SINAMICS S110

Equipment Manual · 10/2008

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SINAMICS S110

Manual

Edition 10.2008
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Legal information

Warning notice system

This manual contains notices you have to observe in order to ensure your personal safety, as well as to prevent damage to property. The notices referring to your personal safety are highlighted in the manual by a safety alert symbol, notices referring only to property damage have no safety alert symbol. These notices shown below are graded according to the degree of danger.

⚠DANGER
indicates that death or severe personal injury **will** result if proper precautions are not taken.

⚠WARNING
indicates that death or severe personal injury **may** result if proper precautions are not taken.

⚠CAUTION
with a safety alert symbol, indicates that minor personal injury can result if proper precautions are not taken.

CAUTION
without a safety alert symbol, indicates that property damage can result if proper precautions are not taken.

NOTICE
indicates that an unintended result or situation can occur if the corresponding information is not taken into account.

If more than one degree of danger is present, the warning notice representing the highest degree of danger will be used. A notice warning of injury to persons with a safety alert symbol may also include a warning relating to property damage.

Qualified Personnel

The device/system may only be set up and used in conjunction with this documentation. Commissioning and operation of a device/system may only be performed by **qualified personnel**. Within the context of the safety notes in this documentation qualified persons are defined as persons who are authorized to commission, ground and label devices, systems and circuits in accordance with established safety practices and standards.

Proper use of Siemens products

Note the following:

⚠WARNING
Siemens products may only be used for the applications described in the catalog and in the relevant technical documentation. If products and components from other manufacturers are used, these must be recommended or approved by Siemens. Proper transport, storage, installation, assembly, commissioning, operation and maintenance are required to ensure that the products operate safely and without any problems. The permissible ambient conditions must be adhered to. The information in the relevant documentation must be observed.

Trademarks

All names identified by ® are registered trademarks of the Siemens AG. The remaining trademarks in this publication may be trademarks whose use by third parties for their own purposes could violate the rights of the owner.

Disclaimer of Liability

We have reviewed the contents of this publication to ensure consistency with the hardware and software described. Since variance cannot be precluded entirely, we cannot guarantee full consistency. However, the information in this publication is reviewed regularly and any necessary corrections are included in subsequent editions.

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Ordernumber: 6SL3097-4AC10-0BP0
℗ 11/2008

Preface

SINAMICS Documentation

The SINAMICS documentation is organized in 2 parts:

- General documentation / catalogs
- Manufacturer/service documentation

At http://www.siemens.com/motioncontrol/docu information is available on the following topics:

- Ordering documentation

  Here you will find the current overview of publications

- Downloading documentation

  Links to more information for downloading files from Service & Support

- Researching documentation online

  Information on DOConCD and direct access to the publications in DOConWeb.

- Individually compiling documentation on the basis of Siemens contents with the My Documentation Manager (MDM), refer to

  http://www.siemens.com/mdm

The My Documentation Manager offers you a number of features for compiling your own machine documenation

- Training and FAQs

Information on the range of training courses and FAQs (frequently asked questions) are available via the page navigation.

Usage phases and the available tools/documents

Table 1 Usage phase and the available tools / documents

Usage phase	Tools/documents
Orientation	SINAMICS S Sales Documentation
Planning/configuration	SIZER engineering tool Configuration Manuals, Motors
Decision making / ordering	SINAMICS S Catalogs
Installation / assembly	• SINAMICS S110 Equipment Manual
Commissioning	• STARTER parameterization and commissioning tool • SINAMICS S110 Getting Started • SINAMICS S110 Function Manual Drive Functions • SINAMICS S110 List Manual

Usage phase	Tools/documents
Usage / operation	• SINAMICS S110 Function Manual Drive Functions • SINAMICS S110 List Manual
Maintenance/servicing	• SINAMICS S110 Function Manual Drive Functions • SINAMICS S110 List Manual

Target group

This documentation is aimed at machine manufacturers, commissioning engineers, and service personnel who use SINAMICS.

Benefits

This documentation contains the comprehensive information about parameters, function diagrams and faults and alarms required to commission and service the system.

This manual should be used in addition to the other manuals and tools provided for the product.

Standard scope

The scope of the functionality described in this document can differ from the scope of the functionality of the drive system that is actually supplied.

- Other functions not described in this documentation might be able to be executed in the drive system. This does not, however, represent an obligation to supply such functions with a new control or when servicing.
- Functions can be described in the documentation that are not available in a particular product version of the drive system. The functionality of the supplied drive system should only be taken from the ordering documentation.
- Extensions or changes made by the machine manufacturer must be documented by the machine manufacturer.

For reasons of clarity, this documentation does not contain all of the detailed information on all of the product types. This documentation cannot take into consideration every conceivable type of installation, operation and service/maintenance.

Search tools

The following guides are provided to help you locate information in this manual:

1. General table of contents for the complete manual (after the preface).
2. List of abbreviations
3. References.
4. Index

Technical Support

If you have any questions, please contact our hotline:

	Europe/Africa
Telephone	+49 180 5050 - 222
Fax	+49 180 5050 - 223
0.14 €/min. from German landlines, mobile phone prices may differ)	
Internet	http://www.siemens.de/automation/support-request

	America
Telephone	+1 423 262 2522
Fax	+1 423 262 2200
E-mail	mailto:techsupport.sea@siemens.com

	Asia/Pacific
Telephone	+86 1064 757575
Fax	+86 1064 747474
E-mail	mailto:support.asia.automation@siemens.com

Note

You will find telephone numbers for other countries for technical support in the Internet:
http://www.automation.siemens.com/partner

Spare parts

You can find spare parts on the Internet at:
http://support.automation.siemens.com/WW/view/de/16612315

Questions about the documentation

If you have any questions (suggestions, corrections) regarding this technical documentation, please fax or e-mail us at:

Fax	+49 9131 98 2176
E-mail	mailto:docu.motioncontrol@siemens.com

A fax form is at the end of this document.

Internet address for SINAMICS

http://www.siemens.com/sinamics.

EC Declarations of Conformity

The EC Declaration of Conformity for the EMC Directive can be found/obtained:

- in the Internet:
  http://support.automation.siemens.com
  under the Product/Order No. 15257461
- at the responsible regional office of the I DT MC Business Unit of Siemens AG

The EC Declaration of Conformity for the Low-Voltage Directive can be found/obtained

- in the Internet:
  http://support.automation.siemens.com
  under the Product/Order No. 22383669

Note

When operated in dry areas, SINAMICS S devices conform to the Low Voltage Directive 73/23/EEC or 2006/95/EEC.

Note

SINAMICS S devices fulfill EMC Directive 89/336/EEC or 2004/108/EEC in the configuration specified in the associated EC Declaration of Conformity and when the EMC installation guideline is implemented, Order No. 6FC5297-0AD30-0□P□.

Note

The Equipment Manual describes a desired state which, if maintained, ensures reliable operation as desired and compliance with EMC limit values.

Should there be a deviation from the Manual requirements, appropriate actions (e.g. measurements) must be taken to check/prove that the desired reliable operation is ensured and EMC limit values are complied with.

ESD information

⚠ CAUTION

Electrostatic sensitive devices (ESD) are single components, integrated circuits or devices that can be damaged by electrostatic fields or electrostatic discharges.

Regulations for handling ESD components:

When handling components, make sure that personnel, workplaces, and packaging are well earthed.

Personnel may only come into contact with electronic components, if

- They are grounded with an ESD wrist band, or
- They are in ESD areas with conductive flooring, ESD shoes or ESD grounding straps.

Electronic boards should only be touched if absolutely necessary. They must only be handled on the front panel or, in the case of printed circuit boards, at the edge.

Electronic boards must not come into contact with plastics or items of clothing containing synthetic fibers.

Boards must only be placed on conductive surfaces (work surfaces with ESD surface, conductive ESD foam, ESD packing bag, ESD transport container).

Do not place boards near display units, monitors, or television sets (minimum distance from screen: 10 cm).

Measurements must only be taken on boards when the measuring instrument is grounded (via protective conductors, for example) or the measuring probe is briefly discharged before measurements are taken with an isolated measuring device (for example, touching a bare metal housing).

Safety information

⚠ DANGER

Commissioning must not start until you have ensured that the machine, in which the components described here are installed, complies with the Machinery Directive 98/37/EC.

Only appropriately qualified personnel may mount/install, commission and service the SINAMICS S units.

The personnel must take into account the information provided in the technical customer documentation for the product, and be familiar with and observe the specified danger and warning notices.

Operational electrical equipment and motors have parts and components which are at hazardous voltage levels, that if touched, can result in severe bodily injury or death.

All work on the electrical system must be carried out when the system has been disconnected from the power supply.

In combination with the drive system, the motors are generally approved for operation on TN and TT systems with grounded neutral and on IT systems.

In operation on IT systems, the occurrence of a first fault between an active part and ground must be signaled by a monitoring device. In accordance with IEC 60364-4-41 it is recommended that the first fault should be eliminated as quickly as practically possible.

In networks with a grounded external conductor, an isolating transformer with grounded neutral (secondary side) must be connected between the supply and the drive system to protect the motor insulation from excessive stress. The majority of TT systems have a grounded external conductor, so in this case an isolating transformer must be used.

⚠ DANGER

Correct and safe operation of SINAMICS S drive units assumes correct transportation in the transportation packaging, correct long-term storage in the transport packaging, setup and installation, as well as careful operation and maintenance.

The details in the Catalogs and proposals also apply to the design of special equipment versions.

In addition to the danger and warning information provided in the technical customer documentation, the applicable national, local, and system-specific regulations and requirements must be taken into account.

To ensure compliance with EN 61800-5-1 and UL 508, only safety extra-low voltages from the electronics modules may be connected to connections and terminals.

⚠ DANGER

Using protection against direct contact via DVC A (PELV) is only permissible in areas with equipotential bonding and in dry rooms indoors. If these conditions are not fulfilled, then other protective measures against electric shock must be used (e.g. protection using protective impedances or limited voltage or using protective classes I and II).

⚠ DANGER

Electrical, magnetic and electromagnetic fields (EMF) that occur during operation can pose a danger to persons who are present in the direct vicinity of the product - especially persons with pacemakers, implants, or similar devices.

The relevant directives and standards must be observed by the machine/plant operators and persons present in the vicinity of the product. These are, for example, EMF Directive 2004/40/EEC and standards EN 12198-1 and -3 pertinent to the European Economic Area (EEA), as well as accident prevention code BGV 11 and the associated rule BGR 11 "Electromagnetic fields" of the German employer's liability accident insurance association.

These state that a hazard analysis must drawn up for every workplace, from which measures for reducing dangers and their impact on persons are derived and applied, and exposure and danger zones are defined and observed.

The relevant safety notes in each chapter must be observed.

⚠ DANGER

As part of routine tests, SINAMICS S components will undergo a voltage test in accordance with EN 61800-5-1. Before the voltage test is performed on the electrical equipment of machines acc. to EN 60204-1, Section 19.4, all connectors of SINAMICS S equipment must be disconnected/unplugged to prevent the equipment from being damaged.

Motors should be connected up in accordance with the circuit diagram supplied with the motor (refer to the connection examples for Power Modules). They must not be connected directly to the three-phase supply because this will damage them.

⚠ WARNING

Operating the equipment in the immediate vicinity (< 1.8 m) of mobile telephones with a transmitter power of > 1 W may cause the equipment to malfunction.

Explanation of symbols

The symbols are in accordance with IEC 617-2.

Table 2 Symbols

Symbol	Meaning
	Protective earth (PE)
	Ground (e.g. M 24 V)
	Functional ground Equipotential bonding

Residual risks of power drive systems

When carrying out a risk assessment of the machine in accordance with the EU Machinery Directive, the machine manufacturer must consider the following residual risks associated with the control and drive components of a power drive system (PDS).

1. Unintentional movements of driven machine components during commissioning, operation, maintenance, and repairs caused by, for example:
   - Hardware defects and/or software errors in the sensors, controllers, actuators, and connection technology
   - Response times of the controller and drive
   - Operating and/or ambient conditions not within the scope of the specification
   - Parameterization, programming, cabling, and installation errors
   - Use of radio devices / cellular phones in the immediate vicinity of the controller
   - External influences / damage
2. Exceptional temperatures as well as emissions of light, noise, particles, or gas caused by, for example:
   - Component malfunctions
   - Software errors
   - Operating and/or ambient conditions not within the scope of the specification
   - External influences / damage
3. Hazardous shock voltages caused by, for example:
   - Component malfunctions
   - Influence of electrostatic charging
   - Induction of voltages in moving motors
   - Operating and/or ambient conditions not within the scope of the specification
   - Condensation / conductive contamination
   - External influences / damage
4. Operational electrical, magnetic, and electromagnetic fields that can pose a risk to people with a pacemaker and/or implants or metallic objects if they are too close.
5. Release of environmentally hazardous materials and emissions during improper operation and / or improper disposal of components.

For more information about residual risks of the power drive system components, see the relevant chapters in the technical user documentation.

Table of contents

System overview

1

1.1 Field of application

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

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

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

Figure 1-1 SINAMICS applications

1.2 Platform concept and Totally Integrated Automation

All SINAMICS versions are based on a platform concept. Joint hardware and software components, as well as standardized tools for design, configuration, and commissioning tasks ensure high-level integration across all components. SINAMICS handles a wide variety of drive tasks with no system gaps. The different SINAMICS versions can be easily combined with each other.

SINAMICS is part of Siemens "Totally Integrated Automation". Integrated SINAMICS systems covering configuration, data storage, and communication at automation level ensure low-maintenance solutions with SIMATIC, SIMOTION, and SINUMERIK.

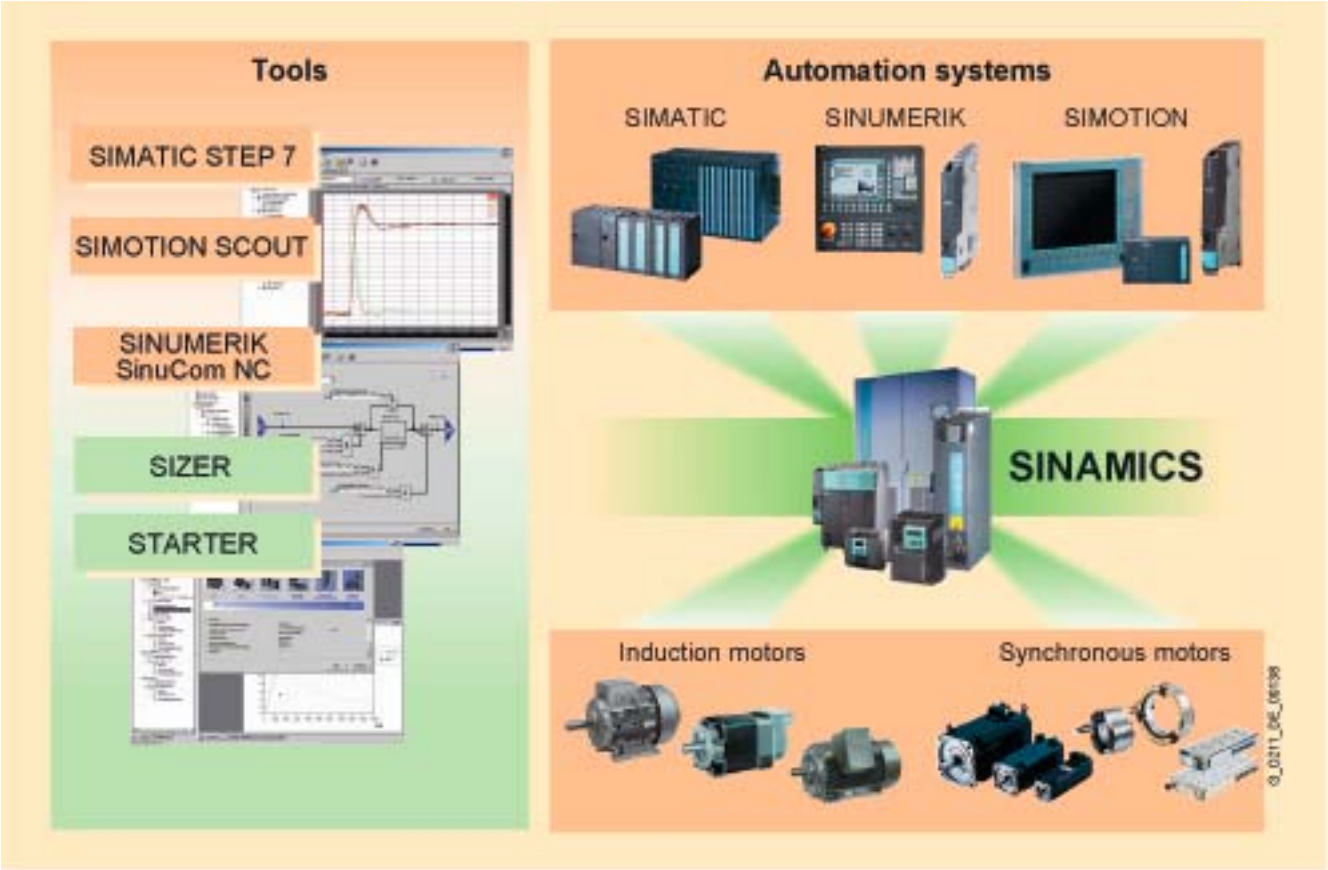


Figure 1-2 SINAMICS as part of the Siemens modular automation system

1.3 Overview of SINAMICS S110

SINAMICS S110 is the "simple servo" in the range of SINAMICS AC Drives. As a modular drive system for single axes in "servo" control mode, it is primarily used for simple positioning tasks in a wide range of industrial applications.

Typical areas of application for positioning, setting up and referencing include:

- Simple infeed tasks (e.g. rotary indexing tables)
- Handling technology, robotics
- Pick & place tasks
- Printing and paper machines
- Packaging machines

As a combination of a power unit (Power Module) and a Control Unit (CU) the SINAMICS S110 forms a single-motor drive in a compact format for machinery and plant construction.

SIZER, a high-performance engineering tool, makes it easier to choose and determine the optimum drive configuration. The drive can be simply commissioned a user-friendly fashion using the STARTER commissioning tool.

SINAMICS S110 can be used to operate synchronous and induction motors. Direct drives, such as linear and torque motors, can only be operated with SINAMICS S120.

1.4 SINAMICS components

This overview shows the components of SINAMICS S110 and S120.

Figure 1-3 SINAMICS S110/S120 component overview

The following system components are available:

- Line-side power components, such as fuses, contactors, reactors and line filters for switching the power supply and complying with EMC regulations.
- Power Modules, with or without integrated line filter, as well as an integrated braking chopper to provide power to the connected motor

To carry out the required functions, SINAMICS S110 is equipped with:

- Control Units that provide the drive and technological functions.
- Supplementary system components that enhance functionality and offer different interfaces for encoders and process signals.

The SINAMICS S110 components were developed for installation in cabinets.

They have the following features and characteristics:

- Easy to handle, simple installation and wiring
- Practical connection system, cable routing in accordance with EMC requirements
- Standard design

1.5 System data

Table 1- 1 General technical data

Electrical data	
Line supply voltage Blocksize format units	 1-ph. 200 V to 240 V AC ±10 % 3-ph. 380 V to 480 V AC ±10 %
Rated pulse frequency Blocksize format units	 4 kHz
Line frequency	47 Hz to 63 Hz
Output voltage Blocksize format units	 0 V to rated line supply voltage at 3-ph. 380 V up to 480 V AC units, 0 V to 0.78 of the line supply voltage for 1-ph. 200 V to 240 V AC units.
Electronics power supply	24 V DC -15/+20 %*), safety extra-low voltage DVC A (PELV)
Short-circuit current rating SCCR in accordance with UL508C (up to 600 V)	• 1.1 kW – 447 kW: 65 kA • 448 kW – 671 kW: 84 kA • 672 kW – 1193 kW: 170 kA • ≥ 1194 kW: 200 kA
Radio interference suppression acc. to EN 61800-3	Category C3 (standard) Category C2 (option) for systems implemented in conformance with the documentation
Overvoltage category	III acc. to EN 60664-1
Degree of pollution	2 acc. to 60664-1

*) If a motor holding brake is used, restricted voltage tolerances may have to be taken into account (-2/+10 %).

Environmental conditions	
Note for the safety functions of Safety Integrated: The components must be protected against conductive pollution (e.g. by installing them in a cabinet with degree of protection IP54B acc. to EN 60529). Provided that conductive pollution can be prevented at the installation site, the degree of protection for the cabinet can be decreased accordingly.	
Degree of protection	IP20 or IPXXB acc. to EN 60529, open type acc. to UL 508
Protective class line supply circuits Protective class electronic circuits	I (with protective conductor connection) III (safety extra-low voltage DVC A /PELV) acc. to EN 61800-5-1
Type of cooling	Internal air cooling, power units with forced air cooling using an integrated fan
Permissible cooling medium temperature (air) and installation altitude in operation	0 °C to +40 °C and up to 1000 m installation altitude without derating, >40 °C up to +55 °C, refer to the characteristic for current derating. Installation altitude >1000 m up to 4000 m, refer to the characteristic for current derating or reduce the ambient temperature by 3.5 K per 500 m.
Chemically active substances • Long-term storage in the transport packaging • Transport in the transport packaging • Operation	 Class 1C2 to EN 60721-3-1 Class 2C2 to EN 60721-3-2 Class 3C2 to EN 60721-3-3

Biological environmental conditions: • Storage in the transport packaging • Transport in the transport packaging • Operation	 Class 1B1 to EN 60721-3-1 Class 2B1 to EN 60721-3-2 Class 3B1 to EN 60721-3-3
Vibratory load • Long-term storage in the transport packaging • Transport in the transport packaging • Operation	 Class 1M2 acc. to EN 60721-3-1 Class 2M3 acc. to EN 60721-3-2 Test values: 10 Hz to 58 Hz 0.075 mm; 58 Hz to 200 Hz 1 g
Shock load • Long-term storage in the transport packaging • Transport in the transport packaging • Operation	 Class 1M2 acc. to EN 60721-3-1 Class 2M3 acc. to EN 60721-3-2 Test values: 15 g / 11 ms
Climatic ambient conditions • Long-term storage in the transport packaging • Transport in the transport packaging • Operation	 Class 1K4 acc. to EN 60721-3-1 Temperature -25 °C to +55 °C Class 2K4 acc. to EN 60721-3-2 Temperature -40 °C to +70 °C Class 3K3 acc. to EN 60721-3-3 Temperature +0 °C to +40 °C Relative / absolute humidity 5% to 90% / 25 g/m^3 ≤ 60%, in environments which contain corrosive gases and/or dust. Oil mist, saline fog, ice, condensation, dripping water, spray water, and splashes or jets of water are not permissible.

Certificates	
Declarations of Conformity	CE (Low-Voltage and EMC Directive)
Approvals	cULus

1.6 Standards

Table 1- 2 Essentially the application-relevant standards

Standards	Title
EN ISO 12100-1	Safety of Machinery; General Design Guidelines; Part 1: Basic terminology, methodology
EN ISO 12100-2	Safety of Machinery; General Design Guidelines; Part 2: Technical Principles and Specifications
EN ISO 13732-1	Ergonomics of the thermal environment; Methods for the assessment of human responses to contact with surfaces; Part 1: Hot surfaces
EN 954-1 / EN ISO 13849-1	Safety of machinery; safety-related parts of control systems; Part 1: General Design Principles
EN 1037	Safety of machinery; avoiding unexpected starting
EN 60146-1-1	Semiconductor converters; general requirements and line-commutated converters; Part 1-1: Defining the basic requirements
EN 60204-1	Electrical equipment of machines; Part 1: General definitions
EN 60228	Conductors for cables and insulated conductors; guidelines for the limiting dimensions of round cables
EN 60269-1	Low-voltage fuses - Part 1: General requirements
IEC 60287-1 to -3	Cables - Calculation of the current carrying capacity Part 1: Current carrying capacity equations (100 % load factor) and calculating the losses Part 2: Thermal resistance - Part 3: Main sections for operating conditions
EN 60529	Degrees of protection provided by enclosures (IP code)
EN 60664-X	Insulation coordination for equipment within low-voltage systems Part 1: Principles, requirements and tests Part 3: Use of coating, potting or moulding for protection against pollution
EN 60721-3-X	Classification of environmental conditions Part 3-0: Classification of environmental parameters and their severities; Introduction Part 3-1: Classification of environmental parameters and their severities; Long-term storage Part 3-2: Classification of environmental parameters and their severities; Transport Part 3-3: Classification of environmental parameters and their severities; stationary use, weather protected
EN 61140	Protection against electric shock; Common aspects for installation and equipment
EN 61158	Digital data communications for measurement and control - Fieldbus for use in industrial control systems
EN 61800-2	Adjustable-speed electrical power drive systems; Part 2: General requirements - Rating specifications for low-voltage adjustable frequency a.c. power drive systems
EN 61800-3	Adjustable-speed electrical power drive systems; Part 3: EMC - Requirements and specific test methods
EN 61800-5-X	Adjustable-speed electrical power drive systems; Part 5: Safety requirements; Main section 1: Electrical, thermal and energy requirements Main section 2: Functional safety requirements
EN ISO 9001	Quality management systems - requirements

Standards	Title
UL 50	Enclosures for Electrical Equipment
UL 508	Industrial Control Equipment
UL 508C	Safety for Power Conversion Equipment

Line-side power components

2

2.1 Introduction

The line connection for a SINAMICS blocksize drive line-up comprises an optional line reactor and an optional line filter:

- Line supply voltages:
  - 1-ph. 200 V to 1-ph. 240 V AC +/- 10%.
  - 3-ph. 380 V to 3-ph. 480 V AC +/- 10%.
- Line reactor versions:
  - 3 versions for frame sizes FSA - FSC (chassis).
  - 5 versions for frame sizes FSD - FSF (3 chassis and 2 standalone).
- Line filter versions:
  - Integrated
  - External
    - chassis
    - standalone

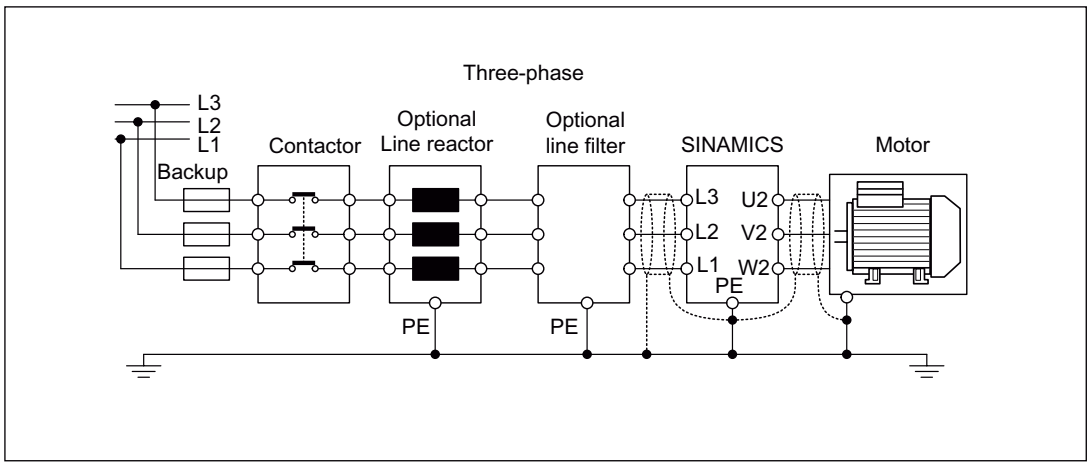


Figure 2-1 Example of a blocksize line connection

Note

The limit values for the radio interference voltage are only complied with when a line reactor and a line filter, Category C2 acc. to EN 61800-3, are used.

CAUTION
The following can occur if line reactors/line filters are used, which have not been approved for SINAMICS by SIEMENS: - the Power Modules could be damaged/destroyed. - Line reactions can occur that can damage or interfere with other loads powered from the same network.

CAUTION
The Power Modules in blocksize format with line filters are only suitable for direct connection to TN line supplies.

2.2 Line connection variants

2.2.1 Methods of line connection

A distinction is made between:

- Direct operation of the line connection components on the supply
- Operation of the Line Connection Components via an Autotransformer
- Operation of the Line Connection Components via an Isolating Transformer

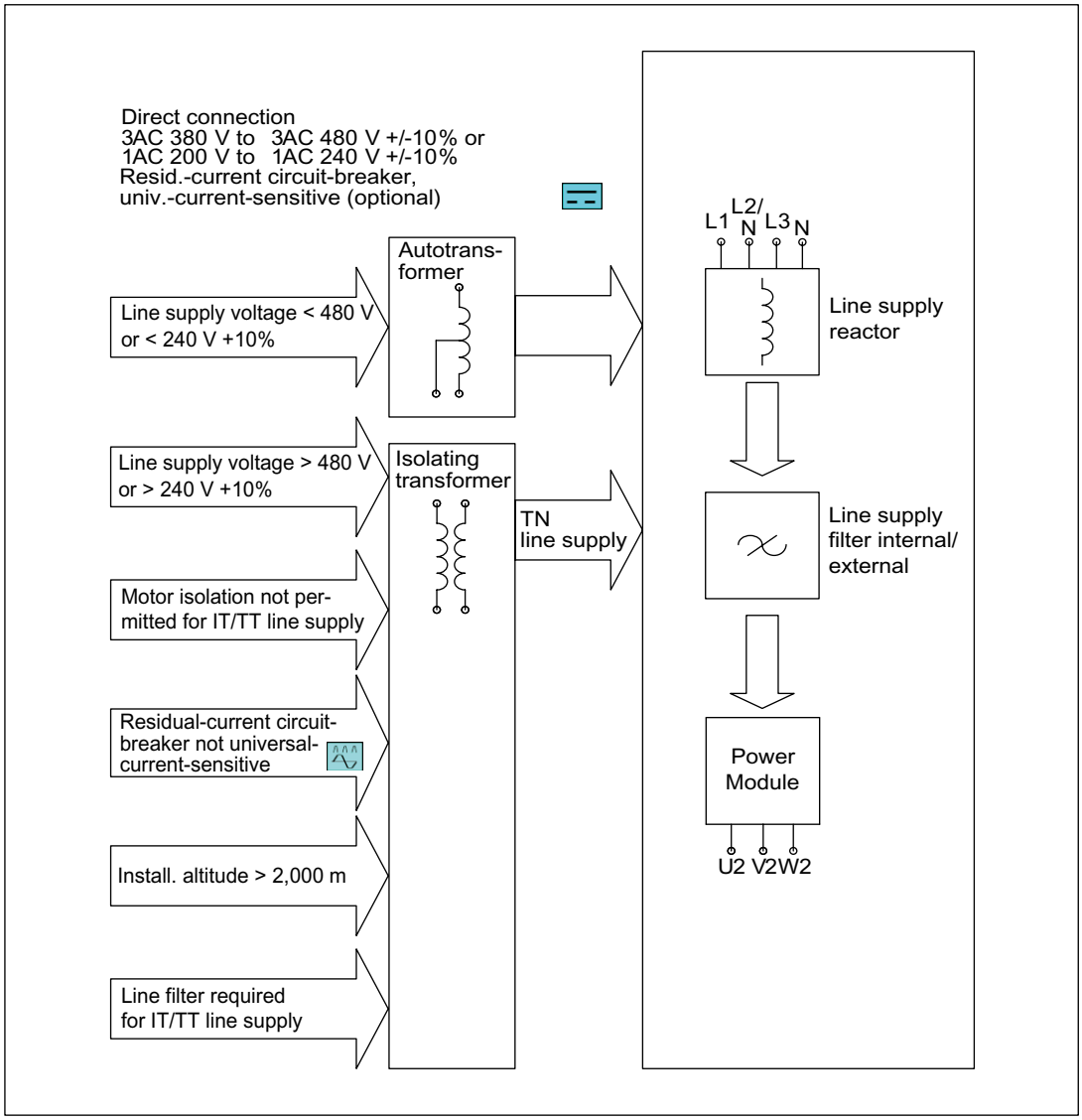


Figure 2-2 Overview of line connection variants

2.2.2 Operation of the Line Connection Components on the Supply Network

The SINAMICS S Blocksize drive system is designed to be directly connected to TN, TT line supply systems with grounded neutral conductor or grounded phase conductor as well as to IT line systems with rated voltages from 3-ph. 380 V to 480 V AC and 1-ph. 200 V to 240 V AC. Operation with line filter is only possible, without having to use additional measures, when connected to TN line supply systems with grounded neutral conductor.

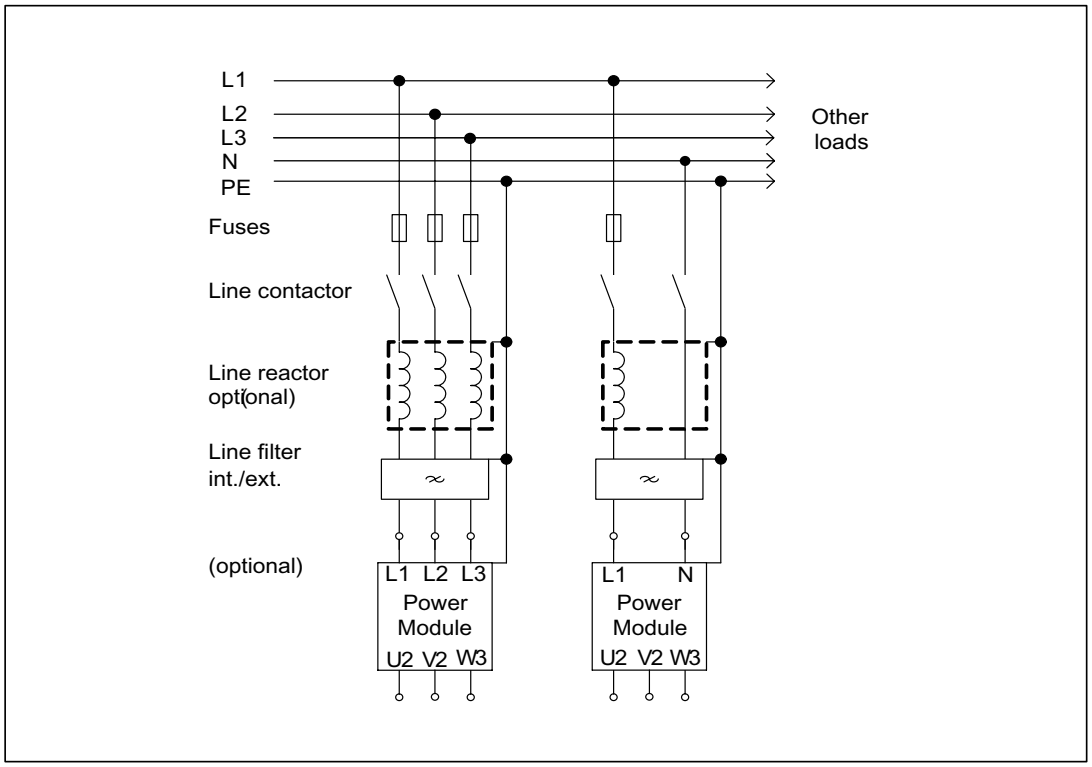


Figure 2-3 Direct operation on the line supply

2.2.3 Operation of the Line Connection Components via an Autotransformer

An autotransformer can be used to adapt the voltage in the range up to 3-ph. 480 V AC +10 % or 1-ph. 240 V AC +10 %.

⚠ CAUTION

To ensure protective separation, an isolating transformer must be used for voltages greater than 3-ph. 480 V AC +10 % and 1-ph. 240 V AC +10 %.

Application example:

- The motor insulation must be protected from excessive voltages.

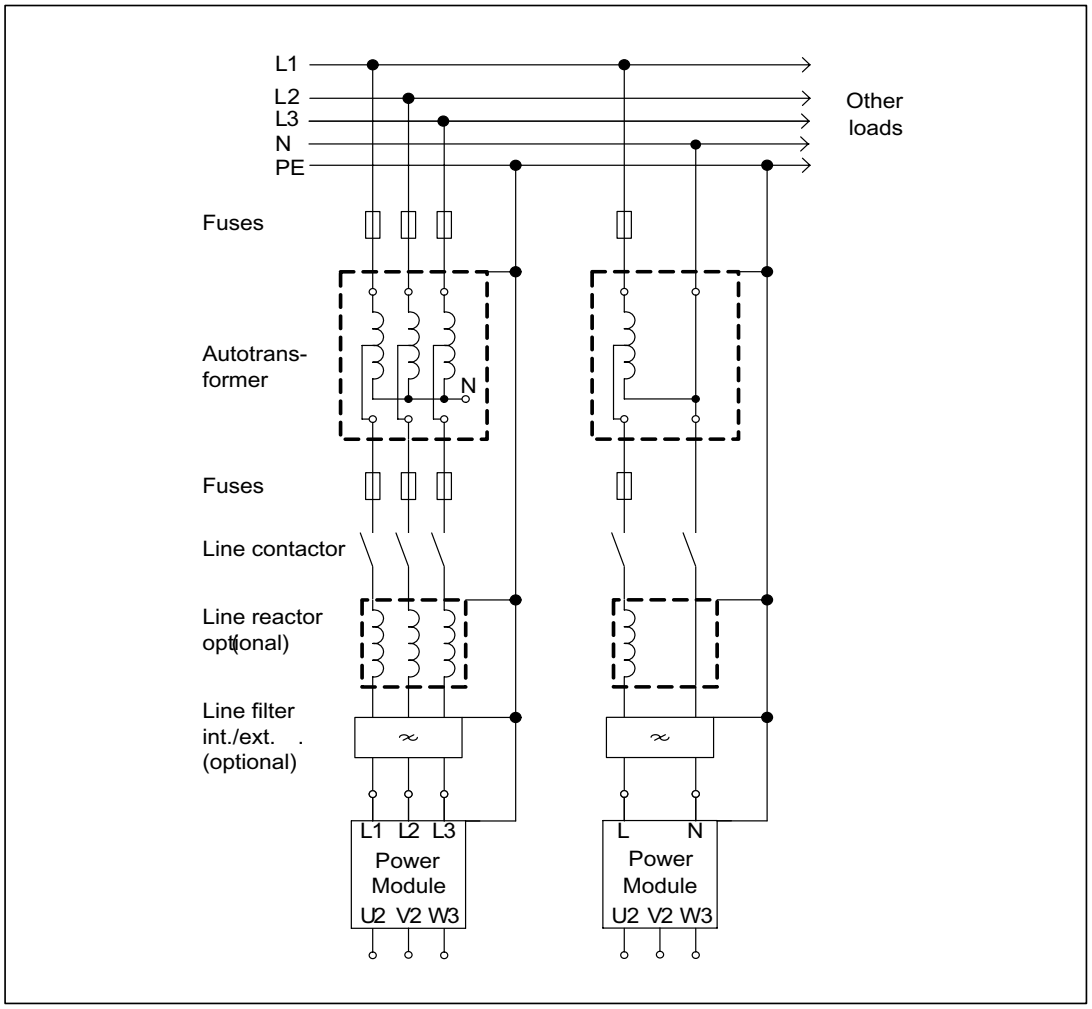


Figure 2-4 Autotransformer

2.2.4 Operation of the Line Connection Components via an Isolating Transformer

The isolating transformer converts the type of the line supply type in the plant (e.g. IT/TT line supply) to a TN line supply. Additional voltage adaptation to the permissible voltage tolerance range is possible.

An isolating transformer must be used in the following cases:

- The insulation of the Power Module and/or the motor is not adequate for the voltages that occur.
- There is no compatibility to an existing residual-current protective device.
- The installation altitude is greater than 2000 m above sea level.
- For all other systems that are not TN line supply systems with grounded neutral conductor, a line filter should always be used.

CAUTION
If the line supply voltage is greater than 3-ph. 480 V AC +10% or 1-ph. 240 V AC +10%, it is not permissible that an autotransformer is used. In order to ensure protective separation, an isolating transformer must always be used.

