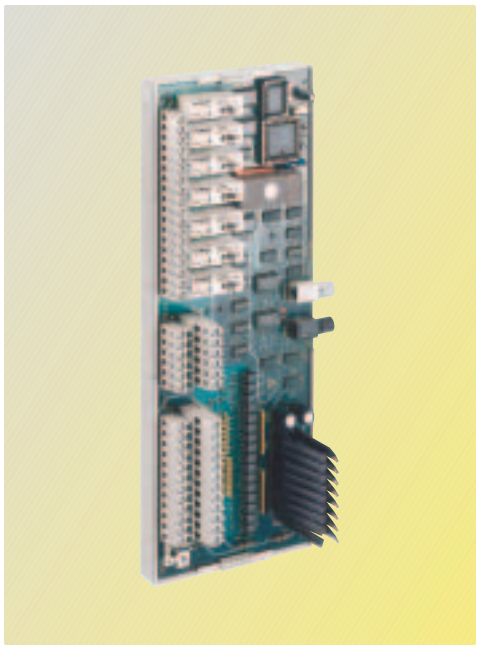


Fig. 4/15
Interface board SCI2

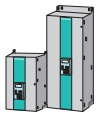
Inputs and outputs

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

Technical Data

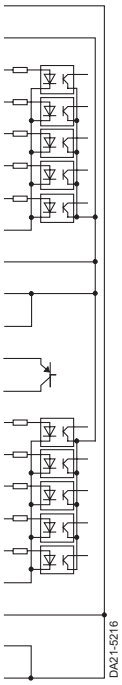
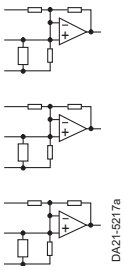
Fixing	Standard mounting rail
Rated input voltage, external	24 V DC (-17 %, +25 %), 1 A
Degree of protection	IP 00
Dimensions H x W x D	SCI1: 95 mm x 300 mm x 80 mm SCI2: 95 mm x 250 mm x 80 mm

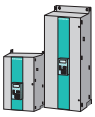
Options



Terminal expansions

Control terminal strip on interface board SCI1

Terminal	No.:	Internal Circuit	Function, Notes	
X427	A1		Auxiliary voltage P 24 V DC, 200 mA for binary inputs	
	A2		Auxiliary voltage M for binary inputs	
	A3		Binary input 6	
	A4		Binary input 7	
	A5		Binary input 8	
	A6		Binary input 9	
	A7		Binary input 10	
	A8		Reference point for binary inputs 6 to 10	
	A9		Auxiliary voltage M for binary inputs	
	A10		Power supply M (connection of external supply)	
	A11		Power supply M (connection of external supply)	
	B1		Binary output 8, driver P 24 V DC	
	B2		Binary output 8, driver 100 mA external, short-circuit proof	
	B3		Binary input 1	
	B4		Binary input 2	
	B5		Binary input 3	
	B6		Binary input 4	
	B7		Binary input 5	
	B8		Reference point for binary inputs 1 to 5	
	B9		Auxiliary voltage P 24 V DC for binary inputs	
	B10	DA21-5216	Power supply P 24 V DC (connection of external supply)	
	B11		Power supply P 24 V DC (connection of external supply)	
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	DA21-5217a		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)

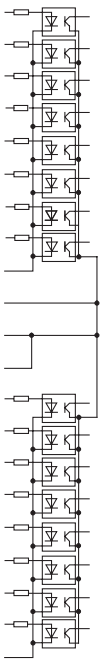
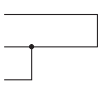


Control terminal strip on interface board SCI1

Terminal	No.:	Internal Circuit	Function, Notes	
X429	1		Binary output 1:	NO 100 V DC / 250 V AC;
	2			240 W / 2000 VA; min.: 24 V, 10 mA
	3		Binary output 2:	NO 100 V DC / 250 V AC;
	4			240 W / 2000 VA; min.: 24 V, 10 mA
	5		Binary output 3:	NO 100 V DC / 250 V AC;
	6			240 W / 2000 VA; min.: 24 V, 10 mA
	7		Binary output 4:	changeover
	8			100 V DC / 250 V AC; 240 W / 2000 VA;
	9			Minimum load: 24 V, 10 mA
	10		Binary output 5:	changeover
	11			100 V DC / 250 V AC; 240 W / 2000 VA;
	12			Minimum load: 24 V, 10 mA
	13		Binary output 6:	changeover
	14			100 V DC / 250 V AC; 240 W / 2000 VA;
	15			Minimum load: 24 V, 10 mA
	16		Binary output 7:	changeover
	17			100 V DC / 250 V AC; 240 W / 2000 VA;
	18			Minimum load: 24 V, 10 mA

DA21-5218

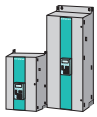
Control terminal strip on interface board SCI2

Terminal	No.:	Internal Circuit	Function, Notes
X437	A1		Binary input 9
	A2		Binary input 10
	A3		Binary input 11
	A4		Binary input 12
	A5		Binary input 13
	A6		Binary input 14
	A7		Binary input 15
	A8		Binary input 16
	A9		Reference point for binary inputs 9 to 16
	A10		Auxiliary voltage M for binary inputs
	A11		Power supply M (connection of external supply)
	A12		Power supply M (connection of external supply)
	B1		Binary input 1
	B2		Binary input 2
	B3		Binary input 3
	B4		Binary input 4
	B5		Binary input 5
	B6		Binary input 6
	B7		Binary input 7
	B8		Binary input 8
	B9		Reference point for binary inputs 1 to 8
	B10		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
	B11		Power supply P 24 V DC (connection of external supply)
	B12		Power supply P 24 V DC (connection of external supply)

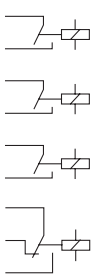
DA21-5219

Options

Terminal expansions

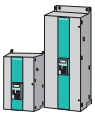


Control terminal strip on interface board SCI2

Terminal	No.:	Internal Circuit	Function, Notes	
X438	A1		Binary output 11, driver 24 V DC	
	A2		Binary output 11, driver 100 mA external, short-circuit proof	
	A3		Binary output 12, driver 24 V DC	
	A4		Binary output 13, driver 100 mA external, short-circuit proof	
	A5		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	
	A6		Auxiliary voltage M for binary outputs	
	B1		Binary output 8, driver 24 V DC	
	B2		Binary output 8, driver 100 mA external, short-circuit proof	
	B3		Binary output 9, driver 24 V DC	
	B4		Binary output 9, driver 100 mA external, short-circuit proof	
	B5	DA21-5220	Binary output 10, driver 24 V DC	
	B6		Binary output 10, driver 100 mA external, short-circuit proof	
X439	1		Binary output 1:	NO 100 V DC / 250 V AC;
	2			240 W / 2000 VA; min.: 24 V, 10 mA
	3		Binary output 2:	NO 100 V DC / 250 V AC;
	4			240 W / 2000 VA; min.: 24 V, 10 mA
	5		Binary output 3:	NO 100 V DC / 250 V AC;
	6			240 W / 2000 VA; min.: 24 V, 10 mA
	7		Binary output 4:	changeover
	8			100 V DC / 250 V AC; 240 W / 2000 VA;
	9			Minimum load: 24 V, 10 mA
	10		Binary output 5:	changeover
	11			100 V DC / 250 V AC; 240 W / 2000 VA;
	12			Minimum load: 24 V, 10 mA
	13		Binary output 6:	changeover
	14			100 V DC / 250 V AC; 240 W / 2000 VA;
	15			Minimum load: 24 V, 10 mA
	16		Binary output 7:	changeover
	17			100 V DC / 250 V AC; 240 W / 2000 VA;
	18	DA21-5218		Minimum load: 24 V, 10 mA

Selection and ordering data

Description		Order No.:
SCI1	Interface board Binary and analog inputs/outputs Supplied unassembled incl. 10 m fiber-optic cable	**6SE7090-0XX84-3EA0**
SCI2	Interface board Binary inputs and outputs Supplied unassembled incl. 10 m fiber-optic cable	**6SE7090-0XX84-3EF0**



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.

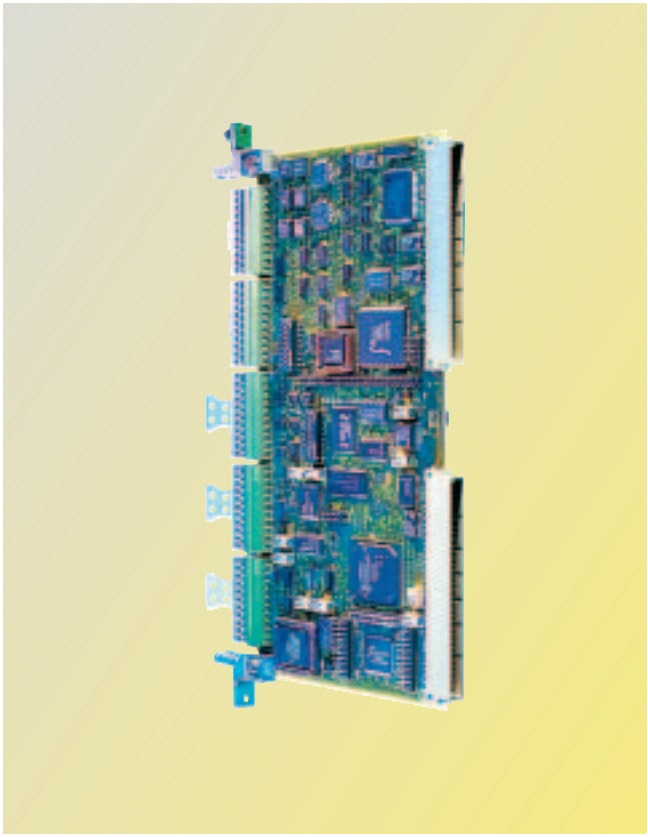


Fig. 4/16
Technology board T400

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 boards

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) baudrates [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.

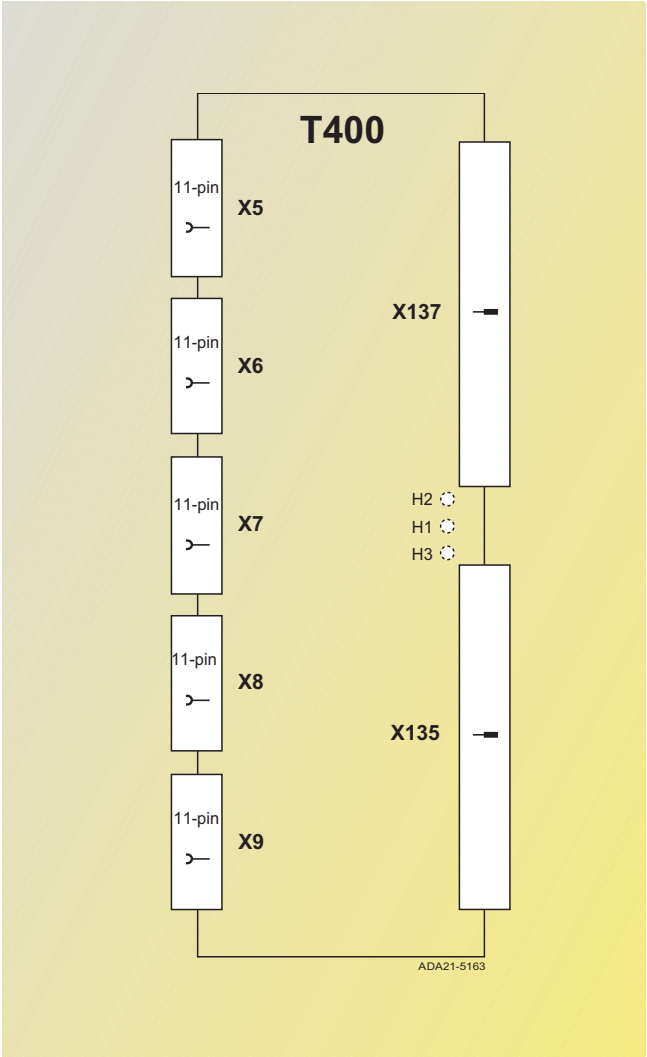
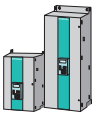


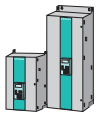
Fig. 4/17
Technology board T400



Technology board T400

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

Technology boards



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 dynamometer 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 conveyor 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 min^{-1}

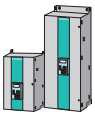
Closed-loop cross-cutter/ shears control

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 synchronism
- 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

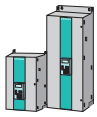


Technology board T400

T400 terminal assignments		Connector	Connector pin	Terminal
+24 V external (for binary inputs and outputs)		X5	1	45
Bidirectional binary input and output 1			2	46
Bidirectional binary input and output 2			3	47
Bidirectional binary input and output 3			4	48
Bidirectional binary input and output 4			5	49
Ground for binary inputs and outputs			6	50
Binary output 1			7	51
Binary output 2			8	52
Binary input 1 (alarm-capable)			9	53
Binary input 2 (alarm-capable)			10	54
Binary input 3 (alarm-capable)			11	55
Binary input 4 (alarm-capable)		X6	1	56
Binary input 5			2	57
Binary input 6			3	58
Binary input 7			4	59
Binary input 8			5	60
Ground for binary inputs and outputs			6	61
Increm. encoder 2: Track A (HTL)	Increm. encoder 2: Track A+ (RS 422)		7	62
Increm. encoder 2: Track B (HTL)	Increm. encoder 2: Track B+ (RS 422)		8	63
Increm. encoder 2: Zero pulse (HTL)	Increm. encoder 2: Zero pulse+ (RS 422)		9	64
Increm. encoder 2: Coarse pulse			10	65
Ground for increm. encoder 2			11	66
Ser. interface 1: Rx-RS 232		X7	1	67
Ser. interface 1: Tx-RS 232			2	68
Ground for ser. interface			3	69
Ser. interface 1: Tx/Rx-RS 485+			4	70
Ser. interface 1: Tx/Rx-RS 485-			5	71
Ser. interface 2: Rx-RS 485+	Absolute encoder 2: Data+		6	72
Ser. interface 2: Rx-RS 485-	Absolute encoder 2: Data-		7	73
Ser. interface 2: Tx (Rx)-RS 485+	Absolute encoder 2: Clock+		8	74
Ser. interface 2: Tx (Rx)-RS 485-	Absolute encoder 2: Clock-		9	75
Absolute encoder 1: Data+			10	76
Absolute encoder 1: Data-			11	77
Absolute encoder 1: Clock+		X8	1	78
Absolute encoder 1: Clock-			2	79
+15 V encoder supply (max. 100 mA)			3	80
Increm. encoder 1: Track A			4	81
Increm. encoder 1: Track B			5	82
Increm. encoder 1: Zero pulse			6	83
Increm. encoder 1: Coarse pulse			7	84
Ground for increm. encoder 1			8	85
Increm. encoder 2: Track A- (with RS 422)			9	86
Increm. encoder 2: Track B- (with RS 422)			10	87
Increm. encoder 2: Zero pulse- (with RS 422)			11	88
Ground for analog inputs and outputs		X9	1	89
Analog input 1	Analog input 1+		2	90
	Analog input 1-		3	91
Analog input 2	Analog input 2+		4	92
	Analog input 2-		5	93
Analog input 3			6	94
Analog input 4			7	95
Analog input 5			8	96
Analog output 1			9	97
Analog output 2			10	98
Ground for analog inputs and outputs			11	99

Selection and ordering data

Description	Order No.:	Order No.: German	Order No.: German/English	Order No.: English
T400 with axle winder without User's Guide	**6DD1842-0AA0**	–	–	–
Axle winder software including User's Guide	**6DD1843-0AA0**	–	–	–
User's Guide for axle winder	–	**6DD1903-0AA0**	–	**6DD1903-0AB0**
T400 with angular synchronism without User's Guide	**6DD1842-0AB0**	–	–	–
Angular synchronism software including User's Guide	**6DD1843-0AB0**	–	–	–
User's Guide for angular synchronism	–	**6DD1903-0BA0**	–	**6DD1903-0BB0**
T400 technology board including brief description	**6DD1606-0AD0**	–	–	–
User's Guide	–	–	**6DD1903-0EA0**	–
T400 with closed-loop cross-cutter/shears control	**6DD1842-0AD0**	–	–	–
User's Guide	–	**6DD1903-0DA0**	–	**6DD1903-0DB0**



Technology boards

Technology board T100

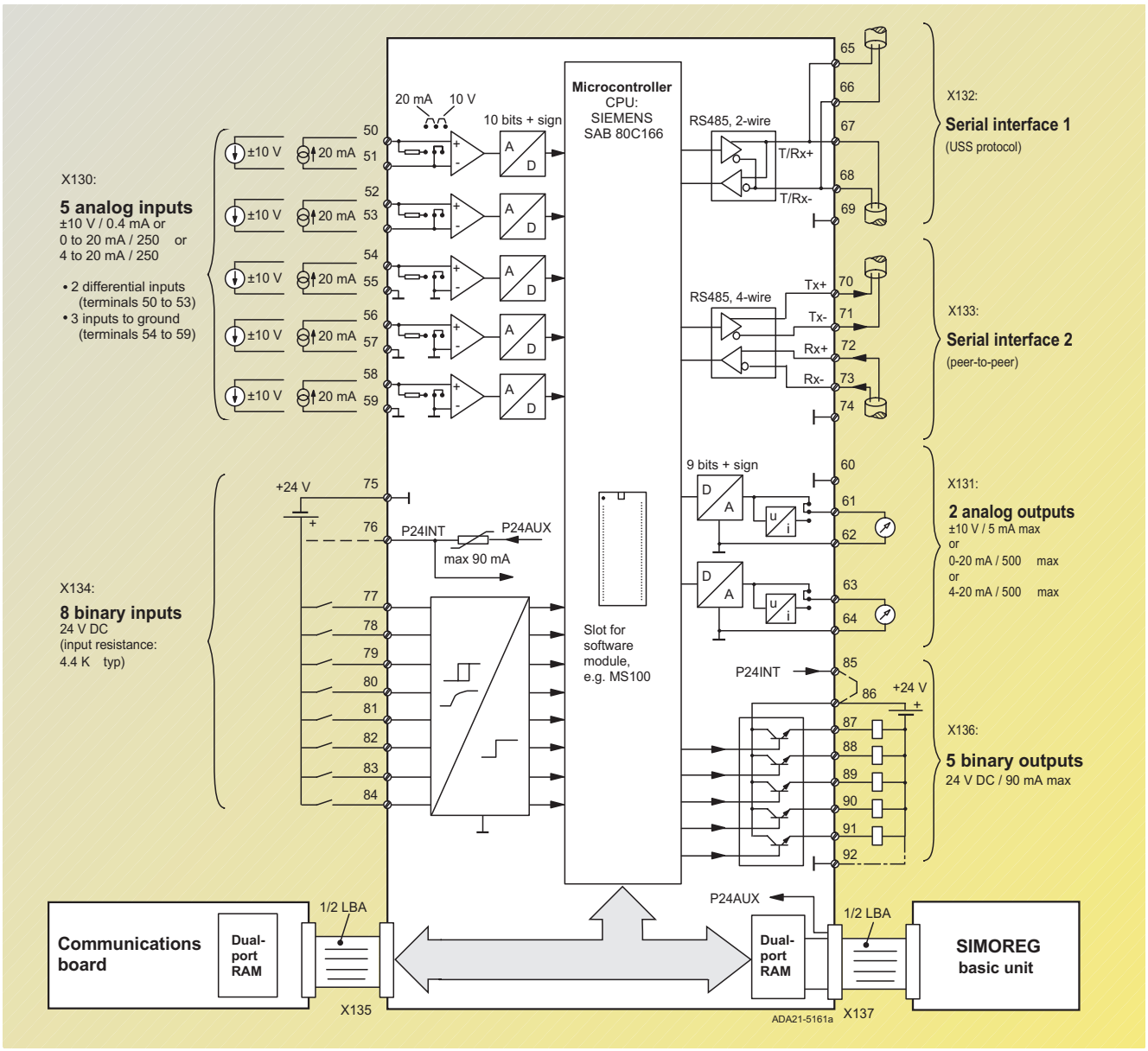


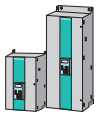
Fig. 4/18
Connection diagram for T100

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 8 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 92 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, with which a digital setpoint cascade can be created.
  - USS 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

Terminal	Features
5 analog inputs	• Possible input level/input impedance – -10 V ... + 10 V/24 kΩ typ – 0 ... ± 20 mA/250 Ω typ – 4 ... 20 mA/250 Ω typ • 2 differential inputs • 3 inputs to ground • Non-floating • Resolution 10 bits + sign
2 analog outputs	• Possible output level/driver capability – -10 V to + 10 V/5 mA max. – 0 to 20 mA/500 Ω max. – 4 to 20 mA/500 Ω max. • Non-floating • Resolution 9 bits + sign
8 binary inputs	• Input level 24 V DC, compatible with SIMATIC: LOW = -33 V to +5 V, HIGH = +13 V to +33 V • Non-floating • Input resistance: 4.4 kΩ typ • Signal status display on PMU and OP1S
5 binary outputs	• Transistor switch, switched in relation to 24 V DC, "open emitter" • Output level compatible with SIMATIC: LOW < +2 V, HIGH +17.5 to +33 V • Switching capacity: 90 mA max. (resistant to sustained short circuits) • Signal status display on PMU and OP1S
24 V DC load power supply for binary inputs and outputs	• 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. • External 24 V DC supply: Permissible voltage range +20 to +30 V
1 peer-to-peer interface	• RS 485 transmission method, 4-wire full duplex • Non-floating • Terminating resistances can be activated by jumpers • Settable baud rate up to 187.5 Kbd • Receive and send signals can be freely interconnected by parameters • Max. cable length for 187.5 kbd: 500 m, For other baud rates 1000 m
1 serial USS interface	• RS 485 transmission method, 2-wire half duplex • Non-floating • Terminating resistances can be activated by jumpers • Settable baud rate up to 187.5 Kbd • Max. cable length for 187.5 kbd: 500 m, For other baud rates 1000 m

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.

Selection and ordering data

Description		Order No.:	Weight (approx.) kg	Dimensions W x H x D mm
T100	Technology board T100 for drive-based technological functions. For further details, integration of the T100 board and accessories, see Catalog DA 65.10 SIMOVERT MASTERDRIVES Vector Control. Supplied unassembled without software modules.	**6SE7090-0XX87-0BB0**	0.5	25 x 235 x 125

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®.

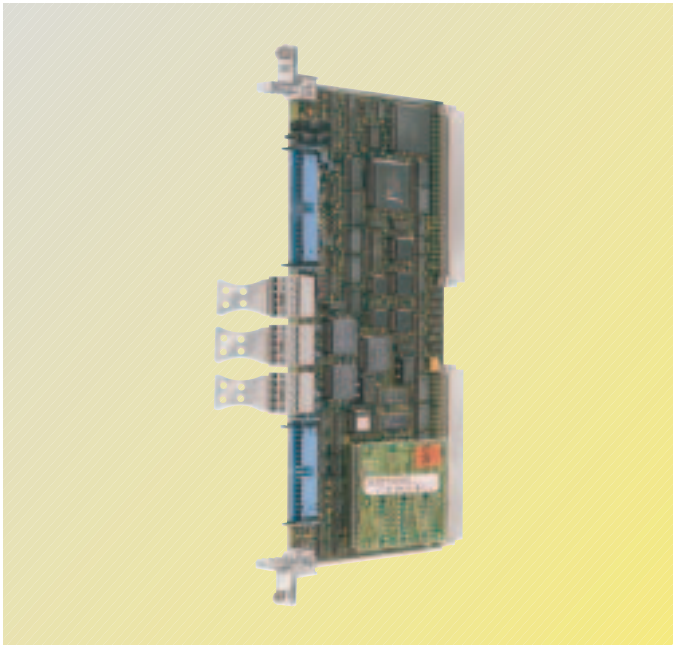
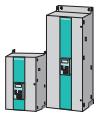


Fig. 4/19
T300 board with memory submodule

Selection and ordering data

Description		Order No.:	Weight (approx.) kg	Dimensions W x H x D mm
T300	Technology board T300, as a hardware package (T300 with 2 connecting cables SC58 and SC60, terminal strip SE300 and hardware operating instructions in English/German). For further details, integration of the T300 board and accessories, see Catalog DA 65.10 SIMOVERT MASTERDRIVES Vector Control. Supplied unassembled and not configured.	**6SE7090-0XX87-4AH0**	2	300 x 400 x 300
	T300 technology board as spare part	**6SE7090-0XX84-0AH2**		



Overview

One of the most important advantages of the SIMOREG 6RA70 is that is 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

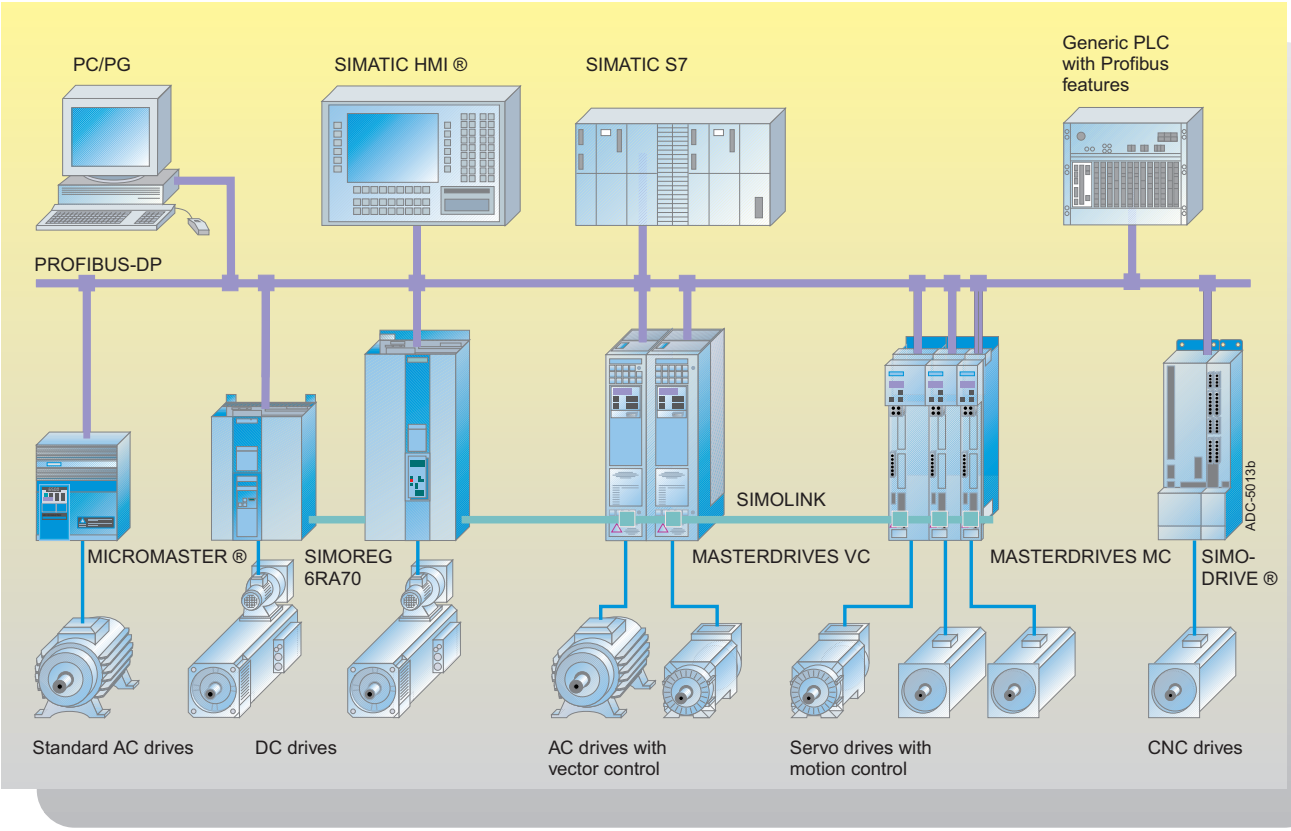


Fig. 4/20

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.

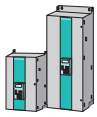
- SIMOLINK fiber-optic network with peer-to-peer functionality for extremely high-speed data exchange (11 Mbaud)
- PROFIBUS-DP communication
- Communication by means of CAN protocol
- DeviceNet communication

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.



Communication

SIMOLINK communication board SLB

The SLB optional board (**S**IMO**L**INK **B**oard) 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.

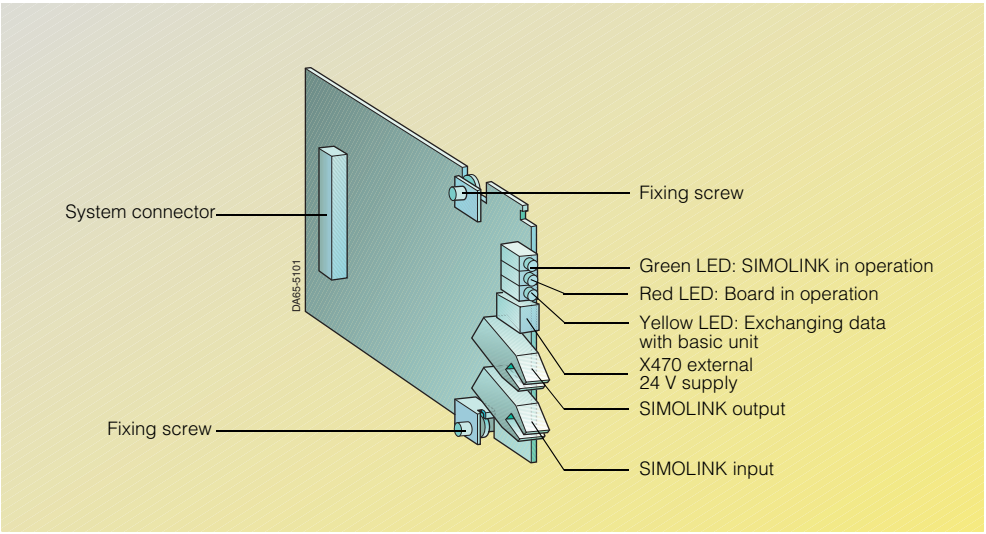


Fig. 4/21
SIMOLINK communication board SLB

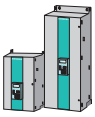
Designation	Value
Size (length x width)	90 mm x 83 mm
External voltage supply	24 V DC
Power consumption from external voltage supply	Max. 200 mA
Voltage supply from basic unit	5 V DC
Power consumption from basic unit voltage supply	Max. 600 mA
Switchover of voltage source	Automatic, external has priority
Station address	Parameter Pxxx Pxxx = 0: Dispatcher function Pxxx ≠ 0: Transceiver function
Data transfer rate	11 Mbaud
Propagation delay	Max. 3 clock cycles
Fiber optic cable	Plastic or glass fibers
Cable length	• Max. 40 m between 2 stations (plastic) • 300 m between 2 stations (glass)
Reduction of transmitter power (values for plastic fiber optic cables)	Parameter Pxxx Pxxx = y: 40 m Pxxx = y: 25 m Pxxx = y: 10 m
Display	3 LEDs • Green: SIMOLINK • Red: Optional board • Yellow: Interface to basic unit

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.

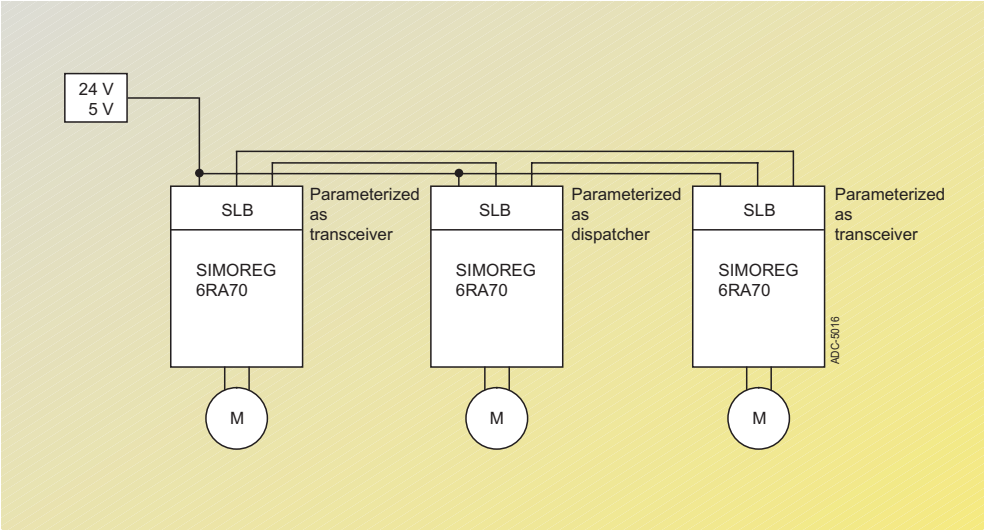


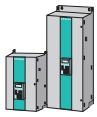
Fig. 4/22
Peer-to-peer functionality with SIMOLINK

Selection and ordering data

Description		Short code	Installation kit for retrofitting, supplied unassembled Order No.	Spare Part Order No.
SIMOLINK SLB communication board[1]			**6SX7010-0FJ00** [2]	**6SE7090-0XX84-0FJ0**
Board, installed in slot	D	**G44**		
	E	**G45**		
	F	**G46**		
	G	**G47**		
Plastic fiber-optic cable, 100 m, 20 X470 connectors, 40 FOC connectors			**6SX7010-0FJ50**	
Plastic fiber-optic cable, 1 X470 connector, 2 FOC connectors			**6SY7000-0AD15**	

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 (**C**ommunication **B**oard **P**ROFIBUS) 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.

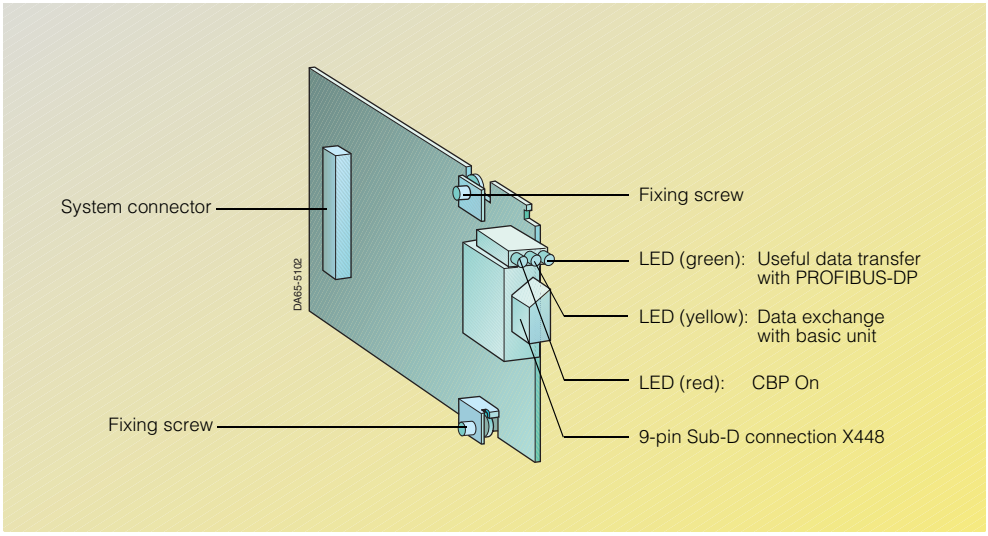


Fig. 4/23
Communication board CBP2

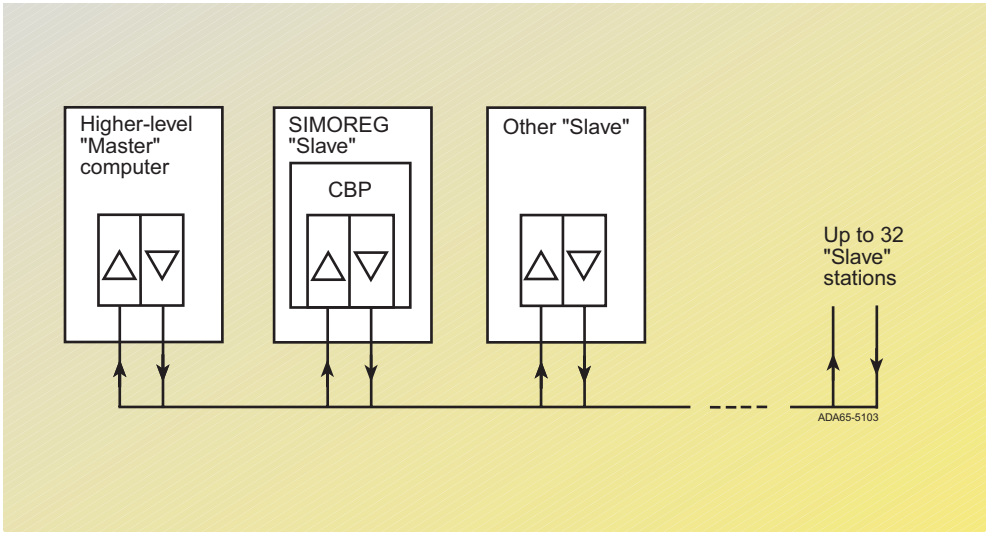
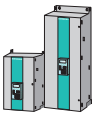


Fig. 4/24
PROFIBUS-DP connections



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.

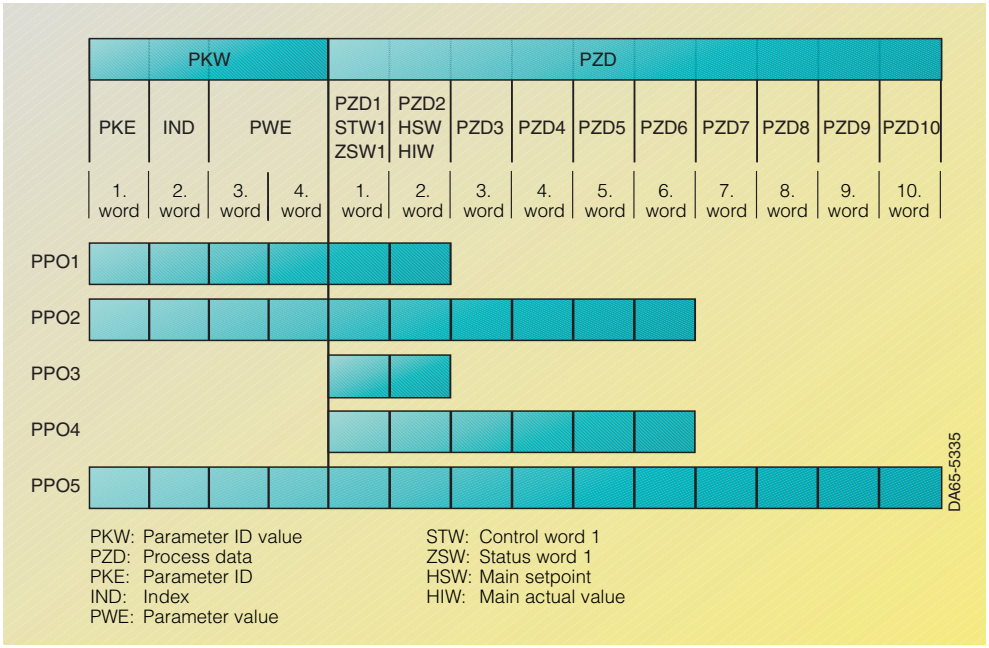


Fig. 4/25
Useful data transfer according to "PROFIBUS profile for variable-speed drives PROFIDRIVE"

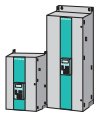
Pin assignments on X488 connector

Pin	Designation	Meaning
1	SHIELD	Ground connection
2	–	Not assigned
3	RxD/TxD-P	Receive/Send data P (B/B')
4	CNTR-P	Control signal
5	DGND	PROFIBUS-DP data reference potential (C/C')
6	VP	Supply voltage +
7	–	Not assigned
8	RxD/TxD-N	Receive/Send data N (A/A')
9	–	Not assigned

Selection and ordering data

Description		Short code	Installation kit for retrofitting, supplied unassembled Order No.	Spare Part Order No.
CBP2 Communication board [1] (PROFIBUS-DP/12 m baud)			**6SX7010-0FF05**	**6SE7090-0XX84-0FF5**
Board, installed in slot	D	**G94**		
	E	**G95**		
	F	**G96**		
	G	**G97**		
PROFIBUS-DP cable (per meter; min. 20 m/max. 100 m)			**6XV1830-0AH10**	
PROFIBUS-DP connector plug			**6ES7972-0BB40-0XA0**	

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 (**C**ontroller **A**rea **N**etwork) 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 (**C**AN **i**n **A**utomation, 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		
Process data	Max. 16 words	
Data transfer rate	10, 20, 50 Kbits/s	Cable length up to 1000 m
	100 Kbits/s	Cable length up to 750 m
	125 Kbits/s	Cable length 530 m
	250 Kbits/s	Cable length 270 m
	500 Kbits/s	Cable length 100 m
	1 Mbits/s	Cable length 9 m
Max. number of bus nodes	≤ 124	

Data exchange with CAN

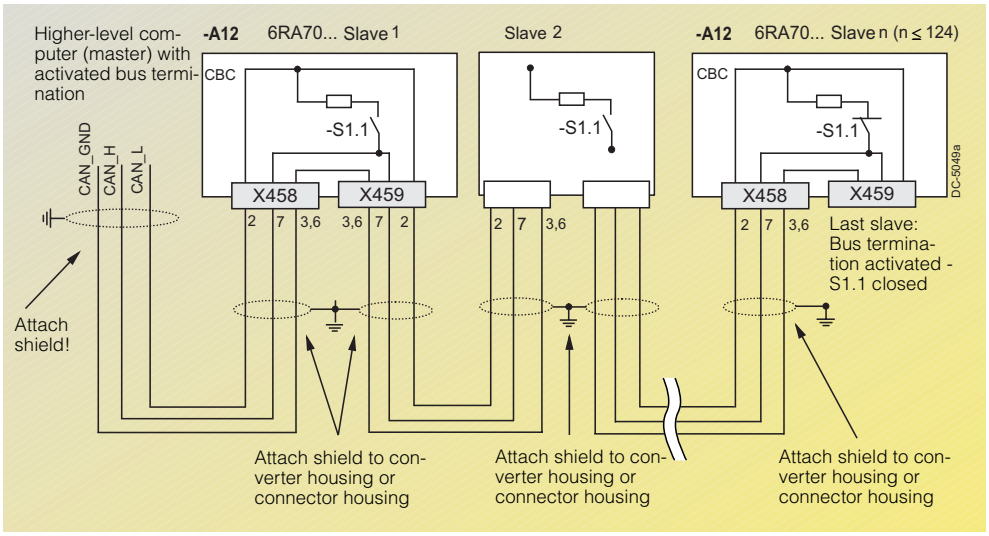


Fig. 4/26
Data exchange between CBC boards with bus interruption

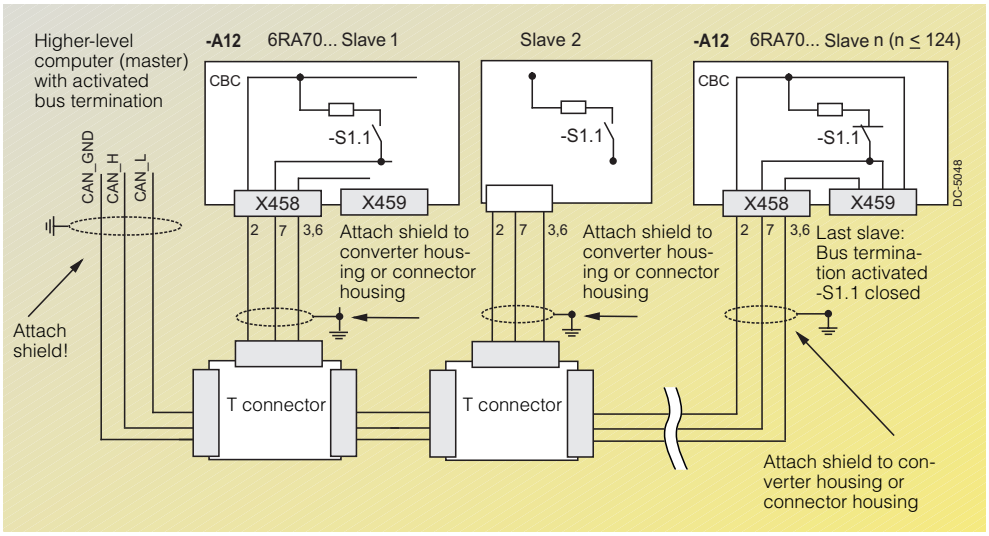
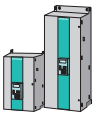


Fig. 4/27
Data exchange between CBC boards without bus interruption



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.

