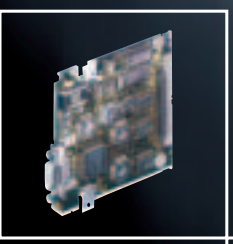
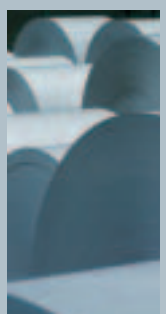
North American Catalog 2004



vector control

SIMOVERT MASTERDRIVES VC

6SE70 AC DRIVES
6SE72 AC ENCLOSURES



SIEMENS

Siemens Family of Applied Drives

From stand-alone drives to the most challenging applications Siemens applied series drives offer a truly integrated family of high performance drives that are unmatched from one continent to the next.

SIMOVERT ™ MASTERDRIVES VC

AC Series of Vector Cotrol
0.5 HP to 8000 HP

SIMOREG ™ 6RA70
DC MASTER
DC Drive Series
7.5 HP to 8000 HP

Customer-specific, integral solutions are available for the most varied of applications in all industrial sectors.

SIMOVERT ™ MASTERDRIVES MC

Motion Control Series
0.5 HP to 355 HP

SIMOVERT MASTERDRIVES Vector Control

North American Catalog 2004

Supersedes:
AC Drives Catalog 2001

SIEMENS

Note!

The technical data is intended for general information.
Please observe the operating instructions and the references indicated on the products for installation, operation and maintenance.

- The technical data, selection and ordering data (Order Nos.), accessories and availability are subject to alteration.
- All dimensions in this catalog are stated in inches (mm).

Vector Control
Overview

SIMOVERT® MASTERDRIVES Vector Control

Overview

Applications

Top solutions with applied drives

The SIMOVERT MASTERDRIVES Vector Control frequency converters are voltage-source DC link converters with fully digital technology and IGBT inverters which, in conjunction with Siemens three-phase AC motors, provide high-performance, economical drives for all industrial sectors and applications.

SIMOVERT MASTERDRIVES – system-based drive technology
A uniform, modular series of standard units

The SIMOVERT MASTERDRIVES Vector Control series of converters is both uniform and modular in design.

- The power output of the standard units ranges from 0.75 HP to over 3000 HP.
- All internationally standard supply voltages from 230 V to 690 V are covered.
- Depending on the application and the required output, there are four types of housing design available: the Compact PLUS unit, the compact unit, the chassis unit and the cabinet unit.
- The hardware and software modules enable tailored and cost effective drive solutions.

As a counterpart to extremely high-performance VC control on the motor side, the SIMOVERT MASTERDRIVES AFE (Active Front End) unit ensures optimum energy supply on the line side as well with its active, line-angle-oriented vector control. SIMOVERT MASTERDRIVES AFE units are characterized by

- freedom from system disturbances, i.e. a very favorable overall power factor
- commutation failure-protected operation even in the event of supply dips and power failure
- the possibility of reactive power compensation
- four-quadrant operation.

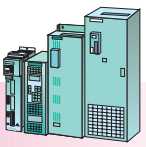
The SIMOVERT MASTERDRIVES are designed as:

- converters for connection to a 3-phase AC system
- inverters for connection to a DC bus
- rectifier units for supplying power to the DC bus.

A wide spectrum of system components and accessories rounds off the range of products.

SIMOVERT MASTERDRIVES The tailored solution

All SIMOVERT MASTERDRIVES share a consistently uniform design. Throughout the whole power range, the units (converters, inverters) and system components (rectifier units, braking units) have a uniform design and a uniform connection system.



Compact PLUS/compact and chassis units · cabinet units

They can be combined in many ways and arranged side by side to match every possible drive requirement.

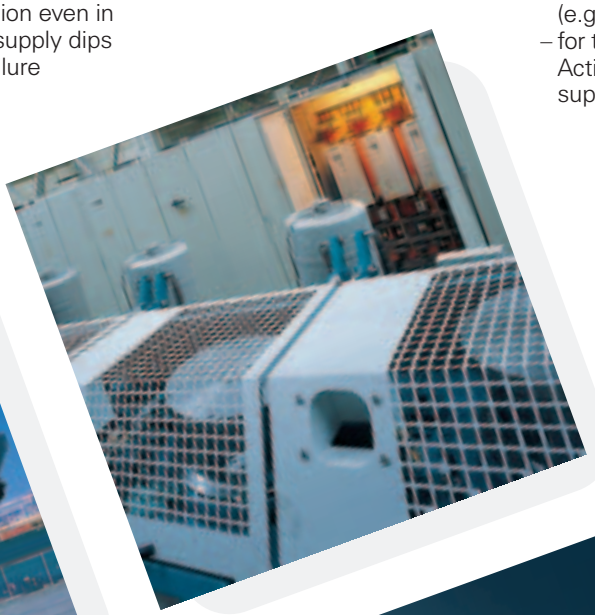
Being system modules, they can be used to create the most suitable drive system, whether this involves single drives or multi-motor drives.

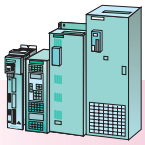
Customer-specific solutions

Cabinets and system configurations for power output ranges from 0.75 HP to 8000 HP can be created to match specific customer requirements, with either air-cooling or water-cooling in our application workshop.

Examples of such applications are

- multi-motor drives (steelworks and rolling mills, the paper and plastic-film industries) and
- single drives
  - in adapted design (e.g. marine drives)
  - for test stands (e.g. with Active Front End for low supply stressing).





Compact PLUS/compact and chassis units · cabinet units

SIMOVERT MASTERDRIVES with water-cooling – for harsh environments

The compact and chassis converters and inverters are also available with water-cooling. By installing in appropriate cabinets, high degrees of protection are achieved in a closed system, thus making them suitable for use in any harsh industrial environment.

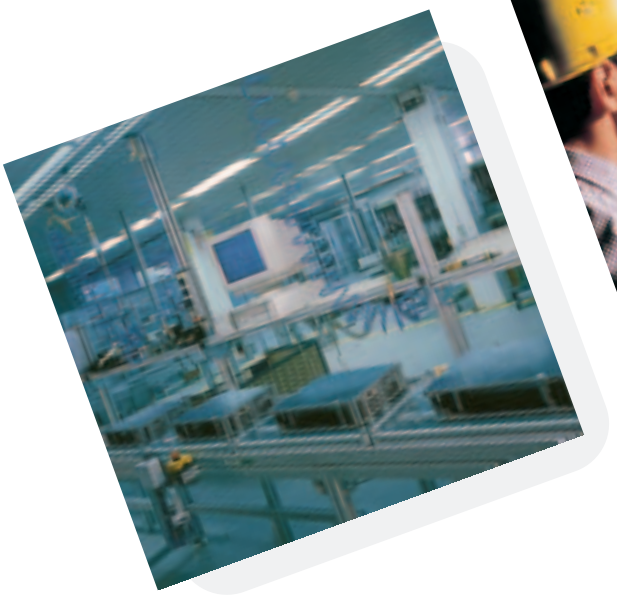
New! The Compact PLUS series

The youngest member of the SIMOVERT MASTERDRIVES Vector Control family with power outputs of 0.75 HP to 25 HP rounds off the product range in the lower power output range. The Compact PLUS series is ideal for applications in machines where only limited space is available.

SIMOVERT MASTERDRIVES – electromagnetically compatible in any environment

The SIMOVERT MASTERDRIVES frequency converters comply with the relevant EMC standard for power electronics.

EMC compliant installation enables them to be used in industry and residential buildings.



Applications

Designed for world-wide use

The SIMOVERT MASTERDRIVES satisfy the relevant international standards and regulations – from the European EN standard and IEC to UL and CSA.

Quality in accordance with DIN ISO 9001

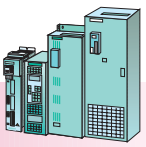
The quality standards according to which the SIMOVERT MASTERDRIVES are manufactured are high and have been acclaimed. All aspects of production, i.e. development, mechanical design, manufacturing, order processing and the logistics supply center of the SIMOVERT MASTERDRIVES, have been certified by an independent authority in accordance with DIN ISO 9001.

Engineering technology with maximum benefit to the customer

The advantages to the customer are apparent:
- solutions, optimized with regard to price and performance
- high quality,
- maximum reliability

and as a result
- flexible production and
- optimized processes.

Our world-wide service and sales network provides all our customers and SIMOVERT MASTERDRIVES users with a direct line to:
- individual advice
- planning
- training and
- service.



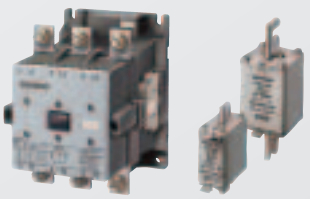
Unit and system components

Converters and Inverters

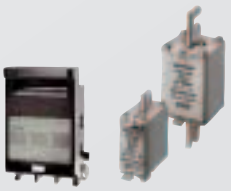
Rectifier units

Braking units and braking resistors

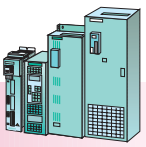
Line-side switching and protection components



DC link components



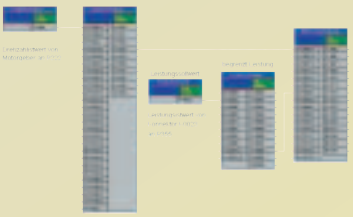
Load-side components



Electronic and software options

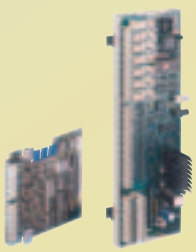
Operator control and visualization

Control



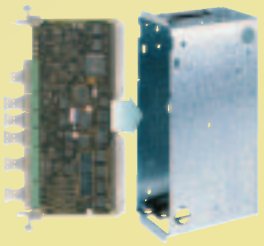
Communication

Interface and expansion boards



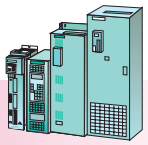
Technology boards

Integration of option boards



SIMOVERT MASTERDRIVES Vector Control

Overview



Order number examples

Compact PLUS/compact and chassis units · cabinet units

Compact PLUS units, compact and chassis units

e.g. **6 S E 7 0 3 1 – 0 E E 6 0 – Z**

SIMOVERT MASTERDRIVES 6SE7 series

Compact PLUS units, compact units, chassis units

Multiplier for output current
e.g.: 2 ≙ × 1
3 ≙ × 10
4 ≙ × 100

Example:
Multiplier = 10
First two positions of output current: 10
Output current rounded off = 100 A

First two positions for output current

Supply voltage code e.g. **E** ≙ 3 AC 380 V – 480 V

Size e.g. chassis size **E**

Control version 6 ≙ SIMOVERT MASTERDRIVES Vector Control

Function release

Supplementary order codes for options

Cabinet units

e.g. **6 S E 7 2 3 1 – 6 F G 0 0 – 3 A B 0 – Z**

SIMOVERT MASTERDRIVES 6SE7 series

NEMA cabinet units

Multiplier for output current
e.g.: 2 ≙ × 1
3 ≙ × 10
4 ≙ × 100

Example:
Multiplier = 10
First two positions of output current: 16
Output current rounded off = 160 A

First two positions for output current

Supply voltage code e.g. **F** ≙ 3 AC 500 V – 600 V

Size e.g. cabinet size **G**

Control version

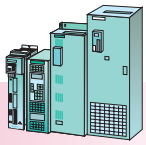
Mechanical version

Electrical version e.g. **3** ≙ converter, single-quadrant

Function release

Supplementary order codes for options

Vector Control
System Description



2

SIMOVERT MASTERDRIVES converters

The SIMOVERT MASTERDRIVES Vector Control series of converters consists of modular, high-performance components. These components can be combined for individual applications.

Converters and inverters

The SIMOVERT MASTERDRIVES are available as:

- converters for connection to a 3-phase AC system.
- inverters for connection to DC buses which are supplied with power by rectifier or rectifier/regenerative units.

The system of components enables a uniform layout, irrespective of whether converters or inverters are used. The components can be installed side by side in almost any combination, even if they are different in size, enabling considerable space savings to be made.

As system modules, they can be used to obtain the right solution to match any drive task, whether single or multi-motor.

The SIMOVERT MASTERDRIVES converter series covers a power output ranging from 0.75 HP to 3000 HP (0.55 kW to 2300 kW) (see Fig. 2/1), with engineered cabinets up to 8000 HP (6000 kW).

The units have a uniform connection system: the line-voltage and DC link terminals are located on top and the motor terminals at the bottom.

The modular and uniform design of the electronic options enables optimized matching to all drive requirements with regard to both technology and communication.

Easy handling and installation and a high level of uniformity were essential factors in the development of the SIMOVERT MASTERDRIVES. This is demonstrated by the standardized housings, mounting and connection levels, as well as by the connections to signal and bus cables.

The SIMOVERT MASTERDRIVES are available as Compact PLUS units, compact units, chassis units and as cabinet units.

- Compact PLUS units are the specialists for limited space conditions. The "BOOKSIZE" format in IP20 degree of protection and the ideal connection system of the units makes the design of extremely compact multi-motor drives possible. Compact PLUS units can be mounted into 12-inch (300 mm) deep cabinets.
- Compact units are designed in the space-saving "BOOKSIZE" format with IP20 degree of protection . The units are simply hung from a standard DIN G rail and secured at the bottom of the cabinet with a screw fastening. Compact units can be mounted into 16-inch (400 mm) deep cabinets.
- Chassis units are designed with IP00 degree of protection. The covers conform with the safety regulations to DIN VDE 0113, Part 5 and DIN VDE 0106, Part 100 (VBG 4). IP20 degree of protection can also be achieved with an optional enclosure kit.

The Compact PLUS units as well as the compact and chassis units can be installed without any space between them.

- Cabinet units are supplied as converters with NEMA 1 degree of protection as standard. Cabinets with higher degrees of protection are also available (see Section 4). The converter cabinet units are ready-to-connect cabinets for single and group drives with options available for every possible application.

Designs available:

- Single-quadrant operation, 6/12 pulse, line-commutated
- Four-quadrant operation, 6-pulse, line-commutated
- Four-quadrant operation, self-commutated with Active Front End.

Rectifier units and rectifier/regenerative units

Types of DC voltage supply units

There are two types of line-commutated DC supply units for supplying one or more inverters:

- The rectifier unit is a 6-pulse rectifier bridge with pre-charging circuit and enables the flow of energy from the power system to the DC voltage bus (single-quadrant operation).

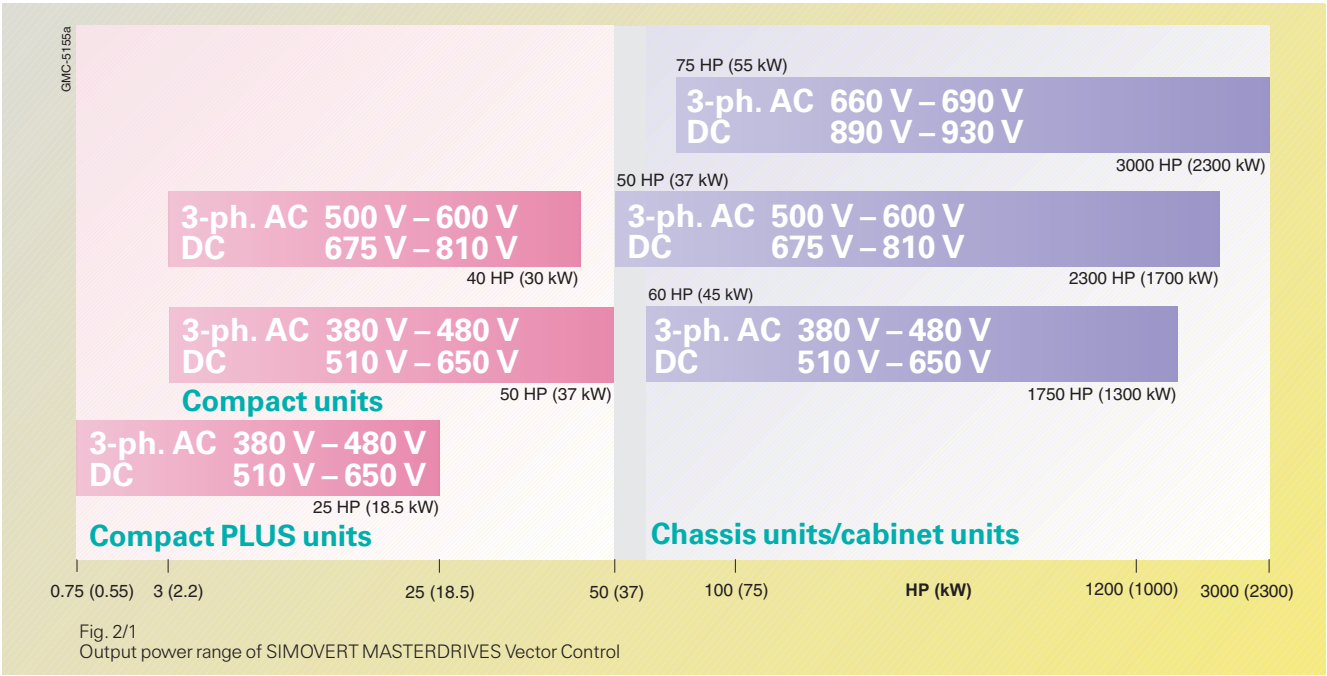


Fig. 2/1
Output power range of SIMOVERT MASTERDRIVES Vector Control

- The rectifier/regenerative unit consists of two anti-parallel 6-pulse thyristor bridges and enables the flow of energy in both directions, i.e. energy can be fed back into the power system (4-quadrant operation). The regenerating bridge is connected via an autotransformer (option).

12-pulse operation

Converters for 12-pulse operation are supplied by two parallel-connected rectifier or rectifier/regenerative units with the same output rating.

They are connected to the supply via a three-winding transformer with two secondary windings electrically displaced by 30 °. In this way, system disturbances are considerably reduced. The relevant harmonic currents of the fifth and seventh order are almost eliminated when compared to 6-pulse operation.

Optimum power infeed is ensured by the self-commutated, AFE (Active Front End) unit. Its core components are an inverter with a CUSA control unit and it generates a regulated DC voltage from a three-phase supply. On the three-phase side, rapid vector control subordinate to this DC voltage control impresses an almost sinusoidal current towards the supply so that, with the help of the line-side clean power filter, system disturbances are kept to a minimum. Vector control also enables power factor ($\cos \varphi$) setting and enabling reactive power compensation as well, whereby the drive's power requirement has priority. A bigger advantage is that, due to the underlying principle of this method, inverter shoot-through with fuse tripping cannot occur when there is a power failure, even during regenerative operation.

Single-quadrant operation, four-quadrant operation

Units for single-quadrant operation can only work in motoring mode. For regenerative mode, a braking unit/braking resistor is necessary.

Units for four-quadrant operation can return regenerative energy to the three-phase supply. This may be necessary, for example, when drives with a large rotating mass have to be braked frequently or rapidly.

System components

In addition to the converter, inverter and rectifier basic units, the system components enable tailor-made solutions to meet the drive requirements.

The system components can be broken down as follows:

- Overcurrent protector units (OCP) for rectifier/regenerative units

  In the case of line-commutating rectifier/regenerative units, the occurrence of undervoltages or voltage dips can cause the inverter to stall and the fuse to trip during regenerative mode. This can mean that the equipment may have to be shut down for a longer period.

  In order to avoid this, the overcurrent protector unit (OCP) can be used in combination with the line-commutated rectifier/regenerative unit (R/R unit) for four-quadrant operation. It prevents fuse tripping by triggering an IGBT in the DC link so that the IGBT cuts off the power. This is of particular advantage in the case of large group drives.

  As soon as the fault has been acknowledged, the equipment is ready for operation.

- Braking units and braking resistors
- Electronic options e.g. technology, communication and interface boards
- Other system components such as switching and protection devices, line reactors and output reactors and radio-interference suppression filters.

Control functions

Control types

The SIMOVERT MASTERDRIVES Vector Control standard software contains two principal control types:

- Frequency control by means of the *V/f*-characteristic curve
  with or without speed feedback and for textile applications. Frequency control is suitable for simple applications and for high level synchronism within group drives.
- Vector control (field-oriented control)
  for dynamic applications in the form of frequency control (without encoder) or speed/torque control (with encoder). The vector control method achieves a dynamic performance which is comparable to that of a DC drive. This is based on precise modeling of the motor and two current components which influence the flux and the torque with a control frequency of 2.5 kHz. Using this vector control method, torque setpoints can be held and limited.

  In the 1:10 speed range, the field-oriented control system of SIMOVERT MASTERDRIVES Vector Control does not require a speed encoder and is largely independent of motor parameters.

The following uses of SIMOVERT MASTERDRIVES Vector Control require a speed encoder:

- High dynamic performance requirements
- Torque control in the control range > 1:10
- Low speeds
- Maximum speed accuracy.

The different types of control are described in detail in Section 6.

Software functions

The basic software contains a wide range of standard functions. These functions provide maximum user-friendliness regarding operator control and the highest degree of flexibility (setpoint selection, changeover between data sets, etc.). They also ensure universal operating conditions and a high level of operational safety (automatic restart, flying restart, DC injection braking, synchronization between converters, wobble generator, motor brake control, etc.).

These functions are described in Section 6.

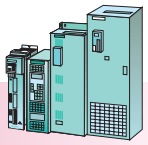
Free function blocks

Using the free function blocks contained in the basic software, the drives can be adapted to the most varied of applications. Simple control systems can thus be created and technology requirements can be dealt with in a decentralized manner.

The function blocks available in SIMOVERT MASTERDRIVES Vector Control can be classified as follows:

- Control blocks
- Signal conversion blocks
- Computing blocks
- Logic blocks
- Signalling blocks
- Timers.

For a detailed description, see Section 6.



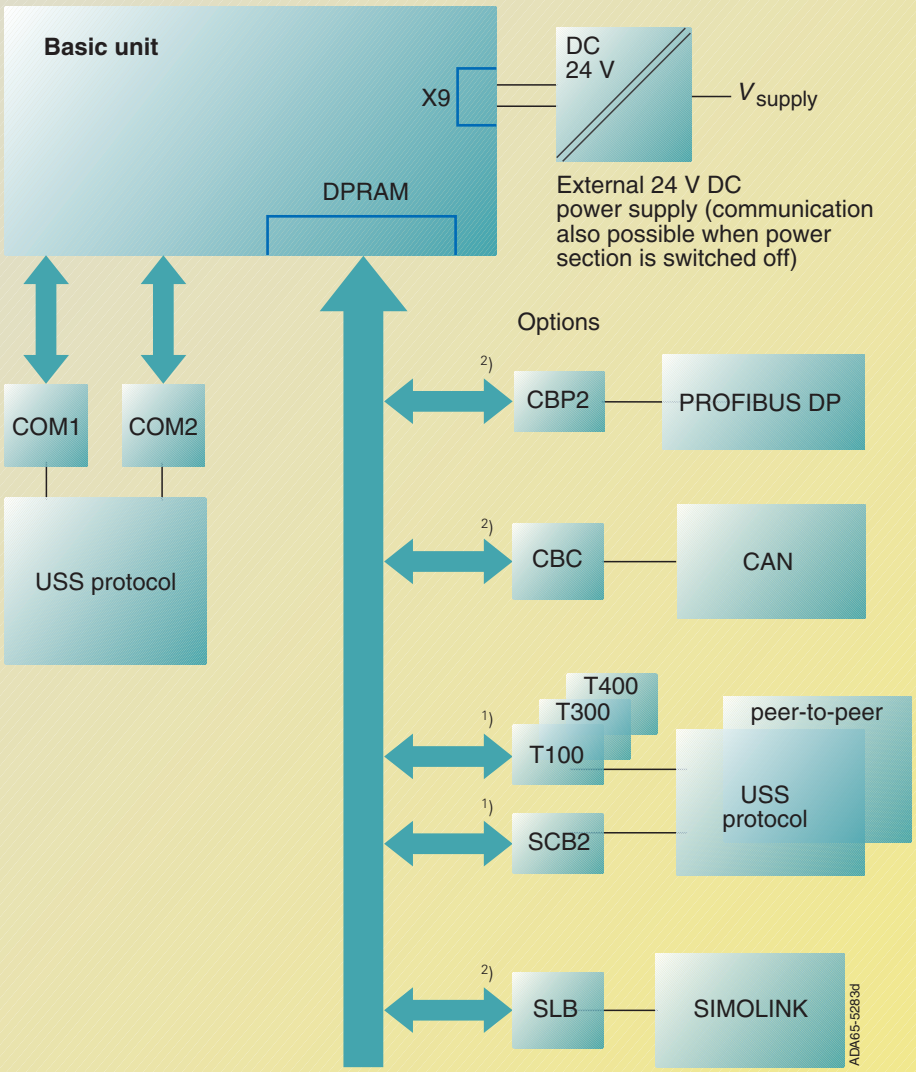


Fig. 2/2
Overview of interfaces

1) Not available for Compact PLUS units.
2) Only two option boards may be used at one time with the Compact PLUS units.

The SIMOVERT MASTERDRIVES Vector Control units have several serial interfaces for communicating with, e.g. higher-level PLC systems, PCs etc. The interfaces can be classified as follows:

- Basic version:
  Two serial interfaces, COM1 and COM2, as standard on the basic unit
- Options:
  Communication and interface boards for different transmission protocols or bus systems.

Interfaces on the basic unit

Compact and chassis units

- Serial interface 1 (COM1) is located on the PMU operator control and parameterizing unit. It is a 9-pole SUB D socket (X300) as an RS485 or RS232 interface (see page 2/7).
- Serial interface 2 (COM2) is located on the X101 control terminal strip of the CUVC board as an RS485 interface (see page 2/8).

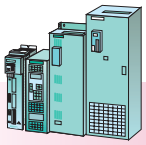
Compact PLUS units

COM1 and COM2 are connected to the X103 SUB D socket. COM2 is also connected to the X100 connector. COM1 is designed as an RS232 interface and COM2 is designed as an RS485 interface.

Both serial interfaces of the basic unit work with the USS® protocol, are bus-capable (with up to 32 nodes) and enable maximum data transfer rates of 38.4 kbit/s.

USS protocol

The USS protocol is a Siemens-specific transmission protocol for drive technology and is implemented as a standard protocol on all interfaces of the basic units. The USS protocol enables bus operation of up to a maximum of 32 nodes on the basis of the RS485 transmission system.



Data is exchanged in accordance with the master-slave access procedure. The USS protocol only allows mono-master operation. This means one master and 31 slaves. Masters can be higher-level systems such as the SIMATIC S5, S7 and PCs or non-Siemens automation systems. SIMOVERT MASTERDRIVES are always slaves.

From an application point of view, the USS protocol is used for the following two applications:

- Data transmission between a PC and one or several MASTERDRIVES for start-up and parameterization of the units using the Drive ES and DriveMonitor engineering tools. The user-friendly operator control panel OP1S also communicates to the SIMOVERT MASTERDRIVES using the USS protocol. COM1 is used for linking up to the PC or the OP1S.
- Communication via the USS protocol to higher-level automation systems such as the SIMATIC S5, SIMATIC S7 or to non-Siemens systems. For this link, COM2 is usually used.

Parallel operation of COM1 and COM2 is possible without any restrictions.

See also documentation: "SIMOVERT MASTERDRIVES, Serial interface with USS protocol," Order No.: 6SE7087-6CX87-4KB0.

Options: Communication and interface boards

The PROFIBUS DP, DeviceNet and CAN serial fieldbus systems can be linked up by means of the communication boards CBP (Communication Board PROFIBUS DP), CBD (Communication Board DeviceNet) or CBC (Communication Board CAN).

Fast data exchange between the MASTERDRIVES units is possible by means of the fiber-optic SLB (SIMOLINK Board) communication board.

In addition to this, the SCB1 and SCB2 interface boards (Serial Communication Board) are available for the USS protocol and peer-to-peer protocol.

The SCB1 and SCB2 are only available for compact and chassis units (not available for Compact PLUS units).

The communication and interface boards can be integrated as options into the electronics box. How the option boards may be installed and combined in the electronics box is described in Section 6 „Integrating the options in the electronics box".

SIMOLINK

SIMOLINK (Siemens Motion Link) is a company-specific development for Siemens drive technology.

SIMOLINK is mainly used for extremely fast and strictly cyclical exchange of process data (control information, setpoints, actual values and additional information) between individual MASTERDRIVES units or between MASTERDRIVES units and a higher-level control system with synchronization of all connected nodes to a common system clock pulse.

SIMOLINK is a digital, serial data transmission protocol using fiber-optic cables as the transmission medium (plastic or glass).

Peer-to-peer protocol

The peer-to-peer protocol is also a company-specific addition to Siemens drive technology.

The difference between peer-to-peer and SIMOLINK is that peer-to-peer does not allow synchronization of the drives. The transmission speed is also considerably slower than with SIMOLINK.

A peer-to-peer connection means a "connection between equal partners". In contrast to the classic master-slave bus systems (e.g. PROFIBUS DP), one and the same converter can be both the master (setpoint source) and the slave (setpoint sink).

Peer-to-peer connection is via the RS485 interface. A special high-speed protocol is used requiring little management. The transmission rate is up to 187.5 kbit/s.

Each drive can receive setpoints and actual values from the preceding drive via its peer receive terminal and transmit data to the subsequent drive via its transmit terminal.

Transmission protocols and fieldbus systems

PROFIBUS DP

For Siemens drive technology, PROFIBUS DP is the standard bus system for all field applications.

PROFIBUS is the world market leader in field-bus technology, and enables cyclical data exchange between the MASTERDRIVES units and higher-level systems such as the SIMATIC S7.

In addition to process control data, PROFIBUS DP also carries information for parameterization and diagnosis of the drives.

The extended functionality of Motion Control with PROFIBUS DP (e.g. slave-to-slave communication between drives) is supported by the CBP2 board.

CBD DeviceNet

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.

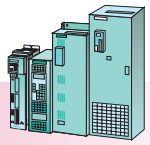
In contrast, DeviceNet I/O Message Connections provide communication paths for special purposes between the transmitting and receiving units. Application-specific I/O data are transferred via an I/O connection. The significance of the data within an "I/O message" is determined by the associated "Connection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

CAN according to CiA

The CAN protocol (Controller Area Network) is specified in the international proposal ISO DIS 11898 where, however, only the electrical parts of the physical layer and the data link layer (Layers 1 and 2 in the ISO/OSI layers reference model) are specified. In their recommendation DS 102-1, the CiA (CAN in Automation, an international association of users and manufacturers) defined the bus interface and the bus medium for use as an industrial fieldbus.

The specifications in ISO-DIS 11898 and in DS 102-1 are complied with by the CBC communication board.

The CBC communication board only supports CAN Layers 1 and 2. Higher-level additional communication specifications of the different user organizations such as CAN open of the CiA are not supported.



Operator control and visualization

SIMOVERT MASTERDRIVES Compact PLUS, compact, chassis and cabinet type units have a unified operator control and visualization concept.

The converters, inverters and rectifier units can either be controlled and visualized from the unit itself or externally:

From the unit itself

- via the PMU operator control and parameterizing unit available in the standard version
- the optional OP1S user-friendly operator control panel
- or a PC with Drive ES or DriveMonitor, see Fig. 2/3.

Externally via

- the control terminal strip
- the COM1 or COM2 base unit serial interfaces
- the communication boards and/or the technology boards (options), see Fig. 2/4.

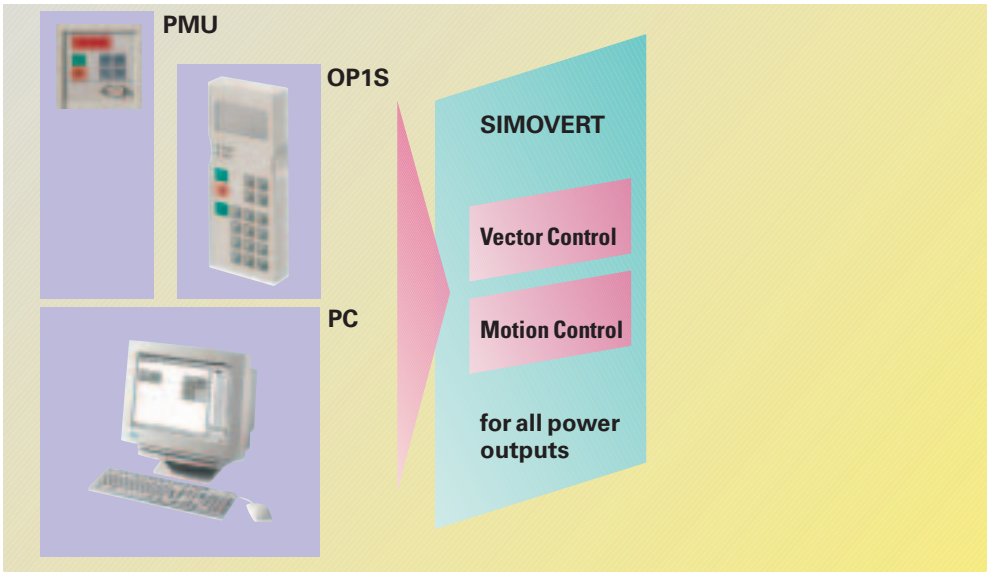


Fig. 2/3
Operator control and visualization from the unit

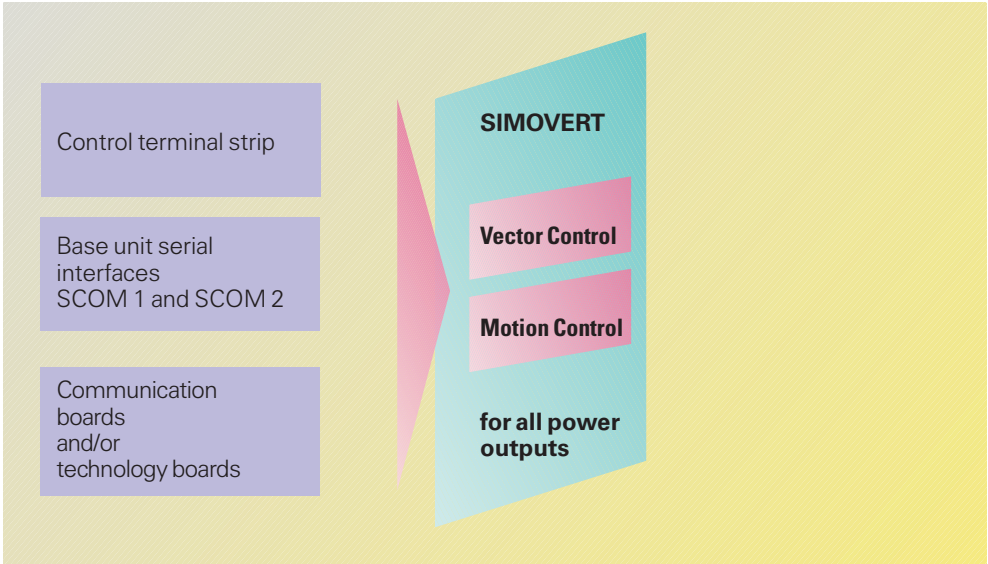
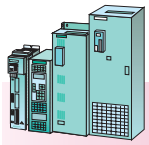


Fig. 2/4
External operator control and visualization



PMU operator control and parameterizing unit

The parameterizing unit available in the standard version of all the units is mounted on the front panel or, in the case of chassis type units, on a bracket located in front of the electronics box.

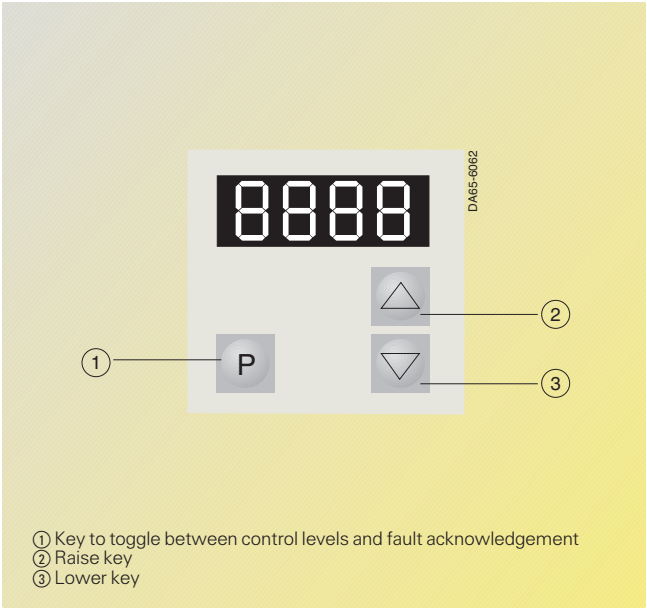
The operator control and parameterizing unit includes the following functions:

- Start-up of converter, inverter, rectifier unit
- Operator control: ON/OFF (not for Compact PLUS units); raise/lower setpoint; clockwise/counter-clockwise rotation (not for Compact PLUS units)
- Display of setpoints and actual values
- Displaying and changing parameters
- Display of converter status
- Display of alarm and fault messages.

The serial interface 1 (COM1) as a 9-pin SUB D socket (X300) is provided on the operator control and parameterizing unit of the compact and chassis units as a RS485 or RS232 interface.

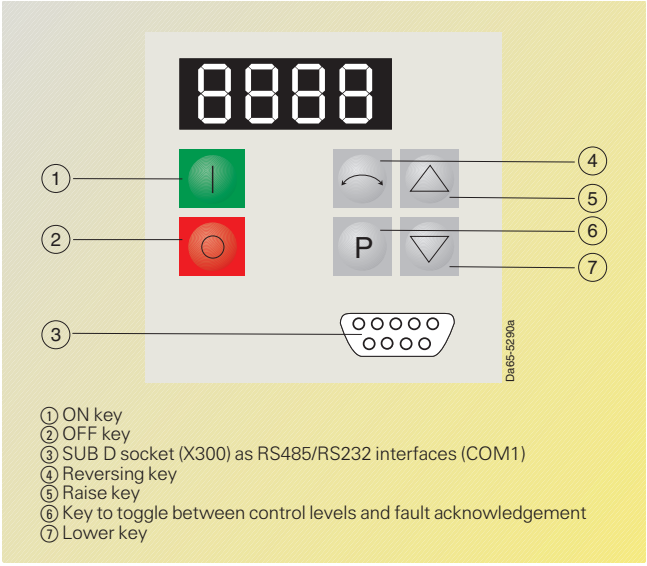
The optional OP1S user-friendly operator control panel or a PC with operator control software (Drive ES or DriveMonitor) can be connected to this interface. (Refer to Fig. 2/7 and the table below).

Compact PLUS units use the SUB D socket X103 for connecting a PC. The user-friendly operator control panel OP1S can also be connected to the X103 but cannot be mechanically installed to the front cover of the Compact PLUS converters and inverters. The OP1S can only be mounted on the front cover of the Compact PLUS rectifier units.



① Key to toggle between control levels and fault acknowledgement
② Raise key
③ Lower key

Fig. 2/5
PMU operator control and parameterizing unit for Compact PLUS units



① ON key
② OFF key
③ SUB D socket (X300) as RS485/RS232 interfaces (COM1)
④ Reversing key
⑤ Raise key
⑥ Key to toggle between control levels and fault acknowledgement
⑦ Lower key

Fig. 2/6
PMU operator control and parameterization unit for compact and chassis units

Pin assignment of the SUB D socket X300 or X103

Pin	Function, information
1	Not assigned
2	Receive line RS232 (V24)
3	Transmit and receive line, RS485 standard, two-wire, positive differential input/output
4	Boot (control signal for software update)
5	Reference potential supply voltage (M5)
6	Supply voltage, 5 V (P5)
7	Transmit line RS232 (V24)
8	Transmit and receive line RS485 standard, two-wire, negative differential input/output
9	Reference potential for RS232 or RS485 interface (with reactor)

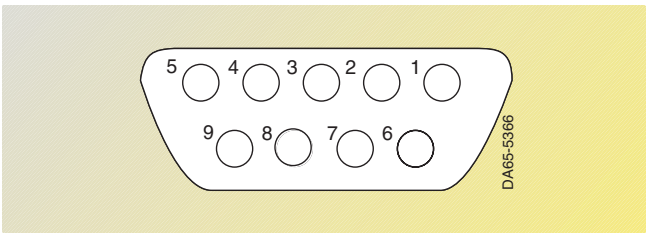
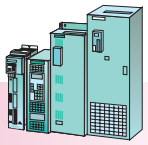


Fig. 2/7
Pin assignment of the SUB D socket X300 or X103



2

OP1S user-friendly operator control panel

The OP1S operator control panel is an optional input/output device which can be used for parameterizing the units. Parameterization is menu-guided and is performed by selecting the parameter number and then entering the parameter value. Plain-text displays greatly facilitate parameterization.

Parameter and parameter value descriptions, as well as text displays in English, German, Spanish, French and Italian, are included in the standard version.

The OP1S is capable of permanently storing parameter sets. It can therefore be used for archiving parameter settings and for transferring parameter sets from one unit to another.
Its storage capacity is sufficient to store 5 CUVC board parameter sets. It is not possible to store data sets of the technology boards (e.g. T100, T300).

On the rear of the OP1S is a 9-pin SUB D connector via which power is supplied and communication with the connected units takes place.

The OP1S operator control panel may be plugged directly onto the SUB D socket of the PMU operator control and parameterizing unit and screwed into the front panel. The OP1S operator panel can also be used as a remote-control device. The cable between the PMU and the OP1S must not exceed 164 ft (50 m). If longer than 16 ft (5 m), a 5 V voltage supply with a current capability of at least 400 mA must be included on the OP1S end as shown in Fig. 2/10.

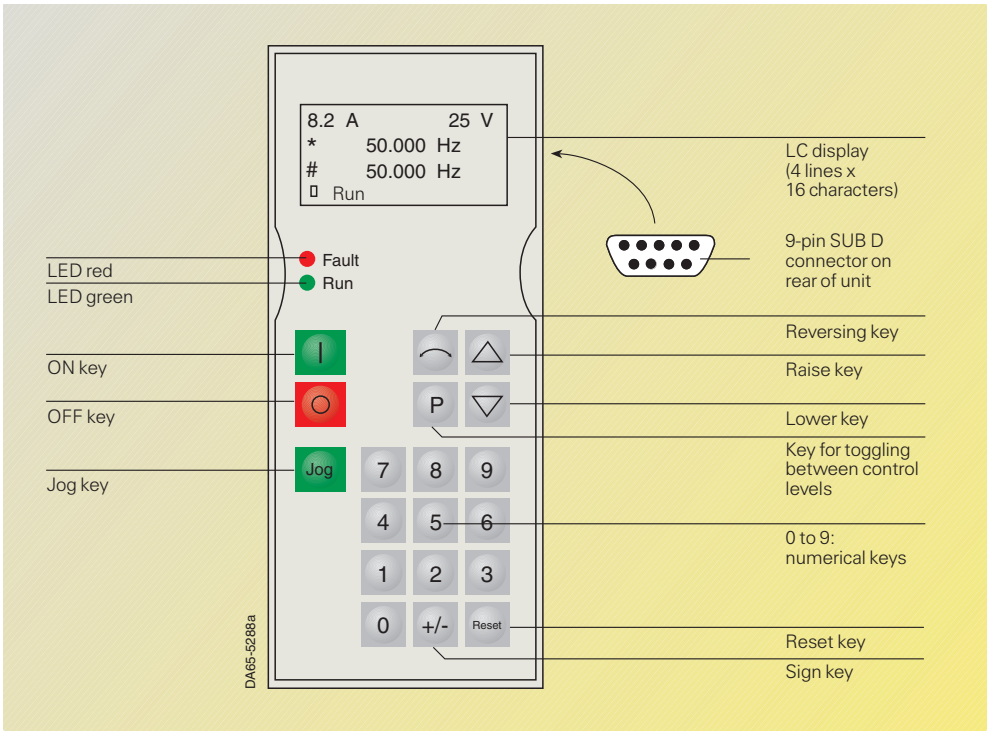


Fig. 2/8
View of the OP1S

OP1S connections via RS485	Pin	Designation	Description
	1		
	2		
	3	RS485 P	Data via RS485 interface
	4		
	5	M 5	Ground
	6	P 5	5 V voltage supply
	7		
	8	PS485 N	Data via RS485 interface
	9		Reference potential

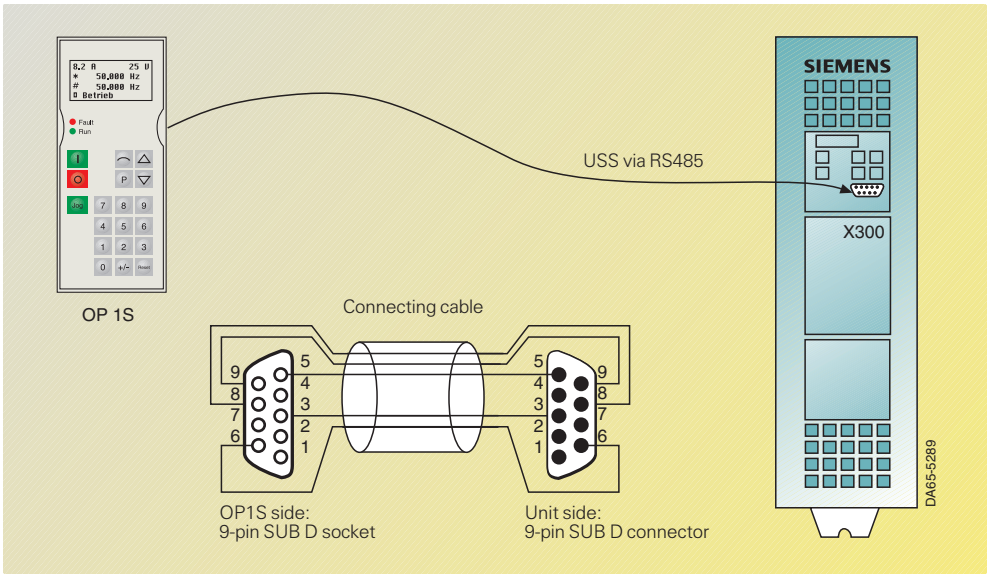


Fig. 2/9
OP1S point-to-point connection up to a cable length of 16 ft (5 m)

The OP1S and the unit to be operated communicate with each other via a serial interface (RS485) using the USS protocol (see Fig. 2/9). During communication, the OP1S assumes the function of a master and the connected units of slaves.

The OP1S can be operated at transfer speeds of 9.6 kbit/s and 19.2 kbit/s and is capable of communicating with up to 31 slaves (address 1 to 31). It can be used in a point-to-point link (operator control of one unit) or with a bus configuration (operator control of several units).

Control terminal strip

All the necessary operating and monitoring functions for SIMOVERT MASTERDRIVES are accessible via the control terminal strip:

- Control commands, e.g. ON/OFF, inverter enable, ramp-function generator enable, setpoint enable, fixed setpoint selection, acknowledgement, etc.
- Analog setpoint inputs, e.g. speed setpoint, torque setpoint

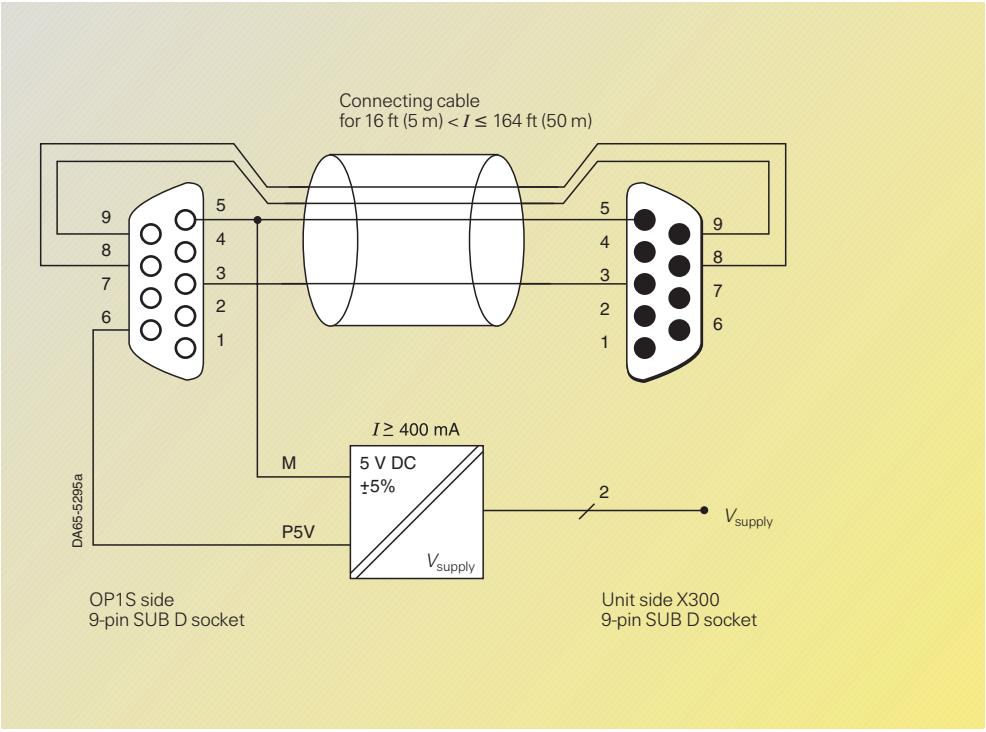


Fig. 2/10
OP1S in a point-to-point link with up to 164 ft (50 m) of cable

- Analog outputs of internally calculated quantities, e.g. motor current, speed, motor voltage, frequency
- Status messages, e.g. ready, run, fault.

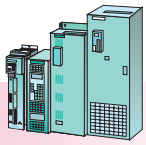
For the assignment of the control terminal strips: refer to page 6/34 and the following.

External 24 V voltage supply and main contactor control

The electronics boards obtain their power supply from the power section (DC link) via a switch-mode power supply of the SIMOVERT MASTERDRIVES. If the DC link is discharged, power can no longer be supplied in this way. If the electronics boards are to be active even when the power section has been switched off, they must be supplied with 24 V DC via the X9 control terminal strip (see page 6/44).

The Compact PLUS inverters must always be supplied externally with 24 V DC.

SIMOVERT MASTERDRIVES have a parameterizable binary output. This output is pre-assigned to control an external main contactor via the ON command of the SIMOVERT MASTERDRIVES. In conjunction with the main contactor, the electronics boards must be supplied with 24 V DC via the X9 control terminal strip.



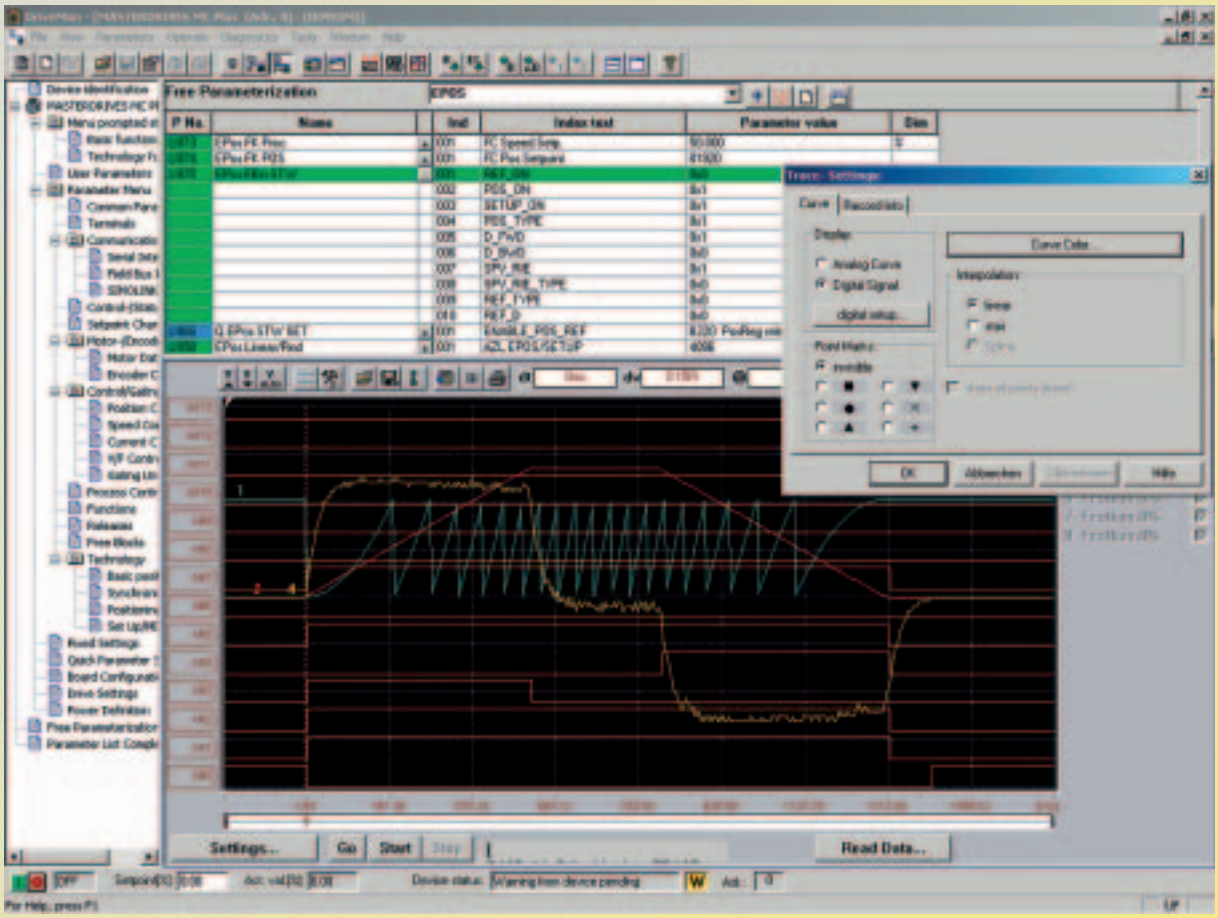


Fig. 2/11
Trace Function with DriveMonitor

The up-to-date version of DriveMonitor on CD-ROM (Windows) is part of the standard scope of supply

DriveMonitor performance characteristics

- Setting and monitoring of all basic-unit parameters via individually creatable tables
- Reading, writing, managing, printing and comparison of parameter sets
- Handling of process data (control commands, setpoints)
- Diagnostics (faults, alarms, fault memory)
- Offline and online operation
- Parameterization of the T100, T300 and T400 technology boards
- Graphic display of the trace-memory function for analysis
- Menu-assisted parameterization during commissioning.

PC configuration (hardware and software equipment)

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

For stand-alone operation (USS)

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

Link-up to automation systems

SIMOVERT MASTERDRIVES can easily be linked up to any automation system, such as a PLC or an industrial PC (Fig. 2/12). The automation system controls the drives according to the requirements of the process. To do this, control data and setpoints are cyclically transmitted to the drives. The latter transmit status data and actual values back to the automation system. Even process-related parameter adaption of the drives is possible (e.g. in the case of a change in recipe).

The fieldbus system is responsible for transporting the information. This is preferably PROFIBUS DP, an open fieldbus standardized in EN 50 170 and supported by many automation systems.

An alternative, which is especially cost-effective and easy to install in any automation system, is the USS protocol.

Finally, links to other fieldbus systems (e.g. CAN) round off the communication possibilities of SIMOVERT MASTERDRIVES.

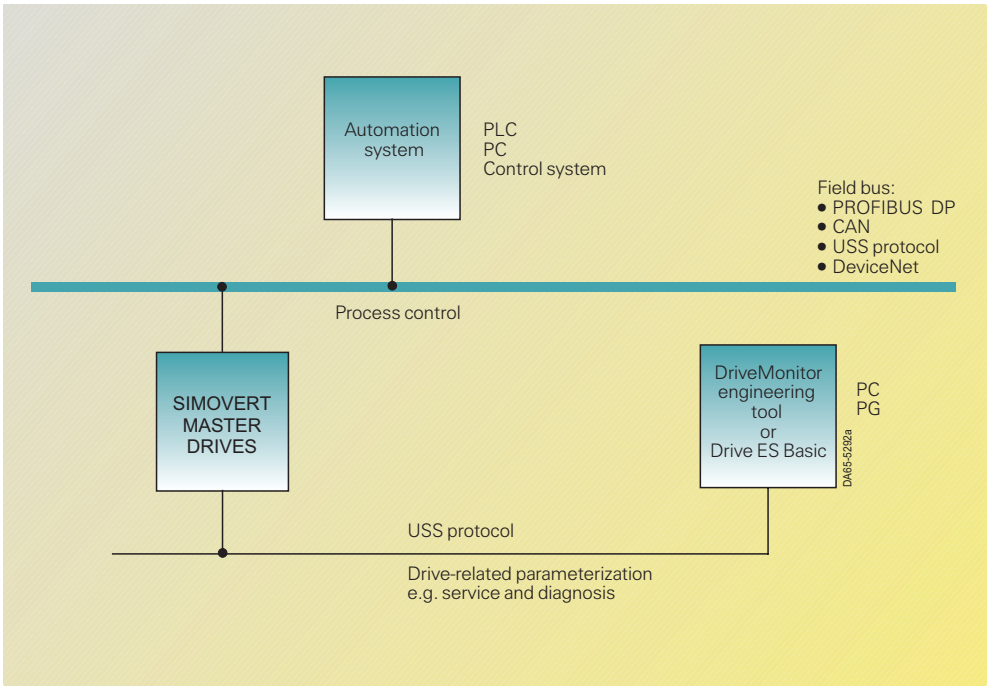
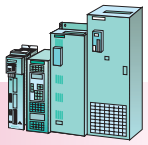


Fig. 2/12
Link between SIMOVERT MASTERDRIVES and a higher-level automation system

In order to ensure that the drive can perform its process-specific task, its parameters must be individually adapted in the start-up phase. The DriveMonitor and Drive ES engineering tools are available for this purpose for the operating systems Windows 98/ME/NT/2000 and XP Professional.

DriveMonitor is supplied free of charge with each drive. Both programs guide the commissioning engineer in a structured manner through the unit parameters and during operation act as service and diagnostic tools.

While only the bus-capable USS protocol is used for communication with the DriveMonitor units, Drive ES Basic also works directly via PROFIBUS DP.



Integrating drives in SIMATIC S7 with Drive ES

The engineering and process control of SIMOVERT MASTERDRIVES in combination with a SIMATIC S7 and STEP® 7 ≥ V 5.0 is particularly user-friendly and convenient.

If the optional Software Drive ES (Drive Engineering System) is installed on the same software platform (PC or PG), then the engineering of the complete system can take place via the STEP 7 Manager. Data transportation is handled by the S7 system bus PROFIBUS DP (see Fig. 2/13).

The optional software Drive ES combines the previously individual steps of configuring (hardware configuring, parameter assignment, technology functions) and the control functions between SIMATIC S7 and SIMOVERT MASTERDRIVES in one software tool.

Fully integrated in the STEP 7 Manager, Drive ES consists of four packages with different functions.

Drive ES Basic is used for convenient start-up and for servicing and diagnostics during plant operation. The great advantage compared to DriveMonitor is in the system-wide data management

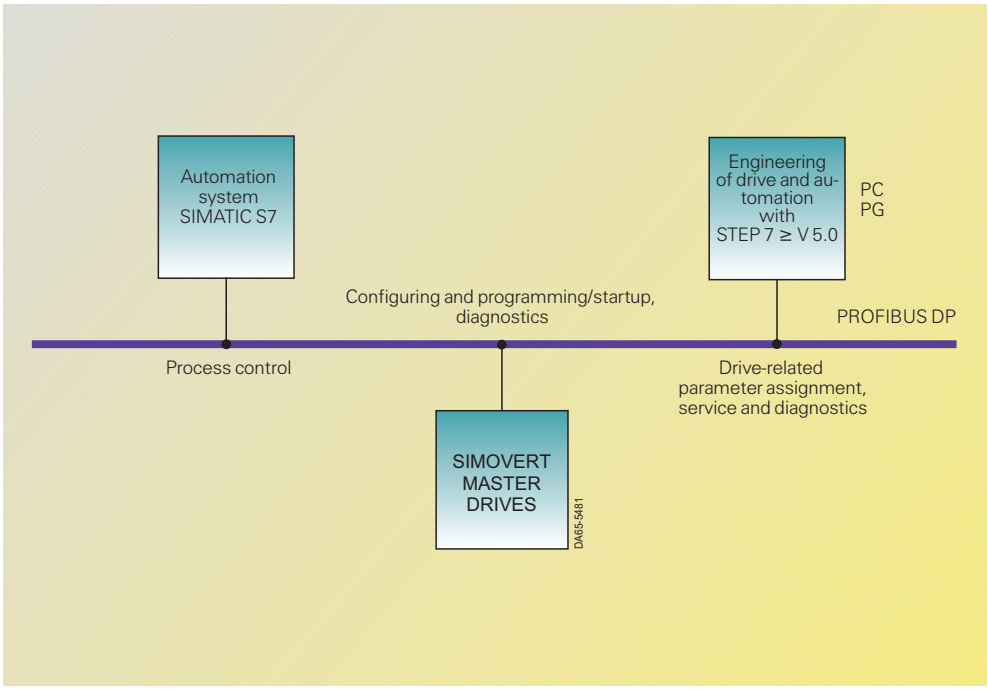


Fig. 2/13
Integration of SIMOVERT MASTERDRIVES in the SIMATIC S7 automation system

of drive and automation data of a project in the STEP 7 Manager, as well as the use of the complete communication possibilities of SIMATIC S7. This includes e.g. the communication via ROUTING as well as the use of the SIMATIC teleservice.

The functions provided in SIMOVERT MASTERDRIVES (basic unit, free block and technology functions) can be graphically configured using Drive ES Graphic together with the SIMATIC tool CFC (Continuous Function Chart).

Drive ES SIMATIC makes a whole library of function blocks available. The communication between SIMATIC S7 and Siemens drives (e.g. SIMOVERT MASTERDRIVES) can then be configured using preconfigured CPU function blocks and simple parameter assignment. Furthermore, incorporation of drives with PROFIBUS DP interface via Drive ES PCS7 in SIMATIC PCS7 is possible.

In joint operation with the PROFIBUS DP communication board CBP2, Drive ES supports additional functionalities such as clock synchronization of drives, slave-to-slave communication between drives and flexible configuration of the cyclic messages (see page 6/56).

Engineering package Drive ES

With Drive ES (*D*rive *E*ngineering *S*ystem) the SIMOVERT MASTERDRIVES series may be fully integrated into the SIMATIC automation world with regard to communication, configuring and data management.

Drive ES consists of four individually available software packages: Drive ES Basic, Drive ES Graphic, Drive ES SIMATIC and Drive ES PCS7.

- Drive ES Basic is the basic software for assigning parameters to all drives online and offline, and the basis for Drive ES Graphic software.
- Drive ES Graphic is the software for the graphical online and offline configuring of BICO function blocks. Requirements are an installed Drive ES Basic and an installed SIMATIC CFC ≥ V 5.1 (graphic programming tool, see Catalog ST 70, Industrial software).
- Drive ES SIMATIC requires STEP 7 to be installed. It provides its own SIMATIC block library, allowing simple and reliable programming of the PROFIBUS DP interface in the SIMATIC CPU for the drives.
- Drive ES PCS7 requires PCS7 to be installed, ≥ Version 5.0. Drive ES PCS7 provides a block library with function blocks for the drives and the associated faceplates for the operator station. It is therefore possible for an operator to control the drives from the PCS7 process control system.

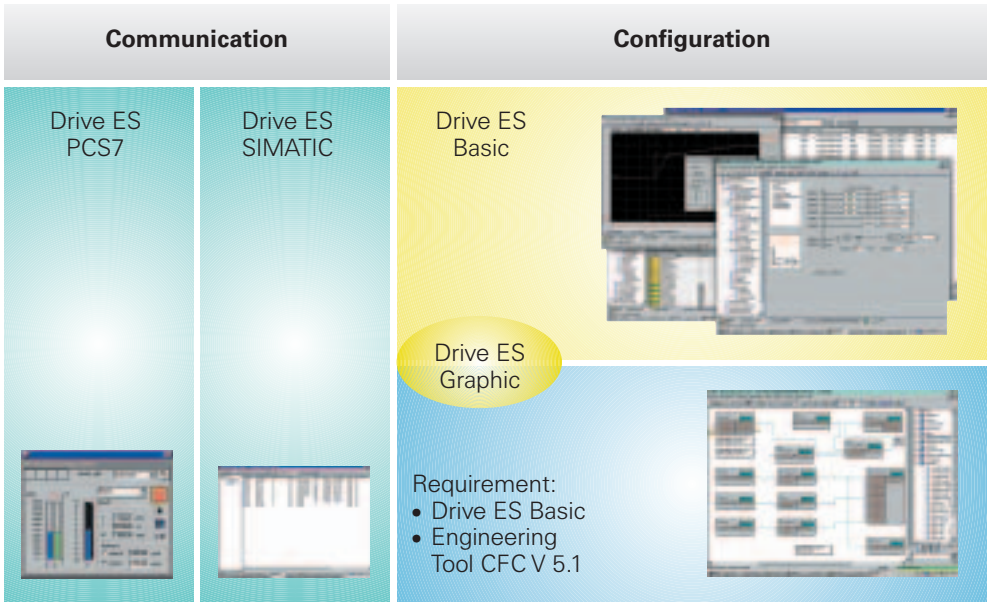


Fig. 2/14
Product structure Drive ES

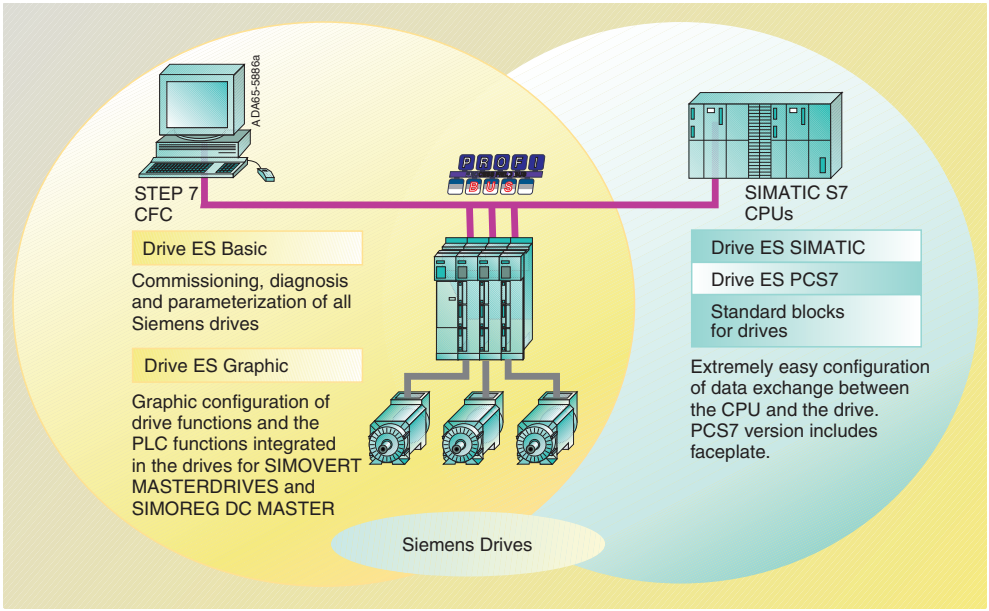
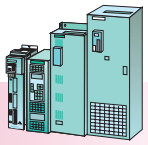


Fig. 2/15
Distribution of tasks for the Drive ES range



Drive ES Basic

- Drive ES is based on the user interface of the SIMATIC manager.
- Parameters and charts of drives are available in the SIMATIC manager (system-wide data management).
- Drive ES ensures the unique assignment of parameters and charts to a drive.
- Archiving of a SIMATIC project including drive data.
- Facility for using SIMATIC Teleservice (V 5).
- Communication via PROFIBUS DP or USS with the drive.

Functions

- Trace evaluation for SIMOVERT MASTERDRIVES.
- Reading out of the fault memory for SIMOVERT MASTERDRIVES.
- Upread and download of parameter sets (as a complete file or as difference file from factory setting).
- Free assembly and editing of parameter sets.
- Utilization of script files.
- Guided commissioning for SIMOVERT MASTERDRIVES.

Installation with STEP 7

Drive ES Basic can be installed as an option for STEP 7 ≥ V 5.0, becoming homogeneously integrated in the SIMATIC environment.

Installation without STEP 7

Drive ES Basic can also be installed without STEP 7, by providing its own drive manager (based on the SIMATIC manager).

Drive ES Graphic

- Function charts are saved drive specific in SIMATIC CFC format.
- Configuring of drive functions in BICO technology with SIMATIC CFC.
- Offline functionality.
- Test mode (online functionality) with Change connection, Change value, Activate block.
- Readback and reverse documentation.
- For SIMOVERT MASTERDRIVES vector control software version ≥ 3.2 and motion control software version ≥ 1.3.

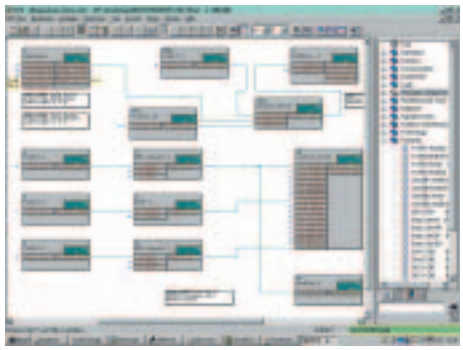


Fig. 2/16
Graphic programming with Drive ES Graphic and CFC

Drive ES SIMATIC

- Provides function blocks and examples of projects for the SIMATIC CPU which handle communication via PROFIBUS DP or USS with Siemens drives.
- Communication set-up via parameters as opposed to programming.

Features

- Blocks in STEP 7 design; symbolic addressing; function blocks with entity data, online help.
- Can be used in all SIMATIC programming and configuring environments such as LAD, CSF, STL, SCL, CFC.
- New block structure: modular individual functions for runtime-optimized programming.

Block functions

- Writing and reading of process data of freely configurable length and consistency.
- Cyclic and acyclic exchange of parameters, monitoring of communication, reading out of fault memory from SIMOVERT MASTERDRIVES.
- Parameter download via the CPU to the drive.

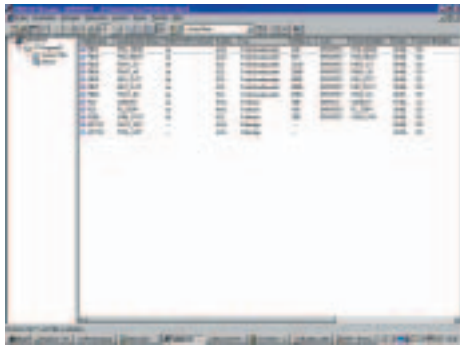


Fig. 2/17
Integrating drives into the STEP 7 manager

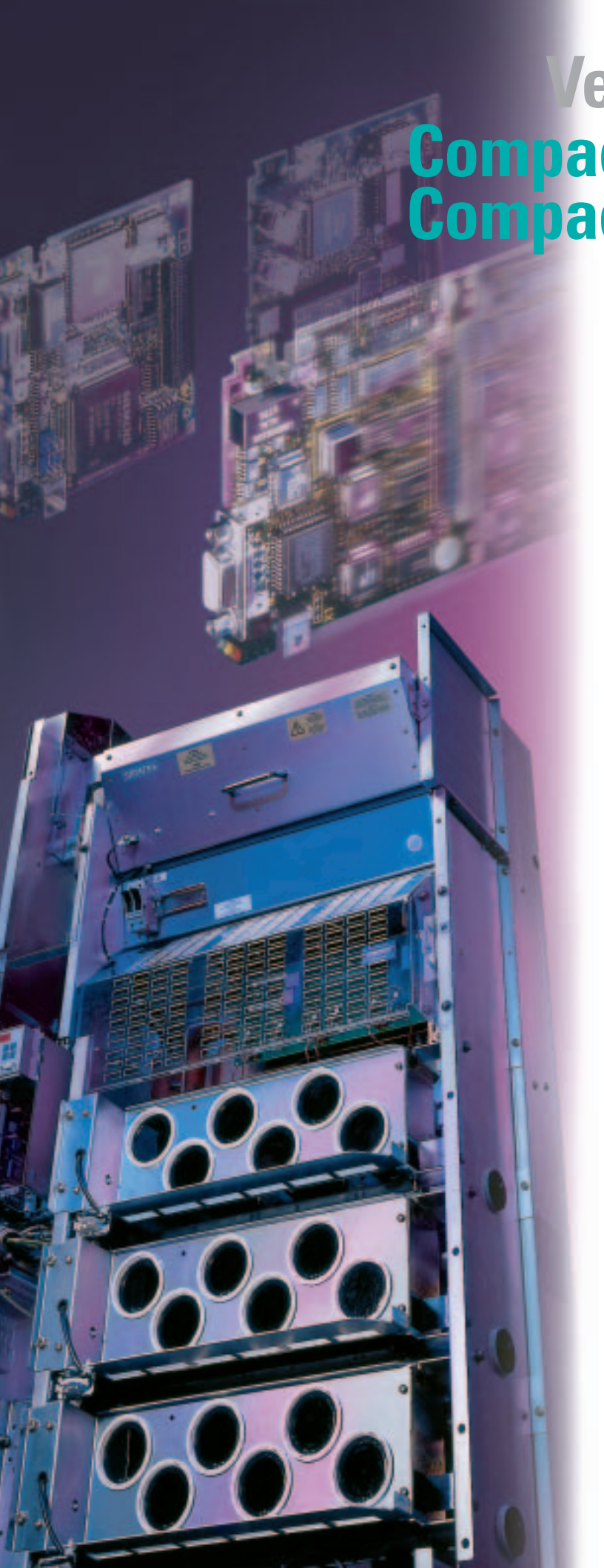
- Complete reparameterization after converter exchange at the push of a button from the CPU.

Drive ES PCS7

- Incorporates the drives with PROFIBUS DP interface in PCS7.
- Can be used from STEP 7 or PCS7 V 5 on.

Block functions

- Image and control blocks for incorporating drives in PCS7 (SIMOVERT MASTERDRIVES with speed interface).



Vector Control
Compact PLUS, Compact and Chassis Units

Fig. 3/1
Compact PLUS units

Fig. 3/2
Compact units

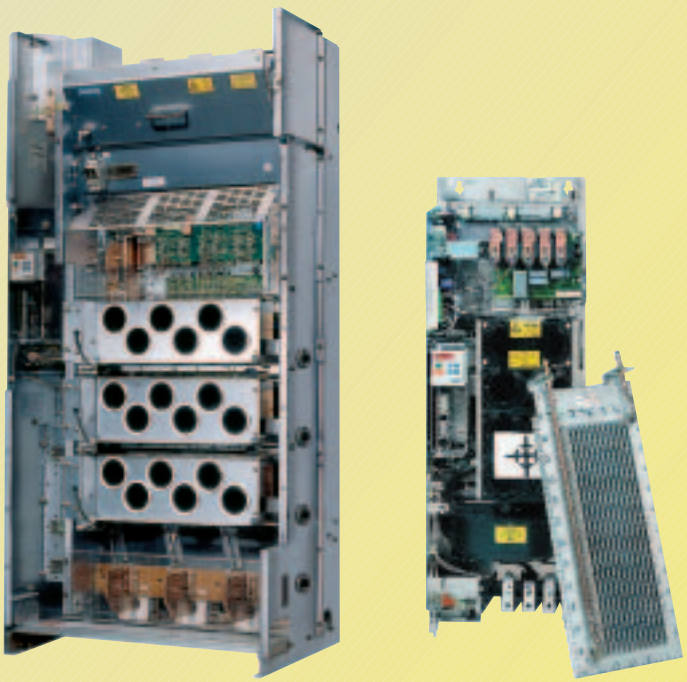
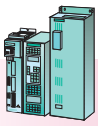


Fig. 3/3
Chassis units



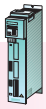
Converters, inverters, AFE inverters, rectifier units, rectifier/regenerative units and braking units

Cooling type	Forced ventilation with integral fan
Air-cooled Permissible ambient and cooling-medium temperature during operation	+32 °F (0 °C) to +104 °F (+40 °C) (reduction curves for +104 °F (+40 °C) < T < +122 °F (+50 °C), see page 6/3)
Water-cooled ● Cooling water inlet temperature ● Permissible ambient temperature during operation	 +41 °F (+5 °C) to 100.4 °F (+38 °C) +32 °F (0 °C) to +104 °F (+40 °C)
Permissible ambient temperature during storage and transport	–13 °F (–25 °C) to +158 °F (+70 °C)
Installation altitude	≤ 3282 ft (1000 m) above sea level (100 % load capability) > 3282 ft (1000 m) to 13126 ft (4000 m) above sea level (for reduction curves, see Section 6)
Humidity rating	Relative humidity ≤ 85 %, moisture condensation not permissible
Climatic category	Class 3K3 to EN 60 721-3-3
Environmental class	Class 3C2 to EN 60 721-3-3
Insulation	Pollution degree 2 to DIN VDE 0110-1 (HD 625. 1 S1: 1996), moisture condensation not permissible
Overvoltage category	Category III to DIN VDE 0110-1 (HD 625. 1 S1: 1996)
Degree of protection	To EN 60 529: Compact PLUS units: IP20; chassis units: IP00 (IP20 optional)
Protection class	Class I to EN 61 140
Shock protection	To DIN VDE 0106 Part 100 and BGV A2 (previously VBG 4)
Radio-interference suppression ● Standard ● Options	To EMC product standard EN 61 800-3 for variable-speed drives No radio-interference suppression Class B1 or Class A1 to EN 61 800-3
Additional information	The units are motor-side ground-fault protected, short-circuit-proof and may be operated under no-load conditions.
Paint finish	For indoor installation
Mechanical specifications ● during operation ● during transport	To EN 60 068-2-6 10 Hz to 58 Hz constant deflection 0.003 in (0.075 mm) 58 Hz to 500 Hz constant acceleration 32 ft/s² (9.8 m/s²) (1 g) 5 Hz to 9 Hz constant deflection 0.14 in (3.5 mm) 9 Hz to 500 Hz constant acceleration 32 ft/s² (9.8 m/s²) (1 g)

Approvals according to UL/CSA[1]	UL File No.	CSA File No.
● Converters and inverters	E 145 153	LR 21927
● Rectifier units and rectifier/regenerative units[2]	E 145 153	LR 21927
● Braking units and braking load resistors[2]	E 145 153	LR 21927
● Braking resistors for Compact PLUS units	E 233 422	210040 (Certificate 1185101)
● d*v*/d*t*- and sinusoidal filter[2]	E 145 153	LR 21927
● Radio-interference suppression filter type 6SE70 ...[2]	E 145 153	LR 21927
● Line commutating and output reactors (iron)	E 103 902	
● 3NE1 series fuses are	E 167 357	

1) UL and CSA approval is not valid for units and system components 3 AC 660 V – 690 V and 890 V – 930 V DC.

2) UL and CSA approval only in combination with SIMOVERT MASTERDRIVES converters or inverters.



Technical characteristics of the Compact PLUS units

The Compact PLUS units are available as complete stand-alone (AC to AC) drives referred to as converters as well as inverter drives (DC to AC) for connection to a common DC bus.

The converter has an integrated brake chopper. For regenerative mode, an external braking resistor is additionally required.

Additional Compact PLUS inverters can be connected to the converter via the DC link busbars. The total rating of the inverters to be connected can be up to the rating of the converter, e.g. a 5 HP converter can supply a 3 HP inverter and two 1 HP inverters.

A switch-mode power supply unit fed from the DC link supplies the control electronics of the converter. The control electronics can also be supplied with 24 V DC from an external source via the X9 connector strip, e.g. in order to maintain communication with a higher-level control unit when the power section is switched off (DC link discharged).

The switch-mode power supply unit of a converter can also supply the power for the control electronics of an additional two inverters.

The control electronics of the inverters are always supplied with 24 V DC from an external source via the X100 connector strip. The position of the X100 connector strip is the same for all units and enables simple wiring of the 24 DC V power supply.

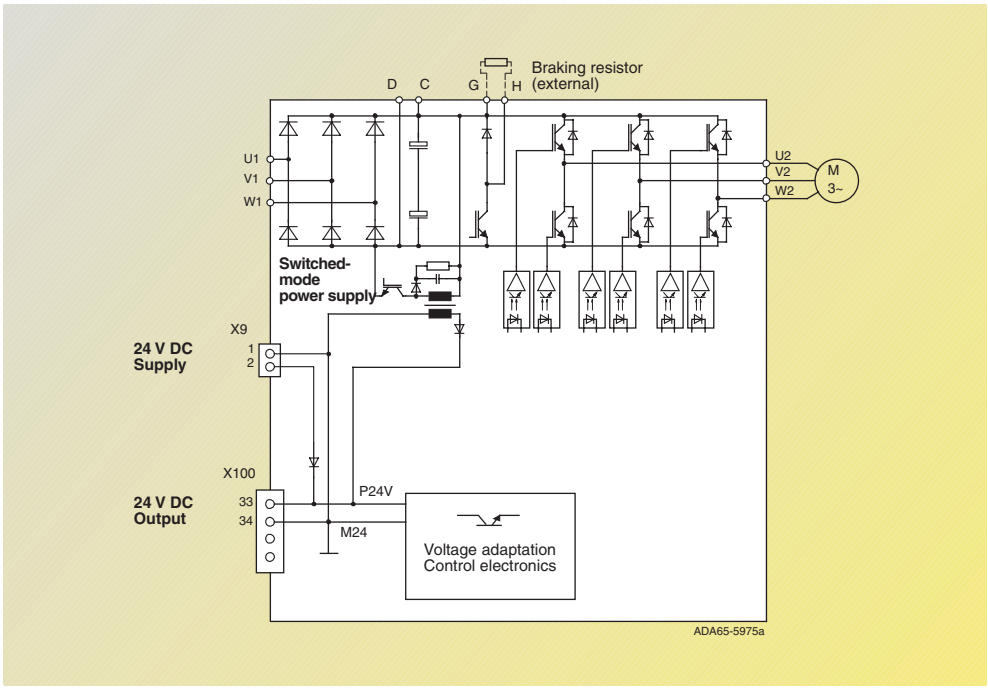


Fig. 3/4
Converter

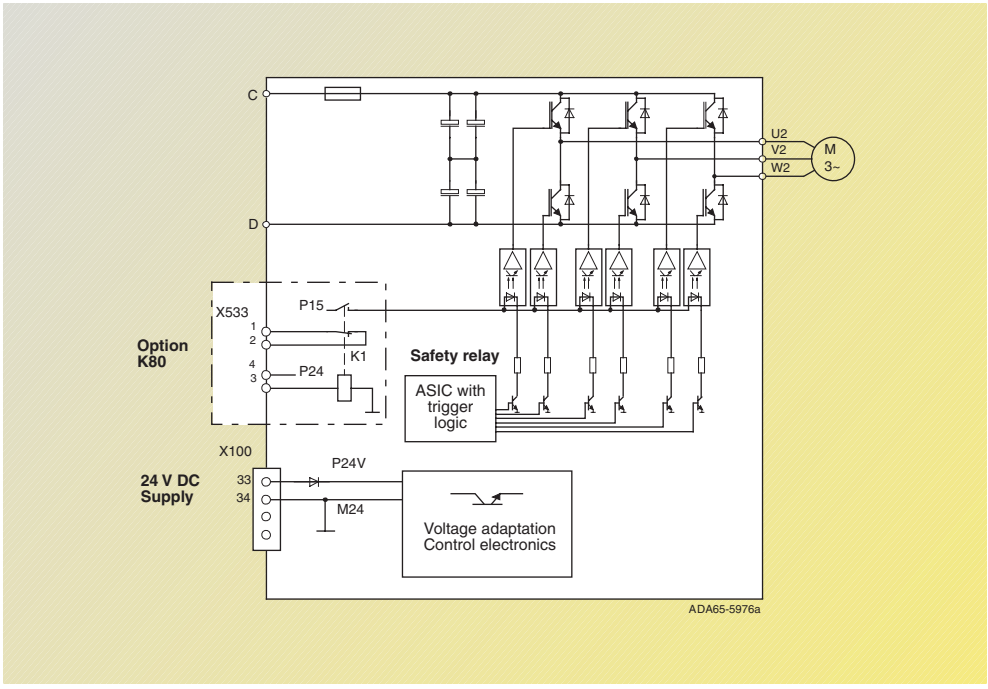


Fig. 3/5
Inverter with "Safe Stop" option

Optional devices

Safe Stop (K80)

With an appropriate external protective circuit, unexpected starting of the drive is prevented in accordance with EN 954-1, Safety Category 3.

Operation from an earth-free power supply (L20)

Converters without radio-interference suppression capacitors for connection to ungrounded IT networks. This configuration is recommended when the supply type is unknown and is also the standard stocking configuration for North America.

Note:

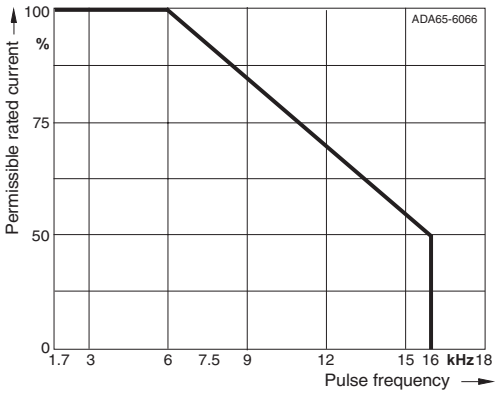
Rectifier units and inverters are suitable for operation connected to an earth-free power supply. The control electronics are always earthed (PELV circuit).

Technical data for Compact PLUS units

Rated voltage	
Supply voltage V_{supply}	3 AC 380 V – 15 % to 480 V +10 %
DC link voltage V_D[1])	DC 510 V – 15 % to 650 V +10 %
Output voltage Converter	3 AC 0 V to V_{supply}
Inverter	3 AC 0 V to 0.75 x V_D
Rated frequency	
Supply frequency	50/60 Hz (± 6 %)
Output frequency – V/f = constant	0 Hz to 200 Hz (500 Hz for textile)
– V = constant	8 Hz to 300 Hz
Pulse frequency	
Minimum pulse frequency	1.7 kHz
Factory setting	2.5 kHz
Maximum setting	16 kHz
Load class II to EN 60 146-1-1	See also Section 6, Engineering Information
Base load current	0.91 x rated output current
Short-time current	1.36 x rated output current for 60 s or 1.60 x rated output current for 30 s
Cycle time	300 s
Power factor • fundamental • overall	 ≥ 0.98 0.93 to 0.96
Efficiency	0.96 to 0.98

Reduction curves

For reduction factors due to different installation conditions (installation altitude, ambient temperature), see Section 6.



Max. adjustable pulse frequency depending on output and type of construction:

for Compact PLUS units
16 kHz

Options for Compact PLUS units

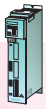
The Compact PLUS units can be ordered supplied with the following options in the table.

For a description of the options, see page 3/89.

Supplementary order code		Converter	Inverter
K80	Safe Stop	●	●
L20	Operation with an IT supply	●	–
M08	Coated boards	●	●

● Option possible
– Option not possible or not relevant

1) For max. DC link voltage for operation with AFE, see table on page 3/19.



Selection and ordering data

Compact PLUS converters (AC to AC)

Nominal power rating[4]		Rated output current	Base load current	Short-time current[1]	Supply current[2] Single-motor drive	Line current[3] Multi-motor drive		Power loss at 2.5 kHz single-motor drive (multi-motor drive)	Braking power with integrated braking chopper		
									Smallest permissible value of external braking resistor	Rated braking power P_{20} with R_{min}	Short-time braking power P_3 with R_{min}
		I_N	I_G						R_{min}		
HP	(kW)	A	A	A	A	A	Order No.	kW	Ω	kW	kW
Supply voltage 3-ph. 380 V to 480 V AC											
0.75	**(0.55)**	1.5	1.4	2.4	1.7	2.6	**6SE7011–5EP60Z + L20**	0.05 (0.05)	80	5	7.5
1.5	**(1.1)**	3.0	2.7	4.8	3.3	5.3	**6SE7013–0EP60Z + L20**	0.07 (0.08)	80	5	7.5
2	**(1.5)**	5.0	4.6	8.0	5.5	8.8	**6SE7015–0EP60Z + L20**	0.10 (0.11)	80	5	7.5
4	**(3)**	8.0	7.3	12.8	8.8	14	**6SE7018–0EP60Z + L20**	0.14 (0.16)	40	10	15
5	**(4)**	10.0	9.1	16.0	11.0	18	**6SE7021–0EP60Z + L20**	0.15 (0.17)	40	10	15
7.5	**(5.5)**	14.0	12.7	22.4	15.4	25	**6SE7021–4EP60Z + L20**	0.17 (0.20)	20	20	30
10	**(7.5)**	20.5	18.7	32.8	22.6	36	**6SE7022–1EP60Z + L20**	0.22 (0.26)	20	20	30
15	**(11)**	27.0	24.6	43.2	29.7	48	**6SE7022–7EP60Z + L20**	0.29 (0.34)	11	36	54
20	**(15)**	34.0	30.9	54.4	37.4	60	**6SE7023–4EP60Z + L20**	0.39 (0.46)	11	36	54

Compact PLUS inverters (DC to AC)

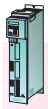
Nominal power rating		Rated output current	Base load current	Short-time current[1]	Rated DC link current		Power loss at 2.5 kHz
		I_N	I_G				
HP	(kW)	A	A	A	A	Order No.	kW
DC voltage 510 V to 650 V DC							
1	**(0.75)**	2.0	1.8	3.2	2.4	**6SE7012–0TP60**	0.05
2	**(1.5)**	4.0	3.6	6.4	4.8	**6SE7014–0TP60**	0.06
3	**(2.2)**	6.1	5.6	9.8	7.3	**6SE7016–0TP60**	0.07
5	**(4)**	10.2	9.3	16.3	12.1	**6SE7021–0TP60**	0.09
7.5	**(5.5)**	13.2	12.0	21.1	15.7	**6SE7021–3TP60**	0.14
10	**(7.5)**	17.5	15.9	28.0	20.8	**6SE7021–8TP60**	0.17
15	**(11)**	25.5	23.2	40.8	30.3	**6SE7022–6TP60**	0.22
20	**(15)**	34.0	30.9	54.4	40.5	**6SE7023–4TP60**	0.30
25	**(18.5)**	37.5	34.1	60.0	44.6	**6SE7023–8TP60**	0.35

1) Short-time current = **1.6 x I_N** for **30 s** or **1.36 x I_N** for **60 s**.

2) Rated supply current for converter without additional inverter. If the converter feeds additional inverters, the rated supply current is **1.76 x I_N**. See also Engineering Information, Section 6.

3) Converter feeds additional inverter; Supply current = **1.76 x I_N**.

4) Power ratings are nominal estimates. Check the motor nameplate current for specific sizing.



Dimensions W x H x D		For dimension drawing, see Section 7	Weight, approx.		Cooling air requirement		Power connections –Terminals for supply line finely stranded/ multi-stranded		Motor finely stranded/ multi-stranded		Auxiliary current requirement 24 V DC Max. version (max. at 20 V)
in	(mm)	No.	lb	(kg)	ft³/min	(m³/s)	AWG	(mm²)	AWG	(mm²)	A
1.8 x 14.2 x 10.2	(45 x 360 x 260)	1	7.5	(3.4)	4.24	(0.002)	11 / 11	(4 / 4)	11 / 11	(4 / 4)	1.3
2.7 x 14.2 x 10.2	(67.5 x 360 x 260)	1	8.6	(3.9)	19.08	(0.009)	11 / 11	(4 / 4)	11 / 11	(4 / 4)	1.3
2.7 x 14.2 x 10.2	(67.5 x 360 x 260)	1	9.0	(4.1)	19.08	(0.009)	11 / 11	(4 / 4)	11 / 11	(4 / 4)	1.3
3.6 x 14.2 x 10.2	(90 x 360 x 260)	1	9.9	(4.5)	38.14	(0.018)	11 / 11	(4 / 4)	11 / 11	(4 / 4)	1.3
3.6 x 14.2 x 10.2	(90 x 360 x 260)	1	9.9	(4.5)	38.14	(0.018)	11 / 11	(4 / 4)	11 / 11	(4 / 4)	1.3
5.3 x 14.2 x 10.2	(135 x 360 x 260)	2	23.8	(10.8)	86.87	(0.041)	7 / 6	(10 / 16)	7 / 6	(10 / 16)	1.5
5.3 x 14.2 x 10.2	(135 x 360 x 260)	2	24.0	(10.9)	86.87	(0.041)	7 / 6	(10 / 16)	7 / 6	(10 / 16)	1.5
7.1 x 14.2 x 10.2	(180 x 360 x 260)	2	32.4	(14.7)	129.25	(0.061)	4 / 2	(25 / 35)	6 / 4	(16 / 25)	1.9
7.1 x 14.2 x 10.2	(180 x 360 x 260)	2	32.9	(14.9)	129.25	(0.061)	4 / 2	(25 / 35)	6 / 4	(16 / 25)	1.9

Dimensions W x H x D		For dimension drawing, see Section 7	Weight, approx.		Cooling air requirement		Power connections DC bus	–Terminals for motor finely stranded/ multi-stranded		Auxiliary current requirement 24 V DC Max. version (max. at 20 V)
in	(mm)	No.	lb	(kg)	ft³/min	(m³/s)	DIN 46 433	AWG	(mm²)	A
1.8 x 14.2 x 10.2	(45 x 360 x 260)	3	6.6	(3.0)	4.24	(0.002)	E-Cu 3 x 10	11 / 11	(4 / 4)	1.3
2.7 x 14.2 x 10.2	(67.5 x 360 x 260)	3	7.5	(3.4)	19.08	(0.009)	E-Cu 3 x 10	11 / 11	(4 / 4)	1.3
2.7 x 14.2 x 10.2	(67.5 x 360 x 260)	3	7.5	(3.4)	19.08	(0.009)	E-Cu 3 x 10	11 / 11	(4 / 4)	1.3
3.6 x 14.2 x 10.2	(90 x 360 x 260)	3	8.4	(3.8)	38.14	(0.018)	E-Cu 3 x 10	11 / 11	(4 / 4)	1.3
5.3 x 14.2 x 10.2	(135 x 360 x 260)	4	19.4	(8.8)	86.87	(0.041)	E-Cu 3 x 10	7 / 6	(10 / 16)	1.5
5.3 x 14.2 x 10.2	(135 x 360 x 260)	4	19.6	(8.9)	86.87	(0.041)	E-Cu 3 x 10	7 / 6	(10 / 16)	1.5
5.3 x 14.2 x 10.2	(135 x 360 x 260)	4	19.8	(9.0)	86.87	(0.041)	E-Cu 3 x 10	7 / 6	(10 / 16)	1.5
7.1 x 14.2 x 10.2	(180 x 360 x 260)	4	28.0	(12.7)	129.25	(0.061)	E-Cu 3 x 10	6 / 4	(16 / 25)	1.7
7.1 x 14.2 x 10.2	(180 x 360 x 260)	4	28.4	(12.9)	129.25	(0.061)	E-Cu 3 x 10	6 / 4	(16 / 25)	1.7

Technical characteristics of compact and chassis units

The converter is designed as a stand-alone AC to AC unit. The compact and chassis converters cannot supply additional inverters via its DC link connections "C" and "D". A braking unit (for regenerative mode) or system components are connected to terminals "C" and "D". The converter is connected to a three-phase power system. The precharging circuit for charging the DC link capacitors is already integrated.

Inverters are DC to AC units connected to the DC voltage supply via terminals "C" and "D". The DC voltage is supplied, for example, via a rectifier unit, rectifier/regenerative unit or an AFE unit. The rectifier unit precharges the DC link capacitors when the DC voltage supply is switched on, i.e. it is not permissible for the inverter to be directly connected to a charged DC busbar (see Engineering Information, Part 6). The A – D and J – L type of construction inverters have integrated DC link fuses as a standard feature. In the case of the E – G chassis units, integrated DC link fuses can be ordered as an option.

The control electronics of converters and inverters are supplied from the DC link via a switch-mode power supply unit. The control electronics can also be supplied with 24 V DC from an external source via the X9 connector strip, e.g. in order to maintain communication with a higher-level control unit when the power section is off (DC link discharged).

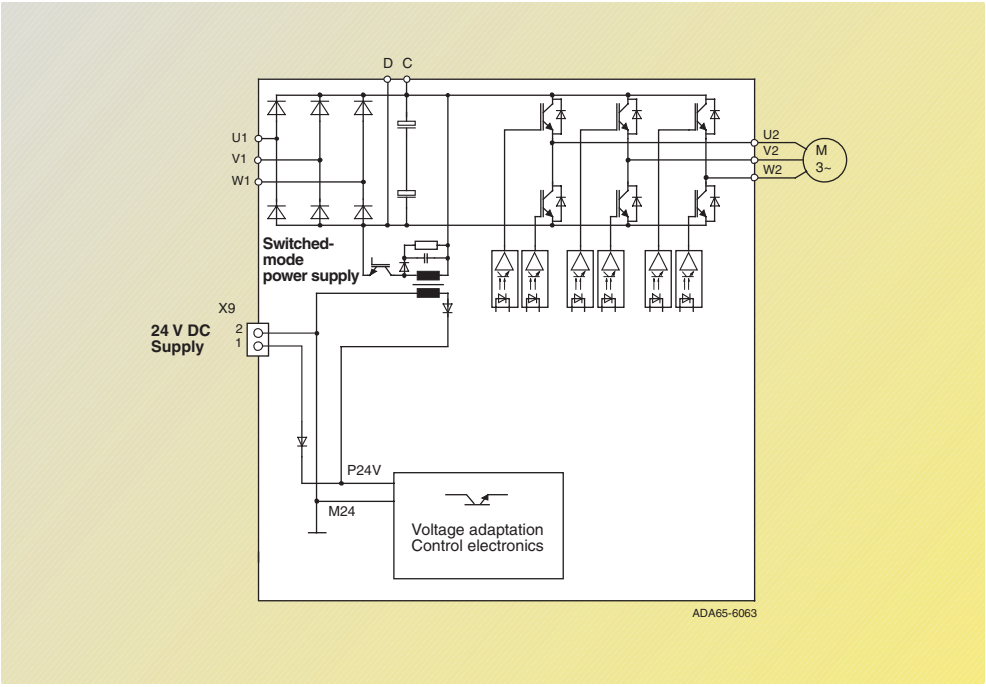


Fig. 3/6
Converters

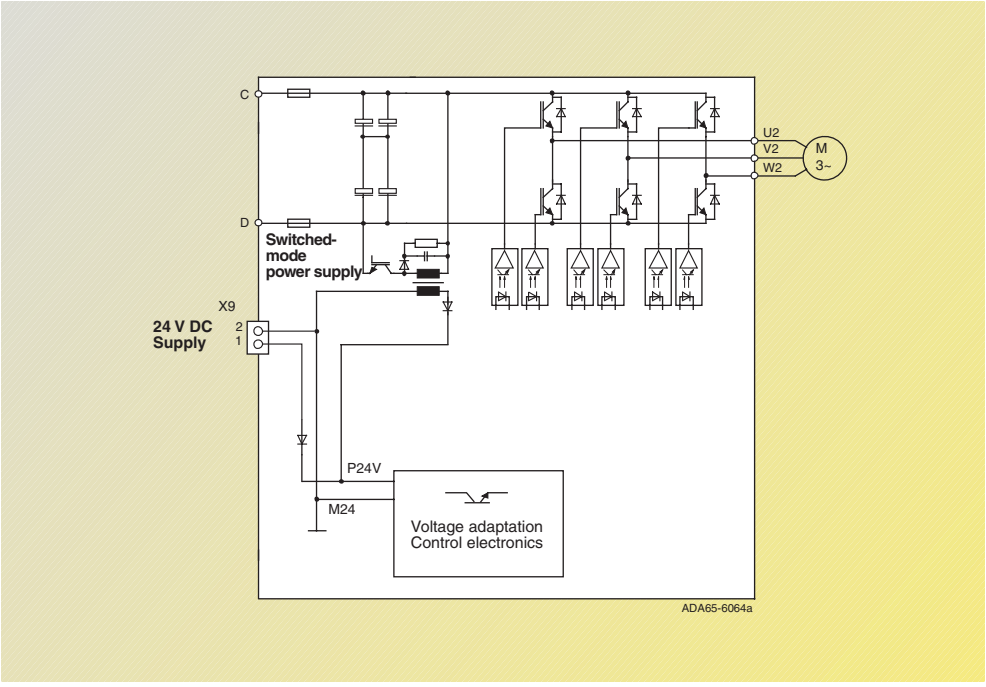


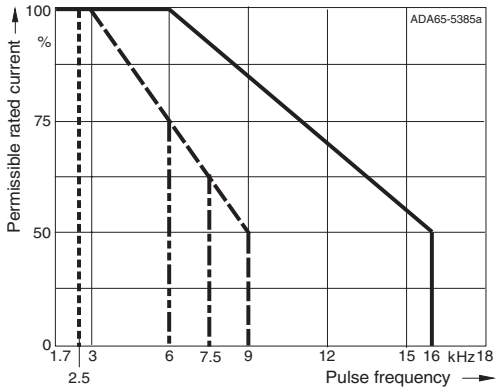
Fig. 3/7
Inverters

Technical data for compact and chassis units

Rated voltage			
Supply voltage V_{supply}	3 AC 380 V – 15 % to 480 V +10 %	3 AC 500 V – 15 % to 600 V +10 %	3 AC 660 V – 15 % to 690 V +15 %
DC link voltage V_D[3])	DC 510 V – 15 % to 650 V +10 %	DC 675 V – 15 % to 810 V +10 %	DC 890 V – 15 % to 930 V +15 %
Output voltage Converter	3 AC 0 V to V_{supply}	3 AC 0 V to V_{supply}	3 AC 0 V to V_{supply}
Inverter	3 AC 0 V to 0.75 x V_D	3 AC 0 V to 0.75 x V_D	3 AC 0 V to 0.75 x V_D
Rated frequency			
Supply frequency	50/60 Hz (± 6 %)	50/60 Hz (± 6 %)	50/60 Hz (± 6 %)
Output frequency – V/f = constant	0 Hz to 200 Hz max. 500 Hz for textile depending on output rating	0 Hz to 200 Hz max. 500 Hz for textile depending on output rating	0 Hz to 200 Hz max. 300 Hz for textile depending on output rating
– V = constant	8 Hz to 300 Hz depending on output rating	8 Hz to 300 Hz depending on output rating	8 Hz to 300 Hz depending on output rating
Pulse frequency			
Minimum pulse frequency	1.7 kHz	1.7 kHz	1.7 kHz
Factory setting	2.5 kHz	2.5 kHz	2.5 kHz
Maximum setting	depending on output rating, up to 16 kHz	depending on output rating, up to 16 kHz	depending on output rating, up to 7.5 kHz
Load class II to EN 60 146-1-1	See also Section 6. Engineering Information		
Base load current	0.91 x rated output current		
Short-time current	1.36 x rated output current for 60 s or 1.60 x rated output current for units up to size G and a supply voltage of max. 600 V		
Cycle time	300 s		
Power factor • fundamental • overall	≥ 0.98 0.93 to 0.96		
Efficiency	0.96 to 0.98		

Reduction curves

For reduction factors due to different installation conditions (installation altitude, ambient temperature), see Section 6.



Max. adjustable pulse frequency depending on output rating and type of construction:

16 kHz — for types A, B, C and D
at 45 kW; 55 kW; 380 V to 480 V
at 37 kW; 45 kW; 500 V to 600 V

9 kHz — for type E, 200 V to 230 V
at 75 kW; 90 kW; 380 V to 480 V
at 55 kW; 500 V to 600 V

7.5 kHz — at 110 kW; 132 kW; 380 V to 480 V
at 75 kW; 90 kW; 500 V to 600 V
at 55 kW to 110 kW; 660 V to 690 V

6 kHz — at 160 kW to 250 kW; 380 V to 480 V
at 110 kW to 160 kW; 500 V to 600 V
at 132 kW to 200 kW; 660 V to 690 V

2.5 kHz — at 315 kW to 900 kW; 380 V to 480 V
at 200 kW to 1100 kW; 500 V to 600 V
at 250 kW to 2300 kW; 660 V to 690 V

Options for compact and chassis units

Compact and chassis units can be supplied custom ex works with the following options in the table.

■ Standard
● Option possible
– Option not possible or not relevant

1) Option possible with type D and supply voltage 3-ph. 380 V to 480 V AC.

2) Only for supply voltage 3-ph 380 V to 480 V AC and DC voltage 510 V to 650 V DC.

3) For max. DC link voltage for operation with AFE, see table on page 3/19.

Supplementary order code	Description of option	Converter size			Inverter size			
		A – D	E – G	K	A – D	E – G	J, K	L
K80	Safe Stop	–[1])	●	●	■	●	●	●
L03	Basic interference suppression	■	■	●	–	–	●	●
L20[4])	Operation with an IT supply	●	●	■	–	–	–	–
L30	Integrated DC link fuses	–	–	–	■	●	■	■
L33	Without DC link fuses	■	■	■	●	■	–	–
M08	Coated boards	● [2])	–	–	● [2])	–	–	–
M20	IP20 panels	■	●	–	■	●	–	–
M65	Separate DC connection for dv/dt filter	–	–	●	–	–	●	■

For a description of options, see page 3/89.

4) Shown standard in North American order number for A–G size converters to allow connection to grounded and ungrounded supplies.

Selection and ordering data

Nominal power rating[3]			Rated output current	Base load current	Short-time current [1]	Rated DC link current	Supply current (only for converters)	Converter AC to AC	Inverter DC to AC	Power loss at 2.5 kHz		Dimensions W x H x D	
			I_{UN}	I_G	$I_{max.}$					Converter	Inverter		
CT HP	VT HP	(kW)	A	A	A	A	A	Order No.	Order No.	kW	kW	in	(mm)
Supply voltage 3-ph. 380 V to 480 V AC and DC voltage 510 V to 650 V DC													
460 V		**(400 V)**											
3	**3**	**(2.2)**	6.1	5.6	8.3	7.3	6.7	**6SE7016–1EA61Z + L20**	**6SE7016–1TA61**	0.11	0.09	3.5 x 16.7 x 13.8	(90 x 425 x 350)
4	**5**	**(3)**	8	7.3	10.9	9.5	8.8	**6SE7018–0EA61Z + L20**	**6SE7018–0TA61**	0.12	0.10	3.5 x 16.7 x 13.8	(90 x 425 x 350)
5	**7.5**	**(4)**	10.2	9.3	13.9	12.1	11.2	**6SE7021–0EA61Z + L20**	**6SE7021–0TA61**	0.16	0.12	3.5 x 16.7 x 13.8	(90 x 425 x 350)
7.5	**10**	**(5.5)**	13.2	12	18.0	15.7	14.5	**6SE7021–3EB61Z + L20**	**6SE7021–3TB61**	0.16	0.13	5.3 x 16.7 x 13.8	(135 x 425 x 350)
10		**(7.5)**	17.5	15.9	23.9	20.8	19.3	**6SE7021–8EB61Z + L20**	**6SE7021–8TB61**	0.21	0.16	5.3 x 16.7 x 13.8	(135 x 425 x 350)
15	**20**	**(11)**	25.5	23.2	34.8	30.4	28.1	**6SE7022–6EC61Z + L20**	**6SE7022–6TC61**	0.34	0.27	7.1 x 23.6 x 13.8	(180 x 600 x 350)
20	**25**	**(15)**	34	30.9	46.4	40.5	37.4	**6SE7023–4EC61Z + L20**	**6SE7023–4TC61**	0.47	0.37	7.1 x 23.6 x 13.8	(180 x 600 x 350)
25	**30**	**(18.5)**	37.5	34.1	51.2	44.6	41.3	**6SE7023–8ED61Z + L20**	**6SE7023–8TD61**	0.60	0.50	10.6 x 23.6 x 13.8	(270 x 600 x 350)
30		**(22)**	47	42.8	64.2	55.9	51.7	**6SE7024–7ED61Z + L20**	**6SE7024–7TD61**	0.71	0.58	10.6 x 23.6 x 13.8	(270 x 600 x 350)
40	**40**	**(30)**	59	53.7	80.5	70.2	64.9	**6SE7026–0ED61Z + L20**	**6SE7026–0TD61**	0.85	0.69	10.6 x 23.6 x 13.8	(270 x 600 x 350)
50	**50**	**(37)**	72	65.5	98.3	85.7	79.2	**6SE7027–2ED61Z + L20**	**6SE7027–2TD61**	1.06	0.85	10.6 x 23.6 x 13.8	(270 x 600 x 350)
60	**75**	**(45)**	92	84	126	110	101	**6SE7031–0EE60Z + L20**	**6SE7031–0TE60**	1.18	1.05	10.6 x 23.6 x 13.8	(270 x 1050 x 365)
75	**100**	**(55)**	124	113	169	148	136	**6SE7031–2EF60Z + L20**	**6SE7031–2TF60**	1.67	1.35	14.2 x 41.3 x 13.8	(360 x 1050 x 365)
100		**(75)**	146	133	199	174	160	**6SE7031–5EF60Z + L20**	**6SE7031–5TF60**	1.95	1.56	14.2 x 41.3 x 13.8	(360 x 1050 x 365)
125	**150**	**(90)**	186	169	254	221	205	**6SE7031–8EF60Z + L20**	**6SE7031–8TF60**	2.17	1.70	14.2 x 41.3 x 13.8	(360 x 1050 x 365)
150		**(110)**	210	191	287	250	231	**6SE7032–1EG60Z + L20**	**6SE7032–1TG60**	2.68	2.18	20.0 x 57.1 x 18.3	(508 x 1450 x 465)
175	**200**	**(132)**	260	237	355	309	286	**6SE7032–6EG60Z + L20**	**6SE7032–6TG60**	3.40	2.75	20.0 x 57.1 x 18.3	(508 x 1450 x 465)
200	**250**	**(160)**	315	287	430	375	346	**6SE7033–2EG60Z + L20**	**6SE7033–2TG60**	4.30	3.47	20 .0 x 57.1 x 18.3	(508 x 1450 x 465)
250	**300**	**(200)**	370	337	503	440	407	**6SE7033–7EG60Z + L20**	**6SE7033–7TG60**	5.05	4.05	20.0 x 57.1 x 18.3	(508 x 1450 x 465)
350	**450**	**(250)**	510	464	694	607	–	**–**	**6SE7035–1TJ60**	–	5.8	31.5 x 55.1 x 22.2	(800 x 1400 x 565)
350	**450**	**(250)**	510	464	694	607	561	**6SE7035–1EK60**	**–**	7.1	–	31.5 x 68.9 x 22.2	(800 x 1750 x 565)
450	**500**	**(315)**	590	537	802	702	–	**–**	**6SE7036–0TJ60**	–	6.6	31.5 x 55.1 x 22.2	(800 x 1400 x 565)
450	**500**	**(315)**	590	537	802	702	649	**6SE7036–0EK60**	**–**	8.2	–	31.5 x 68.9 x 22.2	(800 x 1750 x 565)
500	**600**	**(400)**	690	628	938	821	–	**–**	**6SE7037–0TJ60**	–	8.8	31.5 x 55.1 x 22.2	(800 x 1400 x 565)
500	**600**	**(400)**	690	628	938	821	759	**6SE7037–0EK60**	**–**	10.2	–	31.5 x 68.9 x 22.2	(800 x 1750 x 565)
600	**700**	**(500)**	860	782	1170	1023	–	**–**	**6SE7038–6TK60**	–	11.9	31.5 x 68.9 x 22.2	(800 x 1750 x 565)
800	**900**	**(630)**	1100	1000	1496	1310	–	**–**	**6SE7041–1TK60**	–	13.4	31.5 x 68.9 x 22.2	(800 x 1750 x 565)
1000	**1100**	**(710)**	1300	1183	1768	1547	–	**–**	**6SE7041–3TL60**	–	14.5	43.3 x 68.9 x 22.2	(1100 x 1750 x 565)

For units with larger nominal power rating (parallel switched units), see page 3/16.

1) Short-time current = **1.6 x I_{UN}**, possible for **30 s to 200 kW**. See Section 6.

2) See Engineering Information, Section 6.

3) Power ratings are nominal estimates. Check the motor nameplate current for specific sizing.

For dimension drawing, see Section 7	Weight approx.		Cooling air requirement		Sound pressure level L_{pA} (1 m)	Power connections – Terminals for sizes A to D – Lugs for sizes E to Q – Location: at top for AC/DC, at bottom for motor					Auxiliary current requirement		
						Finely stranded		Single- and multi-stranded		Retaining bolt	24 V DC Standard version max. at 20 V[2])	24 V DC Max. version max. at 20 V[2])	1-ph. or 2-ph. 230 V fan for inverters
					50 Hz								60 Hz
No.	lb	(kg)	ft³/min	(m³/s)	dB	AWG	(mm²)	AWG	(mm²)		A	A	A
6	18.7	(8.5)	19.08	(0.009)	60	13 to 7	(2.5 to 10)	13 to 6	(2.5 to 16)		1.5	2.5	none
6	18.7	(8.5)	19.08	(0.009)	60	13 to 7	(2.5 to 10)	13 to 6	(2.5 to 16)		1.5	2.5	none
6	18.7	(8.5)	19.08	(0.009)	60	13 to 7	(2.5 to 10)	13 to 6	(2.5 to 16)		1.5	2.5	none
6	27.6	(12.5)	46.62	(0.022)	60	13 to 7	(2.5 to 10)	13 to 6	(2.5 to 16)		1.5	2.5	none
6	27.6	(12.5)	46.62	(0.022)	60	13 to 7	(2.5 to 10)	13 to 6	(2.5 to 16)		1.5	2.5	none
6	46.3	(21)	59.33	(0.028)	60	13 to 6	(2.5 to 16)	7 to 4	(10 to 25)		1.5	2.5	none
6	46.3	(21)	59.33	(0.028)	60	13 to 6	(2.5 to 16)	7 to 4	(10 to 25)		1.5	2.5	none
6	70.6	(32)	114.42	(0.054)	65	13 to 2	(2.5 to 35)	7 to 1/0	(10 to 50)		1.5	2.5	0.44
6	70.6	(32)	114.42	(0.054)	65	13 to 2	(2.5 to 35)	7 to 1/0	(10 to 50)		1.5	2.5	0.44
6	70.6	(32)	114.42	(0.054)	65	13 to 2	(2.5 to 35)	7 to 1/0	(10 to 50)		1.5	2.5	0.44
6	70.6	(32)	114.42	(0.054)	65	13 to 2	(2.5 to 35)	7 to 1/0	(10 to 50)		1.5	2.5	0.44
8	143.3	(65)	211.89	(0.10)	69			max. 2 x 2/0	(max. 2 x 70)	M 10	1.7	2.7	0.44
8	165.4	(75)	296.64	(0.14)	69			max. 2 x 2/0	(max. 2 x 70)	M 10	2.1	3.2	0.60
8	165.4	(75)	296.64	(0.14)	69			max. 2 x 2/0	(max. 2 x 70)	M 10	2.1	3.2	0.60
8	165.4	(75)	296.64	(0.14)	69			max. 2 x 2/0	(max. 2 x 70)	M 10	2.1	3.2	0.60
8	352.8	(160)	656.40	(0.31)	80			max. 2 x 6/0	(max. 2 x 150)	M 12	2.3	3.5	1.1
8	352.8	(160)	656.40	(0.31)	80			max. 2 x 6/0	(max. 2 x 150)	M 12	2.3	3.5	1.1
8	396.9	(180)	868.75	(0.41)	82			max. 2 x 6/0	(max. 2 x 150)	M 12	2.3	3.5	1.4
8	396.9	(180)	868.75	(0.41)	82			max. 2 x 6/0	(max. 2 x 150)	M 12	2.3	3.5	1.4
10	771.8	(350)	974.69	(0.46)	77			max. 2 x 9/0	(max. 2 x 300)	M 12/M 16	3.0	4.2	3.4
12	882.0	(400)	974.69	(0.46)	77			max. 2 x 9/0	(max. 2 x 300)	M 12/M 16	3.1	4.3	–
10	771.8	(350)	974.69	(0.46)	77			max. 2 x 9/0	(max. 2 x 300)	M 12/M 16	3.0	4.2	3.4
12	882.0	(400)	974.69	(0.46)	77			max. 2 x 9/0	(max. 2 x 300)	M 12/M 16	3.1	4.3	–
10	771.8	(350)	1271.34	(0.60)	80			max. 4 x 9/0	(max. 4 x 300)	M 12/M 16	3.0	4.2	6.9
12	882.0	(400)	1271.34	(0.60)	80			max. 4 x 9/0	(max. 4 x 300)	M 12/M 16	3.1	4.3	–
10	1146.6	(520)	1271.34	(0.60)	80			max. 4 x 9/0	(max. 4 x 300)	M 12/M 16	3.0	4.2	6.9
10	1146.6	(520)	1864.63	(0.88)	82			max. 4 x 9/0	(max. 4 x 300)	M 12/M 16	3.0	4.2	22.0
11	1378.1	(625)	1949.39	(0.92)	89			max. 6 x 9/0	(max. 6 x 300)	M 12/M 16	3.0	4.2	22.0

Selection and ordering data

Nominal power rating[3]			Rated output current	Base load current	Short-time current [1]	Rated DC link current	Supply current (only for converters)	Converter AC to AC	Inverter DC to AC	Power loss at 2.5 kHz		Dimensions Unit measurements W x H x D	
			I_{UN}	I_G	$I_{max.}$					Converter	Inverter		
CT HP	VT HP	(kW)	A	A	A	A	A	Order No.	Order No.	kW	kW	in	(mm)
Supply voltage 3-ph. 500 V to 600 V AC and DC voltage 675 V to 810 V DC													
575 V		**(500 V)**											
3	**3**	**(2.2)**	4.5	4.1	6.1	5.4	5.0	**6SE7014–5FB61Z + L20**	**6SE7014–5UB61**	0.10	0.08	5.3 x 16.7 x 13.8	(135 x 425 x 350)
	5	**(3)**	6.2	5.6	8.5	7.4	6.8	**6SE7016–2FB61Z + L20**	**6SE7016–2UB61**	0.11	0.09	5.3 x 16.7 x 13.8	(135 x 425 x 350)
5	**7.5**	**(4)**	7.8	7.1	10.6	9.3	8.6	**6SE7017–8FB61Z + L20**	**6SE7017–8UB61**	0.12	0.10	5.3 x 16.7 x 13.8	(135 x 425 x 350)
7.5	**10**	**(5.5)**	11	10	15	13.1	12.1	**6SE7021–1FB61Z + L20**	**6SE7021–1UB61**	0.16	0.13	5.3 x 16.7 x 13.8	(135 x 425 x 350)
10	**15**	**(7.5)**	15.1	13.7	20.6	18	16.6	**6SE7021–5FB61Z + L20**	**6SE7021–5UB61**	0.21	0.17	5.3 x 16.7 x 13.8	(135 x 425 x 350)
15	**20**	**(11)**	22	20	30	26.2	24.2	**6SE7022–2FC61Z + L20**	**6SE7022–2UC61**	0.32	0.26	7.1 x 23.6 x 13.8	(180 x 600 x 350)
20	**25**	**(18.5)**	29	26.4	39.6	34.5	31.9	**6SE7023–0FD61Z + L20**	**6SE7023–0UD61**	0.59	0.51	10.6 x 23.6 x 13.8	(270 x 600 x 350)
25	**30**	**(22)**	34	30.9	46.4	40.2	37.4	**6SE7023–4FD61Z + L20**	**6SE7023–4UD61**	0.69	0.59	10.6 x 23.6 x 13.8	(270 x 600 x 350)
40	**50**	**(30)**	46.5	42.3	63.5	55.4	51.2	**6SE7024–7FD61Z + L20**	**6SE7024–7UD61**	0.87	0.74	10.6 x 23.6 x 13.8	(270 x 600 x 350)
50	**60**	**(37)**	61	55	83	73	67	**6SE7026–1FE60Z + L20**	**6SE7026–1UE60**	0.91	0.75	10.6 x 41.3 x 14.4	(270 x 1050 x 365)
		(45)	66	60	90	79	73	**6SE7026–6FE60Z + L20**	**6SE7026–6UE60**	1.02	0.84	10.6 x 41.3 x 14.4	(270 x 1050 x 365)
60	**75**	**(55)**	79	72	108	94	87	**6SE7028–0FF60Z + L20**	**6SE7028–0UF60**	1.26	1.04	14.2 x 41.3 x 14.4	(360 x 1050 x 365)
100	**100**	**(75)**	108	98	147	129	119	**6SE7031–1FF60Z + L20**	**6SE7031–1UF60**	1.80	1.50	14.2 x 41.3 x 14.4	(360 x 1050 x 365)
	125	**(90)**	128	117	174	152	141	**6SE7031–3FG60Z + L20**	**6SE7031–3UG60**	2.13	1.80	20.0 x 57.1 x 18.3	(508 x 1450 x 465)
150	**150**	**(110)**	156	142	213	186	172	**6SE7031–6FG60Z + L20**	**6SE7031–6UG60**	2.58	2.18	20.0 x 57.1 x 18.3	(508 x 1450 x 465)
	200	**(132)**	192	174	262	228	211	**6SE7032–0FG60Z + L20**	**6SE7032–0UG60**	3.40	2.82	20.0 x 57.1 x 18.3	(508 x 1450 x 465)
200	**250**	**(160)**	225	205	307	268	248	**6SE7032–3FG60Z + L20**	**6SE7032–3UG60**	4.05	3.40	20.0 x 57.1 x 18.3	(508 x 1450 x 465)
250	**300**	**(200)**	297	270	404	353	–	**–**	**6SE7033–0UJ60**	–	5.00	31.5 x 55.1 x 22.2	(800 x 1400 x 565)
250	**300**	**(200)**	297	270	404	353	327	**6SE7033–0FK60**	**–**	5.80	–	31.5 x 68.9 x 22.2	(800 x 1750 x 565)
300	**350**	**(250)**	354	322	481	421	–	**–**	**6SE7033–5UJ60**	–	5.60	31.5 x 55.1 x 22.2	(800 x 1400 x 565)
300	**350**	**(250)**	354	322	481	421	389	**6SE7033–5FK60**	**–**	6.80	–	31.5 x 68.9 x 22.2	(800 x 1750 x 565)
400	**450**	**(315)**	452	411	615	538	–	**–**	**6SE7034–5UJ60**	–	7.00	31.5 x 55.1 x 22.2	(800 x 1400 x 565)
400	**450**	**(315)**	452	411	615	538	497	**6SE7034–5FK60**	**–**	8.30	–	31.5 x 68.9 x 22.2	(800 x 1750 x 565)
500	**600**	**(400)**	570	519	775	678	–	**–**	**6SE7035–7UK60**	–	8.90	31.5 x 68.9 x 22.2	(800 x 1750 x 565)
600	**700**	**(450)**	650	592	884	774	–	**–**	**6SE7036–5UK60**	–	10.00	31.5 x 68.9 x 22.2	(800 x 1750 x 565)
800	**900**	**(630)**	860	783	1170	1023	–	**–**	**6SE7038–6UK60**	–	11.60	31.5 x 68.9 x 22.2	(800 x 1750 x 565)
1000	**1100**	**(800)**	1080	983	1469	1285	–	**–**	**6SE7041–1UL60**	–	14.20	43.3 x 68.9 x 22.2	(1100 x 1750 x 565)
1100	**1250**	**(900)**	1230	1119	1673	1464	–	**–**	**6SE7041–2UL60**	–	16.70	43.3 x 68.9 x 22.2	(1100 x 1750 x 565)

For units with larger nominal power rating (parallel switched units), see page 3/16.

1) Short-time current = **1.6 x I_{UN}**, possible for **30 s to 160 kW**. See Section 6.

2) See Engineering Information, Section 6.

3) Power ratings are nominal estimates. Check the motor nameplate for specific sizing.

Dimension drawing, see Sect. 7	Weight approx.		Cooling air requirement		Sound pressure level L_{pA} (1 m)	Power connections – Terminals for sizes A to D – Lugs for sizes E to Q – Location: at top for AC/DC, at bottom for motor					Auxiliary current requirement		
						Finely stranded		Single- and multi-stranded		Retaining bolt	24 V DC Standard version max. at 20 V2)	24 V DC Max. version max. at 20 V2)	1-ph. or 2-ph. 230 V fan for inverters
					50 Hz								60 Hz
No.	lb	(kg)	ft³/min	(m³/s)	dB	AWG	(mm²)	AWG	(mm²)		A	A	A
6	27.6	(12.5)	46.62	(0.022)	60	13 to 7	(2.5 to 10)	13 to 6	(2.5 to 16)		1.5	2.5	none
6	27.6	(12.5)	46.62	(0.022)	60	13 to 7	(2.5 to 10)	13 to 6	(2.5 to 16)		1.5	2.5	none
6	27.6	(12.5)	46.62	(0.022)	60	13 to 7	(2.5 to 10)	13 to 6	(2.5 to 16)		1.5	2.5	none
6	27.6	(12.5)	46.62	(0.022)	60	13 to 7	(2.5 to 10)	13 to 6	(2.5 to 16)		1.5	2.5	none
6	27.6	(12.5)	46.62	(0.022)	60	13 to 7	(2.5 to 10)	13 to 6	(2.5 to 16)		1.5	2.5	none
6	46.3	(21)	59.33	(0.028)	60	13 to 6	(2.5 to 16)	7 to 4	(10 to 25)		1.5	2.5	none
6	70.6	(32)	114.42	(0.054)	65	13 to 3	(2.5 to 35)	7 to 1/0	(10 to 50)		1.5	2.5	0.44
6	70.6	(32)	114.42	(0.054)	65	13 to 3	(2.5 to 35)	7 to 1/0	(10 to 50)		1.5	2.5	0.44
6	70.6	(32)	114.42	(0.054)	65	13 to 3	(2.5 to 35)	7 to 1/0	(10 to 50)		1.5	2.5	0.44
8	143.3	(65)	211.89	(0.10)	69			max. 2 x 2/0	(max. 2 x 70)	M 10	1.7	2.7	0.44
8	143.3	(65)	211.89	(0.10)	69			max. 2 x 2/0	(max. 2 x 70)	M 10	1.7	2.7	0.44
8	165.4	(75)	296.64	(0.14)	69			max. 2 x 2/0	(max. 2 x 70)	M 10	2.1	3.2	0.60
8	165.4	(75)	296.64	(0.14)	80			max. 2 x 2/0	(max. 2 x 70)	M 10	2.1	3.2	0.60
8	352.8	(160)	656.40	(0.31)	80			max. 2 x 6/0	(max. 2 x 150)	M 12	2.3	3.5	1.1
8	352.8	(160)	656.40	(0.31)	80			max. 2 x 6/0	(max. 2 x 150)	M 12	2.3	3.5	1.1
8	396.9	(180)	868.75	(0.41)	82			max. 2 x 6/0	(max. 2 x 150)	M 12	2.3	3.5	1.4
8	396.9	(180)	868.75	(0.41)	82			max. 2 x 6/0	(max. 2 x 150)	M 12	2.3	3.5	1.4
10	771.8	(350)	974.69	(0.46)	77			max. 2 x 9/0	(max. 2 x 300)	M 12/M 16	3.0	4.2	3.4
12	882.0	(400)	974.69	(0.46)	77			max. 2 x 9/0	(max. 2 x 300)	M 12/M 16	3.1	4.3	–
10	771.8	(350)	974.69	(0.46)	77			max. 2 x 9/0	(max. 2 x 300)	M 12/M 16	3.0	4.2	3.4
12	882.0	(400)	974.69	(0.46)	77			max. 2 x 9/0	(max. 2 x 300)	M 12/M 16	3.1	4.3	–
10	771.8	(350)	974.69	(0.46)	77			max. 2 x 9/0	(max. 2 x 300)	M 12/M 16	3.0	4.2	3.4
12	882.0	(400)	974.69	(0.46)	77			max. 2 x 9/0	(max. 2 x 300)	M 12/M 16	3.1	4.3	–
10	1146.6	(520)	1271.34	(0.60)	80			max. 4 x 9/0	(max. 4 x 300)	M 12/M 16	3.0	4.2	6.9
10	1146.6	(520)	1271.34	(0.60)	80			max. 4 x 9/0	(max. 4 x 300)	M 12/M 16	3.0	4.2	6.9
10	1146.6	(520)	1864.63	(0.88)	82			max. 4 x 9/0	(max. 4 x 300)	M 12/M 16	3.0	4.2	22.0
11	1378.1	(625)	1949.39	(0.92)	89			max. 6 x 9/0	(max. 6 x 300)	M 12/M 16	3.0	4.2	22.0
11	1378.1	(625)	1949.39	(0.92)	89			max. 6 x 9/0	(max. 6 x 300)	M 12/M 16	3.0	4.2	22.0

Selection and ordering data

Nominal power rating[2]	Rated output current	Base load current	Short-time current	Rated DC link current	Supply current (only for converters)	Converter AC to AC	Inverter DC to AC	Power loss at 2.5 kHz		Dimensions Unit measurements W x H x D	
	I_{UN}	I_G	$I_{max.}$					Converter	Inverter		
kW	A	A	A	A	A	Order No.	Order No.	kW	kW	in	(mm)
Supply voltage 3-ph. 660 V to 690 V AC and DC voltage 890 V to 930 V DC											
690 V											
55	60	55	82	71	66	**6SE7026–0HF60Z + L20**	**6SE7026–0WF60**	1.05	0.90	14.2 x 41.3 x 14.4	(360 x 1050 x 365)
75	82	75	112	98	90	**6SE7028–2HF60Z + L20**	**6SE7028–2WF60**	1.47	1.24	14.2 x 41.3 x 14.4	(360 x 1050 x 365)
90	97	88	132	115	107	**6SE7031–0HG60Z + L20**	**6SE7031–0WG60**	1.93	1.68	20.0 x 57.1 x 18.3	(508 x 1450 x 465)
110	118	107	161	140	130	**6SE7031–2HG60Z + L20**	**6SE7031–2WG60**	2.33	2.03	20.0 x 57.1 x 18.3	(508 x 1450 x 465)
132	145	132	198	173	160	**6SE7031–5HG60Z + L20**	**6SE7031–5WG60**	2.83	2.43	20.0 x 57.1 x 18.3	(508 x 1450 x 465)
160	171	156	233	204	188	**6SE7031–7HG60Z + L20**	**6SE7031–7WG60**	3.50	3.05	20.0 x 57.1 x 18.3	(508 x 1450 x 465)
200	208	189	284	248	229	**6SE7032–1HG60Z + L20**	**6SE7032–1WG60**	4.30	3.70	20.0 x 57.1 x 18.3	(508 x 1450 x 465)
250	297	270	404	353	–	**–**	**6SE7033–0WJ60**	–	5.80	31.5 x 55.1 x 22.2	(800 x 1400 x 565)
250	297	270	404	353	327	**6SE7033–0HK60**	**–**	6.60	–	31.5 x 68.9 x 22.2	(800 x 1750 x 565)
315	354	322	481	421	–	**–**	**6SE7033–5WJ60**	–	6.30	31.5 x 55.1 x 22.2	(800 x 1400 x 565)
315	354	322	481	421	389	**6SE7033–5HK60**	**–**	7.40	–	31.5 x 68.9 x 22.2	(800 x 1750 x 565)
400	452	411	615	538	–	**–**	**6SE7034–5WJ60**	–	7.80	31.5 x 55.1 x 22.2	(800 x 1400 x 565)
400	452	411	615	538	497	**6SE7034–5HK60**	**–**	9.10	–	31.5 x 68.9 x 22.2	(800 x 1750 x 565)
500	570	519	775	678	–	**–**	**6SE7035–7WK60**	–	9.40	31.5 x 68.9 x 22.2	(800 x 1750 x 565)
630	650	592	884	774	–	**–**	**6SE7036–5WK60**	–	11.00	31.5 x 68.9 x 22.2	(800 x 1750 x 565)
800	860	783	1170	1023	–	**–**	**6SE7038–6WK60**	–	13.90	31.5 x 68.9 x 22.2	(800 x 1750 x 565)
1000	1080	983	1469	1285	–	**–**	**6SE7041–1WL60**	–	17.20	43.3 x 68.9 x 22.2	(1100 x 1750 x 565)
1200	1230	1119	1673	1464	–	**–**	**6SE7041–2WL60**	–	22.90	43.3 x 68.9 x 22.2	(1100 x 1750 x 565)

For units with larger nominal power rating (parallel switched units), see page 3/16.

1) See Engineering Information, Section 6.

2) Power ratings are nominal estimates. Check the motor nameplate current for specific sizing.

Dimension drawing, see Sect. 7	Weight approx.		Cooling air requirement		Sound pressure level L_{pA} (1 m)	Power connections – Terminals for sizes A to D – Lugs for sizes E to Q – Location: at top for AC/DC, at bottom for motor			Auxiliary current requirement		
						Single- and multi-stranded		Retaining bolt	24 V DC Standard version max. at 20 V[1])	24 V DC Max. version max. at 20 V[1])	1-ph. or 2-ph. 230 V fan for inverters
					50 Hz						60 Hz
No.	lb	(kg)	ft³/min	(m³/s)	dB	AWG	(mm²)		A	A	A
8	165.4	(75)	296.64	(0.14)	69	max. 2 x 2/0	max. 2 x 70	M 10	2.1	3.2	0.60
8	165.4	(75)	296.64	(0.14)	69	max. 2 x 2/0	max. 2 x 70	M 10	2.1	3.2	0.60
8	352.8	(160)	656.40	(0.31)	80	max. 2 x 6/0	max. 2 x 150	M 12	2.3	3.5	1.1
8	352.8	(160)	656.40	(0.31)	80	max. 2 x 6/0	max. 2 x 150	M 12	2.3	3.5	1.1
8	396.9	(180)	868.75	(0.41)	82	max. 2 x 6/0	max. 2 x 150	M 12	2.3	3.5	1.4
8	396.9	(180)	868.75	(0.41)	82	max. 2 x 6/0	max. 2 x 150	M 12	2.3	3.5	1.4
8	396.9	(180)	868.75	(0.41)	82	max. 2 x 6/0	max. 2 x 150	M 12	2.3	3.5	1.4
10	771.7	(350)	974.69	(0.46)	77	max. 2 x 9/0	max. 2 x 300	M 12/M 16	3.0	4.2	3.4
12	882.0	(400)	974.69	(0.46)	77	max. 2 x 9/0	max. 2 x 300	M 12/M 16	3.1	4.3	–
10	771.7	(350)	974.69	(0.46)	77	max. 2 x 9/0	max. 2 x 300	M 12/M 16	3.0	4.2	3.4
12	882.0	(400)	974.69	(0.46)	77	max. 2 x 9/0	max. 2 x 300	M 12/M 16	3.1	4.3	–
10	771.7	(350)	974.69	(0.46)	77	max. 2 x 9/0	max. 2 x 300	M 12/M 16	3.0	4.2	3.4
12	882.0	(400)	974.69	(0.46)	77	max. 2 x 9/0	max. 2 x 300	M 12/M 16	3.1	4.3	–
10	1146.6	(520)	1271.34	(0.60)	80	max. 4 x 9/0	max. 4 x 300	M 12/M 16	3.0	4.2	6.9
10	1146.6	(520)	1271.34	(0.60)	80	max. 4 x 9/0	max. 4 x 300	M 12/M 16	3.0	4.2	6.9
10	1146.6	(520)	1864.63	(0.88)	82	max. 4 x 9/0	max. 4 x 300	M 12/M 16	3.0	4.2	22.0
11	1378.1	(625)	1949.39	(0.92)	89	max. 6 x 9/0	max. 6 x 300	M 12/M 16	3.0	4.2	22.0
11	1378.1	(625)	1949.39	(0.92)	89	max. 6 x 9/0	max. 6 x 300	M 12/M 16	3.0	4.2	22.0

Selection and ordering data

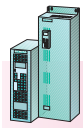
Nominal power rating	Rated output current	Base load current	Short-time current[1]	Rated DC link current	Inverter complete	Inverter/interphase transformer chassis	Total power loss at 2.5 kHz Parallel switching device	Dimensions Unit measurements W x H x D	Dimension drawing, see Section 7	Weight approx.
	I_{UN}	I_G	$I_{max.}$							
kW	A	A	A	A	Type[2]	Order No.	kW	in (mm)	No.	lb (kg)
Supply voltage 510 V to 650 V DC										
400 V										
900	1630	1483	2217	1940	**6SE7041-6TQ60**[3] without interphase transformer chassis	Master **6SE7038-6TK86-3AE0** Slave **6SE7038-6TK86-4AE0**	22.6	(2 x 31.5) x 68.9 x 22.2 ((2 x 800) x 1750 x 565)	10 (2x)	2293.2 (1040)
900	1630	1483	2217	1940	**6SE7041-6TM60**[4] with interphase transformer chassis	Master **6SE7038-6TK86-3AE0** Slave **6SE7038-6TK86-4AE0** interphase transformer chassis **6SE7041-6GS86-5AB1**	23.6	(2 x 31.5 + 20) x 68.9 x 22.2 ((2 x 800 + 508) x 1750 x 565)	13	3087 (1400)
1300	2470	2248	3359	2940	**6SE7042-5TN60**[3] without interphase transformer chassis	Master **6SE7041-3TL86-3AE0** Slave **6SE7041-3TL86-4AE0**	27.5	(2 x 43.3) x 68.9 x 22.2) ((2 x 1100) x 1750 x 565)	11 (2x)	2976.7 (1350)
Supply voltage 675 V to 810 V DC										
500 V										
1000	1400	1274	1904	1666	**6SE7041-4UQ60**[3] without interphase transformer chassis	Master **6SE7038-6UK86-3BE0** Slave **6SE7038-6UK86-4AE0**	19.0	(2 x 31.5) x 68.9 x 22.2 ((2 x 800) x 1750 x 565)	10 (2x)	2535.7 (1150)
1000	1400	1274	1904	1666	**6SE7041-4UM60**[4] with interphase transformer chassis	Master **6SE7038-6UK86-3BE0** Slave **6SE7038-6UK86-4AE0** interphase transformer chassis **6SE7041-6GS86-5AB1**	20.0	(2 x 31.5 + 20) x 68.9 x 22.2 ((2 x 800 + 508) x 1750 x 565)	13	3307.5 (1500)
1100	1580	1438	2149	1880	**6SE7041-6UQ60**[3] without interphase transformer chassis	Master **6SE7038-6UK86-3AE0** Slave **6SE7038-6UK86-4AE0**	21.3	(2 x 31.5) x 68.9 x 22.2 ((2 x 800) x 1750 x 565)	10 (2x)	2535.7 (1150)
1100	1580	1438	2149	1880	**6SE7041-6UM60**[4] with interphase transformer chassis	Master **6SE7038-6UK86-3AE0** Slave **6SE7038-6UK86-4AE0** interphase transformer chassis **6SE7041-6GS86-5AB1**	22.3	(2 x 31.5 + 20) x 68.9 x 22.2 ((2 x 800 + 508) x 1750 x 565)	13	3307.5 (1500)
1500	2050	1866	2788	2440	**6SE7042-1UN60**[3] without interphase transformer chassis	Master **6SE7041-1UL86-3AE0** Slave **6SE7041-1UL86-4AE0**	27.0	(2 x 43.3) x 68.9 x 22.2 ((2 x 1100) x 1750 x 565)	11 (2x)	2976.7 (1350)
1700	2340	2129	3182	2785	**6SE7042-3UN60**[3] without interphase transformer chassis	Master **6SE7041-2UL86-3AE0** Slave **6SE7041-2UL86-4AE0**	31.7	(2 x 43.3) x 68.9 x 22.2 ((2 x 1100) x 1750 x 565)	11 (2x)	2976.7 (1350)
Supply voltage 890 V to 930 V DC										
690 V										
1300	1400	1274	1904	1666	**6SE7041-4WQ60**[3] without interphase transformer chassis	Master **6SE7038-6WK86-3BE0** Slave **6SE7038-6WK86-4AE0**	22.6	(2 x 31.5) x 68.9 x 22.2 ((2 x 800) x 1750 x 565)	10 (2x)	2535.7 (1150)
1300	1400	1274	1904	1666	**6SE7041-4WM60**[4] with interphase transformer chassis	Master **6SE7038-6WK86-3BE0** Slave **6SE7038-6WK86-4AE0** interphase transformer chassis **6SE7041-6GS86-5AB1**	23.6	(2 x 31.5 + 20) x 68.9 x 22.2 ((2 x 800 + 508) x 1750 x 565)	13	3307.5 (1500)
1500	1580	1438	2149	1880	**6SE7041-6WQ60**[3] without interphase transformer chassis	Master **6SE7038-6WK86-3AE0** Slave **6SE7038-6WK86-4AE0**	25.5	(2 x 31.5) x 68.9 x 22.2 ((2 x 800) x 1750 x 565)	10 (2x)	2535.7 (1150)
1500	1580	1438	2149	1880	**6SE7041-6WM60**[4] with interphase transformer chassis	Master **6SE7038-6WK86-3AE0** Slave **6SE7038-6WK86-4AE0** interphase transformer chassis **6SE7041-6GS86-5AB1**	26.5	(2 x 31.5 + 20) x 68.9 x 22.2 ((2 x 800 + 508) x 1750 x 565)	13	3307.5 (1500)
1900	2050	1866	2788	2440	**6SE7042-1WN60**[3] without interphase transformer chassis	Master **6SE7041-1WL86-3AE0** Slave **6SE7041-1WL86-4AE0**	32.7	(2 x 43.3) x 68.9 x 22.2 ((2 x 1100) x 1750 x 565)	11 (2x)	2976.7 (1350)
2300	2340	2129	3182	2785	**6SE7042-3WN60**[3] without interphase transformer chassis	Master **6SE7041-2WL86-3AE0** Slave **6SE7041-2WL86-4AE0**	43.5	(2 x 43.3) x 68.9 x 22.2 ((2 x 1100) x 1750 x 565)	11 (2x)	2976.7 (1350)

1) Short-time current = **1.36 x I_{UN}**, for **60 s**.