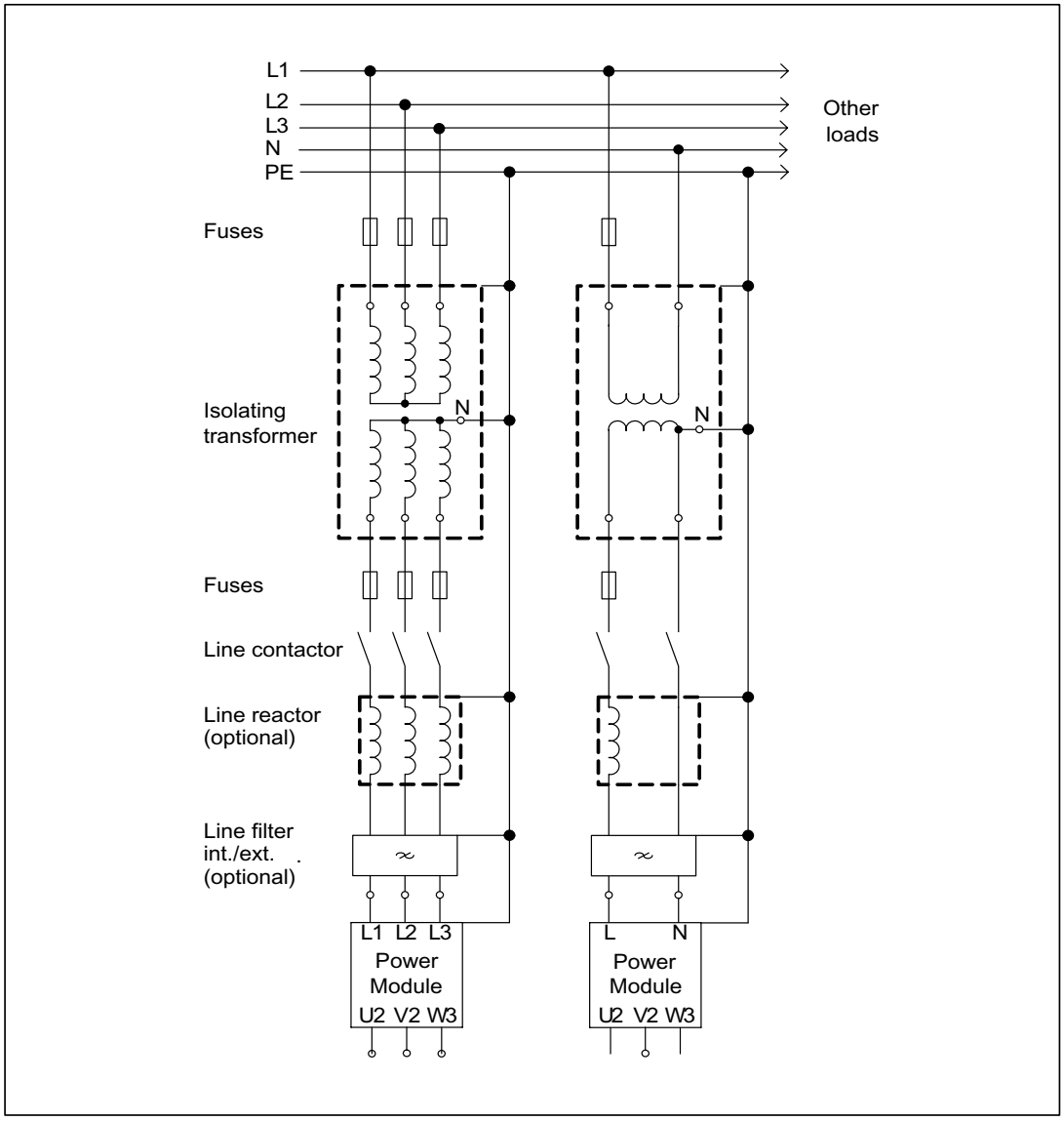


Figure 2-5 Isolating transformer

2.3 Line filter

2.3.1 Description

In conjunction with line reactors and a consequential implementation of the plant/system configuration according to the EMC guidelines (Order No.: 6FC5297-0AD30-0*P2), line filters limit the conducted interferences from Power Modules to permissible values for the industrial environment at the installation location.

*A: German; *B: English

Note

All PM340 Power Modules are available with and without an integrated line filter.
Frame size FSA, 400 V, is an exception, as this always requires an external line filter.

2.3.2 Safety information

⚠ DANGER

Line filters are suitable for direct connection to TN line supplies with grounded neutral conductor.

⚠ WARNING

The cooling clearances of 100 mm above and below the components must be observed. This prevents thermal overload of the line filter.

⚠ WARNING

The connections must not be interchanged:

- Incoming line cable to LINE/NETZ L1, L2, L3
- Outgoing cable to the line reactor to LOAD/LAST L1', L2', L3'

Non-observance may damage the line filter

⚠ CAUTION

Using line filters not released by Siemens AG for SINAMICS can lead to line reactions that can damage or destroy other loads powered from the network.

2.3.3 Dimension drawing, Blocksize

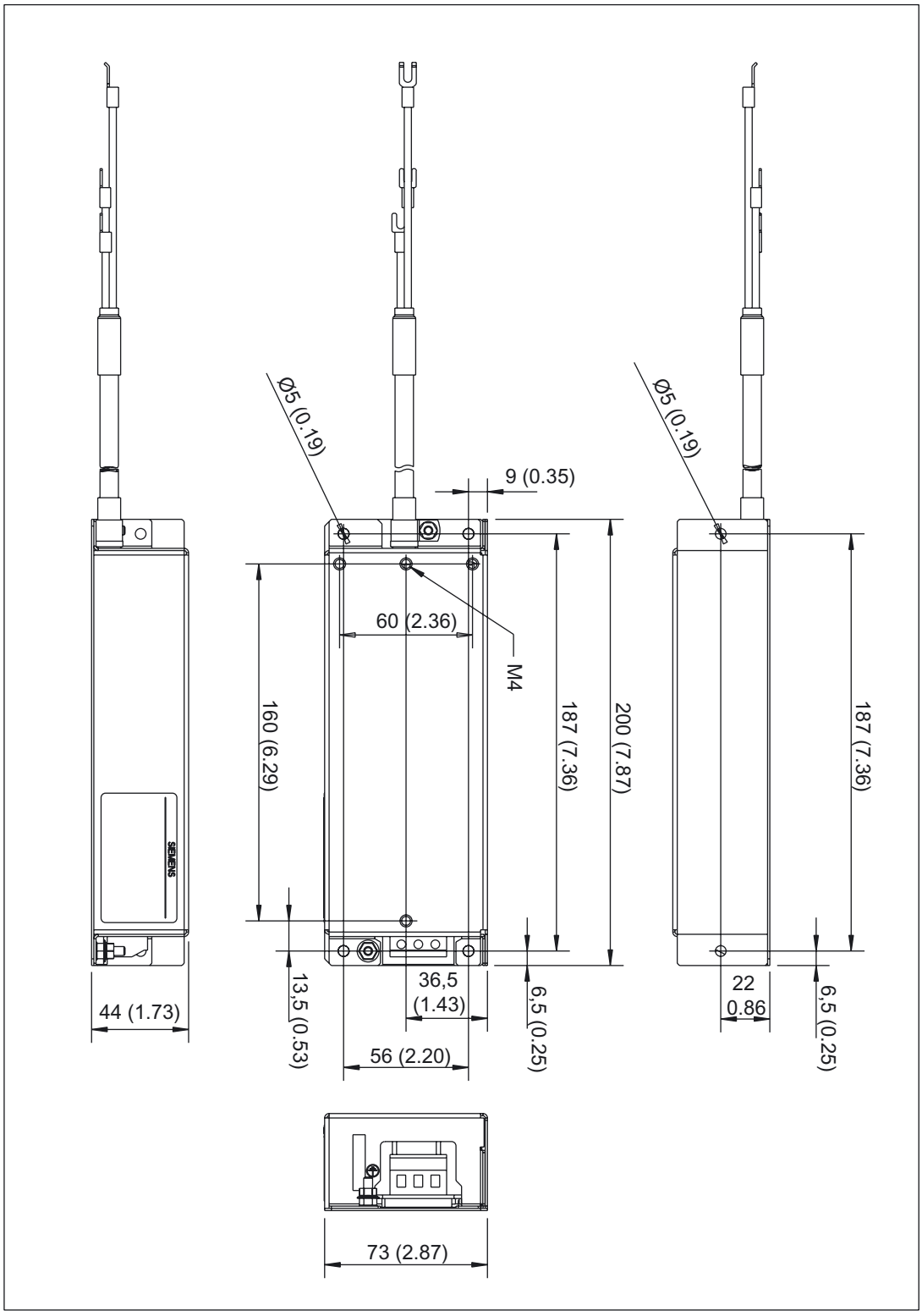


Figure 2-6 Dimension drawing: Line filter, frame size FSA

2.3.4 Installation

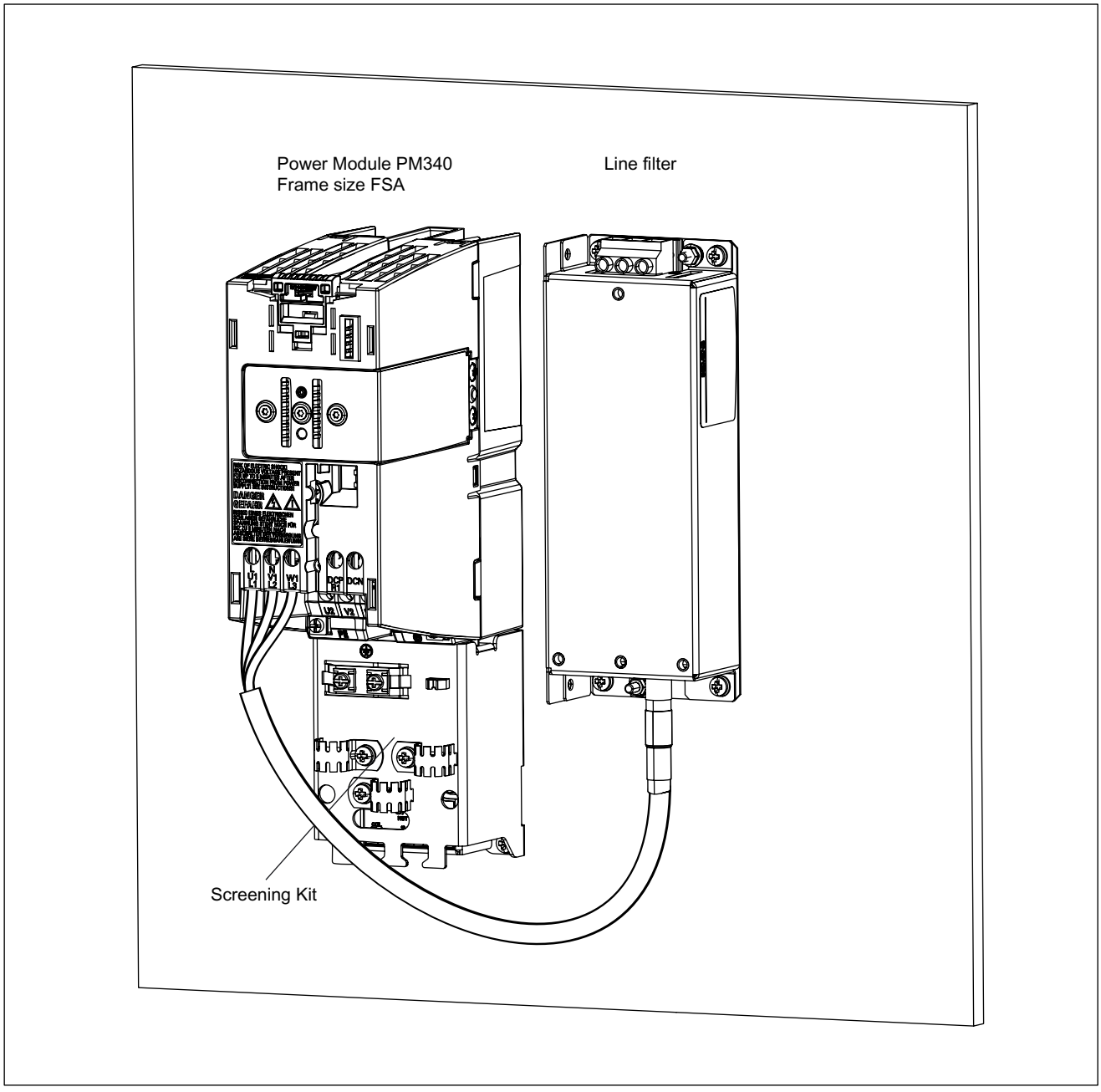


Figure 2-7 Mounting: Power Module PM340 frame size FSA with Screening Kit and line filter

2.3.5 Technical data, Blocksize line filter

Table 2- 1 Technical data, Blocksize line filter

Line supply voltage 3-ph. 380...480 V AC		
Line filter 6SE6400-2FA00-6AD0		
Suitable for Power Module		6SL3210-1SE11-3UA0, 6SL3210-1SE11-7UA0 6SL3210-1SE12-2UA0, 6SL3210-1SE13-1UA0 6SL3210-1SE14-1UA0
Rated current	A	6
Power loss	W	< 5
Line supply connection L1, L2, L3		2.5 mm screw terminals^2
PE connection		At the housing with M4 stud
Load connection U, V, W		Shileded cable 3 x 2.5 mm^2 0.4 m long
Degree of protection		IP20 or IPXXB
Weight, approx.	kg	0.5

2.4 Line reactors

2.4.1 Description

The line reactors limit lower-frequency harmonics that are fed back into the line supply. They are used to smooth voltage spikes (line supply faults) or to bridge voltage dips/interruptions when commutating. We therefore recommend the use of line reactors with the PM340.

2.4.2 Safety information

⚠ WARNING

The cooling clearances of 100 mm above and below the components must be observed.

Note

The connecting cables to the Power Module must be as short as possible (max. 5 m).
If possible, they should be shielded.

⚠ WARNING

The connections must not be interchanged:

- Incoming line cable to 1U1, 1V1, 1W1, and
- Outgoing cable to the load 1U2, 1V2, 1W2.

CAUTION

When using line reactors that have not been approved by SIEMENS for SINAMICS, the following can occur:

- the Power Modules could be damaged/destroyed.
- Line harmonics that may interfere with or damage other loads connected to the same line supply.

⚠ CAUTION

The surface temperature of the line reactors may exceed 80 °C.

2.4.3 Dimension drawings, Blocksize line reactors

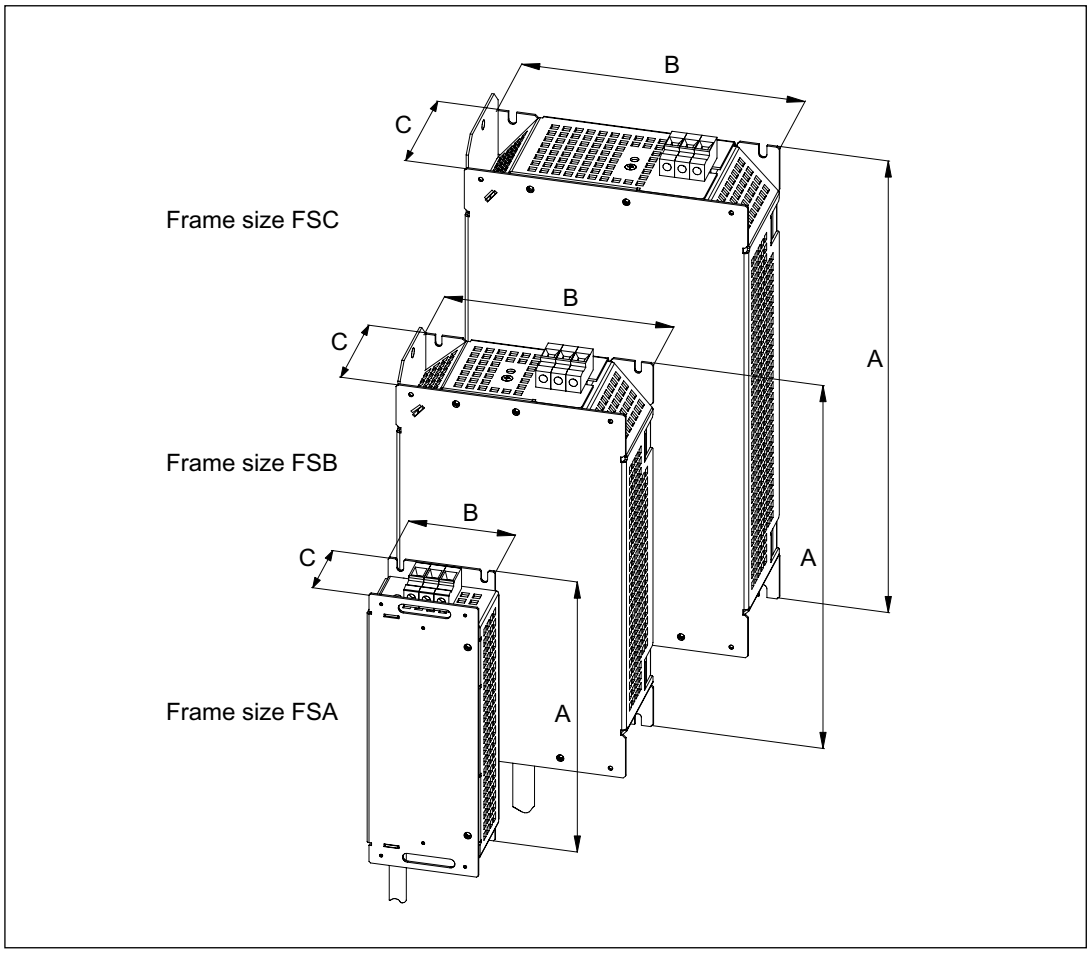


Figure 2-8 Dimension drawing: Line reactor, frame sizes FSA, FSB and FSC

Table 2- 2 Total and retaining dimensions, line reactors, Part 1

Line reactor 6SE6400-	3CC00-4AB3	3CC01-0AB3	3CC00-2AD3	3CC00-4AD3	3CC00-6AD3
Suitable for Power Module 6SL3210-	1SB11-0xxx 1SB12-3xxx	1SB14-0xxx	1SE11-3UA0 1SE11-7UA0	1SE12-2UA0 1SE13-1UA0	1SE14-1UA0
Frame size	FSA				
Dimension A in mm and (inches)	200 (7,87)				
Dimension B in mm and (inches)	75 (2,95)				
Dimension C in mm and (inches)	50 (1,96)				

Table 2- 3 Total and retaining dimensions, line reactors, Part 2

Line reactor	**6SL3203-0CD21-0AA0**	**6SL3203-0CD21-4AA0**
Suitable for Power Module 6SL3210-	**1SE16-0xxx 1SE17-7xxx**	**1SE21-0xxx**
Frame size	**FSB**	
Dimension A in mm and (inches)	270 (10, 62)	
Dimension B in mm and (inches)	153 (6,02)	
Dimension C in mm and (inches)	70 (2,75)	

Table 2- 4 Total and retaining dimensions, line reactors, Part 3

Line reactor 6SL3203-	**0CD22-2AA0**	**0CD23-5AA0**
Suitable for Power Module 6SL3210-	**1SE21-8xxx 1SE22-5xxx**	**1SE23-2xxx**
Frame size	**FSC**	
Dimension A in mm and (inches)	336 (13,22)	336 (13,22)
Dimension B in mm and (inches)	189 (7,44)	189 (7,44)
Dimension C in mm and (inches)	50 (1,96)	80 (3,14)

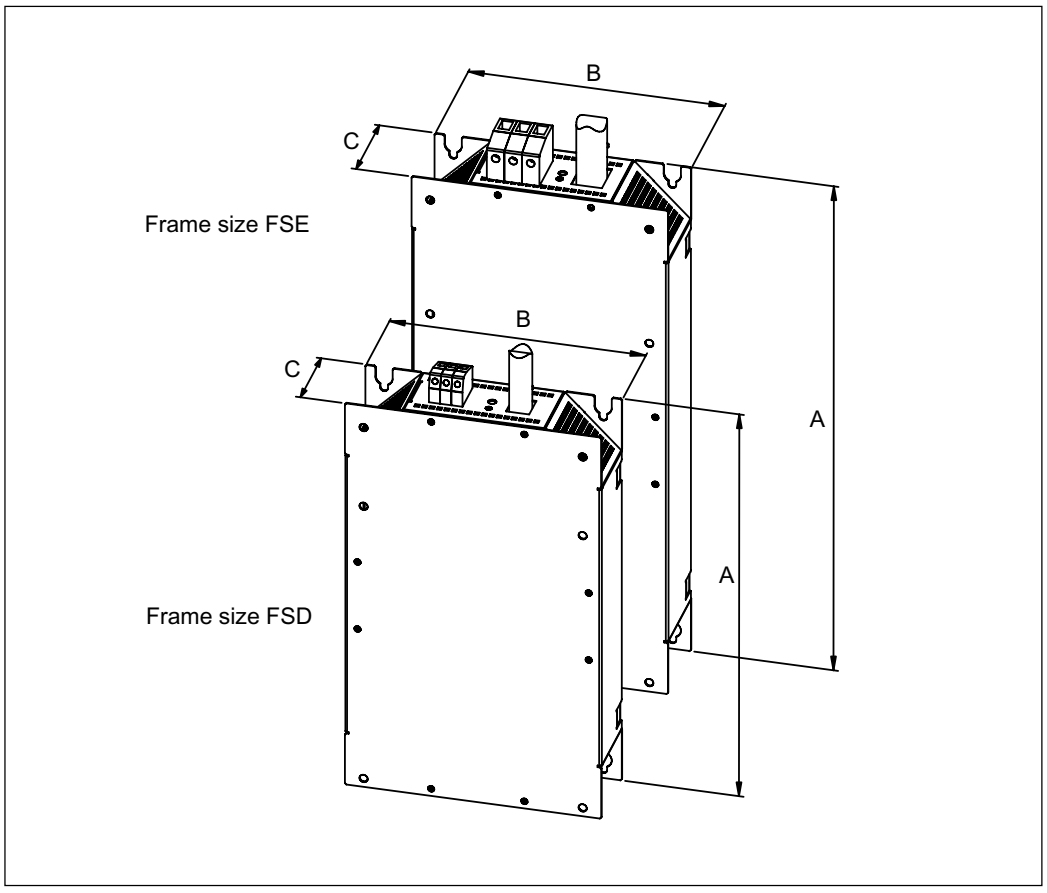


Figure 2-9 Dimension drawing: Line reactor, frame sizes FSD and FSE

Table 2- 5 Total and retaining dimensions, line reactor

Line reactor 6SL3203-	**0CJ24-5AA0**	**0CD25-3AA0**	**0CJ28-6AA0**
Suitable for Power Module 6SL3210-	**1SE23-8xxx 1SE24-5xxx**	**1SE26-0xxx**	**1SE27-5xxx 1SE31-0xxx**
Frame size	**FSD**		**FSE**
Dimension A in mm and (inches)	455 (17,91)		577 (22,71)
Dimension B in mm and (inches)	275 (10,82)		275 (10,82)
Dimension C in mm and (inches)	83,5 (3,28)		93,5 (3,68)

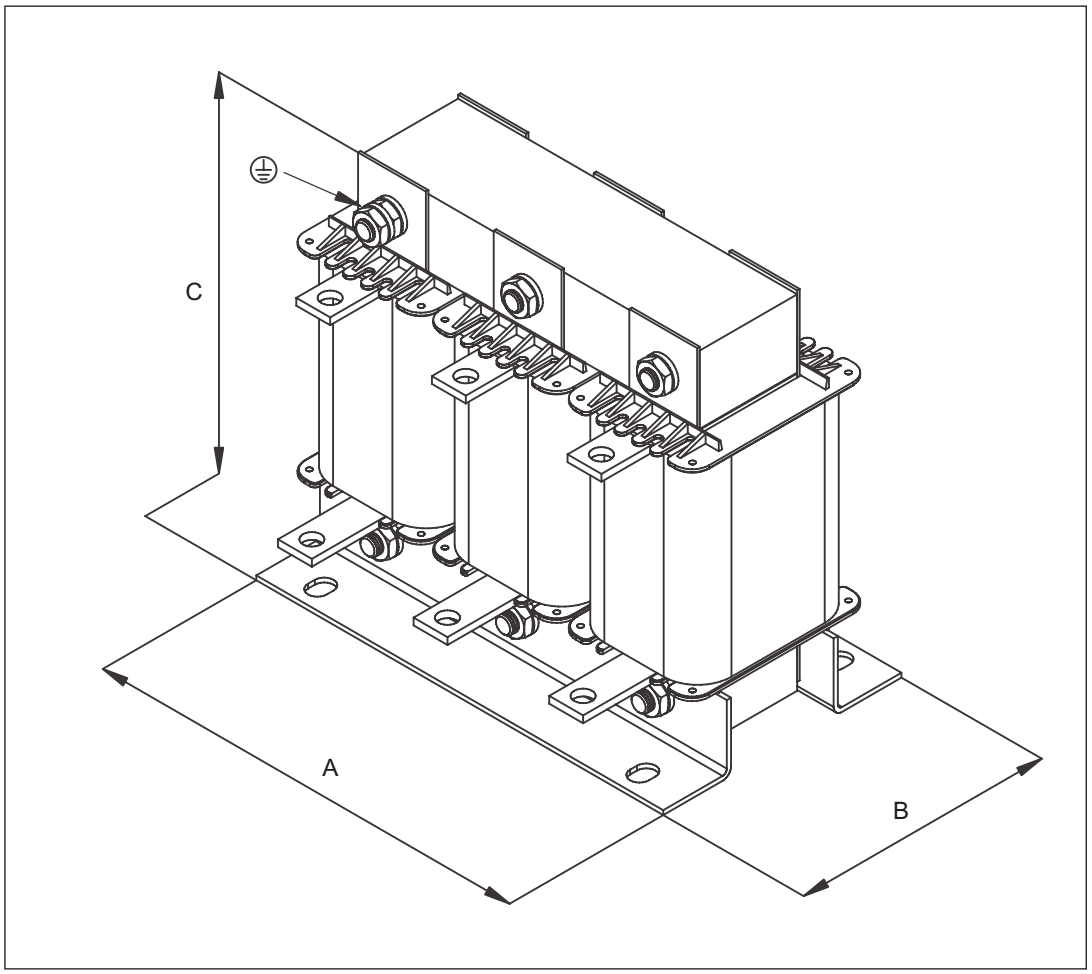


Figure 2-10 Dimension drawing: Line reactor, frame size FSF

Table 2- 6 Total and retaining dimensions, line reactor

Line reactor 6SE6400-	**3CC11-2FD0**	**3CC11-7FD0**
Suitable for Power Module 6SL3210-	**1SE31-1xxx 1SE31-5xxx**	**1SE31-8xxx**
Frame size	**FSF**	
Dimension A in mm and (inches)	240 (9,44)	
Dimension B in mm and (inches)	141 (5,55)	
Dimension C in mm and (inches)	228 (8,97)	

2.4.4 Installation

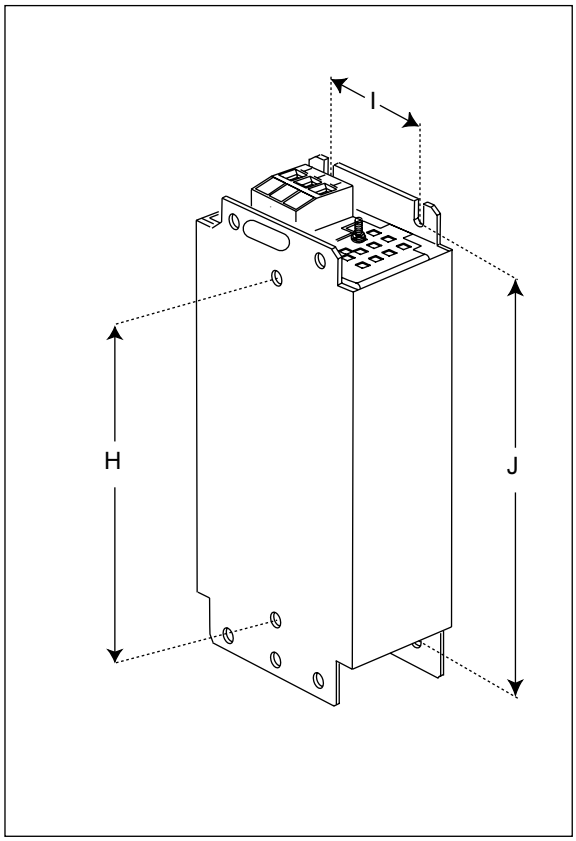


Figure 2-11 Mounting: Line reactor, frame size FSA

Table 2- 7 Overall and retaining dimensions, line reactor, Part 1, all data in mm and (inches)

Line reactor 6SE6400-	**3CC00-4AB3**	**3CC01-0AB3**	**3CC00-2AD3**	**3CC00-4AD3**	**3CC00-6AD3**
Suitable for Power Module 6SL3210-	**1SB11-0UA0 1SB11-0AA0 1SB12-3UA0 1SB12-3AA0**	**1SB14-0UA0 1SB14-0AA0**	**1SE11-3UA0 1SE11-7UA0**	**1SE12-2UA0 1SE13-1UA0**	**1SE14-1UA0**
Frame size	FSA				
H	160 (6,29)				
I	56 (2,20)				
J	187 (7,36)				
	Retaining screw M4 / 1.1 Nm Cable cross-section: 1.0 - 2 mm²).				

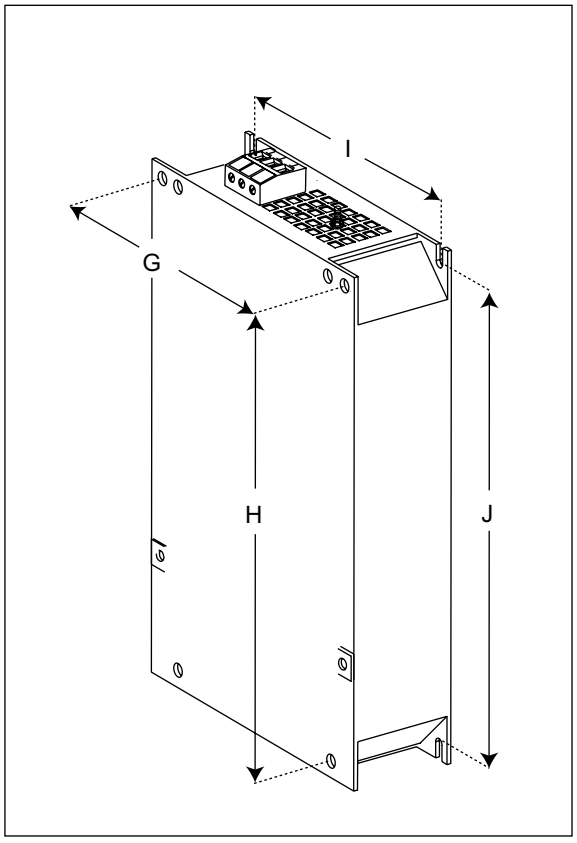


Figure 2-12 Mounting: Line reactor, frame sizes FSB and FSC

Table 2- 8 Total and retaining dimensions, line reactor, Part 2, all data in mm and (inches)

Line reactor 6SL3203-	**0CD21-0AA0**	**0CD21-4AA0**	**0CD22-2AA0**	**0CD22-2AA0**	**0CD23-5AA0**
Suitable for Power Module 6SL3210-	**1SE16-0UA0** **1SE16-0AA0** **1SE17-7UA0** **1SE17-7AA0**	**1SE21-0UA0** **1SE21-0AA0**	**1SE21-8UA0** **1SE21-8AA0** **1SE22-5UA0** **1SE22-5AA0**	**1SE21-8UA0** **1SE21-8AA0** **1SE22-5UA0** **1SE22-5AA0**	**1SE23-2UA0** **1SE23-2AA0**
Frame size	FSB			FSC	
G	138 (5,43)			174 (6,85)	
H	174 (6,85)			204 (8,03)	
I	120 (4,72)			156 (6,14)	
J	200 (7,87)			232 (9,13)	
	Retaining screw M4 / 1.5 Nm Cable cross-section: 1.5 - 6 mm²).			Retaining screw M5 / 2.25 Nm Cable cross-section: 2.5 - 10 mm²).	

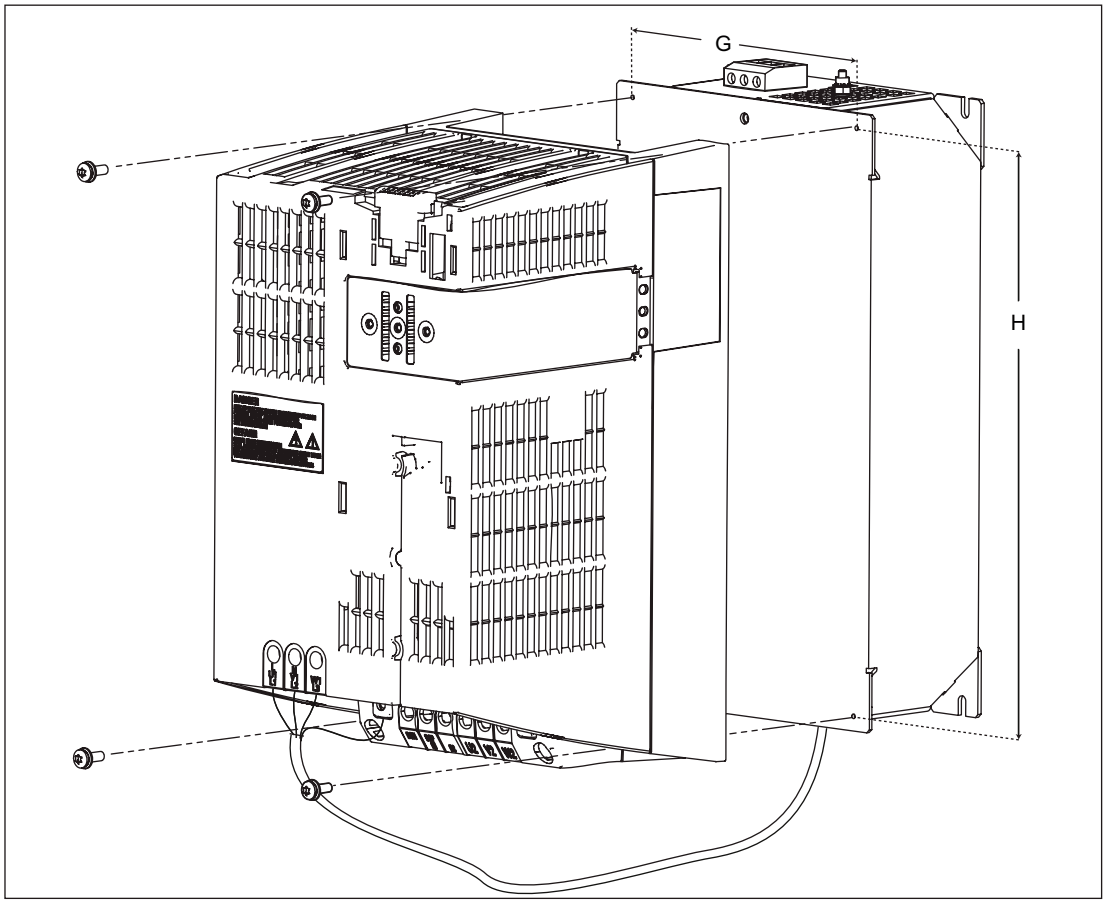


Figure 2-13 Mounting: PM340 and line reactor, frame size FSB

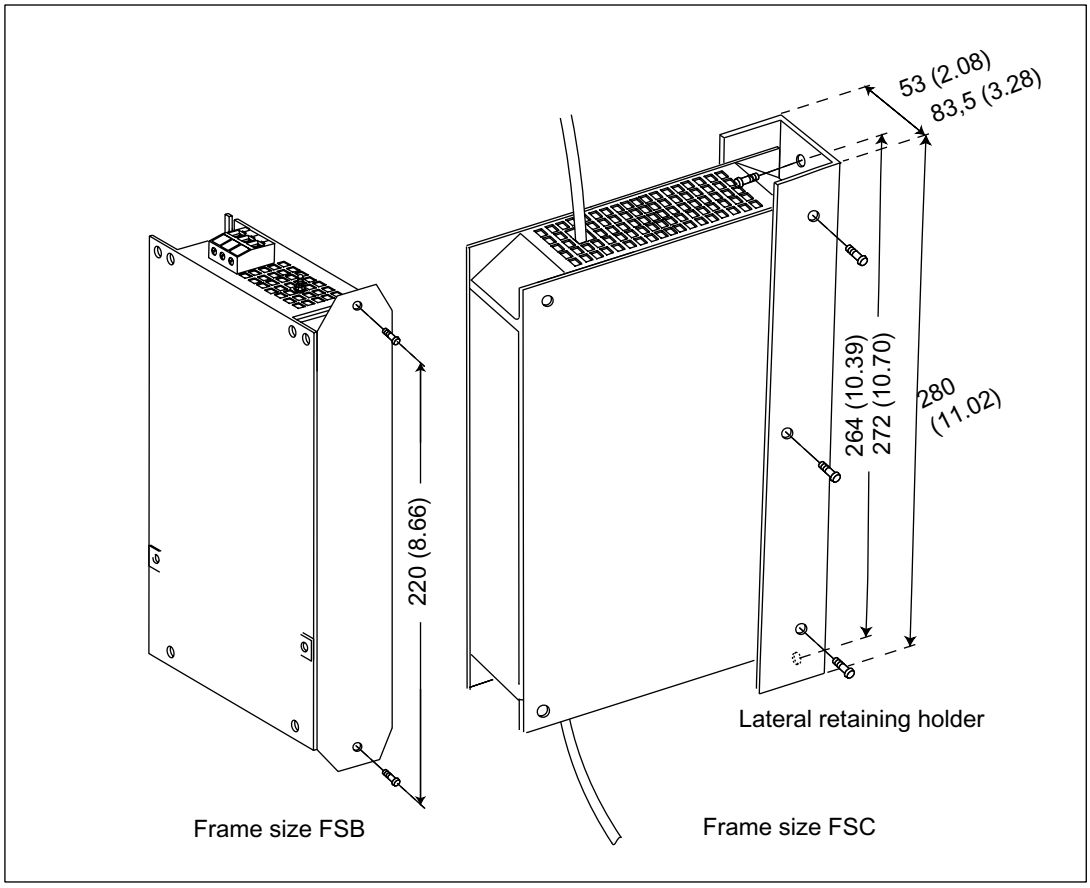


Figure 2-14 Side mounting: Line reactors, frame sizes FSB and FSC

The line reactors for Power Modules, frame sizes FSA - FSE, are designed as sub-chassis components.

The line reactor is retained on the mounting surface and the Power Module is mounted on the line reactor in a space-saving fashion. The cables to the Power Modules are already connected at the line reactor.

The line reactor is connected to the line supply through terminals.