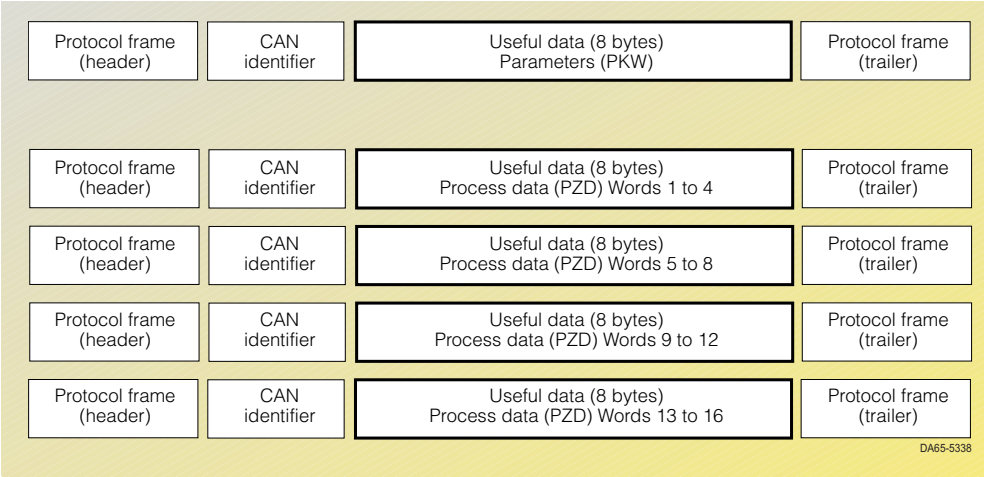


Fig. 4/28
Structure of the useful data in the message frame

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.

Pin	Designation	Meaning
1	–	Not assigned
2	CAN_L	CAN_L bus line
3	CAN_GND	CAN ground (M5 ground)
4	–	Not assigned
5	–	Not assigned
6	CAN_GND	CAN ground (M5 ground)
7	CAN_H	CAN_H bus line
8	–	Not assigned
9	–	Not assigned

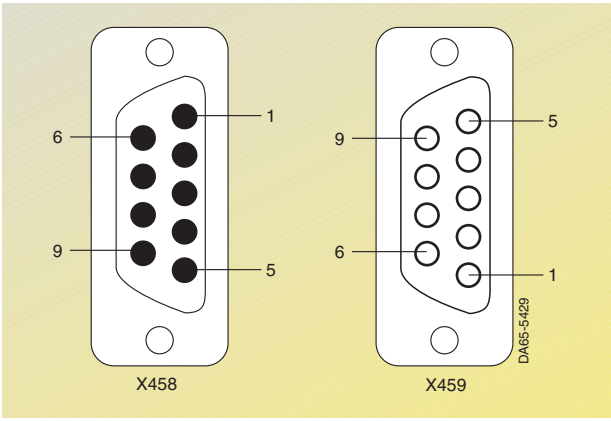


Fig. 4/29
X458 (plug) and X459 (socket) connections

Fitting the CBC board

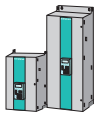
One LBA and one ADB are needed for installing the board.

Selection and ordering data

Description		Short code	Installation kit for retrofitting, supplied unassembled Order No.	Spare Part Order No.
CBC communication board[1] (CAN bus)			**6SX7010-0FG00**	**6SE7090-0XX84-0FG0**
Board, installed in slot	D	**G24**		
	E	**G25**		
	F	**G26**		
	G	**G27**		

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.

Communication



Communication board CBD DeviceNet

The CBD (**C**ommunication **B**oard **D**eviceNet) 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 Message 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 Message 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.

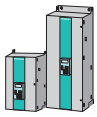
The CBD complies with the "DeviceNet Device Profile for Communication Adapters" (Device Type 12). This profile was selected to ensure that all features and extended functions of the SIMOREG 6RA70 converter can be used be the DeviceNet master. For the same reason, the CBD board has not implemented the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

Data rate	Cable length	Dropcable length max.	Cumulative
125 KB	500 m	6 m	156 m
250 KB	250 m	6 m	78 m
500 KB	100 m	6 m	39 m

Selection and ordering data

Description		Short code	Supplied unassembled Order No.
CBD DeviceNet communication board[1]			**6SX7010-0FK00**
Board, installed in slot	D	**G54**	
	E	**G55**	
	F	**G56**	
	G	**G57**	
Operating instructions			**Supplied with the board**

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 (**S**erial **C**ommunication **B**oard 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).

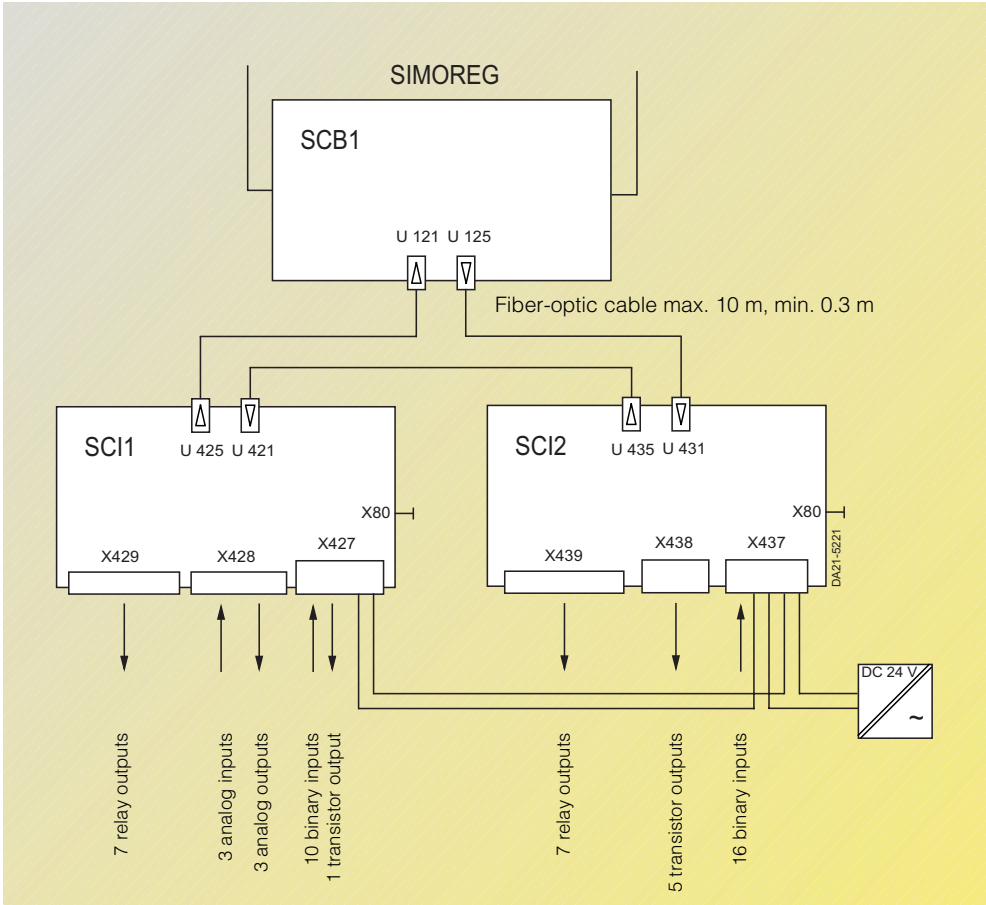
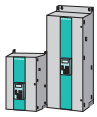


Fig. 4/30
Example to show connection of a serial I/O system comprising an SCB1, SCI1

Selection and ordering data

Description		Order No.:	Weight (approx.) kg	Dimensions W x H x D mm x mm x mm
SCB1	Interface board with fiber-optic cable connection supplied unassembled incl. 10 m FO cable	**6SE7090-0XX84-0BC0**	0.5	25 x 235 x 125



OP1S operator panel

The OP1S (**O**perator **P**anel) 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.

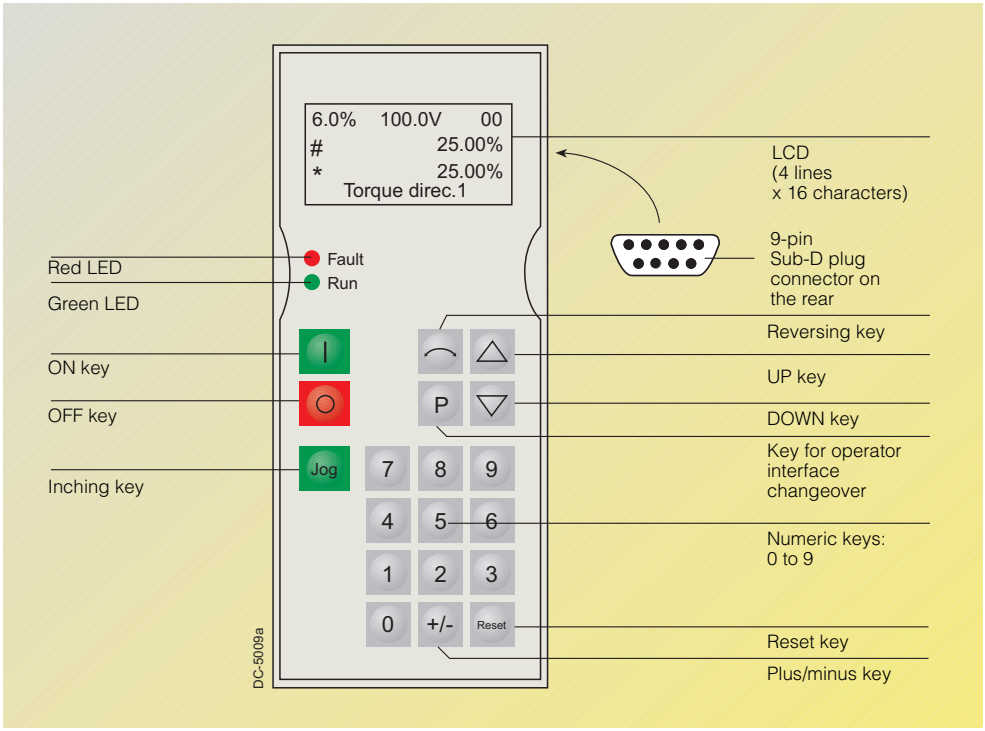


Fig. 4/31
View of the OP1S

OP1S connections with RS 485

Pin	Designation	Meaning
1	–	–
2	–	–
3	RS 485 P	Data via RS 485 interface
4	–	–
5	N5V	Ground
6	P5V	5 V auxiliary voltage supply
7	–	–
8	PS485 N	Data via RS 485 interface
9	–	Reference potential

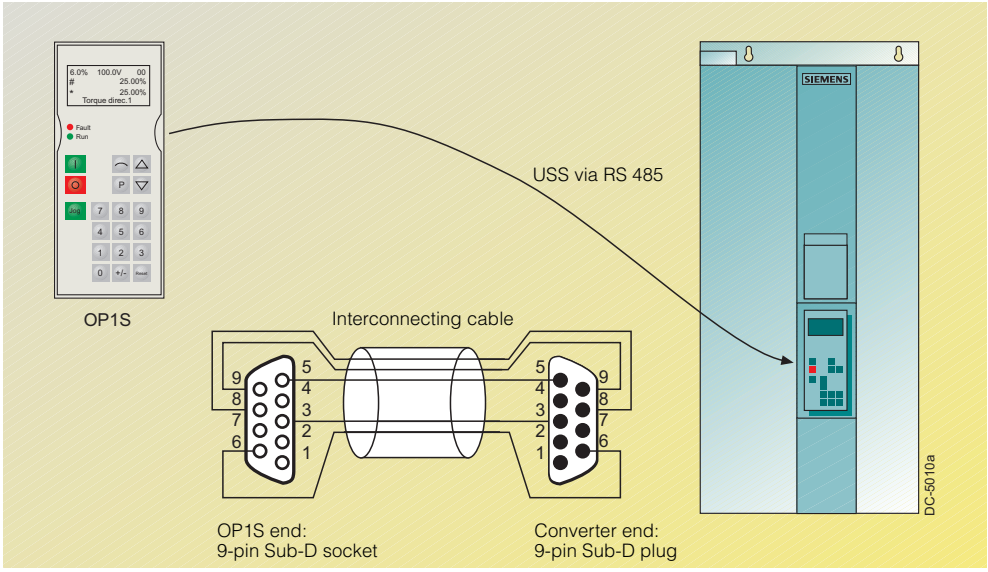
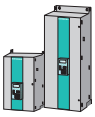


Fig. 4/32
OP1S with point-to-point link



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 kbits/s and 19.2 kbits/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).

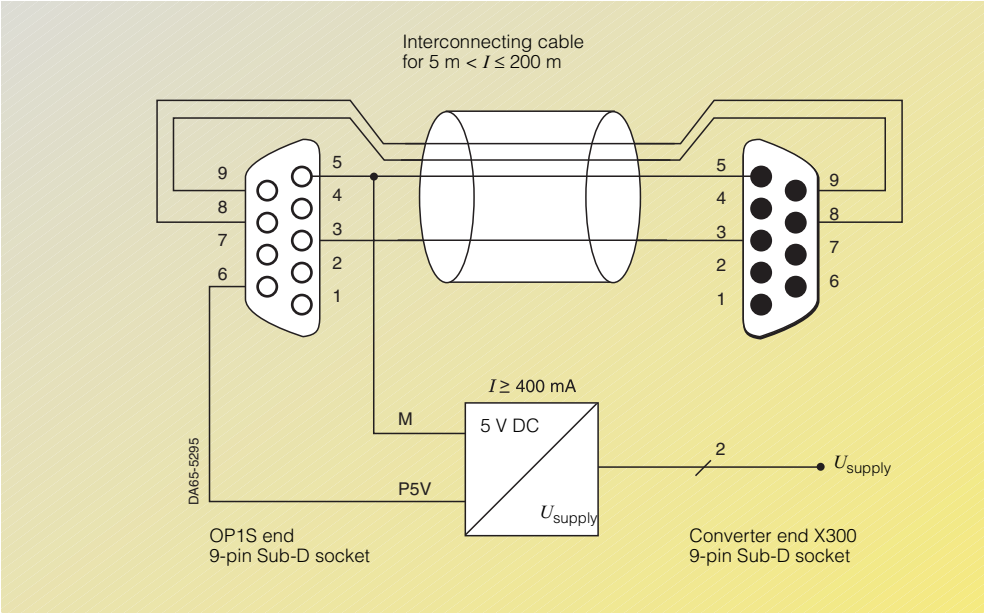
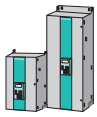


Fig. 4/33
OP1S with point-to-point connection, up to 200 m cable length

Selection and ordering data

Description	Order No.:
OP1S operator panel	**6SE7090-0XX84-2FK0**
Adapter AOP1S for cabinet door mounting including 5 m connecting cable	**6SX7010-0AA00**
Connecting cable PMU OP1S, 3 m	**6SX7010-0AB03**
Connecting cable PMU OP1S, 5 m	**6SX7010-0AB05**



DriveMonitor

Features

The current version of the Drive-Monitor 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 serveral units, bus operation), e. g. with the RS232/ RS485 interface converter, SU1.

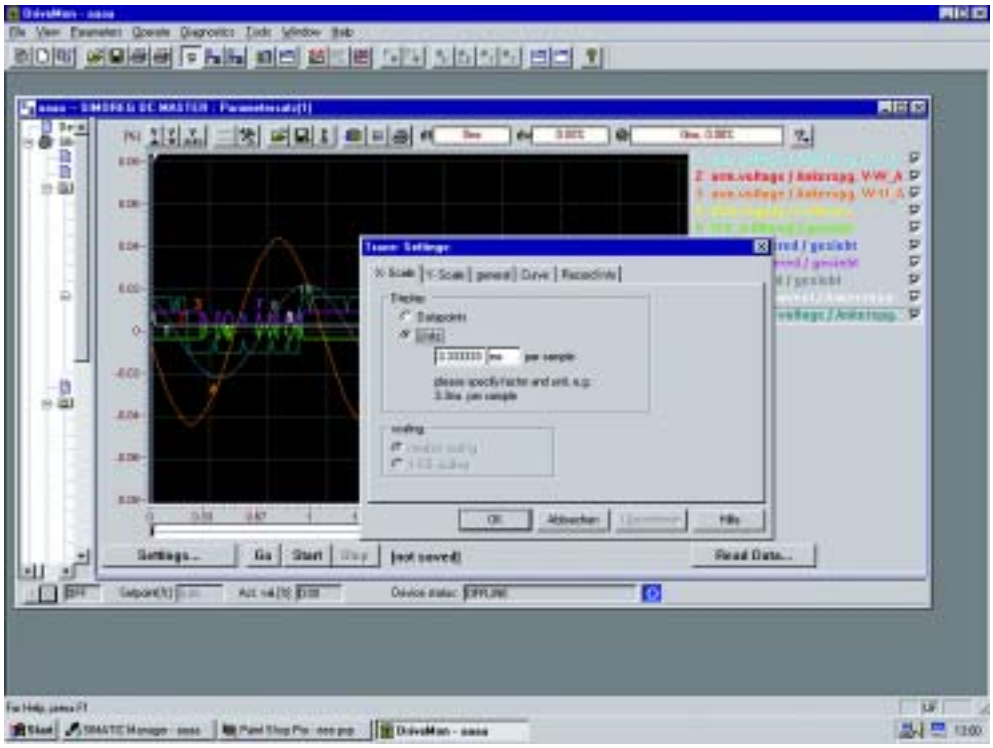


Fig. 4/34
DriveMonitor: Trace function for converter diagnosis

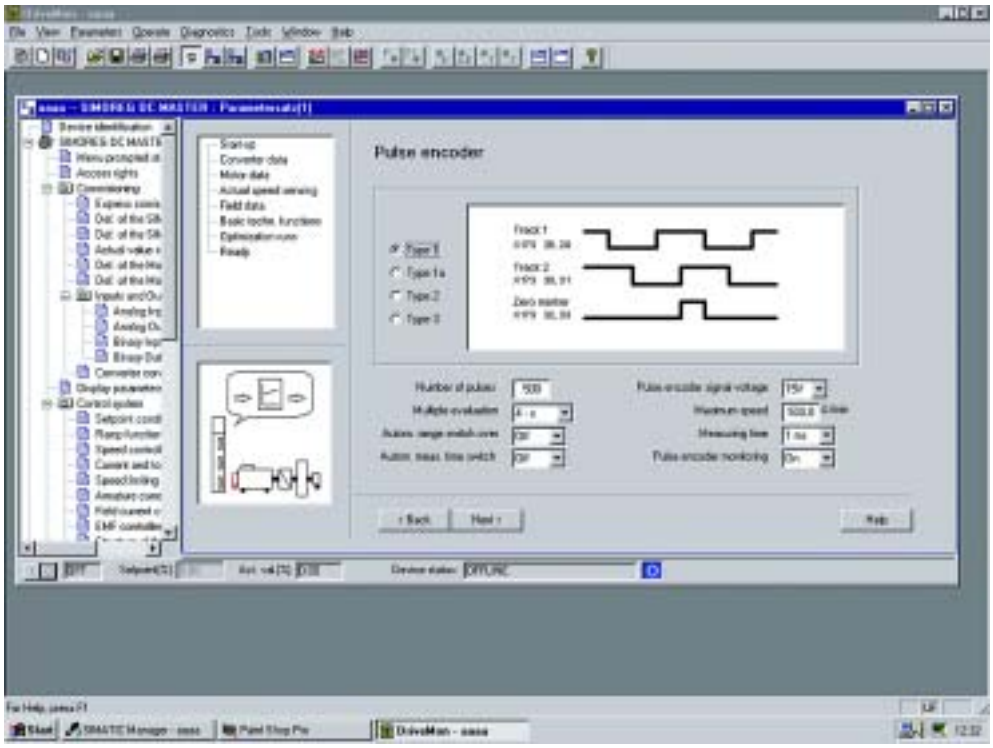
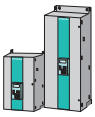


Fig. 4/35
DriveMonitor: Guided start-up



Drive ES engineering package

With Drive ES (**D**rive **E**ngineering **S**ystem), 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 ≥ 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.

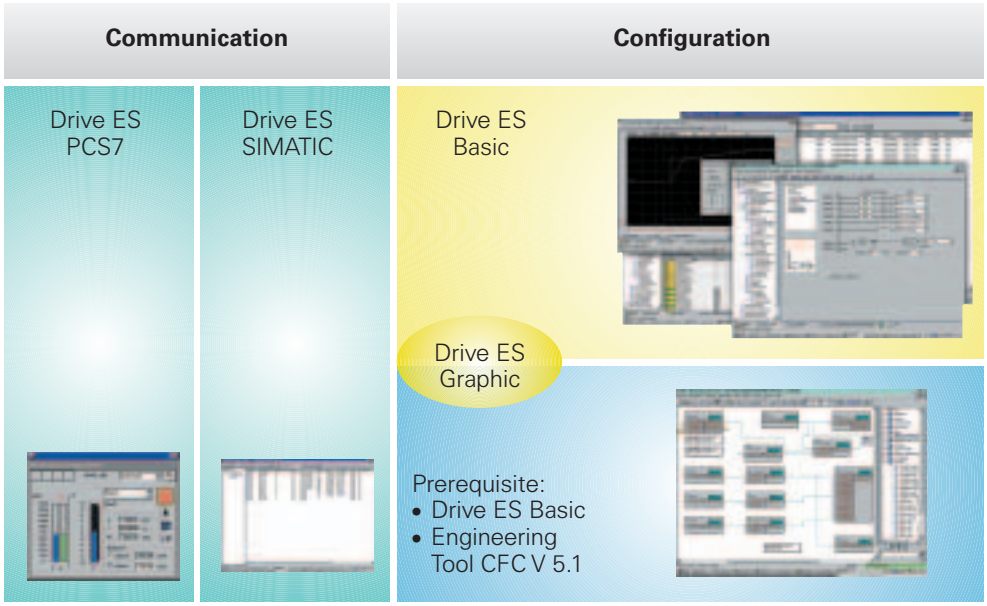


Fig. 4/36
Structure of the Drive ES product

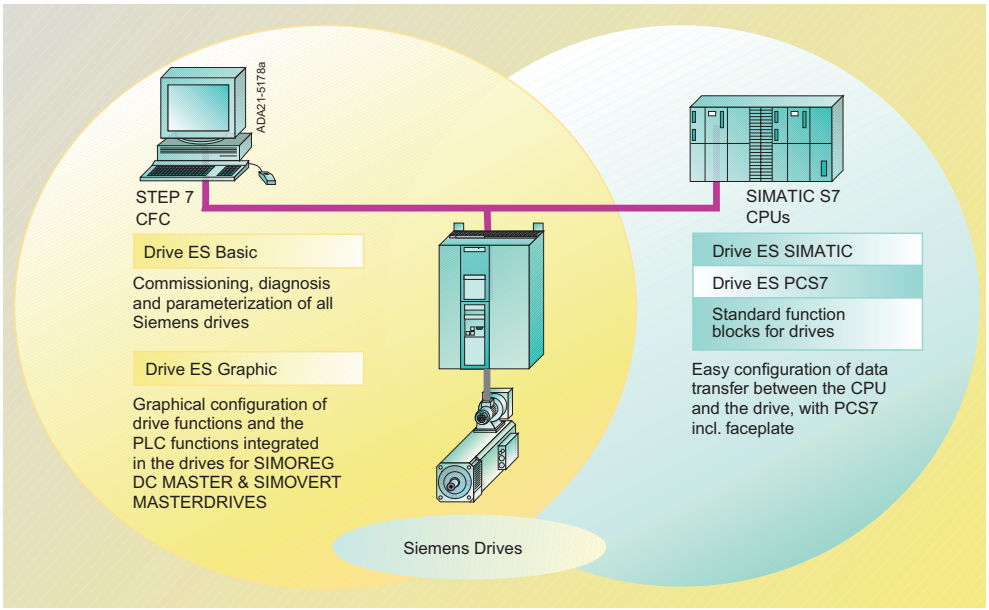
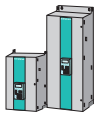


Fig. 4/37
Task distribution for the Drive ES packages



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.
- SIMATIC Teleservice (V5) can be used.
- It communicates with the drive over PROFIBUS-DP or USS.

Functions

- Trace evaluation for SIMOREG DC MASTER.
- Read out fault memory for SIMOREG DC MASTER.
- Upread and download of parameter sets (as a complete file or as a delta file compared to the factory settings).
- 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.

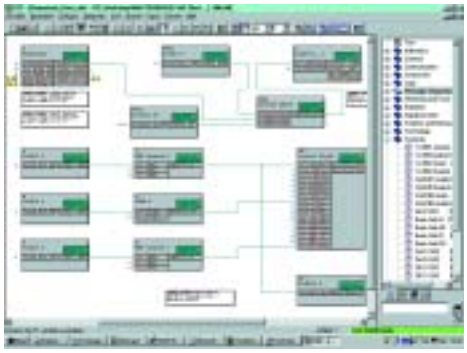


Fig. 4/38
Graphical programming with Drive ES Graphic and CFC

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.

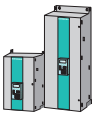
Fig. 4/39
Integrating drives into the STEP 7 Manager

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	Order No.:	Type of delivery	Documentation
Drive ES software packages · For installation as an integral option of STEP 7 Versions ≥ V 5.3, SP 3			
Drive ES Basic V 5.4 [1]) single-user license	**6SW1700-5JA00-4AA0**	CD-ROM, 1 unit	5 standard languages
Drive ES Graphic V 6.0 single-user license	**6SW1700-6JB00-0AA0**	CD-ROM, 1 unit	5 standard languages
Drive ES SIMATIC V 5.4 single-user license	**6SW1700-5JC00-4AA0**	CD-ROM, 1 unit	5 standard languages
Drive ES PCS7 V 6.1 single-user license	**6SW1700-6JD00-1AA0**	CD-ROM, 1 unit	5 standard languages
Drive ES software packages · For installation as an integral option of STEP 7 Versions ≥ V 5.1			
Drive ES Basic V 5.4 [1]) single-user license	**6SW1700-5JA00-4AA0**	CD-ROM, 1 unit	5 standard languages
Drive ES Basic Upgrade V 5 V → 5.4 single-user license	**6SW1700-5JA00-4AA4**	CD-ROM, 1 unit	5 standard languages
Drive ES Basic V 5.1 copy/company license	**6SW1700-5JA00-1AA1**	CD-ROM, 1 unit	5 standard languages
Drive ES Graphic V 6.0 single-user license	**6SW1700-6JB00-0AA0**	CD-ROM, 1 unit	5 standard languages
Drive ES Graphic Upgrade V 5 → V 6.0 single-user license	**6SW1700-6JB00-0AA4**	CD-ROM, 1 unit	5 standard languages
Drive ES SIMATIC V 5.4 single-user license	**6SW1700-5JC00-4AA0**	CD-ROM, 1 unit	5 standard languages
Drive ES SIMATIC Upgrade V 5 → V 5.4 single-user license	**6SW1700-5JC00-4AA4**	CD-ROM, 1 unit	5 standard languages
Drive ES SIMATIC V 5.1 runtime license	**6SW1700-5JC00-1AC0**	Only product certificate (without software and documentation)	5 standard languages
Drive ES PCS7 V 6.1 single-user license	**6SW1700-6JD00-1AA0**	CD-ROM, 1 unit	5 standard languages
Drive ES PCS7 V 5.1 runtime license	**6SW1700-5JD00-1AC0**	Only product certificate (without software and documentation)	5 standard languages

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 DRVDPS7C)
- **Communication software "USS protocol"** for
  S7-200 with CPU 214/CPU 215/CPU 216 (DRVUSS2 driver program for STEP 7 Micro programming tool)
  S7-300 with CP 340/341 and S7-400 with CP 441 (function block library DRVUSSS7)
- **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

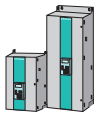
6 weeks before expiry, the customer and his Siemens contact will be informed in writing that the update service will automatically be extended by another year if it is not cancelled on the part of the customer.

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

Scope of supply	Order No.:
Software update service	
Drive ES Basic Update service for single license for copy license	 **6SW1700-0JA00-0AB2** **6SW1700-0JA00-1AB2**
Drive ES SIMATIC Update service for single license	 **6SW1700-0JC00-0AB2**
Drive ES PCS7 Update service for single license	 **6SW1700-0JD00-0AB2**

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

Performance options



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 %).

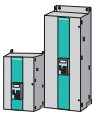
Application

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

DIN VDE 0106 Part 10	Protection against electric shock; location of actuators near live parts.
DIN VDE 0110 Part 1	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”.
DIN VDE 0113 Part 1	Electrical equipment of industrial machines (where applicable).
DIN EN 50 178/DIN VDE 0160	Regulations for the equipment of electrical power installations with electronic equipment.
EN 61 000-4-2 and EN 61 000-4-4	Interference immunity
DIN IEC 60 068-2-6 acc. to degree of severity 12 (SN29 010 Part 1)	Mechanical stress

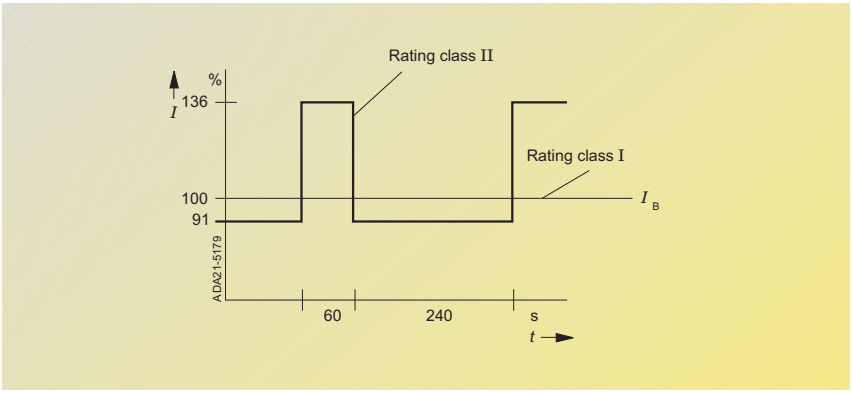


SIMOREG 6RL70 rectifier module · 3-ph. AC 690 V, 1000 A and 2000 A

Type		6RL70□□-□KS00-0	
		91-6	95-4
Rated supply voltage [3]	V	3-ph. AC 690 (+10% / –20%)	
Rated input current	A	865	1730
Rated supply voltage fan	V	1-ph. AC 230 (±10%) 50 Hz / 60 Hz	
Nominal fan current	A	2.6 / 3.3	
Fan noise level	dBA	85 / 87	
Air flow rate	m^3/h	1400	2400
Rated DC voltage	V	930	
Rated DC current	A	**1000**	**2000**
Rating Class II acc. to EN 60 146-1-1 [1]			
Rated output current mean value	A	910	1820
Base-load duty period	s	240	
Output overcurrent mean value	A	**1365**	**2720**
Overcurrent duration	s	60	
Rated output	kW	930	1860
Power loss at rated DC current (approx.)	W	3.12	4.94
Operational ambient temperature	°C	0 to 40 at I_{rated} separately cooled [2]	
Storage and transport temperature	°C	–25 to +70	
Installation altitude above sea level		≤ 1000 m at rated DC current [4]	
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	142

4

1) Duty cycle



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

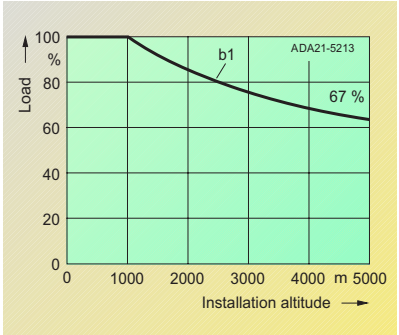
Ambient or coolant temperature	Load factor K1 In devices with self-cooling	In devices with enhanced cooling
≤ +30 °C	1.18	1.10
+35 °C	1.12	1.05
+40 °C	1.06	1.00
+45 °C	1.00	0.95
+50 °C	0.94	0.90
+55 °C	0.88	
+60 °C	0.82	

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

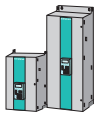
4) Load values K2 as a function of the installation altitude. Overall reduction factor K = K1 * K2 (for K1 see Footnote 2)

Installation altitude m	1000	2000	3000	4000	5000
Reduction factor K2	1.0	0.835	0.74	0.71	0.67

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



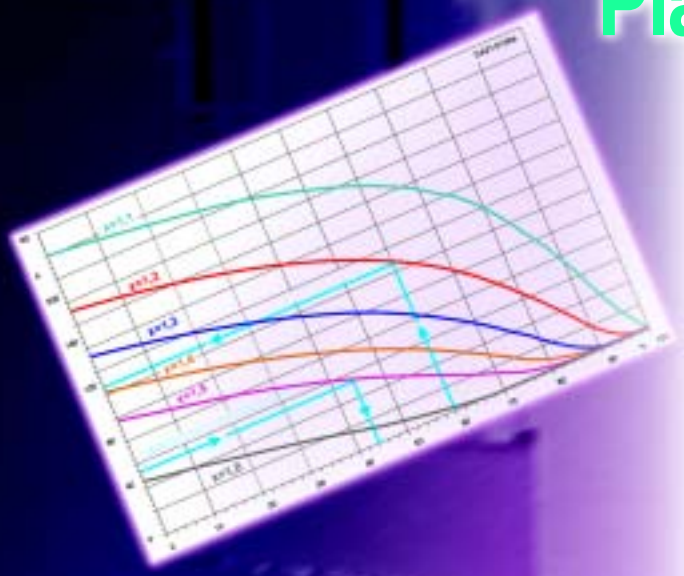
Curve b1: Reduction factor of load values (DC current) at installation altitudes above 1000 m.

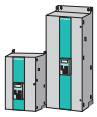


Notes

SIMOREG 6RA70 DC MASTER

Planning guide





Dynamic overload capability

Calculation of dynamic overload capability

Overview of function

The rated DC current (= maximum permissible continuous DC current) specified on the converter rating plate may be exceeded in operation. The amount by which the rated value may be exceeded and for what period are explained in more detail below.

The absolute upper limit for the absolute overload current corresponds to 1.8 times the DC current rating.
The maximum overload period depends both on the time characteristic of the overload current and on the load history of the converter and is specific to individual units.

Every overload must be preceded by an "underload" (load phase with load current < rated DC current). After the maximum permissible overload period has expired, the load current must be reduced to a value at least ≤ rated DC current.

The dynamic overload period 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 vale. Two alternative reactions can be parameterized:

- Alarm with reduction of armature current setpoint to rated DC current or
- 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

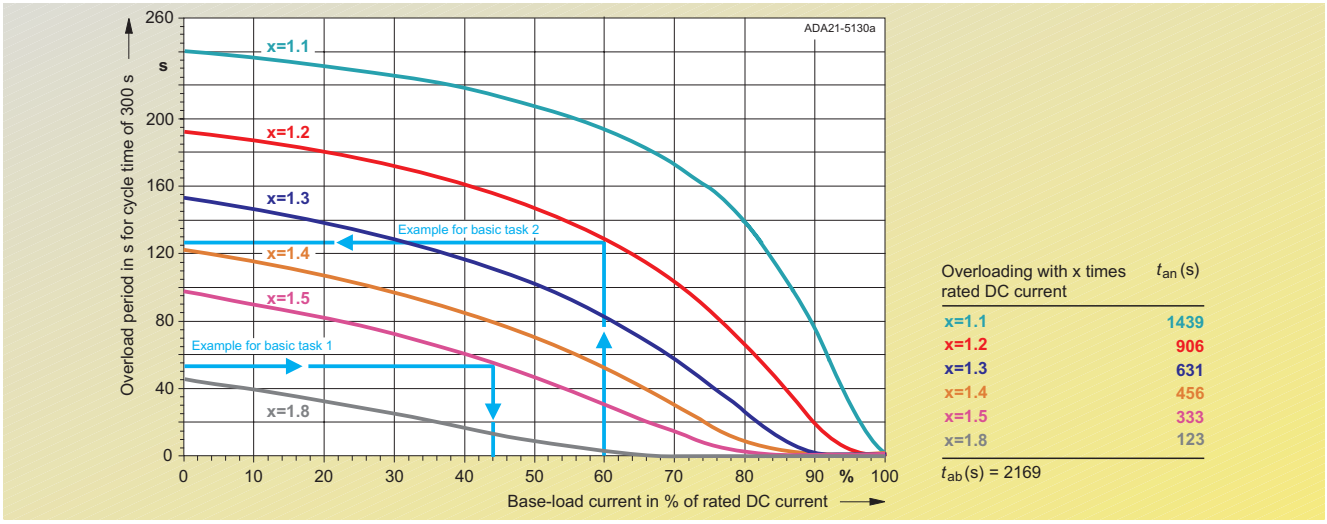


Fig. 5/1
Characteristics for example calculations for basic tasks 1 and 2

5

Basic task 1

- Known quantities:
  Converter, cycle time, overload factor, overload period
- Quantities to be found:
  (min.) base-load duty period and 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$_{300}$ = 300 s/113.2 s) x 20 s = 53 s ->
  – Max. base-load current = 44% I_{rated} = 13.2 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

	Definition
Base-load duty period$_{300}$	Min. base-load duty period for 300 s cycle time (300 s overload period)
Overload period$_{300}$	Max. overload period for 300 s cycle time

Table 1
Explanation of terms

	Cycle time	
	< 300 s	**≥ 300 s**
1. Determine curve	Selection of limit characteristic for specific converter and overload factor (see Fig. 5/1)	
2. Overload period$_{300}$ =	300 s/cycle time x overload period	Overload period$_{300}$
3. Base-load duty period$_{300}$ =	300 s overload period$_{300}$	300 s overload period$_{300}$
4. Base-load duty period$_{300}$ < base-load duty period$_{300}$ for max. base-load current = 0	Yes: Required cycle time not configurable No: Read off max. baseload 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 2
Steps to solve basic task 1

	Cycle time	
	< 300 s	**≥ 300 s**
1. Determine curve	Selection of limit characteristic for specific converter and overload factor (see Fig. 5/1)	
2. Max. overload period =	(cycle time/300 s) x overload period$_{300}$	300 s base-load duty period$_{300}$
3. Min. base-load period =	Cycle time - max. overload period	Cycle time - max. overload period

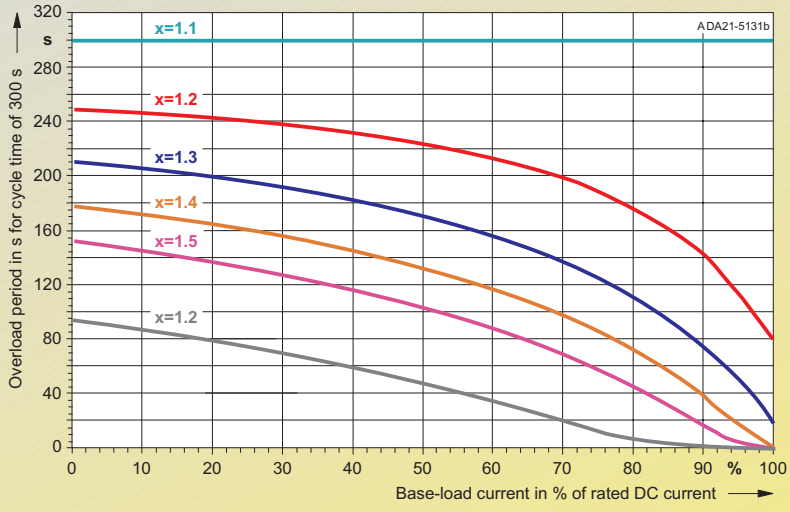
Table 3
Steps to solve basic task 2

Example for basic task 2

- Known quantities:
  – 30 A converter
  – Cycle time 140 s
  – Overload factor 1.15
  – Base-load current = 0.6 I_{rated} = 18 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_{rated} ->
  – Overload period$_{300}$ = 127 s
  – Max. overload period = (140 s/300 s) x 127 s = 59 s
  – Min. base-load duty period = 140 s – 59 s = 81 s

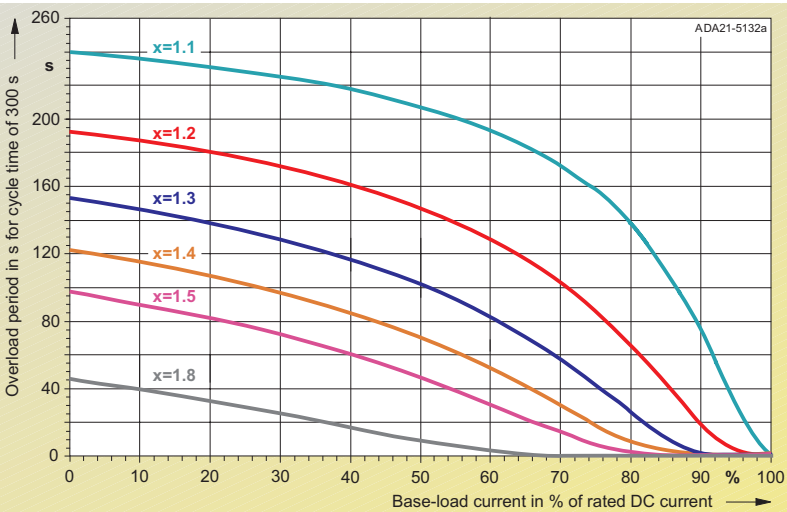
Dynamic overload capability

Calculation of dynamic overload capability



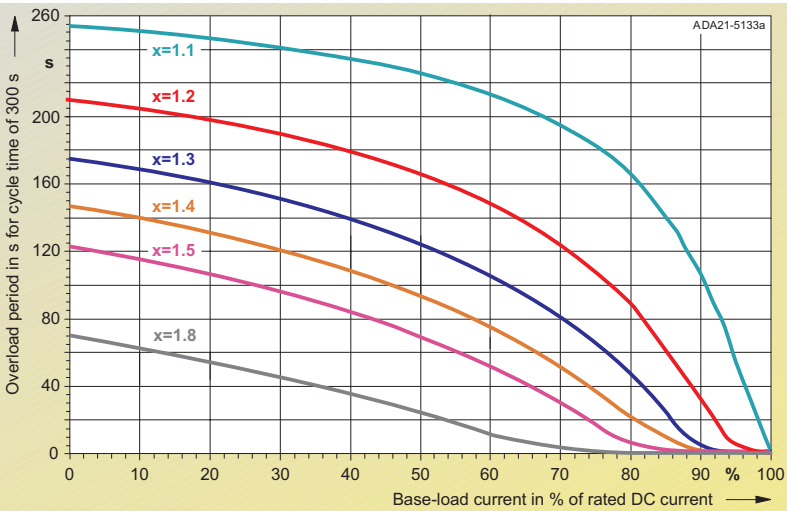
Overloading with x times rated DC current	t_{an} (s)
x=1.1	
x=1.2	1633
x=1.3	1112
x=1.4	833
x=1.5	651
x=1.8	382
t_{ab} (s) = 2281	

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



Overloading with x times rated DC current	t_{an} (s)
x=1.1	1439
x=1.2	906
x=1.3	631
x=1.4	456
x=1.5	333
x=1.8	123
t_{ab} (s) = 2169	

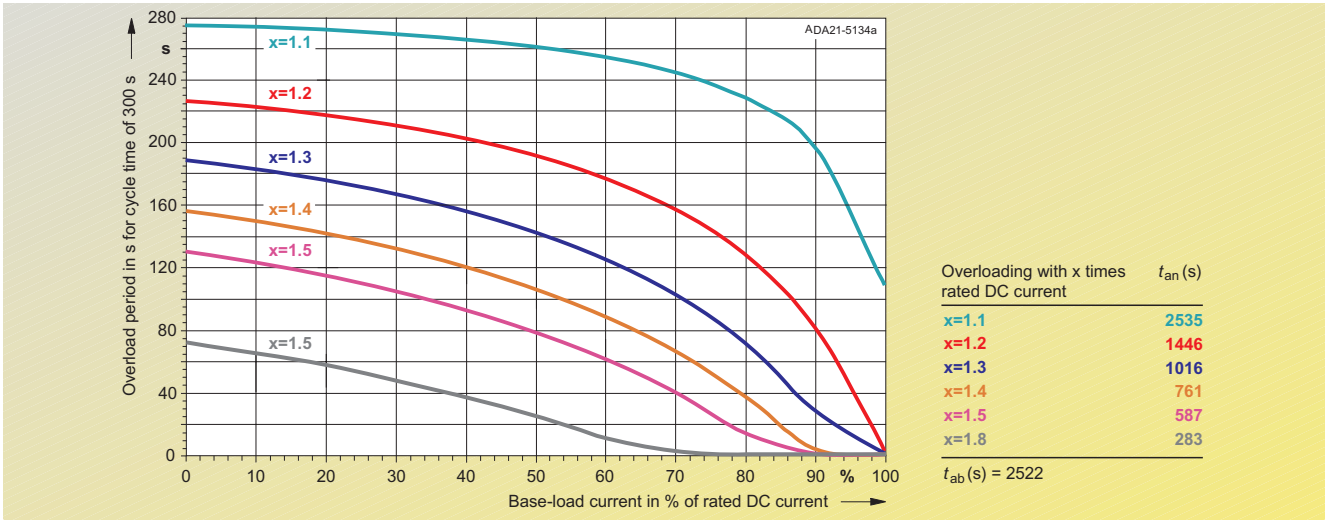
Fig. 5/3
6RA7018-6DS22 30 A/1Q/400 V, 6RA7018-6FS22 30 A/1Q/460 V, 6RA7018-6DV62 30 A/4Q/400 V, 6RA7018-6FV62 30 A/4Q/460 V