2) For ordering master and slave unit together. Options only possible for master unit.

3) Delivery in two transport units. DC busbar system and signal cabling to be installed on-site.

4) Delivery in three transport units. DC busbar system and signal cabling to be installed on-site. Interphase transformer chassis connection package (for connecting to inverters) included in scope of delivery.



Cooling air requirement	Sound pressure level L_{pA} (1 m)	Power connections – Terminals for sizes A to D – Lugs for sizes E to Q – Location: at top for AC/DC, at bottom for motor			Auxiliary current requirement		
		Single- and multi-stranded		Retaining bolt	24 V DC Standard version max. at 20 V[1]	24 V DC Max. version max. at 20 V[1]	1-ph. or 2-ph. 230 V fan for inverters
	50 Hz						60 Hz
ft^3/min (m^3/s)	dB	AWG (mm^2)			A	A	A
3602.1 (1.70)	87	max. 2 x 4 x 9/0	(max. 2 x 4 x 300)	M 12/M 16	5.2	6.6	13.8
3602.1 (1.70)	87	max. 2 x 4 x 9/0	(max. 2 x 4 x 300)	M 12/M 16	5.2	6.6	13.8
3898.8 (1.84)	91	max. 2 x 6 x 9/0	(max. 2 x 6 x 300)	M 12/M 16	5.2	6.6	44.0
3814 (1.80)	87	max. 2 x 4 x 9/0	(max. 2 x 4 x 300)	M 12/M 16	5.2	6.6	44.0
3814 (1.80)	87	max. 2 x 4 x 9/0	(max. 2 x 4 x 300)	M 12/M 16	5.2	6.6	44.0
3814 (1.80)	87	max. 2 x 4 x 9/0	(max. 2 x 4 x 300)	M 12/M 16	5.2	6.6	44.0
3814 (1.80)	87	max. 2 x 4 x 9/0	(max. 2 x 4 x 300)	M 12/M 16	5.2	6.6	44.0
3898.8 (1.84)	91	max. 2 x 6 x 9/0	(max. 2 x 6 x 300)	M 12/M 16	5.2	6.6	44.0
3898.8 (1.84)	91	max. 2 x 6 x 9/0	(max. 2 x 6 x 300)	M 12/M 16	5.2	6.6	44.0
3814 (1.80)	87	max. 2 x 4 x 9/0	(max. 2 x 4 x 300)	M 12/M 16	5.2	6.6	44.0
3814 (1.80)	87	max. 2 x 4 x 9/0	(max. 2 x 4 x 300)	M 12/M 16	5.2	6.6	44.0
3814 (1.80)	87	max. 2 x 4 x 9/0	(max. 2 x 4 x 300)	M 12/M 16	5.2	6.6	44.0
3814 (1.80)	87	max. 2 x 4 x 9/0	(max. 2 x 4 x 300)	M 12/M 16	5.2	6.6	44.0
3898.8 (1.84)	91	max. 2 x 6 x 9/0	(max. 2 x 6 x 300)	M 12/M 16	5.2	6.6	44.0
3898.8 (1.84)	91	max. 2 x 6 x 9/0	(max. 2 x 6 x 300)	M 12/M 16	5.2	6.6	44.0

1) See Engineering Information, page 6/44.

3

Technical characteristics

The design of the power section of AFE inverters is identical to that of the standard inverters of the SIMOVERT MASTER-DRIVES series. It is therefore not necessary to keep special spare parts for AFE inverters.

The CUSA control board makes a standard inverter into an AFE inverter.

The power range is 6.8 kW to 1200 kW with supply voltages of 3 AC 400 V, 500 V and 690 V. For power outputs of > 250 kW, only cabinet units can be supplied (see Section 4).

For power outputs > 50 kW, i.e. all chassis units, a special sine filter called the Clean Power Filter is necessary.

N.B.!

AFE inverters are aligned inversely to the supply and cannot function autonomously. In order to function, they need at least the following system components:

- VSB voltage sensing board
- Precharger
- Main contactor
- AFE reactor.

Compact units

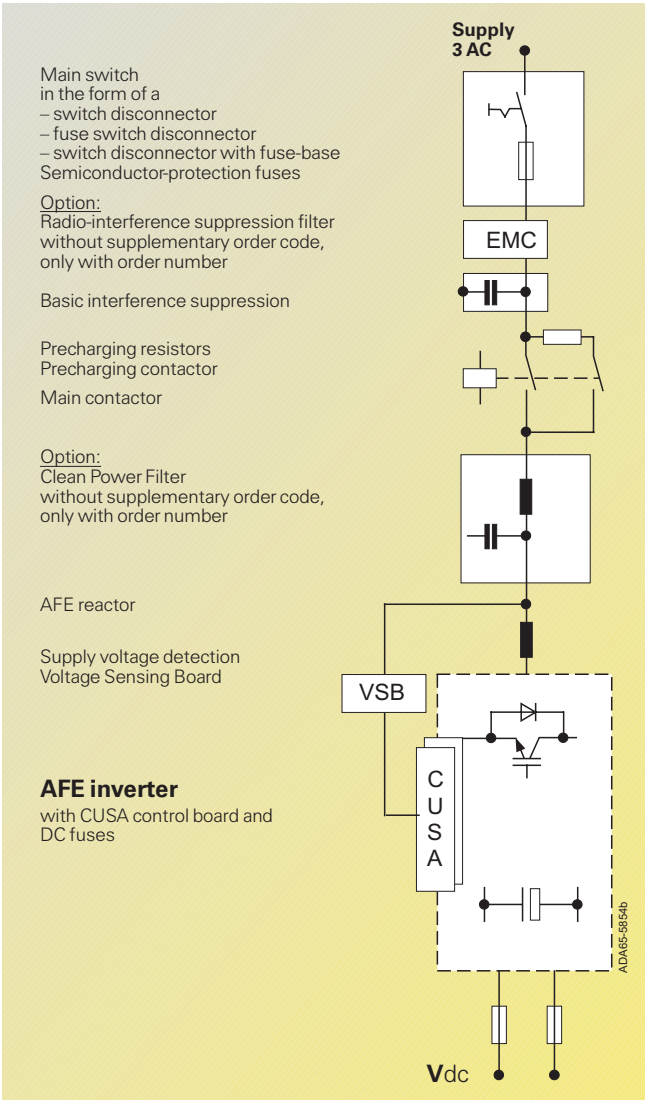


Fig. 3/8
AFE compact units

Chassis units

In order to facilitate handling when chassis units are used, all the necessary system components together with some supply components, including the Clean Power filter, are combined to form an **AFE supply connecting module**.

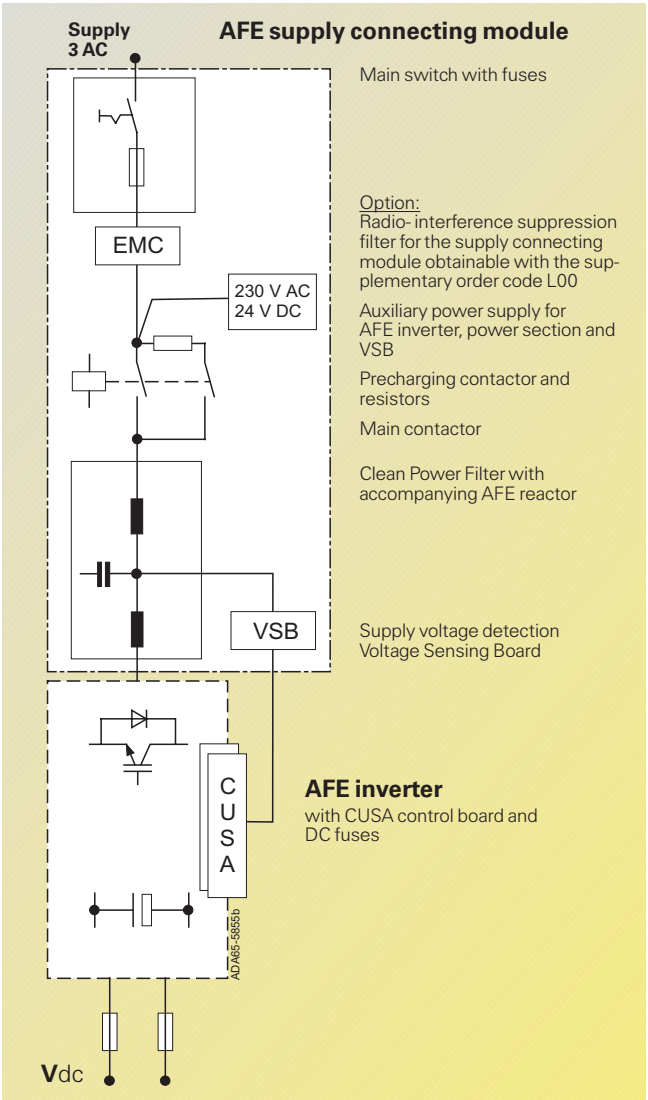


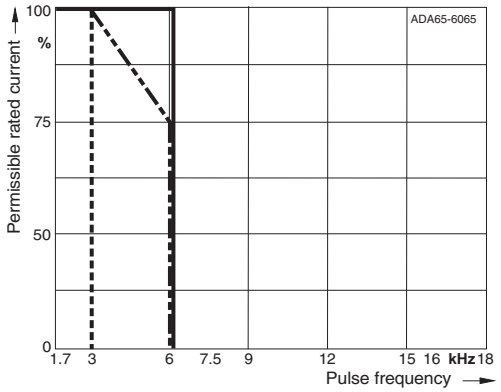
Fig. 3/9
AFE chassis units

Technical data

Rated voltage			
Supply voltage	3 AC 380 V – 20 % to 460 V + 5 %	3 AC 500 V – 20 % to 575 V + 5 %	3 AC 660 V – 20 % to 690 V + 5 %
Output voltage Operating range of control of DC link voltage	Factory setting 600 V DC for compact units 632 V DC for chassis and cabinet units Minimum 1.5x rms value of the supply voltage Maximum 740 V DC	Factory setting 790 V DC for chassis and cabinet units Minimum 1.5x rms value of the supply voltage Maximum 920 V DC	Factory setting 1042 V DC for chassis and cabinet units Minimum 1.5x rms value of the supply voltage Maximum 1100 V DC
Rated frequency			
Supply frequency	50/60 Hz (± 10 %)	50/60 Hz (± 10 %)	50/60 Hz (± 10 %)
Load class II to EN 60 146-1-1	see also Engineering Information, Section 6		
Base load current	0.91 x rated output current		
Short-time-current	1.36 x rated output current during 60 s or 1.60 x rated output current during 30 s for units up to size G and supply voltage max. 600 V		
Cycle time	300 s		
Supply power factor • fundamental • overall	1 (Factory setting) > 0.99		
Efficiency	> 0.98		

Reduction curves

For reduction factors due to different installation conditions (installation altitude, ambient temperature), see Section 6.



Max. adjustable pulse frequency depending on output and type of construction:

6 kHz — for type A, B, C and D
for 45 kW; 55 kW; 380 V to 480 V
for 37 kW; 45 kW; 500 V to 600 V
for 75 kW; 90 kW; 380 V to 480 V
for 55 kW; 500 V to 600 V
for 110 kW; 132 kW; 380 V to 480 V
for 75 kW; 90 kW; 500 V to 600 V
for 55 kW to 110 kW; 660 V to 690 V

6 kHz — for 160 kW to 250 kW; 380 V to 480 V
for 110 kW to 160 kW; 500 V to 600 V
for 132 kW to 200 kW; 660 V to 690 V

3 kHz — for 315 kW to 400 kW; 380 V to 480 V
for 200 kW to 315 kW; 500 V to 600 V
for 250 kW to 400 kW; 660 V to 690 V

Options for AFE inverters

AFE inverters cannot be ordered with options.

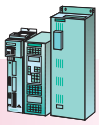
For the ordering of optional electronic boards, see Section 6.

For Engineering Information on self-commutated AFE, see Section 6.

Selection and ordering data

Rated rectifier/ regenerative output at cos φ = 1 and 400 V supply voltage	Short-time rectifier/ regenerative output at cos φ = 1 and 400 V supply voltage	Rated input current 3 AC from/to line	Base load input current 3 AC from/to line	Short-time input current 3 AC from/to line	**AFE inverter** with CUSA control unit 6SE7090–0XX84–0BJ0	Power loss	Spare parts as for VC inverter with nominal power rating		Dimensions Unit measurements W x H x D	Dimension drawing, see Section 7		Weight approx.
P_n	$P_{max.}$	I_{UN}	I_G	$I_{max.}$		P_v	P_{type}					
kW	kW	A	A	A	Order No.	kW	kW	in	(mm)	No.	lb	(kg)
Supply voltage 3-ph. 380 V AC –20 % to 460 V +5 %												
400 V												
6.8	11	10.2	9.2	16.3	**6SE7021–0EA81**	0.14	4	3.5 x 16.7 x 13.8	(90 x 425 x 350)	6	17.6	(8)
9	14	13.2	11.9	21.1	**6SE7021–3EB81**	0.18	5.5	5.3 x 16.7 x 13.8	(135 x 425 x 350)	6	26.5	(12)
12	19	17.5	15.8	28.0	**6SE7021–8EB81**	0.24	7.5	5.3 x 16.7 x 13.8	(135 x 425 x 350)	6	26.5	(12)
17	27	25.5	23.0	40.8	**6SE7022–6EC81**	0.34	11	7.1 x 23.6 x 13.8	(180 x 600 x 350)	6	52.9	(24)
23	37	34	31	54	**6SE7023–4EC81**	0.46	15	7.1 x 23.6 x 13.8	(180 x 600 x 350)	6	52.9	(24)
32	51	47	42	75	**6SE7024–7ED81**	0.63	22	10.6 x 23.6 x 13.8	(270 x 600 x 350)	6	77.2	(35)
40	63	59	53	94	**6SE7026–0ED81**	0.79	30	10.6 x 23.6 x 13.8	(270 x 600 x 350)	6	77.2	(35)
49	78	72	65	115	**6SE7027–2ED81**	0.98	37	10.6 x 23.6 x 13.8	(270 x 600 x 350)	6	77.2	(35)
63	100	92	83	147	**6SE7031–0EE80**	1.06	45	10.6 x 41.3 x 14.4	(270 x 1050 x 365)	8	121.3	(55)
85	135	124	112	198	**6SE7031–2EF80**	1.44	55	14.2 x 41.3 x 14.4	(360 x 1050 x 365)	8	143.3	(65)
100	159	146	131	234	**6SE7031–5EF80**	1.69	75	14.2 x 41.3 x 14.4	(360 x 1050 x 365)	8	143.3	(65)
125	200	186	167	298	**6SE7031–8EF80**	2.00	90	14.2 x 41.3 x 14.4	(360 x 1050 x 365)	8	143.3	(65)
143	228	210	189	336	**6SE7032–1EG80**	2.42	110	20.0 x 57.1 x 18.3	(508 x 1450 x 465)	8	341.8	(155)
177	282	260	234	416	**6SE7032–6EG80**	3.00	132	20.0 x 57.1 x 18.3	(508 x 1450 x 465)	8	341.8	(155)
214	342	315	284	504	**6SE7033–2EG80**	3.64	160	20.0 x 57.1 x 18.3	(508 x 1450 x 465)	8	341.8	(155)
250	400	370	333	592	**6SE7033–7EG80**	4.25	200	20.0 x 57.1 x 18.3	(508 x 1450 x 465)	8	341.8	(155)
Supply voltage 3-ph. 500 V AC –20 % to 575 V +5 %												
500 V												
51	81	61	55	98	**6SE7026–1FE80**	0.86	37	10.6 x 41.3 x 14.4	(270 x 1050 x 365)	8	121.3	(55)
56	90	66	59	106	**6SE7026–6FE80**	0.95	45	10.6 x 41.3 x 14.4	(270 x 1050 x 365)	8	121.3	(55)
67	107	79	71	126	**6SE7028–0FF80**	1.14	55	14.2 x 41.3 x 14.4	(360 x 1050 x 365)	8	143.3	(65)
92	147	108	97	173	**6SE7031–1FF80**	1.47	75	14.2 x 41.3 x 14.4	(360 x 1050 x 365)	8	143.3	(65)
109	174	128	115	205	**6SE7031–3FG80**	1.85	90	20.0 x 57.1 x 18.3	(508 x 1450 x 465)	8	341.8	(155)
132	212	156	140	250	**6SE7031–6FG80**	2.25	110	20.0 x 57.1 x 18.3	(508 x 1450 x 465)	8	341.8	(155)
164	262	192	173	307	**6SE7032–0FG80**	2.78	132	20.0 x 57.1 x 18.3	(508 x 1450 x 465)	8	341.8	(155)
192	307	225	203	360	**6SE7032–3FG80**	3.26	160	20.0 x 57.1 x 18.3	(508 x 1450 x 465)	8	341.8	(155)
Supply voltage 3-ph. 660 V AC –20 % to 690 V +5 %												
690 V												
70	96	60	54	82	**6SE7026–0HF80**	1.19	55	14.2 x 41.3 x 14.4	(360 x 1050 x 365)	8	143.3	(65)
96	131	82	74	112	**6SE7028–2HF80**	1.63	75	14.2 x 41.3 x 14.4	(360 x 1050 x 365)	8	143.3	(65)
114	155	97	87	132	**6SE7031–0HG80**	1.83	90	20.0 x 57.1 x 18.3	(508 x 1450 x 465)	8	341.8	(155)
138	188	118	106	160	**6SE7031–2HG80**	2.35	110	20.0 x 57.1 x 18.3	(508 x 1450 x 465)	8	341.8	(155)
170	231	145	131	197	**6SE7031–5HG80**	2.89	132	20.0 x 57.1 x 18.3	(508 x 1450 x 465)	8	341.8	(155)
200	272	171	154	233	**6SE7031–7HG80**	3.40	160	20.0 x 57.1 x 18.3	(508 x 1450 x 465)	8	341.8	(155)
245	333	208	187	283	**6SE7032–1HG80**	4.16	200	20.0 x 57.1 x 18.3	(508 x 1450 x 465)	8	341.8	(155)

Cooling air requirement		Sound pressure level with standard protection degree IP20/IP00 L_{pA} (1 m)	Power connections – Terminals for sizes A to D – Lugs for sizes E to G – Location: at bottom for AFE reactor, at top for DC link connection				Auxiliary current requirement		
			Finely stranded		Single- and multi-stranded		Retaining bolt	24 V DC Standard version	24 V DC Max. version	1-ph. 230 V fan for AFE inverter units
		50 Hz								60 Hz
ft³/min	(m³/s)	dB	AWG	(mm²)	AWG	(mm²)		A	A	A
19.07	(0.009)	60	13 to 7	(2.5 to 10)	13 to 6	(2.5 to 16)		2	3	none
46.62	(0.022)	60	13 to 7	(2.5 to 10)	13 to 6	(2.5 to 16)		2	3	none
46.62	(0.022)	60	13 to 7	(2.5 to 10)	13 to 6	(2.5 to 16)		2	3	none
59.33	(0.028)	60	13 to 6	(2.5 to 16)	7 to 4	(10 to 25)		2	3	none
59.33	(0.028)	60	13 to 6	(2.5 to 16)	7 to 4	(10 to 25)		2	3	none
114.42	(0.054)	65	13 to 3	(2.5 to 35)	7 to 1/0	(10 to 50)		2	3	0.44
114.42	(0.054)	65	13 to 3	(2.5 to 35)	7 to 1/0	(10 to 50)		2	3	0.44
114.42	(0.054)	65	13 to 3	(2.5 to 35)	7 to 1/0	(10 to 50)		2	3	0.44
233.08	(0.11)	69			max. 2 x 2/0	(max. 2 x 70)	M 10	The AFE chassis units are offered with the line connecting module (see system components) as standard. The auxiliary power supply 24 V DC and 230 V AC and the fusing are incorporated in the matching line connecting module.		
317.83	(0.15)	70			max. 2 x 2/0	(max. 2 x 70)	M 10			
317.83	(0.15)	70			max. 2 x 2/0	(max. 2 x 70)	M 10			
317.83	(0.15)	70			max. 2 x 2/0	(max. 2 x 70)	M 10			
699.24	(0.33)	81			max. 2 x 6/0	(max. 2 x 150)	M 12			
699.24	(0.33)	81			max. 2 x 6/0	(max. 2 x 150)	M 12			
932.32	(0.44)	83			max. 2 x 6/0	(max. 2 x 150)	M 12			
932.32	(0.44)	83			max. 2 x 6/0	(max. 2 x 150)	M 12			
233.08	(0.11)	70			max. 2 x 2/0	(max. 2 x 70)	M 10	The AFE chassis units are offered with the line connecting module (see system components) as standard. The auxiliary power supply 24 V DC and 230 V AC and the fusing are incorporated in the matching line connecting module.		
233.08	(0.11)	70			max. 2 x 2/0	(max. 2 x 70)	M 10			
317.83	(0.15)	70			max. 2 x 2/0	(max. 2 x 70)	M 10			
317.83	(0.15)	81			max. 2 x 2/0	(max. 2 x 70)	M 10			
699.24	(0.33)	81			max. 2 x 6/0	(max. 2 x 150)	M 12			
699.24	(0.33)	81			max. 2 x 6/0	(max. 2 x 150)	M 12			
932.32	(0.44)	83			max. 2 x 6/0	(max. 2 x 150)	M 12			
932.32	(0.44)	83			max. 2 x 6/0	(max. 2 x 150)	M 12			
317.83	(0.15)	70			max. 2 x 2/0	(max. 2 x 70)	M 10	The AFE chassis units are offered with the line connecting module (see system components) as standard. The auxiliary power supply 24 V DC and 230 V AC and the fusing are incorporated in the matching line connecting module.		
317.83	(0.15)	70			max. 2 x 2/0	(max. 2 x 70)	M 10			
678.05	(0.32)	81			max. 2 x 6/0	(max. 2 x 150)	M 12			
678.05	(0.32)	81			max. 2 x 6/0	(max. 2 x 150)	M 12			
932.32	(0.44)	81			max. 2 x 6/0	(max. 2 x 150)	M 12			
932.32	(0.44)	83			max. 2 x 6/0	(max. 2 x 150)	M 12			
932.32	(0.44)	83			max. 2 x 6/0	(max. 2 x 150)	M 12			



Technical characteristics

Rectifier units supply the DC bus for inverters with motoring energy and enable operation of a multi-motor system.

The Compact PLUS rectifier units have an integrated braking chopper. For regenerative mode, these rectifier units require only an external braking resistor.

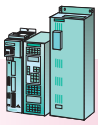
Rectifier/regenerative units supply the DC bus for inverters with motoring energy from a three-phase system and return regenerative energy from the DC bus to the power system. This is achieved using two independent thyristor bridges. The regenerating bridge is connected via an autotransformer.

The advantages of using an autotransformer are as follows:

- maximum motor torque, even during regenerative mode
- improved availability with weak supply systems or during voltage dips.

Rectifier and rectifier/regenerative units are suitable as standard for operation with IT supply systems.

In order to increase the output current, up to 2 additional "parallel units" of the rectifier or rectifier/regenerative unit type K ("base unit") with the same rated current may be connected in parallel (see Engineering Information, page 6/16).



Technical data

Rated voltage			
Supply voltage, motoring	3 AC 380 V – 15 % to 480 V +10 %	3 AC 500 V – 15 % to 600 V +10 %	3 AC 660 V – 15 % to 690 V +15 %
Supply voltage, generating	3 AC 455 V – 15 % to 576 V +10 %	3 AC 600 V – 15 % to 720 V +10 %	3 AC 790 V – 15 % to 830 V +15 %
Output voltage DC link voltage	510 V DC –15 % to 650 V DC +10 %	675 V DC –15 % to 810 V DC +10 %	890 V DC –15 % to 930 V DC +15 %
Rated frequency			
Supply frequency	50/60 Hz (± 6 %)	50/60 Hz (± 6 %)	50/60 Hz (± 6 %)
Load class II to EN 60 146-1-1			
Base load current	0.91 x rated DC link current		
Short-time current	1.36 x rated DC link current during 60 s; additionally for Compact PLUS units: 1.6 x rated DC link current during 30 s		
Cycle time	300 s		
Overload duration	60 s (20 % of the cycle time)		
Power factor, motoring • supply fundamental • overall	 ≥ 0.98 0.93 to 0.96		
Efficiency	0.99 to 0.995		

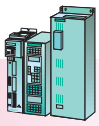
For reduction factors due to different installation conditions (installation altitude, ambient temperature), see Section 6.

Options for rectifier units and rectifier/regenerative units

Rectifier units and rectifier/regenerative units can be supplied ex works with the following options in the table.
For a description of options, see page 3/89. For the ordering of units with optional electronic boards, see Section 6.
Rectifier and rectifier/regenerative units are suitable as standard for operation with IT supply systems.

Supplementary order code	Description of option	Rectifier unit Size				Rectifier/regenerative unit Size		
		Compact PLUS	B, C	E	H, K	C	E	H, K
K91	DC link current detector	–	●	●	■	■	■	■
M20	IP20 panels	–	■	●	–	■	●	–

■ Standard
● Option possible
– Option not possible or not relevant



Selection and ordering data

Nominal power rating[1]		Rated DC link current	DC link base load current	DC link short-time current	Supply current[2]	Rectifier unit	Max. power loss	Braking power with integrated braking chopper: Smallest permissible value of external braking resistor R_{min}	Rated braking power P_{20} with R_{min}	Short-time braking power P_3 with R_{min}
HP	(kW)	A	A	A	A	Order No.	kW	Ω	kW	kW
Compact PLUS units										
Supply voltage 3-ph. 380 V AC –15 % to 480 V AC +10 % 50/60 Hz										
20	**(15)**	41	–	66[4]	36	**6SE7024–1EP85–0AA0**	0.13	19	20	30
67	**(50)**	120	–	192[4]	108	**6SE7031–2EP85–0AA0**	0.27	6.5	60	90
134	**(100)**	230	–	368[4]	207	**6SE7032–3EP85–0AA0**	0.60	3.4	116	174
Compact and chassis units										
Supply voltage 3-ph. 380 V to 480 V AC		Can also be connected to 3-ph. 200 V to 230 V								
20	**(15)**	41	37	56	36	**6SE7024–1EB85–0AA0**	0.12	–	–	–
50	**(37)**	86	78	117	75	**6SE7028–6EC85–0AA0**	0.26	–	–	–
100	**(75)**	173	157	235	149	**6SE7031–7EE85–0AA0**	0.62	–	–	–
150	**(110)**	270	246	367	233	**6SE7032–7EE85–0AA0**	0.86	–	–	–
200	**(160)**	375	341	510	326	**6SE7033–8EE85–0AA0**	1.07	–	–	–
250	**(200)**	463	421	630	403	**6SE7034–6EE85–0AA0**	1.32	–	–	–
300	**(250)**	605	551	823	526	**6SE7036–1EE85–0AA0**	1.67	–	–	–
525	**(400)**	821	747	1117	710	**6SE7038–2EH85–0AA0**[3]	3.29	–	–	–
650	**(500)**	1023	931	1391	888	**6SE7041–0EH85–0AA0**[3]	3.70	–	–	–
825	**(630)**	1333	1213	1813	1156	**6SE7041–3EK85–0AA0**[3]	4.85	–	–	–
1000	**(800)**	1780	1620	2421	1542	**6SE7041–8EK85–0AA0**[3]	6.24	–	–	–
Supply voltage 3-ph. 500 V to 600 V AC										
30	**(22)**	41	37	56	36	**6SE7024–1FB85–0AA0**	0.21	–	–	–
50	**(37)**	72	66	98	63	**6SE7027–2FC85–0AA0**	0.22	–	–	–
75	**(55)**	94	86	128	81	**6SE7028–8FC85–0AA0**	0.28	–	–	–
100	**(75)**	142	129	193	123	**6SE7031–4FE85–0AA0**	0.65	–	–	–
175	**(132)**	235	214	320	203	**6SE7032–4FE85–0AA0**	0.97	–	–	–
250	**(200)**	354	322	481	307	**6SE7033–5FE85–0AA0**	1.25	–	–	–
300	**(250)**	420	382	571	366	**6SE7034–2FE85–0AA0**	1.27	–	–	–
400	**(315)**	536	488	729	465	**6SE7035–4FE85–0AA0**	1.74	–	–	–
600	**(400)**	774	704	1053	671	**6SE7037–7FH85–0AA0**[3]	3.30	–	–	–
800	**(630)**	1023	931	1391	888	**6SE7041–0FH85–0AA0**[3]	4.03	–	–	–
1000	**(800)**	1285	1169	1748	1119	**6SE7041–3FK85–0AA0**[3]	5.40	–	–	–
1200	**(900)**	1464	1332	1991	1269	**6SE7041–5FK85–0AA0**[3]	5.87	–	–	–
1400	**(1100)**	1880	1711	2557	1633	**6SE7041–8FK85–0AA0**[3]	6.65	–	–	–
Supply voltage 3-ph. 660 V to 690 V AC										
200	**(160)**	222	202	302	194	**6SE7032–2HE85–0AA0**	1.08	–	–	–
300	**(250)**	354	322	481	308	**6SE7033–5HE85–0AA0**	1.33	–	–	–
400	**(315)**	420	382	571	366	**6SE7034–2HE85–0AA0**	1.58	–	–	–
600	**(400)**	536	488	729	465	**6SE7035–4HE85–0AA0**	2.02	–	–	–
800	**(630)**	774	704	1053	671	**6SE7037–7HH85–0AA0**[3]	3.70	–	–	–
1000	**(800)**	1023	931	1391	888	**6SE7041–0HH85–0AA0**[3]	4.15	–	–	–
1300	**(1000)**	1285	1169	1748	1119	**6SE7041–3HK85–0AA0**[3]	5.54	–	–	–
1400	**(1100)**	1464	1332	1991	1269	**6SE7041–5HK85–0AA0**[3]	6.00	–	–	–
2000	**(1500)**	1880	1711	2557	1633	**6SE7041–8HK85–0AA0**[3]	7.62	–	–	–

1) Nominal power ratings are quoted for ease of assigning components only. The drive outputs are dependent on the inverters connected and are to be dimensioned accordingly. When rectifier units 3-ph. 380 V to 480 V AC are used on a 3-ph. 200 V to 230 V AC supply, the rated currents remain the same and the nominal power rating is reduced to about 50 %.

2) The current data refer to a line supply inductance of 3 % referred to the rectifier unit impedance *Z*, i.e. the ratio of the system fault level to the converter output is 33:1 or 100:1 if an additional 2 % line reactor is used.

Rectifier unit impedance: $Z = \frac{V_{supply}}{\sqrt{3} \cdot I_{V_{supply}}}$

3) An interface adapter **6SE7090–0XX85–1TA0** is required if these rectifier units are used for 12-pulse system.

4) Short-time current:
1.6 x I_N for **30 s**
1.36 x I_N for **60 s**

Dimensions W x H x D in	(mm)	Dimension drawing, see Section 7 No.	Weight approx. lb	(kg)	Cooling air requirement ft³/min	(m³/s)	Sound pressure level with standard protection degree IP20/IP00 L_{pA} (1 m) 50 Hz dB	Power connections – Terminals for sizes B, C and P – Lugs for sizes E, H and K – Location: at bottom for AC, at top for DC: Finely stranded AWG	(mm²)	Single- and multi-stranded AWG	(mm²)	Retaining bolt	Auxiliary current requirement: 24 V DC Standard version max. at 20 V[1] A	24 V DC Max. version max. at 20 V[1] A	1-ph. or 2-ph. 230 V fan 60 Hz A
3.5 x 14.2 x 10.2	(90 x 360 x 260)	5	29.3	(13.3)	38.14	(0.018)	60	7	(10)	7	(10)	–	–	0.5	–
5.3 x 14.2 x 10.2	(135 x 360 x 260)	5	13.2	(6.0)	86.87	(0.041)	68	1/0	(50)	1/0	(50)	–	–	0.7	–
7.1 x 14.2 x 10.2	(180 x 360 x 260)	5	5.9	(2.7)	112.30	(0.053)	65	3/0	(95)	3/0	(95)	–	–	0.7	–
5.3 x 16.7 x 13.8	(135 x 425 x 350)	6	26.5	(12)	46.62	(0.022)	60	13 to 7	(2.5 to 10)	13 to 6	(2.5 to 16)		0.5	–	none
7.1 x 23.6 x 13.8	(180 x 600 x 350)	6	39.7	(18)	59.33	(0.028)	60	13 to 7	(2.5 to 35)	7 to 1/0	(10 to 50)		0.5	–	none
10.6 x 41.3 x 14.4	(270 x 1050 x 365)	14	99.2	(45)	423.78	(0.2)	75			2 x 9/0	(2 x 300)	M 12	0.3	–	0.75
10.6 x 41.3 x 14.4	(270 x 1050 x 365)	14	99.2	(45)	423.78	(0.2)	75			2 x 9/0	(2 x 300)	M 12	0.3	–	0.75
10.6 x 41.3 x 14.4	(270 x 1050 x 365)	14	99.2	(45)	423.78	(0.2)	75			2 x 9/0	(2 x 300)	M 12	0.3	–	0.75
10.6 x 41.3 x 14.4	(270 x 1050 x 365)	14	99.2	(45)	423.78	(0.2)	75			2 x 9/0	(2 x 300)	M 12	0.3	–	0.75
10.6 x 41.3 x 14.4	(270 x 1050 x 365)	14	99.2	(45)	423.78	(0.2)	75			2 x 9/0	(2 x 300)	M 16	0.3	–	0.75
20.0 x 41.3 x 22.2	(508 x 1050 x 565)	15	286.7	(130)	1483.23	(0.70)	80			4 x 9/0	(4 x 300)	M 12	1.0	2.3	3.5
20.0 x 41.3 x 22.2	(508 x 1050 x 565)	15	286.7	(130)	1483.23	(0.70)	80			4 x 9/0	(4 x 300)	M 12	1.0	2.3	3.5
31.5 x 55.1 x 22.2	(800 x 1400 x 565)	17	573.3	(260)	2118.9	(1.00)	86			4 x 9/0	(4 x 300)	M 12	1.0	2.3	7.0
31.5 x 55.1 x 22.2	(800 x 1400 x 565)	17	661.5	(300)	2118.9	(1.00)	86			4 x 9/0	(4 x 300)	M 12	1.0	2.3	7.0
5.3 x 16.7 x 13.8	(135 x 425 x 350)	6	26.5	(12)	46.62	(0.022)	60	13 to 7	(2.5 to 10)	13 to 6	(2.5 to 16)		0.5	–	none
7.1 x 23.6 x 13.8	(180 x 600 x 350)	6	39.7	(18)	59.33	(0.028)	60	13 to 3	(2.5 to 35)	7 to 1/0	(10 to 50)		0.5	–	none
7.1 x 23.6 x 13.8	(180 x 600 x 350)	6	39.7	(18)	59.33	(0.028)	60	13 to 3	(2.5 to 35)	7 to 1/0	(10 to 50)		0.5	–	none
10.6 x 41.3 x 14.4	(270 x 1050 x 365)	14	99.2	(45)	423.78	(0.2)	75			2 x 9/0	(2 x 300)	M 12	0.3	–	0.75
10.6 x 41.3 x 14.4	(270 x 1050 x 365)	14	99.2	(45)	423.78	(0.2)	75			2 x 9/0	(2 x 300)	M 12	0.3	–	0.75
10.6 x 41.3 x 14.4	(270 x 1050 x 365)	14	99.2	(45)	423.78	(0.2)	75			2 x 9/0	(2 x 300)	M 12	0.3	–	0.75
10.6 x 41.3 x 14.4	(270 x 1050 x 365)	14	99.2	(45)	423.78	(0.2)	75			2 x 9/0	(2 x 300)	M 16	0.3	–	0.75
10.6 x 41.3 x 14.4	(270 x 1050 x 365)	14	99.2	(45)	423.78	(0.2)	75			2 x 9/0	(2 x 300)	M 16	0.3	–	0.75
20.0 x 41.3 x 22.2	(508 x 1050 x 565)	15	286.6	(130)	1483.23	(0.70)	80			4 x 9/0	(4 x 300)	M 12	1.0	2.3	3.5
20.0 x 41.3 x 22.2	(508 x 1050 x 565)	15	286.6	(130)	1483.23	(0.70)	80			4 x 9/0	(4 x 300)	M 12	1.0	2.3	3.5
31.5 x 55.1 x 22.2	(800 x 1400 x 565)	17	573.3	(260)	2118.9	(1.00)	86			4 x 9/0	(4 x 300)	M 12	1.0	2.3	7.0
31.5 x 55.1 x 22.2	(800 x 1400 x 565)	17	661.5	(300)	2118.9	(1.00)	86			4 x 9/0	(4 x 300)	M 12	1.0	2.3	7.0
31.5 x 55.1 x 22.2	(800 x 1400 x 565)	17	661.5	(300)	2118.9	(1.00)	86			4 x 9/0	(4 x 300)	M 12	1.0	2.3	7.0
10.6 x 41.3 x 14.4	(270 x 1050 x 365)	14	99.2	(45)	423.78	(0.2)	75			2 x 9/0	(2 x 300)	M 12	0.3	–	0.75
10.6 x 41.3 x 14.4	(270 x 1050 x 365)	14	99.2	(45)	423.78	(0.2)	75			2 x 9/0	(2 x 300)	M 12	0.3	–	0.75
10.6 x 41.3 x 14.4	(270 x 1050 x 365)	14	99.2	(45)	423.78	(0.2)	75			2 x 9/0	(2 x 300)	M 16	0.3	–	0.75
10.6 x 41.3 x 14.4	(270 x 1050 x 365)	14	99.2	(45)	423.78	(0.2)	75			2 x 9/0	(2 x 300)	M 16	0.3	–	0.75
20.0 x 41.3 x 22.2	(508 x 1050 x 565)	15	286.6	(130)	1483.23	(0.70)	80			4 x 9/0	(4 x 300)	M 12	1.0	2.3	3.5
20.0 x 41.3 x 22.2	(508 x 1050 x 565)	15	286.6	(130)	1483.23	(0.70)	80			4 x 9/0	(4 x 300)	M 12	1.0	2.3	3.5
31.5 x 55.1 x 22.2	(800 x 1400 x 565)	17	573.3	(260)	2118.9	(1.00)	86			4 x 9/0	(4 x 300)	M 12	1.0	2.3	7.0
31.5 x 55.1 x 22.2	(800 x 1400 x 565)	17	661.5	(300)	2118.9	(1.00)	86			4 x 9/0	(4 x 300)	M 12	1.0	2.3	7.0
31.5 x 55.1 x 22.2	(800 x 1400 x 565)	17	661.5	(300)	2118.9	(1.00)	86			4 x 9/0	(4 x 300)	M 12	1.0	2.3	7.0

1) See Engineering Information, page 6/44.

Selection and ordering data

Nominal power rating[1]		Rated DC link output current[4]	Base load DC link current[4]	Short-time DC link current[4]	Input current[2]	Rectifier/ regenerative unit[3]	Max. power loss	Dimensions W x H x D	
HP	(kW)	A	A	A	A	Order No.	kW	in	(mm)
Supply voltage 3-ph. 380 V to 480 V AC Can also be connected to 3-ph. 200 V to 230 V AC									
10	**(7.5)**	21	19	29	18	**6SE7022–1EC85–1AA0**	0.15	7.1 x 23.6 x 13.8	(180 x 600 x 350)
20	**(15)**	41	37	56	35	**6SE7024–1EC85–1AA0**	0.20	7.1 x 23.6 x 13.8	(180 x 600 x 350)
50	**(37)**	86	78	117	74	**6SE7028–6EC85–1AA0**	0.31	7.1 x 23.6 x 13.8	(180 x 600 x 350)
100	**(75)**	173	157	235	149	**6SE7031–7EE85–1AA0**	0.69	10.6 x 41.3 x 14.4	(270 x 1050 x 365)
120	**(90)**	222	202	302	192	**6SE7032–2EE85–1AA0**	0.97	10.6 x 41.3 x 14.4	(270 x 1050 x 365)
175	**(132)**	310	282	422	269	**6SE7033–1EE85–1AA0**	1.07	10.6 x 41.3 x 14.4	(270 x 1050 x 365)
200	**(160)**	375	341	510	326	**6SE7033–8EE85–1AA0**	1.16	10.6 x 41.3 x 14.4	(270 x 1050 x 365)
250	**(200)**	463	421	630	403	**6SE7034–6EE85–1AA0**	1.43	10.6 x 41.3 x 14.4	(270 x 1050 x 365)
300	**(250)**	605	551	823	526	**6SE7036–1EE85–1AA0**	1.77	10.6 x 41.3 x 14.4	(270 x 1050 x 365)
525	**(400)**	821	747	1117	710	**6SE7038–2EH85–1AA0**	3.29	20.0 x 55.1 x 22.2	(508 x 1400 x 565)
650	**(500)**	1023	931	1391	888	**6SE7041–0EH85–1AA0**	3.70	20.0 x 55.1 x 22.2	(508 x 1400 x 565)
825	**(630)**	1333	1213	1813	1156	**6SE7041–3EK85–1AA0**	4.85	31.5 x 67.9 x 22.2	(800 x 1725 x 565)
1000	**(800)**	1780	1620	2421	1542	**6SE7041–8EK85–1AA0**	6.24	31.5 x 67.9 x 22.2	(800 x 1725 x 565)
Supply voltage 3-ph. 500 V to 600 V AC									
15	**(11)**	27	25	37	23	**6SE7022–7FC85–1AA0**	0.19	7.1 x 23.6 x 13.8	(180 x 600 x 350)
30	**(22)**	41	37	56	35	**6SE7024–1FC85–1AA0**	0.21	7.1 x 23.6 x 13.8	(180 x 600 x 350)
50	**(37)**	72	66	98	62	**6SE7027–2FC85–1AA0**	0.30	7.1 x 23.6 x 13.8	(180 x 600 x 350)
75	**(55)**	94	86	128	81	**6SE7028–8FC85–1AA0**	0.35	7.1 x 23.6 x 13.8	(180 x 600 x 350)
100	**(90)**	151	137	205	130	**6SE7031–5FE85–1AA0**	0.76	10.6 x 41.3 x 14.4	(270 x 1050 x 365)
175	**(132)**	235	214	320	202	**6SE7032–4FE85–1AA0**	1.14	10.6 x 41.3 x 14.4	(270 x 1050 x 365)
200	**(160)**	270	246	367	232	**6SE7032–7FE85–1AA0**	1.11	10.6 x 41.3 x 14.4	(270 x 1050 x 365)
250	**(200)**	354	322	481	307	**6SE7033–5FE85–1AA0**	1.36	10.6 x 41.3 x 14.4	(270 x 1050 x 365)
300	**(250)**	420	382	571	366	**6SE7034–2FE85–1AA0**	1.38	10.6 x 41.3 x 14.4	(270 x 1050 x 365)
400	**(315)**	536	488	729	465	**6SE7035–4FE85–1AA0**	2.00	10.6 x 41.3 x 14.4	(270 x 1050 x 365)
600	**(450)**	774	704	1053	671	**6SE7037–7FH85–1AA0**	3.30	20.0 x 55.1 x 22.2	(508 x 1400 x 565)
800	**(630)**	1023	931	1391	888	**6SE7041–0FH85–1AA0**	4.03	20.0 x 55.1 x 22.2	(508 x 1400 x 565)
1000	**(800)**	1285	1169	1748	1119	**6SE7041–3FK85–1AA0**	5.40	31.5 x 67.9 x 22.2	(800 x 1725 x 565)
1200	**(900)**	1464	1332	1991	1269	**6SE7041–5FK85–1AA0**	5.87	31.5 x 67.9 x 22.2	(800 x 1725 x 565)
1400	**(1100)**	1880	1711	2557	1633	**6SE7041–8FK85–1AA0**	7.65	31.5 x 67.9 x 22.2	(800 x 1725 x 565)
Supply voltage 3-ph. 660 V to 690 V AC									
140	**(110)**	140	127	190	120	**6SE7031–4HE85–1AA0**	0.82	10.6 x 41.3 x 14.4	(270 x 1050 x 365)
200	**(160)**	222	202	302	191	**6SE7032–2HE85–1AA0**	1.26	10.6 x 41.3 x 14.4	(270 x 1050 x 365)
250	**(200)**	270	246	367	232	**6SE7032–7HE85–1AA0**	1.15	10.6 x 41.3 x 14.4	(270 x 1050 x 365)
400	**(315)**	420	382	571	366	**6SE7034–2HE85–1AA0**	1.68	10.6 x 41.3 x 14.4	(270 x 1050 x 365)
525	**(400)**	536	488	729	465	**6SE7035–3HE85–1AA0**	1.81	10.6 x 41.3 x 14.4	(270 x 1050 x 365)
825	**(630)**	774	704	1053	671	**6SE7037–7HH85–1AA0**	3.70	20.0 x 55.1 x 22.2	(508 x 1400 x 565)
1000	**(800)**	1023	931	1391	888	**6SE7041–0HH85–1AA0**	4.15	20.0 x 55.1 x 22.2	(508 x 1400 x 565)
1300	**(1000)**	1285	1169	1748	1119	**6SE7041–3HK85–1AA0**	5.54	31.5 x 67.9 x 22.2	(800 x 1725 x 565)
1400	**(1100)**	1464	1332	1991	1269	**6SE7041–5HK85–1AA0**	6.00	31.5 x 67.9 x 22.2	(800 x 1725 x 565)
2000	**(1500)**	1880	1711	2557	1633	**6SE7041–8HK85–1AA0**	7.62	31.5 x 67.9 x 22.2	(800 x 1725 x 565)

1) Nominal power ratings are quoted for ease of assigning components only. The drive outputs are dependent on the inverters connected and are to be dimensioned accordingly.
When rectifier/regenerative units 3-ph. 380 V to 480 V AC are used on a 3-ph. 200 V to 230 V AC supply, the rated currents remain the same and the nominal power rating is reduced to about 50 %.

2) The current data refer to a line supply inductance of 5 % referred to the rectifier unit impedance Z, i. e. the ratio of the system fault level to the converter output is 20:1 or 100:1 if an additional 4 % line reactor is used.

Rectifier unit impedance: $Z = \frac{V_{supply}}{\sqrt{3} \cdot I_{V\,supply}}$

3) An interface adapter **6SE7090–0XX85–1TA0** is required if these rectifier units are used for 12-pulse system.

4) Engineering Information:
In generating mode only 92 % of the indicated current value is permissible.

Compact and chassis units

Rectifier/regenerative units

Dimension drawing, see Section 7	Weight approx.		Cooling air requirement		Sound pressure level with standard protection degree IP20/IP00 L_{pA} (1 m)	Power connections – Terminals for size C – Lugs for sizes E, H, K – Location: – AC motoring at top for sizes C, H, K; at bottom for size E – DC at top for sizes C, E, H, K – AC generating at bottom for sizes C, E, H, K: Finely stranded		Single- and multi-stranded		Retaining bolt	Auxiliary current requirement: 24 V DC Standard version max. at 20 V 1)	24 V DC Max. version max. at 20 V 1)	1-ph. or 2-ph. 230 V
					50 Hz								60 Hz
No.	lb	(kg)	ft³/min	(m³/s)	dB	AWG	(mm²)	AWG	(mm²)		A	A	A
6	50.7	(23)	59.33	(0.028)	60	13 to 3	(2.5 to 35)	7 to 1/0	(10 to 50)		0.9	2.0	none
6	50.7	(23)	59.33	(0.028)	60	13 to 3	(2.5 to 35)	7 to 1/0	(10 to 50)		0.9	2.0	none
6	50.7	(23)	59.33	(0.028)	60	13 to 3	(2.5 to 35)	7 to 1/0	(10 to 50)		0.9	2.0	none
14	99.2	(45)	423.78	(0.2)	75			2 x 9/0	(2 x 300)	M 12	0.7	2.0	0.75
14	99.2	(45)	423.78	(0.2)	75			2 x 9/0	(2 x 300)	M 12	0.7	2.0	0.75
14	99.2	(45)	423.78	(0.2)	75			2 x 9/0	(2 x 300)	M 12	0.7	2.0	0.75
14	114.7	(52)	423.78	(0.2)	75			2 x 9/0	(2 x 300)	M 12	0.7	2.0	0.75
14	114.7	(52)	423.78	(0.2)	75			2 x 9/0	(2 x 300)	M 12	0.7	2.0	0.75
14	143.3	(65)	423.78	(0.2)	75			2 x 9/0	(2 x 300)	M 16	0.7	2.0	0.75
16	385.9	(175)	1483.23	(0.70)	80			4 x 9/0	(4 x 300)	M 12	1.0	2.3	3.5
16	385.9	(175)	1483.23	(0.70)	80			4 x 9/0	(4 x 300)	M 12	1.0	2.3	3.5
18	992.2	(450)	2118.9	(1.00)	86			4 x 9/0	(4 x 300)	M 12	1.0	2.3	7.0
18	1036.3	(470)	2118.9	(1.00)	86			4 x 9/0	(4 x 300)	M 12	1.0	2.3	7.0
6	50.7	(23)	59.33	(0.028)	60	13 to 3	(2.5 to 35)	7 to 1/0	(10 to 50)		0.7	2.0	none
6	50.7	(23)	59.33	(0.028)	60	13 to 3	(2.5 to 35)	7 to 1/0	(10 to 50)		0.7	2.0	none
6	50.7	(23)	59.33	(0.028)	60	13 to 3	(2.5 to 35)	7 to 1/0	(10 to 50)		0.7	2.0	none
6	50.7	(23)	59.33	(0.028)	60	13 to 3	(2.5 to 35)	7 to 1/0	(10 to 50)		0.7	2.0	none
14	99.2	(45)	423.78	(0.2)	75			2 x 9/0	(2 x 300)	M 12	0.7	2.0	0.75
14	99.2	(45)	423.78	(0.2)	75			2 x 9/0	(2 x 300)	M 12	0.7	2.0	0.75
14	99.2	(45)	423.78	(0.2)	75			2 x 9/0	(2 x 300)	M 12	0.7	2.0	0.75
14	121.3	(55)	423.78	(0.2)	75			2 x 9/0	(2 x 300)	M 12	0.7	2.0	0.75
14	121.3	(55)	423.78	(0.2)	75			2 x 9/0	(2 x 300)	M 16	0.7	2.0	0.75
14	149.9	(68)	423.78	(0.2)	75			2 x 9/0	(2 x 300)	M 16	0.7	2.0	0.75
16	385.9	(175)	1483.23	(0.70)	80			4 x 9/0	(4 x 300)	M 12	1.0	2.3	3.5
16	385.9	(175)	1483.23	(0.70)	80			4 x 9/0	(4 x 300)	M 12	1.0	2.3	3.5
18	992.2	(450)	2118.9	(1.00)	86			4 x 9/0	(4 x 300)	M 12	1.0	2.3	7.0
18	992.2	(450)	2118.9	(1.00)	86			4 x 9/0	(4 x 300)	M 12	1.0	2.3	7.0
18	1036.3	(470)	2118.9	(1.00)	86			4 x 9/0	(4 x 300)	M 12	1.0	2.3	7.0
14	143.3	(65)	423.78	(0.2)	75			2 x 9/0	(2 x 300)	M 12	0.7	2.0	0.75
14	143.3	(65)	423.78	(0.2)	75			2 x 9/0	(2 x 300)		0.7	2.0	0.75
14	121.3	(55)	423.78	(0.2)	75			2 x 9/0	(2 x 300)		0.7	2.0	0.75
14	121.3	(55)	423.78	(0.2)	75			2 x 9/0	(2 x 300)	M 16	0.7	2.0	0.75
14	154.3	(70)	423.78	(0.2)	75			2 x 9/0	(2 x 300)	M 16	0.7	2.0	0.75
16	385.9	(175)	1483.23	(0.70)	80			4 x 9/0	(4 x 300)	M 12	1.0	2.3	3.5
16	385.9	(175)	1483.23	(0.70)	80			4 x 9/0	(4 x 300)	M 12	1.0	2.3	3.5
18	992.2	(450)	2118.9	(1.00)	86			4 x 9/0	(4 x 300)	M 12	1.0	2.3	7.0
18	992.2	(450)	2118.9	(1.00)	86			4 x 9/0	(4 x 300)	M 12	1.0	2.3	7.0
18	1036.3	(470)	2118.9	(1.00)	86								

1) See Engineering Information, page 6/44.

Selection and ordering data

Nominal power rating[1]		Rated DC link output current[2][3]	Base load DC link current[3]	Short-time DC link current[3]	Input current	Rectifier unit	Rectifier/ regenerative unit	Max. power loss	Dimensions W x H x D		Dimension drawing, see Section 7	Weight approx.	
HP	(kW)	A	A	A	A	Order No.	Order No.	kW	in	(mm)	No.	lb	(kg)
Supply voltage 3-ph. 380 V to 480 V AC													
825	**(630)**	1333	1213	1813	1146	**6SE7041–3EK85–0AD0**	–	4.85	31.5 x 55.1 x 22.2	(800 x 1400 x 565)	17	573.3	(260)
825	**(630)**	1333	1213	1813	1146	–	**6SE7041–3EK85–1AD0**	4.85	31.5 x 67.9 x 22.2	(800 x 1725 x 565)	18	992.2	(450)
1000	**(800)**	1780	1620	2421	1531	**6SE7041–8EK85–0AD0**	–	6.24	31.5 x 55.1 x 22.2	(800 x 1400 x 565)	17	661.5	(300)
1000	**(800)**	1780	1620	2421	1531	–	**6SE7041–8EK85–1AD0**	6.24	31.5 x 67.9 x 22.2	(800 x 1725 x 565)	18	1036.3	(470)
Supply voltage 3-ph. 500 V to 600 V AC													
1000	**(800)**	1285	1169	1748	1105	**6SE7041–3FK85–0AD0**	–	5.40	31.5 x 55.1 x 22.2	(800 x 1400 x 565)	17	573.3	(260)
1000	**(800)**	1285	1169	1748	1105	–	**6SE7041–3FK85–1AD0**	5.40	31.5 x 67.9 x 22.2	(800 x 1725 x 565)	18	992.2	(450)
1200	**(900)**	1464	1332	1991	1259	**6SE7041–5FK85–0AD0**	–	5.87	31.5 x 55.1 x 22.2	(800 x 1400 x 565)	17	661.5	(300)
1200	**(900)**	1464	1332	1991	1259	–	**6SE7041–5FK85–1AD0**	5.87	31.5 x 67.9 x 22.2	(800 x 1725 x 565)	18	992.2	(450)
1400	**(1100)**	1880	1711	2557	1617	**6SE7041–8FK85–0AD0**	–	6.65	31.5 x 55.1 x 22.2	(800 x 1400 x 565)	17	661.5	(300)
1400	**(1100)**	1880	1711	2557	1617	–	**6SE7041–8FK85–1AD0**	6.65	31.5 x 67.9 x 22.2	(800 x 1725 x 565)	18	1036.3	(470)
Supply voltage 3-ph. 660 V to 690 V AC													
1300	**(1000)**	1285	1169	1748	1105	**6SE7041–3HK85–0AD0**	–	5.54	31.5 x 55.1 x 22.2	(800 x 1400 x 565)	17	573.3	(260)
1300	**(1000)**	1285	1169	1748	1105	–	**6SE7041–3HK85–1AD0**	5.54	31.5 x 67.9 x 22.2	(800 x 1725 x 565)	18	992.2	(450)
1400	**(1100)**	1464	1332	1991	1259	**6SE7041–5HK85–0AD0**	–	6.00	31.5 x 55.1 x 22.2	(800 x 1400 x 565)	17	661.5	(300)
1400	**(1100)**	1464	1332	1991	1259	–	**6SE7041–5HK85–1AD0**	6.00	31.5 x 67.9 x 22.2	(800 x 1725 x 565)	18	992.2	(450)
2000	**(1500)**	1880	1711	2557	1617	**6SE7041–8HK85–0AD0**	–	7.62	31.5 x 55.1 x 22.2	(800 x 1400 x 565)	17	661.5	(300)
2000	**(1500)**	1880	1711	2557	1617	–	**6SE7041–8HK85–1AD0**	7.62	31.5 x 67.9 x 22.2	(800 x 1725 x 565)	18	1036.3	(470)

See Engineering Information, page 6/16.

1) Nominal power ratings are quoted for ease of assigning components only. The drive outputs are dependent on the inverters connected and are to be dimensioned accordingly.

2) The rated output current when rectifier units are connected in parallel via a 2 % line commutating reactor is calculated according to the following formula:

$\sum I = 0.9 \times n \times$ rated output current

n = Number of parallel units $1 \leq n \leq 3$.

3) Engineering Information:
In generating mode only 92 % of the indicated current value is permissible .

Cooling air requirement		Sound pressure level with standard protection degree IP20/IP00 L_{pA} (1 m)	Power connections – Lugs for size K – Location: Rectifier units: at bottom for AC, at top for DC; Regenerative unit: at top for AC motoring, at bottom for AC generating, at top for DC			Auxiliary current requirement		
			Cable cross-section		Retaining bolt	24 V DC Standard version max. at 20 V1)	24 V DC Max. version max. at 20 V1)	1-ph. or 2-ph. 230 V fan
		50 Hz						60 Hz
ft^3/min	(m^3/s)	dB	AWG	(mm^2)		A	A	A
2118.9	(1.0)	86	4 x 9/0	(4 x 300)	M 12	0.5	–	7.0
2118.9	(1.0)	86	4 x 9/0	(4 x 300)	M 12	0.5	–	7.0
2118.9	(1.0)	86	4 x 9/0	(4 x 300)	M 12	0.5	–	7.0
2118.9	(1.0)	86	4 x 9/0	(4 x 300)	M 12	0.5	–	7.0
2118.9	(1.0)	86	4 x 9/0	(4 x 300)	M 12	0.5	–	7.0
2118.9	(1.0)	86	4 x 9/0	(4 x 300)	M 12	0.5	–	7.0
2118.9	(1.0)	86	4 x 9/0	(4 x 300)	M 12	0.5	–	7.0
2118.9	(1.0)	86	4 x 9/0	(4 x 300)	M 12	0.5	–	7.0
2118.9	(1.0)	86	4 x 9/0	(4 x 300)	M 12	0.5	–	7.0
2118.9	(1.0)	86	4 x 9/0	(4 x 300)	M 12	0.5	–	7.0
2118.9	(1.0)	86	4 x 9/0	(4 x 300)	M 12	0.5	–	7.0
2118.9	(1.0)	86	4 x 9/0	(4 x 300)	M 12	0.5	–	7.0
2118.9	(1.0)	86	4 x 9/0	(4 x 300)	M 12	0.5	–	7.0
2118.9	(1.0)	86	4 x 9/0	(4 x 300)	M 12	0.5	–	7.0
2118.9	(1.0)	86	4 x 9/0	(4 x 300)	M 12	0.5	–	7.0
2118.9	(1.0)	86	4 x 9/0	(4 x 300)	M 12	0.5	–	7.0

1) See Engineering Information, page 6/44.

Technical characteristics

The OCP (overcurrent protector unit) is an autonomous module of the SIMOVERT MASTERDRIVES series. It can also be easily retrofitted to already existing equipment that includes rectifier/regenerative units from the SIMOVERT MASTERDRIVES range.

It is connected as a supplementary device in the divided positive cable of the DC link between the rectifier/regenerative unit and the associated inverters.

The OCP is available as a chassis unit with 2 rated currents for DC links with the following supply voltages:

- 3-ph. 380 V to 480 V AC + 10 % (DC link voltage 510 V DC to 650 V DC + 10 %)
- 3-ph. 660 V to 690 V AC + 15 % (DC link voltage 675 V DC to 930 V DC + 15 %)

OCPs for DC links with a supply voltage of 3-ph. 500 V to 600 V AC + 10 % can be implemented with units for 3-ph. 690 V AC.

Using an OCP has the following benefits and advantages:

- Component and servicing costs are substantially reduced due to avoidance of fuse tripping and destruction of thyristors in the rectifier/regenerative unit.
- Availability is increased, minimizing expensive plant downtime and production stoppage times.
- The OCP can be bypassed in the event of a fault so that the rectifier/regenerative unit continues to be operational without the OCP.

Using an OCP is cost-effective and is therefore especially recommended for retrofitting in existing plant that uses SIMOVERT MASTERDRIVES. For new projects, the use of an AFE (fully pulsed with filter) may be more appropriate as this solution offers additional advantages and benefits.

An AFE

- prevents or eliminates inverter stalling (the OCP minimizes the negative effects of switch-off)
- produces considerably less network disturbances
- enables setting of the power factor up to the level of power factor compensation
- enables highly dynamic closed-loop control of the DC link voltage.

For the assignment of OCPs to rectifier/regenerative units, see page 3/31, "Selection and Ordering Data".

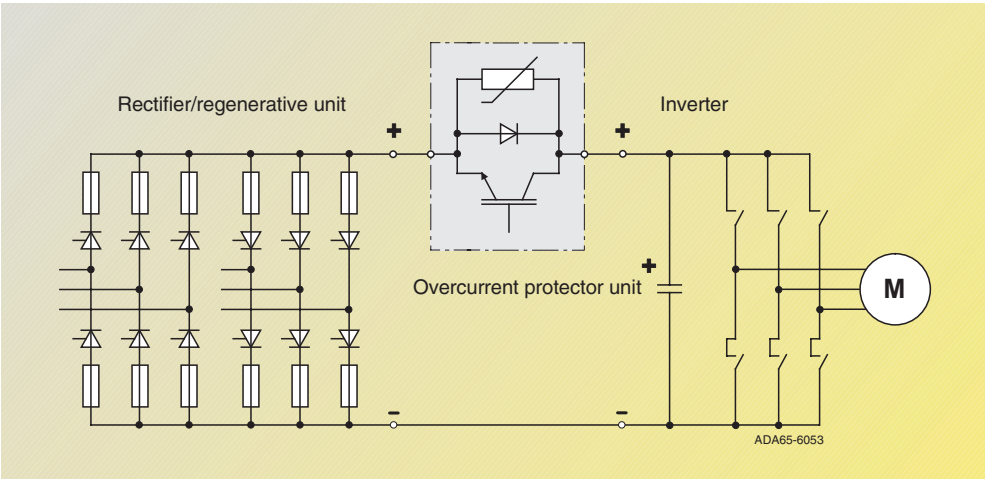


Fig. 3/10

Technical data

Cooling-medium temperature	+32 °F to +104 °F (0 °C to +40 °C)
Permissible ambient temperature during storage and transport	–13 °F to +158 °F (–25 °C to +70 °C)
Cooling air requirement	1165.39 ft³/min (0.55 m³/s)
Climatic category	3K3 to DIN IEC 721-3-3/04.90
Pollution degree	Pollution degree 2 to DIN VDE 0110 Part 1/01.89, Moisture condensation not permissible
Overvoltage category (power section)	Category III to DIN VDE 0110 Part 2/01.89
Overvoltage strength (with connected inverter)	Class 1 to DIN VDE 0160/04.91
Degree of protection	IP00 to EN 60 529 (DIN VDE 0470 Part 1/11.92)
Immunity	IEC 801-2, IEC 801-4
Mechanical specifications	To DIN IEC 60 068-2-6/06.90
Sound pressure level L_{pA} (3.3 ft (1 m)) 50 Hz 60 Hz	80 dB 83 dB

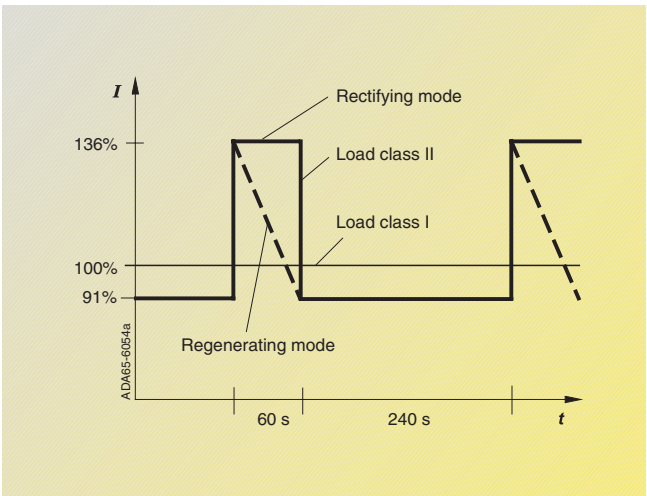


Fig. 3/11
Base load and overload to load class II to EN 60 146-1-1

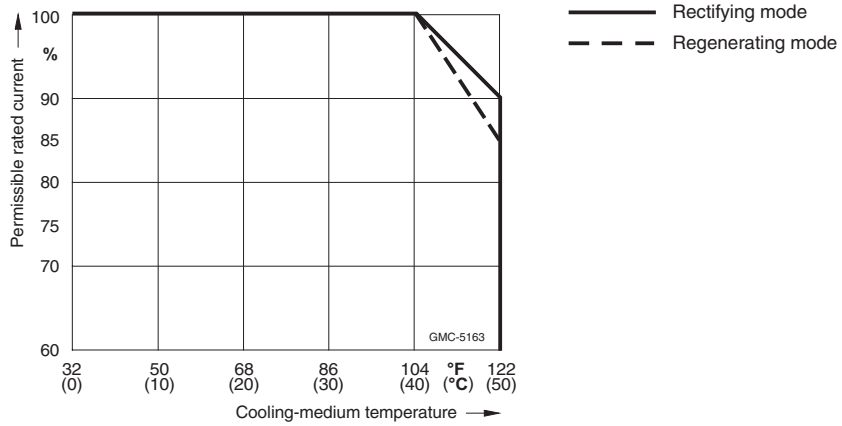
Selection and ordering data

Rated DC link current		Rated DC link base load current		Base load duration	DC link short-time current		Short-time current duration	Max. power loss at		Overcurrent protector unit (OCP)	Dimensions W x H x D	Dimension drawing, see Section 7	Weight approx.
Infeed current	Regenerative current	Infeed current	Regenerative current		Infeed current	Regenerative current	see Fig.	Infeed	Regeneration				
A	A	A	A	s	A	A	No.	kW	kW	Order No.	in (mm)	No.	lb (kg)
Rated DC link voltage 510 V to 650 V DC +10%													
1023	945	930	860	240	1390	1280	3/11	1.1	2.3	**6SE7041–0TS85–5JA0**	23.1 x 29.5 x 18.5 (587 x 750 x 470)	19	165.4 (75)
1780	1640	1620	1500	240	2430	2030	3/11	1.6	4	**6SE7041–8TS85–5JA0**	23.1 x 29.5 x 18.5 587 x 750 x 470	19	165.4 (75)
Rated DC link voltage 675 V to 930 V DC +15%													
1023	945	930	860	240	1390	1280	3/11	1.1	2.4	**6SE7041–0WS85–5JA0**	23.1 x 29.5 x 18.5 587 x 750 x 470	19	165.4 (75)
1880	1730	1711	1580	240	2566	2350	3/11	1.7	4.6	**6SE7042–0WS85–5JA0**	23.1 x 29.5 x 18.5 587 x 750 x 470	19	165.4 (75)

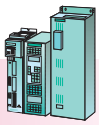
Assignment of overcurrent protector units (OCP) to rectifier/regenerative units

Overcurrent protector unit	Rectifier/regenerative unit					
Order No.	Type	Type	Type	Type	Type	Type
Supply voltage 3-ph. 380 V to 480 V +10%						
6SE7041–0TS85–5JA0	6SE7038–2EH85–1AA0	6SE7041–0EH85–1AA0				
6SE7041–8TS85–5JA0	6SE7041–3EK85–1AA0[1)]	6SE7041–8EK85–1AA0[1)]				
Supply voltage 3-ph. 500 V to 690 V +15%						
6SE7041–0WS85–5JA0	6SE7037–7FH85–1AA0	6SE7041–0FH85–1AA0		6SE7037–7HH85–1AA0	6SE7041–0HH85–1AA0	
6SE7042–0WS85–5JA0	6SE7041–3FK85–1AA0[1)]	6SE7041–5FK85–1AA0[1)]	6SE7041–8FK85–1AA0[1)]	6SE7041–3HK85–1AA0[1)]	6SE7041–5HK85–1AA0[1)]	6SE7041–8HK85–1AA0[1)]

Reduction curves



1) The assignment for type K units also applies to parallel units (–1AD0).



Technical characteristics

Pulse Resistor Braking

DC link braking units used in combination with braking resistors can decrease the deceleration time and increase the braking power. When a motor is occasionally generating power (i.e. when stopping) this energy is fed back to the DC link. On a non-regenerative drive the DC link voltage can become excessively high (DC link over-voltage fault) due to the inertia or ramp times. Through the use of pulse resistor braking this excess energy is dissipated through the braking unit and across the resistor in the form of heat.

Braking Units

The braking unit is connected to the converter or common DC bus in parallel to the DC link. The braking units consist of an IGBT that is switched (pulsed) on at predetermined DC link voltage levels to dissipate energy across the braking resistor. The appropriate resistor must always be connected to the braking unit. Braking energy can not be converted without one.

The braking unit operates autonomously of the converter or inverters. The braking unit electronics are supplied form the DC link voltage. Braking units can be connected in parallel to increase braking power, however each braking unit requires its own braking resistor.

Compact PLUS chopper

The Compact PLUS converters and rectifier units have an integrated braking chopper. Only an external braking resistor is required to dissipate the braking energy during generative operation.

Applications in which braking energy occurs only occasionally, e.g. emergency stop, can be implemented with compact braking resistors that are specially matched to Compact PLUS units. These compactly dimensioned braking resistors can absorb high levels of braking power for a short time.

More information

regarding dimensioning of the braking units and braking resistors can be found in Section 6, Engineering Information.

Fig. 3/12
Braking unit and braking resistor for compact and chassis units

Fig. 3/13
Braking resistor for Compact PLUS units

Technical data

Rated voltage				
DC link voltage	280 V DC –15 % to 340 V DC +10 %	510 V DC –15 % to 650 V DC +10 %	675 V DC –15 % to 810 V DC +10 %	890 V DC –15 % to 930 V DC +15 %
Thresholds				
Upper threshold 1		774 V	967 V	1158 V
Lower threshold 2	NA	673 V	841 V	1070 V
Load class II to EN 60 146-1-1				
Rated power P_{20}	P_{20} power at the upper threshold: The duration is a function of the internal or external resistor			
Continuous power P_{DB}	Continuous power at the upper threshold: The value is dependent on the internal and external resistor			
Short-time power P_3	1.5 x P_{20} power at the upper threshold: The duration is a function of the internal and external resistor			
Cycle time	90 s			
Overload duration	20 s (22 % of the cycle time)			

Braking units cannot be ordered with options.

Note: At the time of this publication the size S and A braking units ending in order number ...–2DA0 were scheduled to be superseded. The newer type units have smaller envelope dimensions and do not contain an internal braking resistor. If a newer type unit is to replace a superseded braking unit which was only operating with the internal braking resistor, an appropriate Compact PLUS braking resistor can be used.

When a superseded unit is being replaced and signals are connected to control terminal X38, then the control terminal strip must be re-wired.
Ensure the ground X38/Pin 2 is connected to the ground on the receiver so the signal level of the electronic switch is detected.

Superseded units	Newer type S units
Order No.	Order No.
6SE7021–6CS87–2DA0	**6SE7021–6CS87–2DA1**
6SE7023–2CA87–2DA0	**6SE7023–2CS87–2DA1**
6SE7026–3CA87–2DA0	**6SE7026–3CS87–2DA1**
6SE7018–0ES87–2DA0	**6SE7018–0ES87–2DA1**
6SE7021–6ES87–2DA0	**6SE7021–6ES87–2DA1**
6SE7023–2EA87–2DA0	**6SE7023–2ES87–2DA1**
6SE7028–0EA87–2DA0	**6SE7028–0ES87–2DA1**
6SE7016–4FS87–2DA0	**6SE7016–4FS87–2DA1**
6SE7021–3FS87–2DA0	**6SE7021–3FS87–2DA1**
6SE7026–4FA87–2DA0	**6SE7026–4FS87–2DA1**

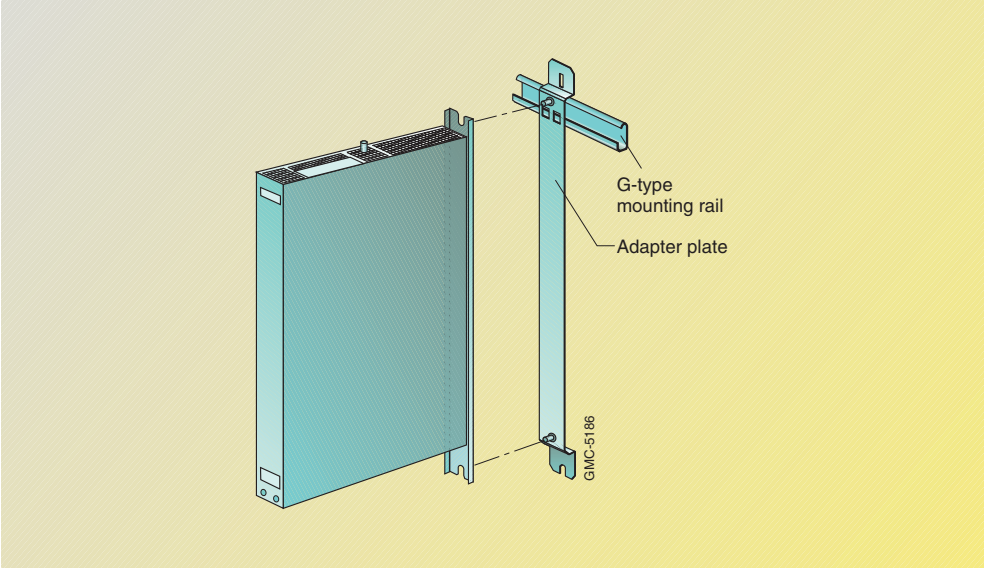
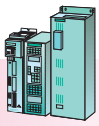


Fig. 3/14
Adapter plate 6SX7010–0KC01 is required for mounting on G-Type rail for size S newer type braking units



Selection and ordering data

Braking resistors for Compact PLUS units

Braking power[1]					Braking resistor
P_{20}	P_3	P_{DB}	Resistance	Cycle time T	
kW	kW	kW	Ω	s	Order No.
2[3]	3	0.15	200	3200	**6SE7013–2ES87–2DC0**
4[3]	6	0.3[4]	100	6400	**6SE7016–3ES87–2DC0**
5	7.5	1.25	80	90	**6SE7018–0ES87–2DC0**
10	15	2.5	40	90	**6SE7021–6ES87–2DC0**
12[3]	18	0.9[5]	33.3	6400	**6SE7022–0ES87–2DC0**
20	30	5	20	90	**6SE7023–2ES87–2DC0**
50	75	12.5	8	90	**6SE7028–0ES87–2DC0**
100	150	25	4	90	**6SE7031–6ES87–2DC0**

Braking units and braking resistors for compact and chassis units

Braking power[1]			Braking unit	Dimensions		Weight		Braking resistor, external	
P_{20}	P_3	P_{DB}		W x H x D					Resist-ance[2]
kW	kW	kW	Order No.	in	(mm)	lb	(kg)	Order No.	Ω
DC link voltage 280 V to 310 V DC									
5	7.5	1.25	**6SE7021–6CS87–2DA1**	1.8 x 14.2 x 9.7	(45 x 360 x 247)	6.6	(3)	**6SE7021–6CS87–2DC0**	20
10	15	2.5	**6SE7023–2CS87–2DA1**	1.8 x 14.2 x 9.7	(45 x 360 x 247)	7.3	(3.3)	**6SE7023–2CS87–2DC0**	10
20	30	5	**6SE7026–3CS87–2DA1**	1.8 x 14.2 x 9.7	(45 x 360 x 247)	9.0	(4.1)	**6SE7026–3CS87–3DC0**	5
DC link voltage 510 V to 650 V DC[2]									
5	7.5	1.25	**6SE7018–0ES87–2DA1**	1.8 x 14.2 x 9.7	(45 x 360 x 247)	6.6	(3)	**6SE7018–0ES87–2DC0**	80
10	15	2.5	**6SE7021–6ES87–2DA1**	1.8 x 14.2 x 9.7	(45 x 360 x 247)	6.8	(3.1)	**6SE7021–6ES87–2DC0**	40
20	30	5	**6SE7023–2ES87–2DA1**	1.8 x 14.2 x 9.7	(45 x 360 x 247)	7.3	(3.3)	**6SE7023–2ES87–2DC0**	20
50	75	12.5	**6SE7028–0ES87–2DA1**	1.8 x 14.2 x 9.7	(45 x 360 x 247)	9.0	(4.1)	**6SE7028–0ES87–2DC0**	8
100	150	25	**6SE7031–6EB87–2DA0**	5.3 x 16.7 x 13.8	(135 x 425 x 350)	9.7	(18)	**6SE7031–6ES87–2DC0**	4
170	255	42.5	**6SE7032–7EB87–2DA0**	5.3 x 16.7 x 13.8	(135 x 425 x 350)	39.7	(18)	**6SE7032–7ES87–2DC0**	2.35
DC link voltage 675 V to 810 V DC[2]									
5	7.5	1.25	**6SE7016–4FS87–2DA1**	1.8 x 14.2 x 9.7	(45 x 360 x 247)	6.6	(3)	**6SE7016–4FS87–2DC0**	124
10	15	2.5	**6SE7021–3FS87–2DA1**	1.8 x 14.2 x 9.7	(45 x 360 x 247)	6.8	(3.1)	**6SE7021–3FS87–2DC0**	62
50	75	12.5	**6SE7026–4FS87–2DA1**	1.8 x 14.2 x 9.7	(45 x 360 x 247)	9.0	(4.1)	**6SE7026–4FS87–2DC0**	12.4
100	150	25	**6SE7031–3FB87–2DA0**	5.3 x 16.7 x 13.8	(135 x 425 x 350)	39.7	(18)	**6SE7031–3FS87–2DC0**	6.2
200	300	50	**6SE7032–5FB87–2DA0**	5.3 x 16.7 x 13.8	(135 x 425 x 350)	39.7	(18)	**6SE7032–5FS87–2DC0**	3.1
DC link voltage 890 V to 930 V DC[2]									
50	75	12.5	**6SE7025–3HS87–2DA1**	1.8 x 14.2 x 9.7	(45 x 360 x 247)	9.0	(4.1)	**6SE7025–3HS87–2DC0**	17.8
200	300	50	**6SE7032–1HB87–2DA0**	5.3 x 16.7 x 13.8	(135 x 425 x 350)	39.7	(18)	**6SE7032–1HS87–2DC0**	4.45

See Section 6 for information on paralleling braking units for additional braking capacity.

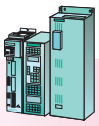
1) For power definition, see Section 6.

2) Permits the braking power for
switch-on application threshold = 774 V
(≙ supply voltage 3 AC 460 V)
switch-on application threshold = 967 V
(≙ supply voltage 3 AC 575 V)
switch-on application threshold = 1158 V
(≙ supply voltage 3 AC 690 V)

3) Braking resistor in type Compact PLUS for occasionally incurring braking energy, e. g. emergency stop.

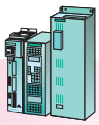
4) CSA rating 240 W.

5) CSA rating 720 W.



Dimensions W x H x D		Weight		Dimension drawing, see Section 7	recommended for connection to converter	recommended for connection to rectifier unit
in	(mm)	lb	(kg)	No.		
1.7 x 9.8 x 4.7	(44 x 250 x 120)	3.1	(1.4)	23	6SE7011–5EP60; 6SE7013–0EP60; 6SE7015–0EP60	
1.7 x 9.8 x 4.7	(44 x 250 x 120)	4.2	(1.9)	23	6SE7018–0EP60; 6SE7021–0EP60	
5.7 x 7.1 x 21.2	(145 x 180 x 540)	13.2	(6)	24	6SE7011–5EP60; 6SE7013–0EP60; 6SE7015–0EP60	
5.7 x 14.2 x 21.2	(145 x 360 x 540)	26.5	(12)	24	6SE7018–0EP60; 6SE7021–0EP60	
5.3 x 13.8 x 8.0	(134 x 350 x 203)	15.0	(6.8)	25	6SE7021–4EP60; 6SE7022–1EP60	
17.7 x 12.0 x 19.1	(450 x 305 x 485)	37.5	(17)	26	6SE7021–4EP60; 6SE7022–1EP60; 6SE7022–7EP60; 6SE7023–4EP60	6SE7024–1EP85–0AA0
29.3 x 12.0 x 19.1	(745 x 305 x 485)	59.5	(27)	26		6SE7031–2EP85–0AA0
29.3 x 23.8 x 19.1	(745 x 605 x 485)	103.6	(47)	27		6SE7032–3EP85–0AA0

Dimensions W x H x D		Weight		Dimension drawing, see Section 7	Power connections: Terminals DC voltage: Top External resistor: Bottom Connectable cable cross-section Finely stranded		Single- and multi-stranded		Power connections: Lugs DC voltage: Top External resistor: Bottom Cable cross-section		Retaining bolt
in	(mm)	lb	(kg)	No.	AWG	(mm^2)	AWG	(mm^2)	AWG	(mm^2)	
5.7 x 7.1 x 21.2	(145 x 180 x 540)	13.2	(6)	20; 24	16 to 6	(1.5 to 16)	16 to 6	(1.5 to 16)	–	–	–
5.7 x 14.2 x 21.2	(145 x 360 x 540)	25.4	(11.5)	20; 24	16 to 6	(1.5 to 16)	16 to 6	(1.5 to 16)	–	–	–
16.9 x 12.0 x 19.1	(430 x 305 x 485)	37.5	(17)	20; 26	16 to 6	(1.5 to 16)	16 to 6	(1.5 to 16)	–	–	–
5.7 x 7.1 x 21.2	(145 x 180 x 540)	13.2	(6)	20; 24	16 to 6	(1.5 to 16)	16 to 6	(1.5 to 16)	–	–	–
5.7 x 14.2 x 21.2	(145 x 360 x 540)	25.4	(11.5)	20; 24	16 to 6	(1.5 to 16)	16 to 6	(1.5 to 16)	–	–	–
16.9 x 12.0 x 19.1	(430 x 305 x 485)	37.5	(17)	20; 26	16 to 6	(1.5 to 16)	16 to 6	(1.5 to 16)	–	–	–
29.1 x 12.0 x 19.1	(740 x 305 x 485)	59.5	(27)	20; 26	16 to 6	(1.5 to 16)	16 to 6	(1.5 to 16)	–	–	–
29.1 x 23.8 x 19.1	(740 x 605 x 485)	103.6	(47)	22; 27	–	–	–	–	max. 1 x 3/0	(max. 1 x 95)	M 8
29.1 x 52.2 x 19.1	(740 x 1325 x 485)	227.1	(103)	22; 28	–	–		–	max. 1 x 3/0	(max. 1 x 95)	M 8
5.7 x 7.1 x 21.2	(145 x 180 x 540)	13.2	(6)	20; 24	16 to 6	(1.5 to 16)	16 to 6	(1.5 to 16)	–	–	–
5.7 x 14.2 x 21.2	(145 x 360 x 540)	25.4	(11.5)	20; 24	16 to 6	(1.5 to 16)	16 to 6	(1.5 to 16)	–	–	–
29.1 x 12.0 x 19.1	(740 x 305 x 485)	59.5	(27)	20; 26	16 to 6	(1.5 to 16)	16 to 6	(1.5 to 16)	–	–	–
29.1 x 23.8 x 19.1	(740 x 605 x 485)	94.8	(43)	22; 27	–	–	–	–	max. 1 x 3/0	(max. 1 x 95)	M 8
29.1 x 52.2 x 19.1	(740 x 1325 x 485)	209.5	(95)	22; 28	–	–	–	–	max. 1 x 3/0	(max. 1 x 95)	M 8
29.1 x 12.0 x 19.1	(740 x 305 x 485)	61.7	(28)	20; 26	16 to 6	(1.5 to 16)	16 to 6	(1.5 to 16)	–	–	–
29.1 x 52.2 x 19.1	(740 x 1325 x 485)	222.7	(101)	22; 28	–	–	–	–	max. 1 x 3/0	(max. 1 x 95)	M 8



Technical characteristics of line-side components

Line fuses

The 3NE1 SITOR® fuse protects both cables and semiconductors in one fuse. This results in considerable cost savings and shorter installation times.

For Order No. and equipment assignments, see page 3/38 onwards.

Input line reactor

The input line reactor reduces the harmonic currents and the commutating dips of the converters, rectifier units and rectifier/regenerative units. The effect of the reactor depends on the ratio of the system fault power to the drive's power.

Recommendation for the ratio of system fault power to drive's power > 33 : 1:

- A 2 – 3 % input line reactor should be used for converters and rectifier units.
- A 4 – 5 % input line reactor is recommended for rectifier/ regenerative units.

For Order No. and equipment assignments, see page 3/38 onwards.

An input line reactor also limits current peaks caused by potential dips of the supply voltage (e.g. due to compensation equipment or ground faults).

Autotransformer for the rectifier/regenerative units

In regenerating mode, rectifier/regenerative units need a 20 % higher supply voltage at the antiparallel inverter bridge. The voltage can be stepped up using an autotransformer. The autotransformers are rated for 100 % duty cycle. They comply with the necessary technical requirements and cannot be replaced by any other type.

For Order No. and equipment assignments, see page 3/65.

For dimensions, see Section 7.

Radio-interference suppression filters (line filters)

For power ratings of up to 50 HP (37 kW), the line filters reduce the interference voltages produced by converter, rectifier and rectifier/regenerative units to the limits permissible for residential supply systems according to EN 55 011, Class B1. These filters also comply to the limit values for Class A1.

For units with larger output ratings, the line filters reduce the radio-interference voltages of the converters, rectifier units and rectifier/regenerative units to the limits applicable to industrial supply systems.

For Order No. and equipment assignments, see page 3/38 onwards.

For dimensions, see Section 7.

The radio-interference suppression filters with Order No. 6SE70 can be used for a maximum supply voltage of 3-ph. 480 V AC and with TT and TN power systems (earthed systems) only.

The radio-interference suppression filters with Order No. B84143 are available for a supply voltage of up to 3-ph. 690 V AC. Their use in TT, TN or IT systems (insulated systems) must be indicated by the order number supplement.

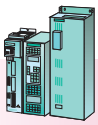
For IT systems, these filters can also be used in the 3-ph. 380 V to 480 V AC as well as in the 3-ph. 500 V to 600 V AC voltage range.

Notes regarding use of filters

- The limit values in the case of converters, rectifier units and rectifier/regenerative units are complied with only in conjunction with an input line reactor of 2 – 5 % v_K. The input line reactors are to be mounted in a metal cabinet.
- Line filters for earthed and non-earthed systems are available.
  The concept of a non-earthed system is violated by use of a radio-interference suppression filter. For more information, see the EMC product standard, EN 61 800-3.
  The use of a radio-interference suppression filter in a non-earthed system is therefore only a compromise between radio-interference suppression and interference-free operation when an earth fault occurs.
- In the case of units of sizes A to D, a connecting adapter for cable shields is to be used, see page 3/67.
- For the use of power cable for motor connection, see page 3/72.
- The cabinet design, the equipment layout and the wiring are to be carried out in accordance with EMC guidelines.

Information

For installation of SIMOVERT MASTERDRIVES according to EMC guidelines, see page 6/45.



Technical characteristics of DC link components

Components for connecting inverters and braking units

The inverters and braking units can be connected to the DC bus in three ways:

1. Direct connection

   As standard, the necessary fuses are integrated in the inverters, except for inverters sizes E to G (integrated fuses for these units available with option code L30), see page 3/89.

2. Electromechanical connection

   The electromechanical connection consists of a fuse switch disconnector, with fuses or disconnector lugs.

   Note:
   This connection must not be activated with a live system.

3. Electrical connection

   The electrical connection basically consists of fuse switch disconnectors, precharging resistors, a precharging contactor and a connecting contactor.

With Compact PLUS units, the DC links are connected by means of a special connecting system. There are no further components required except for the 0.1 x 0.4 in (3 x 10 mm) buses (Cu tinned to DIN 46 433).

For Engineering Information, see Section 6.

For selection and ordering data of the components, see page 3/48 onwards.

Free-wheeling diode

The free-wheeling diode prevents consequential damage to braking units and lower output rating inverters when the DC fuses on a higher power rating inverter blow or when, with a rectifier/regenerative unit, the fuses blow in the event of commutation failure.

For Engineering Information, see Section 6.

Technical characteristics of load-side components and cables

Output reactors

Output reactors compensate capacitive charging/discharging currents when long motor cables are connected and limit the d*v*/d*t* at the motor terminals.

For the maximum cable lengths which can be connected with and without reactors, see page 6/49.

Voltage limitation filters (output dv/dt filters)

Voltage limitation filters are to be used together with motors where the dielectric strength of the insulating system is unknown or insufficient.

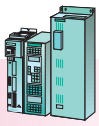
Sine filters

The use of sine filters ensures that the motors are supplied with a practically sinusoidal voltage and current waveform. The distortion factor for a motor voltage frequency of 60 Hz with a sine filter is approximately 5 %. The stress on the motors which are supplied via sine filters is below the level according to DIN VDE 0530.

Engineering Information

On the load-side components, see Section 6.

For selection and ordering data, see page 3/38 and onwards.



Selection and ordering data

Nominal power rating		Converter AC to AC	Commutating reactor v_D = 3 %[1]		Radio-interference suppression filter		
				Rated current		Class[7]	P_v type
HP	(kW)	Order No.	Order No.	A	Order No.		W
Compact PLUS units[3]							
Supply voltage 3-ph. 380 V to 480 V AC							
460 V	**(400 V)**		**460 V, 50/60 Hz**				
0.75	**(0.55)**	**6SE7011–5EP60Z + L20**	LR4730SL[2]	2	6SE7012–0EP87–0FB1[5]	B1	5
1.5	**(1.1)**	**6SE7013–0EP60Z + L20**	LR4730TL[2]	4	6SE7016–0EP87–0FB1[5]	B1	13
2	**(1.5)**	**6SE7015–0EP60Z + L20**	LR47301L[2]	8	6SE7016–0EP87–0FB1[5]	B1	13
4	**(3)**	**6SE7018–0EP60Z + L20**	LR47301L[2]	8	6SE7021–2EP87–0FB1[5]	B1	23
5	**(4)**	**6SE7021–0EP60Z + L20**	LR47302L[2]	8	6SE7021–2EP87–0FB1[5]	B1	23
7.5	**(5.5)**	**6SE7021–4EP60Z + L20**	LR47303L[2]	12	6SE7021–8EP87–0FB1[5]	B1	26
10	**(7.5)**	**6SE7022–1EP60Z + L20**	LR47304L[2]	18	6SE7023–4ES87–0FB1 6SE7023–8EP87–0FB1[6]	B1	30
15	**(11)**	**6SE7022–7EP60Z + L20**	LR47305L[2]	25	6SE7023–4ES87–0FB1 6SE7023–8EP87–0FB1[6]	B1	30
20	**(15)**	**6SE7023–4EP60Z + L20**	LR473A6L[2]	35	6SE7023–4ES87–0FB1 6SE7023–8EP87–0FB1[6]	B1	30
Compact and chassis units							
Supply voltage 3-ph. 380 V to 480 V AC							
460 V	**(400 V)**		**460 V, 50/60 Hz**				
3	**(2.2)**	**6SE7016–1EA61Z + L20**	LR47301L	8	6SE7021–0ES87–0FB1[4]	B1	15
4	**(3)**	**6SE7018–0EA61Z + L20**	LR47301L	8	6SE7021–0ES87–0FB1[4]	B1	15
5	**(4)**	**6SE7021–0EA61Z + L20**	LR47302L	8	6SE7021–0ES87–0FB1[4]	B1	15
7.5	**(5.5)**	**6SE7021–3EB61Z + L20**	LR47303L	12	6SE7021–8ES87–0FB1[4]	B1	20
10	**(7.5)**	**6SE7021–8EB61Z + L20**	LR47304L	18	6SE7021–8ES87–0FB1[4]	B1	20
15	**(11)**	**6SE7022–6EC61Z + L20**	LR47305L	25	6SE7023–4ES87–0FB1[4]	B1	30
20	**(15)**	**6SE7023–4EC61Z + L20**	LR473A6L	35	6SE7023–4ES87–0FB1[4]	B1	30
25	**(18.5)**	**6SE7023–8ED61Z + L20**	LR47306L	35	6SE7027–2ES87–0FB1[4]	B1	40
30	**(22)**	**6SE7024–7ED61Z + L20**	LR47307L	45	6SE7027–2ES87–0FB1[4]	B1	40
40	**(30)**	**6SE7026–0ED61Z + L20**	LR47308L	55	6SE7027–2ES87–0FB1[4]	B1	40
50	**(37)**	**6SE7027–2ED61Z + L20**	LR473A9L	80	6SE7027–2ES87–0FB1[4]	B1	40
60	**(45)**	**6SE7031–0EE60Z + L20**	LR47309L	100	6SE7031–2ES87–0FA1[4]	A1	50
75	**(55)**	**6SE7031–2EF60Z + L20**	LR47310L	130	6SE7031–8ES87–0FA1[4]	A1	70
100	**(75)**	**6SE7031–5EF60Z + L20**	LR47311L	130	6SE7031–8ES87–0FA1[4]	A1	70
125	**(90)**	**6SE7031–8EF60Z + L20**	LR47312L	160	6SE7031–8ES87–0FA1[4]	A1	70
150	**(110)**	**6SE7032–1EG60Z + L20**	LR47313L	200	6SE7033–2ES87–0FA1[4]	A1	100
175	**(132)**	**6SE7032–6EG60Z + L20**	LR47314LE	250	6SE7033–2ES87–0FA1[4]	A1	100
200	**(160)**	**6SE7033–2EG60Z + L20**	LR47315LE	320	6SE7033–2ES87–0FA1[4]	A1	100
250	**(200)**	**6SE7033–7EG60Z + L20**	LR47316LE	400	6SE7036–0ES87–0FA1[4]	A1	120
350	**(250)**	**6SE7035–1EK60**	LR47317LE	500	6SE7036–0ES87–0FA1[4]	A1	120
450	**(315)**	**6SE7036–0EK60**	LR47318LE	600	6SE7036–0ES87–0FA1[4]	A1	120
500	**(400)**	**6SE7037–0EK60**	LR47319LE	750	6SE7041–0ES87–0FA1[4]	A1	200

1) To verify proper selection compare motor rated current to reactor selection tables.

2) Additional capacity required for multi-motor configuration.

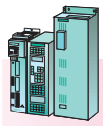
3) The recommended system components are for a converter that acts as a single drive. If the converter supplies a multi-motor system, the supply current is larger than the current for a single drive by a factor of up to 1.6 (rated supply current = 1.76 x rated output current I_R).
In this case, system components with a corresponding current-carrying capacity are to be selected.

4) Can only be used with TT and TN systems (earthed systems).

5) Filter with integrated commutating reactor u_D = 2 % with UL certification.

6) Filter with integrated commutating reactor V_D = 2 % and UL certification.

7) Compliance with limit-value class according to EN 55 011 can only be ensured if a line commutating reactor with V_D = 2 – 5 % is used.



Fuse switch disconnectors[1)2)]			Semiconductor-protection fuses Duty class gR[3)] incl. cable protection			Main contactor/ AC contactor[4)]	
	Rated current	Max. fuse size		Rated current	Size	AC 1 duty at 40°C	Rated current
Order No.	A		Order No.	A		Order No.	A
3NP40 10–0CH01	100	000	3NE1 813–0	16	000	3RT10 15	18
3NP40 10–0CH01	100	000	3NE1 813–0	16	000	3RT10 15	18
3NP40 10–0CH01	100	000	3NE1 813–0	16	000	3RT10 15	18
3NP40 10–0CH01	100	000	3NE1 813–0	16	000	3RT10 15	18
3NP40 10–0CH01	100	000	3NE1 813–0	16	000	3RT10 15	18
3NP40 10–0CH01	100	000	3NE1 814–0	20	000	3RT10 16	22
3NP40 10–0CH01	100	000	3NE1 815–0	25	000	3RT10 16	22
3NP40 10–0CH01	100	000	3NE1 803–0	35	000	3RT10 25	40
3NP40 10–0CH01	100	000	3NE1 802–0	40	000	3RT10 34	50
3NP40 10–0CH01	100	000	–			3RT1015	18
3NP40 10–0CH01	100	000	3NE1 813–0	16	000	3RT1015	18
3NP40 10–0CH01	100	000	3NE1 813–0	16	000	3RT1015	18
3NP40 10–0CH01	100	000	3NE1 814–0	20	000	3RT1016	22
3NP40 10–0CH01	100	000	3NE1 815–0	25	000	3RT1016	22
3NP40 10–0CH01	100	000	3NE1 803–0	35	000	3RT1025	40
3NP40 10–0CH01	100	000	3NE1 802–0	40	000	3RT1034	50
3NP40 10–0CH01	100	000	3NE1 817–0	50	000	3RT1034	50
3NP40 10–0CH01	100	000	3NE1 818–0	63	000	3RT1035	60
3NP40 10–0CH01	100	000	3NE1 820–0	80	000	3RT1044	100
3NP40 10–0CH01	100	000	3NE1 021–0	100	00	3RT1044	100
3NP40 70–0CA01	160	00	3NE1 021–0	100	00	3RT1045	120
3NP42 70–0CA01	250	0; 1	3NE1 224–0	160	1	3RT1446	140
3NP42 70–0CA01	250	0; 1	3NE1 225–0	200	1	3RT1055	185
3NP42 70–0CA01	250	0; 1	3NE1 227–0	250	1	3RT1056	215
3NP42 70–0CA01	250	0; 1	3NE1 227–0	250	1	3RT1456	275
3NP43 70–0CA01	400	1; 2	3NE1 230–0	315	1	3RT1065	330
3NP43 70–0CA01	400	1; 2	3NE1 332–0	400	2	3RT1065	330
3NP43 70–0CA01	400	1; 2	3NE1 333–0	450	2	3RT1075	430
3NP44 70–0CA01	630	2; 3	3NE1 435–0	560	3	3RT1076	610
3NP44 70–0CA01	630	2; 3	3NE1 436–0	630	3	2 x 3RT1075	774
–			3NE1 438–1	800	3	3 x 3RT1075	774

1) Fuse switch disconnectors:
Please observe the size of the semiconductor-protection fuses!

2) Can be optionally used depending on requirements. For further information, see catalog "Industrial Controls".

3) The cable cross-sections must be dimensioned according to DIN VDE 0100, VDE 0298 Part 4 and as a function of the rated fuse currents.

4) See catalog "Industrial Control".

Selection and ordering data

Nominal power rating		Converter AC to AC	Commutating reactor v_D = 2 – 3 %[1]		Radio-interference suppression filter[3]	
				Rated current		P_v type
HP	(kW)	Order No.	Order No.	A	Order No.	W
Supply voltage 3-ph. 500 V to 600 V AC						
575 V	**(500 V)**		**575 V, 50/60 Hz**			
3	**(2.2)**	**6SE7014–5FB61Z + L20**	LR57301L	4	B84143–A25–R21[4]	25
	(3)	**6SE7016–2FB61Z + L20**	LR57302L	8	B84143–A25–R21[4]	25
5	**(4)**	**6SE7017–8FB61Z + L20**	LR57302L	8	B84143–A25–R21[4]	25
7.5	**(5.5)**	**6SE7021–1FB61Z + L20**	LR57303L	12	B84143–A25–R21[4]	25
10	**(7.5)**	**6SE7021–5FB61Z + L20**	LR57304L	18	B84143–A25–R21[4]	25
15	**(11)**	**6SE7022–2FC61Z + L20**	LR57305L	25	B84143–A25–R21[4]	25
20	**(18.5)**	**6SE7023–0FD61Z + L20**	LR573A6L	35	B84143–A36–R21[4]	30
25	**(22)**	**6SE7023–4FD61Z + L20**	LR57306L	35	B84143–A36–R21[4]	30
40	**(30)**	**6SE7024–7FD61Z + L20**	LR57308L	45	B84143–A50–R21[4]	35
50	**(37)**	**6SE7026–1FE60Z + L20**	LR573A9L	55	B84143–A80–R21[4]	40
	(45)	**6SE7026–6FE60Z + L20**	LR57309L	80	B84143–A80–R21[4]	40
60	**(55)**	**6SE7028–0FF60Z + L20**	LR57309L	80	B84143–A80–R21[4]	40
100	**(75)**	**6SE7031–1FF60Z + L20**	LR57311L	100	B84143–A120–R21[4]	50
	(90)	**6SE7031–3FG60Z + L20**	LR57312L	130	B84143–A150–R21[4]	60
150	**(110)**	**6SE7031–6FG60Z + L20**	LR57313L	160	B84143–A180–R21[4]	70
	(132)	**6SE7032–0FG60Z + L20**	LR57314LE	200	B84143–B250–S□□	90
200	**(160)**	**6SE7032–3FG60Z + L20**	LR57315LE	250	B84143–B250–S□□	90
250	**(200)**	**6SE7033–0FK60**	LR57316LE	320	B84143–B320–S□□	100
300	**(250)**	**6SE7033–5FK60**	LR57317LE	400	B84143–B600–S□□	120
400	**(315)**	**6SE7034–5FK60**	LR57318LE	500	B84143–B600–S□□	120
Supply voltage 3-ph. 660 V to 690 V AC						
690 V			**690 V, 50 Hz**[2]			
60	**(55)**	**6SE7026–0HF60Z + L20**	4EP4000–3US00	63	B84143–A80–R21[4]	40
100	**(75)**	**6SE7028–2HF60Z + L20**	4EU2452–3UA00–0AA0	91	B84143–A120–R21[4]	50
	(90)	**6SE7031–0HG60Z + L20**	4EU2552–7UA00–0AA0	100	B84143–A120–R21[4]	50
150	**(110)**	**6SE7031–2HG60Z + L20**	4EU2552–3UA00–0AA0	125	B84143–A120–R21[4]	50
	(132)	**6SE7031–5HG60Z + L20**	4EU2552–0UB00–0AA0	160	B84143–A150–R21[4]	60
200	**(160)**	**6SE7031–7HG60Z + L20**	4EU2752–5UA00–0AA0	180	B84143–A180–R21[4]	70
250	**(200)**	**6SE7032–1HG60Z + L20**	4EU2752–6UA00–0AA0	224	B84143–B250–S□□	90
300	**(250)**	**6SE7033–0HK60**	4EU3052–3UA00–0AA0	315	B84143–B320–S□□	100
400	**(315)**	**6SE7033–5HK60**	4EU3052–4UA00–0AA0	400	B84143–B600–S□□	120
500	**(400)**	**6SE7034–5HK60**	4EU3652–5UA00–0AA0	500	B84143–B600–S□□	120

B84143–B . . . –S□□

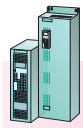
For 500 V TT and TN systems (earthed system)	**2 0**
For 690 V TT and TN systems (earthed system)	**2 1**
For 380 V to 690 V IT systems (non-earthed system)	**2 4**

1) To verify proper selection compare motor rated current to reactor selection tables.

2) For operation at 60 Hz the rated current of these reactors is reduced to 90 % of the listed value.

3) Available from EPCOS (www.epcos.com). Further information on the filters can be found at www4.ad.siemens.de. Please enter the following number under "Entry ID": 65 67 129.

4) Can only be used with TT and TN systems (earthed system).



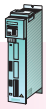
Fuse switch disconnectors[1)2)]			Semiconductor-protection fuses Duty class gR[3)] incl. cable protection			Main contactor/ AC contactor[4)]	
	Rated current	Max. fuse size		Rated current	Size	AC 1 duty at 40 °C	Rated current
Order No.	A		Order No.	A		Order No.	A
3NP40 10–0CH01	100	000	3NE1 813–0	16	000	3RT10 15	18
3NP40 10–0CH01	100	000	3NE1 813–0	16	000	3RT10 15	18
3NP40 10–0CH01	100	000	3NE1 814–0	20	000	3RT10 15	18
3NP40 10–0CH01	100	000	3NE1 814–0	20	000	3RT10 15	18
3NP40 10–0CH01	100	000	3NE1 814–0	20	000	3RT10 16	22
3NP40 10–0CH01	100	000	3NE1 803–0	35	000	3RT10 25	40
3NP40 10–0CH01	100	000	3NE1 802–0	40	000	3RT10 25	40
3NP40 10–0CH01	100	000	3NE1 802–0	40	000	3RT10 25	40
3NP40 10–0CH01	100	000	3NE1 818–0	63	000	3RT10 35	60
3NP40 10–0CH01	100	000	3NE1 818–0	63	000	3RT10 44	100
3NP40 10–0CH01	100	000	3NE1 820–0	80	000	3RT10 44	100
3NP40 70–0CA01	160	00	3NE1 021–0	100	00	3RT10 44	100
3NP40 70–0CA01	160	00	3NE1 022–0	125	00	3RT10 45	120
3NP42 70–0CA01	250	0; 1	3NE1 224–0	160	1	3RT10 54	160
3NP42 70–0CA01	250	0; 1	3NE1 225–0	200	1	3RT10 55	185
3NP42 70–0CA01	250	0; 1	3NE1 227–0	250	1	3RT10 56	215
3NP42 70–0CA01	250	0; 1	3NE1 227–0	250	1	3RT14 56	275
3NP43 70–0CA01	400	1; 2	3NE1 331–0	350	2	3RT10 65	330
3NP43 70–0CA01	400	1; 2	3NE1 332–0	400	2	3RT10 75	430
3NP44 70–0CA01	630	2; 3	3NE1 334–0	500	2	3RT10 75	610
3NP40 10–0CH01	100	000	3NE1 818–0	63	000	3RT10 44	100
3NP40 10–0CH01	100	000	3NE1 021–0	100	00	3RT10 44	100
3NP40 70–0CA01	160	00	3NE1 022–0	125	00	3RT10 45	120
3NP42 70–0CA01	250	0; 1	3NE1 224–0	160	1	3RT14 46	140
3NP42 70–0CA01	250	0; 1	3NE1 224–0	160	1	3RT10 54	160
3NP42 70–0CA01	250	0; 1	3NE1 225–0	200	1	3RT10 56	215
3NP42 70–0CA01	250	0; 1	3NE1 227–0	250	1	3RT14 56	275
3NP43 70–0CA01	400	1; 2	3NE1 332–0	400	2	3RT10 65	330
3NP44 70–0CA01	630	2; 3	3NE1 332–0	400	2	3RT14 66	400
3NP44 70–0CA01	630	2; 3	3NE1 334–0	500	2	3RT10 76	610

1) Fuse switch disconnectors:
Please observe the size of semiconductor-protection fuses!

2) Can be optionally used depending on requirements. For further information, see catalog "Industrial Controls".

3) The cable cross-sections must be dimensioned according to DIN VDE 0100, VDE 0298 Part 4 and as a function of the rated fuse currents.

4) See catalog "Industrial Controls".

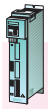


Selection and ordering data

Nominal power rating		Converter AC to AC	Inverter DC to AC	Output reactor[2] v_D = 3 % $f_{max.}$ = 90 Hz		Output reactor[1] Iron-core reactor $f_{max.}$ = 300 Hz	P_v max.
HP	(kW)	Order No.	Order No.	Order No.	mh	Order No.	W
Supply voltage 3-ph. 380 V to 480 V AC							
460 V	**(400 V)**			$f_{pulse} \leq$ 16 kHz		$f_{pulse} \leq$ 3 kHz	
0.75	**(0.55)**	**6SE7011–5EP60Z + L20**	–	LR4730SL	12.0	6SE7013–0ES87–1FE0	50
1.5	**(1.1)**	**6SE7013–0EP60Z + L20**	–	LR4730TL	9.0	6SE7013–0ES87–1FE0	50
2	**(1.5)**	**6SE7015–0EP60Z + L20**	–	LR47301L	5.0	6SE7015–0ES87–1FE0	60
4	**(3)**	**6SE7018–0EP60Z + L20**	–	LR47301L	5.0	6SE7021–0ES87–1FE0	80
5	**(4)**	**6SE7021–0EP60Z + L20**	–	LR47302L	3.0	6SE7021–0ES87–1FE0	80
7.5	**(5.5)**	**6SE7021–4EP60Z + L20**	–	LR47303L	2.5	6SE7021–8ES87–1FE0	95
10	**(7.5)**	**6SE7022–1EP60Z + L20**	–	LR47304L	1.5	6SE7022–6ES87–1FE0	110
15	**(11)**	**6SE7022–7EP60Z + L20**	–	LR47305L	1.2	6SE7022–6ES87–1FE0	110
20	**(15)**	**6SE7023–4EP60Z + L20**	–	LR473A6L	0.8	6SE7023–4ES87–1FE0	130
Supply voltage 510 V to 650 V DC							
460 V	**(400 V)**					$f_{pulse} \leq$ 3 kHz	
1	**(0.75)**	–	**6SE7012–0TP60**	LR4730TL	9.0	6SE7013–0ES87–1FE0	50
2	**(1.5)**	–	**6SE7014–0TP60**	LR47301L	5.0	6SE7015–0ES87–1FE0	60
3	**(2.2)**	–	**6SE7016–0TP60**	LR47301L	5.0	6SE7016–1ES87–1FE0	80
5	**(4)**	–	**6SE7021–0TP60**	LR47302L	3.0	6SE7021–0ES87–1FE0	80
7.5	**(5.5)**	–	**6SE7021–3TP60**	LR47303L	2.5	6SE7021–8ES87–1FE0	95
10	**(7.5)**	–	**6SE7021–8TP60**	LR47304L	1.5	6SE7021–8ES87–1FE0	95
15	**(11)**	–	**6SE7022–6TP60**	LR47305L	1.2	6SE7022–6ES87–1FE0	110
20	**(15)**	–	**6SE7023–4TP60**	LR473A6L	0.8	6SE7023–4ES87–1FE0	130
25	**(18.5)**	–	**6SE7023–8TP60**	LR47306L	0.8	6SE7024–7ES87–1FE0	190

1) See Engineering Information, Section 6, load-side components.

2) General purpose NEMA supplied reactor. See page 3/73 for complete list.



Output filter reactor[1]) Ferrite-core reactor	$f_{max.}$	P_v max.	Output dv/dt filter[1]) $f_{max.}$ = 300 Hz	P_v max.	Output sinusoidal filter[1])	$f_{max.}$	P_v max.
Order No.	Hz	W	Order No.	W	Order No.	Hz	W
$f_{pulse} \leq 6$ kHz			$f_{pulse} \leq 3$ kHz		$f_{pulse} = 6$ kHz		
–			–		–		
–			–		–		
6SE7016–1ES87–1FF1	600	96	6SE7016–2FB87–1FD0	100	6SE7016–1EA87–1FC0	400	150
6SE7021–0ES87–1FF1	600	96	6SE7021–5FB87–1FD0	150	6SE7021–0EB87–1FC0	400	200
6SE7021–0ES87–1FF1	600	96	6SE7021–5FB87–1FD0	150	6SE7021–0EB87–1FC0	400	200
6SE7021–8ES87–1FF1	600	96	6SE7021–5FB87–1FD0	150	6SE7021–8EB87–1FC0	400	250
6SE7022–6ES87–1FF0	600	100	6SE7022–2FC87–1FD0	170	6SE7022–6EC87–1FC0	400	300
6SE7022–6ES87–1FF0	600	100	6SE7022–2FC87–1FD0	170	6SE7022–6EC87–1FC0	400	300
6SE7023–4ES87–1FF0	600	115	6SE7023–4FC87–1FD0	170	6SE7023–4EC87–1FC0	400	400
$f_{pulse} \leq 6$ kHz			$f_{pulse} \leq 3$ kHz		$f_{pulse} = 6$ kHz		
–			–		–		
–			–		–		
6SE7016–1ES87–1FF1	600	96	6SE7016–2FB87–1FD0	100	6SE7016–1EA87–1FC0	400	150
6SE7021–0ES87–1FF1	600	96	6SE7021–5FB87–1FD0	150	6SE7021–0EB87–1FC0	400	200
6SE7021–8ES87–1FF1	600	96	6SE7021–5FB87–1FD0	150	6SE7021–8EB87–1FC0	400	250
6SE7021–8ES87–1FF1	600	96	6SE7021–5FB87–1FD0	150	6SE7021–8EB87–1FC0	400	250
6SE7022–6ES87–1FF0	600	100	6SE7022–2FC87–1FD0	170	6SE7022–6EC87–1FC0	400	300
6SE7023–4ES87–1FF0	600	115	6SE7023–4FC87–1FD0	170	6SE7023–4EC87–1FC0	400	400
6SE7024–7ES87–1FF0	600	170	6SE7024–7FC87–1FD0	200	6SE7024–7ED87–1FC0	400	500

Selection and ordering data

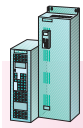
Nominal power rating		Converter AC to AC	Inverter DC to AC	Output reactor[2] v_D = 3 % $f_{max.}$ = 90 Hz		Output reactor[1] Iron-core reactor $f_{max.}$ = 300 Hz	P_v max.
HP	(kW)	Order No.	Order No.	Order No.	mh	Order No.	W
Supply voltage 3-ph. 380 V to 480 V and DC voltage 510 V to 650 V DC							
460 V	**(400 V)**			$f_{pulse} \leq$ 16 kHz		$f_{pulse} \leq$ 3 kHz	
3	**(2.2)**	**6SE7016–1EA61Z + L20**	**6SE7016–1TA61**	LR47301L	5.0	6SE7016–1ES87–1FE0	80
4	**(3)**	**6SE7018–0EA61Z + L20**	**6SE7018–0TA61**	LR47301L	5.0	6SE7021–0ES87–1FE0	80
5	**(4)**	**6SE7021–0EA61Z + L20**	**6SE7021–0TA61**	LR47302L	3.0	6SE7021–0ES87–1FE0	80
7.5	**(5.5)**	**6SE7021–3EB61Z + L20**	**6SE7021–3TB61**	LR47303L	2.5	6SE7021–8ES87–1FE0	95
10	**(7.5)**	**6SE7021–8EB61Z + L20**	**6SE7021–8TB61**	LR47304L	1.5	6SE7021–8ES87–1FE0	95
15	**(11)**	**6SE7022–6EC61Z + L20**	**6SE7022–6TC61**	LR47305L	1.2	6SE7022–6ES87–1FE0	110
20	**(15)**	**6SE7023–4EC61Z + L20**	**6SE7023–4TC61**	LR473A6L	0.8	6SE7023–4ES87–1FE0	130
25	**(18.5)**	**6SE7023–8ED61Z + L20**	**6SE7023–8TD61**	LR47306L	0.8	6SE7024–7ES87–1FE0	190
30	**(22)**	**6SE7024–7ED61Z + L20**	**6SE7024–7TD61**	LR47307L	0.7	6SE7024–7ES87–1FE0	190
40	**(30)**	**6SE7026–0ED61Z + L20**	**6SE7026–0TD61**	LR47308L	0.5	6SE7027–2ES87–1FE0	130
50	**(37)**	**6SE7027–2ED61Z + L20**	**6SE7027–2TD61**	LR473A9L	0.4	6SE7027–2ES87–1FE0	130
60	**(45)**	**6SE7031–0EE60Z + L20**	**6SE7031–0TE60**	LR47309L	0.3	6SE7031–0ES87–1FE0	190
75	**(55)**	**6SE7031–2EF60Z + L20**	**6SE7031–2TF60**	LR47310L	0.2	6SE7031–5ES87–1FE0	220
100	**(75)**	**6SE7031–5EF60Z + L20**	**6SE7031–5TF60**	LR47311L	0.2	6SE7031–5ES87–1FE0	220
125	**(90)**	**6SE7031–8EF60Z + L20**	**6SE7031–8TF60**	LR47312L	0.15	6SE7031–8ES87–1FE0	300
150	**(110)**	**6SE7032–1EG60Z + L20**	**6SE7032–1TG60**	LR47313L	0.11	6SE7032–6ES87–1FE0	300
175	**(132)**	**6SE7032–6EG60Z + L20**	**6SE7032–6TG60**	LR47314LE	0.091	6SE7032–6ES87–1FE0	300
200	**(160)**	**6SE7033–2EG60Z + L20**	**6SE7033–2TG60**	LR47315LE	0.075	6SE7033–2ES87–1FE0	370
250	**(200)**	**6SE7033–7EG60Z + L20**	**6SE7033–7TG60**	LR47316LE	0.06	6SE7033–7ES87–1FE0	380
350	**(250)**	**6SE7035–1EK60**	**6SE7035–1TJ60**	LR47317LE	0.05	6SE7035–1ES87–1FE0	460
450	**(315)**	**6SE7036–0EK60**	**6SE7036–0TJ60**	LR47318LE	0.04	6SE7037–0ES87–1FE0	620
500	**(400)**	**6SE7037–0EK60**	**6SE7037–0TJ60**	LR47319LE	0.029	6SE7037–0ES87–1FE0	620
600	**(500)**	**–**	**6SE7038–6TK60**			6SE7038–6ES87–1FE0	740
800	**(630)**	**–**	**6SE7041–1TK60**			6SE7041–1ES87–1FE0	860
1000	**(710)**	**–**	**6SE7041–3TL60**			[3]	
	(900)	**–**	without interphase transformer chassis **6SE7041–6TQ60**			6SE7038–6ES87–1FE0 (2x)	740 (2x)
	(900)	**–**	with interphase transformer chassis **6SE7041–6TM60**			6SE7038–6ES87–1FE0 (2x)	740 (2x)
	(1300)	**–**	without interphase transformer chassis **6SE7042–5TN60**			[3]	

Attention!
Please observe footnotes 2 to 6.

1) See Engineering Information, Section 6, load-side components.

2) General purpose NEMA supplied reactor. See page 3/73 for complete list.

3) No reactor required. Maximum cable length 2625 ft (800 m) shielded, 3938 ft (1200 m) unshielded.



Output filter reactor[1] Ferrite-core reactor	$f_{max.}$	P_v max.	Output dv/dt filter[1] $f_{max.}$ = 300 Hz	P_v max.	Output sinusoidal filter[1]	$f_{max.}$	P_v max.
Order No.	Hz	W	Order No.	W	Order No.	Hz	W
$f_{pulse} \leq 6$ kHz			$f_{pulse} \leq 3$ kHz		$f_{pulse} = 6$ kHz		
6SE7016–1ES87–1FF1	600	96	6SE7016–2FB87–1FD0	100	6SE7016–1EA87–1FC0	400	150
6SE7021–0ES87–1FF1	600	96	6SE7021–5FB87–1FD0	150	6SE7021–0EB87–1FC0	400	200
6SE7021–0ES87–1FF1	600	96	6SE7021–5FB87–1FD0	150	6SE7021–0EB87–1FC0	400	200
6SE7021–8ES87–1FF1	600	96	6SE7021–5FB87–1FD0	150	6SE7021–8EB87–1FC0	400	250
6SE7021–8ES87–1FF1	600	96	6SE7021–5FB87–1FD0	150	6SE7021–8EB87–1FC0	400	250
6SE7022–6ES87–1FF0	600	100	6SE7022–2FC87–1FD0	170	6SE7022–6EC87–1FC0	400	300
6SE7023–4ES87–1FF0	600	115	6SE7023–4FC87–1FD0	170	6SE7023–4EC87–1FC0	400	400
6SE7024–7ES87–1FF0	600	170	6SE7024–7FC87–1FD0	200	6SE7024–7ED87–1FC0	400	500
6SE7024–7ES87–1FF0	600	170	6SE7024–7FC87–1FD0	200	6SE7024–7ED87–1FC0	400	500
6SE7027–2ES87–1FF0	600	135	6SE7026–0HE87–1FD0	230	6SE7027–2ED87–1FC0	400	600
6SE7027–2ES87–1FF0	600	135	6SE7028–2HE87–1FD0	300	6SE7027–2ED87–1FC0	400	600
6SE7031–0ES87–1FF0	500	170	6SE7031–2HS87–1FD0	390	6SE7031–0EE87–1FH0	200	450
6SE7031–5ES87–1FF0	500	300	6SE7031–7HS87–1FD0	480	6SE7031–5EF87–1FH0	200	600
6SE7031–5ES87–1FF0	500	300	6SE7031–7HS87–1FD0	480	(6SE7031–5EF87–1FH0[7]))	200	600
6SE7031–8ES87–1FF0	500	300	6SE7032–3HS87–1FD0	500	6SE7031–5EF87–1FH0[2])	200	600
6SE7032–6ES87–1FF0	500	350	6SE7033–0HS87–1FD0	700	6SE7031–8EF87–1FH0[3])	200	750
6SE7032–6ES87–1FF0	500	350	6SE7033–0HS87–1FD0	700	6SE7031–8EF87–1FH0[4])	200	750
6SE7033–2ES87–1FF0	500	350	6SE7033–5HS87–1FD0	800	6SE7032–6EG87–1FH0[5])	200	900
6SE7033–7ES87–1FF0	500	350	6SE7034–5HS87–1FD0	950	6SE7032–6EG87–1FH0[6])	200	900
6SE7035–1ES87–1FF0	500	400	6SE7035–7HS87–1FD0	1300	–		
6SE7037–0ES87–1FF0	500	480	6SE7036–5HS87–1FD0	1500	–		
6SE7037–0ES87–1FF0	500	480	6SE7038–6HS87–1FD0	1800	–		
6SE7038–6ES87–1FF0	500	530	6SE7038–6HS87–1FD0	1800	–		
–			–		–		
–			–		–		
–			6SE7038–6HS87–1FD0 (2x)	1800 (2x)	–		
–			–		–		
–			–		–		

1) See Engineering Information, Section 6, also observe footnotes 2 to 6.

2) Rated current of the units with sinusoidal filter due to derating at a pulse frequency of 6 kHz, I_S = 140 A.

3) Rated current of the units with sinusoidal filter due to derating at a pulse frequency of 6 kHz, I_S = 158 A.

4) Rated current of the units with sinusoidal filter due to derating at a pulse frequency of 6 kHz, I_S = 195 A.

5) Rated current of the units with sinusoidal filter due to derating at a pulse frequency of 6 kHz, I_S = 236 A.

6) Rated current of the units with sinusoidal filter due to derating at a pulse frequency of 6 kHz, I_S = 278 A.

7) Rated current of the units with sinusoidal filter due to derating at a pulse frequency of 6 kHz, I_S = 110 A and therefore lower than for the units with 75 HP (55 kW) (no derating at 6 kHz).

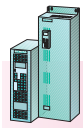
Selection and ordering data

Nominal power rating		Converter AC to AC	Inverter DC to AC	Output reactor[1] Iron-core reactor $f_{max.}$ = 300 Hz	P_v max.	Output dv/dt filter[1] $f_{max.}$ = 300 Hz	P_v max.	Output sinusoidal filter[1]	$f_{max.}$	P_v max.
HP	(kW)	Order No.	Order No.	Order No.	W	Order No.	W	Order No.	Hz	W
Supply voltage 3-ph. 500 V to 600 V AC and DC voltage 675 V to 810 V DC										
575 V	**(500 V)**			$f_{pulse} \leq 3$ kHz		$f_{pulse} \leq 3$ kHz		$f_{pulse} \leq 3$ kHz		
3	**(2.2)**	**6SE7014–5FB61**	**6SE7014–5UB61**	6SE7016–2FS87–1FE0[3]	130	6SE7016–2FB87–1FD0	100	6SE7016–2FB87–1FH0	200	200
	(3)	**6SE7016–2FB61**	**6SE7016–2UB61**	6SE7016–2FS87–1FE0[3]	130	6SE7016–2FB87–1FD0	100	6SE7016–2FB87–1FH0	200	200
5	**(4)**	**6SE7017–8FB61**	**6SE7017–8UB61**	6SE7021–5FS87–1FE0[3]	190	6SE7021–5FB87–1FD0	150	6SE7021–5FC87–1FH0	200	300
7.5	**(5.5)**	**6SE7021–1FB61**	**6SE7021–1UB61**	6SE7021–5FS87–1FE0[3]	190	6SE7021–5FB87–1FD0	150	6SE7021–5FC87–1FH0	200	300
10	**(7.5)**	**6SE7021–5FB61**	**6SE7021–5UB61**	6SE7021–5FS87–1FE0[3]	190	6SE7021–5FB87–1FD0	150	6SE7021–5FC87–1FH0	200	300
15	**(11)**	**6SE7022–2FC61**	**6SE7022–2UC61**	6SE7022–2FS87–1FE0[3]	220	6SE7022–2FC87–1FD0	170	6SE7022–2FD87–1FH0	200	400
20	**(18.5)**	**6SE7023–0FD61**	**6SE7023–0UD61**	6SE7023–4FS87–1FE0[3]	190	6SE7023–4FC87–1FD0	170	6SE7023–4FD87–1FH0	200	500
25	**(22)**	**6SE7023–4FD61**	**6SE7023–4UD61**	6SE7023–4FS87–1FE0[3]	190	6SE7023–4FC87–1FD0	170	6SE7023–4FD87–1FH0	200	500
40	**(30)**	**6SE7024–7FD61**	**6SE7024–7UD61**	6SE7024–7FS87–1FE0[3]	220	6SE7024–7FC87–1FD0	200	6SE7024–7FE87–1FH0	200	600
50	**(37)**	**6SE7026–1FE60**	**6SE7026–1UE60**	6SE7026–0HS87–1FE0[3]	300	6SE7026–0HE87–1FD0	230	6SE7026–1FF87–1FH0	100	450
	(45)	**6SE7026–6FE60**	**6SE7026–6UE60**	6SE7028–2HS87–1FE0[3]	370	6SE7028–2HE87–1FD0	300	6SE7028–0FF87–1FH0	100	600
60	**(55)**	**6SE7028–0FF60**	**6SE7028–0UF60**	6SE7028–2HS87–1FE0[3]	370	6SE7028–2HE87–1FD0	300	6SE7028–0FF87–1FH0	100	600
100	**(75)**	**6SE7031–1FF60**	**6SE7031–1UF60**	6SE7031–2HS87–1FE0[3]	500	6SE7031–2HS87–1FD0	390	6SE7031–3FG87–1FH0	100	750
	(90)	**6SE7031–3FG60**	**6SE7031–3UG60**	6SE7031–2HS87–1FE0[3]	500	6SE7031–2HS87–1FD0	390	6SE7031–3FG87–1FH0	100	750
150	**(110)**	**6SE7031–6FG60**	**6SE7031–6UG60**	6SE7031–7HS87–1FE0[3]	620	6SE7031–7HS87–1FD0	480	6SE7031–6FG87–1FH0	100	900
	(132)	**6SE7032–0FG60**	**6SE7032–0UG60**	6SE7032–3HS87–1FE0[3]	620	6SE7032–3HS87–1FD0	500	–		
200	**(160)**	**6SE7032–3FG60**	**6SE7032–3UG60**	6SE7032–3HS87–1FE0[3]	620	6SE7032–3HS87–1FD0	500	–		
250	**(200)**	**6SE7033–0FK60**	**6SE7033–0UJ60**	6SE7033–0GS87–1FE0[3]	870	6SE7033–0HS87–1FD0	700	–		
300	**(250)**	**6SE7033–5FK60**	**6SE7033–5UJ60**	6SE7033–5GS87–1FE0[3]	1050	6SE7033–5HS87–1FD0	800	–		
400	**(315)**	**6SE7034–5FK60**	**6SE7034–5UJ60**	6SE7034–5GS87–1FE0[3]	1270	6SE7034–5HS87–1FD0	950	–		
500	**(400)**	**–**	**6SE7035–7UK60**	6SE7035–7GS87–1FE0[3]	1840	6SE7035–7HS87–1FD0	1300	–		
600	**(450)**	**–**	**6SE7036–5UK60**	6SE7036–5GS87–1FE0[3]	1980	6SE7036–5HS87–1FD0	1500	–		
800	**(630)**	**–**	**6SE7038–6UK60**	6SE7038–6GS87–1FE0	2350	6SE7038–6HS87–1FD0	1800	–		
1000	**(800)**	**–**	**6SE7041–1UL60**	6SE7041–2GS87–1FE0		on request[2]		–		
1100	**(900)**	**–**	**6SE7041–2UL60**	6SE7041–2GS87–1FE0		on request[2]		–		
			without interphase transformer chassis							
	(1000)	**–**	**6SE7041–4UQ60**	6SE7038–6GS87–1FE0 (2x)	2350 (2x)	6SE7038–6HS87–1FD0 (2x)	1800 (2x)	–		
	(1100)	**–**	**6SE7041–6UQ60**	6SE7038–6GS87–1FE0 (2x)	2350 (2x)	6SE7038–6HS87–1FD0 (2x)	1800 (2x)	–		
			with interphase transformer chassis							
	(1000)	**–**	**6SE7041–4UM60**	–				–		
	(1100)	**–**	**6SE7041–6UM60**	–				–		
			without interphase transformer chassis							
	(1500)	**–**	**6SE7042–1UN60**	6SE7041–2GS87–1FE0 (2x)	2350 (2x)	on request		–		
			without interphase transformer chassis							
	(1700)	**–**	**6SE7042–3UN60**	6SE7041–2GS87–1FE0 (2x)	2350 (2x)	on request		–		

1) See Engineering Information, Section 6.

2) The following cable lengths are permissible in combination with the TG 31024-05 limiting network and output filter reactor: 98 ft (30 m) shielded/164 ft (50 m) unshielded; with 1 supplementary reactor (i.e. 2 output filter reactors) 328 ft (100 m) shielded/492 ft (150 m) unshielded.

3) See page 3/73 for a list of general purpose NEMA supplied reactors.



Nominal power rating	Converter AC to AC	Inverter DC to DC	Output reactor[1] Iron-core reactor $f_{max.}$ = 300 Hz	P_v max.	Output dv/dt filter[1] $f_{max.}$ = 300 Hz	P_v max.
kW	Order No.	Order No.	Order No.	W	Order No.	W
Supply voltage 3-ph. 660 V to 690 V AC and DC voltage 890 V to 930 V DC						
690 V			$f_{pulse} \leq 3$ kHz		$f_{pulse} \leq 3$ kHz	
55	**6SE7026–0HF60**	**6SE7026–0WF60**	6SE7026–0HS87–1FE0	300	6SE7026–0HE87–1FD0	230
75	**6SE7028–2HF60**	**6SE7028–2WF60**	6SE7028–2HS87–1FE0	370	6SE7028–2HE87–1FD0	300
90	**6SE7031–0HG60**	**6SE7031–0WG60**	6SE7031–2HS87–1FE0	500	6SE7031–2HS87–1FD0	390
110	**6SE7031–2HG60**	**6SE7031–2WG60**	6SE7031–2HS87–1FE0	500	6SE7031–2HS87–1FD0	390
132	**6SE7031–5HG60**	**6SE7031–5WG60**	6SE7031–7HS87–1FE0	620	6SE7031–7HS87–1FD0	480
160	**6SE7031–7HG60**	**6SE7031–7WG60**	6SE7031–7HS87–1FE0	620	6SE7031–7HS87–1FD0	480
200	**6SE7032–1HG60**	**6SE7032–1WG60**	6SE7032–3HS87–1FE0	620	6SE7032–3HS87–1FD0	500
250	**6SE7033–0HK60**	**6SE7033–0WJ60**	6SE7033–0GS87–1FE0	870	6SE7033–0HS87–1FD0	700
315	**6SE7033–5HK60**	**6SE7033–5WJ60**	6SE7033–5GS87–1FE0	1050	6SE7033–5HS87–1FD0	800
400	**6SE7034–5HK60**	**6SE7034–5WJ60**	6SE7034–5GS87–1FE0	1270	6SE7034–5HS87–1FD0	950
500	**–**	**6SE7035–7WK60**	6SE7035–7GS87–1FE0	1840	6SE7035–7HS87–1FD0	1300
630	**–**	**6SE7036–5WK60**	6SE7036–5GS87–1FE0	1980	6SE7036–5HS87–1FD0	1500
800	**–**	**6SE7038–6WK60**	6SE7038–6GS87–1FE0	2350	6SE7038–6HS87–1FD0	1800
1000	**–**	**6SE7041–1WL60**	6SE7041–2GS87–1FE0		on request[2]	
1200	**–**	**6SE7041–2WL60**	6SE7041–2GS87–1FE0		on request[2]	
		without interphase transformer chassis				
1300	**–**	**6SE7041–4WQ60**	6SE7038–6GS87–1FE0 (2x)	2350 (2x)	6SE7038–6HS87–1FD0 (2x)	1800 (2x)
1500	**–**	**6SE7041–6WQ60**	6SE7038–6GS87–1FE0 (2x)	2350 (2x)	6SE7038–6HS87–1FD0 (2x)	1800 (2x)
		with interphase transformer chassis				
1300	**–**	**6SE7041–4WM60**	–	–	–	–
1500	**–**	**6SE7041–6WM60**	–	–	–	–
		without interphase transformer chassis				
1900	**–**	**6SE7042–1WN60**	6SE7041–2GS87–1FE0 (2x)	–	–	–
		without interphase transformer chassis				
2300	**–**	**6SE7042–3WN60**	6SE7041–2GS87–1FE0 (2x)	–	–	–

1) See Engineering Information, Section 6.