2.4.5 Electrical Connection

Line supply/load connection

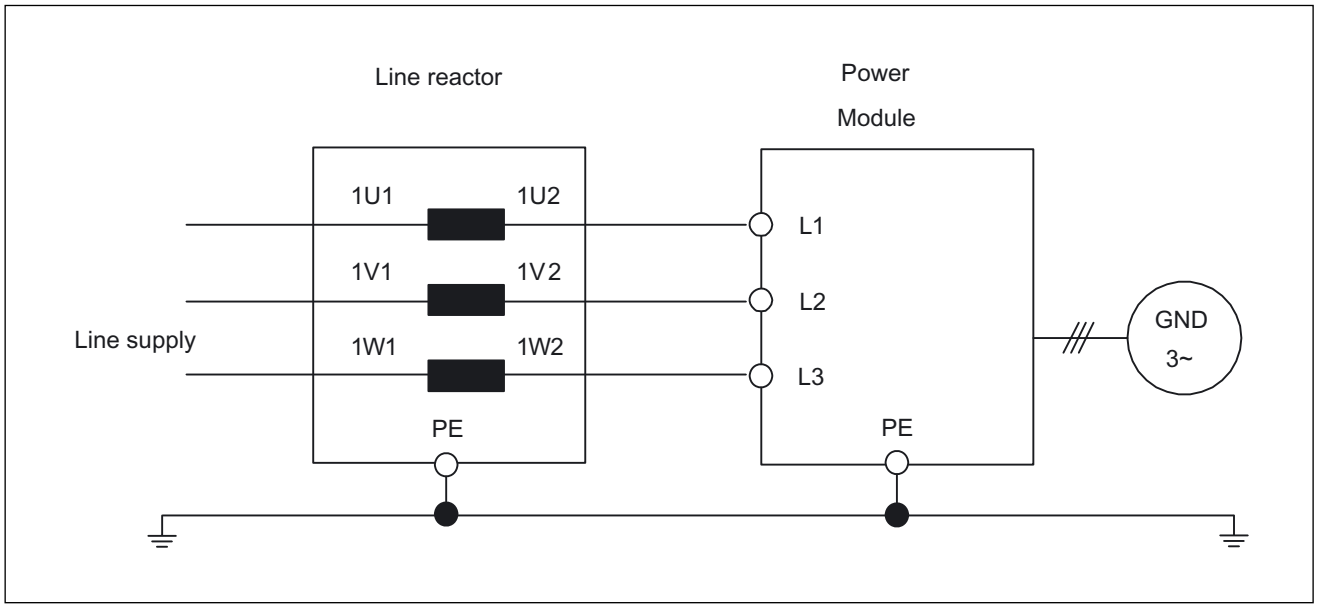


Figure 2-15 Power Module with line filter

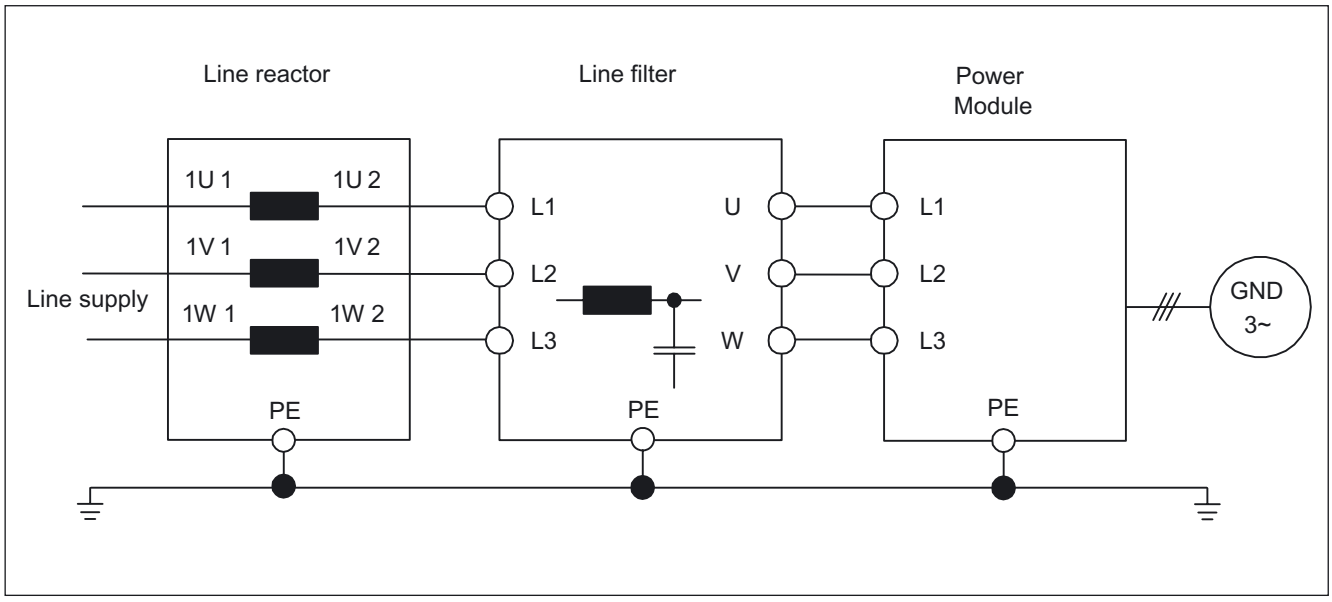


Figure 2-16 Power Module Blocksize with line reactor and line filter

2.4.6 Technical data, Blocksize

Table 2- 9 Technical data, blocksize line reactors, Part 1

Line supply voltage 1-ph 200 V AC -10 % to 240 V AC +10%			
Order No. 6SE6400-		**3CC00-4AB3**	**3CC01-0AB3**
Suitable for Power Module 6SL3210-		1SB11-0xxx 1SB12-3xxx	1SB14-0xxx
Rated line reactor current	A	3,4	8,1
Power loss 50 / 60 Hz	W	12,5 / 15	11,5 / 14,5
Line supply connection U1, V1, W1		6 mm screw terminals^2	6 mm screw terminals^2
Load connection 1U2, 1V2, 1W2		Cable 3 x 1.5 mm^2	Cable 3 x 1.5 mm^2
PE connection		M5 stud	M5 stud
Degree of protection		IP20 or IPXXB	IP20 or IPXXB
Weight	kg	1,3	1,3

Table 2- 10 Technical data, Blocksize line reactors, Part 2

Line supply voltage 3-ph 380 V AC -10 % to 480 V AC +10 %					
Order No.		**6SE6400- 3CC00-2AD3**	**6SE6400- 3CC00-4AD3**	**6SE6400- 3CC00-6AD3**	**6SL3203- 0CD21-0AA0**
Suitable for Power Module 6SL3210-		1SE11-3UA0 1SE11-7UA0	1SE12-2UA0 1SE13-1UA0	1SE14-1UA0	1SE16-0xxx 1SE17-7xxx
Rated line reactor current	A	1,9	3,5	4,8	9
Power loss 50 / 60 Hz	W	6 / 7	12,5 / 15	7,5 / 9	9 / 11
Line supply connection U1, V1, W1		6 mm screw terminals^2	6 mm screw terminals^2	6 mm screw terminals^2	6 mm screw terminals^2
Load connection 1U2, 1V2, 1W2		Cable 4 x 1.5 mm^2 Length approx. 0.38 m	Cable 4 x 1.5 mm^2 Length approx. 0.38 m	Cable 4 x 1.5 mm^2 Length approx. 0.38 m	Cable 4 x 1.5 mm^2 Length approx. 0.46 m
PE connection		At the housing with M5 stud	At the housing with M5 stud	At the housing with M5 stud	At the housing with M5 stud
Degree of protection		IP20 or IPXXB	IP20 or IPXXB	IP20 or IPXXB	IP20 or IPXXB
Weight	kg	1,2	1,3	1,3	3,4

Table 2- 11 Technical data, Blocksize line reactors, Part 3

Line supply voltage 3-ph 380 V AC -10 % to 480 V AC +10 %					
Order No. 6SL3203-		**0CD21-4AA0**	**0CD22-2AA0**	**0CD23-5AA0**	**0CJ24-5AA0**
Suitable for Power Module 6SL3210-		1SE21-0xxx	1SE21-8xxx 1SE22-5xxx	1SE23-2xxx	1SE23-8xxx 1SE24-5xxx
Rated line reactor current	A	11,6	25	31,3	54
Power loss 50 / 60 Hz	W	27 / 32	98 / 118	37 / 44	90 / 115
Line supply connection U1, V1, W1		6 mm screw terminals^2	6 mm screw terminals^2	6 mm screw terminals^2	16 mm screw terminals^2
Load connection 1U2, 1V2, 1W2		Cable 4 x 1.5 mm^2 Length approx. 0.46 m	Cable 4 x 2.5 mm^2 Length approx. 0.49 m	Cable 4 x 2.5 mm^2 Length approx. 0.49 m	Cable 4 x 16 mm^2 Length approx. 0.70 m
PE connection		At the housing with M5 stud	At the housing with M5 stud	At the housing with M5 stud	At the housing with M8 screw
Degree of protection		IP20 or IPXXB	IP20 or IPXXB	IP20 or IPXXB	IP20 or IPXXB
Weight	kg	3,4	6,3	6,4	13

Table 2- 12 Technical data, blocksize line reactors, Part 4

Line supply voltage 3-ph 380 V AC -10 % to 480 V AC +10 %					
Order No.		**6SL3203- 0CD25-3AA0**	**6SL3203- 0CJ28-6AA0**	**6SE6400- 3CC11-2FD0**	**6SE6400- 3CC11-7FD0**
Suitable for Power Module 6SL3210-		1SE26-0xxx	1SE27-5xxx 1SE31-0xxx	1SE31-1xxx 1SE31-5xxx	1SE31-8xxx
Rated line reactor current	A	71	105	178	225
Power loss 50 / 60 Hz	W	90 / 115	170 / 215	280 / 360	280 / 360
Line supply connection U1, V1, W1		16 mm screw terminals^2	50 mm screw terminals^2	Flat connector for M10 cable lug	Flat connector for M10 cable lug
Load connection 1U2, 1V2, 1W2		Cable 4 x 16 mm^2 Length approx. 0.70 m	Cable 4 x 35 mm^2 Length approx. 0.70 m	Flat connector for M10 cable lug	Flat connector for M10 cable lug
PE connection		At the housing with M8 screw	At the housing with M8 screw	On housing with M8 bolt	On housing with M8 bolt
Degree of protection		IP20 or IPXXB	IP20 or IPXXB	IP00	IP00
Weight	kg	13	19	25	25

Power Modules

3

3.1 Power Modules Blocksize (PM340)

3.1.1 Description

The Power Modules in blocksize format are designed as follows:

- Line side diode rectifier
- DC link electrolytic capacitors with pre-charging circuit
- Output inverter
- Braking chopper for (external) braking resistor
- Power supply 24 V DC / 1 A
- Gating unit, actual value sensing
- Fan to cool the power semiconductors

The Power Modules cover the power range from 0.12 kW to 90.0 kW and are available in versions with and without line filter.

Table 3- 1 Overview, Power Modules PM340 (selection)

	
Power Module (230 V) frame size FSA, with and without integrated line filter Power Module (400 V) frame size FSA, without integrated line filter	Power Module frame size FSB, with and without integrated line filter

	
Power Module frame size FSC, with and without integrated line filter	Power Module frame size FSD, without line filter
	
Power Module frame size FSE, without line filter	Power Module frame size FSF, without line filter

3.1.2 Safety information

⚠ CAUTION

During transport and during storage, Power Modules must be protected against mechanical shock and vibration. It is also important to protect the unit against water (rain) and against excessively high/excessively low temperatures.

Note

Connection authorization

Power Modules have been designed for use in the industrial environment and generate current harmonics on the line side as a result of the rectifier circuit.

When connecting a machine with integrated Power Modules to the public low-voltage line supply, authorization is required in advance from the local power supply company (utility company) if

- the rated input current of the motor ≤ 16 A per conductor, and
- the rated input current of the motor does not comply with the requirements specified in EN 61000-3-2 regarding current harmonics.

⚠ DANGER

Grounding/protective grounding of the Power Module

The Power Module housing must always be grounded. If the Power Module is not correctly grounded, then extremely hazardous states can occur, which under certain circumstances, can result in death.

⚠ DANGER

It must be checked as to whether the Power Module is designed for the correct power supply - higher supply voltages may not be connected to the Power Module.

⚠ DANGER

After connecting the line and motor feeder cables to the appropriate terminals, check that the front covers (only frame sizes FSD to FSF) are closed and latched. Only then may the Power Module be connected to the power supply.

NOTICE

For a UL-approved system use UL-approved copper conductors only.

⚠ DANGER

Once all the supply voltages have been disconnected, a hazardous voltage may be present in the power unit for up to 5 minutes. The cover for the terminals may only be opened after this time has definitely elapsed.

When opening the protective cover, you must activate the release. A suitable tool (e.g. screwdriver) must be used for this purpose.

Damaged components must not be used, otherwise this could result in secondary damage or accidents.

⚠ DANGER

The hazard warning in the local language for the DC link discharge time must be affixed to the component. A set of labels in 16 languages is provided with the component.

⚠ DANGER

The drive components generate high leakage currents in the protective conductor. The components must only be operated in cabinets or in closed electrical operating areas and must be connected with the protective conductor. To protect against electric shock, the protective conductor connection on the cabinet or machine must be implemented in accordance with one of the following measures:

- stationary connection and protective conductor connection by means of ≥ 10 mm^2 Cu or ≥ 16 mm^2 Al
- stationary connection and automatic shutdown of the power supply if the protective conductor is interrupted

⚠ WARNING

Power Modules must be mounted in the vertical position.

For the Power Modules, the following cooling clearances must be maintained above and below the component:

- frame sizes FSA and FSB: 100 mm (3.93 inches),

- frame size FSC: 125 mm (4.92 inches),

- frame sizes FSD and FSE: 300 mm (11.81 inches) and

- frame size FSF: 350 mm (13.77 inches).

When mounting the Power Modules, the following clearances must be maintained between the components:

- frame size FSB: 40 mm (1.57 inches)

- frame size FSC: 50 mm (1.96 inches)

Devices, that could restrict the cooling air flow may not be mounted/installed in this area. It must be carefully ensured that the cooling air flow of the Power Modules can flow unrestricted.

Note

Power Modules of frame sizes FSA, FSD, FSE and FSF can be mounted without any lateral clearance.

⚠ DANGER

Cable shields and unused power cable conductors (e.g. brake conductors) must be connected to PE potential to prevent capacitive cross-talk charges.

Non-observance can cause lethal shock voltages.

3.1.3 Interface description

3.1.3.1 Overview

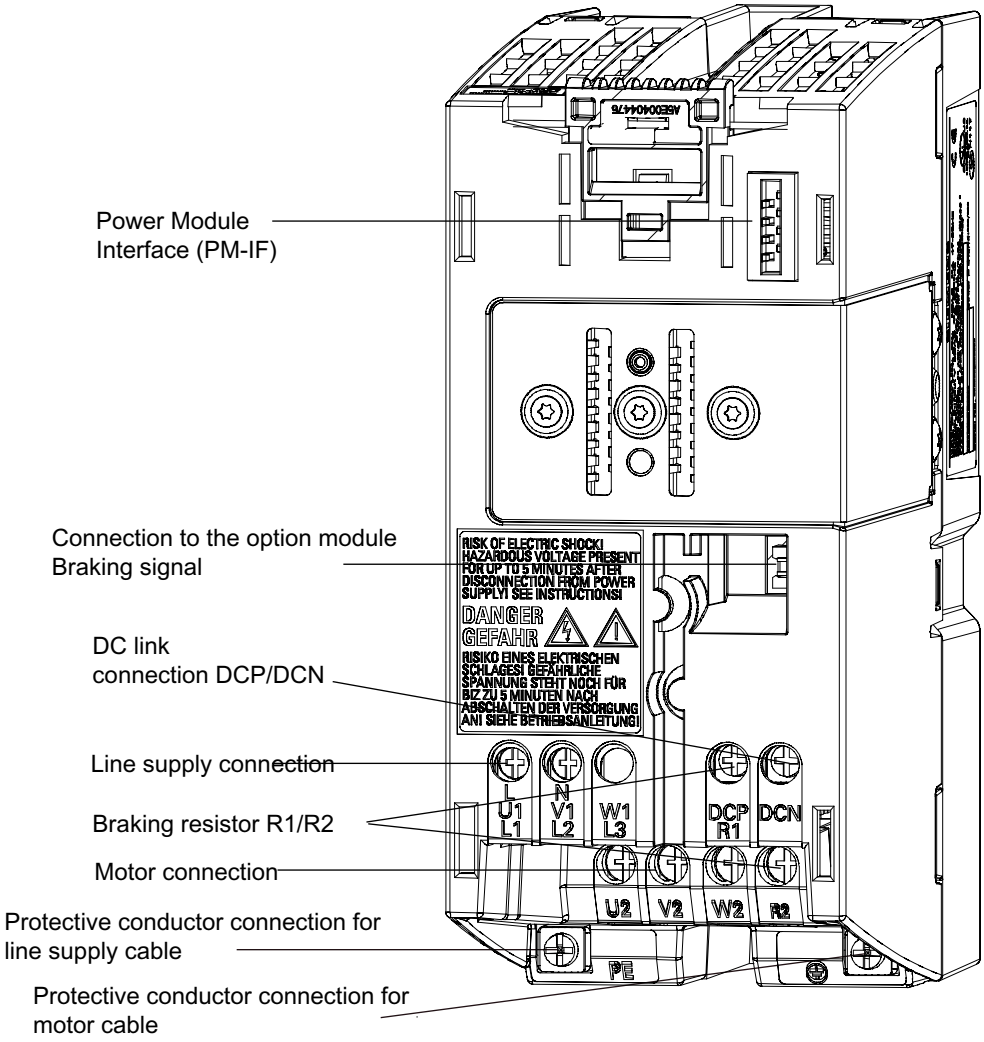


Figure 3-1 PM340, frame size FSA

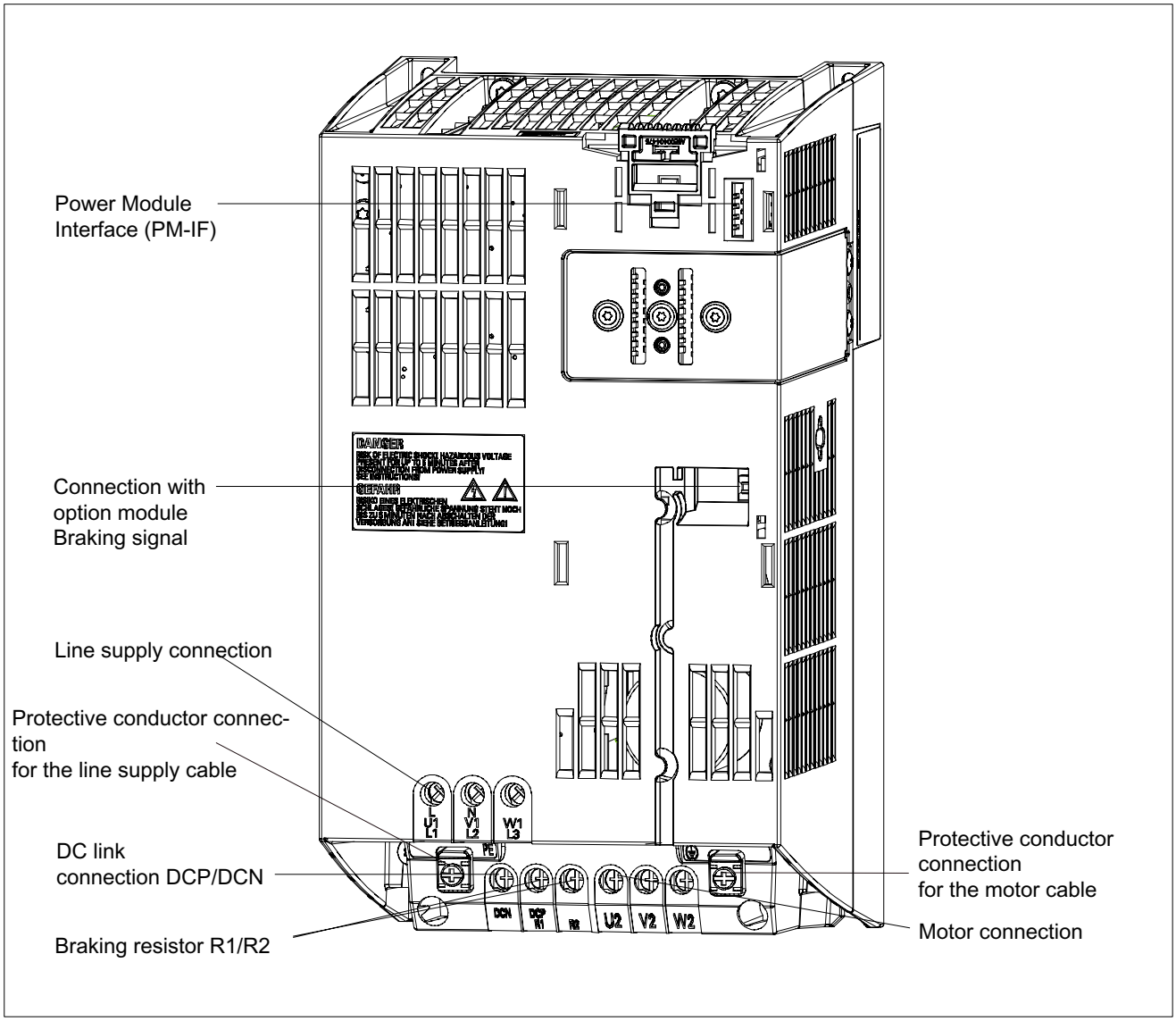


Figure 3-2 PM340, frame size FSB

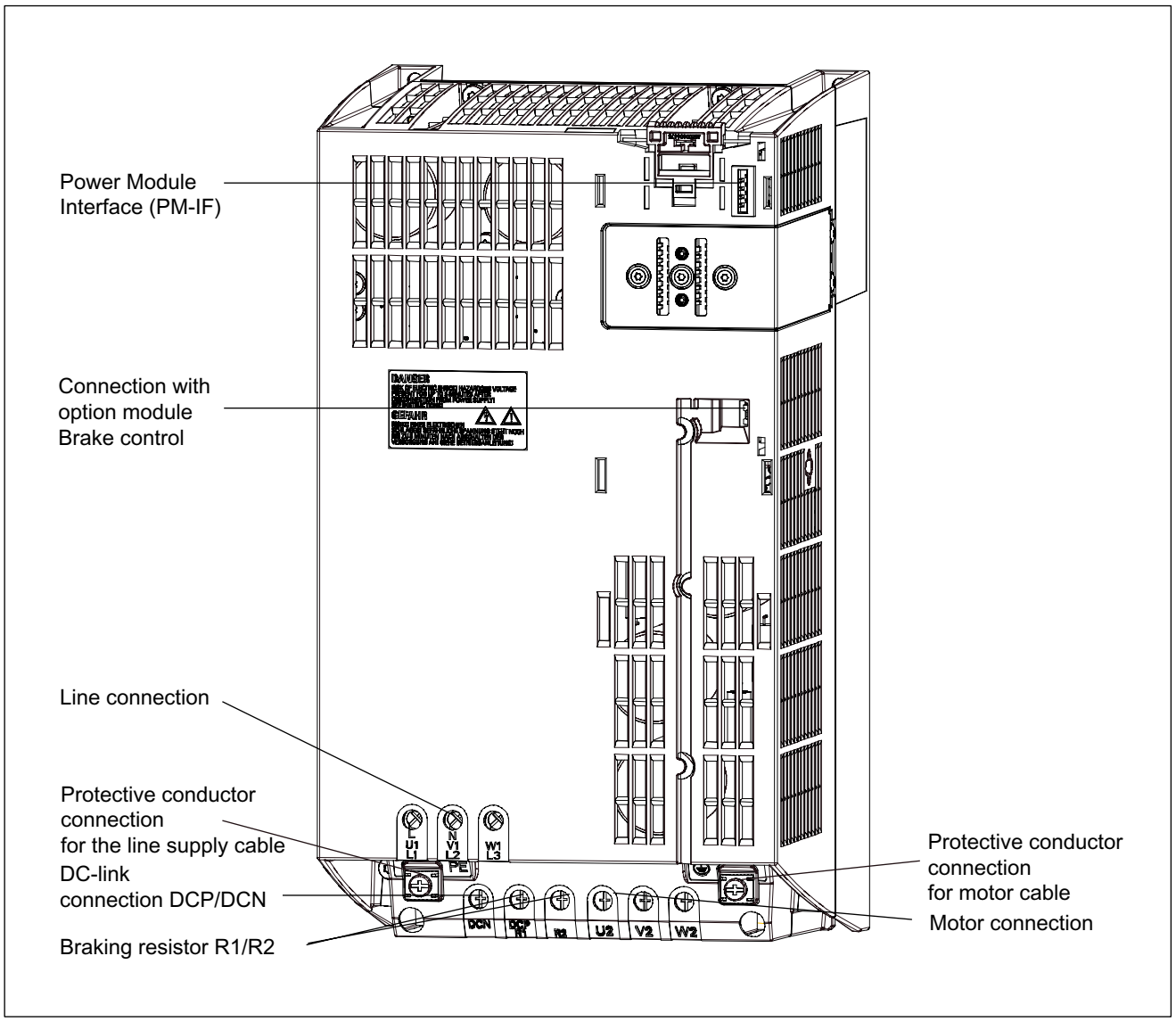


Figure 3-3 PM340, frame size FSC

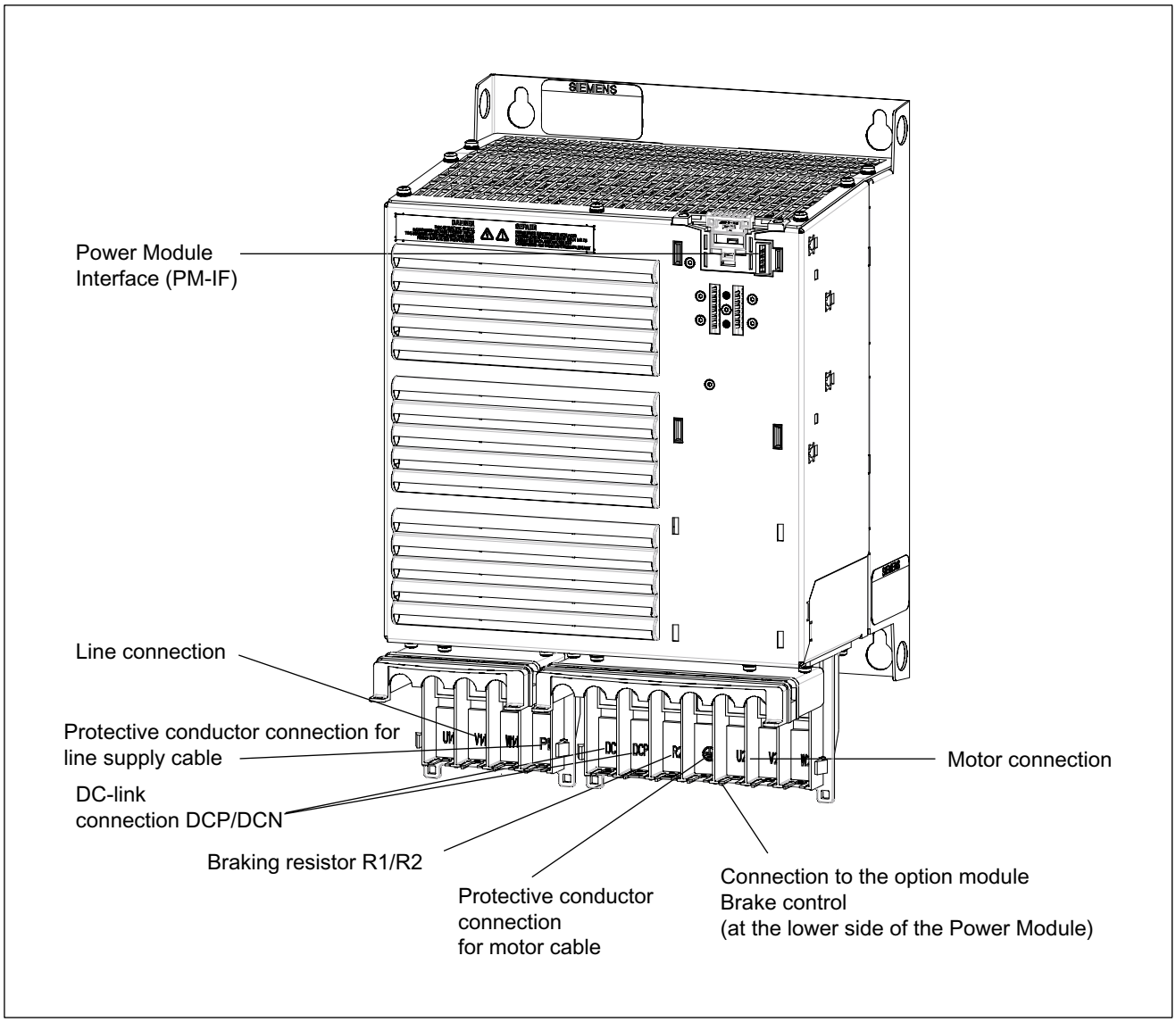


Figure 3-4 PM340, frame size FSD

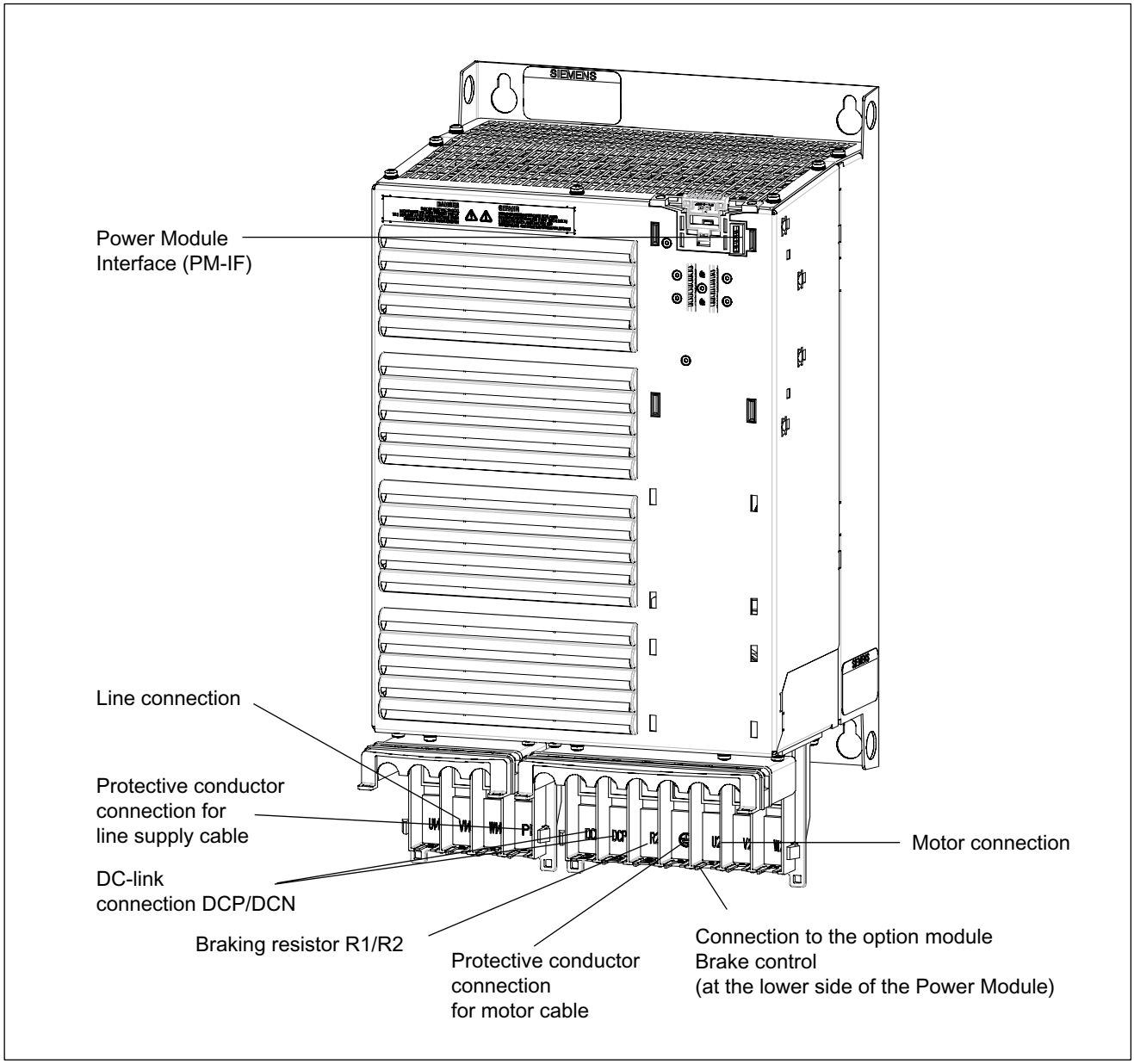


Figure 3-5 PM340, frame size FSE

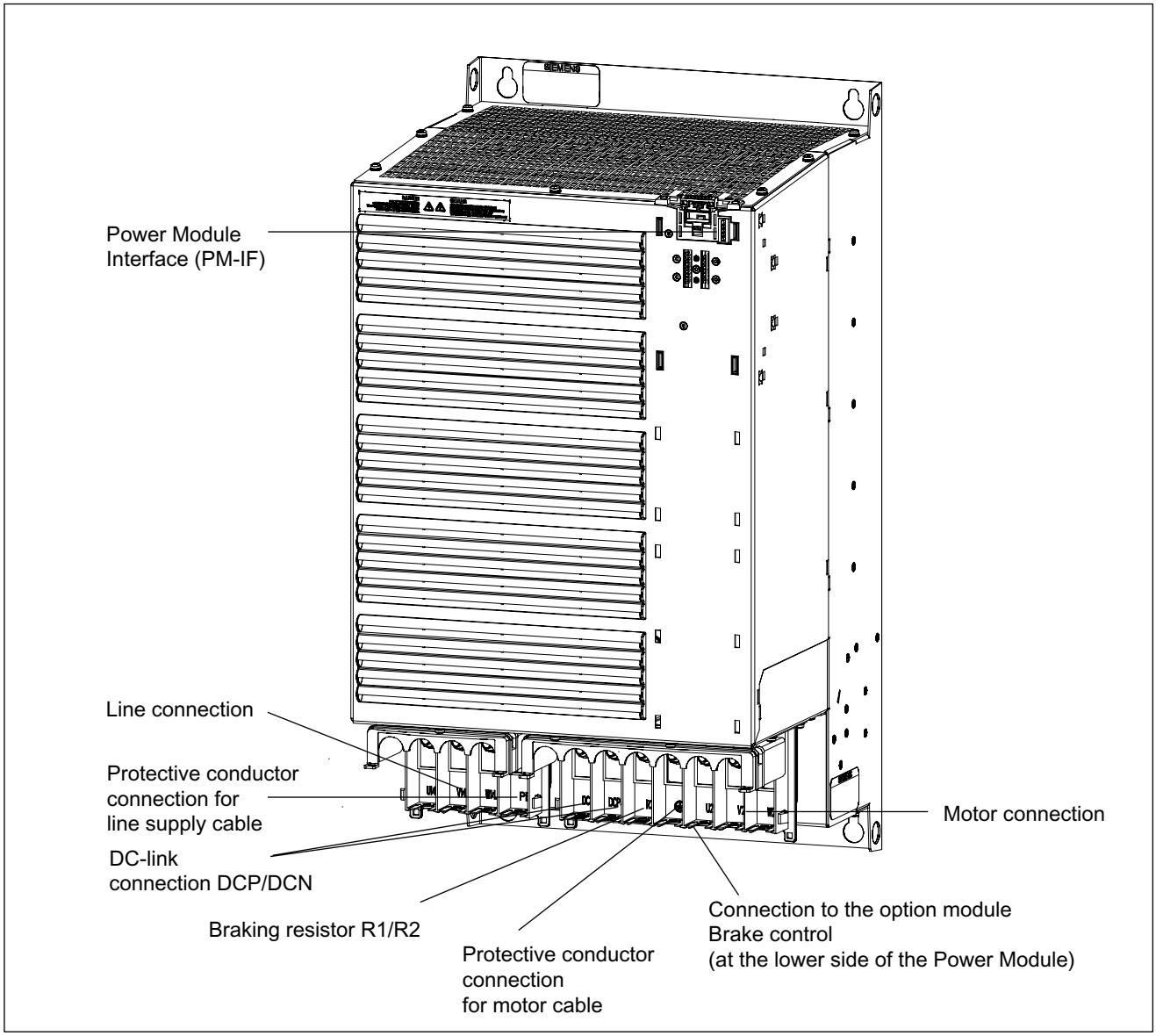


Figure 3-6 PM340, frame size FSF

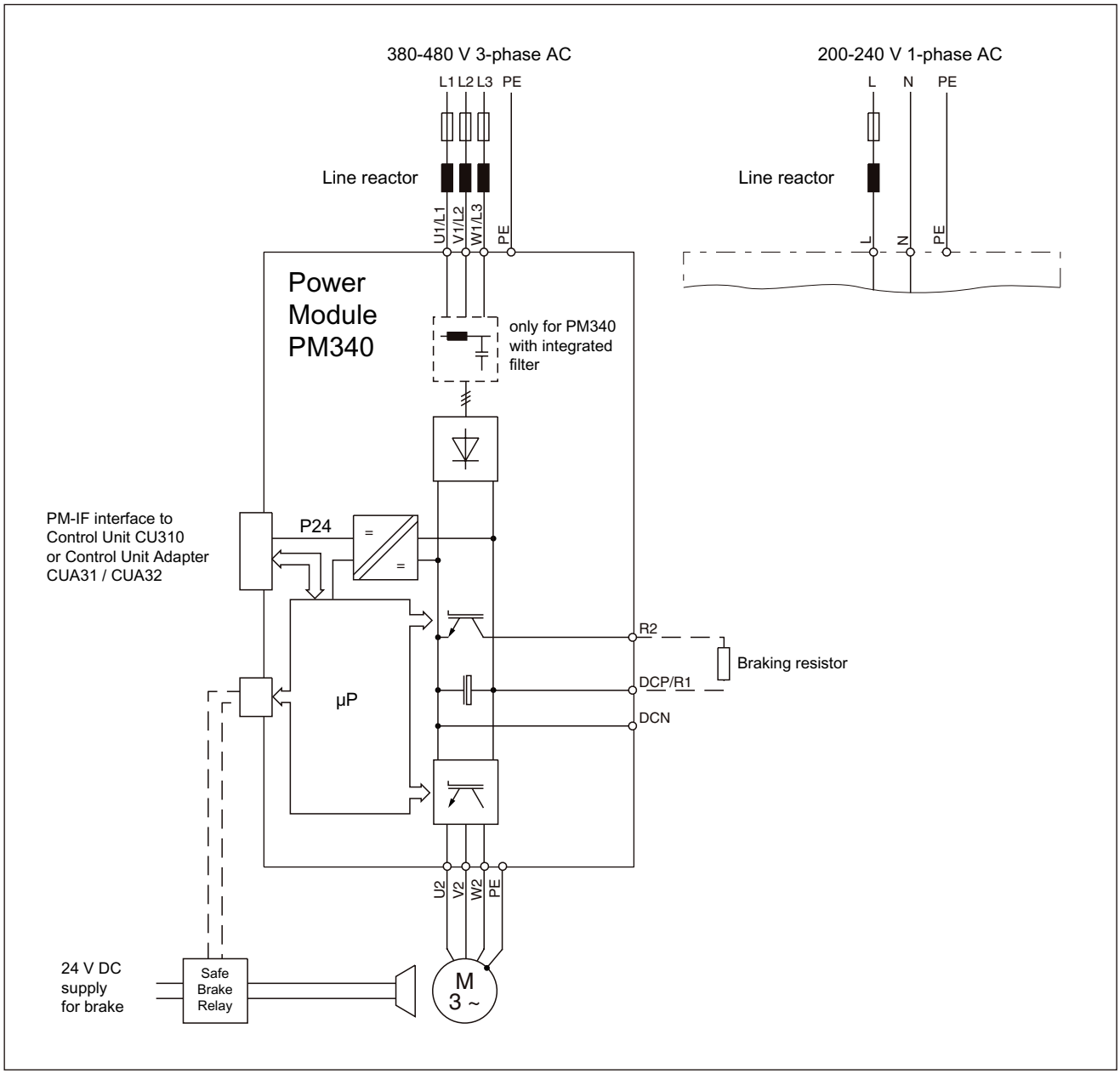


Figure 3-7 PM340 connection example

Arrangement of the line supply and motor terminals.

The following diagram shows the arrangement of the line and motor terminals for frame sizes FSA to FSF of the PM340 Power Module. The diagram also includes the terminal tightening torques.

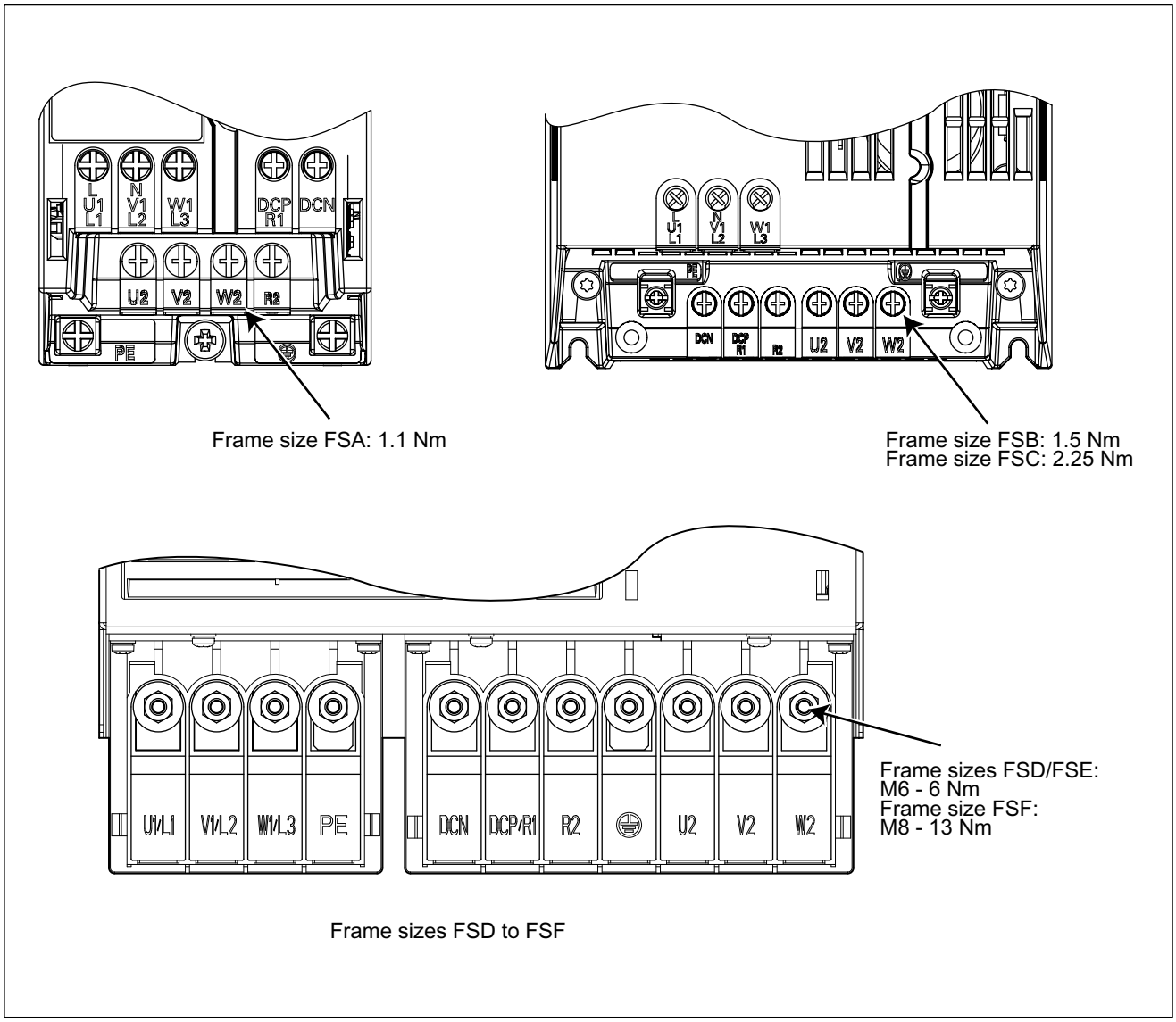


Figure 3-8 Arrangement of the line supply and motor terminals for the PM340

3.1.3.2 Line supply connection

Table 3- 2 Terminal strip, line supply connection 1-ph. 200 V - 240 V AC

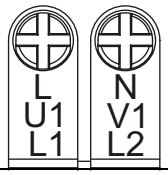
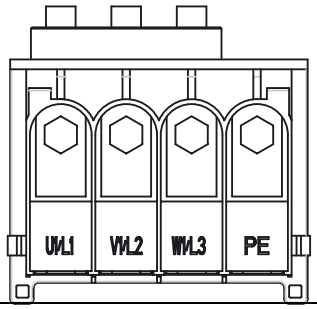
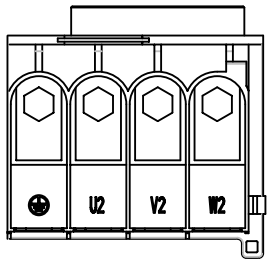
	Terminal	Signal name	Technical specifications
	1	L	Line phase L
	2	N	Line phase N
Max. conductor cross-section: 2.5 mm²			

Table 3- 3 Terminal strip, line supply connection 3-ph. 380 V - 480 V AC

	Terminal	Signal name	Technical specifications
	1	U1/L1	External conductor L1
	2	V1/L2	External conductor L2
	3	W1/L3	External conductor L3
	4	PE	PE connection

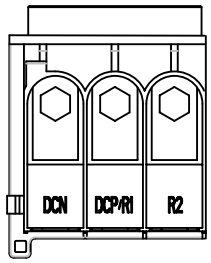
3.1.3.3 Motor connection

Table 3- 4 Terminal strip, motor connection 200 V - 240 V 1 AC and 380 V - 480 V 3 AC

	Terminal	Technical specifications
	⏚	PE connection
	U2	Motor phase U
	V2	Motor phase V
	W2	Motor phase W

3.1.3.4 Braking resistor and DC link connection

Table 3- 5 Terminal strip, braking resistor, and DC link connection

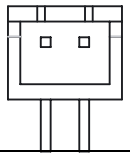
	Terminal	Technical specifications
	DCN	DC link negative
	DCP/R1	DC link positive and positive connection for braking resistor
	R2	Negative connection for the braking resistor

Note

To connect the cable lugs of the brake resistor cable to a PM340 Power Module frame size FSA it is necessary to nip the lug on connection R2 off using a diagonal cutter tool. Take great care to ensure that no pieces of plastic fall into the housing.