Overloading with x times rated DC current	t_{an} (s)
x=1.1	2071
x=1.2	1352
x=1.3	988
x=1.4	756
x=1.5	592
x=1.8	296
t_{ab} (s) = 2169	

Fig. 5/4
6RA7025-6DS22 60 A/1Q/400 V, 6RA7025-6FS22 60 A/1Q/460 V, 6RA7025-6GS22 60 A/1Q/575 V

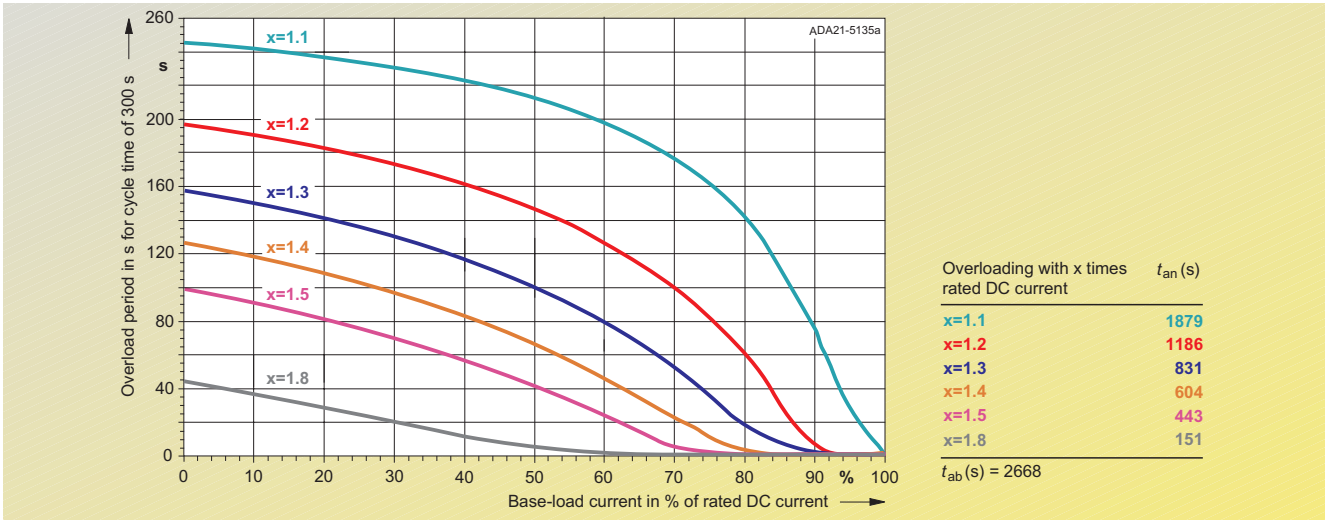
Calculation of dynamic overload capability



Overloading with x times rated DC current	t_{an} (s)
x=1.1	2535
x=1.2	1446
x=1.3	1016
x=1.4	761
x=1.5	587
x=1.8	283

t_{ab} (s) = 2522

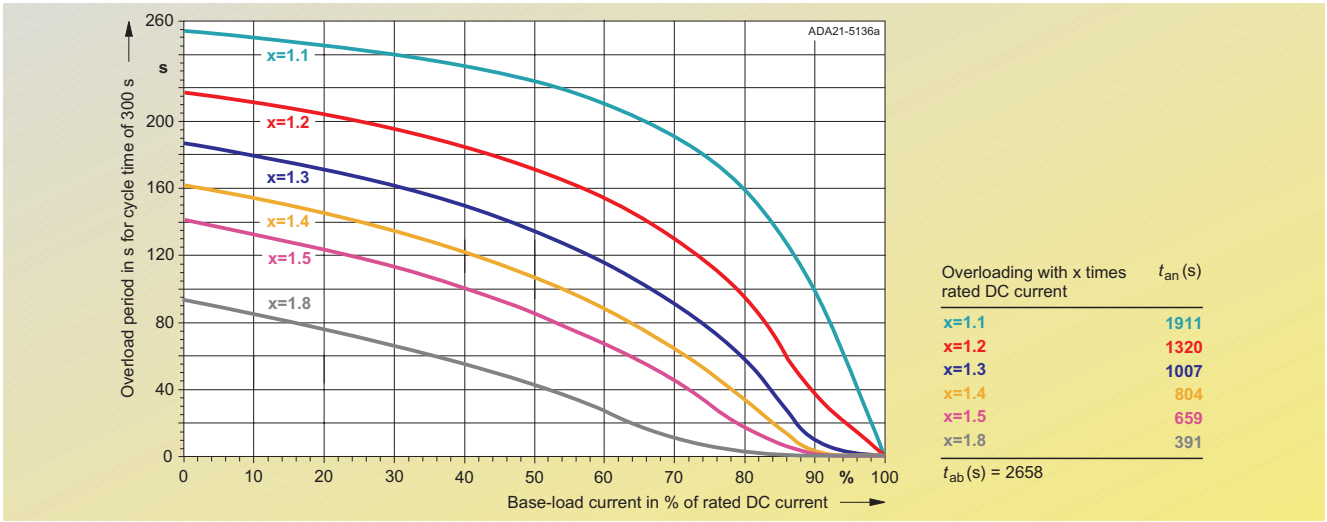
Fig. 5/5
6RA7025-6DV62 60 A/4Q/400 V, 6RA7025-6FV62 60 A/4Q/460 V, 6RA7025-6GV62 60 A/4Q/575 V



Overloading with x times rated DC current	t_{an} (s)
x=1.1	1879
x=1.2	1186
x=1.3	831
x=1.4	604
x=1.5	443
x=1.8	151

t_{ab} (s) = 2668

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



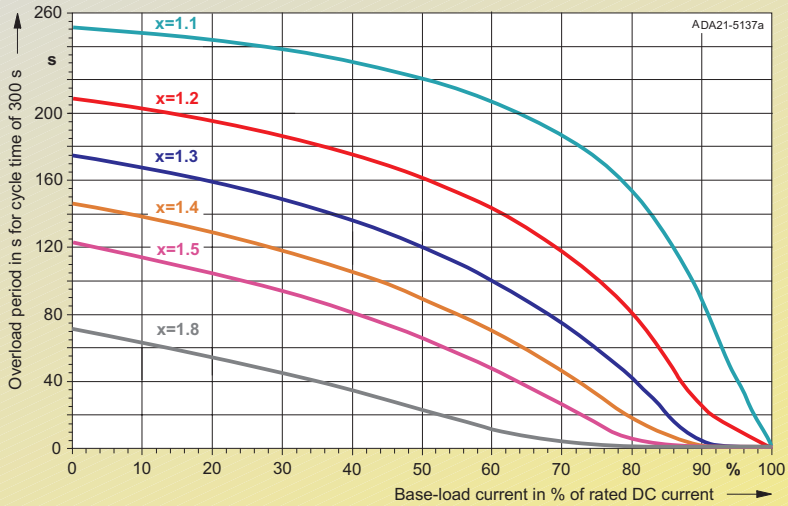
Overloading with x times rated DC current	t_{an} (s)
x=1.1	1911
x=1.2	1320
x=1.3	1007
x=1.4	804
x=1.5	659
x=1.8	391

t_{ab} (s) = 2658

Fig. 5/7
6RA7028-6DV62 90 A/4Q/400 V, 6RA7028-6FV62 90 A/4Q/460 V

Dynamic overload capability

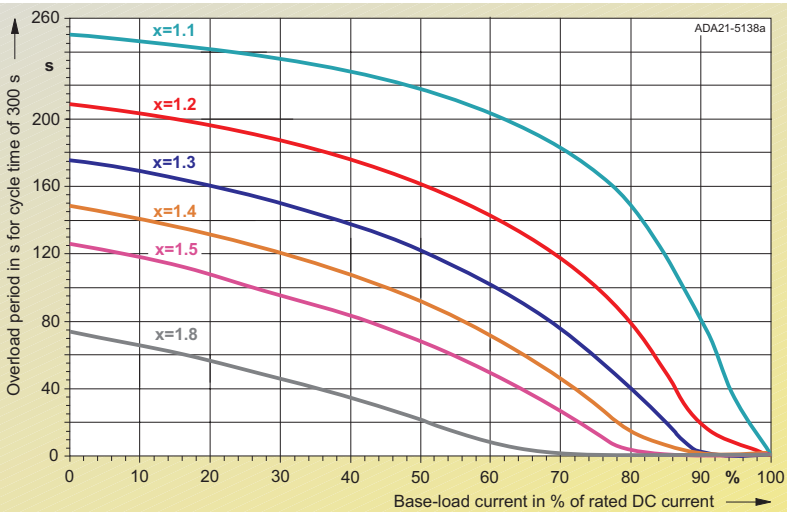
Calculation of dynamic overload capability



Overloading with x times rated DC current	t_{an} (s)
x=1.1	1994
x=1.2	1318
x=1.3	968
x=1.4	743
x=1.5	582
x=1.8	289

t_{ab} (s) = 3110

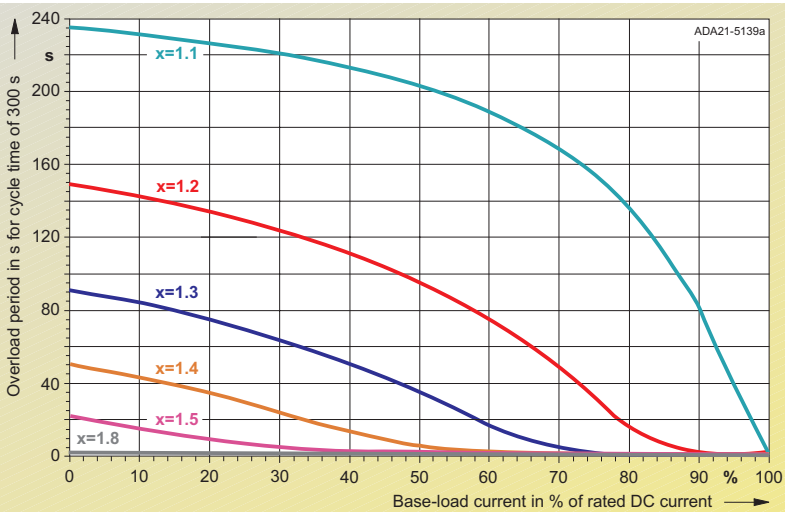
Fig. 5/8
6RA7031-6DS22 125 A/1Q/400 V, 6RA7031-6FS22 125 A/1Q/460 V, 6RA7031-6GS22 125 A/1Q/575 V



Overloading with x times rated DC current	t_{an} (s)
x=1.1	2160
x=1.2	1453
x=1.3	1079
x=1.4	836
x=1.5	662
x=1.8	344

t_{ab} (s) = 3112

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

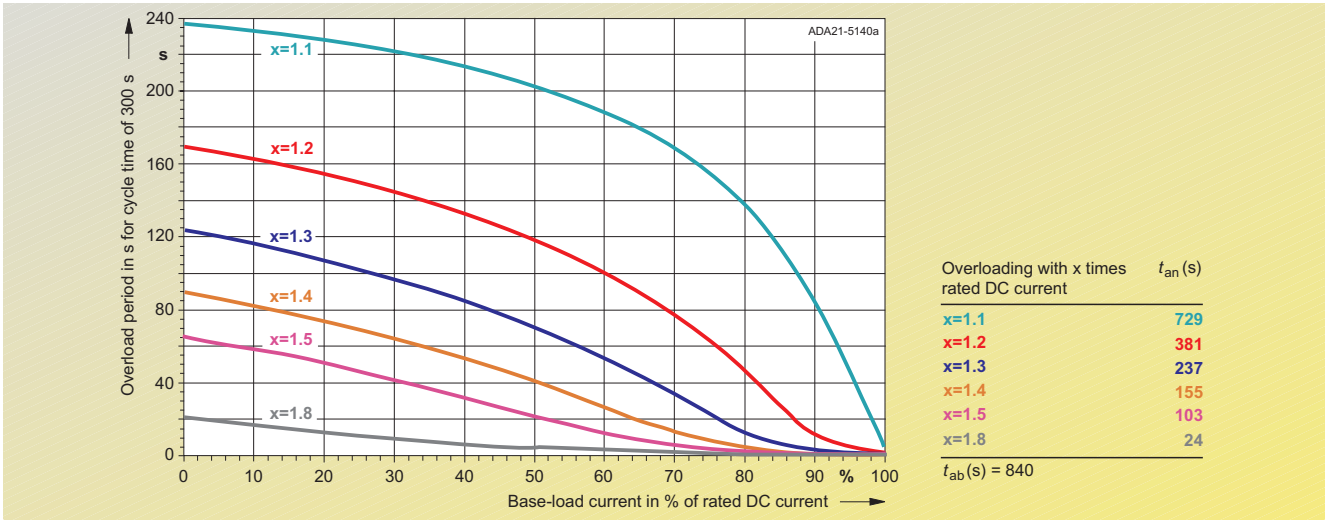


Overloading with x times rated DC current	t_{an} (s)
x=1.1	680.00
x=1.2	318.00
x=1.3	167.00
x=1.4	78.00
x=1.5	25.00
x=1.8	0.96

t_{ab} (s) = 766

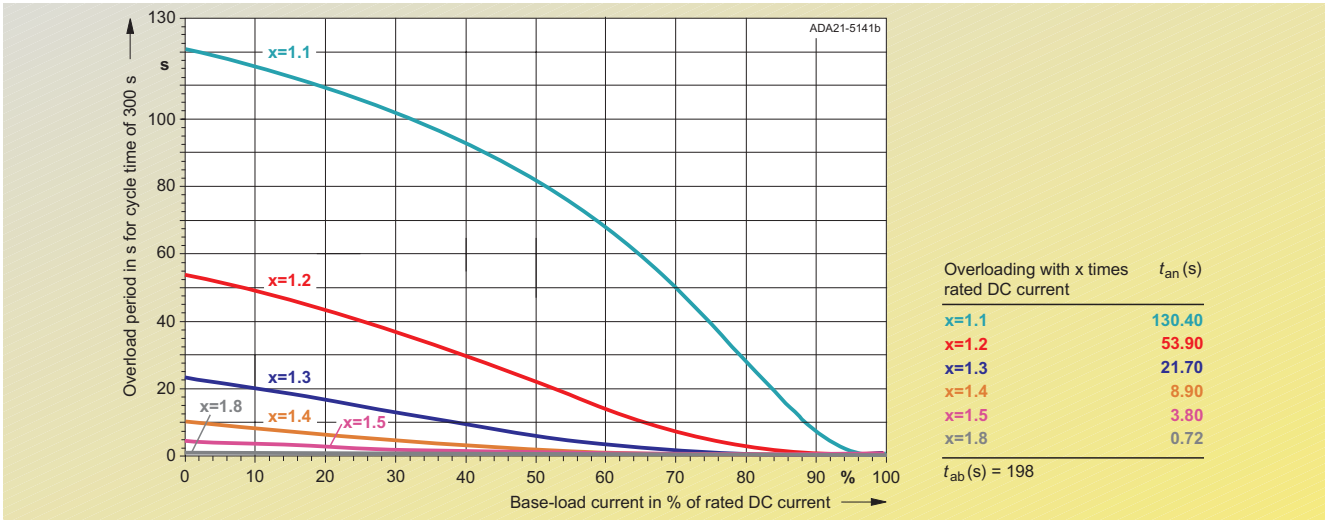
Fig. 5/10
6RA7075-6DS22 210 A/1Q/400 V, 6RA7075-6FS22 210 A/1Q/460 V, 6RA7075-6GS22 210 A/1Q/575 V,
6RA7075-6DV62 210 A/4Q/400 V, 6RA7075-6FV62 210 A/4Q/460 V, 6RA7075-6GV62 210 A/4Q/575 V

Calculation of dynamic overload capability



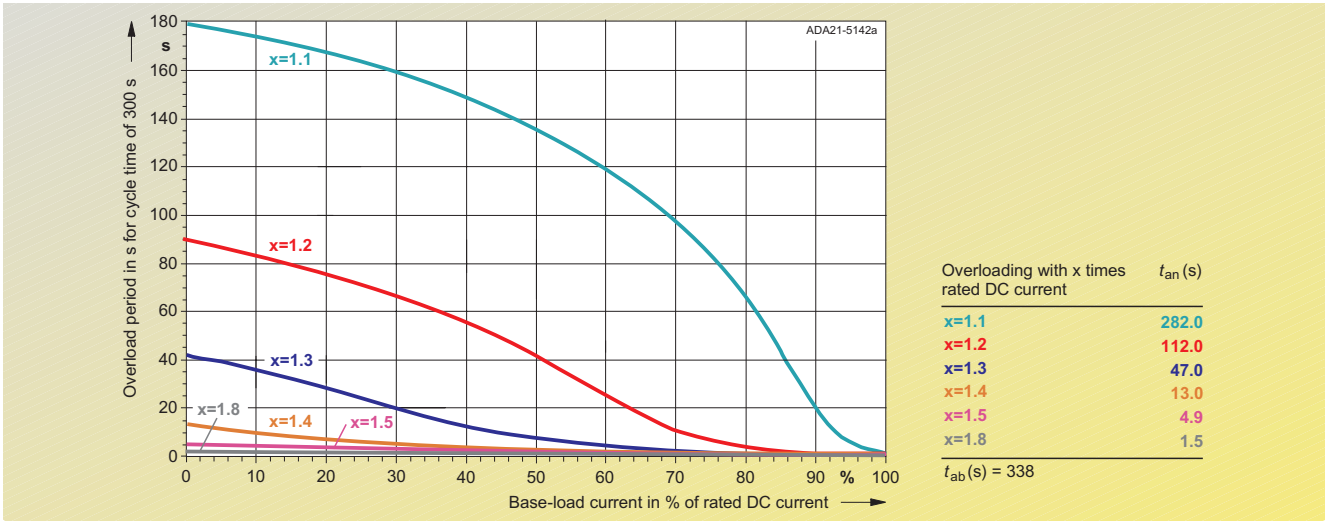
Overloading with x times rated DC current	t_{an} (s)
x=1.1	729
x=1.2	381
x=1.3	237
x=1.4	155
x=1.5	103
x=1.8	24
t_{ab} (s) = 840	

Fig. 5/11
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



Overloading with x times rated DC current	t_{an} (s)
x=1.1	130.40
x=1.2	53.90
x=1.3	21.70
x=1.4	8.90
x=1.5	3.80
x=1.8	0.72
t_{ab} (s) = 198	

Fig. 5/12
6RA7081-6DS22 400 A/1Q/400 V, 6RA7081-6GS22 400 A/1Q/575 V

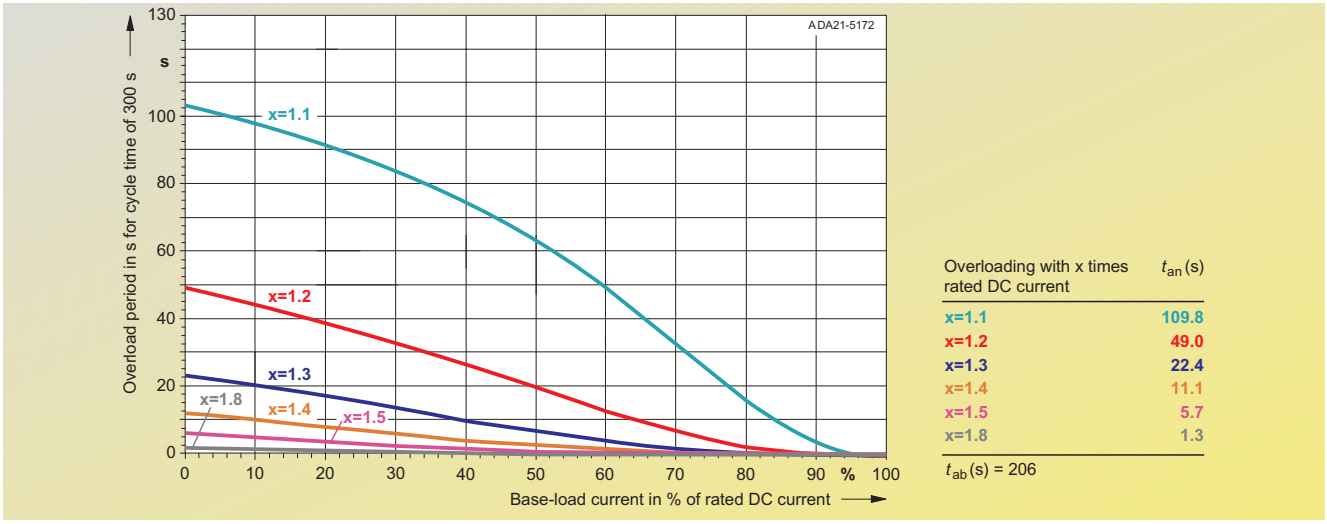


Overloading with x times rated DC current	t_{an} (s)
x=1.1	282.0
x=1.2	112.0
x=1.3	47.0
x=1.4	13.0
x=1.5	4.9
x=1.8	1.5
t_{ab} (s) = 338	

Fig. 5/13
6RA7081-6DV62 400 A/4Q/400 V, 6RA7081-6GV62 400 A/4Q/575 V

Dynamic overload capability

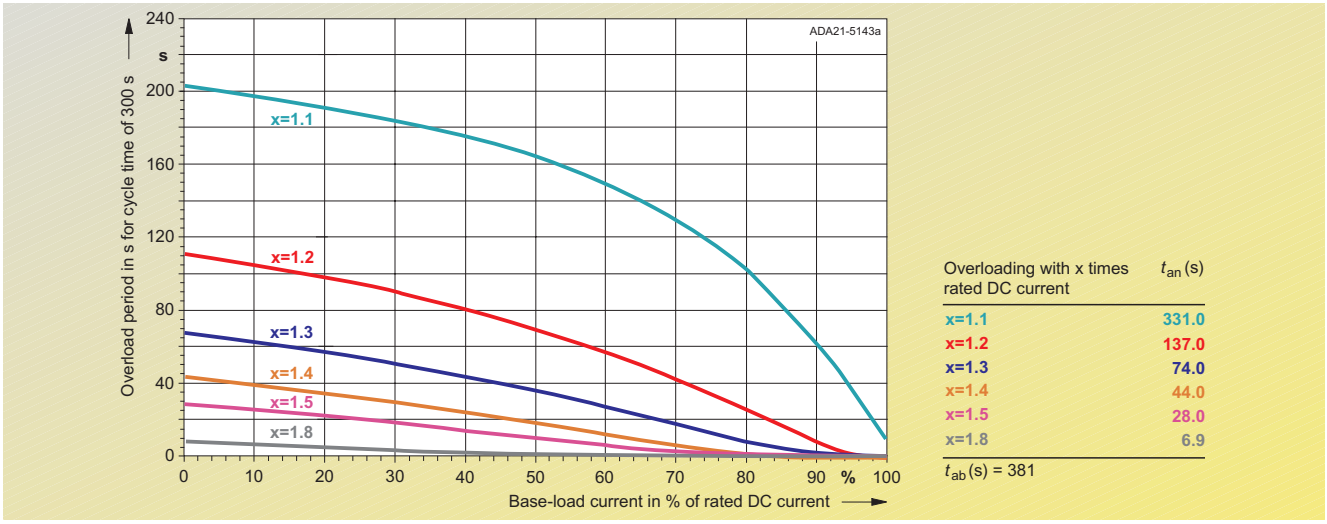
Calculation of dynamic overload capability



Overloading with x times rated DC current	t_{an} (s)
x=1.1	109.8
x=1.2	49.0
x=1.3	22.4
x=1.4	11.1
x=1.5	5.7
x=1.8	1.3

t_{ab} (s) = 206

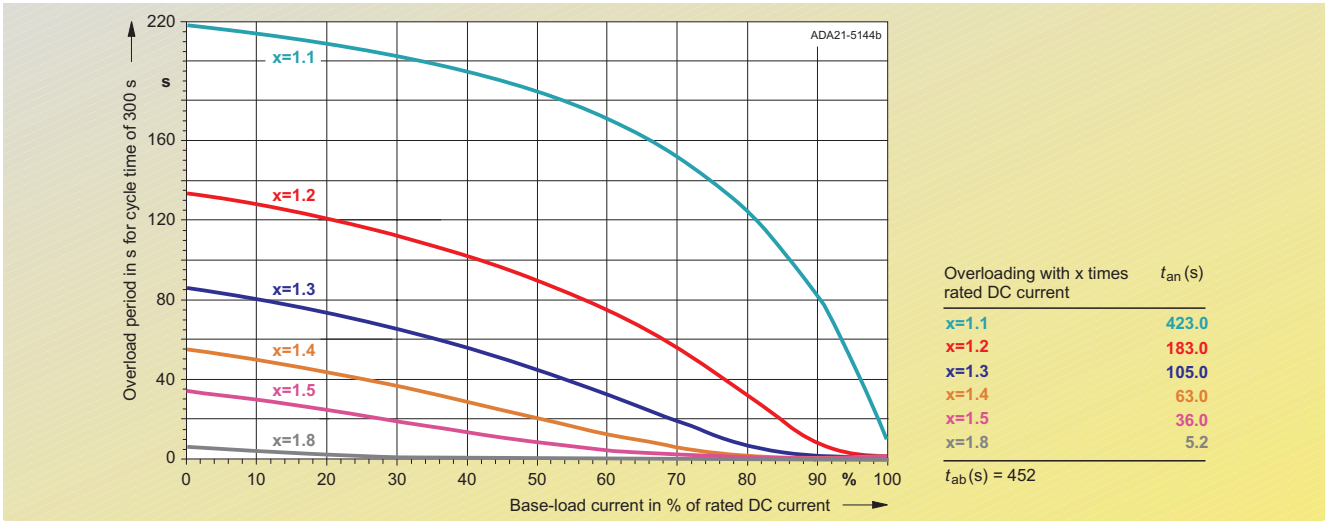
Fig. 5/14
6RA7082-6FS22 450 A/1Q/460 V, 6RA7082-6FV62 450 A/4Q/460 V



Overloading with x times rated DC current	t_{an} (s)
x=1.1	331.0
x=1.2	137.0
x=1.3	74.0
x=1.4	44.0
x=1.5	28.0
x=1.8	6.9

t_{ab} (s) = 381

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

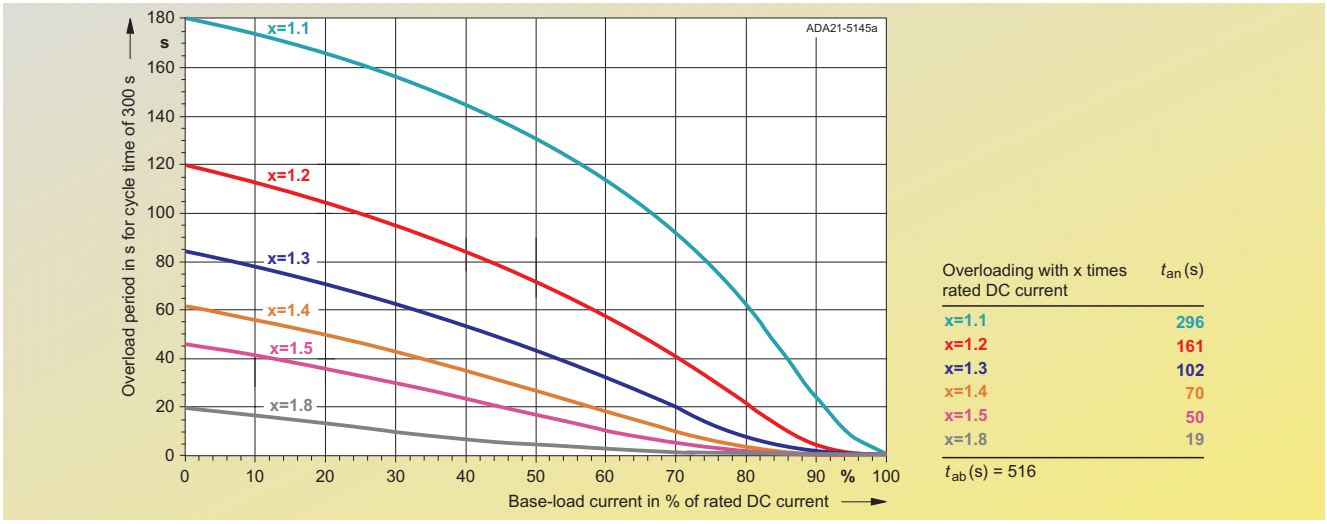


Overloading with x times rated DC current	t_{an} (s)
x=1.1	423.0
x=1.2	183.0
x=1.3	105.0
x=1.4	63.0
x=1.5	36.0
x=1.8	5.2

t_{ab} (s) = 452

Fig. 5/16
6RA7085-6DV62 600 A/4Q/400 V, 6RA7085-6FV62 600 A/4Q/460 V, 6RA7085-6GV62 600 A/4Q/575 V

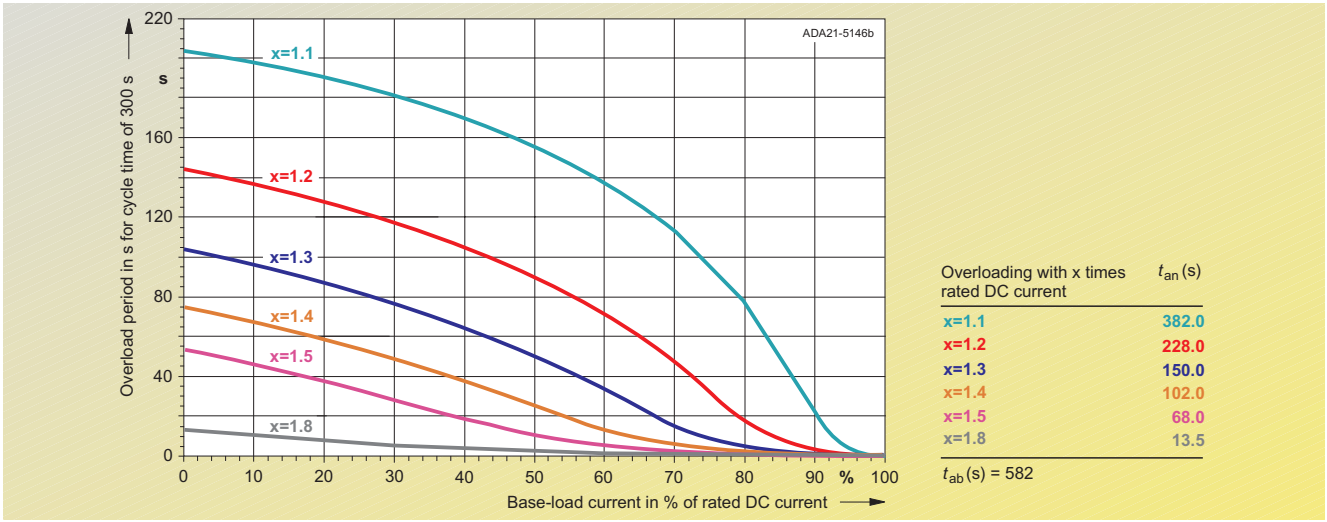
Calculation of dynamic overload capability



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

t_{ab} (s) = 516

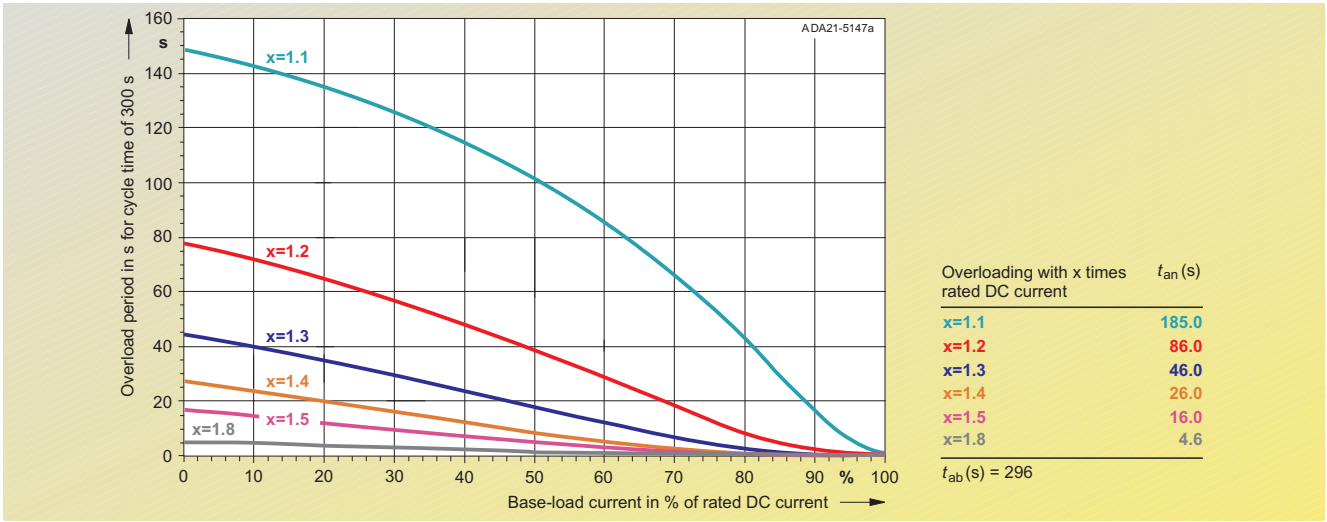
Fig. 5/17
6RA7087-6DS22 850 A/1Q/400 V, 6RA7087-6FS22 850 A/1Q/460 V, 6RA7087-6GS22 800 A/1Q/575 V, 6RA7086-6KS22 720 A/1Q/690 V



Overloading with x times rated DC current	t_{an} (s)
x=1.1	382.0
x=1.2	228.0
x=1.3	150.0
x=1.4	102.0
x=1.5	68.0
x=1.8	13.5

t_{ab} (s) = 582

Fig. 5/18
6RA7087-6DV62 850 A/4Q/400 V, 6RA7087-6FV62 850 A/4Q/460 V, 6RA7087-6GV62 850 A/4Q/575 V, 6RA7086-6KV62 760 A/4Q/690 V



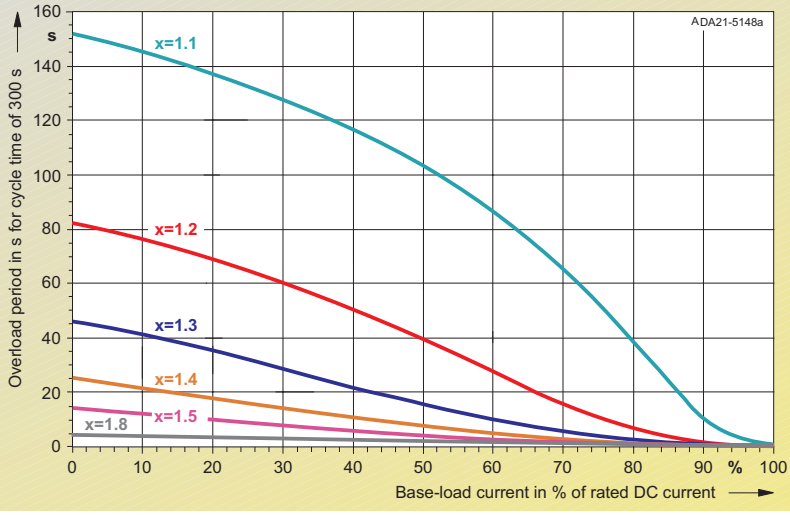
Overloading with x times rated DC current	t_{an} (s)
x=1.1	185.0
x=1.2	86.0
x=1.3	46.0
x=1.4	26.0
x=1.5	16.0
x=1.8	4.6

t_{ab} (s) = 296

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

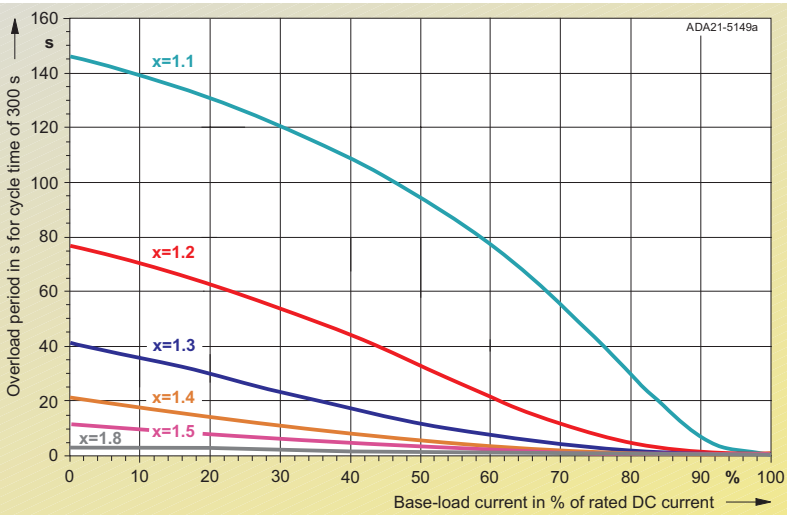
Calculation of dynamic overload capability



Overloading with x times rated DC current	t_{an} (s)
x=1.1	218.0
x=1.2	99.0
x=1.3	50.0
x=1.4	25.0
x=1.5	13.0
x=1.8	3.6

t_{ab} (s) = 373

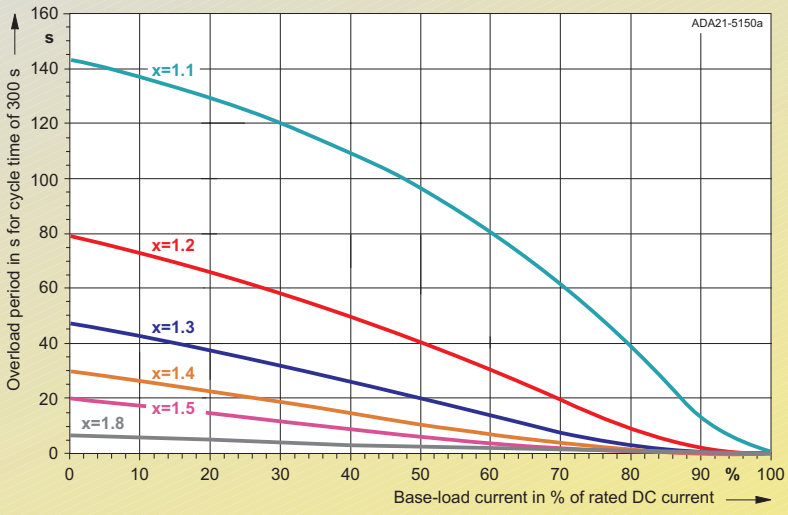
Fig. 5/20
6RA7090-6KV62 1000 A/4Q/690 V, 6RA7088-6LV62 950 A/4Q/830 V



Overloading with x times rated DC current	t_{an} (s)
x=1.1	208.0
x=1.2	91.0
x=1,3	43.6
x=1.4	20.5
x=1.5	10.5
x=1.8	2.9

t_{ab} (s) = 366

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

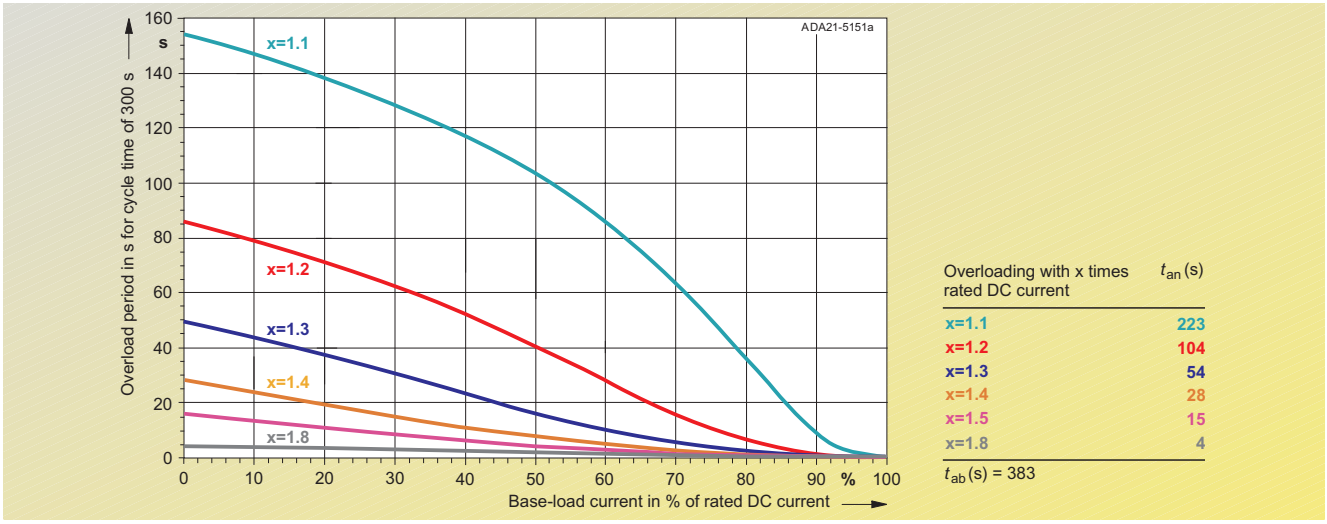


Overloading with x times rated DC current	t_{an} (s)
x=1.1	180
x=1.2	88
x=1.3	49
x=1.4	30
x=1.5	19
x=1.8	6

t_{ab} (s) = 312

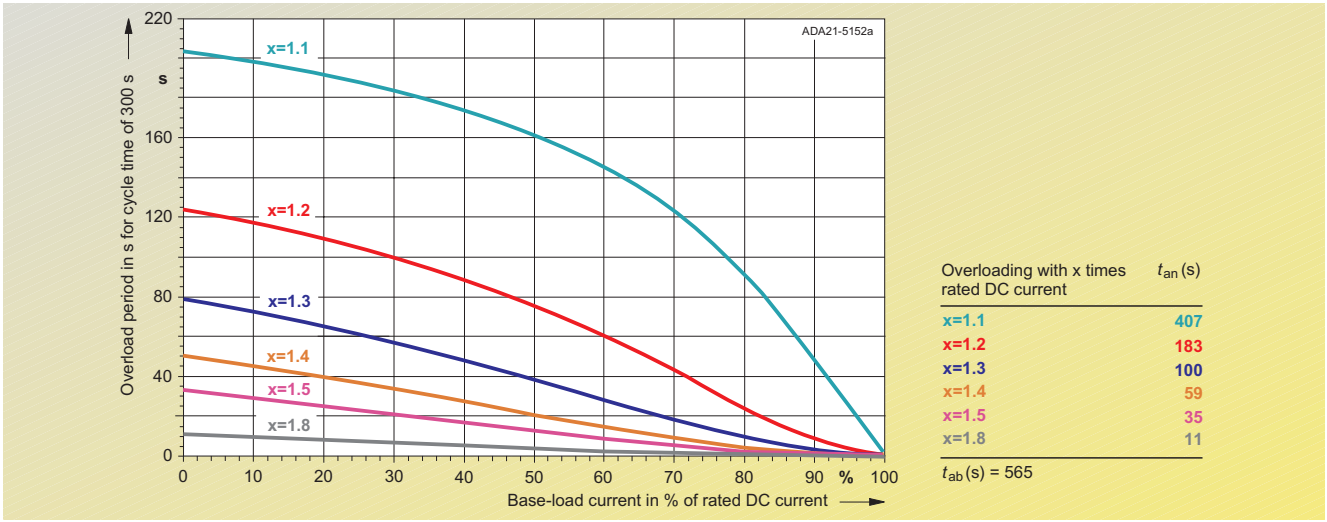
Fig. 5/22
6RA7091-6DS22 1200 A/1Q/400 V, 6RA7091-6FS22 1200 A/1Q/460 V