2) The following cable lengths are permissible in combination with the TG 31024-05 limiting network and output filter reactor:
98 ft (30 m) shielded/164 ft (50 m) unshielded;
with 1 supplementary reactor (i.e. 2 output filter reactors) 328 ft (100 m) shielded/492 ft (150 m) unshielded.

Selection and ordering data

Nominal power rating		Inverter DC to AC	Fuse switch disconnector for DC coupling[1)2)]			Inverter fuse Duty class gR[2)]			Inverter fuse Duty class aR[2)]		
				I_S	Max. fuse size		I_S	Size		I_S	Size
HP	(kW)	Order No.	Order No.	A		Order No.	A		Order No.	A	
DC voltage 510 V to 650 V											
460 V	**(400 V)**										
3	**(2.2)**	**6SE7016–1TA61**[3)]	3NP40 10–0CH01	100	000	2 x 3NE1 814–0[4)]	20	000	2 x 3NE8 015–1[4)]	25	00
4	**(3)**	**6SE7018–0TA61**[3)]	3NP40 10–0CH01	100	000	2 x 3NE1 815–0[4)]	25	000	2 x 3NE8 015–1[4)]	25	00
5	**(4)**	**6SE7021–0TA61**[3)]	3NP40 10–0CH01	100	000	2 x 3NE1 815–0[4)]	25	000	2 x 3NE8 015–1[4)]	25	00
7.5	**(5.5)**	**6SE7021–3TB61**[3)]	3NP40 10–0CH01	100	000	2 x 3NE1 803–0[4)]	35	000	2 x 3NE8 017–1[4)]	50	00
10	**(7.5)**	**6SE7021–8TB61**[3)]	3NP40 10–0CH01	100	000	2 x 3NE1 817–0[4)]	50	000	2 x 3NE8 017–1[4)]	50	00
15	**(11)**	**6SE7022–6TC61**[3)]	3NP40 10–0CH01	100	000	2 x 3NE1 818–0[4)]	63	000	2 x 3NE8 020–1[4)]	80	00
20	**(15)**	**6SE7023–4TC61**[3)]	3NP40 10–0CH01	100	000	2 x 3NE1 820–0[4)]	80	000	2 x 3NE8 020–1[4)]	80	00
25	**(18.5)**	**6SE7023–8TD61**[3)]	3NP40 70–0CA01	160	00	2 x 3NE1 021–0[4)]	100	00	2 x 3NE8 022–1[4)]	125	00
30	**(22)**	**6SE7024–7TD61**[3)]	3NP40 70–0CA01	160	00	2 x 3NE1 022–0[4)]	125	00	2 x 3NE8 022–1[4)]	125	00
40	**(30)**	**6SE7026–0TD61**[3)]	3NP42 70–0CA01	250	0; 1	2 x 3NE1 224–0[4)]	160	0	2 x 3NE8 024–1[4)]	160	00
50	**(37)**	**6SE7027–2TD61**[3)]	3NP42 70–0CA01	250	0; 1	2 x 3NE1 224–0[4)]	160	0	2 x 3NE8 024–1[4)]	160	00
60	**(45)**	**6SE7031–0TE60**	3NP42 70–0CA01	250	0; 1	–			2 x 3NE3 224	160	1
75	**(55)**	**6SE7031–2TF60**	3NP42 70–0CA01	250	0; 1	–			2 x 3NE3 227	250	1
100	**(75)**	**6SE7031–5TF60**	3NP42 70–0CA01	250	0; 1	–			2 x 3NE3 227	250	1
125	**(90)**	**6SE7031–8TF60**	3NP43 70–0CA01	400	1; 2	–			2 x 3NE3 230–0B	315	1
150	**(110)**	**6SE7032–1TG60**	3NP44 70–0CA01	630	2; 3	–			2 x 3NE3 233	450	1
175	**(132)**	**6SE7032–6TG60**	3NP44 70–0CA01	630	2; 3	–			2 x 3NE3 233	450	1
200	**(160)**	**6SE7033–2TG60**	3NP44 70–0CA01	630	2; 3	–			2 x 3NE3 334–0B	500	2
250	**(200)**	**6SE7033–7TG60**	3NP44 70–0CA01	630	2; 3	–			2 x 3NE3 336	630	2
350	**(250)**	**6SE7035–1TJ60**	2 x 3NP43 70–0CA01	400	1; 2	–			2 x 2 x 3NE3 233[3)]	450	1
450	**(315)**	**6SE7036–0TJ60**	2 x 3NP44 70–0CA01	630	2; 3	–			2 x 2 x 3NE3 335[3)]	560	2
500	**(400)**	**6SE7037–0TJ60**	2 x 3NP44 70–0CA01	630	2; 3	–			2 x 2 x 3NE3 335[3)]	560	2
600	**(500)**	**6SE7038–6TK60**	2 x 3NP44 70–0CA01	630	2; 3	–			2 x 2 x 3NE3 337–8[3)]	710	2
800	**(630)**	**6SE7041–1TK60**	2 x 2 x 3NH3 330	700	2; 3	–			2 x 2 x 3NE3 338–8[3)]	800	2
1000	**(710)**	**6SE7041–3TL60**							2 x 2 x 3NE3 340-8[3)]	900	2
	(900)	without interphase transformer chassis **6SE7041–6TQ60**	4 x 3NP44 70–0CA01	630	2; 3	–			4 x 2 x 3NE3 337–8[3)]	710	2
	(900)	with interphase transformer chassis **6SE7041–6TM60**	4 x 3NP44 70–0CA01	630	2; 3	–			4 x 2 x 3NE3 337–8[3)]	710	2
	(1300)	without interphase transformer chassis **6SE7042–5TN60**	–	–	–	–			4 x 2 x 3NE3 340–8[3)]	900	2

1) See catalog "Industrial Controls". Rated insulation voltage for pollution degree 3 to DIN VDE 0110, Part 1, but conditions of use to pollution degree 2. The rated insulation voltage is therefore ≥ 1000 V.

2) Note fuse sizes when selecting fuse switch disconnectors.

3) DC fuses are integral components of the inverter unit.

4) For the fusing of inverters without integrated DC link fuse (inverter with option L33).

Contactor for isolating the inverter from the DC bus[1]		Precharging resistors				Free-wheeling diode on the DC bus	
	I_S		Dimension drawing, see Section 7	Quantity per inverter	R_S	Diode	Clamp-on cover
Order No.	A	Order No.	No.		Ω	Order No.	Order No.
3RT13 25	1 x 30	6SX7010–0AC06	46	2	27	SKR 3 F 20/12[2]	
3RT13 25	1 x 30	6SX7010–0AC06	46	2	27	SKR 3 F 20/12[2]	
3RT13 25	1 x 30	6SX7010–0AC06	46	2	27	SKR 3 F 20/12[2]	
3RT13 25	1 x 30	6SX7010–0AC06	46	2	27	SKR 3 F 20/12[2]	
3RT13 25	2 x 27	6SX7010–0AC06	46	2	27	SKR 3 F 20/12[2]	
3RT13 25	2 x 27	6SX7010–0AC06	46	2	27	SKR 60 F 12[2]	
3RT13 25	2 x 27	6SX7010–0AC06	46	2	27	SKR 60 F 12[2]	
3RT13 25	2 x 27	6SX7010–0AC06	46	2	27	SKR 60 F 12[2]	
3RT13 36	2 x 50	6SX7010–0AC06	46	2	27	SKR 60 F 12[2]	
3RT13 44	2 x 81	6SX7010–0AC07	46	2	27	SKR 141 F 15[2]	
3RT13 44	2 x 81	6SX7010–0AC07	46	2	27	SKR 141 F 15[2]	
3RT13 44	2 x 81	6SX7010–0AC08	46	2	15	SKR 141 F 15[2]	
3RT13 46	2 x 108	6SX7010–0AC08	46	2	15	SKR 141 F 15[2]	
3TK10	2 x 162	6SX7010–0AC08	46	2	15	SKR 141 F 15[2]	
3TK10	2 x 162	6SX7010–0AC10	46	2	10	SKR 141 F 15[2]	
3TK10	2 x 162	6SX7010–0AC10	46	2	10	2 x SKR 141 F 15[2]	
3TK11	2 x 207	6SX7010–0AC10	46	2	10	2 x SKR 141 F 15[2]	
3TK12	2 x 243	6SX7010–0AC10	46	2	10	2 x SKR 141 F 15[2]	
3TK13	2 x 279	6SX7010–0AC10	46	2	10	2 x SKR 141 F 15[2]	
3TK14	2 x 423	6SX7010–0AC10	46	2	10	D348S16[3]	V50–14.45M[3]
3TK14	2 x 423	6SX7010–0AC11	46	2	5.6	D689S20[3]	V72–26.120M[3]
3TK15	2 x 585	6SX7010–0AC11	46	2	5.6	D689S20[3]	V72–26.120M[3]
3TK17	2 x 765	6SX7010–0AC13	47	2	2.7	D689S20[3]	V72–26.120M[3]
2 x 3TK15	4 x 488	6SX7010–0AC11	46	4	5.6	2 x D689S20[3]	2 x V72–26.120M[3]
2 x 3TK15	4 x 488	6SX7010–0AC13	47	4	2.7	2 x D689S20[3]	2 x V72–26.120M[3]
2 x 3TK17	4 x 638	6SX7010–0AC13	47	4	2.7	2 x D689S20[3]	2 x V72–26.120M[3]
2 x 3TK17	4 x 638	6SX7010–0AC13	47	4	2.7	2 x D689S20[3]	2 x V72–26.120M[3]
4 x 3TK15	4 x 488	6SX7010–0AC13	47	8	2.7	4 x D689S20[3]	4 x V72–26.120M[3]

1) See catalog "Industrial Controls". Rated insulation voltage for pollution degree 2 to DIN VDE 0110 Part 1: 1000 V.

2) See Engineering Information, Section 6. The diodes indicated are available from SEMIKRON (www.semikron.com).

3) See Engineering Information, Section 6. Disc-type diode with a clamp-on cap for mounting on a copper plate or rail. The diodes indicated are available from EUPEC (www.eupec.com).

Selection and ordering data

Nominal power rating		Inverter DC to AC	Fuse switch disconnector for DC coupling[1][2]			Inverter fuse Duty class aR		
				I_S	Max. fuse size		I_S	Size
HP	(kW)	Order No.	Order No.	A		Order No.	A	
DC voltage 675 V to 810 V DC								
575 V	**(500 V)**							
3	**(2.2)**	**6SE7014–5UB61**[3]	3NP42 70–0CA01	250	0; 1	2 x 3NE4 101[4]	32	0
	(3)	**6SE7016–2UB61**[3]	3NP42 70–0CA01	250	0; 1	2 x 3NE4 101[4]	32	0
5	**(4)**	**6SE7017–8UB61**[3]	3NP42 70–0CA01	250	0; 1	2 x 3NE4 101[4]	32	0
7.5	**(5.5)**	**6SE7021–1UB61**[3]	3NP42 70–0CA01	250	0; 1	2 x 3NE4 101[4]	32	0
10	**(7.5)**	**6SE7021–5UB61**[3]	3NP42 70–0CA01	250	0; 1	2 x 3NE4 101[4]	32	0
15	**(11)**	**6SE7022–2UC61**[3]	3NP42 70–0CA01	250	0; 1	2 x 3NE4 117[4]	50	0
20	**(18.5)**	**6SE7023–0UD61**[3]	3NP42 70–0CA01	250	0; 1	2 x 3NE4 120[4]	80	0
25	**(22)**	**6SE7023–4UD61**[3]	3NP42 70–0CA01	250	0; 1	2 x 3NE4 120[4]	80	0
40	**(30)**	**6SE7024–7UD61**[3]	3NP42 70–0CA01	250	0; 1	2 x 3NE4 121[4]	100	0
50	**(37)**	**6SE7026–1UE60**	3NP42 70–0CA01	250	0; 1	2 x 3NE3 222	125	1
	(45)	**6SE7026–6UE60**	3NP42 70–0CA01	250	0; 1	2 x 3NE3 224	160	1
60	**(55)**	**6SE7028–0UF60**	3NP42 70–0CA01	250	0; 1	2 x 3NE3 224	160	1
100	**(75)**	**6SE7031–1UF60**	3NP42 70–0CA01	250	0; 1	2 x 3NE3 225	200	1
	(90)	**6SE7031–3UG60**	3NP42 70–0CA01	250	0; 1	2 x 3NE3 225	200	1
150	**(110)**	**6SE7031–6UG60**	3NP42 70–0CA01	250	0; 1	2 x 3NE3 227	250	1
	(132)	**6SE7032–0UG60**	3NP43 70–0CA01	400	1; 2	2 x 3NE3 232–0B	400	1
200	**(160)**	**6SE7032–3UG60**	3NP43 70–0CA01	400	1; 2	2 x 3NE3 232–0B	400	1
250	**(200)**	**6SE7033–0UJ60**	3NP43 70–0CA01	400	1; 2	2 x 3NE3 334–0B[3]	500	2
300	**(250)**	**6SE7033–5UJ60**	3NP44 70–0CA01	630	2; 3	2 x 3NE3 336[3]	630	2
400	**(315)**	**6SE7034–5UJ60**	3NP44 70–0CA01	630	2; 3	2 x 3NE3 337–8[3]	710	2
500	**(400)**	**6SE7035–7UK60**	2 x 3NP44 70–0CA01	630	2; 3	2 x 2 x 3NE3 333[3]	450	2
600	**(450)**	**6SE7036–5UK60**	2 x 3NP44 70–0CA01	630	2; 3	2 x 2 x 3NE3 334–0B[3]	500	2
800	**(630)**	**6SE7038–6UK60**	2 x 3NP44 70–0CA01	630	2; 3	2 x 2 x 3NE3 336[3]	630	2
1000	**(800)**	**6SE7041–1UL60**	2 x 3NP44 70–0CA01	630	2; 3	2 x 2 x 3NE3 338–8[3]	800	2
1100	**(900)**	**6SE7041–2UL60**				2 x 2 x 3NE3 340–8[3]	900	2
		without interphase transformer chassis						
	(1000)	**6SE7041–4UQ60**	4 x 3NP44 70–0CA01	630	2; 3	4 x 2 x 3NE3 336[3]	630	2
	(1100)	**6SE7041–6UQ60**	4 x 3NP44 70–0CA01	630	2; 3	4 x 2 x 3NE3 336[3]	630	2
		with interphase transformer chassis						
	(1000)	**6SE7041–4UM60**	4 x 3NP44 70–0CA01	630	2; 3	4 x 2 x 3NE3 336[3]	630	2
	(1100)	**6SE7041–6UM60**	4 x 3NP44 70–0CA01	630	2; 3	4 x 2 x 3NE3 336[3]	630	2
		without interphase transformer chassis						
	(1500)	**6SE7042–1UN60**	4 x 3NP44 70–0CA01	630	2; 3	4 x 2 x 3NE3 338–8[3]	800	2
		without interphase transformer chassis						
	(1700)	**6SE7042–3UN60**	–	–	–	4 x 2 x 3NE3 340–8[3]	900	2

1) See catalog "Industrial Controls". Rated insulation voltage for pollution degree 3 to DIN VDE 0110, Part 1, but conditions of use to pollution degree 2. The rated insulation voltage is therefore ≥ 1000 V.

2) Note fuse sizes when selecting fuse switch disconnectors.

3) DC fuses are integral components of the inverter unit.

4) For the fusing of inverters without integrated DC link fuse (inverter with option L33).

Contactor for isolating the inverter from the DC bus[1]		Precharging resistors				Free-wheeling diode on the DC bus	
	I_S		Dimension drawing, see Section 7	Quantity per inverter	R_S	Diode	Clamp-on cover
Order No.	A	Order No.	No.		Ω	Order No.	Order No.
3RT13 25	1 x 30	6SX7010–0AC06	46	2	27	SKR 3 F 20/12[2]	
3RT13 25	1 x 30	6SX7010–0AC06	46	2	27	SKR 3 F 20/12[2]	
3RT13 25	1 x 30	6SX7010–0AC06	46	2	27	SKR 3 F 20/12[2]	
3RT13 25	1 x 30	6SX7010–0AC06	46	2	27	SKR 3 F 20/12[2]	
3RT13 25	1 x 30	6SX7010–0AC06	46	2	27	SKR 3 F 20/12[2]	
3RT13 25	2 x 27	6SX7010–0AC06	46	2	27	SKR 3 F 20/12[2]	
3RT13 25	2 x 27	6SX7010–0AC06	46	2	27	SKR 60 F 12[2]	
3RT13 25	2 x 27	6SX7010–0AC06	46	2	27	SKR 60 F 12[2]	
3RT13 36	2 x 50	6SX7010–0AC07	46	2	27	SKR 60 F 12[2]	
3RT13 44	2 x 81	6SX7010–0AC07	46	2	27	SKR 60 F 12[2]	
3RT13 44	2 x 81	6SX7010–0AC08	46	2	15	SKR 60 F 12[2]	
3RT13 44	2 x 81	6SX7010–0AC08	46	2	15	SKR 60 F 12[2]	
3RT13 44	2 x 81	6SX7010–0AC08	46	2	15	SKR 141 F 15[2]	
3RT13 46	2 x 108	6SX7010–0AC08	46	2	15	SKR 141 F 15[2]	
3TK10	2 x 162	6SX7010–0AC10	46	2	10	SKR 141 F 15v	
3TK10	2 x 162	6SX7010–0AC10	46	2	10	2 x SKR 141 F 15[2]	
3TK10	2 x 162	6SX7010–0AC10	46	2	10	2 x SKR 141 F 15[2]	
3TK11	2 x 207	6SX7010–0AC11	46	2	5.6	D348S16[3]	V50–14.45M[3]
3TK13	2 x 279	6SX7010–0AC11	46	2	5.6	D348S16[3]	V50–14.45M[3]
3TK14	2 x 423	6SX7010–0AC13	47	2	2.7	D689S20[3]	V72–26.120M[3]
3TK14	2 x 423	6SX7010–0AC13	47	2	2.7	D689S20[3]	V72–26.120M[3]
3TK15	2 x 585	6SX7010–0AC13	47	2	2.7	D689S20[3]	V72–26.120M[3]
3TK17	2 x 765	6SX7010–0AC13	47	2	2.7	D689S20[3]	V72–26.120M[3]
2 x 3TK15	4 x 488	6SX7010–0AC13	47	4	2.7	2 x D689S20[3]	2 x V72–26.120M[3]
2 x 3TK15	4 x 488	6SX7010–0AC13	47	4	2.7	2 x D689S20[3]	2 x V72–26.120M[3]
2 x 3TK15	4 x 488	6SX7010–0AC13	47	4	2.7	2 x D689S20[3]	2 x V72–26.120M[3]
2 x 3TK17	4 x 638	6SX7010–0AC13	47	4	2.7	2 x D689S20[3]	2 x V72–26.120M[3]
2 x 3TK15	4 x 488	6SX7010–0AC13	47	4	2.7	2 x D689S20[3]	2 x V72–26.120M[3]
2 x 3TK17	4 x 638	6SX7010–0AC13	47	4	2.7	2 x D689S20[3]	2 x V72–26.120M[3]
4 x 3TK15	4 x 488	6SX7010–0AC13	47	8	2.7	4 x D689S20[3]	4 x V72–26.120M[3]
4 x 3TK15	4 x 488	6SX7010–0AC13	47	8	2.7	4 x D689S20[3]	4 x V72–26.120M[3]

1) See catalog “Industrial Controls”. Rated insulation voltage for pollution degree 2 to DIN VDE 0110 Part 1: 1000 V.

2) See Engineering Information, Section 6. The diodes indicated are available from SEMIKRON (www.semikron.com).

3) See Engineering Information, Section 6. Disc-type diode with a clamp-on cap for mounting on a copper plate or rail. The diodes indicated are available from EUPEC (www.eupec.com).

Selection and ordering data

Nominal power rating	Inverter DC to AC	Fuse switch disconnector for DC coupling[1)2)]			Inverter fuse Duty class aR		
			I_S	Max. fuse size		I_S	Size
kW	Order No.	Order No.	A		Order No.	A	
DC voltage 890 V to 930 V DC							
690 V							
55	**6SE7026–0WF60**	3NP42 70–0CA01	250	0; 1	2 x 3NE3 222	125	1
75	**6SE7028–2WF60**	3NP42 70–0CA01	250	0; 1	2 x 3NE3 224	160	1
90	**6SE7031–0WG60**	3NP42 70–0CA01	250	0; 1	2 x 3NE3 225	200	1
110	**6SE7031–2WG60**	3NP42 70–0CA01	250	0; 1	2 x 3NE3 225	200	1
132	**6SE7031–5WG60**	3NP43 70–0CA01	400	1; 2	2 x 3NE3 230–0B	315	1
160	**6SE7031–7WG60**	3NP43 70–0CA01	400	1; 2	2 x 3NE3 230–0B	315	1
200	**6SE7032–1WG60**	3NP43 70–0CA01	400	1; 2	2 x 3NE3 232–0B	400	1
250	**6SE7033–0WJ60**	3NP43 70–0CA01	400	1; 2	2 x 3NE3 234–0B[3)]	500	1
315	**6SE7033–5WJ60**	3NP44 70–0CA01	630	2; 3	2 x 3NE3 336[3)]	630	2
400	**6SE7034–5WJ60**	3NP44 70–0CA01	630	2; 3	2 x 3NE3 337–8[3)]	710	2
500	**6SE7035–7WK60**	2 x 3NP44 70–0CA01	630	2; 3	2 x 2 x 3NE3 333[3)]	450	2
630	**6SE7036–5WK60**	2 x 3NP44 70–0CA01	630	2; 3	2 x 2 x 3NE3 334–0B[3)]	500	2
800	**6SE7038–6WK60**	2 x 3NP44 70–0CA01	630	2; 3	2 x 2 x 3NE3 336[3)]	630	2
1000	**6SE7041–1WL60**	2 x 3NP44 70–0CA01	630	2; 3	2 x 2 x 3NE3 338–8[3)]	800	2
1200	**6SE7041–2WL60**				2 x 2 x 3NE3 340–8[3)]	900	2
	without interphase transformer chassis						
1300	**6SE7041–4WQ60**	4 x 3NP44 70–0CA01	630	2; 3	4 x 2 x 3NE3 336[3)]	630	2
1500	**6SE7041–6WQ60**	4 x 3NP44 70–0CA01	630	2; 3	4 x 2 x 3NE3 336[3)]	630	2
	with interphase transformer chassis						
1300	**6SE7041–4WM60**	4 x 3NP44 70–0CA01	630	2; 3	4 x 2 x 3NE3 336[3)]	630	2
1500	**6SE7041–6WM60**	4 x 3NP44 70–0CA01	630	2; 3	4 x 2 x 3NE3 336[3)]	630	2
	without interphase transformer chassis						
1900	**6SE7042–1WN60**	4 x 3NP44 70–0CA01	630	2; 3	4 x 2 x 3NE3 338–8[3)]	800	2
	without interphase transformer chassis						
2300	**6SE7042–3WN60**	–	–	–	4 x 2 x 3NE3 340–8[3)]	900	2

1) See catalog "Industrial Controls". Rated insulation voltage for pollution degree 3 to DIN VDE 0110, Part 1, but conditions of use to pollution degree 2. The rated insulation voltage is therefore ≥ 1000 V.

2) Note fuse sizes when selecting fuse switch disconnectors.

3) DC fuses are integral components of the inverter unit.

Contactor for isolating the inverter from the DC bus[1]		Precharging resistors				Free-wheeling diode on the DC bus	
	I_S		Dimension drawing, see Section 7	Quantity per inverter	R_S	Diode	Clamp-on cover
Order No.	A	Order No.	No.		Ω	Order No.	Order No.
2 x 3RT13 25	4 x 22	6SX7010–0AC07	30	2	27	SKR 141 F 15[2]	
2 x 3RT13 36	4 x 41	6SX7010–0AC08	30	2	15	SKR 141 F 15[2]	
2 x 3RT13 36	4 x 41	6SX7010–0AC08	30	2	15	SKR 141 F 15[2]	
2 x 3RT13 36	4 x 71	6SX7010–0AC08	30	2	15	SKR 141 F 15[2]	
2 x 3RT13 44	4 x 73	6SX7010–0AC10	30	2	10	SKR 141 F 15[2]	
2 x 3RT13 44	4 x 73	6SX7010–0AC10	30	2	10	SKR 141 F 15[2]	
2 x 3RT13 44	4 x 73	6SX7010–0AC10	30	2	10	2 x SKR 141 F 15[2]	
2 x 3TK10	3 x 162	6SX7010–0AC11	30	2	5.6	D348S16[3]	V50 – 14.45M[3]
2 x 3TK10	4 x 146	6SX7010–0AC11	30	2	5.6	D348S16[3]	V50 – 14.45M[3]
2 x 3TK11	4 x 183	6SX7010–0AC13	31	2	2.7	D689S20[3]	V72–26.120M[3]
2 x 3TK12	4 x 219	6SX7010–0AC13	31	2	2.7	D689S20[3]	V72–26.120M[3]
2 x 3TK12	4 x 219	6SX7010–0AC13	31	2	2.7	D689S20[3]	V72–26.120M[3]
2 x 3TK14	4 x 402	6SX7010–0AC13	31	2	2.7	D689S20[3]	V72–26.120M[3]
2 x 3TK15	4 x 488	6SX7010–0AC13	31	4	2.7	2 x D689S20[3]	2 x V72–26.120M[3]
2 x 3TK15	4 x 488	6SX7010–0AC13	31	4	2.7	2 x D689S20[3]	2 x V72–26.120M[3]
2 x 3TK15	4 x 488	6SX7010–0AC13	31	4	2.7	2 x D689S20[3]	2 x V72–26.120M[3]
2 x 3TK17	4 x 638	6SX7010–0AC13	31	4	2.7	2 x D689S20[3]	2 x V72–26.120M[3]
2 x 3TK15	4 x 488	6SX7010–0AC13	31	4	2.7	2 x D689S20[3]	2 x V72–26.120M[3]
2 x 3TK17	4 x 638	6SX7010–0AC13	31	4	2.7	2 x D689S20[3]	2 x V72–26.120M[3]
4 x 3TK15	4 x 488	6SX7010–0AC13	31	8	2.7	4 x D689S20[3]	4 x V72–26.120M[3]
4 x 3TK15	4 x 488	6SX7010–0AC13	31	8	2.7	4 x D689S20[3]	4 x V72–26.120M[3]

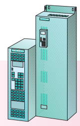
1) See catalog "Industrial Controls". Rated insulation voltage for pollution degree 2 to DIN VDE 0110 Part 1: 1000 V.

2) See Engineering Information, Section 6. The diodes indicated are available from SEMIKRON (www.semikron.com).

3) See Engineering Information, Section 6. Disc-type diode with a clamp-on cap for mounting on a copper plate or rail. The diodes indicated are available from EUPEC (www.eupec.com).

Selection and ordering data

Rated rectifier/re-generative output at cos φ = 1 and 400 V supply voltage	AFE inverter with CUSA control board 6SE7090–0XX84–0BJ0	AFE supply connecting module with VSB voltage sensing board 6SE7090–0XX84–1GA1 and AFE reactor for compact units AFE reactor only	Rated current	Power loss	Weight approx.		Dimensions line connecting module		Dimensions AFE reactor is supplied loose	
P_n				P_v			W x H x D		W x H x D	
kW	Order No.	Order No.	A	W	lb	(kg)	in	(mm)	in	(mm)
Supply voltage 3-ph. 380 V AC –20 % to 460 V AC +5 %										
400 V										
6.8	**6SE7021–0EA81**	6SE70 21–3ES87–1FG0	13	17	17.6	(8)		–	10.6 x 9.8 x 7.7	(270 x 250 x 196)
9	**6SE7021–3EB81**	6SE70 21–3ES87–1FG0	13	23	17.6	(8)		–	10.6 x 9.8 x 7.7	(270 x 250 x 196)
12	**6SE7021–8EB81**	6SE70 22–6ES87–1FG0	26	30	26.5	(12)		–	11.8 x 9.8 x 7.3	(300 x 250 x 185)
17	**6SE7022–6EC81**	6SE70 22–6ES87–1FG0	26	43	26.5	(12)		–	11.8 x 9.8 x 7.3	(300 x 250 x 185)
23	**6SE7023–4EC81**	6SE70 24–7ES87–1FG0	47	58	44.1	(20)		–	14.2 x 11.8 x 7.3	(360 x 300 x 185)
32	**6SE7024–7ED81**	6SE70 24–7ES87–1FG0	47	80	44.1	(20)		–	14.2 x 11.8 x 7.3	(360 x 300 x 185)
40	**6SE7026–0ED81**	6SE70 27–2ES87–1FG0	72	100	70.6	(32)		–	14.9 x 11.8 x 7.7	(380 x 300 x 196)
49	**6SE7027–2ED81**	6SE70 27–2ES87–1FG0	72	123	70.6	(32)		–	14.9 x 11.8 x 7.7	(380 x 300 x 196)
63	**6SE7031–0EE80**	6SE71 31–0EE83–2NA0	92	500	242.6	(110)	10.8 x 51.6 x 16.1	(274 x 1310 x 408)	11.8 x 10.5 x 8.3	(300 x 267 x 212)
85	**6SE7031–2EF80**	6SE71 31–2EF83–2NA0	124	630	352.8	(160)	17.3 x 51.6 x 18.5	(440 x 1310 x 470)	14.0 x 13.4 x 8.3	(355 x 340 x 212)
100	**6SE7031–5EF80**	6SE71 31–5EF83–2NA0	146	710	363.8	(165)	17.3 x 51.6 x 18.5	(440 x 1310 x 470)	14.0 x 13.4 x 10.7	(355 x 340 x 272)
125	**6SE7031–8EF80**	6SE71 31–8EF83–2NA0	186	860	374.9	(170)	17.3 x 51.6 x 18.5	(440 x 1310 x 470)	14.0 x 13.4 x 10.9	(355 x 340 x 278)
143	**6SE7032–1EG80**	6SE71 32–1EG83–2NA0	210	1100	518.2	(235)	22.8 x 52.7 x 18.1	(580 x 1339 x 459)	16.5 x 15.3 x 12.3	(420 x 389 x 312)
177	**6SE7032–6EG80**	6SE71 32–6EG83–2NA0	260	1300	529.2	(240)	22.8 x 52.7 x 18.1	(580 x 1339 x 459)	16.5 x 15.3 x 12.3	(420 x 389 x 312)
214	**6SE7033–2EG80**	6SE71 33–2EG83–2NA0	315	1500	650.5	(295)	22.8 x 52.7 x 18.1	(580 x 1339 x 459)	18.9 x 14.9 x 14.8	(480 x 380 x 376)
250	**6SE7033–7EG80**	6SE71 33–7EG83–2NA0	370	1820	672.5	(305)	22.8 x 52.7 x 18.1	(580 x 1339 x 459)	18.9 x 14.9 x 14.8	(480 x 380 x 376)
Supply voltage 3-ph. 500 V AC –20 % to 575 V AC +5 %										
500 V										
51	**6SE7026–1FE80**	6SE71 26–1FE83–2NA0	61	410	220.5	(100)	10.8 x 51.6 x 16.1	(274 x 1310 x 408)	11.6 x 10.5 x 8.3	(300 x 267 x 212)
56	**6SE7026–6FE80**	6SE71 26–6FE83–2NA0	66	440	253.6	(115)	10.8 x 51.6 x 16.1	(274 x 1310 x 408)	11.6 x 10.5 x 8.3	(300 x 267 x 212)
67	**6SE7028–0FF80**	6SE71 28–0FF83–2NA0	79	560	330.7	(150)	17.3 x 51.6 x 18.5	(440 x 1310 x 470)	14.0 x 13.2 x 8.7	(355 x 335 x 220)
92	**6SE7031–1FF80**	6SE71 31–1FF83–2NA0	108	710	374.8	(170)	17.3 x 51.6 x 18.5	(440 x 1310 x 470)	14.0 x 13.4 x 11.1	(355 x 340 x 282)
109	**6SE7031–3FG80**	6SE71 31–3FG83–2NA0	128	830	458.6	(208)	22.8 x 52.7 x 18.1	(580 x 1339 x 459)	14.0 x 13.4 x 11.3	(355 x 340 x 288)
132	**6SE7031–6FG80**	6SE71 31–6FG83–2NA0	156	930	518.2	(235)	22.8 x 52.7 x 18.1	(580 x 1339 x 459)	16.5 x 15.3 x 12.3	(420 x 389 x 312)
164	**6SE7032–0FG80**	6SE71 32–0FG83–2NA0	192	1390	540.2	(245)	22.8 x 52.7 x 18.1	(580 x 1339 x 459)	16.5 x 15.3 x 12.3	(420 x 389 x 312)
192	**6SE7032–3FG80**	6SE71 32–3FG83–2NA0	225	1570	639.5	(290)	22.8 x 52.7 x 18.1	(580 x 1339 x 459)	18.9 x 15.0 x 14.8	(480 x 380 x 376)
Supply voltage 3-ph. 660 V AC –20 % to 690 V AC +5 %										
690 V										
70	**6SE7026–0HF80**	6SE71 26–0HF83–2NA0	60	600	319.7	(145)	17.3 x 51.6 x 18.5	(440 x 1310 x 470)	14.0 x 13.2 x 8.7	(355 x 335 x 220)
96	**6SE7028–2HF80**	6SE71 28–2HF83–2NA0	82	710	374.8	(170)	17.3 x 51.6 x 18.5	(440 x 1310 x 470)	14.0 x 13.2 x 11.1	(355 x 335 x 282)
114	**6SE7031–0HG80**	6SE71 31–0HG83–2NA0	97	790	471.9	(214)	22.8 x 52.7 x 18.1	(580 x 1339 x 459)	14.0 x 13.4 x 11.3	(355 x 340 x 288)
138	**6SE7031–2HG80**	6SE71 31–2HG83–2NA0	118	1060	518.2	(235)	22.8 x 52.7 x 18.1	(580 x 1339 x 459)	16.5 x 15.3 x 12.3	(420 x 390 x 312)
170	**6SE7031–5HG80**	6SE71 31–5HG83–2NA0	145	1240	540.2	(240)	22.8 x 52.7 x 18.1	(580 x 1339 x 459)	16.5 x 15.3 x 12.3	(420 x 390 x 312)
200	**6SE7031–7HG80**	6SE71 31–7HG83–2NA0	171	1370	639.5	(290)	22.8 x 52.7 x 18.1	(580 x 1339 x 459)	18.9 x 15.0 x 14.8	(480 x 380 x 376)
245	**6SE7032–1HG80**	6SE71 32–1HG83–2NA0	208	1610	661.5	(300)	22.8 x 52.7 x 18.1	(580 x 1339 x 459)	18.9 x 15.0 x 14.8	(480 x 380 x 376)



Switch disconnector[2] Rated current		Switch disconnector with fuse holders[2] Rated current max. fuse size			Fuse switch disconnectors[1][2] Rated current max. fuse size			Semiconductor-protection fuses Duty class gR[2] incl. cable protection Rated current max. fuse size		
Order No.	A	Order No.	A	Size	Order No.	A	Size	Order No.	A	Size
3KA50 30–1EE01	63	3KL50 30–1EB01	63	00	3NP40 10–0CH01	100	00	3NE1 813–0	16	00
3KA50 30–1EE01	63	3KL50 30–1EB01	63	00	3NP40 10–0CH01	100	00	3NE1 814–0	20	00
3KA50 30–1EE01	63	3KL50 30–1EB01	63	00	3NP40 10–0CH01	100	00	3NE1 815–0	25	00
3KA50 30–1EE01	63	3KL50 30–1EB01	63	00	3NP40 10–0CH01	100	00	3NE1 803–0	35	00
3KA50 30–1EE01	63	3KL50 30–1EB01	63	00	3NP40 10–0CH01	100	00	3NE1 802–0	40	00
3KA50 30–1EE01	63	3KL50 30–1EB01	63	00	3NP40 10–0CH01	100	00	3NE1 818–0	63	00
3KA51 30–1EE01	80	3KL52 30–1EB01	125	00	3NP40 10–0CH01	100	00	3NE1 820–0	80	00
3KA51 30–1EE01	80	3KL52 30–1EB01	125	00	3NP40 10–0CH01	100	00	3NE1 820–0	80	00
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1) See catalog "Industrial Controls". Rated insulation voltage for pollution degree 3 to DIN VDE 0110, Part 1, but conditions of use to pollution degree 2. The rated insulation voltage is therefore ≥ 1000 V.

2) Note fuse sizes when selecting fuse switch disconnectors.

Selection and ordering data

Rated rectifier/ regenerative output at cos φ = 1 and 400 V supply voltage P_n	**AFE inverter** with CUSA control board 6SE7090–0XX84–0BJ0	**AFE supply connecting module** with VSB voltage sensing board 6SE7090–0XX84–1GA1 and AFE reactor **for compact units AFE reactor only**	Radio-interference suppression filter		Main contactor/ AC contactor 230 V		Precharging Precharging contactor 230 V (with compact AFE 24 V control voltage)	
				Class	Rated current		Rated current	
kW	Order No.	Order No.	Order No.		Order No.	A	Order No.	A
Supply voltage 3-ph. 380 V AC –20 % to 460 V AC +5 %								
400 V								
6.8	**6SE7021–0EA81**	6SE70 21–3ES87–1FG0	6SE70 21–0ES87–0FB1	A1	3RT10 15	16	3RT10 16–. BB4 .	
9	**6SE7021–3EB81**	6SE70 21–3ES87–1FG0	6SE70 21–8ES87–0FB1	A1	3RT10 16	20	3RT10 16–. BB4 .	
12	**6SE7021–8EB81**	6SE70 22–6ES87–1FG0	6SE70 21–8ES87–0FB1	A1	3RT10 16	20	3RT10 16–. BB4 .	
17	**6SE7022–6EC81**	6SE70 22–6ES87–1FG0	6SE70 23–4ES87–0FB1	A1	3RT10 25	35	3RT10 16–. BB4 .	
23	**6SE7023–4EC81**	6SE70 24–7ES87–1FG0	6SE70 23–4ES87–0FB1	A1	3RT10 34	45	3RT10 16–. BB4 .	
32	**6SE7024–7ED81**	6SE70 24–7ES87–1FG0	6SE70 27–2ES87–0FB1	A1	3RT10 35	55	3RT10 16–. BB4 .	
40	**6SE7026–0ED81**	6SE70 27–2ES87–1FG0	6SE70 27–2ES87–0FB1	A1	3RT10 44	90	3RT10 16–. BB4 .	
49	**6SE7027–2ED81**	6SE70 27–2ES87–1FG0	6SE70 27–2ES87–0FB1	A1	3RT10 44	90	3RT10 16–. BB4 .	
63	**6SE7031–0EE80**	6SE71 31–0EE83–2NA0	option L00 for supply connecting module	A1	integrated in the supply connecting module			
85	**6SE7031–2EF80**	6SE71 31–2EF83–2NA0	option L00 for supply connecting module	A1	integrated in the supply connecting module			
100	**6SE7031–5EF80**	6SE71 31–5EF83–2NA0	option L00 for supply connecting module	A1	integrated in the supply connecting module			
125	**6SE7031–8EF80**	6SE71 31–8EF83–2NA0	option L00 for supply connecting module	A1	integrated in the supply connecting module			
143	**6SE7032–1EG80**	6SE71 32–1EG83–2NA0	option L00 for supply connecting module	A1	integrated in the supply connecting module			
177	**6SE7032–6EG80**	6SE71 32–6EG83–2NA0	option L00 for supply connecting module	A1	integrated in the supply connecting module			
214	**6SE7033–2EG80**	6SE71 33–2EG83–2NA0	option L00 for supply connecting module	A1	integrated in the supply connecting module			
250	**6SE7033–7EG80**	6SE71 33–7EG83–2NA0	option L00 for supply connecting module	A1	integrated in the supply connecting module			
Supply voltage 3-ph. 500 V AC –20 % to 575 V AC +5 %								
500 V								
51	**6SE7026–1FE80**	6SE71 26–1FE83–2NA0	option L00 for supply connecting module	A1	integrated in the supply connecting module			
56	**6SE7026–6FE80**	6SE71 26–6FE83–2NA0	option L00 for supply connecting module	A1	integrated in the supply connecting module			
67	**6SE7028–0FF80**	6SE71 28–0FF83–2NA0	option L00 for supply connecting module	A1	integrated in the supply connecting module			
92	**6SE7031–1FF80**	6SE71 31–1FF83–2NA0	option L00 for supply connecting module	A1	integrated in the supply connecting module			
109	**6SE7031–3FG80**	6SE71 31–3FG83–2NA0	option L00 for supply connecting module	A1	integrated in the supply connecting module			
132	**6SE7031–6FG80**	6SE71 31–6FG83–2NA0	option L00 for supply connecting module	A1	integrated in the supply connecting module			
164	**6SE7032–0FG80**	6SE71 32–0FG83–2NA0	option L00 for supply connecting module	A1	integrated in the supply connecting module			
192	**6SE7032–3FG80**	6SE71 32–3FG83–2NA0	option L00 for supply connecting module	A1	integrated in the supply connecting module			
Supply voltage 3-ph. 660 V AC –20 % to 690 V AC +5 %								
690 V								
70	**6SE7026–0HF80**	6SE71 26–0HF83–2NA0	option L00 for supply connecting module	A1	integrated in the supply connecting module			
96	**6SE7028–2HF80**	6SE71 28–2HF83–2NA0	option L00 for supply connecting module	A1	integrated in the supply connecting module			
114	**6SE7031–0HG80**	6SE71 31–0HG83–2NA0	option L00 for supply connecting module	A1	integrated in the supply connecting module			
138	**6SE7031–2HG80**	6SE71 31–2HG83–2NA0	option L00 for supply connecting module	A1	integrated in the supply connecting module			
170	**6SE7031–5HG80**	6SE71 31–5HG83–2NA0	option L00 for supply connecting module	A1	integrated in the supply connecting module			
200	**6SE7031–7HG80**	6SE71 31–7HG83–2NA0	option L00 for supply connecting module	A1	integrated in the supply connecting module			
245	**6SE7032–1HG80**	6SE71 32–1HG83–2NA0	option L00 for supply connecting module	A1	integrated in the supply connecting module			

Precharging Resistor Rated value		Clean power filter			Voltage sensing board VSB
1 unit required per phase			Power loss	Basic interference suppression	For DIN rail mounting with enclosure
Order No.	Ω	Order No.	W	Order No.	Order No.
6SX70 10–0AC81	22	6SE70 21–0EB87–1FC0	200	6SX70 10–0FB10	6SX70 10–0EJ00
6SX70 10–0AC81	22	6SE70 21–8EB87–1FC0	250	6SX70 10–0FB10	6SX70 10–0EJ00
6SX70 10–0AC81	22	6SE70 21–8EB87–1FC0	250	6SX70 10–0FB10	6SX70 10–0EJ00
6SX70 10–0AC80	10	6SE70 22–6EC87–1FC0	300	6SX70 10–0FB10	6SX70 10–0EJ00
6SX70 10–0AC80	10	6SE70 23–4EC87–1FC0	400	6SX70 10–0FB10	6SX70 10–0EJ00
6SX70 10–0AC80	10	6SE70 24–7ED87–1FC0	500	6SX70 10–0FB10	6SX70 10–0EJ00
6SX70 10–0AC80	10	6SE70 27–2ED87–1FC0	600	6SX70 10–0FB10	6SX70 10–0EJ00
6SX70 10–0AC80	10	6SE70 27–2ED87–1FC0	600	6SX70 10–0FB10	6SX70 10–0EJ00
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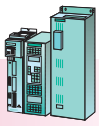


Selection and ordering data

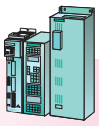
Nominal power rating		Rectifier unit	Fuse switch disconnectors[1][2]		
				Rated current	Max. fuse size
HP	(kW)	Order No.	Order No.	A	
Compact PLUS units					
Supply voltage 3-ph. 380 V to 480 V AC					
20	**(15)**	**6SE7024–1EP85–0AA0**	3NP40 10–0CH01	100	000
67	**(50)**	**6SE7031–2EP85–0AA0**	3NP42 70–0CA01	250	0; 1
134	**(100)**	**6SE7032–3EP85–0AA0**	3NP42 70–0CA01	250	0; 1
Compact and chassis units					
Supply voltage 3-ph. 380 V to 480 V AC					
20	**(15)**	**6SE7024–1EB85–0AA0**	3NP40 10–0CH01	100	000
50	**(37)**	**6SE7028–6EC85–0AA0**	3NP40 10–0CH01	100	000
100	**(75)**	**6SE7031–7EE85–0AA0**	3NP42 70–0CA01	250	0; 1
150	**(110)**	**6SE7032–7EE85–0AA0**	3NP42 70–0CA01	250	0; 1
200	**(160)**	**6SE7033–8EE85–0AA0**	3NP53 60–0CA00	400	1; 2
250	**(200)**	**6SE7034–6EE85–0AA0**	3NP53 60–0CA00	400	1; 2
300	**(250)**	**6SE7036–1EE85–0AA0**	3NP54 60–0CA00	630	2; 3
525	**(400)**	**6SE7038–2EH85–0AA0**	–	–	–
650	**(500)**	**6SE7041–0EH85–0AA0**	–	–	–
825	**(630)**	**6SE7041–3EK85–0A□0**	–	–	–
1000	**(800)**	**6SE7041–8EK85–0A□0**	–	–	–
Supply voltage 3-ph. 500 V to 600 V AC					
30	**(22)**	**6SE7024–1FB85–0AA0**	3NP40 10–0CH01	100	000
50	**(37)**	**6SE7027–2FC85–0AA0**	3NP40 10–0CH01	100	000
75	**(55)**	**6SE7028–8FC85–0AA0**	3NP40 70–0CA01	160	00
100	**(75)**	**6SE7031–4FE85–0AA0**	3NP40 70–0CA01	160	00
175	**(132)**	**6SE7032–4FE85–0AA0**	3NP42 70–0CA01	250	0; 1
250	**(200)**	**6SE7033–5FE85–0AA0**	3NP53 60–0CA00	400	1; 2
300	**(250)**	**6SE7034–2FE85–0AA0**	3NP53 60–0CA00	400	1; 2
400	**(315)**	**6SE7035–4FE85–0AA0**	3NP54 60–0CA00	630	2; 3
600	**(450)**	**6SE7037–7FH85–0AA0**	–	–	–
800	**(630)**	**6SE7041–0FH85–0AA0**	–	–	–
1000	**(800)**	**6SE7041–3FK85–0A□0**	–	–	–
1200	**(900)**	**6SE7041–5FK85–0A□0**	–	–	–
1400	**(1100)**	**6SE7041–8FK85–0A□0**	–	–	–
Supply voltage 3-ph. 660 V to 690 V AC					
200	**(160)**	**6SE7032–2HE85–0AA0**	3NP42 70–0CA01	250	0; 1
300	**(250)**	**6SE7033–5HE85–0AA0**	3NP53 60–0CA00	400	1; 2
400	**(315)**	**6SE7034–2HE85–0AA0**	3NP53 60–0CA00	400	1; 2
600	**(400)**	**6SE7035–4HE85–0AA0**	3NP54 60–0CA00	630	2; 3
800	**(630)**	**6SE7037–7HH85–0AA0**	–	–	–
1000	**(800)**	**6SE7041–0HH85–0AA0**	–	–	–
1300	**(1000)**	**6SE7041–3HK85–0A□0**	–	–	–
1400	**(1100)**	**6SE7041–5HK85–0A□0**	–	–	–
2000	**(1500)**	**6SE7041–8HK85–0A□0**	–	–	–

Rectifier unit	**A**
Rectifier unit with power section[3]	**D**

1) Switch disconnectors:
Note size of cable-protection and semiconductor-protection fuses!

2) Can be optionally used depending on requirements. For further information see catalog "Industrial Controls".

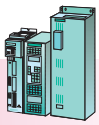
3) For parallel connection.



Semiconductor-protection fuses Duty class gR[1] (incl. cable protection)			Main contactor/ AC contactor[2]	
	Rated current	Size	AC 1 duty 55 °C	Rated current
Order No.	A		Order No.	A
3NE1 802–0	40	000	3RT10 34	50
3NE1 022–0	125	00	3RT10 54	160
3NE1 227–0	250	1	3RT10 64	275
3NE1 802–0	40	000	3RT10 34	45
3NE1 820–0	80	000	3RT10 44	90
3NE1 224–0	160	1	3TK50	190
3NE1 227–0	250	1	3TK52	315
3NE1 331–0	350	2	3TK54	380
3NE1 332–0	400	2	3TK56	500
3NE1 435–0	560	3	2 x 3TK52	567
Semiconductor protection fuses aR (without cable protection) already integrated in the standard unit			3 x 3TK52	788
			3 x 3TK54	950
			3 x 3TK56	1250
			3 x 3TK15	1950
3NE1 802–0	40	000	3RT10 34	45
3NE1 818–0	63	000	3RT10 44	90
3NE1 021–0	100	00	3RT10 44	90
3NE1 022–0	125	00	3RT14 46	135
3NE1 227–0	250	1	3TK52	315
3NE1 231–0	350	2	3TK52	315
3NE1 332–0	400	2	3TK54	380
3NE1 334–0	500	2	3TK56	500
Semiconductor protection fuses aR (without cable protection) already integrated in the standard unit			2 x 3TK54	788
			3 x 3TK54	950
			3 x 3TK56	1250
			3 x 3TK14	1410
			3 x 3TK15	1950
3NE1 225–0	200	1	3TK50	190
3NE1 230–0	315	1	3TK52	315
3NE1 225–0	400	2	3TK54	380
3NE1 334–0	500	3	3TK56	500
Semiconductor protection fuses aR (without cable protection) already integrated in the standard unit			2 x 3TK54	788
			3 x 3TK54	950
			3 x 3TK56	1250
			3 x 3TK14	1410
			3 x 3TK15	1950

1) The cable cross-sections must be dimensioned according to DIN VDE 0100, VDE 0298 Part 4 as a function of the rated fuse currents.

2) See catalog "Industrial Controls".



Selection and ordering data

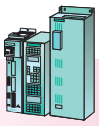
Nominal power rating		Rectifier unit	Radio-interference suppression filter	Commutating reactor v_D = 2 – 3 %		
					Rated current	
HP	(kW)	Order No.	Order No.	Order No.	A	mh
Compact PLUS units						
Supply voltage 3-ph. 380 V to 480 V AC						
				480 V, 50/60 Hz		
20	**(15)**	**6SE7024–1EP85–0AA0**	6SE7023–4ES87–0FB1[2])	LR473A6L	35	0.8
67	**(50)**	**6SE7031–2EP85–0AA0**	6SE7031–8ES87–0FA1[2])	LR47309L	100	0.3
134	**(100)**	**6SE7032–3EP85–0AA0**	6SE7033–2ES87–0FA1[2])	LR47313L	200	0.11
Compact and chassis units						
Supply voltage 3-ph. 380 V to 480 V AC						
				480 V, 50/60 Hz		
20	**(15)**	**6SE7024–1EB85–0AA0**	6SE7023–4ES87–0FB1[2])	LR473A6L	35	0.8
50	**(37)**	**6SE7028–6EC85–0AA0**	6SE7027–2ES87–0FB1[2])	LR473A9L	80	0.4
100	**(75)**	**6SE7031–7EE85–0AA0**	6SE7031–8ES87–0FA1[2])	LR47312L	160	0.15
150	**(110)**	**6SE7032–7EE85–0AA0**	6SE7033–2ES87–0FA1[2])	LR47314LE	250	0.09
200	**(160)**	**6SE7033–8EE85–0AA0**	6SE7033–2ES87–0FA1[2])	LR47315LE	320	0.075
250	**(200)**	**6SE7034–6EE85–0AA0**	6SE7036–0ES87–0FA1[2])	LR47316LE	400	0.06
300	**(250)**	**6SE7036–1EE85–0AA0**	6SE7036–0ES87–0FA1[2])	LR47317LE	500	0.05
525	**(400)**	**6SE7038–2EH85–0AA0**	6SE7041–0ES87–0FA1[2])	LR47319LE	750	0.029
650	**(500)**	**6SE7041–0EH85–0AA0**	6SE7041–0ES87–0FA1[2])	4EU3652–0UB00–1BA0	910	0.0155
825	**(630)**	**6SE7041–3EK85–0A□0**	6SE7041–6ES87–0FA1[2])	4EU3652–7UC00–1BA0	1120	0.0126
1000	**(800)**	**6SE7041–8EK85–0A□0**	6SE7041–6ES87–0FA1[2])	4EU3951–0UC00–0A	1600	0.0088
Supply voltage 3-ph. 500 V to 600 V AC						
				575 V, 50/60 Hz		
30	**(22)**	**6SE7024–1FB85–0AA0**	B84143–A50–R21[2])[3])	LR57307L	35	0.8
50	**(37)**	**6SE7027–2FC85–0AA0**	B84143–A80–R21[2])[3])	LR573A9L	55	0.5
75	**(55)**	**6SE7028–8FC85–0AA0**	B84143–A80–R21[2])[3])	LR57310L	80	0.4
100	**(75)**	**6SE7031–4FE85–0AA0**	B84143–A120–R21[2])[3])	LR57312L	130	0.2
175	**(132)**	**6SE7032–4FE85–0AA0**	B84143–B 250–S□□[3])	LR57314LE	200	0.11
250	**(200)**	**6SE7033–5FE85–0AA0**	B84143–B 320–S□□[3])	LR57316LE	320	0.075
300	**(250)**	**6SE7034–2FE85–0AA0**	B84143–B 600–S□□[3])	LR57317LE	400	0.06
400	**(315)**	**6SE7035–4FE85–0AA0**	B84143–B 600–S□□[3])	LR57318LE	500	0.05
600	**(450)**	**6SE7037–7FH85–0AA0**	B84143–B1000–S□□[3])	LR57320LE	750	0.029
800	**(630)**	**6SE7041–0FH85–0AA0**	B84143–B1000–S□□[3])	4EU36 52–4UA00–1BA0	910	0.020
1000	**(800)**	**6SE7041–3FK85–0A□0**	B84143–B1600–S□□[3])	4EU39 51–5UB00–0A	1120	0.0164
1200	**(900)**	**6SE7041–5FK85–0A□0**	B84143–B1600–S□□[3])	4EU39 51–7UB00–0A	1250	0.0147
1400	**(1100)**	**6SE7041–8FK85–0A□0**	B84143–B1600–S□□[3])	4EU43 51–2UB00–0A	1600	0.0115
Supply voltage 3-ph. 660 V to 690 V AC						
				690 V, 50 Hz[1])		
200	**(160)**	**6SE7032–2HE85–0AA0**	B84143–B 250–S□□[3])	4EU27 52–6UA00–0AA0	224	0.113
300	**(250)**	**6SE7033–5HE85–0AA0**	B84143–B 320–S□□[3])	4EU30 52–3UA00–0AA0	315	0.0805
400	**(315)**	**6SE7034–2HE85–0AA0**	B84143–B 600–S□□[3])	4EU30 52–4UA00–0AA0	400	0.0634
600	**(400)**	**6SE7035–4HE85–0AA0**	B84143–B 600–S□□[3])	4EU36 52–5UA00–0AA0	500	0.0507
800	**(630)**	**6SE7037–7HH85–0AA0**	B84143–B1000–S□□[3])	4EU36 52–7UA00–1BA0	710	0.0357
1000	**(800)**	**6SE7041–0HH85–0AA0**	B84143–B1000–S□□[3])	4EU39 51–0UA00–0A	910	0.0279
1300	**(1000)**	**6SE7041–3HK85–0A□0**	B84143–B1600–S□□[3])	4EU39 51–6UB00–0A	1120	0.0226
1400	**(1100)**	**6SE7041–5HK85–0A□0**	B84143–B1600–S□□[3])	4EU43 51–0UB00–0A	1250	0.0203
2000	**(1500)**	**6SE7041–8HK85–0A□0**	B84143–B1600–S□□[3])	4EU45 51–4UA00	1600	0.0159

Rectifier unit	**A**
Rectifier unit for parallel connection	**D**
for 500 V TT and TN systems (earthed system)	**2 0**
for 690 V TT and TN systems (earthed system)	**2 1**
for 380 V to 690 V IT systems (non-earthed and insulated system)	**2 4**

1) For operation at 60 Hz the rated current of these reactors is reduced to 90 % of the listed value.

2) Can only be used with TT and TN systems (earthed system).

3) Further information on the filters can be obtained from EPCOS (www.epcos.com) at www4.ad.siemens.de. Please enter the following number under "Entry ID": 65 67 129.



Commutating reactor $v_D = 4 - 5\ \%$		
	Rated current	Inductance
Order No.	A	mh
480 V, 50/60 Hz		
LR475A6L	35	1.2
LR47509L	100	0.45
LR47513L	200	0.185
480 V, 50/60 Hz		
LR475A6L	35	1.2
LR475A9L	100	0.45
LR47512L	160	0.23
LR47514LE	250	0.15
LR47515LE	320	0.125
LR47516LE	400	0.105
LR47517LE	500	0.085
LR47519LE	750	0.048
4EU39 51–1UB00–0A	910	0.031
4EU43 51–3UB00–0A	1120	0.0252
4EU43 51–5UB00–0A	1600	0.0176
575 V, 50/60 Hz		
LR57507L	35	1.2
LR575A9L	55	0.85
LR57510L	80	0.7
LR57512L	130	0.3
LR57514LE	200	0.185
LR57516LE	320	0.125
LR57517LE	400	0.105
LR57518LE	500	0.085
LR57520LE	710	0.048
4EU43 51–5UA00–0A	910	0.0404
4EU45 51–5UA00	1120	0.0328
4EU45 51–6UA00	1250	0.0294
4EU47 51–3UA00	1600	0.023
690 V, 50 Hz[1])		
4EU36 52–8UB00–0AA0	224	0.0226
4EU36 52–0UC00–0AA0	315	0.161
4EU39 51–8UA00–0A	400	0.127
4EU39 51–0UB00–0A	500	0.101
4EU43 51–6UA00–0A	710	0.0714
4EU45 51–3UA00	910	0.0557
4EU47 51–2UA00	1120	0.0453
4EU50 51–1UA00	1250	0.0406
4EU52 51–1UA00	1600	0.0317

Selection and ordering data

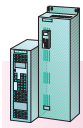
Nominal power rating		Rectifier/ regenerative unit	Fuse switch disconnectors[1)2)]			Semiconductor-protection fuses Duty class aR[3)] (incl. cable protection)		
				Rated current	Max. fuse size		Rated current	Size
HP	(kW)	Order No.	Order No.	A		Order No.	A	
Supply voltage 3-ph. 380 V to 480 V AC								
10	**(7.5)**	**6SE7022–1EC85–1AA0**	3NP42 70–0CA01	250	0; 1	3NE4 101	32	0
20	**(15)**	**6SE7024–1EC85–1AA0**	3NP42 70–0CA01	250	0; 1	3NE4 118	63	0
50	**(37)**	**6SE7028–6EC85–1AA0**	3NP42 70–0CA01	250	0; 1	3NE4 122	125	0
100	**(75)**	**6SE7031–7EE85–1AA0**	3NP42 70–0CA01	250	0; 1	3NE3 227	250	1
120	**(90)**	**6SE7032–2EE85–1AA0**	3NP42 70–0CA01	250	0; 1	3NE3 230–0B	315	1
175	**(132)**	**6SE7033–1EE85–1AA0**	3NP53 60–0CA00	400	1; 2	3NE3 233	450	1
200	**(160)**	**6SE7033–8EE85–1AA0**	3NP53 60–0CA00	400	1; 2	3NE3 333	450	2
250	**(200)**	**6SE7034–6EE85–1AA0**	3NP54 60–0CA00	630	2; 3	3NE3 335	560	2
300	**(250)**	**6SE7036–1EE85–1AA0**	3NP54 60–0CA00	630	2; 3	3NE3 338–8	800	2
525	**(400)**	**6SE7038–2EH85–1AA0**	–	–	–	Semiconductor protection fuses aR (without cable protection) already integrated in the standard unit		
650	**(500)**	**6SE7041–0EH85–1AA0**	–	–	–			
825	**(630)**	**6SE7041–3EK85–1A□0**	–	–	–			
1000	**(800)**	**6SE7041–8EK85–1A□0**	–	–	–			
Supply voltage 3-ph. 500 V to 600 V AC								
15	**(11)**	**6SE7022–7FC85–1AA0**	3NP42 70–0CA01	250	0; 1	3NE4 102	40	0
30	**(22)**	**6SE7024–1FC85–1AA0**	3NP42 70–0CA01	250	0; 1	3NE4 118	63	0
50	**(37)**	**6SE7027–2FC85–1AA0**	3NP42 70–0CA01	250	0; 1	3NE4 121	100	0
75	**(55)**	**6SE7028–8FC85–1AA0**	3NP42 70–0CA01	250	0; 1	3NE3 222	125	1
100	**(90)**	**6SE7031–5FE85–1AA0**	3NP42 70–0CA01	250	0; 1	3NE3 224	160	1
175	**(132)**	**6SE7032–4FE85–1AA0**	3NP42 70–0CA01	250	0; 1	3NE3 230–0B	315	1
200	**(160)**	**6SE7032–7FE85–1AA0**	3NP53 60–0CA00	400	1; 2	3NE3 231	350	1
250	**(200)**	**6SE7033–5FE85–1AA0**	3NP53 60–0CA00	400	1; 2	3NE3 333	450	2
300	**(250)**	**6SE7034–2FE85–1AA0**	3NP54 60–0CA00	630	2; 3	3NE3 334–0B	500	2
400	**(315)**	**6SE7035–4FE85–1AA0**	3NP54 60–0CA00	630	2; 3	3NE3 336	630	2
600	**(450)**	**6SE7037–7FH85–1AA0**	–	–	–	Semiconductor protection fuses aR (without cable protection) already integrated in the standard unit		
800	**(630)**	**6SE7041–0FH85–1AA0**	–	–	–			
1000	**(800)**	**6SE7041–3FK85–1A□0**	–	–	–			
1200	**(900)**	**6SE7041–5FK85–1A□0**	–	–	–			
1400	**(1100)**	**6SE7041–8FK85–1A□0**	–	–	–			
Supply voltage 3-ph. 660 V to 690 V AC								
140	**(110)**	**6SE7031–4HE85–1AA0**	3NP42 70–0CA01	250	0; 1	3NE3 224	160	1
200	**(160)**	**6SE7032–2HE85–1AA0**	3NP53 60–0CA00	400	1; 2	3NE3 230–0B	315	1
250	**(200)**	**6SE7032–7HE85–1AA0**	3NP53 60–0CA00	400	1; 2	3NE3 231	350	1
400	**(315)**	**6SE7034–2HE85–1AA0**	3NP54 60–0CA00	630	2; 3	3NE3 335	560	2
525	**(400)**	**6SE7035–3HE85–1AA0**	3NP54 60–0CA00	630	2; 3	3NE3 336	630	2
825	**(630)**	**6SE7037–7HH85–1AA0**	–	–	–	Semiconductor protection fuses aR (without cable protection) already integrated in the standard unit		
1000	**(800)**	**6SE7041–0HH85–1AA0**	–	–	–			
1300	**(1000)**	**6SE7041–3HK85–1A□0**	–	–	–			
1400	**(1100)**	**6SE7041–5HK85–1A□0**	–	–	–			
2000	**(1500)**	**6SE7041–8HK85–1A□0**	–	–	–			

Rectifier/regenerative unit	**A**
Rectifier/regenerative unit for parallel connection	**D**

1) Switch disconnectors:
Note size of cable-protection and semiconductor-protection fuses!

2) Can be optionally used depending on requirements. For further information see catalog "Industrial Controls".

3) The cable cross-sections must be dimensioned according to DIN VDE 0100, VDE 0298 Part 4 as a function of the rated fuse currents.



Main contactor/AC contactor[1])	
AC 1 duty 55 °C	Rated current
Order No.	A
3RT10 25	35
3RT10 34	45
3RT10 44	90
3TK50	190
3TK52	315
3TK54	380
3TK56	500
3TK56	500
2 x 3TK54	684
3 x 3TK52	788
3 x 3TK56	1250
3 x 3TK56	1250
3 x 3TK15	1950
3RT10 25	35
3RT10 34	45
3RT10 44	90
3RT10 44	90
3TK50	190
3TK52	315
3TK52	315
3TK54	380
3TK56	500
2 x 3TK54	684
2 x 3TK56	900
3 x 3TK56	1250
3 x 3TK56	1250
3 x 3TK14	1410
3 x 3TK15	1950
3TK50	190
3TK52	315
3TK52	315
3TK56	500
2 x 3TK54	684
2 x 3TK56	900
3 x 3TK56	1250
3 x 3TK56	1250
3 x 3TK14	1410
3 x 3TK15	1950

1) See catalog "Industrial Controls".

Selection and ordering data

Nominal power rating		Rectifier/ regenerative unit	Commutating reactor $v_D = 2 - 3\ \%$			Commutating reactor $v_D = 4 - 5\ \%$		
				Rated current			Rated current	Inductance
HP	(kW)	Order No.	Order No.	A	mh	Order No.	A	mh
Supply voltage 3-ph. 380 V to 480 V AC								
			480 V, 50/60 Hz			**480 V, 50/60 Hz**		
10	**(7.5)**	**6SE7022–1EC85–1AA0**	LR47304L	18	1.5	LR47504L	18	2.5
20	**(15)**	**6SE7024–1EC85–1AA0**	LR473A6L	35	0.8	LR475A6L	35	1.2
50	**(37)**	**6SE7028–6EC85–1AA0**	LR473A9L	80	0.4	LR47508L	80	0.7
100	**(75)**	**6SE7031–7EE85–1AA0**	LR47312L	160	0.15	LR47512L	160	0.23
120	**(90)**	**6SE7032–2EE85–1AA0**	LR47313L	200	0.11	LR47513L	200	0.185
175	**(132)**	**6SE7033–1EE85–1AA0**	LR47314LE	250	0.09	LR47514LE	250	0.15
200	**(160)**	**6SE7033–8EE85–1AA0**	LR47315LE	320	0.075	LR47515LE	320	0.125
250	**(200)**	**6SE7034–6EE85–1AA0**	LR47316LE	400	0.06	LR47516LE	400	0.105
300	**(250)**	**6SE7036–1EE85–1AA0**	LR47317LE	500	0.05	LR47517LE	500	0.085
525	**(400)**	**6SE7038–2EH85–1AA0**	LR47319LE	750	0.029	LR47519LE	750	0.048
650	**(500)**	**6SE7041–0EH85–1AA0**	4EU36 52–7UC00–1BA0	1120	0.0126	4EU43 51–3UB00–0A	1120	0.0252
825	**(630)**	**6SE7041–3EK85–1A□0**	4EU39 51–8UB00–0A	1400	0.0101	4EU43 51–4UB00–0A	1500	0.0188
1000	**(800)**	**6SE7041–8EK85–1A□0**	on request	1800		on request	1800	
Supply voltage 3-ph. 500 V to 600 V AC								
			575 V, 50/60 Hz			**575 V, 50/60 Hz**		
15	**(11)**	**6SE7022–7FC85–1AA0**	LR57306L	25	1.2	LR57506L	25	2.0
30	**(22)**	**6SE7024–1FC85–1AA0**	LR57307L	35	0.8	LR57507L	35	1.2
50	**(37)**	**6SE7027–2FC85–1AA0**	LR57309L	80	0.4	LR57509L	80	0.7
75	**(55)**	**6SE7028–8FC85–1AA0**	LR57310L	80	0.4	LR57510L	80	0.7
100	**(90)**	**6SE7031–5FE85–1AA0**	LR57312L	130	0.2	LR57512L	130	0.3
175	**(132)**	**6SE7032–4FE85–1AA0**	LR57314LE	200	0.11	LR57514LE	200	0.185
200	**(160)**	**6SE7032–7FE85–1AA0**	LR57315LE	250	0.09	LR57515LE	250	0.150
250	**(200)**	**6SE7033–5FE85–1AA0**	LR57316LE	320	0.075	LR57516LE	320	0.125
300	**(250)**	**6SE7034–2FE85–1AA0**	LR57317LE	400	0.06	LR57517LE	400	0.105
400	**(315)**	**6SE7035–4FE85–1AA0**	LR57318LE	500	0.05	LR57518LE	500	0.085
600	**(450)**	**6SE7037–7FH85–1AA0**	LR57320LE	750	0.029	LR57520LE	750	0.048
800	**(630)**	**6SE7041–0FH85–1AA0**	4EU39 51–5UB00–0A	1120	0.0164	4EU45 51–5UA00	1120	0.0328
1000	**(800)**	**6SE7041–3FK85–1A□0**	4EU39 51–7UB00–0A	1250	0.0147	4EU45 51–6UA00	1250	0.0294
1200	**(900)**	**6SE7041–5FK85–1A□0**	4EU43 51–2UB00–0A	1600	0.0115	4EU47 51–3UA00	1600	0.023
1400	**(1100)**	**6SE7041–8FK85–1A□0**	on request	2000		on request	2000	
Supply voltage 3-ph. 660 V to 690 V AC								
			690 V, 50 Hz[1]			**690 V, 50 Hz**[1]		
140	**(110)**	**6SE7031–4HE85–1AA0**	4EU25 52–0UB00–0AA0	160	0.159	4EU30 52–2UB00–0AA0	180	0.282
200	**(160)**	**6SE7032–2HE85–1AA0**	4EU27 52–6UA00–0AA0	224	0.113	4EU36 52–8UB00–0AA0	224	0.226
250	**(200)**	**6SE7032–7HE85–1AA0**	4EU27 52–6UA00–0AA0	224	0.113	4EU36 52–8UB00–0AA0	224	0.226
400	**(315)**	**6SE7034–2HE85–1AA0**	4EU30 52–4UA00–0AA0	400	0.0634	4EU39 51–8UA00–0A	400	0.127
525	**(400)**	**6SE7035–3HE85–1AA0**	4EU36 52–4UC00–0AA0	560	0.0453	4EU39 51–4UB00–0A	560	0.0906
825	**(630)**	**6SE7037–7HH85–1AA0**	on request	800		on request	800	
1000	**(800)**	**6SE7041–0HH85–1AA0**	4EU39 51–6UB00–0A	1120	0.0226	4EU47 51–2UA00	1120	0.0453
1300	**(1000)**	**6SE7041–3HK85–1A□0**	4EU43 51–0UB00–0A	1250	0.0203	4EU50 51–1UA00	1250	0.0406
1400	**(1100)**	**6SE7041–5HK85–1A□0**	4EU45 51–4UA00	1600	0.0159	4EU52 51–1UA00	1600	0.0317
2000	**(1500)**	**6SE7041–8HK85–1A□0**	on request	2000		on request	2000	

Rectifier unit	**A**
Rectifier unit for parallel connection	**D**

1) For operation at 60 Hz the rated current of these reactors is reduced to 90 % of the listed value.

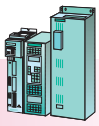
Regenerative autotransformer		Radio-interference suppression filter
100 % power-on duration	P_v 50/60 Hz	
Order No.	kW	Order No.
460 V primary/552 V secondary, 60 Hz		
4AP27 95–0UA21–8AN2	0.15	6SE7023–4ES87–0FB1[2)]
4AP30 95–0UA21–8AN2[1)]	0.20	6SE7027–2ES87–0FB1[2)]
4AU39 95–0UA11–8AN2[1)]	0.60	6SE7031–2ES87–0FA1[2)]
4BU43 95–0UA01–8A[1)]	0.80	6SE7031–8ES87–0FA1[2)]
4BU45 95–0UA21–8A[1)]	0.90	6SE7033–2ES87–0FA1[2)]
4BU47 95–0UA11–8A[1)]	1.00	6SE7033–2ES87–0FA1[2)]
4BU51 95–0UA01–8A[1)]	1.60	6SE7036–0ES87–0FA1[2)]
4BU53 95–0UA11–8A[1)]	1.80	6SE7036–0ES87–0FA1[2)]
4BU54 95–0UA01–8A[1)]	2.10	6SE7041–0ES87–0FA1[2)]
4BU56 95–0UA11–8A	2.30	6SE7041–0ES87–0FA1[2)]
4BU58 95–0UA11–8A	4.10	6SE7041–0ES87–0FA1[2)]
4BU59 95–0UA01–8A	4.40	6SE7041–6ES87–0FA1[2)]
on request		6SE7041–6ES87–0FA1[2)]
575 V primary/690 V secondary, 60 Hz		
4AP30 95–0UA51–8AN2	0.20	B84143–A36–R21[2)3)]
4AU36 95–0UA01–8AN2	0.48	B84143–A50–R21[2)3)]
4AU36 95–0UA11–8AN2	0.48	B84143–A80–R21[2)3)]
on request		B84143–A120–R21[2)3)]
on request		B84143–A150–R21[2)3)]
on request		B84143–B 250–S□□[3)]
on request		B84143–B 320–S□□[3)]
on request		B84143–B 320–S□□[3)]
on request		B84143–B 600–S□□[3)]
on request		B84143–B 600–S□□[3)]
on request		B84143–B1000–S□□[3)]
on request		B84143–B1000–S□□[3)]
on request		B84143–B1600–S□□[3)]
on request		B84143–B1600–S□□[3)]
on request		B84143–B2500–S□□[3)]
690 V primary/828 V secondary, 50/60 Hz		
4BU47 95–0UA31–8A	1.00	B84143–B 250–S□□[3)]
4BU52 95–0UA21–8A	1.70	B84143–B 250–S□□[3)]
4BU53 95–0UA31–8A	1.80	B84143–B 320–S□□[3)]
4BU55 95–0UA11–8A	2.20	B84143–B 600–S□□[3)]
4BU58 95–0UA31–8A	4.10	B84143–B 600–S□□[3)]
4BU60 95–0UA21–8A	4.60	B84143–B1000–S□□[3)]
4BU62 95–0UA31–8A	5.70	B84143–B1000–S□□[3)]
4BU63 95–0UA01–8A	6.00	B84143–B1600–S□□[3)]
4BU64 95–0UA11–8A	6.40	B84143–B1600–S□□[3)]
4BU65 95–0UA01–8A	6.80	B84143–B1600–S□□[3)]

for 500 V TT and TN systems (earthed system)	2 0
for 690 V TT and TN systems (earthed system)	2 1
for 380 V to 690 V IT systems (non-earthed and insulated system)	2 4

1) See page 3/77 for NEMA supplied autotransformers.

2) Can only be used with TT and TN systems (earthed system).

3) Further information on the filters can be obtained from EPCOS (www.epcos.com) at www4.ad.siemens.de. Please enter the following number under "Entry ID": 65 67 129.



Recommended system components for braking units and braking resistors

Selection and ordering data

Nominal power rating	Components for braking units[1]	Fuse switch disconnector for DC coupling			Fuses for braking units		
P_{20}			Rated current	Max. fuse size		Rated current	Size
kW	Order No.	Order No.	A		Order No.	A	
DC link voltage 510 V to 650 V DC							
5	**6SE7018–0ES87–2DA0**	3NP42 70–0CA01	250	0; 1	2 x 3NE4 101	32	0
10	**6SE7021–6ES87–2DA0**	3NP42 70–0CA01	250	0; 1	2 x 3NE4 101	32	0
20	**6SE7023–2EA87–2DA0**	3NP42 70–0CA01	250	0; 1	2 x 3NE4 102	40	0
50	**6SE7028–0EA87–2DA0**	3NP42 70–0CA01	250	0; 1	2 x 3NE4 121	100	0
100	**6SE7031–6EB87–2DA0**	3NP42 70–0CA01	250	0; 1	2 x 3NE3 225	200	1
170	**6SE7032–7EB87–2DA0**	3NP53 60–0CA00	400	0; 1	2 x 3NE3 230–0B	315	1
DC link voltage 675 V to 810 V DC							
5	**6SE7016–4FS87–2DA0**	3NP42 70–0CA01	250	0; 1	2 x 3NE4 101	32	0
10	**6SE7021–3FS87–2DA0**	3NP42 70–0CA01	250	0; 1	2 x 3NE4 101	32	0
50	**6SE7026–4FA87–2DA0**	3NP42 70–0CA01	250	0; 1	2 x 3NE4 120	80	0
100	**6SE7031–3FB87–2DA0**	3NP42 70–0CA01	250	0; 1	2 x 3NE3 224	160	1
200	**6SE7032–5FB87–2DA0**	3NP 53 60–0CA00	400	1; 2	2 x 3NE3 230–0B	315	1
DC link voltage 890 V to 930 V DC							
50	**6SE7025–3HA87–2DA0**	3NP42 70–0CA01	250	0; 1	2 x 3NE4 118	63	0
200	**6SE7032–1HB87–2DA0**	3NP42 70–0CA01	250	0; 1	2 x 3NE3 227	250	1

System components
Capacitor module and DC link module

Capacitor module for Compact PLUS units

The capacitor module enables short-time energy buffering.

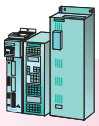
Capacitance		Max. DC link voltage		Dimensions W x H x D		Weight	
		continuous	short-time				
mF	Order No.	V	V	in	(mm)	lb	(kg)
5.1	**6SE7025–0TP87–2DD0**	715	780	3.5 x 14.2 x 10.2	(90 x 360 x 260)	13.2	(6)

DC link module for Compact PLUS units

The DC link coupling module enables transition of the power wiring from the Cu busbar system to cables, e.g. for connecting other unit types from the SIMOVERT MASTERDRIVES series such as compact or chassis AFE rectifier/regenerative units.

Continuous current		Voltage range	Dimensions W x H x D		Weight	
A	Order No.		in	(mm)	lb	(kg)
120	**6SE7090–0XP87–3CR0**	510 V DC –15 % to 650 V +10 %	3.5 x 14.2 x 10.2	(90 x 360 x 260)	5.9	(2.7)

1) Braking units which are connected in parallel on a DC bus or several converters must be fused using the specified fuses.



Selection and ordering data

Panels for increasing the degree of protection of chassis units

Description	Size	Order No.	Dimensions W x H x D in (mm)	Weight lb (kg)
IP20 panels (retrofit kit)				
For converters and inverters without PMU[1])	E	**6SE7090–0XE87–3AC0**	10.6 x 41.3 x 14.6 (270 x 1050 x 370)	33.1 (15)
	F G	**6SE7090–0XF87–3AC0**	14.2 x 41.3 x 14.6 (360 x 1050 x 370)	37.5 (17)
		6SE7090–0XG87–3AC0	20.0 x 57.1 x 18.9 (508 x 1450 x 480)	55.1 (25)
For rectifier units	E	**6SE7090–0XE85–0TC0**	10.6 x 41.3 x 14.6 (270 x 1050 x 370)	33.1 (15)
For rectifier/regenerative units without PMU[1])	E	**6SE7090–0XE85–1TC0**	10.6 x 41.3 x 14.6 (270 x 1050 x 370)	33.1 (15)

G rail for mounting the compact units

Supplier	Length		Order No.
G rail to EN 50 035, steel			
Phoenix Contact (www.phoenixcon.com)	6.6 ft	(2 m)	**12 01 002**
Weidmüller (www.weidmueller.com)	6.6 ft	(2 m)	**51450**
Weidmüller	3.3 ft	(1 m)	**51451**

DIN rail 1.4 in (35 mm) for mounting the interface modules e.g.: ATI, DTI, SCI

Supplier	Length		Order No.
DIN rail acc. to EN 50 022			
Siemens AG	1.6 ft	(0.5 m)	**8GR4 926**
Siemens AG	3.3 ft	(1 m)	**8GR4 928**

Tinned copper busbars for Compact PLUS

The DC link connection is made using three busbars:

positive connection (C)
negative connection (D)
protective earth (PE)

Supplier	Length		Order No.
Copper busbar E-Cu 3 x 10 mm tinned and rounded to DIN 46 433[2]), rated current 120 A			
Siemens	3.3 ft	(1 m)	**8WA2 842**
Phoenix Contact (www.phoenixcon.com)			**NLS–Cu 3/10**

Connecting adapter for cable shields – for compact units

The shield of the load-side cable and the shields of an additional 8 control cables can be connected here. Absolutely necessary for compliance with limit-value class B1!

Size	Order No.
Connecting adapter for cable shields incl. shield clamp for power lines	
A	**6SE7090–0XA87–3CA1**
B	**6SE7090–0XB87–3CA1**
C	**6SE7090–0XC87–3CA1**
D	**6SE7090–0XD87–3CA1**

Shield clamps to connect control-cable shields

Designation	Order No.
Shield clamps	
Shield clamps, quantity = 15	**6SY7000–0AD60**

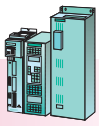
Plug set for Compact PLUS units

Plug set with power socket connectors X1, X2, X6 (motor, power supply, braking resistor) for all sizes and plugs for the terminal strips of the base unit X100, X101, X104, X533 and X9.

Designation	Order No.
Plug set	
Plug set Compact PLUS	**6SY7000–0AE51**

1) The retrofit kit contains all the mechanical components and cables. The PMU of the base unit is to be integrated into the front door.

2) DIN 46 433 has been replaced by EN 13 601. Busbar designation according to the new standard: e.g. bar EN 13 601 – CW004A – D – 3 x 10 – RD tinned.



Technical characteristics of the 6FX MOTION CONNECT power and signal cables

Motor cables

The 6FX5 and 6FX8 cables are suitable for use with the most varied of production and processing machines.

The cables can be used universally. They are:

- mechanically and chemically robust,
- CFC and silicone free,
- EMC-tested,
- with UL certification.

They meet demanding requirements and are characterized by:

- high bending cycles together with small bending radii,
- resistance to aggressive substances,
- environment-friendliness (CFC, silicone and halogen free),
- and their large contribution to electromagnetic compatibility.

Encoder cables

With the prefabricated 6FX5 and 6FX7 cables, connection of an incremental encoder to the CUVC control board (or technology board or the SBP option board) is significantly simplified. The connector for the incremental encoder is already attached. This saves time and avoids wiring errors.

The 6FX. cables, prefabricated and sold by the meter, are described in detail in Catalog NC Z.

3

Technical Data MOTION CONNECT 500 and MOTION CONNECT 800

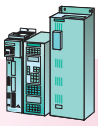
	MOTION CONNECT 500 Type 6FX5008–. . . . .–. . . .	MOTION CONNECT 800 Type 6FX8008–. . . . .–. . . .
Certifications		
Power/signal cables		
• VDE[1])	yes	yes
• c/UL or UL/CSA	758/C22.2N.210.2–M9C	758/C22.2N.210.2–M9C
• UL/CSA File No.[2])	yes	yes
Electrical data acc. to DIN VDE 0472		
Rated voltage		
• power cable V_0/V		
– supply cores	600/1000 V	600/1000 V
– signal cores	24 V (VDE) 1000 V (UL)	24 V (VDE) 1000 V (UL/CSA)
• signal cable	30 V	30 V
Test voltage		
• power cable		
– supply cores	4 kV_{rms}	4 kV_{rms}
– signal cores	2 kV_{rms}	2 kV_{rms}
• signal cable	500 V_{rms}	500 V_{rms}
Operating temperature		
on the surface		
rated voltage		
• fixed cable	–4 °F to +176 °F (–20 °C to +80 °C)	–58 °F to +176 °F (–50 °C to +80 °C)
• moving cable	+32 °F to +140 °F (0 °C to +60 °C)	–40 °F to +140 °F (–20 °C to +60 °C)
Mechanical data		
Max. tensile stress per conductor cross-section		
• fixed cable	50 N/mm²	50 N/mm²
• moving cable	–	20 N/mm²
Smallest permissible bending radius		
• fixed cable (power cable)	5 x D_{max}	6 x D_{max}
fixed cable (signal cable)	see catalog NC Z	see catalog NC Z
• moving cable (power cable)	see catalog NC Z	see catalog NC Z
moving cable (signal cable)	see catalog NC Z	see catalog NC Z
Torsional stress	30 °/m absolute	30 °/m absolute
Power cable bends		
• 1.5 to 6 mm² + signal	100 x 10^3	10 x 10^6
• 10 to 50 mm²	100 x 10^3	3 x 10^6
Signal cable bends	2 x 10^6	10 x 10^6
Traverse rate (power cables)		
• 1.5 to 6 mm² + signal	30 m/min.	180 m/min.
• 10 to 50 mm²	30 m/min.	100 m/min.
Traverse rate (signal cables)	180 m/min. (5 m); 100 m/min. (15 m)	180 m/min.
Acceleration (power cables)	2 m/s²	5 m/s² (5 m); 10 m/s² (2.5 m)
Acceleration (signal cables)	5 m/s²	5 m/s² (5 m); 10 m/s² (2.5 m)
Chemical data		
Insulation material	CFC-free	Halogen, silicone and CFC-free, DIN 47 2815/IEC 60 754-1
Oil resistance	DIN VDE 0472, part 803, type of test B hydraulic oil only	VDE 0472, part 803, type of test B
Outer sheath		
• power cable	PVC, color DESINA: orange RAL 2003	PUR DIN VDE 0282, part 10, color DESINA: orange RAL 2003
• signal cable	PVC, color DESINA: green RAL 6018	PUR DIN VDE 0282, part 10, color DESINA: green RAL 6018
Flame-resistant[3])	IEC 60 332.3	IEC 60 332.3

The cables are not suitable for outdoor use.
The technical data of these cables only apply to simple bends with horizontal travel of up to five meters.
Degree of protection for the customized power and signal cables and their extension cables **when plugged and closed: IP67**

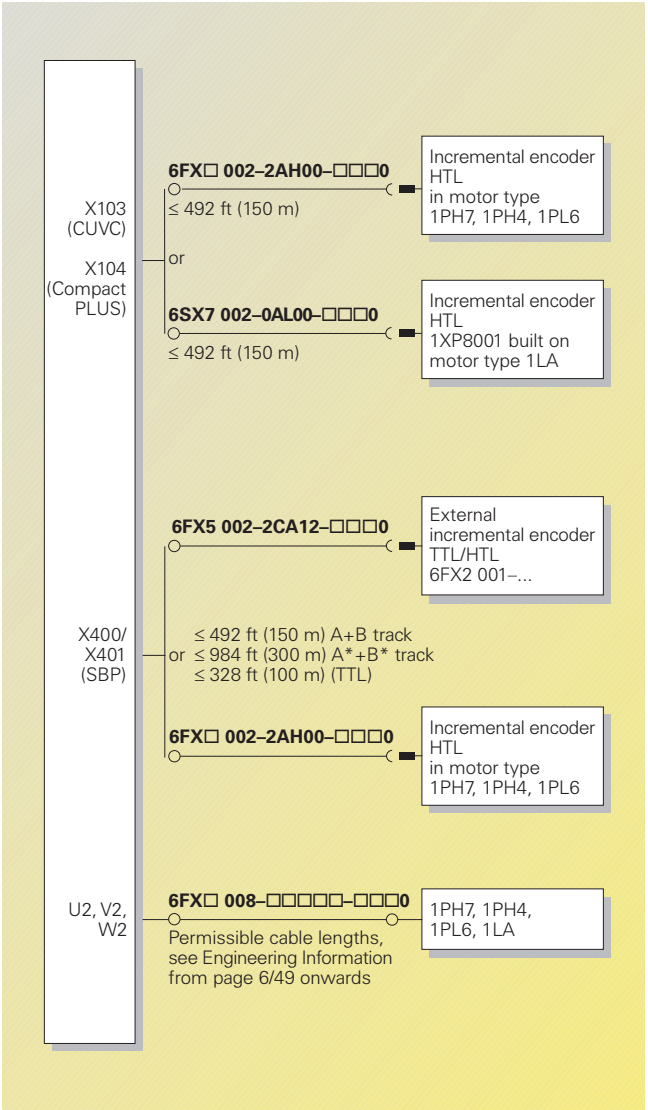
1) The corresponding registration numbers are printed on the cable sheath.

2) The File No. of the respective manufacturers are printed on the cable sheath.

3) For UL/CSA VW1 is printed on the cable sheath. Not for c/UL.



Connection overview



Please note the maximum permissible cable lengths. Longer cables can interfere with the correct functioning of the unit. The order number supplement □ for the cable type 6FX□ ... and the length code in general (–□□□0) as well as preferred lengths can be found on page 3/70.

Current carrying capacity (I_z) of PVC-insulated copper cables acc. to IEC 60 204-1: 1997 ++ Corrigendum 1998

Cross-section	Current carrying capacity I_z (A) for different installation methods (see C 1.2)			
mm²	B1	B2	C	E
0.75	7.6	–	–	–
1.0	10.4	9.6	11.7	11.5
1.5	13.5	12.2	15.2	16.1
2.5	18.3	16.5	21	22
4	25	23	28	30
6	32	29	36	37
10	44	40	50	52
16	60	53	66	70
25	77	67	84	88
35	97	83	104	114
50	–	–	123	123
70	–	–	155	155
95	–	–	192	192
120	–	–	221	221
Electronics (pairs)				
0.2	–	–	4.0	4.0
0.3	–	–	5.0	5.0
0.5	–	–	7.1	7.1
0.75	–	–	9.1	9.1

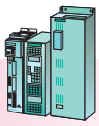
Correction factors

Ambient air temperature		Correction factor
°F	(°C)	
86	(30)	1.15
95	(35)	1.08
104	(40)	1.00
113	(45)	0.91
122	(50)	0.82
131	(55)	0.71
140	(60)	0.58

Note: The correction factors are taken from IEC 60 364-5-523, Table 52-D1.

The current carrying capacity I_z of PVC-insulated cables given in the table above assumes an ambient air temperature of 104 °F (40 °C). For other ambient air temperatures, the installer must correct these values using the factors given in the "Correction factors" table.

PUR cables are also subject to this standard.



3

Power cables for connecting 1PH7, 1PH4, 1PL6 and 1LA type motors

6FX□ 008–1BB . .
without brake cable, with shield

mm²	Cable by the meter Order No.	Weight[1] 6FX8 lb/ft (kg/m)	6FX5 lb/ft (kg/m)	Smallest permissible bending radius 6FX8 in (mm)	6FX5 in (mm)
4 x 1.5	**6FX□ 008–1BB11–□□A0**	0.11 (0.16)	0.12 (0.18)	3.94 (100)	7.28 (185)
4 x 2.5	**6FX□ 008–1BB21–□□A0**	0.16 (0.24)	0.16 (0.24)	4.72 (120)	8.27 (210)
4 x 4	**6FX□ 008–1BB31–□□A0**	0.21 (0.31)	0.22 (0.32)	5.12 (130)	9.45 (240)
4 x 6	**6FX□ 008–1BB41–□□A0**	0.29 (0.43)	0.31 (0.46)	6.69 (170)	11.22 (285)
4 x 10	**6FX□ 008–1BB51–□□A0**	0.42 (0.63)	0.49 (0.73)	8.27 (210)	14.17 (360)
4 x 16	**6FX□ 008–1BB61–□□A0**	0.64 (0.95)	0.74 (1.1)	10.24 (260)	17.32 (440)
4 x 25	**6FX 5 008–1BB25–□□A0**	–	0.95 (1.42)	–	19.88 (505)
4 x 35	**6FX 5 008–1BB35–□□A0**	–	1.26 (1.87)	–	22.44 (570)
4 x 50	**6FX 5 008–1BB50–□□A0**[2]	–	2.3 (3.42)	–	26.97 (685)
4 x 70	**6FX 5 008–1BB70–□□A0**[2]	–	2.77 (4.12)	–	30.31 (770)
4 x 95	**6FX 5 008–1BB05–□□A0**[2]	–	3.21 (4.78)	–	935 (36.81)
4 x 120	**6FX 5 008–1BB12–□□A0**[2]	–	4.11 (6.11)	–	39.76 (1010)
4 x 150	**6FX 5 008–1BB15–□□A0**[2]	–	5.21 (7.75)	–	44.69 (1135)
4 x 185	**6FX 5 008–1BB18–□□A0**[2]	–	6.35 (9.45)	–	47.05 (1195)

MOTION CONNECT 800 **8**
MOTION CONNECT 500 **5**

Form of delivery

1 B	33 ft (10 m)	Rings (25, 35, 50 mm²)
1 F	164 ft (50 m)	Rings (for deviations, see table)
2 A	328 ft (100 m)	Rings (for deviations, see table)
3 A	656 ft (200 m)	Disposable drum (not for cables > 10 mm²)
6 A	1640 ft (500 m)	Disposable drum only for 6FX8 (not for cables > 10 mm²)

6FX□ 008–1BA . .
with brake cable, with total shield

mm²	Cable by the meter Order No.	Weight[1] 6FX8 lb/ft (kg/m)	6FX5 lb/ft (kg/m)	Smallest permissible bending radius 6FX8 in (mm)	6FX5 in (mm)
4 x 1.5 + 2 x 1.5	**6FX□ 008–1BA11–□□A0**	0.17 (0.25)	0.15 (0.22)	4.92 (125)	9.45 (240)
4 x 2.5 + 2 x 1.5	**6FX□ 008–1BA21–□□A0**	0.21 (0.31)	0.19 (0.28)	5.51 (140)	10.24 (260)
4 x 4 + 2 x 1.5	**6FX□ 008–1BA31–□□A0**	0.27 (0.4)	0.24 (0.36)	5.91 (150)	11.42 (290)
4 x 6 + 2 x 1.5	**6FX□ 008–1BA41–□□A0**	0.36 (0.53)	0.36 (0.54)	7.68 (195)	12.01 (305)
4 x 10 + 2 x 1.5	**6FX□ 008–1BA51–□□A0**	0.5 (0.74)	0.5 (0.75)	9.06 (230)	15.55 (395)
4 x 16 + 2 x 1.5	**6FX□ 008–1BA61–□□A0**	0.74 (1.10)	0.74 (1.10)	10.83 (275)	17.32 (440)
4 x 25 + 2 x 1.5	**6FX□ 008–1BA25–□□A0**	0.98 (1.46)	1.05 (1.56)	12.8 (325)	20.87 (530)
4 x 35 + 2 x 1.5	**6FX□ 008–1BA35–□□A0**	1.41 (2.10)	1.35 (2.01)	14.96 (380)	23.23 (590)
4 x 50 + 2 x 1.5	**6FX□ 008–1BA50–□□A0**	1.85 (2.75)	2.22 (3.30)	16.54 (420)	26.97 (685)

MOTION CONNECT 800 **8**
MOTION CONNECT 500 **5**

Form of delivery

1 B	33 ft (10 m)	Rings (25, 35, 50 mm²)
1 F	164 ft (50 m)	Rings (for deviations, see table)
2 A	328 ft (100 m)	Rings (for deviations, see table)
3 A	656 ft (200 m)	Disposable drum (not for cables > 10 mm²)
6 A	1640 ft (500 m)	Disposable drum (not for cables > 10 mm²)

Deviations from form of delivery

6FX . 008–	164 ft (50 m) (–1FA0)	328 ft (100 m) (–2AA0)
–1BA25	Disposable drum	Disposable drum
–1BA35	Disposable drum	Disposable drum
–1BA50	Disposable drum	Disposable drum
–1BA51 / –1BB51		Disposable drum
–1BA61 / –1BB61		Disposable drum

The cross-sections 25, 35 and 50 mm² can also be ordered and delivered by the meter from 33 ft (10 m) to 161 ft (49 m) (according to the length code of the prefabricated cables) and in 33 ft (10 m) rings.

1) Weight of the cables without connectors.

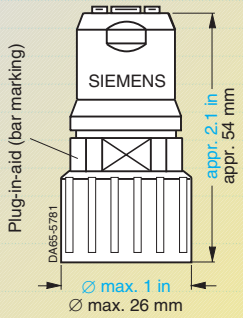
2) For a cable cross-section ≥ 50 mm² and a cable length of 164 ft (50 m), 328 ft (100 m) and 656 ft (200 m), the cables are supplied on drums.

Encoder cables for connecting to motors with HTL incremental encoder (cable length ≤ 492 ft (150 m) without transmission of the inverted signals and cable lengths 492 ft (150 m) to 984 ft (300 m) with transmission of the inverted signals and use of the DTI or SBP module)

Cable design and connector assignment

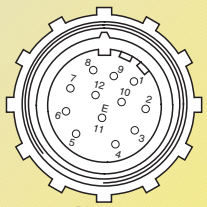
Type 6FX5002–2AH00– . . . 0 consisting of:

Motor side Connector type: 6FX2003–0CE12			Cable sold by the meter 6FX . 008–1BD21– . . .	Free end	Converter side X103 terminal strip on CUVC X104 terminal strip on Compact PLUS
Dimension drawing	PIN	Signal name	Core color	Signal name	Pin No.
					
	2	KTY 84+	white-red (0.5 mm²)	KTY 84+	30
	11	KTY 84–	white-black (0.5 mm²)	KTY 84–	29
	12	+15 V	white-yellow (0.5 mm²)	+15 V	28
	10	0 V	white-blue (0.5 mm²)	0 V	23
	5	Track A	black	Track A	24
	7	CTRL TACHO	green	CTRL TACHO	27
	8	Track B	red	Track B	25
	3	Zero track	blue	Zero track	26
	1	$\overline{\text{Track B}}$	orange	$\overline{\text{Track B}}$	only with DTI, X402
	6	$\overline{\text{Track A}}$	brown	$\overline{\text{Track A}}$	only with DTI, X402
	4	$\overline{\text{Zero track}}$	violet	$\overline{\text{Zero track}}$	–
	9	free	yellow	free	–
			Outer shield on connector housing		



Connector with union nuts and female contacts

View of the female contacts



Selection and ordering data

Cable	Order No.
Prefabricated cables (Length ≤ 492 ft (150 m)) MOTION CONNECT 500	
Encoder cable for connection to motors with HTL incremental encoder	**6FX5002–2AH00 – □ □ □ 0**

1	0 ft (0 m)	**A**	0 ft (0 m)	**A**	0 ft (0 m)
2	328 ft (100 m)	**B**	33 ft (10 m)	**B**	3.3 ft (1 m)
		C	66 ft (20 m)	**C**	6.6 ft (2 m)
		D	98 ft (30 m)	**D**	9.8 ft (3 m)
		E	131 ft (40 m)	**E**	13.1 ft (4 m)
		F	164 ft (50 m)	**F**	16.4 ft (5 m)
		G	197 ft (60 m)	**G**	19.7 ft (6 m)
		H	229 ft (70 m)	**H**	23 ft (7 m)
		J	263 ft (80 m)	**J**	26.2 ft (8 m)
		K	295 ft (90 m)	**K**	29.5 ft (9 m)
Length code					

Example:

3.3 ft (1 m): . . .	–	1	A	B	0
26.2 ft (8 m): . . .	–	1	A	J	0
55.8 ft (17 m): . . .	–	1	B	H	0
193.5 ft (59 m): . . .	–	1	F	K	0
364.2 ft (111 m): . . .	–	2	B	B	0

Cable	Length ft	(m)	Order No.
Not prefabricated, sold by the meter			
Encoder cables for connection to motors with HTL incremental encoder Number of cores x cross-section [mm²] 4 x 2 x 0.38 + 4 x 0.5 External diameter for 6FX5: 0.4 in (10.0 mm)	164	(50)	**6FX□008–1BD21–1FA0**
	328	(100)	**6FX□008–1BD21–2AA0**
	656	(200)	**6FX□008–1BD21–3AA0**
	1640	(500)	**6FX□008–1BD21–6AA0**

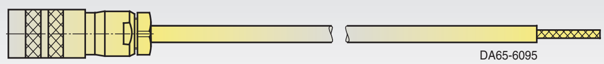
MOTION CONNECT 800	**8**
MOTION CONNECT 500	**5**

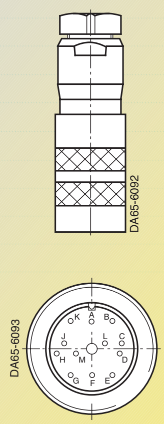
Designation	Order No.	Packaging unit quantity
Accessories		
Signal connector with union nut and female contact for encoder cable connection to the motor, 12-pin.	**6FX2003–0CE12**	**3**
Signal connector with external winding and pin contacts for extending cables, 12-pin.	**6FX2003–1CF12**	**3**

Encoder cables for connecting 1LA type motors with 1XP8001–1 incremental encoder

Cable design and connector assignment

Type 6SX7002–0AL00– . . . 0, prefabricated





Motor side with connector PIN	Signal name	Converter side X103 terminal strip on CUVC X104 terminal strip on Compact PLUS Signal name	Pin No.
A	$\overline{U_{a2}}$		
B	U_p = +10 ... 30 V	Tacho P15	28
C	U_{a0}		
D	$\overline{U_{a0}}$		
E	U_{a1}	Track A	24
F	$\overline{U_{a1}}$		
G	$\overline{U_{a5}}$		
H	U_{a2}	Track B	25
K	0 V	Tacho M	23
L	0 V		
M	U_p = +10 ... 30 V		

Selection and ordering data

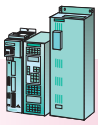
Cable	Order No.
Prefabricated (Length ≤ 492 ft (150 m))	
Encoder cable for connection to 1LA type motors with 1PX8001–1 incremental encoder	**6SX7002–0AL00 – □ □ □ 0**

Length code

1st position		2nd position		3rd position	
1	0 ft (0 m)	**A**	0 ft (0 m)	**A**	0 ft (0 m)
2	328 ft (100 m)	**B**	33 ft (10 m)	**B**	3.3 ft (1 m)
		C	66 ft (20 m)	**C**	6.6 ft (2 m)
		D	98 ft (30 m)	**D**	9.8 ft (3 m)
		E	131 ft (40 m)	**E**	13.1 ft (4 m)
		F	164 ft (50 m)	**F**	16.4 ft (5 m)
		G	197 ft (60 m)	**G**	19.7 ft (6 m)
		H	229 ft (70 m)	**H**	23 ft (7 m)
		J	263 ft (80 m)	**J**	26.2 ft (8 m)
		K	295 ft (90 m)	**K**	29.5 ft (9 m)

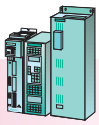
Example:

3.3 ft (1 m): . . .	– 1 A B 0
26.2 ft (8 m): . . .	– 1 A J 0
55.8 ft (17 m): . . .	– 1 B H 0
193.5 ft (59 m): . . .	– 1 F K 0
364.2 ft (111 m): . . .	– 2 B B 0



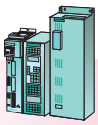
NEMA reactor selection chart, line input and output reactors

Nominal power rating		Rated current	Inductance		
HP CT	VT	A	mh	Order No. Loose (open)	Order No. Loose (NEMA 1)
3 % Inductance, 460 V AC 3-ph., 60 Hz					
0.75		2	12	**LR4730SL**	**LR4730SLE**
1.5		4	9	**LR4730TL**	**LR4730TLE**
3	3	8	5	**LR47301L**	**LR47301LE**
	5	8	5	**LR47301L**	**LR47301LE**
5	7.5	8	3	**LR47302L**	**LR47302LE**
7.5	10	12	2.5	**LR47303L**	**LR47303LE**
10		18	1.5	**LR47304L**	**LR47304LE**
15	20	25	1.2	**LR47305L**	**LR47305LE**
20	25	35	0.8	**LR473A6L**	**LR473A6LE**
25	30	35	0.8	**LR47306L**	**LR47306LE**
30	30	45	0.7	**LR47307L**	**LR47307LE**
40	40	55	0.5	**LR47308L**	**LR47308LE**
50	50	80	0.4	**LR473A9L**	**LR473A9LE**
60	60	100	0.3	**LR47309L**	**LR47309LE**
	75	100	0.3	**LR47309L**	**LR47309LE**
75	100	130	0.2	**LR47310L**	**LR47310LE**
100	125	130	0.2	**LR47311L**	**LR47311LE**
125	150	160	0.15	**LR47312L**	**LR47312LE**
150	200	200	0.11	**LR47313L**	**LR47313LE**
200	250	250	0.09		**LR47314LE**
250	300	320	0.075		**LR47315LE**
300	350	400	0.06		**LR47316LE**
400	450	500	0.05		**LR47317LE**
500	600	600	0.04		**LR47318LE**
600	700	750	0.029		**LR47319LE**



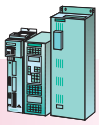
NEMA reactor selection chart, line input and output reactors

Nominal power rating		Rated current	Inductance		
HP CT	VT	A	mh	Order No. Loose (open)	Order No. Loose (NEMA 1)
5 % Inductance, 460 V AC 3-ph., 60 Hz					
0.75		2	20	**LR4750SL**	**LR4750SLE**
1.5		4	12	**LR4750TL**	**LR4750TLE**
3	3	8	7.5	**LR47501L**	**LR47501LE**
	5	8	5	**LR47502L**	**LR47502LE**
5	7.5	8	5	**LR47502L**	**LR47502LE**
7.5	10	12	2.5	**LR47503L**	**LR47503LE**
10		18	2.5	**LR47504L**	**LR47504LE**
15	20	25	2	**LR47505L**	**LR47505LE**
20	25	35	1.2	**LR475A6L**	**LR475A6LE**
25	30	35	1.2	**LR47506L**	**LR47506LE**
30	30	45	0.7	**LR47507L**	**LR47507LE**
40	40	80	0.7	**LR47508L**	**LR47508LE**
50	50	100	0.45	**LR475A9L**	**LR475A9LE**
60	60	100	0.45	**LR47509L**	**LR47509LE**
	75	100	0.45	**LR47509L**	**LR47509LE**
75	100	100	0.3	**LR47510L**	**LR47510LE**
100	125	130	0.3	**LR47511L**	**LR47511LE**
125	150	160	0.23	**LR47512L**	**LR47512LE**
150	200	200	0.185	**LR47513L**	**LR47513LE**
200	250	250	0.15		**LR47514LE**
250	300	320	0.125		**LR47515LE**
300	350	400	0.105		**LR47516LE**
400	450	500	0.085		**LR47517LE**
500	600	600	0.065		**LR47518LE**
600	700	750	0.048		**LR47519LE**



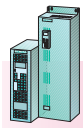
NEMA reactor selection chart, line input and output reactors

Nominal power rating		Rated current	Inductance		
HP CT	VT	A	mh	Order No. Loose (open)	Order No. Loose (NEMA 1)
3 % Inductance, 575 V AC 3-ph., 60 Hz					
3	3	4	9	**LR57301L**	**LR57301LE**
	5	8	5	**LR57302L**	**LR57302LE**
5	7.5	8	5	**LR57302L**	**LR57302LE**
7.5	10	8	3	**LR57303L**	**LR57303LE**
10	15	12	2.5	**LR57304L**	**LR57304LE**
15	20	18	1.5	**LR57305L**	**LR57305LE**
20	25	25	1.2	**LR573A6L**	**LR573A6LE**
25	30	25	1.2	**LR57306L**	**LR57306LE**
30	40	35	0.8	**LR57307L**	**LR57307LE**
40	50	45	0.7	**LR57308L**	**LR57308LE**
50	60	55	0.5	**LR573A9L**	**LR573A9LE**
60	75	80	0.4	**LR57309L**	**LR57309LE**
75	100	80	0.4	**LR57310L**	**LR57310LE**
100	125	100	0.3	**LR57311L**	**LR57311LE**
125	150	130	0.2	**LR57312L**	**LR57312LE**
150	200	160	0.15	**LR57313L**	**LR57313LE**
200	250	200	0.11		**LR57314LE**
250	300	250	0.09		**LR57315LE**
300	350	320	0.075		**LR57316LE**
350	400	400	0.06		**LR573B7LE**
400	500	400	0.06		**LR57317LE**
500	600	500	0.05		**LR57318LE**
600	700	600	0.04		**LR57319LE**
700	800	750	0.029		**LR57320LE**



NEMA reactor selection chart, line input and output reactors

Nominal power rating		Rated current	Inductance		
HP CT	VT	A	mh	Order No. Loose (open)	Order No. Loose (NEMA 1)
5 % Inductance, 575 V AC 3-ph., 60 Hz					
3	3	4	12	**LR57501L**	**LR57501LE**
	5	8	7.5	**LR57502L**	**LR57502LE**
5	7.5	8	7.5	**LR57502L**	**LR57502LE**
7.5	10	8	5	**LR57503L**	**LR57503LE**
10	15	12	4.2	**LR57504L**	**LR57504LE**
15	20	18	2.5	**LR57505L**	**LR57505LE**
20	25	25	2	**LR575A6L**	**LR575A6LE**
25	30	25	2	**LR57506L**	**LR57506LE**
30	40	35	1.2	**LR57507L**	**LR57507LE**
40	50	45	1.2	**LR57508L**	**LR57508LE**
50	60	55	0.85	**LR575A9L**	**LR575A9LE**
60	75	80	0.7	**LR57509L**	**LR57509LE**
75	100	80	0.7	**LR57510L**	**LR57510LE**
100	125	100	0.45	**LR57511L**	**LR57511LE**
125	150	130	0.3	**LR57512L**	**LR57512LE**
150	200	160	0.23	**LR57513L**	**LR57513LE**
200	250	200	0.185		**LR57514LE**
250	300	250	0.15		**LR57515LE**
300	350	320	0.125		**LR57516LE**
350	400	400	0.105		**LR575B7LE**
400	500	400	0.105		**LR57517LE**
500	600	500	0.085		**LR57518LE**
600	700	600	0.065		**LR57519LE**
700	800	750	0.048		**LR57520LE**



NEMA supplied autotransformers

Standard specifications

Standard autotransformers are self-ventilated, NEMA 3 R enclosed, 50/60 Hz, 115C rise, Class F, Wye connection, 0.6 % regulation, impedance 0.6 – 1.4 %, copper windings, UL and CSA (UL 180 °C insulation class), all units will be CE marked.

Rating HP	kVA	Loose Order No.[1)]	Enclosure size
Voltage 3-ph., 460 V AC input/552 V AC output			
15	18	**A451E**	NH5
	20	**A452E**	NH5
	22.5	**A453E**	NH5
20	25	**A454E**	NH5
	28	**A455E**	NH5
25	31.5	**A456E**	NH5
	35.5	**A457E**	NH5
30	40	**A458E**	NH5
	45	**A459E**	NH5
40	50	**A45AE**	NH5
	56	**A45BE**	NH5
50	63	**A45CE**	NH5
	71	**A45DE**	NH5
60	80	**A45EE**	NH5
75	91	**A45FE**	NH5
	100	**A45GE**	NH6
	112.5	**A45HE**	NH6
100	125	**A45JE**	NH6
	140	**A45KE**	NH6
125	160	**A45LE**	NH6
150	180	**A45ME**	NH6
	200	**A45NE**	NH3
	225	**A45PE**	NH3
200	250	**A45RE**	NH4
	280	**A45SE**	NH4
250	315	**A45TE**	NH4
	355	**A45VE**	NH4
300	400	**A45WE**	NH4

1) For open type autotransformers substitute an "L" for the "E" in the last digit of the order number.

Selection and ordering data

Standard specifications

Standard isolation transformers are self-ventilated, dry type, NEMA 3R enclosed, aluminum wound, 3-phase, 60 Hz, rated for maximum 302 °F (150 °C) rise when installed in a 104 °F (40 °C) ambient. Primaries are delta connected, with ±5 % taps; secondaries are wye connected, for either 230 V AC or 460 V AC. The transformers are designed with a 428 °F (220 °C) insulation system and are rated for full load operation at altitudes up to 3300 ft (1000 m) above sea level without derating. One normally closed thermostat is provided in each winding for protection against excessive temperature rise.

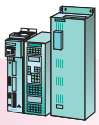
HP	kVA	Enclosure size	Secondary 230 V AC Order No.[1]	Secondary 460 V AC Order No.[1]
460 V AC primary				
3	5	NH5	**T422.**	**T442.**
5	7.5	NH5	**T423.**	**T443.**
7.5	11	NH5	**T424.**	**T444.**
10	14	NH5	**T425.**	**T445.**
15	20	NH6	**T426.**	**T446.**
20	27	NH6	**T427.**	**T447.**
25	34	NH6	**T428.**	**T448.**
30	40	NH6	**T429.**	**T449.**
40	51	NH6	**T42A.**	**T44A.**
50	63	NH3	**T42B.**	**T44B.**
60	75	NH3	**T42C.**	**T44C.**
75	93	NH3	**T42D.**	**T44D.**
100	118	NH3	**T42E.**	**T44E.**
125	145	NH4	**T42F.**	**T44F.**
160	175	NH4	**T42G.**	**T44G.**
200	220	NJ1	**T42H.**	**T44H.**
260	275	NJ1	**T42J.**	**T44J.**
300	330	NJ1	**T42K.**	**T44K.**
400	440	NJ2	**T42L.**	**T44L.**
500	550	NJ2	**T42M.**	**T44M.**
600	660	NJ3	**T42N.**	**T44N.**
700	770	NJ3	**T42P.**	**T44P.**
800	880	NJ3	**N/A**	**T44Q.**
900	990	NJ6	**N/A**	**T44R.**
1 000	1 080	NJ6	**N/A**	**T44S.**
230 V AC primary				
3	5	NH5	**T222.**	**T242.**
5	7.5	NH5	**T223.**	**T243.**
7.5	11	NH5	**T224.**	**T244.**
10	14	NH5	**T225.**	**T245.**
15	20	NH6	**T226.**	**T246.**
20	27	NH6	**T227.**	**T247.**
25	34	NH6	**T228.**	**T248.**
30	40	NH6	**T229.**	**T249.**
40	51	NH6	**T22A.**	**T24A.**
50	63	NH3	**T22B.**	**T24B.**
60	75	NH3	**T22C.**	**T24C.**
75	93	NH3	**T22D.**	**T24D.**
100	118	NH3	**T22E.**	**T24E.**
125	145	NH4	**T22F.**	**T24F.**
160	175	NH4	**T22G.**	**T24G.**
200	220	NJ1	**T22H.**	**T24H.**
260	275	NJ1	**T22J.**	**T24J.**
300	330	NJ1	**T22K.**	**T24K.**
400	440	NJ2	**T22L.**	**T24L.**
500	550	NJ2	**T22M.**	**T24M.**
600	660	NJ3	**T22N.**	**T24N.**
700	770	NJ3	**T22P.**	**T24P.**

Standard transformers	**S**	**S**
Customized transformers	**C**	**C**

1) For standard transformers insert "**S**", (i.e., **T442.** becomes **T442S**).
For customized transformers insert "**C**", (i.e., **T442.** becomes **T442C**).

NEMA supplied transformer options

Transformer options	Order No.
Altitude above 3 300 ft (1000 m) 3001 – 8500 ft 8501 – 11000 ft	 **TM001** **TM002**
Copper windings	**TM003**
C.S.A labeling	**TM004**
Special primary (600 V maximum) Dual voltage Special voltage	 **TM005** **TM006**
±2 – 2 1/2 % taps	**TM007**
Electrostatic shielding	**TM008**
Temperature rise: 239 °F (115 °C) 176 °F (80 °C)	 **TM009** **TM010**
50 Hz	**TM011**
Special paint	**TM012**
Thermostat	
122 °F (50 °C) ambient	**TM013**
1.15 Service factor	**TM014**
Fungus proofing (Tropical protection)	**TM015**
Space heaters	**TM016**
Export packing: 7.5 to 63 kVA 75 to 175 kVA 220 to 660 kVA 770 to 880 kVA	**TM017**
Standard K factor for DITS is K4 K Factor 7 K Factor 9 K Factor 13	 **TM018** **TM019** **TM020**



CBP2 communication board

CBP2 for PROFIBUS DP

The CBP2 communication board (*C*ommunication *B*oard *P*ROFIBUS) is for connecting SIMOVERT MASTERDRIVES to the PROFIBUS DP field bus system.

The CBP2 communication board supports the extended functionality of PROFIBUS DP such as:

- flexible configuration of cyclic messages
- slave-to-slave communication between drives
- operation of SIMATIC OP as PROFIBUS DP master class 2

The CBP2 is fully compatible with the CBP and replaces this board.

For a more detailed description of communication via PROFIBUS DP and integration of the CBP or CBP2 boards in the electronics box, see Engineering Information, Section 6.

Note

Catalog ST 70 describes the functions and components such as Profibus connectors (e.g. 6SE7972–0BA40–0XA0, Profibus cable (e.g. 6XV18 30–0AH10), optical bus terminals or optical link modules (for connection to the optical PROFIBUS DP).

		CBP 2 board (supplied loose) Order No.
CBP2	**Communication board for PROFIBUS DP**	**6SX7010–0FF05**

CBC communication board

CBC for CAN

The CBC communication board (*C*ommunication *B*oard *C*AN) is for connecting SIMOVERT MASTERDRIVES to the CAN protocol.

For a more detailed description of communication via CAN and integration of the CBC board in the electronics box, see Engineering Information, Section 6.

		CBC board (supplied loose) Order No.
CBC	**Communication board for CAN**	**6SX7010–0FG00**

CBD communication board

CBD for DeviceNet

The CBD communication board (*C*ommunication *B*oard *D*eviceNet) facilitates communication between the SIMOVERT MASTERDRIVES and higher-level programmable controllers or other field devices by means of the DeviceNet protocol.

For a more detailed description of communication via DeviceNet and integration of the CBD board in the electronics box, see Engineering Information, Section 6.

		CBD board (supplied loose) Order No.
CBD	**Communication board for DeviceNet**	**6SX7010–0FK00**

SLB communication board

SLB for SIMOLINK

The SLB (*SIMO*LINK *B*OARD) communication board is for the rapid exchange of data between different drives.

For a more detailed description of communication via SIMOLINK and integration of the SLB board in the electronics box, see Engineering Information, Section 6.

Note

Only available for converters and inverters.

		SLB board (supplied loose) Order No.
SLB	**Communication board for SIMOLINK**	**6SX7010–0FJ00**[1]

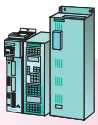
System package for SLB

consisting of
40 fiber-optic cable connectors
20 plugs X470
100 m plastic fiber-optic cable — **6SX7010–0FJ50**

Extra package for SLB (supplied with the SLB)

consisting of
2 fiber-optic cable connectors
1 plug X470
5 m plastic fiber-optic cable fine and coarse emery paper — **6SY7000–0AD15**

1) Including 5 m of plastic fiber optic cable and two connectors.



EB1 terminal expansion board

The EB1 expansion board (*E*xpansion *B*oard *1*) enables the number of digital and analog inputs and outputs to be expanded as follows:

- 3 digital inputs
- 4 bidirectional digital inputs/outputs
- 24 V voltage supply for the digital outputs
- 1 analog input with a differential amplifier input
- 2 analog inputs
- 2 analog outputs.

For a more detailed description, diagram and circuit diagram, see Engineering Information, Section 6.

For integration of the EB1 in the electronics box, see Engineering Information, Section 6.

Only available for converters and inverters.

		EB1 board (supplied loose) Order No.
EB1	**Expansion board 1**	**6SX7010–0KB00**

EB2 terminal expansion board

The EB2 expansion board (*E*xpansion *B*oard *2*) enables the number of digital and analog inputs and outputs to be expanded as follows:

- 2 digital inputs
- 24 V voltage supply for the digital inputs
- 1 relay output with changeover contacts
- 3 relay outputs with NO contact
- 1 analog input with differential amplifier inputs
- 1 analog output.

For a more detailed description, its appearance and circuit diagram, see Engineering Information, Section 6.

For integration of the EB2 in the electronics box, see Engineering Information, Section 6.

Only available for converters and inverters.

		EB2 board (supplied loose) Order No.
EB2	**Expansion board 2**	**6SX7010–0KC00**

SBP incremental encoder board

The incremental encoder SBP (*S*ensor *B*oard *P*ulse) enables an incremental encoder or frequency generator setpoint to be connected to converters and inverters.

For a detailed description of the SBP board and its integration in the electronics box, see Engineering Information in Section 6.

		SBP board (supplied loose) Order No.
SBP	**Incremental encoder board**	**6SX7010–0FA00**

Bus adapter[1])

Bus adapter for the electronics box LBA

The electronics box can easily be retrofitted with the backplane bus adapter LBA (*L*ocal *B*us *A*dapter). Two supplementary boards or the optional boards plugged onto the ADB (*Ad*apter *B*oard) can be combined with the CUVC (CUR, CUSA) control board.

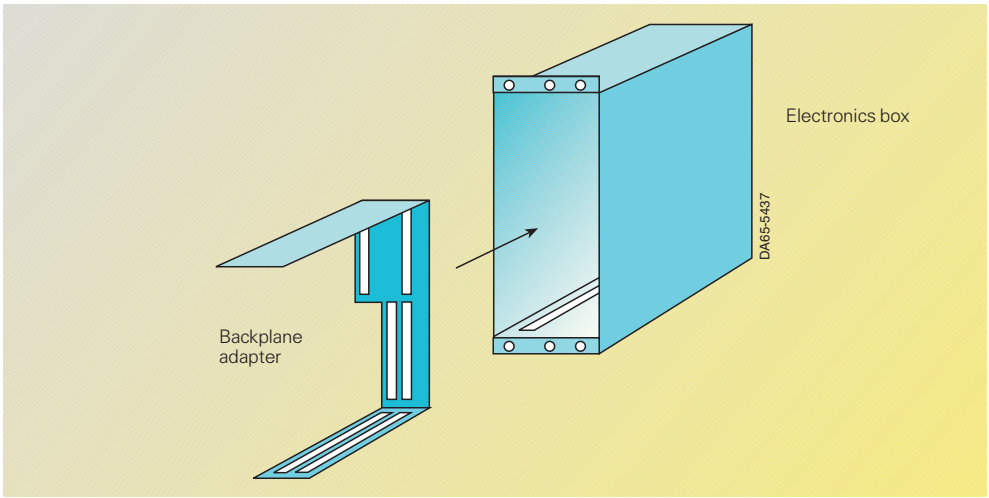


Fig. 3/14

Adapter		Supplied loose Order No.
LBA	**Backplane adapter**	
		6SE7090–0XX84–4HA0

ADB adapter board[1])

The ADB (*A*dapter *B*oard) is the carrier for connecting half-size option boards in mounting positions 2 and 3 as described in Section 6 "Integration of the options in the electronics box".

		Supplied loose Order No.
ADB	**Adapter board**	
		6SX7010-0KA00

T100 technology board[1])

The T100 technology board expands the base unit with many drive-related technological functions such as:

- higher-level PID controller
- comfort ramp-function generator with smoothing
- comfort motorized potentiometer
- wobble generator
- drive-related control.

For a more detailed description of the T100 board, see Engineering Information, Section 6.

For integration of the T100 in the electronics box, see Engineering Information, Section 6.

Board		Order No.
T100	**Technology board**	
	Supplied loose, including hardware instruction manual, without software module[2])	**6SE7090–0XX87–0BB0**
	Additional hardware instruction manual, for additional requirements in 5 languages (G/E/F/I/S)	**6SE7080–0CX87–0BB0**
	MS100 software module "Universal Drive" for the T100 (EPROM), without manual	**6SE7098–0XX84–0BB0**
	The manual for the MS100 software module "Universal Drive" is available in the following languages:	
	German (G)	**6SE7080–0CX84–0BB1**
	English (E)	**6SE7087–6CX84–0BB1**
	French (F)	**6SE7087–7CX84–0BB1**
	Italian (I)	**6SE7087–2CX84–0BB1**
	Spanish (S)	**6SE7087–8CX84–0BB1**

T300 technology board[1])

The T300 technology board can be used to create technological functions for various applications such as:

- closed-loop tension and position control
- winders
- coilers
- synchronous and positioning control
- hoisting drives
- drive-related control functions.

For a more detailed description of the T300 board, see Engineering Information, Section 6.

For integrating the T300 in the electronics box, see Engineering Information, Section 6.

For selection and ordering data, see page 3/83.

1) Attention!
Only for compact and chassis units.

2) The LBA backplane bus adapter is required for mounting (see above).

T300 technology board · Components

The selection table specifies which supplementary technological components are needed for a specific task.
Example: The multi-motor drive function is required. All products which are listed in the multi-motor drive column are required.

Ordering information			Components required for the standard software package				Components required for self-generated application software, using	
Product description	Comment	Order No.	Multi-motor drive	Axial winder	Angular synchronous control	Positioning control	STRUC L	STRUC G
T300 technology board with two SC58 and SC60 connecting cables, SE300 terminal block and G/E hardware instruction manual	German/English	**6SE7090–0XX87–4AH0**	•	•	•	•	•	•
T300 technology boards as spare part		**6SE7090–0XX84–0AH2**	•	•	•	•	•	•
LBA local bus adapter for MASTERDRIVES electronics box	Also used to install a communication board	**6SE7090–0XX84–4HA0**	•	•	•	•	•	•
Additional instruction manual for the T300 hardware	German/English French	**6SE7087–6CX84–0AH1** **6SE7087–7CX84–0AH1**						
Standard software package, multi-motor drive on an MS360 memory module without manual		**6SE7098–6XX84–0AH0**	•					
Manual, multi-motor drive[2])	German English	**6SE7080–0CX84–6AH1** **6SE7087–6CX84–6AH1**	•					
Multi-motor drive standard softw. package on floppy disk in STRUC source code[3]) MD360		**6SW1798–6XX84–0AH0**						
Standard software package, axial winder on an MS320 memory module, without manual		**6SE7098–2XX84–0AH0**		•				
Manual, axial winder[2])	German English	**6SE7080–0CX84–2AH1** **6SE7087–6CX84–2AH1**		•				
Axial winder standard software package on floppy disk in STRUC source code[3]) MD320		**6SW1798–2XX84–0AH0**						
Standard software package, angular synchronous control[4]) on an MS340 memory module without manual		**6SE7098–4XX84–0AH0**			•			
Manual, angular synchronous control[2])	German English French	**6SE7080–0CX84–4AH1** **6SE7087–6CX84–4AH1** **6SE7087–7CX84–4AH1**			•			
Angular synchronous control standard software package on floppy disk in STRUC source code[3]) MD340		**6SW1798–4XX84–0AH0**						
Standard software package, positioning control on an MS380 memory module without manual		**6SE7098–8XX84–0AH0**				•		
Manual, positioning control[2])	German English	**6SE7080–0CX84–8AH1** **6SE7087–6CX84–8AH1**				•		
Standard software package, positioning control on floppy disk in STRUC® source code[3]) MD380		**6SW1798–8XX84–0AH0**						
Generation software and accessories for configuring (see Catalog ST DA)								
STRUC G/L Version 4.2 on CD-ROM with the Service IBS start-up program	See text German/English	**6DD1801–1DA2**						•
Configuring PC for STRUC G PT, installed ready to run	See the text							•
Empty MS300 memory module for T300, 8 Kbytes EEPROM	MS300 or MS301	**6SE7098–0XX84–0AH0**					•	•
Empty MS301 memory module for T300, 8 Kbytes EEPROM		**6SE7098–0XX84–0AH1**					•	•
Parallel programming unit PPX1, external programming unit, for connection to a printer port with power supply unit (for PC/PG) with UP3 progr. Adapter	The same for STRUC L PT and G PT	**6DD1672–0AD0**					•	•
PG7x0 connecting cable to T300 if Service IBS start-up program is used[1])	Self-assembly according to the T300 instruction manual	–					•	•
PC-AT connecting cable to T300 if Service IBS start-up program is used[1])	Self-assembly according to the T300 instruction manual	–					•	•

1) Depending on whether a SIMATIC-PG or a standard PC is used for start-up only one of the two cables is required.

2) Order the required number of manuals in the desired language, irrespective of the number of T300 standard software packages which have been ordered.

3) Only required if the standard is to be changed; requires STRUC configuring software.

4) The standard software package is only required for the slave drive(s). Example: Two drives which operate in angular synchronism: One standard software package for angular synchronous control is required.

T400 technology board[1])

The T400 is used to implement supplementary process-specific functions (e.g. for tension and position controls, winders, reels, synchro 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.

Users who wish to implement specialist applications or market their own technological know-how can create their own process solution on the T400 using the CFC configuring language, a feature of SIMATIC STEP 7.

Process-specific functions are configured with CFC and then executed cyclically by the processor. The closed-loop control sampling time is about 1 ms.

Available standard configurations

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

For a more detailed description of the T400 board, see Engineering Information, Section 6.

For integration of the T400 in the electronics box, see Engineering Information, Section 6.

Description	Order No.
T400 technology board	
w/Axial winder software SPW 420	**6DD1-842-0AA0**
Winder software on floppy (no manual)	**6DD1-843-0AA0**
Winder instructions/manual	**6DD1-903-0AA0**
T400 technology board	
w/Angular synchronous control SPA 440	**6DD1-842-0AB0**
Angular asynchr. software on floppy (no manual)	**6DD1-843-0AB0**
Angular synchr. instructions/manual	**6DD1-903-0BB0**
T400 Technology board, without software	**6DD1-606-0AD0**

1) Attention!
Only for compact and chassis units.

SCB1 interface board[1])

The SCB1 interface board (*S*erial *C*ommunication *B*oard 1) has a fiber-optic cable connection and therefore provides the following possibilities:

- peer-to-peer connection between several drive units with a max. data transfer rate of 38.4 Kbit/s.
- serial I/O system with the SCI1 and SCI2 serial interface boards.

For a more detailed description of the SCB1 board, see Engineering Information, Section 6.

For integration of the SCB1 in the electronics box, see Engineering information, Section 6.

Board/ Conductor		Supplied loose Order No.
SCB1	**Interface board**	
	incl. 33 ft (10 m) fiber optic cable	**6SE7090–0XX84–0BC0**
LWL	**Plastic fiber optic cable 5 m**	
Use extra package for SLB board		**6SY7000–0AD15**

SCB2 interface board[1])

The SCB2 Interface Board (*S*erial *C*ommunication *B*oard 2) has a floating RS485 interface with a maximum data transfer rate of 187.5 Kbit/s and thus enables the following alternatives:

- peer-to-peer connection between several drive units
- bus coupling to a max. of 31 slaves connected to a master (e.g. SIMATIC) using the USS protocol.

For a more detailed description of the SCB2 board, see Engineering Information, Section 6.

For integration of the SCB2 in the electronics board, see Engineering Information, Section 6.

Board		Supplied loose Order No.
SCB2	**Interface board**	
		6SE7090–0XX84–0BD1

TSY synchronizing board[1])

The TSY synchronizing board (*T*achometer and *S*ynchronizing *B*oard) enables two converters or inverters to be synchronized to a common load (e.g. starting converter to main converter). TSY also may be used for conditioning and routing of net signals, tracked by the VSB board, for the supply synchronization function.

For a more detailed description and examples of connection, see Engineering Information, Section 6.

For integration of the TSY board in the electronics box, see Engineering Information, Section 6.

Board		Supplied loose Order No.
TSY	**Synchronizing board**	
		6SE7090–0XX84–0BA0

SCI1 and SCI2 interface boards[1])

With the SCI1 (*S*erial *C*ommunication *I*nterface 1) and SCI2 (*S*erial *C*ommunication *I*nterface 2) interface boards and the SCB1 interface board, a serial I/O system can be created with fiber-optic cables, thus enabling considerable additions to the binary and analog inputs and outputs.

In addition, the fiber-optic cables safely disconnect the drive units in accordance with VDE 0100 and 0160 (PELV function).

For a more detailed description of the SCI1 and SCI2 boards, see Engineering Information, Section 6.

Board/ Conductor		Supplied loose Order No.
SCI1	**Interface board**	
	incl. 33 ft (10 m) fiber-optic cable	**6SE7090–0XX84–3EA0**
SCI2	**Interface board**	
	incl. 33 ft (10 m) fiber-optic cable	**6SE7090–0XX84–3EF0**
LWL	**Plastic fiber-optic cable 16.4 ft (5 m)**	
Use extra package for SLB board		**6SY7000–0AD15**

DTI digital tachometer interface[1])

Digital tachometers with different voltage levels can be connected at the DTI (*D*igital *T*acho *I*nterface) board. The inputs are floating.

The board enables the following signals to be connected:

- HTL encoders with differential outputs
- floating HTL encoders
- TTL encoders
- encoder cables > 492 ft (150 m)
- TTL output at X405
- level converter, HTL to TTL.

For a more detailed description with an example of connection, see Engineering Information, Section 6.

Board		Supplied loose Order No.
DTI	**Digital tachometer interface**	
		6SE7090–0XX84–3DB0

VSB Voltage Sensing Board

The VSB board (*V*oltage *S*ensing *B*oard) is used for measuring the supply voltage and supply frequency. It is used for the AFE rectifier/regenerative unit for the supply synchronization function of a converter – fed motor to the supply or back. The VSB board works in the function of supply synchronization only together with the TSY board.

Board		Supplied loose Order No.
VSB	**Voltage Sensing Board**	
		6SX7010–0EJ00

1) Attention!
Only for compact and chassis units.

APMU adapter for cabinet-door mounting

The PMU parameterizing unit included in the standard version of all drive units can also be built into a cabinet door using the APMU adapter.

For dimensions and door cut-out, see below.

Note

The OP1S operator control panel can also be plugged onto the APMU.

Designation	Order No.
APMU adapter for mounting in cabinet door, incl. 6.6 ft (2 m) cable	**6SX7010–0AA10**

3

OP1S comfort operator control panel

The OP1S operator control panel (*O*perator *P*anel) is an optional input/output unit which can be used for parameterizing the drive units. Plain text displays greatly facilitate parameterization.

For a more detailed description of the OP1S operator control panel, see Section 2 "Operator control and visualization".

Designation		Order No.
OP1S control panel		**6SE7090–0XX84–2FK0**
AOP1S adapter for cabinet-door mounting incl. 16.4 ft (5 m) connecting cable		**6SX7010–0AA00**
Connecting cable PMU-OP1S 9.8 ft (3 m)	9.8 ft (3 m)	**6SX7010–0AB03**
Connecting cable PMU-OP1S 16.4 ft (5 m)	16.4 ft (5 m)	**6SX7010–0AB05**

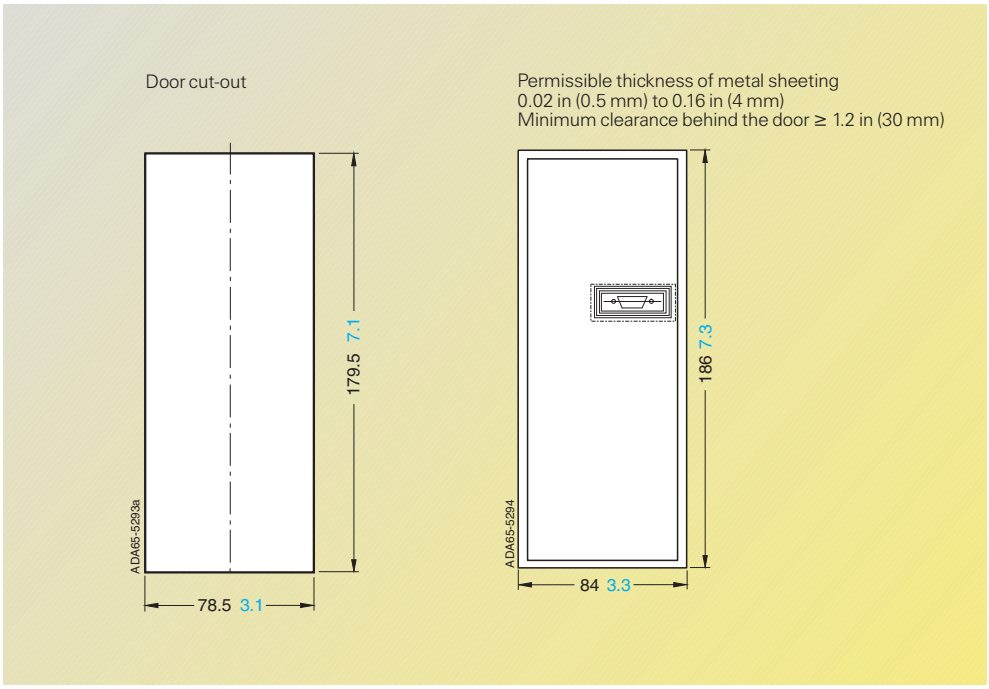
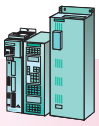


Fig. 3/16
AOP1S/APMU adapter and door cut-out

Dimensions in mm
Dimensions in inches



Integration of drives in SIMATIC S7 with Drive ES

Drive ES Basic is used for convenient startup, servicing and diagnostics of Siemens drives. It can be integrated in STEP 7 or installed on a PC/PG as a stand-alone version. For the stand-alone version, Drive ES Basic installs a drive manager instead of the SIMATIC manager but the drive manager has the same look and feel. For integrated installation as an option for STEP 7, the basic STEP 7 version as indicated in the ordering data must be used.

In conjunction with the SIMATIC tool CFC (Continuous Function Chart), Drive ES Graphic is used for the graphic configuring of functions provided in SIMOVERT MASTERDRIVES (base unit, free block and technology functions). Prerequisite: A Drive ES Basic V 5 and a CFC > V 5.1 must already have been installed in the computer.

Drive ES SIMATIC makes SIMATIC block libraries available, so that configuring the communication between SIMATIC S7 and Siemens drives (e.g. SIMOVERT MASTERDRIVES) is reduced to simple parameter assignment. Drive ES SIMATIC replaces the DVA_S7 software package for all STEP 7 versions ≥ V 5.0 and can also be installed and used independently, i.e. without Drive ES Basic.

Drive ES PCS7 provides a block library with image and control blocks with which Siemens drives (e.g. SIMOVERT MASTERDRIVES) can be integrated in the SIMATIC PCS7 process control system on the basics of a speed interface. The drives can then be controlled and visualized from the operator station (OS) via the drive faceplates. The PCS7 library can also be used independently, i.e. without Drive ES Basic, under PCS7 versions V 5.0 and V 5.1.