3.1.3.5 Connection to the option module, brake control

Table 3- 6 Connector

	Terminal	Designation	Technical specifications
	1	Low	Low signal, option module brake control at PM340
	2	High	High signal, option module brake control at PM340

3.1.4 Dimension drawings

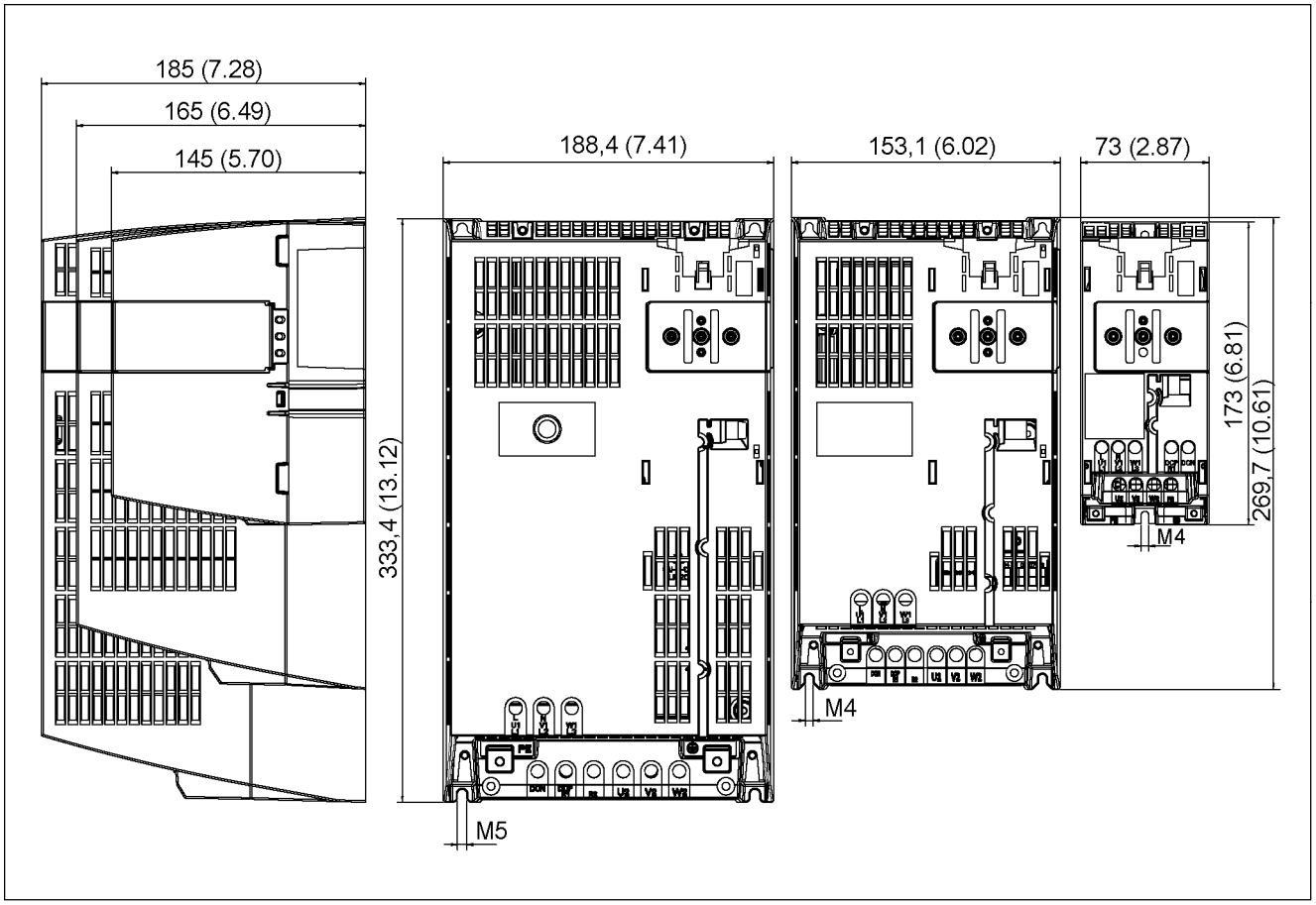


Figure 3-9 Dimension drawings, Power Module PM340

	Frame size FSC	Frame size FSB	Frame size FSA

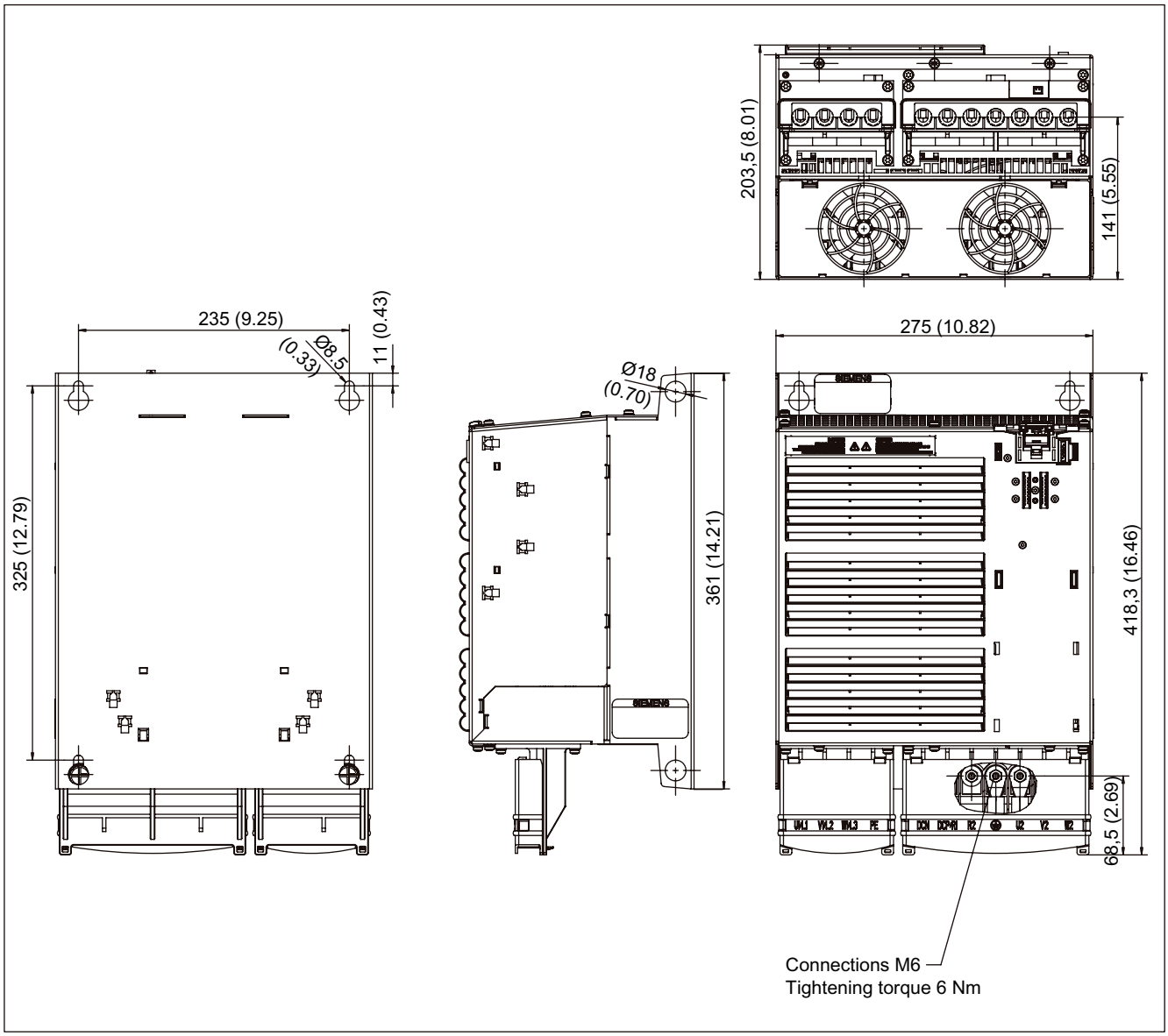


Figure 3-10 Dimension drawing: Power Module PM340, frame size FSD

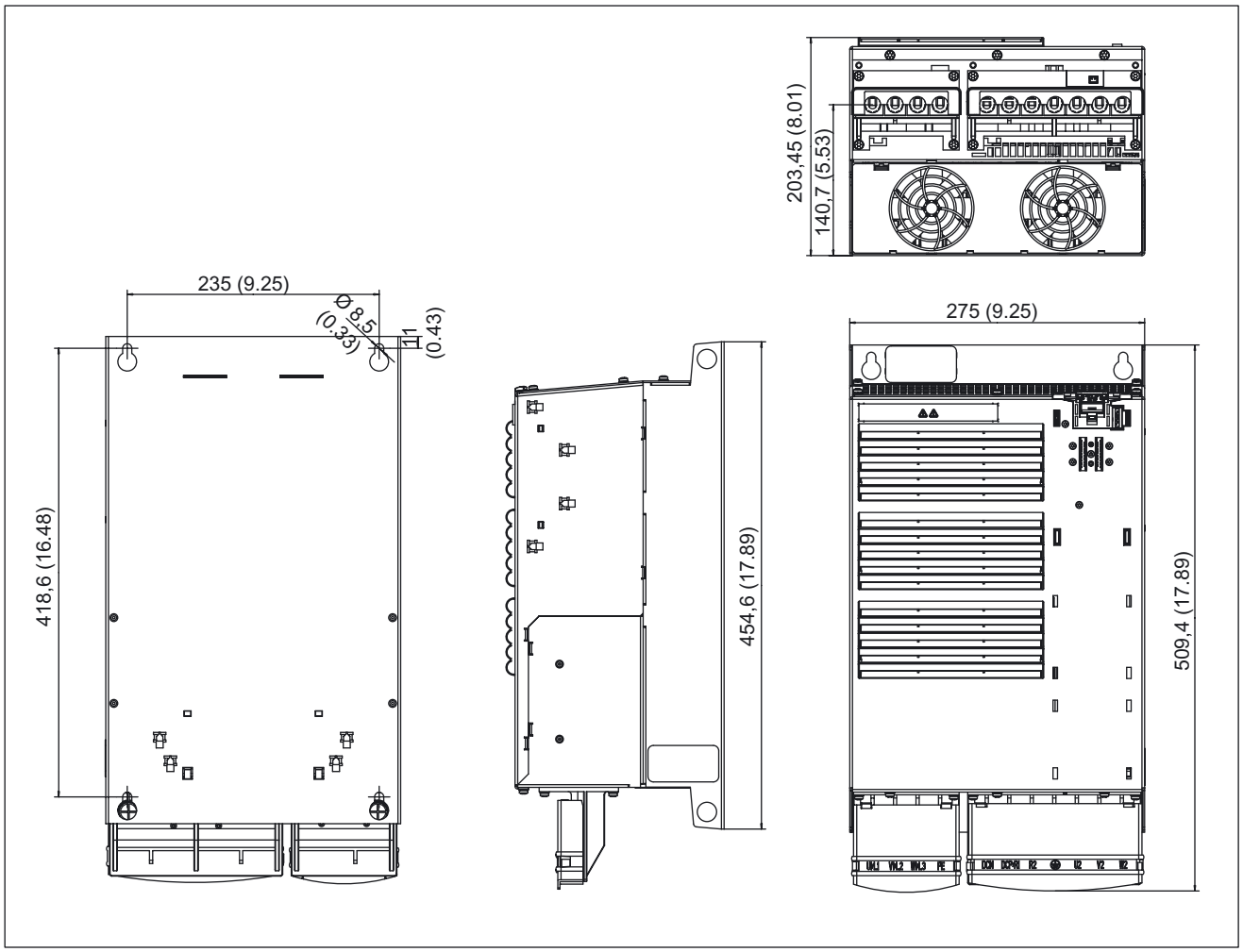


Figure 3-11 Dimension drawing: Power Module PM340 with integrated line filter, frame size FSD

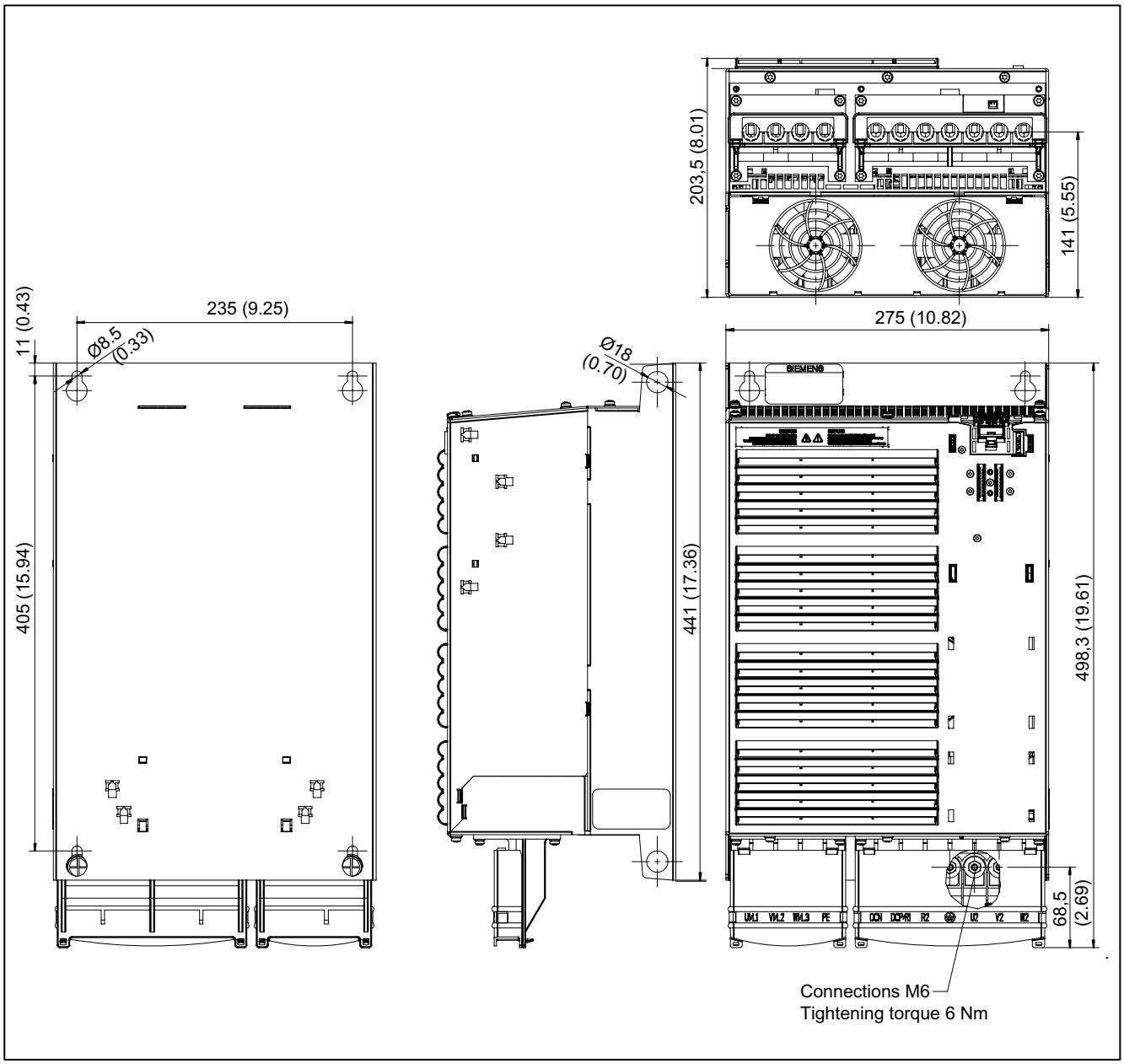


Figure 3-12 Dimension drawing: Power Module PM340, frame size FSE

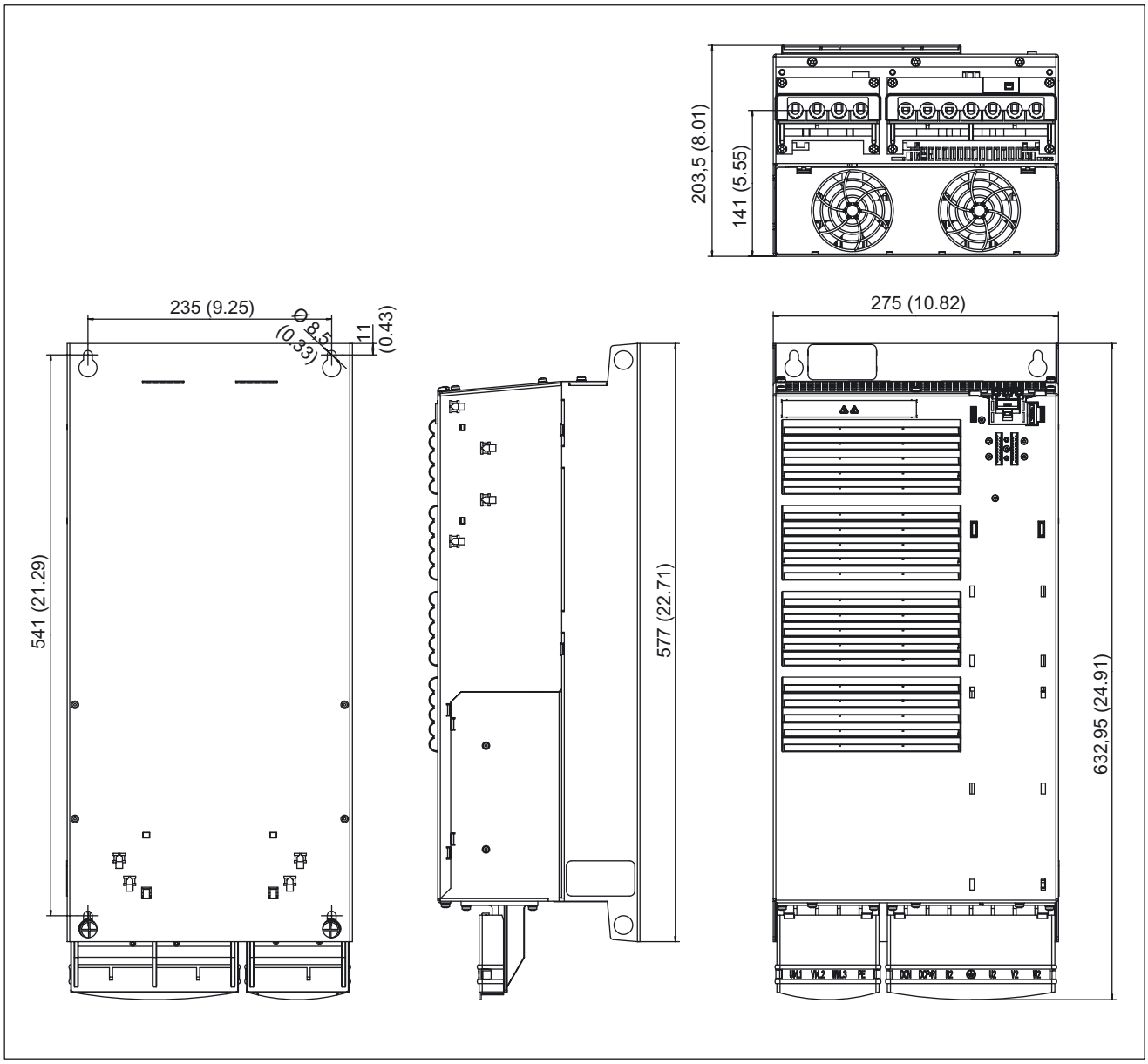


Figure 3-13 Dimension drawing: Power Module PM340 with integrated line filter, frame size FSE

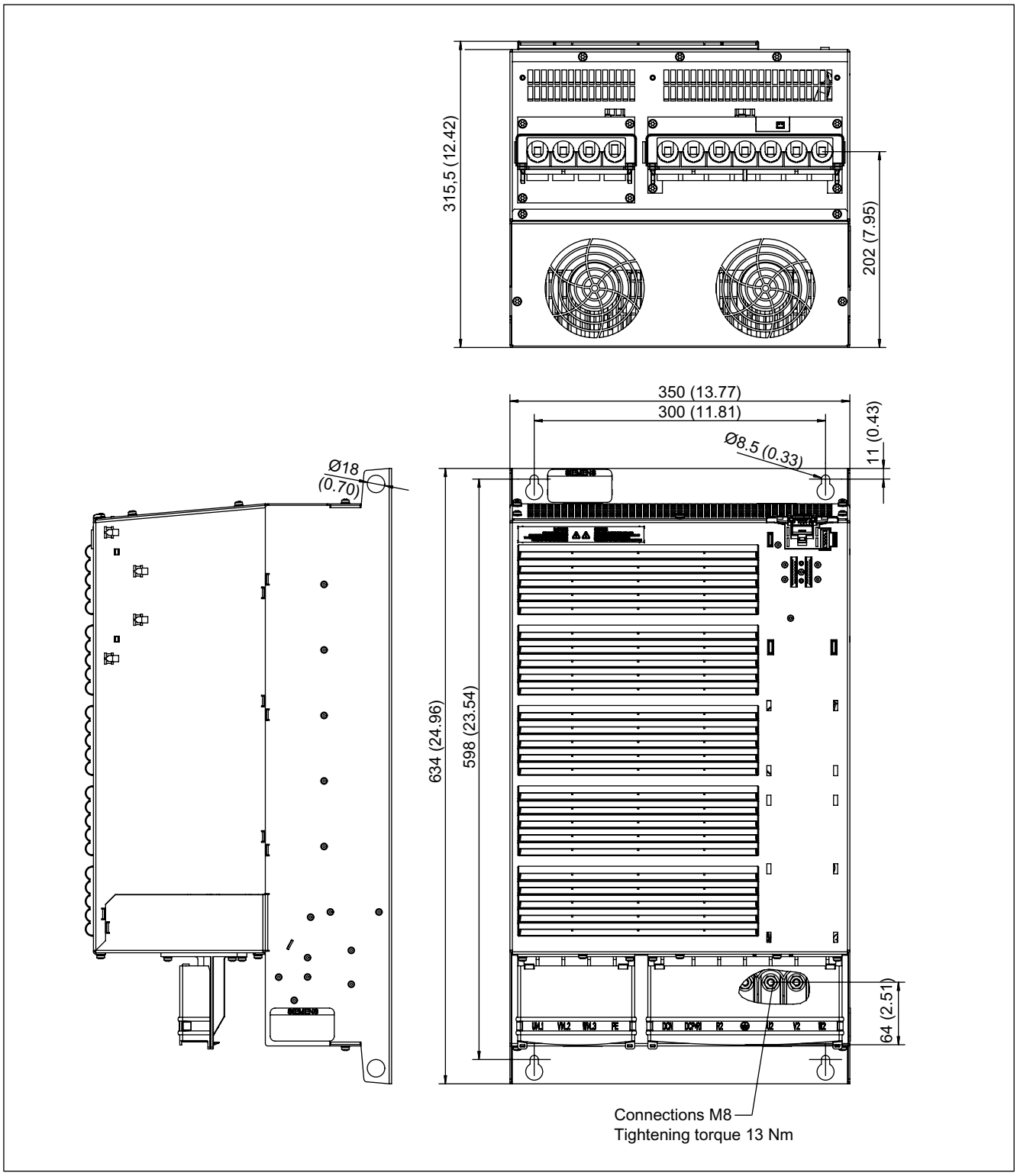


Figure 3-14 Dimension drawing: Power Module PM340, frame size FSF

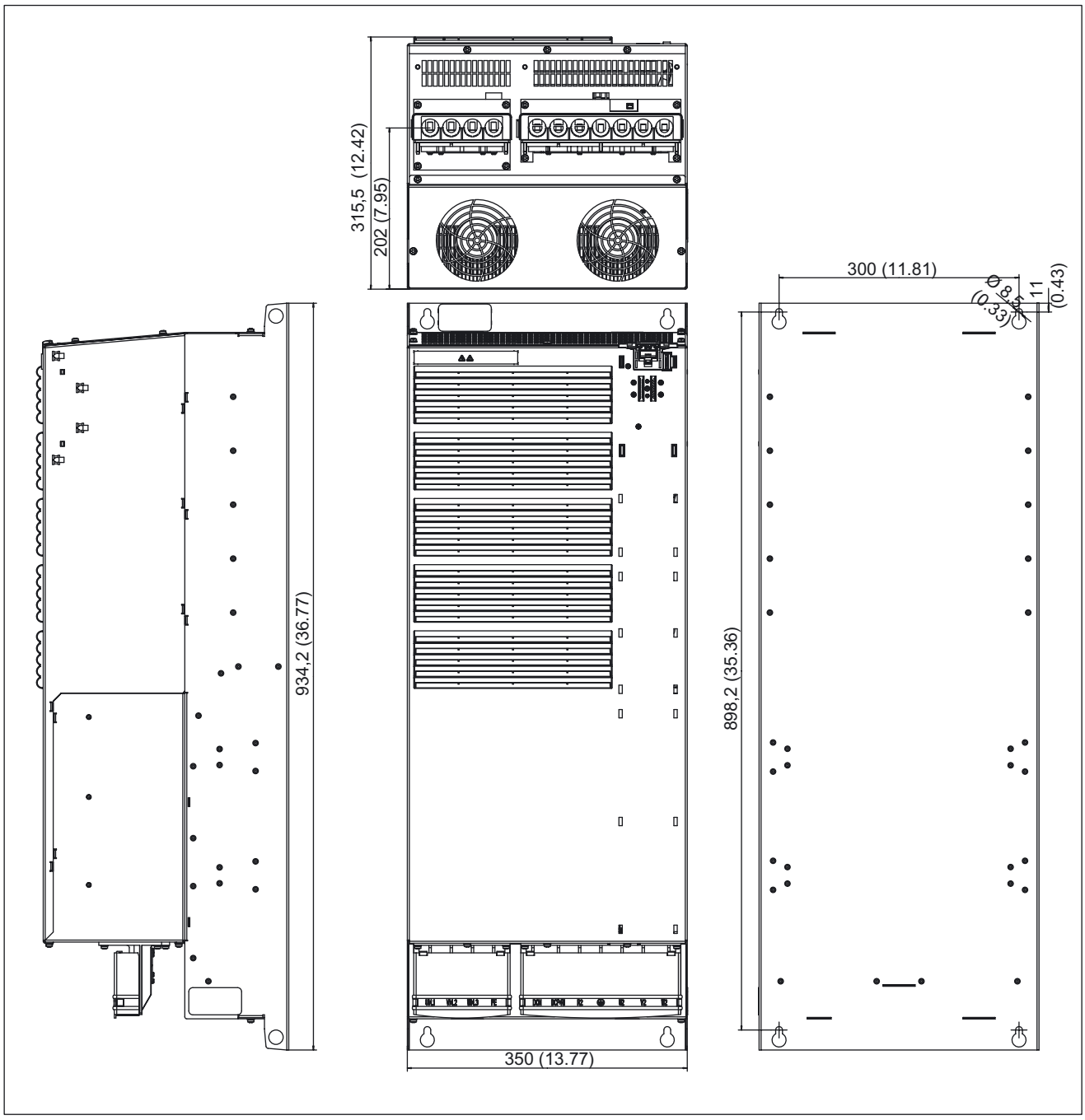


Figure 3-15 Dimension drawing: Power Module PM340 with integrated line filter, frame size FSF

3.1.5 Mounting

Drilling templates for frame sizes FSA and FSC

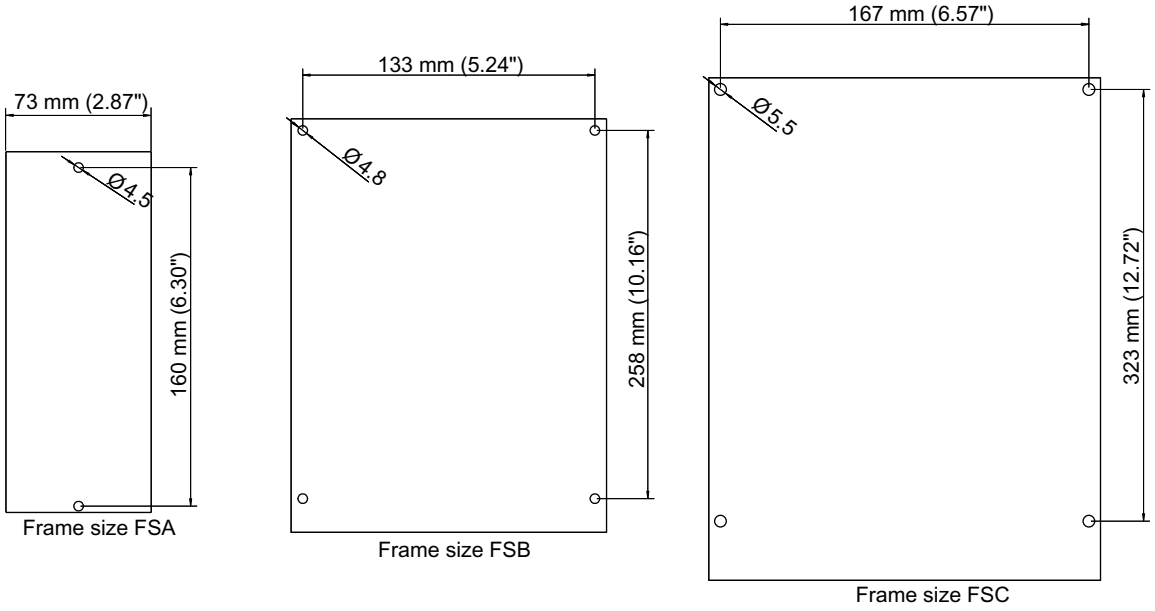


Figure 3-16 Drilling templates for frame sizes FSA and FSC

Drilling templates for frame sizes FSD to FSF

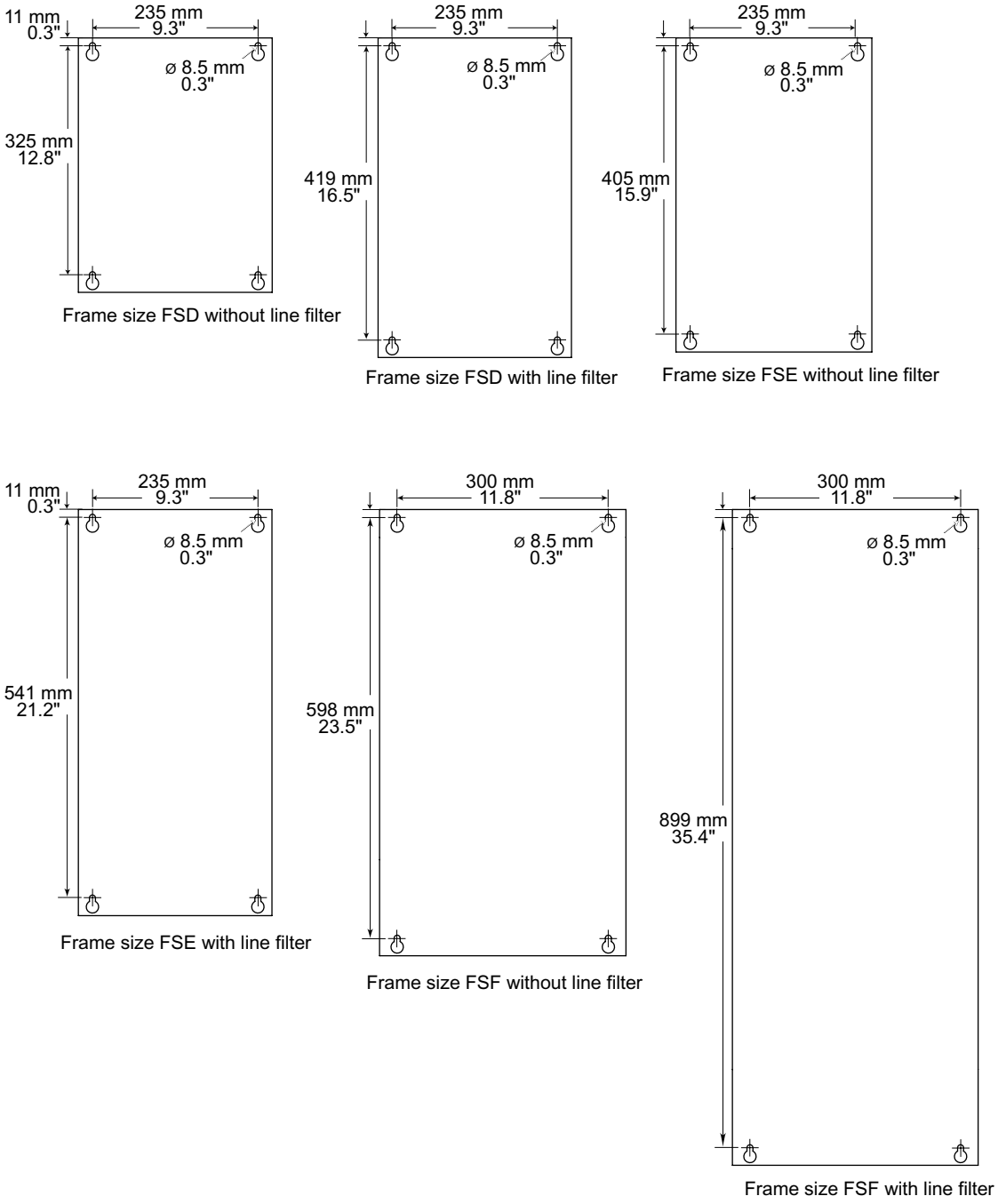


Figure 3-17 Drilling templates for frame sizes FSD to FSF - with and without line filter

The dimensions and the tightening torques when retaining the Power Modules are specified in the following table.

Table 3- 7 PM340, dimensions and tightening torques when mounting

Frame size	Height, width, depth		Dimensions (with Control Unit)	Retaining type	Tightening torques
FSA	HxWxD	mm	173 x 73 x 145	2 x M4 studs, 2 x M4 nuts, 2 x M4 washers	2.5 Nm with washers
		Inches	6.81 x 2.87 x 5.71		
FSB	HxWxD	mm	270 x 153 x 165	4 x M4 studs, 4 x M4 nuts, 4 x M4 washers	
		Inches	10.63 x 6.02 x 6.50		
FSC	HxWxD	mm	334 x 189 x 185	4 x M5 studs, 4 x M5 nuts, 4 x M5 washers	
		Inches	13.1 x 7.41 x 7.28		
FSD without line filter	HxWxD	mm	419 x 275 x 204	4 x M6 studs, 4 x M6nuts, 4 x M6 washers	6 Nm with washers
		Inches	16.3 x 10.8 x 8.0		
FSD with integrated line filter	HxWxD	mm	512 x 275 x 204		
		Inches	20.1 x 10.8 x 8.0		
FSE without line filter	HxWxD	mm	499 x 275 x 204		
		Inches	19.6 x 10.8 x 8.0		
FSE with integrated line filter	HxWxD	mm	635 x 275 x 204		
		Inches	25 x 10.8 x 8.0		
FSF without line filter	HxWxD	mm	635 x 350 x 316	4 x M8 studs, 4 x M8 nuts, 4 x M8 washers	13 Nm with washers
		Inches	25.0 x 13.8 x 12.4		
FSF with integrated line filter	HxWxD	mm	934 x 350 x 316		
		Inches	36.8 x 13.8 x 12.4		

Table 3- 8 PM340, load terminals - tightening torques

Frame size	Tightening torques	
FSA	Nm	1,1
FSB	Nm	1,5
FSC	Nm	2,25
FSD	Nm	6
FSE	Nm	6
FSF	Nm	13

For frame sizes FSD to FSF, the terminals are accessed by releasing the tongue at the side of the terminal covers using a suitable flat screwdriver. The cover can then be pushed upwards and engaged in this position as shown in the following diagram.

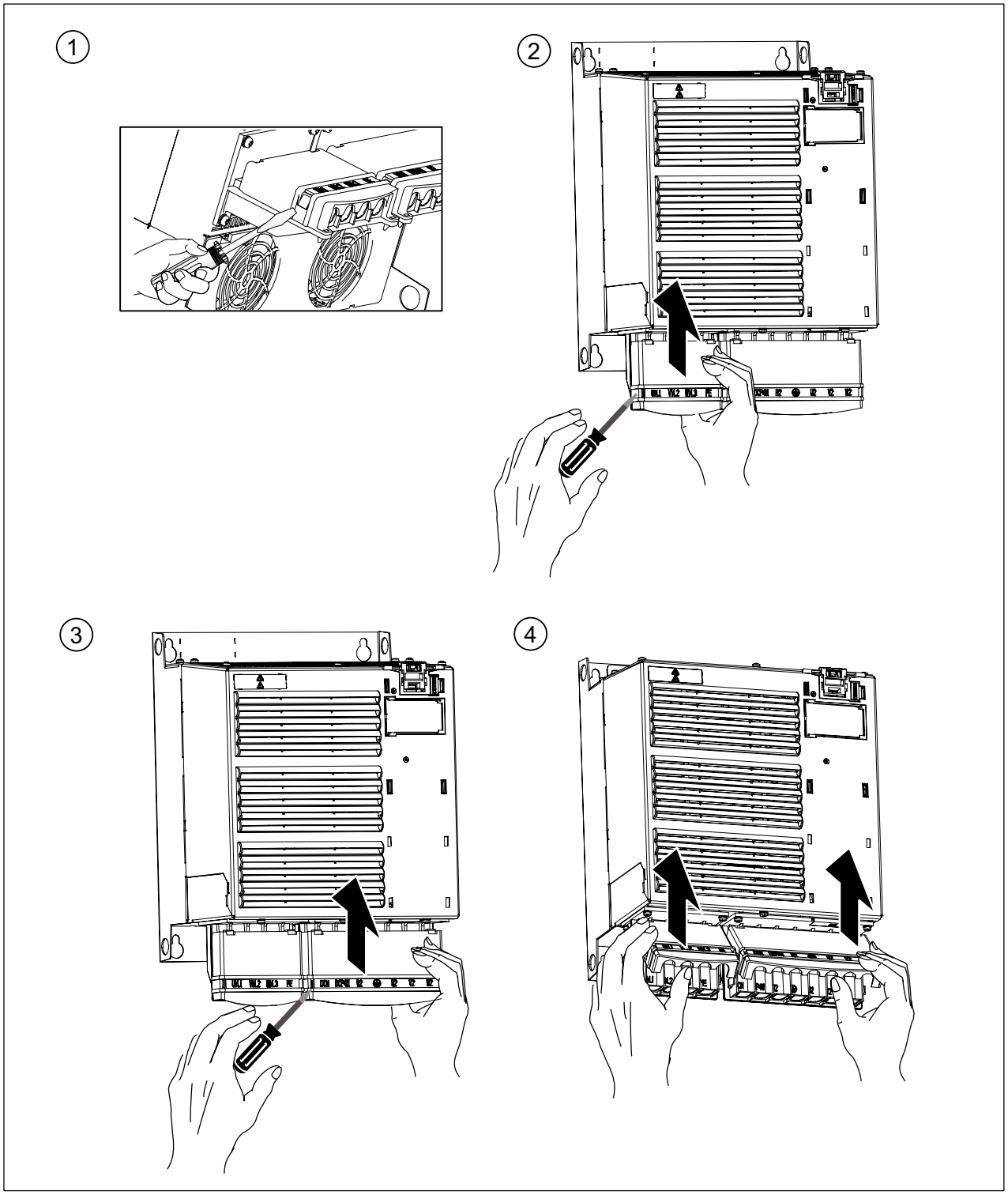


Figure 3-18 Access to the line and motor terminals for frame sizes FSD to FSF

⚠ DANGER
Once the terminal cover has been removed, the degree of protection of the Power Module is reduced to IP00.