Calculation of dynamic overload capability



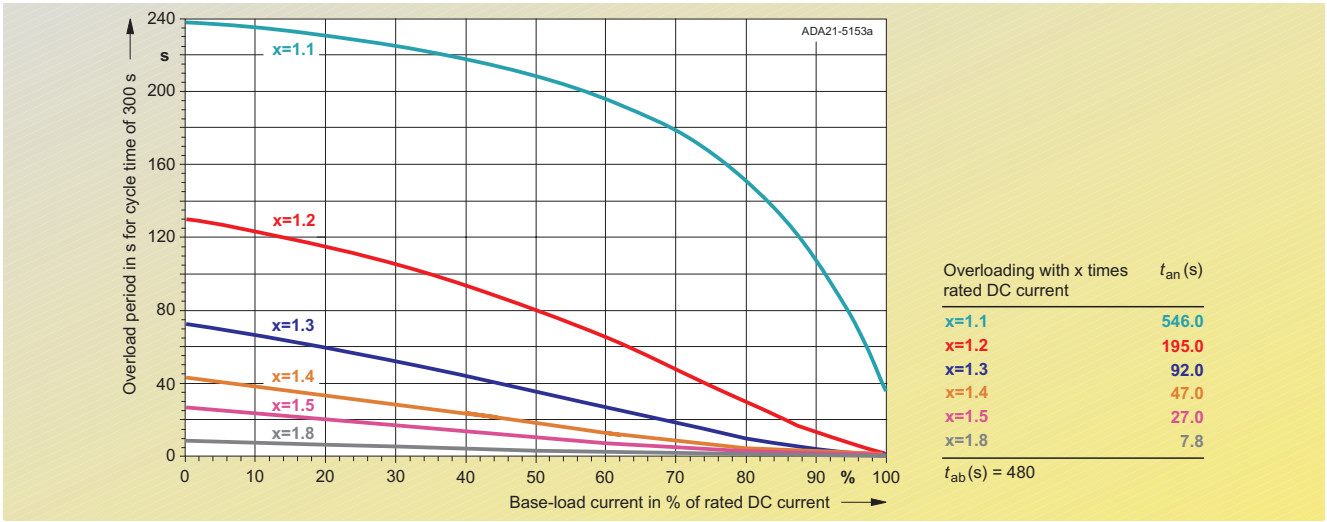
Overloading with x times rated DC current	t_{an} (s)
x=1.1	223
x=1.2	104
x=1.3	54
x=1.4	28
x=1.5	15
x=1.8	4
t_{ab} (s) = 383	

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



Overloading with x times rated DC current	t_{an} (s)
x=1.1	407
x=1.2	183
x=1.3	100
x=1.4	59
x=1.5	35
x=1.8	11
t_{ab} (s) = 565	

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

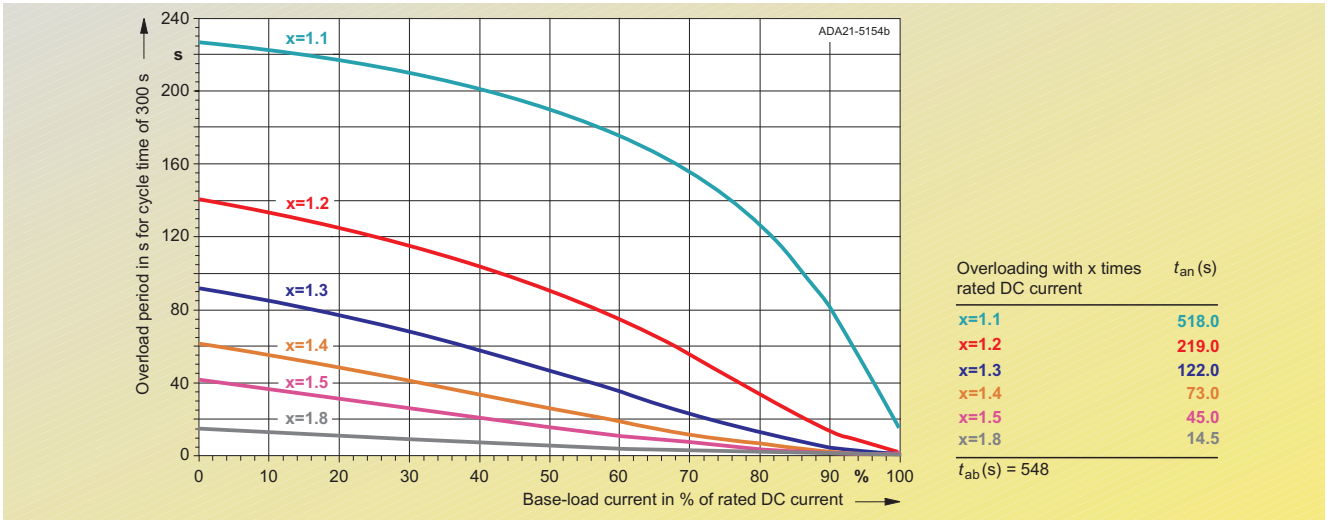


Overloading with x times rated DC current	t_{an} (s)
x=1.1	546.0
x=1.2	195.0
x=1.3	92.0
x=1.4	47.0
x=1.5	27.0
x=1.8	7.8
t_{ab} (s) = 480	

Fig. 5/25
6RA7093-4KV62 1500 A/4Q/690 V, 6RA7093-4LV62 1500 A/4Q/830 V

Dynamic overload capability

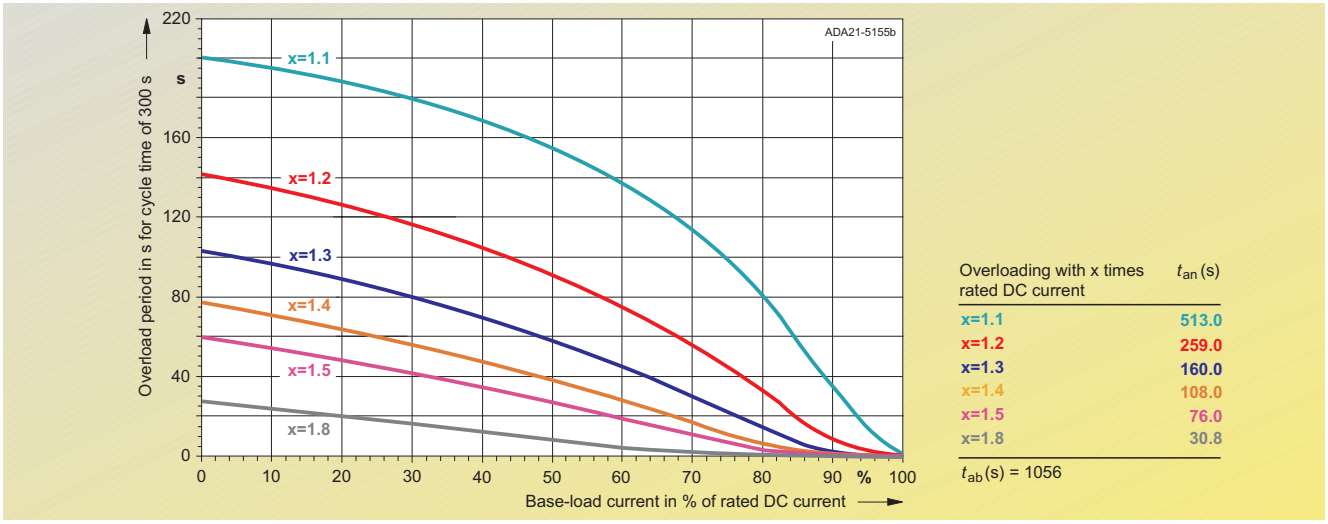
Calculation of dynamic overload capability



Overloading with x times rated DC current	t_{an} (s)
x=1.1	518.0
x=1.2	219.0
x=1.3	122.0
x=1.4	73.0
x=1.5	45.0
x=1.8	14.5

t_{ab} (s) = 548

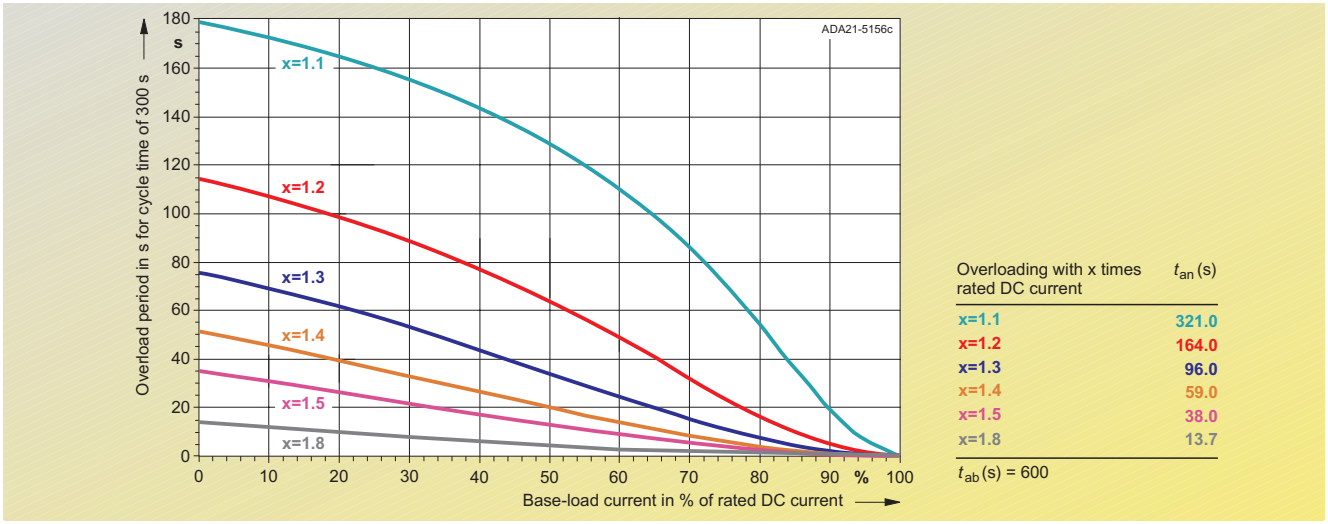
Fig. 5/26
6RA7093-4DS22 1600 A/1Q/400 V, 6RA7093-4GS22 1600 A/1Q/575 V, 6RA7093-4DV62 1600 A/4Q/400 V, 6RA7093-4GV62 1600 A/4Q/575 V



Overloading with x times rated DC current	t_{an} (s)
x=1.1	513.0
x=1.2	259.0
x=1.3	160.0
x=1.4	108.0
x=1.5	76.0
x=1.8	30.8

t_{ab} (s) = 1056

Fig. 5/27
6RA7095-4LS22 1900 A/1Q/830 V, 6RA7095-4LV62 1900 A/4Q/830 V

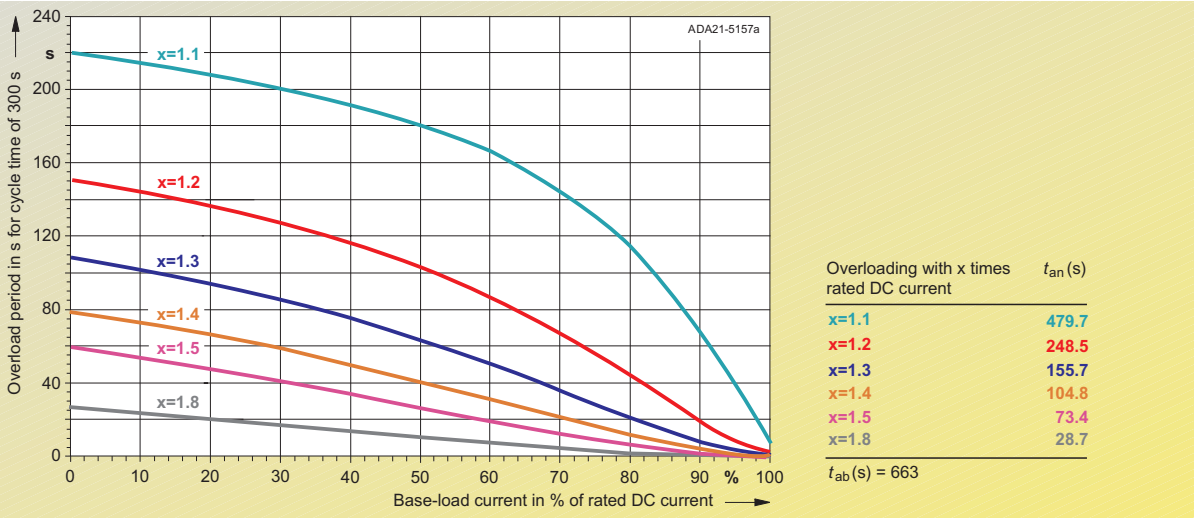


Overloading with x times rated DC current	t_{an} (s)
x=1.1	321.0
x=1.2	164.0
x=1.3	96.0
x=1.4	59.0
x=1.5	38.0
x=1.8	13.7

t_{ab} (s) = 600

Fig. 5/28
6RA7095-4DS22 2000 A/1Q/400 V, 6RA7095-4GS22 2000 A/1Q/575 V

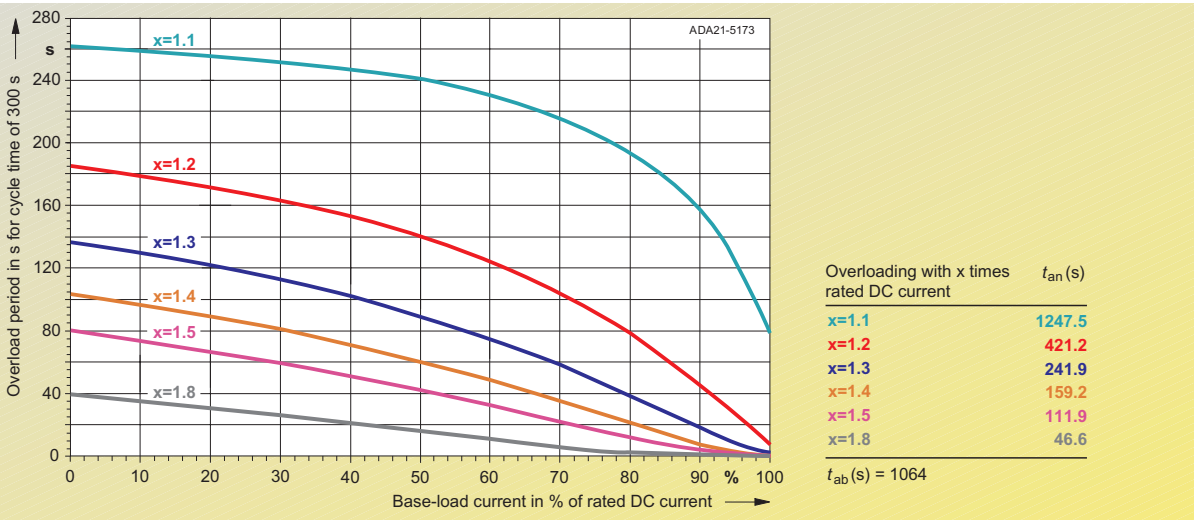
Calculation of dynamic overload capability



Overloading with x times rated DC current	t_{an} (s)
x=1.1	479.7
x=1.2	248.5
x=1.3	155.7
x=1.4	104.8
x=1.5	73.4
x=1.8	28.7

t_{ab} (s) = 663

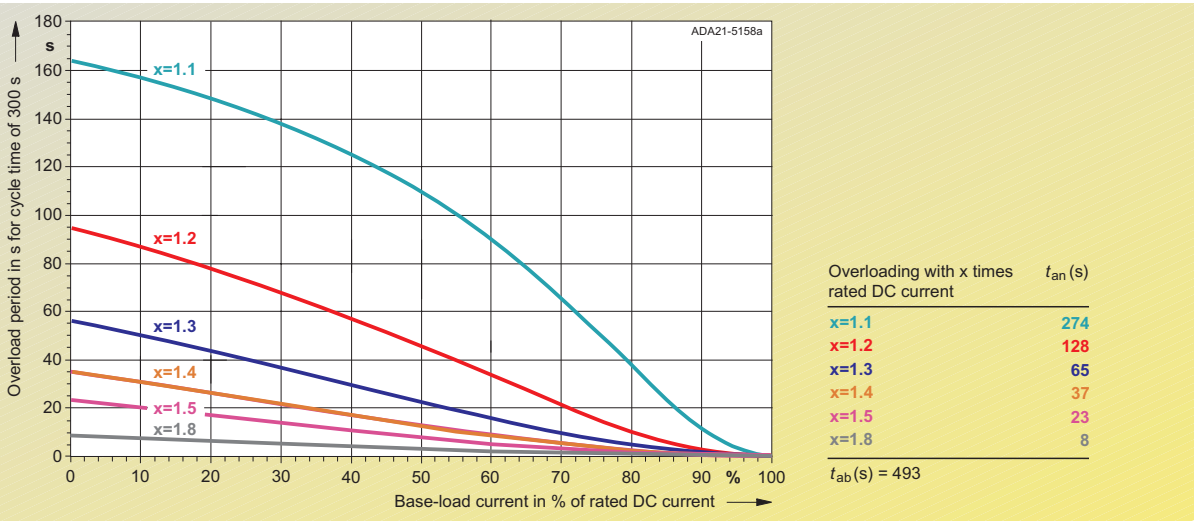
Fig. 5/29
6RA7095-4KS22 2000 A/1Q/690 V



Overloading with x times rated DC current	t_{an} (s)
x=1.1	1247.5
x=1.2	421.2
x=1.3	241.9
x=1.4	159.2
x=1.5	111.9
x=1.8	46.6

t_{ab} (s) = 1064

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



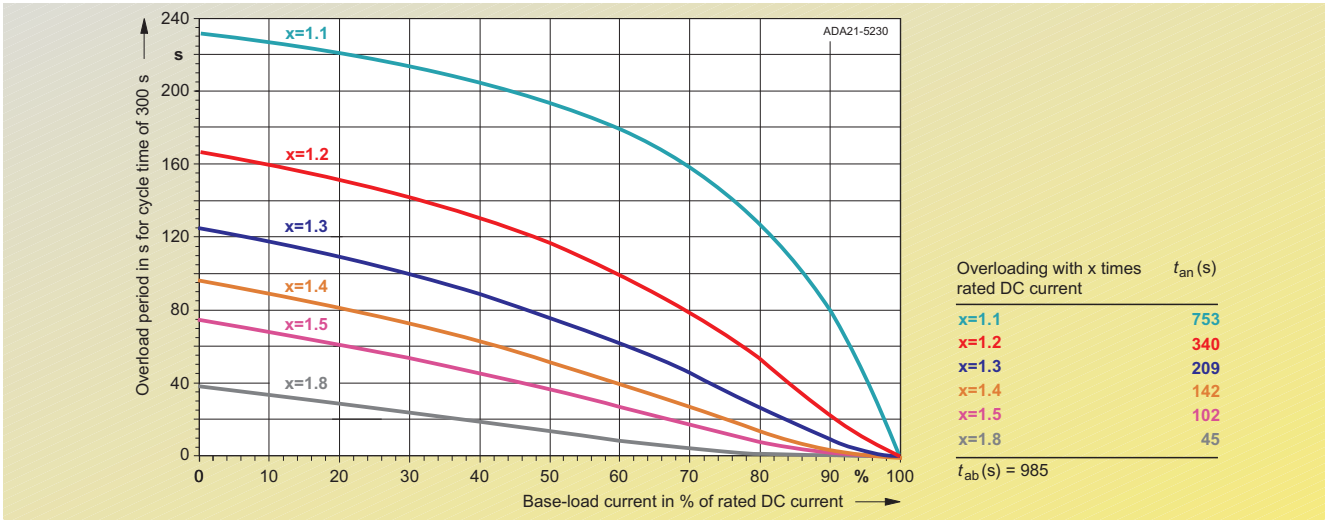
Overloading with x times rated DC current	t_{an} (s)
x=1.1	274
x=1.2	128
x=1.3	65
x=1.4	37
x=1.5	23
x=1.8	8

t_{ab} (s) = 493

Fig. 5/31
6RA7095-4DV62 2000 A/4Q/400 V, 6RA7095-4KV62 2000 A/4Q/690 V

Dynamic overload capability

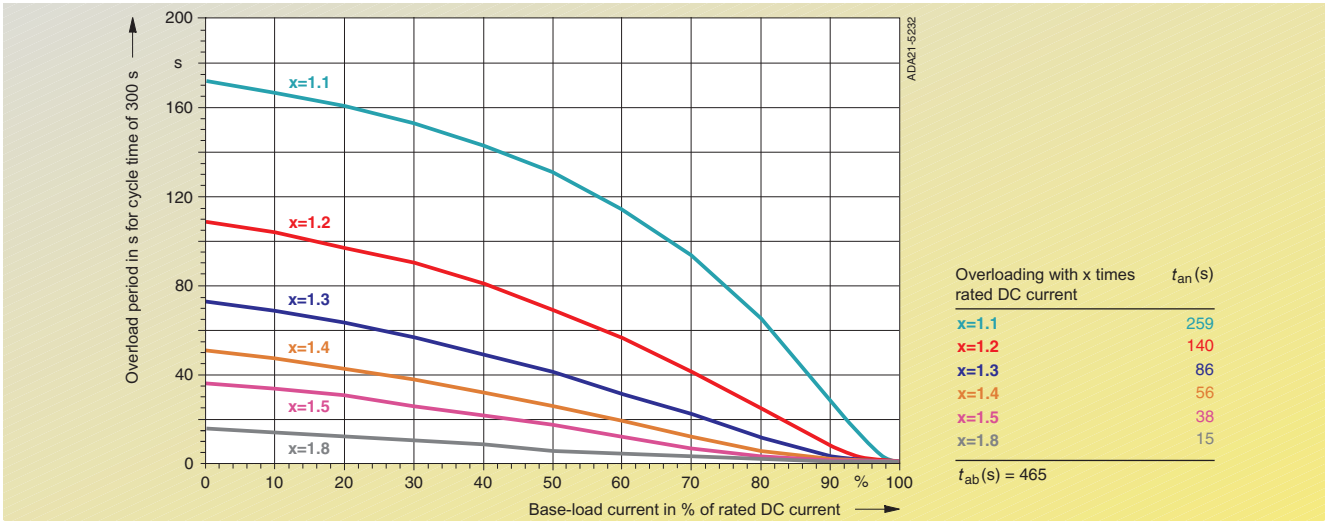
Calculation of dynamic overload capability



Overloading with x times rated DC current	t_{an} (s)
x=1.1	753
x=1.2	340
x=1.3	209
x=1.4	142
x=1.5	102
x=1.8	45

t_{ab} (s) = 985

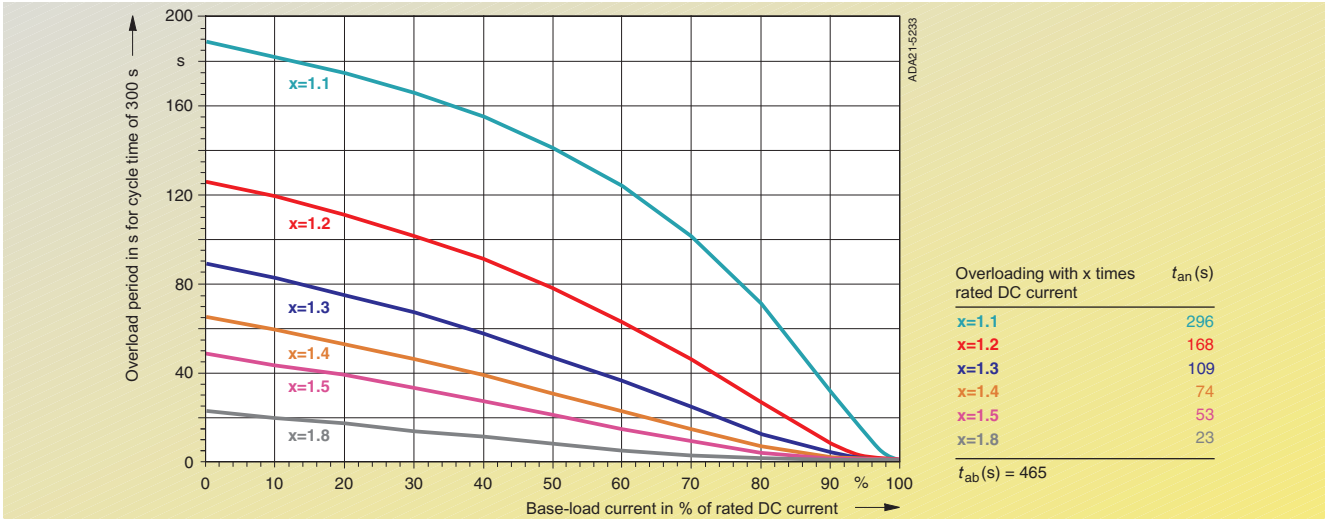
Fig. 5/32
6RA7096-4GS22 2200 A/1Q/575 V, 6RA7096-4GV62 2200 A/4Q/575 V



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

t_{ab} (s) = 465

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

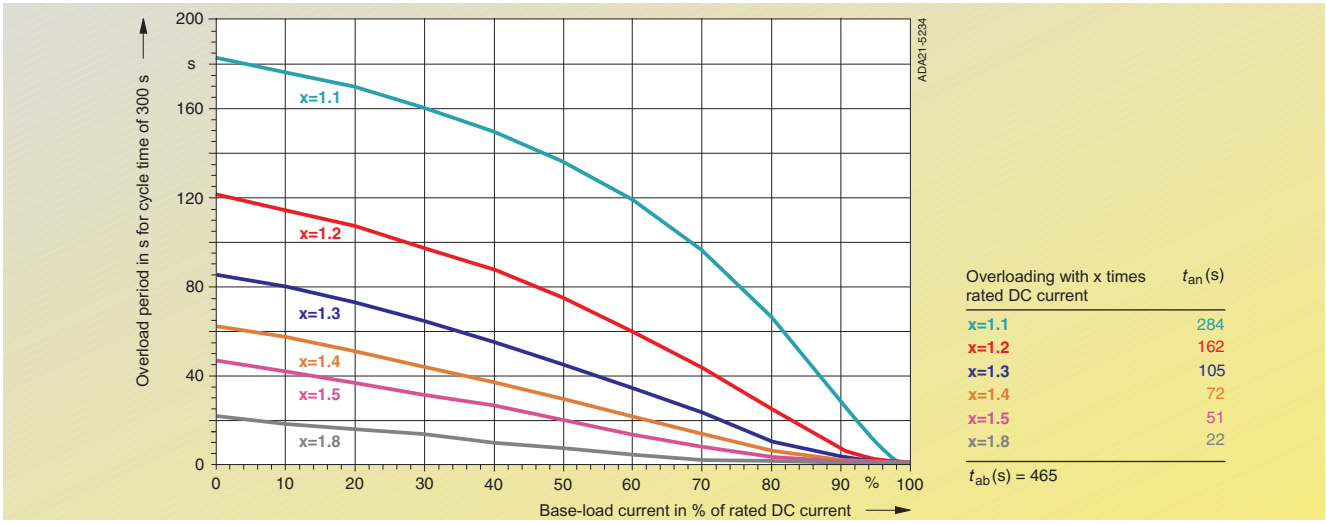


Overloading with x times rated DC current	t_{an} (s)
x=1.1	296
x=1.2	168
x=1.3	109
x=1.4	74
x=1.5	53
x=1.8	23

t_{ab} (s) = 465

Fig. 5/34
6RA7097-4KS22 2600 A/1Q/690 V, 6RA7097-4KV62 2600 A/4Q/690 V

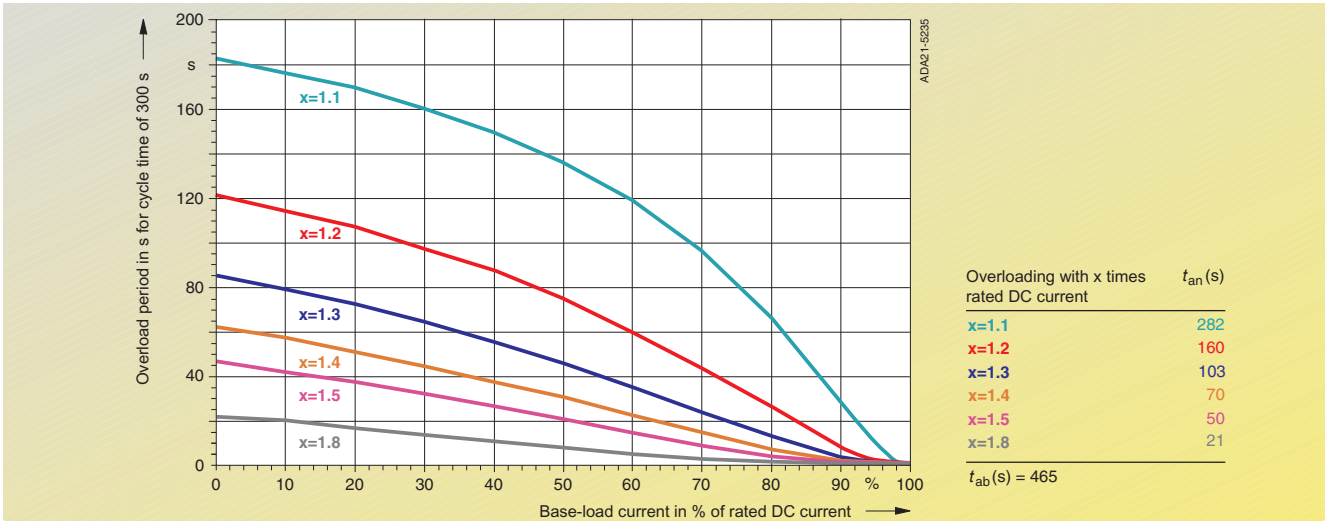
Calculation of dynamic overload capability



Overloading with x times rated DC current	t_{an} (s)
x=1.1	284
x=1.2	162
x=1.3	105
x=1.4	72
x=1.5	51
x=1.8	22

t_{ab} (s) = 465

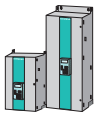
Fig. 5/35
6RA7097-4GS22 2800 A/1Q/575 V, 6RA7097-4GV62 2800 A/4Q/575 V



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

t_{ab} (s) = 465

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



Dynamic overload capability

Rating classes

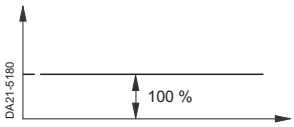
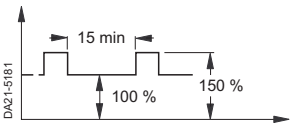
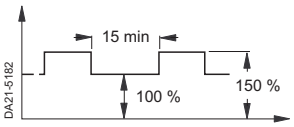
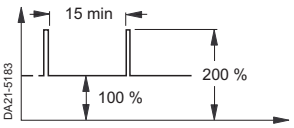
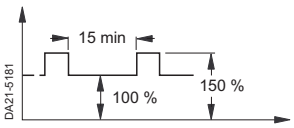
To enable the SIMOREG DC MASTER converters to be adapted to the loading profile of the machine as easily as possible, they can – in addition to individual dimensioning on the basis of the limit curves for dynamic overload capability – also be dimensioned using preset and easily parameterized load cycles.

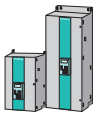
The adjustment is made on the SIMOREG DC MASTER using Parameter P067.

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 maschine or the mechanical system against overloading!

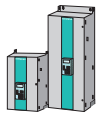
The overload duration actually permitted for the specific power section is always larger than the overload duration corresponding to the rating class. Compliance with the overload duration actually permitted for the power section is monitored by the SIMOREG DC MASTER.

Rating class (Parameter)	Load for converter	Load cycle
DC I (P067=1)	$I_{DC\ I}$ continuous (I_{dN})	
DC II (P067=2)	$I_{DC\ II}$ for 15 min and 1.5 x $I_{DC\ II}$ for 60 s	
DC III (P067=3)	$I_{DC\ III}$ for 15 min and 1.5 x $I_{DC\ III}$ for 120 s	
DC IV (P067=4)	$I_{DC\ IV}$ for 15 min and 2 x $I_{DC\ IV}$ for 10 s	
US Rating (P067=5)	I_{US} for 15 min and 1.5 x I_{US} for 60 s Note With this setting, an ambient temperature or coolant temperature of 45 °C is permitted for all converter types.	



Load cycles for single-quadrant applications

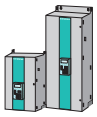
Recommended SIMOREG DC Master		T_u	Load cycles DC I	DC II		DC III		DC IV		US Rating T_u = 45 °C	
			Continu-ous	15 min 100%	60 s 150%	15 min 100%	120 s 150%	15 min 100%	10 s 200%	15 min 100%	60 s 150%
	Type	°C	A	A	A	A	A	A	A	A	A
400 V, 1Q	6RA7018-6DS22	45	30	24.9	37.4	24.2	36.3	22.4	44.8	24.9	37.4
	6RA7025-6DS22	45	60	51.4	77.1	50.2	75.3	46.4	92.8	51.4	77.1
	6RA7028-6DS22	45	90	74.4	111.6	72.8	109.2	65.4	130.8	74.4	111.6
	6RA7031-6DS22	45	125	106.1	159.2	103.4	155.1	96.3	192.6	106.1	159.2
	6RA7075-6DS22	40	210	164.9	247.4	161.4	242.1	136.5	273.0	157.5	236.3
	6RA7078-6DS22	40	280	226.8	340.2	219.3	329.0	201.0	402.0	215.8	323.7
	6RA7081-6DS22	40	400	290.6	435.9	282.6	423.9	244.4	488.8	278.4	417.6
	6RA7085-6DS22	40	600	462.6	693.9	446.3	669.5	413.2	826.4	443.4	665.1
	6RA7087-6DS22	40	850	652.3	978.5	622.4	933.6	610.1	1220.2	620.2	930.3
	6RA7091-6DS22	40	1200	879.9	1319.9	850.8	1276.2	786.6	1573.2	842.6	1263.9
	6RA7093-4DS22	40	1600	1255.5	1883.3	1213.1	1819.7	1139.9	2279.8	1190.1	1785.2
	6RA7095-4DS22	40	2000	1510.2	2265.3	1456.3	2184.5	1388.8	2777.6	1438.7	2158.1
	6RA7098-4DS22	40	3000	2288.0	3432.0	2189.1	3283.6	2164.0	4328.0	2178.6	3267.9
460 V, 1Q	6RA7018-6FS22	45	30	24.9	37.4	24.2	36.3	22.4	44.8	15.0	22.5
	6RA7025-6FS22	45	60	51.4	77.1	50.2	75.3	46.4	92.8	30.0	45.0
	6RA7028-6FS22	45	90	74.4	111.6	72.8	109.2	65.4	130.8	60.0	90.0
	6RA7031-6FS22	45	125	106.1	159.2	103.4	155.1	96.3	192.6	100.0	150.0
	6RA7075-6FS22	40	210	164.9	247.4	161.4	242.1	136.5	273.0	140.0	210.0
	6RA7078-6FS22	40	280	226.8	340.2	219.3	329.0	201.0	402.0	210.0	315.0
	6RA7082-6FS22	40	450	320.6	480.9	311.2	466.8	274.3	548.6	255.0	382.5
	6RA7085-6FS22	40	600	462.6	693.9	446.3	669.5	413.2	826.4	430.0	645.0
	6RA7087-6FS22	40	850	652.3	978.5	622.4	933.6	610.1	1220.2	510.0	765.0
	6RA7091-6FS22	40	1200	879.9	1319.9	850.8	1276.2	786.6	1573.2	850.0	1275.0
575 V, 1Q	6RA7025-6GS22	45	60	51.4	77.1	50.2	75.3	46.4	92.8	51.4	77.1
	6RA7031-6GS22	45	125	106.1	159.2	103.4	155.1	96.3	192.6	106.1	159.2
	6RA7075-6GS22	40	210	164.9	247.4	161.4	242.1	136.5	273.0	157.5	236.3
	6RA7081-6GS22	40	400	290.6	435.9	282.6	423.9	244.4	488.8	278.4	417.6
	6RA7085-6GS22	40	600	462.6	693.9	446.3	669.5	413.2	826.4	443.4	665.1
	6RA7087-6GS22	40	800	607.7	911.6	581.5	872.3	559.3	1118.6	578.0	867.0
	6RA7090-6GS22	40	1000	735.8	1103.7	713.4	1070.1	648.0	1296.0	700.4	1050.6
	6RA7093-4GS22	40	1600	1255.5	1883.3	1213.1	1819.7	1139.9	2279.8	1190.1	1785.2
	6RA7095-4GS22	40	2000	1663.0	2494.5	1591.2	2386.8	1568.4	3136.8	1569.5	2354.3
	6RA7096-4GS22	40	2200	1779.6	2669.4	1699.9	2549.9	1697.2	3394.4	1678.0	2517.0
	6RA7097-4GS22	40	2800	2136.6	3204.9	2044.1	3066.1	2022.1	4044.2	2024.0	3036.0
690 V, 1Q	6RA7086-6KS22	40	720	553.1	829.7	527.9	791.9	515.8	1031.6	525.9	788.9
	6RA7088-6KS22	40	950	700.1	1050.2	677.1	1015.7	624.4	1248.8	668.1	1002.2
	6RA7093-4KS22	40	1500	1156.9	1735.4	1118.2	1677.3	1047.0	2094.0	1101.9	1652.9
	6RA7095-4KS22	40	2000	1589.3	2384.0	1522.2	2283.3	1505.5	3011.0	1503.9	2255.9
	6RA7097-4KS22	40	2600	1992.7	2989.1	1906.3	2859.4	1887.2	3774.4	1876.9	2815.3
830 V, 1Q	6RA7088-6LS22	40	900	663.8	995.7	642.0	963.0	592.1	1184.2	633.5	950.3
	6RA7093-4LS22	40	1500	1156.9	1735.4	1118.2	1677.3	1047.0	2094.0	1101.9	1652.9
	6RA7095-4LS22	40	1900	1485.4	2228.1	1421.6	2132.4	1396.9	2793.8	1414.2	2121.3
950 V, 1Q	6RA7096-4MS22	40	2200	1674.3	2511.4	1603.3	2404.9	1570.7	3141.4	1588.1	2382.1



Dynamic overload capability

Load cycles for four-quadrant applications

Recommended SIMOREG DC Master		T_u	Load cycles DC I	DC II		DC III		DC IV		US Rating T_u = 45 °C	
			Continu-ous	15 min 100%	60 s 150%	15 min 100%	120 s 150%	15 min 100%	10 s 200%	15 min 100%	60 s 150%
	Type	°C	A	A	A	A	A	A	A	A	A
400 V, 4Q	6RA7013-6DV62	45	15	13.9	20.9	13.5	20.3	12.6	25.2	13.9	20.9
	6RA7018-6DV62	45	30	24.9	37.4	24.2	36.3	22.4	44.8	24.9	37.4
	6RA7025-6DV62	45	60	53.1	79.7	51.8	77.7	47.2	94.4	53.1	79.7
	6RA7028-6DV62	45	90	78.2	117.3	76.0	114.0	72.2	144.4	78.2	117.3
	6RA7031-6DV62	45	125	106.1	159.2	103.6	155.4	95.4	190.8	106.1	159.2
	6RA7075-6DV62	40	210	164.9	247.4	161.4	242.1	136.5	273.0	157.5	236.3
	6RA7078-6DV62	40	280	226.8	340.2	219.3	329.0	201.0	402.0	215.8	323.7
	6RA7081-6DV62	40	400	300.1	450.2	292.4	438.6	247.4	494.8	285.5	428.3
	6RA7085-6DV62	40	600	470.8	706.2	453.9	680.9	410.4	820.8	450.1	675.2
	6RA7087-6DV62	40	850	658.3	987.5	634.2	951.3	579.6	1159.2	626.4	939.6
	6RA7091-6DV62	40	1200	884.1	1326.2	857.5	1286.3	768.8	1537.6	842.3	1263.5
	6RA7093-4DV62	40	1600	1255.5	1883.3	1213.1	1819.7	1139.9	2279.8	1190.1	1785.2
	6RA7095-4DV62	40	2000	1477.7	2216.6	1435.3	2153.0	1326.7	2653.4	1404.6	2106.9
	6RA7098-4DV62	40	3000	2288.0	3432.0	2189.1	3283.6	2164.0	4328.0	2178.6	3267.9
460 V, 4Q	6RA7018-6FV62	45	30	24.9	37.4	24.2	36.3	22.4	44.8	15.0	22.5
	6RA7025-6FV62	45	60	53.1	79.7	51.8	77.7	47.2	94.4	30.0	45.0
	6RA7028-6FV62	45	90	78.2	117.3	76.0	114.0	72.2	144.4	60.0	90.0
	6RA7031-6FV62	45	125	106.1	159.2	103.6	155.4	95.4	190.8	100.0	150.0
	6RA7075-6FV62	40	210	164.9	247.4	161.4	242.1	136.5	273.0	140.0	210.0
	6RA7078-6FV62	40	280	226.8	340.2	219.3	329.0	201.0	402.0	210.0	315.0
	6RA7082-6FV62	40	450	320.6	480.9	311.2	466.8	274.3	548.6	255.0	382.5
	6RA7085-6FV62	40	600	470.8	706.2	453.9	680.9	410.4	820.8	430.0	645.0
	6RA7087-6FV62	40	850	658.3	987.5	634.2	951.3	579.6	1159.2	510.0	765.0
	6RA7091-6FV62	40	1200	884.1	1326.2	857.5	1286.3	768.8	1537.6	850.0	1275.0
575 V, 4Q	6RA7025-6GV62	45	60	53.1	79.7	51.8	77.7	47.2	94.4	53.1	79.7
	6RA7031-6GV62	45	125	106.1	159.2	103.6	155.4	95.4	190.8	106.1	159.2
	6RA7075-6GV62	40	210	164.9	247.4	161.4	242.1	136.5	273.0	157.5	236.3
	6RA7081-6GV62	40	400	300.1	450.2	292.4	438.6	247.4	494.8	285.5	428.3
	6RA7085-6GV62	40	600	470.8	706.2	453.9	680.9	410.4	820.8	450.1	675.2
	6RA7087-6GV62	40	850	658.3	987.5	634.2	951.3	579.6	1159.2	626.4	939.6
	6RA7090-6GV62	40	1100	804.7	1207.1	782.6	1173.9	689.6	1379.2	766.8	1150.2
	6RA7093-4GV62	40	1600	1255.5	1883.3	1213.1	1819.7	1139.9	2279.8	1190.1	1785.2
	6RA7095-4GV62	40	2000	1663.0	2494.5	1591.2	2386.8	1568.4	3136.8	1569.5	2354.3
	6RA7096-4GV62	40	2200	1779.6	2669.4	1699.9	2549.9	1697.2	3394.4	1678.0	2517.0
	6RA7097-4GV62	40	2800	2136.6	3204.9	2044.1	3066.1	2022.1	4044.2	2024.0	3036.0
690 V, 4Q	6RA7086-6KV62	40	760	598.7	898.1	575.4	863.1	532.9	1065.8	569.3	854.0
	6RA7090-6KV62	40	1000	737.3	1106.0	715.2	1072.8	639.5	1279.0	702.3	1053.5
	6RA7093-4KV62	40	1500	1171.6	1757.4	1140.1	1710.2	1036.6	2073.2	1116.2	1674.3
	6RA7095-4KV62	40	2000	1477.7	2216.6	1435.3	2153.0	1326.7	2653.4	1404.6	2106.9
	6RA7097-4KV62	40	2600	1992.7	2989.1	1906.3	2859.4	1887.2	3774.4	1876.9	2815.3
830 V, 4Q	6RA7088-6LV62	40	950	700.8	1051.2	679.8	1019.7	607.8	1215.6	667.6	1001.4
	6RA7093-4LV62	40	1500	1171.6	1757.4	1140.1	1710.2	1036.6	2073.2	1116.2	1674.3
	6RA7095-4LV62	40	1900	1485.4	2228.1	1421.6	2132.4	1396.9	2793.8	1414.2	2121.3
950 V, 4Q	6RA7096-4MV62	40	2200	1674.3	2511.4	1603.3	2404.9	1570.7	3141.4	1588.1	2382.1



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_k min. 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.