Scope of supply

	Order No.	Supplied as	Documentation
Software packages Drive ES · Installation as integrated option for STEP 7 from version ≥ V 5.0			
Drive ES Basic V 5.0[1] Single licence	**6SW1700–0JA00–0AA0**	CD-ROM, 1 piece	five standard languages
Drive ES Graphic V 5.0 Single licence	**6SW1700–0JB00–0AA0**	CD-ROM, 1 piece	five standard languages
Drive ES SIMATIC V 5.0 Single licence	**6SW1700–0JC00–0AA0**	CD-ROM, 1 piece	five standard languages
Software packages Drive ES · Installation as integrated option for STEP 7 from version ≥ V 5.1			
Drive ES Basic V 5.1[1] Single licence	**6SW1700–5JA00–1AA0**	CD-ROM, 1 piece	five standard languages
Drive ES Basic V 5.1[1] copy licence (60 installations)	**6SW1700–5JA00–1AA1**	CD-ROM, 1 piece	five standard languages
Drive ES Graphic V 5.1 Single licence	**6SW1700–5JB00–1AA0**	CD-ROM, 1 piece	five standard languages
Drive ES SIMATIC V 5.1 Single licence	**6SW1700–5JC00–1AA0**	CD-ROM, 1 piece	five standard languages
Drive ES PCS7 V 5.1 Single licence	**6SW1700–5JD00–1AA0**	CD-ROM, 1 piece	five standard languages
Software packages Drive ES · Installation as integrated option for STEP 7 from version ≥ V 5.2			
Drive ES Basic V 5.2[1] Single licence	**6SW1700–5JA00–2AA0**	CD-ROM, 1 piece	five standard languages
Drive ES Basic Upgrade[1] **V 5.x → V 5.2** Single licence	**6SW1700–5JA00–2AA4**	CD-ROM, 1 piece	five standard languages
Drive ES Basic V 5.2[1] copy licence (60 installations)	**6SW1700–5JA00–2AA1**	CD-ROM, 1 piece + Copy licence contract	five standard languages
Drive ES Graphic V 5.2 Single licence	**6SW1700–5JB00–2AA0**	CD-ROM, 1 piece	five standard languages
Drive ES Graphic Upgrade V 5.x → V 5.2 Single licence	**6SW1700–5JB00–2AA4**	CD-ROM, 1 piece	five standard languages
Drive ES SIMATIC V 5.3 Single licence	**6SW1700–5JC00–3AA0**	CD-ROM, 1 piece	five standard languages
Drive ES SIMATIC Upgrade V 5.x → V 5.3 Single licence	**6SW1700–5JC00–3AA4**	CD-ROM, 1 piece	five standard languages
Drive ES SIMATIC V 5.x Copy runtime licence	**6SW1700–5JC00–1AC0**	Product document only (w/o software and documentation)	five standard languages
Drive ES PCS7 V 5.2 Single licence	**6SW1700–5JD00–2AA0**	CD-ROM, 1 piece	five standard languages
Drive ES PCS7 Upgrade V 5.x → V 5.2 Single licence	**6SW1700–5JD00–2AA4**	CD-ROM, 1 piece	five standard languages
Drive ES PCS7 V 5.x Copy runtime licence	**6SW1700–5JD00–1AC0**	Product document only (w/o software and documentation)	five standard languages

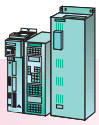
Contents of the Drive ES SIMATIC package

- **Communication software "PROFIBUS DP"** for
  S7-300 with CPUs with integrated DP interface (block libraries DRVDPS7, POSMO)
  S7-400 with CPUs with integrated DP interface or with CP443-5 (block libraries DRVDPS7, POSMO)
  S7-300 with CP342-5 (block library DRVDPS7C)
- **Communication software "USS-Protocoll"** for
  S7-200 with CPU 214/CPU 215/CPU 216 (driver program DRVUSS2 for programming tool STEP 7-micro)
  S7-300 with CP 340/341 and S7-400 with CP 411 (block library DRVUSSS7)
- **STEP 7-Slave object manager**
  for convenient configuration of drives as well as for acyclic PROFIBUS DP communication with the drives, support for conversion of DVA_S7 for Drive ES projects (only from V 5.1)
- **SETUP program** for installation of the software in the STEP 7 environment

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

- **Block library for SIMATIC PCS7**
  Image and control blocks for SIMOVERT MASTERDRIVES VC and MC as well as MICRO-/MIDIMASTER 3rd and 4th generation
- **STEP 7-Slave object manager**
  for convenient configuration of drives as well as for acyclic PROFIBUS DP communication with the drives
- **SETUP program** for software installation in the PCS7 environment

1) Drive ES Basic can also be installed stand-alone without STEP 7 (for details see accompanying text).



Software update service for Drive ES

A software update service can also be purchased for the Drive ES software. The user is automatically supplied with the current software, service packs and complete versions for one year after the date of ordering.

Scope of supply	Order No.
Software update service	
Drive ES Basic	**6SW1700–0JA00–0AB2**
Drive ES Graphic	**6SW1700–0JB00–0AB2**
Drive ES SIMATIC	**6SW1700–0JC00–0AB2**
Drive ES PCS7	**6SW1700–0JD00–0AB2**

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 if the customer already has a complete version of the software.

Communication packages for SIMATIC S5

The DVA_S5 software allows the incorporation of drives in the STEP 5 system environment for STEP 5 version ≥ 6.0.

For a more detailed description see Section 2 "SIMOVERT MASTERDRIVES in the world of automation".

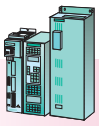
Scope of supply	Order No.	Supplied as	Documentation
"DVA_S5" option software for SIMATIC S5 (STEP 5 > V 6.0)			
• **"PROFIBUS DP" communication software** for S5-95U/DP-Master S5-115 to S5-155U with IM308-B/C	**6DD1800–0SW0**	3.5" floppy disk	German/English
• **"USS Protocol" communication software** for S5-95/S5-100 with CP 521Si S5-115 to S5-155U with CP 524			

Start-up, parameterization and diagnostics with DriveMonitor

The DriveMonitor program can be used for control and visualization of SIMOVERT MASTERDRIVES using a graphic user interface.

For a more detailed description of DriveMonitor, see Section 2 "Operator control and visualization".

Designation	Order No.	Supplied as
DriveMonitor Version ≥ V 5.1 for SIMOVERT MASTERDRIVES with operating instructions and Compendium		
Supplied separately	**6SX7010–0FA10**	CD-ROM
Combination cable for the firmware boot function and communication with the PC Pre-assembled signal cables with a boot switch integrated in the cable connector case for booting firmware. The cable connects the MASTERDRIVES units with the RS 232 C interface of the PC via the –X300 or –X103 connector. Length 9.8 ft (3 m).	**9AK1012–1AA00**	–
Interface converter SU1 RS 232 C – RS 485, incl. mounting accessories; Power supply: 1 AC 115/230 V	**6SX7005–0AA00**	–



Options with code and description

Supplementary order code	Description of option	• Option possible – Not available												
		Converter			Inverter			Rectifier unit			AFE	Rectifier/regenerative unit		
		A – D P	E – G	K	A – D P	E – G	J, K, L, M, Q	B, C P	E	H, K		C	E	H, K
Documentation														
D77	Documentation in French/English	•	•	•	•	•	•	•	•	•	–	•	•	•
D78	Documentation in Spanish/English	•	•	•	•	•	•	•	•	•	–	•	•	•
D72	Documentation in Italian/English	•	•	•	•	•	•	•	•	•	–	•	•	•
D90	Documentation in Japanese/English	•	•	•	•	•	•	•	•	•	–	•	•	•

3

L03

Basic-interference suppression together with radio-interference suppression filters and TT and TN systems

With the L03 option, unit sizes J to Q are fitted with discharge capacitors in the DC link. The option can be retrofitted by Siemens qualified personnel.

L20

Operation with an IT system

With the L20 option, operation with non-earthed systems (IT systems), the basic-interference capacitors built in as standard are no longer necessary. The control electronics are always earthed.

L30

Inverter fuses installed, fuse type for DIN/IEC approval and UL

Option L30 can only be ordered for inverter sizes E to G.
Inverter fuses are for protecting inverters connected to a DC bus. Inverter fuses must always be provided when at least 2 inverters are operated on this bus. The inverters do not have to be protected when a single inverter of a rectifier unit or a rectifier/regenerative unit is supplied with a matched power rating. The same conditions apply as with a converter. For option L30 the inverter fuses indicated are integrated in the inverter. The option can be retrofitted by Siemens qualified personnel.

L33

Compact inverters without fuses

For a description, see L30. With the L33 option, which can be used for compact inverters sizes A to D, the inverter fuses are not built into the inverter and are not supplied with the drive unit. The inverter fuses must be ordered separately and mounted externally.

K80

Safe Stop

The function "Safe Stop" is a "device for the prevention of an unexpected start-up" to EN 60 204-1, section 5.4. It is realized in connection with an external circuit.

- The function "Safe Stop" can be retrofitted by Siemens service personnel for chassis units size E and upwards.

K91

DC link current measurement

The DC link current is measured indirectly using line-side current transformers. Available for rectifier units B, C and E.

M08

Coated boards

Coating of the boards protects sensitive components, especially SMD components, against attack by harmful gases, chemically active dust and humidity. The M08 option thus increases the robustness of the boards in an aggressive environment. The coating does not serve as protection in a tropical climate. In the case of condensation or conductive contamination on the board, a voltage flashover in the power section is not prevented.

M20[1)]

IP20 panels

With the M20 option, unit sizes E to G are provided with an IP20 panel (wall mounting possible). Control is via a PMU built into the front panel. The option can be retrofitted by Siemens qualified personnel.

M65

Separate DC connection for d*v*/d*t* filter

With the help of the M65 option, available for unit sizes J, K, M and Q, the d*v*/d*t* filters can be connected (on the motor side) to a DC-link-voltage terminal lug (with size L; already integrated as standard).

D77

Documentation in French/English

Operating instructions are supplied in French/English.

D78

Documentation in Spanish/English

Operating instructions are supplied in Spanish/English.

D72

Documentation in Italian/English

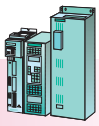
Operating instructions are supplied in Italian/English.

D90

Documentation in Japanese/English

Operating instructions are supplied in Japanese/English additionally.

1) The panels can also be supplied separately, see page 3/67.



Vector Control
6SE72 Converter Cabinet Units

Order number example

e.g. **6SE7233–7EG00–3AB0**

SIMOVERT MASTERDRIVES 6SE7 series

Cabinet units
IEC = 1
NEMA = 2

Multiplier for output current

Output current rounded off
e.g. 37 x 10 = 370 A

Supply voltage code
e.g. 3-ph. 380 V – 460 V AC

Cabinet size
e.g. cabinet size **G**

4

General information

This chapter covers the most popular configurations of the MASTERDRIVES 6SE72 Vector Control AC drive cabinet units. Numerous other enclosure configurations and ratings exist. Below are a sample of the additional configurations and ratings available. Contact your local sales office for additional information and pricing.

- 12 and 18-pulse configurations
- Regenerative configurations
- Active Front Ends
- Harmonic Filtering
- Water-cooling
- RFI, sinewave, and d*v*/d*t* filtering
- NEMA 4 and NEMA 12 enclosures
- Wall-mounted units
- Soft start bypass
- 230 V and 690 V ratings
- Additional HP ranges not listed from 1 to 5000 HP
- Common DC bus designs
- Complete coordinated drive systems

The 6SE72 enclosures are NEMA 1 design and UL approved. The standard enclosure is Rittal with optional 8MF enclosures available. For overseas delivery, 6SE71 IEC designed units are also available.

Fig. 4/1

Ratings and selection

6SE72 NEMA Cabinets

6SE72 model numbers define pre-engineered NEMA drive packages. 6SE72 drive packages with a particular HP and voltage rating consists of an enclosure, a 6SE70 chassis or combination of chassis units, and a door mounted text operator panel (OP1).

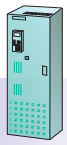
The 6SE72 drive packages can be modified with additional power options. As wired and mounted power options are added, the space required to mount these options increases. A simple system has been designed to aid in the selection of the proper size enclosure. This system divides the 6SE72 numbers into two categories:

1. Basic enclosure:
   No space for any power options.
2. Standard enclosure:
   Space for the following selected power options.
   - Line fuses
   - Disconnect switch or circuit-breaker
   - Input reactor
   - Input contactor[1])
   - Dynamic braking chopper[2])
   - Output contactor[2])
   - Overload relay[2])

1) Except for cabinet sizes K and L.

2) Not in all cases.
Refer to factory.

NEMA 1 cabinet selection 380 V to 460 V AC



Selection and ordering data

Nominal power rating[1][4] CT	Base load current[2]	Nominal power rating[1][4][5] VT	Rated current[3]	Nominal power rating	**Standard Enclosure**[6]	Dimension drawing, see Section 7	Nominal dimensions W x H x D	Weight approx.
	I_G		I_N					
HP (460 V AC)	A	HP (460 V AC)	A	kW (400 V AC)	Order No.	Cabinet size	inches (mm)	lb (kg)
Supply voltage 380 V to 460 V AC								
60	84	**75**	92	45	**6SE7231–0EF00–3AB0**	F	24 x 95 x 24 (600 x 2400 x 600)	500 (226.8)
75	113	**100**	124	55	**6SE7231–2EF00–3AB0**	F	24 x 95 x 24 (600 x 2400 x 600)	525 (238.1)
100	133	**125**	146	75	**6SE7231–5EF00–3AB0**	F	24 x 95 x 24 (600 x 2400 x 600)	525 (238.1)
125	169	**150**	186	90	**6SE7231–8EF00–3AB0**	F	24 x 95 x 24 (600 x 2400 x 600)	525 (238.1)
150	191	**175**	210	110	**6SE7232–1EG00–3AB0**	G	36 x 95 x 24 (900 x 2400 x 600)	780 (353.7)
175	237	**200**	260	132	**6SE7232–6EG00–3AB0**	G	36 x 95 x 24 (900 x 2400 x 600)	780 (353.7)
200	287	**250**	315	160	**6SE7233–2EG00–3AB0**	G	36 x 95 x 24 (900 x 2400 x 600)	800 (362.8)
250	337	**300**	370	200	**6SE7233–7EG00–3AB0**	G	36 x 95 x 24 (900 x 2400 x 600)	840 (380.9)
350	464	**450**	510	250	**6SE7235–1EK00–3AB0**	K	60 x 95 x 24 (1500 x 2400 x 600)	1700 (771.0)
450	537	**500**	590	315	**6SE7236–0EK00–3AB0**	K	60 x 95 x 24 (1500 x 2400 x 600)	1700 (771.0)
500	628	**600**	690	400	**6SE7237–0EK00–3AB0**	K	60 x 95 x 24 (1500 x 2400 x 600)	1820 (825.4)
600	783	**700**	860	500	**6SE7238–6EL00–3AB0**	L	72 x 95 x 24 (1800 x 2400 x 600)	2300 (1043.1)
700	875	**800**	1000	630	**6SE7241–0EN00–3AB0**	N	108 x 95 x 24 (2700 x 2400 x 600)	3000 (1360.5)
800	1000	**900**	1100	630	**6SE7241–1EN00–3AB0**	N	108 x 95 x 24 (2700 x 2400 x 600)	3000 (1360.5)
900	1075	**1000**	1183	710	**6SE7241–2EU00–3AB0**	U	144 x 95 x 24 (3600 x 2400 x 600)	4000 (1814.1)
1000	1183	**1100**	1300	710	**6SE7241–3EU00–3AB0**	U	144 x 95 x 24 (3600 x 2400 x 600)	4000 (1814.1)

1) Check the actual motor current before guaranteeing final **HP** capability.

2) Units can run continuously at the listed I_G rating with 50 % additional load capability available for a maximum of 1 minute.

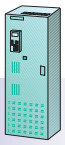
3) The I_N rating is 100 % continuous, with no anticipated overload capability (typically fans, pumps, etc.). Drives running at current levels below I_N have the capability to run 135 % current for **up to** one minute, with a maximum duty cycle of 300 s.

4) HP ratings are based on 460 V AC.

5) Motor currents vary by **type/speed** and manufacturer. Motor currents must be verified to ensure variable torque rating is not exceeded.

6) NEMA 1 enclosure and door-mounted OP1S are standard on all 6SE72 units.

Basic Enclosure[6]	Dimension drawing, see Section 7	Nominal dimensions W x H x D	Weight approx.	Mounted units
Order No.	Cabinet size	inches (mm)	lb (kg)	Order No.
				6SE7031–0EE60
				6SE7031–2EF60
				6SE7031–5EF60
				6SE7031–8EF60
6SE7232–1EF00–3AB0	F	24 x 95 x 24 (600 x 2400 x 600)	720 (326.5)	6SE7032–1EG60
6SE7232–6EF00–3AB0	F	24 x 95 x 24 (600 x 2400 x 600)	720 (326.5)	6SE7032–6EG60
6SE7233–2EF00–3AB0	F	24 x 95 x 24 (600 x 2400 x 600)	740 (335.7)	6SE7033–2EG60
6SE7233–7EF00–3AB0	F	24 x 95 x 24 (600 x 2400 x 600)	740 (335.7)	6SE7033–7EG60
6SE7235–1EG00–3AB0	G	36 x 95 x 24 (900 x 2400 x 600)	1350 (612.2)	6SE7035–1EK60
6SE7236–0EG00–3AB0	G	36 x 95 x 24 (900 x 2400 x 600)	1350 (612.2)	6SE7036–0EK60
6SE7237–0EG00–3AB0	G	36 x 95 x 24 (900 x 2400 x 600)	1470 (666.6)	6SE7037–0EK60
6SE7238–6EK00–3AB0	K	60 x 95 x 24 (1500 x 2400 x 600)	2250 (1020.4)	6SE7041–0EH85–0AA0 6SE7038–6TK60
6SE7241–0EL00–3AB0	L	72 x 95 x 24 (1800 x 2400 x 600)	2600 (1179.1)	6SE7041–3EK85–0AA0 6SE7041–1TK60
6SE7241–1EL00–3AB0	L	72 x 95 x 24 (1800 x 2400 x 600)	2600 (1179.1)	6SE7041–3EK85–0AA0 6SE7041–1TK60
6SE7241–2ET00–3AB0	T	108 x 95 x 24 (2700 x 2400 x 600)	3600 (1632.6)	6SE7041–8EK85–0AA0 6SE7041–3TL60
6SE7241–3ET00–3AB0	T	108 x 95 x 24 (2700 x 2400 x 600)	3600 (1632.6)	6SE7041–8EK85–0AA0 6SE7041–3TL60



Mounted option selection 380 V to 460 V AC

Selection and ordering data

Nominal power rating[1][4] CT	Base load current[2]	Nominal power rating[1][4][5] VT	Rated current[3]	Nominal power rating	**Standard Enclosure**[6]	**Input device** – C/B **or** fused switch[7][8]		
						Input circuit breaker	**Fused disconnect switch**	**Fuses for disconnect switch**
	I_G		I_N					
HP (460 V AC)	A	HP (460 V AC)	A	kW (400 V AC)	Order No.			
Supply voltage 380 V to 460 V AC								
60	84	**75**	92	45	**6SE7231–0EF00–3AB0**	Q50-B-100	Q54-B-125	Q56-A-100
75	113	**100**	124	55	**6SE7231–2EF00–3AB0**	Q50-B-125	Q54-B-250	Q56-A-150
100	133	**125**	146	75	**6SE7231–5EF00–3AB0**	Q50-B-200	Q54-B-250	Q56-A-175
125	169	**150**	186	90	**6SE7231–8EF00–3AB0**	Q50-B-200	Q54-B-250	Q56-A-200
150	191	**175**	210	110	**6SE7232–1EG00–3AB0**	Q50-B-300	Q54-B-400	Q56-A-250
175	237	**200**	260	132	**6SE7232–6EG00–3AB0**	Q50-B-300	Q54-B-400	Q56-A-300
200	287	**250**	315	160	**6SE7233–2EG00–3AB0**	Q50-B-480	Q54-B-400	Q56-A-350
250	337	**300**	370	200	**6SE7233–7EG00–3AB0**	Q50-B-480	Q54-B-600	Q56-A-450
350	464	**450**	510	250	**6SE7235–1EK00–3AB0**	Q50-B-480	Q54-B-600	Q56-A-500
450	537	**500**	590	315	**6SE7236–0EK00–3AB0**	Q50-B-600	Q54-B-800	Q56-A-750
500	628	**600**	690	400	**6SE7237–0EK00–3AB0**	Q50-B-960	Q54-B-1200	Q56-A-800
600	782	**700**	860	500	**6SE7238–6EL00–3AB0**	Q50-B-960	Q54-B-1200	Q56-A-900
700	875	**800**	1000	630	**6SE7241–0EN00–3AB0**	Q50-B-1280	Q54-B-1600	Q56-A-1200
800	1000	**900**	1100	630	**6SE7241–1EN00–3AB0**	Q50-B-1280	Q54-B-1600	Q56-A-1350
900	1075	**1000**	1183	710	**6SE7241–2EU00–3AB0**	Q50-B-1280	Q54-B-1600	Q56-A-1350
1000	1183	**1100**	1300	710	**6SE7241–3EU00–3AB0**	Q50-B-1600	Q54-B-1600	Q56-A-1600

Standard enclosure

1) Check the actual motor current before guaranteeing final **HP** capability.

2) Units can run continuously at the listed I_G rating with 50 % additional load capability available for a maximum of 1 minute.

3) The I_N rating is 100 % continuous, with no anticipated overload capability (typically fans, pumps, etc.). Drives running at current levels below I_N have the capability to run 135 % current for **up to** one minute, with a maximum duty cycle of 300 s.

4) HP ratings are based on 460 V AC.

5) Motor currents vary by **type/speed** and manufacturer. Motor currents must be verified to ensure variable torque rating is not exceeded.

6) NEMA 1 enclosure and door-mounted OP1S are standard on all 6SE72 units.

7) For either option, semiconductors fuses are provided additionally as standard.

8) Only one of these options can be mounted in the enclosure size indicated. For more than one of these options, an add-on enclosure is required. Refer to factory for dimensions.

Reactor – input **or** output[8]			Contactor – input **or** output[8]		3 Contactor bypass	
Input line reactor		Output reactor	Input contactor	Output contactor	Manual	Isolated
3 %	5 %					
Q64-A-125-4	Q64-B-125-4	Q65-A-507	Q59-A-100	Q58-A-100	Q63-B-100	Q63-C-100
Q64-A-200-4	Q64-B-200-4	Q65-A-508	Q59-A-150	Q58-A-150	Q63-B-150	Q63-C-150
Q64-A-200-4	Q64-B-200-4	Q65-A-508	Q59-A-150	Q58-A-150	Q63-B-200	Q63-C-200
Q64-A-200-4	Q64-B-250-4	Q65-A-509	Q59-A-200	Q58-A-200	Q63-B-200	Q63-C-200
Q64-A-300-4	Q64-B-300-4	Q65-A-510	Q59-A-260	Q58-A-260	Q63-B-300	Q63-C-300
Q64-A-300-4	Q64-B-400-4	Q65-A-510	Q59-A-260	Q58-A-260	Q63-B-350	Q63-C-350
Q64-A-400-4	Q64-B-500-4	Q65-A-511	Q59-A-400	Q58-A-400	Q63-B-480	Q63-C-480
Q64-A-400-4	Q64-B-500-4	Q65-A-512	Q59-A-400	Q58-A-400	Q63-B-480	Q63-C-480
Q64-A-600-4	Q64-B-700-4	Q65-A-513	Q59-A-630	Q58-A-630	Q63-B-600	Q63-C-600
Q64-A-900-4	Q64-B-900-4	Q65-A-514	Q59-A-630	Q58-A-630	Q63-B-700	Q63-C-700
Q64-A-900-4	Q64-B-900-4	Q65-A-514	Q59-A-820	Q58-A-820		
Q64-A-1000-4	Q64-B-1230-4	Q65-A-515	Q59-A-1350	Q58-A-1350		
Q64-A-1580-4	Q64-B-1580-4					
Q64-A-1580-4	Q64-B-1580-4					
Q64-A-1580-4	Q64-B-1580-4					
Q64-A-1580-4	Q64-B-1580-4					

Standard enclosure
Add-on enclosure

NEMA 1 cabinet selection
500 V to 575 V AC

Selection and ordering data

Nominal power rating[1][4] CT	Base load current[2]	Nominal power rating[1][4][5] VT	Rated current[3]	Nominal power rating	**Standard Enclosure**[6]	Dimension drawing, see Section 7	Nominal dimensions W x H x D	Weight approx.
	I_G		I_N					
HP (575 V AC)	A	HP (575 V AC)	A	kW (500 V AC)	Order No.	Cabinet size	inches (mm)	lb (kg)
Supply voltage 500 V to 575 V AC								
50	56	**60**	61	37	**6SE7226–1FF00–3AB0**	F	24 x 95 x 24 (600 x 2400 x 600)	500 (226.8)
	60		66	45	**6SE7226–6FF00–3AB0**	F	24 x 95 x 24 (600 x 2400 x 600)	500 (226.8)
60	72	**75**	79	55	**6SE7228–0FF00–3AB0**	F	24 x 95 x 24 (600 x 2400 x 600)	525 (238.1)
100	98	**100**	108	75	**6SE7231–1FF00–3AB0**	F	24 x 95 x 24 (600 x 2400 x 600)	525 (238.1)
	117	**125**	128	90	**6SE7231–3FG00–3AB0**	G	36 x 95 x 24 (900 x 2400 x 600)	780 (353.7)
150	142	**150**	156	110	**6SE7231–6FG00–3AB0**	G	36 x 95 x 24 (900 x 2400 x 600)	780 (353.7)
	174	**200**	192	132	**6SE7232–0FG00–3AB0**	G	36 x 95 x 24 (900 x 2400 x 600)	840 (380.9)
200	205	**250**	225	160	**6SE7232–3FG00–3AB0**	G	36 x 95 x 24 (900 x 2400 x 600)	840 (380.9)
250	270	**300**	297	200	**6SE7233–0FK00–3AB0**	K	60 x 95 x 24 (1500 x 2400 x 600)	1700 (771.0)
300	322	**350**	354	250	**6SE7233–6FK00–3AB0**	K	60 x 95 x 24 (1500 x 2400 x 600)	1700 (771.0)
400	411	**450**	452	315	**6SE7234–5FK00–3AB0**	K	60 x 95 x 24 (1500 x 2400 x 600)	1700 (771.0)
450	430	**500**	480	400	**6SE7234–8FL00–3AB0**	L	72 x 95 x 24 (1800 x 2400 x 600)	2300 (1043.1)
500	519	**600**	570	400	**6SE7235–7FL00–3AB0**	L	72 x 95 x 24 (1800 x 2400 x 600)	2300 (1043.1)
600	592	**700**	650	450	**6SE7236–5FL00–3AB0**	L	72 x 95 x 24 (1800 x 2400 x 600)	2400 (1088.4)
700	670	**800**	760	630	**6SE7237–6FL00–3AB0**	L	72 x 95 x 24 (1800 x 2400 x 600)	2400 (1088.4)
800	783	**900**	860	630	**6SE7238–6FL00–3AB0**	L	72 x 95 x 24 (1800 x 2400 x 600)	2400 (1088.4)
1000	983	**1100**	1080	800	**6SE7241–1FU00–3AB0**	U	144 x 95 x 24 (3600 x 2400 x 600)	4400 (1995.5)
1100	1119	**1250**	1230	900	**6SE7241–2FU00–3AB0**	U	144 x 95 x 24 (3600 x 2400 x 600)	4450 (2018.1)

1) Check the actual motor current before guaranteeing final **HP** capability.

2) Units can run continuously at the listed I_G rating with 50 % additional load capability available for a maximum of 1 minute.

3) The I_N rating is 100 % continuous, with no anticipated overload capability (typically fans, pumps, etc.). Drives running at current levels below I_N have the capability to run 135 % current for **up to** one minute, with a maximum duty cycle of 300 s.

4) HP ratings are based on 575 V AC.

5) Motor currents vary by **type/speed** and manufacturer. Motor currents must be verified to ensure variable torque rating is not exceeded.

6) NEMA 1 enclosure and door-mounted OP1S are standard on all 6SE72 units.

Basic Enclosure[6]	Dimension drawing, see Section 7	Nominal dimensions W x H x D	Weight approx.	Mounted units
Order No.	Cabinet size	inches (mm)	lb (kg)	Order No.
				6SE7026–1FE60
				6SE7026–6FE60
				6SE7028–0FF60
				6SE7031–1FF60
6SE7231–3FF00–3AB0	F	24 x 95 x 24 (600 x 2400 x 600)	720 (326.5)	6SE7031–3FG60
6SE7231–6FF00–3AB0	F	24 x 95 x 24 (600 x 2400 x 600)	720 (326.5)	6SE7031–6FG60
6SE7232–0FF00–3AB0	F	24 x 95 x 24 (600 x 2400 x 600)	780 (353.7)	6SE7032–0FG60
6SE7232–3FF00–3AB0	F	24 x 95 x 24 (600 x 2400 x 600)	780 (353.7)	6SE7032–3FG60
6SE7233–0FG00–3AB0	G	36 x 95 x 24 (900 x 2400 x 600)	1350 (612.2)	6SE7033–0FK60
6SE7233–6FG00–3AB0	G	36 x 95 x 24 (900 x 2400 x 600)	1350 (612.2)	6SE7033–5FK60
6SE7234–5FG00–3AB0	G	36 x 95 x 24 (900 x 2400 x 600)	1350 (612.2)	6SE7034–5FK60
6SE7234–8FK00–3AB0	K	60 x 95 x 24 (1500 x 2400 x 600)	2250 (1020.4)	6SE7037–7FH85–0AA0 6SE7035–7UK60
6SE7235–7FK00–3AB0	K	60 x 95 x 24 (1500 x 2400 x 600)	2250 (1020.4)	6SE7037–7FH85–0AA0 6SE7035–7UK60
6SE7236–5FK00–3AB0	K	60 x 95 x 24 (1500 x 2400 x 600)	2350 (1065.8)	6SE7041–0FH85–0AA0 6SE7036–5UK60
6SE7237–6FK00–3AB0	K	60 x 95 x 24 (1500 x 2400 x 600)	2350 (1065.8)	6SE7041–0FH85–0AA0 6SE7038–6UK60
6SE7238–6FK00–3AB0	K	60 x 95 x 24 (1500 x 2400 x 600)	2350 (1065.8)	6SE7041–0FH85–0AA0 6SE7038–6UK60
6SE7241–1FT00–3AB0	T	108 x 95 x 24 (2700 x 2400 x 600)	4000 (1814.1)	6SE7041–3FK85–0AA0 6SE7041–1UL60
6SE7241–2FT00–3AB0	T	108 x 95 x 24 (2700 x 2400 x 600)	4050 (1836.7)	6SE7041–5FK85–0AA0 6SE7041–2UL60

Selection and ordering data for options

Nominal power rating[1][4] CT	Base load current[2]	Nominal power rating[1][4][5] VT	Rated current[3]	Nominal power rating	**Standard Enclosure**[6]	**Input device** – C/B **or** fused switch[7][8]		
						Input circuit breaker	**Fused disconnect switch**	**Fuses for disconnect switch**
HP (575 V AC)	A	HP (575 V AC)	A	kW (500 V AC)	Order No.			
Supply voltage 500 V to 575 V AC								
50	56	**60**	61	37	**6SE7226–1FF00–3AB0**	Q50-B-075	Q54-B-100	Q56-A-080
	60		66	45	**6SE7226–6FF00–3AB0**	Q50-B-100	Q54-B-100	Q56-A-100
60	72	**75**	79	55	**6SE7228–0FF00–3AB0**	Q50-B-100	Q54-B-125	Q56-A-125
100	98	**100**	108	75	**6SE7231–1FF00–3AB0**	Q50-B-125	Q54-B-125	Q56-A-150
	117	**125**	128	90	**6SE7231–3FG00–3AB0**	Q50-B-200	Q54-B-250	Q56-A-175
150	142	**150**	156	110	**6SE7231–6FG00–3AB0**	Q50-B-200	Q54-B-250	Q56-A-200
	174	**200**	192	132	**6SE7232–0FG00–3AB0**	Q50-B-200	Q54-B-400	Q56-A-250
200	205	**250**	225	160	**6SE7232–3FG00–3AB0**	Q50-B-300	Q54-B-400	Q56-A-300
250	270	**300**	297	200	**6SE7233–0FK00–3AB0**	Q50-B-300	Q54-B-400	Q56-A-400
300	322	**350**	354	250	**6SE7233–6FK00–3AB0**	Q50-B-480	Q54-B-600	Q56-A-450
400	411	**450**	452	315	**6SE7234–5FK00–3AB0**	Q50-B-480	Q54-B-600	Q56-A-600
450	430	**500**	480	400	**6SE7234–8FL00–3AB0**	Q50-B-480	Q54-B-600	Q56-A-600
500	519	**600**	570	400	**6SE7235–7FL00–3AB0**	Q50-B-600	Q54-B-800	Q56-A-750
600	592	**700**	650	450	**6SE7236–5FL00–3AB0**	Q50-B-960	Q54-B-800	Q56-A-900
700	670	**800**	760	630	**6SE7237–6FL00–3AB0**	Q50-B-960	Q54-B-1200	Q56-A-1200
800	783	**900**	860	630	**6SE7238–6FL00–3AB0**	Q50-B-960	Q54-B-1200	Q56-A-1200
1000	983	**1100**	1080	800	**6SE7241–1FU00–3AB0**	Q50-B-1280	Q54-B-1600	Q56-A-1350
1100	1119	**1250**	1230	900	**6SE7241–2FU00–3AB0**	Q50-B-1280	Q54-B-1600	Q56-A-1600

Standard enclosure

1) Check the actual motor current before guaranteeing final **HP** capability.

2) Units can run continuously at the listed I_G rating with 50 % additional load capability available for a maximum of 1 minute.

3) The I_N rating is 100 % continuous, with no anticipated overload capability (typically fans, pumps, etc.). Drives running at current levels below I_N have the capability to run 135 % current for **up to** one minute, with a maximum duty cycle of 300 s.

4) HP ratings are based on 575 V AC.

5) Motor currents vary by **type/speed** and manufacturer. Motor currents must be verified to ensure variable torque rating is not exceeded.

6) NEMA 1 enclosure and door-mounted OP1S are standard on all 6SE72 units.

7) For either option, semiconductors fuses are provided additionally as standard.

8) Only one of these options can be mounted in the enclosure size indicated. For more than one of these options, an add-on enclosure is required. Refer to factory for dimensions.

Reactor – input **or** output[8]			Contactor – input **or** output[8]		3 Contactor bypass	
Input line reator		Output reactor	Input contactor	Output contactor	Manual	Isolated
3 %	5 %					
Q64-A-60-6	Q64-B-60-6	Q65-A-521	Q59-A-100	Q58-A-070	Q63-B-070	Q63-C-070
Q64-A-75-6	Q64-B-75-6	Q65-A-522	Q59-A-100	Q58-A-100	Q63-B-100	Q63-C-100
Q64-A-125-6	Q64-B-125-6	Q65-A-523	Q59-A-100	Q58-A-150	Q63-B-125	Q63-C-125
Q64-A-125-6	Q64-B-125-6	Q65-A-523	Q59-A-150	Q58-A-150	Q63-B-125	Q63-C-125
Q64-A-125-6	Q64-B-200-6	Q65-A-524	Q59-A-150	Q58-A-200	Q63-B-200	Q63-C-200
Q64-A-200-6	Q64-B-200-6	Q65-A-524	Q59-A-200	Q58-A-200	Q63-B-200	Q63-C-200
Q64-A-200-6	Q64-B-200-6	Q65-A-525	Q59-A-200	Q58-A-200	Q63-B-250	Q63-C-250
Q64-A-300-6	Q64-B-250-6	Q65-A-525	Q59-A-260	Q58-A-260	Q63-B-300	Q63-C-300
Q64-A-300-6	Q64-B-400-6	Q65-A-526	Q59-A-400	Q58-A-400	Q63-B-350	Q63-C-350
Q64-A-400-6	Q64-B-400-6	Q65-A-527	Q59-A-400	Q58-A-400	Q63-B-480	Q63-C-480
Q64-A-600-6	Q64-B-500-6	Q65-A-528	Q59-A-630	Q58-A-630	Q63-B-500	Q63-C-500
Q64-A-600-6	Q64-B-700-6	Q65-A-529	Q59-A-630	Q58-A-630	Q63-B-700	Q63-C-700
Q64-A-600-6	Q64-B-700-6	Q65-A-529	Q59-A-630	Q58-A-630	Q63-B-700	Q63-C-700
Q64-A-900-6	Q64-B-700-6	Q65-A-530	Q59-A-820	Q58-A-820		
Q64-A-900-6	Q64-B-900-6	Q65-A-531	Q59-A-820	Q58-A-820		
Q64-A-900-6	Q64-B-900-6	Q65-A-531	Q59-A-1350	Q58-A-1350		
Q64-A-1080-6	Q64-B-1230-6					
Q64-A-1580-6	Q64-B-1230-6					

Standard enclosure
Add-on enclosure

Option Boards

Option boards	Description	Order No.	Option code	Remark
		Loose	Mounted and wired	
LBA	Local Bus Adapter	6SE7090–084–4HA0	**N27**	
ADB	Adapter Board (Carrier)	6SX7010–0KA00	**N91**	
CBP2	Communication Board Profibus DP	6SX7010–0FF05	**N85**	
CBC	Communication Board CANbus	6SX7010–0FG00	**N86**	
CBD	Communication Board DeviceNet	6SX7010–0FK00	**N92**	
SLB	SIMOLINK	6SX7010–0FJ00		
SCB1	Serial Communication Board 1	6SE7090–0XX84–0BC0	**N76**	Requires option N27
SCB2	Serial Communication Board 2	6SE7090–0XX84–0BD1	**N77**	Requires option N27
SCI1	Serial I/O Interface Module	6SE7090–0XX84–3EA0	**Q08**	Requires option N76 and N27
SCI2	Serial I/O Interface Module	6SE7090–0XX84–3EF0	**Q09**	Requires option N76 and N27
EB1	Expansion Board 1	6SX7010–0KB00	**N88**	
EB2	Expansion Board 2	6SX7010–0KC00	**N89**	
SBP	Sensor Board Pulse	6SX7010–0FA00	**N93**	
	120 V Signal Converter	A1–108–100–823	**Q12–A–005**	Requires option N89
ATI	Analog Tachometer Interface	6SE7090–0XX84–3DF0	**N36**	
DTI	Digital Tachometer Interface	6SE7090–0XX84–3DB0	**N37**	
TSY	Synchronizing Board	6SE7090–0XX84–0BA0	**N28**	Requires option N27
T300	Technology Board (w/o software)	6SE7090–0XX87–4AH0	**N30–300**	Requires option N27
T300	Technology Board – Center Winder	6SE7098–2XX84–0AH0	**N30–320**	Requires option N27
T300	Technology Board – Angular Synchronization	6SE7098–4XX84–0AH0	**N30–340**	Requires option N27
T300	Technology Board – Multi-Drive Load Share	6SE7098–6XX84–0AH0	**N30–360**	Requires option N27
T300	Technology Board – Linear Position	6SE7098–8XX84–0AH0	**N30–380**	Requires option N27
T400	Technology Board – (w/o software)	6DD1–606–0AD0	**N90–400**	Requires option N27
T400	Technology Board – w/ Axial Winder	6DD1–842–0AA0	**N90–420**	Requires option N27
T400	Technology Board – w/ Angular Synchronization	6DD1–842–0AB0	**N90–440**	Requires option N27
T400	Technology Board – w/ Cut to Length	6DD1–842–0AC0	**N90–450**	Requires option N27

Input reactor options

An input reactor can be used to reduce the level of harmonic distortion injected on the line and reduces the sensitivity of the VFD to voltage spikes in the network, serving as a buffer against rapid rises of current from the line to the DC link.

A 3 % inductor primarily improves the sensitivity of the VFD to voltage spikes, as well as assuring the minimum current form factor.

A 5 % inductor provides additional effective harmonic filtering, that in many cases satisfies the recommended practices and requirements of IEEE 519-1992.

Nominal power rating		Input line reactor Mounted and wired	
CT	VT	3 %	5 %
HP	HP	Order No.	Order No.
Input voltage 3-ph. 380 V to 460 V AC			
60	60/75	**Q64–A–125–4**	**Q64–B–125–4**
75	100	**Q64–A–200–4**	**Q64–B–200–4**
100	125	**Q64–A–200–4**	**Q64–B–200–4**
125	150	**Q64–A–200–4**	**Q64–B–250–4**
150	200	**Q64–A–300–4**	**Q64–B–400–4**
200	250	**Q64–A–400–4**	**Q64–B–500–4**
250	300	**Q64–A–400–4**	**Q64–B–500–4**
300	350	**Q64–A–600–4**	**Q64–B–700–4**
350	400	**Q64–A–600–4**	**Q64–B–700–4**
400	450	**Q64–A–600–4**	**Q64–B–900–4**
500	600	**Q64–A–900–4**	**Q64–B–900–4**
600	700	**Q64–A–1000–4**	**Q64–B–1230–4**
700 – 1000	800 – 1100	**Q64–A–1580–4**	**Q64–B–1580–4**
Input voltage 3-ph. 575 V AC			
50	60	**Q64–A–60–6**	**Q64–B–60–6**
60	75	**Q64–A–75–6**	**Q64–B–75–6**
75	100	**Q64–A–125–6**	**Q64–B–125–6**
100	125	**Q64–A–125–6**	**Q64–B–125–6**
125	150	**Q64–A–125–6**	**Q64–B–200–6**
150	200	**Q64–A–200–6**	**Q64–B–200–6**
200	250	**Q64–A–300–6**	**Q64–B–250–6**
250	300	**Q64–A–300–6**	**Q64–B–400–6**
300	350	**Q64–A–400–6**	**Q64–B–400–6**
400	450	**Q64–A–600–6**	**Q64–B–500–6**
450	500	**Q64–A–600–6**	**Q64–B–700–6**
500	600	**Q64–A–600–6**	**Q64–B–700–6**
600	700	**Q64–A–900–6**	**Q64–B–700–6**
700	800	**Q64–A–900–6**	**Q64–B–900–6**
800	900	**Q64–A–900–6**	**Q64–B–900–6**
900 – 1000	1000 –1100	**Q64–A–1080–6**	–
900 – 1100	1000 –1250	–	**Q64–B–1230–6**
1100 – 1500	1250 – 1600	**Q64–A–1580–6**	–
1250 – 1500	1300 – 1600	–	**Q64–B–1580–6**

Note: Input reactors are designed for the listed voltages above.
For special voltages, please contact factory.

Output reactor options

Output reactor

Output reactors may be used to reduce current and voltage harmonics and may be required in applications utilizing long motor leads. The voltage rise is limited to less than 500 V/microsecond when using an output reactor.

Nominal power rating CT	VT	Max. frequency[1]	Output reactor Mounted and wired
HP	HP	Hz	Order No.
Output voltage 3-ph. 380 V to 460 V AC			
60	**75**	90	**Q65–A–507**
75	**100**	90	**Q65–A–508**
100	**125**	90	**Q65–A–508**
125	**150**	90	**Q65–A–509**
150	**200**	90	**Q65–A–510**
200	**250**	90	**Q65–A–511**
250	**300**	90	**Q65–A–512**
300	**350**	90	**Q65–A–513**
350	**400**	90	**Q65–A–513**
400	**500**	90	**Q65–A–514**
500	**600**	90	**Q65–A–514**
600	**700**	90	**Q65–A–515**
Output voltage 3-ph. 500 V to 575 V AC			
50	**60**	90	**Q65–A–521**
60	**75**	90	**Q65–A–522**
75	**100**	90	**Q65–A–523**
100	**125**	90	**Q65–A–523**
125	**150**	90	**Q65–A–524**
150	**200**	90	**Q65–A–524**
200	**200**	90	**Q65–A–525**
250	**300**	90	**Q65–A–526**
300	**350**	90	**Q65–A–527**
350	**400**	90	**Q65–A–528**
400	**500**	90	**Q65–A–528**
500	**600**	90	**Q65–A–529**
600	**700**	90	**Q65–A–530**
700	**800**	90	**Q65–A–531**
800	**900**	90	**Q65–A–531**

1) Consult factory for sizing of output reactors with higher rated output frequency.

Circuit breaker options

The AC input breakers offered are Siemens circuit breakers with thermal trip mechanisms which provide short-circuit protection and maintenance isolation. Its interrupting capacity is selected for a minimum short-circuit level of 14 kA at 480 V, or another standard value near 33 times the nominal input current of the VFD, whichever is higher.

In cases where the fault level at the point of connection is greater than these levels, additional fusing is recommended and provided in order to safely interrupt short-circuits within the VFD enclosure. The circuit breaker is mounted inside, with an external operator handle.

The circuit breaker should be based on:

- The motor's or drive's maximum rated continuous current. Refer to the option code selection table.
- Reaction time, a breaker typically requires more than 4 milliseconds to open.
- Coordination of the breaker's trip characteristics with upstream and downstream devices.
- If the coordination is not adequate, consider using a combination of fuses/fusible disconnect/breakers.
- Breaker interrupting ratings. See table.

Drive circuit breaker for floor mount units (including external vertical operating handle)

Nominal power rating 460 V		575 V		Mounted and wired
CT	VT	CT	VT	
HP	HP	HP	HP	Order No.
40/50	40/50	50	60	**Q50–B–075**
60	60/75	60	75	**Q50–B–100**
75	100	75/100	100/125	**Q50–B–125**
100/125	125/150	125/150	150/200	**Q50–B–200**
150	200	200/250	250/300	**Q50–B–300**
200 – 350	250 – 400	300 – 450	350 – 500	**Q50–B–480**
400/450	450/500	500	600	**Q50–B–600**
500/600	600/700	600 – 800	700 – 900	**Q50–B–960**
700 – 900	800 – 1000	900 – 1250	1000 – 1300	**Q50–B–1280**
1000	1100	1300 – 1500	1400 – 1600	**Q50–B–1600**

Circuit breakers are rated for across the line motor-start operation when the drive is bypassed. They have adjustable instantaneous magnetic trips that should enable the motor to start without nuisance tripping due to the motor inrush current. Adjusting the circuit breaker's magnetic trip allows an inrush current of up to 10 times the rated motor current.

In addition to the breaker's built-in overcurrent protection, the motor requires an external overcurrent relay per the Canadian Electric Code 28-308 and National Electric Code when a bypass option is used.

Shunt trip

Shunt trip units are used to trip a circuit breaker as required. Available options include SHUNT and UNDERVOLTAGE trips. If both are required, external provisions will have to be considered.

The selected cable lug meets the Canadian and National Electric codes for 75 °C cables. Rotary breaker handles can be padlocked OFF with up to 3 5/16" padlocks.

Breaker interrupting ratings

Line voltage	220/240 V AC	380/415/480 V AC	525/600 V AC
1 to 100 A	65 kA	25 kA	18 kA
101 to 200 A	65 kA	35 kA	18 kA
201 to 480 A	65 kA	35 kA	25 kA
481 to 640 A	65 kA	50 kA	25 kA

Description	Order No.
Circuit Breaker Shunt Trip 100 A Frame[1])	**Q51–A–100**
Circuit Breaker Shunt Trip 200 A Frame[1])	**Q51–A–200**
Circuit Breaker Shunt Trip 480 A Frame[1])	**Q51–A–480**
Circuit Breaker Shunt Trip 1600 A Frame[1])	**Q51–A–1600**

1) This option requires a 120 V AC power source.

Fused disconnect switch

Fused disconnect switch

The fused input disconnect provides a mechanical means of disconnecting power to the VFD and overcurrent protection for the VFD.

Note:

This protection or equivalent may be required by NEC or local codes.

Fused disconnects are three-phase, 600 V AC, 50/60 Hz, CSA and UL-certified. Disconnects are rated for no-load operation, and are not to be operated (opened/closed) when the circuit is under load. The disconnects with fuses have short-circuit ratings of 100 kA symmetrical. Their rated ampere interrupting capabilities are shown in the following chart.

Disconnect switch with vertical handle

Max. nominal power rating 460 V		575 V		
CT	VT	CT	VT	
HP	HP	HP	HP	Order No.
3 – 50	3 – 50	3 – 60	3 – 75	**Q54–B–100**
60	60/75	75/100	100	**Q54–B–125**
75 – 125	100 – 150	125/150	125 – 200	**Q54–B–250**
150 – 200	200 – 250	200/250	200 – 300	**Q54–B–400**
250 – 350	300 – 400	300 – 450	350 – 500	**Q54–B–600**
400/450	450/500	500/600	600/700	**Q54–B–800**
500/600	600/700	700 – 900	800 – 1000	**Q54–B–1200**
700 – 1000	800 – 1100	1000 – 1300	1100 – 1400	**Q54–B–1600**

Note: Disconnect switches cannot be supplied without fuses.
ADD option Q56–A–xxx (input fuses – standard motor class) when ordering a disconnect switch.

Rated AC breaking currents at 0.35 power factor

Unit rating	30 A	60 A	100 A	200 A	400 A	600 A	800 A
500 V	256	500	800	3200	3200	5000	5000
600 V	256[1])	350	500	2400	3200	5000	5000

1) The power factor is 0.45.

Fuses for disconnect switches (continued)

Fuses selected in the disconnects are time-delay type HRC. These fuses provide branch-circuit protection to the input of the drive.

The disconnect selection should be based on:

- The motor's rated current for across-the-line operation or the drive's maximum rated current. Refer to the selection table.
- Coordination of the breaker's trip characteristics with upstream and downstream devices. If the coordination is not adequate, consider using a combination of fuses/fusible disconnect/breakers.
- Coordination of the fuse's time-current characteristics with upstream and downstream devices.

The cable lug selected meets the Canadian and National Electric codes for 75 °C cables.

NEMA-rated pistol handles can be padlocked OFF with up to three 1/4" padlocks.

The option codes do not include a switch enclosure.

An external overcurrent relay is required when used with motors in a bypass mode.

AC input fuses
Standard motor class

Max. nominal power rating 460 V		575 V		Mounted and wired
CT	VT	CT	VT	Option code
HP	HP	HP	HP	
40	40	50	60	**Q56–A–80**
50	50	–	–	**Q56–A–090**
–	–	60	75	**Q56–A–100**
60	60/75	75	–	**Q56–B–125**
–	–	100	100	**Q56–A–150**
75	100	125	125	**Q56–B–175**
100	125	150	150	**Q56–A–200**
125	150	–	200	**Q56–A–250**
150	–	200	250	**Q56–A–300**
–	200	–	–	**Q56–A–350**
200	250	250	300	**Q56–A–400**
–	–	300	350	**Q56–A–450**
250	300	350	400	**Q56–A–500**
300/350	350/400	400/450	450/500	**Q56–A–600**
400	450	–	–	**Q56–A–650**
–	–	500	600	**Q56–A–750**
450	500	–	–	**Q56–A–800**
500	600	600	700	**Q56–A–900**
600	700	700/800	800/900	**Q56–A–1200**
700	800	900/1000	1000/1100	**Q56–A–1350**
800/900	900/1000	–	–	**Q56–A–1500**
–	–	1100/1250	1250/1300	**Q56–A–1600**
1000	1100	1300/1400	1400/1500	**Q56–A–1800**
–	–	1500	1600	**Q56–A–2000**

Fuses selected with the disconnect:

All fuses are HRCI-J (HRC-L for fuses greater than 600 A). All fuses have:

- Ratings for 600 V AC (and less)
- Interrupting rating 200 kA RMS Sym. but the short-circuit rating of the disconnects with fuses is 100 kA
- Certification to CSA Standard C22.2 No. 106-M1985 and UL Standard 198C
- The time delay fuses allow 500 % ampere rating for 10 seconds minimum.

Contactor options

Input contactor

An input contactor is offered to disconnect the incoming AC line voltage from the MASTERDRIVES 6SE70.

Its use is recommended for the highest degree of protection in the case of faults detected by the VFD. The VFD then has the ability to isolate itself from the network for any fault event.

An input contactor is also employed if a bypass option is selected in order to electrically isolate the VFD from the energized bypass circuit.

Max. nominal power rating 460 V		575 V		
CT	VT	CT	VT	
HP	HP	HP	HP	Order No.
50/60	50 – 75	50/75	60 – 100	**Q59–A–100**
75	100	100/125	125	**Q59–A–150**
100	125	150	150/200	**Q59–A–200**
125/150	125/200	200	250	**Q59–A–260**
200/250	250/300	250/300	300 – 400	**Q59–A–400**
300/450	350 – 500	400 – 500	450 – 600	**Q59–A–630**
500	600	600/700	700/800	**Q59–A–820**
600	700	800	900	**Q59–A–1350**

4

Output contactor

An output contactor is offered to disconnect the MASTERDRIVES 6SE70 from the motor.

Max. nominal power rating 460 V		575 V		
CT	VT	CT	VT	
HP	HP	HP	HP	Order No.
40	40	50	60	**Q58–A–070**
50/60	50 – 75	60	75	**Q58–A–100**
75/100	100/125	75/100	100/125	**Q58–A–150**
125	150	125/150	150/200	**Q58–A–200**
150	200	200	250	**Q58–A–260**
200/250	250/300	250/300	300/350	**Q58–A–400**
300 – 450	350 – 500	350 – 500	400 – 600	**Q58–A–630**
500	600	600/700	700/800	**Q58–A–820**
600	700	800	900	**Q58–A–1350**

Pulsed resistor braking

Pulsed resistor braking options

The pulsed resistor braking option converts regenerative energy into heat which is discharged through a bank of resistors. This method of power dissipation can be used to decrease the deceleration time associated with high inertia loads.

When specifying pulsed resistor braking, it is important to consider the duty cycle associated with the regenerative period. Refer to Section 6 for sizing information.

The pulsed resistor is controlled so that the increasing voltage of the DC bus during generator operation is limited to the maximum permissible value.

The chopper transistor (DC current controller) can be mounted in the drive enclosure or in the resistor enclosure, depending on the rating.

Dynamic braking controllers and external resistors

Braking with external resistor			Braking chopper control
P_{20}[1]	P_3[2]	P_D[3]	Mounted and wired chopper only
kW	kW	kW	Order No.
DC link voltage 510 V to 620 V DC (380 V to 460 V AC)			
20	30	5	**Q60–620C** **Q61–620C**
50	75	12.5	**Q60–620D** **Q61–620D**
100	150	25	**Q60–620E** **Q61–620E**
170	255	42.5	**Q60–620F** **Q61–620F**
DC link voltage 680 V to 780 V DC (500 V – 575 V AC)			
20	30	5	**Q60–780C** **Q61–780C**
50	75	12.5	**Q60–780D** **Q61–780D**
100	150	25	**Q60–780E** **Q61–780E**
200	300	50	**Q61–780F** **Q61–780F**

1) P_{20} = rated power
2) P_3 = peak power
3) P_D = steady state power rating

Bypass options

3 contactor manual transfer[1])

The 3 contactor manual switch transfer bypass option provides a means of bypassing the drive (using electrical contactors) and running the load directly across the line in the event of a drive failure.

The 3 contactor manual transfer bypass option does not provide drive isolation. The purchaser must ensure that sufficient system capability is available to allow acceleration of the load under direct online operation.

Nominal power rating 460 V AC		575 V AC		
CT	VT	CT	VT	
HP	HP	HP	HP	Order No.
–	–	50	60	**Q63–B–070**
50	50	–	–	**Q63–B–075**
60	60/75	60	75	**Q63–B–100**
–	–	75/100	100	**Q63–B–125**
75	100	–	125	**Q63–B–150**
100/125	125/150	125/150	150	**Q63–B–200**
–	–	–	200	**Q63–B–250**
150	–	200	250	**Q63–B–300**
–	200	250	300	**Q63–B–350**
250	300	300	350	**Q63–B–480**
–	–	350/400	400/450	**Q63–B–500**
300 – 400	350 – 450	–	–	**Q63–B–600**
450	500	450/500	500/600	**Q63–B–700**

3 contactor isolated transfer[1])

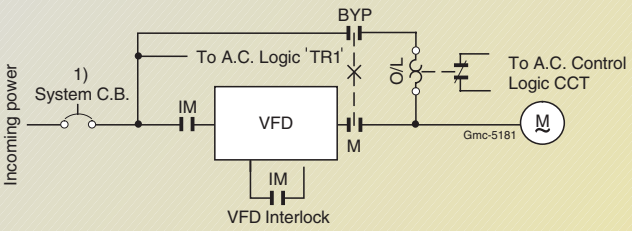
The 3 contactor isolated transfer bypass option provides a means of bypassing the drive, utilizing electrical contactors, and running the load directly across the line in the event of a drive failure.

The 3 contactor isolated transfer bypass option provides drive isolation by utilizing input and output disconnect switches. The purchaser must ensure that sufficient system capacity is available to allow acceleration of the load under direct online operation.

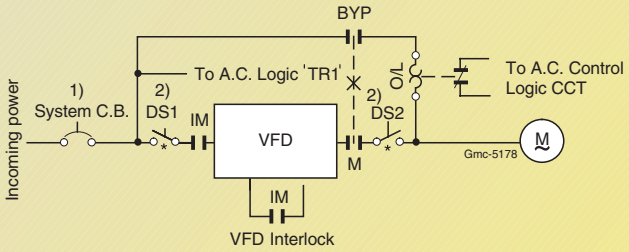
Nominal power rating 460 V AC		575 V AC		
CT	VT	CT	VT	
HP	HP	HP	HP	Order No.
–	–	50	60	**Q63–C–070**
50	50	60	75	**Q63–C–075**
60	60/75	75/100	100	**Q63–C–100**
–	–	–	125	**Q63–C–125**
75	100	–	–	**Q63–C–150**
100/125	125/150	125/150	150	**Q63–C–200**
–	–	–	200	**Q63–C–250**
150	–	200	250	**Q63–C–300**
–	200	250	300	**Q63–C–350**
250	300	300	350	**Q63–C–480**
–	–	350/400	400/450	**Q63–C–500**
300 – 400	350 – 450	–	–	**Q63–C–600**
450	500	450/500	500/600	**Q63–C–700**

1) This option requires an additional enclosure and a 115 V AC power source for control power.

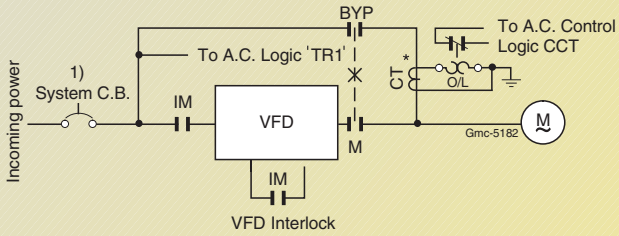
Bypass single line



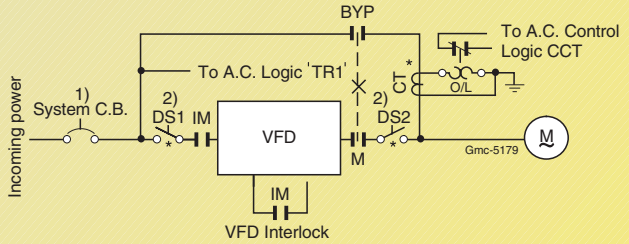
Q63B (less than 200 A) manual bypass single line



Q63C (less than 200 A) isolated bypass single line



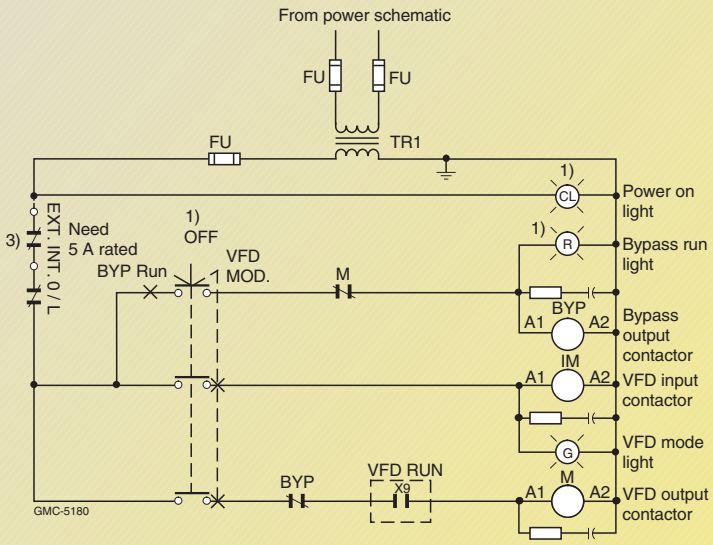
Q63B (greater than 200 A) manual bypass single line



Q63C (greater than 200 A) isolated bypass single line

Fig. 4/2

Bypass control circuit



Typical bypass control circuit

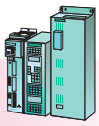
Fig. 4/3

1) By Siemens, door mounted
2) Panel mounted
3) By customer

* Do not turn DS1 or DS2 ON or OFF when system is running.

Vector Control
Documentation and Training

5



Documentation overview

The documentation for the SIMOVERT MASTERDRIVES units (converters, inverters, rectifier units and rectifier/regenerative units), along with options are supplied on a CD-ROM in electronic format. The most updated versions can also be downloaded from Siemens website. Printed documentation must be ordered separately.

The detailed description of the parameter list and control concepts as well as the corresponding explanations on the additionally available free function blocks which can be combined and connected as required via the BICO system, necessitate the documentation to be split up into two parts as follows:

- The **operating instructions** containing the information necessary for standard drives, without parameter list and without binector/connector lists. The operating instructions as printed version must be ordered separately and varies by individual unit type.
- The **Compendium** for converter and inverter units contains the detailed documentation for the software, including parameter list and binector/connector lists as well as block circuit diagrams for types of open-loop and closed-loop control and function blocks. The Compendium as printed version must be ordered separately and applies for all types of units.

The Compendium is necessary when

– additional signals, above and beyond those of the factory settings, are to be processed, i.e. if access has to be made to the parameter list

– the full range of functions of the converter software, including communication via fieldbus systems, is to be used

– additional inputs/outputs are used via the EB1 and EB2 expansion boards

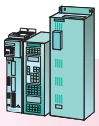
– the free function blocks are to be used. See page 6/32.

- The **CD-ROM** is included in the factory packaging of the MASTERDRIVES.

This contains:

– all operating instructions and the Compendium in the form of PDF files in all available languages except Japanese

– parameterization and diagnostics program DriveMonitor.



Compact PLUS units
Compact and chassis units

Documentation for Compact PLUS and compact and chassis units – Operating instructions

Converters and inverters

Type of unit	Size	Order No.
AC/AC Compact PLUS unit	P	**6SE708☐–☐JP60**
DC/AC Compact PLUS unit	P	**6SE708☐–☐KP60**
AC/AC compact unit	A to D	**6SE708☐–☐JD60**
AC/AC chassis unit	E to K	**6SE708☐–☐JK60**
DC/AC compact unit	A to D	**6SE708☐–☐KD60**
AC/AC chassis unit	E to Q	**6SE708☐–☐KN60**

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

Self-commutated Active Front End AFE

Type of unit	Size	Order No.
AC/DC compact unit German/English	A to D	**6SE7087–6KD80**
AC/DC chassis unit	E to G	**6SE708☐–☐CX86–2AA0**
AC/DC cabinet units	E to L	**6SE718☐–☐AX80–2AA0**

German	**0 0**
English	**7 6**
Italian	**7 2**
French	**7 7**
Spanish	**7 8**

Rectifier units

Type of unit	Size	Order No.
Compact PLUS unit	P	**6SE708☐–☐NP85–0AA0**
Compact unit	B and C	**6SE708☐–☐AC85–0AA0**
Chassis unit	E	**6SE708☐–☐AE85–0AA0**
Chassis unit	H and K	**6SE708☐–☐AK85–0AA0**

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

Rectifier/regenerative units

Type of unit	Size	Order No.
Compact and chassis units	C to K	**6SE708☐–☐AK85–1AA0**

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

System components

Components	Size	Order No.
Braking units	all	**6SE708☐–☐CX87–2DA1**
Radio-interference suppression filters	all	**6SE708☐–☐CX87–0FB0**
Sinusoidal filters	all	**6SE708☐–☐CX87–1FC0**
d*v*/d*t* filters	all	**6SE708☐–☐CX87–1FD0**

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

Electronics options

Electronics options	Language	Order No.
CBP2 communication board		**6SE708☐–☐NX84–0FF0**
CBC communication board		**6SE708☐–☐NX84–0FG0**
CBD communication board		**6SE708☐–☐NX84–0FK0**
SLB communication board		**6SE708☐–☐NX84–0FJ0**
EB1 expansion board 1		**6SE708☐–☐NX84–0KB0**
EB2 expansion board 2		**6SE708☐–☐NX84–0KC0**
SBP incremental encoder board		**6SE708☐–☐NX84–0FA0**
VSB voltage sensing board		**6SE708☐–☐NX84–1GA0**

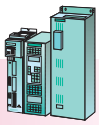
German / English	**7 6**
Italian / English	**7 2**
French / English	**7 7**
Spanish / English	**7 8**
Japanese	**8 0**

T100 technology board – Hardware description	Ge/En/It/Fr/Sp	**6SE7080–0CX87–0BB0**
T300 technology board – Hardware description	German / English French	**6SE7087–6CX84–0AH1** **6SE7087–7CX84–0AH1**
MS320 software module axial winder, for T300	German English	**6SE7080–0CX84–2AH1** **6SE7087–6CX84–2AH1**
Software module MS340 angular synchronous control, for T300	German English French	**6SE7080–0CX84–4AH1** **6SE7087–6CX84–4AH1** **6SE7087–7CX84–4AH1**
MS360 software module multi-motor drive, for T300	German English	**6SE7080–0CX84–6AH1** **6SE7087–6CX84–6AH1**
MS380 software module positioning control, for T300	German English	**6SE7080–0CX84–8AH1** **6SE7087–6CX84–8AH1**
MS 100 software module universal drive, for T100	German English	**6SE7080–0CX84–0BB1** **6SE7087–6CX84–0BB1**
Safe Stop Board SSB	Ge/En/It/Fr/Sp	**6SE7080–0AX87–1JB0**
SCB1, SCI1 and SCI2 interface boards		**6SE708☐–☐CX84–0BC0**
SCB2 interface board		**6SE708☐–☐CX84–0BD0**
TSY synchronizing board		**6SE708☐–☐CX84–0BA0**
DTI digital tachometer interface		**6SE708☐–☐CX84–3DB0**

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

5

Documentation for Compact PLUS and compact and chassis units



Compact PLUS units
Compact and chassis units

Operating instruction library

The file is to be regarded as reference documentation and includes operating instructions for the following components:

- Converters
- Inverters
- Rectifier units[1])
- Rectifier/regenerative units
- Braking units[1])
- Output filters[1])
- Radio-interference suppression filters[1])
- SCB/SCI/DTI/TSY/EB1/EB2 interface boards
- SBP incremental encoder board
- CBP/CBP2 communication boards (PROFIBUS DP)
- CBC communication board (CAN)
- SLB communication board (SIMOLINK)
- OP1S operator control panel

The operating instructions contain a description of the basic functions and installation and start-up instructions.

Language	Order No.
Collected operating instructions	
German / English	**6SE7087–6NX60**
Italian / English	**6SE7087–2NX60**
French / English	**6SE7087–7NX60**
Spanish / English	**6SE7087–8NX60**

Compendium

The Compendium contains the following:

- System description
- Configuration and connection examples
- EMC guidelines
- Function blocks and parameters
- Parameterization
- Parameterizing steps
- Functions
- Process data
- Communication
  SCOM 1/2 interfaces
  USS protocol
  PROFIBUS DP
  CAN
  SIMOLINK
- Annex
  Function diagrams
  Binector list
  Connector list
  Parameter list
  Faults and alarms list.

Language	Order No.
Compendium	
English	**6SE7087–6QX60**
German	**6SE7080–0QX60**
Italian	**6SE7087–2QX60**
French	**6SE7087–7QX60**
Spanish	**6SE7087–8QX60**

Siemens safety engineering

Application manual "Safety Integrated"

The application manual "Safety Integrated" illustrates using technical explanations and application examples how dangers in the use of electric and electronic devices can be prevented or eliminated.

The complete CD-ROM about the safety system

The CD-ROM "Safety Integrated" offers a comprehensive overview of safety technology and the widest range of safety components, embedded at the same time in the standard world of automation.

Language	Order No.
Application manual	
German	**6ZB5000–0AA01–0BA0**
English	**6ZB5000–0AA02–0BA0**
CD-ROM "Safety Integrated"	
German/English	**E20001–D10–M103–X–7400**

1) This documentation is available in French, Spanish and Italian only, i.e. not French/English, Spanish/English, Italian/English.

Training Center

Training Centers are located all over the world and provide a range of training courses for SIMOVERT MASTERDRIVES. The contents of the courses can be customized and the courses can also be conducted on the customer's premises.

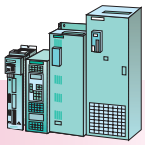
The Customer Training organization provides a wide variety of educational services and products. A dedicated staff of professional instructors and a large investment in hands-on equipment ensures quality results for your training investment.

How to register

Three ways to register:

- by phone: 800.241.4453
- online: **www.sea.siemens.com/training**
- contact your local Siemens Technology Center (distributor)

Fig. 5/1
Training Center



6SE70 CUVC Setup/Maintenance Training Course

General Information

Course code: DVS70M1C
Length: $4^1/_2$ days

Audience

This course is for engineering and maintenance personnel responsible for installing, maintaining, and troubleshooting drive systems that utilize the 6SE70VC AC Drive base unit.

Prerequisites

- STEP 2000 Basics of AC Drives

  For online STEP 2000 courses see: http://www.sea.siemens.com/step

Profile

This course provides the knowledge and skills necessary to set up and maintain the operation of the 6SE70VC "Base Unit." An analysis of the required hardware and the relationship between the various operational components is presented at the beginning of the course. Standard AC motor data and the relationship of this information as applied to the standard features of the drive are discussed. The minimum required steps to properly se tup the drive as well as additional application dependent steps are also presented. The basic operation of the converter and inverter with the corresponding input and output signals are discussed. The course covers analog and digital I/O usage and configuration. A working knowledge of the "Base Drive" communications capabilities is provided.

The course also covers the extensive diagnostic capabilities of the drive. Interpretation of fault/warning codes as well as the proper troubleshooting steps will be discussed. Demonstrations are given on the use standard support software as diagnostic/startup resources.

The course format is a combination of instruction and hands-on exercises aimed at developing job-related knowledge and skills. The hands-on activities are carefully structured to provide course participants with significant exposure to basic drive operation and associated operating characteristics.

Goals

Upon completion of this course, the student shall be able to:

- Configure "base drive" logic and self-tune the drive for proper operation.
- Identify the use of the available fixed function and programmable analog and binary inputs/outputs.
- Effectively troubleshoot an invalid configuration of the drive by utilizing the function diagrams; representing firmware logic level prints.
- Identify hardware configurations and verify required connections.
- State the basic use and operation of the 6SE70VC regulators.
- Develop a logical and concise method of effectively troubleshooting indicated drive FAULTS and WARNINGS.
- Configure and operate the 6SE70VC using the "USS" and SIMOLINK (Peer-to-Peer link) protocols.
- State the basic function and/or use of the 6SE70VC option boards.
- Use motor and drive data for proper initialization of the 6SE70VC.
- Troubleshoot the converter and inverter hardware components.

Topics

1. Introduction to available "Base Unit" hardware
2. Power section connections and signal flow
3. Parameter settings and logical grouping
4. Motor data and related drive settings
5. Base Drive initial setup requirements
6. Self-tuning capabilities
7. Overview of firmware function logic diagrams
8. Analog and binary I/O configuration
9. Usage of CONTROL and STATUS words
10. Basic operation of CONVERTER and INVERTER
11. Interpretation of WARNING and FAULT codes
12. Troubleshooting and diagnostic features
13. Overview of "Base Unit" communication capabilities
14. Drive setup/diagnostic software usage
15. Overview of 6SE70VC options

Demonstration case SIMOVERT MASTERDRIVES CUVC

- For connection to supply voltage 1-ph. 120 V AC (60 Hz)
- Induction motor with encoder
- Ability to set up your own customer application with programmable digital inputs and outputs
- Learn and apply proper start-up procedure
- Compact and portable customer trainer

Includes all of the following:

- Three shippable transport cases (approx. 50 lb each)
- Each case has built-in wheels for transport
- Telescoping tote handles for cases
- Single case display

Order No.:
A1-108-030-033
Order through your local Siemens sales office.

Fig. 5/2
CUVC demonstration case

VC Compact PLUS demonstration case

- Mounting frame in the Rimowa pilot trolley
- Converter with CBP2 board
- Induction motor with pulse encoder
- Braking resistor
- Start-up box
- Documentation and training examples

Weight with case:
approx. 46 lb (21 kg)

Dimensions of case:
H x W x D
21.1 x 10.4 x 15.9 in
(535 x 265 x 405 mm)

For connection to supply voltage 1-ph. 230 V AC (50/60 Hz)

Order No.:
6SX7000–0AC02

For connection to supply voltage 1-ph. 120 V AC (50/60 Hz)

Order No.:
6SX7000–0AC03

Fig. 5/3
VC Compact PLUS demonstration case

Start-up box for SIMOVERT MASTERDRIVES Vector Control

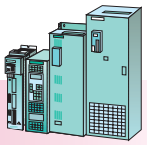
- Setting of analog setpoint ±10 V by means of two potentiometers
- $3^1/_2$-digit digital display
- 4 switches for combined digital inputs and outputs
- 3 switches for digital inputs
- connection to terminal X101 via prefabricated signal cable 4.3 ft (1.3 m)

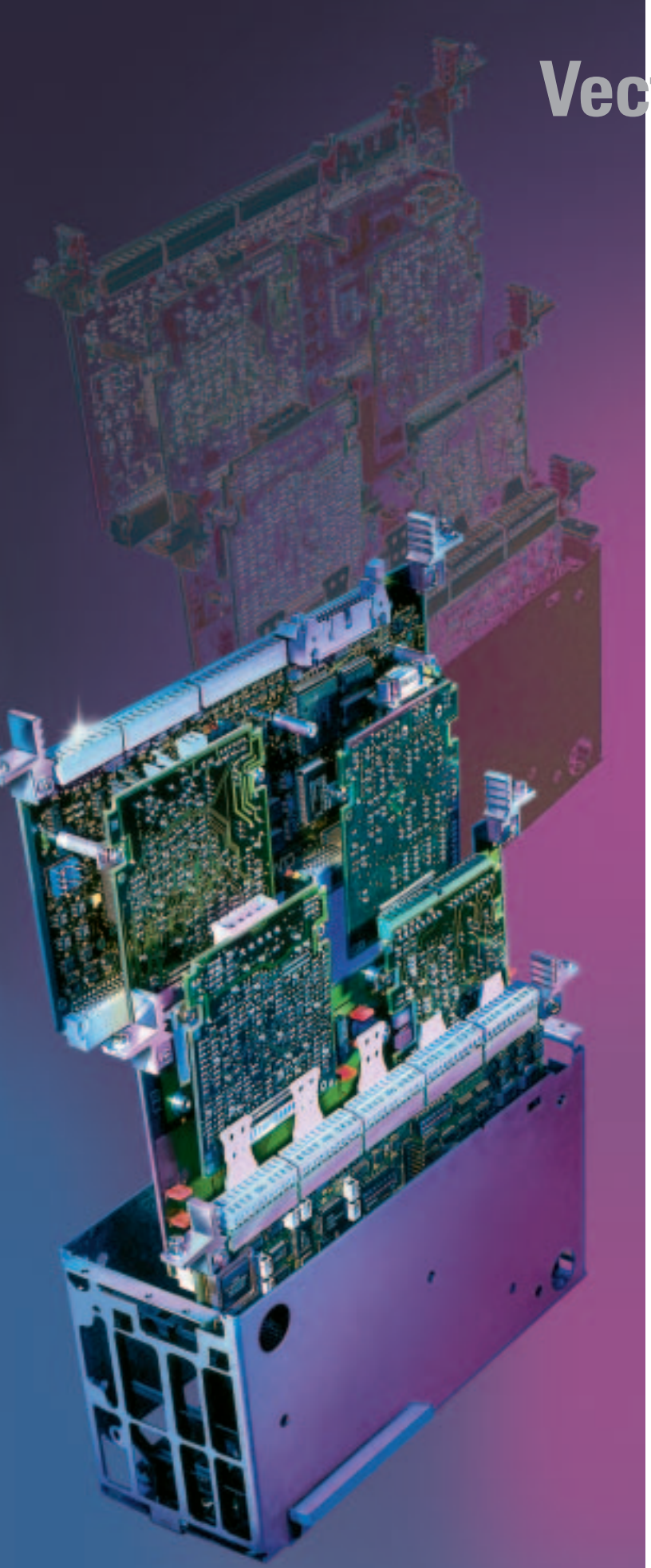
The start-up box uses the 24 V DC auxiliary voltage of terminal X101 for supplying the built-in digital display and for generating the supply voltage for the setting of analog setpoints.

Dimensions:
H x W x D
6.9 x 3.5 x 1.8 in
(175 x 90 x 45 mm)

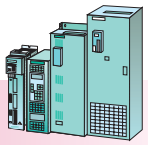
Order No.:
6AG1064–1AA00–0AA0

Fig. 5/4
Start-up box





Vector Control
Engineering Information



Rated data and continuous operation of the converters and inverters

Converters and inverters are designed for continuous motoring mode at the indicated supply voltage or DC link voltage. Occasional fluctuations of the supply voltage within the specified tolerances (see Section 3) have been taken into account.
The rated current I_{UN} of the converters and inverters is dimensioned based on the rated currents of Siemens 6-pole standard motors.
A nominal supply voltage of 400 V, 500 V or 690 V is used as a basis. The power section is protected against overload by an I^2t monitoring function.

The converters and inverters are designed for continuous operation with the rated output current of I_{UN}. If the rated current I_{UN} is utilized over a long period of time (> 60 s), corresponding to the 100 % value of Fig. 6/1 or Fig. 6/2, the unit reaches its maximum permissible operating temperature. Beyond this, the I^2t monitoring function does not allow overloading.

Overload capability of the converters, inverters and rectifier units

The definition of overloading as shown in Fig. 6/1 applies to the converters, inverters and the rectifier units, the rectifier/regenerative units and AFE.

The maximum permissible overload current is 1.36 times the rated current for a period of 60 s, assuming that the drive has just been switched on and has not reached its maximum permissible temperature. During operation itself, overloading up to 1.36 times the rated current is only possible if, before overloading, the load current was smaller than the rated current . For this reason, a base load current < 91 % of the rated current I_{UN} is used as a basis for loading in the case of drives with overload requirements. Given this base load current, the units can be overloaded by 150 % for 60 seconds with a cycle time of 300 seconds (see Fig. 6/1). If the whole overload capability has been utilized, this is detected by the I^2t monitoring function and an alarm is output for 30 s. After this, the load current is reduced to the base load current for 240 s.

For individual converters in the power range from 3 HP to 270 HP (2.2 kW to 200 kW), even higher overloading is possible, namely up to 1.6 times the rated current based on the load cycle shown in Fig. 6/2. This increased overload capability can only be utilized observing the following conditions:

- Can only be used with converters / inverters

  0.75 HP to 270 HP (0.55 kW to 200 kW) at 380 V to 480 V AC

  3 HP to 215 HP (2.2 kW to 160 kW) at 500 V to 600 V AC
- Can only be used in vector control mode, **not** in *V/f* characteristic mode.
- The overload duration is limited to 30 s.
- Increased overload capability can only be utilized up to a motor voltage of maximum 90 % (of the supply voltage).
- The permissible lengths of the motor supply cables with or without reactors must be reduced to half of the maximum values which are otherwise possible.
- Cannot be used in conjunction with sinusoidal filters and d*v*/d*t* filters.
- In regenerative mode and with a braking unit at the upper threshold, the current limit is automatically lowered to 1.36 times the rated current (no current reduction with AFE and rectifier/regenerative unit).

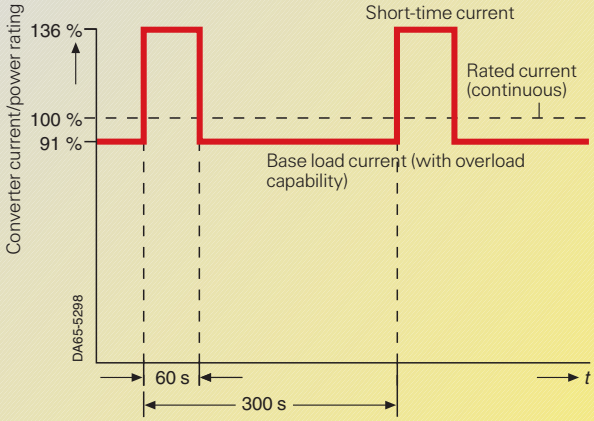


Fig. 6/1
Definition of the rated values, the overload values and the base load values of the converters and inverters

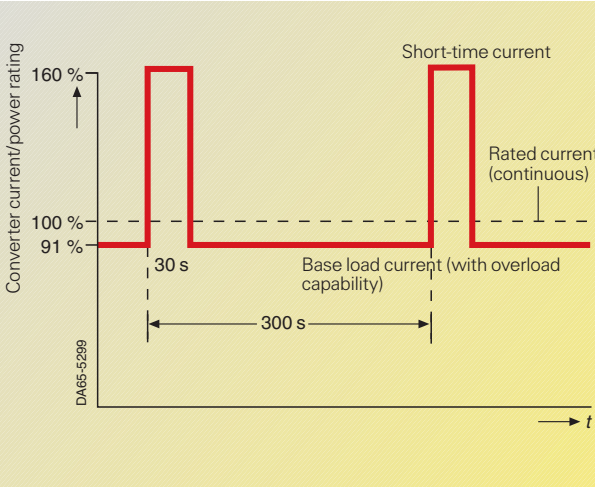


Fig. 6/2
Additional definition of the rated values, the overload values and the base load values of the converters / inverters up to 270 HP (200 kW) 3-ph. 380 V to 480 V AC; 510 V to 650 V DC and up to 215 HP (160 kW) 3-ph. 500 V to 600 V AC; 675 V to 810 V DC

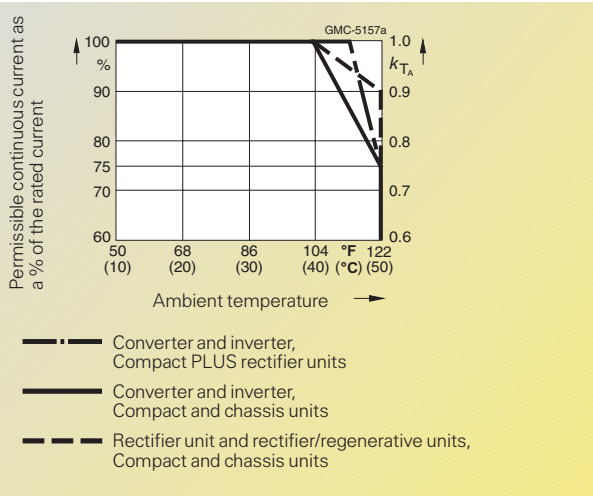


Fig. 6/3
Reduction factor k_{TA} for installation altitudes up to 3280 ft (1000 m) above sea level and different ambient temperatures

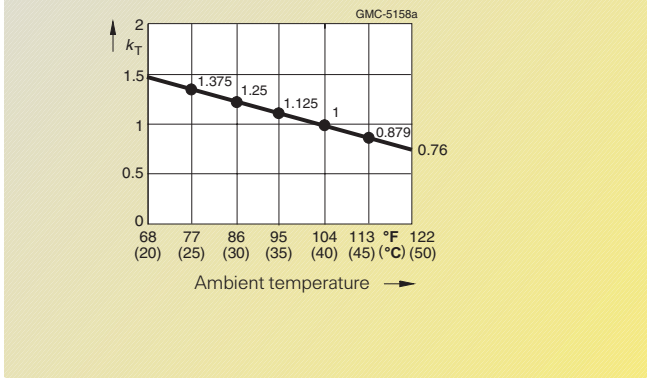


Fig. 6/4
Reduction factor k_T for installation altitudes from 3280 ft (1000 m) to 13125 ft (4000 m) above sea level

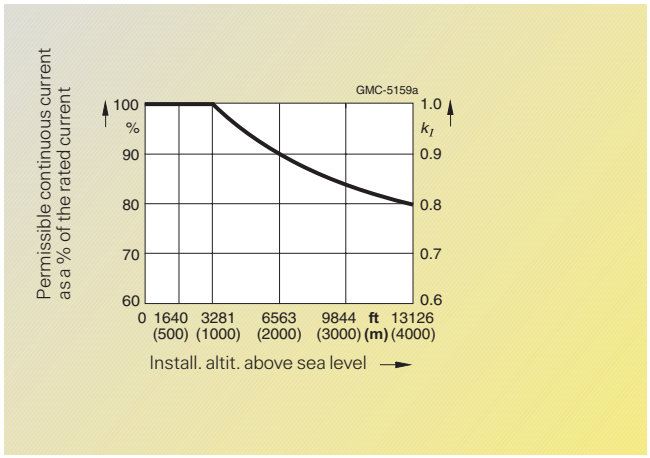


Fig. 6/5
Reduction factor k_I for installation altitudes from 3280 ft (1000 m) to 13125 ft (4000 m) above sea level

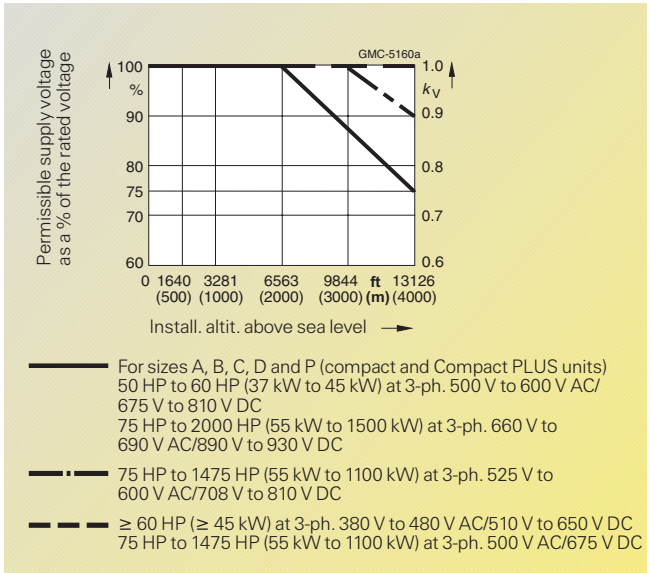


Fig. 6/6
Reduction factor k_V for installation altitudes from 3280 ft (1000 m) to 13125 ft (4000 m) above sea level

Installation conditions and correction factors

If the MASTERDRIVES units are operated at installation altitudes up to 3280 ft (1000 m) above sea level and at ambient or coolant temperatures of > 104 °F (40 °C), the **current reduction factors** in Fig. 6/3 are to be observed for the rated current.

Current reduction (correction factor k_I as shown in Fig. 6/5) is also necessary if the units are used at installation altitudes of between 3280 ft (1000 m) and 13125 ft (4000 m). In the case of lower ambient temperatures (see Fig. 6/4), this current reduction can, if necessary, be compensated by the correction factor, k_T.

$I \leq I_{UN} \cdot k_I \cdot k_T$; $I < I_{UN}$
$I \mathrel{\widehat{=}}$ Permissible continuous current
$I_{UN} \mathrel{\widehat{=}}$ Rated current

Example:
Installation altitude:
6563 ft (2000 m)
Max. ambient temp.:
86 °F (30 °C)
Correction factor $k_I = 0.9$
Correction factor $k_T = 1.25$
$I \leq I_{UN} \cdot 0.9 \cdot 1.25 = I_{UN} \cdot 1.125$
But $I \leq I_{UN}$
Result: Current reduction is not necessary in this example.

In the case of installation altitudes of > 6563 ft (2000 m), in addition to current derating, **voltage reduction** is necessary in accordance with IEC 60 664-1.

The voltage reduction should be carried out in accordance with the correction factor k_V in Fig. 6/6.

Example:
Unit 6SE7026-6FE60
Installation altitude:
9845 ft (3000 m)
Max. ambient temperature:
86 °F (30 °C)
3-ph. 500 V to 600 V AC,
60 HP (45 kW), 66 A

Correction factor $k_I = 0.84$
Correction factor $k_T = 1.25$
Correction factor $k_V = 0.88$
Result: Current reduction is not necessary. Due to the voltage reduction given in Fig. 6/6 (solid line), the converter can still be operated connected to a supply voltage of 3-ph. 500 V AC.

Large rating inverters – Output interphase transformer

The largest power ratings of the SIMOVERT MASTERDRIVES Vector Control series of converters are realised by connecting 2 inverters in parallel. In order to ensure that loading is uniformly distributed between the two inverters, an interphase transformer is used on the converter output (see Fig. 6/7).

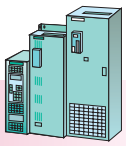
This applies to the following converter/inverter ratings:

- 1200 HP (900 kW) at 400 V (only chassis units),
- 1340 HP and 1475 HP (1000 kW and 1100 kW) at 500 V,
- 1750 HP and 2000 HP (1300 kW and 1500 kW) at 690 V.

Operation without interphase transformer

If the motor to be connected has 2 electrically isolated winding systems which have the same voltage and the same phase position, the outputs of both inverter sections can be connected directly to the two winding systems of the motor. The two magnetically coupled windings then have the same effect as an interphase transformer. An additional interphase transformer is then no longer necessary.

1LA1 type motors for 690 V can be supplied with 2 electrically isolated winding systems. They are to be ordered with the voltage code 1 (11th position of the Order No., e.g. 1LA1 503-4PM**1**).



1 LA8 motors with 2 separate windings cannot be realized for all applications.

1LA8 motors can only be supplied with 2 separate windings on request.

Group drives, i.e. several motors connected in parallel to the converter output, may only be realized using an interphase transformer, if the motors were divided up into 2 equal groups and connected to the two inverter sections without an interphase transformer and the two motor groups had different outputs, which would normally be the case, the existing current-compensation control system for the two inverters would be overloaded and the converter would trip, indicating a fault.

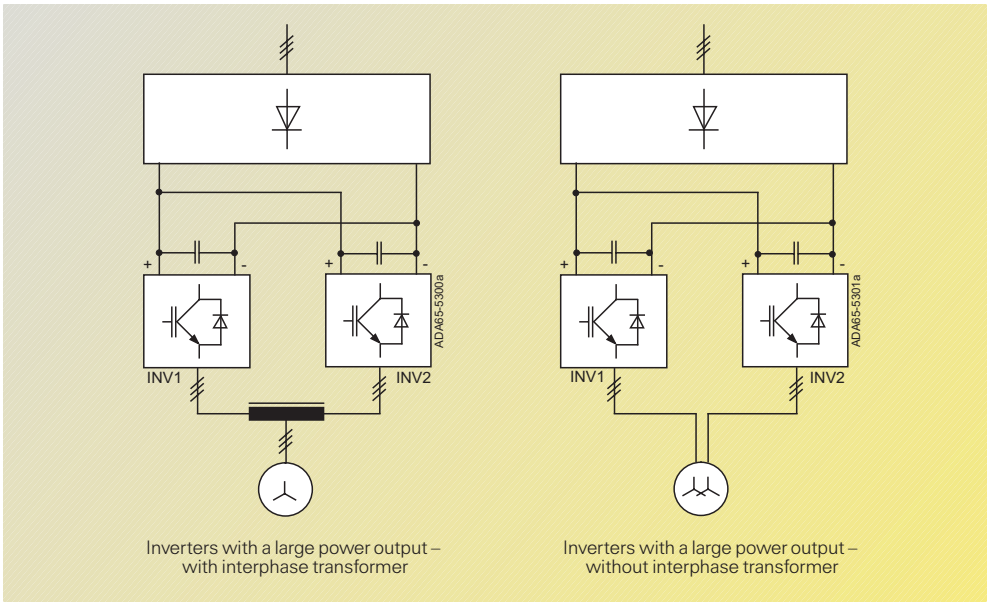


Fig. 6/7

Note

In the case of a group drive, it is recommended that the motors are divided up into 2 groups, i.e. with 2 converters or 2 inverters on a DC bus, each with half of the total output. An interphase transformer is therefore not required, providing a more cost-effective solution.

230 V AC Operation with 6SE70 MASTERDRIVES

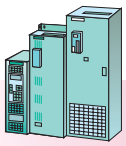
With the release of MASTERDRIVES Vector Control Firmware V 3.33 the 400 V line of converters and inverters are configurable for operation on 230 V AC or 310 V DC supplies.

The 400 V line of compact and chassis rectifiers and regenerative rectifiers continue to be configurable for 230 V AC three-phase systems. Compact PLUS rectifier are not configurable for 230 V AC systems.

Motor current ratings must be used for selection since horsepower ratings in this catalog have not been listed for 230 V AC operation.

Note: In addition to the correct setting of P071 an external 24 V supply is required.

On frame sizes D and above the fan must be supplied externally or the internal transformer must be configured for 230 V primary voltage.



Water-cooled converters – Water-cooling circuit

If a water-cooled SIMOVERT MASTERDRIVES unit is selected, it is necessary to use water of a suitable quality for the cooling circuit. The following notes should help when engineering the cooling circuit.

Design of the cooler of the 6SE70 SIMOVERT MASTERDRIVES

The cooler consists of an aluminium base plate for the converter power semiconductors with internal cooling pipes or a cast aluminium heatsink mounted on the rear. The cooling water flows through the cooling channels.

In order to avoid mechanical distortion of this base plate and the loss involved on the IGBTs mounted on it, the max. permissible operating pressure of the cooling circuit must be < 1 bar for units of sizes A to G and ≤ 2.5 bar for units of size K. When the operating pressure is ≥ 0.5 bar the requirements of the guideline for pressure vessels are to be considered.

According to guidelines 92/23/EG for pressure vessels, the risks arising from cooling circuits are very small. Certification procedures and CE labelling according to this guideline are therefore normally not necessary.

In order to avoid galvanic corrosion and possible destruction of the heat sink, the cooling-water connections of the heat sink are made of stainless steel.

Cooling system requirements

Open cooling systems must not be used. Only **closed** cooling systems should be installed, preferably with monitoring of the water quality of the cooling water.

The electrochemical processes occurring in the cooling system must be minimized by the choice of materials. Mixed installations, i.e. a combination of different materials such as copper, brass, iron and plastics containing halogens (PVC hoses and seals) should be avoided. Examples of materials recommended for the cooling system piping are the stainless steels V2A and V4A (NIROSTA austenite) and the electrically non-conductive hoses EPDM/NBR (EPDM water side).

To suppress the electrochemical processes, equipotential bonding between the various components in the cooling system (SIMOVERT MASTERDRIVES, heat exchanger, piping system, pump, etc.) should be implemented using a copper bus bar or stranded copper conductor of suitable cross-section.

Cooling water requirements

The cooling water must satisfy the following requirements:

- Chemically neutral, clean water, free of solid matter.
- Max. particle size of any particles in water ≤ 0.004 in (0.1 mm)
- pH value 6.0 to 8.0
- Chloride < 40 ppm
- Sulphate < 50 ppm
- Dissolved substances < 340 ppm
- Overall hardness < 170 ppm
- Use of a particle filter (100 μm).

Important!
Operating pressures above 1 bar/2.5 bar depending on the size of the unit are not permissible! The heatsinks are not resistant against sea-water (i.e. sea-water must not be used for cooling)!

If there is a danger of frost, frost-protection measures must be implemented during operation, storage and transport. For example, emptying and blowing out with air, additional heaters, etc.

Antifreeze additive

The use of Antifrogen N antifreeze (available from Clariant; http://www.clariant.com) is recommended. The mixing ratio must be within the range 20 % < antifreeze < 30 %. This ensures protection against frost down to a temperature of at least 14 °F (–10 °C).

Note!

If less than 20 % antifreeze is added, the risk of corrosion is increased. If more than 30 % antifreeze is added, the heat flow and therefore the functioning of the unit is affected. Care must always be taken to ensure that the addition of antifreeze does not alter the kinematic viscosity of the cooling water. It is necessary to adapt the pump output.

Depending on conditions at installation location and on the technical aspects, the cooling circuits described on page 6/5 can be used.

Important!
Moisture condensation on the converter due to undercooling is to be prevented. If necessary, the temperature of the cooling water must be controlled.

Anti-corrosion agent

For the cooling circuit, we recommend using a corrosion inhibitor, e.g. the anti-corrosion agent NALCO 00GE056 available from ONDEO Nalco (www.ondeo-nalco.com). Concentration of corrosion inhibitor in the cooling water: 0.1 to 0.14 %.

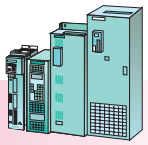
The cooling water should be checked 3 months after the cooling circuit has been filled for the first time and, after this, once a year.

If the cooling water becomes detectably cloudy, discolored or contaminated with bacteria, the cooling circuit must be flushed out and re-filled.

An inspection window should be fitted in the cooling circuit to facilitate inspection of the cooling water.

Cabinet-unit earthing

In the case of water-cooled cabinets, special attention must be paid to earthing. All cabinets must be bolted together to ensure a good conductivity between them (e.g. cabinet brackets conductively connected to each other by screws). This is necessary to avoid differences in potential and thus to prevent the danger of electro-chemical corrosion. For this reason, a PE rail should always be mounted in all cabinets and in the re-cooling system.



Notes on dimensioning of drives

Quadratic load torque drives

Drives with a quadratic load torque (variable torque), as for pumps or fans, require full torque at rated speed. Increased starting-torque levels or load surges do not normally occur. It is not therefore necessary for the converters to have an overload capability.

When a suitable converter for drives with a quadratic load torque is being selected, the continuous rated current of the converter must be at least as high as the motor current at full torque at the required load point.

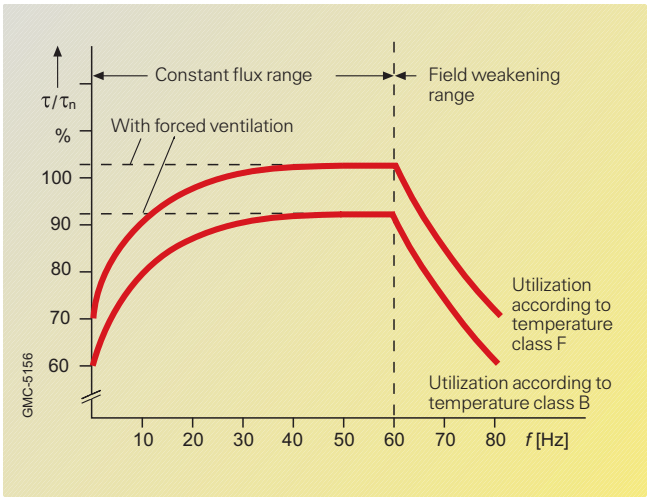


Fig. 6/8
Typical curve of permissible torque in the case of self-ventilated motors with a rated frequency of 60 Hz.

Drives with constant load torque

Motors operated with constant flux are said to have constant torque. As long as a constant volts per hertz ratio is maintained, the motor will have constant torque.

During continuous operation, the self-ventilated motors cannot generate their full rated torque over the whole speed range. The continuously permissible torque is also lowered when the speed is reduced due to the reduced cooling effect. This is illustrated in Fig. 6/8.

Depending on the speed range, a corresponding torque reduction and therefore power-output reduction has to be carried out in the case of self-ventilated motors.

In the case of forced ventilated motors, no reduction of the power output or only a relatively small one is necessary, depending on the speed range.

In the case of frequencies above the rated frequency f_n (60 Hz in Fig. 6/8), the motors are operated in field-weakening range. Here, the available torque is reduced by approximately f_n/f, the power output remains constant. A safety margin of ≥ 30 % from the stalling torque, especially in the control modes with *V/f* characteristic, is to be complied with, which reduces with $(f_n/f)^2$.

In the case of drives with a constant load torque, motors and converters are appropriately selected so that, given the permissible torque in continuous operation (S1), an overload of 50 % is possible for 60 s. This usually provides a sufficient reserve for breakaway and accelerating torques.

The base load current of the converter should therefore be at least as high as the motor current at full torque at the required load point.

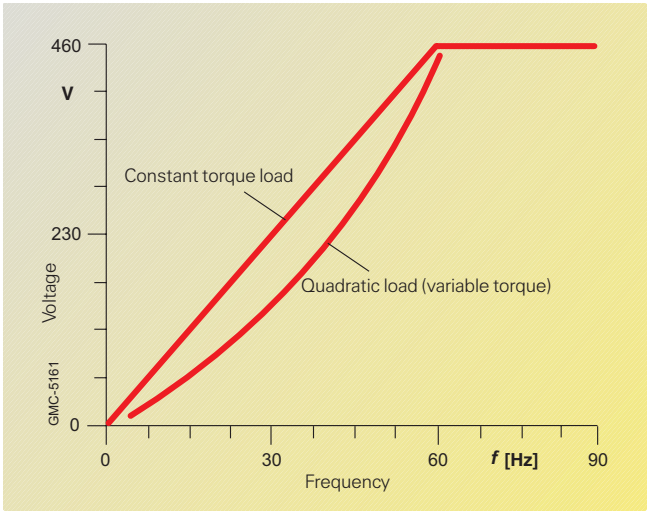


Fig. 6/9

Permissible and non-permissible motor-converter combinations

Rated motor current greater than the rated converter current

If a motor is to be used whose rated current is greater than the rated current of the converter, the following limit is to be complied with, even if the motor is only to be operated under partial load:

For single-motor drives:

$$I_{n\,Motor} \leq I_{max\,Conv.} = 1.36 \times I_{n\,Conv.}$$

For multi-motor drives:

$$\sum_{v} I_{n\,Motor_v} \leq I_{max\,Conv.} = 1.36 \times I_{n\,Conv.}$$

The maximum converter current must be greater or at least equal to the rated motor current of the connected motor or, in the case of multi-motor drives, the total rated motor currents of the connected motors.

If these dimensioning criteria are not complied with, higher current spikes occur due to the lower leakage-inductance levels and can cause tripping.

Lowest permissible rated motor current at the converter

If vector control mode is used, the rated motor current must be at least $^1/_8$ of the rated converter current.

If the *V/f* characteristic is used, this restriction does not apply. If motors with far lower ratings in comparison to the converter rating are used, there are, however, reductions in control quality. This is because the slip compensation, $I \times R$ compensation and I^2t calculation of the motor can no longer be carried out correctly.

6

Notes on motor engineering

Motor type

In addition to the standard 1LA type motors, compact induction motors, type 1PH7/1PL6, can also be used.

1PH7/1PL6 compact induction motors are to be recommended in the case of

- a high speed range with high maximum speeds
- speeds down to zero without a reduction in torque;
- restricted mounting conditions; 1PH7/1PL6 type motors are, on average, up to two shaft heights smaller than comparable standard induction motors with the same rated power output.

For further information and detailed engineering information, see Motor Catalog.

Supply voltages > 500 V for 1LA1, 1LA5, 1LA6, 1LA7 and 1LA8 motors

The standard insulation of 1LA type motors is designed so that they can be operated with the converter at supply voltages of $V \leq 500$ V (or $V_d \leq 740$ V DC) without any restrictions.

At $V > 500$ V, one of the following is necessary:

- a voltage-limiting filter dv/dt,
- a sinusoidal filter,
- or a strengthened motor insulation system.

For 1LA8 type motors, a winding with a strengthened insulating system has been developed for operating the drive with the converter with a supply voltage of up to 690 V. This winding does not require a filter. These motors are identified with an **"M"** at the 10th position of the Order No., e.g. 1LA8 315-2PM.

With the strengthened insulating system, there is less room in the slots for the same number of winding turns compared to the normal version. This results in the slightly lower rated output for these motors.

Motor protection

Motor protection can be provided by the converter software with I^2t monitoring of the motor. Here, the current motor speed is also taken into account. This monitoring function, however, is not 100 % accurate because the motor temperature is only calculated and not measured. In addition to this, the ambient temperature is not taken into account.

Precise motor protection is possible using motor temperature sensors. In the case of SIMOVERT MASTERDRIVES Vector Control, it is possible to connect a KTY84 temperature sensor or a PTC thermistor directly in the base unit.

- PTC thermistors with a knee in the characteristic curve are evaluated for "Trip" or "Alarm" purposes.
- In the case of KTY84 motor-temperature sensors, the temperature of the motor is evaluated. The temperature value can be output via an analog output.
  The values for "Alarm" and "Trip" can be parameterized and, when reached, this can be output via binary outputs.

The measured temperature of the motor is also evaluated for more precise closed-loop control of the torque.

1PH7/1PL6 type motors have a KTY84 motor-temperature sensor in the stator winding as standard. A separate evaluation unit is required for monitoring with PT100 temperature sensors.

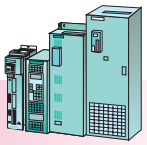
Bearing currents

The main causes of damaging bearing currents are circulating currents in the motor as a result of converter supply. They are also caused by currents flowing through the motor bearings due to unfavorable earthing conditions.

In order to provide protection against damaging bearing currents due to circulating currents, an insulated NDE bearing is used for certain motor sizes.

For 1PH7 and 1PL6 type motors, insulated NDE bearings are available as an option for sizes 180 and above (code L27). For size 280, the insulated bearing is standard. For standard 1LG4 and 1LG6 series motors, insulated NDE bearings for sizes 225 to 315 are recommended for converter operation (supplementary order code L27). Insulated bearings are standard for all 1LA1/PQ1/1LA8/1LL8 and 1PQ8 type motors (size 315 and upwards) that are marked as suitable for converter operation.

If the machine connected to the motor shaft is earthed better than the motor itself, damaging current can flow through the motor bearings and through the bearings of the driven machine. In order to avoid this kind of bearing current, the motor housing must be well earthed, e.g. by using a shielded motor cable.



Notes on selecting power sections

Stand-alone drives are frequency converters which are fed separately from the supply system and drive a motor or motor group, group drive, with a variable-speed function.

Converters (AC to AC units) which are connected to a three-phase supply are used for stand-alone drives.

The converter operates standard in motoring mode, and can drive the connected load with clockwise and/or counter-clockwise rotation.

As a stand-alone drive, the converter operates independently of other converters or inverters, and individually controls the connected motor or motor group. In this version, stand-alone drives can be switched into and out of the process independently.

If the drive is working regeneratively, e.g. when braking a rotating mass, the energy produced must be converted into heat in a braking resistor. Compact and chassis-type converters need a braking unit for this. Compact PLUS converters already have such a braking unit, which is integrated in the converter. For regenerative mode, only the corresponding braking resistor is to be connected.

If energy recovery to the three-phase supply is required, this can be implemented with rectifier/ regenerative units or AFE.

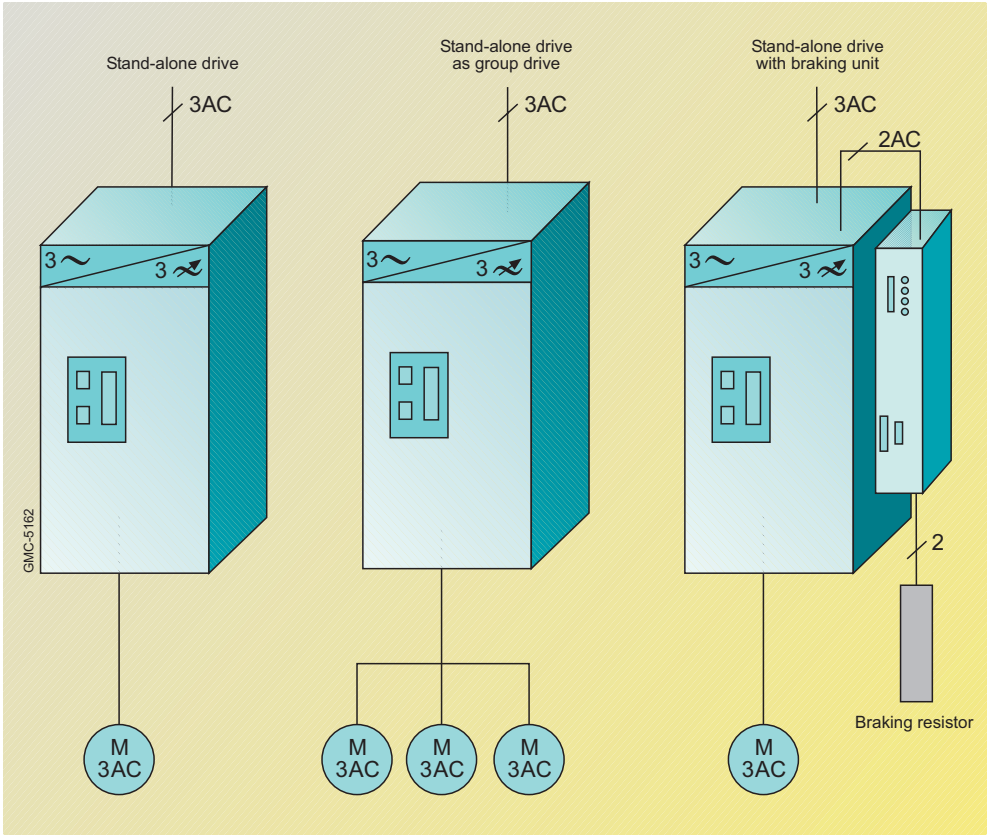


Fig. 6/10
Stand-alone drives/stand-alone drives as group drives with compact and chassis units

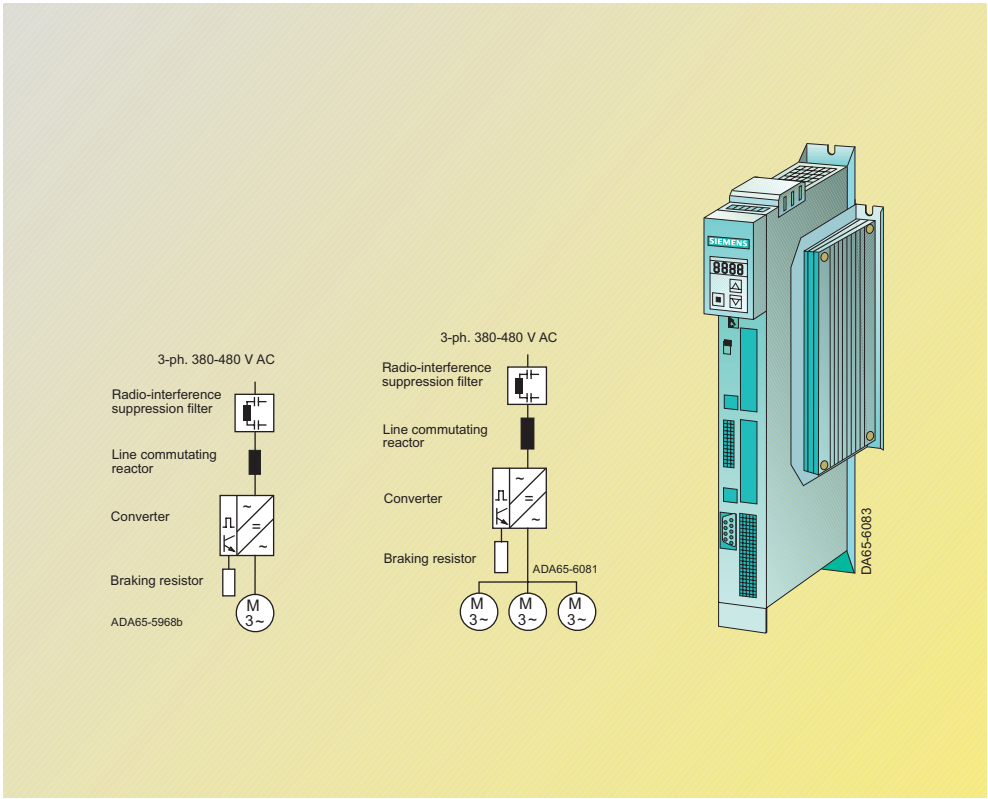


Fig. 6/11
Stand-alone drives/stand-alone drives as group drives with Compact PLUS

Notes on selecting power sections (continued)

Converters for the individual drive can be selected according to criteria, with regard to the rated output current, as described in sections entitled "Configuring of drives".

The converters are also available as cabinet units (see Section 4) with the appropriate options.

The converters must be protected, according to requirements, with the permissible overcurrent and short-circuit-limiting components on the system supply side. Depending on customers' needs, additional switchgear may be required.

In the control cabinet, the radio-interference suppression filter should be installed as near as possible to the connecting point for the supply voltage.

Operation of a supply-side main contactor K1 is possible directly via the On function of the terminal strip and the interfaces of the SIMOVERT MASTERDRIVES electronics (external 24 V DC supply needed).

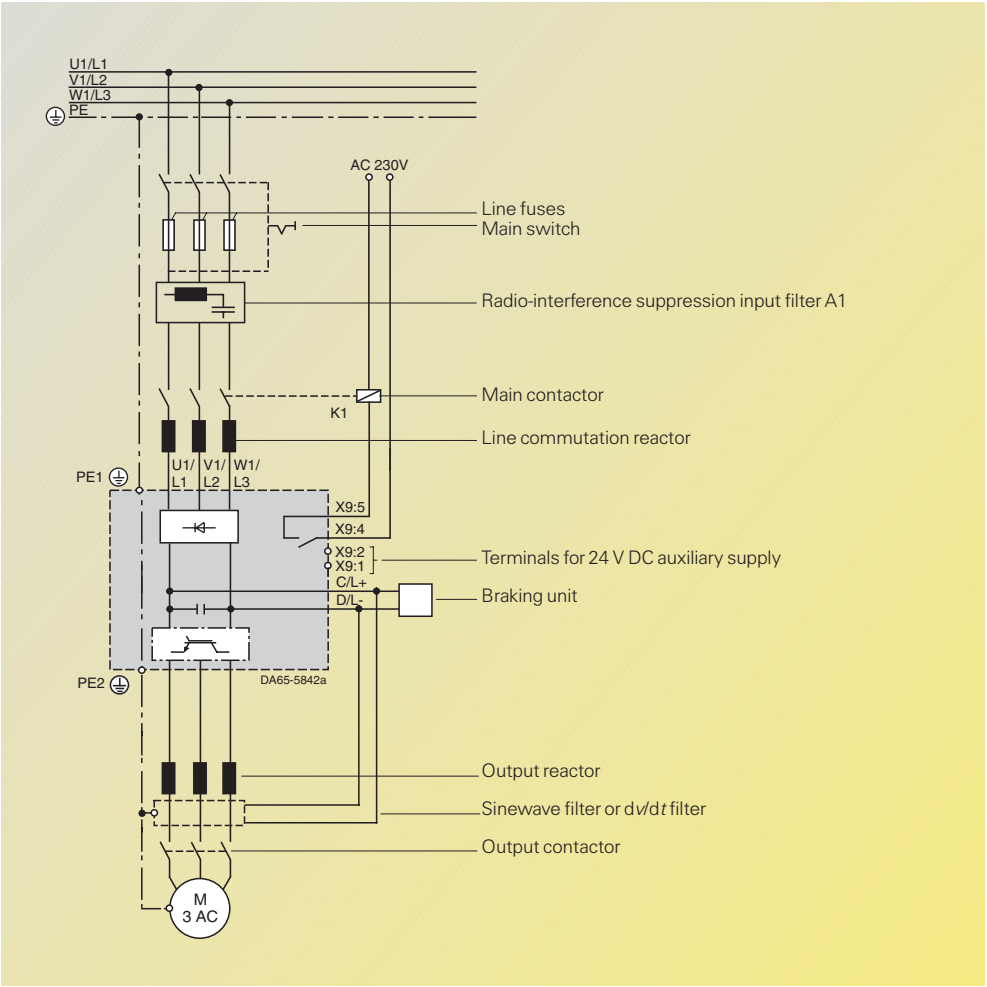


Fig. 6/12
Block diagram of a converter (sizes E to K)

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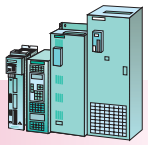


Notes on selecting power sections (continued)

For multi-motor drives, inverters are connected to a common DC bus. The DC supply is produced from the three-phase AC system by rectifier units, rectifier/regenerative units or AFE rectifier/regenerative units.

If this method is used with inverters connected to a DC link, the following advantages, in comparison to single converters, can be made use of:

- When individual motors are working in regenerative mode, energy is returned to the DC link and used by motoring units to make this system very efficient. If regenerative output sometimes occurs, e.g. simultaneous shutdown of all drives, a central braking unit can be provided. The Compact PLUS rectifier units already have an integral braking unit.
- In comparison to single converters, the amount of mounting space required can be reduced. Supply-side components such as fuses, contactors and switchgear as well as line commutating reactors only have to be provided once at a central location.

In order to reduce system perturbations, the central supply rectifier can be either a 12-pulse converter or an AFE rectifier/regenerative unit.

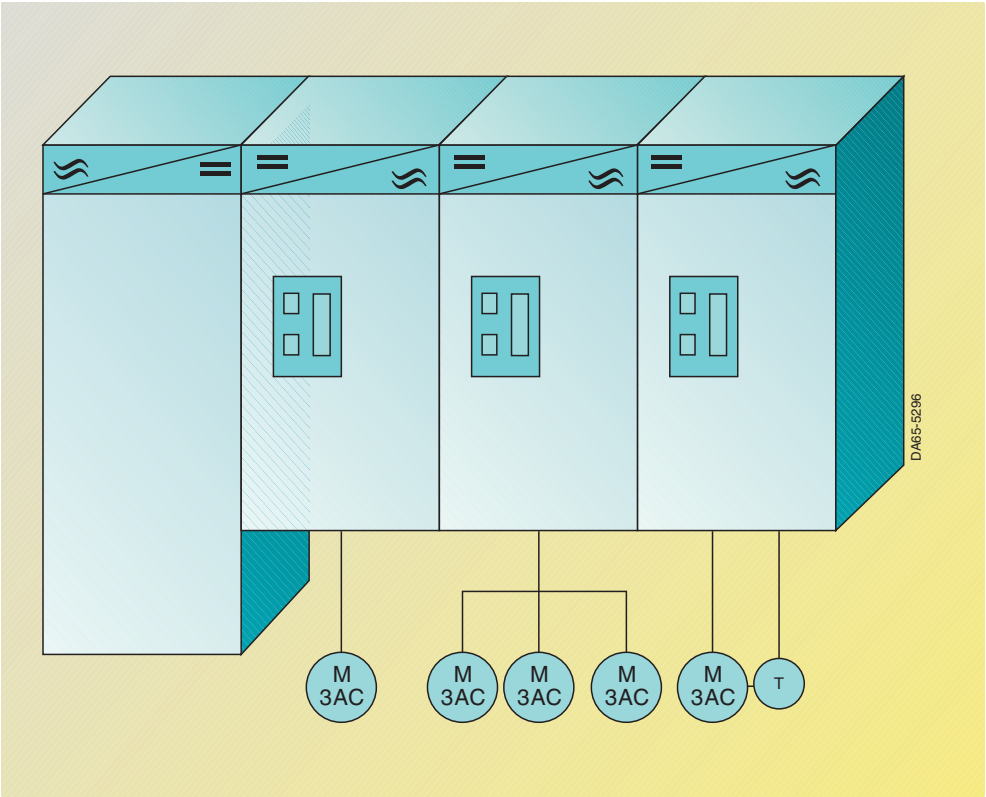


Fig. 6/13
Multi-motor drive

6

Multi-motor drives can be set up with inverters and rectifier units of the type Compact PLUS with a minimum amount of wiring: They are connected to the DC link by means of tin-plated copper busbars in accordance with DIN 46 433 (E-Cu 3 x 10). The busbars are inserted from above into the connector blocks of the units. Electrical contact is ensured by spring terminals, tedious screwing is no longer necessary. The electronics of the rectifier unit and inverter then only need to be supplied from an external 24 V power source and the multi-motor system is ready for operation.

Compact PLUS converters can supply additional inverters and are therefore ideal for setting up smaller multi-motor drives. The converter, in this case, supplies power and 24 V to the inverters.

Additional Compact PLUS inverters can be connected to the converter via the DC link busbar. The total rating of all the connected inverters can be as high as the rating of the converter, e.g. a 7.5 HP (5.5 kW) converter can supply a 5.4 HP (4 kW) inverter and two 1 HP (0.75 kW) inverters. With regard to the incoming power, a simultaneity factor of 0.8 must be ensured, i.e. the rectifier of the converter is thermally designed for 1.6 times the rating. A switch-mode power supply unit supplies the control electronics of the converter with power from the DC link. The control electronics can also be supplied with 24 V DC from an external source via the X9 connector strip, e.g. in order to maintain communication with a higher-level control unit when the power section is switched off (discharged DC link). The switch-mode power supply unit of a converter also provides power for supplying the control electronics of two inverters. The 6SE7011-5EP60 converter can only supply one additional inverter.

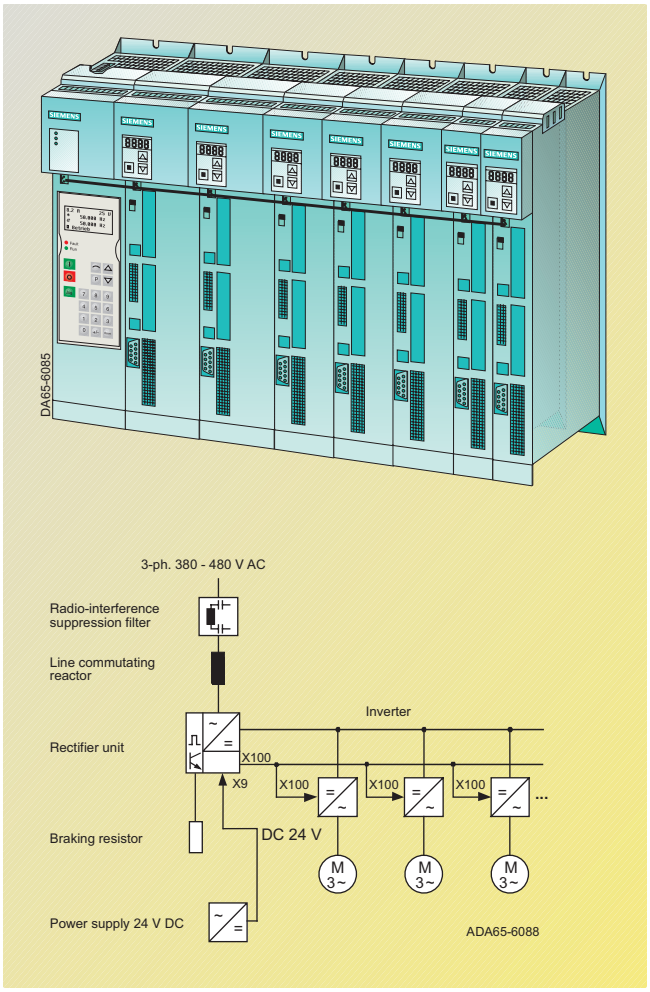


Fig. 6/14
Multi-motor drives with Compact PLUS units

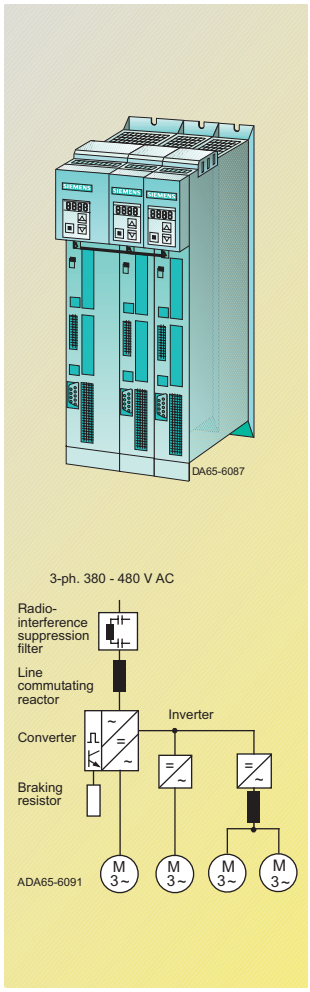


Fig. 6/15
Multi-motor drive with converters and inverters

Short-time power buffering is possible with the capacitor module. The coupling module enables transition of the wiring from the copper busbar system to cables, e.g. for connecting other types of the SIMOVERT MASTERDRIVES series such as compact-type AFE rectifier/regenerative units.

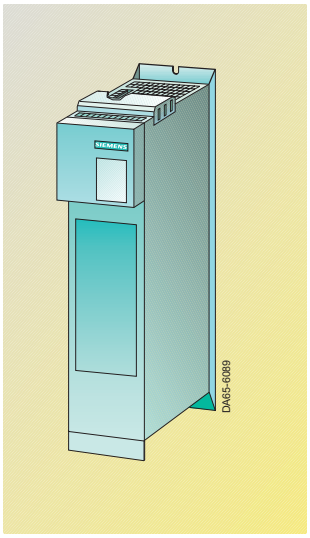


Fig. 6/16
Capacitor module

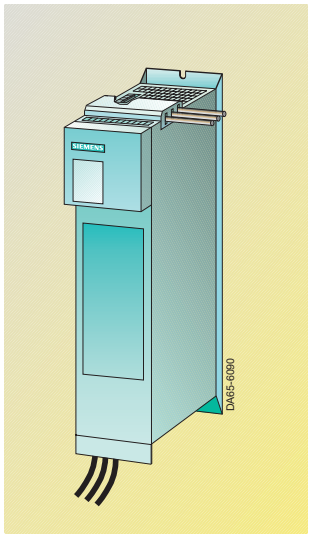
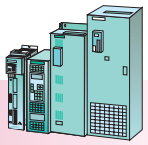


Fig. 6/17
DC link module

6



Notes on selecting power components

The inverters for the individual drives of multi-motor systems can be selected according to the same criteria relating to rated output current as described in "Quadratic load torque $\tau \sim n^2$" and "Drives with constant load torque" (page 6/6) for single-motor drives.

Fuses are necessary between the inverters and the DC bus. The appropriate fuses are partly integrated in the inverter.

Whether additional switching components are to be provided depends on the particular requirements of the customer.

If the customer requires that the inverter units can be connected and disconnected **during operation**, i.e. when DC link voltage is applied, a precharge circuit is to be provided for the DC link capacitors of the inverter unit (see "DC link components", page 6/47). A switch disconnector connects the inverter to the DC link via precharging resistors, a precharging contactor and a coupling contactor. The contactors needed for this can be operated using the signals "Operate main/bypass contactor" or "Precharging active" of the rectifier unit.

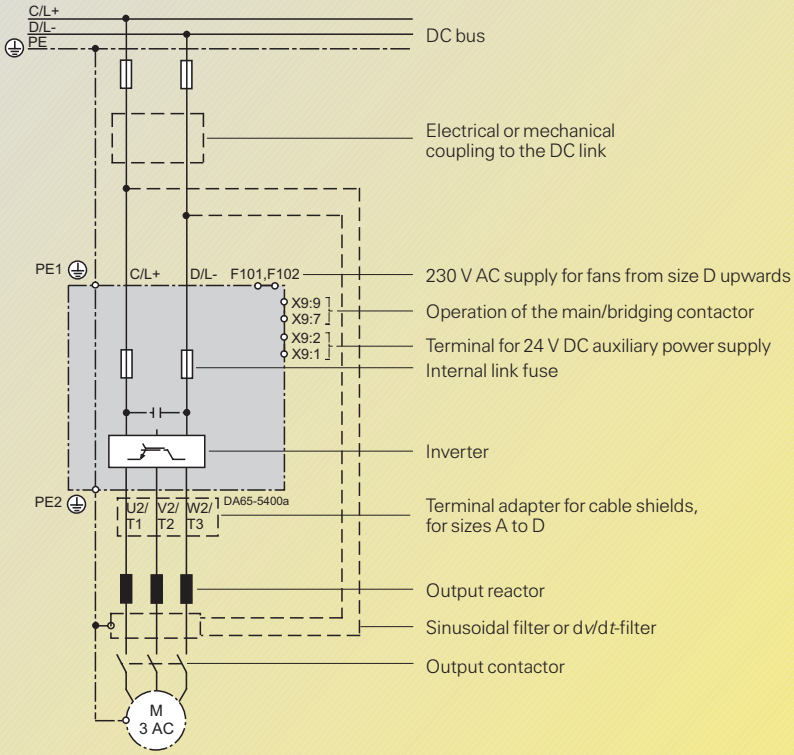


Fig. 6/18
Block diagram of an inverter (sizes A to D, DC voltage ≥ 510 V DC)

Note

The size H and K rectifier units as well as the rectifier/regenerative units determine the connected capacitor load during initialization. If individual inverters are disconnected from the common DC link bus, this must be carried out again. If fixed combinations of inverters are disconnected, the parameters for each combination are known and the control parameters of the rectifier unit or rectifier/regenerative unit can be changed over for each data set.

The self-commutated AFE units do not require initialization. Varying inverter combinations have no effect.

Rectifier units

Rectifier units supply the DC voltage bus for inverters with motoring energy and enable operation of a multi-motor system.

The supply voltage ranges from 3-ph. 380 V to 690 V AC, 50/60 Hz.

The power output of the rectifier units ranges from 15 kW to 1500 kW in sizes B, C, E and P are analog units and do not have a serial interface, e.g. they cannot be operated with PROFIBUS DP. The sizes H and K are digital units and as described on page 6/54 can be extended with the options for the electronics box.

A maximum of 3 size K units can be connected in parallel. The parallel circuit consists of a master unit and up to 2 slave units (see Section 3). In order to ensure uniform load distribution, line commutating reactors with 3 % v_k must be provided. The rated current must also be reduced by 10 %.

If two rectifier units are supplied from a three-winding transformer, 12-pulse operation is possible. In order to ensure uniform distribution of the load and thus optimum functioning of the 12-pulse supply, a line commutating reactor with at least 3 % v_k (not necessary with a double-tier transformer) is necessary in each secondary-side system.

Note

12-pulse operation with size H and size K units takes place in a master-slave configuration. Interface adapters (Order No. 6SE7090-0XX85-1TAO) and separate cable are necessary, see Fig. 6/19 and also selection and ordering data on page 3/24.

In order to operate the rectifier units, an external 24 V DC power supply is necessary. The current required depends on the size of the unit (see Section 3).

In order to electrically isolate a rectifier unit from the supply system, a main switch and/or a switch disconnector can be connected on the supply side.

The rectifier is to be powered-up and powered-down by means of a main contactor which, in the event of a fault, also protects the connected rectifier units against overloading (for sizes B, C, E and P).

An effective isolation from the supply and a limitation of system disturbances are achieved by means of a line commutating reactor.

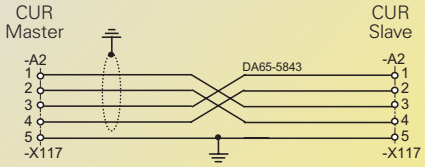


Fig. 6/19
Connection cable type LiYCY 3 x 2 x 0.5 for communication

Note

Rectifier units can only supply a certain number of inverters. The total DC link current flowing on the inverter side must not exceed the rated output DC link current the rectifier unit. When selecting of the rectifier unit, this means that the DC link currents of inverters in regenerative mode are subtracted from the DC link currents of inverters in motoring mode. It must also be noted that the rectifier unit has to precharge the whole effective DC link capacity of the drive.

This results in the following rule:

Compact PLUS rectifier units

- 15 kW

$$I_{zkb\ ee} \geq 0.5 \sum I_{zkb\ wr}$$

- 50 kW and 100 kW

$$I_{zkb\ ee} \geq (0.3...1) \sum I_{zkb\ wrb}$$

Compact sizes B and C rectifier units

$$I_{zkb\ ee} \geq 0.9 \sum I_{zkb\ wr}$$

Chassis sizes E, H and K rectifier units

$$I_{zkb\ ee} \geq (0.3...1) \sum I_{zkb\ wrb}$$

$I_{zkb\ ee}$: Rated DC link current of the rectifier unit

$I_{zkb\ wr}$: Rated DC link current of the inverters

6

Compact PLUS rectifier units

Control functions

The Compact PLUS rectifier units do not have a microprocessor and, after being switched into circuit, immediately charge the DC links of the connected inverters. They are switched on and off by means of the main contactor or the supply voltage. In the event of a fault, a binary output (terminal X91: 1/2) enables the main contactor to be opened. The binary output has a switching capacity of 24 V DC/1 A. If a main contactor with a 230 V coil is used, an interface relay is necessary. The rectifier units are fitted with an integrated brake chopper. For regenerative mode, only a suitable braking resistor has to be connected.

The operating status of the rectifier unit is indicated by three LEDs on the front panel.

When the LEDs light up, they indicate the following operating statuses:

- LED green:
  Rectifier unit ready for operation
- LED red:
  Fault
- LED yellow:
  Brake chopper active

Note

A record of faults is not kept and they do not have to be acknowledged. A fault is indicated as long as the fault signal is being sent (at least 1 s).

If a 100 kW rectifier unit is used to set up a multi-motor drive, it must be ensured that the 120 A current carrying capacity of the copper busbars is lower than the rated DC link current of this rectifier unit. The 100 kW rectifier unit must therefore be placed in the middle of the multi-motor drive and the inverters will then be supplied on the right and left-hand sides via the copper busbars.

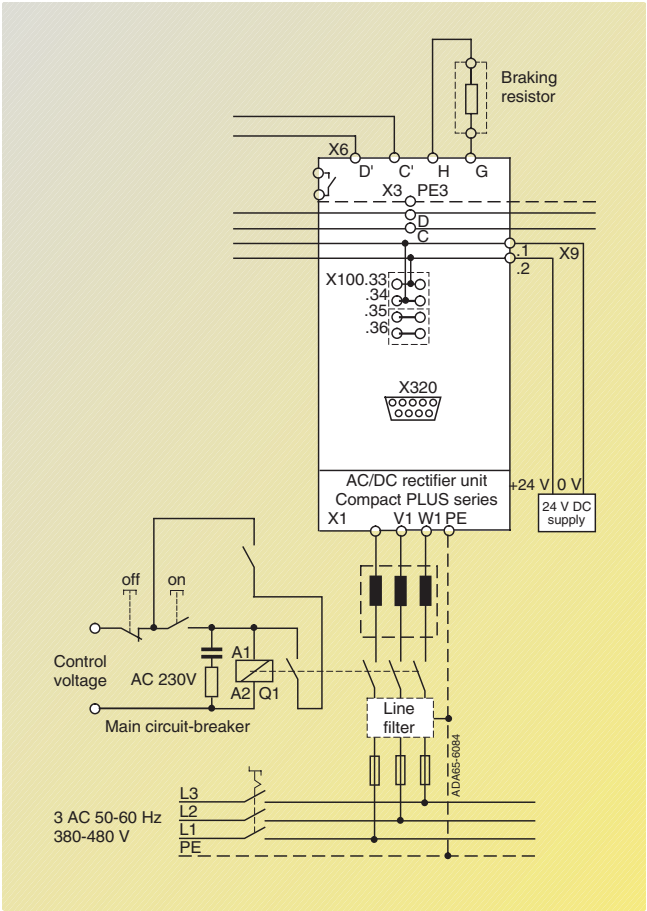


Fig. 6/20
Block diagram of rectifier units, Compact PLUS series

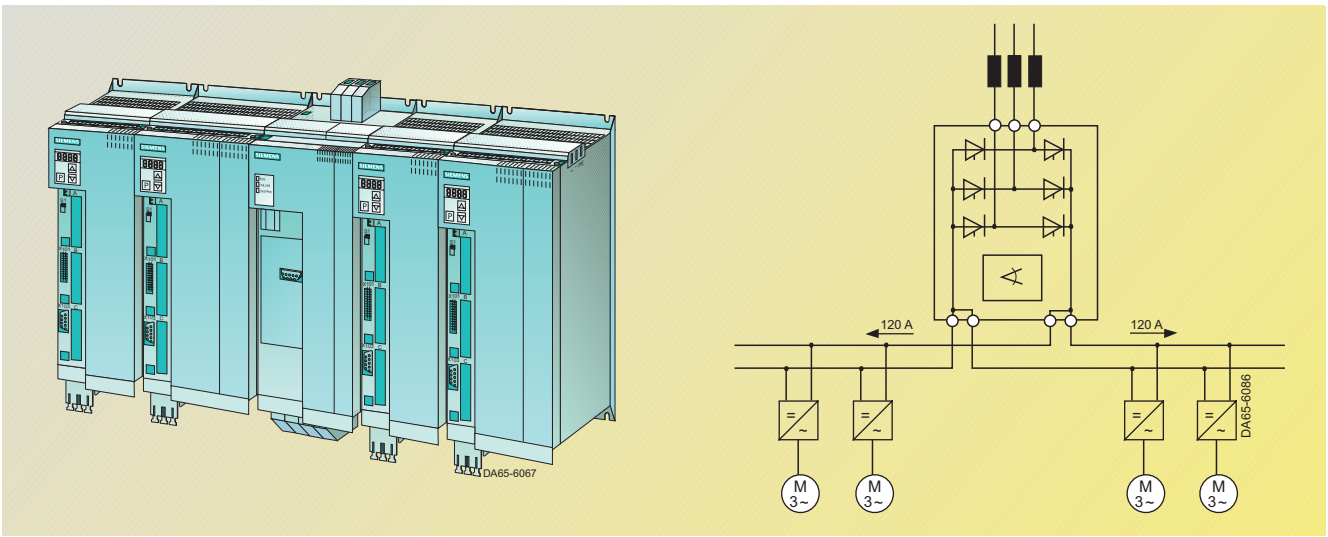


Fig. 6/21
Multi-motor drive with a 100 kW rectifier unit

Rectifier units

Control functions

Rectifier units, sizes B, C and E

These rectifier units do not have a processor board and charge the DC link of the connected inverter immediately after it is powered up. They are powered up/down via the main contactor or by turning on/off the supply voltage.