Operation on non-grounded line supply systems (IT)

It is not permissible to use Power Modules with integrated line filter in IT line supply systems.

3.1.6 Technical data

Table 3- 9 Technical data PM340, Part 1

Line supply voltage 1-ph. 200 V to 240 V AC ± 10%.				
PM340	**6SL3210–**	**1SB11-0UA0**	**1SB12-3UA0**	**1SB14-0UA0**
PM340 with integrated line filter	**6SL3210–**	**1SB11-0AA0**	**1SB12-3AA0**	**1SB14-0AA0**
Rated output current I_n	A	0,9	2,3	3,9
Base load current I_H	A	0,8	2,0	3,4
Output current for S6 duty (40%) I_{s6}	A	1,4	3,3	5,5
Max. output current I_{max}	A	2,0	4,6	7,8
Rated power based on I_n	kW	0,12	0,37	0,75
Rated pulse frequency	kHz	4	4	4
Power loss	kW	0,06	0,075	0,11
Cooling air requirement	m^3/s	0,005	0,005	0,005
Sound pressure level	dB(A)	< 45	< 45	< 45
24 V DC supply for the Control Unit	A	1,0	1,0	1,0
Rated input current[1)] with line reactor without line reactor	A	 1,4 2,2	 4 6	 6,5 10
Class J UL safety fuses Rated current Rated short-circuit current SCCR	 A kA	 6 65	 10 65	 15 65
Circuit breaker type designation IEC 60947 Rated current	 A	5SJ4206-7HG41 6	5SJ4210-7HG41 10	5SJ4216-7HG41 16
Circuit breaker type designation UL489 / CSA C22.2 No. 5-02 Rated current Rated short circuit current SCCR	 A kA	5SJ4206-7HG41 6 14	5SJ4210-7HG41 10 14	5SJ4216-7HG41 16 14
Resistance value of the external braking resistor	Ohms	> 180	> 180	> 180
Max. cable length to braking resistor	m	15	15	15
Line supply connection L, N		Screw terminals for cable cross-sections 1.0 to 2.5 mm^2		
Motor connection U2, V2, W2				

Line supply voltage 1-ph. 200 V to 240 V AC ± 10%.				
PM340	**6SL3210–**	**1SB11-0UA0**	**1SB12-3UA0**	**1SB14-0UA0**
PM340 with integrated line filter	**6SL3210–**	**1SB11-0AA0**	**1SB12-3AA0**	**1SB14-0AA0**
DC link connection, connection for braking resistor DCP/R1, DCN, R2				
PE connection		at the housing with M 4 screw		
Max. motor cable length [2] (without external options)	m	50 (shielded) 75 (unshielded)		
Degree of protection		IP20 or IPXXB		
Frame size		FSA	FSA	FSA
Weight	kg	1,2	1,3	1,3

1) The input current depends on the motor load and line impedance. The input currents apply for load with the rated power (based on In) for a line impedance corresponding to uk = 1 %.

2) Max. motor cable length 15 m (shielded) for Power Modules PM340 with integrated line filter to maintain the limit values of EN 61800-3 Category C2.

Table 3- 10 Technical data PM340, Part 2

Line supply voltage 3-ph. 380 V to 480 V AC ± 10%.						
PM340	**6SL3210-**	**1SE11-3UA0**	**1SE11-7UA0**	**1SE12-2UA0**	**1SE13-1UA0**	**1SE14-1UA0**
PM340 with integrated line filter	**-**	**-**	**-**	**-**	**-**	**-**
Rated output current I_n	A	1,3	1,7	2,2	3,1	4,1
Base load current I_H	A	1,1	1,5	1,9	2,7	3,6
Output current for S6 duty (40%) I_{S6}	A	1,3	2,0	2,5	3,5	4,5
Max. output current I_{max}	A	2,6	3,4	4,4	6,2	8,2
Rated power based on I_n	kW	0,37	0,55	0,75	1,1	1,5
Rated power based on I_H	kW	0,37	0,55	0,75	1,1	1,5
Rated pulse frequency	kHz	4	4	4	4	4
Power loss	kW	0,10	0,10	0,10	0,11	0,11
Cooling air requirement	m^3/s	0.005	0.005	0.005	0.005	0.005
Sound pressure level	dB(A)	< 45	< 45	< 45	< 45	< 45
24 V DC supply for the Control Unit	A	1,0	1,0	1,0	1,0	1,0
Rated input current [1] - with line reactor - without line reactor	A 	 1,3 1,7	 1,7 2,2	 2,2 2,6	 3,1 3,9	 4,1 4,8
Class J UL safety fuses Rated current Rated short-circuit current SCCR	 A kA	 4 65	 4 65	 6 65	 8 65	 10 65
NH Safety fuses Rated current	 A	3NA3 804 4	3NA3 804 4	3NA3 801 6	3NA3 803 10	3NA3 803 10
Circuit breaker type designation IEC 60947 Rated current	 A	3RV1021-1DA10 2.2 - 3.2	3RV1021-1DA10 2.2 - 3.2	3RV1021-1FA10 3.5 - 5	3RV1021-1GA10 4.5 - 6.3	3RV1021-1HA10 5.5 - 8

Line supply voltage 3-ph. 380 V to 480 V AC ± 10%.						
PM340	**6SL3210-**	**1SE11-3UA0**	**1SE11-7UA0**	**1SE12-2UA0**	**1SE13-1UA0**	**1SE14-1UA0**
PM340 with integrated line filter	**-**	**-**	**-**	**-**	**-**	**-**
Resistance value of the external braking resistor	Ohms	> 390	> 390	> 390	> 390	> 390
Max. cable length to braking resistor	m	15	15	15	15	15
Line supply connection L, N		Screw terminals for cable cross-sections 1.0 to 2.5 mm²				
Motor connection U2, V2, W2						
DC link connection, connection for braking resistor DCP/R1, DCN, R2						
PE connection		at the housing with M 4 screw				
Max. motor cable length[2)]	m	50 (shielded) 75 (unshielded)				
Degree of protection		IP20 or IPXXB				
Frame size		FSA	FSA	FSA	FSA	FSA
Weight	kg	1,2	1,2	1,2	1,2	1,2

1) The input current depends on the motor load and line impedance. The input currents apply for a load with the rated power (based on In) for a line impedance corresponding to uk = 1 %.

2) Max. motor cable length 25 m (shielded) for PM340 Power Modules with integrated line filter to maintain the limit values of EN 61800-3 Category C2.

Table 3- 11 Technical data PM340, Part 3

Line supply voltage 3-ph. 380 V to 480 V AC ± 10%.						
PM340	**6SL3210-**	**1SE16-0UA0**	**1SE17-7UA0**	**1SE21-0UA0**	**1SE21-8AA0**	**1SE22-5UA0**
PM340 with integrated line filter	**6SL3210-**	**1SE16-0AA0**	**1SE17-7AA0**	**1SE21-0AA0**	**1SE21-8UA0**	**1SE22-5AA0**
Rated output current I_n	A	5,9	7,7	10,2	18	25
Base load current I_H	A	5,2	6,8	9,1	14	21
Output current for S6 duty (40%) I_{S6}	A	6,4	8,3	10,8	19,6	27,8
Max. output current I_{max}	A	11,8	15,4	20,4	26,4	38
Rated power based on I_n	kW	2,2	3	4	7,5	11
Rated power based on I_H	kW	2,2	3	4	5,5	7,5
Rated pulse frequency	kHz	4	4	4	4	4
Power loss	kW	0,14	0,16	0,18	0,24	0,30
Cooling air requirement	m³/s	0,009	0,009	0,009	0,038	0,038
Sound pressure level	dB(A)	< 50	< 50	< 50	< 60	< 60
24 V DC supply for the Control Unit	A	1,0	1,0	1,0	1,0	1,0
Rated input current[1)] - with line reactor - without line reactor	A	 5,6 6,7	 7,5 8,9	 9,8 12,4	 17,1 23,1	 24,6 32,6

Line supply voltage 3-ph. 380 V to 480 V AC ± 10%.						
PM340	**6SL3210-**	**1SE16-0UA0**	**1SE17-7UA0**	**1SE21-0UA0**	**1SE21-8AA0**	**1SE22-5UA0**
PM340 with integrated line filter	**6SL3210-**	**1SE16-0AA0**	**1SE17-7AA0**	**1SE21-0AA0**	**1SE21-8UA0**	**1SE22-5AA0**
Class J UL safety fuses Rated current Rated short-circuit current SCCR	 A kA	 10 65	 12 65	 15 65	 25 65	 35 65
Safety fuses NH Rated current	 A	3NA3 803 10	3NA3 805 16	3NA3 805 16	3NA3 810 25	3NA3 814 35
Circuit breaker type designation IEC 60947 Rated current	 A	3RV1021-1KA10 9 - 12.5	3RV1021-4AA10 11 - 16	3RV1021-4BA10 14 - 20	3RV1031-4EA10 22 - 32	3RV1031-4FA10 28 - 40
Resistance value of the external braking resistor	Ohms	> 160	> 160	> 160	> 56	> 56
Max. cable length to braking resistor	m	15	15	15	15	15
Line supply connection L, N		Screw terminals for cable cross-sections 1.0 to 6 mm²			Screw terminals for cable cross-sections 2.5 to 10 mm²	
Motor connection U2, V2, W2						
DC link connection, connection for braking resistor DCP/R1, DCN, R2						
PE connection		at the housing with M 5 screw				
Max. motor cable length[2)]	m	50 (shielded) 75 (unshielded)				
Degree of protection		IP20 or IPXXB				
Frame size		FSB	FSB	FSB	FSC	FSC
Weight	kg	4,0	4,0	4,0	6,5	6,5

1) The input current depends on the motor load and line impedance. The input currents apply for a load with the rated power (based on In) for a line impedance corresponding to uk = 1 %.

2) Max. motor cable length 25 m (shielded) for PM340 Power Modules with integrated line filter to maintain the limit values of EN 61800-3 Category C2.

Table 3- 12 Technical data PM340, Part 4

Line supply voltage 3-ph. 380 V to 480 V AC ± 10%.						
PM340	**6SL3210-**	**1SE23-2UA0**	**1SE23-8UA0**	**1SE24-5UA0**	**1SE26-0UA0**	**1SE27-5UA0**
PM340 with integrated line filter	**6SL3210-**	**1SE23-2AA0**	**1SE23-8AA0**	**1SE24-5AA0**	**1SE26-0AA0**	**1SE27-5AA0**
Rated output current I_n	A	32	38	45	60	75
Base load current I_H	A	27	33	40	48	65
Output current for S6 duty (40%) I_{S6}	A	37,1	49	58	78	98
Max. output current I_{max}	A	52	64	76	90	124
Rated power based on I_n	kW	15	18,5	22	30	37
Rated power based on I_H	kW	11	15	18,5	22	30
Rated pulse frequency	kHz	4	4	4	4	4
Power loss	kW	0,40	0,38	0,51	0,69	0,99
Cooling air requirement	l / s	54,9	54,9	54,9	54,9	2 x 54.9
Sound pressure level	dB(A)	< 60	< 60	< 60	< 60	< 60
24 V DC supply for the Control Unit	A	1,0	1,0	1,0	1,0	1,0
Rated input current[1)] - with line reactor - without line reactor	A A	 33 39	 40 46	 47 53	 63 72	 78 88
Class J UL safety fuses Rated current Rated short-circuit current SCCR	 A kA	 45 65	 50 65	 60 65	 90 65	 100 65
Safety fuses NH Rated current	 A	3NA3 817 40	3NA3 820 50	3NA3 822 63	3NA3 824 80	3NA3 830 100
Circuit breaker type designation IEC 60947 Rated current	 A	3RV1031-4HA10 40 - 50	3RV1042-4JA10 45 - 63	3RV1042-4KA10 57 - 75	3RV1042-4MA10 80 - 100	3VL1712-1DD33-0AA0 100 - 125
Circuit breaker type designation UL489 / CSA C22.2 No. 5-02 Rated current Rated short circuit current SCCR	 A kA	--	--	--	3VL2191-3KN30-0AA0 90 65	3VL2110-3KN30-0AA0 100 65
Resistance value of the external braking resistor	Ohms	> 56	> 27	> 27	> 27	> 15
Max. cable length to braking resistor	m	15	15	15	15	15
Line supply connection L, N		Screw terminals	Stud M6,			
Motor connection U2, V2, W2						

Line supply voltage 3-ph. 380 V to 480 V AC ± 10%.						
PM340	**6SL3210-**	**1SE23-2UA0**	**1SE23-8UA0**	**1SE24-5UA0**	**1SE26-0UA0**	**1SE27-5UA0**
PM340 with integrated line filter	**6SL3210-**	**1SE23-2AA0**	**1SE23-8AA0**	**1SE24-5AA0**	**1SE26-0AA0**	**1SE27-5AA0**
DC link connection, connection for braking resistor DCP/R1, DCN, R2		for cable cross-sections 2.5 to 10 mm²	connectable cable cross-sections 10 to 50 mm²			
PE connection		at the housing with M 5 screw	at the housing with M6 screw			
Max. motor cable length[2)]	m	50 (shielded) 75 (unshielded)	70 (shielded) 100 (unshielded)			
Degree of protection		IP20 or IPXXB				
Height PM 340 with integrated line filter	mm	333,4 (13.12)	511 (20.11)	511 (20.11)	511 (20.11)	633 (24.92)
Frame size		FSC	FSD	FSD	FSD	FSE
Weight without line filter/ with integrated line filter	kg	6,5 6,5	15,9 19,3	15,9 19,3	15,9 19,3	19,8 27,1

[1)] The input current depends on the motor load and line impedance. The input currents apply for a load with the rated power (based on In) for a line impedance corresponding to uk = 1 %.

[2)] Max. motor cable length 25 m (shielded) for PM340 Power Modules with integrated line filter to maintain the limit values of EN 61800-3 Category C2.

Table 3- 13 Technical data PM340, Part 5

Line supply voltage 3-ph. 380 V to 480 V AC ± 10%.					
PM340	**6SL3210-**	**1SE31-0UA0**	**1SE31-1UA0**	**1SE31-5UA0**	**1SE31-8UA0**
PM340 with integrated line filter	**6SL3210-**	**1SE31-0AA0**	**1SE31-1AA0**	**1SE31-5AA0**	**1SE31-8AA0**
Rated output current I_n	A	90	110	145	178
Base load current I_H	A	80	95	115	155
Output current for S6 duty (40%) I_{S6}	A	117	143	188	231
Max. output current I_{max}	A	150	180	220	290
Rated power based on I_n	kW	45	55	75	90
Rated power based on I_H	kW	37	45	55	75
Rated pulse frequency	kHz	4	4	4	4
Power loss	kW	1,21	1,42	1,93	2,31
Cooling air requirement	l / s	2 x 54.9	150	150	150
Sound pressure level	dB(A)	62	< 60	< 60	65
24 V DC supply for the Control Unit	A	1,0	1,0	1,0	1,0
Rated input current[1)] - with line reactor - without line reactor	A	 94 105	 115 129	 151 168	 186 204
Class J UL safety fuses Rated current Rated short-circuit current SCCR	 A kA	 125 65	 150 65	 200 65	 250 65

Line supply voltage 3-ph. 380 V to 480 V AC ± 10%.					
PM340	**6SL3210-**	**1SE31-0UA0**	**1SE31-1UA0**	**1SE31-5UA0**	**1SE31-8UA0**
PM340 with integrated line filter	**6SL3210-**	**1SE31-0AA0**	**1SE31-1AA0**	**1SE31-5AA0**	**1SE31-8AA0**
Safety fuses NH Rated current	 A	3NA3 832 125	3NA3 836 160	3NA3 140 200	3NA3 144 250
Circuit breaker type designation IEC 60947 Rated current	 A	3VL1716-1DD33-0AA0 125 - 160	3VL3720-1DC36-0AA0 160 - 200	3VL3720-1DC36-0AA0 160 - 200	3VL3725-1DC36-0AA0 200 - 250
Circuit breaker type designation UL489 / CSA C22.2 No. 5-02 Rated current Rated short circuit current SCCR	 A kA	3VL2112-3KN30-0AA0 125 65	3VL2115-3KN30-0AA0 150 65	3VL3120-3KN30-0AA0 200 65	3VL3125-3KN30-0AA0 250 65
Resistance value of the external braking resistor	Ohms	> 15	> 8,2	> 8,2	> 8,2
Max. cable length to braking resistor	m	15	15	15	15
Line supply connection L, N		Stud M6, connectable cable cross-sections 10 to 50 mm²	Stud M8, max. connection cable cross-section 120 mm²		
Motor connection U2, V2, W2					
DC link connection, connection for braking resistor DCP/R1, DCN, R2					
PE connection		at the housing with M6 screw	At the housing with M8 screw		
Max. motor cable length[2)]	m	70 (shielded) 100 (unshielded)			
Degree of protection		IP20 or IPXXB			
Height PM 340 with integrated line filter	 mm	 633 (24.92)	 934 (36.77)	 934 (36.77)	 934 (36.77)
Frame size		FSE	FSF	FSF	FSF
Weight without line filter/ with integrated line filter	kg	19,8 27,1	50,7 66,7	50,7 66,7	50,7 66,7

1) The input current depends on the motor load and line impedance. The input currents apply for a load with the rated power (based on In) for a line impedance corresponding to uk = 1 %.

2) Max. motor cable length 25 m (shielded) for PM340 Power Modules with integrated line filter to maintain the limit values of EN 61800-3 Category C2.

Interrelationship between the pulse frequency and current de-rating

Table 3- 14 Current de-rating depending on the pulse frequency

Order No.	Line voltage	Rated output current	Power (high overload)	Output current in A at a switching frequency of:						
6SL3210-		A	[kW]	4 kHz	6 kHz	8 kHz 70%	10 kHz	12 kHz 50%	14 kHz	16 kHz 40%
1SB11-0UA0	1-ph. 230 V AC	0,9	0,12	0,9	0,7	0,54	0,4	0,3	0,3	0,2
1SB12-3UA0		2,3	0,37	2,3	1,8	1,3	1,1	0,9	0,8	0,6
1SB14-0UA0		3,9	0,75	3,9	3,1	2,3	1,9	1,5	1,3	1,1
1SE11-3UA0	3-ph. 400 V AC	1,3	0,37	1,3	-	0,91	-	0,65	-	0,52
1SE11-7UA0		1,7	0,55	1,7	-	1,19	-	0,85	-	0,68
1SE12-2UA0		2,2	0,75	2,2	-	1,54	-	1,1	-	0,88
1SE13-1UA0		3,1	1,1	3,1	-	2,17	-	1,55	-	1,24
1SE14-1UA0		4,1	1,5	4,1	-	2,87	-	2,05	-	1,64
1SE16-0UA0		5,9	2,2	5,9	-	4,13	-	2,95	-	2,36
1SE17-7UA0		7,7	3	7,7	-	5,39	-	3,85	-	3,08
1SE21-0UA0		10	4	10	-	7	-	5	-	4
1SE21-8UA0		18	5,5	18	-	12,6	-	9	-	7,02
1SE22-5UA0		25	7,5	25	-	17,5	-	12,5	-	10
1SE23-2UA0		32	15,0	32,0	30,4	28,8	25,6	22,4	19,2	16,0
1SE23-8UA0		38	18,5	38,0	34,2	30,4	26,6	22,8	19,0	15,2
1SE24-5UA0		45	22,0	45,0	40,5	36,0	31,5	27,0	22,5	18,0
1SE26-0UA0		60	30,0	62,0	58,9	55,8	49,6	43,4	37,2	31,0
1SE27-5UA0		75	37,0	75,0	67,5	60,0	52,5	45,0	37,5	30,0
1SE31-0UA0		90	45,0	90,0	76,5	63,0	51,8	40,5	33,8	27,0
1SE31-1UA0		110	55,0	110,0	93,5	77,0	63,3	49,5	41,3	33,0

Order No.	Line voltage	Rated output current	Power (high overload)	Output current in A at a switching frequency of:						
6SL3210 -		A	[kW]	4 kHz	6 kHz	8 kHz 70%	10 kHz	12 kHz 50%	14 kHz	16 kHz 40%
1SE31-5UA0		145	75,0	145,0	112,4	79,8	68,9	58,0	50,8	43,5
1SE31-8UA0		178	15,0	32,0	30,4	28,8	25,6	22,4	19,2	16,0

Overload capability

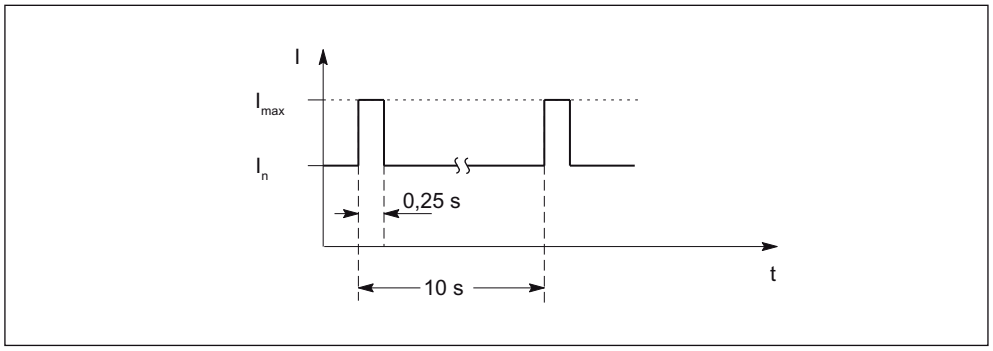


Figure 3-19 Load cycle with pre-load condition (for servo drives)

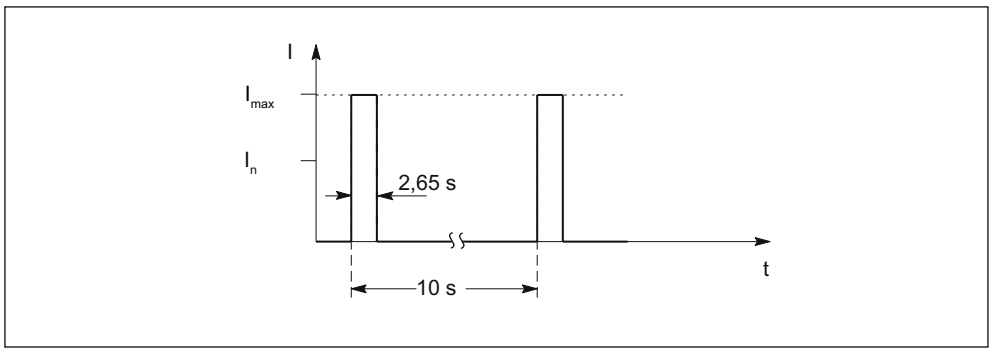


Figure 3-20 Load cycle without pre-load condition (for servo drives)

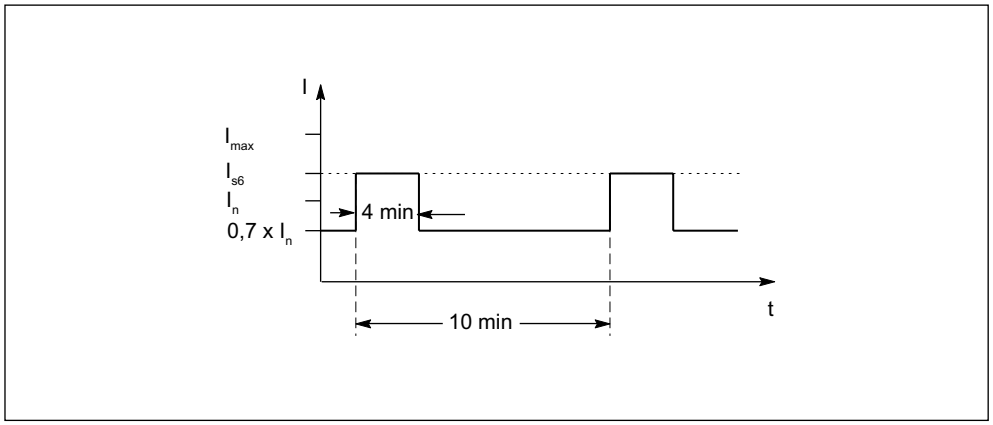


Figure 3-21 S6 load cycle with pre-load condition (for servo drives)

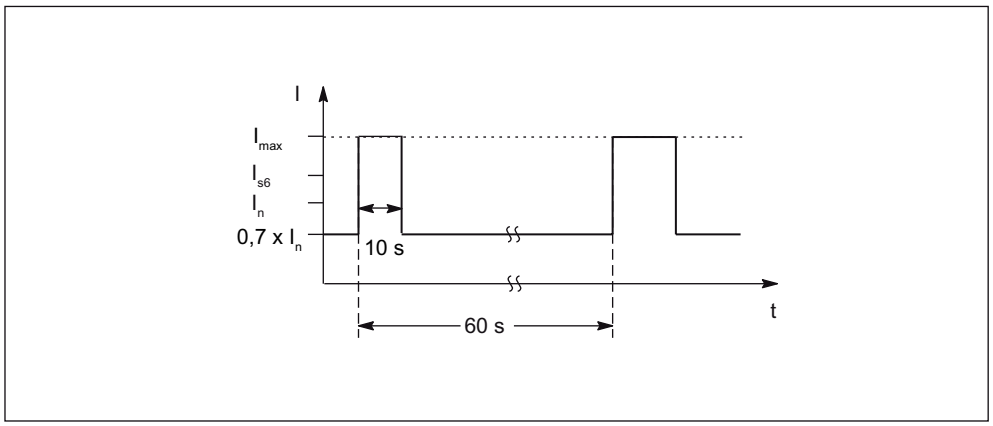


Figure 3-22 Load cycle with pre-load condition (for servo drives)

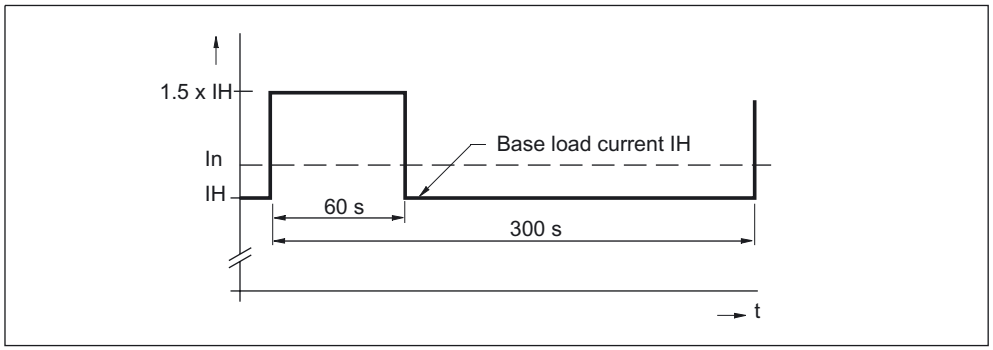


Figure 3-23 Load cycle with 60 s overload with a load cycle period of 300 s

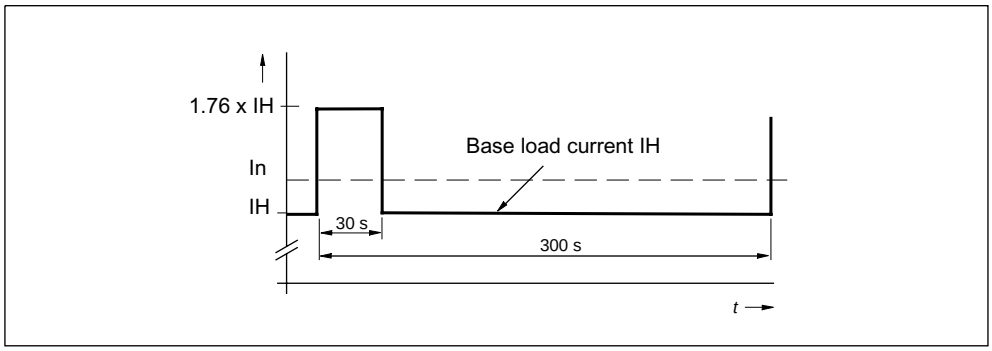


Figure 3-24 Load cycle with 30 s overload with a load cycle period of 300 s

Derating characteristic for Power Modules in blocksize format

Note

The short leading edge of the load cycles shown can only be achieved using speed or torque control.

Figure 3-25 Output current as a function of pulse frequency

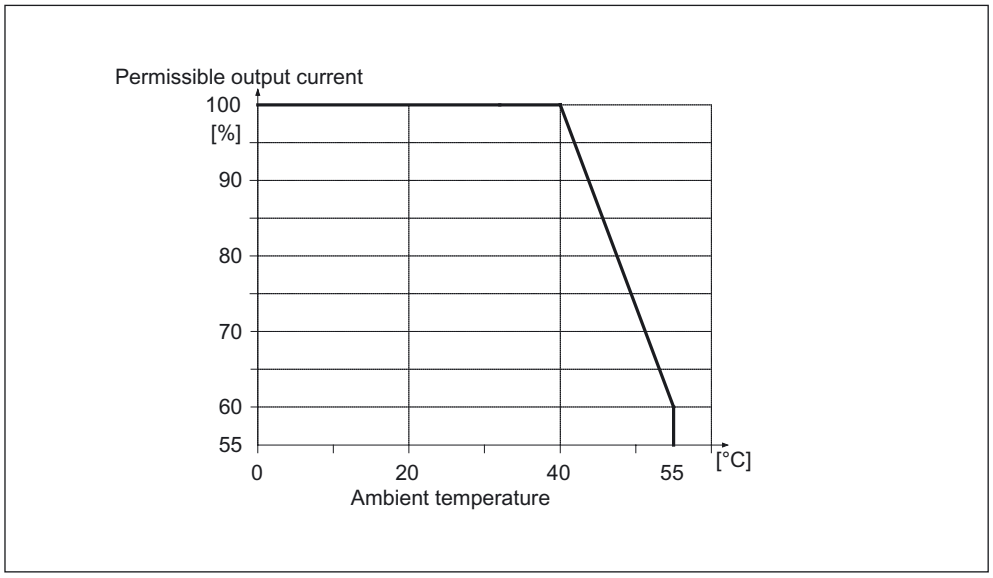


Figure 3-26 Output power as a function of ambient temperature

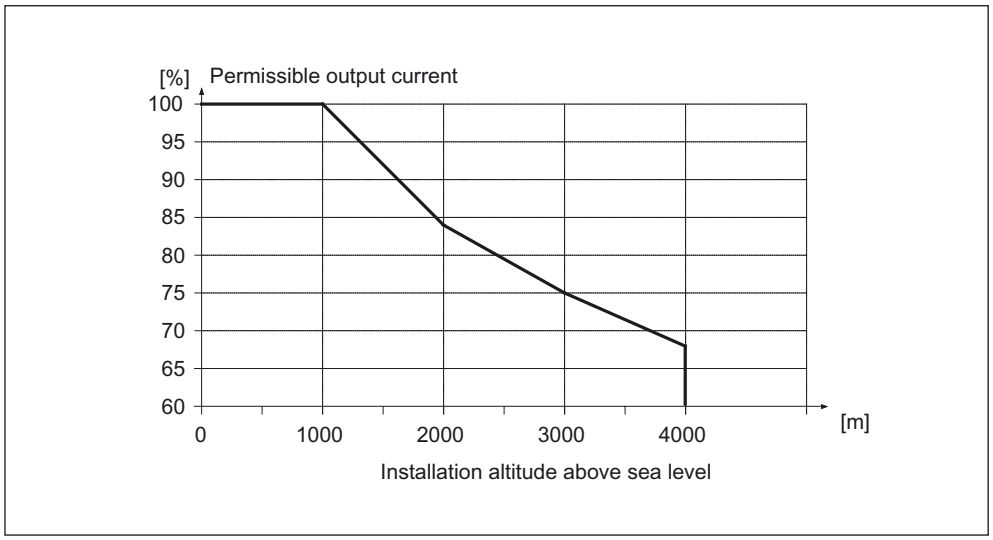


Figure 3-27 Output power as a function of installation altitude

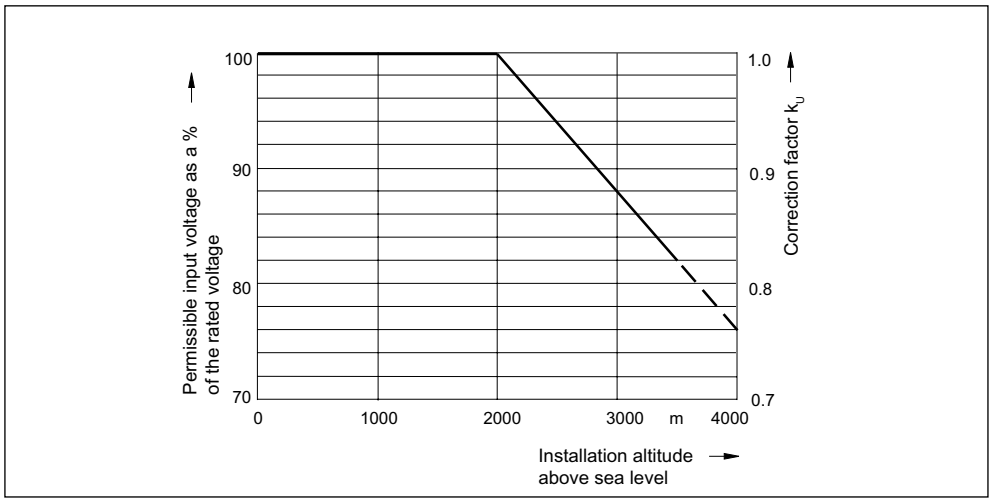


Figure 3-28 Voltage correction factor as a function of installation altitude

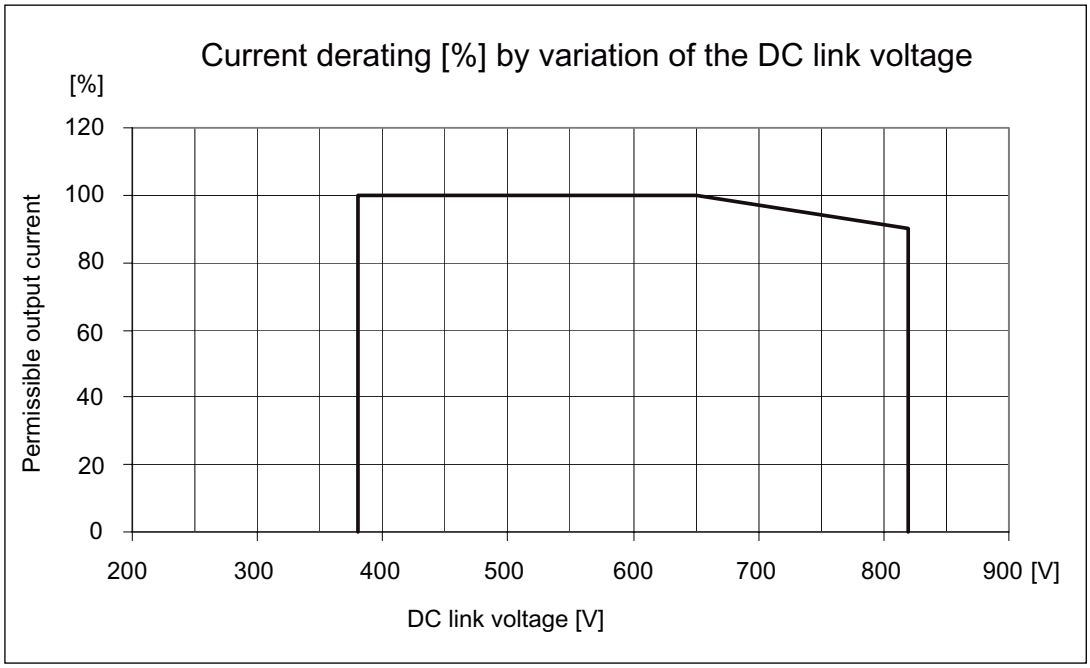


Figure 3-29 Current derating by variation of the DC link voltage

3.2 Power Modules Blocksize Liquid Cooled (PM340)

3.2.1 Description

The Power Modules in Blocksize Liquid Cooled format (frame sizes FSD - FSF) are designed as follows:

- Line-side diode rectifier
- DC link electrolytic capacitors with pre-charging circuit
- Output inverter
- Braking chopper for (external) braking resistor
- 24 V DC / 1 A power supply
- Gating unit, actual value acquisition
- Internal liquid cooling

The Blocksize Liquid Cooled Power Modules cover the power range from 18.5 kW to 90.0 kW and are also without an integrated line filter.

Table 3- 15 Overview of Liquid Cooled Power Modules PM340

	
Power Module frame size FSD Liquid Cooled	Power Module frame size FSE Liquid Cooled

	
Power Module frame size FSF Liquid Cooled	

3.2.2 Safety information

⚠ CAUTION

During transport and during storage, Power Modules must be protected against mechanical shock and vibration. It is also important to protect the unit against water (rain) and against excessively high/excessively low temperatures.

Note

Connection authorization

Power Modules have been designed for use in the industrial environment and generate current harmonics on the line side as a result of the rectifier circuit.

When a machine with integrated Power Modules is connected to the public network, authorization is required from the local power supply company if the rated input current of the machine does not fulfill the requirements of EN 61000-3-2 with respect to current harmonics.

⚠ DANGER

Grounding/protective grounding of the Power Module

The Power Module housing must always be grounded. If the Power Module is not correctly grounded, then extremely hazardous states can occur, which under certain circumstances, can result in death.

⚠ DANGER

It must be checked as to whether the Power Module is designed for the correct power supply - higher supply voltages may not be connected to the Power Module.

⚠ DANGER

After connecting the line and motor feeder cables to the appropriate terminals, check that the front covers (only frame sizes FSD to FSF) are closed and latched. Only then may the Power Module be connected to the power supply.

NOTICE

For UL-approved systems, only MOTION-CONNECT lines can be used and the fuses tested for UL approval must be installed (see "Technical specifications").

⚠ DANGER

Once all the supply voltages have been disconnected, a hazardous voltage may be present in the power unit for up to 5 minutes. The cover for the terminals may only be opened after this time has definitely elapsed.

When opening the protective cover, you must activate the release. A suitable tool (e.g. screwdriver) must be used for this purpose.

Damaged components must not be used, otherwise this could result in secondary damage or accidents.

⚠ DANGER

The drive components generate high leakage currents in the protective conductor. The components must only be operated in cabinets or in closed electrical operating areas and must be connected with the protective conductor. To protect against electric shock, the protective conductor connection on the cabinet or machine must be implemented in accordance with one of the following measures:

- stationary connection and protective conductor connection by means of ≥ 10 mm^2 Cu or ≥ 16 mm^2 Al
- stationary connection and automatic shutdown of the power supply if the protective conductor is interrupted

⚠ DANGER

The hazard warning in the local language for the DC link discharge time must be affixed to the component. A set of labels in 16 languages is provided with the component.

⚠ WARNING

Power Modules must be mounted in the vertical position.

For the Liquid Cooled Power Modules, a cooling clearance of 100 mm (3.93 inches) must be maintained above and below the component.

Devices, that could restrict the cooling air flow may not be mounted/installed in this area. It must be carefully ensured that the cooling air flow of the Power Modules can flow unrestricted.

Note

The Power Modules with frame sizes FSD, FSE, and FSF can be mounted without any lateral clearance.

⚠ DANGER

Cable shields and unused power cable conductors (e.g. brake conductors) must be connected to PE potential to prevent capacitive cross-talk charges.

Non-observance can cause lethal shock voltages.

⚠ WARNING

The equipment must be safely disconnected from the supply before any installation or service work is carried out on cooling circuit components.

The cooling circuit may only be connected by a trained specialist.