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:

$I_{max} = n \times I_{N(SIMOREG)}$

n = number of SIMOREG units

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

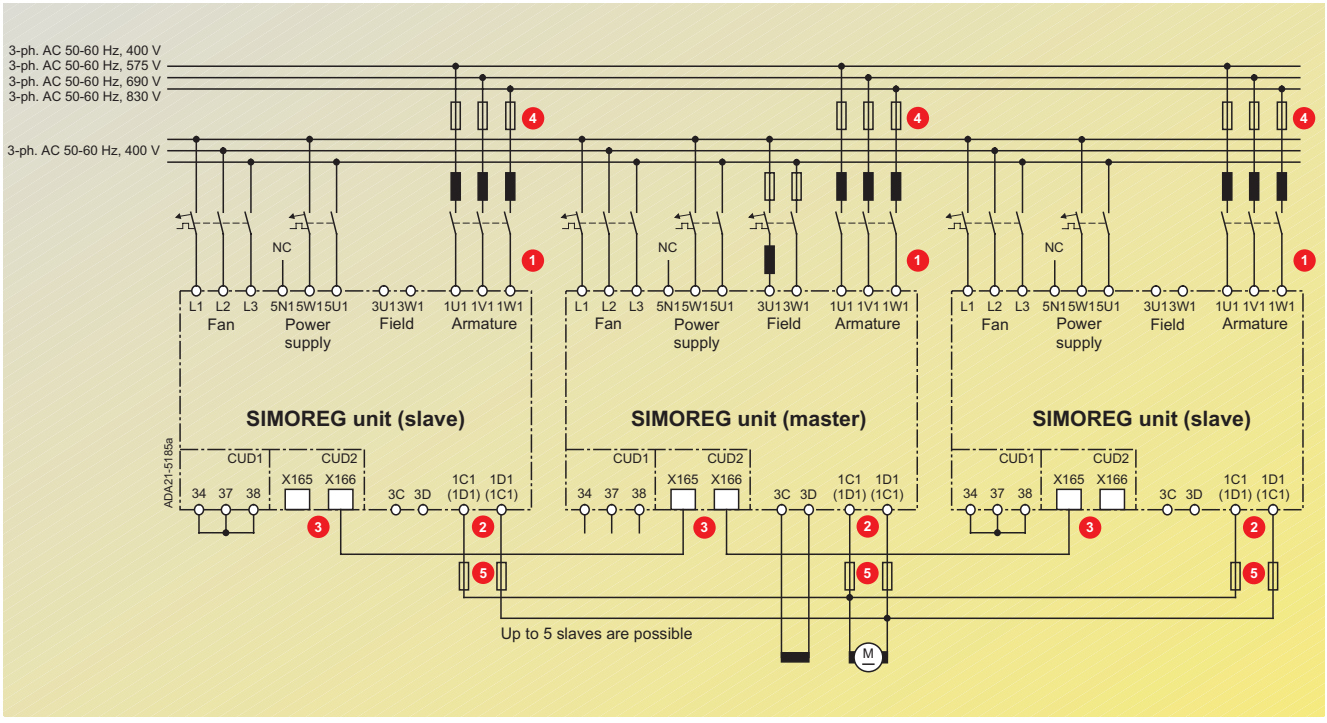


Fig. 5/37
Terminal connections for parallel connection

1. It is essential that 1U1, 1V1 and 1W1 are in-phase.
2. It is essential that 1C1 and 1D1 are in-phase.
3. 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).
   To connect n units in parallel, (n-1) cables will be required.
   When a unit is connected to the start or end of the bus, the bus termination must be activated (U805=1).
4. These fuses are only to be inserted for units up to 850 A.
5. Only for units up to 850 A in 4Q mode.

12-pulse operation, supplying high inductances, condensation protection

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 x I_{dN} (L_{D1})
2. Inductance of reactor at I_{dmax} (L_{D2})

Inductance for 50 Hz line frequency:

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

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

Inductance for 60 Hz line frequency:

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

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

Legend:

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

Fig. 5/38
Calculation of required inductance

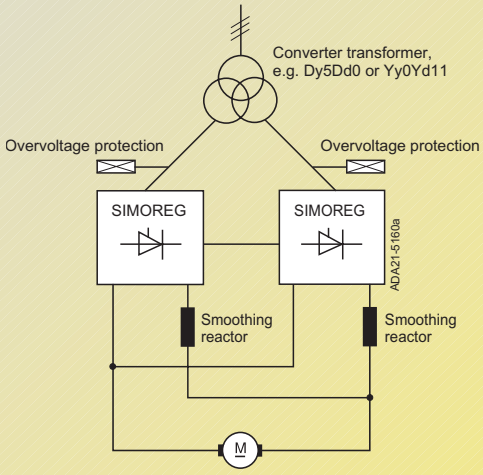


Fig. 5/39
12-pulse operation

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.

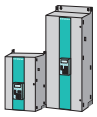
Note

An external snubber circuit (e.g. resistor or block varistor) must be provided at the DC voltage output of the converter.

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.



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.

	Rated input voltage range	
	5 V P140 = 0x	**15 V P140 = 1x**
Low level	Differential voltage < 0.8 V	Differential voltage < 5 V
High level	Differential voltage > 2 V	Differential voltage > 8 V[1)]
Hysteresis	> 0.2 V	< 1 V
Common mode	± 10 V	± 10 V

Table 4
Explanation of terms

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

Table 5
Minimum distance between edges

	f_{max}				
	50 kHz	**100 kHz**	**150 kHz**	**200 kHz**	**300 kHz**
Differential voltage [4)]	to 27 V	to 22 V	to 18 V	to 16 V	to 14 V

Table 6
Maximum input frequency as a function of supply voltage

Switching frequency

The maximum frequency of the encoder pulses is 300 kHz. To ensure correct evaluation of the encoder pulses, the minimum distance T_{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.

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.

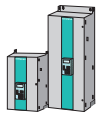
Generally, a twisted-pair cable with a common pair shield is sufficient for each track. Crosstalk between the cables is thus reduced. The shielding of all pairs protects against noise pulses. The shield must be connected to the shield bar of the SIMOREG converter over the largest possible surface area.

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_{min}:
$L_G = + (90° - f_p \times T_{min} \times 360° \times 10^{-6})$
L_G [°] = Phase error
f_p [kHz] = Pulse frequency
T_{min} [ns] = 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 1800-3, 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 it 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

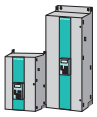
If two devices are electromagnetically incompatible, you can reduce the emitted interference of the source or increase the interference immunity of the sink.

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 used, 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 circuitry must be implemented directly at the particular coil.

Rule 3

Signal lines [1] should be routed into the cabinet from one level if possible.

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 [2]. 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 mm^2 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 converter.

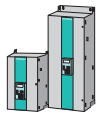
Rule 15

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.

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.

Instructions for the electromagnetically compatible installation of drives



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.

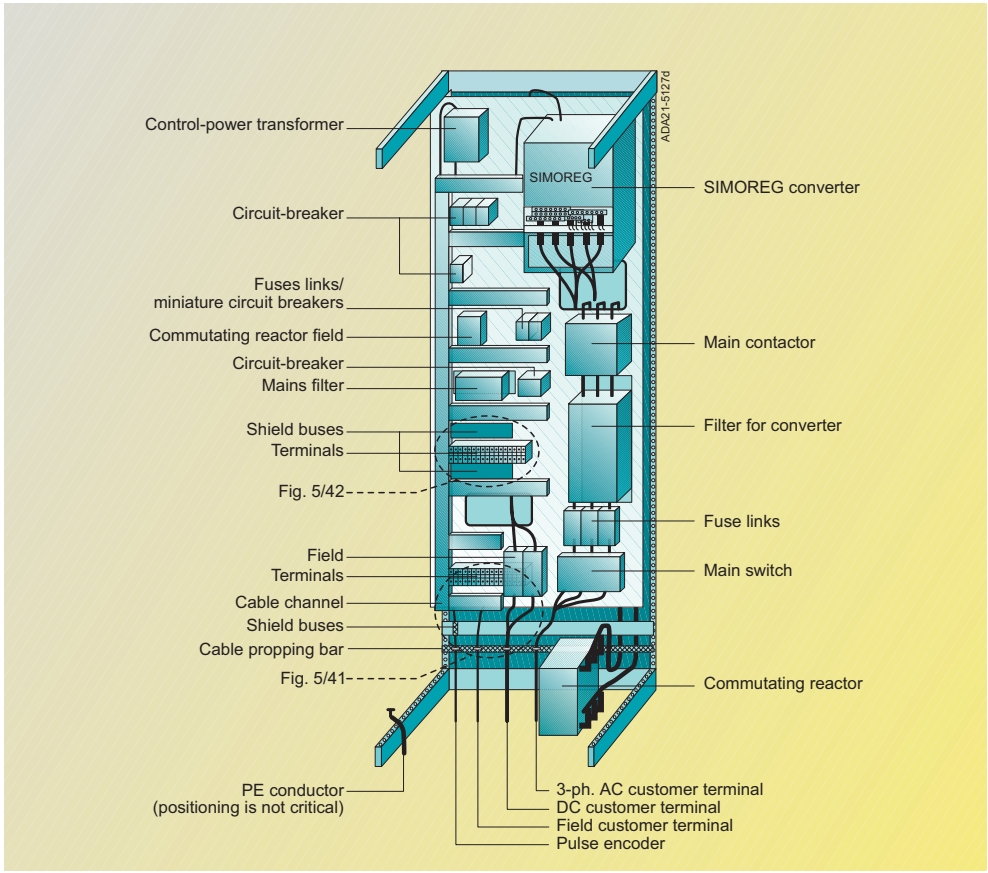


Fig. 5/40
Example of cabinet arrangement with a SIMOREG converter

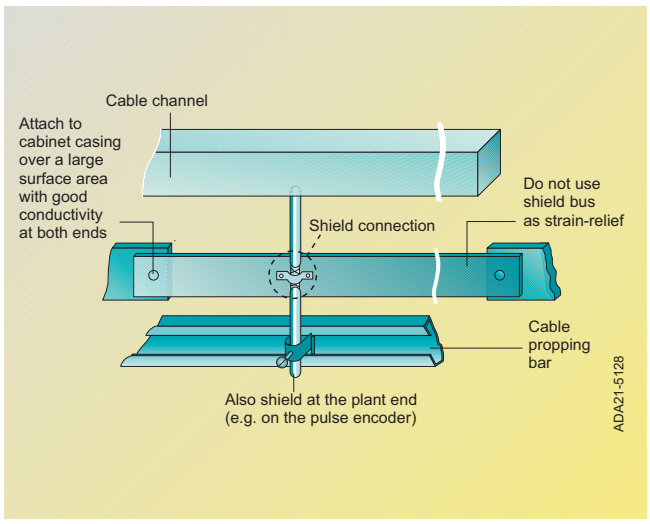


Fig. 5/41
Shielding with routing into the cabinet

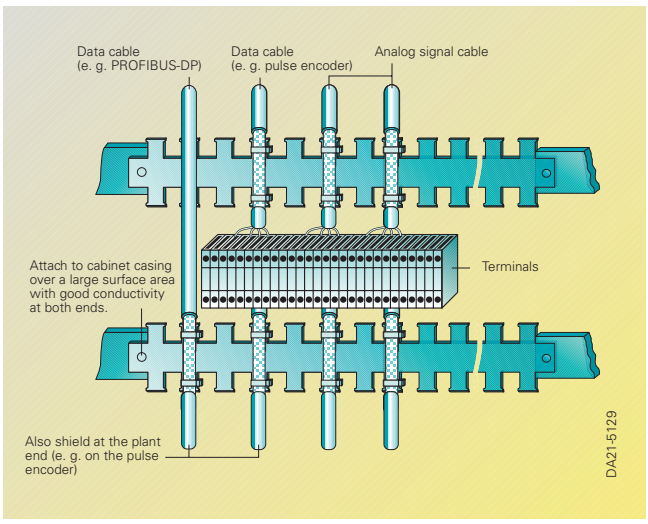


Fig. 5/42
Shielding in the cabinet

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.

Line commutating reactors

A converter must always be connected to the supply via a commutating inductance. This must be at least 4 % u_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 u_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 u_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_{Ln} specified in the Table for the reactors apply for operation at a supply frequency f = 50 Hz. Operation of the reactors at a supply frequency f = 60 Hz is permissible. In this case, the permissible rated current I_{Ln} is reduced to 90 %.

I_{Ln} (60 Hz) = 0.9 · I_{Ln} (50 Hz)

At the same time, the voltage drop ΔU increases by 8 %.

1. The commutating reactor in the field circuit is designed for the rated current of the motor field.
2. 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.
3. 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.
4. 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.
5. The radio interference suppression filter for the electronics power supply at 230 V is designed for ≥ 2 A .

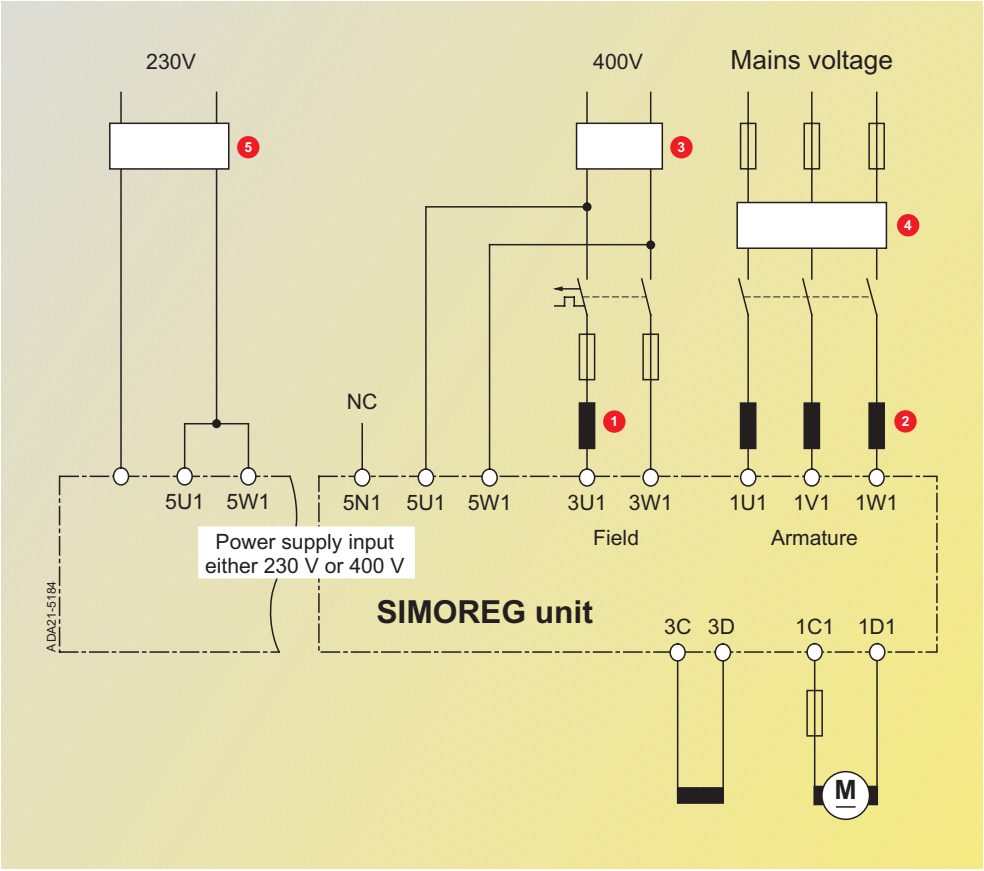
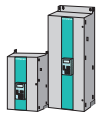


Fig. 5/43
Arrangement of the reactors and radio interference suppression filters

Components



Commutating reactors

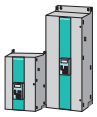
Thermal permissible continuous current [4] $I_{th\ max}$ A	Max. AC current I_{Lmax} A	Permissible continuous DC current I_{dn} [3] A	Referred voltage drop u_D of the reactor at I_{Lmax} and U_N Order No.: **400 V**	Order No.: **500 V**	Order No.: **690 V**	Order No.: **750 V**
Single-phase commutating reactors $I_{th\ max} = I_{Lmax}$ with inductive load						
8	8	9.8	4EM48 07-1CB00	–	–	–
10	10	12.3	4EM49 11-7CB00	–	–	–
11.2	11.2	13.7	4EM49 11-8CB00	–	–	–
12.5	12.5	15.3	4EM49 12-0CB00	–	–	–
14	14	17.2	4EM49 12-1CB00	–	–	–
15	15	18.4	4EM50 00-2CB00	–	–	–
18	18	22	4EM50 05-6CB00	–	–	–
20	20	24.5	4EM50 05-7CB00	–	–	–
22.4	22.4	27.4	4EM50 05-8CB00	–	–	–
24	24	29.4	4EM51 00-2CB00	–	–	–
28	28	34	4EM61 00-2CB00	–	–	–
31.5	31.5	39	4EM61 00-3CB00	–	–	–
35.5	35.5	43	4EM52 12-8CB00	–	–	–
40	40	49	4EM52 00-1CB00	–	–	–
45	45	55	4EM62 00-3CB00	–	–	–
50	50	61	4EM53 16-6CB00	–	–	–
Three phase commutating reactors $I_{th\ max} = 0.8 \cdot I_{Lmax}$ with inductive load 3-ph. AC 50 Hz						
16	20	19.6	4EP36 01-3DS00	4EP36 01-8DS00	–	–
18	22.4	22	4EP36 01-4DS00	4EP36 02-0DS00	–	–
20	25	24.5	4EP36 01-5DS00	4EP37 02-0DS00	–	–
22.4	28	27.4	–	4EP37 02-1DS00	–	–
25	31.5	31	4EP37 01-5DS00	4EP37 02-2DS00	–	–
28	35.5	34	4EP37 01-6DS00	4EP38 01-7DS00	–	–
31.5	40	39	4EP37 01-7DS00	4EP38 01-8DS00	–	–
35.5	45	43	4EP37 01-8DS00	4EP38 02-0DS00	–	–
40	50	49	4EP38 00-2DS00	4EP38 00-4DS00	–	–
45	56	55	4EP38 01-6DS00	4EP39 01-5DS00	–	–
50	63	61	4EP38 00-3DS00	4EP39 00-3DS00	–	–
56	71	69	4EP39 01-4DS00	4EP40 03-1DS00	–	–
63	80	77	4EP39 00-2DS00	4EP40 00-4DS00	–	–
71	91	87	4EP40 02-7DS00	4EP40 03-2DS00	–	–
80	100	98	4EP40 00-3DS00	4EU24 22-8AA00-0AA0	–	–
91	112	112	4EP40 02-8DS00	4EU24 22-0BA00-0AA0	–	–
100	125	123	4EP40 03-0DS00	4EU25 22-6BA00-0AA0	–	–
112	140	137	4EU24 22-6AA00-0AA0	4EU25 22-7BA00-0AA0	–	–
125	160	153	4EU24 22-7AA00-0AA0	4EU25 22-8BA00-0AA0	–	–
140	180	172	4EU25 22-2BA00-0AA0	4EU25 22-0CA00-0AA0	–	–
160	200	196	4EU25 22-3BA00-0AA0	4EU27 22-0CA00-0AA0	–	–
180	224	221	4EU25 22-4BA00-0AA0	4EU27 22-1CA00-0AA0	–	–
200	250	245	4EU25 22-5BA00-0AA0	4EU27 22-2CA00-0AA0	4EU27 22-0DA00-1BA0	–
224	280	275	4EU27 22-5BA00-0AA0	4EU27 22-3CA00-0AA0	4EU30 22-8BA00-0AA0	–
250	315	306	4EU27 22-6BA00-0AA0	4EU27 22-4CA00-0AA0	4EU30 22-0CA00-0AA0	4EU30 22-2CA00-0AA0
280	355	343	4EU27 22-7BA00-0AA0	4EU30 22-5BA00-0AA0	4EU30 22-1CA00-0AA0	4EU36 22-5DA00-0AA0
315	400	386	4EU27 22-8BA00-0AA0	4EU30 22-6BA00-0AA0	4EU36 22-0DA00-0AA0	4EU36 22-6DA00-0AA0
355	450	435	4EU30 22-1BA00-0AA0	4EU30 22-7BA00-0AA0	4EU36 22-1DA00-0AA0	4EU36 22-7DA00-0AA0
400	500	490	4EU30 22-2BA00-0AA0	4EU36 22-4CA00-0AA0	4EU36 22-2DA00-0AA0	4EU36 22-8DA00-1BA0
450	560	551	4EU30 22-3BA00-0AA0	4EU36 22-5CA00-0AA0	4EU36 22-3DA00-0AA0	4EU36 22-0EA00-1BA0
500	630	613	4EU30 22-4BA00-0AA0	4EU36 22-6CA00-0AA0	4EU36 22-4DA00-0AA0	4EU39 21-1CA00-A0
560	710	686	4EU36 22-0CA00-0AA0	4EU36 22-7CA00-0AA0	4EU39 21-8BA00-0A	4EU39 21-2CA00-A0
630	800	772	4EU36 22-1CA00-0AA0	4EU36 22-8CA00-1BA0	4EU39 21-0CA00-0A	4EU43 21-4DA00-A0
710	910	870	4EU36 22-2CA00-1BA0	4EU39 21-6BA00-0A	4EU43 21-0DA00-0A	4EU43 21-5DA00-A0
800	1000	980	4EU36 22-3CA00-1BA0	4EU39 21-7BA00-0A	4EU43 21-1DA00-0A	4EU43 21-6DA00-A0
910	1120	1115	4EU39 21-2BA00-0A	4EU43 21-4CA00-0A	4EU43 21-2DA00-0A	4EU45 21-4BA00-A0
980	1230	1200	–	–	4EU43 21-0AY00-0A	–
1000	1250	1225	4EU39 21-3BA00-0A	4EU43 21-5CA00-0A	4EU43 21-3DA00-0A	4EU45 21-5BA00
1040	1300	1280	4EU39 21-0AL00-0A	4EU43 21-0AX00-0A [2])	–	–
1310	1640	1600	4EU43 21-0AW00-0A	4EU45 21-0AK00 [2])	4EU45 21-0AP00	–
1600	2000	1950	4EU43 21-0CA10-0A	4EU50 21-0AA00	4EU51 21-0AA00	–

1) All reactors with $U_N \leq 600$ V acc. to UL

2) Referred voltage drop of the reactor u_D~ 4% at I_{Ln} and U_N= 575 V

3) With series-connected 6-pulse bridge circuit

4) Rated current $I_{Ln} = 0.9 \times I_{th\ max}$.



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 mm^2 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

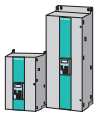
Rated current Radio interference suppression filters	Radio interference suppression filters	Terminal cross-section mm^2	Weight approx.	Dimensions H x W x D
A	Type	Holes for M . .	kg	mm x mm x mm
8	B84143-G8-R11*	4 mm^2	1.3	80 x 230 x 50
20	B84143-G20-R11*	4 mm^2	1.3	80 x 230 x 50
36	B84143-G36-R11*	6 mm^2	2.8	150 x 280 x 60
50	B84143-G50-R11*	16 mm^2	3.3	150 x 60 x 330
66	B84143-G66-R11*	25 mm^2	4.4	150 x 330 x 80
90	B84143-G90-R11*	25 mm^2	4.9	150 x 330 x 80
120	B84143-G120-R11*	50 mm^2	7.5	200 x 380 x 90
150	B84143-G150-R11*	50 mm^2	8.0	200 x 380 x 90
220	B84143-G220-R11*	95 mm^2	11.5	220 x 430 x 110
150	B84143-B150-S**	M10	13	140 x 310 x 170
180	B84143-B180-S**	M10	13	140 x 310 x 170
250	B84143-B250-S**	M10	15	115 x 360 x 190
320	B84143-B320-S**	M10	21	115 x 360 x 260
400	B84143-B400-S**	M10	21	115 x 360 x 260
600	B84143-B600-S**	M10	22	115 x 410 x 260
1000	B84143-B1000-S**	M12	28	165 x 420 x 300
1600	B84143-B1600-S**	2 x M12	34	165 x 550 x 300
2500	B84143-B2500-S**	4 x M12	105	200 x 810 x 385

List of suggested RI suppression filters from Siemens

Rated current Radio interference suppression filters	Radio interference suppression filters	Terminal cross-section	Ground bolt	Weight approx.	Dimensions H x W x D
A	Type	mm^2		kg	mm x mm x mm
12	6SE7021-0ES87-0FB1	4	M6	2.5	215 x 90 x 81
18	6SE7021-8ES87-0FB1	4	M6	2.5	215 x 90 x 81
36	6SE7023-4ES87-0FB1	16	M6	4	231 x 101 x 86
80	6SE7027-2ES87-0FB1	50	M10	9	308 x 141 x 141
120	6SE7031-2ES87-0FA1	50	M10	10	348 x 171 x 141
190	6SE7031-8ES87-0FA1	95	M10	10	404 x 171 x 141
320	6SE7033-2ES87-0FA1	Terminal link	M10 x 30	21	300 x 260 x 116
600	6SE7036-0ES87-0FA1	Terminal link	M10 x 30	22	350 x 260 x 116
1000	6SE7041-0ES87-0FA1	Terminal link	M10 x 30	28	350 x 300 x 166
1600	6SE7041-6ES87-0FB1	Terminal link	M12 x 30	34	400 x 300 x 166

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



Harmonics

Supply harmonics of converters in fully controlled, three-phase bridge connections B6C and (B6)A(B6)C

Converters for medium power are mainly designed in fully controlled three-phase bridge connection. An example of harmonics of a typical installed configuration for two delay angles (α = 20° and α = 60°) are shown below.

The values have been adopted from a previous publication: "Oberschwingungen im netzseitigen Strom sechspulsiger netzgeführter Stromrichter" (Harmonics in the supply current of six-pulse line-commutated converters) by H. Arremann and G. Möltgen, Siemens Forschungs.- und Entwicklungsberichte, Vol. 7 (1978) No. 2,

This is accompanied by formulas with which, depending on the operating data in the specific case, supply voltage (no-load voltage U_{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 harmonic spectrum is attained when the values calculated with the following formulas for short-circuit power S_K at the connection point of the unit and the armature inductance L_a of the motor coincide with the actual values of the installation. If the values differ, a separate calculation of harmonics is necessary.

a) α = 20°
Fundamental factor g = 0.962

ν	I_ν/I_1	ν	I_ν/I_1
5	0.235	29	0.018
7	0.100	31	0.016
11	0.083	35	0.011
13	0.056	37	0.010
17	0.046	41	0.006
19	0.035	43	0.006
23	0.028	47	0.003
25	0.024	49	0.003

b) α = 60°
Fundamental factor g = 0.953

ν	I_ν/I_1	ν	I_ν/I_1
5	0.283	29	0.026
7	0.050	31	0.019
11	0.089	35	0.020
13	0.038	37	0.016
17	0.050	41	0.016
19	0.029	43	0.013
23	0.034	47	0.013
25	0.023	49	0.011

The fundamental current I_1 as the reference quantity is calculated with the following formula:

$I_1 = g \times 0.817 \times I_d$

where I_d = DC of the examined operating point
and g = fundamental factor (see above)

The harmonic currents calculated from the above tables apply only to

a) Short-circuit power S_K at the connection point of the converter:

$$S_K = \frac{U^2_{V0}}{X_N}(\text{VA})$$

where

$$X_N = X_K - X_D = 0.03536 \times \frac{U_{V0}}{I_d} - 2\pi f_N \times L_D(\Omega) \text{ and}$$

U_{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.

b) Armature inductance L_a:

$$L_a = 0.0488 \times \frac{U_{V0}}{f_N \times I_d}(\text{H})$$

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:

The given drive has the following data:

U_{vo} = 400 V

I_d = 150 A

f_N = 50 Hz

L_D = 0.169 mH (4EU2421-7AA10 with I_{LN} = 125 A)

where

$$X_N = 0.03536 \times \frac{400}{150} - 2\pi \times 0.169 \times 10^{-3} = 0.0412\ \Omega$$

resulting in the following required short-circuit power of the system at the connection point of the converter:

$$S_K = \frac{400^2}{0.0412} = 3.88 \text{ MVA}$$

and the following required armature inductance of the motor:

$$L_a = 0.0488 \times \frac{400}{50 \times 150} = 2.0 \text{ mH}$$

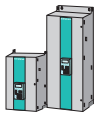
The harmonic currents listed in the tables I_ν
(where $I_1 = g \times 0.817 \times I_d$ for delay angle α = 20° and α = 60°) apply only to the values S_K and L_a. If the values differ, a separate calculation is necessary.

When designing filters and reactor compensations, the harmonic values thus calculated can only serve as a basis if the calculated values for S_K and L_a coincide with the actual values of the drive. In all other cases a separate calculation must be made (especially when compensated machines are used because of the very low armature inductance).

SIMOREG
6RA70 DC MASTER
SIMOREG CM

6

SIMOREG CM



Application

Fig. 6/1
SIMOREG CM

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.

6

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.

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.

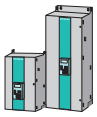
The OP1S can be installed as an economic alternative to control cubicle measuring instruments which display physical measured quantities.

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.

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.



Technical data

Type 6RA7000-0MV62-0

Measurable rated supply voltage armature	**V**	85 / 250 / 575 / 1000
Rated supply voltage electronics supply	**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)
Rated supply voltage field [1])	**V**	2-ph. AC 400 (+15 % / –20%) 2-ph. AC 460 (+10 %)
Rated frequency	**Hz**	The converters automatically adjust to the connected line frequency within a frequency range of 45 to 65 Hz [2])
Rated DC voltage field [1])	**V**	Max. 325 / 373
Rated DC current field	**A**	**40**
Operational ambient temperature	**°C**	0 to +60
Storage and transport temperature	**°C**	–25 to +70
Control stability		Δ_n = 0.006 % of the rated motor speed, valid for pulse encoder operation and digital setpoint Δ_n = 0.1 % of the rated motor speed, valid for analog tacho and analog setpoint [3])
Environmental class	**EN 60721-3-3**	3K3
Degree of protection	**EN 60529**	IP 00
See dimension drawing on Page		9/16
Weight approx.	**kg**	15

6

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
DIN EN 50178 / DIN VDE 0160	Regulations for the equipment of electrical power installations with electronic equipment.
EN 61800-3	Variable-speed drives, Part 3, EMC product standard including special test procedures
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 undervoltages 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:

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 °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)

Block diagram

SIMOREG CM

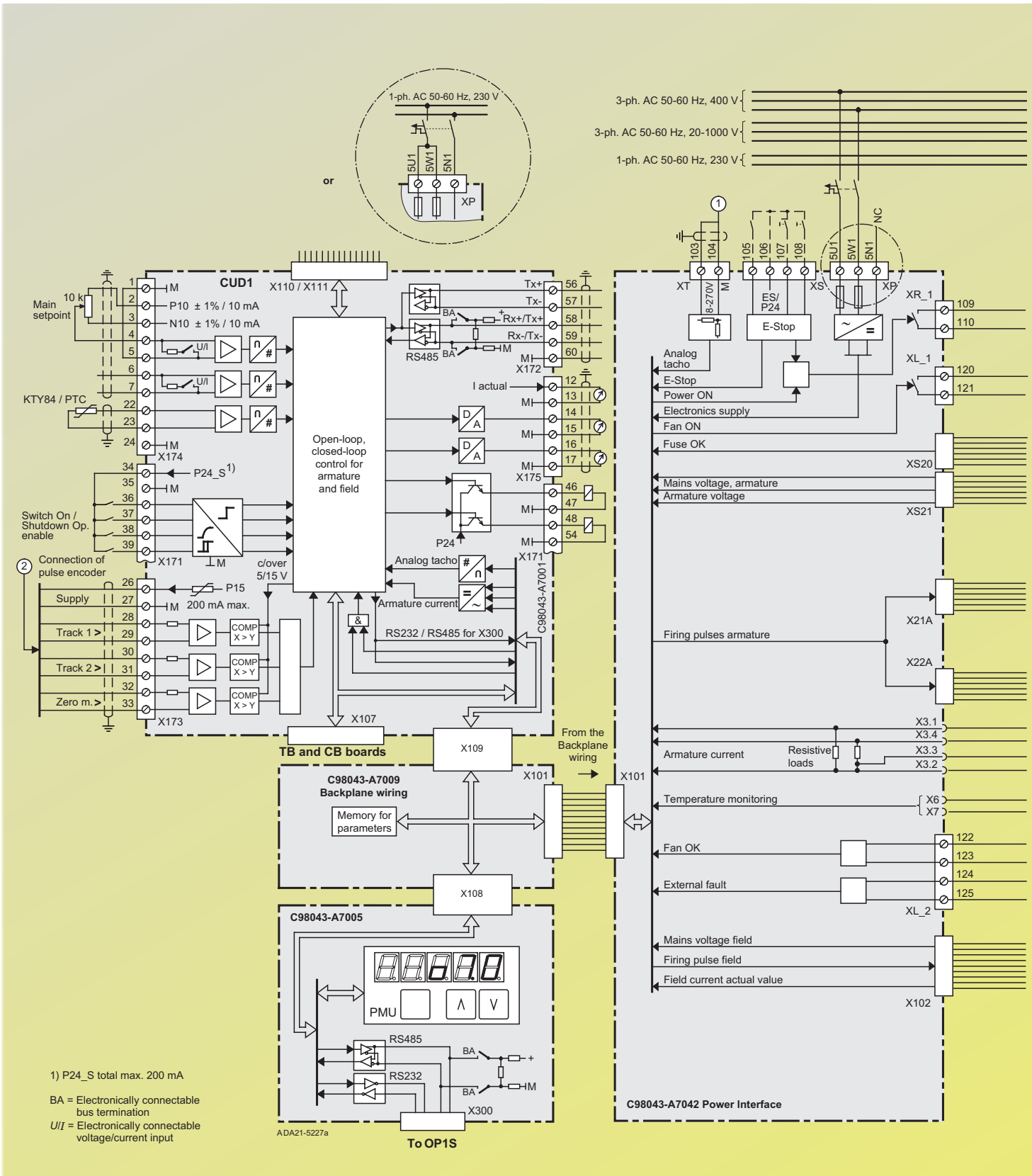
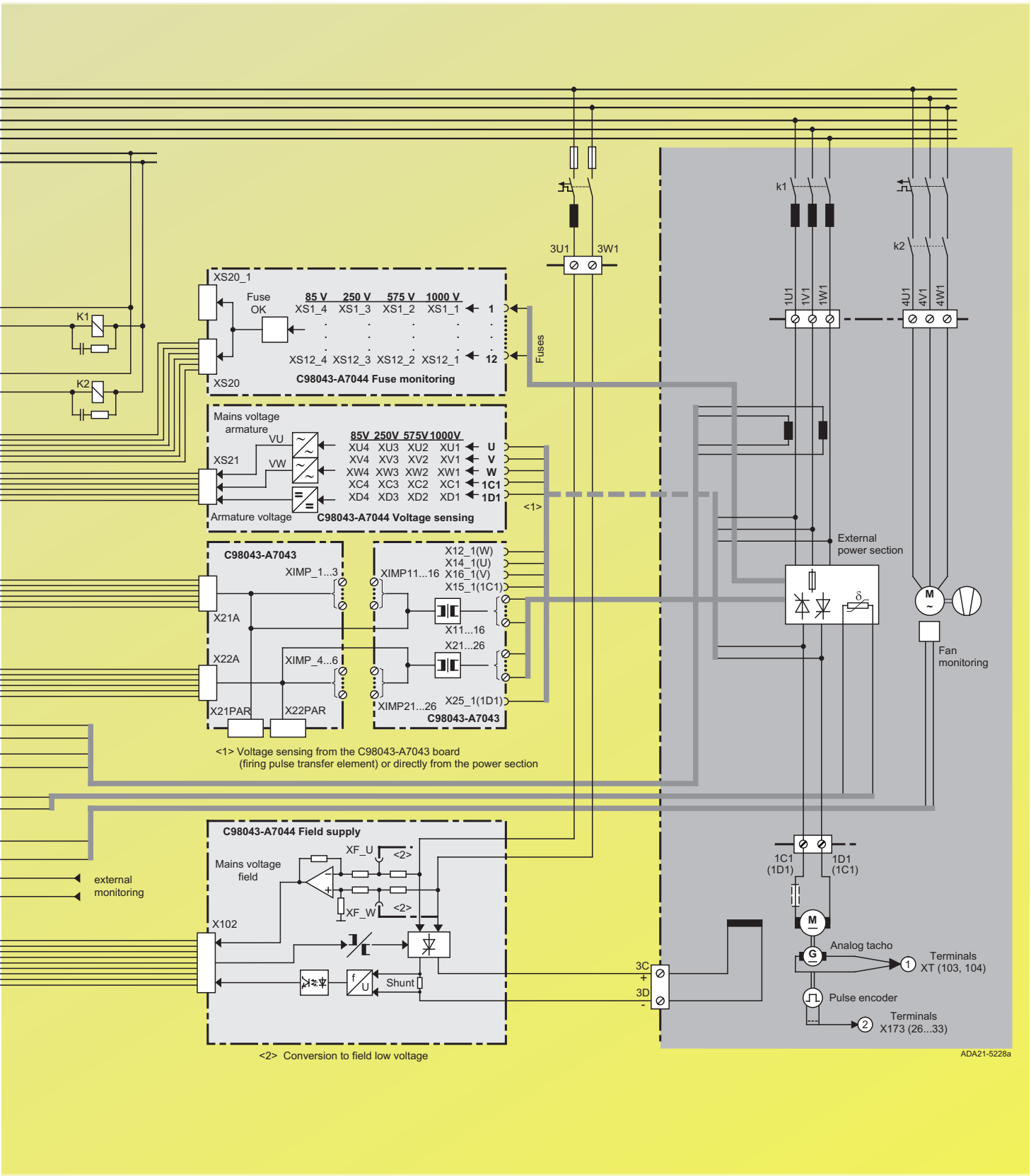
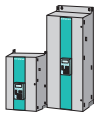


Fig. 6/2


XS20_1
Fuse OK
85 V 250 V 575 V 1000 V
XS1_4 XS1_3 XS1_2 XS1_1
1
XS12_4 XS12_3 XS12_2 XS12_1
12
XS20
C98043-A7044 Fuse monitoring
Fuses
K1
K2
3U1 3W1
k1
k2
1U1 1V1 1W1
4U1 4V1 4W1
Mains voltage armature
VU
VW
XS21
Armature voltage
85V 250V 575V 1000V
XU4 XU3 XU2 XU1 U
XV4 XV3 XV2 XV1 V
XW4 XW3 XW2 XW1 W
XC4 XC3 XC2 XC1 1C1
XD4 XD3 XD2 XD1 1D1
C98043-A7044 Voltage sensing
<1>
External power section
C98043-A7043
XIMP_1...3
X21A
X22A
XIMP_4...6
X21PAR
X22PAR
XIMP11...16
X12_1(W)
X14_1(U)
X16_1(V)
X15_1(1C1)
X11...16
X21...26
X25_1(1D1)
XIMP21...26
C98043-A7043
Fan monitoring
<1> Voltage sensing from the C98043-A7043 board
(firing pulse transfer element) or directly from the power section
C98043-A7044 Field supply
Mains voltage field
XF_U
XF_W
<2>
X102
Shunt
external monitoring
3C
3D
1C1 (1D1)
1D1 (1C1)
Analog tacho
Terminals XT (103, 104)
Pulse encoder
Terminals X173 (26...33)
<2> Conversion to field low voltage
ADA21-5228a

SIMOREG CM



Options

The SIMOREG CM can be subdivided into several modules. These modules can be mounted separately.

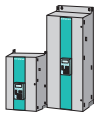
Sets of preassembled cables are available as options for interconnecting the separate modules of the CM unit.

This allows fast, flexible adaptation to system requirements.

Description	Connection	Cable length	Order No.:
Supplementary housing Rear housing part including accessories for the mounting of the firing pulse transfer module and/or fuse monitoring module in a parallel connection	–	–	**6RY1705-0CM00**
Set of unassembled parts Screws, dowel pins and snap-on devices for the external mounting of module parts	–	–	**6RY1707-0CM00**
Preassembled ribbon cable set 2 off 26-core ribbon cable, shielded 2 off 10-core ribbon cable, shielded 1 off 20-core ribbon cable, shielded	From X21A, X22A on FBG -A7042- to X21A, X22A on FBG -A7043- From XS20, XS21 on FBG -A7042- to XS20, XS21 on FBG -A7044- From X102 on FBG -A7042- to X102 on FBG -A7044-	3 m 10 m	**6RY1707-0CM01** **6RY1707-0CM02**
Preassembled cable set for current transformer 2 off 2-core twisted-pair cable	From X3 on FBG -A7042- to the current transformers	2 m 10 m	**6RY1707-0CM03** **6RY1707-0CM04**
Preassembled cable set for heat sink temperature sensing 1 off 2-core shielded cable	From X6 and X7 on FBG -A7042- to temperature sensor on KK	10 m	**6RY1707-0CM05**
Preassembled cable set for firing pulse cables Bridging set for 12 off 2-core twisted-pair cable	From XIMP11 through XIMP16 and XIMP21 through XIMP26 to the thyristors	3 m	**6RY1707-0CM06**
Preassembled cable set for the fuse monitoring system 6 off 2-core twisted-pair cable	From XS1_. through XS12_. (according to the voltage: 85 V, 250 V, 575 V or 1000 V) to the fuses	10 m	**6RY1707-0CM07**
Preassembled cable set for voltage measurement 1 off 3-core twisted-pair cable U-V-W 1 off 2-core twisted-pair cable C-D	From XU., XV., XW. (according to the voltage: 85 V, 250 V, 575 V or 1000 V) to the supply voltage terminals From XC., XD. (according to the voltage: 85 V, 250 V, 575 V or 1000 V) to the armature voltage terminals	3 m	**6RY1707-0CM08**
Preassembled cable set for activation of the firing pulse transfer devices 12 off 2-core twisted-pair cable 2 off 12-core shielded cable	From XIMP1, XIMP4 or XIMP2, XIMP5 or XIMP3, XIMP6 on FBG through A7043- (side panels) on the firing pulse transfer modules (single boards) with Terminals X11 through X16 and X21 through X26 From XIMP1, XIMP4 and/or XIMP2, XIMP5 and/or XIMP3, XIMP6 on FBG -A7043- to external firing pulse transfer devices	1 m 10 m	**6RY1707-0CM13** **6RY1707-0CM10**
Preassembled cable set for cradle in-line mounting 2 off 26-core ribbon cable 2 off 10-core ribbon cable 1 off 20-core ribbon cable	From X21A, X22A on FBG -A7042- to X21A, X22A on FBG -A7043- From XS20, XS21 on FBG -A7042- to XS20, XS21 on FBG -A7044- From X102 on FBG -A7042- to X102 on FBG -A7044-	–	**6RY1707-0CM11**

SIMOREG
6RA70 DC MASTER
SIMOREG CCP

SIMOREG CCP



Overview

Fig. 7/1
SIMOREG CCP

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.

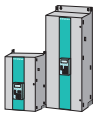
By expanding the basic software of the SIMOREG DC MASTER, an inverter commutation failure is quickly detected and a command is then issued to the SIMOREG CCP to turn-off the power semiconductors in the basic unit. The SIMOREG CCP turns-off the power semiconductors, ensures that the right conditions are available to reduce the current in the motor and absorbs the magnetic energy, stored in the motor, as electrical energy.

Benefits

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



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:

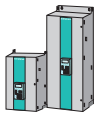
1. The firing pulses in the SIMOREG DC MASTER are blocked immediately
2. The SIMOREG DC MASTER transmits (via serial interface) an "extinguish command" to the SIMOREG CCP
3. The SIMOREG CCP extinguishes the thyristors by connecting precharged extinguishing capacitors antiparallel to all thyristors. Consequently, 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.



Overview SIMOREG DC MASTER – SIMOREG CCP

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:

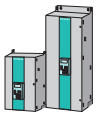
For plant configurations with reduced rated values (e.g. DC Rating, US Rating, voltage de-rating), in some circumstances suitable device combinations can be found that are not listed in the above table.