A binary output (terminal X9: 4, 5) with a switching voltage of 230 V AC enables switching of the main contactor in the event of a fault. The signalling contact (terminal X36: 1, 2) can be used to signal "Overtemperature" or "Precharge enable" as required.

Rectifier units, sizes H and K

These rectifier units are equipped with a processor board and an electronics box. Communication with a PLC via PROFIBUS DP or with the USS protocol is therefore possible.

A binary output (terminal X9: 4, 5) with a switching voltage of 230 V AC can be used to operate the main contactor (operation main contactor rectifier/regenerative unit, see Fig. 6/22).

For the control terminal strip functionality, see page 6/42, "Control terminal strip on the CUR control board".

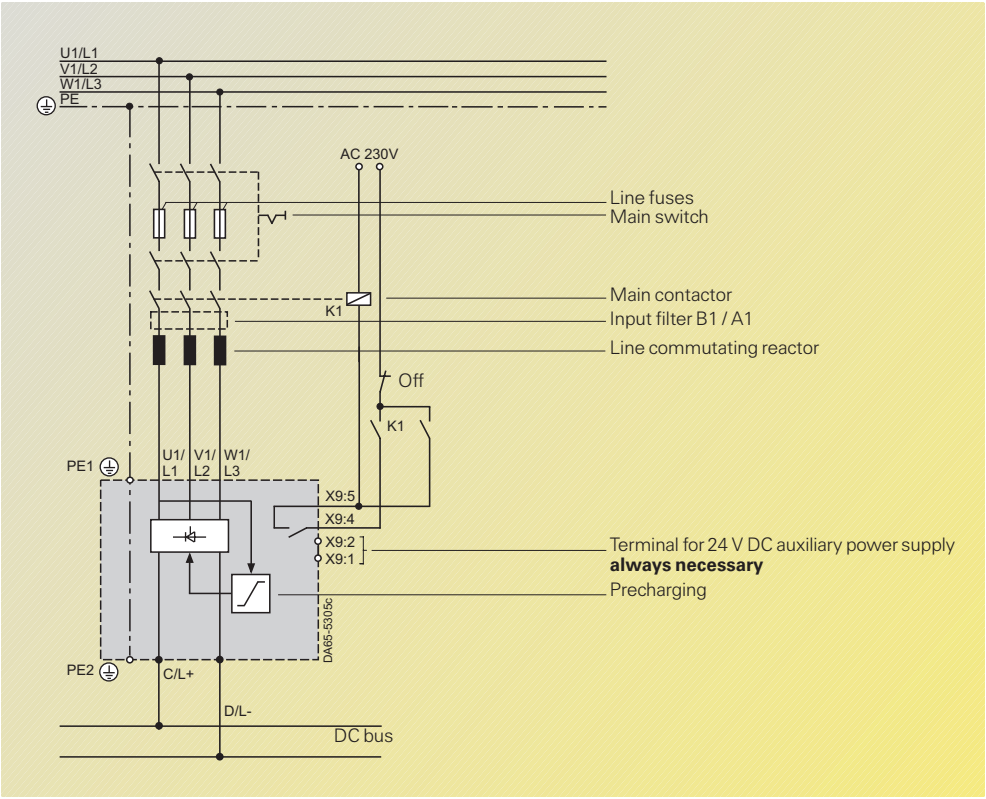


Fig. 6/22
Block diagram of the rectifier unit (sizes B, C and E)

Standard functions for rectifier units, sizes H and K

Basic setting/reserve setting

This function logically combines process data (setpoints and control functions). In other words, it enables, for example, switching from manual operation to automatic operation (internal/external) between two sources, e.g. between the operator control panel (terminal strip, interfaces, dual port RAM) to the terminal strip (interfaces, dual port RAM, operator control panel).

Reserve data sets

This control function includes 4 reserve data sets so that the control parameters can be stored and selected for varying numbers of connected inverters. Selection can also take place during operation. In this way, the rectifier units are able to use modified control data when inverters are powered up/down.

Circuit identification

With this measurement, the parameter settings of the DC link controller for the rectifier units are determined and optimized.

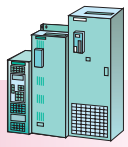
Automatic restart

This restarts the drive when the power returns following a power failure.

Terminal	Function
X9: 1	24 V DC power supply
X9: 2	Ground
X9: 4 / X9: 5	Contact material Ag CdO Operation of main contactor. Load capability: 230 V AC: 7.5 A ($\cos\varphi = 0.4$), L/R = 7 ms, 30 V DC: 5 A; DC 60 V: 1 A. Minimum load: 100 mA
X36: 1 / X36: 2	Contact material AgPb Alarm: Overtemperature, Precharging fault. Load capability: 48 V AC, 60 VA ($\cos\varphi = 1$) to 160 VA ($\cos\varphi = 0.8$); 48 V DC, 24 W Minimum load: 5 mA
X19: 1	Power supply for fans, sizes E, H, K
X19: 2	230 V 50/60 Hz

Assignment of the control terminal strip on rectifier units size B, C, E and H, K (only X19)

Note:
If a size H or K rectifier unit supplies an inverter for which the kinetic buffering function for bridging power failures or dips is activated, the automatic-restart function must be enabled.



Rectifier/regenerative units

Rectifier/regenerative units (line-commutated) not only supply the DC bus for inverters with motor power from a three-phase supply, they also inject regenerative power[1]) back into the line supply from the DC bus. This is done by means of two independent thyristor bridges; the regenerative bridge is connected via an autotransformer (for selection and ordering data, see Section 3).

The autotransformer for the regenerative bridge has the following advantage:

- maximum motor torque at full motor speed, even when regenerating.

When a rapid changeover from infeed to regeneration is carried out, a dead time of 15 ms has to be taken into account.

Rectifier/regenerative units can only be ordered as chassis units for mounting in control cubicles.

The supply voltage ranges from 3-ph. 380 V AC to 690 V AC, 50/60 Hz.

Rectifier units for 3-ph. 50/60 Hz 380 V AC to 3-ph. 50/60 Hz 480 V AC can also be connected to 3-ph. 50/60 Hz 200 V AC to 3-ph. 50/60 Hz 230 V AC with the same rated current; the output power is reduced according to the ratio of the supply voltages.

The output range of the rectifier/regenerative units is from 7.5 kW to 1500 kW in sizes C, E, H and K.

Parallel switching of size K parallel units

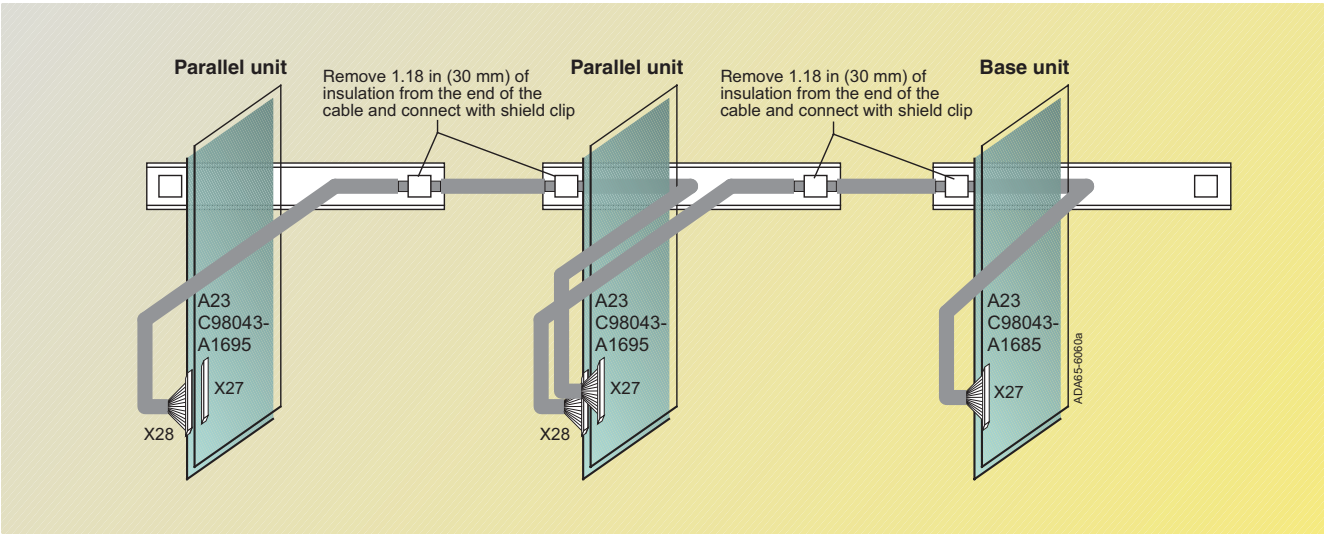


Fig. 6/23
Base and parallel units

Up to 2 units with the same rated current can be connected in parallel to the power sections of rectifier units or rectifier/regenerative units of type K ("base unit") in order to increase output current.

The parallel circuit consists of a master unit and up to 2 slave units.

The parallel units are to be mounted on the left side of the base unit.

In the following table, the parallel units suitable for a parallel connection are assigned to the respective base units.

Base unit (Master) Type	Parallel unit (Slave) Type
Rectifier units	
6SE7041-3EK85-0AA0	6SE7041-3EK85-0AD0
6SE7041-8EK85-0AA0	6SE7041-8EK85-0AD0
6SE7041-3FK85-0AA0	6SE7041-3FK85-0AD0
6SE7041-5FK85-0AA0	6SE7041-5FK85-0AD0
6SE7041-8FK85-0AA0	6SE7041-8FK85-0AD0
6SE7041-3HK85-0AA0	6SE7041-3HK85-0AD0
6SE7041-5HK85-0AA0	6SE7041-5HK85-0AD0
6SE7041-8HK85-0AA0	6SE7041-8HK85-0AD0
Rectifier/regenerative units	
6SE7041-3EK85-1AA0	6SE7041-3EK85-1AD0
6SE7041-8EK85-1AA0	6SE7041-8EK85-1AD0
6SE7041-3FK85-1AA0	6SE7041-3FK85-1AD0
6SE7041-5FK85-1AA0	6SE7041-5FK85-1AD0
6SE7041-8FK85-1AA0	6SE7041-8FK85-1AD0
6SE7041-3HK85-1AA0	6SE7041-3HK85-1AD0
6SE7041-5HK85-1AA0	6SE7041-5HK85-1AD0
6SE7041-8HK85-1AA0	6SE7041-8HK85-1AD0

1) Generating mode is permissible with 92 % of the rated DC link current.

Rectifier/regenerative units (continued)

When planning parallel switching, it must be ensured that (due to the distribution of current among the power sections) the output current is 10 % less than the total of the rated currents of the individual power sections.

For uniform distribution of current between the base unit and parallel unit(s), the following is necessary:

- Use of identical power sections (for assignment of base unit and parallel unit(s), see table)
- Phase coincidence at the rectifier/regenerative power-section connections between base unit and parallel unit(s)
- Separate commutating reactors and (in the case of rectifier/regenerative units), separate autotransformer with the same technical data for base unit and parallel unit(s). Each individual parallel path must have a minimum v_k value of 2 %.

Rectifier/regenerative units

In the case of very high v_k values of the incoming power supply ("soft power supply"), primary connection of the autotransformer must be directly at the point of incoming power (before the commutating reactors). This is necessary to ensure that the total v_k value in the regenerative direction is not too high.

If the total v_k value in the regenerative direction is very high, the thyristor commutating time is increased, thus making it necessary to reduce the inverter stability limit (parameter P776). This can make it necessary to lower V_d.

Preconditions:

- Same fuses for base unit and parallel unit(s)
- Same cable lengths to the power-section terminals of base unit and parallel unit(s)
- Do not use any output reactors in the DC link

The maximum permissible total cable length between basic unit and parallel unit 1 or (if present) parallel unit 2 is 49.2 ft (15 m).

The scope of supply of a parallel unit includes a 13.1 ft (4 m) 50-pole shielded round cable (Order No. as spare part: 6SY7010-8AA00). Order No. for 32.8 ft (10 m) cable, round, shielded: 6QX5368 (other lengths on request).

Up to 3 size K units can be connected in parallel. The parallel circuit consists of a master unit and up to 2 slave units (see Section 3). For uniform division of power, line commutating reactors with at least 2 % v_k must be provided. In this case, the rated current must be reduced by 10 %.

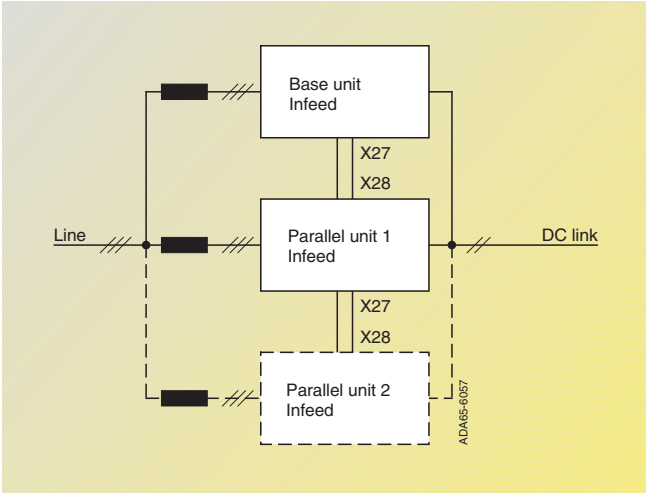


Fig. 6/24
Parallel circuit with rectifier units

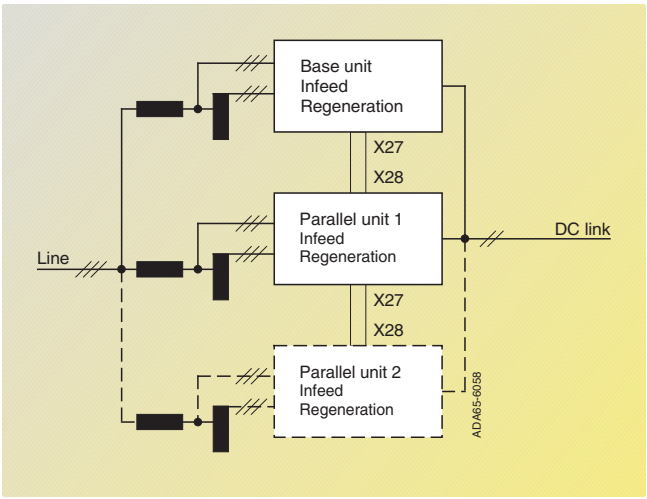


Fig. 6/25
Arrangement of "rigid power supply"

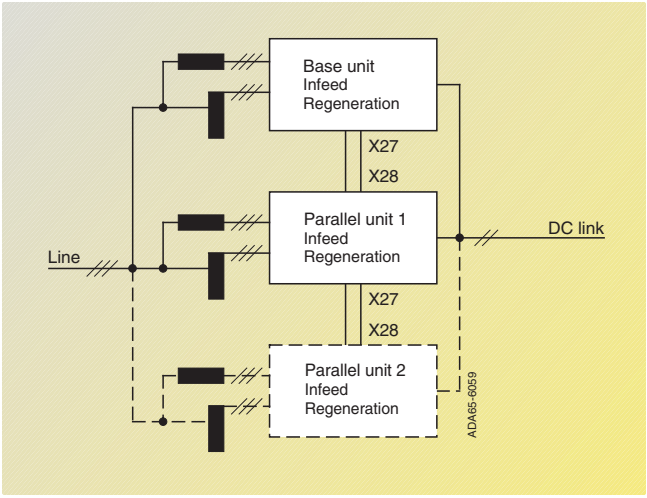
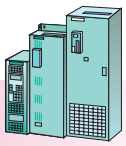


Fig. 6/26
Arrangement of "soft power supply"



Rectifier/regenerative units (continued)

12-pulse operation

Supplying two rectifier/regenerative units via a three-winding transformer enables 12-pulse operation. In order to enable a uniform load distribution for these rectifier/regenerative units and thus optimum working of the 12-pulse system, a line commutating reactor with at least 2% v_k (not required in the case of a double-tier transformer) is necessary in each secondary-side system.

Note

12-pulse operation with size H and K units takes place in a master-slave configuration. Interface adapters (Order No. 6SE7090-0XX85-1TA0) and separate cables are necessary, see Fig. 6/19 and also selection and ordering data, page 3/26.

Standard design

- supply connecting panel for motoring rectifier bridges
- supply connecting panel for generating, anti-parallel rectifier bridges
- 6-pulse thyristor bridge for the motor torque direction; 6-pulse anti-parallel thyristor bridge for the generative torque direction; earth-fault-proof precharging.
- PMU parameterizing and operator control unit
- electronics box with CUR control board
- DC link connecting panel

Note

Rectifier/regenerative units can only supply a certain number of inverters. The total DC link current flowing on the inverter side must not exceed the rated output DC link current of the rectifier unit. When selecting the rectifier unit, this means that the DC link currents of inverters in regenerative mode are subtracted from the DC link currents of inverters in motoring mode. It must also be noted that the rectifier unit has to precharge the whole effective DC link capacity of the drive.
This results in the following ruling regarding dimensions:

$$I_{\text{zkb ee}} \geq (0.3...1)\sum I_{\text{zkb wrb}}$$

$I_{\text{zkb ee}}$: Rated output DC link current of the rectifier/regenerative unit

$I_{\text{zkb wr}}$: Rated DC link current of the inverters

6

Rectifier/regenerative units (continued)

The rectifier/regenerative units require a relative impedance voltage of at least 5 % on the supply side. This is achieved by using a line commutating reactor or an appropriate converter transformer. The rectifier/regenerative units are decoupled from the supply and system perturbations are limited in accordance with DIN VDE 0160.

The maximum relative impedance voltage must not, however, exceed 10 %. In practice, the following combinations can be expected.

Supply (transformer)	Line reactor	Autotransformer
$v_D \leq 3\,\%$	4 %	2 %
$3\,\% < v_D \leq 6\,\%$	2 %	2 %
$6\,\% < v_D \leq 8\,\%$	without	2 %

Note on 12-pulse operation

For this purpose, three-winding transformers with 6 % v_D should be provided. In addition, 3 % line commutating reactors are to be built in for uniform load distribution. In the case of double-tier transformers it is possible to eliminate the line commutating reactors. An external 24 V DC power supply is required for operating rectifier/regenerative units. The current required depends on the rating of the unit (see Section 3).

In order to electrically isolate a rectifier unit from the supply system, a main switch and/or a switch disconnector can be connected on the supply side.

The rectifier is powered-up and powered-down by means of a main contactor which, in the event of a fault, also protects the connected rectifier/regenerative units. It is imperative that the main contactor is controlled via the equipment electronics (X9: 4 to 5). If the main contactor is actuated by bypassing the equipment

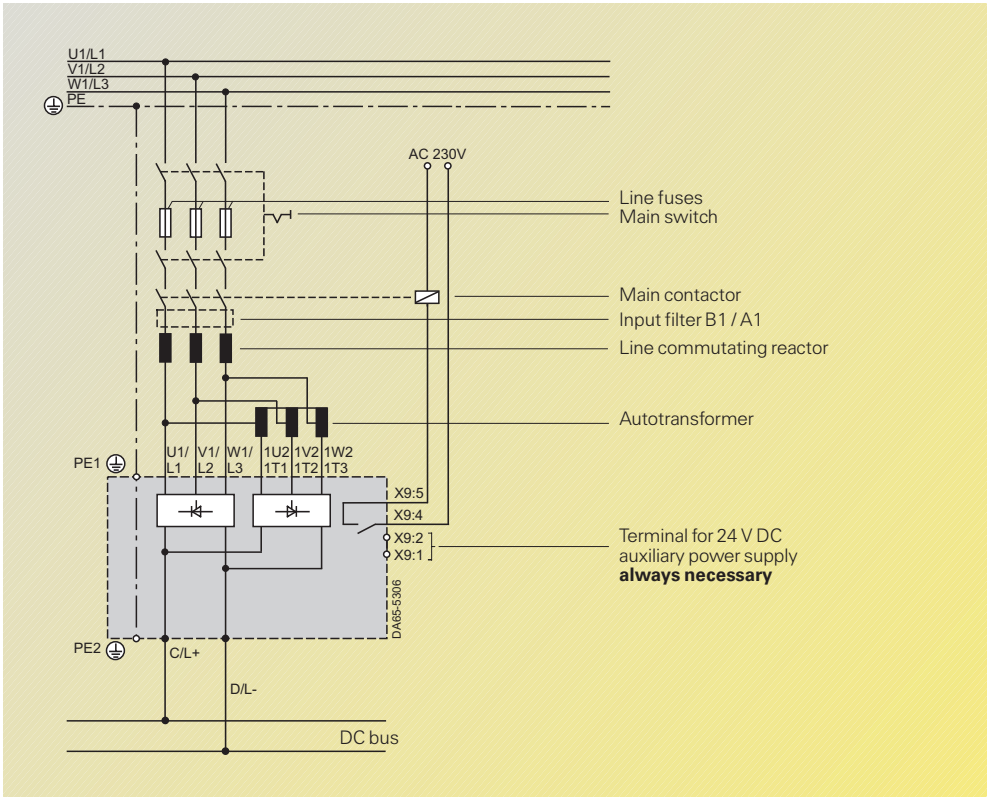


Fig. 6/27
Block diagram of the rectifier/regenerative unit

electronics in regenerative mode, fuses in the unit are triggered or thyristors shoot through (converter communication failure). The emergency Stop circuit must be set up so that the equipment electronics receive the Stop command first and thus disconnects the main contactor from the supply. Only after a delay is the supply for the main contactor disconnected by the emergency Stop circuit.

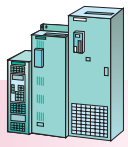
The electronics box of the rectifier/regenerative unit contains the CUR control board. It can accommodate two additional boards (communication and/or technology board). The rectifier/regenerative unit can thus be automated with PROFIBUS DP and can perform distributed technological tasks using the technology boards.

The open-loop and closed-loop control functions are fully digital with a microprocessor system and ASICs implemented on a PC board using SMD technology (CUR board):

- sequence control and operator control via PMU
- gating unit and command stage
- voltage and current controllers
- monitoring function and actual-value processing
- terminal strip
- communication via dual-port RAM and the SCom1 basic unit serial interfaces.

For information on the control terminal strip on the CUR board, see page 6/42.

The rectifier/regenerative units have the same standard functions as the rectifier units, sizes H and K; see page 6/15.



Overcurrent protector units for rectifier/regenerative units

The OCP unit can be used for new projects and existing installations. For the scope of supply and the assignment to rectifier/regenerative units, see Section 3.
When it is retrofitted, the positive busbar between the rectifier/regenerative unit and the inverter has to be divided and the OCP unit then looped in. The negative busbar is not affected (the correct flow of current must be ensured – incoming current via diode, feedback current via IGBT). The OCP unit must be built into an additional cabinet or, in the case of retrofitting, on the roof of an existing cabinet (horizontal).
The units are air-cooled. It must be ensured that the additional heat loss which occurs can be removed. It is calculated as the product of

- the DC link current and the diode's forward voltage in supply mode or
- the DC link current and the voltage drop at the IGBT in regenerative mode.

The efficiency of the rectifier/regenerative unit is only minorly influenced.

If the motor current is constant, the DC link current depends on the speed. For an economically efficient design of the rectifier/regenerative unit and the OCP unit, this feature of operation must be taken into account. Only at full speed, for example, is the full motor current taken as DC link current. At lower speeds, the DC link current can be reduced proportionally. For this reason, the OCP unit has been designed in duty class II in inverter mode with a delta function (see page 3/30, Fig. 3/11).
The necessary version of the hardware and software of rectifier/regenerative units must be checked, especially when retrofitting:

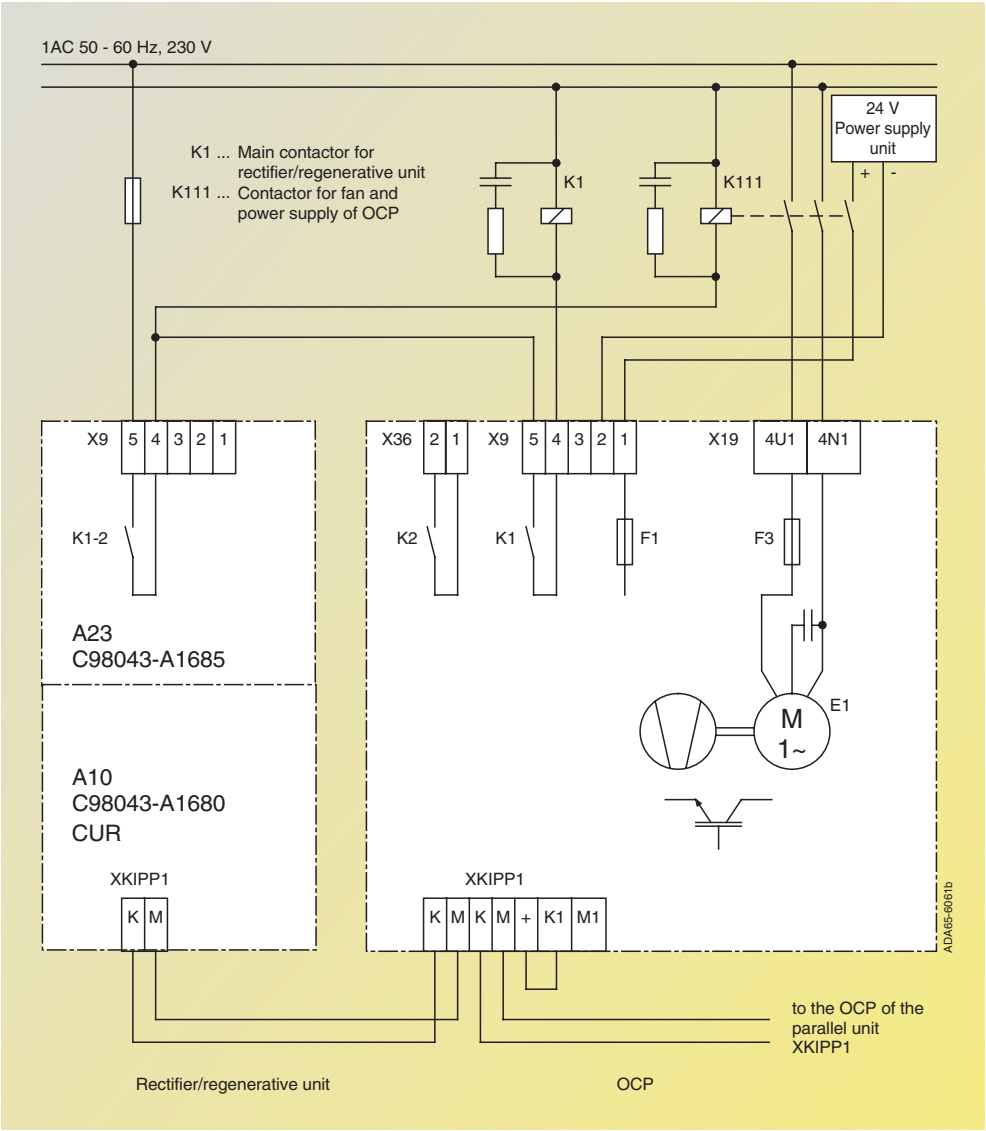


Fig. 6/28
Connection diagram of the controller

- CUR electronics board of the rectifier/regenerative unit:
  ≥ Version 13.
  Order No. for upgrading:
  6SE7090-0XX85-1DA0
  (without EPROM)
- Software version for rectifier/regenerative unit:
  ≥ Version 4.5.
  Order No. for upgrading:
  6SW1701-0DA14 (EPROM).

As a component of the SIMOVERT MASTERDRIVES drive system, the OCP unit is protected by the fuses in the rectifier/regenerative unit and in the DC link of the inverter and does not require extra fusing. It is self-protected by the electronically triggered power cut-off feature in normal operation.

Similar to the rectifier/regenerative units, the OCP unit must be supplied with 24 V DC from an external source because of the electronics (maximum power intake 0.5 A at 24 V).

Due to air-current monitoring, the OCP unit's fan must always be connected in circuit with the external 24 V DC supply (see Fig. 6/28). Here, a switch-off delay (approx. 15 s) of K111 is advantageous due to fan coasting.

Due to the OCP unit's own air-current monitoring function, the equipment is prevented from being switched off in an uncontrolled manner in the event that the OCP unit fan is defective (warning signalled by a floating relay contact, fault signalled by another floating relay contact). Inside the unit, the fan is protected by a fuse. The fan type and fuse are the same as those in the rectifier/regenerative unit.

Overcurrent protector units for rectifier/regenerative units (continued)

A two-pole control cable (XKIPP1, see Fig. 6/28) must be laid between the CUR electronics board of the rectifier/regenerative unit and the stall protection device.
Apart from correct assignment of the OCP unit to the rectifier/regenerative unit (rated current and rated voltage) and correct connection of the OCP unit, no further settings or adaptations have to be carried out on the OCP unit.

Parallel connection of size K rectifier/regenerative units with OCP unit

- 6-pulse circuits:
  If rectifier/regenerative units are connected in parallel, an OCP unit must be connected between each rectifier/regenerative unit and the DC link. Each of the parallel-connected units needs its own OCP unit in the cable leading to the DC link. The OCP units are to be connected to each other by means of control cables between the XKIPP1 terminal strips.
- 12-pulse circuits:
  In the case of 12-pulse circuits, it is also possible to use one OCP unit for both rectifier/regenerative units provided that the total rated current of the individual units together does not exceed the rated current of the OCP unit. In this case, however, it must be noted that redundancy no longer exists if one rectifier/regenerative unit fails, the reason being that the failed unit switches off the OCP unit via terminals K and M.

Operation with non-Siemens rectifier/ regenerative units

The OCP unit was specially developed for line-commutating rectifier/regenerative units of the SIMOVERT MASTERDRIVES drive system. A special advantage of the software of the rectifier/regenerative unit is that stalling of the inverter is detected at an early stage and a switch-off signal is sent to the OCP unit. In this way, formation of a high "stalling current" can be prevented in nearly all cases.
In exceptions, this signal may be too slow. The IGBT is then switched off by means of its own V_{CE} monitoring function, whereby higher overcurrents have to be handled which affect the voltage surge suppressors and reduces their lifetime.
It can be assumed that, in the case of non-Siemens rectifier/regenerative units, this special software function does not exist and there is a high switching load every time the inverter stalls.
Combination with a non-Siemens rectifier/ regenerative unit is therefore not advisable.

AFE unit (Active Front End)

Function

The AFE unit's main components are a voltage source DC link converter with a CUSA control board. From a three-phase power supply, it generates a regulated DC voltage, the so-called DC link voltage. This DC link voltage is kept almost constant irrespective of the supply voltage, even during regenerative operation.

On the three-phase side, a supply-angle-oriented high-speed vector controller is subordinate to the DC link voltage controller. This vector controller impresses an almost sinusoidal current towards the supply and, with the help of the Clean Power filter, minimizes harmonics.

The vector controller also enables the power factor cos φ and thus reactive power compensation to be set, whereby the drive's power requirement has priority.

The VSB board (Voltage Sensing Board) functions as a supply-angle encoder and works according to a principle similar to that of an encoder.

Power spectrum

	AFE compact units	AFE chassis units	AFE cabinet units
Infeed rating	6.8 kW to 49 kW at 400 V	63 kW to 250 kW at 400 V 51 kW to 192 kW at 500 V 70 kW to 245 kW at 690 V	Standard cabinet unit 37 kW to 1200 kW Application 1200 kW to 6000 kW
Design	Compact A to D	Chassis E to G	–

Caution!

AFE inverters are aligned inversely to the supply and are not capable of functioning autonomously. In order to function, they need at least the following system components:

For the compact units

- Precharger
- Main contactor
- AFE reactor
- VSB voltage sensing board

For safety reasons, an AFE rectifier/regenerative unit must be connected to the supply via a line contactor. An external 24 V power supply is therefore always necessary for supplying the VSB board and the AFE inverter.

For the chassis units

- AFE supply connecting module

This module contains a Clean Power filter and also main circuit-breaker with fuses, the 230 V power supply and 24 V power supply as well as the VSB, precharger and the main contactor.

Technical characteristics

Optimum infeed and regenerative feedback

SIMOVERT MASTERDRIVES AFE are 100 % capable of regenerative power feedback without the need for an auto-transformer. Even during regenerative mode, power losses do not occur as is the case with a braking resistor. The transition from motoring to regenerative mode is stepless, with pulse-frequency response. The exactly regulated DC link voltage ensures optimum supply of the drive inverter, almost independently of the supply voltage.

Minimal network disturbances thanks to AFE with Clean Power technology

With SIMOVERT MASTERDRIVES AFE, harmonics and commutating dips are avoided, except for a very small residue. Optimum matching between the electronically controlled active section (AFE inverter) and the passive section (Clean Power filter) ensures that almost sinusoidal voltages and currents are impressed in the direction of the supply. Network disturbances practically no longer occur.

Maximum availability even if the supply system is instable

With SIMOVERT MASTERDRIVES AFE, it is possible to intentionally operate a drive system reliably irrespective of the properties displayed by the power supply, i.e. active protection against power outages, overvoltages, frequency and voltage fluctuations by means of AFE vector control and high-speed electronic monitoring. The downstream Clean Power filter provides optimum passive protection against transient power peaks.

If the voltage moves outside the permissible range or if it fails completely, the electronics reports the problem immediately and the AFE disconnects the drive from the supply by actively switching it off. As a consequence, inverter commutation failure with fuse tripping can no longer occur even during regenerative mode. The back voltage of the AFE inverter to the supply is impressed with a high control and pulse frequency and tolerates even very short power interruptions in the millisecond range. In the case of single-phase power dips, the controller distributes the power to the other two phases and can continue to work for seconds.

AFE (Active Front End) compact and chassis units

Optimum power conversion

Because the AFE method does not place stress on the power supply systems by producing harmonics, the supply currents are lower. Supply components can thus be rated lower than with conventional methods. This applies to the line transformer, the supply cables as well as the fuses and the switches.

Optimum drive utilization due to the step-up controllability of the AFE technology

Because the DC link voltage is kept constant irrespective of the supply voltage, lower rating of the drive inverters and motor currents is also possible.

Uniform configuration

Because the AFE method is free of system disturbances and very robust when it comes to line-voltage and frequency fluctuations, uniform, reliable and simple configuration is possible with regard to the power-supply properties and system disturbances.

Supply voltage range

SIMOVERT MASTERDRIVES AFE can be operated from a 3-phase power supply system with or without an earthed neutral point.
Supply voltage ranges:
3 ph. 380 V AC -20 % to 460 V AC +5 %
3 ph. 500 V AC -20 % to 575 V AC +5 %
3 ph. 660 V AC -20 % to 690 V AC +5 %.

Power system tolerances

A high-performance vector controller with high-speed encoder (VSB) enables operation from power systems whose properties fluctuate and are difficult to define.

The following therefore applies to power system undervoltages:

a) In the case of short voltage dips, i.e. < 1 min, and up to 30 % of rated voltage, unrestricted operation is possible. If a long-term deviation from the rated value occurs, the power configuration must be adapted.
b) In the case of short voltage dips lasting from approx. 20 ms to 1 min and up to 50 % of the rated voltage, a special auxiliary power supply (24 V and control power i.e. contactors) must be provided and the power correspondingly configured.
c) Transient supply undervoltages in the range < 20 ms are tolerated up to 50 % of the rated voltage.
d) In the case of supply dips of > 50 %, the AFE actives switches off with the fault "Supply undervoltage" and the line contactor is opened.

The following therefore applies to supply overvoltages:

a) Transient supply overvoltages in the range of 10 ms are tolerated up to 50 % of the rated voltage.
b) The continuously tolerated maximum voltage is 485 V supply voltage rms for 400 V units,
605 V supply voltage rms for 500 V units and
725 V supply voltage rms for 690 V units.
c) Short-time overvoltages of 20 % to 30 % in the range of 1 s to 1 min can be tolerated, depending on the loading level. In the case of 690 V units, this is only 10 to 20 %.

AFE MASTERDRIVES in a master-slave circuit

AFE rectifier/regenerative units can be connected in parallel by cascading (master-slave mode). Power outputs can thus be combined as if they were modules, and redundant arrangements are possible.

The following is applicable:
The power outputs do not have to be the same and it is permissible to mismatch them up to a ratio of 1:4. Whereas only one unit can work as the master, the number of slaves can be ≥ 1. Previously, master/slave combinations with only one slave were used.

Functioning of the master unit (AFE master)

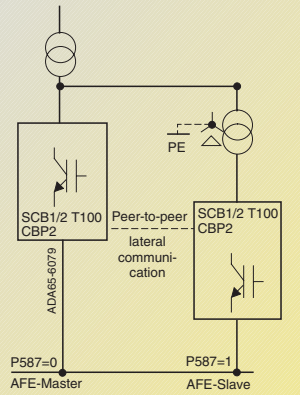
- In connection with the AFE function, the "MASTER" unit is responsible for controlling the DC link voltage V_d. The output of the V_d controller (observation parameter r263) must be sent as a current setpoint to the slave.
  The unit is defined as the master by means of parameter P587 "Slave AFE" = 0.
  Parameter P443 (V_d setpoint) is then processed as the main setpoint.

Functioning of the slave unit (AFE slave)

- The slave unit takes and controls the current setpoint I_{ActSet} from the master unit. The unit is defined as the slave by means of parameter P587 "Slave AFE" = 1.
  Parameter P486 (I_{Set}) is then processed as the main setpoint.

Data link between master and slave

- 1. SCB1/2 or T100 peer-to-peer link
  2. PROFIBUS slave-to-slave communication CBP2, slave-to-slave communication can be parameterized by means of Drive ES.



For the slave unit, its own low-voltage isolation transformer **must** be assigned.

Data:

Winding connection: Dyn5
Transmission ratio 1:1
v_k = 4% to 6%
Rated apparent power of the transformer at least 1.2 times the rated power of the AFE.

Fig. 6/29

Clean Power filter

Whereas the Clean Power filter is generally necessary for the chassis units (sizes E to G), it is optional in the case of Compact units.

For very small line transformers, i.e. for a power ratio of P_{AFE} to P_{Trans} = 1:5, use of this filter is recommended (e.g. if P_{AFE} = 6.8 kW , a Clean Power filter should be used where the line transformer output < 34 kVA).

Basic interference-suppression board

The basic interference-suppression board (6SX7010-0FB10) must be used if an EMC filter has not been configured so that at least basic EMC interference suppression is ensured. It is only permissible to use this board on earthed supply systems.

AFE (Active Front End) compact and chassis units (continued)

Nominal power rating and rectifier/regenerative power

The rectifier/regenerative power describes the actual possible power of the AFE inverter when $\cos\varphi = 1$ and the rated voltage is applied. There is also the term "nominal power rating." This is a purely formal term which is based on the way of thinking relating to motor-side inverters and is intended to facilitate the stocking of spare parts. The background to this is that the power sections of the AFE inverters are designed identically to the power sections belonging to the standard inverters of the SIMOVERT MASTERDRIVES series. Special stocking of spare parts is therefore not necessary.

Example:

An AFE inverter with 6.8 kW infeed/regenerative power has the order number 6SE7021-0EA81. What spare parts and how many are stocked can then be derived from the basic inverter with a nominal power rating of 4 kW, i.e. an inverter type 6SE7021-0TA61.

Ordering examples

1st example
AFE unit with 63 kW, 400 V (chassis unit) with operating instructions
Item 1
AFE supply connecting module
6SE7131-0EE83-2NA0
Item 2
AFE inverter
6SE7031-0EE80
Item 3
Operating instructions
6SE7080-0CX86-2AA0

2nd example
AFE unit with 6.8 kW, 400 V (Compact unit with minimum configuration) with EMC filter
Item 1
AFE inverter
6SE7021-0EA81
Item 2
VSB with housing
6SX7010-0EJ00
Item 3
AFE reactor
6SE7021-3ES87-1FG0
Item 4
Precharging resistors
6SX7010-0AC81 (3 pieces)
Item 5
EMC filter
6SE7021-0ES87-0FB1
Recommendation for line and precharging contactor:
3RT1016 with 24 V actuation.

Note

A 24 V power supply must be provided externally.

Rated data and continuous operation of the AFE inverters

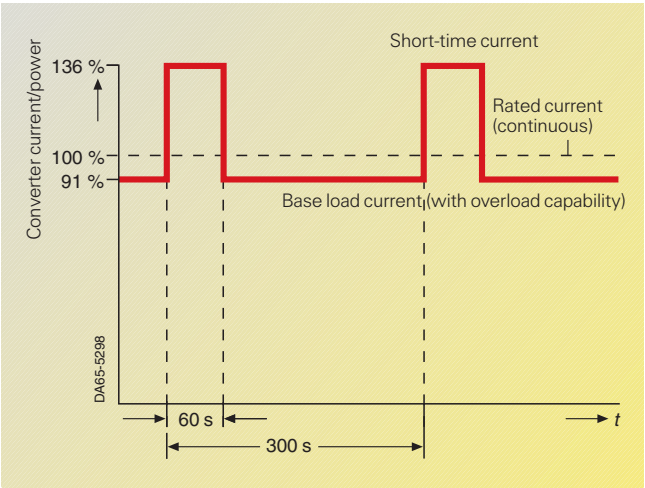


Fig. 6/30
Definition of the rated value and also the overload and base load values

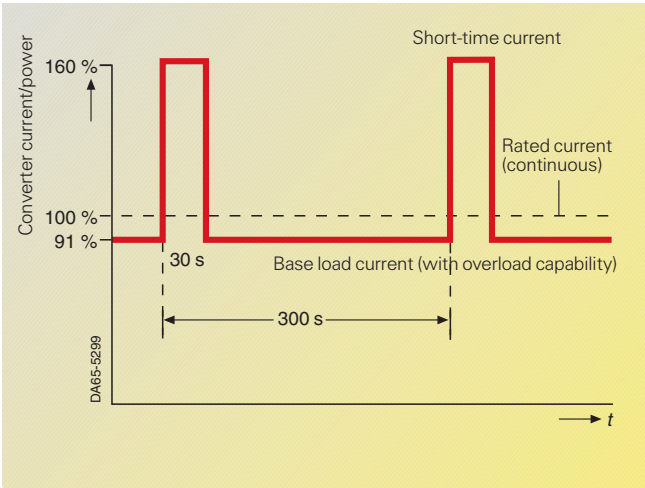


Fig. 6/31
Additional definition of the rated value and the overload and base load values

The line voltage used as a basis is 400 V in the case of compact units and 400 V, 500 V or 690 V in the case of chassis units. The power section is protected against overload using I^2t monitoring.

The units are designed for continuous operation with an AFE input current I_{UN}. If this current is used over a long period of time (> 60 s), corresponding to the 100 % value of Fig. 6/30 or 6/31, the unit reaches its maximum permissible operating temperature and the I^2t monitoring does not allow any overload above this.

AFE (Active Front End) compact and chassis units (continued)

Overload capability of the AFE inverters

For explanations, see "Overload capability of the converter" (see page 6/2).

Installation conditions and correction factors

For explanations, see page 6/3.

AFE inverters with a large power output

AFE inverters can be connected in parallel for increasing the power output. For configuration, please contact your local sales office.
The largest cabinet unit has a nominal power rating of 1200 kW at 690 V.
The largest chassis unit has a nominal power rating of 200 kW at 690 V supply voltage.
The largest compact unit has a nominal power rating of 37 kW at 400 V.

Water-cooled AFE inverters Cooling circuit

For explanations, see pages 6/4 and 6/5.

Notes on dimensioning of the AFE power

Due to the sinusoidal, precisely controlled voltages and currents, SIMOVERT MASTERDRIVES AFE can be designed very simply and reliably.

The following applies:
$P_{AFE} = 1.73 \cdot V_{Supply} \cdot I_{AFE} = P_{mech} + P_{Losses}$

The power loss is determined by the efficiency of the inverters and the motor. The mechanical power, i.e. the product of the motor torque and the motor speed, is defined by the application. What is decisive for dimensioning, therefore, is the power and not the torque as is the case with drive inverters. One or several inverters can be connected to the output. The maximum power of the connected inverters can be 4 times the rated power of the AFE inverter. The sum of the power taken from the supply is not permitted to continuously exceed the rated power of the AFE inverter.

Methods of operation and control

There are several ways of operating and controlling the unit:

- via the PMU parameterizing unit
- via an optional OP1S operator panel
- via the terminal strip
- via a serial interface.

In combination with automation systems, the unit is controlled via optional interfaces (e.g. PROFIBUS DP) or via technology boards (T100, T300).

Capacitor module for Compact PLUS units

The capacitor module enables short-time energy buffering, e.g. for bridging brief power supply failures or for absorbing braking energy. The buffered energy W can be calculated with the following formula:

$$W = \frac{1}{2} \cdot C \cdot \left(V_{d1}^2 - V_{d2}^2\right)$$

C effective capacity of the capacitor module 5.1 mF

V_{d1} DC link voltage at the start of buffering

V_{d2} DC link voltage at the end of buffering

Example:
V_{d1} = 560 V; V_{d2} = 420 V
→ W = 350 Ws

For example, a 4 HP (3 kW) converter under rated load can be buffered with this energy for approximately 100 ms.

The capacitor module has an integrated precharging function. The integrated precharging function is used when the module is connected to a Compact PLUS converter and to a Compact PLUS 20 HP (15 kW) rectifier unit.

Only one capacitor module can be connected to a Compact PLUS converter or 20 HP (15 kW) rectifier unit.

If the capacitor module is connected to multi-motor drives with 70 HP (50 kW) and 135 HP (100 kW) Compact PLUS rectifier units, the integrated precharging function is not used. The reason is that these rectifier units carry out precharging by means of phase angle control. In this configuration, a capacitor module counts as an inverter with a rated DC link current of 110 A.

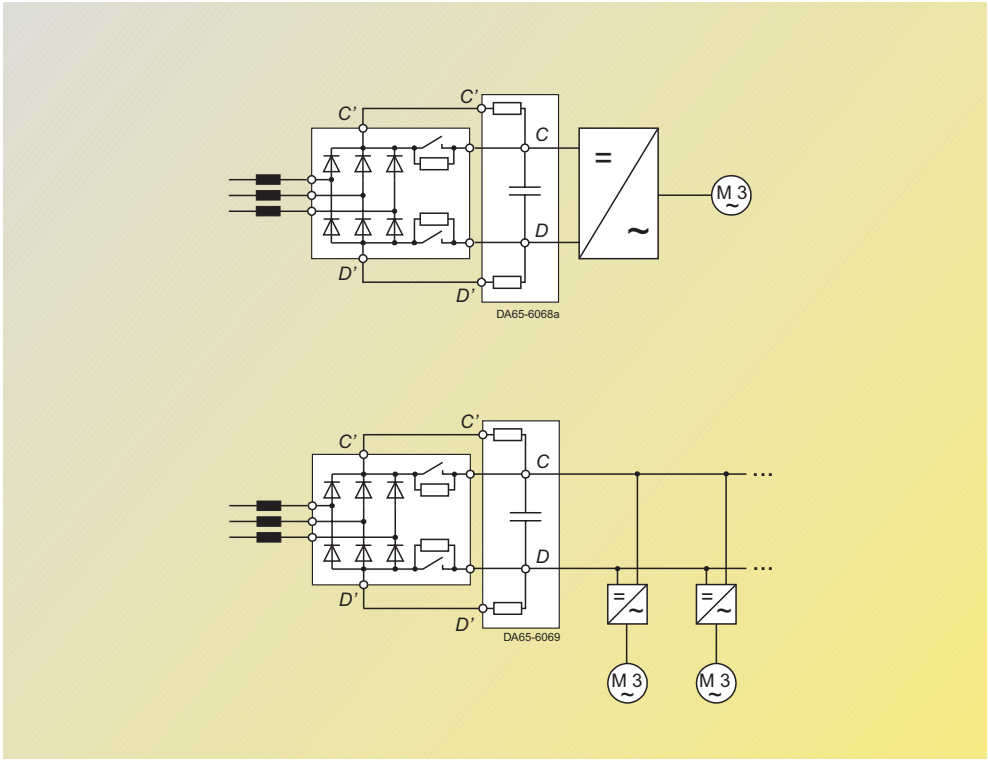


Fig. 6/32
Connection of capacitor module to Compact PLUS converters and rectifier unit 20 HP (15 kW)

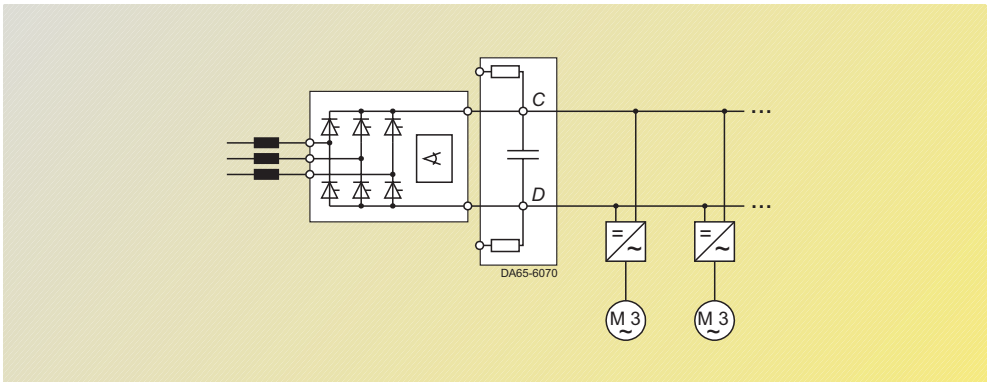


Fig. 6/33
Connection of capacitor module to 70 HP (50 kW) and 135 HP (100 kW) Compact PLUS rectifier units

Block diagrams

The standard software contains various open-loop and closed-loop control functions for all relevant applications. These include

- Control modes with *V/f* characteristic for simple applications
- Vector control modes for medium to high dynamic performance drives.

Control modes with V/f control characteristic

V/f characteristic with tachometer

Frequency control with closed-loop speed control for single induction motor drives, where, with slip compensation, sufficient speed accuracy is not achieved. The actual speed from an analog tachometer can be evaluated via an analog input and the actual speed value of a 2-track incremental encoder via the incremental encoder input.

V/f characteristic for general applications

As frequency control with slip compensation for single-motor and multi-motor drives with induction motors, without any high demands regarding dynamic performance, e.g. pumps and fans, simple traversing drives.

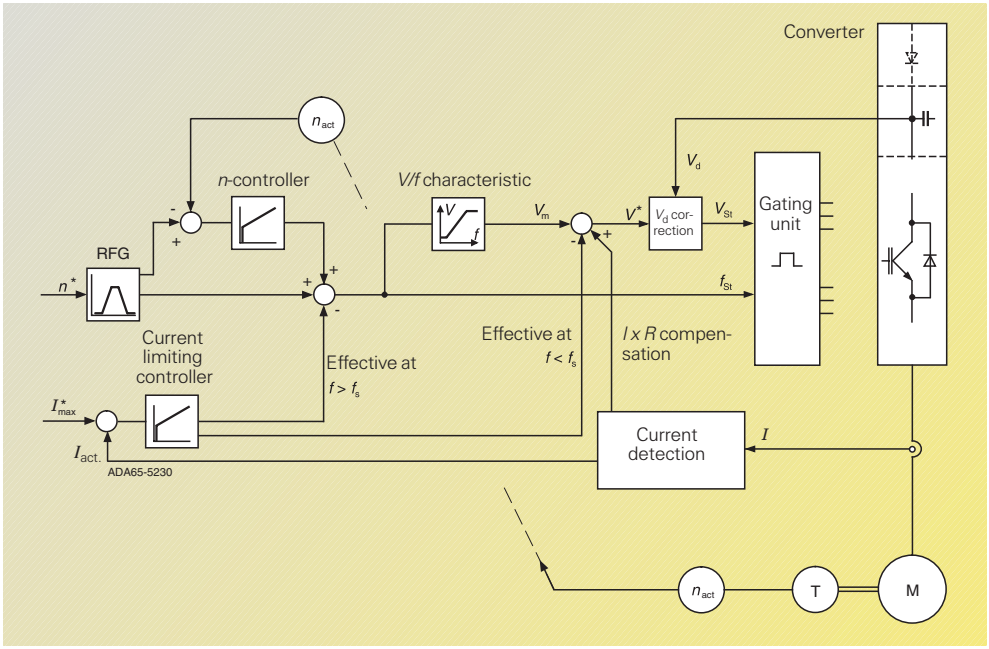


Fig. 6/34
Speed control with *V/f* characteristic

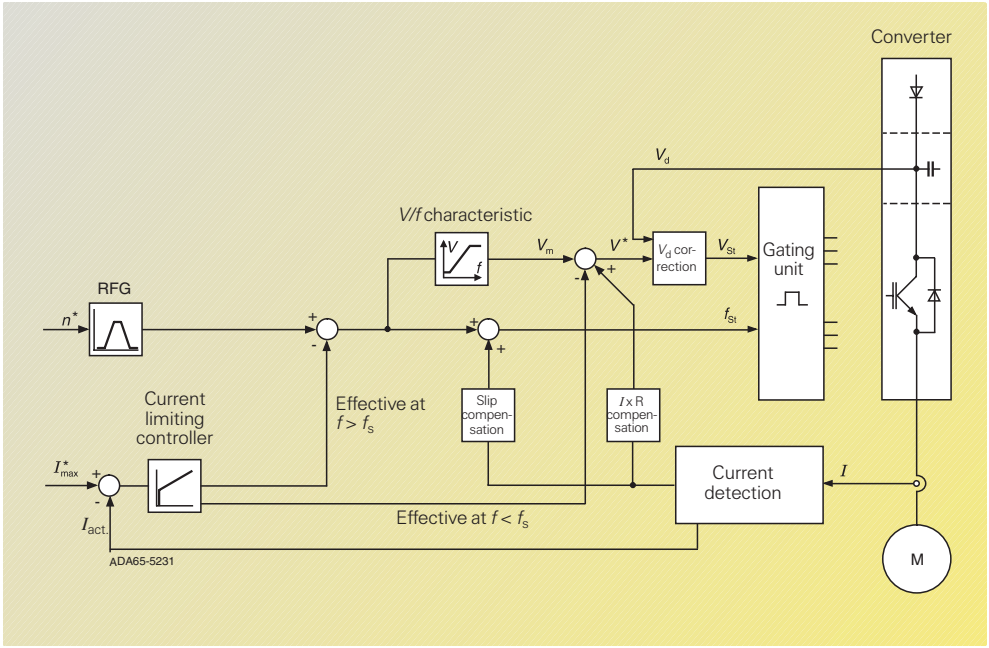
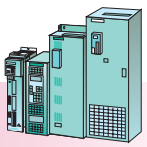


Fig. 6/35
V/f control without speed detection



Block diagrams (continued)

V/f characteristic for textile applications

Frequency control without the frequency (resolution: 0.001 Hz) being influenced by the control function; for single-motor and multi-motor drives with SIEMOSYN motors and reluctance motors with high speed accuracy, e.g. in the textile industry.

These *V/f* characteristic types of control include the following functions:

- *I* x *R* compensation
- current limiting control with influence on the voltage and frequency
- choice between characteristics for constant-torque drives and drives for pumps and fans (with $\tau \sim n^2$).

Stall protection damping to prevent motor resonance effects and slip compensation can be activated (except with *V/f* characteristic for textile applications).

With the *V/f* characteristic for textile applications, the current limiting controller acts on the output voltage only.

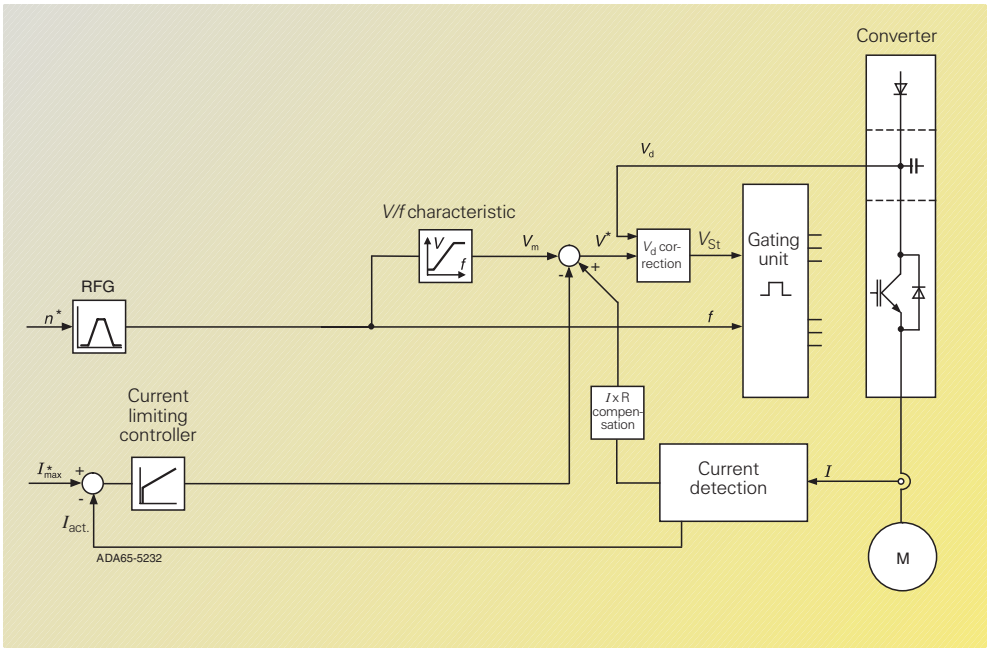


Fig. 6/36
V/f control for textile applications

Vector control or field-oriented control

The vector types of control can be used only for induction motors and for single-motor drives or multi-motor drives with a mechanically coupled load. With these types of control, a dynamic performance comparable to that of a DC drive is achieved. This is enabled by the torque and flux generating components which can be precisely determined and controlled. Reference torques can be maintained and effectively limited with the vector control system.

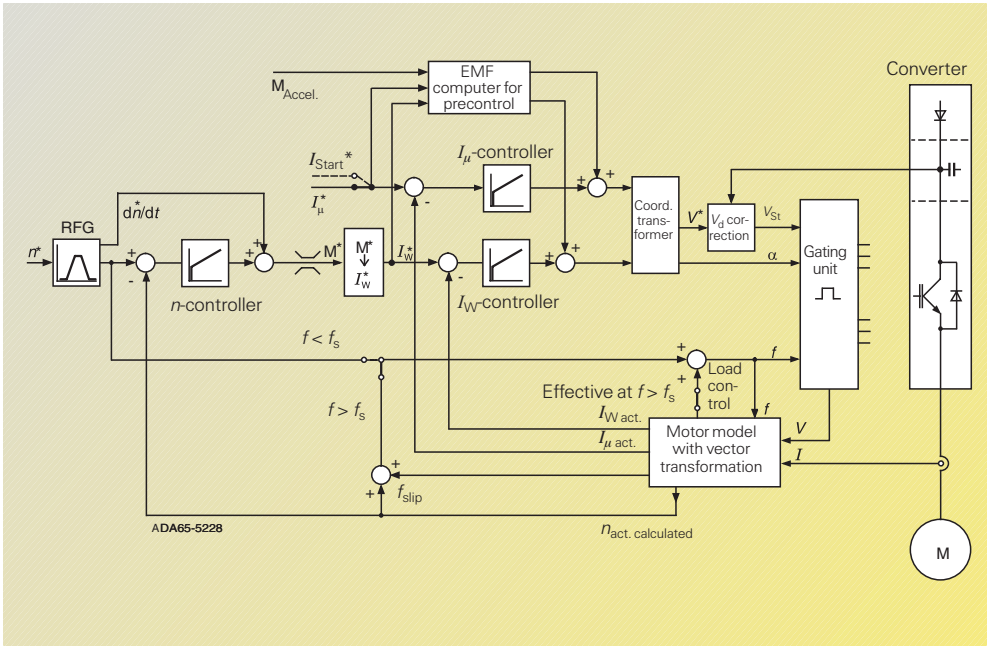


Fig. 6/37
Frequency control: field-oriented control without speed detection

Frequency control or field-oriented control without speed detection

Preferably used for single-motor drives with induction motors, from low to high-performance dynamic demands, at speed setting ranges of up to 1:10, i.e. for most industrial applications such as extruders and fans with a large power output, traversing and hoisting drives and centrifuges.

Block diagrams (continued)

Field oriented speed control with speed detection

For single-motor drives with induction motors and high demands regarding dynamic performance even at low speeds, plus increased accuracy, e.g. elevators and positioning drives, drives for continuous webs, for cranes with positioning requirements, etc.

An incremental encoder, e.g. an incremental encoder with 1024 pulses per revolution or more, is necessary for this type of closed-loop speed control. Due to its accuracy, a DC tachometer is not suitable.

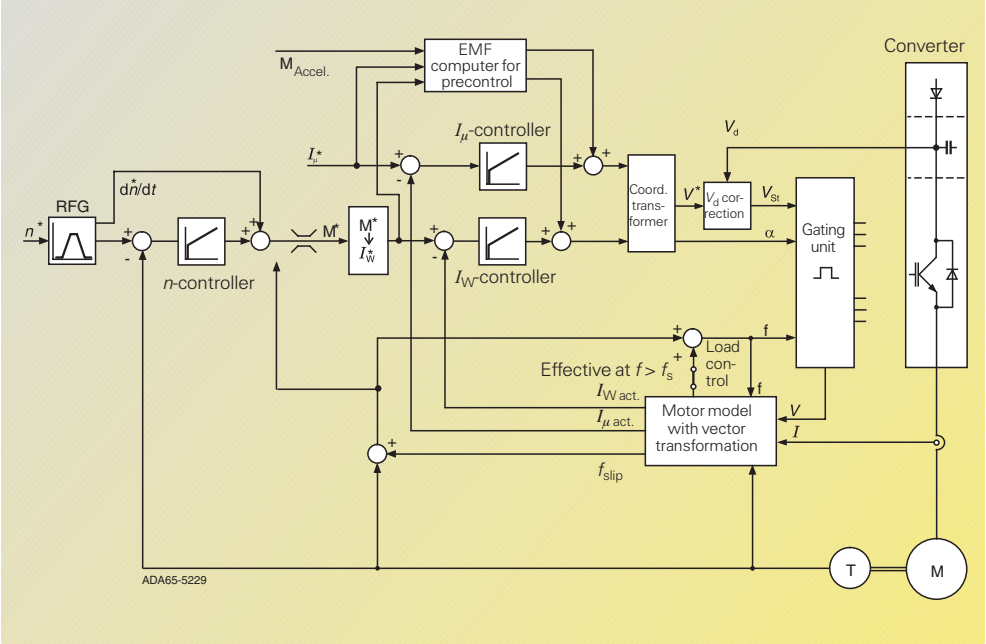


Fig. 6/38
Closed-loop speed control: field-oriented control with speed detection

Field-oriented torque control with speed detection

For single-motor drives with induction motors; applications with high dynamic performance demand if, for technological reasons, a reference torque must be maintained, e.g. winder drives, slave drives with closed-loop tension control and master-slave drives.

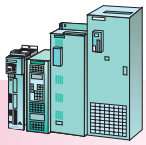
An incremental encoder is also necessary for this type of closed-loop control, preferably with 1024 pulses per revolution or more. Due to its accuracy, a DC tachometer is not suitable.

Control with or without speed detection

In certain applications, the question often arises as to whether speed detection is necessary or not. The criteria listed below can be of help.

Speed detection is necessary when

- the highest degree of speed accuracy is required
- the highest demands regarding dynamic performance have to be satisfied
- torque control in the setting range >1:10 is required
- a defined and/or changing torque has to be maintained at speeds lower than approx. 10 % of the rated motor speed.



Control performance

For maximum permissible output frequencies, see table. The rated motor frequency must be at least 8 Hz. The following three-phase motors can therefore be used:

- Standard motors with 50 Hz or 60 Hz characteristics, also
  - with an "87 Hz characteristic" (motor winding switched from Y→ Δ)
  - with a "29 Hz characteristic" (motor winding switched from Δ → Y)
- 1PH7/1PL6 type motors
- SIMOSYN 1FU type motors and 1FP type reluctance motors.

Supply voltages	Output	Max. inverter frequency for	Max. inverter frequency for constant-flux range	Max. inverter frequency for field-weakening range	Max. inverter frequency for constant-flux range	Max. inverter frequency for field-weakening range
		V/f textile	*V/f* characteristic	*V/f* characteristic	Vector control	Vector control
3-ph. 380 to 480 V AC	0.75 to 270 HP (0.55 to 200 kW)	500 Hz	200 Hz	300 Hz or 5 · f_n Mot	200 Hz	300 Hz or 5 · f_n Mot
	335 to 1750 HP (250 to 1300 kW)	300 Hz	200 Hz	300 Hz or 5 · f_n Mot	200 Hz	250 Hz or 5 · f_n Mot
3-ph. 500 to 600 V AC	3 to 15 HP (2.2 to 11 kW)	500 Hz	200 Hz	300 Hz or 5 · f_n Mot	200 Hz	300 Hz or 5 · f_n Mot
	25 to 215 HP (18.5 to 160 kW)	300 Hz	200 Hz	300 Hz or 5 · f_n Mot	200 Hz	300 Hz or 5 · f_n Mot
	270 to 2300 HP (200 to 1700 kW)	300 Hz	200 Hz	300 Hz or 5 · f_n Mot	200 Hz	250 Hz or 5 · f_n Mot
3-ph. 660 to 690 V AC	75 to 270 HP (55 to 200 kW)	300 Hz	200 Hz	300 Hz or 5 · f_n Mot	200 Hz	300 Hz or 5 · f_n Mot
	335 to 3000 HP (250 to 2300 kW)	300 Hz	200 Hz	300 Hz or 5 · f_n Mot	200 Hz	250 Hz or 5 · f_n Mot

Speed and torque accuracy levels, rise times

Operating mode	*V/f* characteristic	V/*f* textile	f control	*n* control	*T* control
Setpoint resolution digital	0.001 Hz, 31 bits + sign				0.1 %, 15 bits + sign
Setpoint resolution analog	f_{max}/2048				
Internal frequency resolution	0.001 Hz, 31 bits + sign				
Frequency accuracy		0.001 Hz			
Speed accuracy[4] at n > 10 % at n < 5 % during field-weakening operation	0.2 · f_{slip}[1] f_{slip}[1]		0.1 · f_{slip}[2] f_{slip} $f_{max}/f_n \cdot f_{slip}/10$	0.0005 %[3] 0.001 %[3] 0.001 %[3]	
Speed rise time			25 ms for n > 2 %	20 ms	
Frequency constancy		0.005 %			
Torque linearity					< 1 %
Torque accuracy in the constant-flux range in the field-weakening range			< 2.5 % for n > 5 % < 5 %	< 2.5 % for n > 1 % < 5 %	< 2.5 % for n > 1 % < 5 %
Torque rise time			approx. 5 ms for n > 10 %	approx. 5 ms	approx. 5 ms
Torque ripple			< 2 %	< 2 %	< 2 %

Note

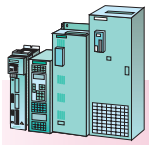
Percentages relate to the rated speed or the rated torque of the respective motor.

1) These values apply without a tachometer. If speed detection is used, the same values apply to stationary operation as in the column for "n control". If an analog tachometer is used, its accuracy must also be taken into account.

2) The slip values of standard motors are: 6 % for 1.35 HP (1 kW), 3 % for 13.5 HP (10 kW), 2 % for 40 HP (30 kW), 1 % for 135 HP (100 kW), 0.5 % for > 670 HP (500 kW). For motor outputs of 40 HP (30 kW) and more, the speed accuracy is therefore ≤ 0.3 %.

3) These values apply if an incremental encoder with 1024 pulses per revolution is used.

4) These values apply over a time average of 10 s.



Incremental encoder evaluation

With SIMOVERT MASTERDRIVES Vector Control units, an incremental encoder can be evaluated in the standard unit.

Incremental encoders with the following specifications can be connected:

- HTL encoder with 2 tracks offset by 90°
- Supply voltage V = 11 V to 30 V
- HTL level: H ≥ 8 V; L ≤ 3 V
- Input current: approx. 3.5 mA at 15 V
- Number of increments which can be evaluated 60 – 10000 pulses per revolution
- Limit frequency: f_{max} = 400 kHz.

The base unit has a supply voltage for the encoder with a load capability of 190 mA.

The SBP option board is used for evaluating TTL encoders. The SBP board can also evaluate unipolar and bipolar HTL level encoders. The DTI adapter board (can only be used together with compact and chassis units) enables floating connection of the encoder.

Software functions

The following software functions are provided in the standard unit:

BICO data sets (standard/reserve setting)

logically combine process data (setpoints and open-loop control functions). In other words, they enable, for example, switching from manual operation to automatic operation (internal/external) between two sources, e.g. between the operator control panel (terminal strip, interfaces, dual port RAM) and the terminal strip (interfaces, dual port RAM, operator control panel).

Setpoint input

The sum of the main setpoints and the supplementary setpoints can be used. The setpoints can be entered either internally or externally. Internally as the fixed setpoint, motorized-potentiometer setpoint or inching setpoint, externally via the analog input, the serial interfaces or the option boards. The internal fixed setpoints and the motorized-potentiometer setpoint can be toggled or adjusted by means of control commands from all interfaces.

Function data sets FDS (setpoint data sets SDS)

The control function includes 4 setpoint data sets which can be toggled. These data sets each include, for example, 4 fixed setpoints, a suppression bandwidth for resonance frequencies, a minimum frequency and a set of ramp-function generator data. This allows the control function to be adapted to different setpoints or other technical requirements. The ramp-function generator, for example, provides separately adjustable ramp-up and ramp-down times, initial and final rounding-off times and adjustable waiting times during braking.

Technology controllers

e.g. for pressure or power control.

Motor data set (MDS)

This control function includes 4 motor data sets so that the open-loop and closed-loop control parameters can be stored and selected for different motors. One or more different motors with different control modes can thus be operated. When a changeover is made to the "Ready" status, the control data are adapted to the parameterized operating data of the motor.

Motor identification

The open-loop and closed-loop control parameters are pre-assigned with the help of the parameterized converter and motor data. The subsequently executed DC and no-load measurement optimizes the parameter settings using these measurement results. This function allows the drives to be both quickly and simply optimized.

$V_{d\ max}$ controller

This controller adjusts the frequency when the DC link voltage is too high, e.g. if the set ramp-down time is too short, the drive converter does not go into fault condition but increases the ramp-down time.

Automatic restart

This restarts the drive when the power returns following a power failure; there is no time limit.

Kinetic buffering

This buffers power failures or dips as long as the drive kinetic energy is large enough.

Restart-on-the-fly

This function allows the SIMOVERT MASTERDRIVES Vector Control to be connected to a rotating motor.

DC current braking

This permits occasional braking without the need for a pulsed resistor or regenerative feedback. The DC braking activation point can be parameterized along the ramp-down ramp.

Converter-converter synchronization

(not for Compact PLUS)

enables motors or motor groups to be switched from one converter/inverter to another. The overlapping changeover is via an output reactor. The TSY board is necessary for this function.

Evaluation of motor temperature sensors

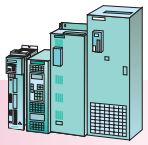
KTY84 for alarms and tripping or thermistor for alarms or tripping.

Wobble generator

with triangular wobble pattern, adjustable P steps and a synchronizing input and output for traversing drives in the textile industry.

Brake operation

With this function, brakes fitted to the motor or external brakes can be operated. Parameterizable values are e.g. threshold values and delay times for the closing and opening of the brakes.



Free function blocks with BICO system

In the software of the base units, there are function blocks which can be "softwired" as required with the help of the "BICO system." The user is therefore able to tailor the MASTERDRIVES exactly to the task to be solved.

Data between the function blocks as well as with the available control variables such as actual values and setpoints is exchanged via "plug-in connectors" which are designated either as binectors (for binary signals) or connectors (for analog signals as a 16 or 32 bit word), depending on the type of signal to be transmitted. BICO system = Binector-Connector system.

As freely usable function blocks, the following are available (with influence on the computing time):

• General function blocks

Fixed setpoints
Indicator blocks
Converter blocks
Diagnostic blocks

• Arithmetic and control blocks

Adders, subtracters
Multipliers, dividers
Absolute-value generators with filtering
Sign inverters
Limiters, limit-value monitors
Minimum, maximum selection
Timers
Polygon curve characteristics
Storage elements

• Logic blocks

AND elements
OR elements
EXCLUSIVE OR elements
Inverters
NAND elements
RS storage elements
D storage elements
Timers, pulse generator

• Complex blocks

Ramp-function generator, software counter
PID controller
Wobble generator
Brake control

Note

Refer to the Compendium for a complete list and description of the blocks.

Safe Stop

The "Safe Stop" function for SIMOVERT MASTERDRIVES is a "device for avoiding unexpected starting" according to EN 60 204-1, Section 5.4. In combination with an external circuit, the "Safe Stop" function for SIMOVERT MASTERDRIVES has been certified by the professional association in accordance with EN 954-1 Safety Category 3. With the "Safe Stop" function, motor-side contactors as a second switch-off path can be dispensed with.

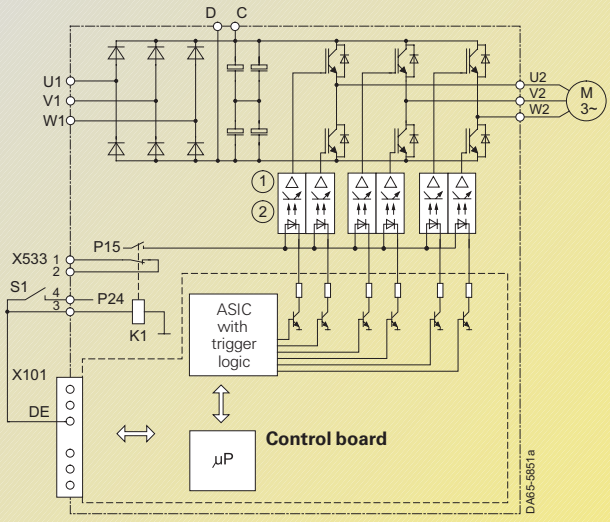
The "Safe Stop" function prevents unexpected starting of the connected motor from standstill. The "Safe Stop" is only to be activated when the drive is at standstill because, otherwise, it loses its ability to brake the motor.

The "Safe Stop" function is integrated in compact inverters 510 V to 650 V DC and 675 V to 810 V DC and is available for Compact PLUS and chassis units (converters and inverters) as option K80.

Method of functioning

The safety relay with positively driven contacts uses the NO contact to interrupt the power supply to the optocoupler/fiber-optic cable and thus prevents pulsing of the power section for building up a phase sequence.

The NC contact (= checkback contact) is used to report the switching status of the safety relay to the external control unit. The checkback contact of the safety relay always has to be evaluated and can be used for directly triggering a second switch-off path as shown in Fig. 6/40. The "Safe Stop" function is to be activated before the protective device is opened. If the NO contact of the safety relay is stuck, the checkback contact of the K2 main contactor switches off. The circuit in Fig. 6/40 assumes that the operator triggers the protective device at regular intervals. This checks the effectiveness of the switch-off paths.



① Triggering amplifier
② Optocoupler or fiber-optic cable

DE DI digital input
S1 NO contact for canceling the "Safe Stop" function (installation side)
K1 Safety relay

Fig. 6/39
Basic circuit of the "Safe Stop" function
(terminal designation applies to chassis unit with option K80)

Safe Stop (continued)

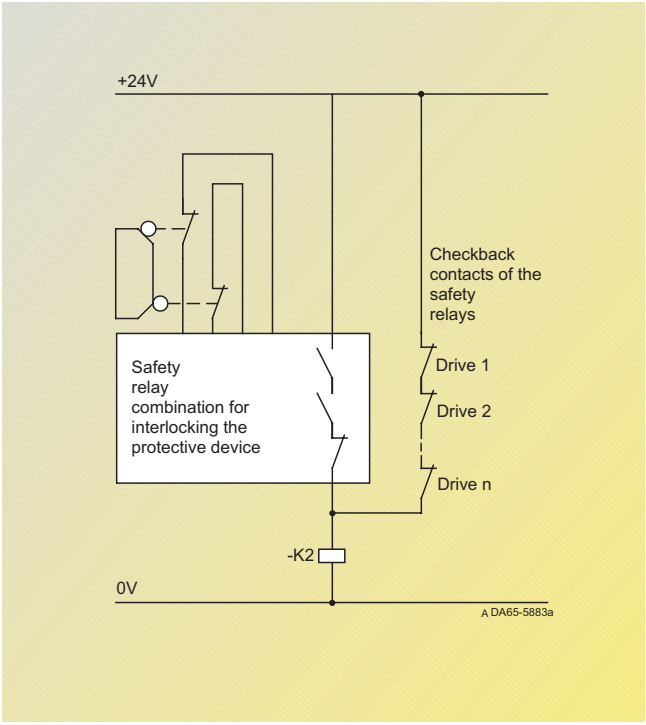


Fig. 6/40
Direct triggering of the K2 main contactor via the checkback contact of the safety relay

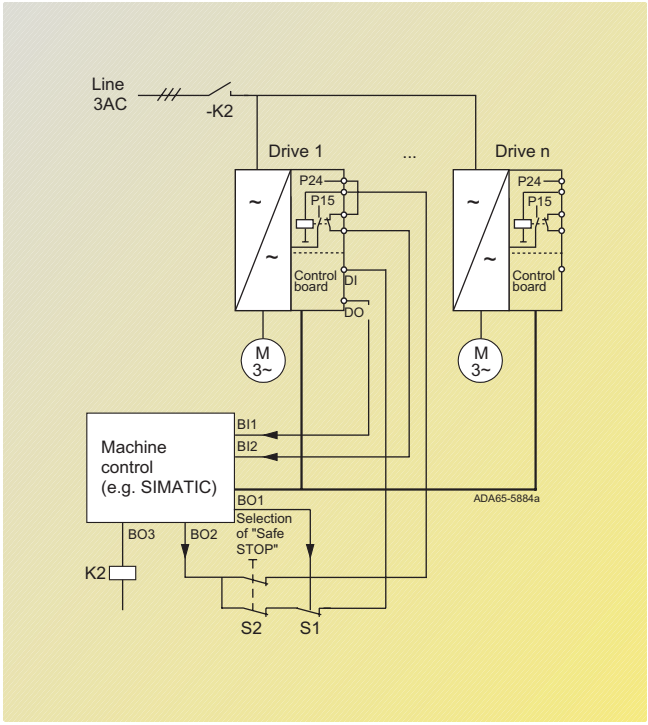


Fig. 6/41
Test of the switch-off paths via the machine control

In conjunction with the machine control, the switch-off paths in the converter or inverter can be tested and the higher-level K2 contactor is opened if a fault is discovered. The machine control unit selects "Safe Stop" via binary output BO2 and tests the reaction of the safety relay via binary input BI2. BO2 then changes to operating mode and the reaction of the control board can be tested via BO1 and S1 by means of BI1. When "Safe Stop" is selected in the status word, the control board must signal back the "OFF2" command. If a reaction does not match expectations according to the programmed reaction, the control unit generates a fault and opens the K2 main contactor. The switch-off paths can also be tested via a communication link, e.g. PROFIBUS DP.

The circuit shown in Fig. 6/41 assumes that the machine control tests the effectiveness of the switch-off paths at regular intervals and before each start (e.g. every 8 hours).

When the "Safe Stop" function is activated, electrical isolation from the supply does not take place. The function is therefore not a device for providing protection against electric shock.

Functional safety and applications

The entire machine must be fully isolated from the supply by means of the main switch for operational interruptions, maintenance, repair and cleaning work **on the electrical equipment** such as SIMOVERT MASTERDRIVES and motors (EN 60 204/5.3).

The "Safe Stop" function supports the requirements according to EN 954-1 Category 3 and EN 1037 relating to the safety of machines.

The function is based on switching off/interrupting the power supply for firing the IGBT modules so that a "hazardous movement" is prevented.

In the case of induction motors, no rotational movement is possible even if several faults occur.

In applications with synchronous motors, e.g. 1FT6, 1FK6, it must be pointed out that, due to the physics when 2 faults occur, and in very particular constellations, a residual movement can occur.

Fault example:
Simultaneous breakdown of an IGBT in one phase in the positive branch and an IGBT of another phase in the negative branch.

Residual movement:

$$\alpha_{max} = \frac{360}{\text{Pole number of the motor}}$$

e.g. 1FT6, 6-pole motor
$\alpha = 60°$

In order to estimate the hazard potential of this critical residual movement, a safety evaluation must be carried out by the engineer.

Advantage:
Motor contactors are no longer needed to meet these requirements.

Caution!
When "Safe Stop" has been activated, hazardous voltages are still present at the motor terminals due to the inverter circuit.

For further information on Siemens safety engineering, please visit the internet at: http://www.siemens.com/safety.

The application manual "Safety Integrated: The safety program for protecting man, machine, environment and process for the world's industries" with technical explanations and application examples can be ordered or downloaded at the above internet address.

Control terminal strip Compact PLUS units

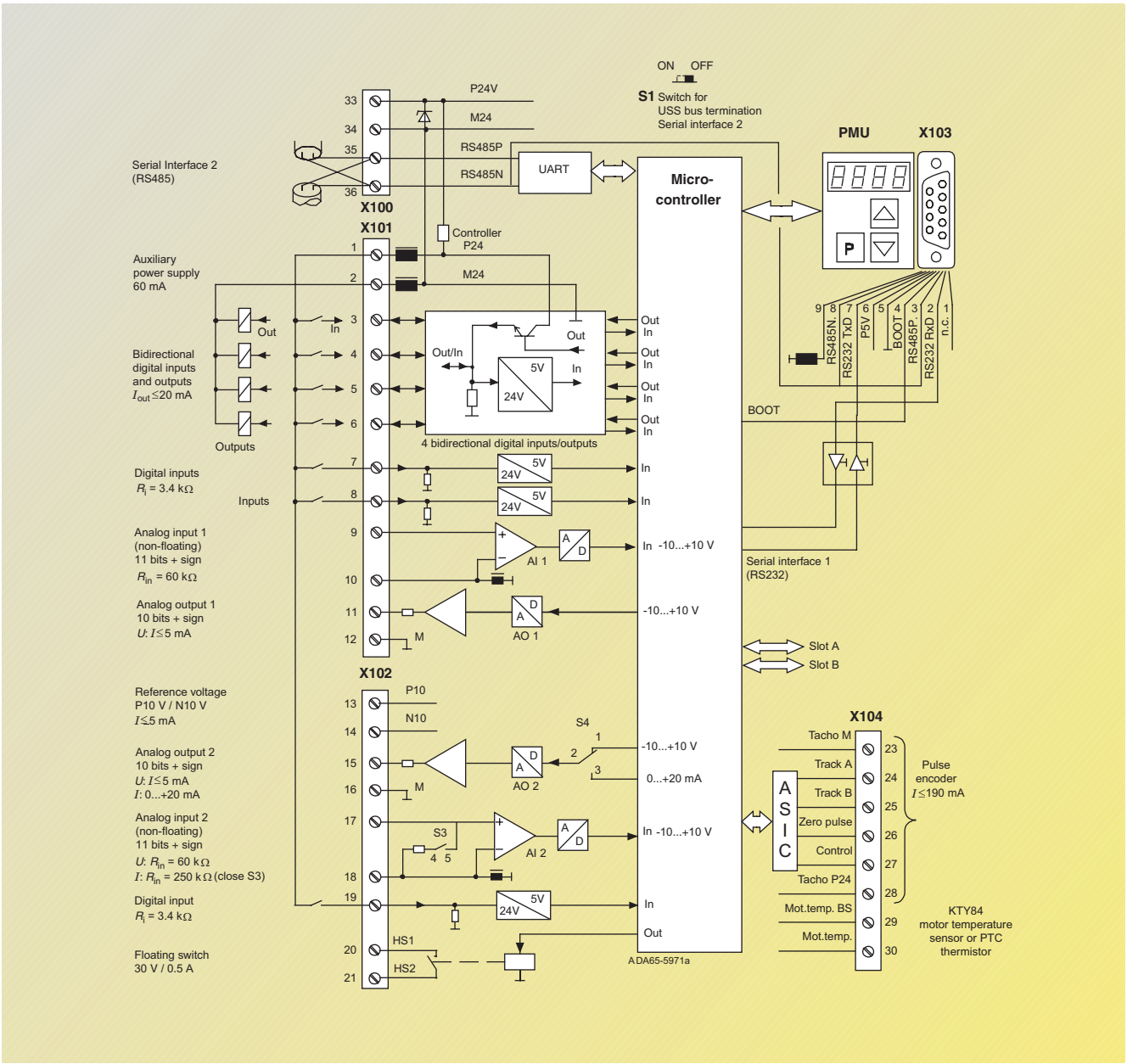


Fig. 6/42

Note

Analog input parameter programmable:
–10 V to +10 V
0 V to +10 V
0 mA to 20 mA
4 mA to 20 mA
–20 mA to +20 mA

Analog output 2:
The display range with impressed current (S4: 2; 3, S4: 5; 6) 0 mA (4 mA) to 20 mA refers to the entire value range of the output parameter:
e.g. motor torque –200 % τ_{Motn} to +200 % τ_{Motn} corresponds to 0 mA up to 20 mA.

For spare or replacement connectors for the terminal strip, see "Plug set for Compact PLUS units" on page 3/67.

Control terminal strip Compact PLUS units (continued)

Preassignment of the terminal strip

a) Factory setting (without quick parameterization)

Control commands (single bits of the control word) and feedback signals (single bits of the status word) are assigned to the individual control sources (operator control panel, terminal strip, serial interface) by parameterization using binectors and connectors. For this purpose, two BICO sets are provided via which the control commands can be switched over to different sources. The factory setting ensures that the unit can be operated

- with BICO set 1 via the PMU operator control panel as standard or the OP1S as an option
- with BICO set 2 via the terminal strip.

Switching over between BICO set 1 and BICO set 2 thus corresponds to the previous switch-over "Base/Reserve".
The following tables show the terminal assignment of BICO set 2. They apply to compact, chassis and cabinet units (without external terminal strip).

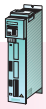
Terminal	No.	Type	Preassignment	Comment
Control terminal strip on Compact PLUS units in accordance with the factory setting with PMU or OP1S				
X101	1	P24	Voltage supply for control terminal strip [1]	
	2	M throttled		
	3	Binary input/output 1	Fault	Parameterized as binary output
	4	Binary input/output 2	Operation	Parameterized as binary output
	5	Binary input/output 3	Change-over BICO set	Control panel/terminal strip
	6	Binary input/output 4	None	
	7	Binary input 5	Acknowledge	
	8	Binary input 6	Off 2	
	9	Analog input 1		
	10	M analog 1		
	11	Analog output 1		
	12	M analog 1		
X102	13	P10		
	14	N10		
	15	Analog output 2		
	16	M analog 2		
	17	Analog input 2		
	18	M analog 2		
	19	Binary input 7	On/Off 1	
	20	HS1		
	21	HS2		

Note: Binary outputs on the terminal strip are SIMATIC-compatible transistor outputs, not floating relay contacts!

The speed setpoint has been set in the factory via the operator control panel with higher/lower keys or by means of the fixed setpoint, changeable via the operator control panel.

If the main setpoint is to be entered via analog input 1, terminals X101: 9/10, the following parameters are to be set:
P443 Source, main setpoint → K0011
P444 Scaling, main setpoint.

1) The P24 voltage supply of terminal X101:1 must not be connected to the 24 V DC auxiliary supply's (20 V to 30 V) positive pole, which is supplied via terminal X9 (damage to the internal 24 V controller!).



Control terminal strip Compact PLUS units (continued)

Preassignments of the terminal strip (cont.)

b) Terminal assignments after quick parameterization

In the case of quick parameterization and with the following preassignments of the terminal strip, a selection can be made which is different to the factory setting by means of parameter P368.

Terminal	No.	Type	Preassignment	Comment
Control terminal strip on Compact PLUS units after quick parameterization P368 = 1: "Analog input and terminal strip"				
X101	1	P24	Voltage supply for control terminal strip [1]	
	2	M throttled		
	3	Binary input/output 1	Fault	
	4	Binary input/output 2	Operation	
	5	Binary input/output 3	Warning	
	6	Binary input/output 4	None	Reserve for options
	7	Binary input 5	Acknowledge	
	8	Binary input 6	Off 2	
	9	Analog input 1	Speed setpoint	
	10	M analog 1		
	11	Analog output 1	Actual speed	
	12	M analog 1		
X102	13	P10		
	14	N10		
	15	Analog output 2		
	16	M analog 2		
	17	Analog input 2	Torque setpoint with torque control	
	18	M analog 2		
	19	Binary input 7	On/Off 1	
	20	HS1		
	21	HS2		

With this preassignment, a total of 4 parameterizable fixed setpoints can be selected (either as main setpoints or as torque setpoints). This is done via the binary inputs FSetp bit 0 and FSetp bit 1.

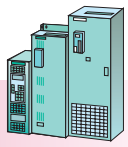
Terminal	No.	Type	Preassignment	Comment
Control terminal strip on Compact PLUS units after quick parameterization P368 = 2: "Fixed setpoints and terminal strip"				
X101	1	P24	Voltage supply for control terminal strip [1]	
	2	M throttled		
	3	Binary input/output 1	Fault	
	4	Binary input/output 2	Operation	
	5	Binary input/output 3	FSetp bit 0	
	6	Binary input/output 4	FSetp bit 1	
	7	Binary input 5	Acknowledge	
	8	Binary input 6	Off 2	
	9	Analog input 1		
	10	M analog 1		
	11	Analog output 1	Actual speed	
	12	M analog 1		
X102	13	P10		
	14	N10		
	15	Analog output 2		
	16	M analog 2		
	17	Analog input 2	None	
	18	M analog 2		
	19	Binary input 7	On/Off 1	
	20	HS1		
	21	HS2	None	

1) The P24 voltage supply of terminal X101:1 must not be connected to the 24 V DC auxiliary supply's (20 V to 30 V) positive pole, which is supplied via terminal X9 (damage to the internal 24 V controller!).

Control terminal strip Compact PLUS units (continued)

Terminal	No.	Type	Preassignment	Comment
Control terminal strip on Compact PLUS units after quick parameterization P368 = 3: "Motor potentiometer and terminal strip"				
X101	1	P24	Voltage supply for control terminal strip [1)]	
	2	M throttled		
	3	Binary input/output 1	Fault	
	4	Binary input/output 2	Operation	
	5	Binary input/output 3	Motor potentiometer higher	
	6	Binary input/output 4	Motor potentiometer lower	
	7	Binary input 5	Acknowledge	
	8	Binary input 6	Off 2	
	9	Analog input 1		
	10	M analog 1		
	11	Analog output 1	Actual speed	
	12	M analog 1		
X102	13	P10		
	14	N10		
	15	Analog output 2	None	
	16	M analog 2		
	17	Analog input 2	None	
	18	M analog 2		
	19	Binary input 7	On/Off 1	
	20	HS1		
	21	HS2	None	

1) The P24 voltage supply of terminal X101:1 must not be connected to the 24 V DC auxiliary supply's (20 V to 30 V) positive pole, which is supplied via terminal X9 (damage to the internal 24 V controller!).



Control terminal strip on the CUVC control board (Vector Control)

Application: SIMOVERT MASTERDRIVES compact and chassis converters and inverters
Order No. of CUVC: 6SE7090-0XX84-0AB0

Spare connectors for the terminal strip:

- For A – D frame compact units Order No. 6SY7000-0AD27 (connectors X101 to X103 and 9 pin X9).
- For E – L frame chassis units Order No. 6SY7000-0AD28 (connectors X101 to X103 and 5 pin X9).

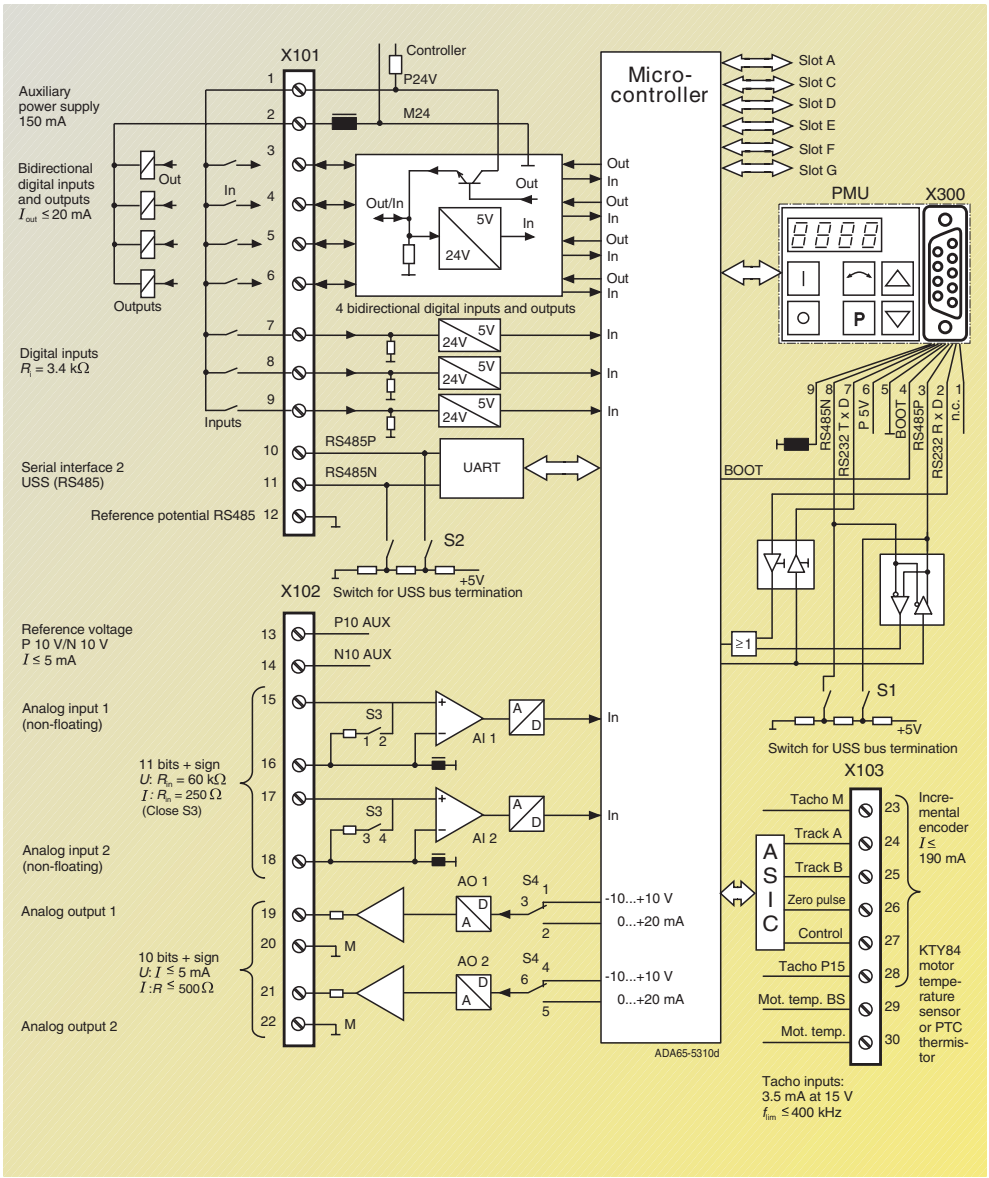


Fig. 6/43

Note

Analog input parameter programmable:
–10 V to +10 V
0 V to +10 V
0 mA to 20 mA
4 mA to 20 mA
–20 mA to +20 mA

Analog output:
The display range with impressed current (S4: 2; 3, S4: 5; 6) 0 mA (4 mA) to 20 mA refers to the entire value range of the output parameter:
e.g. motor torque –200 % τ_{Motn} to +200 % τ_{Motn} corresponds to 0 mA up to 20 mA.

Control terminal strip on the CUVC control board (Vector Control) (continued)

Preassignments of the terminal strip

a) Factory setting (without quick parameterization)

Control commands (single bits of the control word) and feedback signals (single bits of the status word) are assigned to the individual control sources (operator control panel, terminal strip, serial interface) by parameterization using binectors and connectors. For this purpose, two BICO sets are provided via which the control commands can be switched over to different sources. The factory setting ensures that the unit can be operated

- with BICO set 1 via the PMU operator control panel as standard or the OP1S as an option
- with BICO set 2 via the terminal strip.

Switching over between BICO set 1 and BICO set 2 thus corresponds to the previous switch-over "Base/Reserve".
The following tables show the terminal assignment of BICO set 2. They apply to compact, chassis and cabinet units (without external terminal strip).

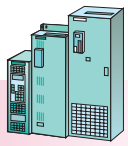
Note: Binary outputs on the terminal strip of the CUVC board are SIMATIC-compatible transistor outputs, not floating relay contacts!

The speed setpoint has been set in the factory via the operator control panel with higher/lower keys or by means of the fixed setpoint, changeable via the operator control panel.

If the main setpoint is to be entered via analog input 1, terminals X102: 15/16, the following parameters are to be set:
P443 Source, main setpoint → K0011
P444 Scaling, main setpoint.

Terminal	No.	Type	Preassignment	Comment
Control terminal strip on the CUVC control board in accordance with the factory setting For Compact and chassis units with PMU or OP1S				
X101	1	P24	Voltage supply for control terminal strip [1]	
	2	M throttled		
	3	Binary input/output 1	Fault	Parameterized as binary output
	4	Binary input/output 2	Operation	Parameterized as binary output
	5	Binary input/output 3	Change-over BICO set	Control panel/terminal strip
	6	Binary input/output 4	None	
	7	Binary input 5	Acknowledge	
	8	Binary input 6	Off 2	
	9	Binary input 7	On/Off 1	
	10	RS485 P		Serial interface
	11	RS485 N		Com2
	12	RS485 M		
X102	13	P10		
	14	N10		
	15	Analog input 1	None	
	16	M analog 1		
	17	Analog input 2	None	
	18	M analog 2		
	19	Analog output 1	Actual speed	
	20	M analog 1		
	21	Analog output 2	None	
	22	M analog 2		
Terminal strip on CUVC control board in accordance with the factory setting For cabinet units without any additional external terminal strip; with PMU or OP1S				
X101	1	P24	Voltage supply for control terminal strip [1]	
	2	M throttled		
	3	Binary input/output 1	Acknowledge	Parameterized as binary output
	4	Binary input/output 2	Change-over BICO set	Control panel/terminal strip
	5	Binary input/output 3	Fault	
	6	Binary input/output 4	None	Reserve for options
	7	Binary input 5	External fault	
	8	Binary input 6	External alarm	
	9	Binary input 7	On/Off 1	
	10	RS485 P		Serial interface
	11	RS485 N		Com2
	12	RS485 M		
X102	13	P10		
	14	N10		
	15	Analog input 1	None	
	16	M analog 1		
	17	Analog input 2	None	
	18	M analog 2		
	19	Analog output 1	Actual speed	
	20	M analog 1		
	21	Analog output 2	None	
	22	M analog 2		

1) The P24 voltage supply of terminal X101:1 must not be connected to the 24 V DC auxiliary supply's (20 V to 30 V) positive pole, which is supplied via terminal X9 (damage to the internal 24 V controller!).



Control terminal strip on the CUVC control board (Vector Control) (continued)

Preassignments of the terminal strip (cont.)

b) Terminal assignments after quick parameterization

In the case of quick parameterization and with the following preassignments of the terminal strip, a selection can be made which is different to the factory setting by means of parameter P368.

Control terminal strip on the CUVC control board after quick parameterization
P368 = 1: "Analog input and terminal strip"

Terminal	No.	Type	Preassignment	Comment
X101	1	P24	Voltage supply for control terminal strip [1]	
	2	M throttled		
	3	Binary input/output 1	Fault	
	4	Binary input/output 2	Operation	
	5	Binary input/output 3	Warning	
	6	Binary input/output 4	None	Reserve for options
	7	Binary input 5	Acknowledge	
	8	Binary input 6	Off 2	
	9	Binary input 7	On/Off 1	
	10	RS485 P		Serial interface
	11	RS485 N		Com2
	12	RS485 M		
X102	13	P10		
	14	N10		
	15	Analog input 1	Speed setpoint	
	16	M analog 1		
	17	Analog input 2	Torque setpoint with torque control	
	18	M analog 2		
	19	Analog output 1	Actual speed	
	20	M analog 1		
	21	Analog output 2	None	
	22	M analog 2		

With this preassignment, a total of 4 parameterizable fixed setpoints can be selected (either as main setpoints or as torque setpoints). This is done via the binary inputs FSetp bit 0 and FSetp bit 1.

Control terminal strip on the CUVC control board after quick parameterization
P368 = 2: "Fixed setpoints and terminal strip"

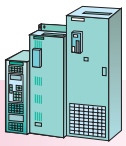
Terminal	No.	Type	Preassignment	Comment
X101	1	P24	Voltage supply for control terminal strip [1]	
	2	M throttled		
	3	Binary input/output 1	Fault	
	4	Binary input/output 2	Operation	
	5	Binary input/output 3	FSetp bit 0	
	6	Binary input/output 4	FSetp bit 1	
	7	Binary input 5	Acknowledge	
	8	Binary input 6	Off 2	
	9	Binary input 7	On/Off 1	
	10	RS485 P		Serial interface
	11	RS485 N		Com2
	12	RS485 M		
X102	13	P10		
	14	N10		
	15	Analog input 1	None	
	16	M analog 1		
	17	Analog input 2	None	
	18	M analog 2		
	19	Analog output 1	Actual speed	
	20	M analog 1		
	21	Analog output 2	None	
	22	M analog 2		

1) The P24 voltage supply of terminal X101:1 must not be connected to the 24 V DC auxiliary supply's (20 V to 30 V) positive pole, which is supplied via terminal X9 (damage to the internal 24 V controller!).

Control terminal strip on the CUVC control board (Vector Control) (continued)

Terminal	No.	Type	Preassignment	Comment
Control terminal strip on the CUVC control board after quick parameterization P368 = 3: "Motor potentiometer and terminal strip"				
X101	1	P24	Voltage supply for control terminal strip [1]	
	2	M throttled		
	3	Binary input/output 1	Fault	
	4	Binary input/output 2	Operation	
	5	Binary input/output 3	Motor potentiometer higher	
	6	Binary input/output 4	Motor potentiometer lower	
	7	Binary input 5	Acknowledge	
	8	Binary input 6	Off 2	
	9	Binary input 7	On/Off 1	
	10	RS485 P		Serial interface
	11	RS485 N		Com2
	12	RS485 M		
X102	13	P10		
	14	N10		
	15	Analog input 1	None	
	16	M analog 1		
	17	Analog input 2	None	
	18	M analog 2		
	19	Analog output 1	Actual speed	
	20	M analog 1		
	21	Analog output 2	None	
	22	M analog 2		

1) The P24 voltage supply of terminal X101:1 must not be connected to the 24 V DC auxiliary supply's (20 V to 30 V) positive pole, which is supplied via terminal X9 (damage to the internal 24 V controller!).

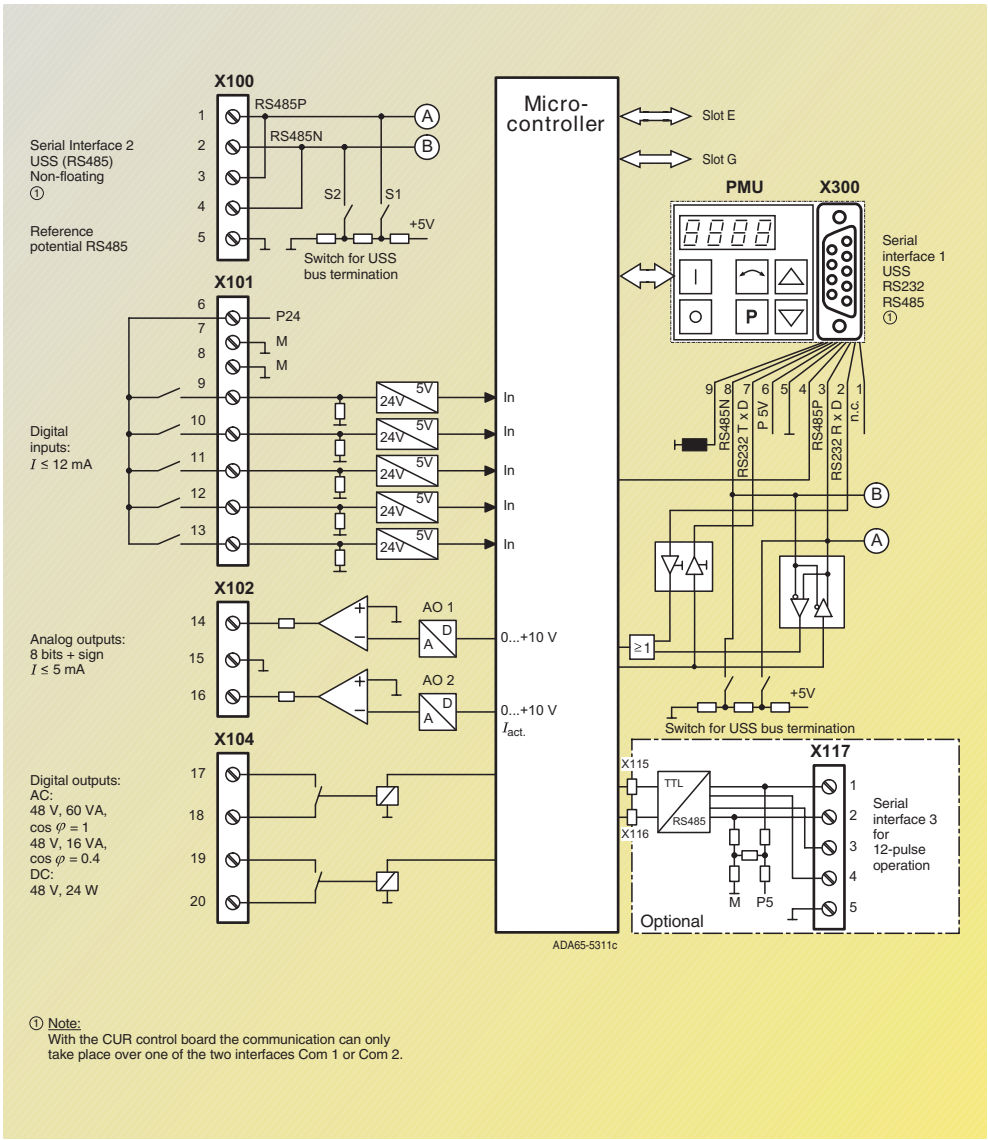


Control terminal strip on the CUR control board (rectifier unit and rectifier/regenerative unit)

Application: SIMOVERT MASTERDRIVES rectifier/ regenerative units and rectifier units with a rated current ≥ 774 A
Order No. of the CUR: 6SE7090–0XX85–1DA0

The firmware for the CUR control board must be ordered separately.

Order No. EPROM with up-to-date firmware: 6SW1701–0DA14



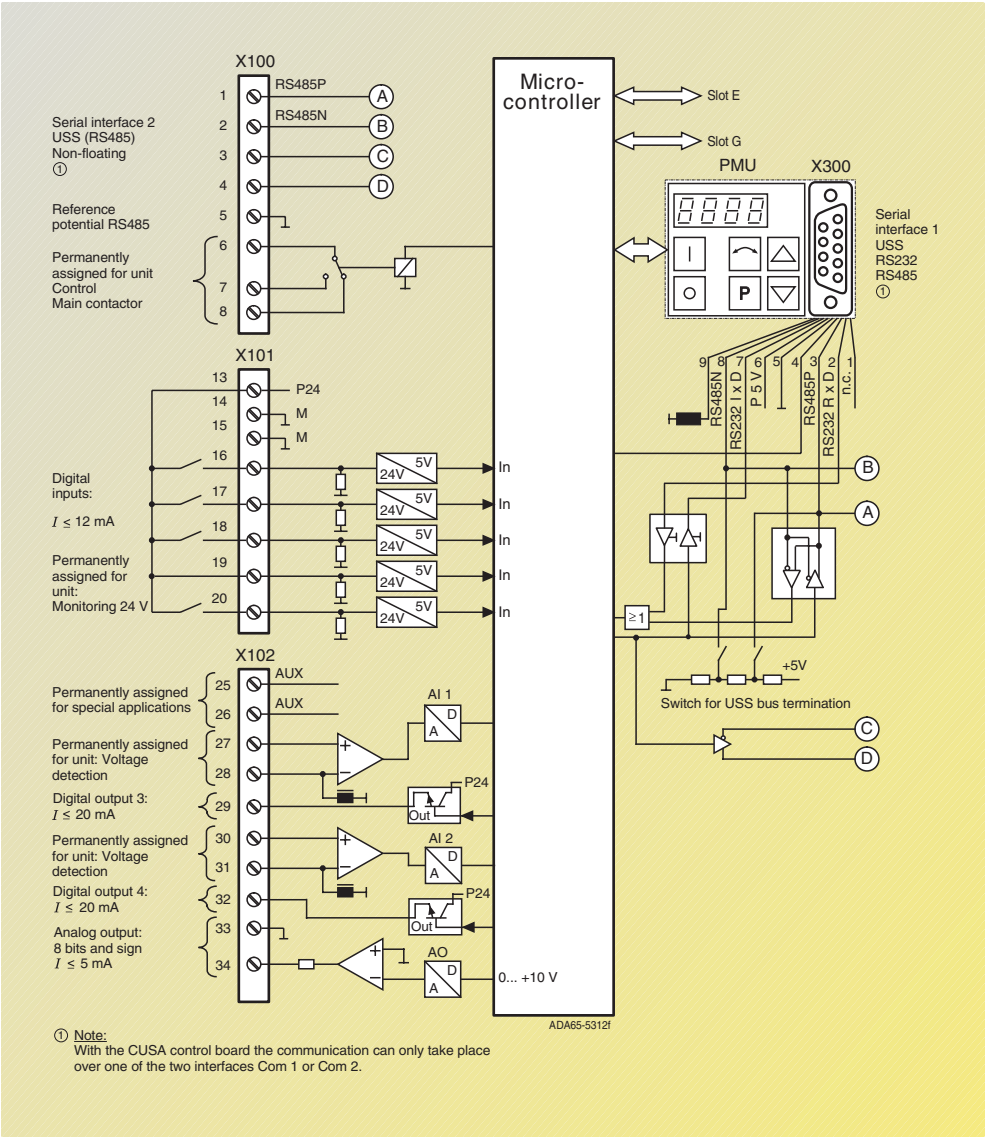
① Note:
With the CUR control board the communication can only take place over one of the two interfaces Com 1 or Com 2.

Fig. 6/44

Control terminal strip on the CUSA control board (AFE inverter)

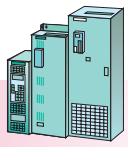
Application:
SIMOVERT MASTER-DRIVES compact, chassis and cabinet units, as control electronics for the self-commutated AFE unit
Order No. of the CUSA:
6SE7090–0XXB4–0BJ0

Connector for the terminal strip:
Order No.: 6SY7000–0AC50
(connectors X100 to X102)



① Note:
With the CUSA control board the communication can only take place over one of the two interfaces Com 1 or Com 2.

Fig. 6/45



Control terminal strip X9

Control terminal strip X9 acts as an interface to the electronics and to the power section. The electronics frame is connected to the earth conductor inside the unit.

The following functions are connected to control terminal strip X9:

24 V DC auxiliary power supply (for all units)

The external auxiliary power supply is necessary when the SIMOVERT MASTERDRIVES has to operate its own main contactor via the CUVC/CUR/CUSA board. The auxiliary power supply must be in the form of a PELV circuit (Protective Extra Low Voltage).

The auxiliary power supply also secures communication to the automation system, even if the supply to the power section has been turned off.

Voltage range 20 V to 30 V DC

If the safety relay of the "Safe STOP" function is supplied with power via terminal X9: 5 or X533: 4, the voltage of the auxiliary power supply must be in the range of 22 V to 30 V DC.

The values specified in the Selection and ordering data, Section 3 under "Aux. current requirement DC 24 V, standard version at 20 V" indicate the power requirement of the converter necessary for operating the electronics and for simulating the power section. The power requirement indicated in the column "24 V DC maximum version for 20 V" has to be provided by the external power supply under worst-case conditions (fitting the electronics box with the largest loads).
The table below shows the power requirement of the option boards and also indicates the minus requirement of the inverter units and when the "simulation of the power section" function is not being used.

Auxiliary power requirement of the units

Use	Current requirement at 24 V DC:					
Size	A to D	E	F	G	J, K, L	M, Q
For current values, see Technical data, Section 3 Standard version for 20 V						
Without simulation	–200 mA	–240 mA	–350 mA	–600 mA	–850 mA	–1600 mA
Inverter	–100 mA					
Electronic options						
SCB 1	+ 50 mA					
SCB 2	+150 mA					
SLB	+190 mA					
CBP	+190 mA					
CBC	+160 mA					
EB1	+135 mA					
EB2	+135 mA					
SBP	+250 mA					
TSY without encoder	+155 mA					
T100 + (BIN + BOUT)	370 mA + 180 mA					
T300 without encoder	+695 mA					
Encoder 1XP8001-1	I_o/I_{max}: +95 mA/190 mA					

Operation of main contactor (for all units)

All SIMOVERT MASTERDRIVES Vector Control units have a parameterizable binary output which is preassigned with the task of operating an external main contactor by means of the "ON" command of the SIMOVERT MASTERDRIVES. Precondition: external 24 V DC power supply.

Different versions of control terminal strip X9

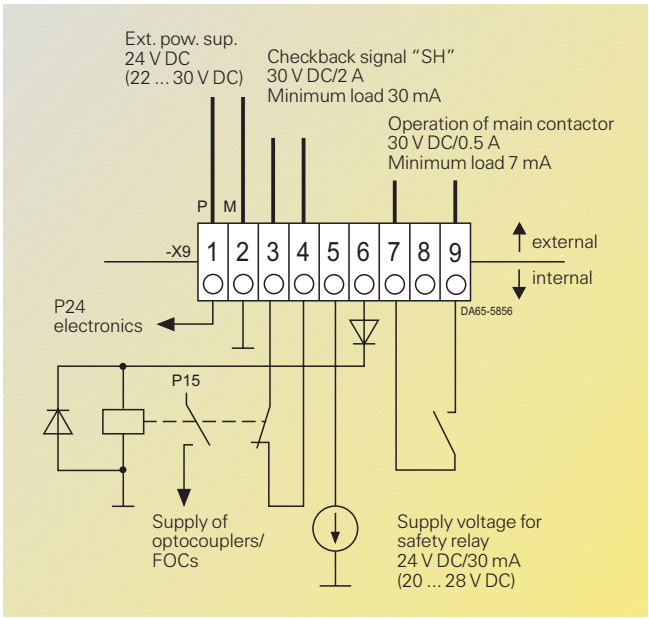


Fig. 6/46
Control terminal strip X9 for compact inverters (sizes A to D) with the "Safe STOP" function

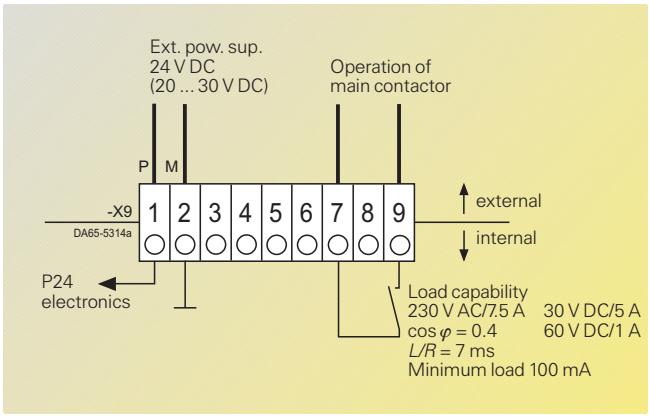


Fig. 6/47
Control terminal strip X9 for compact converters (sizes A to D)

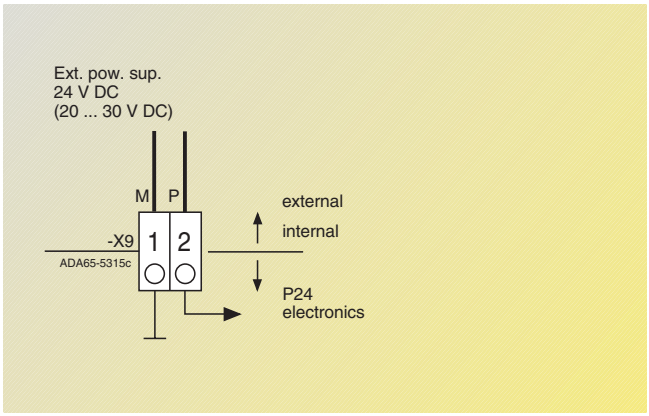
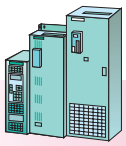


Fig. 6/48
Control terminal strip X9 for Compact PLUS converters



EMC stands for electromagnetic compatibility and, according to the definition of the EMC directive, describes the "ability of a device to function satisfactorily in an electromagnetic environment without itself causing electromagnetic interference which is unacceptable for other devices in this environment." In order to ensure that the relevant EMC standards are complied with, the devices must demonstrate a sufficiently high immunity, on the one hand, and interference emission must be limited to compatible values, on the other.

The **product standard, EN 61 800-3**, relevant to "variable-speed drives" describes the requirements for residential and industrial sectors.

Immunity

The units satisfy the requirements of the EMC product standard, EN 61 800-3, for the industrial sector and thus the lower values regarding immunity required by the residential sector as well.

Interference emission and radio-interference suppression

If converters are used in a residential area, conducted interference or electromagnetically emitted interference must not exceed the limit values according to "B1".

Type of interference	Level of interference	Comments
Electrostatic discharge	up to 12 kV	
Rapid transient interference (burst)	up to 4 kV	for power section
	up to 2 kV	for signal cables

A residential area in this sense is a connection, i.e. an outgoing section of a transformer, to which private households are also connected.

The EMC directive requires that an industrial system as a whole is electromagnetically compatible with its environment.

In order to limit the interference emission, the following measures must be provided:

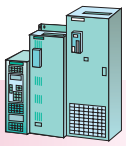
- Radio-interference suppression filters, including line commutating reactors for reducing the conducted interference
- Shielded cables for motor supply cables and signal cables for reducing electromagnetically emitted interference
- Compliance with the installation guidelines.

In systems with MASTERDRIVES units and other components, e.g. contactors, switches, monitoring units, automation units etc., it must be ensured that no interference is emitted to the outside and also that the individual units do not cause any interference among themselves. In this respect, the measures described in the Compendium, Section 3, "Design of Drives in Conformance with EMC guidelines" are to be implemented (Compendium Order No., see Section 5 "Documentation and Training").

The most important of these measures are as follows:

- The components of a system must be housed in a cabinet which acts like a Faraday cage.
- Signal cables and motor supply cables must be shielded. The shields must be connected to earth at both ends.
- Signal cables should be spatially separated (at least 0.7 ft (0.2 m)) from the power cables. If necessary, screening plates are to be provided.

For further measures and details, see the installation guidelines referred to.



Supply-side components

Line fuses

The 3NE1 SITOR fuse provides both cable protection and semiconductor protection in one fuse. This results in significant cost savings and reduced installation times.

For Order No. and assignment, see Section 3.

Line commutating reactor

The line commutating reactor reduces the harmonics of the converter, the rectifier unit and the rectifier/regenerative unit. The effect of the reactor depends on the ratio of the line short-circuit output to the drive output. Recommended ratio of line short-circuit output to drive output > 33 : 1:

- Use a 2–3 % line commutating reactor for converters and rectifier units.
- Use a 4–5 % line commutating reactor for rectifier/regenerative units.

A line commutating reactor also limits current spikes caused by line-supply voltage disturbances (e.g. due to compensation equipment or earth faults) or switching operations on the power system.

Reactors for supply voltages of 380 V to 480 V and 50 Hz can be used with 60 Hz without any restrictions. In the case of supply voltages of 690 V, the permissible operating current with 60 Hz must be reduced to 90 % of the specified value and it may be necessary to use a reactor with the next higher current rating (see Selection and ordering data, Section 3).

Autotransformers for rectifier/regenerative units

Rectifier/regenerative units require a 20 % higher supply voltage at the anti-parallel inverter bridge for regenerative operation. An autotransformer can be used to adapt the voltage accordingly.

For Order No. and assignment, see Section 3;
for dimension drawings, see Section 7.

Radio-interference suppression filters

When integrated in the installation in accordance with EMC guidelines, SIMOVERT MASTERDRIVES applications comply with the EMC product standard for electrical drives, EN 61 800-3.

The radio-interference suppression filters, in conjunction with the line commutating reactor, reduce the interference voltages of the converters, the rectifier units and the rectifier/regenerative units – up to an output of 50 HP (37 kW) . The specified limits acc. to EN 55 011 Class B1 (residential sector) for 3-ph. 200 V AC to 230 V AC and 3-ph. 380 V to 480 V AC are adhered to with the suggested filters (TN systems).

Radio-interference suppression filters with rated currents up to 2500 A and rated voltages of up to 690 V are available for the different types of power systems in the industrial sector.

For Order No. and assignment, see Section 3;
for dimension drawings, see Section 7.

For limit values, see "Electromagnetic compatibility (EMC)" on page 6/45.

Note

If several converters are built into a drive cabinet or control room, a common shared filter with the total current of the installed converters is recommended in order to avoid exceeding the limit values. The individual converters are to be decoupled with the corresponding line commutation reactor.

DC link components

The DC bus is a DC voltage system which supplies the inverters.

The DC bus itself is supplied via a rectifier unit or a rectifier/regenerative unit whose supply-side fuses also protect the DC bus against short-circuits and overload.

The inverter and the braking units can be connected to the DC bus in three ways:

- Direct connection with the fuses integrated in the unit
  Option: **L30**
  for sizes E to G.
- Electro-mechanical connection (Fig. 6/49)
  A load switch disconnector (2-pole connection) with two SITOR fuses (which protect the inverter) connects the inverter and braking units to the DC bus.
  The DC bus must be in a de-energized state when inverters or braking units are switched in or out.
  For ordering data, see Section 3.
- Electrical connection (Fig. 6/50)
  A load switch disconnector (2-pole connection) with SITOR fuses, precharging resistors and a coupling contactor connects inverters to the DC bus.
  In the standard version, the coupling contactor can be operated by the electronics of the inverter. The inverters can thus be switched in/out while the DC bus is live. During switch-in and switch-out, the inverter pulses are blocked, i.e. switching takes place without power. During configuration, it must be ensured that the contacts do not open during operation, e.g. if the control voltage for the contactor coils fails. For ordering data, see Section 3.

The suggested components have rated insulation voltages of ≥ 1000 V when used under conditions according to VDE 0110 and with pollution degree 2.

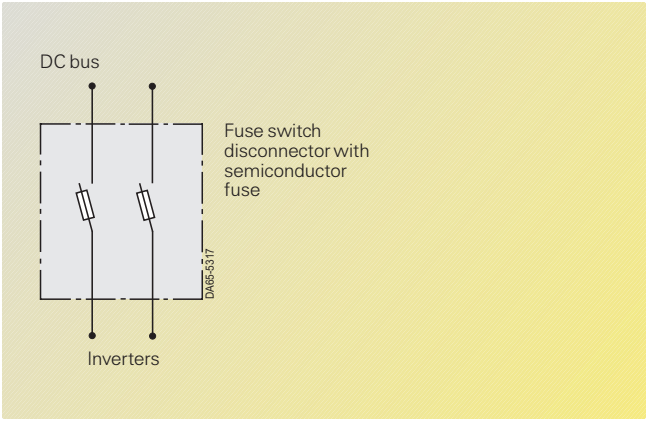


Fig. 6/49
Electro-mechanical connection

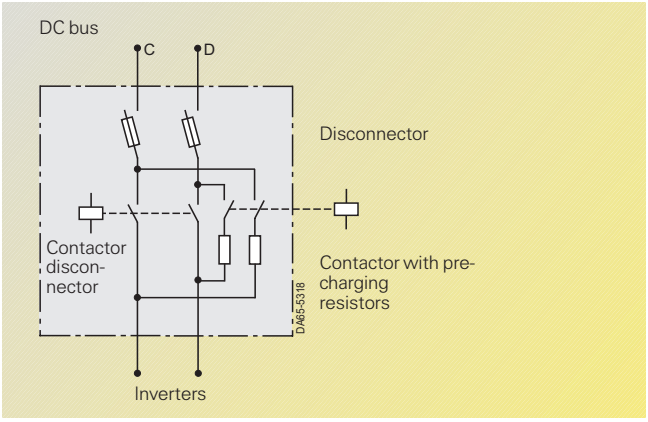


Fig. 6/50
Electrical connection

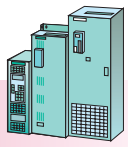
DC voltage range	Precharging contactor type
to 810 V	3TC44
810 V to 930 V	3TC52

Free-wheeling diode on the DC bus

The free-wheeling diodes for multi-motor drives (inverters connected to a common DC bus) are to be used for the following applications:

1. When a braking unit is connected.
2. When the output range exceeds the levels in the following table:

DC voltage range	Nominal DC voltage output or rated current of the inverters
510 V to 650 V	3 HP to 20 HP (2.2 kW to 15 kW) (6.1 A to 34 A)
	7.5 HP to 60 HP (5.5 kW to 45 kW) (13.2 A to 92 A)
	25 HP to 120 HP (18.5 kW to 90 kW) (47 A to 186 A)
	50 HP to 215 HP (37 kW to 160 kW) (72 A to 315 A)
	60 HP to 335 HP (45 kW to 250 kW) (92 A to 510 A)
	150 HP to 1750 HP (110 kW to 1300 kW) (210 A to 2470 A)
675 V to 810 V	3 HP to 75 HP (2.2 kW to 55 kW) (4.5 A to 79 A)
	15 HP to 150 HP (11 kW to 110 kW) (22 A to 156 A)
	25 HP to 335 HP (18.5 kW to 250 kW) (29 A to 354 A)
	60 HP to 600 HP (45 kW to 450 kW) (66 A to 650 A)
	100 HP to 2300 HP (75 kW to 1700 kW) (108 A to 2340 A)
890 V to 930 V	75 HP to 270 HP (55 kW to 200 kW) (60 A to 208 A)
	120 HP to 3000 HP (90 kW to 2300 kW) (128 A to 2340 A)



Braking units and braking resistors

The braking resistors listed in Section 3 match the braking units and allow full utilization of the braking capability.

When braking resistors and braking units are combined, it must be guaranteed that the resistance of a resistor is not less than the minimum allowed resistance, otherwise the braking unit may be damaged.

The braking units of the same or adjacent power ratings, e.g. P_{20} = 100 kW and 170 kW or 5 kW and 10 kW, can be connected in parallel to increase the power. Each braking unit, however, requires its own load resistor. The maximum permissible continuous braking power connected to a converter or inverter is
$P_{DBMAX} \leq 0.6\ P_{conv.}$
$P_{20MAX} \leq 2.4\ P_{conv.}$

Braking units are used when regenerative power occurs occasionally and for a short time, e.g. during braking of the drive (emergency stop). For braking over a longer period of time, rectifier/regenerative units or AFE units are to be used.

P_{20} = Rated Power

P_3 = Peak Power = 1.5 x P_{20}

P_{DB} = 0.25 x P_{20} = Steady State power rating

The following applies with respect to paralleled braking units:

P_{20} total = 0.9 x collective P_{20} of individual units

P_3 total = collective P_3 of individual units

P_{DB} total = collective P_{DB} of individual units

Note

Fuses are not required for single-motor drives (one braking unit on converter). Fuses complying with page 3/66 should be fitted on multi-motor systems with common DC bus. These fuses only provide protection in "critical situations." They do not protect the braking unit or braking resistor.

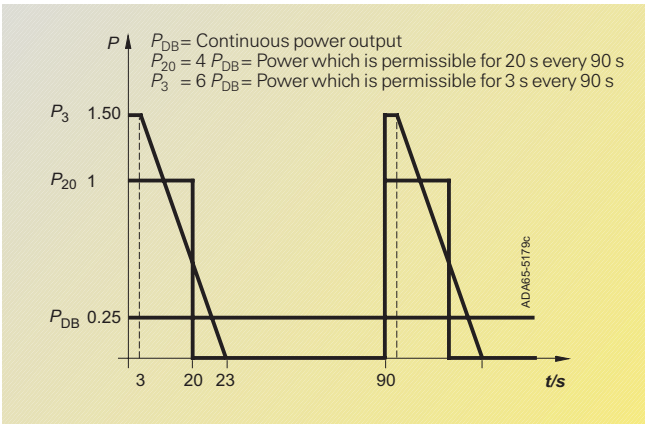


Fig. 6/51
Load diagram

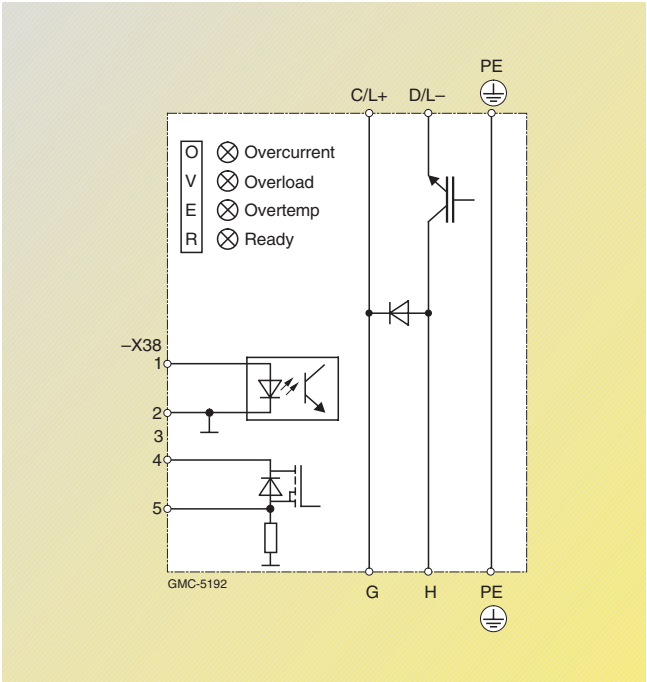


Fig. 6/52
General schematic diagram of 6SE70..-..S..-2DA1 braking units

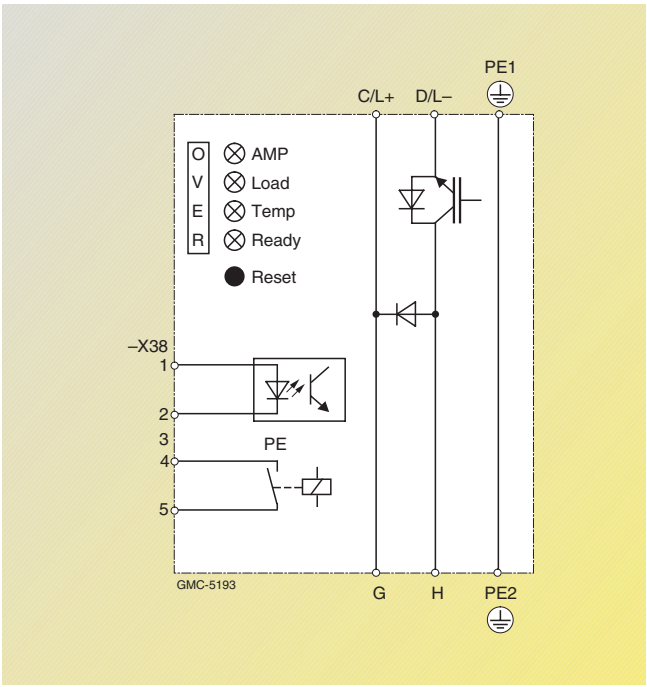


Fig. 6/53
General schematic diagram of 6SE70..-..B..-2DA0 braking units

Load-side components and cables

Output reactors

compensate capacitive recharging currents in long cables.

The maximum cable lengths which can be connected to the standard unit without reactors are specified in the first table on this page.

Longer power cables should be dimensioned according to the second table below.

Maximum cable lengths without output reactors

Output	Rated voltage	Non-shielded cables	Shielded cables
to 5 HP (to 4 kW)	380 V to 600 V	164 ft (50 m)	115 ft (35 m)
7.5 HP (5.5 kW)	380 V to 600 V	230 ft (70 m)	164 ft (50 m)
10 HP (7.5 kW)	380 V to 600 V	328 ft (100 m)	220 ft (67 m)
15 HP (11 kW)	380 V to 600 V	361 ft (110 m)	246 ft (75 m)
20 HP (15 kW)	380 V to 600 V	410 ft (125 m)	279 ft (85 m)
25 HP (18.5 kW)	380 V to 600 V	443 ft (135 m)	295 ft (90 m)
30 HP (22 kW)	380 V to 600 V	492 ft (150 m)	328 ft (100 m)
40 HP to 270 HP (30 kW to 200 kW)	380 V to 690 V	492 ft (150 m)	328 ft (100 m)
335 HP to 850 HP (250 kW to 630 kW)	380 V to 480 V	656 ft (200 m)	443 ft (135 m)
950 HP to 1750 HP (710 kW and 1300 kW)	380 V to 480 V	656 ft (200 m)	443 ft (135 m)
1070 HP to 1475 HP (900 kW to 1100 kW)	380 V to 480 V	656 ft (200 m)	443 ft (135 m)
335 HP to 3000 HP (250 kW to 2300 kW)	500 V to 690 V	492 ft (150 m)	328 ft (100 m)

Maximum cable lengths when output filter reactors are used

Note

If a converter/inverter supplies several motors (group drive), the capacitive charge/discharge currents of the motor cables are added together. In the case of group drives, therefore, an output filter reactor should always be used. The total cable length is the sum of the cable lengths for the individual motors.

Number of reactors in series		1	2	3
Converter/ inverter rating	Rated voltage	Reactor[2]		
		Non-shielded cables		
0.75 HP to 1.5 HP (0.55 kW to 1.1 kW)	380 V to 480 V	328 ft (100 m)	[1]	[1]
2 HP to 5 HP (1.5 kW to 4 kW)	380 V to 600 V	295 ft (90 m)	[1]	[1]
7.5 HP (5.5 kW)	380 V to 600 V	656 ft (200 m)	[1]	[1]
10 HP (7.5 kW)	380 V to 600 V	738 ft (225 m)	1477 ft (450 m)	[1]
15 HP (11 kW)	380 V to 600 V	788 ft (240 m)	1575 ft (480 m)	[1]
20 HP (15 kW)	380 V to 600 V	853 ft (260 m)	1706 ft (520 m)	[1]
25 HP (18.5 kW)	380 V to 600 V	919 ft (280 m)	1838 ft (560 m)	[1]
30 HP (22 kW)	380 V to 600 V	984 ft (300 m)	1969 ft (600 m)	2953 ft (900 m)
40 HP to 270 HP (30 kW to 200 kW)	380 V to 690 V	984 ft (300 m)	1969 ft (600 m)	2953 ft (900 m)
335 HP to 850 HP (250 kW to 630 kW)	380 V to 480 V	1313 ft (400 m)	2625 ft (800 m)	3938 ft (1200 m)
1475 HP (1100 kW)	380 V to 480 V	1313 ft (400 m)	2625 ft (800 m)	3938 ft (1200 m)
335 HP to 3000 HP (250 kW to 2300 kW)[3]	500 V to 690 V	984 ft (300 m)	1969 ft (600 m)	2953 ft (900 m)
1070 HP to 2000 HP (900 kW to 1500 kW)[4]	380 V to 690 V	984 ft (300 m)	1477 ft (450 m)	1969 ft (600 m)

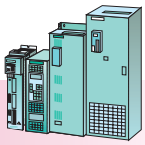
Number of reactors in series		1	2	3
Converter/ inverter rating	Rated voltage	Reactor[2]		
		Shielded cables		
0.75 HP to 1.5 HP (0.55 kW to 1.1 kW)	380 V to 480 V	197 ft (60 m)	[1]	[1]
2 HP to 5 HP (1.5 kW to 4 kW)	380 V to 600 V	328 ft (100 m)	[1]	[1]
7.5 HP (5.5 kW)	380 V to 600 V	443 ft (135 m)	[1]	[1]
10 HP (7.5 kW)	380 V to 600 V	492 ft (150 m)	984 ft (300 m)	[1]
15 HP (11 kW)	380 V to 600 V	525 ft (160 m)	1050 ft (320 m)	[1]
20 HP (15 kW)	380 V to 600 V	574 ft (175 m)	1149 ft (350 m)	[1]
25 HP (18.5 kW)	380 V to 600 V	623 ft (190 m)	1231 ft (375 m)	[1]
30 HP (22 kW)	380 V to 600 V	656 ft (200 m)	1313 ft (400 m)	1969 ft (600 m)
40 HP to 270 HP (30 kW to 200 kW)	380 V to 690 V	656 ft (200 m)	1313 ft (400 m)	1969 ft (600 m)
335 HP to 850 HP (250 kW to 630 kW)	380 V to 480 V	886 ft (270 m)	1739 ft (530 m)	2625 ft (800 m)
1475 HP (1100 kW)	380 V to 480 V	886 ft (270 m)	1739 ft (530 m)	2625 ft (800 m)
335 HP to 3000 HP (250 kW to 2300 kW)[3]	500 V to 690 V	656 ft (200 m)	1313 ft (400 m)	1969 ft (600 m)
1070 HP to 2000 HP (900 kW to 1500 kW)[4]	380 V to 690 V	656 ft (200 m)	984 ft (300 m)	1477 ft (450 m)

1) Cannot be used.