3.2.3 Interface description

3.2.3.1 Overview

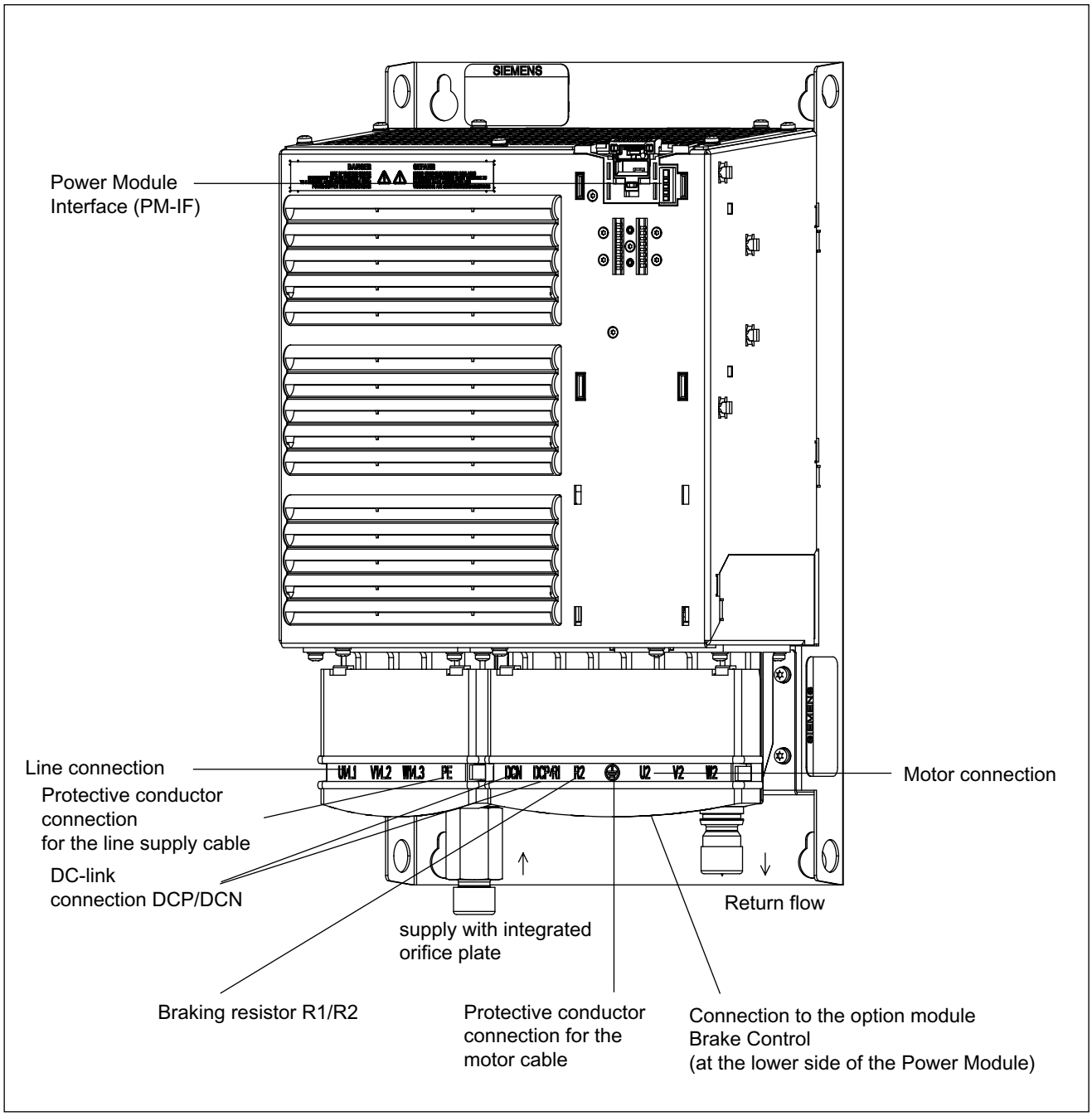


Figure 3-30 Liquid Cooled Power Module PM340 (Example: Frame size FSD)

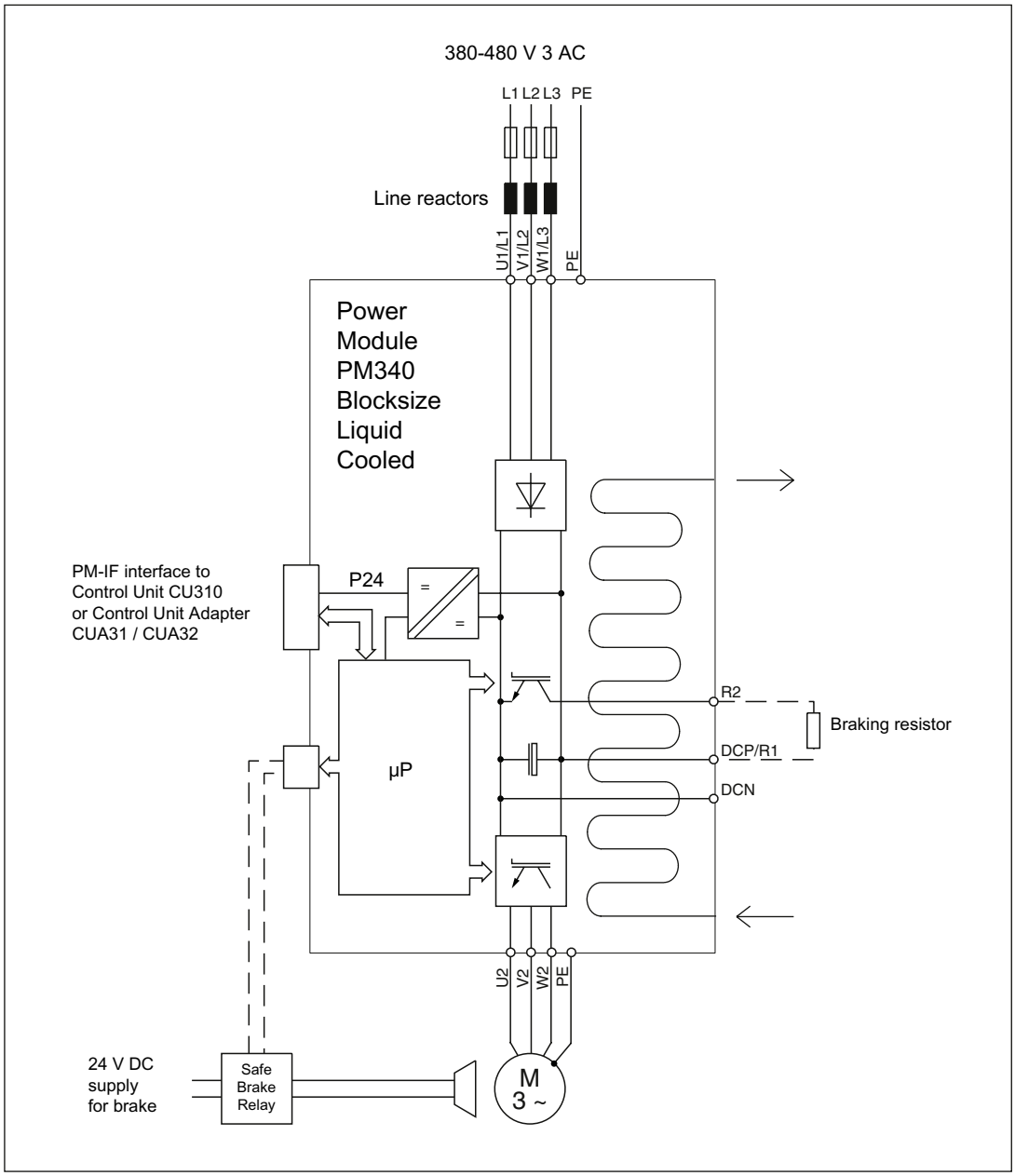


Figure 3-31 Connection example Power Module PM340 Liquid Cooled, 3 AC 380 V to 480 V

Arrangement of the line and motor terminals

The following diagram shows the arrangement of the line and motor terminals for PM340 Power Modules (frame sizes FSD to FSF). The diagram also includes the terminal tightening torques.

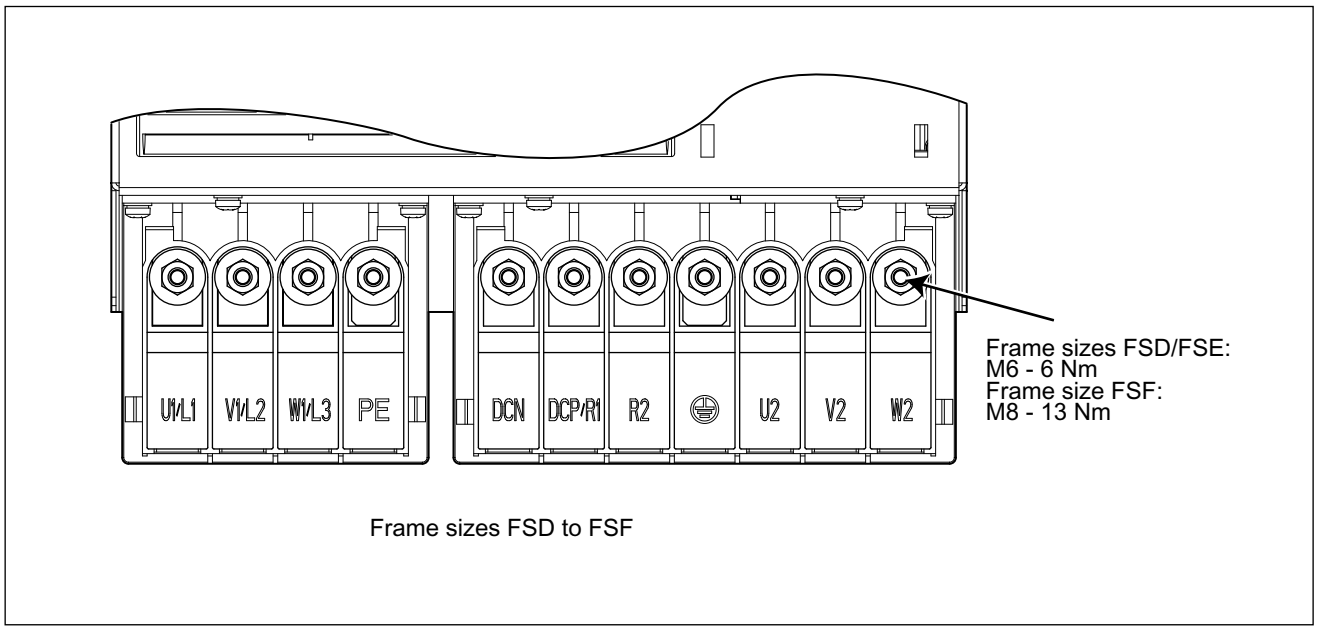
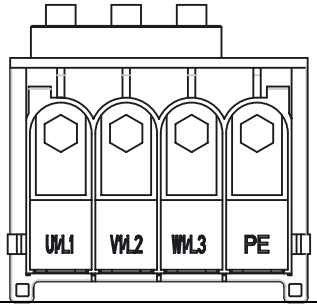


Figure 3-32 Arrangement of the line supply and motor terminals for the PM340

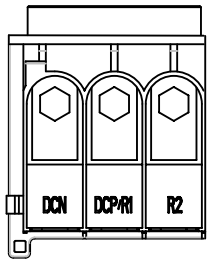
3.2.3.2 Line supply connection

Table 3- 16 Terminal strip, line supply connection 3-ph. 380 V - 480 V AC

	Terminal	Signal name	Technical specifications
	1	U1/L1	External conductor L1
	2	V1/L2	External conductor L2
	3	W1/L3	External conductor L3
	4	PE	PE connection

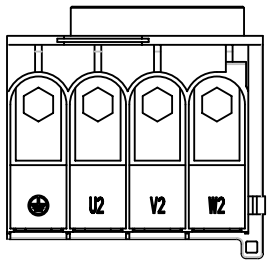
3.2.3.3 Braking resistor and DC link connection

Table 3- 17 Terminal strip, braking resistor, and DC link connection

	Terminal	Technical specifications
	DCN	DC link negative
	DCP/R1	DC link positive and positive connection for braking resistor
	R2	Negative connection for the braking resistor

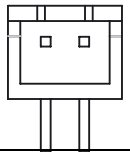
3.2.3.4 Motor connection

Table 3- 18 Terminal strip, motor connection 380 V - 480 V 3 AC

	Terminal	Technical specifications
	⏚	PE connection
	U2	Motor phase U
	V2	Motor phase V
	W2	Motor phase W

3.2.3.5 Connection to the option module, brake control

Table 3- 19 Connector

	Terminal	Designation	Technical specifications
	1	Low	Low signal, option module brake control at PM340
	2	High	High signal, option module brake control at PM340

3.2.4 Dimension drawings

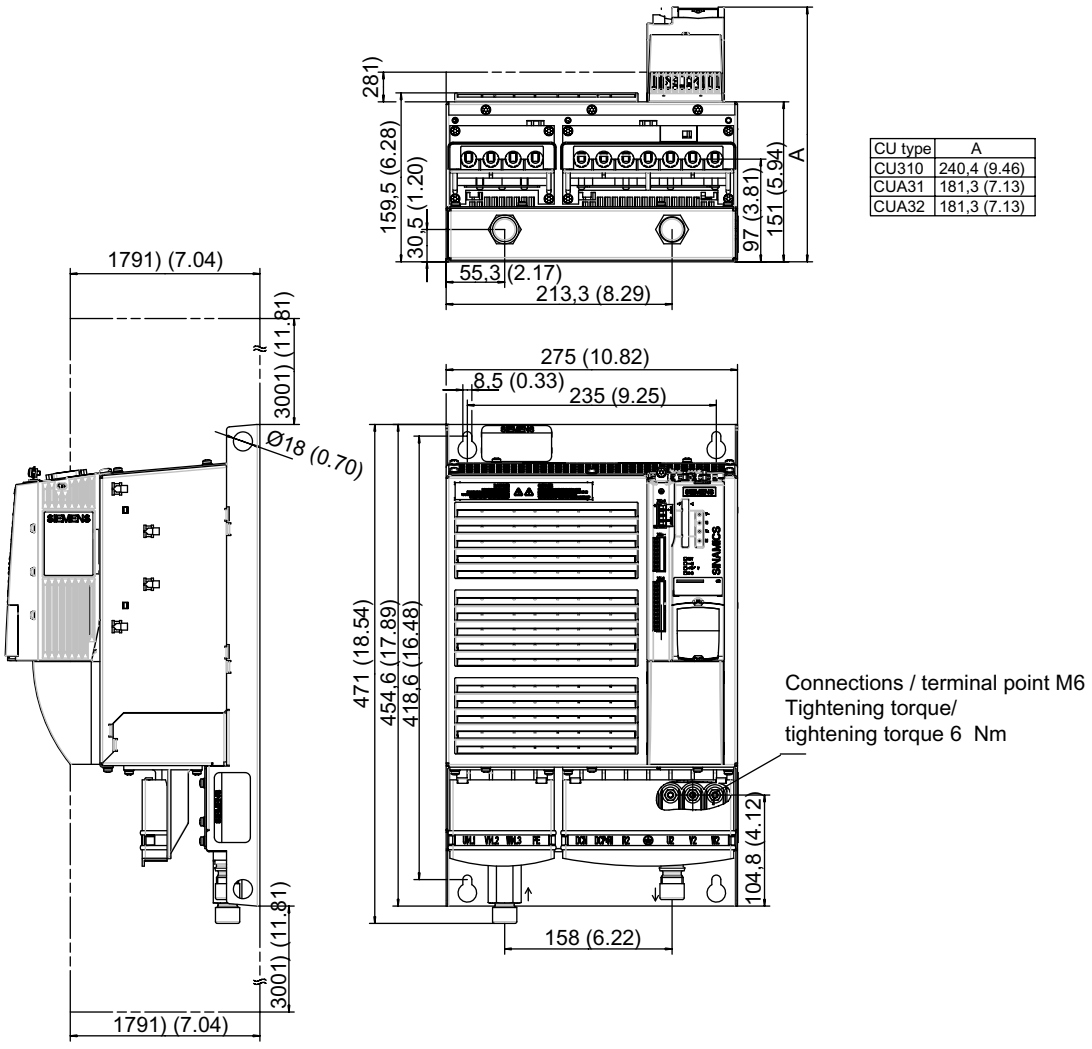


Figure 3-33 Dimension drawing: Power Module PM340, frame size FSD Liquid Cooled

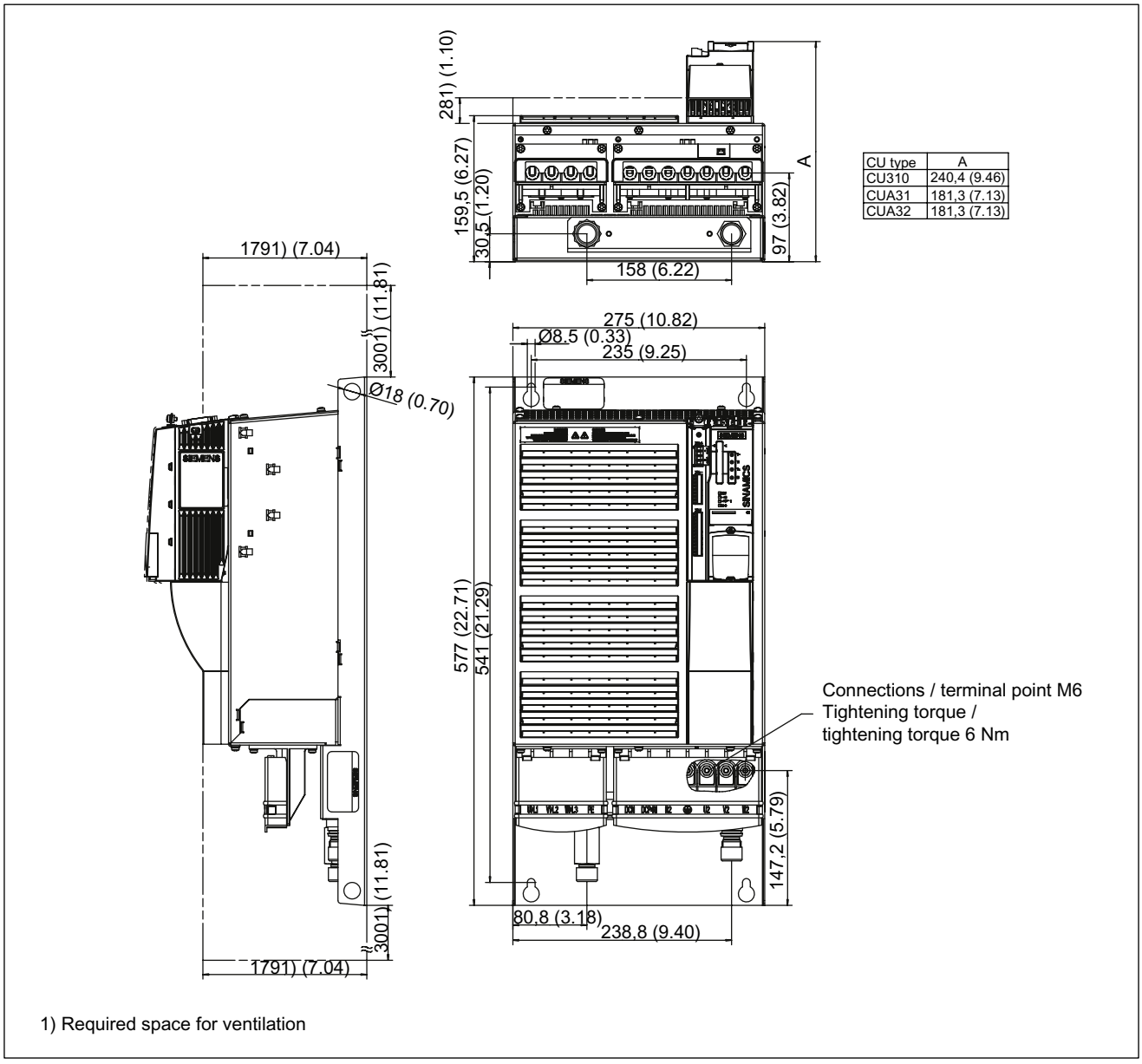


Figure 3-34 Dimension drawing: Power Module PM340, frame size FSE Liquid Cooled

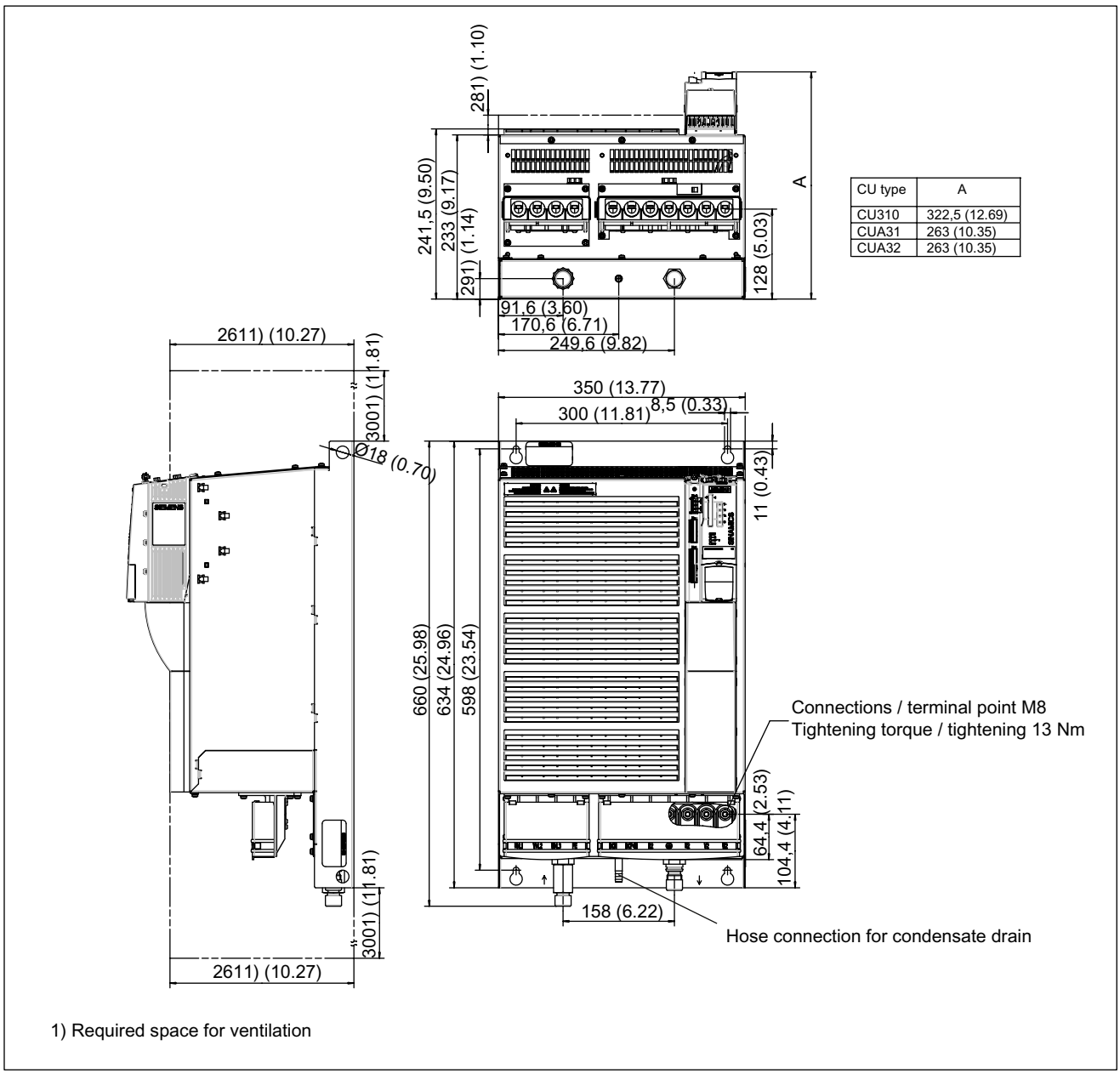


Figure 3-35 Dimension drawing: Power Module PM340, frame size FSF Liquid Cooled

3.2.5 Installation

The coolant hoses should be connected before the devices are installed.

Hole drilling templates for frame sizes FSD to FSF

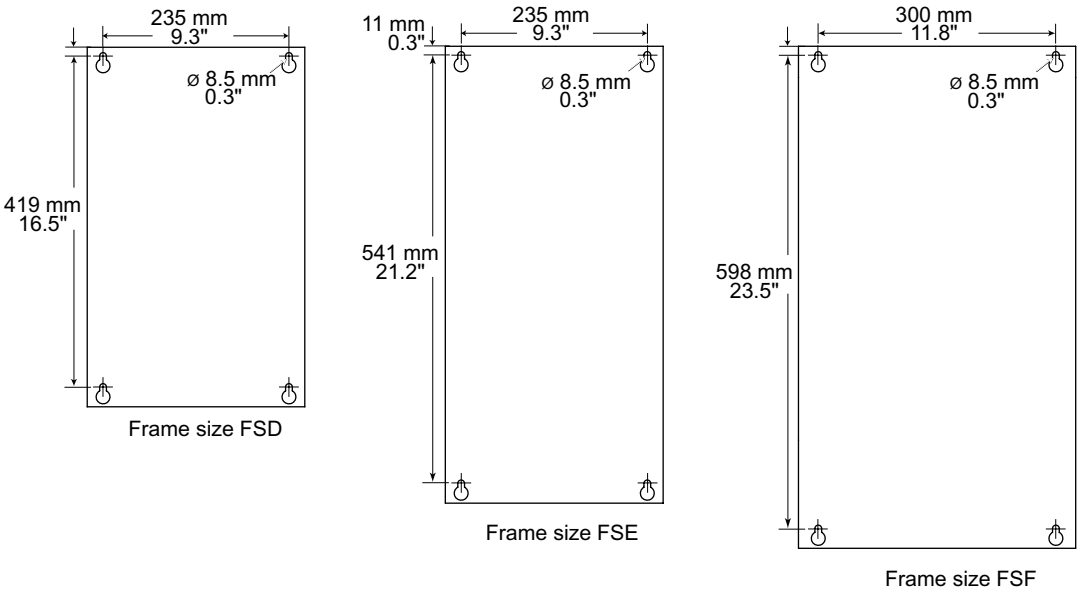


Figure 3-36 Hole drilling templates for frame sizes FSD to FSF

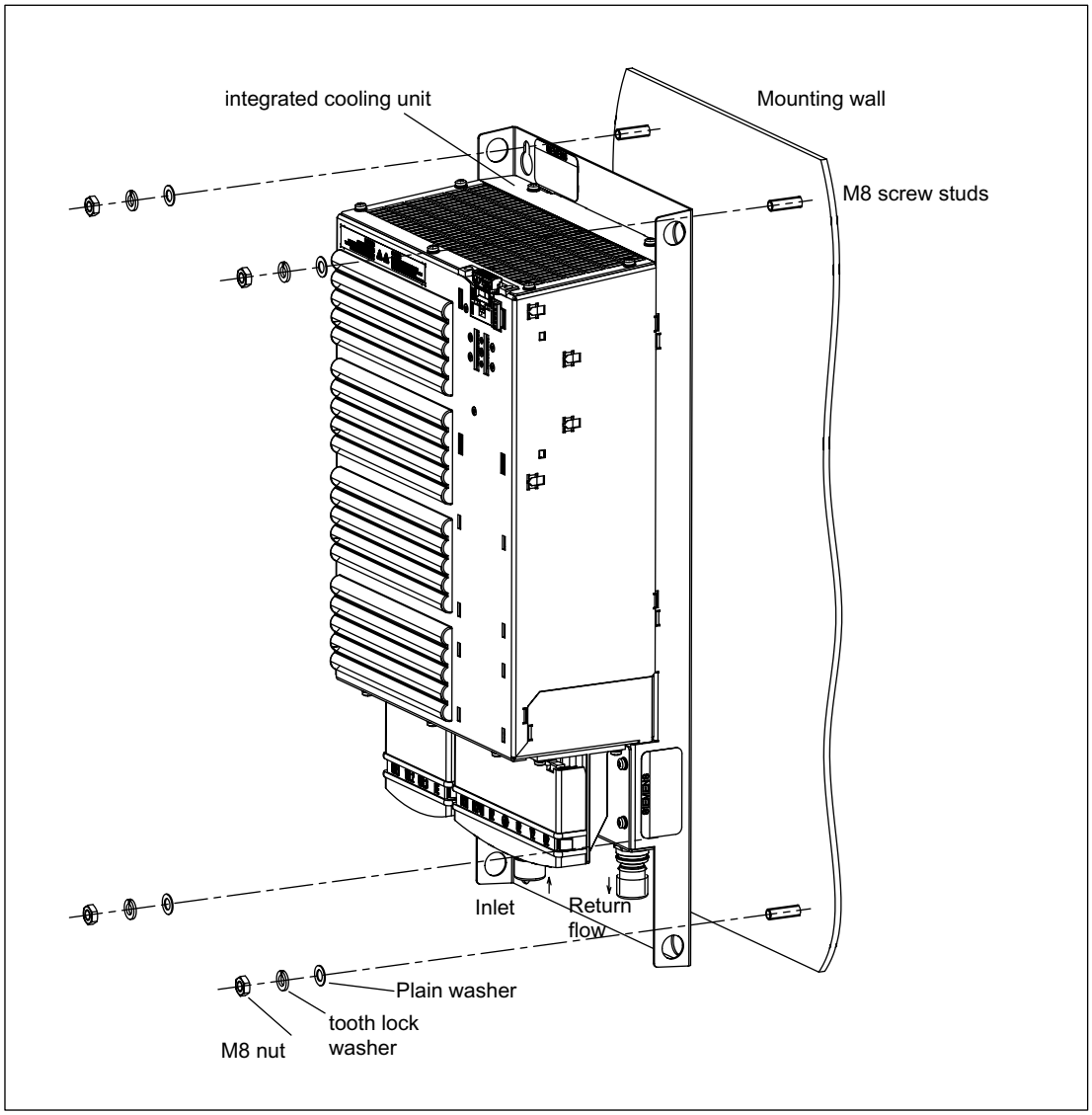


Figure 3-37 Installation of Power Module PM340 Liquid Cooled with integrated cooling unit (example: frame size FSE)

The connections for the coolant are on the underside.
Water connection thread type: Pipe thread ISO 228 G ½ B.

For frame sizes FSD to FSF, the terminals are accessed by releasing the tongue at the side of the terminal covers using a suitable flat screwdriver. The cover can then be pushed upwards and engaged in this position as shown in the following diagram.

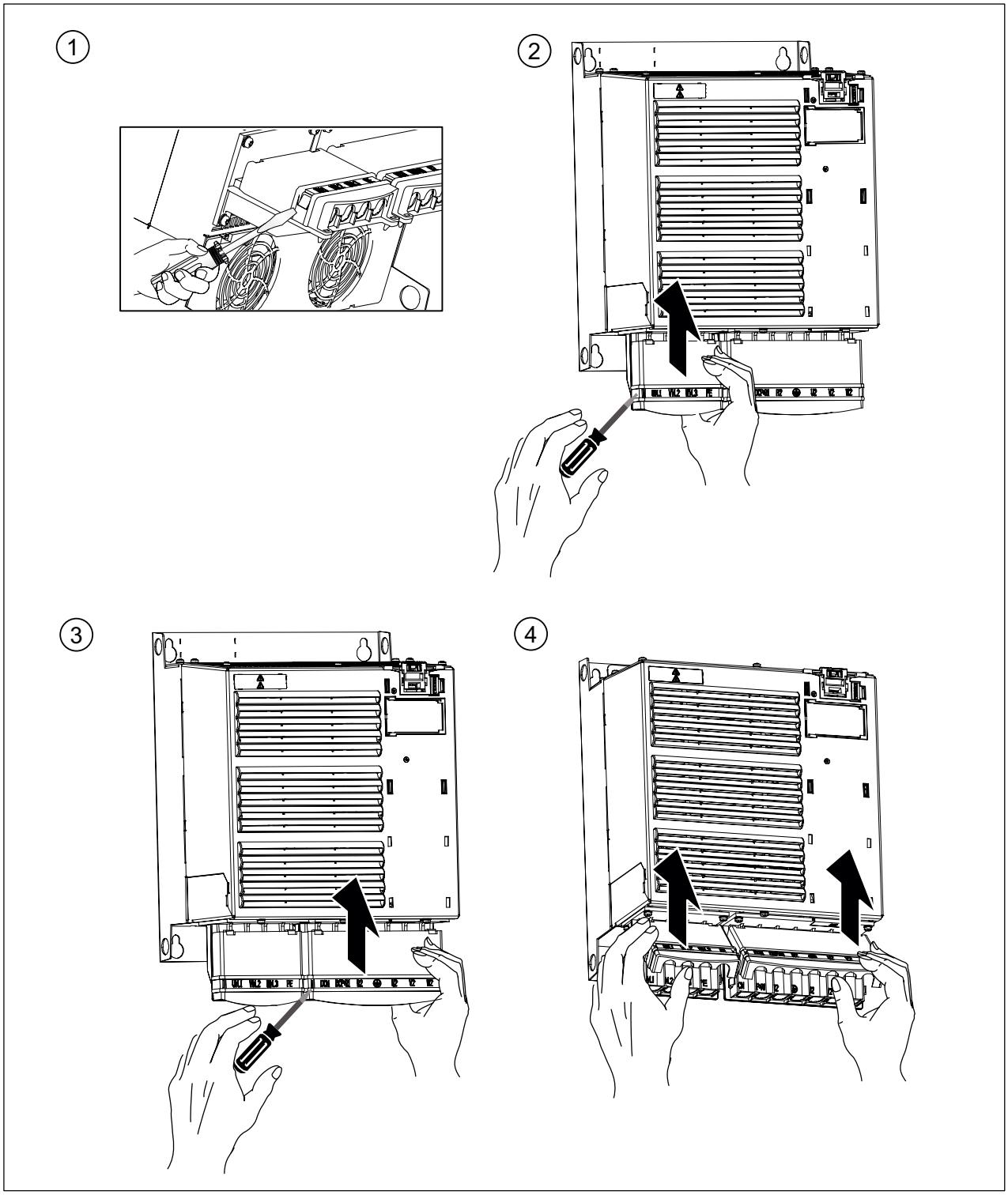


Figure 3-38 Access to the line and motor terminals for frame sizes FSD to FSF

⚠ DANGER
Once the terminal cover has been removed, the degree of protection of the Power Module is reduced to IP00.

3.2.6 Electrical connection

When connecting the SINAMICS S120 Liquid Cooled devices, you should use cables with the cross-sections specified in the relevant technical specifications.

The coolant connection is established by means of 1/2" coupling. The supply and return connections on SINAMICS devices must be established by means of a flexible, non-conductive hose to prevent electrochemical corrosion, reduce the transmission of vibrations, and dampen pressure transients in the coolant. The hose should be about 1.5 m in length (total of supply and return lines).

3.2.7 Commissioning

Prior to commissioning

Once the devices have been installed and before they are commissioned, the cooling circuit must be checked for leaks.

After commissioning

The recommended servicing procedure for the cooling circuit is to check the fill level and the coolant for discoloration or cloudiness at least once a year.

If the coolant level has dropped, the loss should be corrected on closed or semi-open circuits with a prepared mixture of distilled water and inhibitor or Antifrogen N.

3.2.8 Technical specifications

Table 3- 20 Technical specifications for Power Modules PM340 format Blocksize Liquid Cooled, Part1

PM340 Power Module	6SL3215-	1SE23-0AA0	1SE26-0AA0	1SE27-5UA0
Rated output current I_n	A	38	60	75
Base load current I_H	A	33	48	65
Output current for S6 duty (40%) I_{S6}	A	49	78	98
Max. output current I_{max}	A	64	90	124
Rated power based on I_n	kW	18,5	30	37
Rated power based on I_H	kW	15	22	30
Rated pulse frequency	kHz	4	4	4
Power loss	kW	0,38	0,69	0,99
Power loss to ambient air, approx.	kW	0,09	0,13	0,16
Coolant requirements	l/min	8	8	8
Sound pressure level	dB(A)	< 60	< 60	< 60
24 V DC supply for the Control Unit	A	1,0	1,0	1,0
Rated input current [1)] - with line reactor - without line reactor	A	 40 46	 63 72	 78 88
Class J UL safety fuses Rated current Rated short-circuit current SCCR	 A kA	 50 65	 90 65	 100 65
Safety fuses NH Rated current	 A	3NA3 820 50	3NA3 824 80	3NA3 830 100
Circuit-breaker type designation IEC 60947 Rated current	 A	3RV1042-4JA10 45 - 63	3RV1042-4MA10 80 - 100	3VL1712-1DD33-0AA0 100 - 125
Circuit-breaker type designation UL489 / CSA C22.2 No. 5-02 Rated current Rated short-circuit current SCCR	 A kA	--	3VL2191-3KN30-0AA0 90 65	3VL2110-3KN30-0AA0 100 65
Resistance value of the external braking resistor	Ohms	> 27	> 27	> 15
Max. cable length to braking resistor	m	15	15	15
Line connection L1, L2, L3		Stud M6, connectable cable cross-sections 10 to 50 mm²for ring cable lugs		
Motor connection U2, V2, W2				
DC link connection, connection for braking resistor DCP/R1, DCN, R2				
PE connection		M6 studs		
Max. motor cable length	m	70 (shielded) 100 (unshielded)		
Degree of protection		IP20 or IPXXB		
Depth - PM340 - PM340 with Control Unit CU310 - PM340 with CUA31 - PM340 with CUA32	 mm	 159,5 (6.28) 240,4 (9.46) 181,3 (7.13) 181,3 (7.13)		

PM340 Power Module	6SL3215-	1SE23-0AA0	1SE26-0AA0	1SE27-5UA0
Frame size		FSD	FSD	FSE
Weight with CU310	kg	10,5 11,5	10,5 11,5	14,8 15,8

1) The input current depends on the motor load and line impedance. The input currents apply for a load with the rated power (based on In) for a line impedance corresponding to uk = 1 %.

Table 3- 21 Technical specifications for Power Modules PM340 format Blocksize Liquid Cooled, Part 2

PM340 Power Module	6SL3215-	1SE31-0UA0	1SE31-1UA0	1SE31-8UA0
Rated output current I_n	A	90	110	178
Base load current I_H	A	80	95	155
Output current for S6 duty (40%) I_{S6}	A	117	143	231
Max. output current I_{max}	A	150	180	290
Rated power based on I_n	kW	45	55	90
Rated power based on I_H	kW	37	45	75
Rated pulse frequency	kHz	4	4	4
Power loss	kW	1,21	1,42	2,31
Power loss to ambient air, approx.	kW	0,19	0,21	0,35
Coolant requirements	l/min	8	8	8
Sound pressure level	dB(A)	62	< 60	65
24 V DC supply for the Control Unit	A	1,0	1,0	1,0
Rated input current1) - with line reactor - without line reactor	A A	 94 105	 115 129	 186 204
Class J UL safety fuses Rated current Rated short-circuit current SCCR	 A kA	 125 65	 150 65	 250 65
Safety fuses NH Rated current	 A	3NA3 832 125	3NA3 836 160	3NA3 144 250
Circuit-breaker type designation IEC 60947 Rated current	 A	3VL1716-1DD33-0AA0 125 - 160	3VL3720-1DC36-0AA0 160 - 200	3VL3725-1DC36-0AA0 200 - 250
Circuit-breaker type designation UL489 / CSA C22.2 No. 5-02 Rated current Rated short-circuit current SCCR	 A kA	3VL2112-3KN30-0AA0 125 65	3VL2115-3KN30-0AA0 150 65	3VL3125-3KN30-0AA0 250 65
Resistance value of the external braking resistor	Ohms	> 15	> 8,2	> 8,2
Max. cable length to braking resistor	m	15	15	15
Line connection L1, L2, L3		Stud M6, connectable cable cross-sections 10 to 50 mm²for ring cable lugs	Stud M8, max. connection cable cross-section 120 mm²	
Motor connection U2, V2, W2				
DC link connection, connection for braking resistor DCP/R1, DCN, R2				
PE connection				
Max. motor cable length	m	70 (shielded) 100 (unshielded)		
Degree of protection		IP20 or IPXXB		

PM340 Power Module	6SL3215-	1SE31-0UA0	1SE31-1UA0	1SE31-8UA0
Depth				
- PM340		159,5 (6.28)	241,5 (9.50)	241,5 (9.50)
- PM340 with Control Unit CU310	mm	240,4 (9.46)	322,5 (12.69)	322,5 (12.69)
- PM340 with CUA31		181,3 (7.13)	263 (10.35)	263 (10.35)
- PM340 with CUA32		181,3 (7.13)	263 (10.35)	263 (10.35)
Frame size		FSE	FSF	FSF
Weight	kg	14,8	29,2	29,2
With CU310		15,8	30,2	30,2

[1] The input current depends on the motor load and line impedance. The input currents apply for a load with the rated power (based on In) for a line impedance corresponding to uk = 1 %.