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)

SIMOREG DC MASTER		**Converter Commutation Protector SIMOREG CCP**				
Type	Rated DC voltage/DC current	**6RA7085-6FC00-0** 460 V / 600 A	**6RA7091-6FC00-0** 460 V / 1200 A	**6RA7095-6FC00-0** 460 V / 2000 A	**6RA7090-6KC00-0** 690 V / 1000 A	**6RA7095-6KC00-0** 690 V / 2000 A
6RA7013-6DV62-0	420 V / 15 A	–	–	–	–	–
6RA7018-6DV62-0	420 V / 30 A	–	–	–	–	–
6RA7025-6DV62-0	420 V / 60 A	–	–	–	–	–
6RA7028-6DV62-0	420 V / 90 A	–	–	–	–	–
6RA7031-6DV62-0	420 V / 125 A	–	–	–	–	–
6RA7075-6DV62-0	420 V / 210 A	–	–	–	–	–
6RA7078-6DV62-0	420 V / 280 A	x	–	–	–	–
6RA7081-6DV62-0	420 V / 400 A	x	–	–	–	–
6RA7085-6DV62-0	420 V / 600 A	x	x	–	–	–
6RA7087-6DV62-0	420 V / 850 A	–	x	–	–	–
6RA7091-6DV62-0	420 V / 1200 A	–	x	x	–	–
6RA7093-4DV62-0	420 V / 1600 A	–	–	x	–	–
6RA7095-4DV62-0	420 V / 2000 A	–	–	x	–	–
6RA7098-4DV62-0	420 V / 3000 A	–	–	–	–	–
6RA7018-6FV62-0	480 V / 30 A	–	–	–	–	–
6RA7025-6FV62-0	480 V / 60 A	–	–	–	–	–
6RA7028-6FV62-0	480 V / 90 A	–	–	–	–	–
6RA7031-6FV62-0	480 V / 125 A	–	–	–	–	–
6RA7075-6FV62-0	480 V / 210 A	–	–	–	–	–
6RA7078-6FV62-0	480 V / 280 A	x	–	–	–	–
6RA7082-6FV62-0	480 V / 450 A	x	–	–	–	–
6RA7085-6FV62-0	480 V / 600 A	x	x	–	–	–
6RA7087-6FV62-0	480 V / 850 A	–	x	–	–	–
6RA7091-6FV62-0	480 V / 1200 A	–	x	–	–	–
6RA7025-6GV62-0	600 V / 60 A	–	–	–	–	–
6RA7031-6GV62-0	600 V / 125 A	–	–	–	–	–
6RA7075-6GV62-0	600 V / 210 A	–	–	–	–	–
6RA7081-6GV62-0	600 V / 400 A	–	–	–	x	–
6RA7085-6GV62-0	600 V / 600 A	–	–	–	x	–
6RA7087-6GV62-0	600 V / 850 A	–	–	–	x	–
6RA7090-6GV62-0	600 V / 1100 A	–	–	–	–	x
6RA7093-4GV62-0	600 V / 1600 A	–	–	–	–	x
6RA7095-4GV62-0	600 V / 2000 A	–	–	–	–	x
6RA7096-4GV62-0	600 V / 2200 A	–	–	–	–	–
6RA7097-4GV62-0	600 V / 2800 A	–	–	–	–	–
6RA7086-6KV62-0	725 V / 760 A	–	–	–	x	–
6RA7090-6KV62-0	725 V / 1000 A	–	–	–	x	x
6RA7093-4KV62-0	725 V / 1500 A	–	–	–	–	x
6RA7095-4KV62-0	725 V / 2000 A	–	–	–	–	x
6RA7097-4KV62-0	725 V / 2600 A	–	–	–	–	–
6RA7088-6LV62-0	875 V / 950 A	–	–	–	–	–
6RA7093-4LV62-0	875 V / 1500 A	–	–	–	–	–
6RA7095-4LV62-0	875 V / 1900 A	–	–	–	–	–
6RA7096-4MV62-0	1000 V / 2200 A	–	–	–	–	–

x = suitable
– = Not suitable (see note)



Technical data

Type		6RA70□□-6FC00-0			6RA70□□-6KC00-0	
		85	91	95	90	95
Rated voltage	**V**	460 (+15 % / –20 %)			690 (+10% / –20%)	
Rated current	**A**	600	1200	2000	1000	2000
Live area that can be covered [1])	**A**	up to 600	up to 1200	up to 2000	up to 1000	up to 2000
Rated supply voltage electronics power supply	**V**	2 AC 380 (–20 %) to 460 (+15 %); I_n = 1 A or 1 AC 190 (–20 %) to 230 (+15 %); I_n = 2 A				
Rated frequency	**Hz**	45 to 65				
Power loss	**W**	100	100	100	100	100
Operational ambient temperature	**°C**	0 to 55				
Storage and transport temperature	**°C**	–25 to +70				
Installation altitude above sea level	**m**	≤ 1000				
Environmental class		3K3 accord. to DIN IEC 60 721-3-3				
Degree of pollution		2 accord. to EN 60178 [2])				
Degree of protection		IP00 accord. to DIN EN 60529				
See dimension drawings on Page		9/17				
Weight (approx.)	**kg**	35	35	35	35	35
Fuses for connections 1U1, 1V1, 1W1 and 1C1, 1D1		3NA3 365-6 1 fuse per conn.	3NA3 365-6 1 fuse per conn.	3NA3 365-6 2 fuse in parall. per conn.	3NA3 365-6 1 fuse per conn.	3NA3 365-6 2 fuse in parall. per conn.
Fuses for connections 2U1, 2V1, 2W1 (10 A line protection)	**A**	Diazed 5SD604				

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".

7

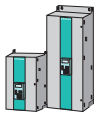
Standards

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		Protection against electric shock
	Part 1 A08.03	Classification of electrical and electronic equipment
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) The current range that can be covered corresponds to the actual rated current of the 6RA70 SIMOREG DC MASTER (display parameter r072.02).
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.

Overview diagram



SIMOREG CCP

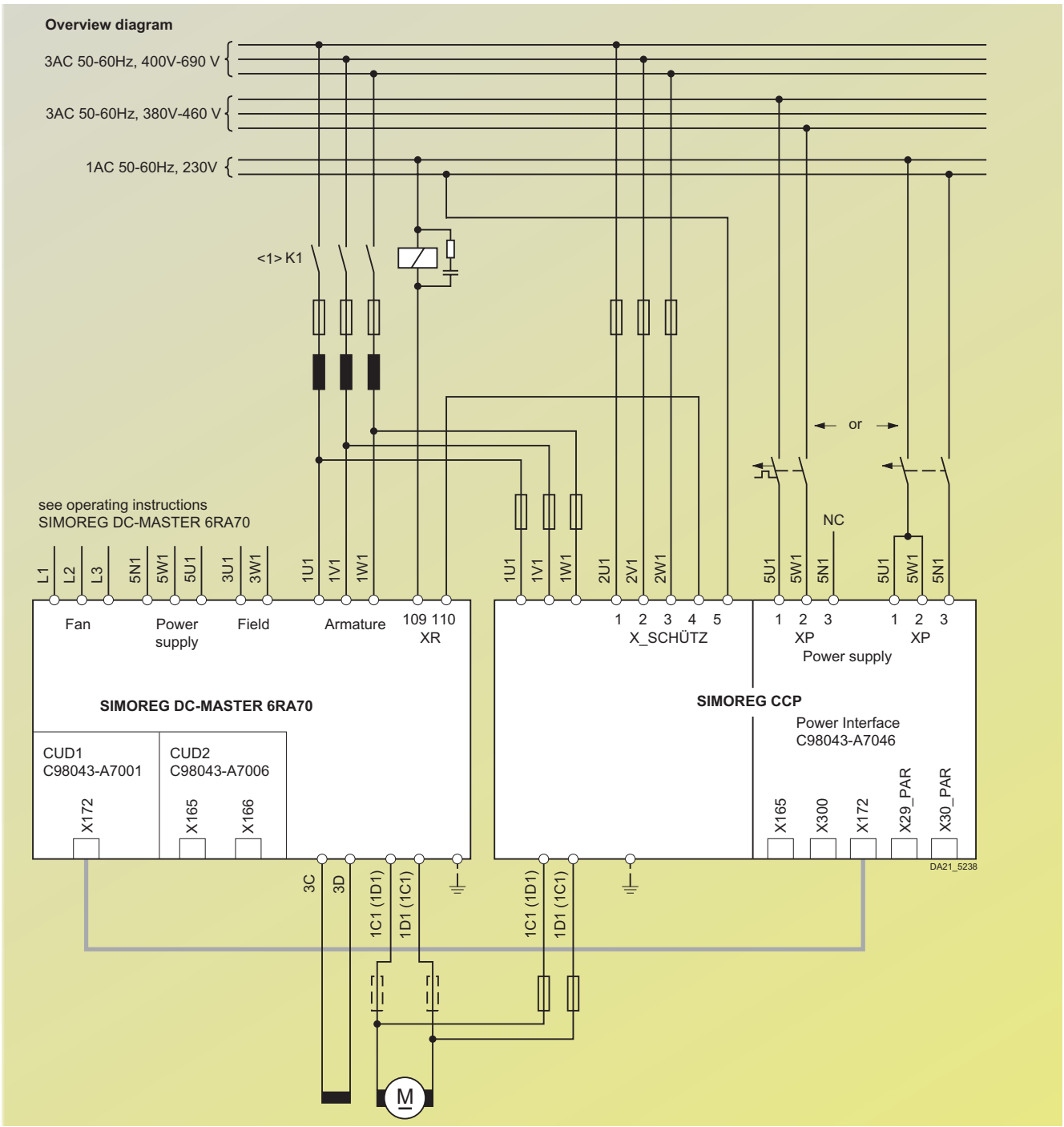


Fig. 7/2

<1> CAUTION!

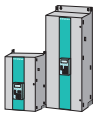
Operation without main contactor is not permitted. The control voltage for the main contactor (or the circuit-breaker) must always be led via the XR terminal (connections 109 and 110) of the SIMOREG device **and** the X_SCHÜTZ terminal (connections 4 and 5) of the SIMOREG CCP

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).



Overview diagram of device connected in parallel

SIMOREG CCP

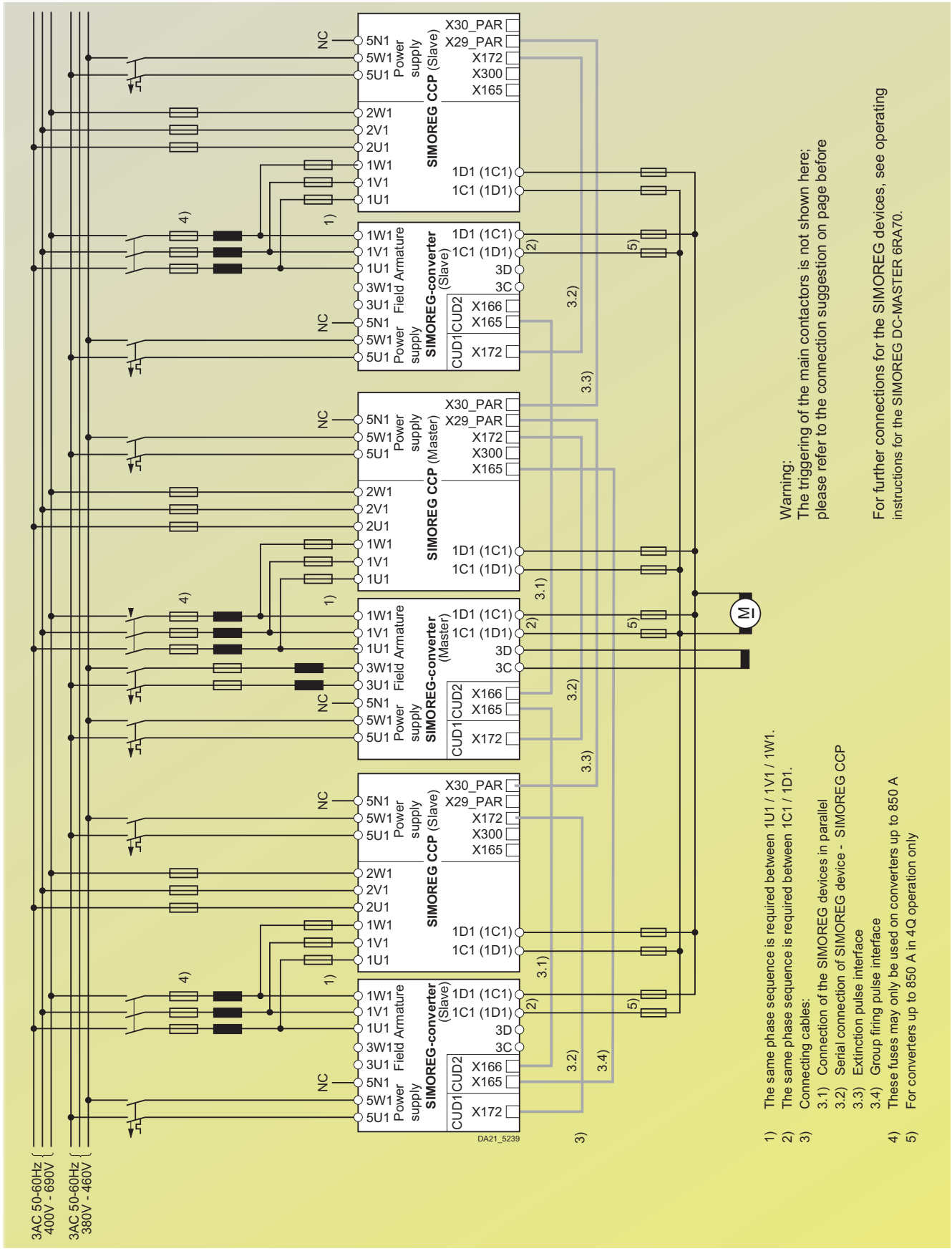
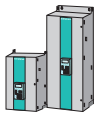


Fig. 7/3

SIMOREG CCP



Options

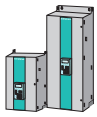
Description	Order No.:
Operating instructions in printed form for Converter Commutation Protector SIMOREG CCP in German / English French / Italian / Spanish	 **6RX1700-0DD74** **6RX1700-0DD83**
Operating instructions for SIMOREG DC Master 6RA70 and SIMOREG CCP and Drive Monitor in German / English / French / Italian / Spanish on CD-ROM	**6RX1700-0AD64**
UTP CAT5 patch cable 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 and connecting cable for the group firing-pulse interface to the SIMOREG (CUD2)	**6RY1707-0AA08**

SIMOREG 6RA70 DC MASTER

Selection and Ordering Data

Selection and Ordering Data

Chassis converters for single-quadrant operation



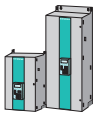
Rated data Armature circuit				Field circuit		Converter	Fuses Armature circuit		Excitation circuit
Rated supply voltage [1]	Rated DC voltage	Rated DC current	Rated output	Rated supply voltage [1]	Rated DC current		Phase [3]	DC current [3]	
V	V	A	kW	V	A	Order No.:	Order No.:	Order No.:	Each unit Order No.:
3-ph. AC 400	485	**30**	14.5	2-ph. AC 400	5	**6RA7018-6DS22-0**	3NE8003-1	–	5SD420
		60	29		10	**6RA7025-6DS22-0**	3NE1817-0	–	5SD420
		90	44		10	**6RA7028-6DS22-0**	3NE1820-0	–	5SD420
		125	61		10	**6RA7031-6DS22-0**	3NE1021-0	–	5SD420
		210	102	2-ph. AC 400	15	**6RA7075-6DS22-0**	3NE3227	–	5SD440
		280	136		15	**6RA7078-6DS22-0**	3NE3231	–	5SD440
		400	194		25	**6RA7081-6DS22-0**	3NE3233	–	5SD440
		600	291		25	**6RA7085-6DS22-0**	3NE3336	–	5SD440
		850	412	2-ph. AC 400	30	**6RA7087-6DS22-0**	3NE3338-8	–	5SD480
		1200	582		30	**6RA7091-6DS22-0**	[2]	–	5SD480
		1600	776		40	**6RA7093-4DS22-0**	[2]	–	3NE1802-0 [3]
		2000	970		40	**6RA7095-4DS22-0**	[2]	–	3NE1802-0 [3]
		3000	1455		85	**6RA7098-4DS22-0**	[2]	–	3NE8021-1 [3]
3-ph. AC 460	550	**30**	16.5	2-ph. AC 460	5	**6RA7018-6FS22-0**	3NE1815-0	–	5SD420
		60	33		10	**6RA7025-6FS22-0**	3NE1817-0	–	5SD420
		90	49.5		10	**6RA7028-6FS22-0**	3NE1820-0	–	5SD420
		125	68.7	2-ph. AC 460	10	**6RA7031-6FS22-0**	3NE1021-0	–	5SD420
		210	115		15	**6RA7075-6FS22-0**	3NE3227	–	5SD440
		280	154		15	**6RA7078-6FS22-0**	3NE3231	–	5SD440
		450	247	2-ph. AC 460	25	**6RA7082-6FS22-0**	3NE3233	–	5SD440
		600	330		25	**6RA7085-6FS22-0**	3NE3336	–	5SD440
		850	467		30	**6RA7087-6FS22-0**	3NE3338-8	–	5SD480
		1200	660		30	**6RA7091-6FS22-0**	[2]	–	5SD480
3-ph. AC 575	690	**60**	41	2-ph. AC 460	10	**6RA7025-6GS22-0**	3NE1817-0	–	5SD420
		125	86		10	**6RA7031-6GS22-0**	3NE1021-0	–	5SD420
		210	145		15	**6RA7075-6GS22-0**	3NE3227	–	5SD440
		400	276	2-ph. AC 460	25	**6RA7081-6GS22-0**	3NE3233	–	5SD440
		600	414		25	**6RA7085-6GS22-0**	3NE3336	–	5SD440
		800	552		30	**6RA7087-6GS22-0**	3NE3338-8	–	5SD480
		1000	690	2-ph. AC 460	30	**6RA7090-6GS22-0**	[2]	–	5SD480
		1600	1104		40	**6RA7093-4GS22-0**	[2]	–	3NE1802-0 [3]
		2000	1380		40	**6RA7095-4GS22-0**	[2]	–	3NE1802-0 [3]
		2200	1518		85	**6RA7096-4GS22-0**	[2]	–	3NE8021-1 [3]
		2800	1932		85	**6RA7097-4GS22-0**	[2]	–	3NE8021-1 [3]
3-ph. AC 690	830	**720**	598	2-ph. AC 460	30	**6RA7086-6KS22-0**	3NE3337-8	–	5SD480
		950	789		30	**6RA7088-6KS22-0**	[2]	–	5SD480
		1500	1245	2-ph. AC 460	40	**6RA7093-4KS22-0**	[2]	–	3NE1802-0 [3]
		2000	1660		40	**6RA7095-4KS22-0**	[2]	–	3NE1802-0 [3]
		2600	2158		85	**6RA7097-4KS22-0**	[2]	–	3NE 8021-1 [3]
3-ph. AC 830	1000	**900**	900	2-ph. AC 460	30	**6RA7088-6LS22-0**	[2]	–	5SD480
		1500	1500		40	**6RA7093-4LS22-0**	[2]	–	3NE1802-0 [3]
		1900	1900		40	**6RA7095-4LS22-0**	[2]	–	3NE1802-0 [3]
3-ph. AC 950	1140	**2200**	2508	2-ph. AC 460	85	**6RA7096-4MS22-0**	[2]	–	3NE8021-1 [3]

8

1) 50/60 Hz

2) Integrated branch fuses, no external semiconductor protection devices are necessary

3) UL recognized



Chassis converters for four-quadrant operation

Rated data Armature circuit				Field circuit		Converter	Fuses Armature circuit		Excitation circuit
Rated supply voltage [1]	Rated DC voltage	Rated DC current	Rated output	Rated supply voltage [1]	Rated DC current		Phase [4]	DC current [4]	
V	V	A	kW	V	A	Order No.:	Order No.:	Order No.:	Each unit Order No.:
3-ph. AC 400	420	**15**	6.3	2-ph. AC 400	3	**6RA7013-6DV62-0**	3NE1814-0	3NE1814-0	5SD420
		30	12.6		5	**6RA7018-6DV62-0**	3NE8003-1	3NE4102	5SD420
		60	25		10	**6RA7025-6DV62-0**	3NE1817-0	3NE4120	5SD420
		90	38		10	**6RA7028-6DV62-0**	3NE1820-0	3NE4122	5SD420
		125	52.5	2-ph. AC 400	10	**6RA7031-6DV62-0**	3NE1021-0	3NE4124	5SD420
		210	88		15	**6RA7075-6DV62-0**	3NE3227	3NE3227	5SD440
		280	118		15	**6RA7078-6DV62-0**	3NE3231	3NE3231	5SD440
		400	168		25	**6RA7081-6DV62-0**	3NE3233	3NE3233	5SD440
		600	252	2-ph. AC 400	25	**6RA7085-6DV62-0**	3NE3336	3NE3336	5SD440
		850	357		30	**6RA7087-6DV62-0**	3NE3338-8	3NE3334-0B [3]	5SD480
		1200	504		30	**6RA7091-6DV62-0**	[2]	[2]	5SD480
		1600	672		40	**6RA7093-4DV62-0**	[2]	[2]	3NE1802-0 [4]
		2000	840		40	**6RA7095-4DV62-0**	[2]	[2]	3NE1802-0 [4]
		3000	1260		85	**6RA7098-4DV62-0**	[2]	[2]	3NE8021-1 [4]
3-ph. AC 460	480	**30**	14.4	2-ph. AC 460	5	**6RA7018-6FV62-0**	3NE1815-0	3NE4102	5SD420
		60	28.8		10	**6RA7025-6FV62-0**	3NE1817-0	3NE4120	5SD420
		90	43		10	**6RA7028-6FV62-0**	3NE1820-0	3NE4122	5SD420
		125	60	2-ph. AC 460	10	**6RA7031-6FV62-0**	3NE1021-0	3NE4124	5SD420
		210	100		15	**6RA7075-6FV62-0**	3NE3227	3NE3227	5SD440
		280	134		15	**6RA7078-6FV62-0**	3NE3231	3NE3231	5SD440
		450	216	2-ph. AC 460	25	**6RA7082-6FV62-0**	3NE3233	3NE3334-0B	5SD440
		600	288		25	**6RA7085-6FV62-0**	3NE3336	3NE3336	5SD440
		850	408		30	**6RA7087-6FV62-0**	3NE3338-8	3NE3334-0B [3]	5SD480
		1200	576		30	**6RA7091-6FV62-0**	[2]	[2]	5SD480
3-ph. AC 575	600	**60**	36	2-ph. AC 460	10	**6RA7025-6GV62-0**	3NE1817-0	3NE4120	5SD420
		125	75		10	**6RA7031-6GV62-0**	3NE1021-0	3NE4124	5SD420
		210	126		15	**6RA7075-6GV62-0**	3NE3227	3NE3227	5SD440
		400	240	2-ph. AC 460	25	**6RA7081-6GV62-0**	3NE3233	3NE3233	5SD440
		600	360		25	**6RA7085-6GV62-0**	3NE3336	3NE3336	5SD440
		850	510		30	**6RA7087-6GV62-0**	3NE3338-8	3NE3334-0B [3]	5SD480
		1100	660	2-ph. AC 460	30	**6RA7090-6GV62-0**	[2]	[2]	5SD480
		1600	960		40	**6RA7093-4GV62-0**	[2]	[2]	3NE1802-0 [4]
		2000	1200		40	**6RA7095-4GV62-0**	[2]	[2]	3NE1802-0 [4]
		2200	1320		85	**6RA7096-4GV62-0**	[2]	[2]	3NE8021-1 [4]
		2800	1680		85	**6RA7097-4GV62-0**	[2]	[2]	3NE8021-1 [4]
3-ph. AC 690	725	**760**	551	2-ph. AC 460	30	**6RA7086-6KV62-0**	3NE3337-8	3NE3334-0B [3]	5SD480
		1000	725		30	**6RA7090-6KV62-0**	[2]	[2]	5SD480
		1500	1088		40	**6RA7093-4KV62-0**	[2]	[2]	3NE1802-0 [4]
		2000	1450		40	**6RA7095-4KV62-0**	[2]	[2]	3NE1802-0 [4]
		2600	1885		85	**6RA7097-4KV62-0**	[2]	[2]	3NE8021-1 [4]
3-ph. AC 830	875	**950**	831	2-ph. AC 460	30	**6RA7088-6LV62-0**	[2]	[2]	5SD480
		1500	1313		40	**6RA7093-4LV62-0**	[2]	[2]	3NE1802-0 [4]
		1900	1663		40	**6RA7095-4LV62-0**	[2]	[2]	3NE1802-0 [4]
3-ph. AC 950	1000	**2200**	2200	2-ph. AC 460	85	**6RA7096-4MV62-0**	[2]	[2]	3NE8021-1 [4]

SIMOREG CM Control Module 6RA70

Rated data Armature circuit				Field circuit		SIMOREG CM	Fuses Excitation circuit
Rated supply voltage [1]	Rated DC voltage	Rated DC current	Rated output	Rated supply voltage [1]	Rated DC current		
V	V	A	kW	V	A	Order No.:	Each unit Order No.:
3AC 85/250/ 575/1000	–	–	–	2-ph. AC 460	40	**6RA7000-0MV62-0**	3NE1802-0 [4]

1) 50/60 Hz

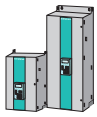
2) Integrated branch fuses, no external semiconductor protection devices are necessary

3) Parallel connection

4) UL recognized

Selection and Ordering Data

Electronics options



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.

6RA70□□-□□□□□-0-Z
□□□+□□□+...

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

Board	Description	Short code	Order No.:
	Technology software in the basic unit ("freely-definable function blocks")	**S00**	**6RX1700-0AS00**
CUD2	Terminal expansion board for basic unit	**K00**	**6RX1700-0AK00**
	Parallel connection cable		**6RY1707-0AA08**
–	Option extra-low voltage for 400 V / 460 V / 575 V units Unit is retrofitted for operation with 15 to 85 V	**L04**	**–**

Options for which an LBA or LBA + ADB are necessary

Board	Description		Short code	Short code Installed in slot D	E	F	G	Order No.:
LBA	Local Bus Adapter for the electronics box Prerequisite for installing optional supplementary boards		**K11**	–	–	–	–	**6SE7090-0XX84-4HA0**
ADB	Adapter board [1] Prerequisite for installing SBP, EB1, EB2, SLB, CBP2, CBC and CBD	Location 2 Location 3	– –	**K01** –	**K01** –	– **K02**	– **K02**	**6SE7090-0XX84-0KA0**
SBP	Pulse encoder evaluation board [1] [2] [3] (small-format board; ADB is necessary)		–	**C14**	**C15**	**C16**	**C17**	**6SX7010-0FA00**
EB1	Terminal expansion board [1] [3] (small-format board; ADB is necessary)		–	**G64**	**G65**	**G66**	**G67**	**6SX7010-0KB00**
EB2	Terminal expansion board [1] [3] (small-format board; ADB is necessary)		–	**G74**	**G75**	**G76**	**G77**	**6SX7010-0KC00**
SLB	SIMOLINK board [1] [3] (small-format board; ADB is necessary)		–	**G44**	**G45**	**G46**	**G47**	**6SX7010-0FJ00**
CBP2	Communication board with interface for SINEC L2 DP, (PROFIBUS-DP) [1] [3] (small-format board; ADB is necessary)		–	**G94**	**G95**	**G96**	**G97**	**6SX7010-0FF05**
CBC	Communication board with interface for CAN protocol [1] [3] (small-format board; ADB is necessary)		–	**G24**	**G25**	**G26**	**G27**	**6SX7010-0FG00**
CBD	Communication board with interface for DeviceNet protocol [1] [3] (small-format board; ADB is necessary)		–	**G54**	**G55**	**G56**	**G57**	**6SX7010-0FK00**
SCB1	Interface board with fiber-optic cable connection Supplied incl. 10 m fiber-optic cable		–	–	–	–	–	**6SE7090-0XX84-0BC0**
T100	Technology board incl. hardware manual without software module [3]		–	–	–	–	–	**6SE7090-0XX87-0BB0**
	Hardware manual for T100		–	–	–	–	–	**6SE7080-0CX87-0BB0**
MS100	Software module "Universal drive" for T100 (EPROM) without manual		–	–	–	–	–	**6SE7098-0XX84-0BB0**
	Manual for software module MS100 "Universal drive"							
	• German		–	–	–	–	–	**6SE7080-0CX84-0BB1**
	• English		–	–	–	–	–	**6SE7087-6CX84-0BB1**
	• French		–	–	–	–	–	**6SE7087-7CX84-0BB1**
	• Spanish		–	–	–	–	–	**6SE7087-8CX84-0BB1**
	• Italian		–	–	–	–	–	**6SE7087-2CX84-0BB1**
T300	Technology board with 2 connecting cables SC58 and SC60, terminal strip SE300 and hardware manual [3]		–	–	–	–	–	**6SE7090-0XX87-4AH0**
T400	Technology board (incl. Brief Description) [3]		–	–	–	–	–	**6DD1606-0AD0**
	User's Guide for T400 hardware and configuration		–	–	–	–	–	**6DD1903-0EA0**

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:

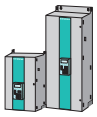
Board	Spare part (no accessories) Order No.:
SBP	6SE7090-0XX84-0FA0
EB1	6SE7090-0XX84-0KB0
EB2	6SE7090-0XX84-0KC0
SLB	6SE7090-0XX84-0FJ0
CBP2	6SE7090-0XX84-0FF5
CBC	6SE7090-0XX84-0FG0
CBD	6SE7090-0XX84-0FK0

The retrofit kit is required for installation in the SIMOREG unit to ensure that the connectors required for system installation and the Brief Description are obtained.

For installation of the boards in the SIMOREG unit, the Local Bus Adapter LBA and the Adapter Board ADB are also required. These must be ordered separately.

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.

Board	Description	Order No.:
SCI1	Interface board binary and analog inputs/outputs supplied with 10 m fiber-optic cable	**6SE7090-0XX84-3EA0**
SCI2	Interface board binary inputs/outputs supplied with 10 m fiber-optic cable	**6SE7090-0XX84-3EF0**

Options for the SIMOREG CM unit

Description	Length	Order No.:
Supplementary housing Rear housing part including accessories for the mounting of the firing pulse transfer module and/or fuse monitoring module in a parallel connection	–	**6RY1705-0CM00**
Set of unassembled parts Screws, dowel pins and snap-on devices for the external mounting of module parts	–	**6RY1707-0CM00**
Preassembled ribbon cable set 2 off 26-core ribbon cable, shielded 2 off 10-core ribbon cable, shielded 1 off 20-core ribbon cable, shielded	3 m 10 m	**6RY1707-0CM01** **6RY1707-0CM02**
Preassembled cable set for current transformer 2 off 2-core twisted-pair cable	2 m 10 m	**6RY1707-0CM03** **6RY1707-0CM04**
Preassembled cable set for heat-sink temperature sensing 1 off 2-core shielded cable	10 m	**6RY1707-0CM05**
Preassembled cable set for firing pulse leads Bridging kit for 12 off 2-core twisted-pair cable	3 m	**6RY1707-0CM06**
Preassembled cable set for fuse monitoring 6 off 2-core twisted-pair cable	10 m	**6RY1707-0CM07**
Preassembled cable set for voltage sensing 1 off 3-core twisted-pair cable U-V-W 1 off 2-core twisted-pair cable	3 m	**6RY1707-0CM08**
Preassembled cable set for actiavtion of the firing pulse transfer elements 12 off 2-core twisted-pair cable 2 off 12-core shielded cable	1 m 10 m	**6RY1707-0CM13** **6RY1707-0CM10**
Preassembled cable set for cradle mounting side by side 2 off 26-core ribbon cable 2 off 10-core ribbon cable 1 off 20-core ribbon cable		**6RY1707-0CM11**

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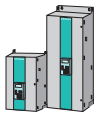
Rated voltage	Rated current	Live area that can be covered *)	SIMOREG CCP	Order No.
460 V	600 A	up to 600 A	600 A/460 V	**6RA7085-6FC00-0**
460 V	1200 A	up to 1200 A	1200 A/460 V	**6RA7091-6FC00-0**
460 V	2000 A	up to 2000 A	2000 A/460 V	**6RA7095-6FC00-0**
690 V	1000 A	up to 1000 A	1000 A/690 V	**6RA7090-6KC00-0**
690 V	2000 A	up to 2000 A	2000 A/690 V	**6RA7095-6KC00-0**

*) see “Technical Data”

Options for the SIMOREG CCP Converter Commutation Protector

Description	Short code	Order No.:
UTP CAT5 patch cable in accordance with ANSI/EIA/TIA 568 Parallel switch cable for SIMOREG 6RA70 and SIMOREG CP approx. 5m 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)		**6RX1707-0AA08**

Miscellaneous options



Operating and monitoring

Description	Length	Order No.:
Connecting cable DriveMonitor PC – PMU (RS232)	3 m	**6SX7005-0AB00**
Interface converter SU1 RS232 - RS485, including mounting accessories, connection to power supply: 1 CA 115 V / 230 V	–	**6SX7005-0AA00**
OP1S operator panel	–	**6SE7090-0XX84-2FK0**
Adapter AOP1 for cabinet door mounting of OP1S Including 5 m connecting cable	–	**6SX7010-0AA00**
Connecting cable PMU – OP1S	3 m 5 m	**6SX7010-0AB03** **6SX7010-0AB05**

SIMOREG 6RL70 rectifier module

Rated data armature circuit				Order No.:	Fuses armature circuit
Rated supply voltage [1])	Rated DC voltage	Rated DC current	Rated power		Phase [3])
V	V	A	kW		Order No.:
3-ph. AC 690	930	**1000**	930	**6RL7091-6KS00-0**	[2])
3-ph. AC 690	930	**2000**	1860	**6RL7095-4KS00-0**	[2])

Documentation

Description	Short code	Order No.:
SIMOREG DC MASTER operating instructions The units are supplied with a Brief Description, Operating Instructions must be ordered.		
• German	**D00**	**6RX1700-0AD00**
• Italian	**D72**	**6RX1700-0AD72**
• English	**D76**	**6RX1700-0AD76**
• French	**D77**	**6RX1700-0AD77**
• Spanish	**D78**	**6RX1700-0AD78**
Operating Instructions and DriveMonitor in all the languages listed above on CD-ROM	**D64**	**6RX1700-0AD64**
Unit without description	**D99**	**–**
SIMOREG CM operating instructions The units are supplied with German Operating Instructions as standard, other language versions must be ordered with short code.		
• German	**–**	**6RX1700-0BD00**
• Italian	**D72**	**6RX1700-0BD72**
• English	**D76**	**6RX1700-0BD76**
• French	**D77**	**6RX1700-0BD77**
• Spanish	**D78**	**6RX1700-0BD78**
Operating Instructions and DriveMonitor in all the languages listed above on CD-ROM	**D64**	**6RX1700-0AD64**
SIMOREG 6RL70 operating instructions The units are supplied with Operating Instructions in five languages. English, German, French, Italian and Spanish	**–**	**6RX1700-0CD64**
Commutation Protector SIMOREG CCP Operating instructions in printed form in.		
• German / English	**D74**	**6RX1700-0DD74**
• French / Italian / Spanish	**D83**	**6RX1700-0DD83**
Operating Instructions and DriveMonitor in all the languages listed above on CD-ROM	**D64**	**6RX1700-0AD64**

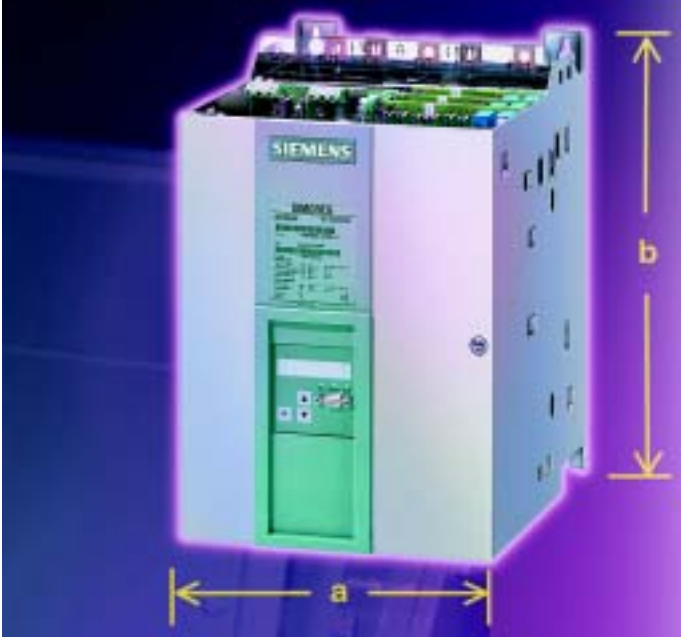
8

1) 50/60 Hz

2) Integrated branch fuses,
no external semiconductor protection devices are necessary

3) UL recognized

SIMOREG
6RA70 DC MASTER
Dimension Drawings



Dimension Drawings

Converters for single-quadrant operation

3-ph. AC 400 V and 460 V, 30 A

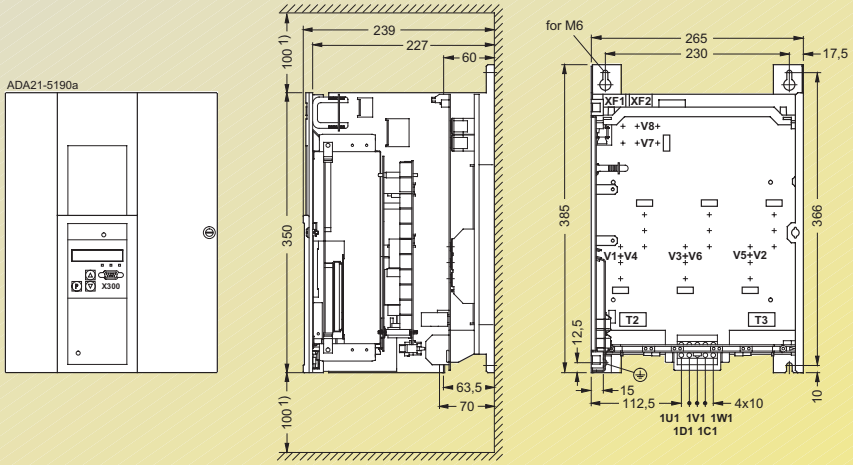


Fig. 9/1

3-ph. AC 400 V and 575 V, 60 A to 280 A

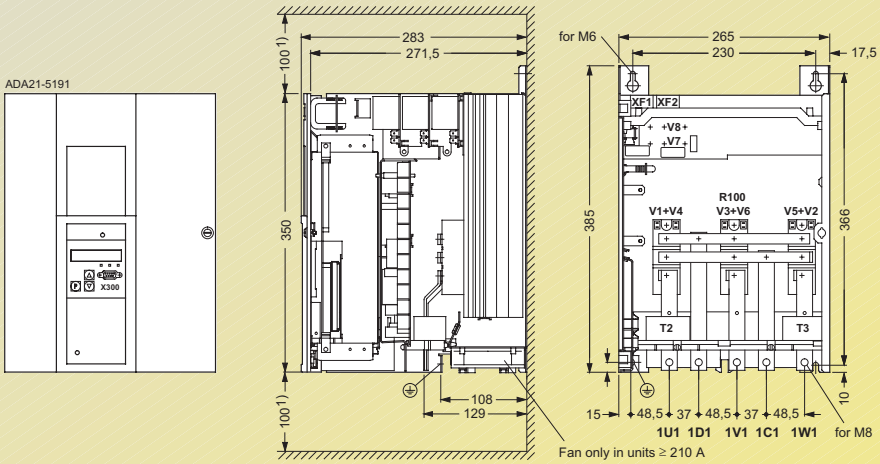
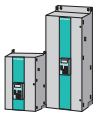


Fig. 9/2

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

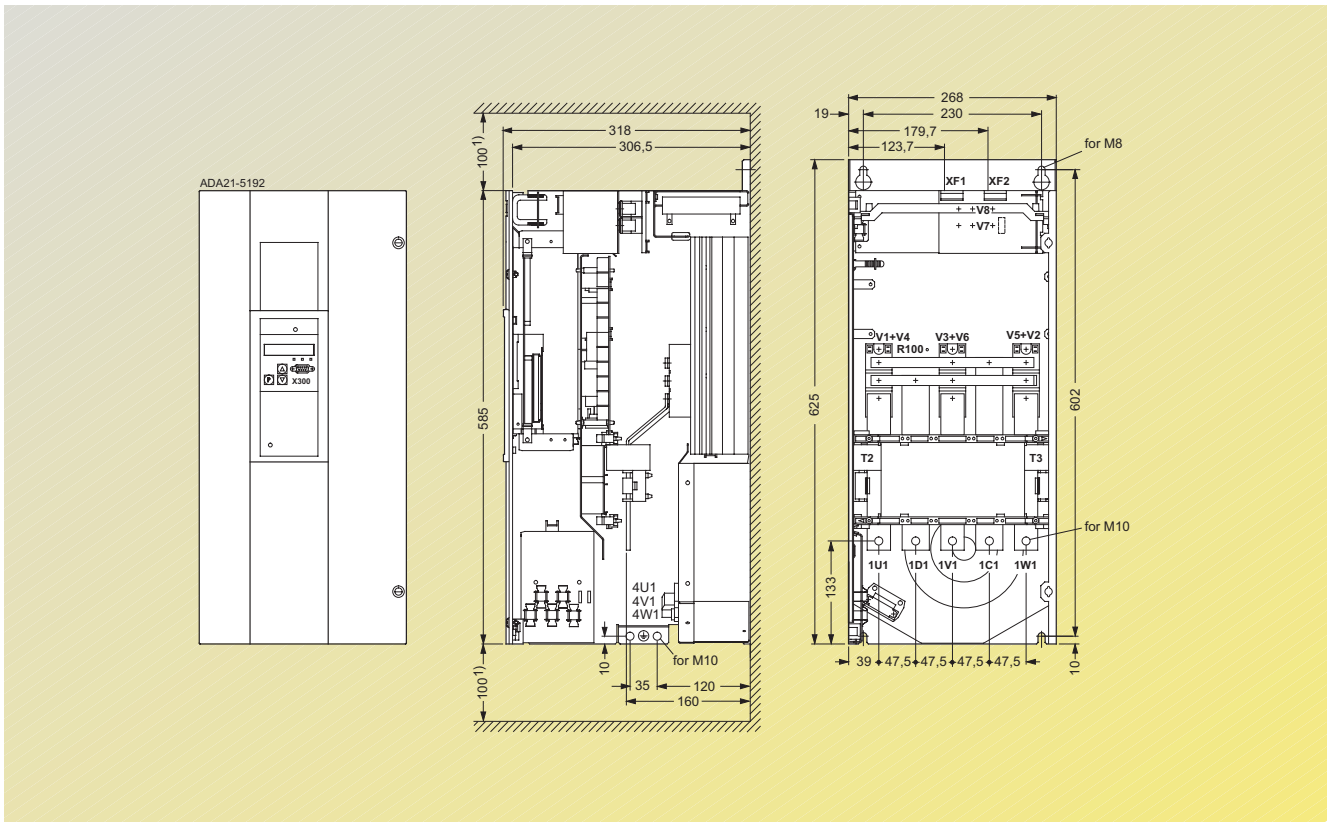


Fig. 9/3

3-ph. AC 400 V and 575 V, 600 A

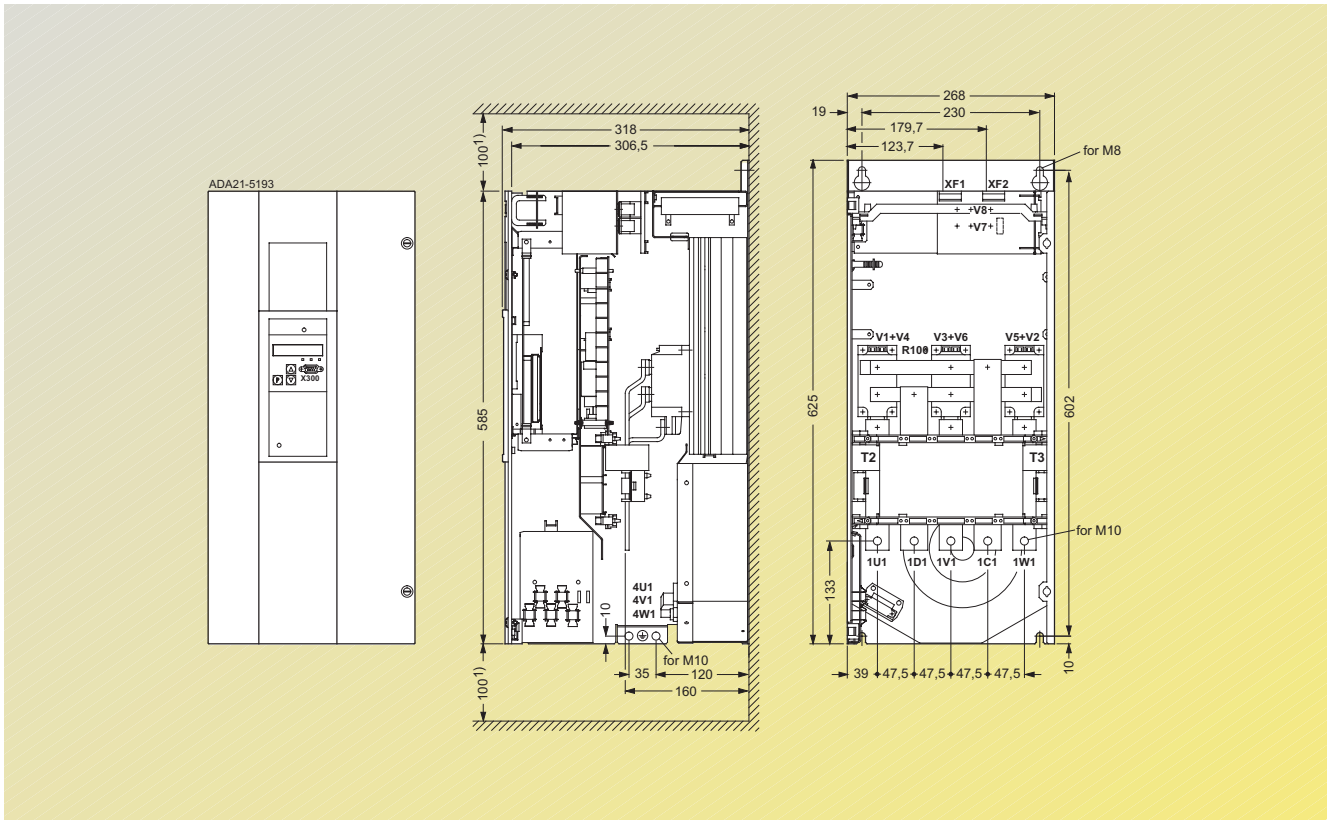


Fig. 9/4

1) Minimum free space for air circulation; it is necessary to ensure that the cooling air intake is sufficient.