2) In the case of sizes M, N and Q, 2 inverters are connected in parallel and the number of reactors for the permissible cable lengths is therefore required for each inverter section.

3) Applies to sizes E, F, G, J, K, L, N and Q.

4) Applies to size M.



Load-side components and cables (continued)

Use of iron-core reactors

- Drives with standard and non-standard induction motors with a rated motor frequency (frequency at the start of field weakening) of up to 87 Hz and a maximum frequency of 200 Hz.
- Drives with reluctance motors or permanent-magnet synchronous motors with a maximum frequency of 120 Hz.

Use of ferrite-core reactors

- Induction-motor drives with a rated motor frequency (frequency at the start of field weakening) of 200 Hz and a maximum frequency of 300 Hz.
- Drives with reluctance motors or permanent-magnet synchronous motors with a maximum frequency of 600 Hz.
- The ferrite-core reactors can also be used up to the maximum pulse frequency of the units. The derating of the units at higher pulse frequency compensates the higher reactor losses at the higher pulse frequency. Pulse frequencies exceeding 6 kHz cause the resonant frequency to change and therefore influence the permissible cable lengths.

The permissible cable lengths are calculated as follows from the data given in the 2nd table on page 6/49:

$$I_{permissible} \leq I_{table} \cdot \frac{6\ kHz}{f_{pulse}}$$

only valid for $f_{pulse} > 6$ kHz.

The output reactors, together with the conductor capacitance/cable capacitance, limit the voltage rate-of-rise in the motor winding (see table below).

In the case of cable lengths > 25 ft (7.5 m) the output filter reactor does not have a defined limiting effect on the voltage spikes across the motor terminals due to reflections.

Maximum d*v*/d*t* < 500 V/μs with output filter reactor

Converter/ inverter size	Non-shielded cables	Shielded cables
A to D	> 98 ft (30 m)	> 66 ft (20 m)
E to N	> 492 ft (150 m)	> 328 ft (100 m)

Voltage limiting filters

Voltage limiting filters (output d*v*/d*t* filters for SIMOVERT MASTERDRIVES Vector Control) should be used for motors where the voltage strength of the insulation system is not known or is inadequate. Standard Siemens 1LA5/1LA6/1LA8 type motors only require a d*v*/d*t* filter for supply voltages of > 500 V + 10 %.

The d*v*/d*t* filters limit the voltage rate-of-rise to values of < 500 V/μs and the typical voltage spikes for the rated supply voltage to the following values:

- < 1000 V at $V_{supply} \leq$ 575 V,
- < 1150 V at 660 V $\leq V_{supply} \leq$ 690 V

with a motor cable length of ≤ 492 ft (150 m).

When reactors and filters are connected in series, the cable lengths can be dimensioned according to the above table.

Maximum cable lengths when a d*v*/d*t*-filter is used

Converter/ inverter rated current	d*v*/d*t*-filter	d*v*/d*t*-filter and reactor	d*v*/d*t*-filter and 2 reactors[2]	d*v*/d*t*-filter	d*v*/d*t*-filter and reactor	d*v*/d*t*-filter and 2 reactors[2]
	Non-shielded cables			Shielded cables		
5 A to 22 A	492 ft (150 m)	[1]	[1]	328 ft (100 m)	[1]	[1]
≤ 370 A[4]	492 ft (150 m)	984 ft (300 m)	1477 ft (450 m)	328 ft (100 m)	656 ft (200 m)	984 ft (300 m)
≤ 225 A[5]	492 ft (150 m)	984 ft (300 m)	1477 ft (450 m)	328 ft (100 m)	656 ft (200 m)	984 ft (300 m)
510 A to 1300 A[4]	492 ft (150 m)	1231 ft (375 m)	[1]	328 ft (100 m)	820 ft (250 m)	[1]
297 A to 1230 A[5]	492 ft (150 m)	1231 ft (375 m)	[1]	328 ft (100 m)	820 ft (250 m)	[1]
≥ 1400 A[6]	[3]	[3]	[3]	[3]	[3]	[3]

Note

The total cable length is the sum of the cable lengths connected to the individual motors. From a motor current of ≥ 120 A, single-motor drives can also be supplied with parallel cables (up to the maximum permissible cable length) in the case of standard units.

The voltage limiting filters can be used up to a maximum frequency of 300 Hz.

The d*v*/d*t* filters can **only** be used with a motor connected.

For selection and ordering data for the d*v*/d*t* filters, see Section 3; for dimensions, see Section 7.

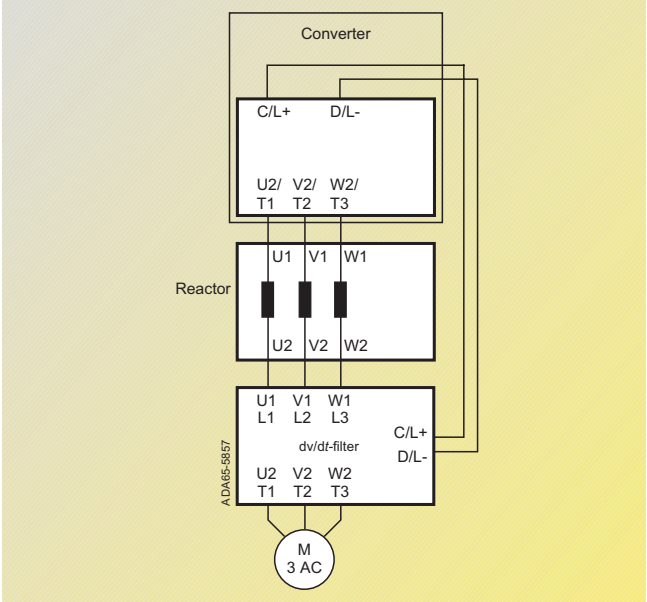


Fig. 6/55
Converter with reactor

1) Cannot be used.
2) Voltage limiting is no longer effective for supply voltages of > 500 V.
3) Not available at present.
4) Rated supply voltage 380 V to 480 V.
5) Rated supply voltage 500 V to 690 V.
6) Rated supply voltage 380 V to 690 V.

Load-side components and cables (continued)

Sinusoidal filters

ensure that the motor voltage and currents are almost sinusoidal. The harmonic distortion factor for a 60 Hz motor voltage with sinusoidal filter, for example, is approximately 5 %. The stressing levels of motors which are supplied via sinusoidal filters are lower than the values specified in DIN VDE 0530.

When engineering the drive, it should be ensured that the output voltage of converters and inverters with sinusoidal filters is approximately 85 % of the associated supply voltage at 380 V to 480 V and approximately 90 % at 500 V to 600 V.

The sinusoidal filters for supply voltages of 380 V to 480 V are designed for a 6 kHz pulse frequency. The maximum output frequency is:

Cable lengths which can be connected when a sinusoidal filter is used

Output	380 V to 480 V	500 V to 600 V	380 V to 480 V	500 V to 600 V
	Non-shielded cables		Shielded cables	
to 5 HP (to 4 kW)	820 ft (250 m)	1149 ft (350 m)	558 ft (170 m)	820 ft (250 m)
7.5 HP (5.5 kW)	1050 ft (320 m)	1559 ft (475 m)	689 ft (210 m)	1050 ft (320 m)
10 HP (7.5 kW)	1313 ft (400 m)	1805 ft (550 m)	886 ft (270 m)	1313 ft (400 m)
15 HP (11 kW)	1641 ft (500 m)	2297 ft (700 m)	1083 ft (330 m)	1641 ft (500 m)
20 HP (15 kW)	1969 ft (600 m)	2953 ft (900 m)	1313 ft (400 m)	1969 ft (600 m)
25 HP to 175 HP (18.5 kW to 132 kW)	A	B	0.67 · A	A

$$A = 600\ \text{m} + 7.5\frac{\text{m}}{\text{kW}} \cdot (P - 15\ \text{kW})$$

$$B = 900\ \text{m} + 10\frac{\text{m}}{\text{kW}} \cdot (P - 15\ \text{kW})$$

P Rated motor output of the converter or inverter

- 400 Hz for compact units (sizes A to D),
- 200 Hz for chassis units (sizes E to G).
  Note the current derating for chassis units as a result of the 6 kHz pulse frequency!

The sinusoidal filters for supply voltages of 500 V to 600 V are designed for a pulse frequency of 3 kHz.

The maximum output frequency is:

- 200 Hz for compact units (sizes B to D),
- 100 Hz for chassis units (sizes E to G).

Sinusoidal filters are suitable for supplying Ex(d) motors. They limit the voltage stressing in the motor terminal boxes to below 1080 V up to a supply voltage of ≤ 500 V.

For possible cable lengths, see table.

Note

The total cable length is the sum of the cable lengths connected to the individual motors. From a motor current of ≥ 120 A, single-motor drives can also be operated with parallel cables (up to the maximum permissible cable length) in the case of standard units.

For selection and ordering data for the sinusoidal filters, see Section 3; for dimension drawings, see Section 7.

Required cross-sections of protective conductor

The protective conductor is to be dimensioned considering the following functions:

- In the event of an earth fault, it must be ensured that no excessively high touch voltages occur on the protective conductor as a result of voltage drops of the earth-fault current (< 50 V AC or 120 V DC, EN 50 178 Section 5.3.2.2, IEC 60 364, IEC 60 543).
- The earth fault current flowing in the protective conductor in the event of an earth fault must not overheat the protective conductor.
- In the event of a fault in accordance with EN 50 178, Section 8.3.3.4, it is possible that continuous currents can flow through the protective conductor. The cross-section of the protective conductor is therefore to be dimensioned for this continuous current.

The cross-section of the protective conductor is to be selected in accordance with EN 60 204-1, IEC 60 364.

Cross-section, outer conductor	Min. cross-section of external protective conductors
to 16 mm² (AWG 5)	Cross-section of outer conductor as minimum
16 mm² to 35 mm² (AWG 5 to AWG 2)	16 mm² (AWG 5)
from 35 mm² (AWG 2)	Min. 50 % of cross-section of outer conductor

- Switchgear and motors are usually earthed separately using a local earth electrode. With this constellation, the earth-fault current, in the event of an earth fault, flows through the parallel earth connections and is divided up. In spite of the cross-sections of the protective conductor as specified in the table, no non-permissible touch voltages then occur with this kind of earthing.
- The MASTERDRIVES converters, inverters, rectifier units (> 500 HP (400 kW)) and rectifier/regenerative units limit the current to an effective value in accordance with the rated current, thanks to their rapid control.

  Given these facts, we recommend that the cross-section of the protective conductor is generally the same as the cross-section of the outer conductor for earthing the control cubicle and the motor.

Option boards for Compact PLUS units

Option boards for the available slots (slot A and B) of Compact PLUS converters and inverters.

Communication Boards

CBP2

- Communication via PROFIBUS DP
- The CBP2 board supports PROFIBUS Profile V3 (slave-to-slave communication, acyclical communication with Master Class II).

CBC

- Communication via CAN Bus
- The CBC board supports CAN levels 1 and 2.

CBD

- Communication via DeviceNet protocol

SLB

- Fast drive coupling via the SIMOLINK board (fiber-optic cable) with a maximum of 201 nodes.

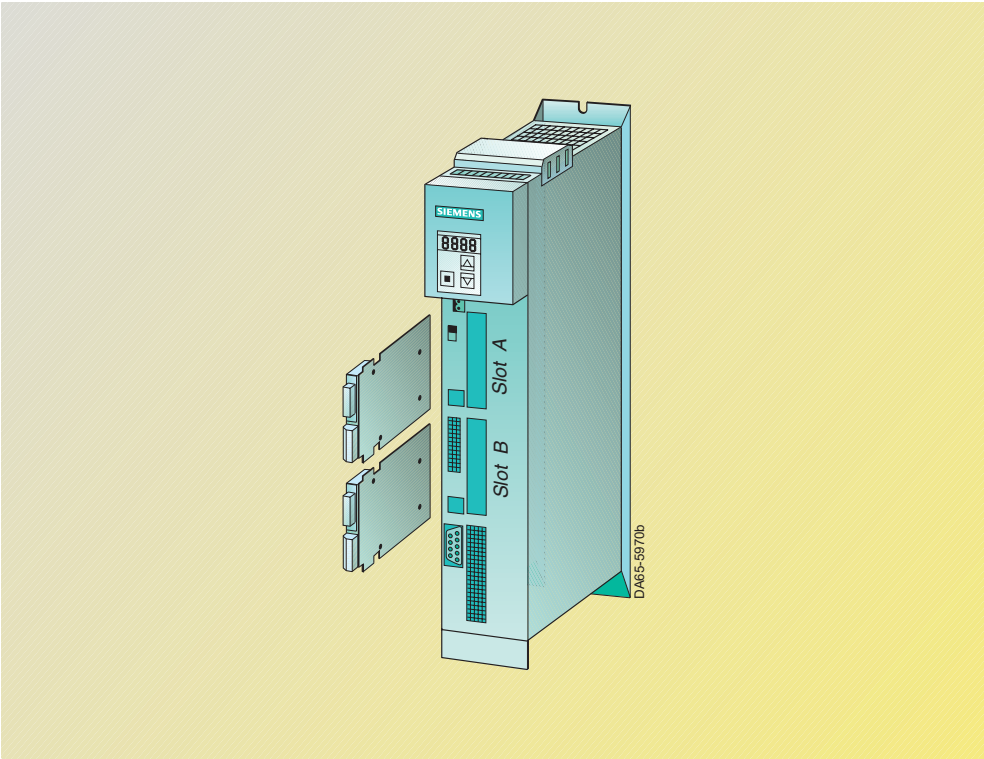


Fig. 6/56
Integration of option boards

Terminal Expansion Boards

EB1

- 4 bidirectional digital inputs/outputs
- 3 digital inputs
- 2 analog outputs
- 3 analog inputs

EB2

- 3 relay outputs with make contacts
- 1 relay output with change-over contact
- 2 digital inputs
- 1 analog output
- 1 analog input

Incremental Encoder Evaluation

SBP

- Evaluation of an external encoder or frequency generator, e.g. setpoint signal
- HTL or TTL level selectable

Note

The base unit already has a motor encoder input (incremental encoder HTL).

A maximum of two option boards can be plugged into the Compact PLUS converters and inverters. Even two identical option boards are possible with the exception of the SLB and SBP boards. For a description of the option boards, see page 6/56 and the following. Option boards are mounted into the Compact PLUS units by removing the side panel and popping out the slot insert on the front cover.

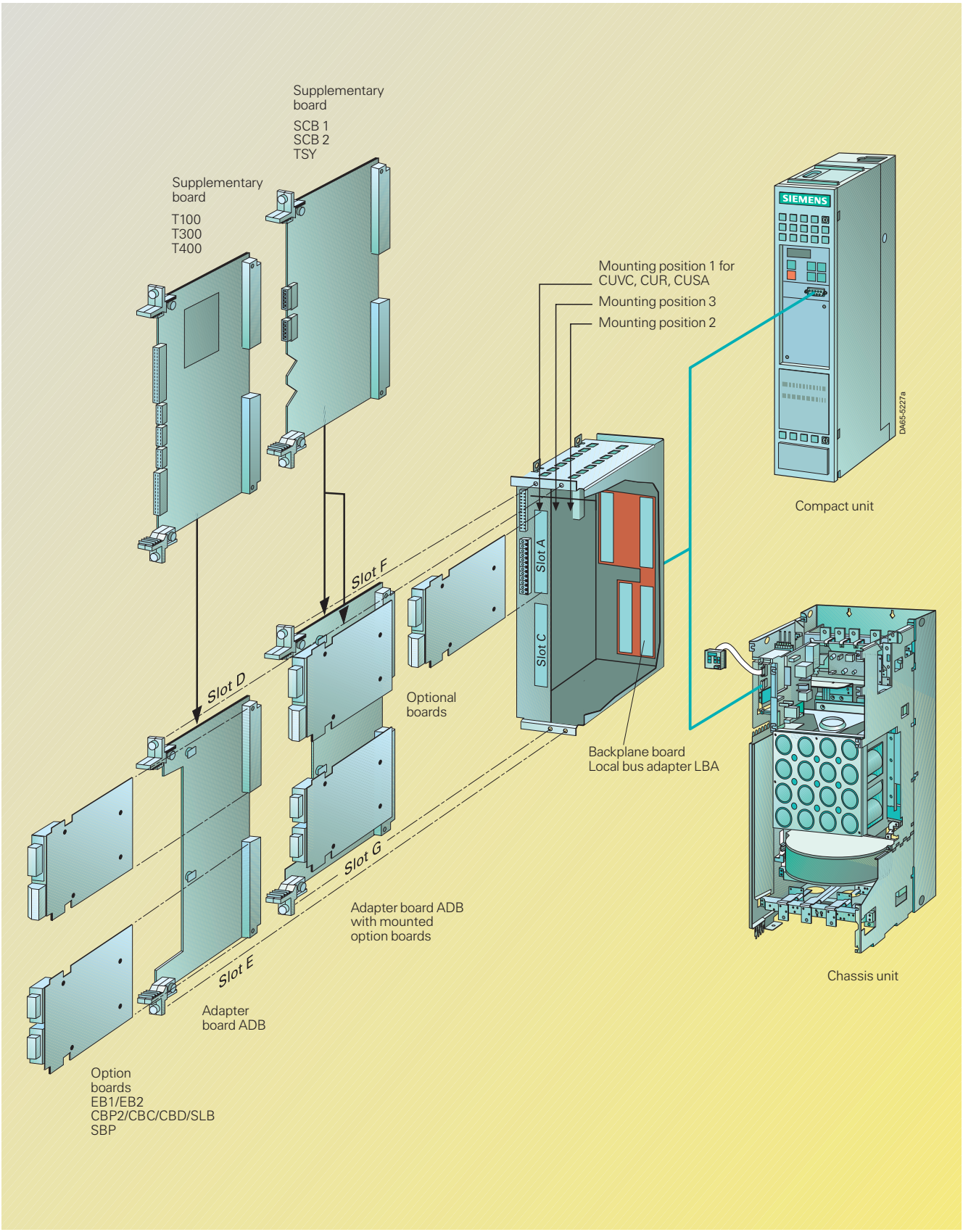
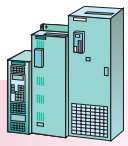


Fig. 6/57
Integration of the optional boards and supplementary boards in the electronics box of compact and chassis units



Integrating boards in the electronics box

Note

If technology boards (T100, T300, T400) are used, the following rules apply:

- Only one technology board can be used, in mounting position 2 only.
- Only one CB communication board can be used. It must be mounted in slot G using an ADB adapter board. The communication board communicates directly with the technology board (a condition for standard engineering).
- If a SIMOLINK board (SLB) is used, it is to be plugged into a slot on the basic electronics board. The SIMOLINK board communicates directly with the basic unit. Signal connections to the technology board can be established by means of BICO links.

Boards	Mounting position 1		Mounting position 3		Mounting position 2		Max. number of boards in the electronics box
Electronics box with CUVC control board - option board possibilities							
Boards			**LBA[1])**		**LBA[1])**		
Communication							
SCB1	CUVC		•		•		only one SCB1
SCB2	CUVC		•		•		or SCB2
Technology							
T100/T300/T400	CUVC		–		•		only one technology or
TSY	CUVC		•		•		synchronizing board
Option boards	Slot A	Slot C	ADB and LBA[2]) Slot F	Slot G	ADB and LBA[2]) Slot D	Slot E	
Communication							
CBP2[3])	•	•	•	•	•	•	max. two CBP2
CBC	•	•	•	•	•	•	max. two CBC
SLB	•	•	•	•	•	•	only one SLB
CBD	•	•	•	•	•	•	max. two CBD
Expansion boards							
EB1	•	•	•	•	•	•	max. two EB1
EB2	•	•	•	•	•	•	max. two EB2
Incremental encoder boards							
SBP	•	•	•	•	•	•	only one SBP
Electronics box with CUR or CUSA control board - option board possibilities							
Boards			**LBA[1])**		**LBA[1])**		
Communication							
SCB1	CUR/CUSA		•		•		only one SCB1
SCB2	CUR/CUSA		•		•		or SCB2
Technology							
T100/T300	CUR/CUSA		–		•		only one technology or
TSY	CUR/CUSA		•		•		synchronizing board
Option boards	Slot A	Slot C	ADB and LBA[2]) Slot F	Slot G	ADB and LBA[2]) Slot D	Slot E	
Communication							
CBP2	–	–	–	•	–	•	only one CBP2
CBC	–	–	–	•	–	•	only one CBC
CBD	–	–	–	•	–	•	only one CBD

• Possible mounting position – Mounting not possible

Note

Fig. 6/58 shows the technically possible equipment variants.

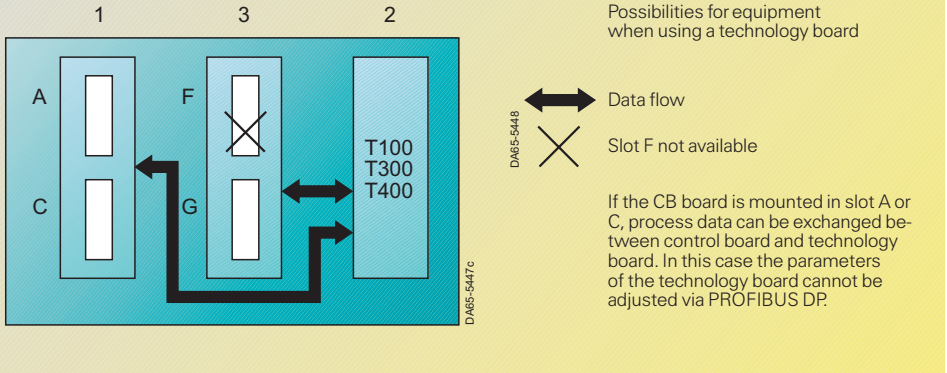


Fig. 6/58
Integration of boards in the electronics box

1) Supplementary board in mounting position 2 or 3 only possible with backplane bus LBA. Mounting position 3 can only be used if mounting position 2 is assigned.

2) Option boards in mounting position 2 or 3 only possible with backplane bus LBA and adapter board ADB. Mounting position 3 can only be used if mounting position 2 is occupied.

3) For mechanical reasons only 90° angled PROFIBUS connectors can be used (e.g. 6ES7972–0BA11–0XA0). With swivel and axial connectors as well as OLP (Optical Link Plug), especially on compact units the front door cannot be closed anymore. With compact units version A the CBP2 should not be mounted in slot A because the parameterization unit PMU can touch the PROFIBUS connector if the front door is closed.

USS protocol

The user data which can be transmitted with the USS protocol have the structure shown in Fig. 6/59.

The PKW area allows reading and writing of parameter values and the reading of parameter descriptions and texts. This mechanism is mainly used for exchanging data for operator control and visualization as well as start-up and diagnosis.

The PZD area contains the signals necessary for process control – such as control words and setpoints – from the automation system to the drive, and status words and actual values from the drive to the automation system.

For MASTERDRIVES Vector Control units, USS interfaces are available on

- the basic CUVC board (SCom1, SCom2)
- the T100 technology board
- the SCB2 interface board.

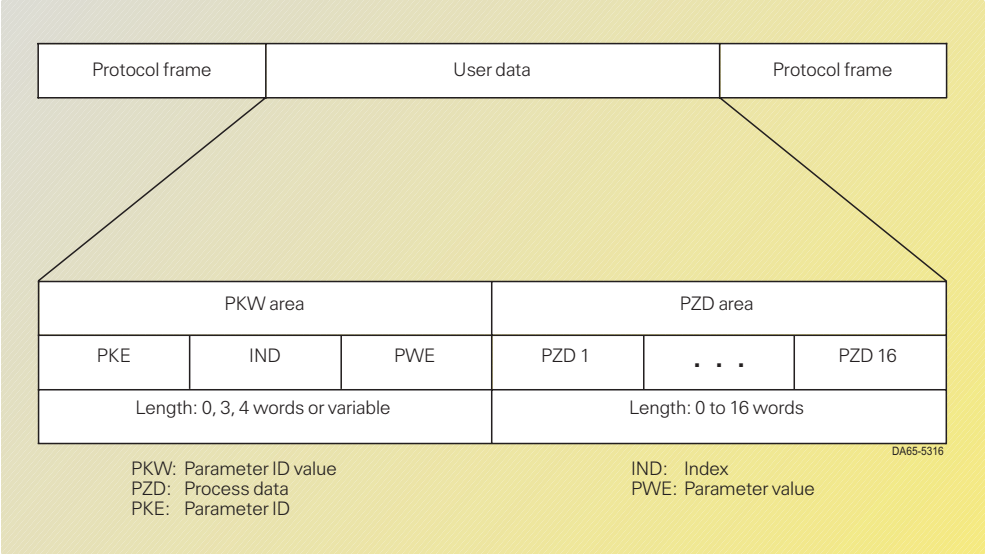


Fig. 6/59
Telegram structure with the USS protocol

USS master		Additional hardware/software
SIMATIC S5	AG95/AG100U with CP521 Si communication processor	RS232/RS485 interface converter DVA_S5 option package for SIMATIC S5 (see page 3/88)
	AG115 to AG155U with CP524 communication processor	RS485 interface module for CP524 373 memory module for CP524 COM 525 parameterization software for CP524 S5R00T special driver for CP524 (6ES5897-2MB11) DVA_S5 option package for SIMATIC S5 (see page 3/88)
SIMATIC S7	S7-200 (CPU 214, 215 or 216)	STEP 7-MICRO/DOS or STEP 7-MICRO/WIN configuration tool for S7-200
	S7-300 with CP340-1C	Configuration package for CP340, point-to-point coupling Drive ES SIMATIC (STEP 7 ≥ V 5.0) option software (see pages 2/12 to 2/14, 3/87 and 3/88)
	S7-400 with CP441	X27 RS422/RS485 interface module Configuration package for CP441, point-to-point coupling Drive ES SIMATIC (STEP 7 ≥ V 5.0) option software (see pages 2/12 to 2/14, 3/87 and 3/88)
SIMATIC TI	FIM505 field interface module	
SIMADYN D	CS7 adaption board with SS4 interface module	
PC	RS485 interface card or RS232/RS485 converter, USS driver	

Bus topology

The USS bus is to be established as a line without spur lines.

Bus cable

The SINEC L2 bus cable (Order No. 6XV1830-0AH10) can be used as the bus cable. The maximum cable length is 3938 ft (1200 m).

Installing the bus cable

The USS bus cable is usually connected with screw or plug-in terminals. The SCom1 on the basic board is accessible via a 9-pole SUB-D socket. The pin or terminal assignment of the SCom1 is given in Section 2 and that of the SCom2 in the section "System components".

The assignment of the interface on the supplementary boards can be found in the respective operating instructions.

Bus termination

The bus cable is to be terminated at both ends (first and last node). In the case of MASTERDRIVES Vector Control units, it is terminated with the S1 switches (SCom1, X300) or S2 (SCom2, X101) on the base electronics board.

Possible USS masters are

- a user-friendly operator control panel, OP1S (local operator control)
- a Drive ES or a DriveMonitor PC (central parameterization and diagnosis) or
- an automation system (see table).

Possible USS automation masters and the necessary hardware/software additions are shown in the table.

Configuring of USS communication

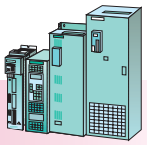
Configuration of USS communication in an automation system consists of the following steps:

- parameterization of the USS master
- creation of the communication program in the master
- parameterization of the drives.

Parameterization of the master and the communication program is system-specific.

Parameterization of the drives consists of two steps (example of SCom1/SCom2):

- parameterization of the interface (parameters P700, P701, P702, P703, P704)
- parameterization of the process data interconnection and parameterizing enable (control words P554 to P591, setpoints P443, P433, etc., status words and actual values P707, P708, parameter access P053).



PROFIBUS DP

If the PROFIBUS DP is used, the CBP or CBP2 communication board is necessary for interfacing drives to higher-level automation systems.

With extended functionality, the CBP2 is fully compatible with the CBP and has replaced it as standard. In the following, therefore, "CBP" signifies both boards; individual special features of the CBP2 are indicated.

Functionality of the CBP

- Cyclical user data exchange with the master according to the "PROFIBUS Profile for PROFIDRIVE Variable-Speed Drives".
- Acyclical communication channel for exchanging parameter values up to a length of 118 words with a SIMATIC S7 CPU.

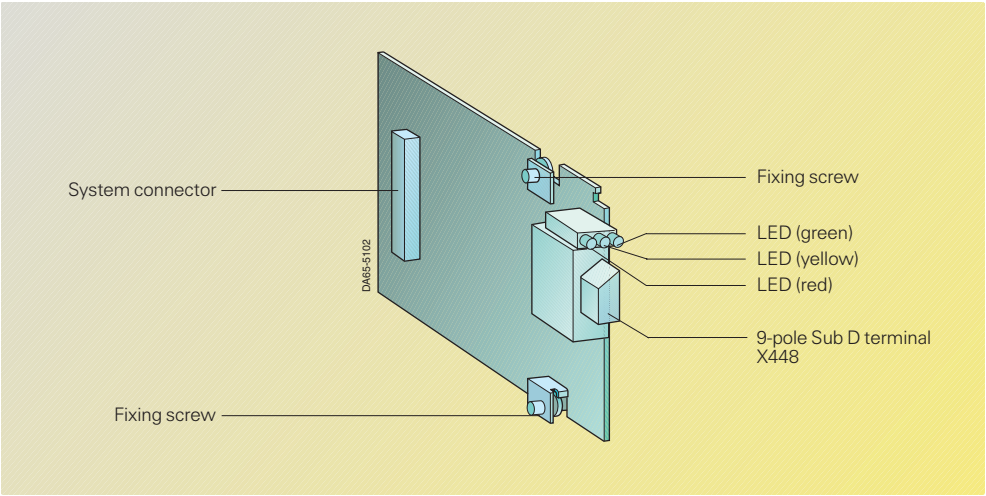


Fig. 6/60
CBP communication board

- Acyclical communication channel for connecting the Drive ES Basic start-up, parameterization and diagnostics tools.
- Support of the PROFIBUS control commands, SYNC and FREEZE, for synchronized data transfer from the master to several slaves and vice versa.

Extended functionality of the CBP2

to PROFIBUS profile, drive systems V3 PROFIDRIVE

- Flexible configuration of cyclic messages at up to 16 process data words
- Direct communication for direct exchange of data between slaves
- Acyclic communication channel for direct access of a SIMATIC OP to a drive.

6

PROFIBUS DP (continued)

Cyclic exchange of user data

In the PROFIBUS profile on which the CBP functionality is based, the structure of the user data, amongst other items, with which a DP master can access the drives is defined. There are five permanently defined PPO (parameter process-data objects); these are subdivided into a PKW area (parameter identifier value area, up to 4 words) and the PZD area (process data area, up to 10 words).

The PKW area enables reading and writing of parameter values and the reading of parameter descriptions. This mechanism is used to visualize or change any of the slaves' parameters.

The PZD area contains the data – such as control words and setpoints needed for process control – from the automation system to the drive or status words and actual values from the drive to the automation system.

When a CBP2 is used, local user data structures with up to 16 process data words can now also be utilized in addition to the five PPO types.

Technical data of the CBP

- RS485 interface acc. to EN 50 170, short-circuit-proof and floating
- Baud rates from 9.6 Kbit/s to 12 Mbit/s.

Mounting of the CBP

In MASTERDRIVES Vector Control, slots A, C, E and G in the electronics box are available (see also page 6/53). For slots G and E, the local bus adapter (6SE7090–0XX84–4HA0) and the adapter board (6SE7090–0XX84–0KA0) are necessary.

Possible user data structures with the CBP and CBP2

PPO type	PKW area			PZD area			Functionality	
	PKW	IND	PWE	PZD1	• • •	PZD16	CBP	CBP2
PPO1	fixed length: 4 words			fixed length: 2 words			✔	✔
PPO2	fixed length: 4 words			fixed length: 6 words			✔	✔
PPO3	fixed length: 0 words			fixed length: 2 words			✔	✔
PPO4	fixed length: 0 words			fixed length: 6 words			✔	✔
PPO5	fixed length: 4 words			fixed length: 10 words			✔	✔
none	0 or 4 words			flexible configurable from 1 to 16 words				✔

PKW: Parameter ID value
PZD: Process data
PKE: Parameter ID
IND: Index
PWE: Parameter value

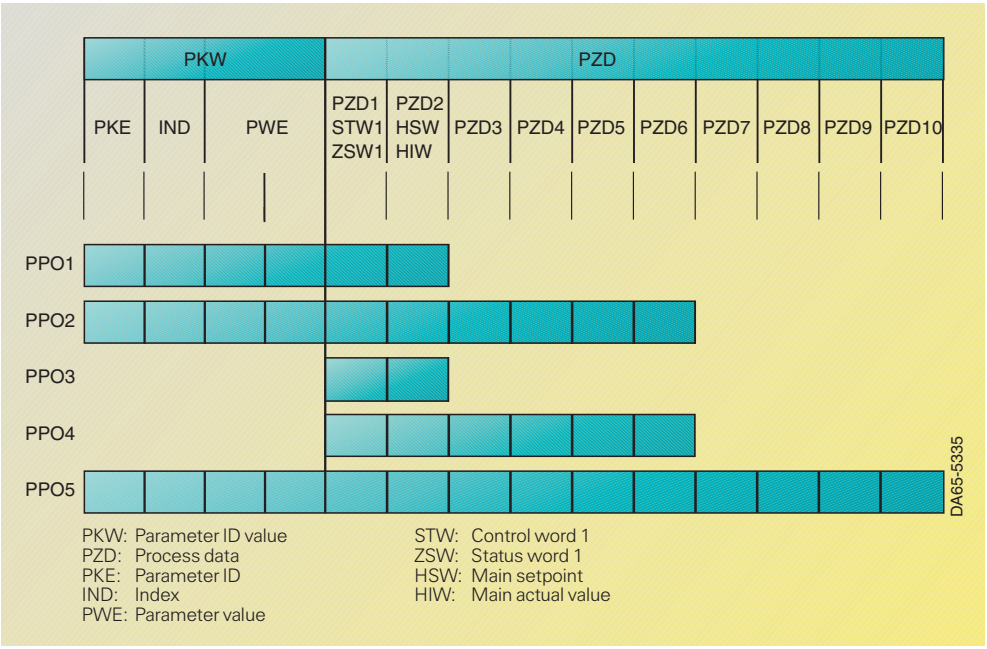


Fig. 6/61
User data structure in the "PROFIBUS Profile for PROFIDRIVE Variable-Speed Drives"

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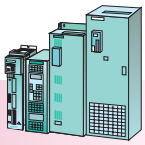


PROFIBUS DP (continued)

Bus cable

A bus cable to the PROFIBUS DP specifications is to be used for data transmission (see page 3/80).

Bus connection

The bus is connected to the PROFIBUS DP via the 9-pole Sub-D socket (X448) in accordance with the PROFIBUS DP standard. For the pin assignment at terminal X448, see the table, top right.

On the bus side, a 9-pole Sub-D connector plug is necessary (see page 3/80).

The CBP2 communication board can alternatively be connected via an optical bus terminal or an optical link module to the optical PROFIBUS DP (see page 3/80).

Bus termination

Each RS485 bus segment must be provided at both its ends with a bus termination. The bus is terminated by means of a switch integrated in the PROFIBUS DP plug-in connector; with its help the termination can be opened or closed.

PROFIBUS DP master systems

Drives can generally be coupled to any DP master in accordance with EN 50 170. The lower table on this page contains a list of the automation masters most frequently used in drive technology, which can be used together with the CBP2.

Pin assignment at terminal X448

Pin	Designation	Meaning	Area
1	SHIELD	Ground connection	
2	–	Not assigned	
3	RxD/TxD-P	Receive/transmit data P (B/B')	RS485
4	CNTR-P	Control signal	TTL
5	DGND	PROFIBUS DP data reference potential (C/C')	
6	VP	Supply voltage plus	5 V ± 10 %
7	–	Not assigned	
8	RxD/TxD-N	Receive/transmit data N (A/A')	RS485
9	–	Not assigned	

PROFIBUS DP master systems		Additional software[1])
SIMATIC S5	AG95U/DP master AG115 to AG155U with IM308-C (or CP5431) communication board	COM PROFIBUS parameterization software DVA_S5 option package for SIMATIC S5 (see page 3/88)
SIMATIC S7	S7-300 with CPU315-2DP, 318-2 S7-300 with CP342-5 S7-400 with CPU413-/414-/416-2DP, 417-4 S7-400 with CP443-5 Ext. S7-400 with IM467	Drive ES SIMATIC (STEP 7 ≥ V 5.0) (see page 3/88)
SIMATIC M7	IF 964 interface module	
SIMATIC TI	TI545/TI555 with integrated DP interface FIM505 field interface module	
SIMADYN D	CS7 adaption board with SS52 interface module	
PC	CP5613/5614 (PCI) communication board	COM PROFIBUS parameterization software
	CP55511 (PCMCIA) communication board CP5611 (PCI) communication board	SOFTNET-DP/Windows 95/98/NT for PROFIBUS
	CP5412 (A2) communication board	software package DP-5412/Windows 95/98/NT

Configuration of PROFIBUS DP communication

Configuration of DP communication consists of the following steps:

Configuring the DP master

With SIMATIC S7, the bus system is configured together with the hardware in STEP 7. The CBP is already integrated here so that the cyclic exchange of user data can be configured (STEP 7 < V 4.02: it can be made known by loading file SI8045AX.200 supplied).

Here, a CBP2 is configured as a CBP.

To be able to configure the extended functionality of the CBP2, software package Drive ES Basic or Drive ES SIMATIC is needed in addition to STEP 7 ≥ V 5.0. (Additional hardware requirement for implementation of direct communication: S7-CPU with integrated DP interface more recent than 04/99.)

With SIMATIC S5, the bus system can be configured via the COM PROFIBUS software. The CBP board is already integrated in COM PROFIBUS as of version 3.2; for older versions, the procedure is as for STEP 7. The extended CBP2 functionality is not supported by SIMATIC S5.

In principle, the CBP2 can be made known to other configuration tools by adopting file "SIEM8045.GSD".

Creating the communication program in the master

The communication program is application-specific. For convenient programming, the software Drive ES SIMATIC is available for SIMATIC S7. Option software DVA_S5 is available for programming communication on a SIMATIC S5.

Parameterization of the drives

Parameterization of the drives consists of two steps:

- parameterization of the interface (parameter P918)
- parameterization of the process-data interconnection and parameterization enabling (control words P554 to P591, setpoints P443, P433 etc., status words and actual values P734, process-data monitoring P722, parameter access P053).

1) For the ordering data of the additional items, see Catalogs ST 50 and ST 70.

CAN

The CBC board (Communication Board CAN) enables SIMOVERT MASTERDRIVES units to communicate with a higher-level automation system, with each other and with field devices by means of the CAN protocol. Power is supplied via the base unit.

The CAN protocol (*C*ontroller *A*rea *N*etwork) is specified in the international standard recommendation ISO DIS 11898 where, however, only the electrical components of the physical layer and the data-link layer (layers 1 and 2 in the ISO and OSI layers reference model) are specified. The CiA (*C*AN *i*n *A*utomation, an international association of users and manufacturers) has defined its use as an industrial field bus with the DS 102-1 recommendations for bus interfacing and the bus medium.

- The specifications in ISO-DIS 11898 and in DS 102-1 are complied with by the CBC board.
- The CBC board only supports CAN layers 1 and 2. At present, additional higher-level communications specifications of the different user organizations such as CAN open of the CiA are *not* supported (CAN open upon request).

The CBC board is limited to the specifications of CAN and is therefore not tied to the dependent specifications of the user organizations. Data exchange with SIMOVERT MASTERDRIVES takes place according to the user data specification for drive systems with PROFIBUS DP: PROFIBUS Profile for PROFIDRIVE Variable-Speed Drives, PNO, Order No. 3.071.

The user data structure is divided into two areas:

- Process data (control words, setpoints, status words and actual values)
- Parameter area (mechanism for reading and writing parameter values, e.g. settings, alarms, fault numbers or values).

These areas are transmitted as communication objects (identifiers).

Functions		
Process data	max. 16 words	
Data transfer rate:	10, 20, 50 Kbit/s	up to 3282 ft (1000 m) cable length
	100 Kbit/s	up to 2461 ft (750 m) cable length
	125 Kbit/s	1739 ft (530 m) cable length
	250 Kbit/s	886 ft (270 m) cable length
	500 Kbit/s	328 ft (100 m) cable length
	1 Mbit/s	30 ft (9 m) cable length
Max. bus nodes:	≤ 124	

Individual communication objects for the process data from and to the drive are defined, as well as for the parameter tasks of "reading" and "writing".

A defined description can be found in the Compendium for SIMOVERT MASTERDRIVES (for Order No., see Section 5).

Data exchange via CAN

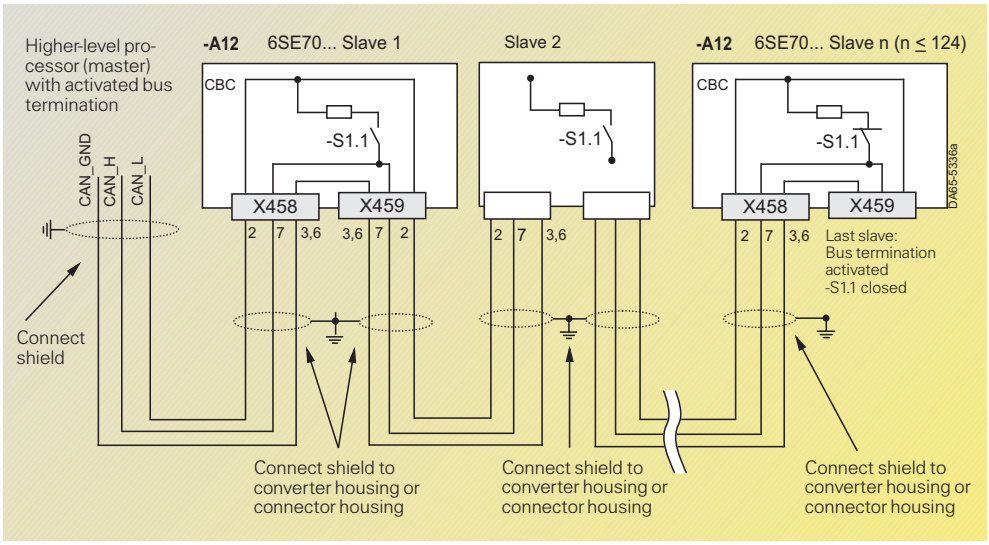


Fig. 6/62
Data exchange between CBC boards, with bus interruption

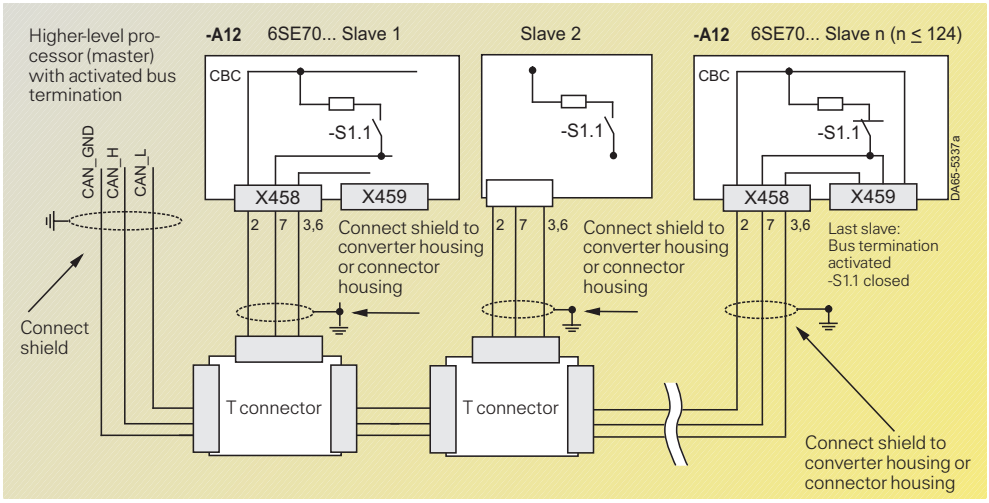
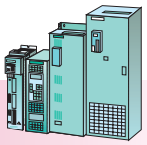


Fig. 6/63
Data exchange between the CBC boards, without bus interruption



CAN (continued)

The CAN protocol enables rapid data exchange between the bus nodes. With regard to user data, a distinction is made between parameter values (PKW) and process data (PZD).

A CAN data telegram consists of a protocol header, the CAN identifier (up to 8 bytes of user data) and the protocol trailer. The CAN identifier serves to uniquely identify the data telegram. A total of 2048 different CAN identifiers are possible in the standard message format. In the extended message format, 2^{29} CAN identifiers are possible.

The extended message format is tolerated by the CBC board but not evaluated. The CAN identifier specifies the priority of the data telegram. The smaller the number of the CAN identifier, the higher is its priority.

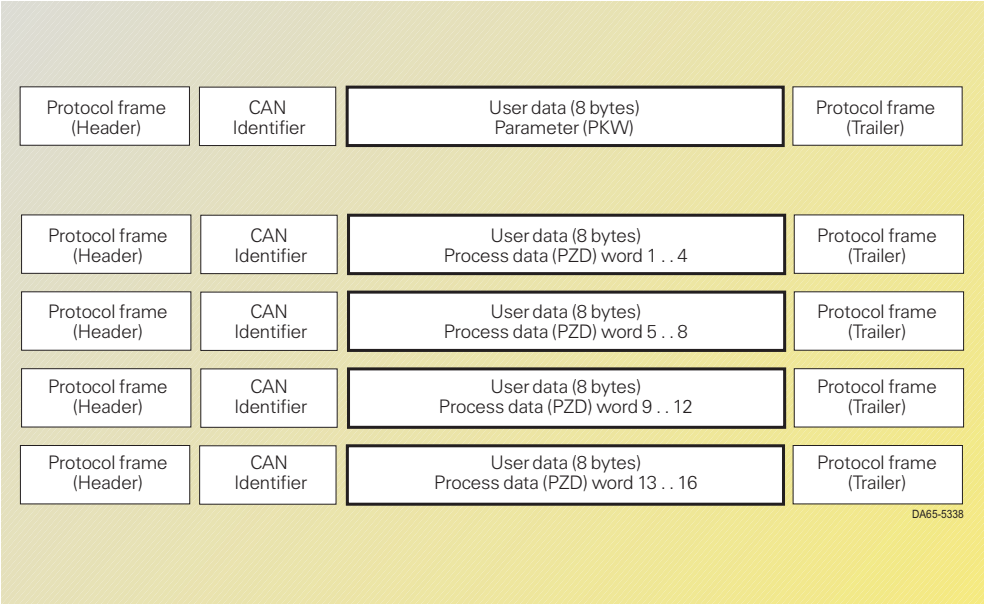


Fig. 6/64
Structure of the net data in the telegram

A maximum of 8 bytes can be transmitted in a CAN data telegram. The PKW area always consists of 4 words or 8 bytes, i.e. the data can be transferred in a single data telegram. In the case of SIMOVERT MASTERDRIVES, the process-data area, for example, consists of 16 words. A total of 4 data telegrams is therefore needed in order to transfer all process data.

X458 and X459 terminals on the CBC board

The CBC communication board has a 9-pole Sub-D connector (X458) and a 9-pole Sub-D socket (X459) for connection to the CAN.

Both terminals are assigned identically and are connected internally. The connecting interface is short-circuit-proof and floating.

Fitting the CBC board

In the compact and chassis units, slots A, C, E and G in the electronics box are available. If one of slots E and G is used, the backplane bus LBA (Order No. 6SE7090–0XX84–4HA0) and adapter board ADB (Order No. 6SE7090–0XX84–0KA0) are required.

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

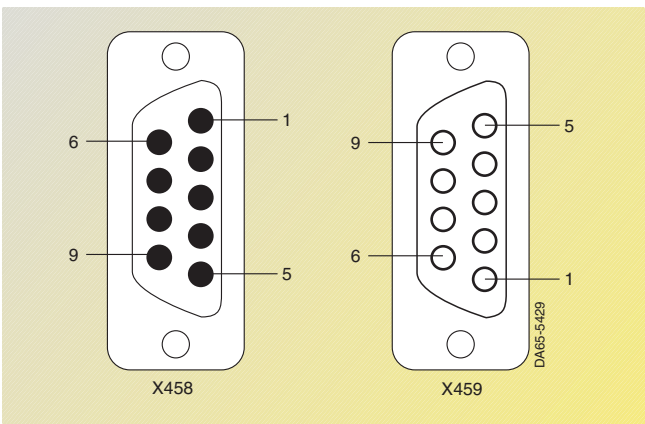
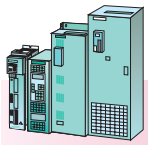


Fig. 6/65
Terminals X458 (plug) and X459 (socket)



CBD

The CBD (Communications Board DeviceNet) permits MASTERDRIVES to be coupled to automation units, or other field devices via the DeviceNet™ protocol. The CBD board can be inserted in the MASTERDRIVES electronics box, and operates with all of the software and hardware versions of the MASTERDRIVES.

The CBD supports both DeviceNet Explicit Messages and I/O Messages to implement the equivalent of the process data and parameter portions of drive communication.

DeviceNet Explicit Message Connections provide generic, multi-purpose communication paths between two devices. They provide the means by which non-time critical functions are performed (for example module configuration and drive parameterization).

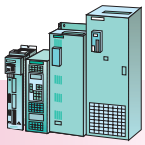
By contrast, DeviceNet I/O Message Connections provide time-critical special-purpose communication paths between a transmitting device and one or more receiving devices. Process data moves across this I/O Connection. The meaning of the data within an I/O Message is implied by the associated Connection ID.

The CBD supports the Predefined Master/Slave Connection Set as defined in the DeviceNet specification. Both poll and bit strobe I/O messages are supported.

The CBD follows the DeviceNet Device Profile for the Communication Adapter (Device Type 12). The Communication Adapter Profile was chosen so that all the flexibility and advanced features of the MASTERDRIVES could be used by the DeviceNet master. For the same reason, the CBD did not implement the DeviceNet AC Drives profile.

		Drop length	
Data rate	Trunk distance	Maximum drop	Cumulative
125 Kb	1640 ft (500 m)	20 ft (6 m)	512 ft (156 m)
250 Kb	820 ft (250 m)	20 ft (6 m)	256 ft (78 m)
500 Kb	328 ft (100 m)	20 ft (6 m)	128 ft (39 m)

	Order No.
Description	
CBD DeviceNet Board	6SX7010–0FK00
Instruction manual	Included above



SIMOLINK

The SIMOLINK drive interface is for rapid data exchange between different drives. This is based on a closed ring in which all nodes are integrated.

The SLB communication board (SIMOLINK board) is for linking drives to the SIMOLINK. Each SLB communication board is a node connected to the SIMOLINK. The maximum number of nodes is limited to 201.

Data is exchanged between the individual nodes via fiber-optic cable. Plastic-fiber or glass-fiber cable can be used.

The SLB option board has a 24 V voltage input allowing external voltage supply to be connected to the board. This ensures that data exchange is maintained via SIMOLINK even if the converter/inverter has been turned off.

The board has three LEDs which provide information on the current operating status.

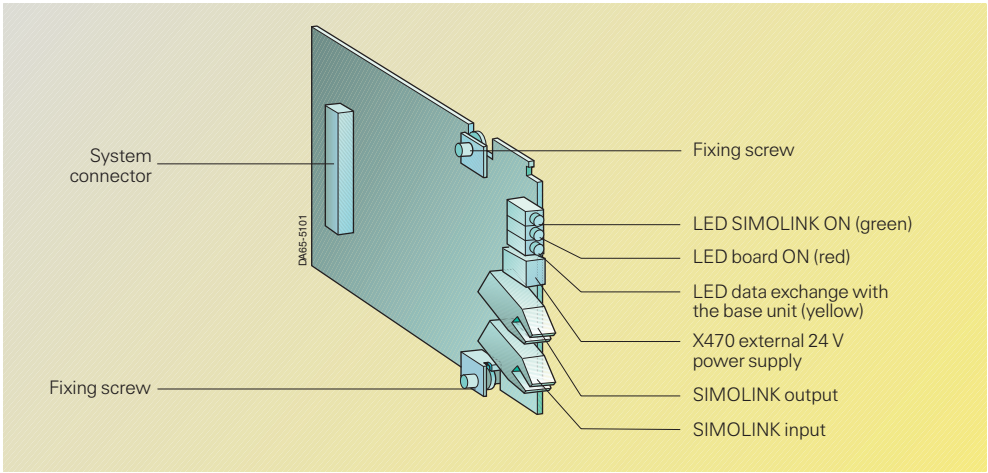


Fig. 6/66
SLB communication board

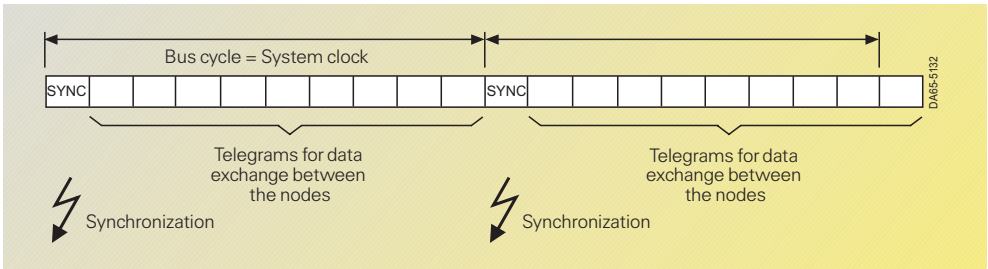


Fig. 6/67
SIMOLINK telegram traffic

6

Features

- The transmission medium is a fiber-optic cable. Glass-fiber or plastic-fiber cables can be used.
- The structure of the SIMOLINK is a fiber-optic cable ring. Each node in the ring acts as a signal amplifier.
- Depending on the selected medium, the following distances are possible:
  - max. 131 ft (40 m) between each node with plastic-fiber cable, or
  - max. 984 ft (300 m) between each node with glass-fiber cable.
- A maximum of 201 nodes can be linked with each other via SIMOLINK.
- The nodes are synchronized by means of a SYNC telegram which is generated by a node with a special function, namely the dispatcher function, and simultaneously received by all other nodes. The SYNC telegram is generated with absolute time-equidistance and is jitter-free. The time between two SYNC telegrams is the bus circulating time of the SIMOLINK and, at the same time, corresponds to the common system clock for synchronization of all connected nodes.
- Data transfer between the nodes is strictly cyclical and takes place in the clock of the bus cycle. This means that all data which the nodes read or write are transferred between two SYNC telegrams. This ensures that the latest data are available to all nodes on the bus at the same time.

SIMOLINK (continued)

Method of operation

The SLB board is the link between the converter/inverter and the SIMOLINK. It can be used as a SIMOLINK dispatcher or as a SIMOLINK transceiver. The changeover between the two functions is determined by parameterization.

Peer-to-peer functionality

The peer-to-peer functionality with the SIMOLINK is, in principle, the same as peer-to-peer connection known from the MASTERDRIVES and SIMOREG systems. With SIMOLINK, the exchange of process data between the MASTERDRIVES Vector Control units has the following advantages:

- Very high speed (11 Mbit/s; 100 items of 32-bit data in 0.63 ms)
- Free choice, i.e. each MASTERDRIVES Vector Control unit can send process data to or receive them from any other MASTERDRIVES Vector Control.
- Max. 16 items of 32-bit process data per MASTERDRIVES Vector Control is possible via the SIMOLINK; i.e. each MASTERDRIVES Vector Control can receive up to 8 process data (32-bit values) or send up to 8 process data to other MASTERDRIVES Vector Control units.

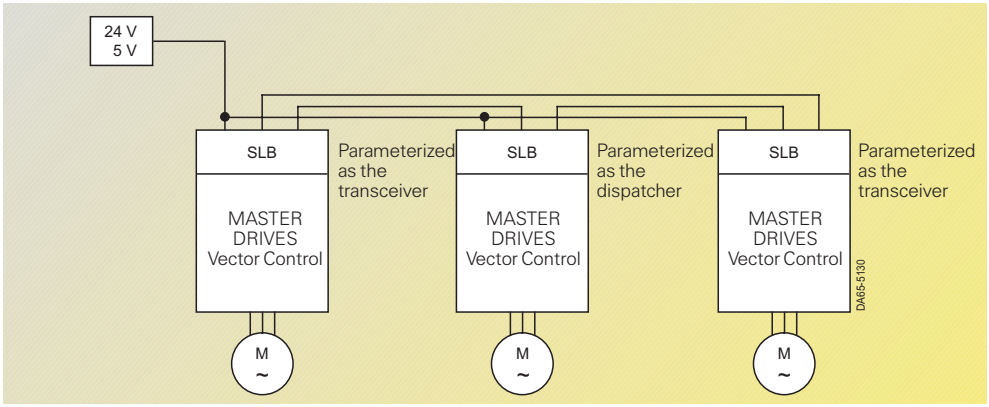


Fig. 6/68
Peer-to-peer functions with the SIMOLINK

Parameterization

Data traffic is parameterized solely by means of the parameters of the base MASTERDRIVES Vector Control unit. An additional configuration tool is not needed. For configuration of the SLB, the following parameter settings are basically necessary:

- Specification of the bus address:
  - 0 to 200, whereby the following applies: 0 = simultaneously to the dispatcher function
  - 1 to 200 = simultaneously to the transceiver function
- Transmission power
- Bus cycle time
- Number of nodes and telegrams per node
- Monitoring time for fault messages in the event of communications failure.

The BICO system is used for configuring which process data are to be sent by a MASTERDRIVES Vector Control unit. The BICO system is also used to determine at what position in the control system the process data are to act. The SLB can be parameterized with the PMU, the OP1S or the PC-based Drive ES or DriveMonitor tools.

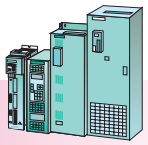
Voltage supply

The option board can be supplied with the necessary operating voltage either internally by the converter/inverter or externally. Priority is given to the external power supply. The changeover takes place automatically on the option board.

Note

The external power supply must not be changed over during bus operation. If the power supply is automatically changed over, a reset signal is generated on the board, thus causing several telegrams to be lost.

Technical Data of the SLB board	Designation	Value
	Size (length x width)	3.5 in x 3.3 in (90 mm x 83 mm)
	External voltage supply	24 V DC
	Current requirement from the external power supply	Max. 200 mA
	Voltage supply from the basic unit	5 V DC
	Current requirement from the power supply of the base unit	Max. 600 mA
	Changeover of the power supply	Automatic; the external supply has priority
	Node address	Can be set in the parameter
	Data transfer rate	11 Mbit/s
	Runtime delay	Max. 3 clock times
	Fiber-optic cable	Plastic (preferable); glass fiber
	Cable length at 32 °F to 158 °F (0 °C to 70 °C)	Max. 131 ft (40 m) (plastic) between 2 nodes 984.5 ft (300 m) (glass fiber) between 2 nodes
	Display	3 LED: yellow: data exchange with the basic unit; green: SIMOLINK in operation; red: board in operation



Serial communication converters · Available protocol converters

The following protocol converters have been tested by and are sold by Siemens Energy & Automation. They basically convert the data sent and received by USS Protocol into data locations in the host. For example, there will be a separate data word in the host corresponding to the control word for each drive. Changing bit 0 of this data word (usually with ladder logic) will start or stop that individual drive. Another separate data word for each drive would be the speed reference for each drive.

DTU-3006

The DTU-3006 is an intelligent PLC to Siemens Drives Communication Interface Unit. The DTU-3006 supports over 25 PLC Protocols, including Schneider Automation's Modbus, and converts to USS Protocol.

MD-3006

The MD-3006 is an intelligent PLC to Siemens Drive Communication Interface Unit. The MD-3006 converts Schneider Automation's Modbus Plus to USS Protocol.

DN-3006

The DN-3006 is an intelligent PLC to Siemens Drive Communication Interface Unit. The DN-3006 converts DeviceNet to USS Protocol. It has slower communication speeds than CBD.

PD-3006

The PD-3006 is an intelligent PLC to Siemens Drives Communication Interface Unit. The PD-3006 converts PROFIBUS DP to USS Protocol. It has slower communication speeds than CBP2.

SCI-PU

The 6SE70 MASTERDRIVES can be interfaced to Allen-Bradley™ and Modicon™ programmable controllers by utilizing the SCI-PU. The SCI-PU performs the complex protocol conversions, transparent to the programmer or operator.

The SCI-PU provides a multi-drop RS485 bus interface to up to 31 6SE70 drive controllers. The serial interface is fully functional for monitoring and control.

Port A (Host) supports:

- Allen-Bradley Data Highway+™
- Modicon Modbus+ (via Modbus)™
- Allen-Bradley Remote I/O Network

Port B (Drive Protocols) supports

- USS Protocol RS485 Variable telegram length to 187.5 KBaud
- Simple Protocol RS485 10 word telegram length to 38.4 KBaud
- DUST 6B Protocol RS485 Selectable telegram length 117.6 KBaud

™Data Highway is a trademark of Allen-Bradley Company, Inc.

™Modbus is a trademark of Modicon, Inc.

Selection and ordering data

Serial communication converter	Order No.
DTU-3006	**DTU-3006**
MD-3006	**MD-3006**
DN-3006	**DN-3006**
PD-3006	**PD-3006**
SCI-PU	**A1-101-037-811**

EB1 terminal expansion board

With the EB1 (*E*xpansion *B*oard 1), it is possible to expand the number of digital and analog inputs and outputs.

The EB1 terminal expansion board has the following:

- 3 digital inputs
- 4 bidirectional digital inputs/outputs
- 1 analog input with differential signal which can be used as a current/voltage input
- 2 analog inputs (single-ended), which can also be used as digital inputs
- 2 analog outputs
- 1 connection for the external 24 V power supply for the digital outputs

The EB1 terminal expansion board is built into the electronics box. The slots for this board are indicated in the description on page 6/54.

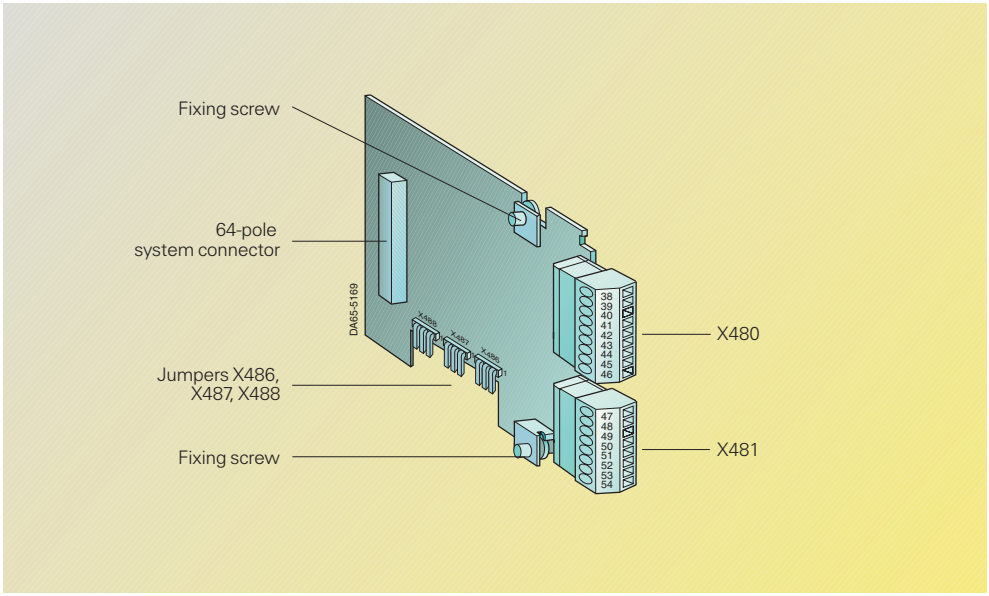


Fig. 6/69
EB1 terminal expansion board

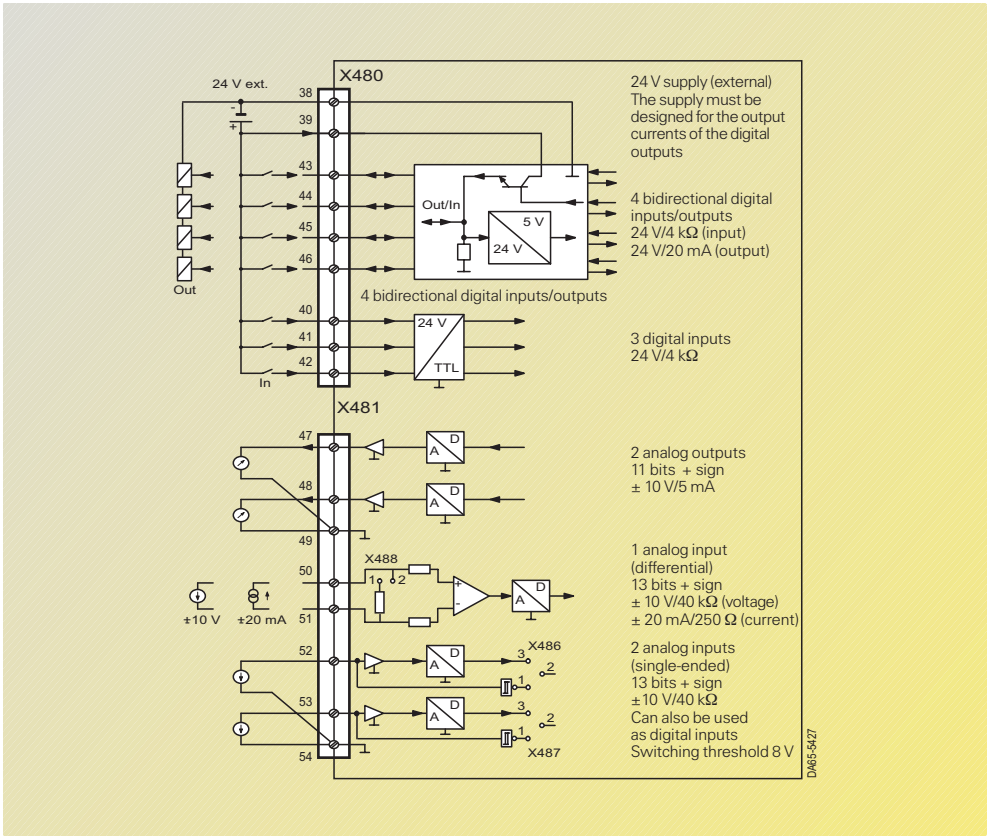
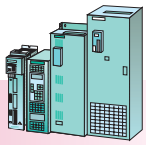


Fig. 6/70
Circuit diagram of the EB1 terminal expansion board



EB1 terminal expansion board (continued)

Connection X480

The following connections are provided on the terminal strip:

- 3 digital inputs
- 4 bidirectional digital inputs/outputs

The ground cables are protected by a reactor. Terminal 46 is at the top when installed.

Note

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

Terminal	Designation	Description	Range
38	M	Ground digital	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
44	DIO2	Digital input/output 2	
45	DIO3	Digital input/output 3	As output: Output voltage P24 ext. –2.5 V, 20 mA
46	DIO4	Digital input/output 4	

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

Connection X481

The following connections are provided on the terminal strip:

- 1 analog input with differential signal, which can be used as a current and voltage input
- 2 analog inputs (single-ended), can also be used as digital inputs
- 2 analog outputs

The ground cables are protected by a reactor. Terminal 47 is at the top when installed.

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

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

Technical Data

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

EB2 terminal expansion board

With the EB2 (*E*xpansion *B*oard 2), the number of digital and analog inputs and outputs can be expanded.

The EB2 terminal expansion board has

- 2 digital inputs
- 1 relay output with changeover contacts
- 3 relay outputs with make contact
- 1 analog input with differential signal which can be used as current input or voltage input
- 1 analog output
- 24 V power supply for the digital inputs

The EB2 terminal expansion board is built into the electronics box. The slots for this board are indicated in the description on page 6/54.

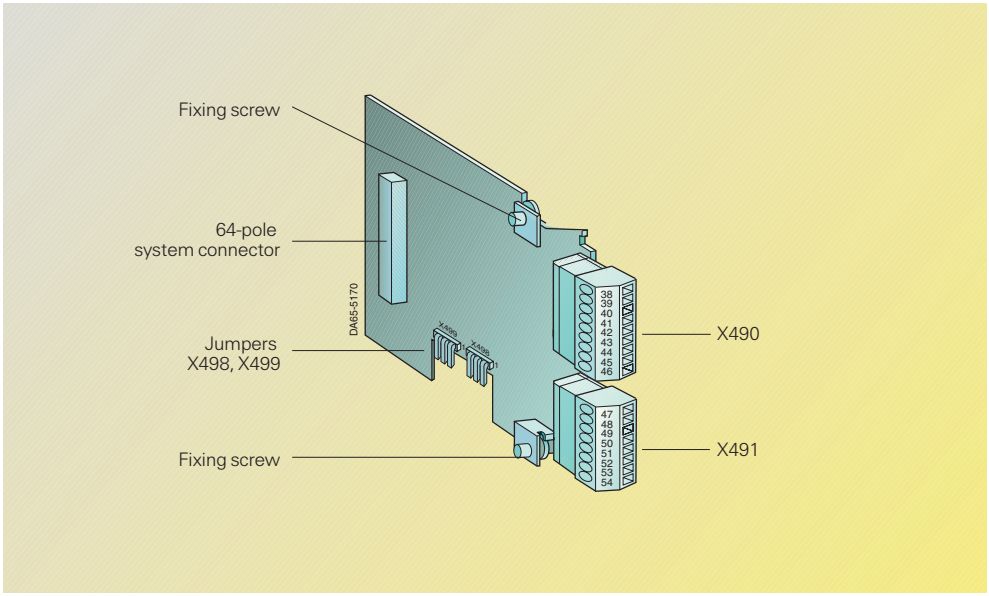


Fig. 6/71
EB2 terminal expansion board

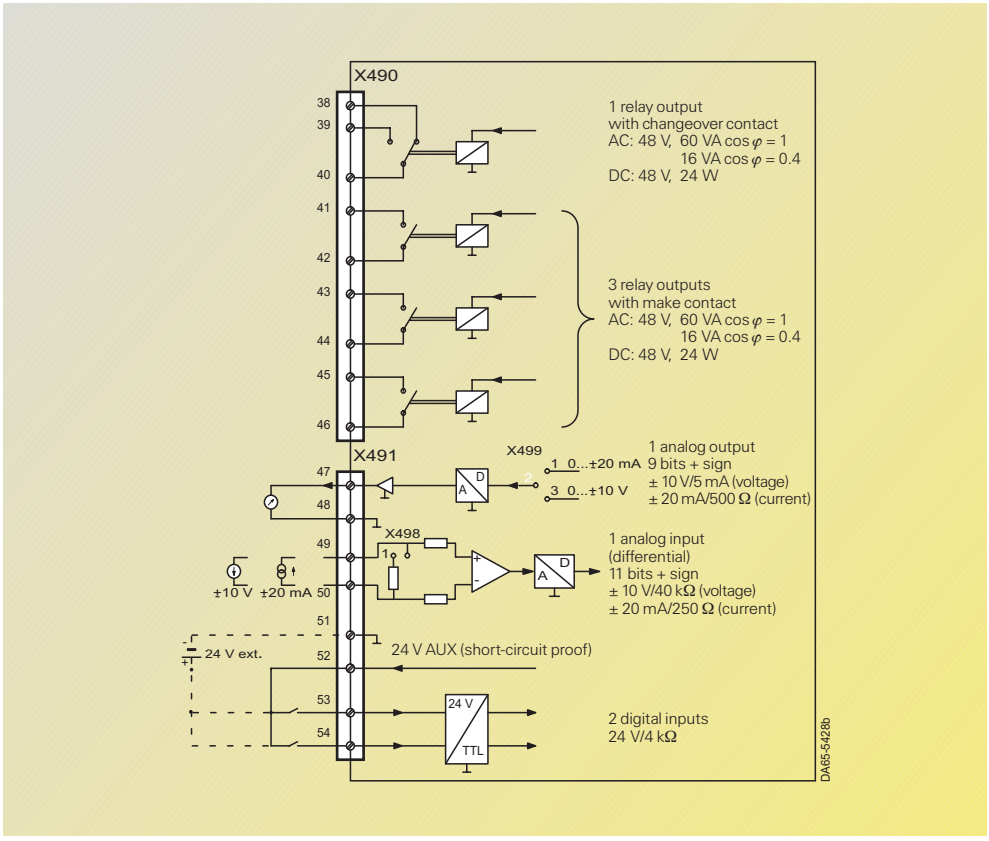
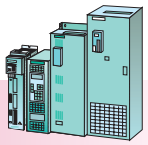


Fig. 6/72
Circuit diagram of the EB2 terminal expansion board



EB2 terminal expansion board (continued)

Connection X490

Load capability of the relay contacts

Type of contact	Changeover contact
Maximum switching voltage	60 V AC, 60 V DC
Maximum switching output	16 VA at 60 V AC ($\cos\varphi = 0.4$) 60 VA at 60 V AC ($\cos\varphi = 1.0$) 3 W at 60 V DC 24 W at 60 V DC

Terminal	Designation	Description
38	DO13	Relay output 1, break contact
39	DO12	Relay output 1, make contact
40	DO11	Relay output 1, reference contact
41	DO22	Relay output 2, make contact
42	DO21	Relay output 2, reference contact
43	DO32	Relay output 3, make contact
44	DO31	Relay output 3, reference contact
45	DO42	Relay output 4, make contact
46	DO41	Relay output 4, reference contact

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

Connection X491

The ground cables are protected by a reactor.

Note

The analog input can be used as a voltage or current input. A jumper is used for switching over.

Terminal	Designation	Description	Range
47	AO	Analog output	±10 V, 5 mA
48	AOM	Ground analog output	0 V
49	AI1P	Analog input +	Differential input: ±11 V/R_i = 4 kΩ
50	AI1N	Analog input –	
51	DIM	Ground digital input	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 mm² to 1.5 mm² (AWG 16)

Technical Data

Designation	Value
Digital inputs	DI1, DI2, DIM
• Voltage range LOW	0 V (– 33 V to +5 V)
• Voltage range HIGH	+24 V (13 V to 33 V)
• Input resistance	4 kΩ
• Smoothing	250 µs
• Electrical isolation	None
Digital outputs (relays)	DO1., DO2., DO3., DO4.
• Type of contact	Changeover contact
• Max. switching voltage	60 V AC, 60 V DC
• Max. switching capacity	
– at 60 V AC:	16 VA ($\cos\varphi = 0.4$) 60 VA ($\cos\varphi = 1.0$)
– at 60 V DC:	3 W 24 W
• Min. permissible load	1 mA, 1 V
Analog input (differential input)	AI1P, AI1N
• Input range	
Voltage	±11 V
Current	±20 mA
• Input resistance	
Voltage	40 kΩ to ground
Current	250 Ω to ground
• Hardware smoothing	220 µs
• Resolution	11 bits + sign
Analog output	AO, AOM
• Voltage range	±10 V, ±0 – 20 mA
• Input resistance	40 kΩ to ground
• Hardware smoothing	10 µs
• Resolution	9 bits + sign

SBP option board for incremental encoders

The SBP option board (*S*ensor *B*oard *P*ulse) enables an incremental encoder or a frequency generator to be connected to the converter and inverter for presetting the frequency or speed setpoint for SIMOVERT MASTERDRIVES.

Connectable incremental encoders and frequency generators

The SBP option board can also be used to evaluate an external encoder or frequency generator.

All standard available pulse encoders can be connected to the option board.

The pulses can be processed in a bipolar or in a unipolar manner as a TTL or HTL level.

The encoder signals can be evaluated up to a pulse frequency of 1 MHz.

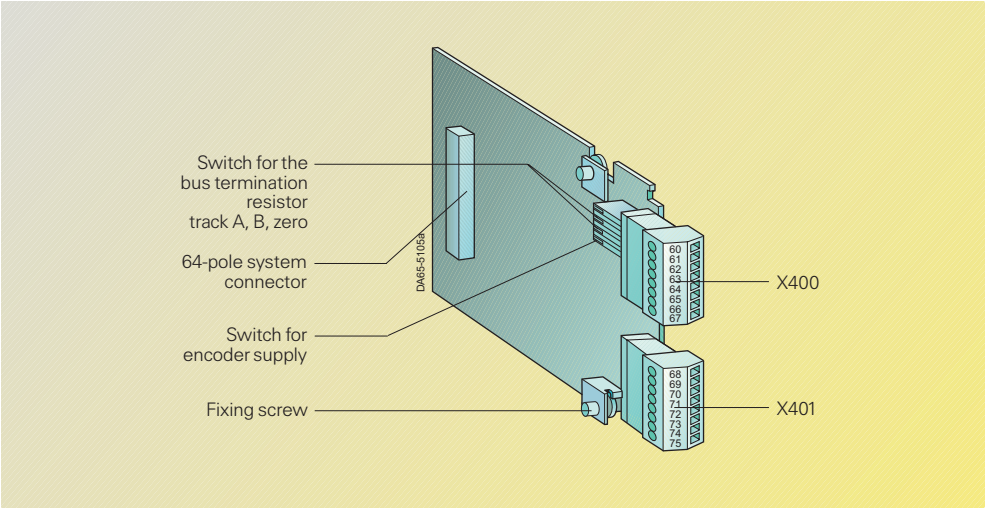


Fig. 6/73
View of the SBP option board

The supply voltage of the connected encoder or frequency generator can be set to 5 V or 15 V.

If the SBP is parameterized as a motor encoder (P130 = 5), incremental encoder evaluation via terminals X103 on the CUVC is deactivated.

Terminals

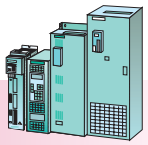
The option board has two terminal strips for the signal cables.

X400	Terminal	Designation	Description	Range
	60	$+V_{SS}$	Power supply for incremental encoder	5 V/15 V $I_{max.}$ = 250 mA
	61	$-V_{SS}$	Ground for power supply	-
	62	–temp	Minus(–) terminal KTY84/PTC100	2)
	63	+temp	Plus(+) terminal KTY84/PTC100	2)
	64	Ground coarse/fine	Ground	1)
	65	Coarse pulse 1	Digital input for coarse pulse 1	1)
	66	Coarse pulse 2	Digital input for coarse pulse 2	1)
	67	Fine pulse 2	Digital input for fine pulse 2	1)

Max. connectable cross-section: 0.14 mm² to 1.5 mm² (AWG 16)
Terminal 60 is at the top when installed.

1) Cannot be evaluated if SIMOVERT MASTERDRIVES Vector Control is used.

2) Can only be evaluated with Compact PLUS.



SBP option board for incremental encoders (continued)

X401

Maximum encoder cable length which can be connected with compliant screening[1]):
– 328 ft (100 m) (TTL signals)
– 492 ft (150 m) with A and B track (HTL signals)
– 984.5 ft 300 m with A+/A– and B+/B– track (HTL signals).

Terminal	Designation	Description	Range
68	A+ track	Plus(+) terminal Track A	TTL/HTL/HTL, unipolar
69	A– track	Minus(–) terminal Track A	TTL/HTL/HTL, unipolar
70	B+ track	Plus(+) terminal Track B	TTL/HTL/HTL, unipolar
71	B– track	Minus(–) terminal Track B	TTL/HTL/HTL, unipolar
72	Zero pulse +	Plus(+) terminal Zero track	TTL/HTL/HTL, unipolar
73	Zero pulse –	Minus(–) terminal Zero track	TTL/HTL/HTL, unipolar
74	CTRL +	Plus(+) terminal Control track	TTL/HTL/HTL, unipolar
75	CTRL – = M	Minus(–) terminal Control track = Ground	TTL/HTL/HTL, unipolar

Max. connectable cross-section: 0.14 mm^2 to 1.5 mm^2 (AWG 16)
Terminal 68 is at the top when installed.

Voltage range of the encoder inputs

	RS422 (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 of differential voltage – LOW	Min. –150 mV	Min. –2 V	Min. 4 V
Switching level of differential voltage – HIGH	Max. 150 mV	Max. 2 V	Max. 8 V

Note

If unipolar signals are connected, one ground terminal for all signals at the CTRL– terminal is sufficient. Due to possible interference susceptibility, it is recommended for cable lengths over 164 ft (50 m) that the four terminals A–, B–, zero pulse – and CTRL– are bypassed and connected to the encoder ground.

Voltage range of the digital inputs

	Rated value	Min.	Max.
Voltage range LOW	0 V	–0.6 V	3 V
Voltage range HIGH	24 V	13 V	33 V
Input current LOW	≤ 2		
Input current HIGH	10 mA	8 mA	12 mA

Note

The inputs are non-floating. The coarse pulse is smoothed with 0.7 ms, the fine pulse with approx. 200 ns.

6

1) See page 6/45, "Electromagnetic compatibility".

Technology applications with the T100

The T100 technology board can be installed in SIMOVERT MASTERDRIVES Vector Control and also in the rectifier/regenerative units of type of construction compact and chassis units. The T100 expands the base units with many additional drive-related technological functions such as

- Higher-level PID controller, which can be used, for example, as a tension, dancer-roll-position, flow, pressure and temperature controller
- Comfort ramp-function generator with rounding-off, parameter sets which can be toggled via a control command, d*v*/d*t* output and triggerable function
- Comfort motorized potentiometer with non-volatile output value storage
- Wobble generator with triangular wobble pattern, adjustable P steps and a synchronizing input and output for traversing drives in the textile industry
- Drive-related control, e.g. power-up/power-down control unit and brake control, velocity and speed processor.
- Terminals with 8 binary inputs, 5 binary outputs, 5 analog inputs and 2 analog outputs (see Fig. 6/75). All external signals are directly connected at the screw/plug-in terminals 50 to 92 on the T100.
- 2 high-speed serial interfaces, which can be used independently of each other (see Fig. 6/75):
  - high-speed peer-to-peer connection with a data transfer rate of up to 187.5 Kbit/s which can be used to configure a digital setpoint cascade
  - USS interface with a data transfer rate of up to 187.5 Kbit/s for creating a low-cost field-bus connection to a SIMATIC PLC or a third-party system.

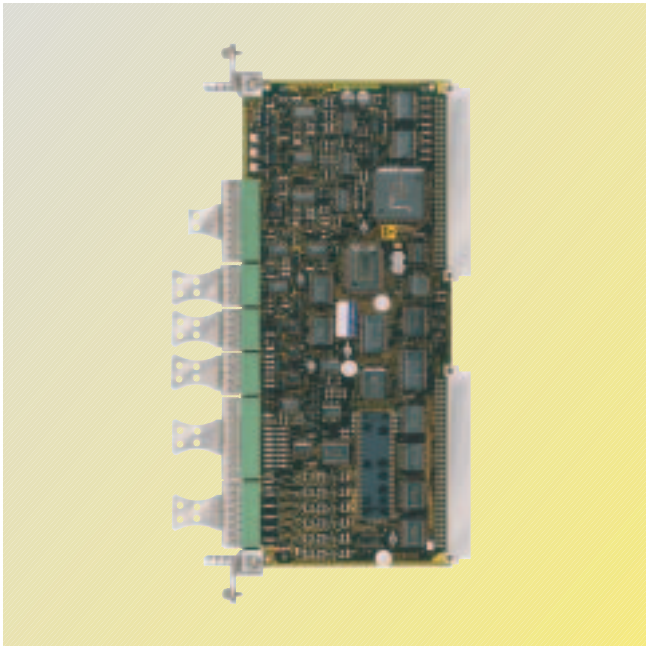


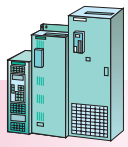
Fig. 6/74
T100 technology board

Technical Data

In addition to the functions already listed, the T100 has a series of freely-connectable control, arithmetic and logic blocks:

5	adders with 3 inputs
3	subtracters
4	sign inverters
3	dividers
4	multipliers
3	high-resolution multipliers/ dividers with 3 inputs
4	absolute-value generators with filtering
2	limiters
2	limit-value monitors with filtering
1	minimum selection with 3 inputs
1	maximum selection with 3 inputs
2	analog signal-tracking/storage elements with non-volatile storage function
2	analog-signal storage elements
1	wobble generator
10	analog-signal changeover elements
1	simple ramp-function generator
1	dead band
3	characteristic blocks
16	AND elements with 3 inputs
8	OR elements with 3 inputs
8	inverters
3	EXCLUSIVE OR elements
6	NAND elements with 3 inputs
7	RS flip flops
2	D flip-flops
5	timers
4	binary-signal changeover functions
1	parameter set changeover
1	velocity and speed computer

The block inputs and outputs, the terminals and the process-data signals of the serial interfaces can be combined with one another as required by suitable parameterization. This applies both to word formats and to binary control and status signals.



Technology applications with the T100 (continued)

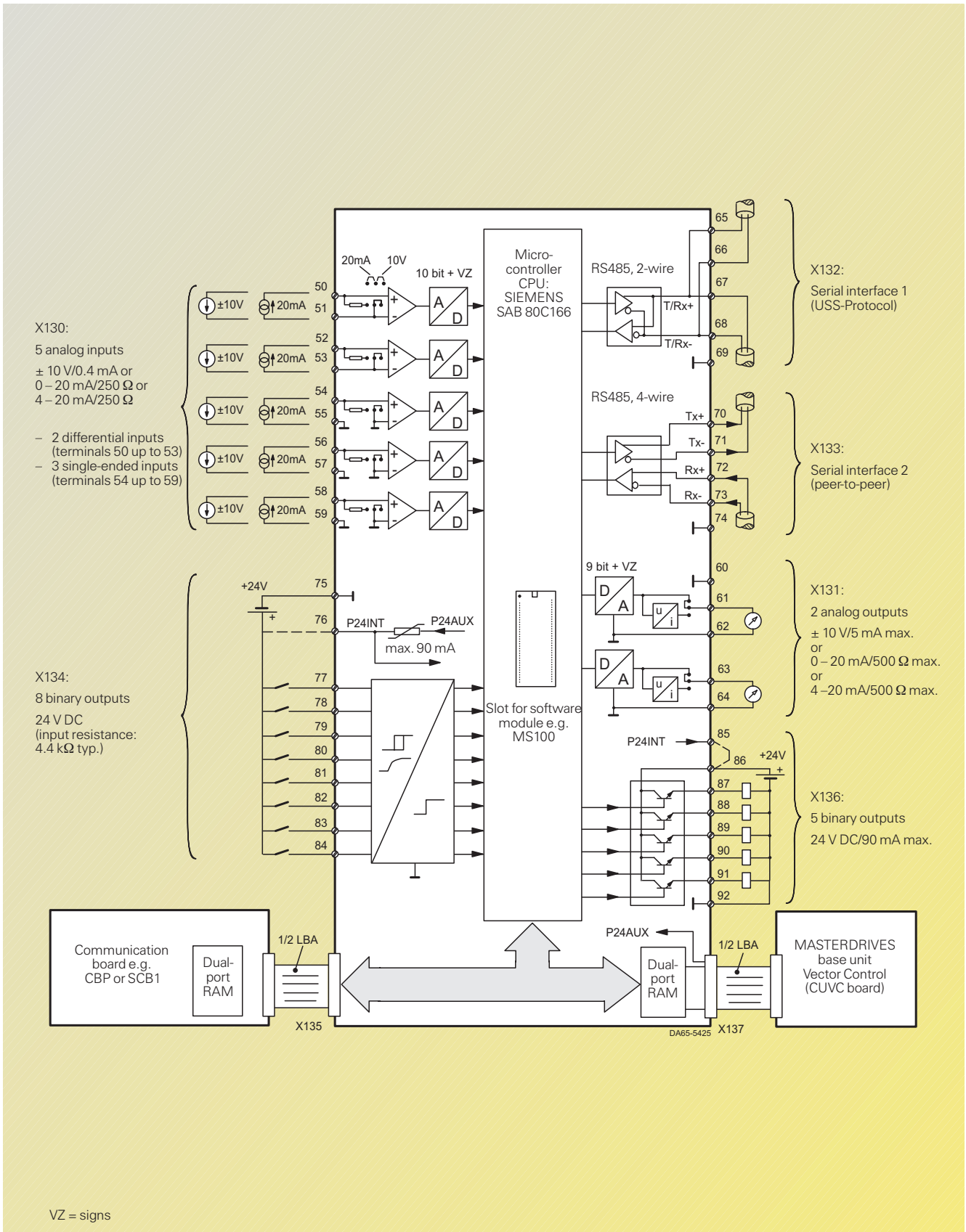


Fig. 6/75
T100 technology board connecting diagram

Technology applications with the T100 (continued)

Communication functions of the T100 technology board

5 analog inputs	• Possible input signal / level resistance □ –10 V to +10 V/24 kΩ typ. □ 0 mA to ±20 mA/250 Ω typ. □ 4 mA to 20 mA/250 Ω typ. • 2 differential inputs • 3 single-ended inputs • Non-floating • Resolution: 10 bits + sign
2 analog outputs	• Possible output level / drive capability □ –10 V to +10 V/5 mA max. □ 0 mA to 20 mA/500 Ω max. □ 4 mA to 20 mA/500 Ω max. • Non-floating • resolution: 9 bits + sign
8 binary inputs	• Input level: 24 V DC, SIMATIC-compatible: LOW = –33 V to +5 V, HIGH = +13 V to +33 V • No electrical isolation • Input resistance: 4.4 kΩ typ. • Signal status indication to PMU and OP1S
5 binary outputs	• Transistor switch, switches 24 V DC ("open emitter") • SIMATIC-compatible output level (LOW < +2 V, HIGH = +17.5 V to +33 V) • Switching capability: 90 mA max (continuously short-circuit-proof, can be connected in parallel) • Signal status indication to PMU and OP1S
24 V DC load power supply for the binary inputs / outputs	• From the MASTERDRIVES unit: A short-circuit-proof 24 V DC supply voltage is available at terminals 76 and 85, which can be loaded with a maximum of 90 mA (see the dotted-line wiring in the connecting diagram on page 6/72)[1]) • External 24 V DC supply. Permissible voltage range: +20 V to +30 V (see the continuous-line wiring in the connecting diagram on page 6/72)
1 peer-to-peer interface	• Data transfer technique: RS485, 4-wire, full-duplex • Non-floating • Cable terminating resistors can be activated using plug-in jumpers • Baud rate can be adjusted up to 187.5 Kbit/s • Adjustable telegram length 1 to 5 words • Joint operation possible with SIMOREG 6RA24 and 6RA70 units and MASTERDRIVES with SCB2 • Receive and transmit signals (also control/status bits) can be freely combined per parameter • Max. cable length: 1641 ft (500 m) at 187.5 Kbit/s, 3281.5 ft (1000 m) at other baud rates
1 serial USS interface	• Data transfer technique: RS485, 2-wire, half-duplex • Non-floating • Bus terminating resistors can be activated by means of plug-in jumpers • Baud rate can be adjusted up to 187.5 Kbit/s • Max. cable length: 1641 ft (500 m) at 187.5 Kbit/s, 3281.5 ft (1000 m) at other baud rates

Communication functions of the T100 technology board

The relevant internal signals and parameters both of the base unit and the T100 can be accessed via the USS interface of the T100.

The T100 has its own parameter memory and can be parameterized via the PMU operator control and parameterizing unit, the optional OP1S operator control unit or a PC loaded by means of Drive ES or DriveMonitor (see pages 2/10 to 2/14).

The PC with Drive ES or DriveMonitor is connected to the USS interface of the SIMOVERT MASTERDRIVES.

All relevant internal T100 signals can be monitored by means of display parameters (multimeter functions).
The T100 has 3 diagnostic LEDs, which indicate the following operating statuses:

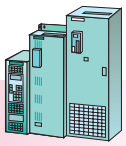
1. The T100 is operating error-free in cyclical mode
2. Data exchange between the T100 and SIMOVERT MASTERDRIVES is OK
3. Data exchange between the T100 and the communication board is OK

Note

All the software functions described here are contained in the MS100 software module "Universal Drive". The software module is a 40-pin EPROM device, which must be ordered separately and is inserted in the dedicated plug-in socket on the T100. The T100 cannot be used without a software module.

For selection and ordering data for the T100 technology board and its components, see Section 3.

1) The total load of the base unit and the technology board must not exceed 150 mA. An external 24 DC power supply must be used if this value is exceeded (to be connected at terminals 76 and 86).



Technology applications with the T300

The T300 can be used to provide additional technological functions for compact and chassis units (e.g. for closed-loop tension and position control, coilers, winders, closed-loop synchronous and positioning controls, transverse cutters, hoisting equipment and drive-related control functions). Supplementary technological functions which are often requested are offered as standard software packages on pre-programmed memory modules.

The T300 and SIMADYN® D are fully compatible with each other.
Users who wish to create special applications or who wish to market their own technological know-how can create their own technological design on the T300 by using the graphics-oriented STRUC® planning language known from the SIMADYN D system (See also ordering data in Section 3).

Fig. 6/77 shows the most important hardware functions of the T300.
The technological functions are configured with STRUC and cyclically executed by the processor. The closed-loop control sampling time is a minimum of 1 ms.

An overview of the hardware and software components of the T300 is provided in Fig. 6/78.

An almost delay-free parallel interface (dual-port RAM) permits data transfer between the base unit and the T300.

The serial connections can be directly connected to terminals on the T300. All other external signals can be connected at the SE300 terminal block outside the base unit. 15 V / 100 mA for supplying pulses is available at SE300 (see Fig. 6/77).

An external 24 V DC power supply must be provided if binary inputs and outputs have to be controlled. The base unit can also provide this voltage supply as long as the total current at terminals X101.13, 23 of the base unit is < 150 mA.

The software package is parameterized – irrespective of which software package is used – with the help of the following:

- a Drive ES or DriveMonitor PC (for a description see pages 2/10 to 2/14)
- the PMU operator control and parameterizing unit
- the OP1S user-friendly control unit
- an interface board (CBP, SCB1, SCB2)
- via an interface of the T300 with the service start-up program (see selection table on page 3/83).

Altered parameters can be stored in the EEPROM (non-volatile).

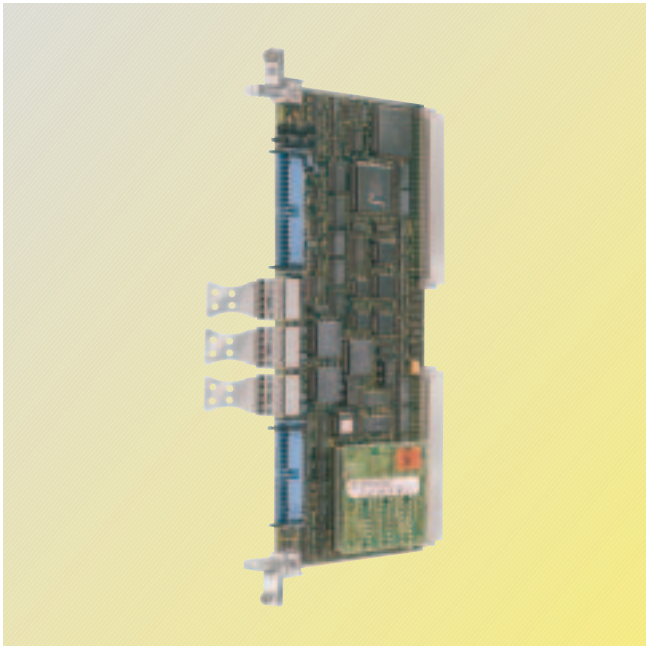
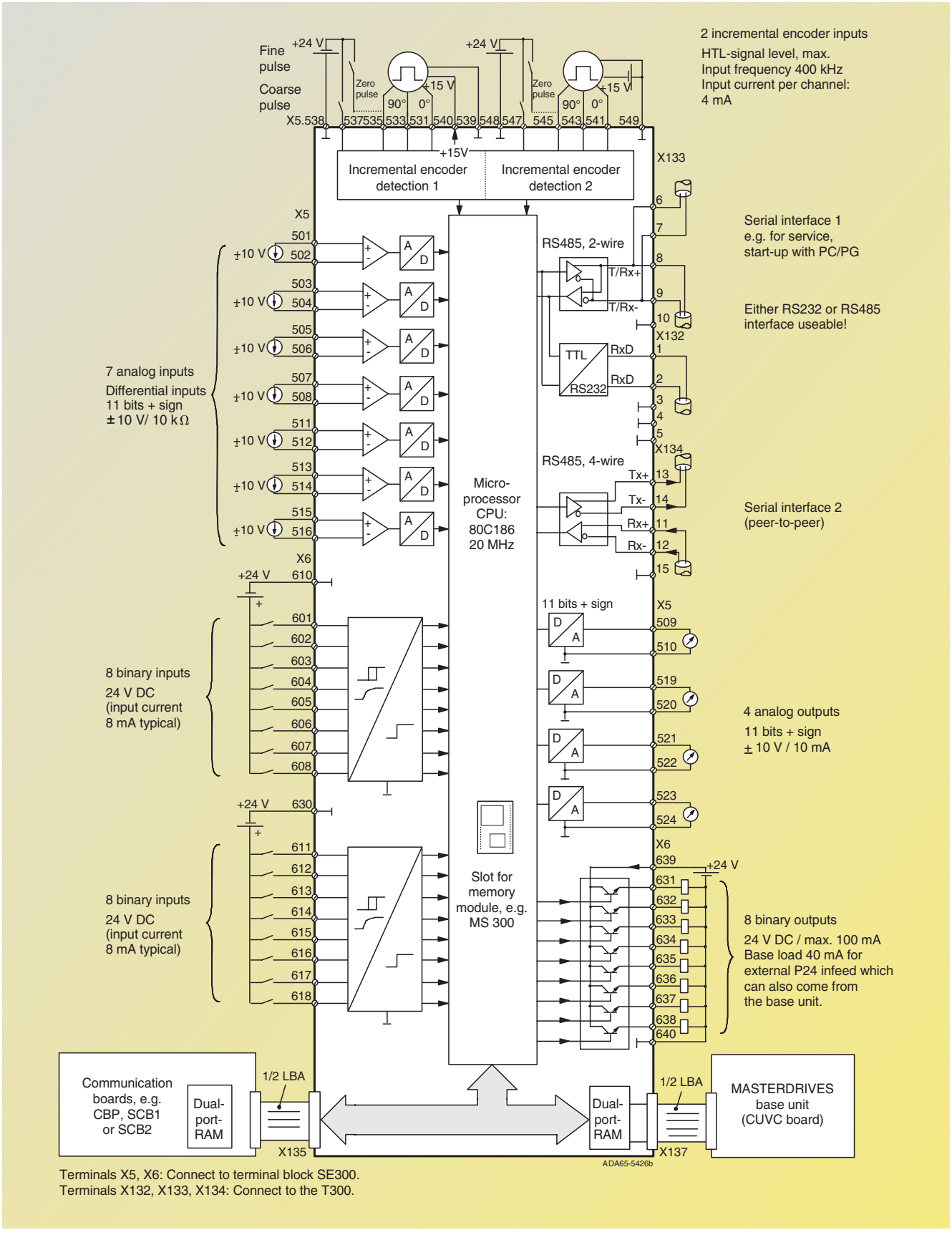


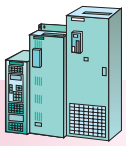
Fig. 6/76
T300 board with memory module

Technology applications with the T300 (continued)



Terminals X5, X6: Connect to terminal block SE300.
Terminals X132, X133, X134: Connect to the T300.

Fig. 6/77
T300 technology board connection diagram



Technology applications with the T300 (continued)

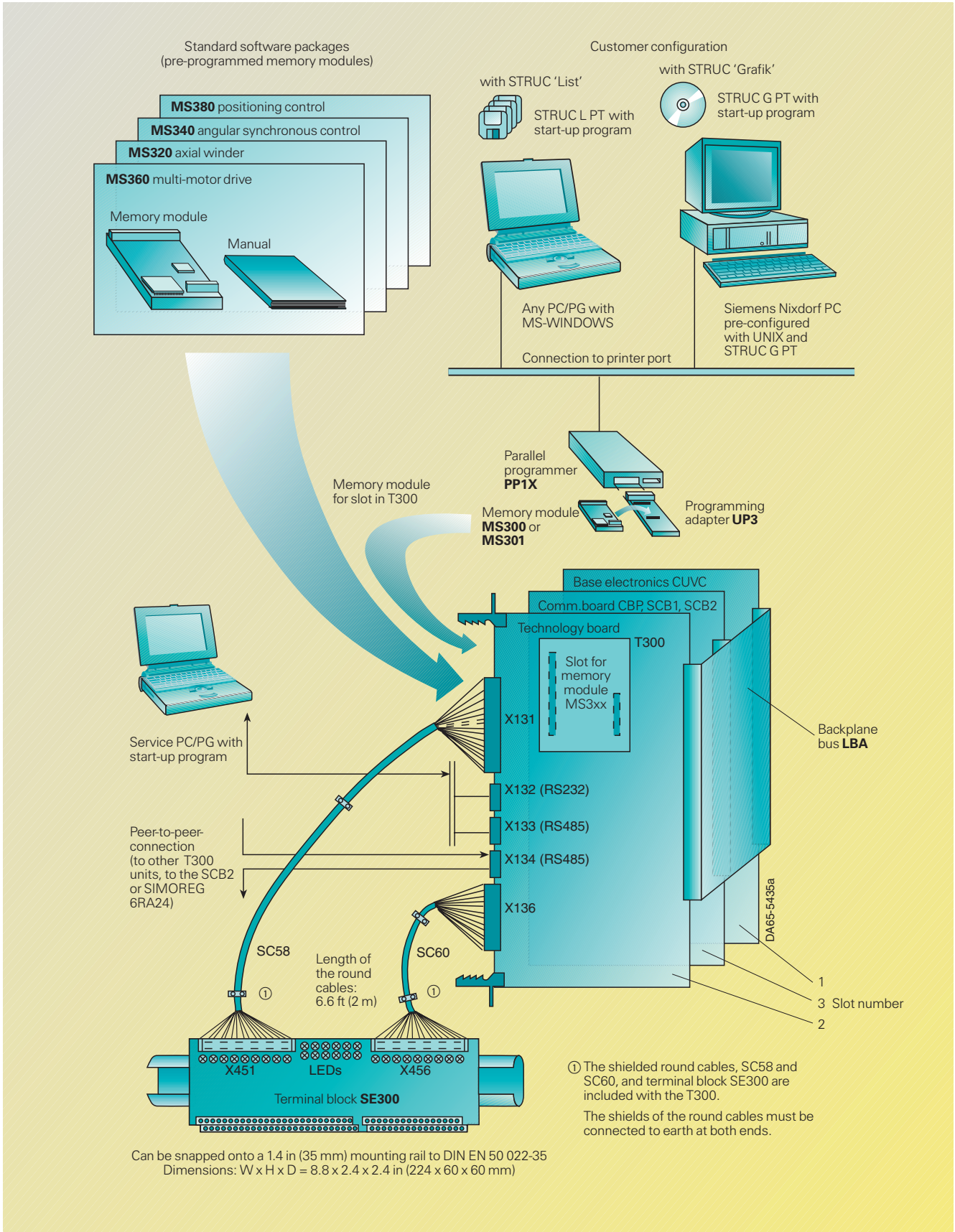


Fig. 6/78
Hardware and software components of the T300 technology board

Technology applications with the T300 (continued)

Terminals of the T300 technology board

7 analog inputs	Differential inputs, non-floating, ±10 V, 11 bits + sign
4 analog outputs	Non-floating, ±10 V, 11 bits + sign
16 binary inputs	Non-floating, 24 V, signal status display via LEDs on the terminal block
8 binary outputs	Non-floating, 24 V, signal status display via LEDs on the terminal block, max. 100 mA. When used: 40 mA base load at terminal 639.
Detection of speed, position and position difference	Inputs for 2 incremental encoders, non-floating, HTL signal level (15 V to 24 V, rated voltage 15 V), max. frequency < 400 Hz, 4 mA input current per channel, signal status display of the incremental encoder inputs via LEDs on the terminal block. 15 V / 100 mA are available at terminal X5.540 for supplying the incremental encoders. This can be taken from the basic unit, in addition to the 15 V / 150 mA of terminal X103.40.
1st serial interface	Can be toggled between RS232/ RS485, preferably used for service and start-up with the help of the STRUC start-up program, Service Start-up
2nd serial interface	RS485 for peer-to-peer connection (setpoint cascade) or USS protocol Max. adjustable baud rate: 115.2 Kbit/s

Standard configurations

are available on a memory module for frequently required applications.
The standard configuration is ready for use if the memory module has been built into the T300. The standard configuration can be adapted to the system requirements by means of parameterization.

Note:
The STRUC L PT or STRUC G PT configuring language is not needed for standard configurations.

Components and features of the standard configuration:

- Peer-to-peer communication (digital setpoint cascade).
- The T300 with standard configuration can be used with or without a communication board (CBx, SCB1 or SCB2).
  The communication board, however, enables:
  - stipulation of the control commands and setpoints for the T300 via a bus system (e.g. PROFIBUS DP) or a point-to-point connection,
  - reading and writing of actual values and status words as well as technology parameters.
- Inputs and outputs as well as process data can be entered in a DPRAM which enables access to be made to all the important data of the SIMOVERT MASTERDRIVES. This makes configuring extremely flexible.
- Important operating data are stored in a non-volatile manner.
- All parameters can be reset to their original loading status.
- Manual with configuring information and start-up instructions.
- Parameter upreading and downloading with DriveMonitor.

Notes on DriveMonitor can be found in Section 2.

Available standard configurations for:

- multi-motor drives
- axial winders
- angular synchronous control
- position control.

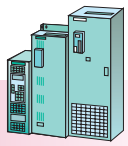
Standard configuration for multi-motor drives with the T300 (MS360)

Applications:

- Higher-level tension or position control for multi-motor drives, which can include foil production systems, paper machines, paper finishing machines and wire drawing machines.
- Load equalization control for tension groups or motors which are mechanically coupled or are coupled via the material web.
- Higher-level control for single-motor drives as a function of pressure, flow etc., e.g. for pumps and extruders.

Features:

- Ramp-function generator for rpm / speed, for local and plant operation.
- Setting of speed ratios or stretch ratios.
- Higher-level PID controller (technology controller) and adaptive P-gain as a function of the control deviations.
- Adaptation of the speed controller's P-gain as a function of the deviation from the set speed or other selectable sources.
- Flexible setting of several internal setpoints, such as inching, crawl and take-up/slack-off.
- Setting to web speed by means of a ramp-up generator.
- Smooth shutdown of the drive, without overshoot, by means of the braking characteristic.
- Drive-related control with evaluation of alarms and faults.
- Load equalization by means of the droop and compensation or torque limits.
- Brake control.
- Two freely-usable motorized potentiometers.
- Stipulation of setpoints (speed setpoint) also possible by means of incremental encoder, for example when a speed setpoint is not available via a terminal or an interface.
- Free components for arithmetic and logic.



Technology applications with the T300 (continued)

Standard configuration for axial winders with the T300 (MS320)

Applications:

- Foil production systems,
- Paper machines,
- Paper finishing systems,
- Coating systems,
- Textile machines,
- All types of printing machine (foil, paper),
- Wire drawing machines,
- Coilers in metal working (e.g. aligning machines, strip handling systems etc.).

Features:

- Suitable for winders and unwinders, with and without flying roll change.
- Direct and indirect closed-loop tension control.
- Dancer roll and tension measuring transducers can be connected.
- Diameter calculation with "Set diameter" and "Hold"; the diameter value can be stored in the event of a power failure.
- Adaptation of tension and speed controller as a function of the diameter.
- Winding hardness control by means of a parameterizable polygon characteristic as a function of the diameter.
- Friction compensation by means of a polygon characteristic, speed-dependent.
- Inertia compensation, as a function of the diameter, web width and gearbox stage.
- Ramp-function generator for ramping-up during flying roll change with subsequent shutdown.
- Incremental encoder for measuring web speed can be connected.
- Measurement of the initial diameter by means of a pulse encoder possible.
- Tension controller can either act on the speed controller or, directly, on the closed-loop torque control system.
- Constant v-control possible.
- Winder-related control with evaluation of alarms and faults.
- Inching and crawl operation.
- Two freely usable motorized potentiometers.
- Smooth drive shutdown, without overshoot, by means of a braking characteristic.

Standard configuration for closed-loop angular control with the T300 (MS340)

Applications:

- Replacing mechanical and electrical shafts; for example, on gantry traversing units, loading and discharge equipment for furnaces and looms.
- Replacing gearboxes with a fixed or changeable ratio; e.g. changeover gearboxes for transition points on conveyor belts or at the transition from one machine section to another, such as on packing machines and book-binding machines.
- Accurate angular synchronism; used also when two machine components mesh, e.g. when napping and carding (dress) fabric. It can also be used for printing or folding bags, round materials etc.

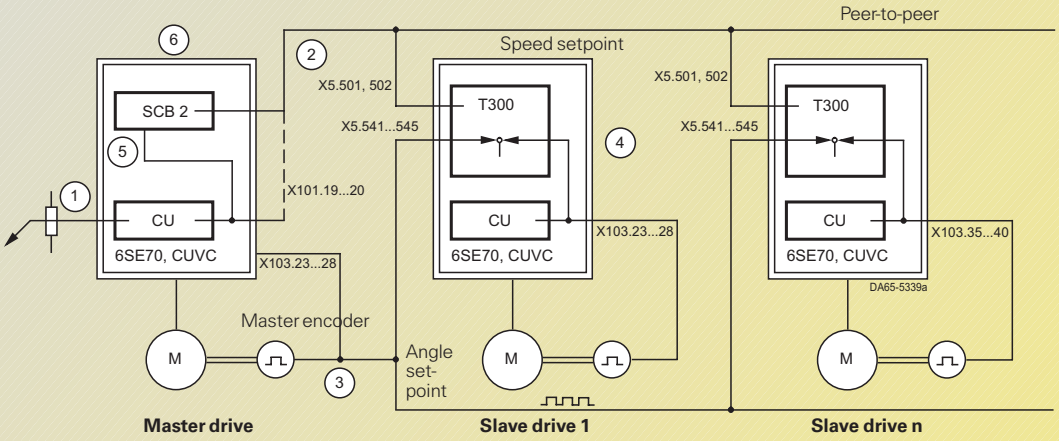
Features:

- Transmission ratio of master drive to slave drive; can be dynamically stipulated as a process data from +16.380 to –16.380 (smallest step range: 0.005) or as a setting parameter, whereby nominator and denominator are resolved separately, each with 15 bits + sign.
- Offset angular settings between drives, as a function of coarse-pulse and fine-pulse marks for detecting the angular position (synchronizing).
- Synchronizing signals can be generated by proximity switches (e.g. BEROs) or by pulse encoders (zero pulse).
- Offset angle can be set dynamically by means of the setpoint from –32768 to +32767 pulse edges.
- Different offset angles can be stipulated for both directions of rotation (automatic changeover for a changed direction of rotation). This is required during synchronizing if the switching positions of the fine-pulse mark for clockwise and counterclockwise rotation of the drive (or the machine component which has to be synchronized to) are different and must be compensated. An additional example is a crane track with surface-mounted fine-pulse marks.
- Reverse inhibit.
- Protection against overspeed and stalling.
- Inching.
- Adaptation of the position controller to match the transmission ratio.
- Setpoint specification (speed setpoint) also possible via incremental encoder; for example when there is no speed setpoint via a terminal or interface.
  - A maximum of 10 slave drives can be connected when
  - pulse encoder cable < 328 ft (100 m)
  - n < 3000 rpm
  - encoder pulse number < 1024 pulses per rotation and output current of encoder ≥ 100 mA.

Note

For further explanations regarding angular synchronous control, see Fig. 6/79.

Technology applications with the T300 (continued)



① The whole speed setpoint, in this example, is stipulated as an analog signal by a potentiometer or a PLC.

② The speed setpoint is passed on to the slave drives via a serial peer-to-peer link. An SCB2 board is needed for the master drive (see Point 5). The peer-to-peer cable can be directly connected to the T300 at the slave drives.
If only medium requirements are placed on the control qualities, the speed setpoint can be passed on by means of analog signals instead of with the peer-to-peer method (output at master drive, e.g. via terminals X101.19 and .20).
It is not necessary to pass on the speed setpoint if the accelerating torque is negligibly small, e.g. due to long ramp-up or ramp-down.

③ A maximum of 10 slave drives can be connected without pulse amplifier if the 1PX8001 incremental encoder with 1024 pulses per rotation is used and the maximum speed is < 3000 rpm. The master encoder is connected both to the master drive and to the T300 boards of the slave drives. An incremental encoder which is located at a preceding part of the machine and is driven there by a shaft can also be used as the master encoder.

④ The incremental encoders of the slave drives are usually connected only to the CUVC. Setpoints are then passed on to the T300 internally via the LBA backplane bus. A built-on encoder can also be directly connected to the T300 (T300 terminals X5.531 to 535) if the motor encoder cannot be used for process-engineering reasons.

⑤ Transfer of speed setpoint with the peer-to-peer method: The setpoints are transferred in a way similar to that described in Point 2. The master drive must be fitted with an SCB2 board; the T300 is equipped as standard with the peer-to-peer function (terminals X134.13 and 14). The peer-to-peer connection (fast setpoint stipulation and transfer) can also be combined with the PROFIBUS DP (for stipulating machine speed, gear ratios, control commands etc.).

⑥ A T300 is not needed for the master drive.

Fig. 6/79
Schematic illustration of angular synchronous control

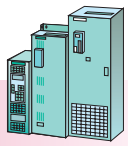
Standard configuration for closed-loop position control with the T300 (MS380)

Applications:

- For closed-loop position control systems with high demands regarding precise motion; for example, in high-bay racking systems, transfer devices, loading and unloading equipment, as well as machining centers, charging and discharging equipment for furnaces, crane gantries, processing machines etc.
- Can be used for cycle times of > 100 ms.

Features:

- Can be used for linear axes and rotary axes as well as for simple roll feeding or infinitely rotating rotary axes.
- Exact positioning without overshoot by pre-controlling of speed.
- 6 data sets for controller optimization, compensation of play, speed and reverse time, maximum speed, can be changed over by means of binary signals or control word.
- 100 position setpoints can be stored and called by means of binary signals or control word.
- Automatic reference-point approaching, taking into account possible system play.
- Absolute positioning possible, in relation to the reference point and relative to the instantaneous position.
- Inching, speed and position controlled.
- Rapid stipulation of important setpoints as process data (e.g. position setpoint, max. speed) via serial interface.
- For positioning purposes, the incremental encoder mounted on the motor as well as an incremental encoder mounted directly on the component to be positioned can be used.
- Multiturn absolute encoder with incremental serial interface (ISI) can be connected (e.g. type CE-65-151 manufactured by
T+R-Electronic,
D-78647 Trassingen,
Germany
Tel.: ++49 74 25/2 28-0).



Technology applications with the T300 (continued)

Configurations created on the T300 by the user

Configuring with STRUC:

Technology functions can be easily created with the function-block oriented STRUC configuring language. It has more than 250 function blocks for open and closed-loop control and arithmetic operations (e.g. PI controllers, ramp-function generators, multipliers and logic gates).

An easy-to-use start-up program which runs on a PG or PC supports start-up and service.

Configuring tools

STRUC L PT, version 4.2.5 and higher

is used to configure the T300 in a list form (see Fig. 6/78).

It is supplied on a 3½" set of floppy disks, either with German or English menu texts as required.

The scope of supply includes the Service start-up program which allows any 10 values in a software package to be simultaneously visualized and any input values to be changed at the function blocks. Most of the connections between the function blocks can be changed and displayed.

System platform requirements for STRUC L PT:

- AT-compatible PC, min. 386 CPU, 4 Mbyte RAM
- parallel printer interface
- $3^1/_2$" floppy disk drive, 8 Mbyte permanent WINDOWS virtual memory must be set-up on the hard disk
- 8 Mbyte memory on the hard disk for STRUC L PT
- 4 Mbyte memory on the hard disk for application software (experienced value)
- MS-DOS, version 5.0 and higher
- MS-WINDOWS, version 3.1 and higher or WINDOWS 95.

STRUC G PT, version 4.2.5 and higher

graphically configures the T300 (see Fig. 6/78). It is supplied on CD-ROM, either with German or English menu texts as required.

We recommend ordering a SIEMENS-NIXDORF STRUC configuring PC with installed UNIX operating system SCO-UNIX and a runtime version of STRUC PT (see minimum SNI-PC requirements). STRUC requires approximately 250 Mbyte on the hard disk, including the reserve for STRUC G application software. The PC, preconfigured with STRUC G PT, has, in addition to the UNIX partition, a DOS partition in which all of the DOS and Windows applications are run.

The scope of supply includes the Service start-up program which allows any 10 values (max.) in a software package to be simultaneously visualized and any input values to be changed at the function blocks. Most of the connections between the function blocks can be changed and displayed.

Minimum SNI-PC requirements

- the hardware must comply with the SCO hardware compatibility manual
- floppy disk drive $3^1/_2$", 3-button mouse
- German or English keyboard
- 16 Mbyte working memory
- graphics card compatible to SCO V 5.0, 1280 · 1024 pixels
- 520 Mbyte hard disk, CD-ROM drive
- color monitor, 43 cm (17").

MS300 or MS301 memory module

is empty and is plugged onto the T300, is programmed with a user application software created by the user.

The MS300 or MS301 are not needed for standard software packages.

They differ from each other only with regard to the size of the EEPROM which is used for storing parameters in the case of standard software packages.

MS300: EEPROM 2 Kbytes, allows storage of 250 altered parameters (experienced value).

MS301: EEPROM 8 Kbytes, allows storage of 1000 altered parameters (experienced value).

External, parallel PP1X programming unit for PG7x0 or PC

is connected to the printer interface of a PG or PC. The MS300 or MS301 memory module can be programmed with the PP1X. For PG and PC hardware requirements, see STRUC L PT.

The scope of supply includes the UP3 programming adapter which is needed for programming the MS300 or MS301.

For selection and ordering data of the T300 technology board and its components, see Section 3.

T400 Technology board

The T400 is used to implement supplementary process-specific functions (e.g. for tension and position controls, winders, reels, synchro 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.

Users who wish to implement specialist applications or market their own technological know-how can create their own process solution on the T400 using the CFC configuring language, a feature of SIMATIC STEP 7.

Process-specific functions are configured with the CFC and then executed cyclically by the processor. 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 the T400. All signals can be directly connected to terminals on the T400. A 15 V/100 mA pulse power supply is available.

An external DC 24 V 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 operator control and parameterization panel,
- the OP1S user-friendly operator control panel,
- a PC with DriveMonitor on the basic unit[1]),
- 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.

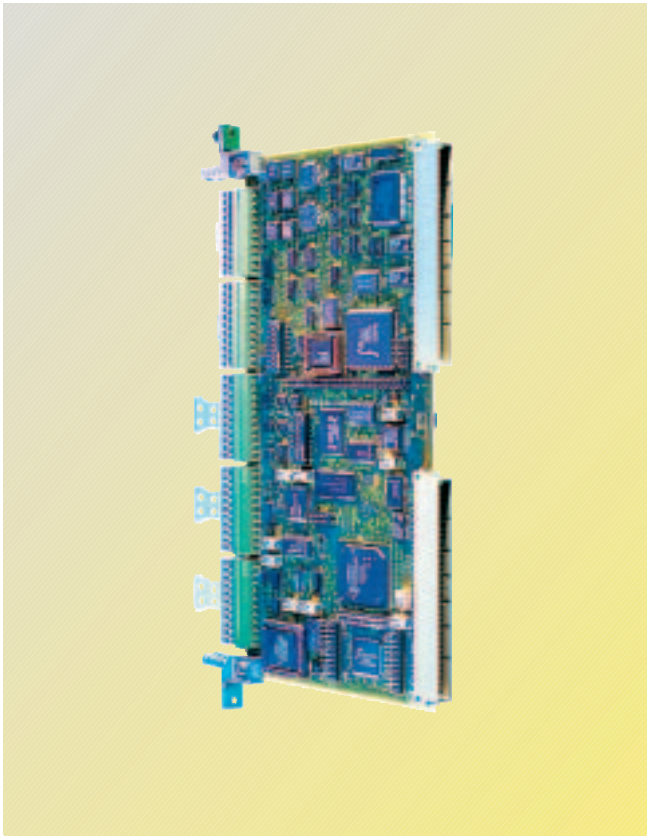
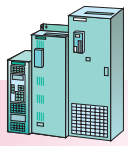


Fig. 6/80
T400 technology board

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.



T400 Technology board (continued)

Features

The T400 has the following features:

- Two analog outputs
- Five analog inputs
- Two binary outputs
- Eight binary inputs, four of which can be used to call alarm tasks
- Four bidirectional binary inputs or outputs
- Two incremental encoder inputs with zero pulse
  - Encoder 1 for HTL (15 V) encoder
  - Encoder 2 for HTL (15 V) or TTL/RS422 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 RS232 and RS485 transmission format: Protocol can be selected via switch on board:
  - Service protocol DUST1 for start-up (CFC test mode, "Service IBS," TELEMASTER) and program download with 19.2 kbaud and RS232 transmission format
  - USS protocol, 2-wire, with selectable RS232 or RS485 transmission format; max. 38.4 KB; configurable as slave for parameterization with OP1S or DriveMonitor or as master for OP2 operator panel connection
- Serial interface 2 with RS485 transmission format and protocol that is selectable through configuring of appropriate function block:
  - Peer-to-peer, for high-speed process link, 4-wire
  - USS protocol, configurable as slave for parameterization with OP1S or DriveMonitor (2- or 4-wire) or as master for OP2 operator panel connection (2-wire)
    Baud rates [kbd]: 9.6/19.2/38.4/93.75/187.5

    Note:
    If serial interface 2 (peer, USS) is used, the 2nd absolute encoder cannot be operated since both applications utilize the same terminals.
- Absolute encoder 1 with SSI or EnDat protocol (RS485) for positioning applications;
- Absolute encoder 2 with SSI or EnDat protocol (RS485) for positioning applications;

  Note:
  If serial interface 2 (peer, USS) is used, the 2nd absolute encoder cannot be operated 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 fan
- 3 LEDs for operational status displays
- Hardlock PAL: Receptacle 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 codes (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

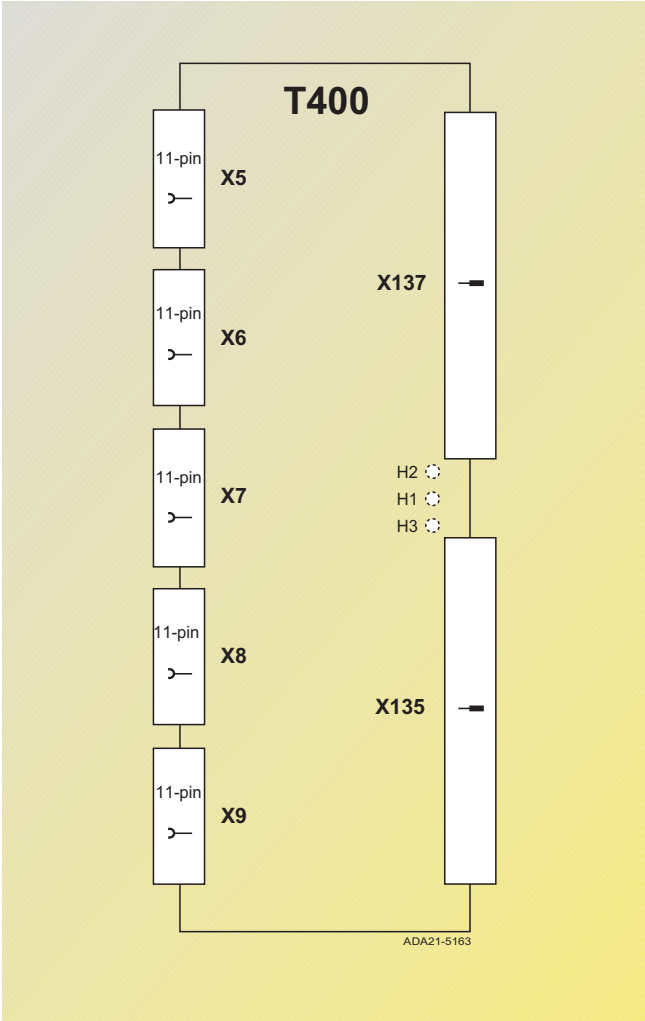
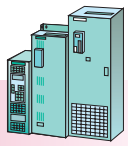


Fig. 6/81
T400 technology board

T400 Technology board (continued)

Type	Features	
General	Isolation of inputs/outputs	No
	Space required	1 slot
	Dimensions (W x H x D) in inches (mm)	10.5 x 5.5 x 0.6 (267 x 140 x 14)
	Weight	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	2
	Output range	±10 V
	Short-circuit protection	Yes
	Short-circuit current	±10 mA
	Resolution	12 bits (4.88 mV)
	Accuracy, absolute	±3 bits
	Linearity error	<1 bit
	Voltage rise time	4.2 V/μs
	Delay time	3.5 μs
Analog inputs	Number	2 differential inputs, 3 unipolar
	Input range	±10 V
	Measuring principle	Sampling
	Conversion time	12 μs
	Input impedance	20 kΩ
	Input filter (–3 dB limit frequency)	1.5 kHz
	Resolution	12 bit (4.88 mV)
	Accuracy, absolute	±3 bit
	Linearity error	< 1 bit
Binary outputs	Number	2 + max. 4 (bidirect.)
	Ext. supply voltage:	
	• Rated value	DC 24 V
	• Permissible range	DC 15 to 33 V
	• for "0" signal	max. 0.1 V
	• for "1" signal	Ext. supply voltage –0.3 V
	Output current	Max. 50 mA/output
	Output current, ext.	50 mA + output currents
	Supply voltage	
	Switching frequency/ohmic load	5 kHz
	Overload protection	Yes (limited to 100 mA)
	Max. switching delay	70 μs
Binary inputs and coarse signals	Number	8 + max. 4 (bidirect.) + max. 2 (coarse pulses)
	Input voltage:	DC 24 V
	• Rated value	–1 to +6 V or input open
	• for "0" signal	+13 to +33 V
	• for "1" signal	
Input current	Input current:	
	• for "0" signal	–
	• for "1" signal	8 mA typ.
	Input smoothing (time constant)	0.1 ms
5 V, 15 V incremental encoder	Number	2
	Signal voltage (rated value):	
	• "Encoder 1"	15 V (HTL only) unipolar
	• "Encoder 2"	5 V or 15 V unipolar or differential
	Max. pulse frequency	1.5 MHz
	Input filter	Configurable on function block (NAV)
5 V incremental encoder	Signal voltage for differential inputs (RS422 encoder):	
	• for "0" signal	< –0.2 V
	• for "1" signal	> 0.2 V
	Signal voltage for unipolar inputs (TTL encoder):	
	• for "0" signal	< 0.8 V
	• for "1" signal	> 2.3 V
	Input current	15 mA (limited)
15 V incremental encoder	Signal voltage for differential inputs	
	• for "0" signal	–30 V to 4 V
	• for "1" signal	8 V to 30 V
	Signal voltage for unipolar inputs	
	• for "0" signal	< 5 V
	• for "1" signal	> 8 V
	Input current	15 mA (limited)
Absolute encoder	Number of connectable encoders	max. 2 Single-turn or multi-turn encoder With SSI (synchronous-serial) or EnDat interface
	Signal voltage	5 V acc. to RS422
	Data transfer rate	100 kHz to 2 MHz
	Data display	Dual, Gray, Gray Excess Code



T400 Technology board (continued)

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. CBP2)

  A communication board can be used to
  1. specify T400 control commands and setpoints 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 DPRAM to provide access to all important MASTERDRIVES 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 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 compensation 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 application:

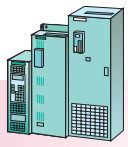
- Substitute for mechanical and electrical shafts, e.g. on gantry traversing mechanisms, feed and discharge machines on furnaces or looms
- Substitute for gear units with fixed or variable gear ratio, e.g. change-gear units, installed at transition points on conveyor belts or at transition point between one machine section and the next, such as on packaging machines, 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. BEROs™) 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 drive (or machine part acting as 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 speed setpoint is not available via terminal or interface
- A maximum of ten slave drives can be connected if pulse encoder cable length < 328 ft (100 m), n < 3000 rev/min

T400 Technology board (continued)

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+ (with RS422)		7	62
Increm. encoder 2:	Track B (HTL)	Increm. encoder 2: Track B+ (with RS422)		8	63
Increm. encoder 2:	Zero pulse (HTL)	Increm. encoder 2: Zero pulse+ (with RS422)		9	64
Increm. encoder 2:	Coarse pulse			10	65
Ground for increm. encoder 2				11	66
Ser. interface 1:	Rx-RS232		X7	1	67
Ser. interface 1:	Tx-RS232			2	68
Ground for ser. interface				3	69
Ser. interface 1:	Tx/Rx-RS485+			4	70
Ser. interface 1:	Tx/Rx-RS485–			5	71
Ser. interface 2:	Rx/RS485+	Absolute encoder 2: Data+		6	72
Ser. interface 2:	Rx/RS485–	Absolute encoder 2: Data–		7	73
Ser. interface 2:	Tx/Rx-RS485+	Absolute endoder 2: Clock+		8	74
Ser. interface 2:	Tx/Rx-RS485+	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 RS422)			9	86
Increm. encoder 2:	Track B– (with RS422)			10	87
Increm. encoder 2:	Zero pulse– (with RS422)			11	88
Ground for analog inputs/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/outputs				11	99



SCB1 interface board [1]

The SCB1 interface board (*S*erial *C*ommunication *B*oard 1) has a fiber-optic cable connection and enables the creation of a:

- peer-to-peer connection between several units with a max. data transfer rate of 38.4 Kbits/s.
- serial I/O system (see Fig. 6/82) in conjunction with the SCI1 and SCI2 serial interface boards (see page 6/88).

The following is thus made possible:

1. Expansion of the binary and analog inputs and outputs of the base units
2. Customized assignment of the terminals for the inputs and outputs (e.g. NAMUR).

The following board combinations are possible:

SCB1 with one SCI1 or SCI2

SCB1 with two SCI1 or SCI2

SCB1 with one SCI1 and one SCI2.

The interface board is built into the electronics box (description see page 6/54).

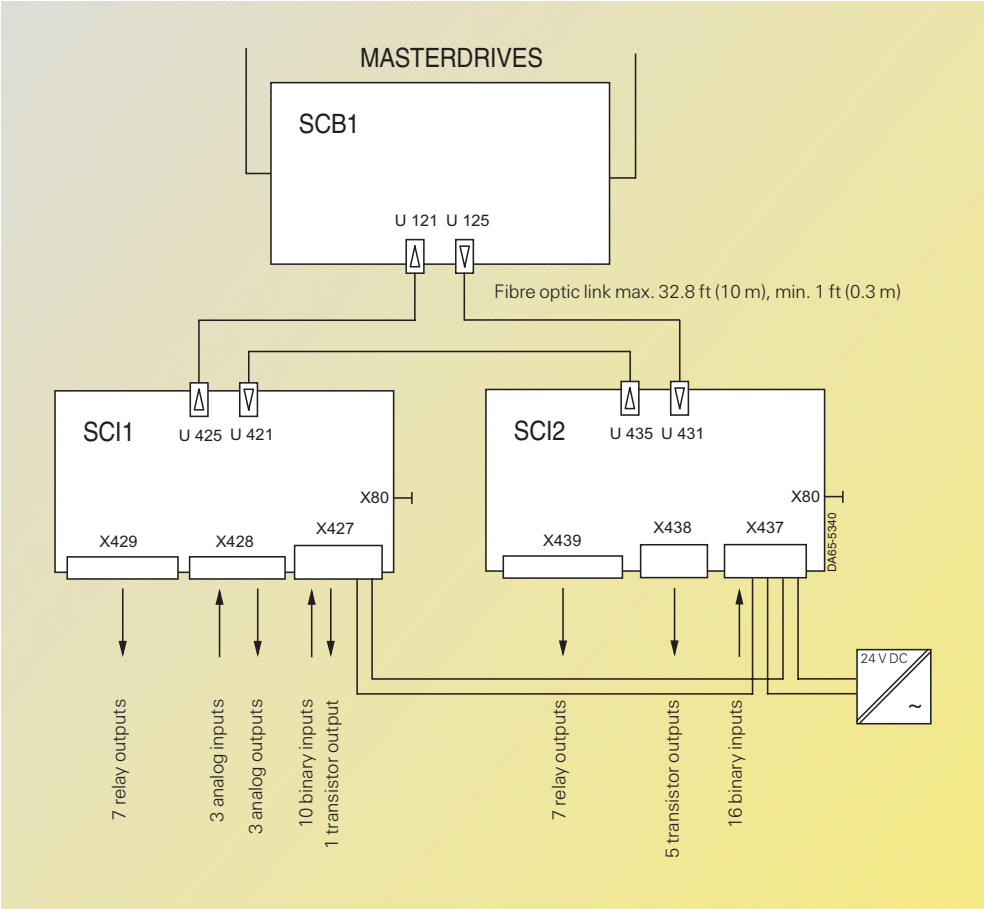


Fig. 6/82
Example of connecting a serial I/O system with SCB1, SCI1 and SCI2

SCB2 interface board [1]

The SCB2 interface board (*S*erial *C*ommunication *B*oard 2) has a floating RS485 interface and enables the following alternatives:

- Peer-to-peer connection between several converters via the RS485 interface (see Fig. 6/83).
- Bus connection with a maximum of 31 slaves connected to a master (e.g. SIMATIC) via the RS485 interface, using the USS protocol (see Fig. 6/85). The maximum data transfer rate is 187.5 Kbits/s.

Note

The SCB2 interface board always operates as a slave.

The SCB2 interface board is inserted at slot 2 or 3 of the electronics box (description see page 6/54).

1) Not for Compact PLUS units.

SCB2 interface board

Peer-to-peer connection

The serial peer-to-peer connection operates via a 4-wire connection (see Fig. 6/83).

A peer-to-peer connection can also be created in parallel with the SCB2, i.e. the corresponding slave drives are controlled by the master drive via a parallel cable (see Fig. 6/84).

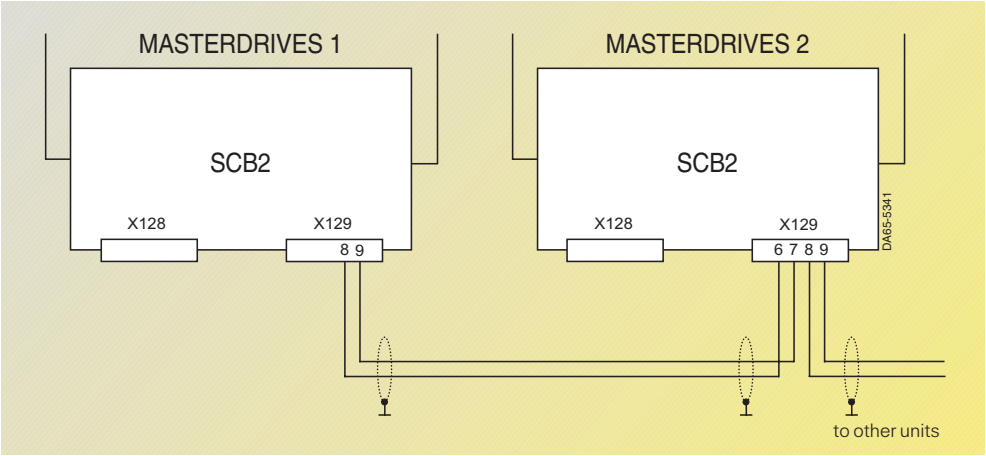


Fig. 6/83
Example of a serial peer-to-peer connection via RS485

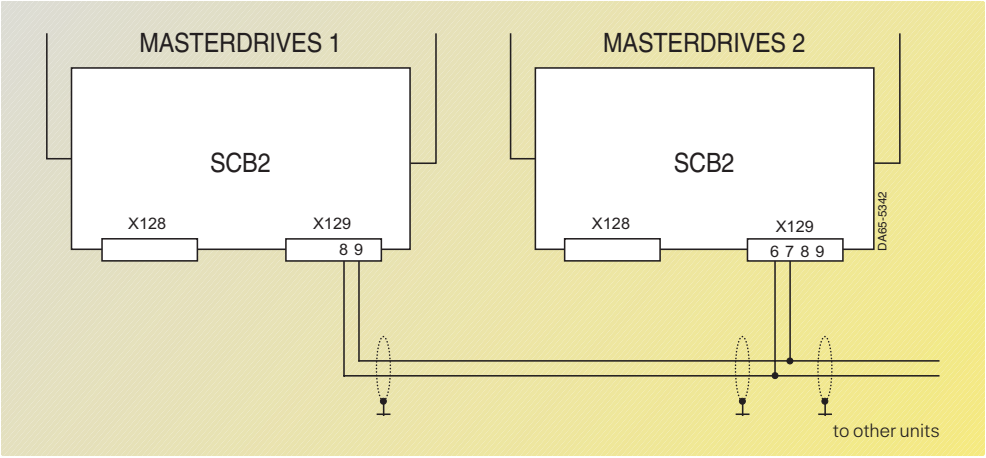


Fig. 6/84
Example of a parallel peer-to-peer connection via RS485

Bus connection with USS protocol

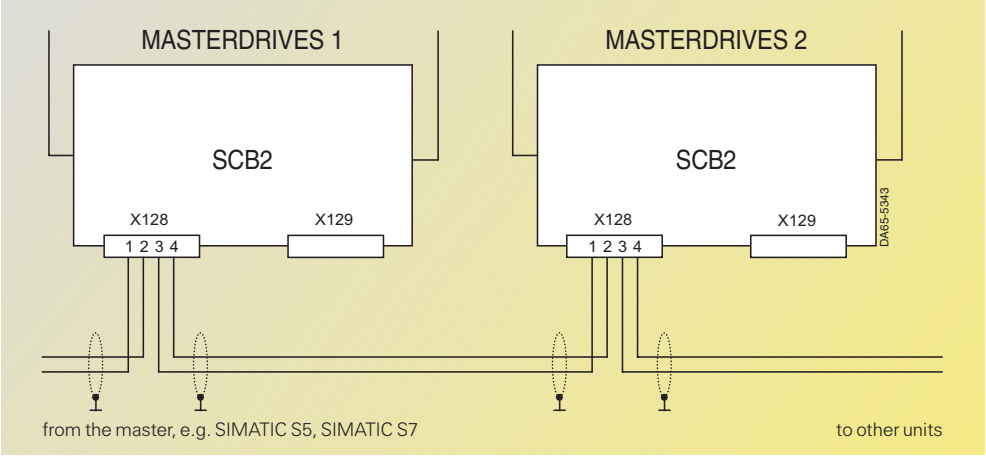
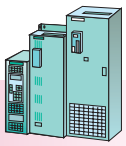


Fig. 6/85
Example of a bus connection with USS protocol via RS485



SCI1 and SCI2 interface boards [1]

A serial I/O system using fiber-optic cables can be established with the SCI1 and SCI2 (*S*erial *C*ommunication /nterface 1 or 2) interface boards and the SCB1 interface board. This allows the number of binary and analog inputs and outputs to be considerably expanded. In addition, the fiber-optic cables safely decouple the units in accordance with DIN VDE 0100 and DIN VDE 0160 (PELV function, e.g. for NAMUR).