Overload capability

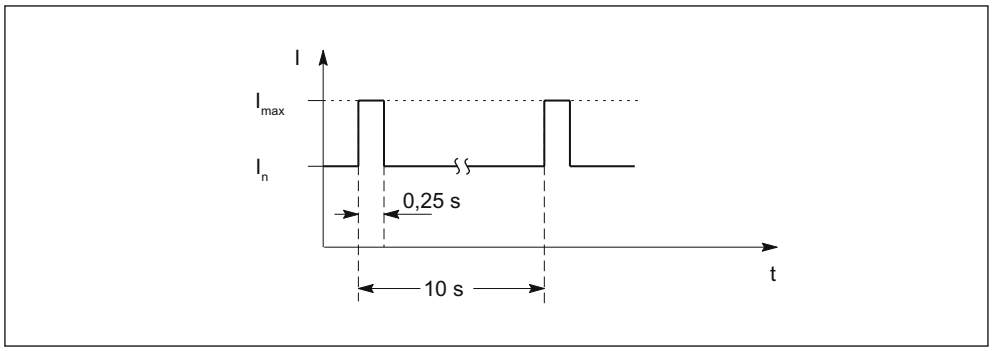


Figure 3-39 Load cycle with pre-load condition (for servo drives)

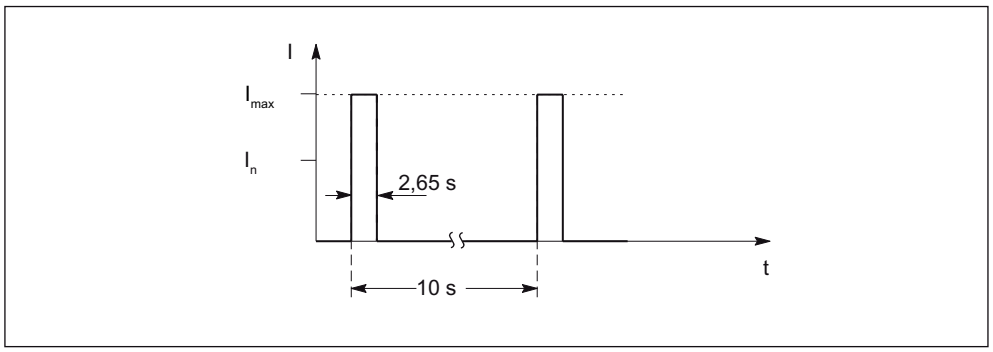


Figure 3-40 Load cycle without pre-load condition (for servo drives)

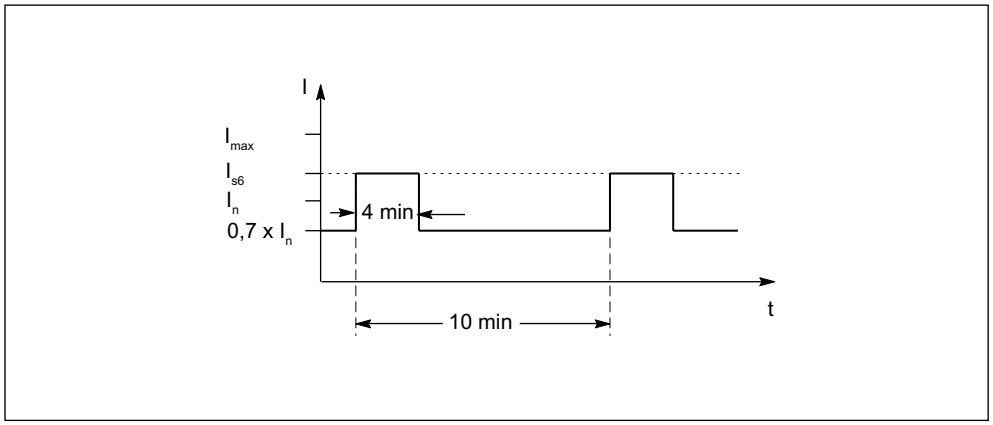


Figure 3-41 S6 load cycle with pre-load condition (for servo drives)

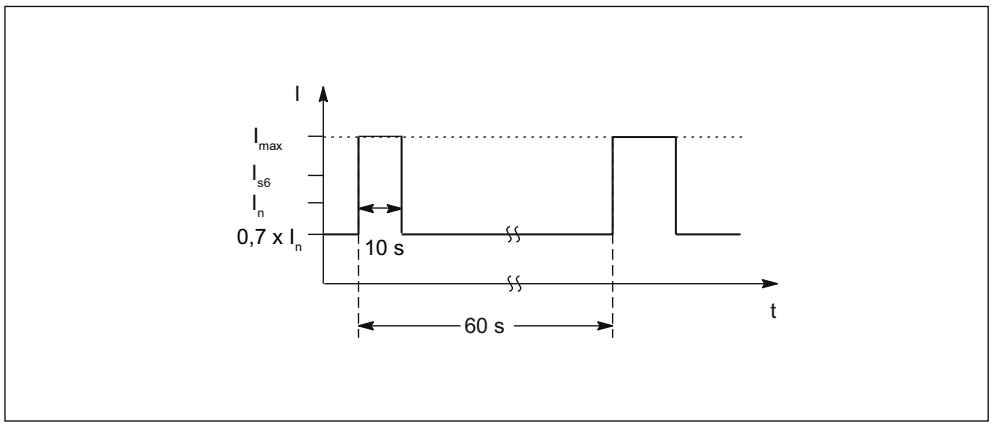


Figure 3-42 Load cycle with pre-load condition (for servo drives)

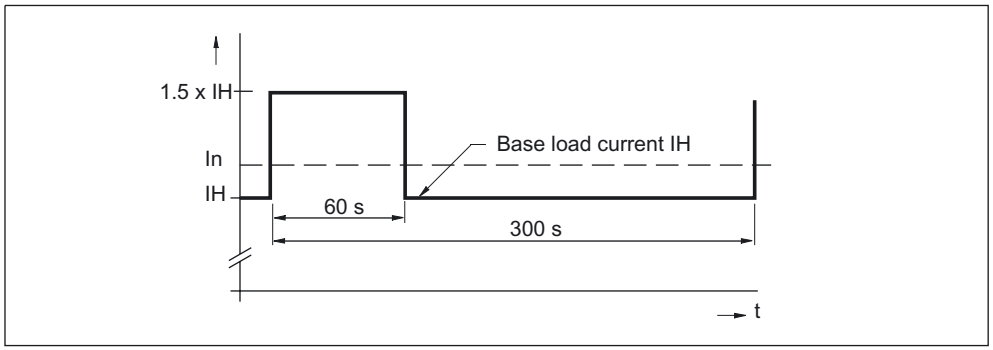


Figure 3-43 Load cycle with 60 s overload with a load cycle period of 300 s

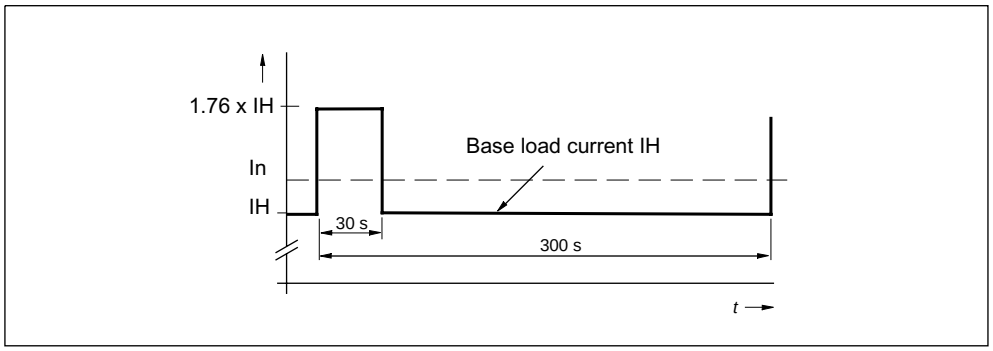


Figure 3-44 Load cycle with 30 s overload with a load cycle period of 300 s

Derating characteristics for Power Modules in blocksize Liquid Cooled format

Note

The short leading edge of the load cycles shown can only be achieved using speed or torque control.

Figure 3-45 Output current as a function of pulse frequency

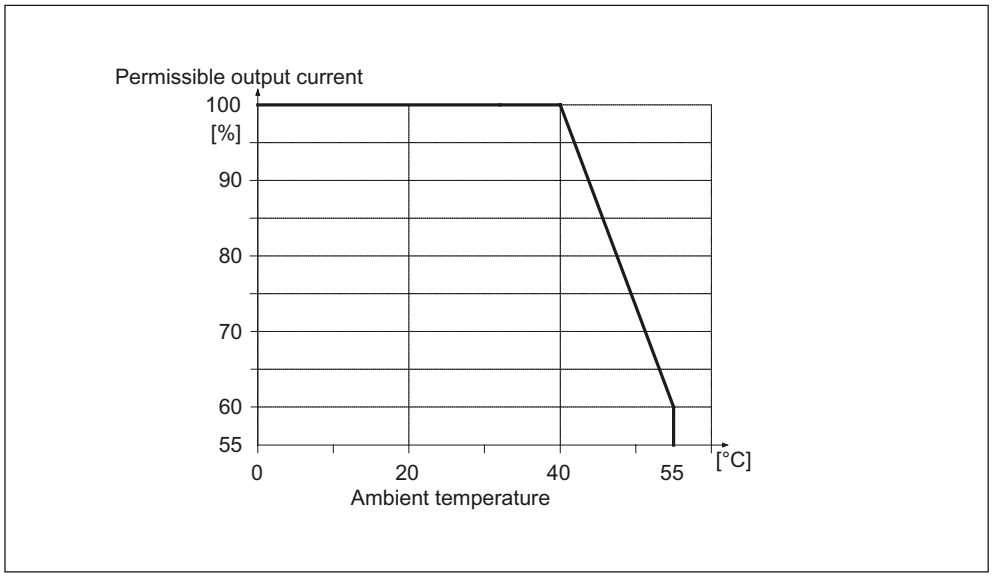


Figure 3-46 Output power as a function of ambient temperature

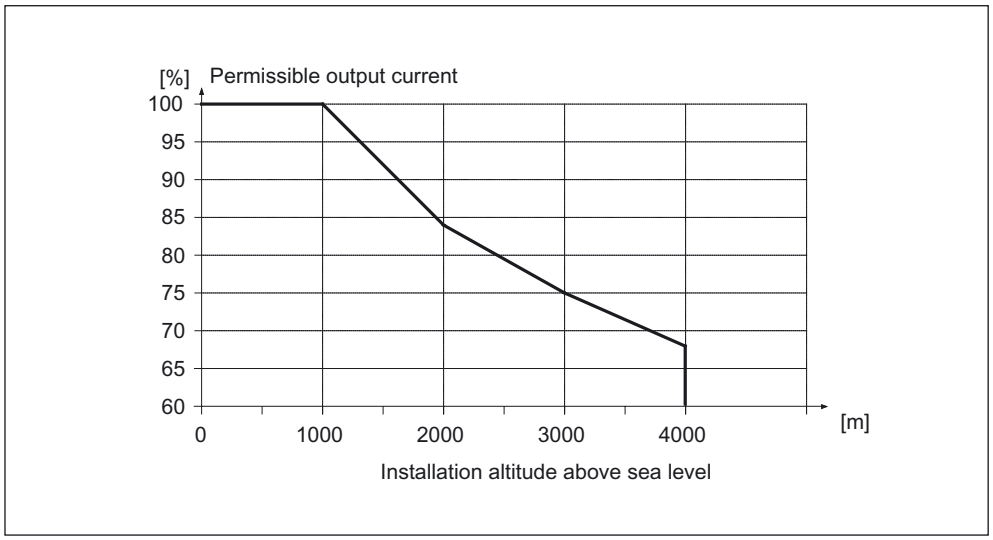


Figure 3-47 Output power as a function of installation altitude

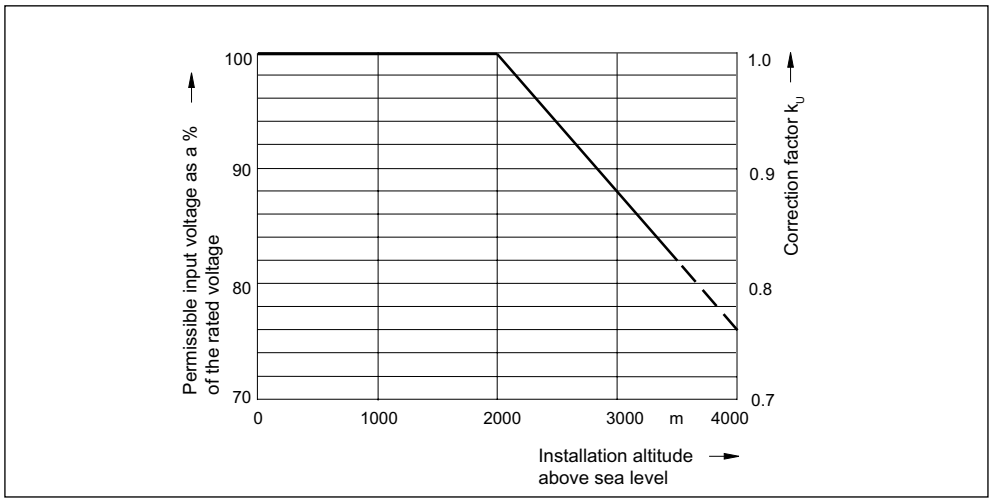


Figure 3-48 Voltage correction factor as a function of installation altitude

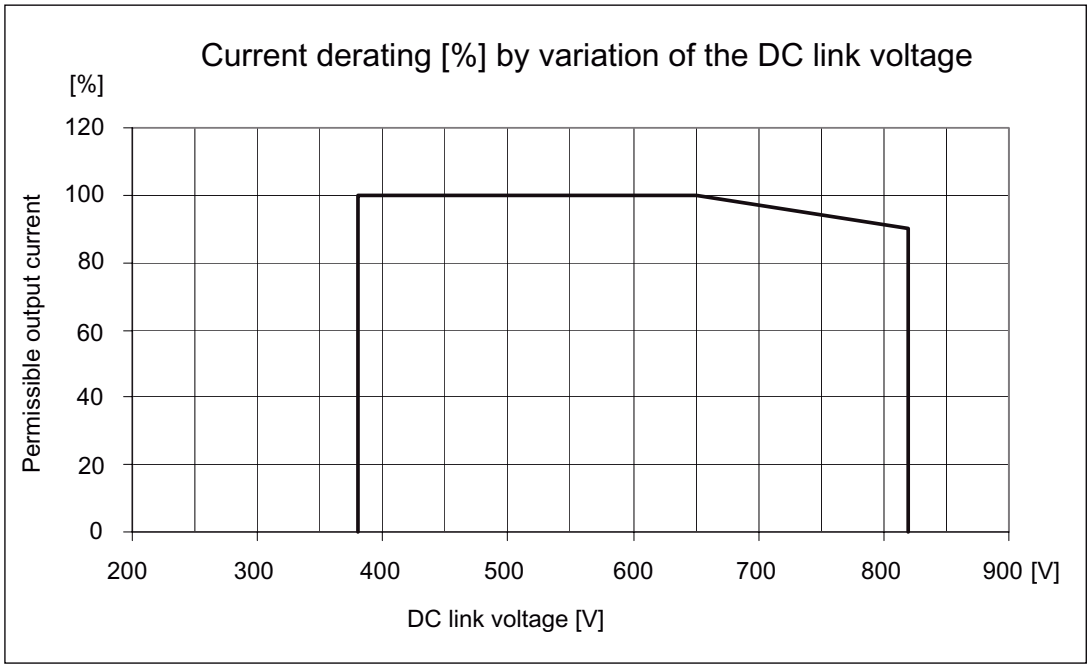


Figure 3-49 Current derating by variation of the DC link voltage

DC link components

4

4.1 Braking resistors (in blocksize format)

4.1.1 Description

The PM340 Power Modules cannot regenerate into the line supply. For regenerative operation, e.g. the braking of a rotating mass, a braking resistor must be connected to convert the resulting energy into heat.

A temperature protection switch monitors the braking resistor for overtemperature and issues a signal on a floating contact if the limit value is exceeded.

4.1.2 Safety information

⚠ CAUTION
The surface temperature of the braking resistors may exceed 80 °C.

Protecting the resistance

The power supply to the Power Modules must be established through a contactor which can then shut down the power supply when the resistor overheats.

A temperature protection switch handles the protective function (this is supplied with each break resistor). This is connected in series with the coil feeder cable for the main contactor.

The contacts of the temperature protection switch close again as soon as the resistor temperature has fallen below the selected value.

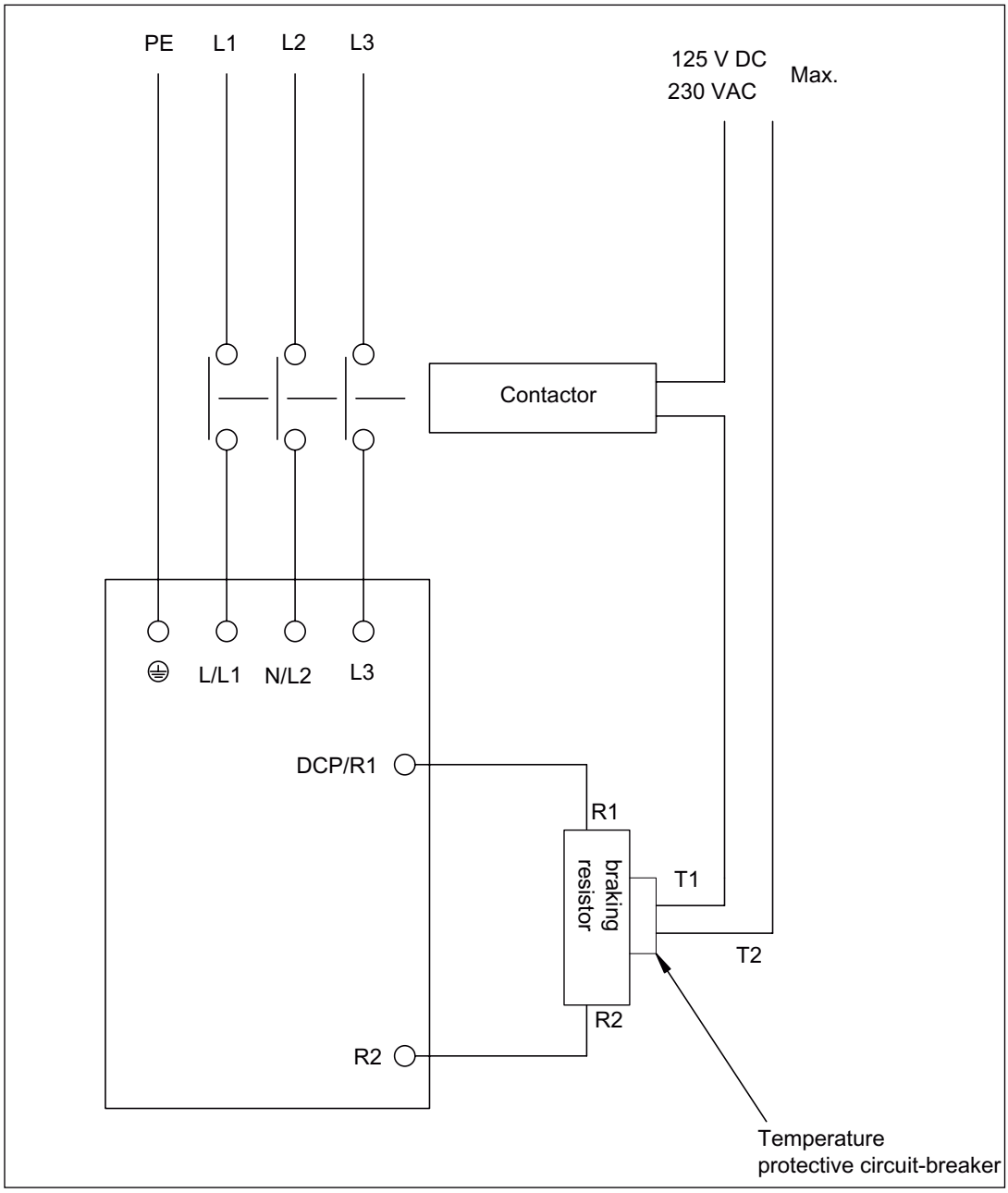


Figure 4-1 Connection example: Braking resistor

4.1.3 Dimension drawings

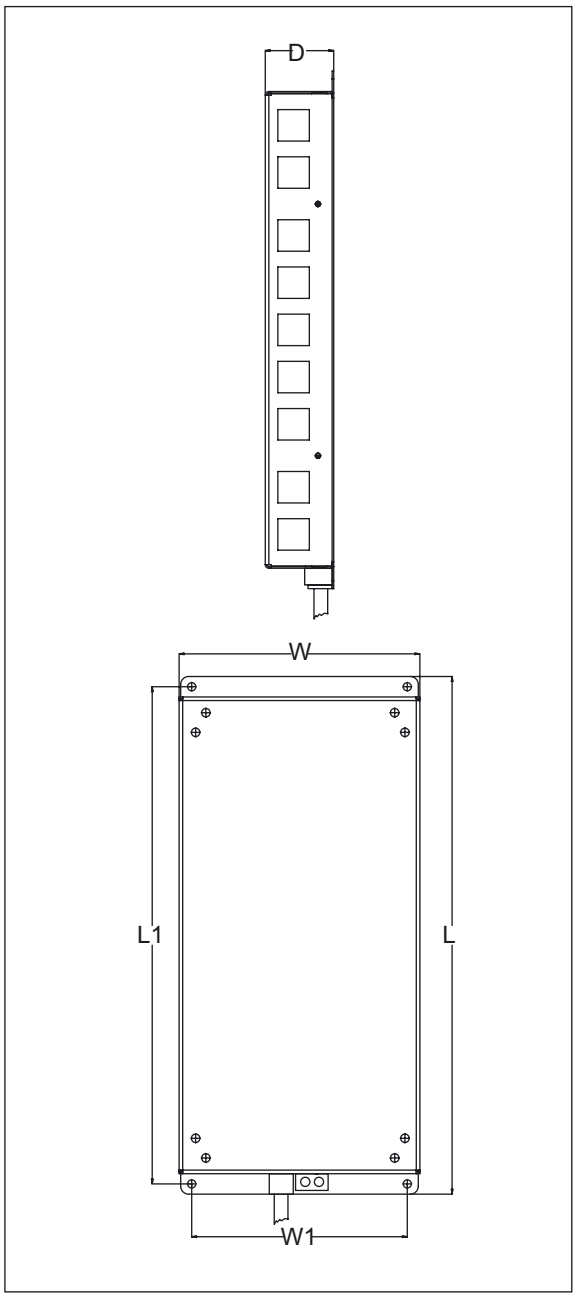


Figure 4-2 Dimension drawing: Braking resistor, frame sizes FSA and FSB

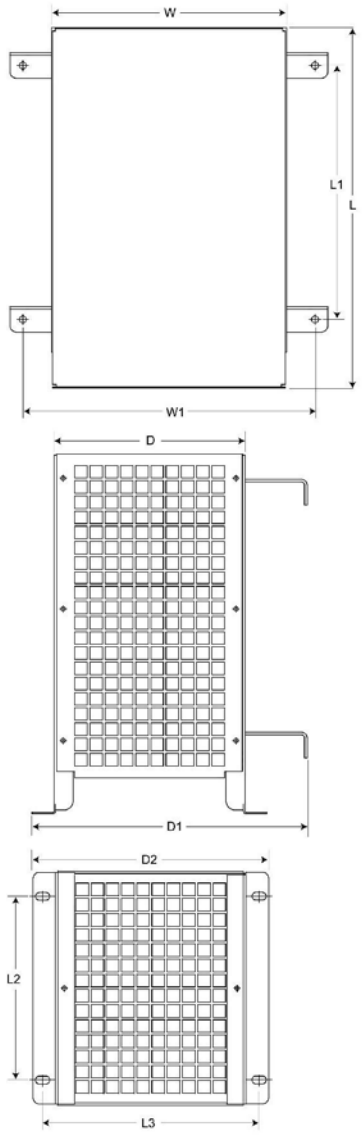


Figure 4-3 Dimension drawing: Braking resistor, frame sizes FSC, FSD, FSE, FSF

Table 4- 1 Dimension data: Braking resistor, all data in mm and (inches), Part 1

Order number	6SE6400-4BC05-0AA0	6SE6400-4BD11-0AA0	6SL3201-0BE12-0AA0	6SE6400-4BD16-5CA0
Frame size	**FSA**	**FSA**	**FSB**	**FSC**
L	230 (9,05)	230 (9,05)	239 (9,40)	285 (11,22)
L1	217 (8,54)	217 (8,54)	226 (8,89)	200 (7,87)
L2	-	-	-	145 (5,70)
L3	-	-	-	170 (6,69)
D	43,5 (1,71)	43,5 (1,71)	43,5 (1,71)	150 (5,90)
D1	-	-	-	217 (8,54)
D2	-	-	-	185 (7,28)
W	72 (2,83)	72 (2,83)	149 (5,86)	185 (7,28)
W1	56 (2,20)	56 (2,20)	133 (5,24)	230 (9,05)

Table 4- 2 Dimension data: Braking resistor, all data in mm and (inches), Part 2

Order number	6SE6400-4BD21-2DA0	6SE6400-4BD22-2EA0	6SE6400-4BD24-0FA0
Frame size	**FSD**	**FSE**	**FSF**
L	515 (20,27)	645 (25,39)	650 (25,59)
L1	350 (13,77)	480 (18,89)	510 (20,07)
L2	205 (8,07)	205 (8,07)	270 (10,62)
L3	195 (7,67)	195 (7,67)	335 (13,18)
D	175 (6,88)	175 (6,88)	315 (12,40)
D1	242 (9,52)	242 (9,52)	382 (15,03)
D2	210 (8,26)	210 (8,26)	382 (15,03)
W	270 (10,62)	270 (10,62)	400 (15,74)
W1	315 (12,40)	315 (12,40)	435 (17,12)

4.1.4 Mounting

The braking resistor is connected at terminals DCP/R1 and R2.

The braking resistors can be installed at the side next to the PM340 Power Modules. The braking resistors for the FSA and FSB frame sizes are designed as sub-chassis components. If the PM340 Power Modules of the FSA or FSB frame size are operated without line reactor, the braking resistors can also be installed under the Power Modules.

The braking resistors can be installed horizontally or vertically. The connections on vertically installed resistors must be at the bottom.

The braking resistors for the Power Modules of the FSC to FSF frame sizes should be placed outside the control cabinet or the switchgear room in order to direct the resulting heat loss away from the Power Modules. This reduces the level of air conditioning required.

4.1.5 Technical data

Table 4- 3 Technical data, braking resistors, Part 1

Order No.		6SE6400-4BC05-0AA0	6SE6400-4BD11-0AA0	6SL3201-0BE12-0AA0	6SE6400-4BD16-5CA0
Resistance	Ohm	180	390	160	56
Rated power P_{DB}	kW	0.05	0.1	0.2	0.65
Peak power P_{max}	kW	1	1.7	4.0	13
Load duration for peak power T_a	s	27.6	13.8	12.6	13.1
Period duration of braking duty cycle t	s	276	276	252	262
Degree of protection		IP20 or IPXXB	IP20 or IPXXB	IP20 or IPXXB	IP20 or IPXXB
Power Connections		Cable 3 x 2.5 mm² shielded, length 0.4 m	Cable 3 x 2.5 mm² shielded, length 0.5 m	Cable 3 x 2.5 mm² shielded, length 0.5 m	Cable 3 x 2.5 mm² shielded, length 0.9 m
Thermoswitch (NC contact) maximum contact load connecting cable		250 V_{AC} / 2.5 A	250 V_{AC} / 2.5 A	250 V_{AC} / 2.5 A	250 V_{AC} / 2.5 A
Weight	kg	1.0	1.0	1.6	3.8

Table 4- 4 Technical data, braking resistors, Part 2

Order No.	6SE6400-	4BD21-2DA0	4BD22-2EA0	4BD24-0FA0
Resistance	Ohm	27	15	8.2
Rated power P_{DB}	kW	1.2	2.2	4.0
Peak power P_{max}	kW	24	44	80
Load duration for peak power T_a	s	13.6	14.5	13.1
Period duration of braking duty cycle t	s	271	290	252
Degree of protection		IP20 or IPXXB	IP20 or IPXXB	IP20 or IPXXB
Power Connections		M6 studs	M6 studs	M6 studs
Thermoswitch (NC contact) maximum contact load connecting cable		250 V_{AC} / 2.5 A	250 V_{AC} / 2.5 A	250 V_{AC} / 0.2 A
Weight	kg	7.4	10.6	16.7

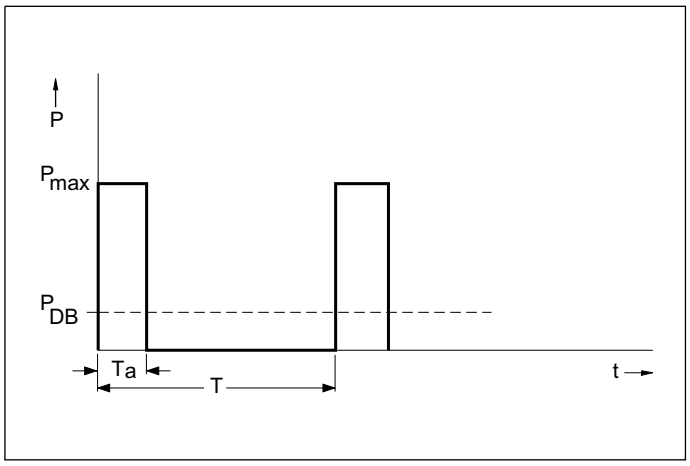


Figure 4-4 Load diagram for the braking resistor, Blocksize format

T [s] period duration of braking duty cycle

T_a [s] load duration for peak power

P_{DB} [W] rated power of the braking resistor

P_{max} [W] peak braking power of the braking resistor

Motor-side power components

5

5.1 Motor reactors (blocksize)

5.1.1 Description

Motor reactors reduce the voltage stress on the motor windings by reducing the voltage gradients at the motor terminals that occur when motors are fed from drive converters. At the same time, the capacitive re-charging currents that additionally load the output of the Power Module when longer motor cables are used are simultaneously reduced.

The motor reactors for Power Modules 3-ph. 380 V to 480 V AC are suitable for a pulse frequency of 4 kHz. Higher pulse frequencies are not permissible.

5.1.2 Safety information

⚠ WARNING
The 100 mm clearances above and below the components must be observed.

Note

The connecting cables to the Power Module must be kept as short as possible (max. 5 m).

CAUTION
When using motor reactors that SIEMENS has not approved for SINAMICS, then these can thermally damage the reactor.

⚠ CAUTION
The surface temperature of the motor reactors can exceed 80 °C.

CAUTION
The maximum permissible output frequency when motor reactors are used is 150 Hz.

CAUTION
The maximum permissible pulse frequency when motor reactors are used is 4 kHz.

5.1.3 Dimension drawings

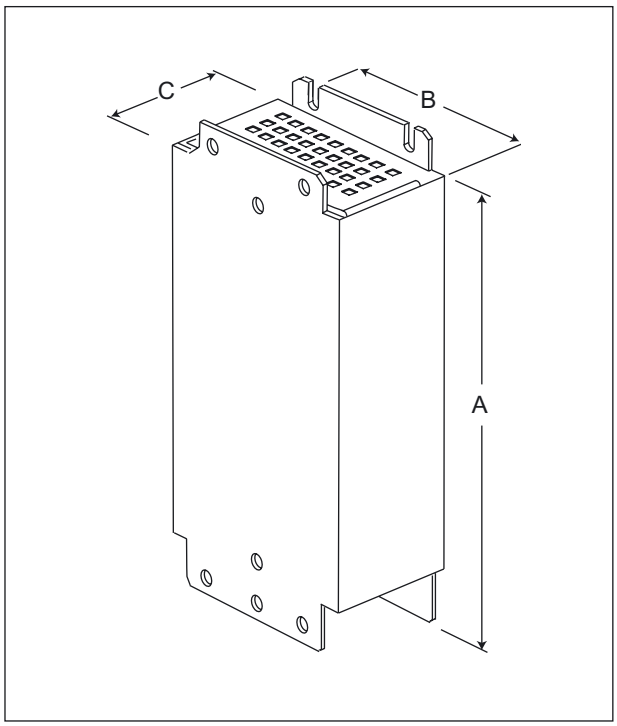


Figure 5-1 Dimension drawing: Motor reactor, frame size FSA

Table 5- 1 Total dimensions: Motor reactor, frame size FSA, all data in mm and (inches)

Motor reactor 6SE6400-	**3TC00-4AD2**
Frame size	**FSA**
Dimension A in mm and (inches)	200 (7,87)
Dimension B in mm and (inches)	75,5 (2,97)
Dimension C in mm and (inches)	110 (4,33)

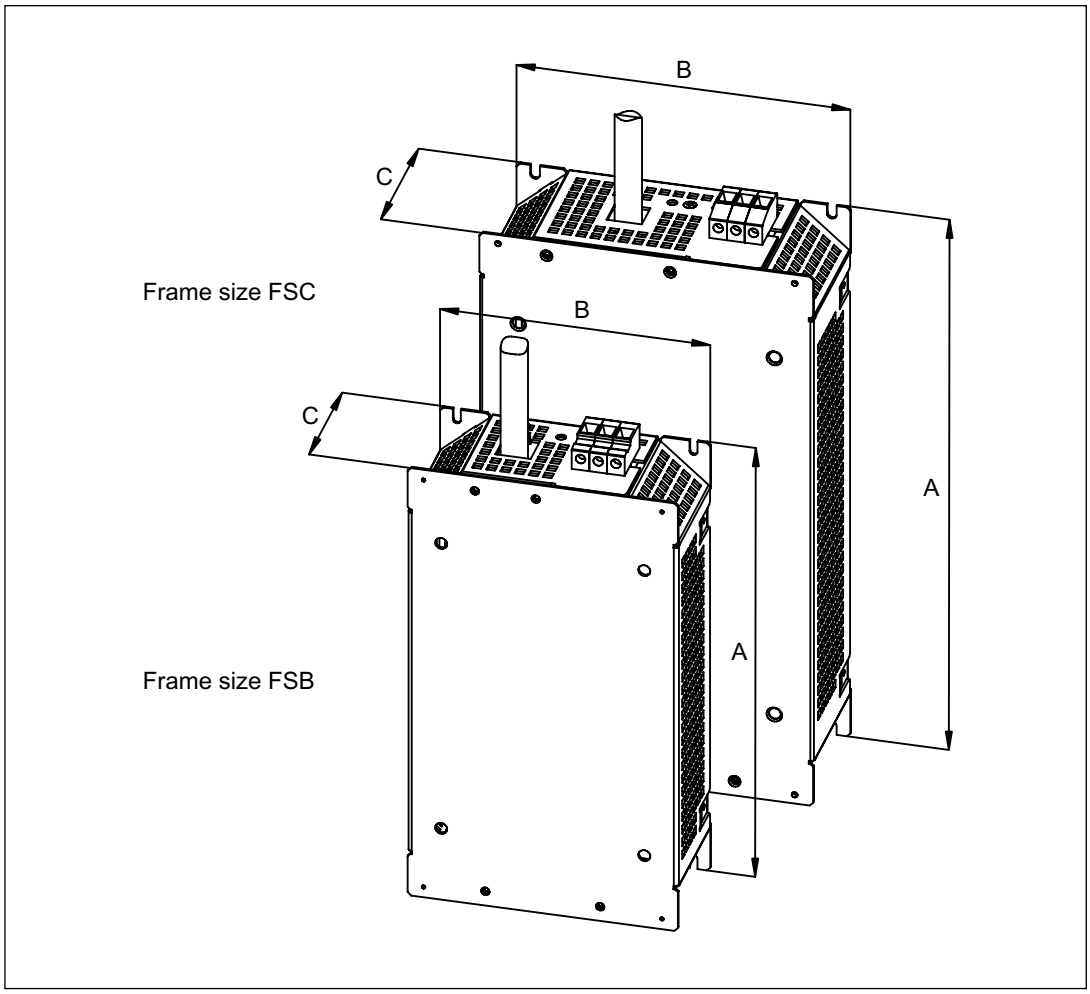


Figure 5-2 Dimension drawing: Motor reactor, frame sizes FSB and FSC

Table 5- 2 Total dimensions: Motor reactor, frame sizes FSB and FSC

Motor reactor 6SL3202-	**0AE21-0CA0**	**0AJ23-2CA0**
Frame size	**FSB**	**FSC**
Dimension A in mm and (inches)	270 (10,62)	334 (13,14)
Dimension B in mm and (inches)	153 (6,02)	189 (7,44)
Dimension C in mm and (inches)	70 (2,75)	50 (1,96)

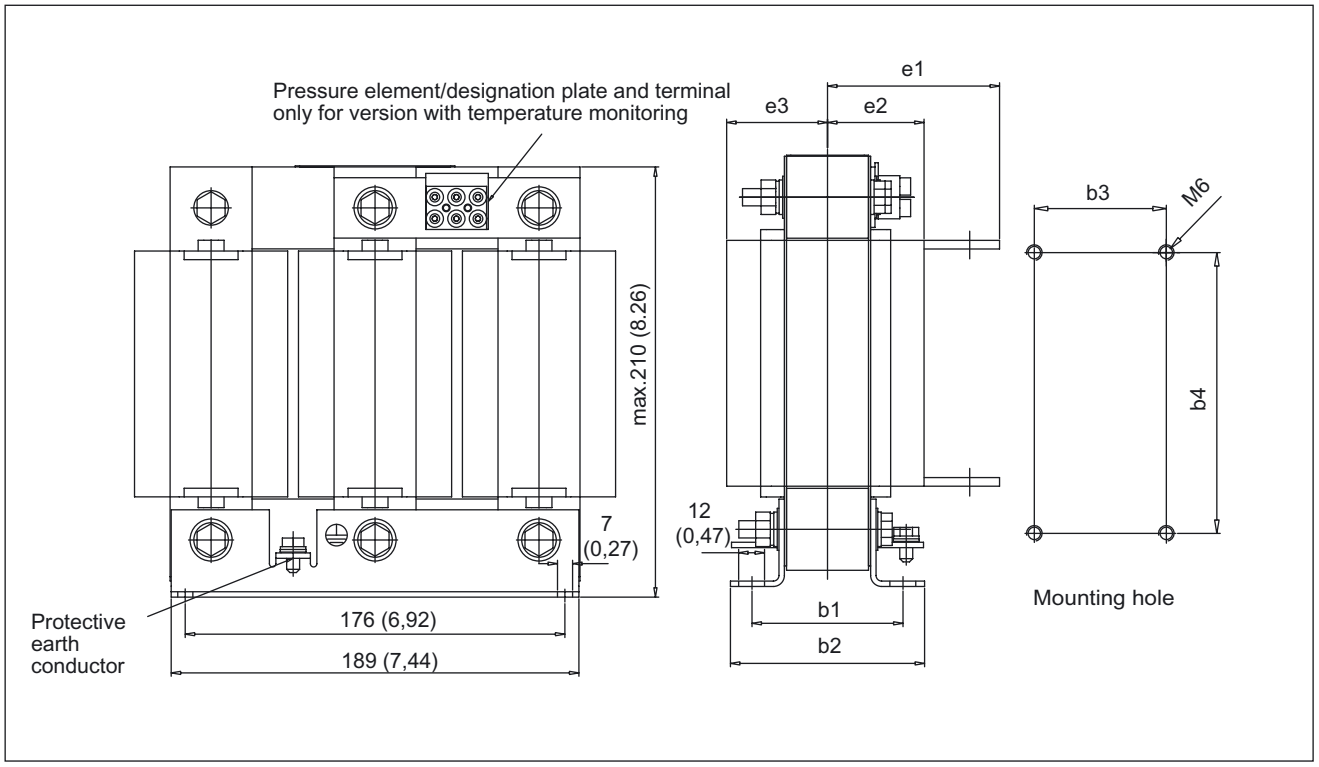


Figure 5-3 Dimension drawing: Motor reactor, frame size FSD

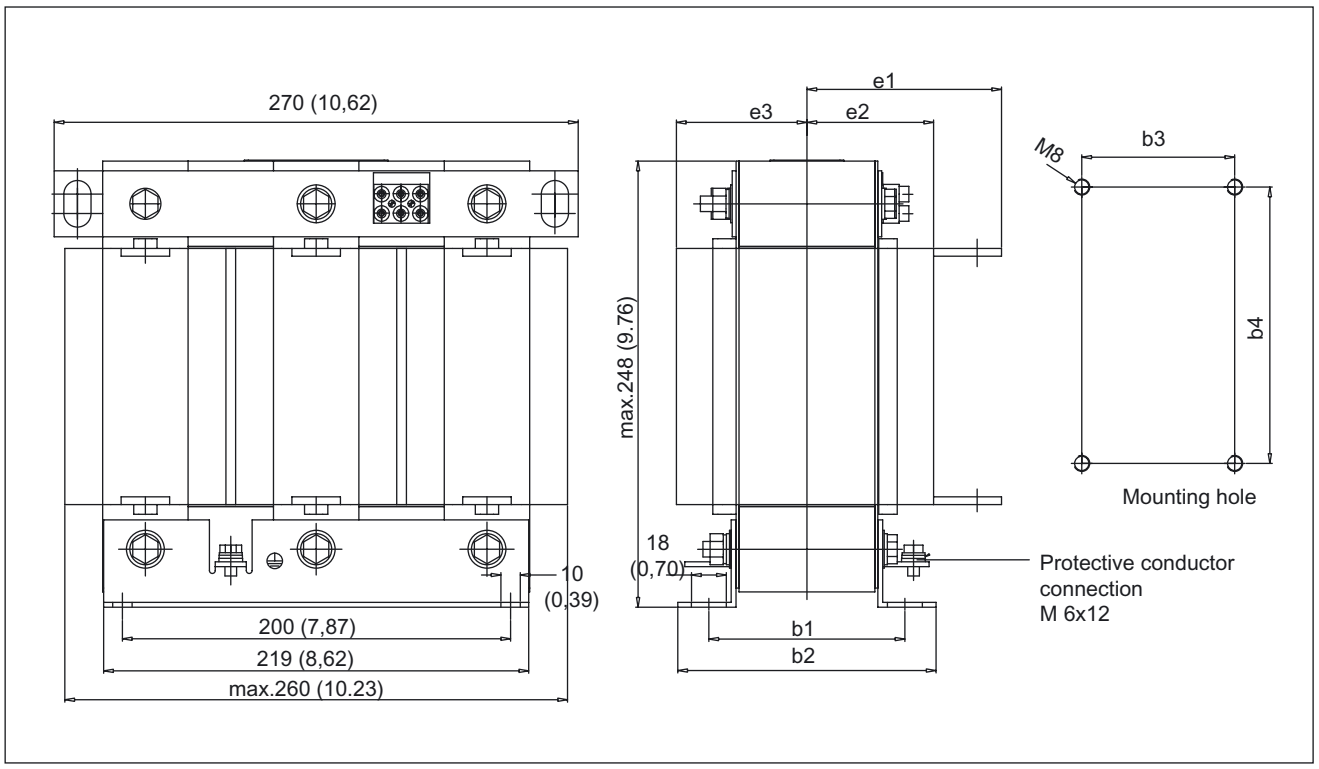


Figure 5-4 Dimension drawing: Motor reactor, frame size FSE

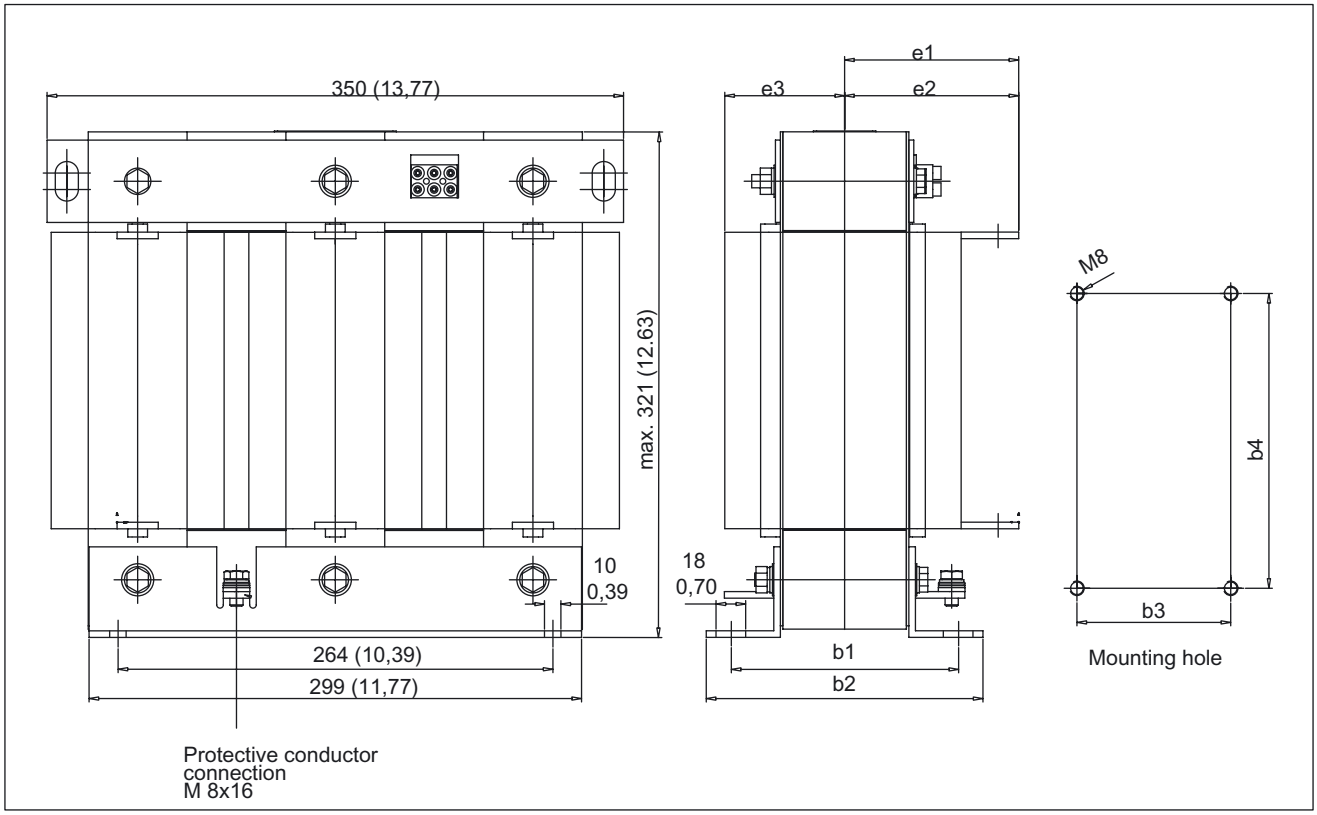


Figure 5-5 Dimension drawing: Motor reactor, frame size FSF

Table 5- 3 Total dimensions: Motor reactor, frame sizes FSD, FSE, all data in mm and (inches)

Motor reactor 6SE6400-	3TC05-4DD0	3TC03-8DD0	3TC07-5ED0	3TC08-0ED0
Frame size	FSD	FSD	FSE	FSE
b1	70 (2,75)	94 (3,70)	101 (3,97)	70 (2.75)
b2	91 (3,58)	115 (4,52)	133 (5,23)	90 (3.54)
b3	70 (2,75)	94 (3,70)	101 (3,97)	70 (2.75)
b4	176 (6,92)	176 (6,92)	200 (7,87)	176 (6.92)
e1	91 (3,58)	103 (4,05)	110 (4,33)	89 ± 2 (3.50 ± 0.07)
e2	57 (2,24)	69 (2,71)	76 (2,99)	79 ± 2 (3.50 ± 0.07)
e3	49 (1,92)	61 (2,40)	68 (2,67)	-

Table 5- 4 Total dimensions: Motor reactor, frame size FSF, all data in mm and (inches)

Motor reactor 6SE6400-	3TC14-5FD0	3TC15-4FD0
Frame size	FSF	FSF
b1	138 (5,43)	101 (3.97)
b2	169 (6,65)	121 (4.76)
b3	138 (5,43)	101 (3.97)
b4	264 (10,39)	200 (7.87)

Motor reactor 6SE6400-	3TC14-5FD0	3TC15-4FD0
Frame size	FSF	FSF
e1	131 (5,15)	119 ± 2 (4.68 ± 0.07)
e2	90 (3,54)	109 ± 2 (4.29 ± 0.07)
e3	78 (3,07)	-

5.1.4 Mounting

The motor reactor must be installed as close as possible to the Power Module.