Dimension Drawings

Converters for single-quadrant operation

3-ph. AC 400 V, 575 V and 690 V, 720 A to 850 A

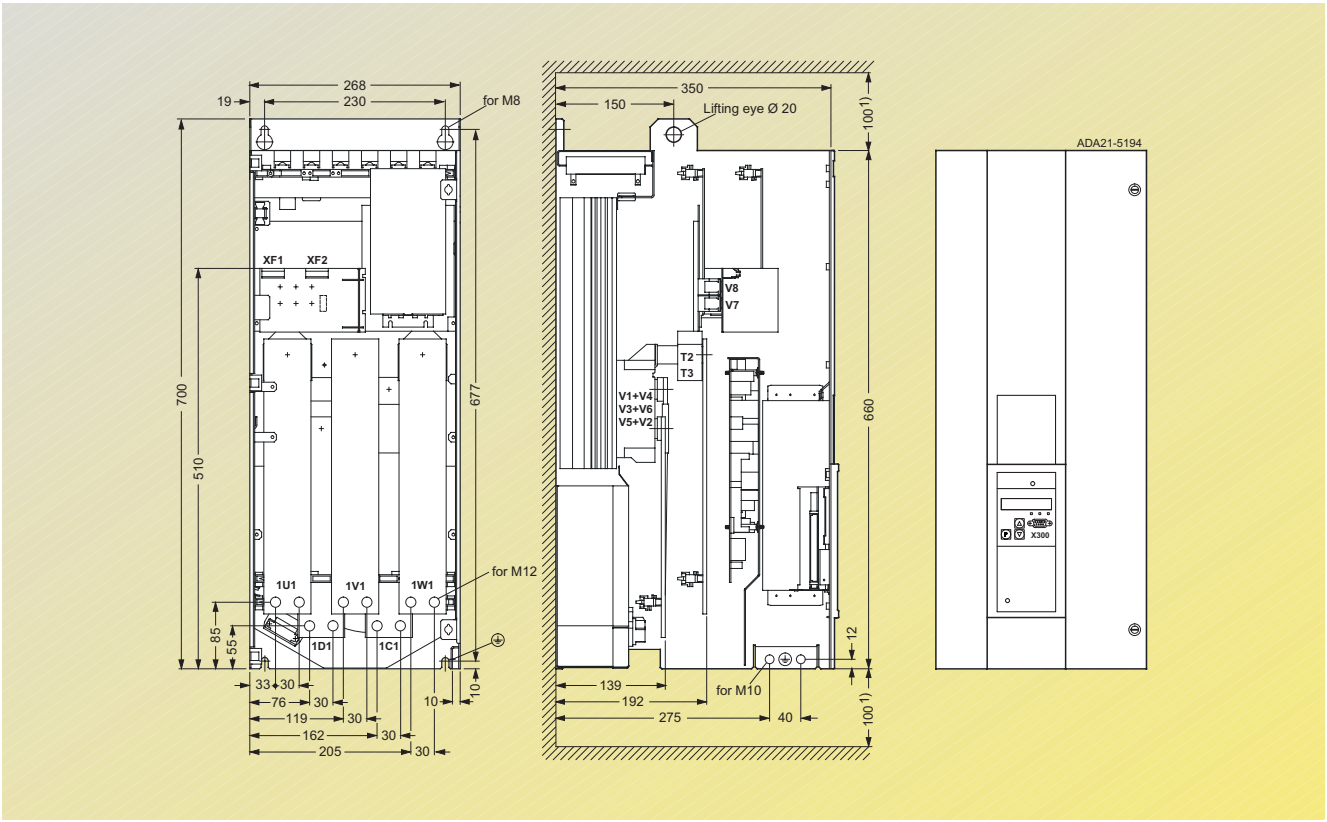


Fig. 9/5

3-ph. AC 400 V, 460 V, 575 V, 690 V and 830 V, 900 A to 1200 A

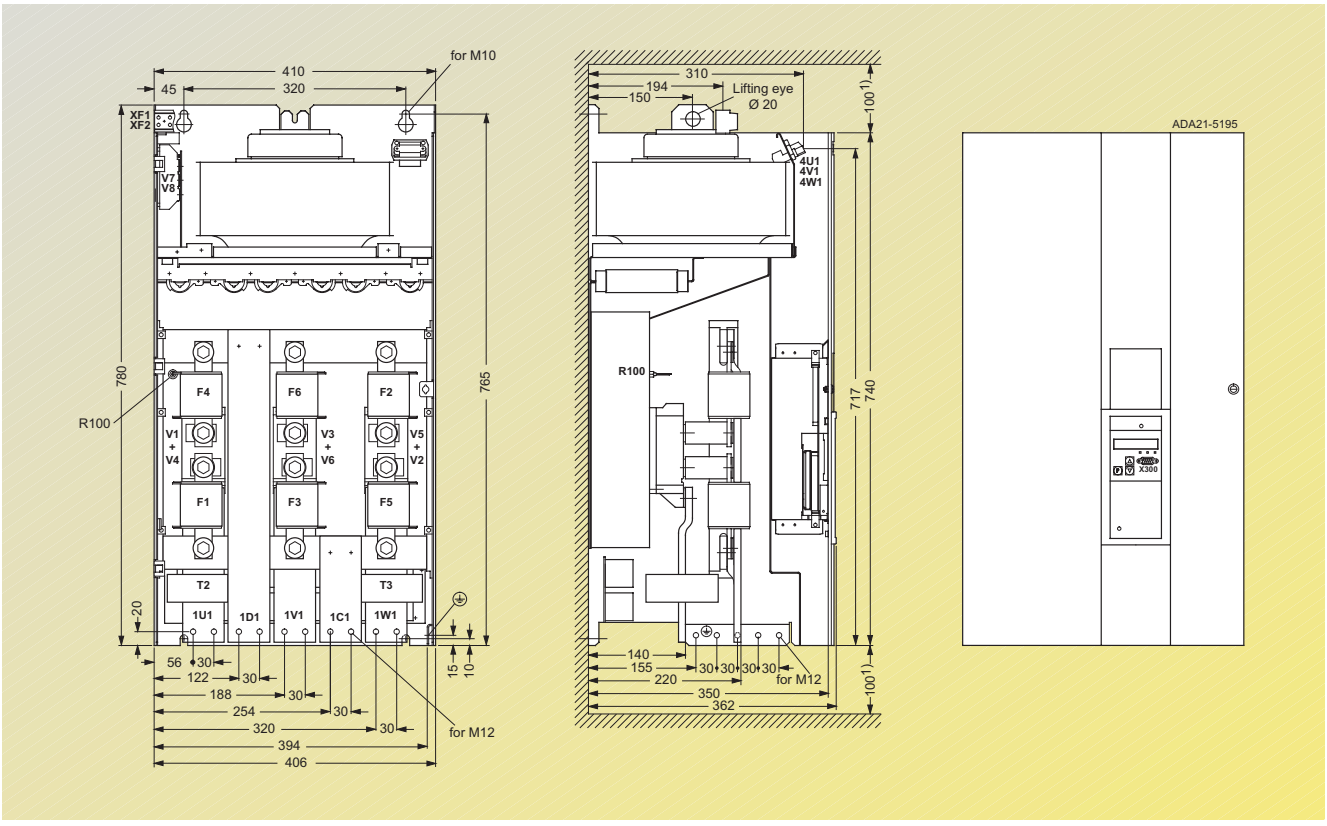


Fig. 9/6

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

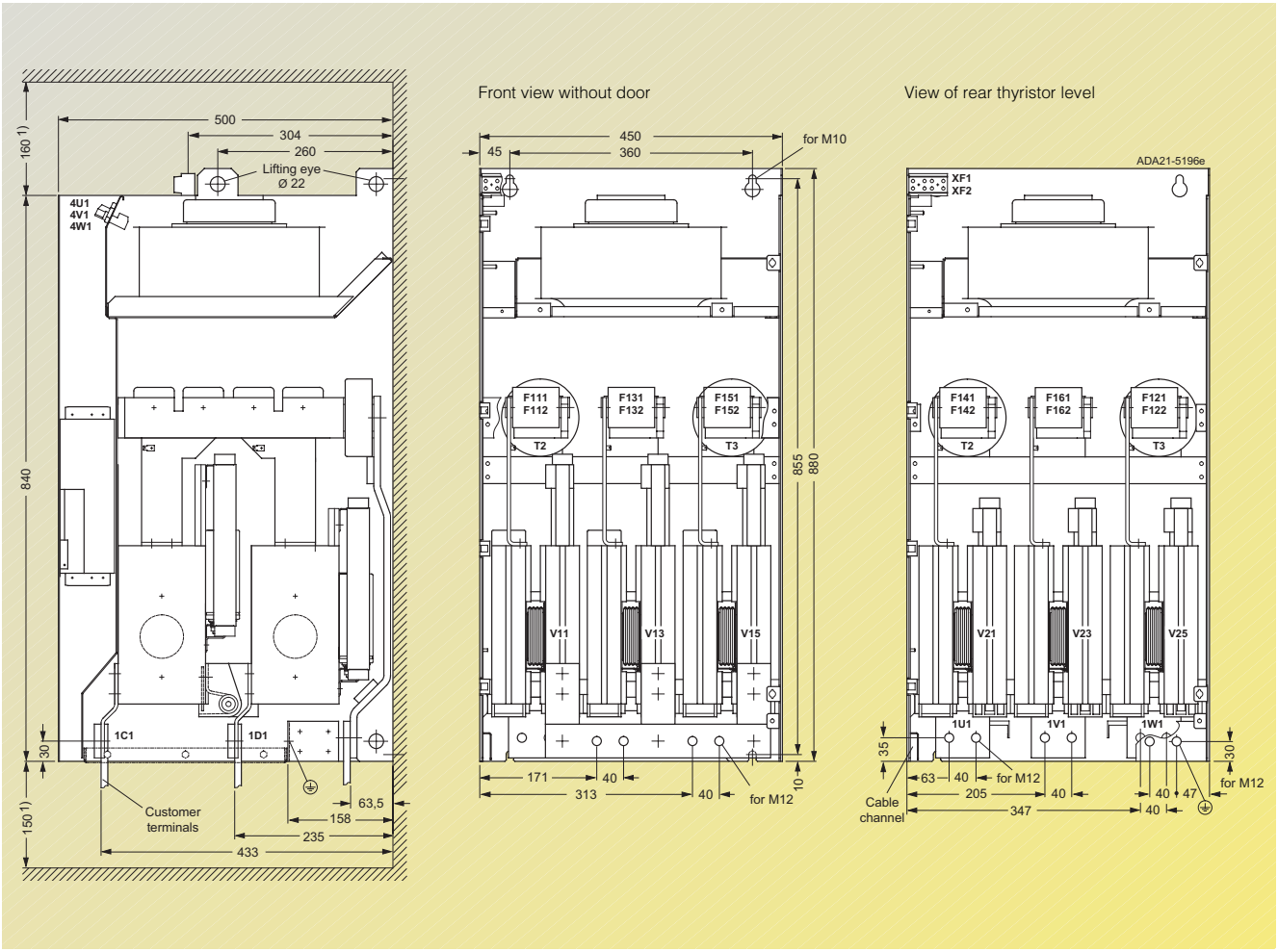
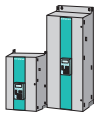


Fig. 9/7

1) Minimum free space for air circulation; it is necessary to ensure that the cooling air intake is sufficient.

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

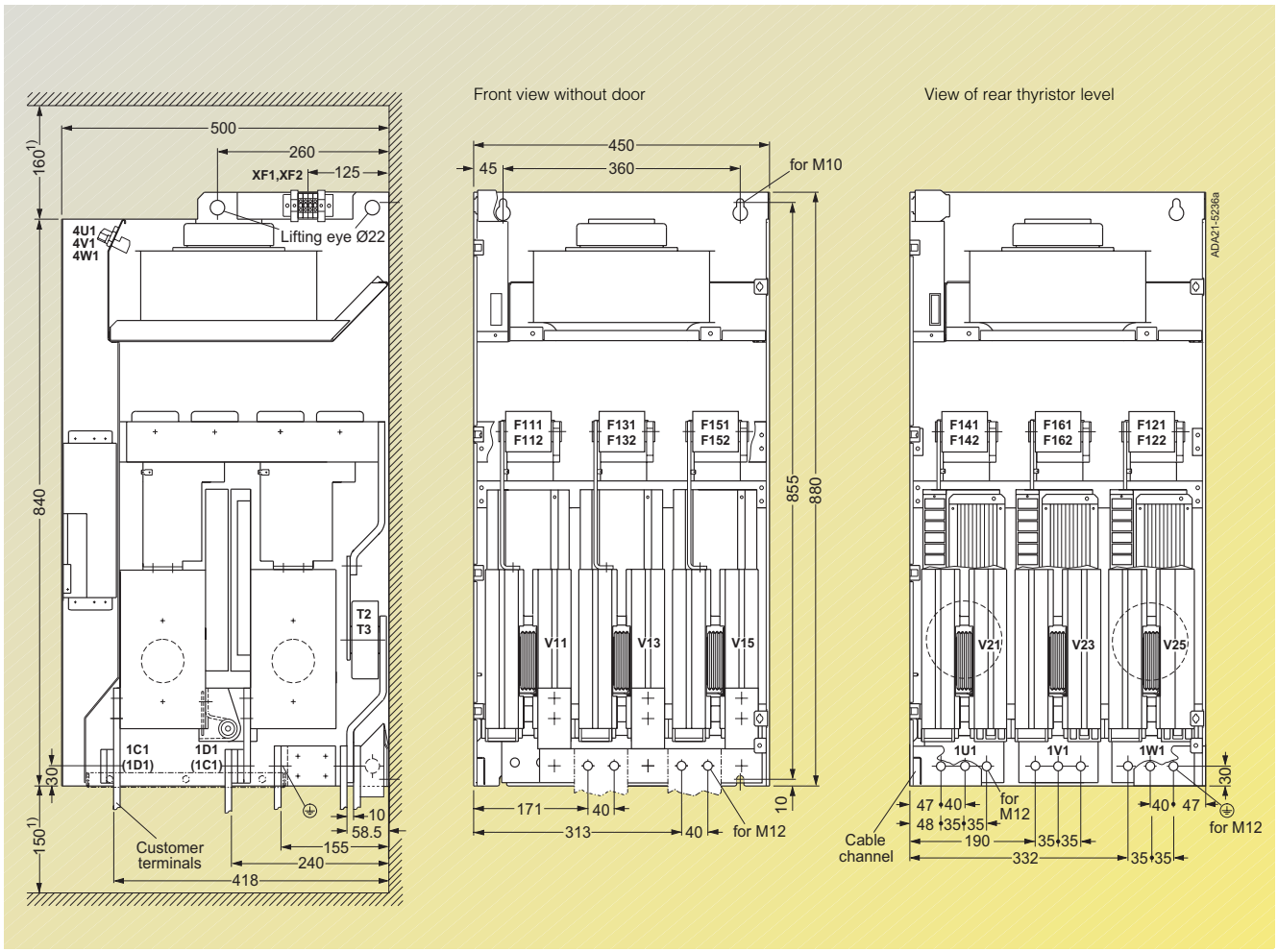


Fig. 9/7a

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

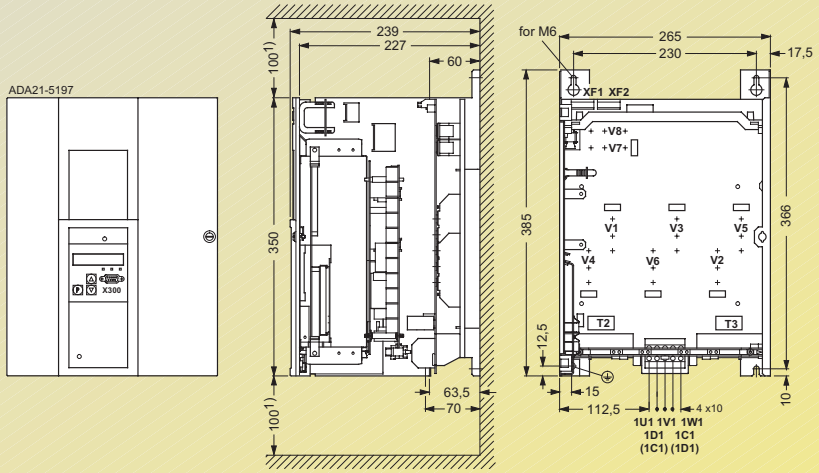


Fig. 9/8

3-ph. AC 400 V and 575 V, 60 A to 280 A

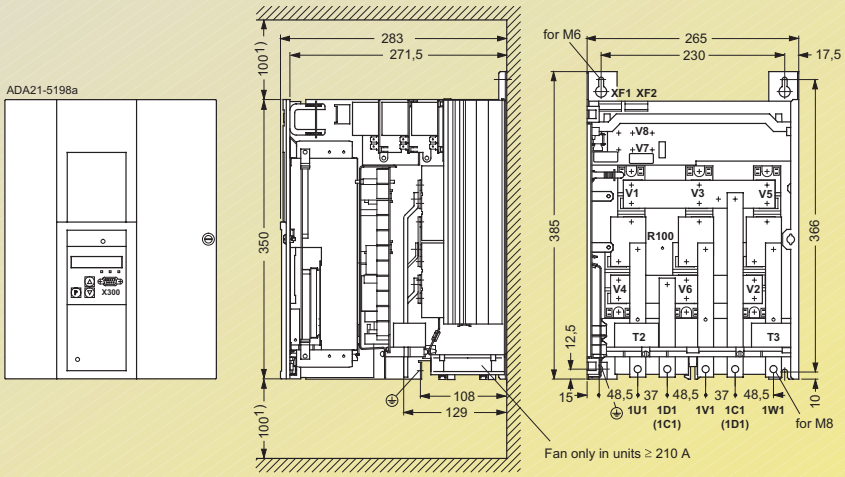


Fig. 9/9

1) Minimum free space for air circulation; it is necessary to ensure that the cooling air intake is sufficient.

Converters for four-quadrant operation

3-ph. AC 400 V and 575 V, 400 A to 600 A

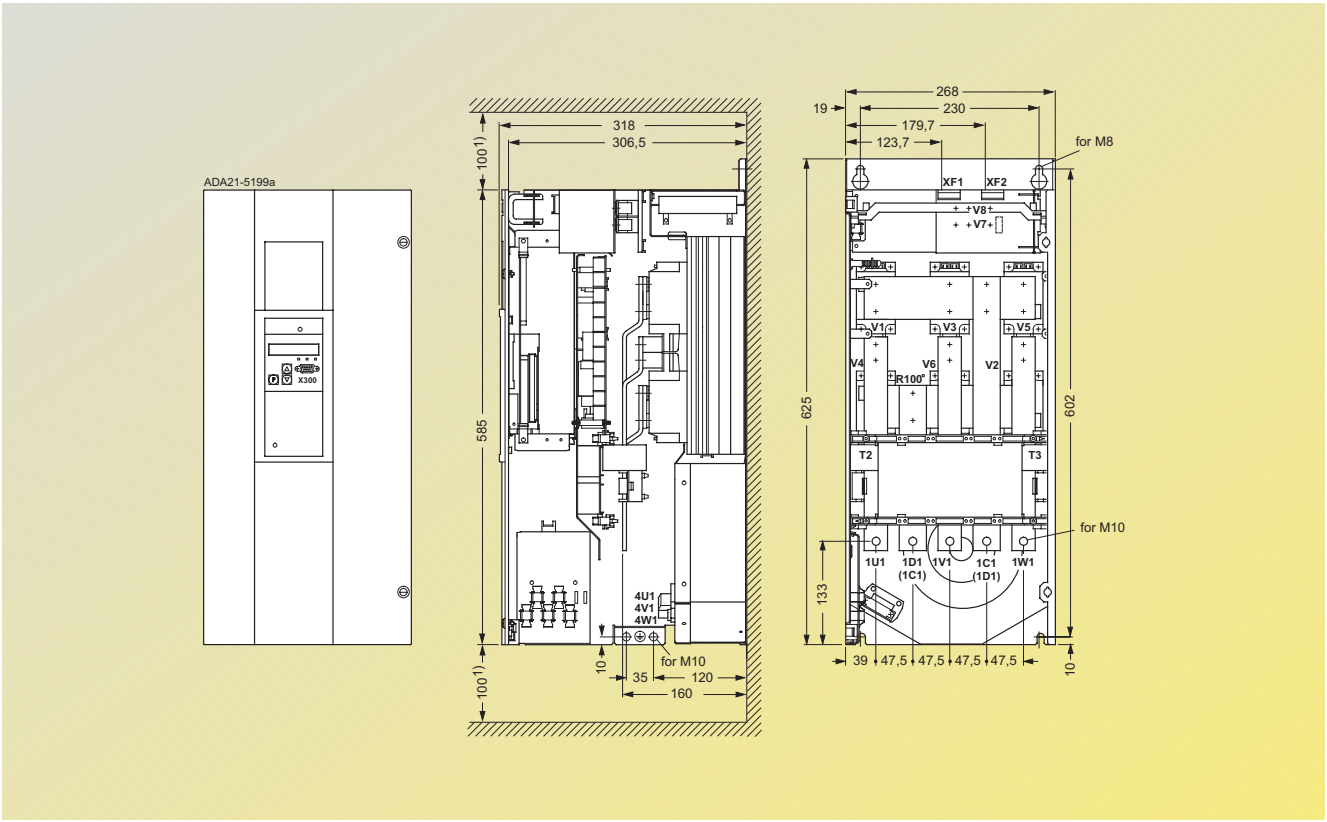


Fig. 9/10

3-ph. AC 400 V, 575 V and 690 V, 760 A to 850 A

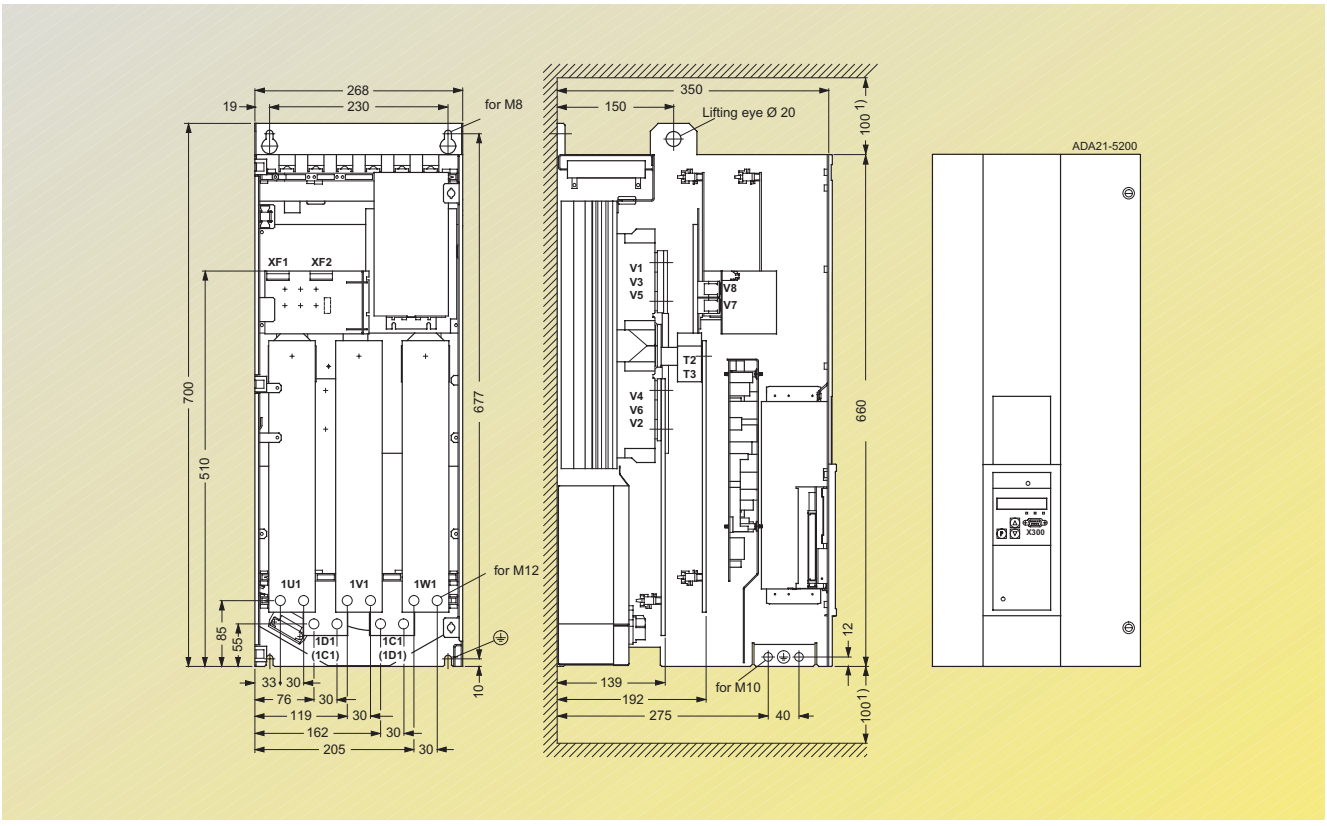


Fig. 9/11

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

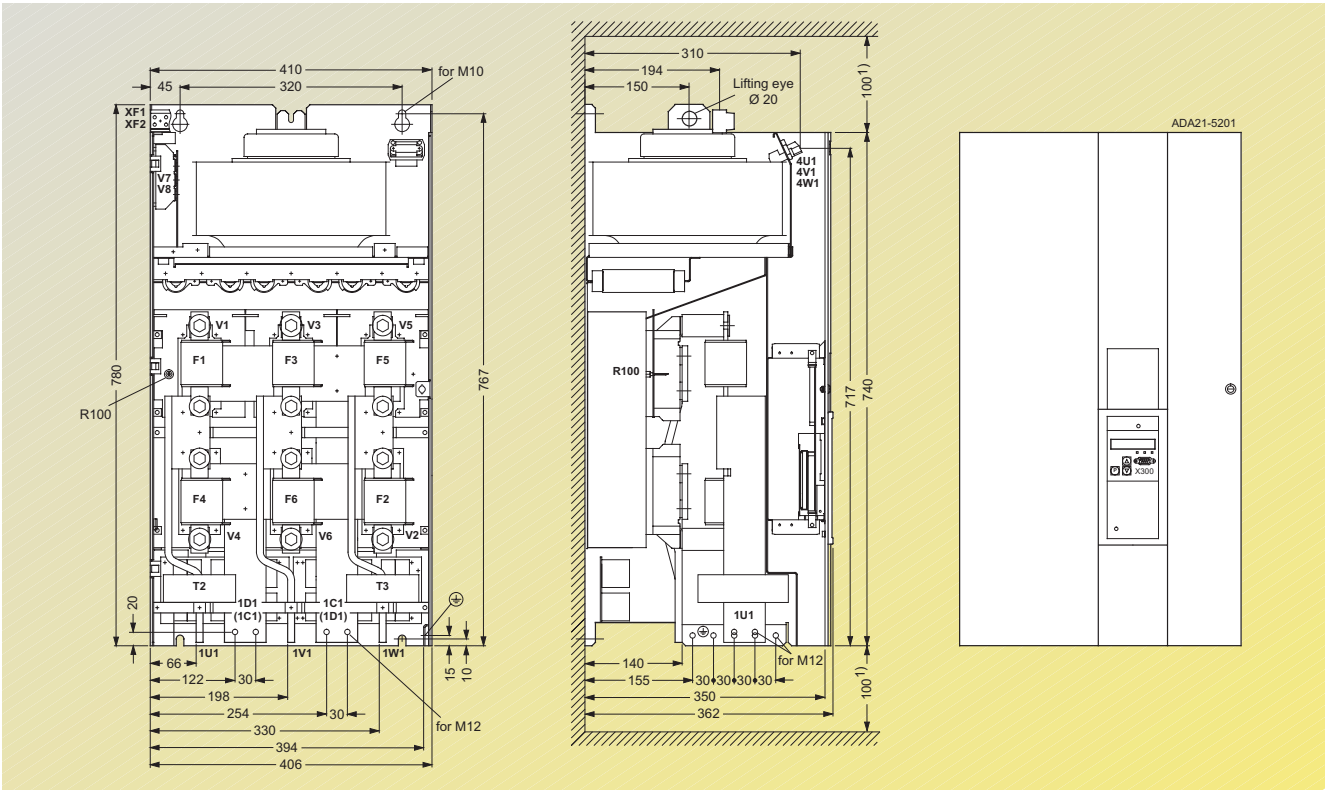


Fig. 9/12

3-ph. AC 400 V, 575 V, 690 V and 830 V, 1500 A to 2000 A; 575 V, 2200 A

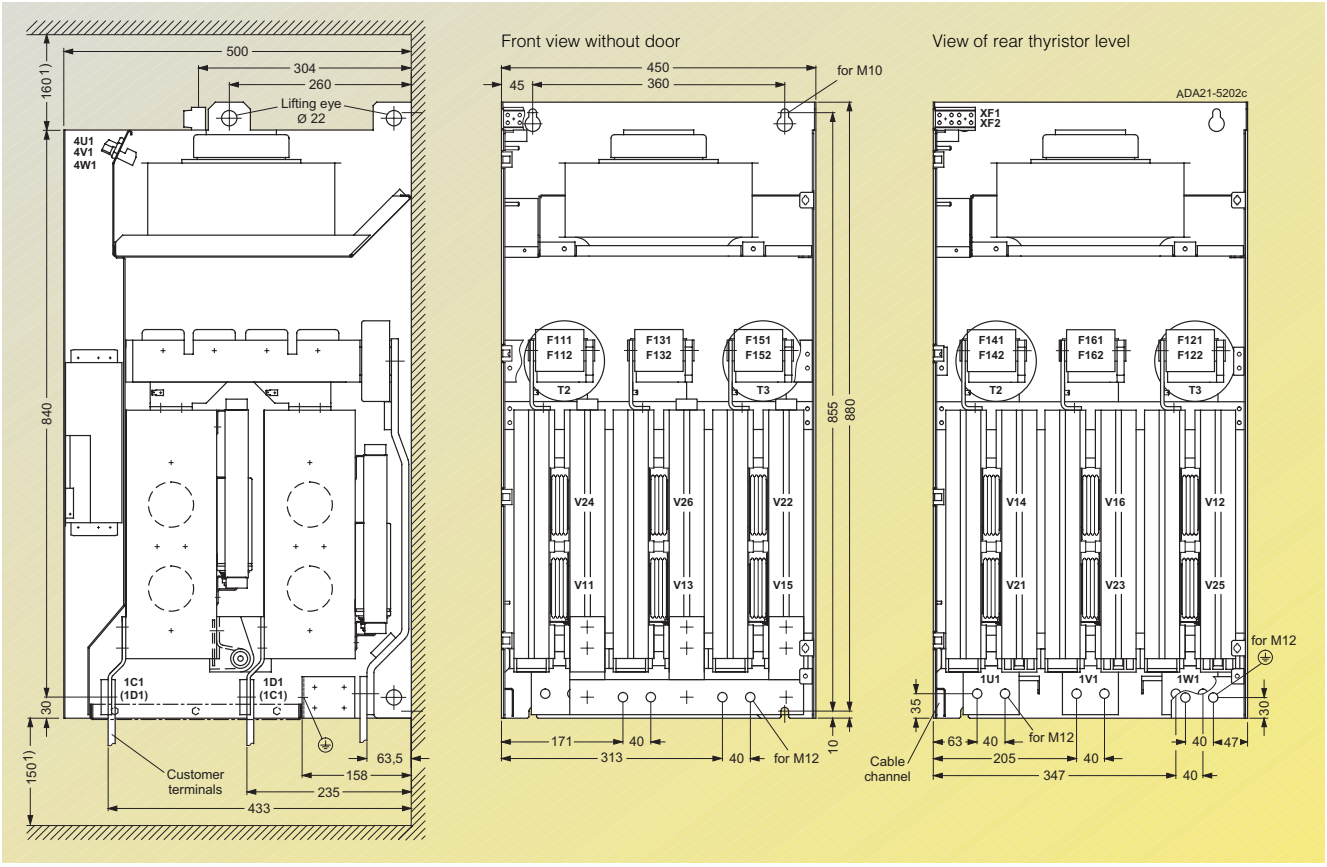
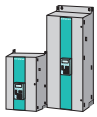


Fig. 9/13

1) Minimum free space for air circulation; it is necessary to ensure that the cooling air intake is sufficient.

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

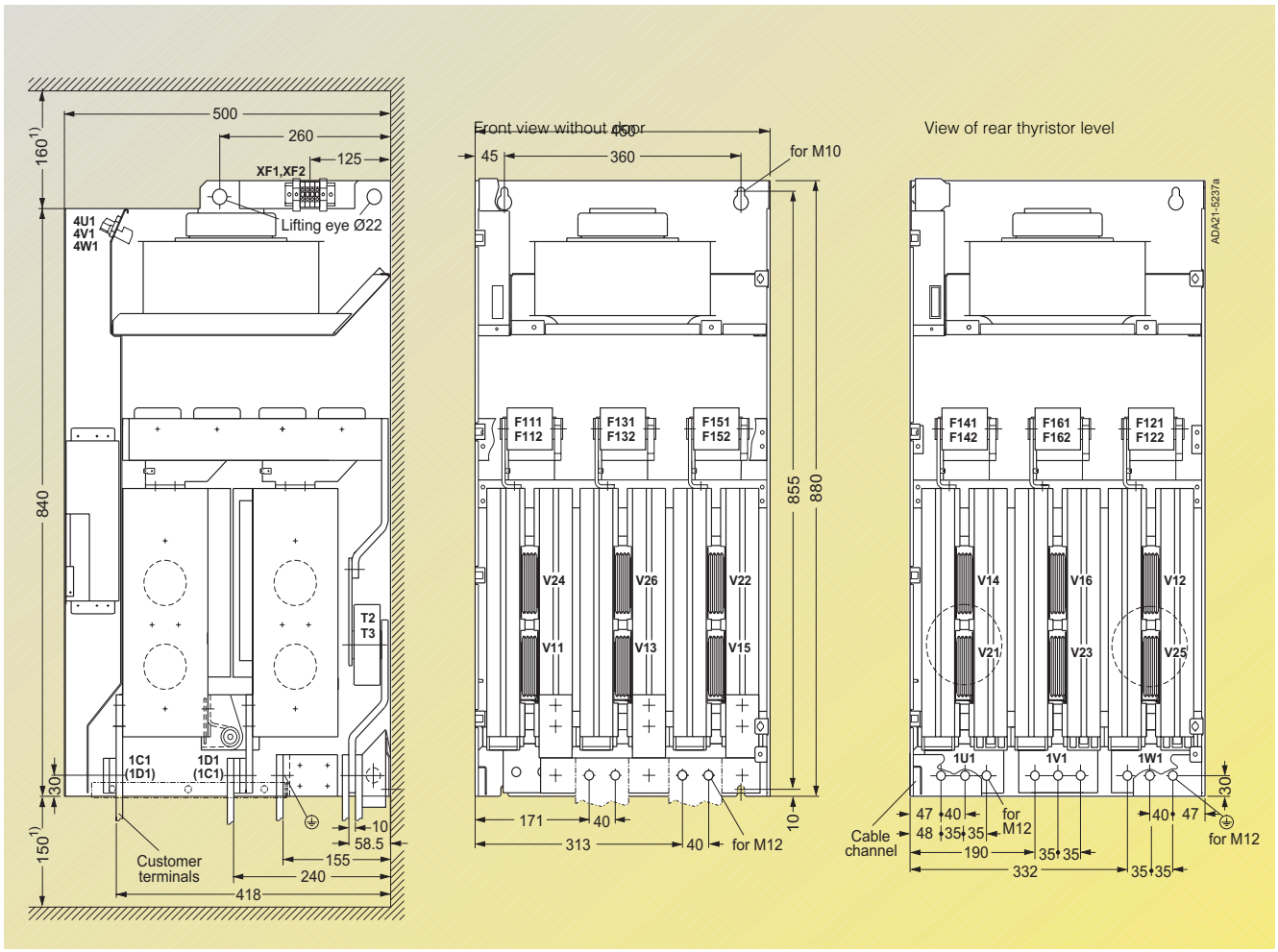


Fig. 9/13a

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

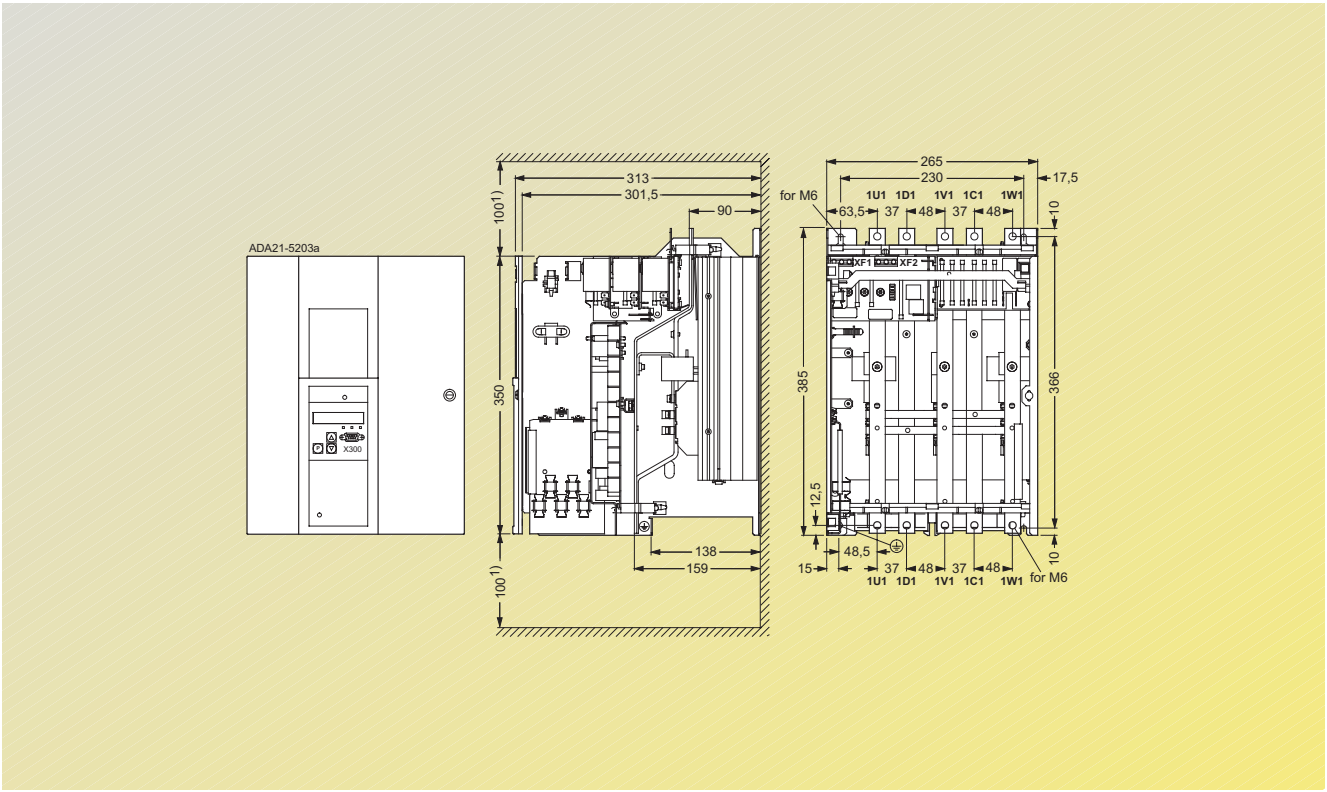


Fig. 9/14

3-ph. AC 460 V, 210 A to 280 A, 1Q

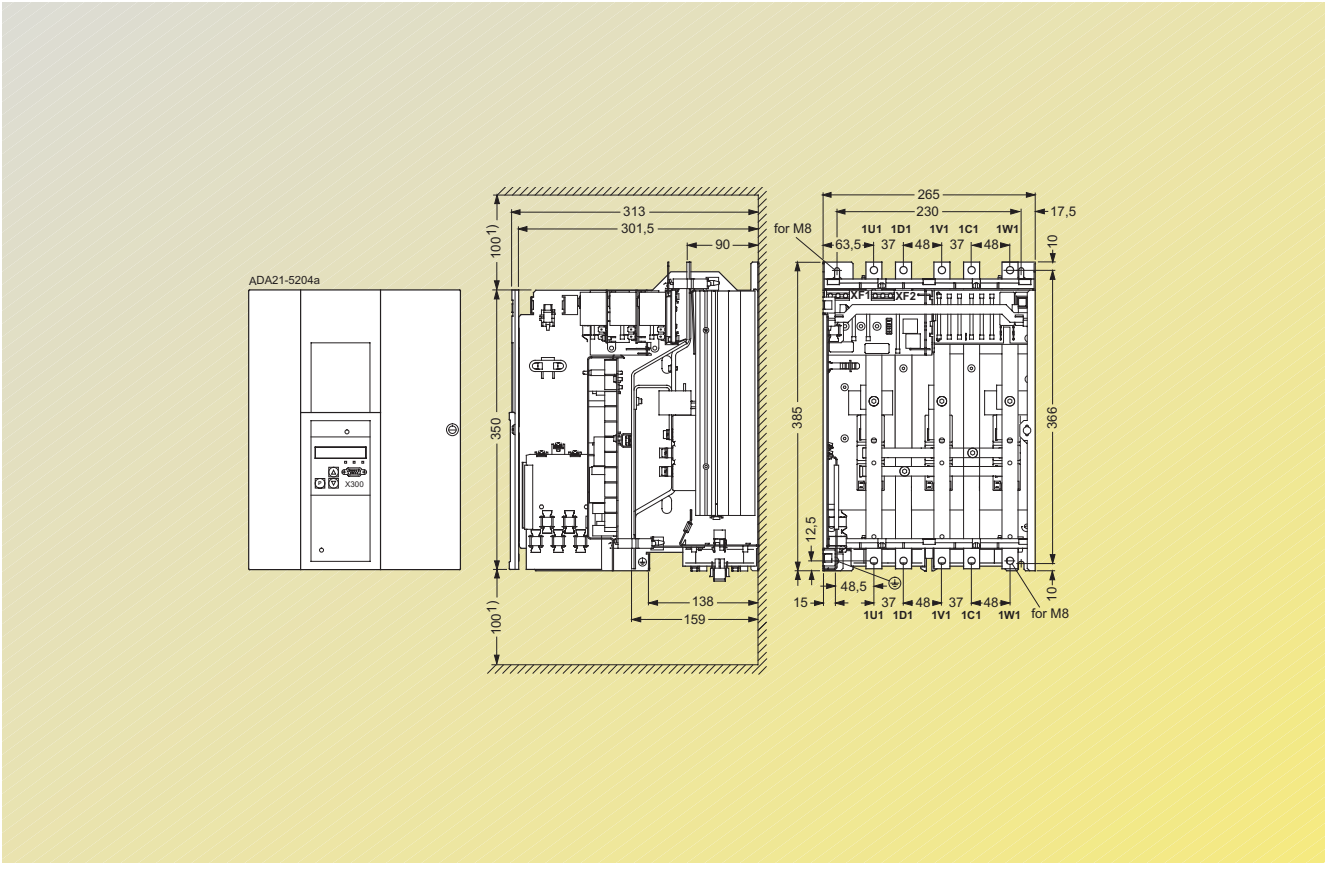


Fig. 9/15

1) Minimum free space for air circulation; it is necessary to ensure that the cooling air intake is sufficient.