The fiber-optic cables, which can be a maximum of 32.8 ft (10 m) long and a minimum of 1 ft (0.3 m), connect the boards in a ring structure. Both the SCI1 and the SCI2 require an external 24 V power supply (each 1 A).

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

The SCI1 and SCI2 interface boards can be snapped onto a DIN rail at a suitable place in the control cabinet.

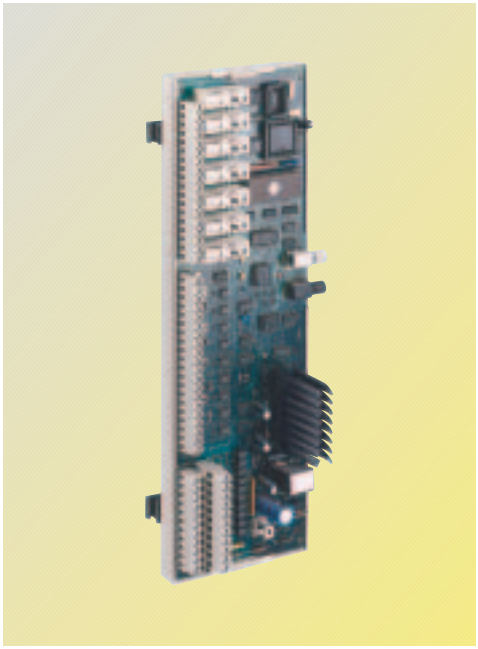


Fig. 6/86
SCI1 interface board

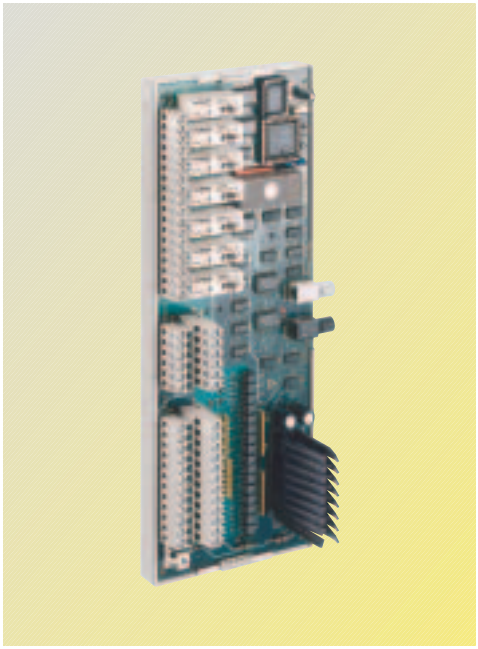


Fig. 6/87
SCI2 interface board

Inputs and outputs Functions	SCI1	SCI2	Description
Binary inputs	10	16	Floating optocoupler inputs in 2 circuits 24 V DC, 10 mA
Binary outputs including: Relay changeover contacts Relay make contacts Transistor outputs	8 4 3 1	12 4 3 5	 Load capability: 250 V AC, 2000 VA (cos φ = 1) 100 V DC, 240 W 24 V DC, max. 100 mA, short-circuit-proof, open-emitter for driving the optocouplers or relay
Analog inputs	3	–	Voltage signals: 0 V to ±10 V Current signals: 0 mA to ±20 mA; 4 mA to 20 mA; 250 Ω load Non-floating inputs
Analog outputs	3	–	Output signals: 0 V to ±10 V, 0 mA to ±20 mA, 4 mA to 20 mA, non-floating max. cable length with shielded cable is 328 ft (100 m), max. load 500 Ω
Supply voltage: Reference voltage +10 V – 10 V 24 V DC	 1 1 2	 2	 5 mA load capability, short-circuit-proof 5 mA load capability, short-circuit-proof Short-circuit-proof output for binary inputs or outputs, load capability 280 mA

Technical Data	
Mounting	DIN mounting rail (see Section 3)
External rated input voltage	24 V DC (–17 %, +25 %), 1 A
Degree of protection	IP00
Dimensions H x W x D	SCI1: 3.7 in x 11.8 in x 3.1 in (95 mm x 300 mm x 80 mm) SCI2: 3.7 in x 9.8 in x 3.1 in (95 mm x 250 mm x 80 mm)

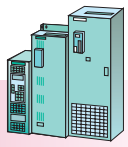
1) Not for Compact PLUS units.

SCI1 and SCI2 interface boards (continued)

Control terminal strip on the SCI1 interface board for cabinet units with PMU or OP1S and the option "NAMUR terminal strip"

Terminal	No.	Type	Preassignment	Notes
X427	A1	P24		
	A2	M		
	A3	BE6	Setpoint lower	
	A4	BE7	Acknowledge	
	A5	BE8	Off 2	
	A6	BE9	Select counter-clockwise rotating field	
	A7	BE10	None	
	A8	M		
	A9	M		
	A10	M		
	A11	M		
X427	B1	P24		
	B2	BA8	None	Transistor output
	B3	BE1	On/Off 1	
	B4	BE2	Select BICO data set 2	Local/remote operation
	B5	BE3	None	
	B6	BE4	None	
	B7	BE5	Setpoint higher	
	B8	M		
	B9	P24		
	B10	P24		
	B11	P24		
X428	1	+10 V stab		
	2	–10 V stab		
	3	AE1 ±10 V	Main setpoint	Analog input 1
	4	M		
	5	AE1 ±20 mA		Shunt resistor 250 Ω
	6	AE2 ±10 V	None	Analog input 2
	7	M		
	8	AE2 ±20 mA		Shunt resistor 250 Ω
	9	AE3 ±10 V	None	Analog input 3
	10	M		
	11	AE3 ±20 mA		Shunt resistor 250 Ω
	12	AA1 ±10 V	Speed	Analog output 1
	13	M		
	14	AA1 0-20 mA		Shunt resistor max. 500 Ω
	15	AA2 ±10 V	Output current	Analog output 2
	16	M		
	17	AA2 0-20 mA		Shunt resistor max. 500 Ω
	18	AA3 ±10 V	Torque	Analog output 3
	19	M		
	20	AA3 0-20 mA		Shunt resistor max. 500 Ω
X429	1	BA1	Ready for power-on	Relay contact
	2			
	3	BA2	Setpoint reached	Relay contact
	4			
	5	BA3	Off 2 signal	Relay contact
	6			
	7	BA4	Fault	Changeover contact: common
	8			break contact
	9			make contact
	10	BA5	None	Changeover contact: common
	11			break contact
	12			make contact
	13	BA6	None	Changeover contact: common
	14			break contact
	15			make contact
	16	BA7	None	Changeover contact: common
	17			break contact
	18			make contact

Relay contacts, maximum loading 100 V DC, 2.4 A or 250 V AC, 8 A



TSY synchronizing board [1]

The TSY (*T*achometer *S*ynchronizing *B*oard) synchronizing board can be used to synchronize two converters or inverters to a common load (e.g. running up for operation with main converters).

Preconditions:

1. Both converters have a TSY synchronizing board.
2. Both converters operate in the *V/f* characteristic mode for textile applications.
3. The *V/f* characteristics, the setpoint and the rotating field of both converters are identical.

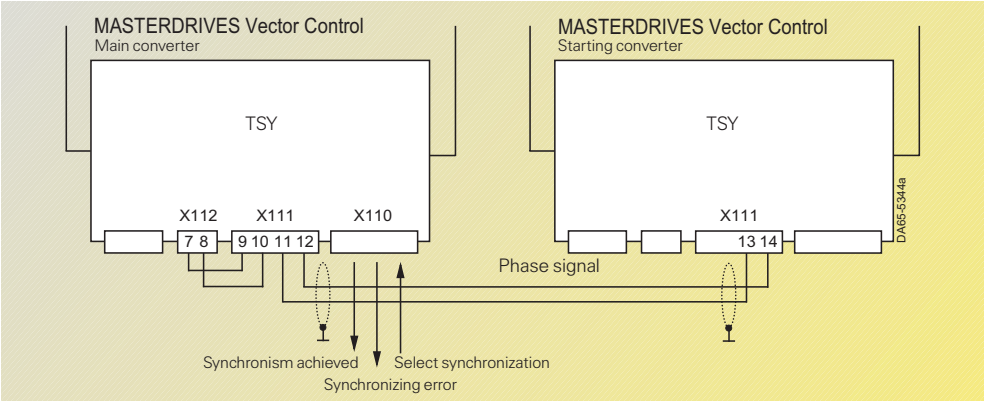


Fig. 6/88
Example of connecting the synchronizing board between the starting converter and the main converter

Synchronization can be activated by means of a command, e.g. from a binary input. After synchronization, the "synchronism achieved" signal is output, e.g. via a binary output. The TSY synchronizing board has two floating binary outputs and one binary input for inputting and outputting binary signals.

1) Not for Compact PLUS units.

DTI digital tachometer interface [1)]

Digital tachometers with different voltage levels can be connected at the DTI board. The inputs are floating.

The board allows the following signals to be connected:

- HTL encoders with differential outputs (Fig. 6/90)
- floating HTL encoders (Fig. 6/91)
- TTL encoders at X401 (Fig. 6/93)
- encoder cables > 492 ft (150 m)
- TTL output at X405 (Fig. 6/92)
- level converter, HTL to TTL

The DTI interface can be connected to:

- the CUVC board
- the T300 board and SE300 terminal block.

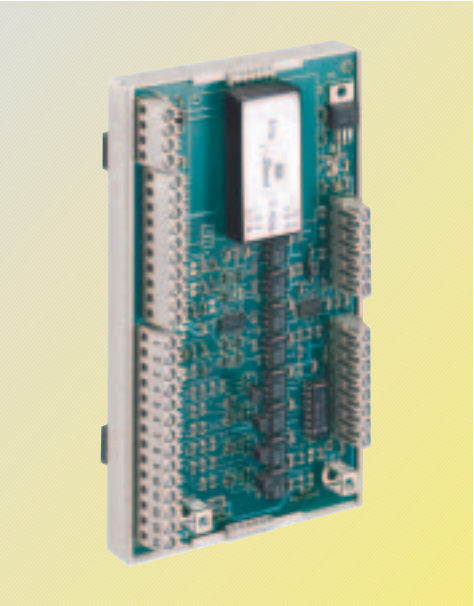


Fig. 6/89
DTI digital tachometer interface

Technical data of the DTI digital tachometer interface

Mounting	DIN mounting rail
External supply voltage necessary	24 V DC 300 mA for HTL encoder 150 mA for TTL encoder
Load capability	15-V-encoder 300 mA 5-V-encoder 400 mA
Input current	12 mA for HTL encoder 42 mA for TTL encoder
Output driver current	15 mA for HTL encoder 20 mA for TTL encoder
Limiting frequency f_{max}	400 kHz
Degree of protection	IP00
Dimension H x W x D	3.8 in x 6.3 in x 1.8 in (96 mm x 160 mm x 46 mm)

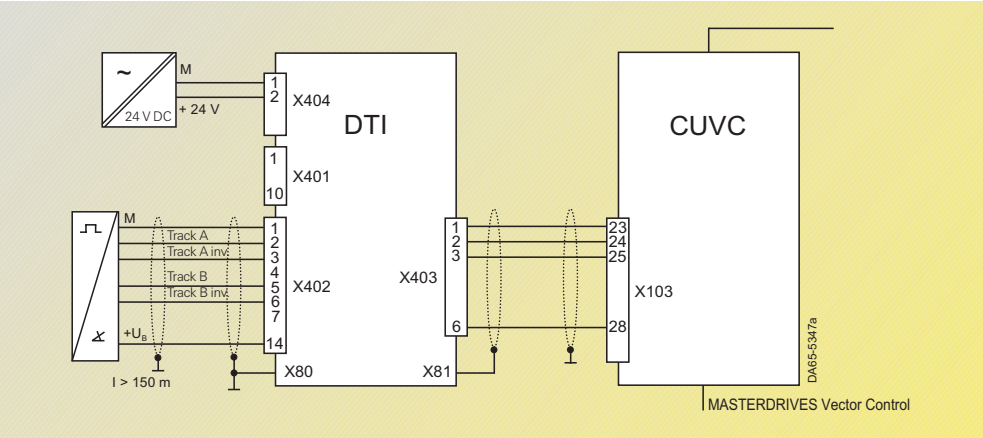


Fig. 6/90
Example of connecting a HTL encoder with differential outputs (e.g. 1XP8001–1) and 15 V encoder voltage

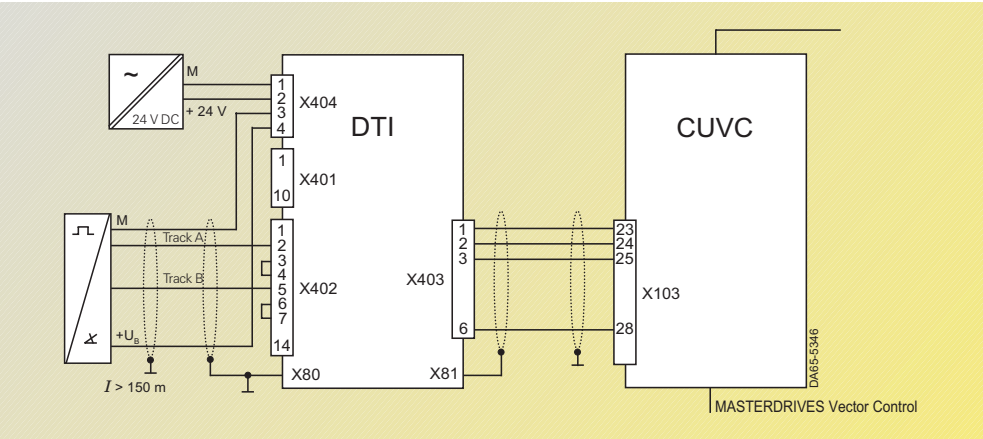
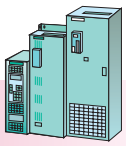


Fig. 6/91
Example of connecting a HTL encoder (e.g. 1XP8001–1) to an external 24 V supply

1) Not for Compact PLUS units.



DTI digital tachometer interface (continued)

Connection X405	Terminal	Designation
	1	Reference potential M5 SYT
	2	Track A
	3	Track, inverted
	4	Track B
	5	Track B, inverted
	6	Zero pulse
	7	Zero pulse, inverted
	8	Supply voltage 5 V

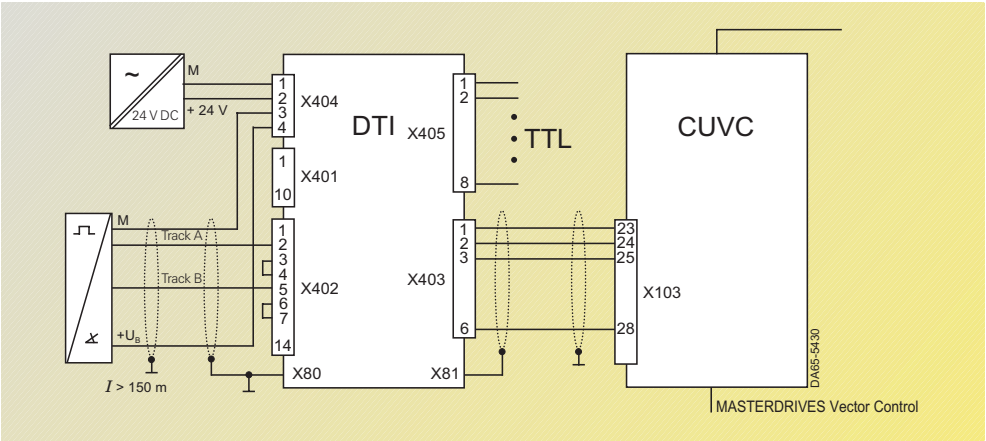


Fig. 6/92
Example of connecting a HTL encoder (e.g. 1XP8001-1) to an external 24 V supply with TTL output

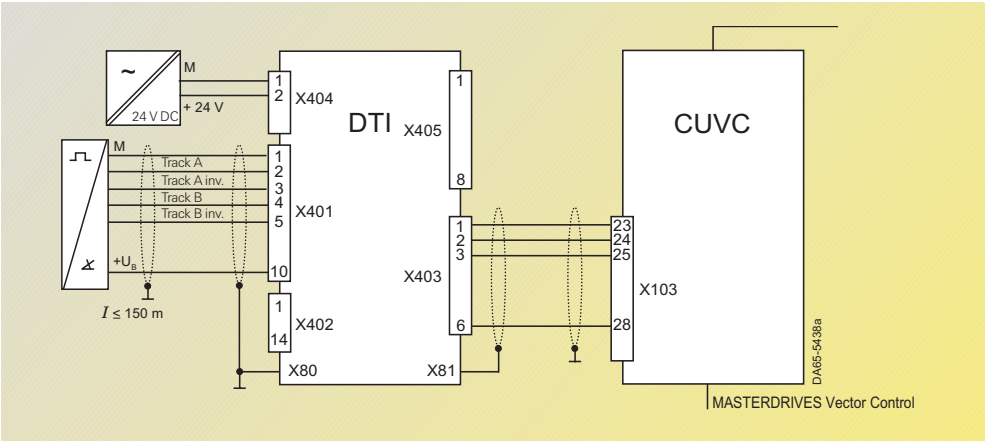


Fig. 6/93
Example of connecting a TTL encoder

120 V AC I/O board

The 120 V AC I/O board converts the standard 24 V DC binary inputs and outputs of the 6SE70 VC drive to inputs and outputs designed to operate at 120 V AC, 50/60 Hz. The 120 V board is designed with the same dimensions as the standard full-size option boards and will mount in the card rack of compact and chassis units. The 120 V board does not connect to the backplane of the card rack so an LBA adapter is not required.

The 120 V board contains seven isolated 120 V AC inputs and three isolated 120 V AC outputs. In addition, the board contains LEDs to indicate the status of each of the inputs/outputs. The EB2 expansion board is used in combination with the 120 V board and must be ordered separately.

Description	Order No.
120 V AC I/O board for CUVC	A1-108-100-823

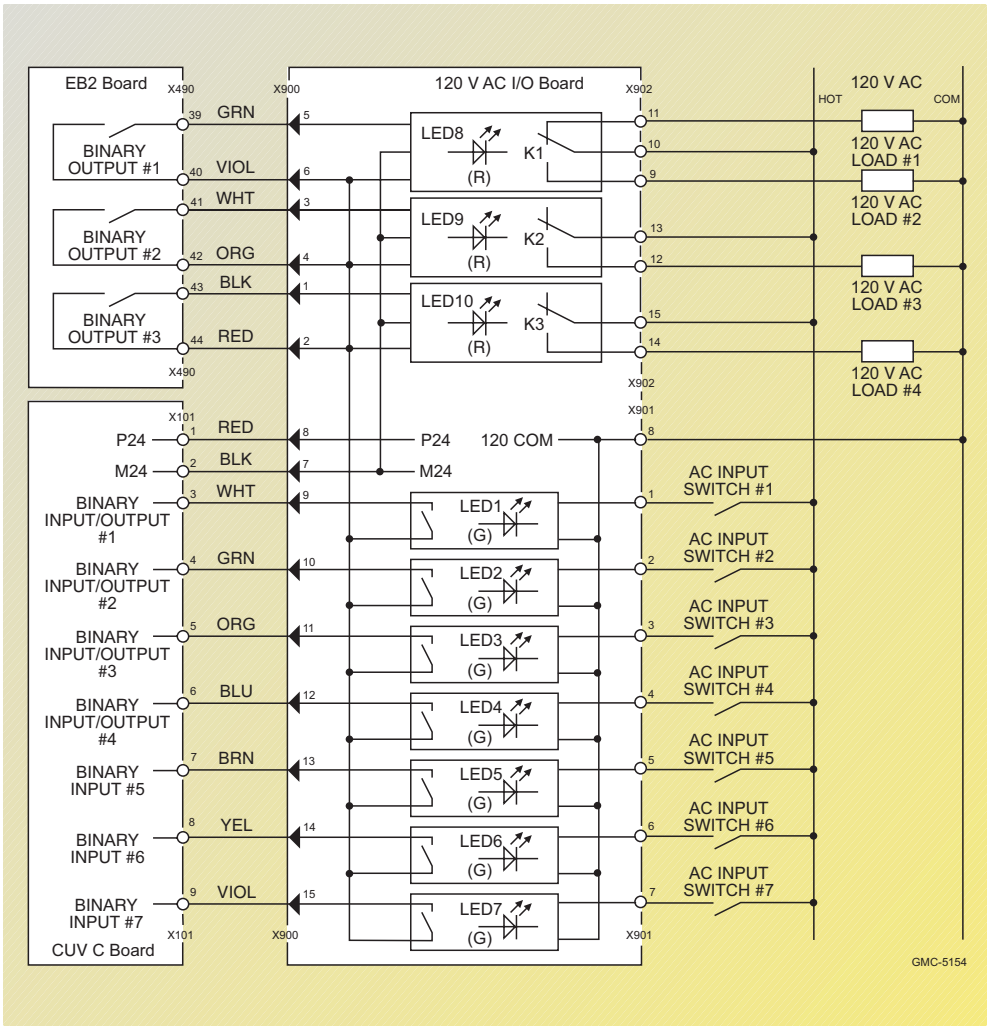
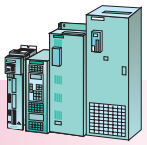
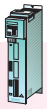


Fig. 6/94
120 V AC I/O board connected to CUVC and EB2 boards



Vector Control
Dimension Drawings

Dimension Drawings



Compact PLUS units

Converters

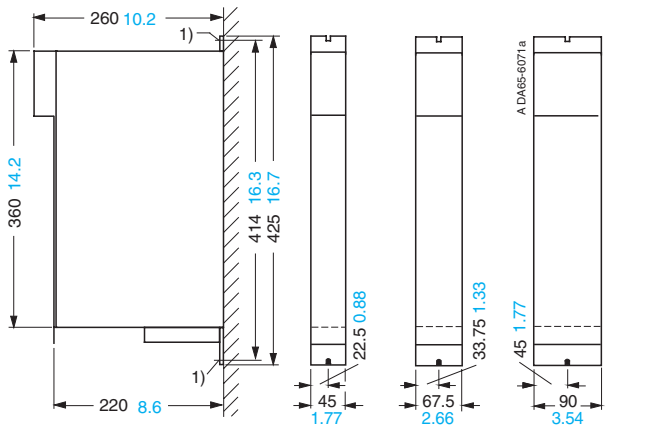


Fig. 1

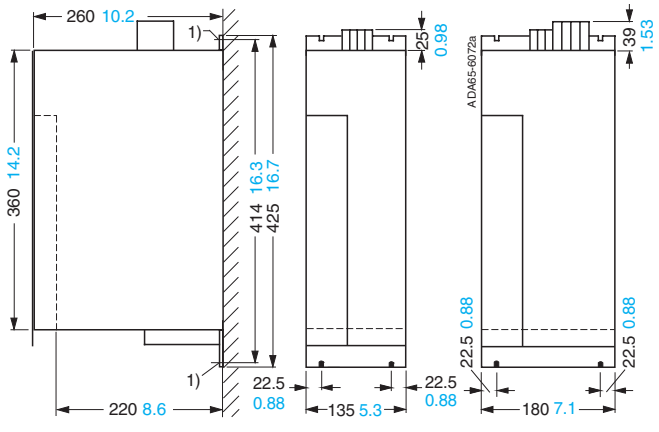


Fig. 2

Inverters

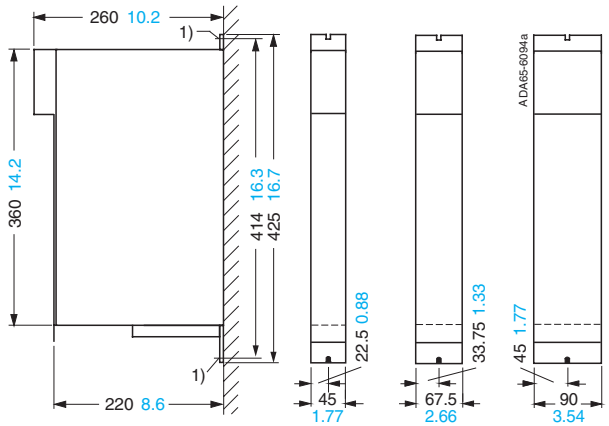


Fig. 3

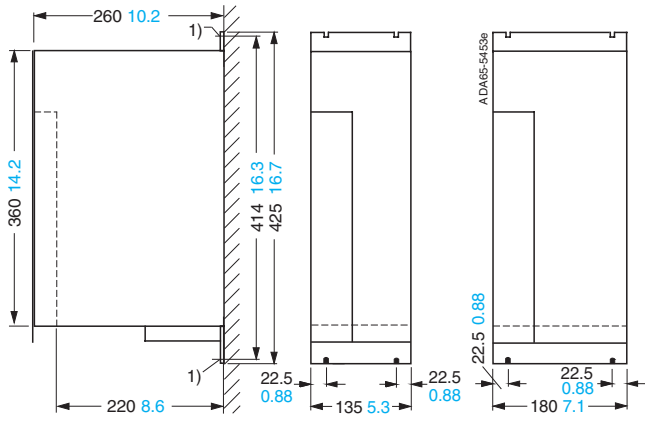


Fig. 4

Rectifiers units

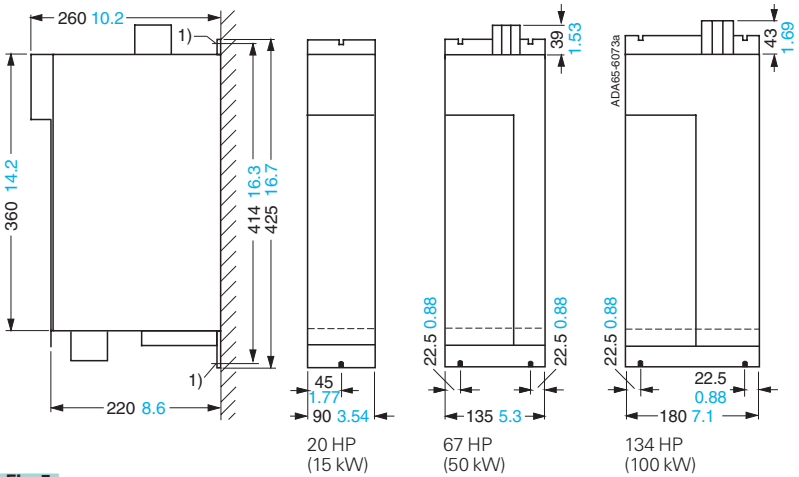


Fig. 5

1) Retaining bolts: M 5.

Dimension in mm
Dimension in inches

Compact and chassis units

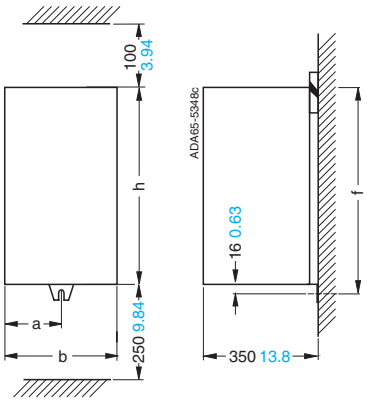


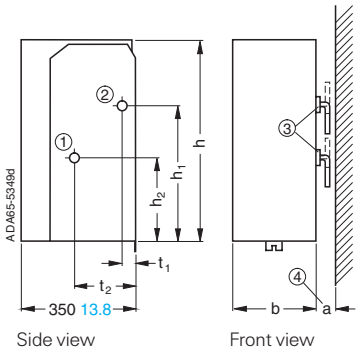
Fig. 6

Sizes A, B, C and D
converters, inverters, AFE inverters,
rectifier unit sizes B and C,
rectifier/regenerative unit size C

Type	a in (mm)	b	f	h
6SE70 . . – . . A	1.77 (45)	3.54 (90)	16.73 (425)	16.73 (425)
6SE70 . . – . . B	2.66 (67.5)	5.31 (135)	16.73 (425)	16.73 (425)
6SE70 . . – . . C	3.54 (90)	7.07 (180)	23.62 (600)	23.62 (600)
6SE70 . . – . . D	1.77[1]) (45[1]))	10.63 (270)	23.62 (600)	23.62 (600)

1) For size D two lugs left and right.

Compact units



① Feed
② Return
③ Threaded elbow joint (enclosed)
④ Space for water connections at the side

Notes

Return: upper connection
Feed: Lower connection
Supply of water:
G $^1/_2$ male thread, flat sealing
Working pressure: max. 1 bar

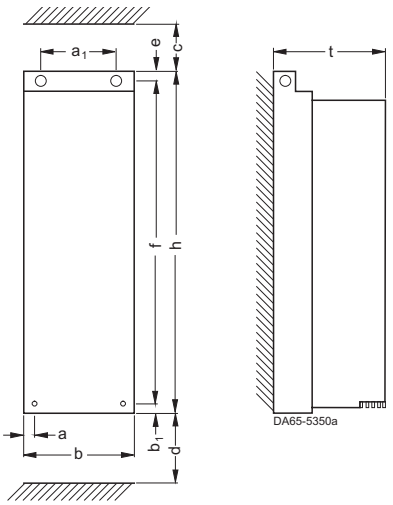
Fig. 7

Sizes B, C and D
water-cooled converter and inverter
position of the water connections

Type	a in (mm)	b	h	h_1	h_2	t_1	t_2
6SE70 . . – . . B	2.56 (65)	5.31 (135)	16.73 (425)	14.96 (380)	5.51 (140)	3.35 (85)	5.51 (140)
6SE70 . . – . . C	2.56 (65)	7.09 (180)	23.62 (600)	19.68 (500)	11.42 (290)	4.13 (105)	1.69 (43)
6SE70 . . – . . D	2.56 (65)	10.63 (270)	23.62 (600)	15.35 (390)	10.00 (254)	1.38 (35)	8.66 (220)

7

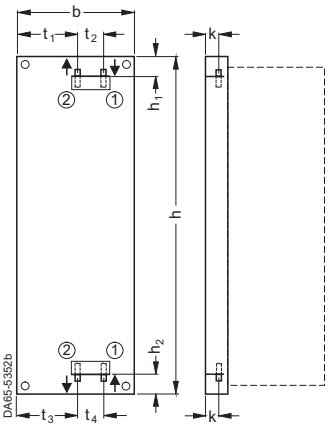
Dimension in mm
Dimension in inches



Type	a in (mm)	a_1	b	b_1	c	d	e	f	h	t
Converter/ inverter										
6SE70 . . – . . E	1.77 (45)	7.07 (180)	10.63 (270)	0.39 (10)	13.78 (350)	15.75 (400)	0.59 (15)	40.35 (1025)	41.34 (1050)	14.37 (365)
6SE70 . . – . . F	1.77 (45)	10.63 (270)	14.17 (360)	0.39 (10)	13.78 (350)	15.75 (400)	0.59 (15)	40.35 (1025)	41.34 (1050)	14.37 (365)
6SE70 . . – . . G	4.69 (119)	10.63 (270)	20.0 (508)	0.98 (25)	13.78 (350)	12.6 (320)	1.97 (50)	54.13 (1375)	57.09 (1450)	18.3 (465)

Fig. 8

Sizes E, F and G
Converter, inverter, AFE inverter



① Feed
② Return

Notes

Seal-off unused water connections with screw and seal (enclosed).

Water supply:
Size E and F,
male thread G 1/2", flat proof

Size G,
male thread G 3/4", flat proof

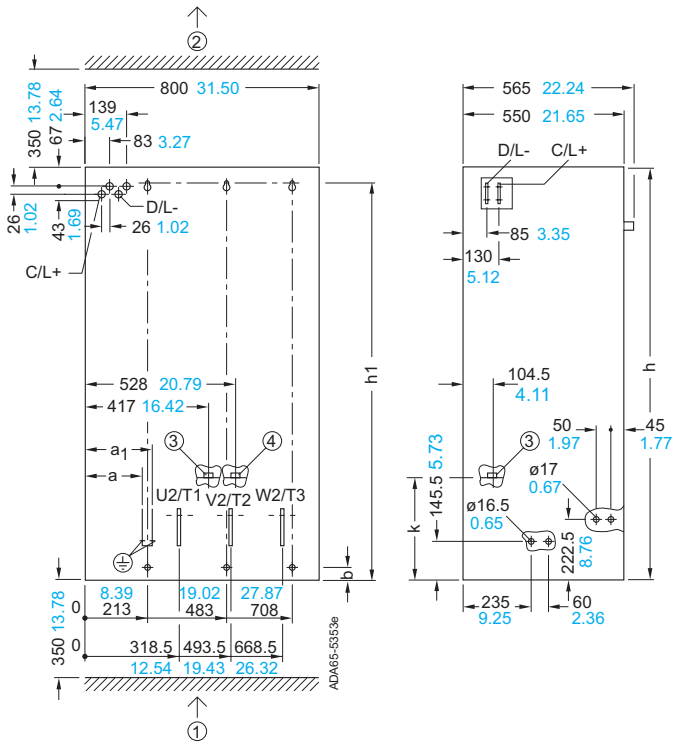
Working pressure:
max. 1 bar

Fig. 9

Sizes E, F and G
water-cooled converter and inverter
position of the water connection

Further dimensions, see Fig. 8.

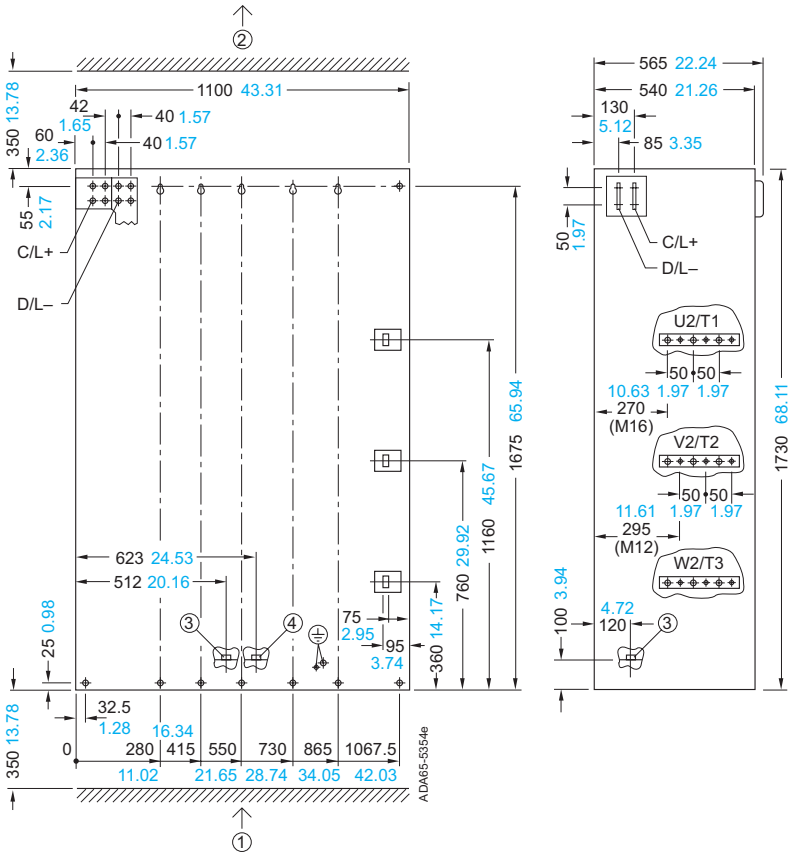
Type	b in (mm)	h	h_1	h_2	t_1	t_2	t_3	t_4	k
Converter/ inverter									
6SE70 . . – . . E	10.63 (270)	41.34 (1050)	1.65 (42)	0.98 (25)	4.61 (117)	2.20 (56)	3.58 (91)	2.20 (56)	1.18 (30)
6SE70 . . – . . F	14.17 (360)	41.34 (1050)	1.65 (42)	0.98 (25)	8.15 (207)	2.20 (56)	7.13 (181)	2.20 (56)	1.18 (30)
6SE70 . . – . . G	20.00 (508)	57.09 (1450)	1.22 (31)	1.57 (40)	9.17 (233)	2.60 (66)	7.52 (191)	2.60 (66)	1.57 (40)



① Air inlet
② Air outlet
③ With water cooling, connection for cooling circuit directly at the heatsink, 1" internal thread (R1")
④ With water cooling, connection return

Type	a in (mm)	a_1	b	h	h_1	k
6SE70 . . – . . J	6.71 (170.5)	8.17 (207.5)	1.77 (45)	55.12 (1400)	52.95 (1345)	13.39 (340)
6SE70 . . – . . K	6.97 (177)	8.23 (209)	0.98 (25)	70.47 (1790)	65.94 (1675)	8.66 (220)
6SE70 . . – . . Q	2 x chassis units for size K, side-by-side					

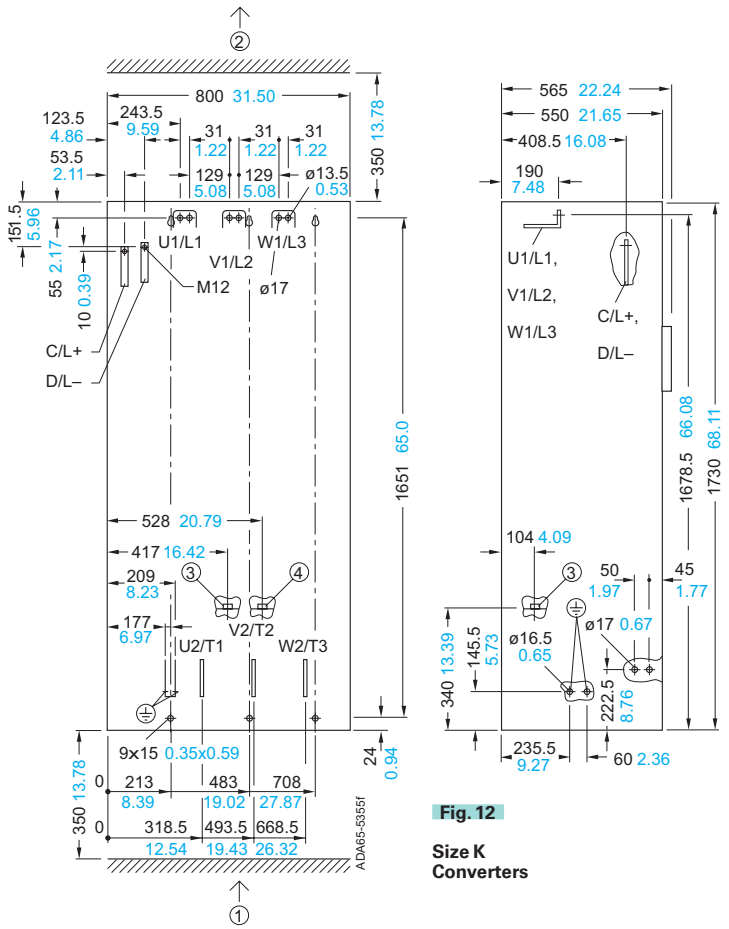
Fig. 10 **Sizes J, K Inverters**



① Air inlet
② Air outlet
③ With water cooling, connection for cooling circuit directly at the heatsink, 1" internal thread (R1")
④ With water cooling, connection return

Fig. 11 **Size L Inverters**

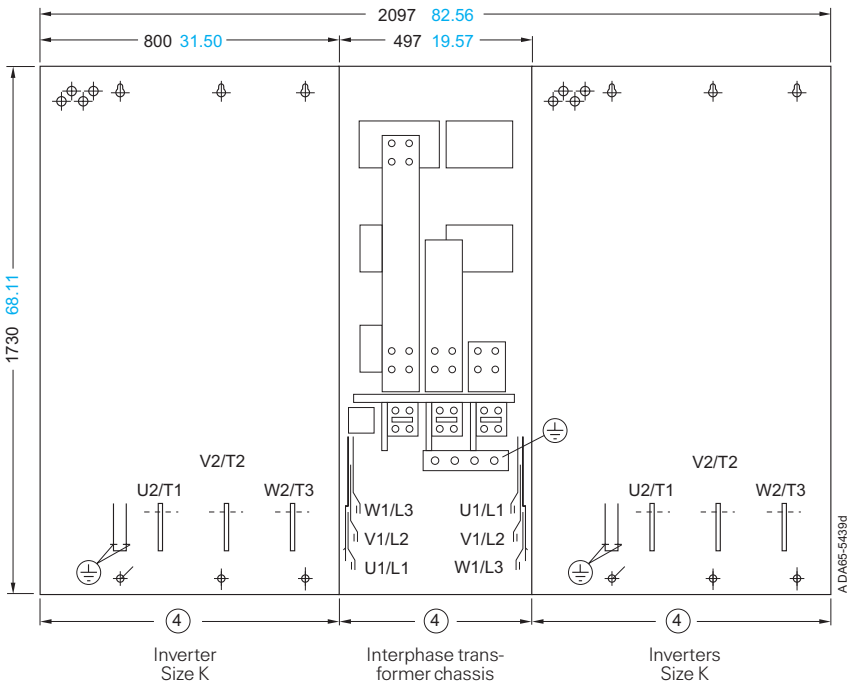
Dimension in mm
Dimension in inches



① Air inlet
② Air outlet
③ With water cooling, connection inlet for cooling circuit directly at the heatsink, 1" internal thread (R1")
④ With water cooling, connection return

Fig. 12

Size K
Converters



① Air inlet
② Air outlet
④ Transport unit

Fig. 13

Size M
Inverter with interphase transformer chassis

Dimension in mm
Dimension in inches

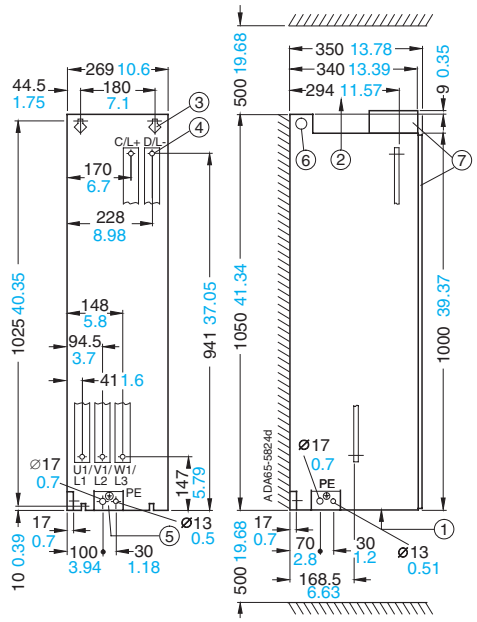


Fig. 14

Size E
Rectifier unit,
rectifier/regenerative unit

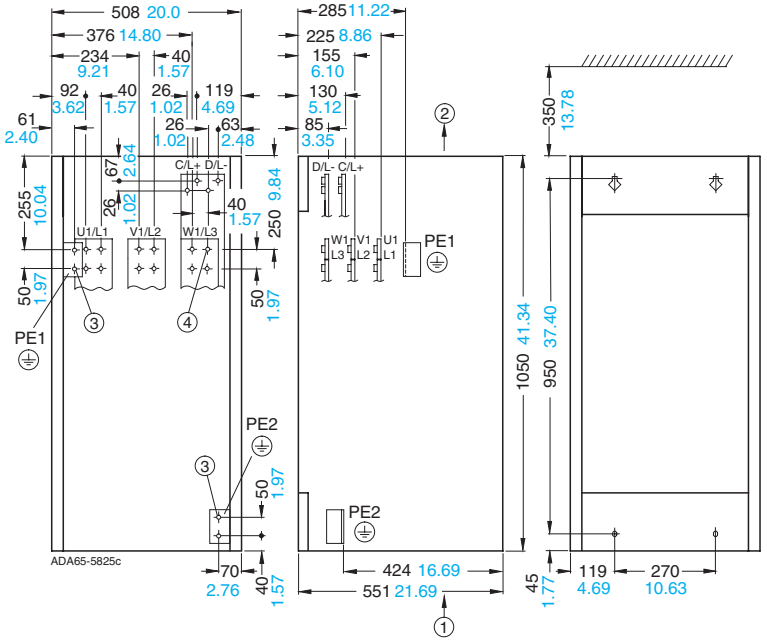


Fig. 15

Size H
Rectifier unit

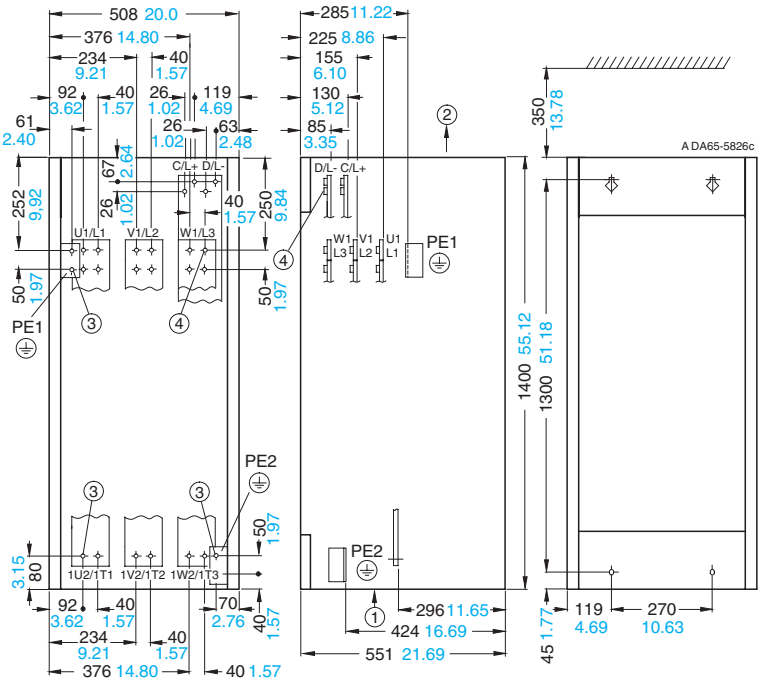
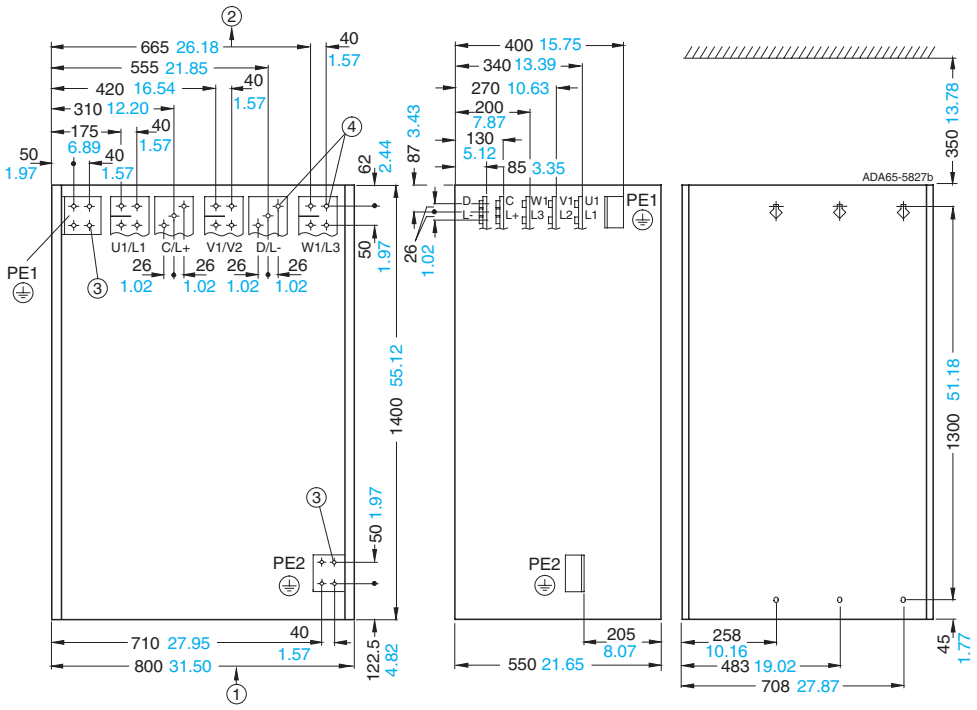


Fig. 16

Size H
Rectifier/regenerative unit

① Air inlet, e.g. up to the closed cabinet base or cable duct
② Air outlet up to a reflecting surface, e.g. ceiling or closed roof
③ Through-hole for M 12 bolt
④ M 12 thread
⑤ Through-hole for M 8 bolt
⑥ Through-hole for power connections
M 16 for 6SE7036–1EE85–0AA0, 6SE7034–2FE85–0AA0, 6SE7035–4FE85–0AA0, 6SE7034–2HE85–0AA0 and 6SE7035–4HE85–0AA0
M 12 for all other units
⑦ Pre-fitted terminal for PE
M 16 for 6SE7036–1EE85–0AA0, 6SE7034–2FE85–0AA0, 6SE7035–4FE85–0AA0, 6SE7034–2HE85–0AA0 and 6SE7035–4HE85–0AA0
M 12 for all other units
⑧ Lifting eye Ø 1.18 in (30 mm)
⑨ Front cover (doors) and terminal cover, only with IP20 version

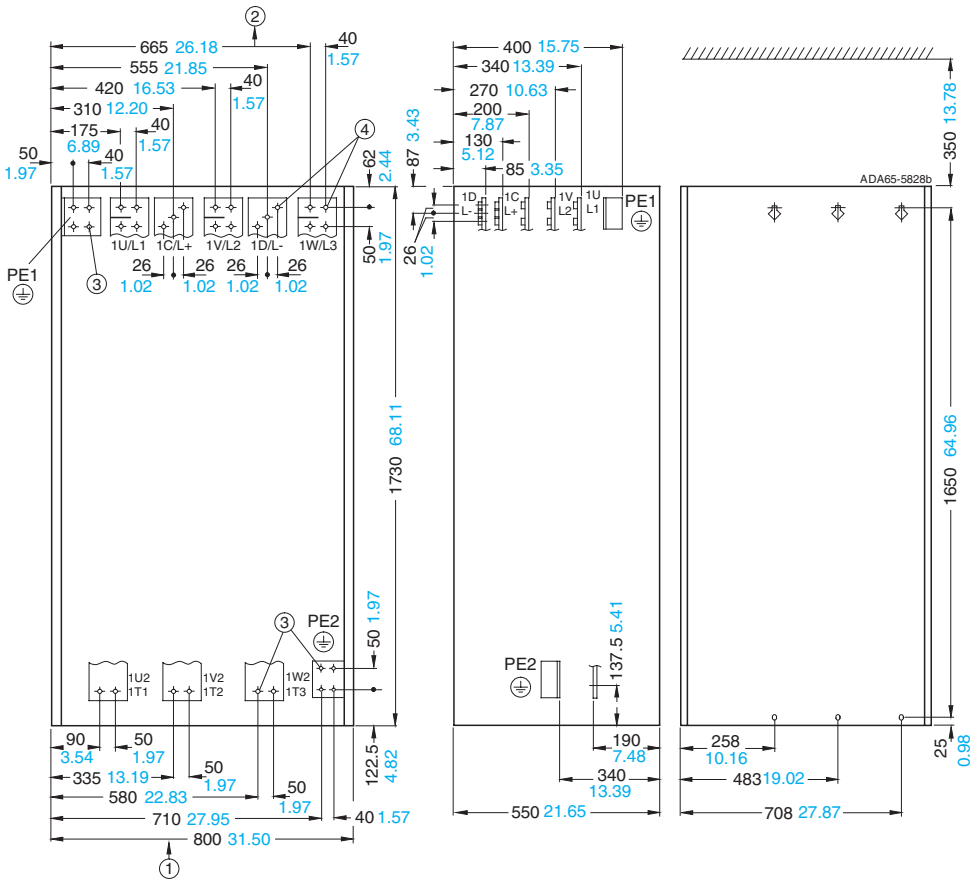
Dimension in mm
Dimension in inches



① Air inlet
② Air outlet
③ Through-hole for M 12 bolt
④ M 12 thread

Fig. 17

Size K
Rectifier unit



① Air inlet
② Air outlet
③ Through-hole for M 12 bolt
④ M 12 thread

Fig. 18

Size K
Rectifier/regenerative units

Dimension in mm
Dimension in inches

7

Compact and chassis units

Overcurrent protector units (OCP)

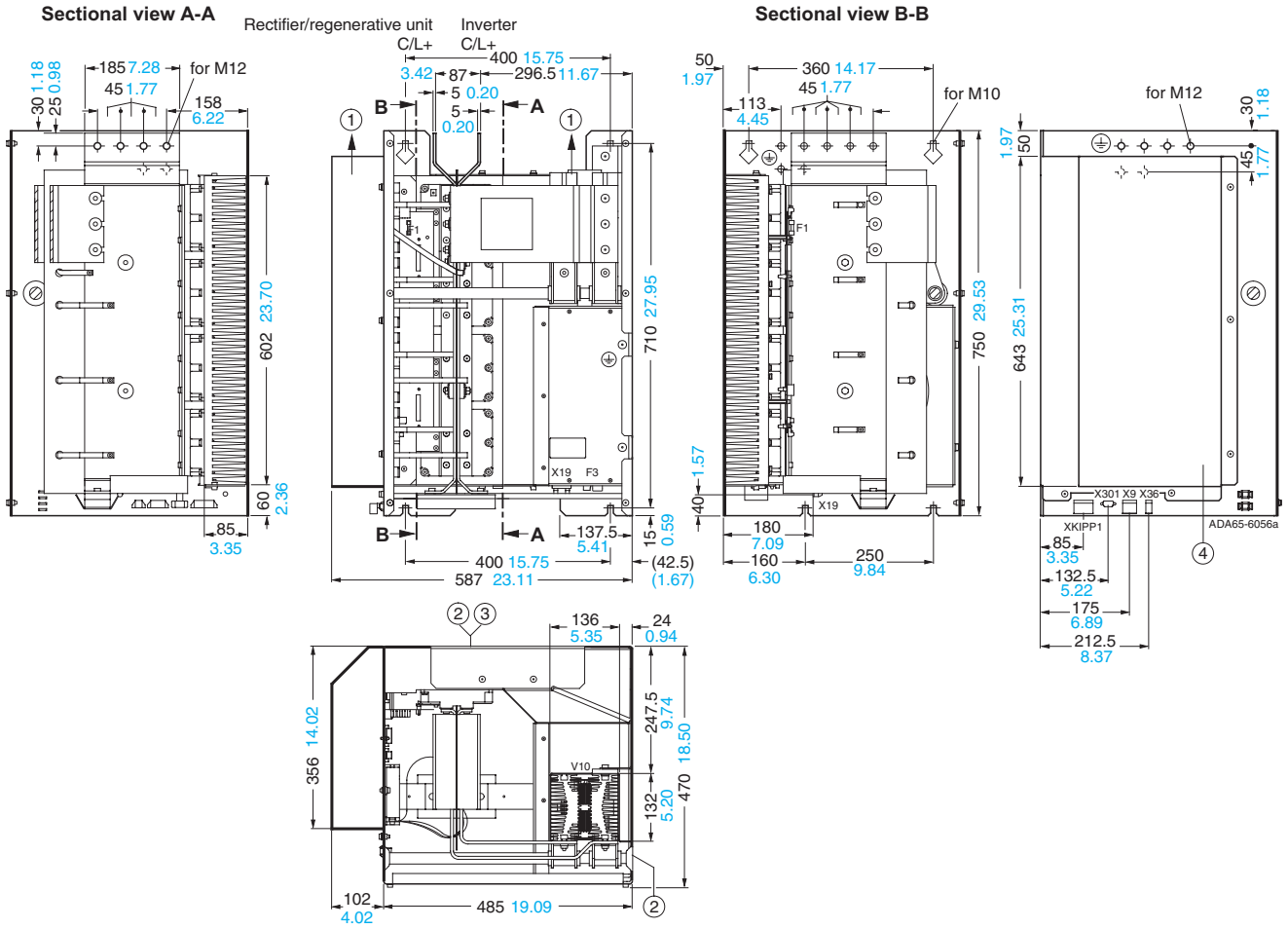


Fig. 19

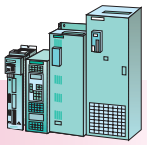
① Air outlet
② Optional mounting surfaces for wall mounting
③ Optional mounting surfaces for horizontal mounting

④ Optional air duct
(Mounting 5 x M 6)
If operated without an air conduit, it must be ensured that air can escape unhindered.
Circulation of exhaust air must be excluded.

Max. wire cross-section for cable with cable lug to DIN 46 234:
8 x 250 mm²

Tightening torque for customer connections:
C/L + = 44 Nm
⏚ = 60 Nm

Dimension in mm
Dimension in inches



Braking units and braking resistors

Compact PLUS/compact and chassis units · cabinet units

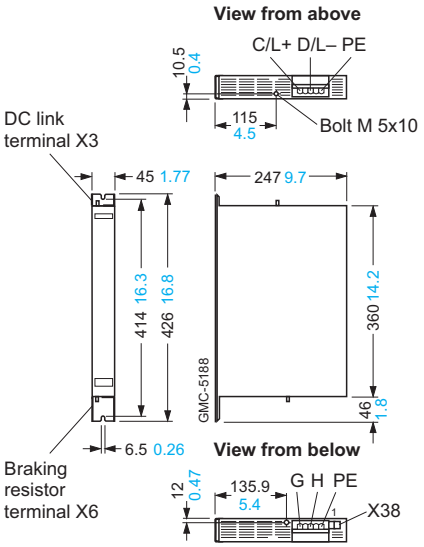


Fig. 20

Braking units size S
6SE70..-..S..-2DA1

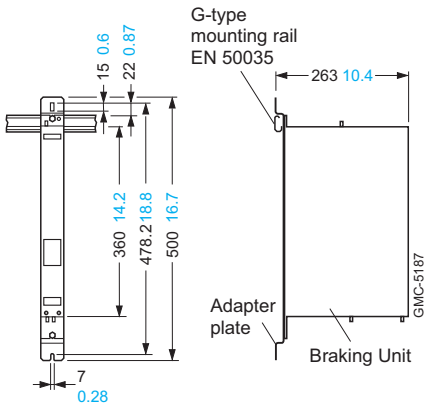
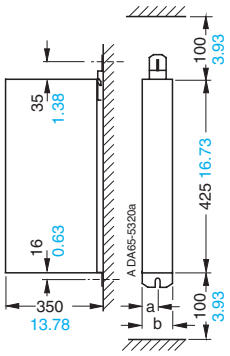


Fig. 21

Adapter plate 6SX7010-0KC01



Type	a in	(mm)	b in	(mm)
6SE70 . . –. . S . . –2DA0*	0.89	(22.5)	1.77	(45)
6SE70 . . –. . A . . –2DA0*	1.77	(45)	3.54	(90)
6SE70 . . –. . B . . –2DA0	2.66	(67.5)	5.31	(135)

* Sizes S and A will be superseded by –2DA1 revision size S.

Fig. 22

Braking units, sizes S, A and B

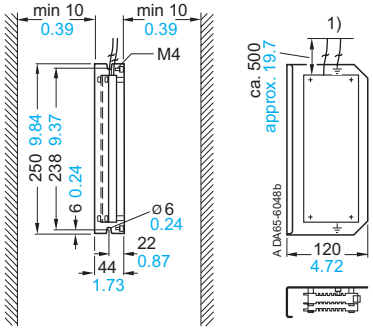


Fig. 23

Braking resistor 2 kW and 4 kW

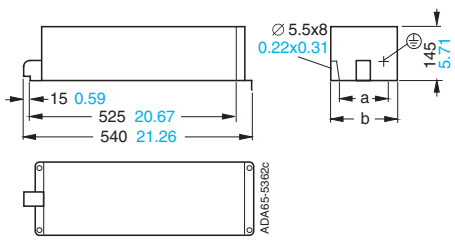


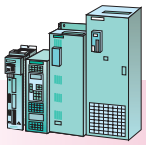
Fig. 24

Braking resistor 5 kW and 10 kW

Type	a in	(mm)	b in	(mm)
6SE70 16–4FS87–2DC0	5.91	(150)	7.09	(180)
6SE70 18–0ES87–2DC0	5.91	(150)	7.09	(180)
6SE70 21–6CS87–2DC0	5.91	(150)	7.09	(180)
6SE70 21–3FS87–2DC0	12.99	(330)	14.17	(360)
6SE70 21–6ES87–2DC0	12.99	(330)	14.17	(360)
6SE70 23–2CS87–2DC0	12.99	(330)	14.17	(360)

1) 6SE7013–2ES87–2DC0: AWG 16 (1.3 mm²)
6SE7016–3ES87–2DC0: AWG 14 (2.1 mm²)

Dimension in mm
Dimension in inches



Compact PLUS/compact and chassis units · cabinet units

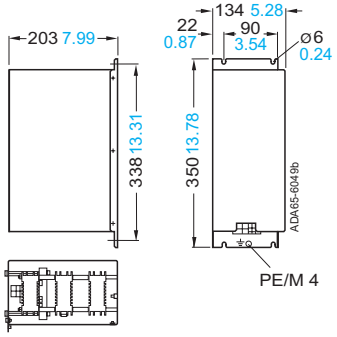
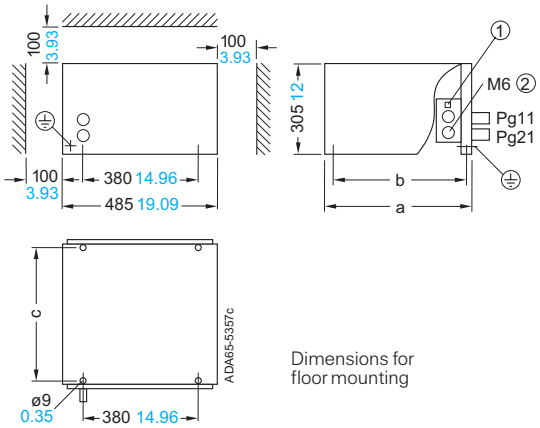


Fig. 25

Braking resistor 12 kW



Wall mounting possible

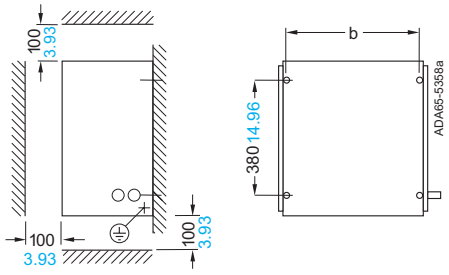


Fig. 26

Braking resistor 20 kW and 50 kW

Type	a in	(mm)	b in	(mm)	c in	(mm)
6SE70 23–2ES87–2DC0	16.93	(430)	15.75	(400)	15.75	(400)
6SE70 26–3CS87–2DC0	16.93	(430)	15.75	(400)	15.75	(400)
6SE70 25–3HS87–2DC0	29.13	(740)	27.95	(710)	27.95	(710)
6SE70 26–4FS87–2DC0	29.13	(740)	27.95	(710)	27.95	(710)
6SE70 28–0ES87–2DC0	29.13	(740)	27.95	(710)	27.95	(710)

Braking units and braking resistors

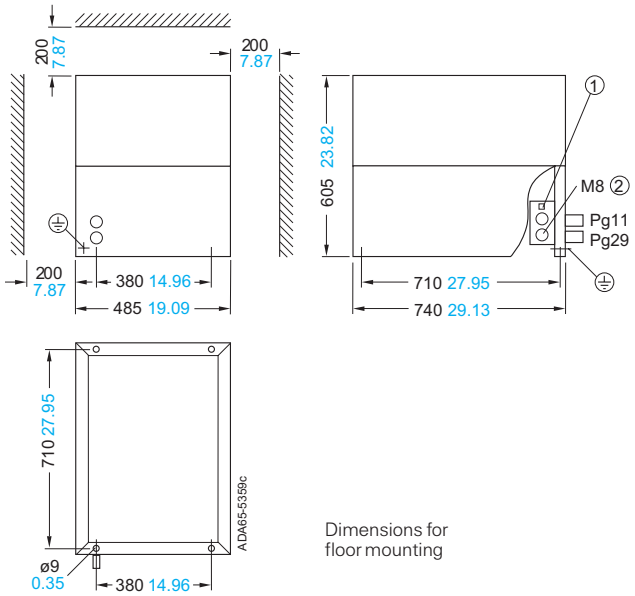


Fig. 27

Braking resistor 100 kW
6SE7031–3FS87–2DC0
6SE7031–6ES87–2DC0

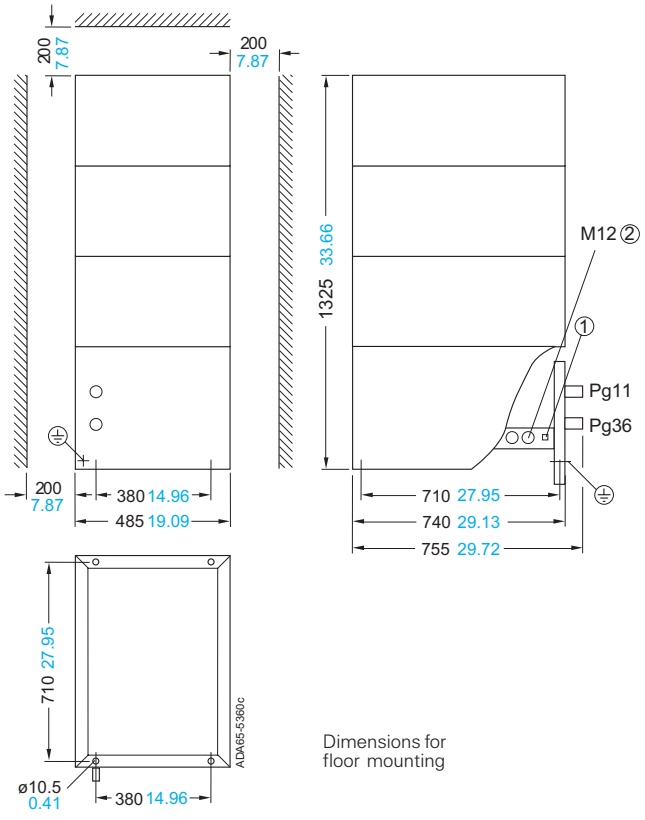


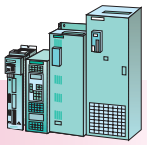
Fig. 28

Braking resistor 170 kW and 200 kW
6SE7032–1HS87–2DC0
6SE7032–5FS87–2DC0
6SE7032–7ES87–2DC0

① T1/T2 socket type screw terminal
② Stud terminal

Dimension in mm
Dimension in inches

7



DC link module and capacitor module

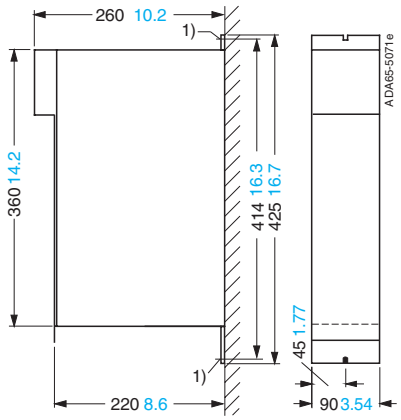


Fig. 29

Precharging resistors

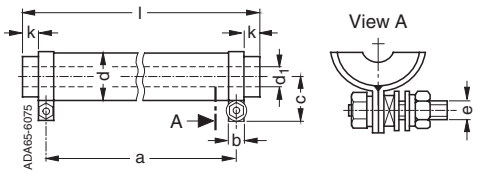


Fig. 30

Type	d in (mm)	l	a	b	c	d_1	e	k	Weight approx. lb (kg)
6SX7010–0AC06	$0.46^{\pm0.03}$ $(11.8^{\pm0.8})$	$2.44^{\pm0.08}$ $(62^{\pm2})$	$2.01^{\pm0.08}$ $(51^{\pm2})$	0.20 (5)	0.45 (11.5)	0.22 (5.5)	M 3 x 12	0.12 (3)	0.029 (0.013)
6SX7010–0AC07	$0.58^{\pm0.03}$ $(14.8^{\pm0.8})$	$3.94^{\pm0.08}$ $(100^{\pm2})$	$3.43^{\pm0.08}$ $(87^{\pm2})$	0.20 (5)	0.51 (13)	0.22 (5.5)	M 3 x 12	0.16 (4)	0.07 (0.033)
6SX7010–0AC08	$0.88^{\pm0.05}$ $(22.3^{\pm1.3})$	$3.94^{\pm0.08}$ $(100^{\pm2})$	$2.79^{\pm0.08}$ $(71^{\pm2})$	0.31 (8)	0.73 (18.5)	0.39 (10)	M 4 x 18	0.41 (10.5)	0.18 (0.08)
6SX7010–0AC10	$0.88^{\pm0.05}$ $(22.3^{\pm1.3})$	$6.50^{\pm0.08}$ $(165^{\pm2})$	$5.35^{\pm0.08}$ $(136^{\pm2})$	0.31 (8)	0.73 (18.5)	0.39 (10)	M 4 x 18	0.41 (10.5)	0.25 (0.113)
6SX7010–0AC11	$0.88^{\pm0.05}$ $(22.3^{\pm1.3})$	$10.43^{\pm0.16}$ $(265^{\pm4})$	$9.29^{\pm0.08}$ $(236^{\pm2})$	0.31 (8)	0.73 (18.6)	0.39 (10)	M 4 x 18	0.41 (10.5)	0.43 (0.194)

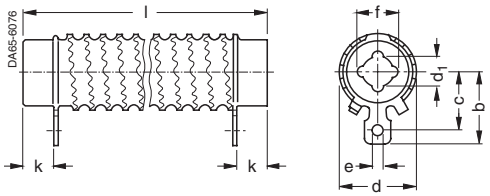
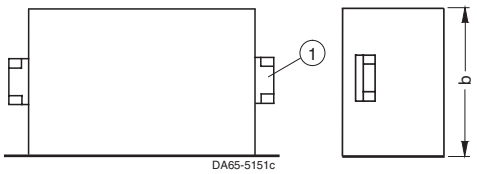


Fig. 31

Type	d in (mm)	l	k	e	b	c	d_1	f	Weight approx. lb (kg)
6SX7010–0AC12	$0.58^{\pm0.04}$ $(37^{\pm1})$	$3.94^{\pm0.1}$ $(100^{\pm2.5})$	0.59 (15)	0.20 (5.2)	1.34 (34)	1.10 (28)	0.55 (14)	0.73 (18.5)	0.44 (0.2)
6SX7010–0AC13	$0.58^{\pm0.04}$ $(37^{\pm1})$	$8.46^{\pm0.21}$ $(215^{\pm5.4})$	0.59 (15)	0.20 (5.2)	1.34 (34)	1.10 (28)	0.55 (14)	0.73 (18.5)	0.88 (0.4)

7

Dimension in mm
Dimension in inches



Type	a in (mm)	b	h	h_1	h_2
6SE7012–0EP87–0FB0	1.75 (44.5)	4.33 (110)	11.42 (290)	9.84 (250)	10.83 (275)
6SE7016–0EP87–0FB0	2.64 (67)	5.12 (130)	12.20 (310)	10.63 (270)	11.61 (295)

Fig. 32

Radio-interference suppression filter
6SE7012–0EP87–0FB0, 6SE7016–0EP87–0FB0,
6SE7012–0EP87–0FB1, 6SE7016–0EP87–0FB1

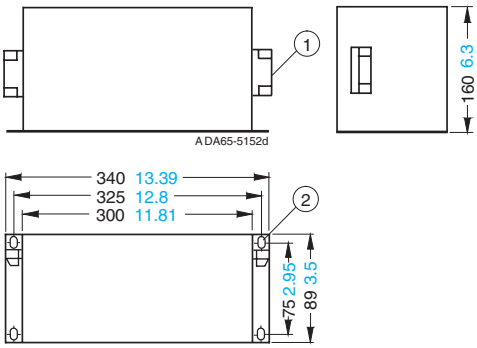
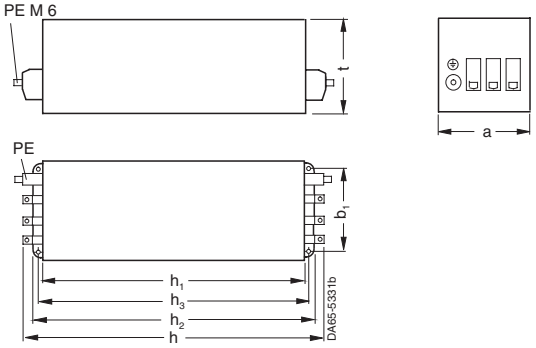


Fig. 33

Radio-interference suppression filter
6SE7021–2EP87–0FB0, 6SE7021–8EP87–0FB0,
6SE7021–2EP87–0FB1, 6SE7021–8EP87–0FB1



Type	a in (mm)	b_1	h	h_1	h_2	h_3	t
6SE7021–0ES87–0FB1	3.54 (90)	2.95 (75)	8.46 (215)	6.54 (166)	7.72 (196)	7.17 (182)	3.19 (81)
6SE7021–8ES87–0FB1	3.54 (90)	2.95 (75)	8.46 (215)	6.54 (166)	7.72 (196)	7.17 (182)	3.19 (81)
6SE7023–4ES87–0FB1	3.98 (101)	3.35 (85)	9.09 (231)	6.54 (166)	7.72 (196)	7.17 (182)	3.39 (86)
6SE7027–2ES87–0FB1	5.55 (141)	4.73 (120)	12.13 (308)	8.7 (221)	10.08 (256)	9.45 (240)	5.55 (141)

Type	Terminals	Earthing stud	Weight approx. lb (kg)
6SE7021–0ES87–0FB1	AWG 10 (4 mm²)	M 6	5.51 (2.5)
6SE7021–8ES87–0FB1	AWG 10 (4 mm²)	M 6	5.51 (2.5)
6SE7023–4ES87–0FB1	AWG 4 (16 mm²)	M 6	8.82 (4)
6SE7027–2ES87–0FB1	AWG 6 – 1/0 (50 mm²)	M 10	19.85 (9)

Fig. 34

Radio-interference suppression filter
6SE7021, 6SE7023, 6SE7027

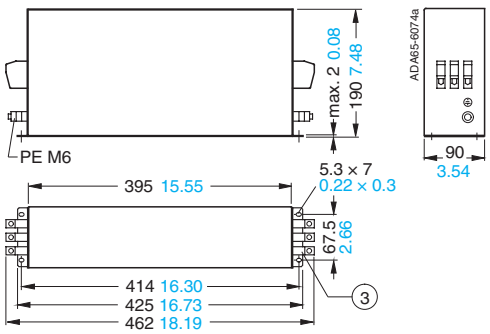


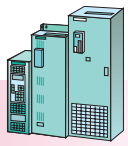
Fig. 35

Radio-interference suppression filter
6SE7023–8EP87–0FB0,
6SE7023–8EP87–0FB1

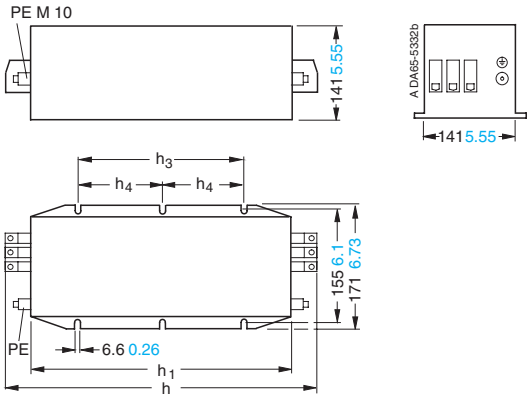
① Power COMBICON
② Oblong hole 0.22 x 0.3 (5.5 x 7.5)
③ Terminals AWG 4 (16 mm²)

1) Dependent on the manufacturer 6 mm² also possible.

Dimension in mm
Dimension in inches



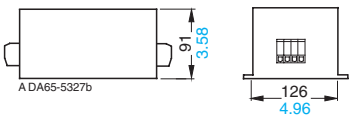
Radio-interference suppression filter



Type	h in (mm)	h_1	h_3	h_4	Terminals	Earthing stud	Weight approx. lb (kg)
6SE7031–2ES87–0FA1	13.70 (348)	10.28 (261)	4.53 (115)	–	50 mm²	M 10	22.05 (10)
6SE7031–8ES87–0FA1	15.91 (404)	11.85 (301)	6.50 (165)	3.25 (82.5)	95 mm²	M 10	22.05 (10)

Fig. 36

Radio-interference suppression filter 6SE7031



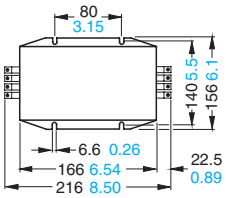
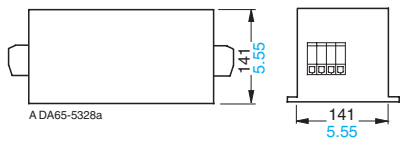


Fig. 37

Radio-interference suppression filter
B84143–A25–R21/A36–R21/A50–R21
Terminals 10 mm²



Type	h		h_1		Terminals	Weight approx.	
	in	(mm)	in	(mm)		lb	(kg)
B8143–A80–R21	11.81	(300)	8.70	(221)	25 mm²	22.05	(10)
B8143–A120–R21/A150–R21	13.70	(348)	10.28	(261)	50 mm²	22.05	(10)

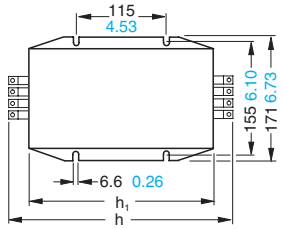
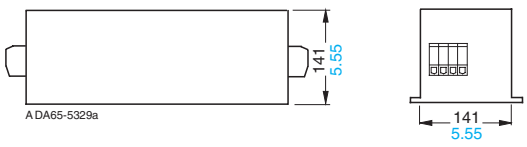


Fig. 38

Radio-interference suppression filter
B84143–A80–R21
B84143–A120–R21/A150–R21



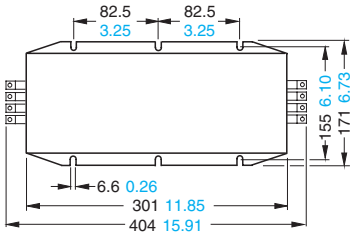
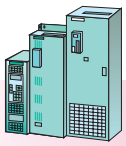
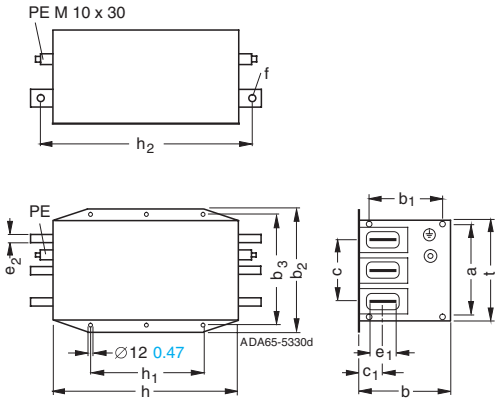


Fig. 39

Radio-interference suppression filter
B84143–A180–R21
6SE7031–8ES87–0FA1
Terminals 95 mm²

Dimension in mm
Dimension in inches





Type	a in (mm)	b	b_1	b_2	b_3	c	c_1	e
B84143–B250–S . .	4.33 (110)	4.53 (115)	–	7.48 (190)	6.50 (165)	3.15 (80)	1.18 (30)	0.59 (15)
B84143–A320–S . . 6SE7033–2ES87–0FA1	7.09 (180)	4.57 (116)	3.35 (85)	10.24 (260)	9.25 (235)	4.72 (120)	1.42 (36)	0.59 (15)
B84143–B600–S . . 6SE7036–0ES87–0FA1	7.09 (180)	4.57 (116)	3.35 (85)	10.24 (260)	9.25 (235)	4.72 (120)	1.42 (36)	0.59 (15)
B84143–B1000–S . . 6SE7041–0ES87–0FA1	8.66 (220)	6.54 (166)	5.31 (135)	11.81 (300)	10.83 (275)	6.30 (160)	2.40 (61)	0.79 (20)

Type	e_1 in (mm)	e_2	f	h	h_1	h_2	Weight approx. lb (kg)
B84143–B250–S . .	0.98 (25)	0.20 (5)	Ø 0.43 (Ø 11)	11.81 (300)	9.45 (240)	14.17 (360)	33 (15)
B84143–A320–S . . 6SE7033–2ES87–0FA1	0.98 (25)	0.20 (5)	Ø 0.43 (Ø 11)	11.81 (300)	9.45 (240)	14.17 (360)	46 (21)
B84143–B600–S . . 6SE7036–0ES87–0FA1	1.18 (30)	0.20 (5)	Ø 0.43 (Ø 11)	13.78 (350)	11.42 (290)	16.14 (410)	48.5 (22)
B84143–B1000–S . . 6SE7041–0ES87–0FA1	1.57 (40)	0.31 (8)	Ø 0.55 (Ø 14)	13.78 (350)	11.42 (290)	16.54 (420)	62 (28)

Fig. 40

Radio-interference suppression filter
B84143–B250–S . ./A320–S . ./
B600–S . ./B1000–S . .
6SE7033, 6SE7036, 6SE7041

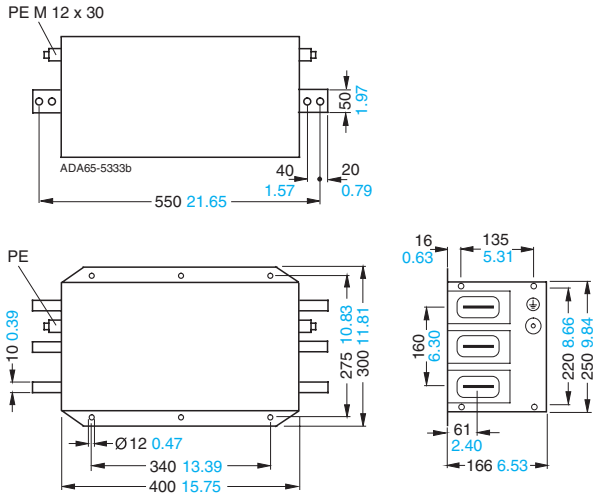


Fig. 41

Radio-interference suppression filter
B84143–B1600–S . .
6SE7041–6ES87–0FA1
Weight approx. 75 lb (34 kg)

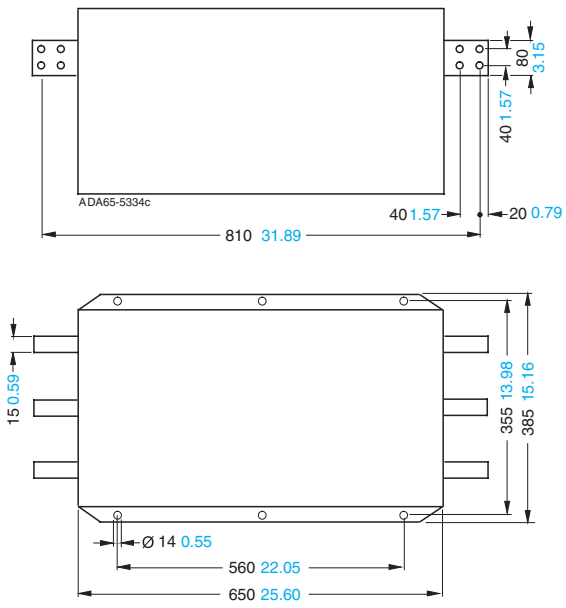
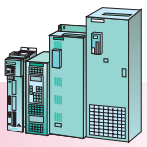


Fig. 42

Radio-interference suppression filter
B84143–B2500–S . .
Weight approx. 232 lb (105 kg)

Dimension in mm
Dimension in inches



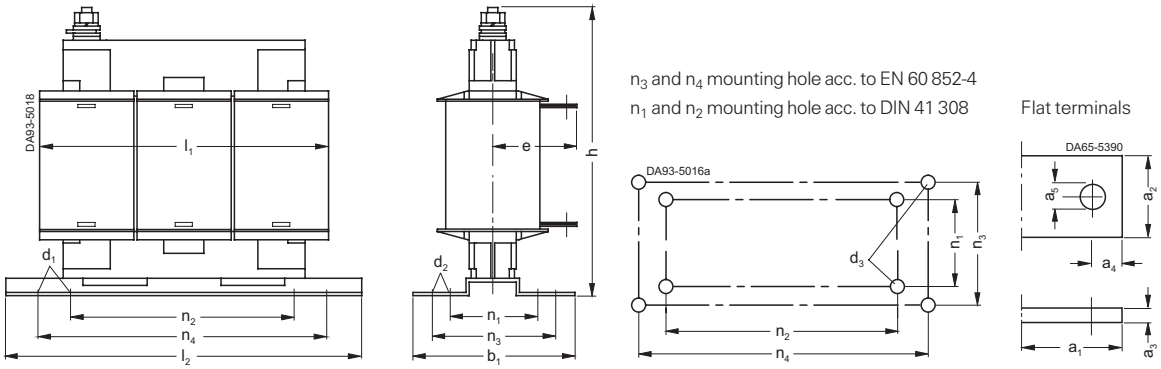
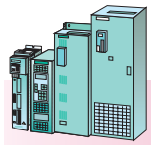


Fig. 43

Commutating reactor 4EP, $I_{LN} \geq 51$ A
with flat terminals, for any mounting position

Type	b_1 in (mm)	d_1	d_2	d_3	e	h	l_1	l_2	n_1	n_2	n_3	n_4	Weight approx. lb (kg)
4EP38	3.46 (88)	0.23 (5.8)	0.43 (11)	M 5	2.99 (76)	6.02 (153)	5.91 (150)	7.01 (178)	2.52 (64)	4.45 (113)	2.68 (68)	6.54 (166)	11.03 (5)
4EP39	3.90 (99)	0.28 (7)	0.51 (13)	M 6	2.87 (73)	7.05 (179)	7.17 (182)	8.62 (219)	2.20 (56)	5.35 (136)	2.72 (69)	7.91 (201)	14.33 (6.5)
4EP40	4.69 (119)	0.28 (7)	0.51 (13)	M 6	3.27 (83)	7.05 (179)	7.17 (182)	8.62 (219)	2.99 (76)	5.35 (136)	3.50 (89)	7.91 (201)	22.05 (10)

Rated current I_{LN} A	a_1 in (mm)	a_2	a_3	a_4	a_5
51 to 80	1.18 (30)	0.79 (20)	0.12 (3)	0.39 (10)	0.35 (9)
81 to 200	1.38 (35)	0.98 (25)	0.20 (5)	0.49 (12.5)	0.43 (11)



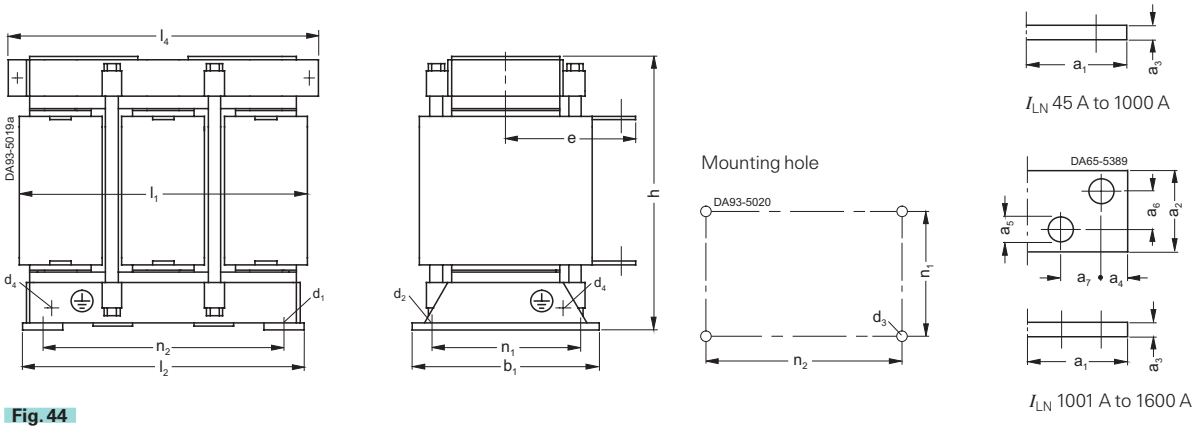
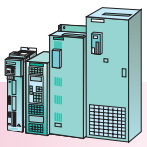


Fig. 44

Commutating reactors 4EU
with flat terminals, for arrangement on horizontal surfaces

Type	b_1 in (mm)	d_1	d_2	d_3	d_4	e max.	h max.	l_1	l_2	l_4	n_1	n_2	Weight approx. lb (kg)
4EU24	3.58 (91)	0.27 (7)	0.51 (13)	M 6	M 6	4.02 (102)	8.27 (210)	8.86 (225)	7.48 (190)	–	2.76 (70)	6.93 (176)	26.24 (11.9)
4EU25	4.53 (115)	0.27 (7)	0.51 (13)	M 6	M 6	4.69 (119)	8.27 (210)	8.86 (225)	7.48 (190)	–	3.70 (94)	6.93 (176)	39.70 (18)
4EU27	5.24 (133)	0.39 (10)	0.71 (18)	M 8	M 6	5.59 (142)	9.76 (248)	10.24 (260)	8.66 (220)	10.63 (270)	3.98 (101)	7.87 (200)	62.18 (28.2)
4EU30	5.83 (148)	0.39 (10)	0.71 (18)	M 8	M 6	5.79 (147)	10.59 (269)	11.61 (295)	9.84 (250)	11.81 (300)	4.65 (118)	8.82 (224)	88.86 (40.3)
4EU36	6.65 (169)	0.39 (10)	0.71 (18)	M 8	M 6	7.75 (197)	12.64 (321)	14.05 (357)	11.81 (300)	13.78 (350)	5.43 (138)	10.39 (264)	134.5 (61)
4EU39	6.85 (174)	0.47 (12)	0.71 (18)	M 10	M 6	7.75 (197)	15.16 (385)	15.94 (405)	14.41 (366)	16.14 (410)	5.55 (141)	12.44 (316)	172 (78)
4EU43	7.64 (194)	0.59 (15)	0.86 (22)	M 12	M 6	8.35 (212)	17.13 (435)	18.03 (458)	16.38 (416)	18.11 (460)	6.10 (155)	14.02 (356)	258 (117)
4EU45	8.70 (221)	0.59 (15)	0.86 (22)	M 12	M 6	8.31 (211)	17.13 (435)	18.03 (458)	16.38 (416)	18.11 (460)	7.17 (182)	14.02 (356)	308.7 (140)
4EU47	9.88 (251)	0.59 (15)	0.86 (22)	M 12	M 6	9.09 (231)	17.13 (435)	18.03 (458)	16.38 (416)	18.11 (460)	8.35 (212)	14.02 (356)	352.8 (160)
4EU50	7.68 (195)	0.49 (12.5)	0.49 (12.5)	M 10	M 12	8.66 (220)	22.24 (565)	20.98 (533)	18.50 (470)	20.39 (518)	6.22 (158)	16.14 (410)	401.3 (182)
4EU52	8.66 (220)	0.49 (12.5)	0.49 (12.5)	M 10	M 12	9.53 (242)	22.24 (565)	20.98 (533)	18.50 (470)	20.39 (518)	7.20 (183)	16.14 (410)	476.3 (216)

Rated current I_{LN} A	a_1 in (mm)	a_2	a_3	a_4	a_5	a_6	a_7
45 to 80	0.79 (20)	0.79 (20)	0.12 (3)	0.39 (10)	0.35 (9)	–	–
81 to 200	0.98 (25)	0.98 (25)	0.20 (5)	0.49 (12.5)	0.43 (11)	–	–
201 to 315	1.18 (30)	1.18 (30)	0.24 (6)	0.59 (15)	0.55 (14)	–	–
316 to 800	1.57 (40)	1.57 (40)	0.24 (6)	0.79 (20)	0.55 (14)	–	–
801 to 1000	1.57 (40)	1.57 (40)	0.31 (8)	0.79 (20)	0.55 (14)	–	–
1001 to 1600	2.36 (60)	2.36 (60)	0.47 (12)	0.67 (17)	0.55 (14)	1.02 (26)	1.02 (26)



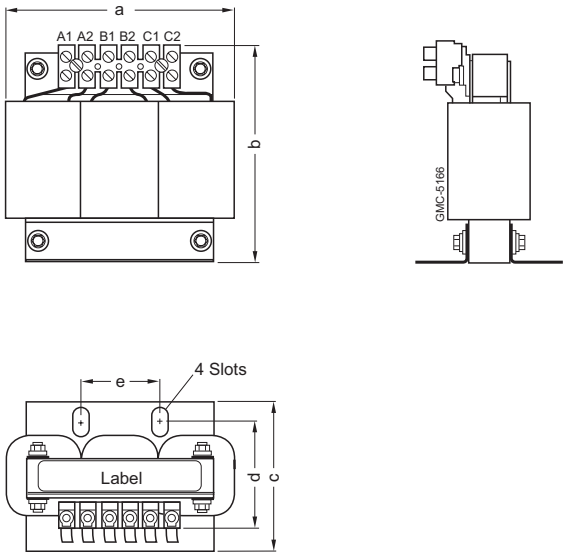


Fig. 45

Type	a		b		c		d		e		Mtg. slot	Wire range AWG	Terminal max. torque	Weight	
	in	(mm)	in	(mm)	in	(mm)	in	(mm)	in	(mm)	in			lb	(kg)
LR4730SL	4.4	(111.8)	4.1	(104.1)	2.8	(71.1)	2	(50.8)	1.44	(36.6)	0.281	22 – 14	4.5	4	(1.8)
LR4730TL	4.4	(111.8)	4.1	(104.1)	3.1	(78.7)	2.35	(59.7)	1.44	(36.6)	0.281	22 – 14	4.5	5	(2.3)
LR47301L	6	(152.4)	4.8	(121.9)	3.4	(86.4)	2.5	(63.5)	2	(50.8)	0.31 x 0.62	22 – 14	4.5	11	(5.0)
LR47302L	6	(152.4)	4.8	(121.9)	3	(76.2)	2.1	(53.3)	2	(50.8)	0.31 x 0.62	22 – 5	4.5	8	(3.6)
LR47303L	6	(152.4)	5	(127.0)	3.3	(83.8)	2.1	(53.3)	2	(50.8)	0.31 x 0.62	22 – 5	16	10	(4.5)
LR47304L	6	(152.4)	5.3	(134.6)	3.5	(88.9)	2.5	(63.5)	2	(50.8)	0.31 x 0.62	22 – 5	16	12	(5.4)
LR47305L	7.2	(182.9)	6	(152.4)	3.4	(86.4)	2.3	(58.4)	3	(76.2)	0.38 x 0.75	22 – 5	16	14	(6.3)
LR473A6L	7.2	(182.9)	5.7	(144.8)	4	(101.6)	2.6	(66.0)	3	(76.2)	0.38 x 0.75	22 – 5	16	16	(7.2)
LR47306L	7.2	(182.9)	5.7	(144.8)	4	(101.6)	2.6	(66.0)	3	(76.2)	0.38 x 0.75	22 – 5	16	16	(7.2)
LR47307L	9	(228.6)	7.4	(188.0)	4.8	(121.9)	3.2	(81.3)	3	(76.2)	0.38 x 0.75	18 – 4	16	28	(12.7)
LR47501L	6	(152.6)	4.8	(121.9)	3.4	(86.4)	2.5	(63.5)	2	(50.8)	0.31 x 0.62	22 – 14	4.5	13	(5.9)
LR47502L	6	(152.6)	4.8	(121.9)	3.4	(86.4)	2.6	(66.0)	2	(50.8)	0.31 x 0.62	22 – 14	4.5	11	(5.0)
LR47503L	6	(152.6)	4.8	(121.9)	3.1	(78.7)	2.1	(53.3)	2	(50.8)	0.31 x 0.62	22 – 5	16	10	(4.5)
LR47504L	8	(203.2)	6	(152.4)	4	(101.6)	2.6	(66.0)	3	(76.2)	0.38 x 0.75	22 – 5	16	16	(7.2)
LR47505L	7.2	(182.9)	5.7	(144.8)	4.3	(109.2)	3.1	(78.7)	3	(76.2)	0.38 x 0.75	22 – 5	16	20	(9.1)
LR475A6L	9	(228.6)	7.4	(188.0)	4.8	(121.9)	3.2	(81.3)	3	(76.2)	0.38 x 0.75	18 – 4	20	30	(13.6)
LR47506L	9	(228.6)	7.4	(188.0)	4.8	(121.9)	3.2	(81.3)	3	(76.2)	0.38 x 0.75	18 – 4	20	30	(13.6)
LR47507L	9	(228.6)	7	(177.8)	4.8	(121.9)	3.2	(81.3)	3	(76.2)	0.38 x 0.75	18 – 4	16	28	(12.7)
LR57301L	4.4	(111.8)	4.1	(104.1)	3.1	(78.7)	2.35	(59.7)	1.44	(36.6)	0.281	22 – 14	4.5	5	(2.3)
LR57302L	6	(152.4)	5	(127.0)	3.4	(86.4)	2.6	(66.0)	2	(50.8)	0.31 x 0.62	22 – 14	4.5	11	(5.0)
LR57303L	6	(152.4)	4.8	(121.9)	3	(76.2)	2.1	(53.3)	2	(50.8)	0.31 x 0.62	22 – 14	4.5	8	(3.6)
LR57304L	6	(152.4)	5	(127.0)	3.3	(83.8)	2.1	(53.3)	2	(50.8)	0.31 x 0.62	22 – 5	16	10	(4.5)
LR57305L	6	(152.4)	5.3	(134.6)	3.5	(88.9)	2.48	(62.99)	2	(50.8)	0.31 x 0.62	22 – 5	16	12	(5.4)
LR573A6L	7.25	(184.15)	6	(152.4)	3.5	(88.9)	2.35	(59.7)	3	(76.2)	0.38 x 0.75	22 – 5	16	14	(6.3)
LR57306L	7.25	(184.15)	6	(152.4)	3.5	(88.9)	2.35	(59.7)	3	(76.2)	0.38 x 0.75	22 – 5	16	14	(6.3)
LR57307L	7.25	(184.15)	5.8	(147.3)	4	(101.6)	2.6	(66.0)	3	(76.2)	0.38 x 0.75	22 – 5	16	16	(7.2)
LR57308L	9	(228.6)	7.4	(188.0)	4.7	(119.4)	3.16	(80.3)	3	(76.2)	0.38 x 0.75	18 – 4	16	28	(12.7)
LR57501L	4.4	(111.8)	4.1	(104.1)	3.4	(86.4)	2.6	(66.0)	1.44	(36.6)	0.281	22 – 14	4.5	6	(2.7)
LR57502L	6	(152.4)	4.8	(121.9)	3.4	(86.4)	2.48	(63.0)	2	(50.8)	0.31 x 0.62	22 – 14	4.5	13	(5.9)
LR57503L	6	(152.4)	5	(127.0)	3.4	(86.4)	2.62	(66.6)	2	(50.8)	0.31 x 0.62	22 – 14	4.5	11	(5.0)
LR57504L	6	(152.4)	5	(127.0)	3.9	(99.1)	2.75	(69.8)	2	(50.8)	0.31 x 0.62	22 – 5	16	18	(8.2)
LR57505L	8	(203.2)	6	(152.4)	4	(101.6)	2.6	(66.0)	3	(76.2)	0.38 x 0.75	22 – 5	16	16	(7.2)
LR575A6L	7.2	(182.9)	5.8	(147.3)	4.3	(109.2)	3.1	(78.7)	3	(76.2)	0.38 x 0.75	22 – 5	16	20	(9.1)
LR57506L	7.2	(182.9)	5.8	(147.3)	4.3	(109.2)	3.1	(78.7)	3	(76.2)	0.38 x 0.75	22 – 5	16	20	(9.1)
LR57507L	9	(228.6)	7	(177.8)	4.8	(121.9)	3.2	(81.3)	3	(76.2)	0.38 x 0.75	18 – 4	16	30	(13.6)
LR57508L	9	(228.6)	7.3	(185.4)	5.3	(134.6)	3.66	(92.96)	3	(76.2)	0.38 x 0.75	18 – 4	16	39	(17.7)

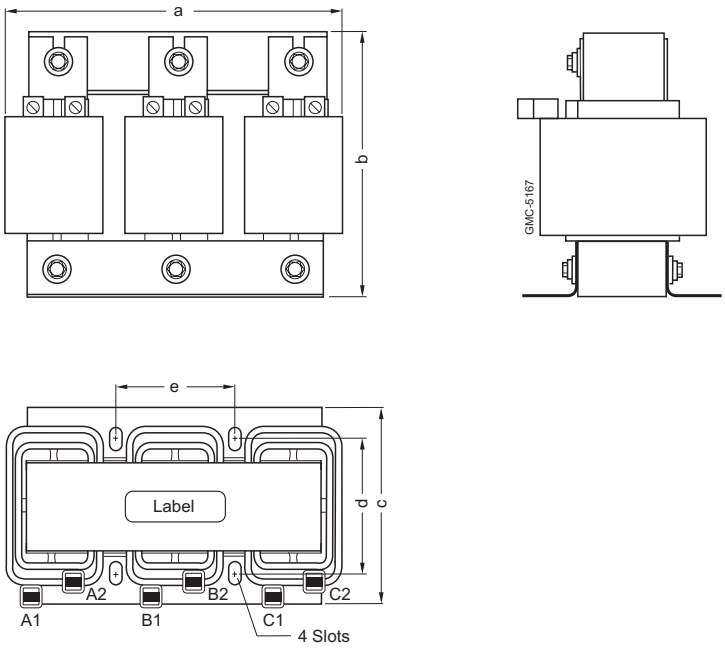
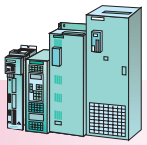


Fig. 46

Type	a		b		c		d		e		Mtg. slot	Wire range AWG	Terminal max. torque	Weight	
	in	(mm)	in	(mm)	in	(mm)	in	(mm)	in	(mm)	in			lb	(kg)
LR47308L	9	(228.6)	7	(177.8)	5.3	(134.6)	3.2	(81.3)	3	(76.2)	0.38 x 0.75	6 – 0	45	27	(12.2)
LR473A9L	10.8	(274.3)	8.5	(215.9)	6.5	(165.1)	3.5	(88.9)	3.6	(91.4)	0.38 x 0.75	6 – 0	45	51	(23.1)
LR47309L	10.8	(274.3)	8.2	(208.3)	5.8	(147.3)	3.6	(91.4)	3.6	(91.4)	0.38 x 0.75	6 – 0	45	51	(23.1)
LR47310L	10.8	(274.3)	8.4	(213.4)	6.75	(171.45)	3.66	(92.96)	3.63	(92.20)	0.38 x 0.75	2 – 0000	150	62	(28.1)
LR47311L	10.8	(274.3)	8.5	(215.9)	6.75	(171.45)	3.66	(92.96)	3.63	(92.20)	0.38 x 0.75	2 – 0000	150	62	(28.1)
LR47312L	11	(279.4)	8.5	(215.9)	7	(177.8)	3.47	(88.14)	3.63	(92.20)	0.38 x 0.75	2 – 0000	150	51	(23.1)
LR47313L	11.5	(292.1)	8.5	(215.9)	8.3	(210.8)	4.41	(112.01)	3.6	(91.4)	0.38 x 0.75	2 – 0000	150	67	(30.4)
LR47508L	10.8	(274.3)	8.4	(213.4)	6.3	(160.0)	4.6	(116.8)	3.6	(91.4)	0.38 x 0.75	6 – 0	45	61	(27.7)
LR475A9L	10.8	(274.3)	8.4	(213.4)	6.3	(160.0)	4.2	(106.7)	3.6	(91.4)	0.38 x 0.75	6 – 0	45	74	(33.6)
LR47509L	10.8	(274.3)	8.4	(213.4)	6.3	(160.0)	4.2	(106.7)	3.6	(91.4)	0.38 x 0.75	6 – 0	45	74	(33.6)
LR47510L	10.8	(274.3)	8.2	(208.3)	5.8	(147.3)	3.6	(91.4)	3.6	(91.4)	0.38 x 0.75	6 – 0	45	51	(23.1)
LR47511L	11.3	(287.0)	8.5	(215.9)	8.5	(215.9)	4.16	(105.66)	3.6	(91.4)	0.38 x 0.75	2 – 0000	150	64	(29.0)
LR47512L	11.3	(287.0)	8.5	(215.9)	9	(228.6)	4.66	(118.36)	3.6	(91.4)	0.38 x 0.75	2 – 0000	150	72	(32.6)
LR47513L	11.5	(292.1)	8.5	(215.9)	10	(254.0)	5.91	(150.11)	3.6	(91.4)	0.38 x 0.75	2 – 0000	150	100	(45.3)
LR573A9L	9	(228.6)	7	(177.8)	5.3	(134.6)	3.16	(80.26)	3	(76.2)	0.38 x 0.75	6 – 0	45	27	(12.2)
LR57309L	10.8	(274.3)	8.5	(215.9)	6.5	(165.1)	3.47	(88.14)	3.63	(92.20)	0.38 x 0.75	6 – 0	45	51	(23.1)
LR57310L	10.8	(274.3)	8.5	(215.9)	6.5	(165.1)	3.47	(88.14)	3.63	(92.20)	0.38 x 0.75	6 – 0	45	51	(23.1)
LR57311L	11	(279.4)	8.5	(215.9)	6.7	(170.2)	3.66	(92.96)	3.63	(92.20)	0.375 x 0.75	6 – 0	45	51	(23.1)
LR57312L	10.8	(274.3)	8.5	(215.9)	6.8	(172.7)	3.66	(92.96)	3.63	(92.20)	0.38 x 0.75	2 – 0000	150	62	(28.1)
LR57313L	11	(279.4)	8.5	(215.9)	7	(177.8)	3.47	(88.14)	3.63	(92.20)	0.38 x 0.75	2 – 0000	150	51	(23.1)
LR575A9L	9	(228.6)	7	(177.8)	6	(152.4)	3.91	(99.31)	3	(76.2)	0.38 x 0.75	6 – 0	45	41	(18.6)
LR57509L	10.8	(274.3)	8.5	(215.9)	6.8	(172.7)	4.16	(105.66)	3.63	(92.20)	0.38 x 0.75	6 – 0	45	61	(27.7)
LR57510L	10.8	(274.3)	8.5	(215.9)	6.8	(172.7)	4.16	(105.66)	3.63	(92.20)	0.38 x 0.75	6 – 0	45	61	(27.7)
LR57511L	11	(279.4)	8.5	(215.9)	7.7	(195.6)	4.16	(105.66)	3.63	(92.20)	0.38 x 0.75	6 – 0	45	74	(33.6)
LR57512L	11.3	(287.0)	8.5	(215.9)	8.5	(215.9)	4.16	(105.66)	3.63	(92.20)	0.38 x 0.75	2 – 0000	150	64	(29.0)
LR57513L	11.3	(287.0)	8.5	(215.9)	9	(228.6)	4.66	(118.36)	3.63	(92.20)	0.38 x 0.75	2 – 0000	150	72	(32.6)



Line reactors (NEMA 1 enclosed)

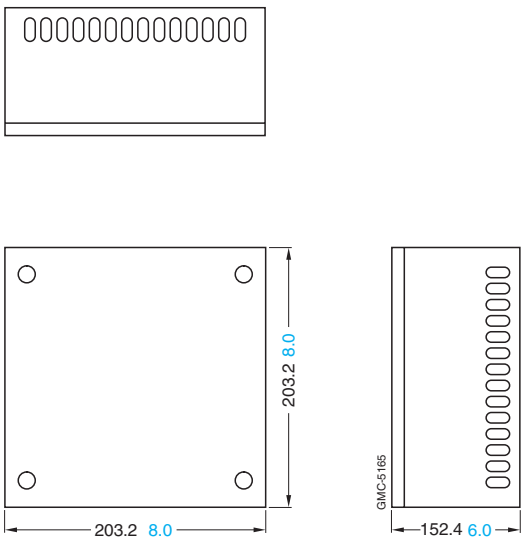


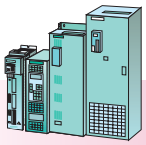
Fig. 47

NEMA Type 1 Wall Mount
weight approx. 7 lb (3.2 kg) in addition to reactor

LR47301LE, LR47302LE, LR47303LE, LR47304LE
LR47501LE, LR47502LE, LR47503LE
LR57301LE, LR57302LE, LR57303LE, LR57304LE, LR57305LE
LR57501LE, LR57502LE, LR57503LE, LR57504LE

7

Dimension in mm
Dimension in inches



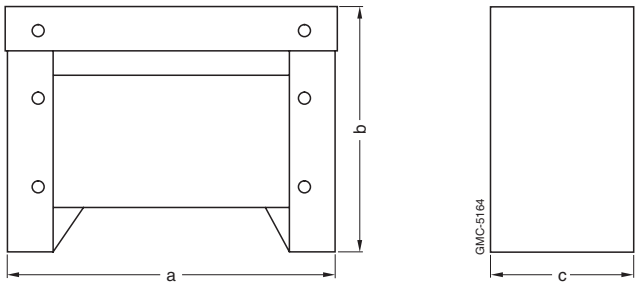
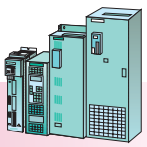


Fig. 48

NEMA Type 1 Floor

Type	Type	Width a		Height b		Depth c		Enclosure weight[1]	
		in	(mm)	in	(mm)	in	(mm)	lb	(kg)
LR47305LE, LR47306LE, LR47307LE, LR47308LE, LR47309LE, LR47310LE, LR47311LE, LR47312LE, LR47313LE, LR473A6LE, LR473A9LE	LR573A6LE, LR57306LE, LR57307LE, LR57308LE, LR573A9LE, LR57309LE, LR57310LE, LR57311LE, LR57312LE, LR57313LE, LR57314LE	13	(330.2)	13	(330.2)	13	(330.2)	18	(8.2)
LR47504LE, LR47505LE, LR47506LE, LR47507LE, LR47508LE, LR47509LE, LR47510LE, LR47511LE, LR47512LE, LR47513LE, LR475A6LE, LR475A9LE	LR57505LE, LR575A6LE, LR57506LE, LR57507LE, LR57508LE, LR57509LE, LR57510LE, LR57511LE, LR57512LE, LR57513LE, LR57514LE								
LR47314LE, LR47315LE, LR47316LE, LR47317LE, LR473B7LE, LR47318LE	LR57315LE, LR57316LE, LR57317LE, LR57318LE, LR57319LE	17	(431.8)	24	(609.6)	17	(431.8)	46	(20.9)
LR47514LE, LR47515LE, LR47516LE, LR47517LE, LR475B7LE, LR47518LE	LR57515LE, LR57516LE, LR57517LE, LR57518LE, LR57519LE								
LR47319LE LR47519LE	LR57320LE LR57520LE	24	(609.6)	30	(762.0)	24	(609.6)	116	(52.6)

1) Enclosure weight in addition to reactor.



Output reactors (iron)

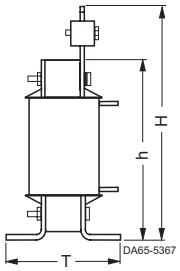


Fig. 49

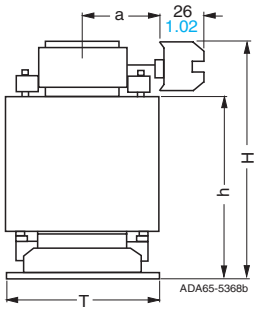


Fig. 50

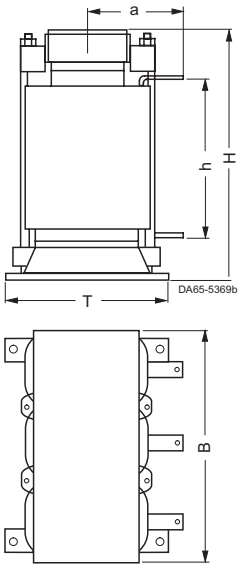


Fig. 51

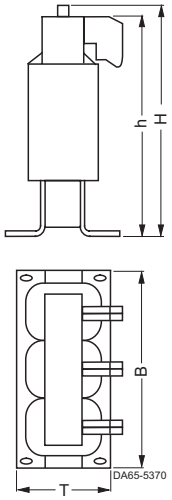
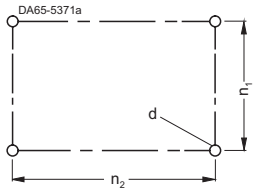


Fig. 52



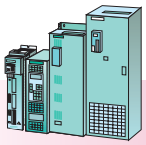
Mounting hole

Output reactors for mounting on horizontal surfaces

Type	Fig. No.	B		H		T		a		h		Weight approx.		n_1		n_2		d
		in	(mm)	in	(mm)	in	(mm)	in	(mm)	in	(mm)	lb	(kg)	in	(mm)	in	(mm)	
6SE7013–0ES87–1FE0	52	4.9	(124)	4.8	(122)	2.8	(73)	–	–	–	–	2.2	(1)	1.6	(42)	–[1]	–[1]	M 4[2]
6SE7015–0ES87–1FE0	52	5.8	(148)	5.8	(139)	3.1	(78)	–	–	–	–	4.8	(2.2)	1.9	(49)	3.5	(90)	M 4[2]
6SE7016–1ES87–1FE0	52	7.0	(178)	6.0	(153)	2.8	(73)	–	–	5.7	(146)	9.7	(4.4)	2.1	(53)	6.5	(166)	M 5[2]
6SE7016–2FS87–1FE0	52	10.5	(267)	8.7	(221)	4.2	(107)	–	–	8.0	(204)	32.0	(14.5)	3.0	(77)	9.8	(249)	M 6[2]
6SE7021–0ES87–1FE0	52	7.0	(178)	6.0	(153)	3.5	(88)	–	–	5.7	(146)	12.1	(5.5)	2.7	(68)	6.5	(166)	M 5[2]
6SE7021–5FS87–1FE0	50	8.1	(207)	8.6	(220)	4.1	(104)	2.2	(55)	–	–	44.1	(20)	2.8	(70.5)	6.9	(176.5)	M 6
6SE7021–8ES87–1FE0	52	8.6	(219)	7.1	(180)	3.9	(99)	–	–	6.6	(168)	17.6	(8)	2.7	(69)	7.9	(201)	M 6[2]
6SE7022–6ES87–1FE0	52	8.6	(219)	7.1	(180)	4.7	(119)	–	–	7.1	(181)	20.3	(9.2)	3.5	(89)	7.9	(201)	M 6[2]
6SE7023–4ES87–1FE0	52	10.5	(267)	8.7	(221)	4.2	(107)	–	–	8.5	(216)	24.3	(11)	3.0	(77)	9.8	(249)	M 6[2]
6SE7024–7ES87–1FE0	51	7.8	(197)	8.6	(220)	4.1	(104)	2.7	(69)	4.1	(103)	44.1	(20)	2.7	(70)	6.9	(176)	M 6
6SE7026–0HS87–1FE0	51	9.3	(235)	9.8	(250)	5.7	(146)	3.8	(98)	–	–	66.1	(30)	4.0	(101)	7.9	(200)	M 8
6SE7027–2ES87–1FE0	49	10.5	(267)	8.7	(221)	4.2	(107)	3.0	(77)	8.1	(206)	24.3	(11)	3.0	(77)	9.8	(249)	M 6[2]
6SE7028–2HS87–1FE0	51	10.4	(264)	11.0	(280)	6.1	(155)	4.0	(101)	–	–	99.2	(45)	0.7	(18)	8.8	(224)	M 8
6SE7031–0ES87–1FE0	49	10.5	(267)	8.7	(221)	4.2	(107)	3.0	(77)	8.1	(206)	37.5	(17)	3.0	(77)	9.8	(249)	M 6
6SE7031–2HS87–1FE0	51	12.4	(314)	13.2	(335)	6.7	(169)	4.3	(109)	–	–	132.3	(60)	5.4	(138)	10.4	(264)	M 8
6SE7031–5ES87–1FE0	51	7.8	(197)	8.6	(220)	5.0	(128)	3.2	(81)	3.9	(100)	55.1	(25)	3.7	(94)	6.9	(176)	M 6
6SE7031–7HS87–1FE0	51	12.4	(314)	13.2	(335)	6.7	(169)	4.3	(109)	–	–	132.3	(60)	5.4	(138)	10.4	(264)	M 8
6SE7031–8ES87–1FE0	51	11.1	(281)	9.8	(250)	5.7	(146)	3.9	(98)	4.7	(119)	66.1	(30)	4.0	(101)	7.9	(200)	M 8
6SE7032–3HS87–1FE0	51	14.4	(367)	15.2	(385)	6.8	(174)	4.4	(112)	–	–	176.4	(80)	5.6	(141.5)	12.5	(316.5)	M 10
6SE7032–6ES87–1FE0	51	11.1	(281)	9.8	(250)	5.7	(146)	4.4	(111)	4.8	(121)	66.1	(30)	4.0	(101)	7.9	(200)	M 8
6SE7033–2ES87–1FE0	51	12.2	(311)	11.0	(280)	6.1	(155)	4.5	(114)	5.5	(139)	99.2	(45)	4.7	(118)	8.8	(224)	M 8
6SE7033–7ES87–1FE0	51	10.4	(264)	11.0	(280)	6.1	(155)	4.0	(101)	–	–	99.2	(45)	4.7	(118)	8.8	(224)	M 8
6SE7035–1ES87–1FE0	51	12.2	(310)	11.0	(280)	6.1	(155)	4.2	(106)	5.9	(150)	99.2	(45)	4.7	(118)	8.8	(224)	M 8
6SE7037–0ES87–1FE0	51	14.2	(360)	13.2	(335)	6.7	(169)	4.5	(114)	7.1	(180)	132.3	(60)	5.4	(138)	10.4	(264)	M 8
6SE7038–6ES87–1FE0	51	16.1	(410)	15.2	(385)	6.8	(174)	5.0	(127)	8.3	(210)	176.4	(80)	5.5	(141)	12.4	(316)	M 10
6SE7022–2FS87–1FE0	51	8.1	(207)	8.6	(220)	5.0	(128)	2.6	(66)	–	–	55.1	(25)	3.7	(94.5)	6.9	(176.5)	M 6
6SE7023–4FS87–1FE0	51	7.8	(197)	8.6	(220)	4.1	(104)	2.8	(72)	4.5	(114)	44.1	(20)	2.8	(70)	6.9	(176)	M 6
6SE7024–7FS87–1FE0	51	7.8	(197)	8.6	(220)	5.0	(128)	3.2	(81)	3.7	(93)	55.1	(25)	5.0	(128)	6.9	(176)	M 6
6SE7033–0GS87–1FE0	51	16.4	(417)	17.1	(435)	7.6	(194)	4.6	(118)	–	–	264.6	(120)	6.1	(155.5)	14.0	(356.5)	M 12
6SE7033–5GS87–1FE0	51	16.4	(417)	17.1	(435)	7.6	(194)	4.6	(118)	–	–	264.6	(120)	6.1	(155.5)	14.0	(356.5)	M 12
6SE7034–5GS87–1FE0	51	16.4	(417)	17.1	(435)	9.9	(251)	5.8	(147)	9.4	(240)	352.8	(160)	8.4	(212.5)	14.0	(356.5)	M 12
6SE7035–7GS87–1FE0	51	21.0	(533)	22.2	(565)	8.1	(207)	–	–	–	–	374.8	(170)	6.7	(170.5)	16.2	(411)	M 10
6SE7036–5GS87–1FE0	51	21.0	(533)	22.2	(565)	9.3	(235)	–	–	–	–	485.1	(220)	7.8	(198.5)	16.2	(411)	M 10
6SE7038–6GS87–1FE0	51	23.9	(608)	25.6	(650)	9.6	(245)	–	–	–	–	617.4	(280)	7.7	(195.5)	18.5	(471)	M 12
6SE7041–1ES87–1FE0	51	16.5	(420)	15.0	(380)	9.2	(233)	6.3	(160)	10.0	(255)	220.5	(100)	8.0	(203)	12.4	(316)	M 10
6SE7041–2GS87–1FE0	51	23.9	(608)	25.6	(650)	12.2	(310)	9.4	(240)	15.2	(385)	683.6	(310)	8.4	(213)	18.5	(470)	M 12

1) Fixing hole in the center of the foot.
2) For any mounting position.

Dimension in mm
Dimension in inches



Compact PLUS/compact and chassis units · cabinet units

Output reactor (ferrite)

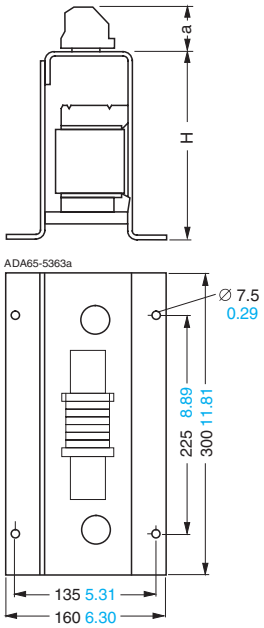


Fig. 53

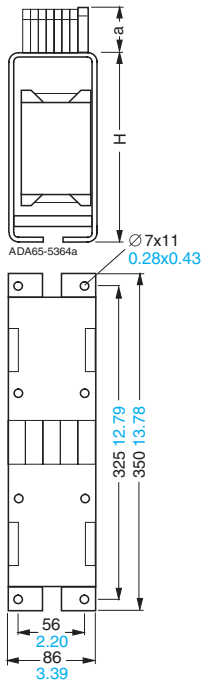


Fig. 54

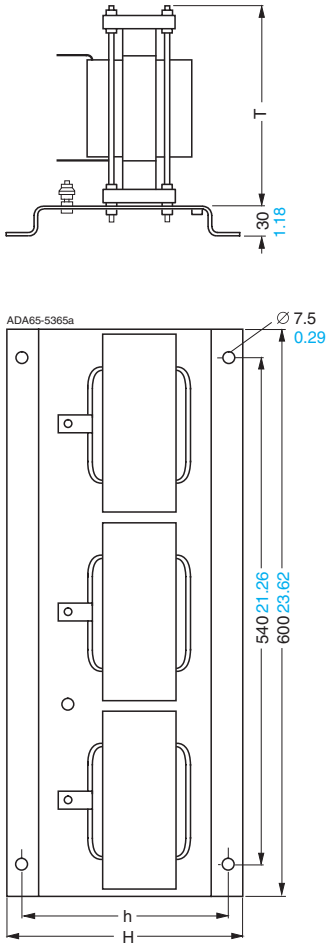


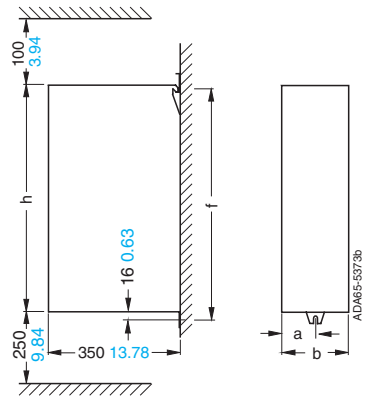
Fig. 55

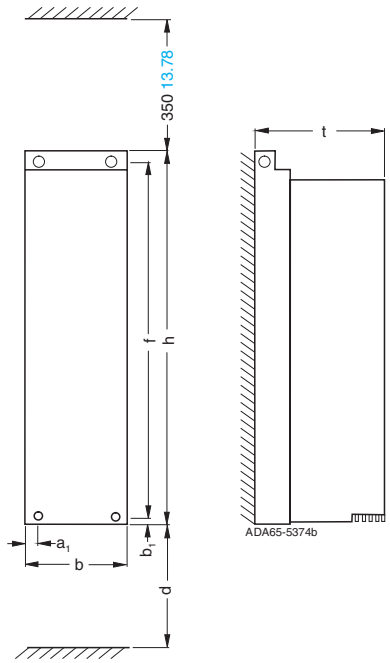
Type	Fig. No.	a		H		h		D		Weight approx.	
		in	(mm)	in	(mm)	in	(mm)	in	(mm)	lb	(kg)
6SE7021–1CS87–1FF0	53	2.0	(50)	7.2	(184)	–	–	–	–	9.9	(4.5)
6SE7021–3CS87–1FF0	53	2.0	(50)	7.2	(184)	–	–	–	–	9.9	(4.5)
6SE7021–8CS87–1FF0	53	2.0	(50)	7.2	(184)	–	–	–	–	12.8	(5.8)
6SE7022–3CS87–1FF0	53	2.0	(50)	7.2	(184)	–	–	–	–	13.2	(6)
6SE7023–2CS87–1FF0	53	2.0	(50)	7.2	(184)	–	–	–	–	10.6	(4.8)
6SE7024–4CS87–1FF0	53	2.0	(50)	7.2	(184)	–	–	–	–	13.2	(6)
6SE7027–0CS87–1FF0	53	2.0	(50)	7.2	(184)	–	–	–	–	16.3	(7.4)
6SE7028–1CS87–1FF0	53	2.0	(50)	11.0	(280)	–	–	–	–	19.4	(8.8)
6SE7016–1ES87–1FF1	54	2.0	(50)	9.1	(230)	–	–	–	–	18.7	(8.5)
6SE7021–0ES87–1FF1	54	2.0	(50)	9.1	(230)	–	–	–	–	18.7	(8.5)
6SE7021–8ES87–1FF1	54	2.0	(50)	9.1	(230)	–	–	–	–	18.7	(8.5)
6SE7022–6ES87–1FF0	53	2.0	(50)	11.0	(280)	–	–	–	–	20.9	(9.5)
6SE7023–4ES87–1FF0	53	2.0	(50)	11.0	(280)	–	–	–	–	26.5	(12)
6SE7024–7ES87–1FF0	53	2.4	(60)	11.0	(280)	–	–	–	–	36.2	(16.4)
6SE7027–2ES87–1FF0	53	2.0	(50)	11.0	(280)	–	–	–	–	30.9	(14)
6SE7031–0ES87–1FF0	53	2.4	(60)	11.0	(280)	–	–	–	–	36.8	(16.7)
6SE7016–2FS87–1FF0	53	2.0	(50)	11.0	(280)	–	–	–	–	28.7	(13)
6SE7021–5FS87–1FF0	53	2.0	(50)	11.0	(280)	–	–	–	–	30.9	(14)
6SE7031–5ES87–1FF0	55	–	–	10.0	(255)	8.9	(225)	10.2	(260)	50.7	(23)
6SE7031–8ES87–1FF0	55	–	–	10.0	(255)	8.9	(225)	10.2	(260)	68.3	(31)
6SE7022–2FS87–1FF0	55	–	–	10.0	(255)	8.9	(225)	10.2	(260)	41.9	(19)
6SE7023–4FS87–1FF0	55	–	–	10.0	(255)	8.9	(225)	10.2	(260)	46.3	(21)
6SE7024–7FS87–1FF0	55	–	–	10.0	(255)	8.9	(225)	10.2	(260)	59.5	(27)
6SE7032–6ES87–1FF0	55	–	–	11.6	(295)	10.6	(270)	10.6	(260)	70.6	(32)
6SE7033–2ES87–1FF0	55	–	–	11.6	(295)	10.6	(270)	10.6	(260)	90.4	(41)
6SE7033–7ES87–1FF0	55	–	–	11.6	(295)	10.6	(270)	10.6	(260)	99.2	(45)
6SE7035–1ES87–1FF0	55	–	–	11.6	(295)	10.6	(270)	11.0	(280)	114.7	(52)
6SE7037–0ES87–1FF0	55	–	–	11.6	(295)	10.6	(270)	11.0	(280)	143.3	(65)
6SE7038–6ES87–1FF0	55	–	–	15.2	(385)	14.2	(360)	10.6	(260)	178.6	(81)

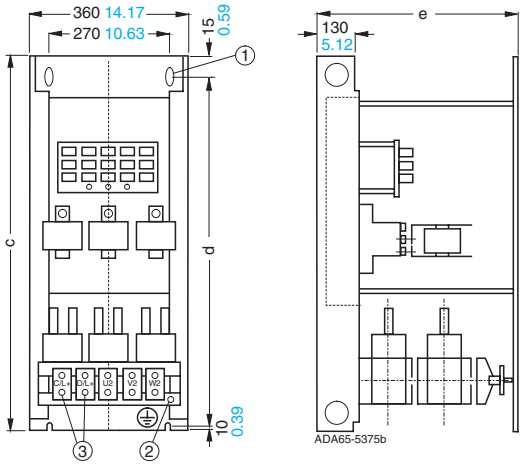
Dimension in mm
Dimension in inches

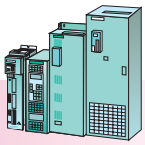
Dimension Drawings

Voltage limiting filters









Compact PLUS/compact and chassis units · cabinet units

Type	$a^{1)}$		b		f		h		Weight approx.	
	in	(mm)	in	(mm)	in	(mm)	in	(mm)	lb	(kg)
d*v*/d*t* filter, sine filter										
6SE70 . . – . . A	1.8	(45)	3.5	(90)	16.7	(425)	16.7	(425)	28.7	(13)
6SE70 . . – . . B	2.7	(67.5)	5.3	(135)	16.7	(425)	16.7	(425)	44.1	(20)
6SE70 . . – . . C	3.5	(90)	7.1	(180)	23.6	(600)	23.6	(600)	81.6	(37)
6SE70 . . – . . D	1.8	(45)	10.6	(270)	23.6	(600)	23.6	(600)	123.5	(56)

Fig. 56

d*v*/d*t* filter and sine filter
6SE70 . . – . . A to 6SE70 . . – . . D

Type	$a^{2)}$	b	b_1	d	f	h	t	Weight approx.
	in (mm)							lb (kg)
Sine filter								
6SE70 . . – . . E	1.8 (45)	10.6 (270)	0.4 (10)	15.7 (400)	40.4 (1025)	41.3 (1050)	13.8 (350)	198.5 (90)
6SE70 . . – . . F	1.8 (45)	14.2 (360)	0.4 (10)	15.7 (400)	40.4 (1025)	41.3 (1050)	13.8 (350)	286.6 (130)
6SE70 . . – . . G	4.7 (119)	20.0 (508)	1.0 (25)	12.6 (320)	56.1 (1425)	57.1 (1450)	17.7 (450)	374.8 (170)
d*v*/d*t* filter								
6SE70 . . – . . E	1.8 (45)	10.6 (270)	0.4 (10)	15.7 (400)	40.4 (1025)	41.3 (1050)	13.8 (350)	121.3 (55)
6SE70 . . – . . S$^{3)}$	1.8 (45)	10.6 (270)	0.4 (10)	15.7 (400)	56.1 (1425)	57.1 (1450)	17.7 (450)	209.5 (95)

Fig. 57

d*v*/d*t* filter and sine filter
6SE70 . . – . . E to 6SE70 . . – . . G, 6SE70 . . – . . S

Type	c		d		e	
	in	(mm)	in	(mm)	in	(mm)
6SE70 . 3– . . S	26.6	(675)	25.6	(650)	14.6	(370)
6SE70 . 4– . . S	26.6	(675)	25.6	(650)	19.3	(490)
6SE70 . 5– . . S	26.6	(675)	25.6	(650)	19.3	(490)
6SE70 . 6– . . S	41.3	(1050)	40.5	(1025)	19.3	(490)
6SE70 . 7– . . S	41.3	(1050)	40.5	(1025)	19.3	(490)
6SE70 . 8– . . S	41.3	(1050)	40.5	(1025)	19.3	(490)

① For M 8 screws
② Earthing stud
③ DC link

Fig. 58

Limiting network for d*v*/d*t* filter

At rated currents ≥ 297 A, the voltage limiting filter consists of a limiting network and a reactor.

1) For frame size D two lugs left and right.

2) Two lugs left and right.