Dimension Drawings

Converters with additional power circuit terminals on their top panel

3-ph. AC 460 V, 450 A to 600 A, 1Q

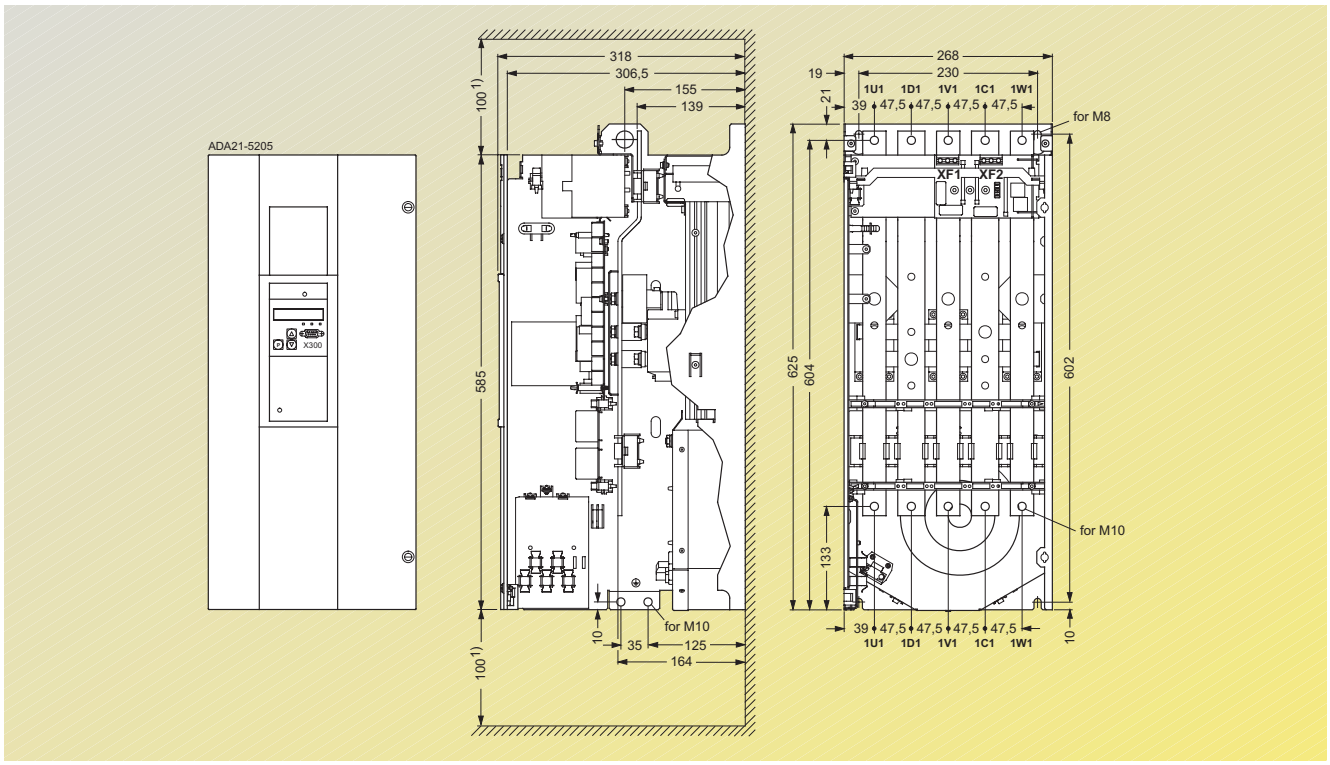


Fig. 9/16

3-ph. AC 460 V, 850 A, 1Q

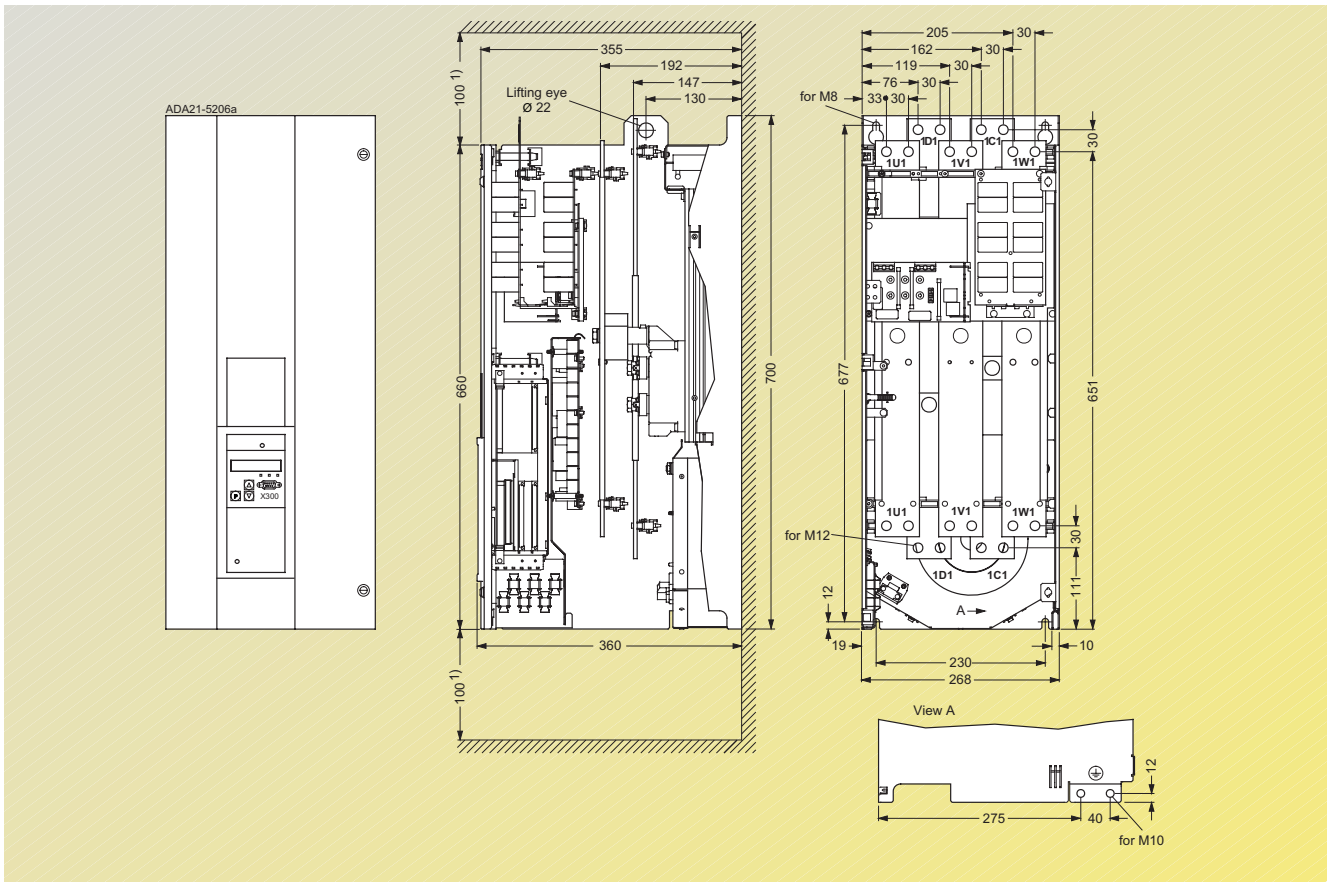
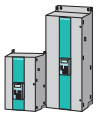


Fig. 9/17

1) Minimum free space for air circulation; it is necessary to ensure that the cooling air intake is sufficient.



3-ph. AC 460 V, 60 A to 125 A, 4Q

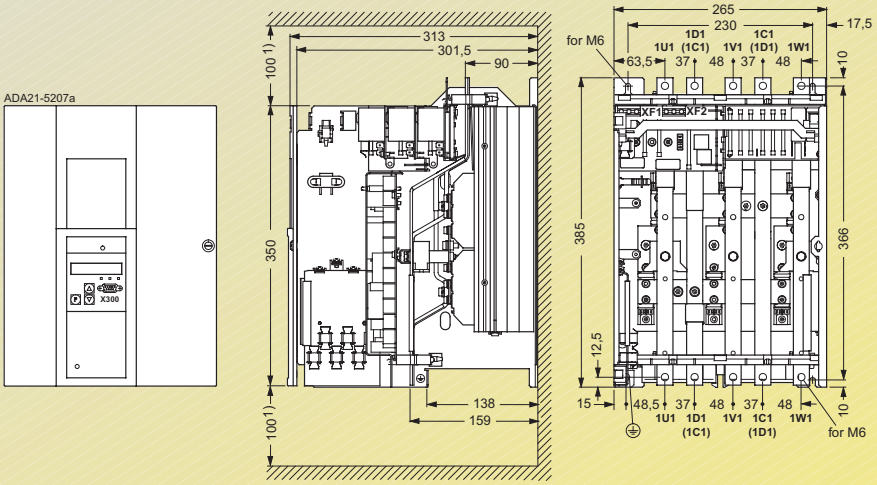


Fig. 9/18

3-ph. AC 460 V, 210 A to 280 A, 4Q

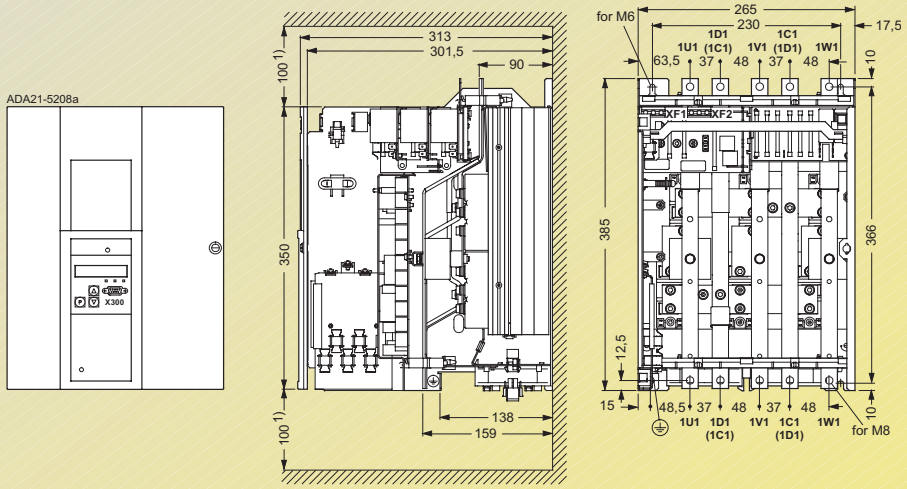


Fig. 9/19

1) Minimum free space for air circulation; it is necessary to ensure that the cooling air intake is sufficient.

Dimension Drawings

Converters with additional power circuit terminals on their top panel

3-ph. AC 460 V, 450 A to 600 A, 4Q

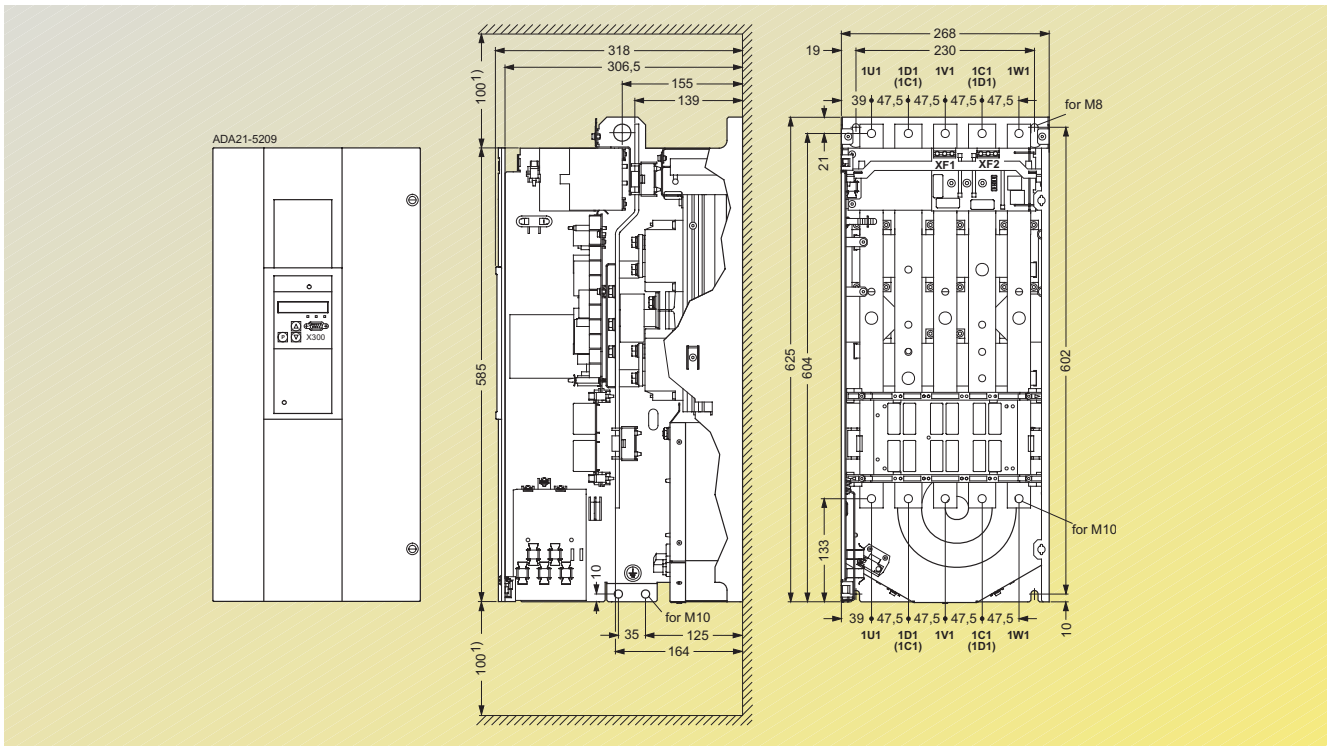


Fig. 9/20

3-ph. AC 460 V, 850 A, 4Q

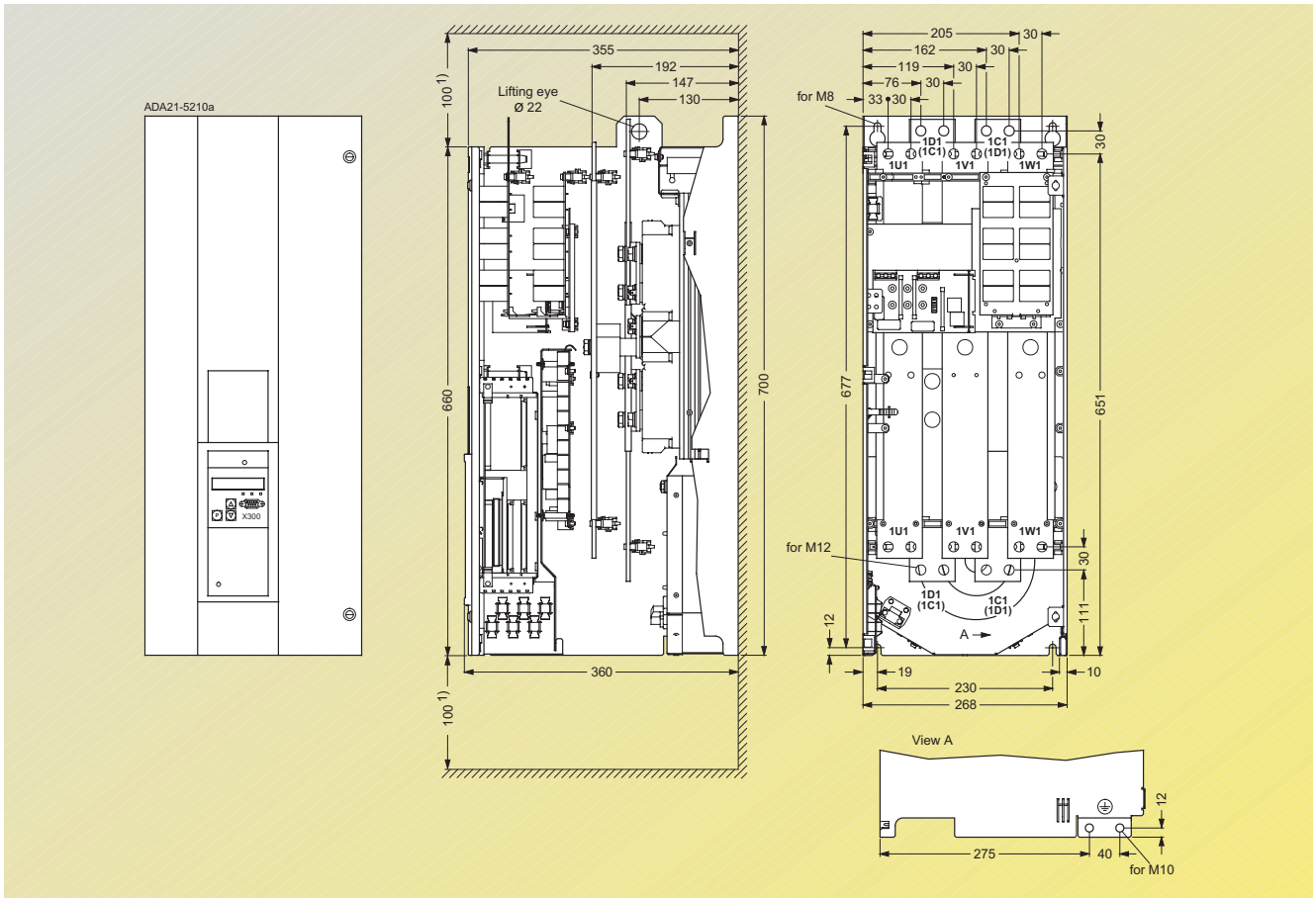


Fig. 9/21

1) Minimum free space for air circulation; it is necessary to ensure that the cooling air intake is sufficient.

3-ph. AC 690 V, 1000 A

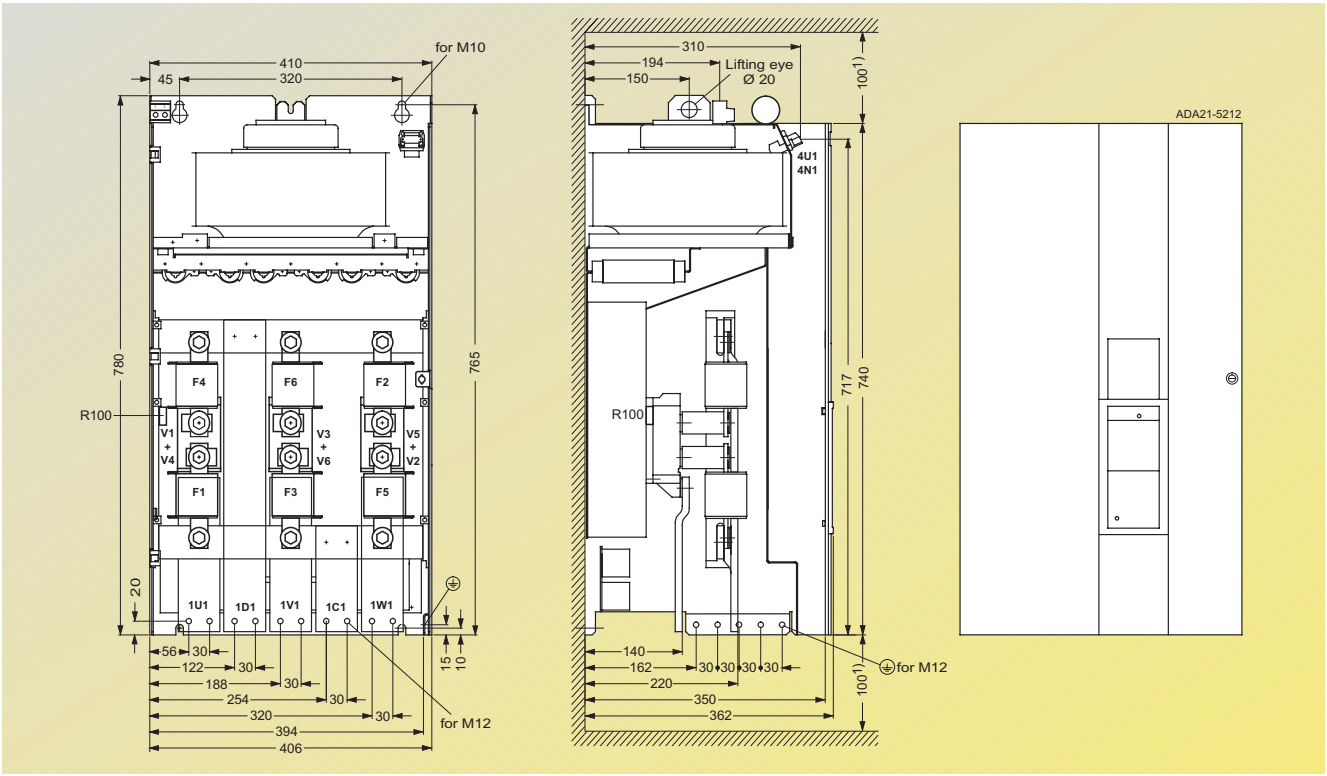


Fig. 9/22

3-ph. AC 690 V, 2000 A

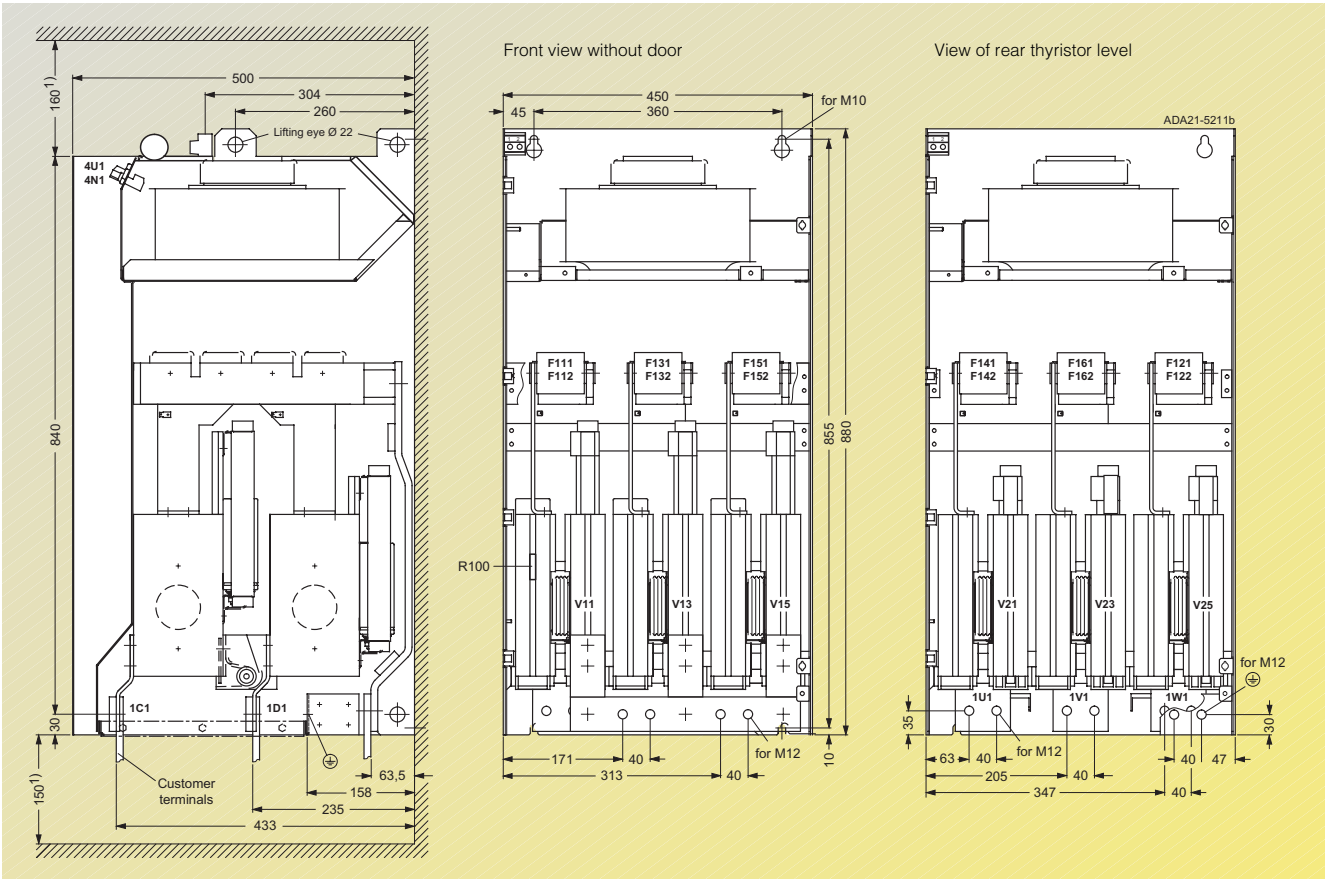


Fig. 9/23

1) Minimum free space for air circulation; it is necessary to ensure that the cooling air intake is sufficient.

Dimension Drawings

SIMOREG CM

Device components assembled (as-supplied state)

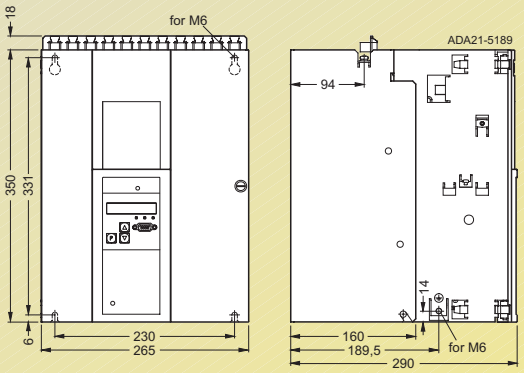


Fig. 9/24

Device components alongside each other

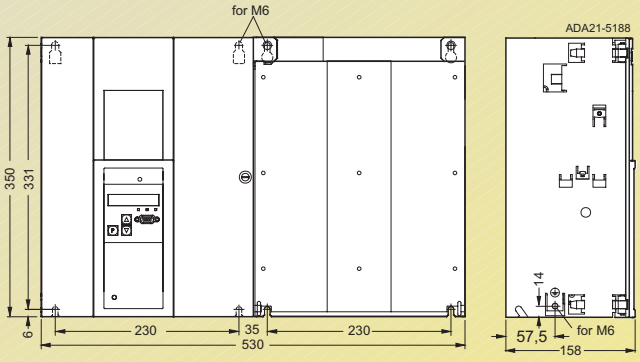
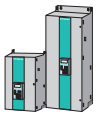


Fig. 9/25



600 A, 1000 A, 1200 A

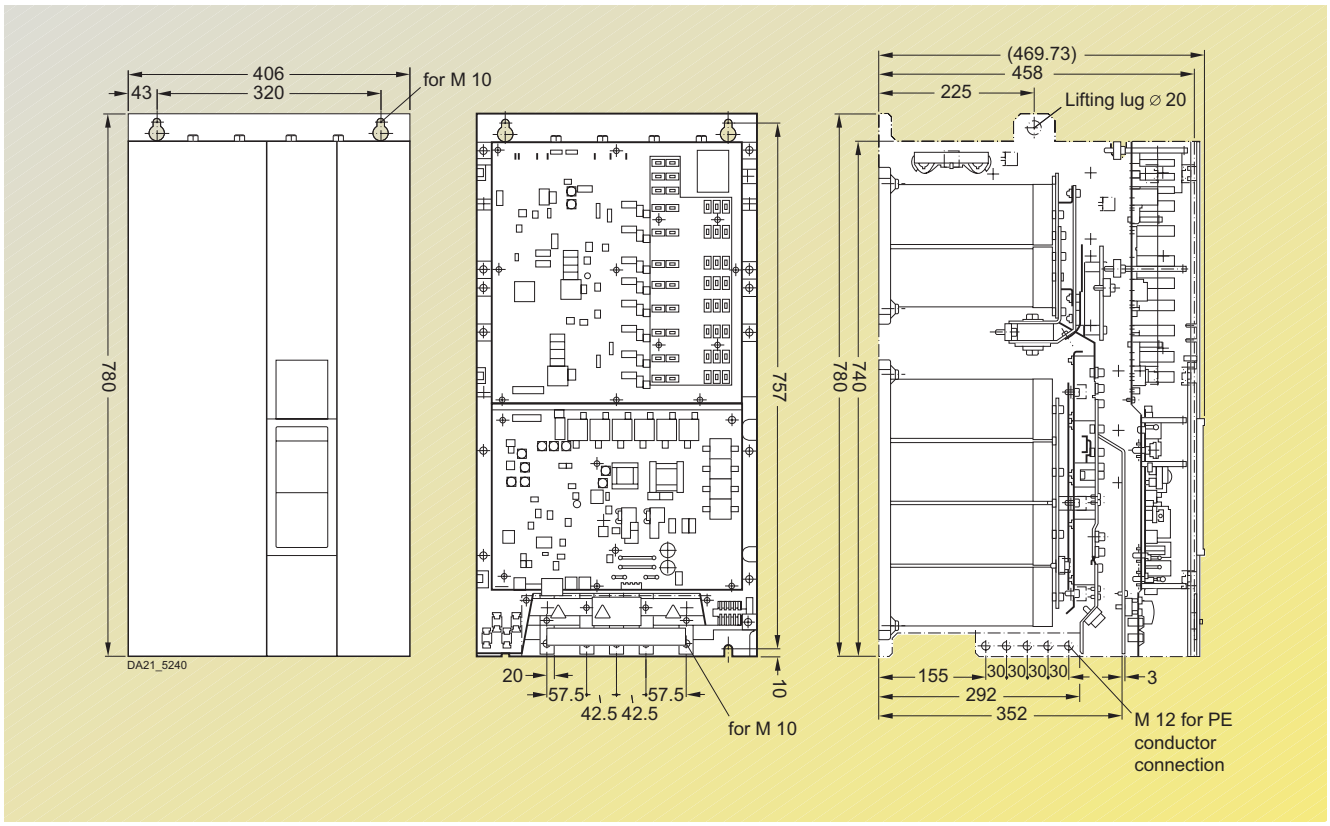


Fig. 9/26

2000 A

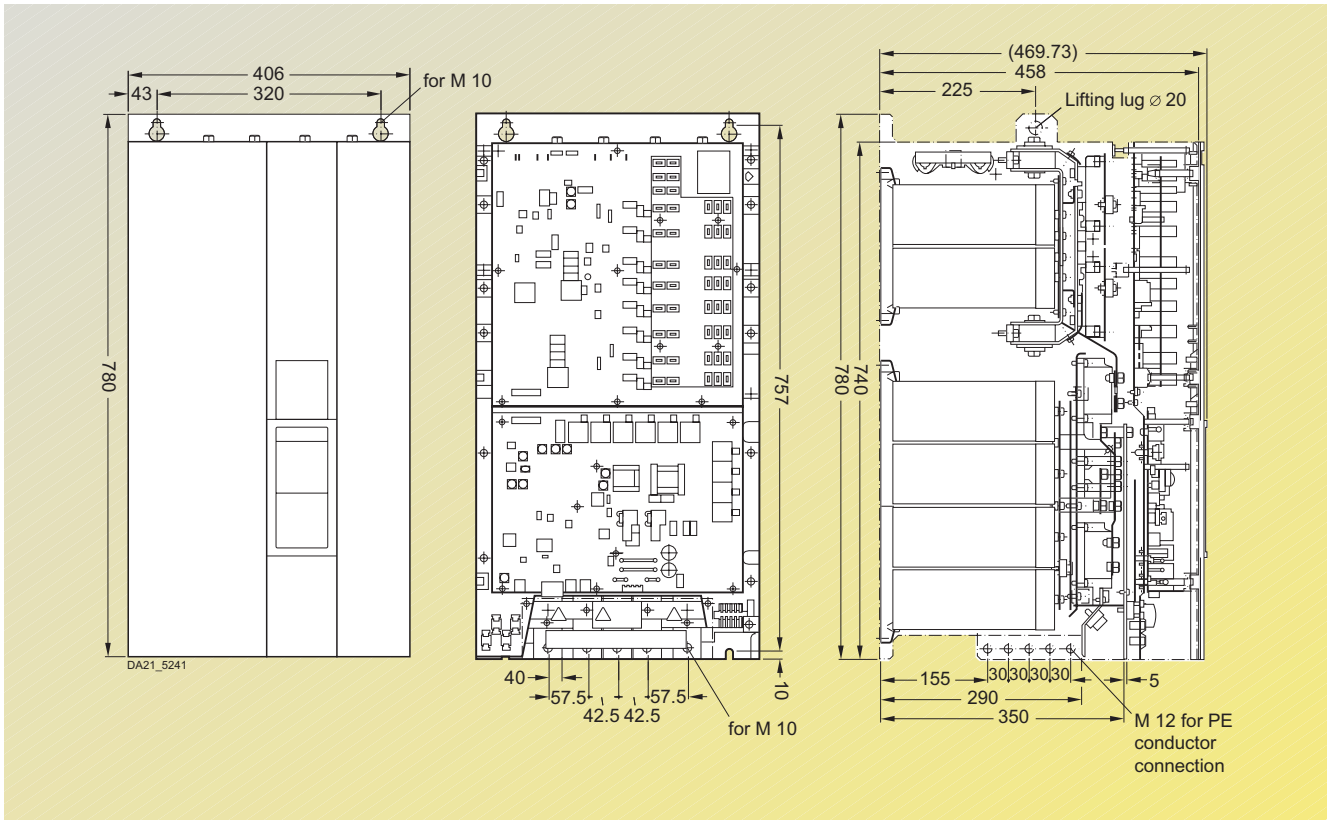
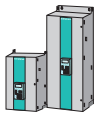


Fig. 9/27

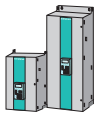


Notes

SIMOREG 6RA70 DC MASTER

Documentation and Training

Documentation



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

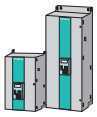
The product CD-ROM contains all the Operating Instructions for the converters and for the SIMOREG CM unit in electronic form. The files are provided in Acrobat and Winword file format.

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:

- 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.



Documentation for SIMOREG units

Description	Language	Short code	Order No.:
SIMOREG DC MASTER operating instructions The converters are supplied with a Brief Description, Operating Instructions must be ordered.	German Italian English French Spanish	**D00** **D72** **D76** **D77** **D78**	**6RX1700-0AD00** **6RX1700-0AD72** **6RX1700-0AD76** **6RX1700-0AD77** **6RX1700-0AD78**
Operating Instructions and DriveMonitor in all the languages listed above on CD-ROM		**D64**	**6RX1700-0AD64**
Unit without description		**D99**	**–**
SIMOREG CM operating instructions The units are supplied with German Operating Instructions as standard, other language versions must be ordered with short code.	German Italian English French Spanish	**–** **D72** **D76** **D77** **D78**	**6RX1700-0BD00** **6RX1700-0BD72** **6RX1700-0BD76** **6RX1700-0BD77** **6RX1700-0BD78**
Operating Instructions and DriveMonitor in all the languages listed above on CD-ROM		**D64**	**6RX1700-0AD64**
SIMOREG 6RL70 operating instructions The units are supplied with Operating Instructions in five languages, English, German, French, Italian and Spanish		**–**	**6RX1700-0CD64**

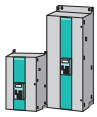
Documentation for electronics options

Description	Order No.:
Communication board CBP2	**6SE708□-□NX84-0FF0**
Communication board CBC	**6SE708□-□NX84-0FG0**
Communication board SLB	**6SE708□-□NX84-0FJ0**
Terminal expansion board EB1	**6SE708□-□NX84-0KB0**
Terminal expansion board EB2	**6SE708□-□NX84-0KC0**
Pulse encoder evaluation board SBP	**6SE708□-□NX84-0FA0**

	▲	▲
German/English	**7**	**6**
Italian/English	**7**	**2**
French/English	**7**	**7**
Spanish/English	**7**	**8**
Japanese	**8**	**0**

Description	Language	Order No.:
T100 technology board hardware description	E/G/Fr/Sp/It	**6SE7080-0CX87-0BB0**
T400 technology board, User's Guide for T400 hardware and project engineering	–	**6DD1903-0EA0**
MS320 software module	German English	**6SE7080-0CX84-2AH1** **6SE7087-6CX84-2AH1**
MS340 software module	German English French	**6SE7080-0CX84-4AH1** **6SE7087-6CX84-4AH1** **6SE7087-7CX84-4AH1**
MS360 software module	German English	**6SE7080-0CX84-6AH1** **6SE7087-6CX84-6AH1**
MS380 software module	German English	**6SE7080-0CX84-8AH1** **6SE7087-6CX84-8AH1**
MS100 software module Universal drive for T100	German English French Spanish Italian	**6SE7080-0CX84-0BB1** **6SE7087-6CX84-0BB1** **6SE7087-7CX84-0BB1** **6SE7087-8CX84-0BB1** **6SE7087-2CX84-0BB1**
Safe Sensor Board SSB	E/G/Fr/Sp/It	**6SE7080-0AX87-1JB0**
SCB1, SCI1 and SCI2 interface boards		**6SE708□-□CX84-0BC0**

	▲	▲
German/English	**7**	**6**
Italian	**7**	**2**
French	**7**	**7**
Spanish	**7**	**8**



Training

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

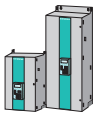
Fig. 10/1

SIMOREG leaming path SD4

Programmers, Configuration engineers, Commissioning engineers, Service personnel, Maintenance personnel

Basics of Drive Technology	SIMOREG K 6RA24 (MP) Commissioning	SIMOREG 6RA70 DC Master Commissioning	Mastering Faults in a Drive – DC-Drives
D-GAT 5 days	D-GMP3 5 days	D-GMP5 5 days	D-IHDC02 3 days

10



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

Fig. 10/2

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.

An automation network can be implemented with the SIMATIC demonstration case in combination with one or more SIMOREG DC MASTER and/or SIMOVERT MASTERDRIVES demonstration cases (SIMOVERT demonstration case MASTERDRIVES CUVC Order No. 6SX7000-0AC01).

A mobile trolley can be ordered to make it easier to transport the demonstration cases.

The demonstration cases are fully assembled and contain all the necessary wiring, connecting cables and signal leads.

The demonstration unit is supplied ready for operation from the control panel.

Mains connection

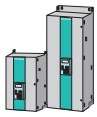
The equipment is connected to the mains via a 16 A CECON plug (5UR5076-3) with a cable of approximately 3 m in length.

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

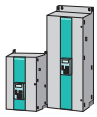
Description	Order No.:
SIMOREG DC MASTER 6RA70 demonstration case	**6RX1700-0SV00**
Demonstration case containing 1GA51.. DC motor	**6RX1240-0MV00**
Mobile trolley for both demonstration cases	**6SX7000-0AE01**

Notes



SIMOREG 6RA70 DC MASTER

Appendix



Environment, resources and recycling

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.

OQS

OQS-CERTIFICATE

OQS Certification and Evaluation Ltd. awards this OQS Certificate to the following organisations:

Siemens Aktiengesellschaft Österreich
SIMEA Siemens Industrial Manufacturing
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Registration No.: 257/1
Date of initial issue: 12 September 1994
Valid until: 21 March 2008

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Vienna, 25 March 2005

OQS Certification and Evaluation Ltd.

TR Ing. Viktor Sehlacek
President

Konrad Scheiber
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A-1210 Wien, Siemensstr. 90-92

This OQS Certificate confirms the application and further development of an effective

ENVIRONMENTAL MANAGEMENT SYSTEM
complying with the requirements of standard
ISO 14001:2004

Development, production and sales of electronically products for the automotive industry and for domestic appliances, power supplies, current converters, telecommunication, traffic, and railway control systems

Registration No.: 355/1
Date of initial issue: 8 April 2004
Valid until: 8 April 2007

The validity of the OQS Certificate will be maintained via annual surveillance audits and three yearly renewal audits.

Vienna, 10 April 2006

OQS Certification and Evaluation Ltd.

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President

Konrad Scheiber
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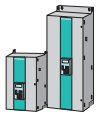
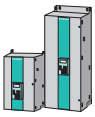
Ing. Wolfgang Hackenmeier
Special representative

A

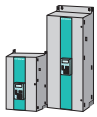


Subject index



Subject index, order number index

Appendix



Abbreviations

A	
ADB	Carrier for small-format supplementary boards (**Ad**apter **B**oard)
C	
CAN	Fieldbus specification for the CiA user organization (CAN in Automation) (**C**ontroller **A**rea **N**etwork)
CAL	**C**AN **A**pplication **L**ayer
CB	Supplementary board for communication (**C**ommunication **B**oard)
CBC	Supplementary board for CAN bus coupling (**C**ommunication **B**oard **C**AN-Bus)
CBD	Supplementary board for DeviceNet interfacing (**C**ommunication **B**oard **D**eviceNet)
CBP2	Supplementary board for PROFIBUS-DP interfacing (**C**ommunication **B**oard **P**ROFIBUS)
COB	**C**ommunication **Ob**ject with CAN bus communication
CUD1	Electronics module C98043-A7001 for SIMOREG DC MASTER (**C**ontrol **U**nit / **D**irect Current)
CUD2	Terminal expansion board C98043-A7006 for CUD1
D	
DeviceNet	Fieldbus specification of ODVA (Open DeviceNet Vendor Association)
DP	**D**ezentrale **P**eripherie
E	
EB1	Supplementary board with additional inputs/outputs (**E**xpansion **B**oard **1**)
EB2	Supplementary board with additional inputs/outputs (**E**xpansion **B**oard **2**)
G	
GSD file	**G**eräte-**S**tamm**d**aten file containing a definition of the communication characteristics of the communication boards for PROFIBUS-DP
I	
ID	**Id**entifier for CAN bus communication
IND	Parameter **Ind**ex
L	
LBA	Backplane wiring for the installation of supplementary modules (**L**ocal **B**us **A**dapter)
M	
MSAC_C1	Designation of a transmission channel for PROFIBUS-DP (**M**aster **S**lave **A**cyclic / **C**lass **1**)
MSCY_C1	Designation of a transmission channel for PROFIBUS-DP (**M**aster **S**lave **C**yclic / **C**lass **1**)
O	
OP1S	Optional control panel with plain text display and internal memory for parameter sets (**O**perator **P**anel **1** / **S**tore)
P	
PDO	**P**rocess **D**ata **O**bject (CAN bus)
PKE	Parameter**ke**nnung
PKW	Related to a parameter (**P**arameter-**K**ennung-**W**ert)
PMU	Simple control panel for the SIMOREG DC MASTERS (**Para**m**e**terization **U**nit)
PNU	Parameter**NU**mber
PPO	Definition of number of parameter and process data words for PROFIBUS-DP communication (**P**arameter **P**rocess data **O**bject)
PROFIBUS-DP	Fieldbus specification of the PROFIBUS-DP association (**Pro**cess **Fi**eld **Bus**)
PWE	Parameter**we**rt
PZD	**Pro**zess**d**aten
S	
SBP	Supplementary board for tacho interfacing (**S**ensor **B**oard **P**ulse)
SCB1	Supplementary board for interfacing from SCI1 or SCI2 via fiber-optic cable (**S**erial **C**ommunication **B**oard **1**)
SCI1	Supplementary board with additional inputs/outputs; I/O slave module on SCB1 (**S**erial **C**ommunication **I**nterface **1**)
SCI2	Supplementary board with additional inputs/outputs; I/O slave module on SCB1 (**S**erial **C**ommunication **I**nterface **2**)
SDO	**S**ervice **D**ata **O**bject (CAN bus)
SIMOLINK	Fieldbus specification for fiber-optic ring bus (**S**iemens **Mo**tion **Link**)
SLB	Supplementary board for SIMOLINK interfacing (**S**IMO**L**INK **B**oard)
STW	**St**euer**w**ort
T	
T100	Supplementary board with technology functions (**T**echnology Board **100**)
T300	Supplementary board with technology functions (**T**echnology Board **300**)
T400	Supplementary board with technology functions (**T**echnology Board **400**)
TB	**T**echnologie**b**augruppe T100, T300 or T400
U	
USS	**U**niverselle **s**erielle **S**chnittstelle
Z	
ZSW	**Z**u**s**tands**w**ort (status word)

Overview

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.

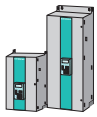
You start by selecting a

- Country,
- Product or
- Sector.

By further specifying the remaining criteria you will find exactly the right contact partner with his/her respective expertise.

A

Information and Ordering in the Internet and on CD-ROM



A&D in the WWW

A detailed knowledge of the range of products and services available is essential when planning and configuring automation systems. It goes without saying that this information must always be fully up-to-date.

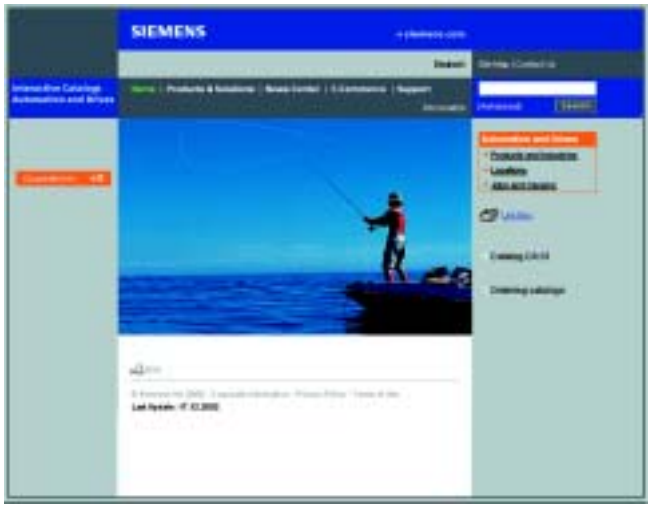
The Siemens Automation and Drives Group (A&D) has therefore built up a comprehensive range of information in the World Wide Web, which offers quick and easy access to all data required.

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

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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.

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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:

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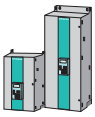

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In the face of harsh competition you need optimum conditions to keep ahead all the time:
A strong starting position. A sophisticated strategy and team for the necessary support - in every phase.
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In Germany
0180 50 50 444 [1])

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1) For country-specific telephone numbers go to our Internet site at:
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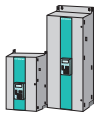
Appendix

Conditions of Sale and Delivery, export regulations



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

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A&D/VuL_ohne MZ/En 05.09.06

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SINAMICS G110 Inverter Chassis Units	D 11.1
SINAMICS GM150/SINAMICS SM150 Medium-Voltage Converter 0.6 MVA to 28 MVA	D 12
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SINAMICS S120 Servo Control Drive System	D 21.2
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