3) 6SE7031– . HS87–1FD0, 6SE7032– . HS87–1FD0

Dimension in mm
Dimension in inches

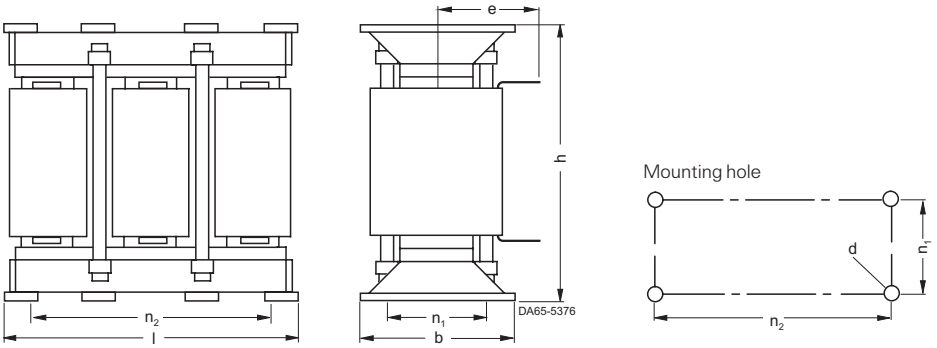
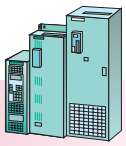
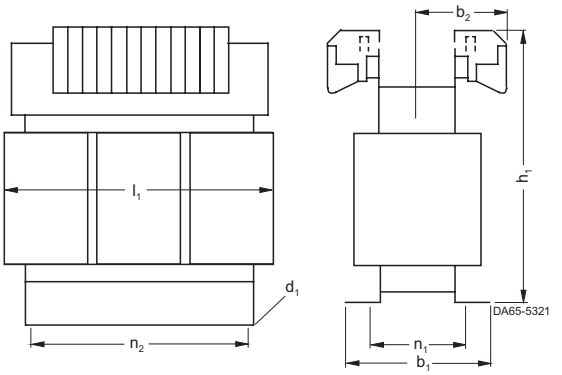


Fig. 59

6SE70 . 3– . . S reactor to 6SE70 . 8– . . S for d*v*/d*t* filter

Type	b		d	e		h		l		n_1		n_2	
	in	(mm)		in	(mm)	in	(mm)	in	(mm)	in	(mm)	in	(mm)
6SE70 . 3– . . S	7.63	(194)	M 12	5.24	(133)	17.13	(435)	16.38	(416)	6.10	(155)	14.02	(356)
6SE70 . 4– . . S	9.88	(251)	M 12	6.26	(159)	17.13	(435)	16.38	(416)	8.35	(212)	14.02	(356)
6SE70 . 5– . . S	8.15	(207)	M 10	7.32	(186)	22.24	(565)	18.50	(470)	6.69	(170)	16.14	(410)
6SE70 . 6– . . S	9.25	(235)	M 10	8.35	(212)	22.24	(565)	18.50	(470)	7.79	(198)	16.14	(410)
6SE70 . 8– . . S	9.65	(245)	M 12	8.54	(217)	25.59	(650)	18.50	(540)	7.79	(198)	18.50	(470)





Mounting hole acc. to DIN 41 308

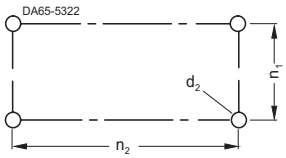


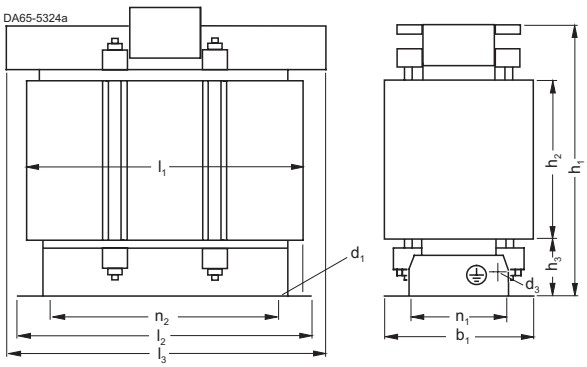
Fig. 60

Autotransformers 4AP25 to 4AP30
for any mounting position

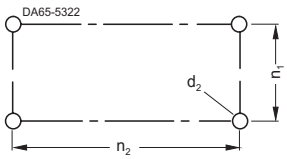
Type	Designation acc. to DIN 41 302	b_1 in (mm)	b_2	d_1	d_2	h_1	l_1	n_1	n_2	Weight approx. lb (kg)
4AP25	3UI 114/62	4.53 (115)	3.35 (85)	0.29 (7.4)	M 6	8.43 (214)	9.02 (229)	3.70 (94)	6.93 (176)	41.89 (19)
4AP27	3UI 132/70	5.24 (133)	3.50 (89)	0.39 (10)	M 8	9.49 (241)	10.39 (264)	3.98 (101)	7.87 (200)	57.33 (26)
4AP30	3UI 150/75	5.83 (148)	3.62 (92)	0.39 (10)	M 8	10.63 (270)	11.81 (300)	4.65 (118)	8.82 (224)	1.46 (37)

Screw terminals

24 A:	solid	0.5 to 6 mm²
	finely stranded	0.5 to 4 mm²
58 A:	solid or stranded	1 to 25 mm²
	finely stranded	2.5 to 16 mm²
94 A:	solid or stranded	4 to 50 mm²



Mounting hole acc. to DIN 41 308



Flat terminals

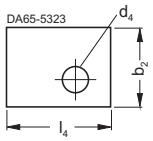


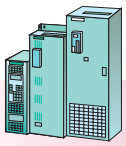
Fig. 61

Autotransformers 4AU36 to 4AU39
with flat terminals, for any mounting position

Permissible constant load for mounting position on vertical surfaces:
$0.95 \cdot P_s$ at $t_a = 131$ °F (55 °C)
P_s at $t_a = 113$ °F (45 °C)

Form	Nominal current A	b_2 in (mm)	d_4	l_4
A	100	0.63 (16)	0.28 (7)	0.98 (25)
A	200	0.79 (20)	0.35 (9)	1.38 (35)
A	400	0.98 (25)	0.43 (11)	1.38 (35)

Type	Designation acc. to DIN 41 302	b_1 in (mm)	d_1	d_2	d_3	h_1	h_2	h_3	l_1	l_2	l_3	n_1	n_2	Weight approx. lb (kg)
4AU36	3UI 180/75	6.65 (169)	0.39 (10)	M 8	M 6	12.60 (320)	5.91 (150)	2.36 (60)	14.17 (360)	12.36 (314)	14.17 (360)	5.43 (138)	10.39 (264)	130.01 (59)
4AU39	3UI 210/70	6.85 (174)	0.47 (12)	M 10	M 6	14.57 (370)	7.09 (180)	2.60 (66)	16.54 (420)	14.41 (366)	16.14 (410)	5.55 (141)	12.44 (316)	178.61 (81)



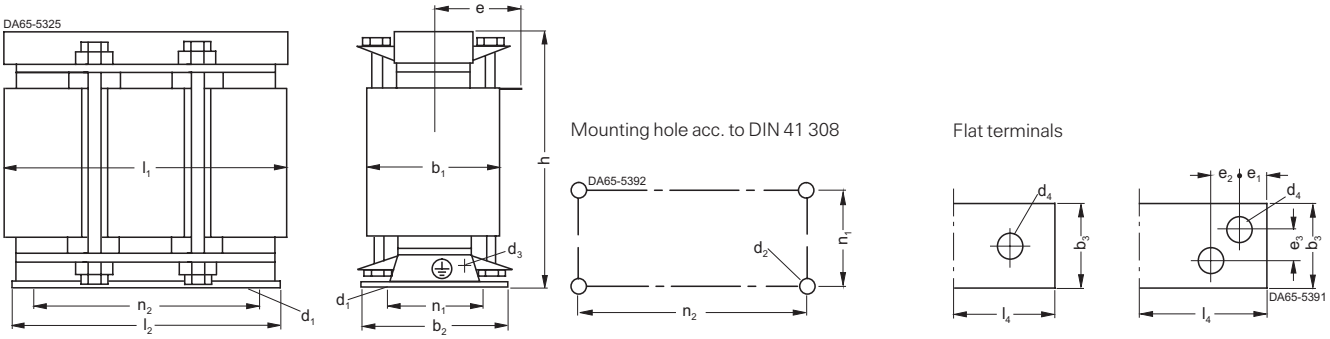


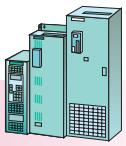
Fig. 62

Autotransformers 4BU
with flat terminals, for arrangement on horizontal surfaces

Form	Nominal current	b_3		d_4		e_1		e_2		e_3		l_4	
	A	in	(mm)	in	(mm)	in	(mm)	in	(mm)	in	(mm)	in	(mm)
A	200	0.79	(20)	0.35	(9)	–	–	–	–	–	–	1.38	(35)
A	400	0.98	(25)	0.43	(11)	–	–	–	–	–	–	1.38	(35)
A	630	1.18	(30)	0.43	(11)	–	–	–	–	–	–	1.57	(40)
A	800	1.18	(30)	0.55	(14)	–	–	–	–	–	–	1.57	(40)
A	1000	1.57	(40)	0.55	(14)	–	–	–	–	–	–	1.97	(50)
C	1250	1.97	(50)	0.55	(14)	0.55	(14)	0.87	(22)	0.87	(22)	2.36	(60)
C	1600	2.36	(60)	0.55	(14)	0.67	(17)	1.02	(26)	1.02	(26)	2.76	(70)

above 1600 A on request

Type	Designation acc. to DIN 41 302	b_1		b_2		d_1		d_2	d_3	h		l_1		l_2		n_1		n_2		Weight approx.	
		in	(mm)	in	(mm)	in	(mm)			in	(mm)	in	(mm)	in	(mm)	in	(mm)	in	(mm)	lb	(kg)
4BU43	3UI 240/ 80	7.64	(194)	7.64	(194)	0.59 x 0.87	(15 x 22)	M 12	M 6	16.54	(420)	18.90	(480)	16.38	(416)	6.10	(155)	14.02	(356)	238.1	(108)
4BU45	3UI 240/107	8.70	(221)	8.70	(221)	0.59 x 0.87	(15 x 22)	M 12	M 6	16.54	(420)	18.90	(480)	16.38	(416)	7.16	(182)	14.02	(356)	297.7	(135)
4BU47	3UI 240/137	9.88	(251)	9.88	(251)	0.59 x 0.87	(15 x 22)	M 12	M 6	16.54	(420)	18.90	(480)	16.38	(416)	8.35	(212)	14.02	(356)	374.8	(170)
4BU51	3UIS 265/107	10.51	(267)	8.15	(207)	0.49	(12.5)	M 10	M 12	20.28	(515)	21.85	(555)	18.50	(470)	6.69	(170)	16.14	(410)	396.9	(180)
4BU52	3UIS 265/120	11.02	(280)	8.66	(220)	0.49	(12.5)	M 10	M 12	20.28	(515)	21.85	(555)	18.50	(470)	7.20	(183)	16.14	(410)	441.0	(200)
4BU53	3UIS 265/135	11.61	(295)	9.25	(235)	0.49	(12.5)	M 10	M 12	20.28	(515)	21.85	(555)	18.50	(470)	7.79	(198)	16.14	(410)	485.1	(220)
4BU54	3UIS 305/125	11.61	(295)	9.65	(245)	0.59	(15)	M 12	M 12	23.03	(585)	24.80	(630)	21.26	(540)	7.79	(198)	18.50	(470)	617.4	(280)
4BU55	3UIS 305/140	12.20	(310)	10.24	(260)	0.59	(15)	M 12	M 12	23.03	(585)	24.80	(630)	21.26	(540)	8.38	(213)	18.50	(470)	683.6	(310)
4BU56	3UIS 305/160	12.99	(330)	11.02	(280)	0.59	(15)	M 12	M 12	23.03	(585)	24.80	(630)	21.26	(540)	9.17	(233)	18.50	(470)	815.5	(370)
4BU58	3UIS 370/150	12.99	(330)	11.42	(290)	0.59	(15)	M 12	M 12	26.18	(665)	30.71	(780)	25.98	(660)	9.49	(241)	22.83	(580)	970.2	(440)
4BU59	3UIS 370/170	13.78	(350)	12.20	(310)	0.59	(15)	M 12	M 12	26.18	(665)	30.71	(780)	25.98	(660)	10.27	(261)	22.83	(580)	1058.4	(480)
4BU60	3UIS 370/195	14.76	(375)	13.19	(335)	0.59	(15)	M 12	M 12	26.18	(665)	30.71	(780)	25.98	(660)	11.26	(286)	22.83	(580)	1323.0	(600)
4BU62	3UIS 455/175	15.94	(405)	12.40	(315)	0.83	(21)	M 16	M 12	29.92	(760)	38.38	(975)	32.28	(820)	10.27	(261)	28.35	(720)	1587.6	(720)
4BU63	3UIS 455/200	16.93	(430)	13.39	(340)	0.83	(21)	M 16	M 12	29.92	(760)	38.38	(975)	32.28	(820)	11.73	(298)	28.35	(720)	1896.3	(860)
4BU64	3UIS 455/230	18.11	(460)	14.57	(370)	0.83	(21)	M 16	M 12	29.92	(760)	38.38	(975)	32.28	(820)	12.72	(323)	28.35	(720)	2293.2	(1040)
4BU65	3UIS 455/260	19.29	(490)	15.75	(400)	0.83	(21)	M 16	M 12	29.92	(760)	38.38	(975)	32.28	(820)	13.90	(353)	28.35	(720)	2579.8	(1170)



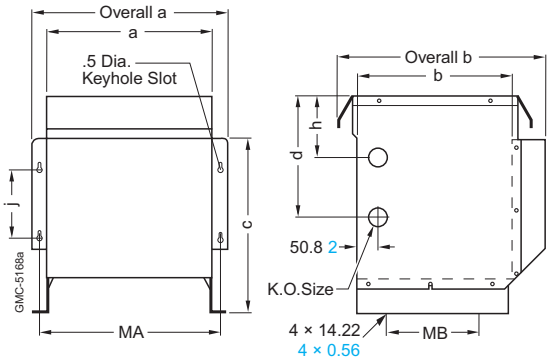


Fig. 63

NH5 & NH6 style enclosures

Enclosure style	Width a in (mm)	Overall width a in (mm)	Depth b in (mm)	Overall depth b in (mm)	Height c in (mm)	Mounting center MA in (mm)	Mounting center MB in (mm)	Bottom K.O. d in (mm)	Top K.O. h in (mm)	Mounting center j in (mm)	K.O. size in (mm)
NH5	16.75 (425)	19.4 (493)	15 (381)	20.20 (513)	21.5 (546)	18 (457)	9 (229)	12 (305)	6 (152)	7 (178)	1.38 x 1.75 (35 x 44.5)
NH6	21.5 (546)	23.9 (607)	19.5 (495)	25.0 (635)	28.75 (730)	22.75 (578)	9 (229)	17 (432)	8.5 (216)	8 (203)	1.38 x 2.5 (35 x 63.5)

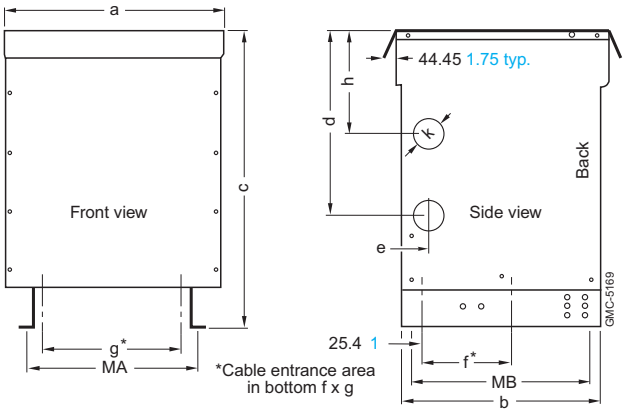


Fig. 64

NH3 and NH4 enclosures

Case style	a in (mm)	b	c	d	e	f	g	h	k	MA	MB
NH3	26.00 (660.40)	21.00 (533.40)	38.00 (965.20)	24.00 (609.60)	3.00 (76.20)	4.75 (120.65)	18.00 (457.20)	8.00 (203.20)	2.00 x 3.00 (50.80 x 76.20)	21.50 (546.10)	19.00 (482.60)
NH4	32.00 (812.80)	25.50 (647.70)	41.00 (1041.40)	24.00 (609.60)	3.00 (76.20)	3.75 (95.25)	20.00 (508.00)	9.00 (228.60)	2.00 x 3.00 (50.80 x 76.20)	23.50 (596.90)	22.00 (558.80)

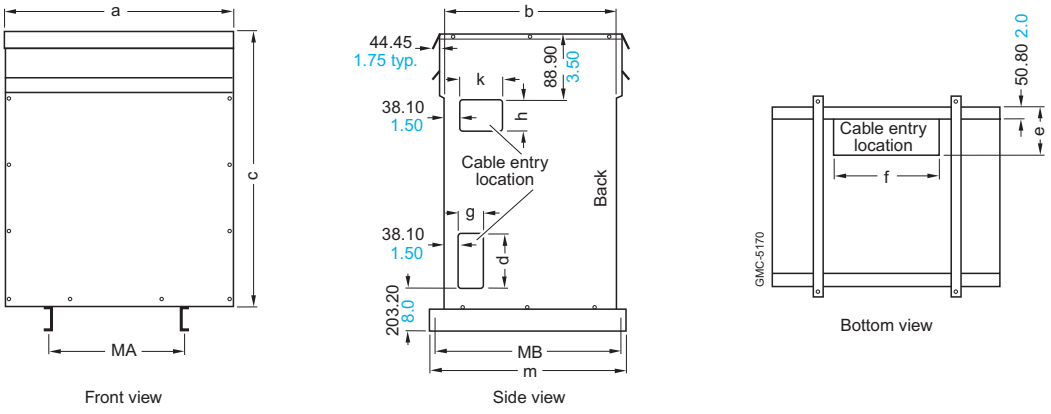


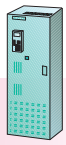
Fig. 65

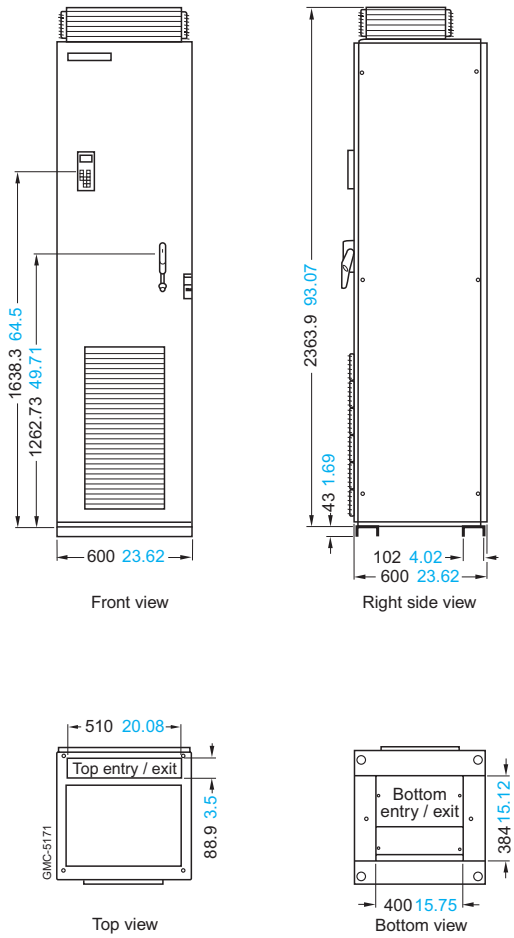
NJ series enclosures

Case style	a in (mm)	b	c	d	e	f	g	h	k	m	MA	MB
NJ1	39.50 (1003.30)	30.00 (762.00)	51.50 (1308.10)	10.00 (254.00)	7.50 (190.50)	21.50 (546.10)	8.00 (203.20)	6.50 (165.10)	13.50 (342.90)	34.00 (863.60)	24.00 (609.60)	32.00 (812.80)
NJ2	48.50 (1231.90)	34.00 (863.60)	59.00 (1498.60)	13.00 (330.20)	8.50 (215.90)	25.00 (635.00)	9.00 (228.60)	8.50 (215.90)	15.50 (393.70)	38.00 (965.20)	27.50 (698.50)	36.00 (914.40)
NJ3	51.50 (1308.10)	39.00 (990.60)	66.00 (1676.40)	16.00 (406.40)	9.50 (241.30)	31.50 (800.10)	10.00 (254.00)	11.50 (292.10)	18.00 (457.20)	43.00 (1092.50)	34.00 (863.60)	41.00 (1041.40)
NJ6	64.00 (1625.60)	40.00 (1016.00)	68.00 (1727.20)	16.00 (406.40)	10.50 (266.70)	37.50 (952.50)	11.00 (279.40)	11.50 (292.10)	18.00 (457.20)	44.00 (1117.60)	40.00 (1016.00)	42.00 (1066.80)

Dimension in mm
Dimension in inches

Dimension Drawings





Notes:

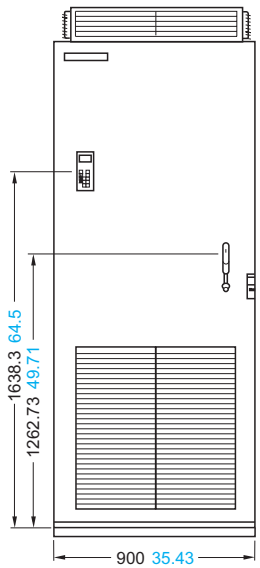
- Finish: pebble grey
- Construction: NEMA 1
- The minimum distance between adjacent drive cabinets is 6.00 in (152.40 mm).
- Do not stack inverters on top of each other.

Fig. 66

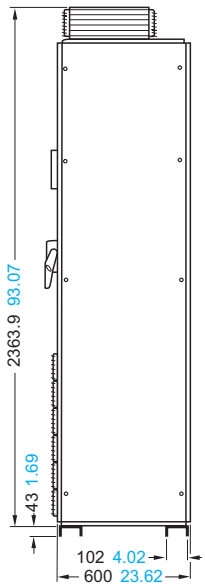
F size cabinet

7

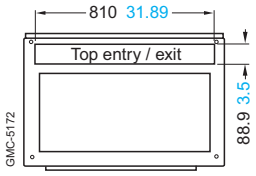
Dimension in mm
Dimension in inches



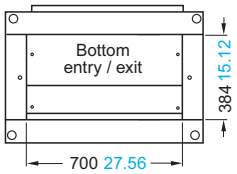
Front view



Right side view



Top view



Bottom view

Notes:

- Finish: pebble grey
- Construction: NEMA 1
- The minimum distance between adjacent drive cabinets is 6.00 in (152.40 mm).
- Do not stack inverters on top of each other.

Fig. 67

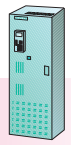
G size cabinet

7

Dimension in mm
Dimension in inches

Dimension Drawings

Converter cabinet units



Cabinet units

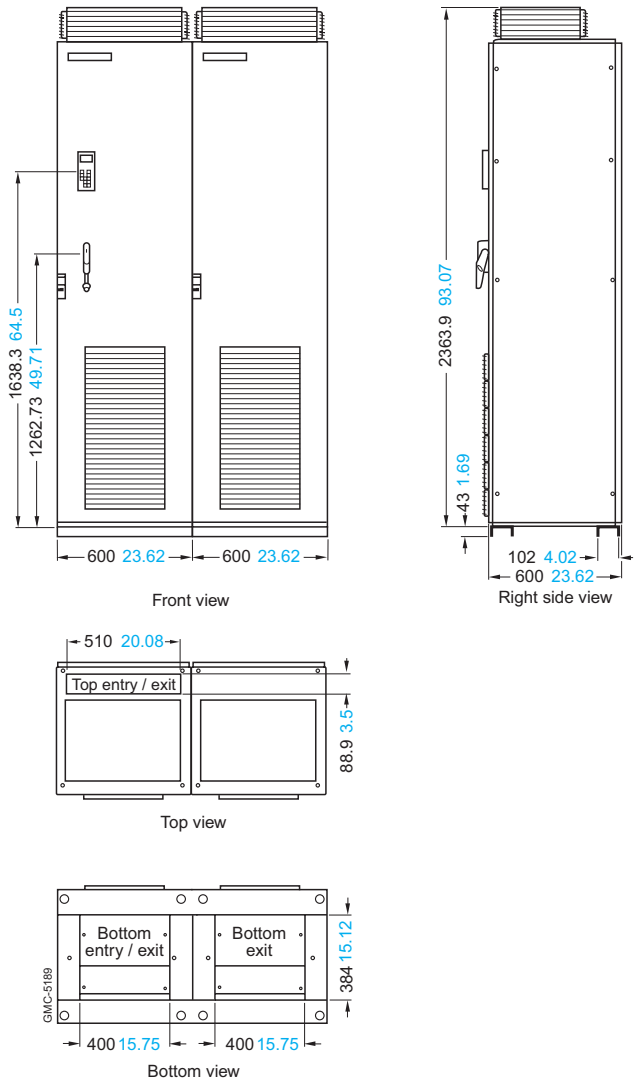


Fig. 68

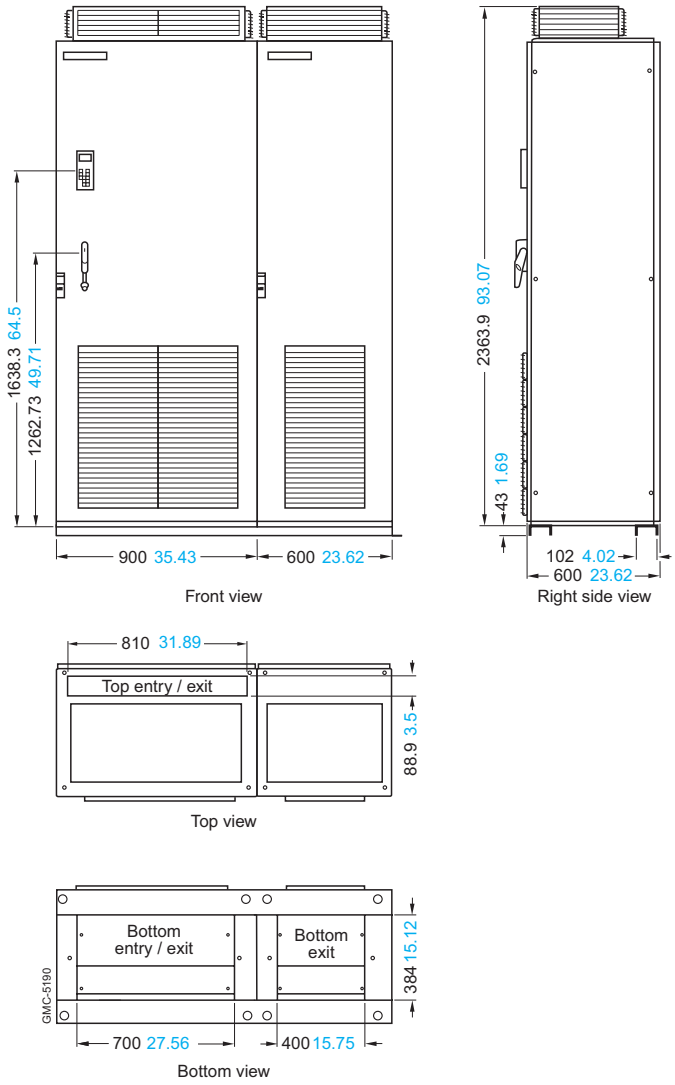
H size cabinet

Notes:

- Finish: pebble grey
- Construction: NEMA 1
- The minimum distance between adjacent drive cabinets is 6.00 in (152.40 mm).
- Do not stack inverters on top of each other.

7

Dimension in mm
Dimension in inches

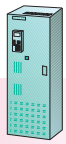


Notes:

- Finish: pebble grey
- Construction: NEMA 1
- The minimum distance between adjacent drive cabinets is 6.00 in (152.40 mm).
- Do not stack inverters on top of each other.

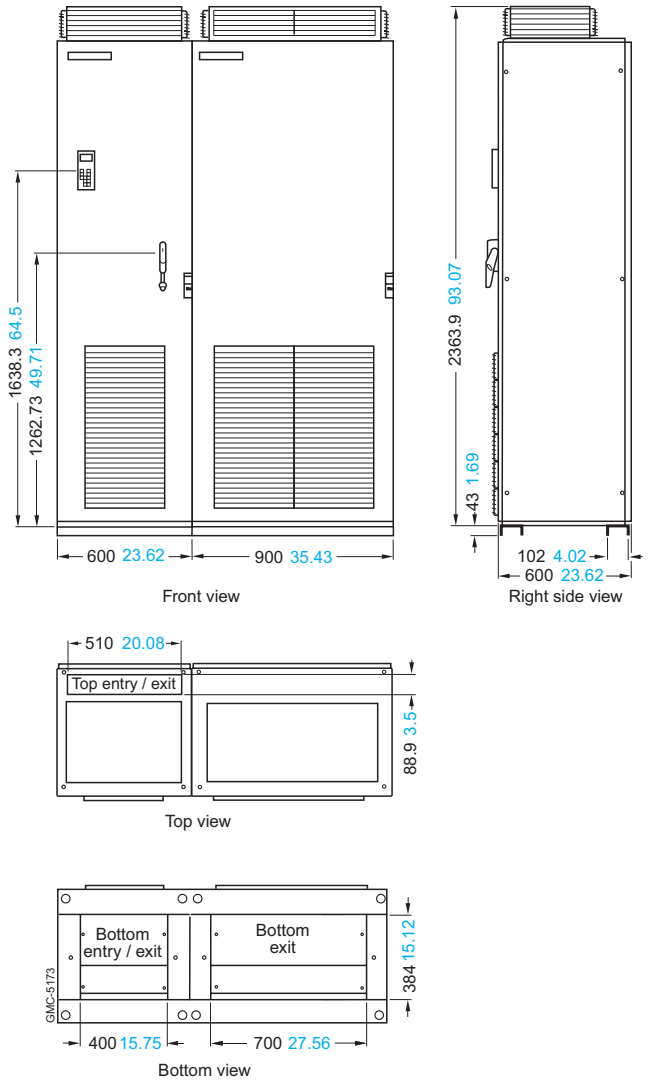
Fig. 69

J size cabinet



Converter cabinet units

Cabinet units



Notes:

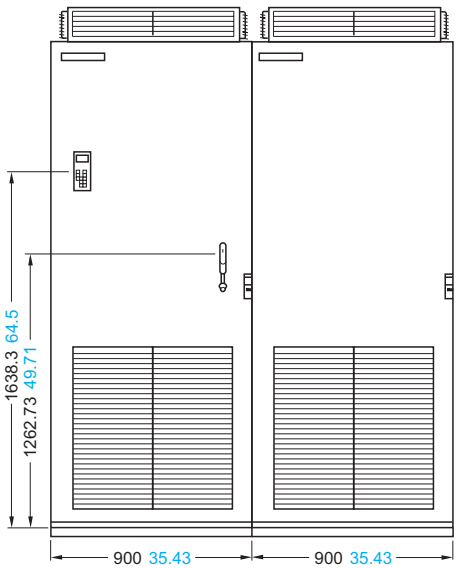
- Finish: pebble grey
- Construction: NEMA 1
- The minimum distance between adjacent drive cabinets is 6.00 in (152.40 mm).
- Do not stack inverters on top of each other.

Fig. 70

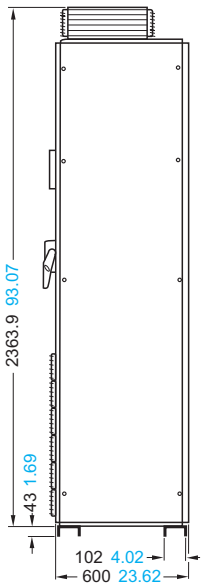
K size cabinet

7

Dimension in mm
Dimension in inches



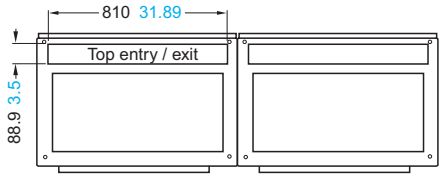
Front view



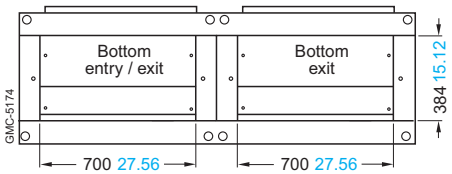
Right side view

Notes:

- Finish: pebble grey
- Construction: NEMA 1
- The minimum distance between adjacent drive cabinets is 6.00 in (152.40 mm).
- Do not stack inverters on top of each other.



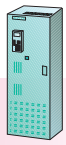
Top view

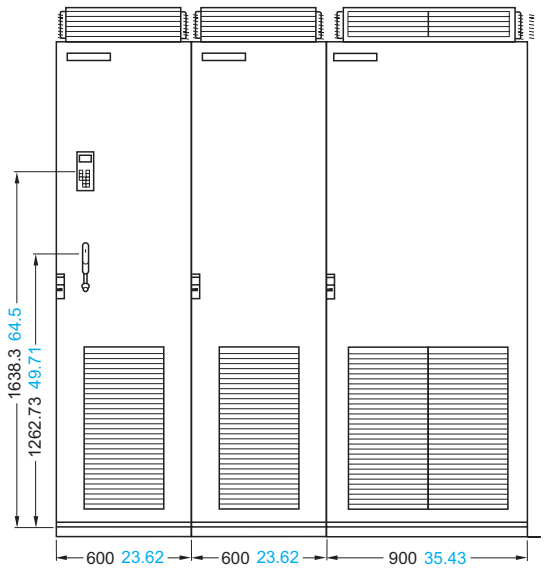


Bottom view

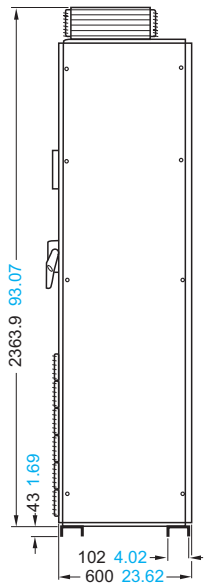
Fig. 71

L size cabinet

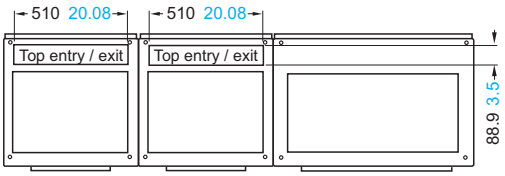




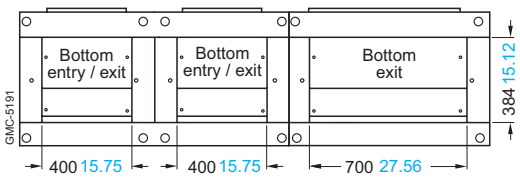
Front view



Right side view



Top view



Bottom view

Notes:

- Finish: pebble grey
- Construction: NEMA 1
- The minimum distance between adjacent drive cabinets is 6.00 in (152.40 mm).
- Do not stack inverters on top of each other.

Fig. 72

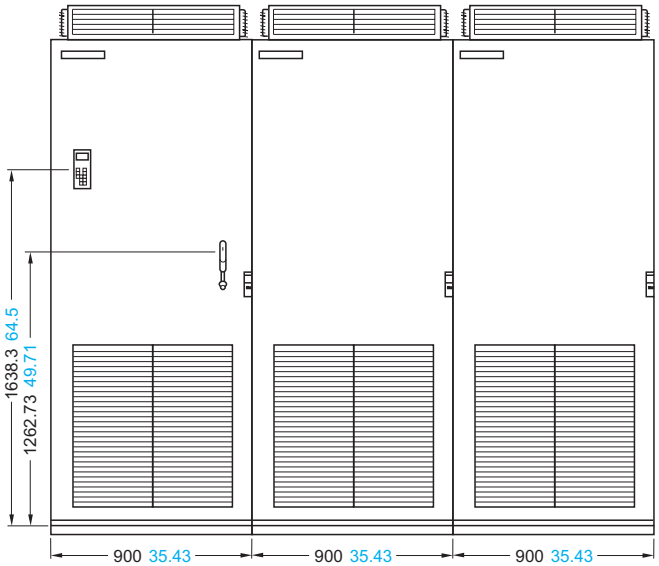
M size cabinet

7

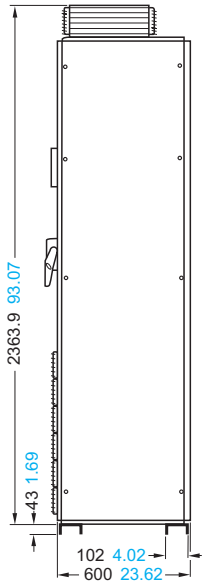
Dimension in mm
Dimension in inches

Cabinet units

Converter cabinet units



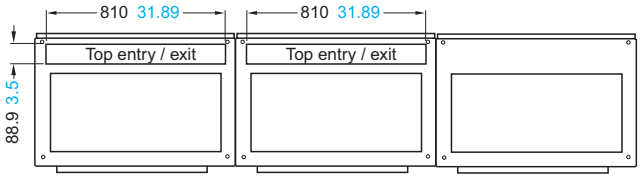
Front view



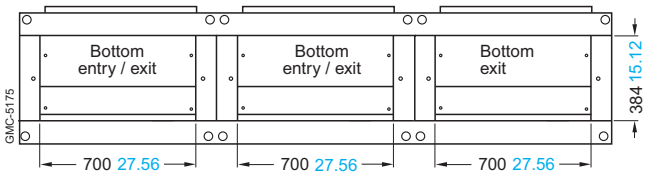
Right side view

Notes:

- Finish: pebble grey
- Construction: NEMA 1
- The minimum distance between adjacent drive cabinets is 6.00 in (152.40 mm).
- Do not stack inverters on top of each other.



Top view



Bottom view

Fig. 73

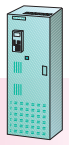
N size cabinet

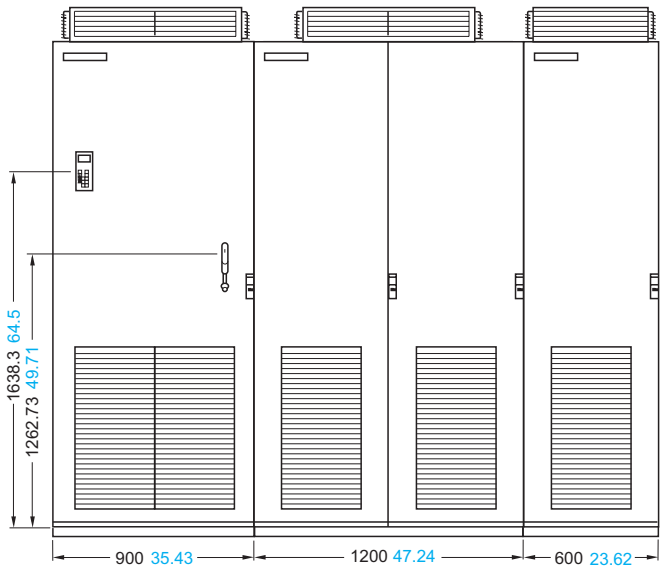
Dimension in mm
Dimension in inches

Dimension Drawings

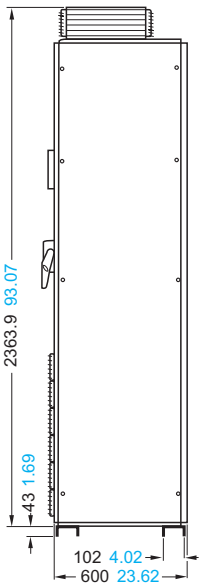
Converter cabinet units

Cabinet units





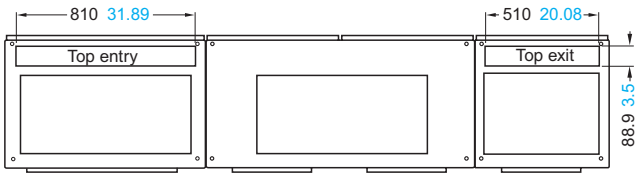
Front view



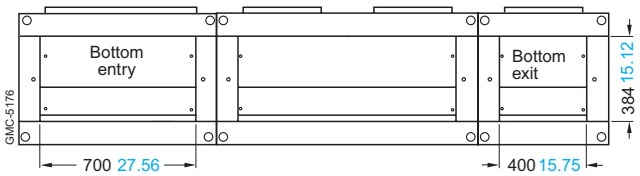
Right side view

Notes:

- Finish: pebble grey
- Construction: NEMA 1
- The minimum distance between adjacent drive cabinets is 6.00 in (152.40 mm).
- Do not stack inverters on top of each other.



Top view



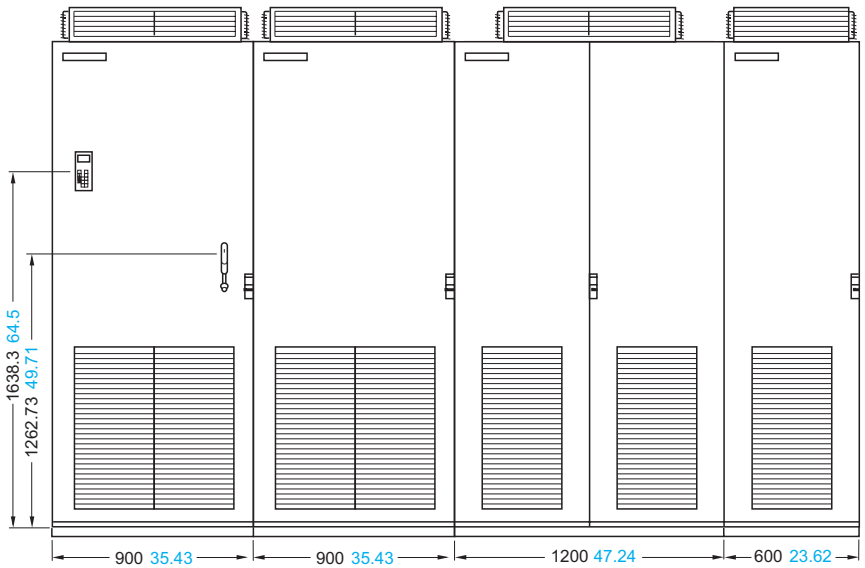
Bottom view

Fig. 74

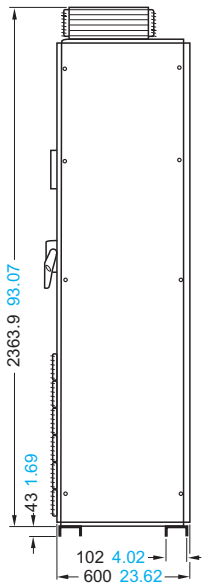
T size cabinet

7

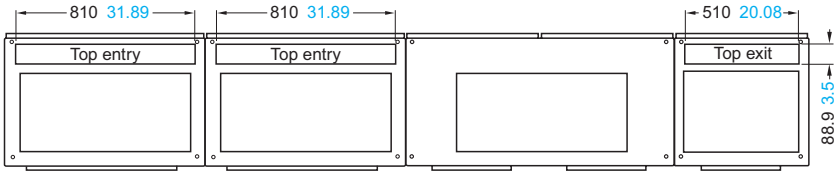
Dimension in mm
Dimension in inches



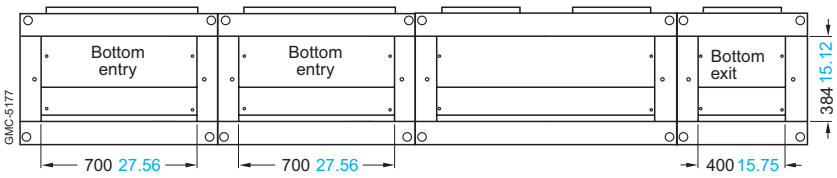
Front view



Right side view



Top view



Bottom view

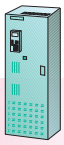
Notes:

- Finish: pebble grey
- Construction: NEMA 1
- The minimum distance between adjacent drive cabinets is 6.00 in (152.40 mm).
- Do not stack inverters on top of each other.

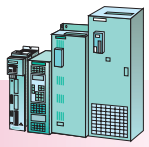
Fig. 75

U size cabinet

Dimension in mm
Dimension in inches



Vector Control
Asynchronous Servomotors



Technical data

Fig. 8/1
1PH7 three-phase motors, frame sizes 100 to 160

Fig. 8/2
1PH7 three-phase motors, frame sizes 180 to 225

Fig. 8/3
1PH7 three-phase motors, frame size 280

Technical characteristics

The 1PH7 three-phase servo-motors are compact, separately-cooled asynchronous motors with squirrel-cage rotor.

They are especially characterized by the following properties:

- high power density with low physical volume
- high degree of protection
- high speed ranges
- speed to zero without reduction of torque
- robustness
- low maintenance requirements
- high lateral-force withstand capability
- high level of concentricity even at low speeds
- integrated encoder system for detecting motor speed, connected by plug
- terminal box for power cable connection
- monitoring of motor temperature by KTY 84.

Application

Hoisting equipment:

- hoists and drives in storage and retrieval systems for high-bay warehouses

Printing industry:

- single and main drives for printing machines

Rubber, plastic, wire and glass:

- drives for extruders, calenders, rubber injection moldings, film machines, conveyor systems
- wire-drawing machines, cable stranding machines etc.

General applications such as winding and coiling machines.

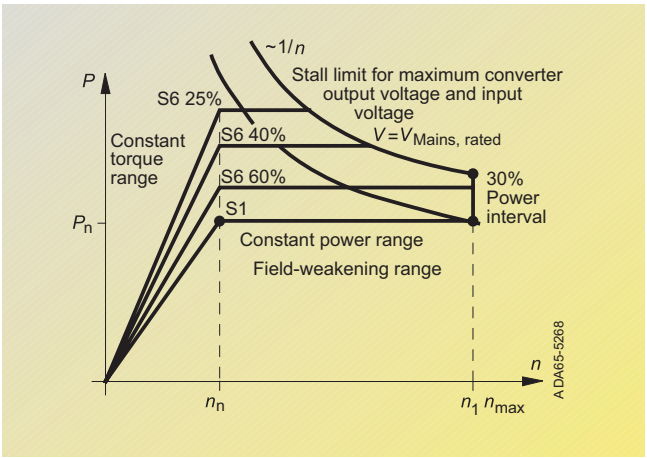


Fig. 8/4
Power-speed characteristic

Stock motors

To meet our customer's logistical expectations, the 1PH7 motor is stocked in its[1]) most demanded configurations in sizes 100 – 160.

The technical features of these stock motors are:

- blower-ventilated. Air flow direction DE to NDE.
- terminal box with cable entry from the right (looking at D-end).
- intergrated pulse encoder (1024 ppr)
- vibration severity class R
- degree of protection IP55
- type of construction IM B 35 (flange/foot mounting).

1) Stock quantities are subject to prior sale.

Technical data

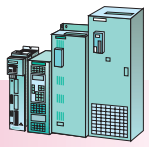
1PH7 motors, frame sizes 100 to 160

	Standard	Options
Type of construction	IM B 3	IM B 5 (only for sizes 100, 132), IM B 35
Degree of protection	IP55	–
Vibration severity	R	S SR
Shaft and flange accuracy	R	–
Shaft extension	With featherkey, half-key balancing	Smooth shaft extension With featherkey, full-key balancing
Terminal box	On top, cable entry from the right	Cable entry from the left or ND-end
Motor protection	KTY 84 in the stator winding	–
Encoder system (plug connection)	Incremental encoder HTL (with MASTERDRIVES VC and MC)	Without encoder (for use with MASTERDRIVES VC, SIMODRIVE 611 universal and POSMO) sin/cos incremental encoder 1 V_{pp} (for use with MASTERDRIVES MC and SIMODRIVE) Absolute-value encoder (EnDat) 2048 p/r (for use with MASTERDRIVES MC and SIMODRIVE) 2-pole resolver (for use with MASTERDRIVES MC and SIMODRIVE)
Paint finish	Without paint coating (with impregnating resin coating)	Normal paint finish anthracite RAL 7016 Special paint finish "worldwide" RAL 7016, other colors on request
Bearings	Permanently lubricated deep-groove ball bearing for coupling and belt drive	Special version for increased speed
Cooling	Separate ventilation The fan is axially mounted on the ND-end Air flow ND-end to D-end	Without separate fan, for pipe connection Air flow from D-end to ND-end
Brake	–	Holding brake with emergency stop function, as a brake module on D-end
Gearbox mounting[1])	–	The following gearboxes can be mounted: • 2-gear gear units 2LG4

1PH7 motors, frame sizes 180 to 225

	Standard	Options
Type of construction	IM B 3	IM B 35
Degree of protection	IP55	–
Vibration severity	R	S SR
Shaft and flange accuracy	N	R
Shaft extension	With featherkey, half-key balancing	Smooth shaft extension With featherkey, full-key balancing
Terminal box	On top, cable entry from the right	Cable entry from D-end, ND-end or the left
Motor protection	KTY 84 in the stator winding	–
Encoder system (connection by plug)	Incremental encoder HTL (with MASTERDRIVES VC and MC)	Without encoder (for use with MASTERDRIVES VC) sin/cos incremental encoder 1 V_{pp} (for use with MASTERDRIVES MC and SIMODRIVE 611 universal) Absolute-value encoder (EnDat) 2048 p/r (for use with MASTERDRIVES MC and SIMODRIVE 611 universal) 2-pole resolver (for use with MASTERDRIVES MC and SIMODRIVE 611 universal)
Paint finish	Normal coating anthracite RAL 7016	Primed Special paint finish "worldwide" RAL 7016
Bearings	Permanently lubricated deep-groove ball bearing for coupling drives	Cylindrical roller bearing for belt drive Cylindrical roller bearing for increased lateral forces Special design for greater maximum speed (only for types 1PH718. and 1PH7224)
Cooling	Separate ventilation The fan is axially mounted on the ND-end Air flow from D-end to ND-end	Without separate fan, for pipe connection Air flow from ND-end to D-end
Brake	–	Holding brake with emergency stop function on D-end, suitable for coupling drive
Gearbox mounting[1])	–	Prepared for fitting a ZF gear unit, see DA 65.3
Silencer	–	Silencer for reducing the sound pressure level (retrofit also possible)

1) Motor is designed to allow mounting to a gearbox. For unsealed gearboxes make sure you use the shaft seal ring option.



Technical data

1PH7 motors, frame size 280

	Standard	Options
Type of construction	IM B 3	IM B 35
Degree of protection	IP55	–
Vibration severity	N	R
Shaft and flange accuracy	N	R
Shaft extension	With featherkey, half-key balancing	Smooth shaft extension With featherkey, full-key balancing
Terminal box	On the right (ND-end), cable entry from below, encoder connector (D-end)	On the left (ND-end), cable entry from below, encoder connector (D-end) On top (ND-end), in the case of a fan ND-end left or right, cable entry from the right, encoder connector (D-end), D-end on request
Motor protection	KTY 84 in the stator winding Additional KTY 84 as standby	–
Encoder system (plug connection)	Incremental encoder HTL (with MASTERDRIVES VC)	Without encoder (MASTERDRIVES VC), other encoders on request
Paint finish	Normal coating anthracite RAL 7016	Primed Special paint finish, “worldwide” RAL 7016, other colors on request
Bearings	Bearing concept for coupling drive with relubricating device	Bearing concept for belt drive or increased lateral forces with relubricating device
Cooling	Separate ventilation, the fan is axially mounted on the ND-end, air flow ND-end to D-end	Without separate fan, for single pipe connection Fan ND-end left or right Fan radially mounted on the D-end (air flow from D-end to ND-end) on request

For additional details and selections see DA 65.3 Servomotors Catalog.

1PH7 Asynchronous servomotors · Selection and ordering example with SIMOVERT MASTERDRIVES Vector Control converters

Motor data (utilization to temperature rise class F)																Converter data	
Rated speed	Size	Motor	Rated power	Rated torque	Rated current	Rated voltage	Speed during field-weakening [1]	Max. operating speed [2]	Power factor	Magnetizing current	Efficiency	Rated frequency	Moment of inertia	Weight	Rated current	Converter/ Inverter
n_n			P_n HP	τ_n lb$_f$-ft	I_n	U_n	n_1	$n_{max.}$		I_μ	η_n	f_n	J lb$_f$-in-s^2	m lb	I_{nU}	
rpm		Order No.	(kW)	(Nm)	A	V	rpm	rpm	cos φ	A		Hz	(kgm^2)	(kg)	A	Order No. [3]*
Mains voltage 3 AC 480 V for SIMOVERT MASTERDRIVES Vector Control converters																
500	160	**1PH7163-..B..-....**	16.1 (12)	169 (230)	30	340	2100	6500	0.86	13	0.841	17.6	1.637 (0.185)	386 (175)	34	**6SE7023-4.C61**
	160	**1PH7167-..B..-....**	21.4 (16)	225 (306)	35	350	1700	6500	0.89	13	0.836	17.7	2.018 (0.228)	463 (210)	37.5	**6SE7023-8.D61**
	180	**1PH7184-..B..-....**	27.5 (20.5)	288 (392)	51	335	2000	5000	0.83	26	0.858	17.5	4.451 (0.503)	816 (370)	59	**6SE7026-0.D61**
	180	**1PH7186-..B..-....**	35.5 (26.5)	372 (506)	67	335	2300	5000	0.79	39.5	0.87	17.3	5.363 (0.666)	970 (440)	72	**6SE7027-2.D61**
	225	**1PH7224-..B..-....**	50.9 (38)	533 (725)	86	335	1800	4500	0.85	37.5	0.888	17.3	13.088 (1.479)	1389 (630)	92	**6SE7031-0.E60**
	225	**1PH7226-..B..-....**	65.7 (49)	688 (935)	112	330	2100	4500	0.85	50	0.9	17.3	17.08 (1.93)	1653 (750)	124	**6SE7031-2.F60**
	225	**1PH7228-..B..-....**	80.4 (60)	842 (1145)	135	340	2200	4500	0.84	61.5	0.907	17.2	20.584 (2.326)	1896 (860)	146	**6SE7031-5.F60**
600	280	**1PH7284-..B..-0...**	127 (95)	1120 (1519)	144	480	1650	3300	0.86	61	0.932	20.3	37.169 (4.2)	2867 (1300)	146	**6SE7031-5.F60**
	280	**1PH7286-..B..-0...**	161 (120)	1413 (1916)	180	480	1750	3300	0.86	80	0.939	20.3	40.019 (5.2)	3308 (1500)	186	**6SE7031-8.F60**
	280	**1PH7288-..B..-0...**	208 (155)	1825 (2474)	233	480	1850	3300	0.86	102	0.941	20.3	55.754 (6.3)	3749 (1700)	260	**6SE7032-6.G60**
1350	100	**1PH7103-..D..-....** [4]	6.3 (4.7)	24 (33)	9.5	433	3000	9000	0.81	4.5	0.83	47.1	0.15 (0.017)	88 (40)	10.2	**6SE7021-0.A61**
	100	**1PH7107-..D..-....** [4]	10.7 (8)	42 (57)	17	405	3800	9000	0.8	8.1	0.853	47	0.257 (0.029)	143 (65)	17.5	**6SE7021-8.B61**
	132	**1PH7133-..D..-....** [4]	20.1 (15)	78 (106)	30	433	3100	8000	0.84	12	0.887	46.4	0.673 (0.076)	198 (90)	34	**6SE7023-4.C61**
	132	**1PH7137-..D..-....** [4]	29.5 (22)	115 (156)	42	416	3200	8000	0.85	17	0.895	46.3	0.965 (0.109)	331 (150)	47	**6SE7024-7.D61**
	160	**1PH7163-..D..-....** [4]	37.5 (28)	146 (198)	53	413	4100	6500	0.83	24	0.911	45.8	1.637 (0.185)	386 (175)	59	**6SE7026-0.D61**
	160	**1PH7167-..D..-....** [4]	45.6 (34)	177 (241)	67	400	4600	6500	0.83	34	0.91	45.8	2.018 (0.228)	463 (210)	72	**6SE7027-2.D61**
	180	**1PH7184-..D..-....**	67 (50)	277 (375)	86	450	3400	5000	0.81	42	0.928	45.8	4.451 (0.503)	816 (370)	92	**6SE7031-0.E60**
	180	**1PH7186-..D..-....**	89.8 (67)	349 (475)	114	460	3600	5000	0.79	59.5	0.93	45.7	5.894 (0.666)	970 (440)	124	**6SE7031-2.F60**
	225	**1PH7224-..D..-....**	123.3 (92)	478 (650)	156	450	3800	4500	0.8	78.5	0.942	45.6	13.088 (1.479)	1389 (630)	186	**6SE7031-8.F60**
	225	**1PH7226-..D..-....**	160.9 (120)	623 (847)	193	460	3500	4500	0.82	88.5	0.945	45.6	17.08 (1.93)	1653 (750)	210	**6SE7032-1.G60**
	225	**1PH7228-..D..-....**	197.1 (147)	767 (1043)	232	460	3300	4500	0.84	99.5	0.947	45.6	20.584 (2.326)	1896 (860)	260	**6SE7032-6.G60**
	280	**1PH7284-..D..-0...**	268 (200)	1044 (1416)	314	470	3300	3300	0.82	159	0.958	45.3	37.169 (4.2)	2867 (1300)	315	**6SE7033-2.G60**
	280	**1PH7286-..D..-0...**	328 (245)	1278 (1733)	414	445	3300	3300	0.8	217	0.96	45.3	40.019 (5.2)	3308 (1500)	510	**6SE7035-1.K/J60**
	280	**1PH7288-..D..-0...**	409 (305)	1592 (2158)	497	450	3300	3300	0.82	250	0.962	45.3	55.754 (6.3)	3749 (1700)	510	**6SE7035-1.K/J60**

Converter	**E** **
Inverter	**T** **

Order No. suffix: see pages 8/8 to 8/10.

1) n_1: motor speed at which, when $P = P_n$, there is still a power reserve of 30 % before the stalling limit is reached or at which the mechanical speed limit is reached or at which the speed is limited by the SIMOVERT MASTERDRIVES Vector Control converter due to $f_{max.} \leq 5 \cdot f_n$.

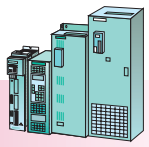
2) Warning! The maximum speed in field-weakening mode is sometimes limited to lower values due to $f_{max} \leq 5 \cdot f_n$.

3) The **9th digit** in the Order No. is to be completed with the suffixes indicated below the table.

4) Typically stocked.

* Listed Compact/Chassis units were selected for standard overload conditions (160 % for 30 s at 300 s load cycle).

** For rated currents below 37.5 A Compact Plus units can also be used.



1PH7 Asynchronous servomotors · Selection and ordering example with SIMOVERT MASTERDRIVES Vector Control converters

Motor data (utilization to temperature rise class F)															Converter data	
Rated speed	Size	Motor	Rated power	Rated torque	Rated current	Rated voltage	Speed during field-weakening [1]	Max. operating speed [2]	Power factor	Magnetizing current	Efficiency	Rated frequency	Moment of inertia	Weight	Rated current	Converter/ Inverter
n_n			P_n HP	τ_n lb_f-ft	I_n	U_n	n_1	$n_{max.}$		I_μ	η_n	f_n	J lb_f-in-s^2	m lb	I_{nU}	
rpm		Order No.	(kW)	(Nm)	A	V	rpm	rpm	cos φ	A		Hz	(kgm^2)	(kg)	A	Order No. [3]*
Mains voltage 3 AC 480 V for SIMOVERT MASTERDRIVES Vector Control converters																
2000	100	**1PH7101-..F..-....** [4]	6.3 (4.7)	16 (22)	10	459	6000	9000	0.72	6	0.862	68.2	0.15 (0.017)	88 (40)	10.2	**6SE7021-0.A61**
	100	**1PH7103-..F..-....** [4]	9.4 (7)	24 (33)	13	459	3400	9000	0.82	5.6	0.86	69.1	0.15 (0.017)	88 (40)	13.2	**6SE7021-3.B61**
	100	**1PH7105-..F..-....** [4]	12.1 (9)	32 (43)	17.5	450	5000	9000	0.78	9.3	0.878	68.3	0.257 (0.029)	143 (65)	17.5	**6SE7021-8.B61**
	100	**1PH7107-..F..-....** [4]	14.7 (11)	39 (53)	23	433	5300	9000	0.79	10.8	0.876	68.6	0.257 (0.029)	143 (65)	25.5	**6SE7022-6.C61**
	132	**1PH7131-..F..-....** [4]	20.1 (15)	53 (72)	25	459	3900	8000	0.88	8.5	0.903	68	0.673 (0.076)	198 (90)	25.5	**6SE7022-6.C61**
	132	**1PH7133-..F..-....** [4]	26.8 (20)	71 (96)	34	459	4100	8000	0.84	15	0.9	68	0.673 (0.076)	198 (90)	34	**6SE7023-4.C61**
	132	**1PH7135-..F..-....** [4]	32.2 (24)	85 (115)	42	459	4700	8000	0.85	17	0.905	67.8	0.965 (0.109)	331 (150)	47	**6SE7024-7.D61**
	132	**1PH7137-..F..-....** [4]	37.5 (28)	99 (134)	55	402	5800	8000	0.85	23	0.9	67.9	0.965 (0.109)	331 (150)	59	**6SE7026-0.D61**
	160	**1PH7163-..F..-....** [4]	49.6 (37)	130 (177)	70	412	6300	6500	0.85	29	0.912	67.5	1.637 (0.185)	386 (175)	72	**6SE7027-2.D61**
	160	**1PH7167-..F..-....** [4]	60.3 (45)	158 (215)	76	459	5400	6500	0.84	32	0.916	67.4	2.018 (0.228)	463 (210)	92	**6SE7031-0.E60**
	180	**1PH7184-..F..-....**	91.2 (68)	239 (325)	120	450	5000	5000	0.78	66	0.935	67.3	4.451 (0.503)	816 (370)	124	**6SE7031-2.F60**
	180	**1PH7186-..F..-....**	126 (94)	331 (450)	165	445	5000	5000	0.78	87	0.941	67.3	5.894 (0.666)	970 (440)	186	**6SE7031-8.F60**
	225	**1PH7224-..U..-....**	166.2 (124)	434 (590)	200	460	4500	4500	0.82	91	0.944	67.2	13.088 (1.479)	1389 (630)	210	**6SE7032-1.G60**
	225	**1PH7226-..F..-....**	205.1 (153)	537 (730)	254	450	4500	4500	0.82	119	0.948	67.2	17.08 (1.93)	1653 (750)	260	**6SE7032-6.G60**
	225	**1PH7228-..F..-....**	262.7 (196)	668 (936)	332	450	4500	4500	0.79	168	0.95	67.1	20.584 (2.326)	1896 (860)	370	**6SE7033-7.G60**
	280	**1PH7284-..F..-0...**	342 (255)	898 (1218)	393	455	3300	3300	0.86	162	0.962	67	37.169 (4.2)	2867 (1300)	510	**6SE7035-1.K/J60**
	280	**1PH7286-..F..-0...**	416 (310)	1092 (1481)	466	455	3300	3300	0.87	182	0.964	67	40.019 (5.2)	3308 (1500)	510	**6SE7035-1.K/J60**
	280	**1PH7288-..F..-0...**	516 (385)	1356 (1838)	586	455	3300	3300	0.87	232	0.965	67	55.754 (6.3)	3749 (1700)	590	**6SE7036-0.K/J60**

Converter	**E**	**
Inverter	**T**	**

Order No. suffix: see pages 8/8 to 8/10.

1) n_1: motor speed at which, when $P = P_n$, there is still a power reserve of 30 % before the stalling limit is reached or at which the mechanical speed limit is reached or at which the speed is limited by the SIMOVERT MASTERDRIVES Vector Control converter due to $f_{max.} \leq 5 \cdot f_n$.

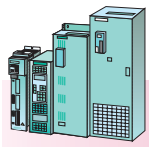
2) Warning! The maximum speed in field-weakening mode is sometimes limited to lower values due to $f_{max} \leq 5 \cdot f_n$.

3) The **9th digit** in the Order No. is to be completed with the suffixes indicated below the table.

4) Typically stocked.

* Listed Compact/Chassis units were selected for standard overload conditions (160 % for 30 s at 300 s load cycle).

** For rated currents below 37.5 A Compact Plus units can also be used.



1PH7 Asynchronous servomotors · Selection and ordering example with SIMOVERT MASTERDRIVES Vector Control converters

Motor data (utilization to temperature rise class F)															Converter data	
Rated speed	Size	Motor	Rated power	Rated torque	Rated current	Rated voltage	Speed during field-weakening [1]	Max. operating speed [2]	Power factor	Magnetizing current	Efficiency	Rated frequency	Moment of inertia	Weight	Rated current	Converter/ Inverter
n_n			P_n HP	τ_n lb_f-ft	I_n	U_n	n_1	$n_{max.}$		I_μ	η_n	f_n	J lb_f-in-s^2	m lb	I_{nU}	
rpm		Order No.	(kW)	(Nm)	A	V	rpm	rpm	cos φ	A		Hz	(kgm^2)	(kg)	A	Order No. [3]*
Mains voltage 3 AC 480 V for SIMOVERT MASTERDRIVES Vector Control converters																
2650	100	**1PH7103-..G..-....**	10.7 (8)	21 (29)	16.5	440	7000	9000	0.78	8.2	0.871	90.3	0.15 (0.017)	88 (40)	17.5	**6SE7021-8.B61**
	100	**1PH7107-..G..-....**	17.4 (13)	34.7 (47)	24.5	459	6700	9000	0.78	12	0.887	90.2	0.257 (0.029)	143 (65)	25.5	**6SE7022-6.C61**
	132	**1PH7133-..G..-....**	32.2 (24)	64 (87)	42	450	5900	8000	0.85	17	0.898	89.6	0.673 (0.076)	198 (90)	47	**6SE7024-7.D61**
	132	**1PH7137-..G..-....**	40.2 (30)	79 (108)	52	450	7100	8000	0.84	21	0.894	89.4	0.965 (0.109)	331 (150)	59	**6SE7026-0.D61**
	160	**1PH7163-..G..-....**	53.6 (40)	106 (144)	76	433	6500	6500	0.82	37	0.895	89	1.637 (0.185)	386 (175)	92	**6SE7031-0.E60**
	160	**1PH7167-..G..-....**	60 (44)	117 (159)	77	459	6500	6500	0.8	40	0.911	89	2.018 (0.228)	463 (210)	92	**6SE7031-0.E60**
2900	180	**1PH7184-..L..-....**	108.6 (81)	196 (267)	158	395	5000	5000	0.8	77	0.934	97.4	4.451 (0.503)	816 (370)	186	**6SE7031-8.F60**
	180	**1PH7186-..L..-....**	135.4 (101)	245 (333)	206	385	5000	5000	0.78	107	0.936	97.3	5.894 (0.666)	970 (40)	210	**6SE7032-1.G60**
	225	**1PH7224-..L..-....**	199.7 (149)	360 (490)	274	395	4500	4500	0.84	115	0.946	97.3	13.088 (1.479)	1389 (630)	315	**6SE7033-2.G60**
	225	**1PH7226-..L..-....**	248 (185)	449 (610)	348	390	4500	4500	0.83	154	0.946	97.2	17.08 (1.93)	1653 (750)	370	**6SE7033-7.G60**
	225	**1PH7228-..L..-....**	288.2 (215)	521 (708)	402	395	4500	4500	0.82	188	0.954	97.2	20.584 (2.326)	1896 (860)	510	**6SE7035-1.K/J60**

Converter	**E** **
Inverter	**T** **

Order No. suffix: see pages 8/8 to 8/10.

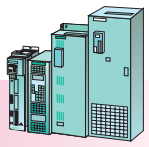
1) n_1: motor speed at which, when $P = P_n$, there is still a power reserve of 30 % before the stalling limit is reached or at which the mechanical speed limit is reached or at which the speed is limited by the SIMOVERT MASTERDRIVES Vector Control converter due to $f_{max.} \leq 5 \cdot f_n$.

2) Warning! The maximum speed in field-weakening mode is sometimes limited to lower values due to $f_{max} \leq 5 \cdot f_n$.

3) The **9th digit** in the Order No. is to be completed with the suffixes indicated below the table.

* Listed Compact/Chassis units were selected for standard overload conditions (160 % for 30 s at 300 s load cycle).

** For rated currents below 37.5 A Compact Plus units can also be used.



1PH7 Asynchronous servomotors · Order No. suffix for sizes 100 to 160

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16
1PH7 . . . – □□ . □□ – □□□□

Blower

With blower, mains supply voltage 3 AC 480 V +5 % –10 %, 60 Hz	2
Without blower, for pipe connection	6

Encoder

Without encoder	A
Incremental encoder HTL (1024 p/r)	H
Incremental encoder HTL (2048 p/r)	J

Direction of cable entry (terminal box on top, looking at D-end)

From the right	0
From ND-end	2
From the left	3

Type of construction

IM B 3, IM V 5, IM V 6		0
IM B 5, IM V 1, IM V 3	(only sizes 100 and 132)	2
IM B 35, IM V 15, IM V 36		3

Holding brake with emergency-stop function[1])

No brake	0

Brake supply voltage: 230 V AC, 50 to 60 Hz

With brake	1
With brake (brake with microswitch)	2
With brake (brake with manual release)	3
With brake (brake with manual release and microswitch)	4

Brake supply voltage: 24 V DC

With brake	5
With brake (brake with microswitch)	6
With brake (brake with manual release)	7
With brake supply (brake with manual release and microswitch)	8

Type of drive	Vibration severity	Shaft and flange accuracy	
Coupling and belt	R	R	B
Coupling and belt	S	R	C
Coupling and belt	SR	R	D
Coupling and belt	N	N (only in conjunction with brake mounting)	K
Increased max. speed[2])	SR	R	L

Air-flow direction	Shaft extension	
D-end → ND-end	With featherkey, half-key balancing	A
ND-end → D-end	With featherkey, half-key balancing	B
D-end → ND-end	With featherkey, full-key balancing	C
ND-end → D-end	With featherkey, full-key balancing	D
D-end → ND-end	Smooth	J
ND-end → D-end	Smooth	K

Paint finish

Without	0
Without, oil-tight flange with radial shaft seal ring[3])	2
Anthracite, normal coating (RAL 7016)	3
Anthracite, normal coating (RAL 7016), oil-tight flange with radial shaft seal ring[3])	5
Anthracite, special coating (RAL 7016)	6
Anthracite, special coating (RAL 7016), oil-tight flange with radial shaft seal ring[3])	8

For additional details and selections see DA 65.3 Servomotors Catalog.

1) Version with brake:
12th data digit "2" or "3",
14th data digit "K",
15th data digit "A", "B", "J" or "K",
16th data digit "0", "3" or "6".

2) Max. possible speed
Size 100: 12,000 rpm
Size 132: 10,000 rpm
Size 160: 8,000 rpm
Only with smooth shaft
(15th data digit "J" or "K").

3) Version prepared for ZF gear-change unit mounting
12th data digit "2" or "3"
13th data digit "0"
14th data digit "B"
15th data digit "C" or "D"
16th data digit "2", "5" or "8"
No build-up of fluid permitted at the shaft exit.

1PH7 Asynchronous servomotors · Order No. suffix for sizes 180 and 225

1PH7 . . . – □□ . □□ – □□□□

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16

Blower

With blower, mains supply voltage 3 AC 480 V +5 % –10 %, 60 Hz	2
Without blower, for pipe connection	6

Encoder

Without encoder	A
Incremental encoder HTL (1024 p/r)	H
Incremental encoder HTL (2048 p/r)	J

Direction of cable entry (terminal box on top, looking at D-end)

From the right	0
From D-end	1
From ND-end	2
From the left	3

Type of construction

IM B 3		0
IM B 6, IM B 7, IM B 8, IM V 5, IM V 6		1
IM B 35	(only for 1PH7184 with flange A400)	3
IM B 35	(only for 1PH7184 with flange A450)	4
IM B 35	(for 1PH7186 with flange A450 and 1PH722. with flange A550)	3
IM B 36, IM V 15	(only for 1PH7184 with flange A400)	5
IM V 36, IM V 15	(only for 1PH7184 with flange A450)	6
IM V 36, IM V 15	(for 1PH7186 with flange A450 and 1PH722. with flange A550)	5

Holding brake with emergency-stop function (suitable for coupling drive in IM B 3 type of construction)[1]

No brake	0
With brake (brake with emergency release screws and microswitch)	2
With brake (brake with manual release and microswitch)	4

Type of drive	Vibration severity	Shaft and flange accuracy	
Coupling	R	N	A
Coupling	R	R	B
Coupling	S	R	C
Coupling	SR	R	D
Belt	R	N	E
Belt	R	R	F
Increased lateral forces	R	N	G
Increased lateral forces	R	R	H
Design for increased max. speed[3]	S	R	J

Air-flow direction	Shaft extension	Blow-out direction	
D-end → ND-end	With featherkey, half-key balancing	right	A
D-end → ND-end	With featherkey, full-key balancing	right	C
D-end → ND-end	Smooth	right	J
ND-end → D-end	With featherkey, half-key balancing	axial	B
ND-end → D-end	With featherkey, full-key balancing	axial	D
ND-end → D-end	Smooth	axial	K

Paint finish

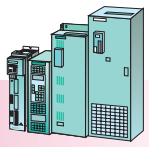
Primed	0
Primed, prepared for ZF gear mounting[2]	2
Anthracite, normal coating (RAL 7016)	3
Anthracite, normal coating (RAL 7016), prepared for ZF gear mounting[2]	5
Anthracite, special coating (RAL 7016)	6
Anthracite, special coating (RAL 7016), prepared for ZF gear mounting[2]	8

For additional details and selections see DA 65.3 Servomotors Catalog.

1) Version with brake:
12th data digit "0,"
14th and 15th data digits "A" and
16th data digit "0," "3" or "6."

2) Version prepared for ZF gear mounting:
only for types 1PH7184, 186 and 224,
12th data digit "3" or "5,"
13th data digit "0,"
14th data digit "B," 15th data digit "C,"
16th data digit "2," "5" or "8."
No build-up of fluid at shaft exit permissible.

3) For size 180 n_{max} = 7,000 rpm
1PH7224 n_{max} = 5,500 rpm
only coupling drive possible.



1PH7 Asynchronous servomotors · Order No. suffix for size 280

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16
1PH728. – □□ . □□ – 0 □□□

Blower, mains supply voltage 3 AC 480 V +/–10 %, 60 Hz			
With separate blower, ND-end top, direction of air flow ND-end to D-end			0
With separate blower, ND-end right, direction of air flow ND-end to D-end			1
With separate blower, ND-end left, direction of air flow ND-end to D-end			2
Without separate blower, for single pipe connection to ND-end			6
Encoder			
Without encoder			A
Incremental encoder HTL (1024 p/r)			H
Incremental encoder HTL (2048 p/r)			J
Terminal box/direction of cable entry (looking at D-end)			
Terminal box ND-end right/cable entry below/encoder connector on D-end[1])			0
Terminal box ND-end left/cable entry below/encoder connector on D-end[2])			1
Terminal box ND-end top/cable entry right/encoder connector on D-end[3])			2
Type of construction			
IM B 3			0
IM B 6, IM B 7, IM B 8, IM V 5, IM V 6			1
IM B 35 (with flange A660)			3
IM V 36, IM V 15 (with flange A660)			5
Type of drive	Vibration severity	Shaft and flange accuracy	
Coupling	N	N	A
Coupling	R	R	B
Belt, increased lateral forces	N	N	E
Belt, increased lateral forces	R	R	F
Shaft extension			
With featherkey, half-key balancing			A
With featherkey, full-key balancing			C
Smooth			J
Paint finish			
Primed			0
Anthracite, normal coating (RAL 7016)			3
Anthracite, special coating (RAL 7016)			6

For additional details and selections see DA 65.3 Servomotors Catalog.

1) Only possible for 8th data digit "0," "2," "6."
2) Only possible for 8th data digit "0," "1," "6."
3) Only possible for 8th data digit "1," "2," "6."

Technical data

Fig. 8/5
1PL6 three-phase motors, frame sizes 180 and 225

Technical characteristics

The 1PL6 three-phase servomotors are compact, separately-cooled asynchronous motors with additional axial ventilation and with degree of protection IP23.

They are especially characterized by the following properties:

- extremely high power density with low physical volume (50 % more power compared with 1PH7 motors with degree of protection IP55)
- speed down to zero without torque reduction
- robustness
- low maintenance requirements
- high lateral-force withstand capability
- high level of concentricity even at lowest speeds
- integrated encoder system for motor speed detection, plug connection
- terminal box for connecting the power cable
- KTY 84 motor temperature monitoring.

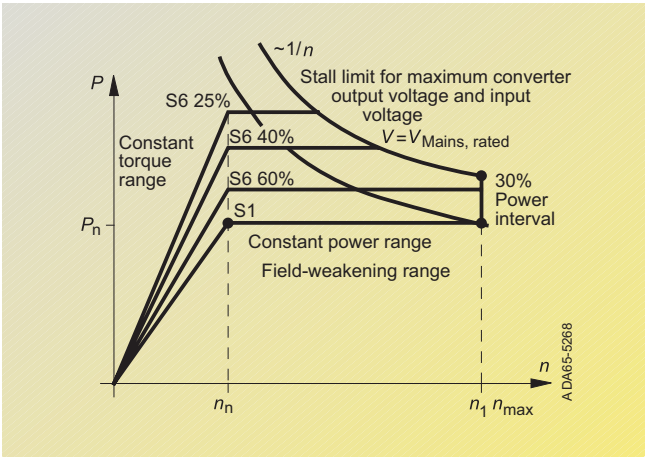


Fig. 8/6
Power-speed characteristic

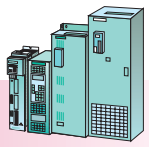
IP23 degree of protection

The three-phase induction motors of Series 1PL6 are rotor-cooled and stator-cooled by means of open-circuit cooling. A built-on separately-driven fan unit is implemented as standard for cooling.

The motors comply with the DIN standards and the IP23 degree of protection according to EN 60034-5 (or IEC 60034-5). With this degree of protection, the motors are not suitable for operation in corrosive atmospheres or for installation outdoors.

1PL6 motors, frame sizes 180 and 225

	Standard	Options
Type of construction	IM B 3	IM B 35
Degree of protection	IP23	–
Vibration severity	R	S SR
Shaft and flange accuracy	N	R
Shaft extension	With featherkey, half-key balancing	Smooth shaft extension With featherkey, full-key balancing
Terminal box	On top, cable entry from the right	Cable entry from D-end, ND-end or the left
Motor protection	KTY 84 in the stator winding	–
Encoder system (plug connection)	Incremental encoder HTL (for use with MASTERDRIVES VC and MC)	Without encoder (for use with MASTERDRIVES VC) sin/cos incremental encoder 1 V_{pp} (for use with MASTERDRIVES MC and SIMODRIVE 611 universal) Absolute-value encoder (EnDat) 2048 p/r (for use with MASTERDRIVES MC and SIMODRIVE 611 universal)
Paint finish	Normal coating anthracite RAL 7016	Primed Special paint finish "worldwide" RAL 7016
Bearings	Permanently lubricated deep-groove ball bearing for coupling drive	Cylindrical roller bearing for belt drive Cylindrical roller bearing for increased lateral forces
Cooling	Separate ventilation and axial ventilation Axial fan on ND-end Air-flow direction from D-end to ND-end	(without separate fan, pipe connection on request) (air-flow direction from ND-end to D-end on request)
Silencer	–	Silencer for reducing the sound pressure level (retrofit also possible)



Technical data

Fig. 8/7
1PL6 three-phase motors, frame size 280

Technical characteristics

The newly developed asynchronous motors of size 280 expand the performance range of the compact asynchronous servomotors of Series 1PL6. The new size is characterized, in particular, by its compact construction despite enhanced performance and consistent emphasis on suitability for use in production machines.

- extremely high power/weight ratio for minimal overall volume (60 % more power than 1PH7 in the IP55 degree of protection)
- variable ventilation design; Standard: Fan unit at non-drive-end
- simple external ventilation by means of connected hose
- terminal box either above, left or right (non-drive-end) as required
- integrated encoder system for sensing the motor speed, connected with connector on terminal box
- monitoring motor temperature by KTY 84; additional KTY 84 as spare part

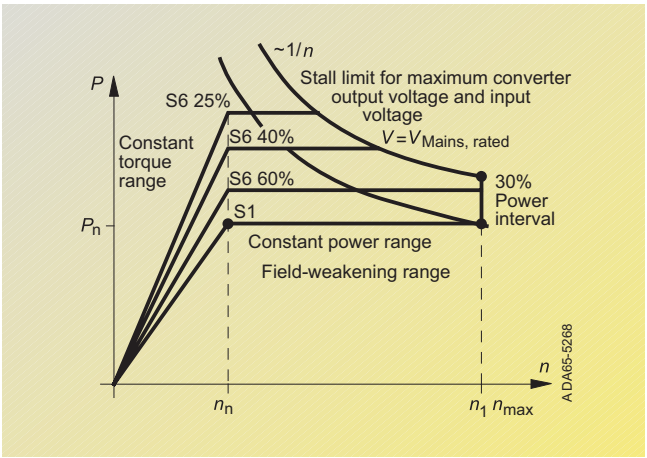


Fig. 8/8
Power-speed characteristic

- bearings with relubricating mechanism and insulated bearing as standard (non-drive-end)

Applications for 1PL6 motors

Installation in dry indoor locations (no aggressive atmosphere)

Hoisting equipment:

- hoists and closing gear for cranes

Printing industry:

- main drives for printing machines

Rubber, plastic and wire:

- drives for extrudes, calenders, rubber injection moldings, film machines, conveyor systems
- wire-drawing machines, cable stranding machines etc.

General applications such as winding and coiling machines.

1PL6 motors, frame size 280

	Standard	Options
Type of construction	IM B 3	IM B 35
Degree of protection	IP23	–
Vibration severity	N	R
Shaft and flange accuracy	N	R
Shaft extension	With featherkey, half-key balancing	Smooth shaft extension With featherkey, full-key balancing
Terminal box	On the right (ND-end), cable entry from below, encoder connector (D-end)	On the left (ND-end), cable entry from below, encoder connector (D-end) On top (ND-end), in the case of a fan ND-end left or right, cable entry from the right, encoder connector (D-end), D-end on request
Motor protection	KTY 84, in the stator winding	–
Encoder system (plug connection)	Incremental encoder HTL (with MASTERDRIVES VC)	Without encoder (with MASTERDRIVES VC), other encoders on request
Paint finish	Normal coating anthracite RAL 7016	Primed Special paint finish, "worldwide" RAL 7016, other colors on request
Bearings	Bearing concept for coupling drive with relubricating device	Bearing concept for belt drive or increased lateral forces with relubricating device
Cooling	Separate ventilation, the fan is radially mounted on the ND-end, air flow ND-end to D-end	Without separate fan, for single pipe connection Fan ND-end left or right Fan radially mounted on the D-end (air flow from D-end to ND-end) on request

1PL6 Asynchronous servomotors · Selection and ordering example with SIMOVERT MASTERDRIVES Vector Control converters

Motor data (utilization to temperature rise class F)															Converter data	
Rated speed	Size	Motor	Rated power	Rated torque	Rated current	Rated voltage	Speed during field-weakening[1]	Max. operating speed[2]	Power factor	Magnetizing current	Efficiency	Rated frequency	Moment of inertia	Weight	Rated current	Converter/ Inverter
n_n			P_n HP	τ_n lb$_f$-ft	I_n	U_n	n_1	$n_{max.}$		I_μ	η_n	f_n	J lb$_f$-in-s^2	m lb	I_{nU}	
rpm		Order No.	(kW)	(Nm)	A	V	rpm	rpm	cos φ	A		Hz	(kgm^2)	(kg)	A	Order No.[3]*
Mains voltage 3 AC 480 V for SIMOVERT MASTERDRIVES Vector Control converters																
500	180	**1PL6184-..B..-0...**	40.2 (30)	421 (573)	66	370	1300	5000	0.84	34	0.844	17.6	4.451 (0.503)	816 (370)	72	**6SE7027-2.D61**
	180	**1PL6186-..B..-0...**	53.6 (40)	562 (764)	91	355	1500	5000	0.84	46	0.845	17.6	5.894 (0.666)	970 (440)	92	**6SE7031-0.E60**
	225	**1PL6224-..B..-0...**	73.7 (55)	772 (1050)	114	370	1300	4500	0.86	46	0.875	17.5	13.088 (1.479)	1389 (630)	124	**6SE7031-2.F60**
	225	**1PL6226-..B..-0...**	96.5 (72)	1011 (1375)	147	375	1500	4500	0.85	66	0.887	17.4	17.08 (1.93)	1653 (750)	146	**6SE7031-5.F60**
	225	**1PL6228-..B..-0...**	120.6 (90)	1264 (1719)	180	380	1400	4500	0.85	79	0.894	17.4	20.584 (2.326)	1896 (860)	186	**6SE7031-8.F60**
1350	180	**1PL6184-..D..-0...**	99.2 (74)	385 (523)	119	460	2200	5000	0.86	44	0.918	46.1	4.451 (0.503)	816 (370)	124	**6SE7031-2.F60**
	180	**1PL6186-..D..-0...**	131.4 (98)	510 (693)	156	460	2400	5000	0.85	60	0.92	46	5.894 (0.666)	970 (440)	186	**6SE7031-8.F60**
	225	**1PL6224-..D..-0...**	183.6 (137)	713 (969)	215	460	2600	4500	0.85	82	0.94	45.8	13.088 (1.479)	1389 (630)	260	**6SE7032-6.G60**
	225	**1PL6226-..D..-0...**	230.6 (172)	895 (1217)	265	460	2500	4500	0.87	88	0.94	45.8	17.08 (1.93)	1653 (750)	315	**6SE7033-2.G60**
	225	**1PL6228-..D..-0...**	292 (218)	1134 (1542)	332	460	2200	4500	0.88	100	0.938	45.8	20.584 (2.326)	1896 (860)	370	**6SE7033-7.G60**
	280	**1PL6284-..D..-0...**	436 (325)	1696 (2299)	478	470	2850	3300	0.89	157	0.955	45.5	37.169 (4.2)	2867 (1300)	510	**6SE7035-1.K/J60**
	280	**1PL6286-..D..-0...**	550 (410)	2140 (2901)	637	445	2950	3300	0.89	215	0.957	45.5	40.019 (5.2)	3308 (1500)	690	**6SE7037-0.K/J60**
	280	**1PL6288-..D..-0...**	677 (505)	2635 (3573)	765	450	2950	3300	0.89	248	0.959	45.5	55.754 (6.3)	3749 (1700)	860	**6SE7038-6TK60**
2000	180	**1PL6184-..F..-0...**	131.4 (98)	344 (468)	161	460	4200	5000	0.83	70	0.934	67.5	4.451 (0.503)	816 (370)	186	**6SE7031-8.F60**
	180	**1PL6186-..F..-0...**	181 (135)	474 (645)	220	460	4200	4500	0.83	94	0.94	67.5	5.894 (0.666)	970 (440)	260	**6SE7032-6.G60**
	225	**1PL6224-..F..-0...**	238.6 (178)	625 (850)	275	460	3800	4500	0.86	91	0.944	67.5	13.088 (1.479)	1389 (630)	315	**6SE7033-2.G60**
	225	**1PL6226-..F..-0...**	294.9 (220)	772 (1050)	342	460	4200	4500	0.86	124	0.948	67.5	17.08 (1.93)	1653 (750)	370	**6SE7033-7.G60**
	225	**1PL6228-..F..-0...**	386.1 (288)	1011 (1375)	450	460	4500	4500	0.85	176	0.948	67.3	20.584 (2.326)	1896 (860)	510	**6SE7035-1.K/J60**
	280	**1PL6284-..F..-0...**	556 (415)	1461 (1981)	616	455	3300	3300	0.9	161	0.961	67.3	37.169 (4.2)	2867 (1300)	690	**6SE7037-0.K/J60**
	280	**1PL6286-..F..-0...**	670 (500)	1761 (2387)	736	455	3300	3300	0.91	181	0.963	67.3	40.019 (5.2)	3308 (1500)	860	**6SE7038-6TK60**
	280	**1PL6288-..F..-0...**	845 (630)	2219 (3009)	924	455	3300	3300	0.91	231	0.965	67.3	55.754 (6.3)	3749 (1700)	1100	**6SE7041-1TK60**
2900	180	**1PL6184-..L..-0...**	151.5 (113)	274 (372)	209	400	5000	5000	0.85	79	0.938	97.6	4.451 (0.503)	816 (370)	210	**6SE7032-1.G60**
	180	**1PL6186-..L..-0...**	201.1 (150)	297 (494)	280	390	5000	5000	0.84	110	0.943	97.5	5.894 (0.666)	970 (440)	315	**6SE7033-2.G60**
	225	**1PL6224-..L..-0...**	274.8 (205)	496 (675)	365	400	4500	4500	0.86	118	0.95	97.5	13.088 (1.479)	1389 (630)	370	**6SE7033-7.G60**
	225	**1PL6226-..L..-0...**	361.9 (270)	654 (889)	470	395	4500	4500	0.87	160	0.952	97.4	17.08 (1.93)	1653 (750)	510	**6SE7035-1.K/J60**
	225	**1PL6228-..L..-0...**	402.1 (300)	726 (988)	530	400	4500	4500	0.86	188	0.952	97.3	20.584 (2.326)	1896 (860)	590	**6SE7036-0.K/J60**

Converter	E
Inverter	T

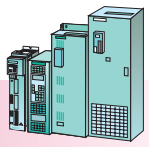
Order No. suffix: see pages 8/14 and 8/15.

1) n_1: Speed at which, for $P = P_n$, 30 % reserve power is still available before reaching the stall limit.

2) Warning! The maximum speed in field-weakening mode is sometimes limited to lower values due to $f_{max} < 5 \cdot f_n$.

3) The **9th digit** in the Order No. is to be completed with the suffixes indicated below the table.

* Listed Compact/Chassis units were selected for standard overload conditions (160 % for 30 s at 300 s load cycle).



1PL6 Asynchronous servomotors · Order No. suffix for sizes 180 and 225

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16
1PL6 . . . – □□ . □□ – 0 □□□

Blower supply voltage
- 3 AC 400 V ±10 %, 50 Hz (for 1PL618., also for 480 V +5 % –10 %, 60 Hz) — **4**
- 3 AC 480 V +5 % –10 %, 60 Hz (only for 1PL622.) — **5**

Encoder
- Without encoder — **A**
- Incremental encoder HTL (1024 p/r) — **H**
- Incremental encoder HTL (2048 p/r) — **J**

Direction of cable entry (terminal box on top)
- From the right — **0**
- From D-end — **1**
- From ND-end — **2**
- From the left — **3**

Type of construction	Hoist concept	
IM B 3	Standard	**0**
IM B 6, IM B 7, IM B 8, IM V 5, IM V 6	For vertical types of construction	**1**
IM B 35	Standard	**3**
IM V 36, IM V 15	For vertical types of construction	**5**

Type of drive	Vibration severity	Shaft and flange accuracy	
Coupling	R	N	**A**
Coupling	R	R	**B**
Coupling	S	R	**C**
Coupling	SR	R	**D**
Belt	R	N	**E**
Belt	R	R	**F**
Increased lateral forces	R	N	**G**
Increased lateral forces	R	R	**H**

Air-flow direction	Shaft extension	
D-end → ND-end	With featherkey, half-key balancing	**A**
D-end → ND-end	Smooth	**J**
D-end → ND-end	With featherkey, full-key balancing	**C**

Paint finish
- Primed — **0**
- Anthracite, normal coating (RAL 7016) — **3**
- Anthracite, special coating (RAL 7016) — **6**

For additional details and selections see DA 65.3 Servomotors Catalog.

1PL6 Asynchronous servomotors · Order Number suffix for size 280

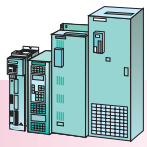
	1 2 3 4 5 6 7	8	9	10	11	12	13	14	15	16
	1PL628.–	□	□	.	□	□	– 0	□	□	□
Blower, mains supply voltage 3 AC 480 V +/–10 %, 60 Hz										
With separate blower, ND-end top, direction of air flow ND-end to D-end		0								
With separate blower, ND-end right, direction of air flow ND-end to D-end		1								
With separate blower, ND-end left, direction of air flow ND-end to D-end		2								
Without separate blower, for single pipe connection to ND-end		6								
Encoder										
Without encoder			A							
Incremental encoder HTL (1024 p/r)			H							
Incremental encoder HTL (2048 p/r)			J							
Terminal box/direction of cable entry (looking at D-end)										
Terminal box ND-end right/cable entry below/encoder connector on D-end[1])					0					
Terminal box ND-end left/cable entry below/encoder connector on D-end[2])					1					
Terminal box ND-end top/cable entry right/encoder connector on D-end[3])					2					
Type of construction										
IM B 3						0				
IM B 6, IM B 7, IM B 8, IM V 5, IM V 6						1				
IM B 35 (with flange A660)						3				
IM V 36, IM V 15 (with flange A660)						5				
Type of drive / **Vibration severity** / **Shaft and flange accuracy**										
Coupling / N / N								A		
Coupling / R / R								B		
Belt, increased lateral forces / N / N								E		
Belt, increased lateral forces / R / R								F		
Shaft extension										
With featherkey, half-key balancing									A	
With featherkey, full-key balancing									C	
Smooth									J	
Paint finish										
Primed										0
Anthracite, normal coating (RAL 7016)										3
Anthracite, special coating (RAL 7016)										6

For additional details and selections see DA 65.3 Servomotors Catalog.

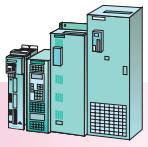
1) Only possible for 8th data digit "0," "2," "6."

2) Only possible for 8th data digit "0," "1," "6."

3) Only possible for 8th data digit "1," "2," "6."



Vector Control
Appendix



Übereinstimmungsbescheinigung

Certificate of Adequacy

SIEMENS

Factory certificate *
regarding electromagnetic compatibility

Manufacturer: 4SE.475 000 0001.00 WB EMV
Siemens Aktiengesellschaft
Drives and Standard Products Group
Business Division Automation and Drives
Address: Sub-Division AC-Drive systems
P.O. Box 3269
D-91050 Erlangen

Product name: SIMOVERT
Type 6SE70Compact drive converters AC-AC and DC-AC

When correctly used, the designated product fulfills all the requirements of Directive 89/336/EEC regarding electromagnetic compatibility.

We confirm the conformance of the above designated product with the Standards:

EN 61800-3 10-1996
EN 61800-3-2 (also IEC 801-2)
EN 61800-3-4 (also IEC 801-4)
EN 61800-3-5 (also IEC 801-5)
IEC 1800-3-3 (also IEC 801-3)
EN 55011 (DIN VDE 0875 Part 11)

Note:

These instructions relating to EMC-correct installation, correct operation, connecting-up conditions and associated instructions in the product documentation supplied must be observed.

Erlangen, 01.06.1998

H. Brückl
A&D DS A P1

Automation & Drives

* acc. to EN 61800 (DIN 50081)

This declaration does not guarantee any features.

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Page 1 of 1

SIEMENS

Automation and Drives

Test certificate

Erlangen, 01.10.2000

Equipment

• Type

Frequency Converter
SIMOVERT
MASTERDRIVES
6SE70... *)

• Order No.:

475 100.9000.00 CP size A - D
476 100.9000.00 CP size E - G
476 200.9000.00 CP size J - L

The routine testing is according to these test instructions

Amount of inspection:

I. Insulation test
- refer to EN 50178, Part 9.4.5.2 and UL508/CSA 22.2-14.M 91, Part 6.8

II. Function test acc. to EN 50178
- Initialization and start-up
- Customer terminal test
- Power section inspection
- Inspection of protection and monitoring devices
- Continuous test at an ambient temperature 55 °C

III. Run-in

IV. Function test acc. to EN 50178
- see II. Function test

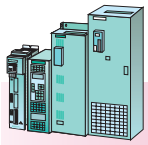
The equipment complied with the test requirements.
The test results are documented within the production data base

*) For complete type, serial number and technical data please see rating plate.

A&D MC GWE P3

Schlögel

Automation & Drives



A word about Siemens

Siemens AG

The parent company of Siemens Energy & Automation is Siemens AG, headquartered in Munich, Germany. Various Siemens divisions provide a broad spectrum of products, systems, and services worldwide. These include: electronic components, medical electronics, power engineering, and automation products and systems, as well as public and private telecommunications networks.

Siemens' worldwide sales exceed $85 billion in 2002, ranking it among the world's largest electrical companies. Siemens ranks second in manufacturing. Siemens employs approximately 450,000 people in 193 countries, 500 manufacturing facilities in 50 countries on 6 continents. A leading edge company, Siemens annually reinvests between 8 – 10 % of sales in research and development activities, ranking in the number one position in this category, along with companies like Intel.

Siemens U.S.A.

Siemens USA consists of a broad range of industrial and infrastructure businesses serving American business and government customers. Representing about 25 percent of Siemens' sales worldwide, the U.S. is the company's largest single market.

In fiscal 2002, the consolidated sales of all Siemens companies in the United States were $20 billion. New orders totaled approximately $21 billion. By revenue, Siemens would rank 98th on the 2002 Fortune 500 America's Largest Employers list.

More than 72,000 employees work at roughly 700 Siemens locations in all 50 states, making Siemens one of the top 100 employers in the U.S.

Siemens Energy & Automation, Inc.

One of the largest Siemens companies in the U.S. is Siemens Energy & Automation, Inc. with over 10,000 employees and annual sales in excess of $2 billion.

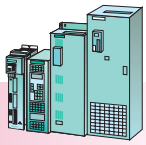
Siemens Energy & Automation is headquartered near Atlanta, Georgia and has 28 U.S. manufacturing facilities. SEA' s facilities throughout the U.S. manufacture, market, and service a wide variety of electrical and electronic equipment and systems that protect, regulate, control, distribute electric power, convert electric power to mechanical energy, and automate various manufacturing and industrial processes. SEA produces 85 % of its products domestically, and markets them worldwide.

Siemens Energy & Automation products are sold in two general market segments: industrial and construction. Our business units are organized into five primary operating divisions: Automation and Motion Division, Power Conversion Division, Process Solutions Division, Power Distribution and Controls Division, and Industrial Services Division.

How the general information is organized

General information

Welcome to Siemens
Siemens policies/protocols
Siemens return goods policy
Siemens repairs & returns for warranty
Siemens technical services
Siemens emergency access
Standard terms and conditions of sale



Customer service United States

Welcome to Siemens US

If you are a new Siemens Drive Products customer, we thank you for doing business with us. We will work hard to earn your trust and serve your company as if it were our own! If you are currently doing business with us, we thank you for the opportunity to grow with you.

Your primary contact point in the United States for the MASTERDRIVES 6SE70 and all other Siemens drive products are the Regional Sales Offices in the following locations:

Atlanta

5405 Metric Place
Suite 100
Norcross, GA 30092
Phone: 7 70-4 52-34 00
Fax: 6 78-2 97-84 09

Dallas

501 Fountain Parkway
2nd Floor
Grand Prairie, TX 75050
Phone: 8 17-6 40-49 29
Fax: 8 17-6 40-96 40

Chicago

1901 N. Roselle Road
Suite 210
Schaumburg, IL 60195
Phone: 8 00-3 33-77 32
Fax: 8 88-3 33-82 06

Houston

13105 NW Freeway
Suite 950
Houston, TX 77040
Phone: 7 13-6 90-30 00
Fax: 7 13-6 90-12 10

Kansas City

6201 College Blvd
Suite 385
Overland Park, KS 66211
Phone: 9 13-4 98-42 00
Fax: 9 13-4 98-42 40

Los Angeles

10655 Business Center Dr
Suite C1
Cypress, CA 90630
Phone: 7 14-2 52-30 00
Fax: 7 14-5 27-72 30

Philadelphia

323 Norristown Road
Suite 210
Amber, PA 19002
Phone: 8 00-3 88-80 67
Fax: 2 15-2 83-47 02

Siemens policies/ protocols

Minimum order

SE&A will assess a $25 handling fee on all ground orders valued at less than $400.

Freight

All of our original product shipments are F.O.B. point of shipment. For standard product orders (excluding motors) greater than $1000 shipping from SE&A distribution centers, charges are freight allowed via method selected by SE&A. For orders less than $1000, motors, and non-standard product freight charges are pre-paid and added to the invoice. All air freight charges are the responsibility of the customer. Also, a customer account number is required for third party billing of freight charges.

Emergency/Expedite fees

When customers require urgent delivery, several methods of expedited delivery are available. Each is noted below along with the associated charges:

NEXT FLIGHT OUT –
This service provides same day service where possible. In all cases, the expedited surcharge is $200. The customer is responsible for the associated freight charges.

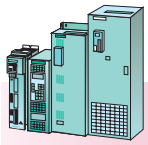
AFTER HOUR SERVICE –
Orders placed for same day shipment after 5:00 pm eastern time and weekends/holidays are subject to a $200 surcharge. The customer is responsible for the associated freight charges.

SPARE PARTS FROM INTERNATIONAL LOCATIONS –
Siemens Energy & Automation supports all Siemens Drive Products in the USA, regardless of their country of origin. However, certain products may require shipment from an international emergency warehouse to meet customer delivery requirements. All parts coming from the emergency warehouse will be charged an additional $300 surcharge, plus all freight costs. (The normal $25 surcharge will not apply). Siemens features an international emergency warehouse that can ship many parts within 24 hours. Most parts can arrive in the United States within 2 – 4 days. Your Customer Service or Sales Representative can check to see if your part is in stock in the emergency warehouse.

CUSTOMER PICK UP –
All customer pick up orders will be ready 2 hours after order is received, and must be picked up within 24 hours. There is no additional charge for this service.

Returns

Standard products fall under the SE&A standard product return guidelines (below). Drive systems in cabinets, built to specification, motors, or other non-standard items do not fall under this policy. Contact your Sales or Customer Service Representative should you have questions regarding return policy.



Siemens return goods policy

A Return Goods Request/ Authorization (RGA) is required to accompany all products returned to Siemens Energy & Automation, Inc. (Siemens). This insures that the returned product is properly identified and credited to your account. Unauthorized returns will be refused and returned to the customer with no liability to Siemens.

To provide our customers maximum opportunity for inventory control, we have established three classes of product returns:

- Accommodation return
- Siemens error return
- Non-Conforming product warranty return

Product built to a customer's specifications cannot be returned for credit or exchange, subject to return only when material in Siemens' opinion has express economic value for potential resale. If returned product is a result of error(s) on the part of Siemens, a full credit to your account will be allowed including freight charges. All other returns, freight and handling will be prepaid by customer.

In all cases except when alleged personal injury/product liability is involved, your account will be credited and a credit memo will be issued within 15 working days from receipt of material. Credit is determined from the original invoice less restocking charges.

Shipments returned without referencing a returned goods authorization (RGA) number will be refused by Siemens. Siemens reserves the right to rebill within 90 days from our receipt of material based on results of a physical inspection of the product.

All claims for loss, damage or delays in transit are to be transacted by the consignee directly with the carrier. The issuance of this RETURN GOODS AUTHORIZATION shall not be construed as an acceptance of any responsibility or liability on the part of the Company or as a waiver of any right to make a determination as to the Company's responsibility.

Return goods authorizations will be automatically cancelled and have no further effect unless the returned goods are received by the Company within 60 days after the date of issuance.

Accommodation return

Accommodation returns provide Siemens customers the opportunity to return product ordered in error or in excessive quantities. Products eligible for return must be of current design and revision level, unopened, unused, undamaged, in the original "as-shipped" package and securely packed to be received by Siemens without damage. Software may only be returned when the seal has not been broken. Customized, engineered and/or energized products may not be returned without prior approval and in Siemens' opinion have express economic value for potential resale.

Accommodation returns are subject to a 20 % restocking charge. After inspection of the returned product, your account will be credited for the full invoice value of the merchandise, less restocking charges.

Customer should not deduct credit for products returned from payments. Credit will be processed within 15 days of receipt of material. The customer is responsible for costs, including freight and handling, for returned product to Siemens.

Siemens error return

Siemens error returns provide customers the opportunity to return material within 60 days of shipment in the event of a Siemens order or shipment error. Original purchase order, invoice number and date must be referenced. Products must be unopened, unused, undamaged, in the original "as-shipped" package or in static protection, and securely packed to be received by Siemens without damage. Software may only be returned when seal has not been broken.

A return goods authorization (RGA) number will be issued as authorization to return the product(s) to Siemens. After receipt and inspection of the returned product, a credit will be issued for the full invoice value of the merchandise, or a replacement part provided. If the returned product(s) packaging is deemed not saleable, a 20 % per item charge will be deducted from the credit issued.

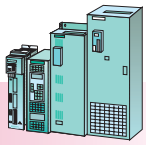
Product should be returned collect by a Siemens approved freight carrier or freight charges may be assessed. Freight charges will be credited if the entire shipment is returned due to Siemens error.

Non-Conforming product warranty return

Non-Conforming product warranty returns enable Siemens customers to return product to the factory for replacement, exchange or credit if found to be non-conforming in accordance with the conditions of the Company's product warranty.

It is at Siemens discretion whether to replace, repair or issue a credit for non-conforming products. The warranty at no cost is conditional, and will be determined by a technical validation of the warranty once the non-conforming item is received in our repair department or authorized service center.

Customer service United States



Siemens return goods process – Accomodation

A Return Goods Request/ Authorization (RGA) is required to accompany all products returned to Siemens. This insures that the returned product is properly identified and credited to your account. Unauthorized returns will be refused and returned to the customer with no liability to Siemens.

Accommodation return

Accommodation returns provide Siemens customers the opportunity to return product ordered in error or in excessive quantities.

Procedures

A. Customer contacts Customer Service or inside sales person to initiate return of material.

B. Products must be unopened, unused, undamaged, in the original "as-shipped" package or in static protection, and securely packed to be received by Siemens without damage. Software may only be returned when seal has not been broken.

C. Siemens Energy & Automation will process your request and a return goods authorization (RGA) number will be issued as authorization to return the product(s) to Siemens.

D. A copy of your approved RGA and shipping instructions will be faxed to you.

E. Customer ships product to designated Siemens location. A Return Goods Request/Authorization (RGA) is required to accompany all material returned to Siemens.

F. The customer is responsible for costs, including freight and handling, for returned product to Siemens.

G. For all material returned in conformance with this policy, a credit will be issued promptly by Siemens within 15 days of receipt of material.

H. Customers should not take a deduction for material returned until Siemens has issued the above mentioned credit.

I. All returned materials are subject to inspection by Siemens. Returns not complying with this policy will be returned to their sending location.

J. Stock products are subject to a 20 % restocking charge. Customized and engineered products are subject to a negotiated restocking charge.

Siemens return goods process – Siemens error

A Return Goods Request/ Authorization (RGA) is required to accompany all products returned to Siemens. This insures that the returned product is properly identified and credited to your account. Unauthorized returns will be refused and returned to the customer with no liability to Siemens.

Siemens error return

Siemens error returns provide customers the opportunity to return material within 60 days of shipment in the event of a Siemens order or shipment error.

Procedures

A. Customer contacts Customer Service or inside sales person to initiate return of material. Original purchase order number or invoice number must be available for reference.

B. Products must be unopened, unused, undamaged, in the original "as-shipped" package or in static protection, and securely packed to be received by Siemens without damage. Software may only be returned when seal has not been broken.

C. Siemens will process your request and a return goods authorization (RGA) number will be issued as authorization to return the product(s) to Siemens.

D. A copy of your approved RGA and shipping instructions will be faxed to you.

E. Customer ships product to designated Siemens location. A Return Goods Request/Authorization (RGA) is required to accompany all material returned to Siemens.

F. Material should be returned following the Routing/Preferred Carrier instructions located on the shipping instructions. If these instructions are not followed freight charges may be assessed.

G. For all material returned in conformance with this policy, a credit will be issued within 15 days of receipt of material or a replacement part provided.

H. Customers should not take a deduction for material returned. Siemens will issue a credit within 15 days of receipt of material.

I. All returned materials are subject to inspection by Siemens. Returns not complying with this policy will be returned to their sending location.

J. An additional 15 % repackaging charge will be applied for returned material not suitable for resale, or returned in broken inner cartons requiring inspection and re-packaging. No re-packaging charge of any kind will be applied when material is returned in undamaged, original inner/outer cartons suitable for resale.

Siemens return goods process – Non-Conforming (Warranty)

A Return Goods Request/ Authorization (RGA) is required to accompany all products returned to Siemens. This insures that the returned product is properly identified and credited to your account. Unauthorized returns will be refused and returned to the customer with no liability to Siemens.

Non-Conforming product return (Drives)

Non-Conforming product warranty returns enable Siemens customers to return product to the factory for replacement, exchange or credit if found to be non-conforming in accordance with the conditions of the Company's product warranty.

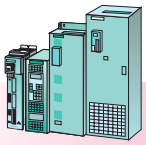
Procedures

A. Customer contacts Customer Service (1-8 00-3 33-74 21) to initiate return of material. A list of products requested to return and alleged failure scenarios are communicated to Siemens for processing.

B. Siemens will process your request and a return goods authorization (RGA) number will be issued as authorization to return the product(s) to Siemens.

C. If the return is an emergency, e.g. your equipment is down, and the warranty can be validated commercially, for approved product categories Siemens will ship a replacement part to you at no charge. If you should fail to return the non-conforming part within 10 days upon instructions from Siemens, you will be invoiced in full for the replacement part.

D. A copy of your approved RGA and shipping instructions will be faxed to you.



Compact PLUS/compact and chassis units · cabinet units

Customer service United States

E. Customer ships product to designated Siemens location. A Return Goods Request/Authorization (RGA) is required to accompany all material returned to Siemens.

F. Material should be returned following the instructions located on the shipping instructions accompanying the RGA form.

G. Conforming products will be shipped back to the customer.

H. For non-conforming material returned in conformance with this policy repair, exchange, or credit at Siemens discretion will be issued after an evaluation of the received material.

I. Customers should not take a deduction for material returned.

J. All returned materials are subject to inspection by Siemens. Returns not complying with this agreement will be returned to their sending location.

Optional warranties

Repair, replacement, and warranty service

All claims for warranty repair or replacement must initially be made to Customer Service at 1-8 00-3 33-74 21. Should the problem not be solved over the phone, an RGA will be issued to return the defective part. If the warranty can be validated commercially (ship date falls within warranty period) a replacement part can be shipped if available. SE&A will pay for best way freight on such replacements. The customer is responsible for expedited freight delivery.

Once the defective product has been returned, a technical evaluation will be performed to validate the warranty. Should the unit be found to not meet warranty requirements, and purchase order will be requested from the customer.

If your warranty has expired, you may still want to take advantage of our excellent repair and replacement service. Highly trained technicians perform incoming tests to determine the exact failure, repair the equipment, and fully test prior to shipment back to the customer. However, if you elect, we may be able to send you a remanufactured part for 60 % of the list price of a new part less your applicable discount on an exchange basis. Remanufactured parts carry a ninety (90) day warranty. Your Sales or Customer Service Representative can tell you which parts are included in our repair and replacement program. Should you take advantage of this program, please note that the original part must be returned to SE&A within ten (10) days, or an invoice will be issued for the additional 40 %.

Replacement warranty

Should a remanufactured replacement of a defective item be the solution to a warranty claim, the remanufactured part shall be under warranty for the duration of the warranty of the original item or ninety (90) days, whichever is longer. A remanufactured part (other than original warranty replacement) carries a ninety (90) day warranty.

Months from	Standard warranty	6 month deferred warranty	12 month deferred warranty
Installation	12	12	12
Manufacturing	18	24	30
% of net	0 %	1 %	2 %

Extended warranty

Drive products offers an extended warranty for all products sold. An extended warranty of 12 months is offered with a surcharge of 5 % of the net price of the product. This extended warranty offer is only available if ordered prior to time of original shipment from Siemens.

Deferred warranty

Siemens also offers a deferred warranty for all products sold. Commissioning must also be purchased to inspect the condition of the drive and supervise the start up. This deferred warranty offer is only available if ordered prior to time of original shipment from Siemens. The deferred warranty is offered for those applications that will have a delayed installation period, but only require a 12 month warranty from the date of commissioning. The chart below is a listing of the warranty periods and fees for the deferred warranty and the extended warranty programs.

Siemens technical services

The Technical Service Group is responsible for technical service support for customers, field service, and sales engineers. Requests for parts, equipment commissioning, emergency service, or routine maintenance are coordinated and scheduled through this group.

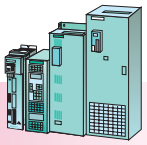
Service coordination and technical support for a wide variety of drive products, including both domestic and international supplied units, are available from this team. Interfacing with the Siemens Service Organization, other Siemens Divisions, and supplier service facilities, this group is the single point of contact in effectively providing remote technical and field service support.

Over the past year, an internal survey showed that greater than 95 % of the problems called in were resolved over the telephone. This level of technical expertise has significantly reduced the number of on-site service calls.

Technical Service is available 24-hours, 7 days a week by dialing 1-8 00-3 33-74 21; ask for Drives Technical Services and the call will be channeled automatically through a call center which activates the appropriate personnel for both parts and technical support.

Siemens emergency access

To activate our Emergency/ After Hours Service, simply dial 1-800-241-4453 and ask for Drives Technical Service and the call will be automatically transferred to our message service, who will in turn page the On-Call Representative.



Standard terms and conditions of sale (9/1/2001)

Siemens Energy & Automation, Inc. („Seller")

1. **WARRANTY**
   (a) Seller warrants that on the date of shipment the goods are of the kind and quality described herein and are free of nonconformities in workmanship and material. This warranty does not apply to goods delivered by Seller but manufactured by others.

   (b) Buyer's exclusive remedy for a nonconformity in any item of the goods shall be the repair or the replacement (at Seller's option) of the item and any affected part of the goods. Seller's obligation to repair or replace shall be in effect for a period of one (1) year from initial operation of the goods but not more than eighteen (18) months from Seller's shipment of the goods, provided Buyer has sent written notice within that period of time to Seller that the goods do not conform to the above warranty. Repaired and replacement parts shall be warranted for the remainder of the original period of notification set forth above, but in no event less than 12 months from repair or replacement. At its expense, Buyer shall remove and ship to Seller any such nonconforming items and shall reinstall the repaired or replaced parts. Buyer shall grant Seller access to the goods at all reasonable times in order for Seller to determine any nonconformity in the goods. Seller shall have the right of disposal of items replaced by it. If Seller is unable or unwilling to repair or replace, or if repair or replacement does not remedy the nonconformity, Seller and Buyer shall negotiate an equitable adjustment in the contract price, which may include a full refund of the contract price for the nonconforming goods.

   (c) SELLER HEREBY DISCLAIMS ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, EXCEPT THAT OF TITLE. SPECIFICALLY, IT DISCLAIMS THE IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, COURSE OF DEALING AND USAGE OF TRADE.

   (d) Buyer and successors of Buyer are limited to the remedies specified in this article and shall have no others for a nonconformity in the goods. Buyer agrees that these remedies provide Buyer and its successors with a minimum adequate remedy and are their exclusive remedies, whether Buyer's or its successors' remedies are based on contract, warranty, tort (including negligence), strict liability, indemnity, or any other legal theory, and whether arising out of warranties, representations, instructions, installations, or non-conformities from any cause.

   (e) Note: This article 1 does not apply to any software which may be furnished by Seller. In such cases, the attached Software License Addendum applies.

2. **PATENTS**
   Seller shall pay costs and damages finally awarded in any suit against Buyer or its vendees to the extent based upon a finding that the design or construction of the goods as furnished infringes a United States patent (except infringement occurring as a result of incorporating a design or modification at Buyer's request), provided that Buyer promptly notifies Seller of any charge of infringement, and Seller is given the right at its expense to settle such charge and to defend or control the defense of any suit based upon such charge. Seller shall have no obligation hereunder with respect to claims, suits or proceedings, resulting from or related to, in whole or in part, (i) the use of software or software documentation, (ii) compliance with Buyer's specifications, (iii) the combination with, or modification of, the goods after delivery by Seller, or (iv) the use of the goods, or any part thereof, in the practice of a process. THIS ARTICLE SETS FORTH SELLER'S ENTIRE LIABILITY WITH RESPECT TO PATENTS.

3. **PERFORMANCE; DELAYS**
   Timely performance by Seller is contingent upon Buyer's supplying to Seller, when needed, all required technical information and data, including drawing approvals, and all required commercial documentation. If Seller suffers delay in performance due to any cause beyond its reasonable control, the time of performance shall be extended a period of time equal to the period of the delay and its consequences. Seller will give to Buyer notice within a reasonable time after Seller becomes aware of any such delay.

4. **SHIPMENT, TITLE AND RISK OF LOSS**
   Unless the delivery terms of this contract expressly provide for F.O.B. destination, shipping/delivery will be F.O.B. Seller's point of shipment with title to the goods and risk of loss or damage passing to Buyer at that point. Buyer will be responsible for shipment during transit and for filing any damage or loss claims directly with the carrier. Seller may make partial shipments.

5. **TAXES**
   Any applicable duties or sales, use, excise, value-added or similar taxes will be added to the price and invoiced separately (unless an acceptable exemption certificate is furnished).

6. **TERMS OF PAYMENT**
   (a) Unless otherwise stated, all payments shall be in United States dollars, and a pro rata payment shall become due as each shipment is made. If shipment is delayed by Buyer, date of notice of readiness for shipment shall be deemed to be date of shipment for payment purposes.

   (b) On late payments, the contract price shall, without prejudice to Seller's right to immediate payment, be increased by 1 1/2 % per month on the unpaid balance, but not to exceed the maximum permitted by law.

   (c) If any time in Seller's judgment Buyer is unable or unwilling to meet the terms specified, Seller may require satisfactory assurance or full or partial payment as a condition to commencing or continuing manufacture or making shipment, and may, if shipment has been made, recover the goods from the carrier, pending receipt of such assurances.

7. **NONCANCELLATION**
   Buyer may not cancel or terminate for convenience, or direct suspension of manufacture, except with Seller's written consent and then only upon terms that will compensate Seller for its engineering, fabrication and purchasing charges and any other costs relating to such cancellation, termination or suspension, plus a reasonable amount for profit.

8. **NUCLEAR**
   Buyer represents and warrants that the goods covered by this contract shall not be used in or in connection with a nuclear facility or application. If Buyer is unable to make such representation and warranty, then Buyer agrees to indemnify and hold harmless Seller and to waive and require its insurers to waive all right of recovery against Seller for any damage, loss, destruction, injury or death resulting from a „nuclear incident," as that term is defined in the Atomic Energy Act of 1954, as amended, whether or not due to Seller's negligence.

9. **LIMITATION OF LIABILITY**
   Neither Seller, nor its suppliers shall be liable, whether in contract, warranty, failure of a remedy to achieve its intended or essential purposes, tort (including negligence), strict liability, indemnity or any other legal theory, for loss of use, revenue or profit, or for costs of capital or of substitute use or performance, or for indirect, special, liquidated, incidental or consequential damages, or for any other loss or cost of a similar type, or for claims by Buyer for damages of Buyer's customers. Seller's maximum liability under this contract shall be the contract price. Buyer and Seller agree that the exclusions and limitations set forth in this article are separate and independent from any remedies which Buyer may have hereunder and shall be given full force and effect whether or not any or all such remedies shall be deemed to have failed of their essential purpose.

10. **GOVERNING LAW AND ASSIGNMENT**
    The laws of the State of Georgia shall govern the validity, interpretation and enforcement of this contract, without regard to its conflicts of law principles. The application of the United Nations Convention on Contracts for the International Sale of Goods shall be excluded. Assignment may be made only with written consent of both parties; provided, however, Seller may assign to its affiliate without Buyer's consent.

11. **ATTORNEY FEES**
    Buyer shall be liable to Seller for any attorney fees and costs incurred by Seller in enforcing any of its rights hereunder.

12. **DISPUTES**
    Either party may give the other party written notice of any dispute arising out of or relating to this contract and not resolved in the normal course of business. The parties shall attempt in good faith to resolve such dispute promptly by negotiations between executives who have authority to settle the dispute. If the matter has not been resolved within 60 days of the notice, either party may initiate non-binding mediation of the dispute.

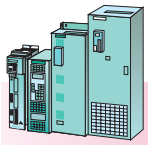
13. **STATUTE OF LIMITATIONS**
    To the extent permitted by applicable law, any lawsuit for breach of contract, including breach of warranty, arising out of the transactions covered by this contract, must be commenced not later than twelve (12) months from the date the cause of action accrued.

14. **PRICES**
    In the event of a price increase or decrease, the price of goods on order will be adjusted to reflect such increase or decrease. This does not apply to a shipment held by request of Buyer. Goods already shipped are not subject to price increase or decrease. Orders on a bid or contract basis are not subject to this article. Seller's prices include the costs of standard domestic packing only. Any deviation from this standard packing (domestic or export), including U.S. Government sealed packing, will result in extra charges. To determine such extra charges, consult Seller's sales offices. Orders of less than $400 will be charged a $25 handling fee.

15. **ADDITIONAL TERMS OF PAYMENT**
    (a) Invoice payment terms are as shown on latest discount sheets as issued from time to time. Cash discounts are not applicable to notes or trade acceptances, to prepaid transportation charges when added to Seller's invoices or to discountable items if there are undisputed past due items on the account. Portions of an invoice in dispute should be deducted and the balance remitted with a detailed explanation of the deduction. Cash discounts will only be allowed on that portion of the invoice paid within the normal discount period.

    (b) Freight will be allowed to any common-carrier free-delivery point within the United States, excluding Alaska and Hawaii, on shipments exceeding $1,000 net or more providing Seller selects the carrier. On shipments to Alaska and Hawaii, freight will be allowed to dockside at the listed port of debarkation nearest the destination point on shipments of $1,000 net or more. Buyer shall pay all special costs such as cartage, stevedoring and insurance. Special freight allowances are as shown on latest discount sheets as issued from time to time. Cataloged weights are estimated, not guaranteed. Seller assumes no responsibility for tariff classifications on carriers.

16. **CHANGES IN LAWS AND REGULATIONS**
    Seller's prices and timely performance are based on all applicable laws, rules, regulations, orders, codes, standards or requirements of governmental authorities effective on the date of Seller's proposal. Any change to any law, rule, regulation, order, code, standard or requirement which requires any change hereunder shall entitle Seller to an equitable adjustment in the prices and any time of performance.



Welcome to Siemens Canada Ltd.

As a subsidiary of Siemens AG, Siemens in Canada draws on the global network of innovation to generate revenues of more than $2 billion. Good news for our economy and our way of life. From its corporate headquarters in Mississauga, Ontario, Siemens employs 6,300 Canadians coast to coast, developing solutions for the entire country. And exporting solutions around the world, in the amount of 60 % of Canadian production.

Siemens after sales support

Call 1-8 88-3 03-33 53 for technical service, spare parts, return material authorizations and warranty issues.

Customer Interaction Centre for after sales support: provides a national, 24 hours, 7 days a week, bilingual service to respond to all customer calls involving return material authorizations, service requests, spare parts orders and warranty issues as well as product comments. The Customer Interaction Centre can also be contacted via email at cic@siemens.ca.

Siemens technical service

Siemens technical services support all Siemens drives in Canada. Throughout Canada Siemens technical services provide technical service support and fields service. Request for equipment commissioning, emergency service, and routine maintenance are coordinated and scheduled through this group. If technical service is required, please call 1-8 88-3 03-33 53.

With over a hundred years' experience in providing reliability, safety, and service, Siemens is there.

Siemens repairs and returns

In case a defective part needs to be returned to Siemens Canada Ltd. for repair or credit, please follow these instructions.

Parts sent to Siemens Canada Ltd. not using the procedures outlined below may cause the warranty to be voided or improper credit to be issued.

1. Call 1-8 88-3 03-33 53 and ask for warranty/defective product returns. The call will be forwarded to the next available Customer Service Representative (CSR). The CSR will provide instruction about how to complete a Field Inspection Report & RMA Request Form (FIR&RMA) with the following important information. The FIR&RMA form shall be faxed to the advised address on the form.
   a) Company name, contact address
   b) Original purchase order number
   c) Model number
   d) Serial number
   e) Detailed fault description
2. A Return Material Authorization form (RMA) will be issued within 24 hours of receipt of your FIR&RMA. The copy of RMA form must accompany the listed items being returned to Siemens. Any item received without the appropriate RMA documentation will not be accepted and returned to the sender collect.

   RMAs are valid for 30 days from date issued. Any returns received after 30 days will be returned to the sender at their expense. A new RMA will have to be requested for the same items before being returned.
3. Electrostatically Sensitive Devices (ESD) handling is to be observed for all electronic- based products. Please use anti-static bags when shipping printed circuit boards back to Siemens. Otherwise the warranty is null or void.
4. If it is a warranty claim, the item will be inspected and the warranty validated, upon receipt. Then the item will be repaired or replaced as appropriate and will be returned at no charge.
5. If it is a non-warranty case, an inspection fee will be charged to cover the cost of evaluating the defective return for possible repair work.

   The item will be inspected and the CSR will issue a quotation for repair. Upon receipt or Purchase Order, the item will be repaired, tested and returned.

Siemens extended warranty

Drive products offer an extended warranty for all products sold. The extended warranty of 12 months is offered with a surcharge of 5 % of the net price of the product. This extended warranty is only available if ordered prior to time of shipment from Siemens.

Months from	Standard warranty	Extended warranty
Installation	12	24
Manufacturing	18	30
% of net	0 %	5 %

Siemens technical training

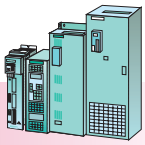
The Siemens technical training centre is committed to providing quality technical courses in the Canadian Electrical and Automation Markets. Siemens develops and gears each course and the related materials to be effective in the competitive Canadian marketplace.

Siemens offers 20 quality courses with expert instructors and dedicated support staff. Our practical, but challenging "hands-on" courses provide the ultimate arena for effective learning and information retention. Training is offered in St. Johns, Dartmouth, Montreal, Mississauga, Calgary, Edmonton, and Vancouver. Custom on-site training tailored to customer requirements and specific requests are also performed.

Following each course, the students can feel confident that they are equipped with the expert knowledge and capabilities to effectively sell or support the product.

Registration or questions on course content can be made to the Training Centre by the following:

Elizabeth Isaac
Training Administrator
Tel.: 9 05-8 19-58 00 Ext. 22 19
Fax: 9 05-8 19-58 22
Email:
elizabeth.isaac@siemens.ca



General terms and conditions of sale

The following terms and conditions of sale shall apply to any sale of goods and services by Siemens Canada Limited (hereinafter called "Siemens"). Purchaser shall be deemed to have full knowledge of the terms and conditions herein and such terms and conditions shall be binding if either the goods and services referred to herein are delivered to and accepted by Purchaser, or if Purchaser does not within five days from the date hereof deliver to Siemens written objection to said terms and conditions or any part thereof.

1. **GENERAL**
In the event of any conflict or inconsistency between the terms and conditions of sale herein and the terms and conditions contained in Purchaser's order or in any other form issued by Purchaser, whether or not any such form has been acknowledged or accepted by Siemens, Siemens' terms and conditions herein shall prevail. No waiver, alteration or modification of these terms and conditions shall be binding upon Siemens unless made in writing and signed by a duly authorized representative of Siemens.

2. **QUOTATIONS**
Unless otherwise stated, Siemens' quotation shall be null and void unless accepted by Purchaser within thirty (30) days from the date of quotation.

3. **PRICES/COST OF TRANSPORTATION**
All quoted prices are based on the current exchange rates, tariffs and costs of manufacture. Unless otherwise stated in the quotation, quoted prices are subject to change by Siemens with or without notice until Purchaser's acceptance. Prices are subject to correction for error. Unless otherwise stated, all prices are f.o.b. factory and include domestic packing. Customary methods of transportation shall be selected by Siemens and such transportation will be at Purchaser's expense. Special methods of transportation will be used upon Purchaser's request and at Purchaser's additional expense provided reasonable notice of Purchaser's transportation requirements are given by Purchaser to Siemens prior to shipment.

4. **TAXES**
Prices do not include Goods & Services Tax, Provincial or Municipal sales, use, value-added or similar tax. Accordingly, in addition to the price specified herein, the amount of any present or future sales, use, value-added or similar tax applicable to the sale of the goods hereunder to or the use of such goods by Purchaser shall be paid by Purchaser to the entire exoneration of Siemens.

5. **DELIVERY**
Delivery schedules are approximate and are based on prevailing market conditions applicable respectively at the time of Siemens' quotation and Siemens' acceptance of Purchaser's order. Delivery shall also depend on the prompt receipt by Siemens of the necessary information to allow maintenance of the manufacturer's engineering and manufacturing schedules. Siemens may extend delivery schedules or may, at its option, cancel Purchaser's order in full or in part without liability other than to return any deposit or prepayment which is unearned by reason of the cancellation.

6. **FORCE MAJEURE**
Siemens shall not be responsible or liable for any loss or damage incurred by Purchaser herein resulting from causes beyond the reasonable control of Siemens including, but without limitation, acts of God, war, invasion, insurrection, riot, the order of any civil or military authority, fire, flood, weather, acts of the elements, delays in transportation, unavailability of equipment or materials, breakdown, sabotage, lock-outs, strikes or labour disputes, faulty castings or forgings, or the failure of Siemens' suppliers to meet their delivery promises. The acceptance of delivery of the equipment by Purchaser shall constitute a waiver of all claims for loss or damage due to any delay whatsoever.

7. **SHIPMENT/DAMAGES OR SHORTAGES IN TRANSPORT/RISK**
Except for obligations stated under "Warranty" herein, Siemens' responsibility for goods ceases upon delivery to the carrier. In the event of loss or damage during shipment, Purchaser's claim shall be against the carrier only. Siemens will, however, give Purchaser any reasonable assistance to secure adjustment of Purchaser's claim against the carrier provided immediate notice of such claim is given by Purchaser to Siemens. Claims for shortages must be made in writing within ten (10) days after receipt of goods by Purchaser. If Siemens does not receive written notification of such shortages within such ten (10) days, it shall be conclusively presumed that the goods were delivered in their entirety. Unless agreed upon otherwise in writing, Siemens reserves the right to make partial shipments and to submit invoices for partial shipments.

8. **TITLE**
Title to the goods or any part thereof shall not pass from Siemens to Purchaser until all payments due hereunder have been duly made in cash, except as otherwise expressly stipulated herein. The goods shall be and remain personal or moveable property, notwithstanding their mode of attachment to realty or other property. If default is made in any of the payments herein, Purchaser agrees that Siemens may retain all payments which have been made on account of the purchase price as liquidated damages, and Siemens shall be free to enter the premises where the goods may be located and remove them as Siemens' property, without prejudice to Siemens' right to recover any further expenses or damages Siemens may suffer by reason of such nonpayment.

9. **LIABILITY**
Siemens shall not be liable for and shall be held harmless by Purchaser from any damage, losses or claims of whatever kind, contractual or delictual, consequential or incidental, direct or indirect, arising out of, in connection with or resulting from the sale governed hereby or the goods, including, but without limitation, the manufacture, repair, handling, installation, possession, use, operation or dismantling of the goods and any and all claims, actions, suits, and proceedings which may be instituted in respect to the foregoing.

10. **WARRANTY**
Goods sold hereunder are covered by a warranty against defects in material and workmanship provided the goods and services are subjected to normal use and service. The applicable warranty period is twelve (12) months from the date of installation or eighteen (18) months from shipping date to Purchaser of any item of the goods, whichever occurs first, or any other warranty period otherwise stipulated in writing by Siemens under this sale. For components not supplied by Siemens, the original manufacturer's warranty shall apply to the extent assignable by Siemens. The obligation under this warranty is limited to the repair or replacement, at Siemens' option, of defective parts f.o.b. point of shipment provided that prompt notice of any defect is given by Purchaser to Siemens in writing within the applicable warranty period and that upon the Purchaser's return of the defective parts to Siemens or, if designated by Siemens, to the location where the works are made, properly packed and with transportation charges prepaid by Purchaser, an inspection thereof shall reveal to Siemens' satisfaction that Purchaser's claim is valid under the terms of this warranty. Purchaser shall assume all responsibility and expense for dismantling, removal, re-installation and freight in connection with the foregoing. The same obligations and conditions extend to replacement parts furnished by Siemens hereunder. Siemens does not assume liability for installation, labour or consequential damages. Siemens makes no warranty other than the one set forth herein. All other warranties, legal, expressed or implied, including but not limited to any expressed or implied warranty of merchantability, of fitness for the intended use thereof or against infringement are hereby expressly excluded.

The applicable warranty ceases to be effective if the goods are altered or repaired other than by persons authorized or approved by Siemens to perform such work. Repairs or replacement deliveries do not interrupt or prolong the term of the warranty. The warranty ceases to be effective if Purchaser fails to operate and use the goods sold hereunder in a safe and reasonable manner and in accordance with any written instructions from the manufacturers.

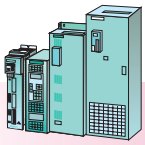
11. **INSTALLATION**
Unless otherwise expressly stipulated, the goods shall be installed by and at the risk and expense of Purchaser. In the event that Siemens is requested to supervise such installation, Siemens' responsibility shall be limited to exercising that degree of skill customary in the trade in supervising installations of the same type. Purchaser shall remain responsible for all other aspects of the work including compliance with the local regulations.

12. **RETURNED GOODS**
No goods may be returned to Siemens without Siemens' prior written permission. Siemens reserves the right to decline all returns or to accept them subject to a handling/restocking charge. Even after Siemens has authorized the return of goods for credit, Siemens reserves the right to adjust the amount of any credit given to Purchaser on return of the goods based on the conditions of the goods on arrival in Siemens' warehouse. Credit for returned goods will be issued to Purchaser only where such goods are returned by Purchaser and not by any subsequent owner of the goods. Goods will be considered for return only if they are in their original condition and packaging.

13. **TERMS OF PAYMENT**
Unless otherwise stated, invoices on "open account" shipment are payable within thirty (30) days of invoice date. Unless specifically provided, no cash discount shall be available to Purchaser. When cash discount is offered, the discount price is computed from the date of invoice. Siemens does not offer cash discount on C.O.D. shipments. Should payment not be made to Siemens when due, Siemens reserves the right, until the price has been fully paid in cash, to charge Purchaser with interest on such overdue payments at the rate of eighteen percent (18 %) per annum. The charging of such interest shall not be construed as obligating Siemens to grant any extension of time in the terms of payment.

14. **CHANGES AND CANCELLATION**
Orders accepted by Siemens are not subject to changes or cancellation by Purchaser, except with Siemens' written consent. In such cases where Siemens authorizes changes or cancellation, Siemens reserves the right to charge Purchaser with reasonable costs based upon expenses already incurred and commitments made by Siemens, including, without limitation, any labour done, material purchased and also including Supplier's usual overhead and reasonable profit and cancellation charges from Siemens' suppliers.

15. **THE AGREEMENT**
An acceptance and official confirmation of Purchaser's order by Siemens shall constitute the complete agreement, subject to the terms and conditions of sale herein set forth, and shall supersede all previous quotations, orders or agreements. The law of the Province of Ontario shall govern the validity, interpretation and enforcement of these terms and conditions of sale and of any contract of which these terms and conditions are a part.



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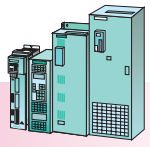
1) For the right partner for your country, please look at our Internet site at:
http://www.siemens.com/automation/service&support



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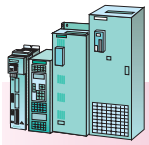

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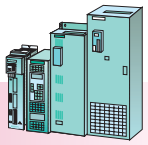

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Rotary inertia (to convert from A to B, multiply by entry in table)

A \ B	lb-in²	lb-ft²	lb-in-s²	lb-ft-s² slug-ft²	Kg-cm²	Kg-cm-s²	gm-cm²	gm-cm-s²	oz-in²	oz-in-s²
lb-in²	1	6.94×10^{-3}	2.59×10^{-3}	2.15×10^{-4}	2.926	2.98×10^{-3}	2.92×10^{3}	2.984	16	4.14×10^{-2}
lb-ft²	144	1	0.3729	3.10×10^{-2}	421.40	0.4297	4.21×10^{5}	429.71	2304	5.967
lb-in-s²	386.08	2.681	1	8.33×10^{-2}	1.129×10^{3}	1.152	1.129×10^{6}	1.152×10^{3}	6.177×10^{3}	16
lb-ft-s² slug-ft²	4.63×10^{3}	32.17	12	1	1.35×10^{-4}	13.825	1.355×10^{7}	1.38×10^{4}	7.41×10^{-4}	192
Kg-cm²	0.3417	2.37×10^{-3}	8.85×10^{-4}	7.37×10^{-5}	1	1.019×10^{-3}	1000	1.019	5.46	1.42×10^{-2}
Kg-cm-s²	335.1	2.327	0.8679	7.23×10^{-2}	980.66	1	9.8×10^{5}	1000	5.36×10^{3}	13.887
gm-cm²	3.417×10^{-4}	2.37×10^{-6}	8.85×10^{-7}	7.37×10^{-8}	1×10^{-3}	1.01×10^{-6}	1	1.01×10^{-3}	5.46×10^{-3}	1.41×10^{-5}
gm-cm-s²	0.335	2.32×10^{-3}	8.67×10^{-4}	7.23×10^{-5}	0.9806	1×10^{-3}	980.6	1	5.36	1.38×10^{-2}
oz-in²	0.0625	4.34×10^{-4}	1.61×10^{-4}	1.34×10^{-5}	0.182	1.86×10^{-4}	182.9	0.186	1	2.59×10^{-3}
oz-in-s²	24.13	0.1675	6.25×10^{-2}	5.20×10^{-3}	70.615	7.20×10^{-2}	7.09×10^{4}	72.0	386.08	1

Torque (to convert from A to B, multiply by entry in table)

A \ B	lb-in	lb-ft	oz-in	N-m	Kg-cm	Kg-m	gm-cm	dyne-cm
lb-in	1	8.333×10^{-2}	16	0.113	1.152	1.152×10^{-2}	1.152×10^{3}	1.129×10^{6}
lb-ft	12	1	192	1.355	13.825	0.138	1.382×10^{4}	1.355×10^{7}
oz-in	6.25×10^{-2}	5.208×10^{-3}	1	7.061×10^{-3}	7.200×10^{-2}	7.200×10^{-4}	72.007	7.061×10^{7}
N-m	8.850	0.737	141.612	1	10.197	0.102	1.019×10^{4}	1×10^{7}
Kg-cm	0.8679	7.233×10^{-2}	13.877	9.806×10^{-2}	1	10^{-2}	1000	9.806×10^{5}
Kg-m	86.796	7.233	1.388×10^{3}	9.806	100	1	1×10^{5}	9.806×10^{7}
gm-cm	8.679×10^{-4}	7.233×10^{-5}	1.388×10^{-2}	9.806×10^{-5}	1×10^{-3}	1×10^{-5}	1	980.665
dyne-cm	8.850×10^{-7}	7.375×10^{-8}	1.416×10^{-5}	10^{-7}	1.0197×10^{-6}	1.019×10^{-8}	1.019×10^{-3}	1

Length (to convert from A to B, multiply by entry in table)

A \ B	Inches	feet	cm	yd	mm	m
Inches	1	0.0833	2.54	0.028	25.4	0.0254
feet	12	1	30.48	0.333	304.8	0.3048
cm	0.3937	0.03281	1	1.09×10^{-2}	10	0.01
yd	36	3	91.44	1	914.4	0.914
mm	0.03937	0.00328	0.1	1.09×10^{-3}	1	0.001
m	39.37	3.281	100	1.09	1000	1

Mass (to convert from A to B, multiply by entry in table)

A \ B	lb	oz	gm	slug
lb	1	16	453.6	0.0311
oz	6.25×10^{-2}	1	28.35	1.93×10^{-3}
gm	2.205×10^{-3}	3.527×10^{-3}	1	6.852×10^{-5}
slug	32.17	514.8	1.459×10^{4}	1

Power (to convert from A to B, multiply by entry in table)

A \ B	H.P.	Watts
H.P. (English)	1	745.7
(lb-in)(deg./sec)	2.645×10^{-6}	1.972×10^{-3}
(lb-in)(RPM)	1.587×10^{-5}	1.183×10^{-2}
(lb-ft)(deg./sec)	3.173×10^{-5}	2.366×10^{-2}
(lb-ft)(RPM)	1.904×10^{-4}	0.1420
Watts	1.341×10^{-3}	1

Rotation (to convert from A to B, multiply by entry in table)

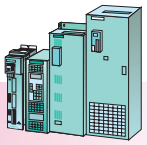
A \ B	RPM	rad/sec.	degrees/sec.
RPM	1	0.105	6.0
rad/sec.	9.55	1	57.30
degrees/sec.	0.167	1.745×10^{-2}	1

Temperature conversion

°F	°C	°C	°F
0	–17.8	–10	14
32	0	0	32
50	10	10	50
70	21.1	20	68
90	32.2	30	86
98.4	37	37	98.4
212	100	100	212
subtract 32 and multiply by $^{5}/_{9}$		multiply by $^{9}/_{5}$ and add 32	

Force (to convert from A to B, multiply by entry in table)

A \ B	lb	oz	gm	dyne	N
lb	1	16	453.6	4.448×10^{-5}	4.4482
oz	0.0625	1	28.35	2.780×10^{-4}	0.27801
gm	2.205×10^{-3}	0.03527	1	1.02×10^{-3}	N.A.
dyne	2.248×10^{-6}	3.59×10^{-5}	890.7	1	0.00001
N	0.22481	3.5967	N.A.	100.000	1



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