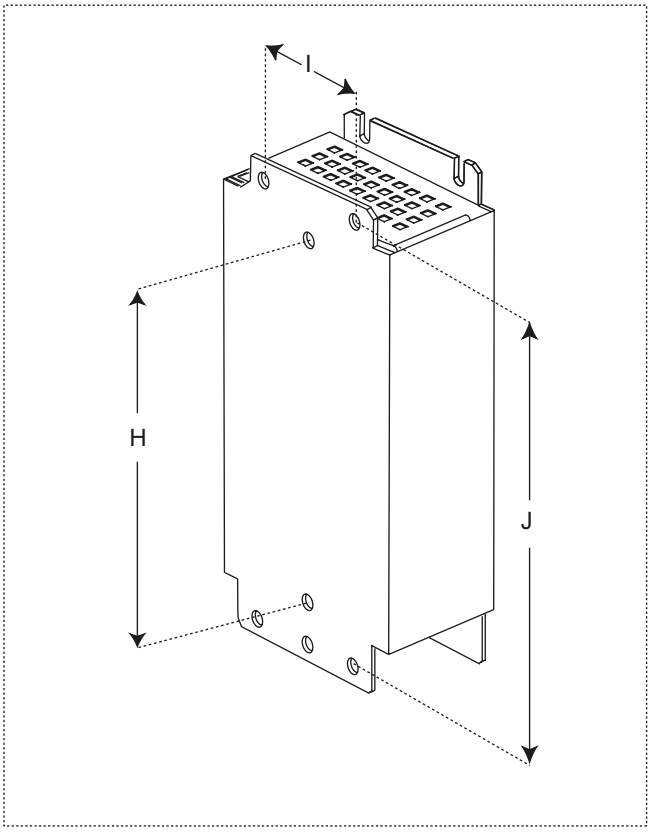


Figure 5-6 Mounting: Motor reactor, frame size FSA

Table 5- 5 Mounting: Motor reactor, frame size FSA, all data in mm and (inches)

Motor reactor 6SE6400-	**3TC00-4AD2**
Suitable for Power Module 6SL3210-	**1SE11-3UA0** **1SE11-7UA0** **1SE12-2UA0** **1SE13-1UA0** **1SE14-1UA0**
Frame size	**FSA**
H	160 (6,29)
I	56 (2,20)
J	187 (7,36)

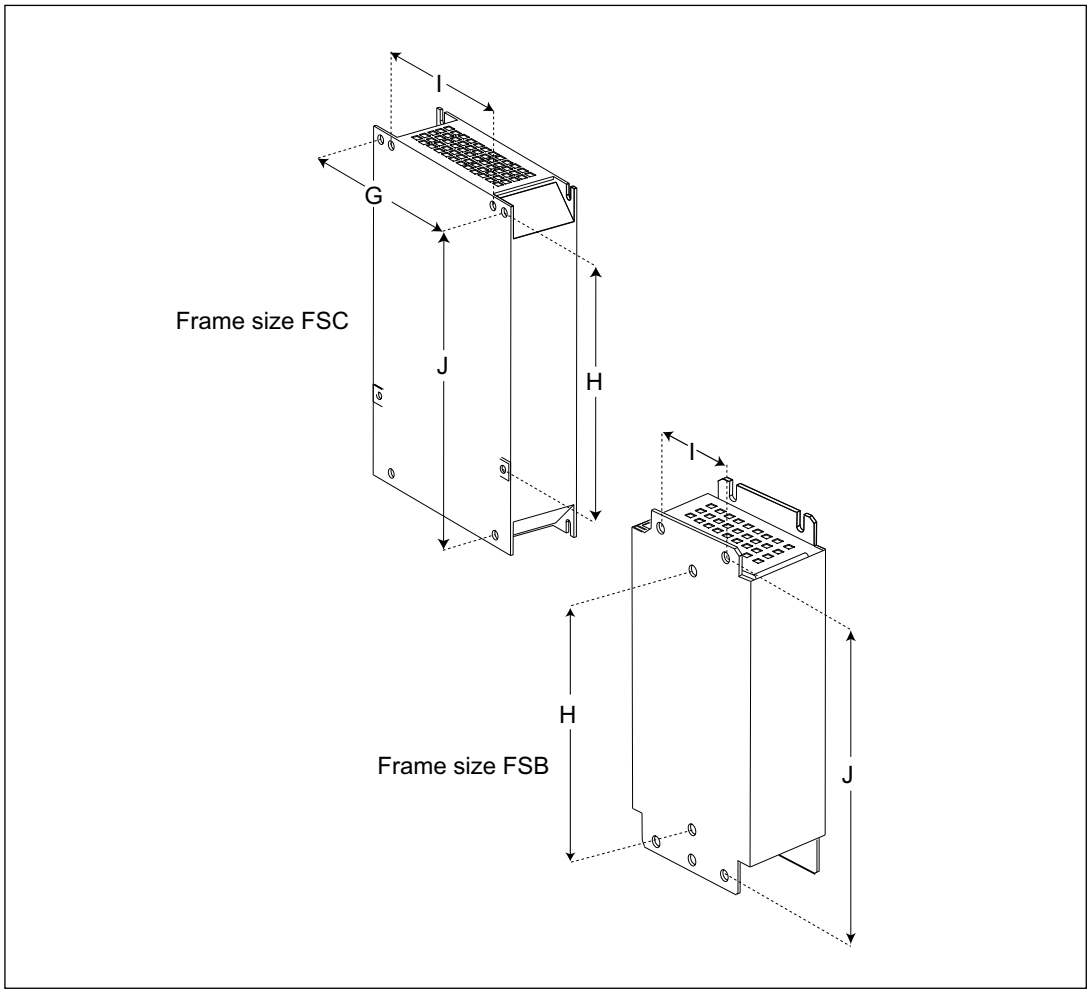


Figure 5-7 Mounting: Motor reactor, frame sizes FSB and FSC

Table 5- 6 Mounting: Motor reactor, frame sizes FSB and FSC, all data in mm and (inches)

Motor reactor	**6SL3202-**	**0AE21-0CA0**	**0AJ23-2CA0**
Suitable for Power Module	**6SL3210-**	**1SE16-0UA0** **1SE17-7UA0** **1SE21-0UA0**	**1SE21-8UA0** **1SE22-5UA0** **1SE23-2UA0**
Frame size		**FSB**	**FSC**
Power Module	G	138 (5,43)	174 (6,85)
	H	174 (6,85)	204 (8,03)
Mounting surface	I	120 (4,72)	156 (6,14)
	J	200 (7,87)	232 (9,13)
Fixing screw		M4	M5

Cable cross-section and terminal tightening torques
Terminals for wiring on site

Frame size	**FSA**	**FSB**	**FSC**
Tightening torque [Nm]	1,1	1,5	2,25
Recommended minimum conductor cross-section [mm^2]	1	1,5	2,5
Highest conductor cross-section [mm^2]	2,5	6	10

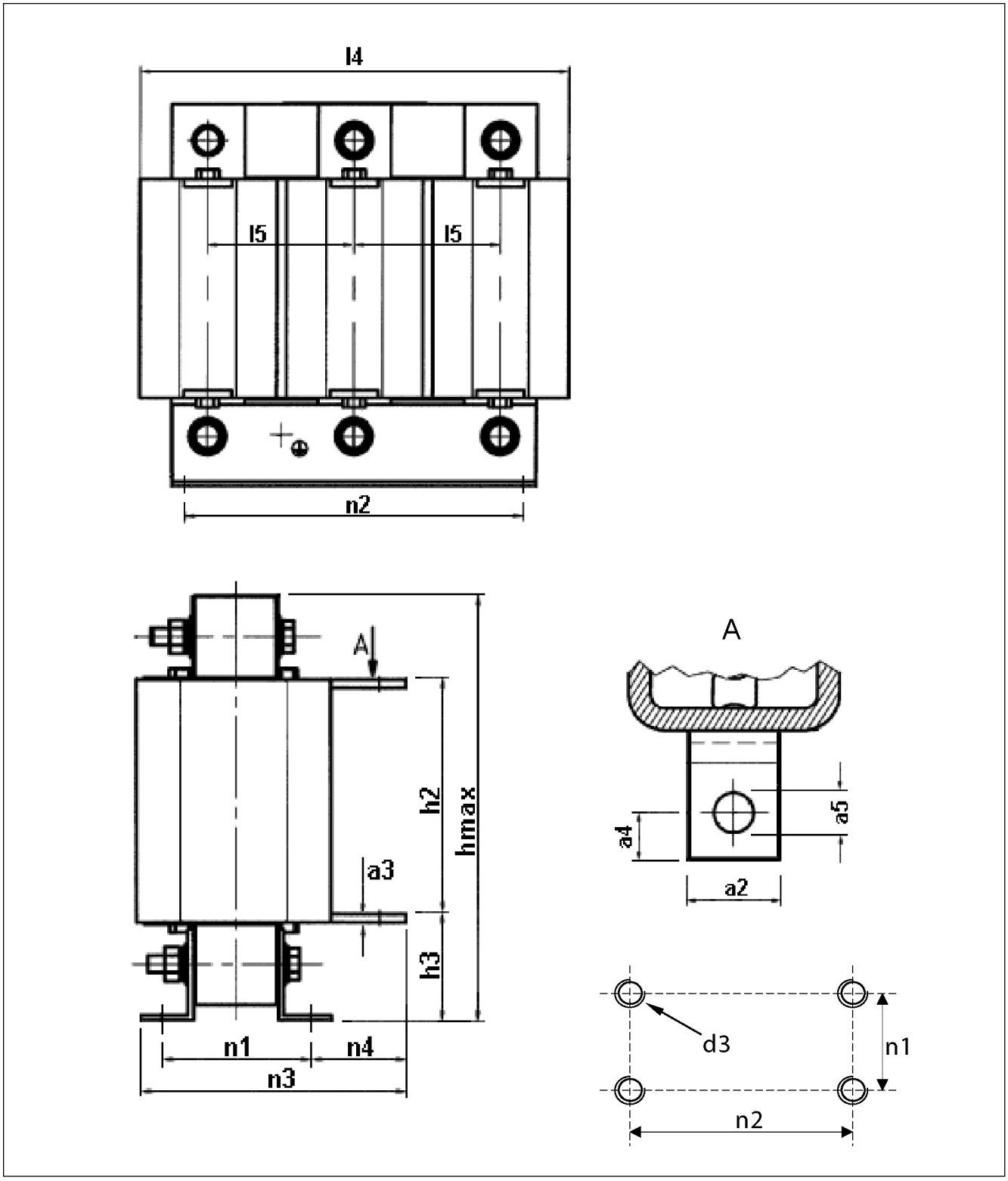


Figure 5-8 Mounting: Motor reactor, frame sizes FSD, FSE, FSF

Table 5- 7 Mounting: Motor reactor, frame sizes FSD, FSE, all data in mm and (inches)

Motor reactor	**6SE6400-**	**3TC05-4DD0**	**3TC03-8DD0**	**3TC07-5ED0**	**3TC08-0ED0**
Suitable for Power Module	**6SL3210-**	**1SE23-8UA0 1SE26-0UA0**	**1SE24-5UA0**	**1SE27-5UA0**	**1SE31-0UA0**
Frame size		**FSD**	**FSD**	**FSE**	**FSE**
Motor reactor	a2	20 (0.78)	20 (0.78)	20 (0.78)	20 (0.78)
	a3	4 (0.15)	4 (0.15)	4 (0.15)	4 (0.15)
	a4	10 (0.39)	10 (0.39)	10 (0.39)	10 (0.39)
	a5	∅6 (0.23)	∅6 (0.23)	∅7 (0.27)	∅7
	l4	225 (8.85)	225 (8.85)	270 (10.62)	225 (8.85)
	l5	76 ±5 (2.99 ±0.19)	76 ±5 (2.99 ±0.19)	88 ±5 (3.46 ±0.19)	76 ±5 (2.99 ±0.19)
	hmax	210 (8.26)	210 (8.26)	248 (9.76)	210 (8.26)
	h2	120 ±2 (4.72 ±0.07)	120 ±2 (4.72 ±0.07)	140 ±2 (5.51 ±0.07)	120 ±2 (4.72 ±0.07)
	h3	45 ±2 (1.77 ±0.07)	45 ±2 (1.77 ±0.07)	50 ±2 (1.96 ±0.07)	45 ±2 (1.77 ±0.07)
	n1	70 (2.75)	94 (3.70)	101 (3.97)	70 (2.75)
	n2	176 (6.88)	176 (6.88)	200 (7.87)	176 (6.88)
	n3	max. 140 (5.51)	max. 164	max. 187.5 (7.38)	max. 140 (5.51)
	n4	54 ±2 (2.12 ±0.07)	54 ±2 (2.12 ±0.07)	68,5 ±2 (2.69 ±0.07)	54 ±2 (2.12 ±0.07)
	d3	M6	M6	M8	M6
	PE	M6	M6	M6	M6
Tightening torque [Nm]		3,5-4,0	3,5-4,0	9,5-10,0 3,5-4,0	3,5-4,0

Table 5- 8 Mounting: Motor reactor, frame size FSF, all data in mm and (inches)

Motor reactor	**6SE6400-**	**3TC14-5FD0**	**3TC15-4FD0**
Suitable for Power Module	**6SL3210-**	**1SE31-1UA0**	**1SE31-5UA0**
Frame size		**FSF**	**FSF**
Motor reactor	a2	20 (0.78)	20 (0.78)
	a3	4 (0.15)	4 (0.15)
	a4	10 (0.39)	10 (0.39)
	a5	∅9 (0.35)	∅9 (0.35)
	l4	357 (14.05)	270 (10.62)
	l5	120 ±5 (4.72 ±0.19)	88 ±5 (3.46 ±0.19)
	hmax	321 (12.63)	248 (9.76)
	h2	185 ±2 (7.28 ±0.07)	140 ±2 (5.51 ±0.07)
	h3	60 ±2 (2.36 ±0.07)	50 ±2 (1.96 ±0.07)
	n1	138 (5.43)	101 (3.97)
	n2	264 (10.39)	200 (7.87)
	n3	max. 220.5 (8.68)	max. 187.5 (7.38)
	n4	65,5 ±2 (2.57 ±0.07)	68,5 ±2 (2.69 ±0.07)
	d3	M8	M8
	PE	M8	M6
Tightening torque [Nm]		9,5-10,0	9,5-10,0 3,5-4,0

Mounting Power Modules and motor reactors

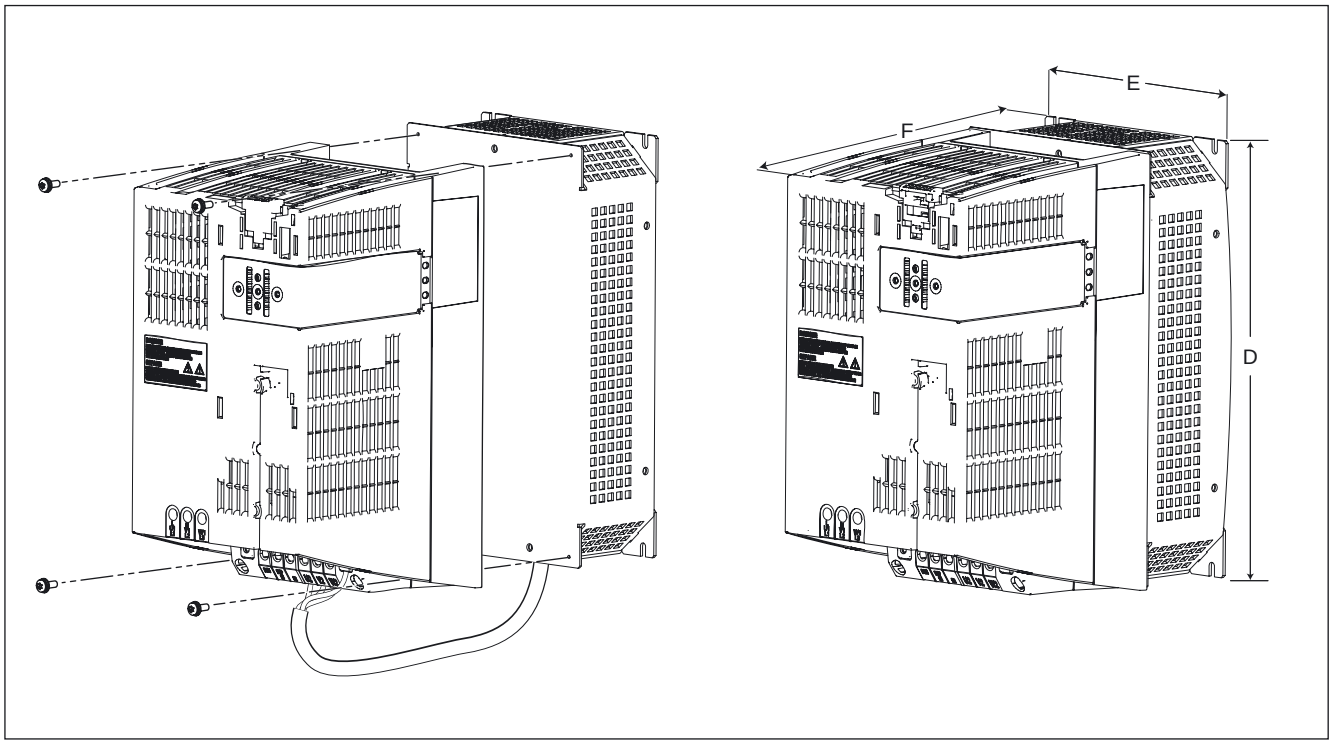


Figure 5-9 Mounting Power Modules and motor reactors, frame sizes FSB and FSC

Table 5- 9 Total dimensions, Power Module 340 and motor reactor, frame sizes FSA, FSB and FSC, all data in mm and (inches)

Motor reactor		**6SE6400-3TC00-4AD3**	**6SE6400-3TC00-4AD2**	**6SL3202-0AE21-0CA0**	**6SL3202-0AJ23-2CA0**
Suitable for Power Module	**6SL3210-**	**1SB11-0UA0**	**1SE11-3UA0** **1SE11-7UA0** **1SE12-2UA0** **1SE13-1UA0** **1SE14-1UA0**	**1SE16-0UA0** **1SE17-7UA0** **1SE21-0UA0**	**1SE21-8UA0** **1SE22-5UA0** **1SE23-2UA0**
Frame size		**FSA**	**FSA**	**FSB**	**FSC**
Total dimension of the Power Module and motor reactor	D	200 (7.87)	200 (7.87)	270 (10.62)	334 (13.14)
	E	75,5 (2.97)	75,5 (2.97)	153 (6.02)	189 (7.44)
	F	259 (10.19)	259 (10.19)	235 (9.25)	245 (9.64)

5.1.5 Electrical connection

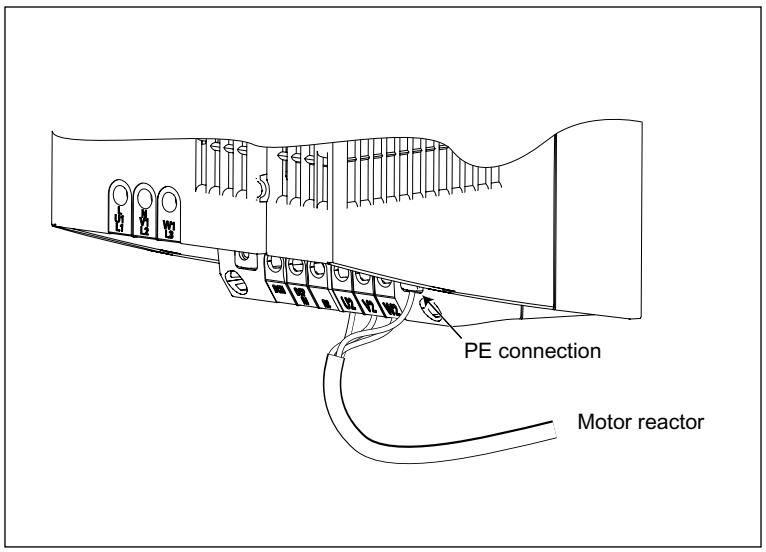


Figure 5-10 Electrical connection

5.1.6 Technical data

Table 5- 10 Motor reactors for Power Modules 3-ph. 380 V to 480 V AC, Part 1

		Motor reactor (for a 4 kHz pulse frequency)					
		6SE6400-3TC00-4AD2					6SL3202-0AE21-0CA0
Rated current	A	4,5					10
Power loss	kW	0,005					0,02
Connection to the Power Module		Cable 4 x 1.5 mm^2 Length approx. 0.3 m					Cable 4 x AWG14 (1.5 mm^2) Length approx. 0.4 m
Motor connection		Screw terminals for cable cross-section 6 mm^2					Screw terminals for cable cross-section 6 mm^2
PE connection		M5 stud					M5 stud
Max. permissible cable length between motor reactor and motor	m	100 (shielded) 150 (non-shielded)	100 (shielded) 150 (non-shielded)	100 (shielded) 150 (non-shielded)	100 (shielded) 225 (non-shielded)	100 (shielded) 225 (non-shielded)	100 (shielded) 150 (non-shielded)
Degree of protection		IP20 or IPXXB	IP20 or IPXXB	IP20 or IPXXB	IP20 or IPXXB	IP20 or IPXXB	IP20 or IPXXB
Weight, approx.	kg	2					4,5
Suitable for Power Module, blocksize format	Type	6SL3210-1SE11-3UA0	6SL3210-1SE11-7UA0	6SL3210-1SE12-2UA0	6SL3210-1SE13-1UA0	6SL3210-1SE14-1UA0	6SL3210-1SE16-0UA0 6SL3210-1SE16-0AA0
Rated current In (power) of the Power Module	A	1,3	1,7	2,2	3,1	4,1	5,9
Frame size		FSA	FSA	FSA	FSA	FSA	FSB

Table 5- 11 Motor reactors for Power Modules 3-ph. 380 V to 480 V AC, Part 2

		Motor reactor (for a 4 kHz pulse frequency)					
		6SL3202-0AE21-0CA0		6SL3202-0AJ23-2CA0			6SE6400-3TC05-4DD0
Rated current	A	10		25			68
Power loss	kW	0,02		0,06			0,2
Connection to the Power Module		Cable 4 x AWG14 (1.5 mm²) Length approx. 0.4 m		Cable 4 x AWG14 (1.5 mm²) Length approx. 0.35 m			Flat connector for M6 cable lug
Motor connection		Screw terminals for cable cross-section 6 mm²		Screw terminals for cable cross-sections 2.5 to 10 mm²			Flat connector for M6 cable lug
PE connection		M5 stud		M5 stud			M6 screw
Max. permissible cable length between motor reactor and motor	m	100 (shielded) 150 (non-shielded)	100 (shielded) 150 (non-shielded)	100 (shielded) 150 (non-shielded)	100 (shielded) 150 (non-shielded)	100 (shielded) 150 (non-shielded)	200 (shielded) 300 (non-shielded)
Degree of protection		IP20 or IPXXB		IP20 or IPXXB			IP00
Weight, approx.	kg	4,5		9			11,5
Suitable for Power Module, blocksize format	Type	6SL3210-1SE17-7UA0 6SL3210-1SE17-7AA0	6SL3210-1SE21-0UA0 6SL3210-1SE21-0AA0	6SL3210-1SE21-8UA0 6SL3210-1SE21-8AA0	6SL3210-1SE22-5UA0 6SL3210-1SE22-5AA0	6SL3210-1SE23-2UA0 6SL3210-1SE23-2AA0	6SL3210-1SE23-8UA0 6SL3210-1SE23-8AA0
Rated current In (power) of the Power Module	A	7,7	10	18	25	32	38
Frame size		FSB	FSB	FSC	FSC	FSC	FSD

Table 5- 12 Motor reactors for Power Modules 3-ph. 380 V to 480 V AC, Part 3

		Motor reactor (for a 4 kHz pulse frequency)					
		6SE6400-3TC03-8DD0	**6SE6400-3TC05-4DD0**	**6SE6400-3TC08-0ED0**	**6SE6400-3TC07-5ED0**	**6SE6400-3TC14-5FD0**	**6SE6400-3TC15-4FD0**
Rated current	A	45	68	104	90	178	178
Power loss	kW	0,2	0,2	0,17	0,28	0,47	0,25
Connection to the Power Module		Flat connector for M6 cable lug	Flat connector for M6 cable lug	Flat connector for M6 cable lug	Flat connector for M6 cable lug	Flat connector for M8 cable lug	Flat connector for M8 cable lug
Motor connection		Flat connector for M6 cable lug	Flat connector for M6 cable lug	Flat connector for M6 cable lug	Flat connector for M6 cable lug	Flat connector for M8 cable lug	Flat connector for M8 cable lug
PE connection		M6 screw	M6 screw	M6 screw	M6 screw	M8 screw	M6 screw
Max. permissible cable length between the motor reactor and motor for line supply voltages 380 V to 400 V for line supply voltages 401 V to 480 V	m	200 (shielded) 300 (non-shielded)	200 (shielded) 300 (non-shielded)	200 (shielded) 300 (non-shielded)	200 (shielded) 300 (non-shielded)	200 (shielded) 300 (non-shielded)	200 (shielded) 300 (non-shielded)
Degree of protection		IP00	IP00	IP00	IP00	IP00	IP00
Weight, approx.	kg	19	11,5	12	27	57	24
Suitable for Power Module, blocksize format	Type	6SL3210-1SE24-5UA0 6SL3210-1SE24-5AA0	6SL3210-1SE26-0UA0 6SL3210-1SE26-0AA0	6SL3210-1SE27-5UA0 6SL3210-1SE27-5AA0	6SL3210-1SE31-0UA0 6SL3210-1SE31-0AA0	6SL3210-1SE31-1UA0 6SL3210-1SE31-1AA0	6SL3210-1SE31-5UA0 6SL3210-1SE31-5AA0
Rated current In (power) of the Power Module	A	45	60	75	90	110	145
Frame size		FSD	FSD	FSE	FSE	FSF	FSF

Table 5- 13 Motor reactors for Power Modules 3-ph. 380 V to 480 V AC, Part 4

		Motor reactor (for a 4 kHz pulse frequency)
		6SE6400-3TC14-5FD0
Rated current	A	178
Power loss	kW	0,47
Connection to the Power Module		Flat connector for M8 cable lug
Motor connection		Flat connector for M8 cable lug
PE connection		M8 screw
Max. permissible cable length between the motor reactor and motor for line supply voltages 380 V to 400 V for line supply voltages 401 V to 480 V	m	 200 (shielded) 300 (non-shielded)
Degree of protection		IP00
Weight, approx.	kg	57
Suitable for Power Module, blocksize format	Type	6SL3210-1SE31-8UA0 6SL3210-1SE31-8AA0
Rated current In (power) of the Power Module	A	178
Frame size		FSF

CU305 Control Units

6

6.1 Description

The CU305 DP Control Unit (PROFIBUS) and CU305 CAN are the components in which the open-loop and closed-loop control functions of a drive are implemented.

The CU305 DP and CU305 CAN have the following interfaces (ports):

Table 6- 1 Overview of the CU305 DP and CU305 CAN interfaces

Type	CU305 DP	CU305 CAN
Digital inputs*/outputs	4	4
Digital inputs, electrically isolated	5	5
Fail-safe digital inputs**	3	3
Analog input	1	1
Failsafe digital output***	1	1
DRIVE-CLiQ interfaces	1	1
PROFIBUS interface	1	--
CAN interface	--	1
Serial interface (RS232)	1	1
Power Module Interface (PM-IF)	1	1
Encoder interface (HTL/TTL/SSI)	1	1
Motor temperature sensor input	1	1
24 V electronics power supply	1	1
Test sockets	2	2
Interface for BOP	1	1

* The bidirectional inputs are desiged as "high-speed inputs" and can be used for BERO (3-core) or measuring probes.

** If the safety functions of the Control Unit are not being used, the failsafe digital inputs can be used as 6 additional electrically isolated digital inputs.

*** If the safety functions of the Control Unit are not being used, the failsafe digital input can be used as 1 additional electrically isolated digital input.

6.2 Safety information

⚠ WARNING
The cooling clearances of 50 mm above and below the components must be observed. It is not permissible that the connecting cables cover the cooling openings.

6.3 Interface description

6.3.1 Overview CU305 DP

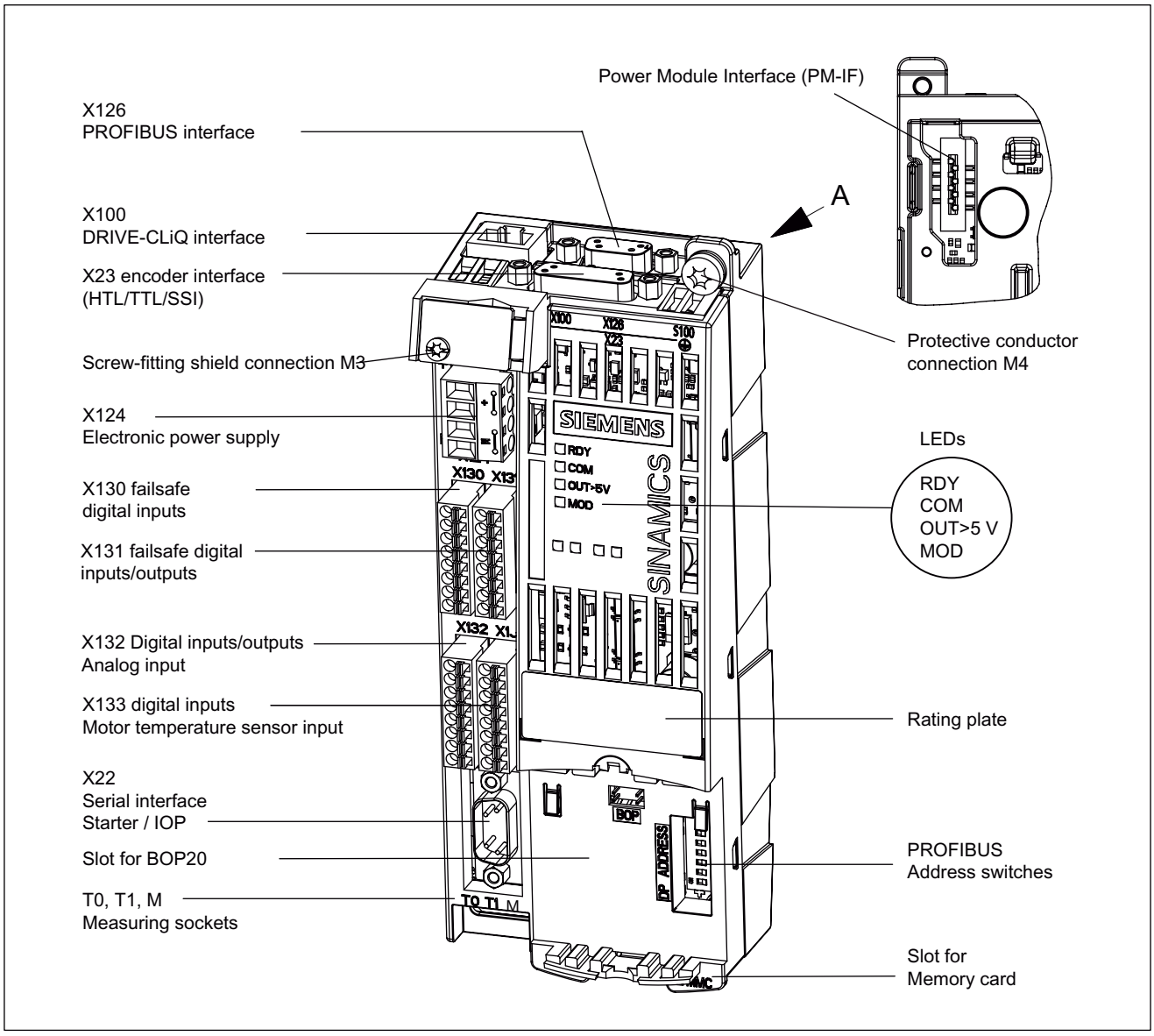


Figure 6-1 Description of the CU305 DP interfaces (ports)

6.3.2 Overview CU305 CAN

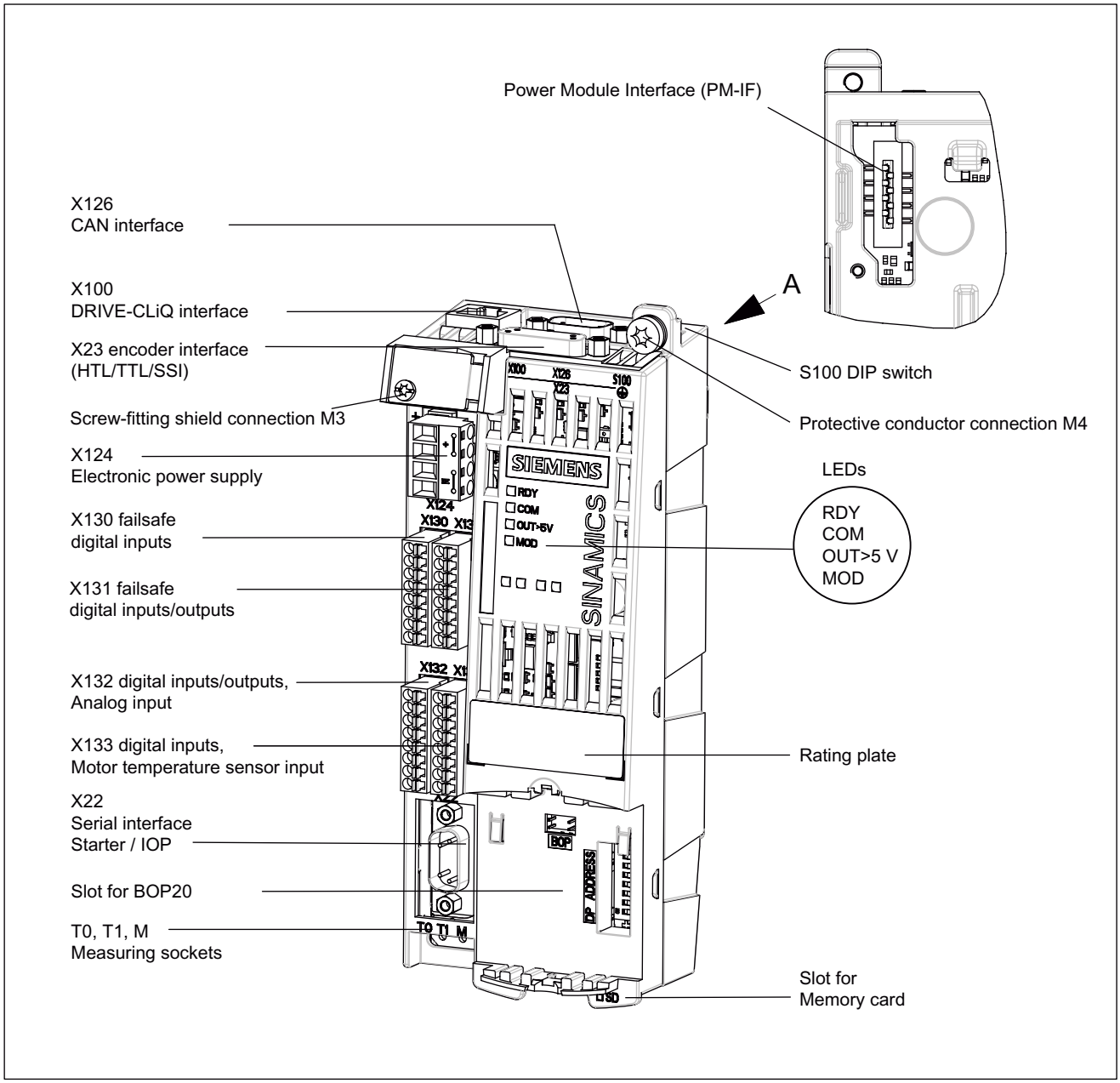


Figure 6-2 Interface description CU305 CAN

6.3.3 Connection examples

Connection examples without the safety function

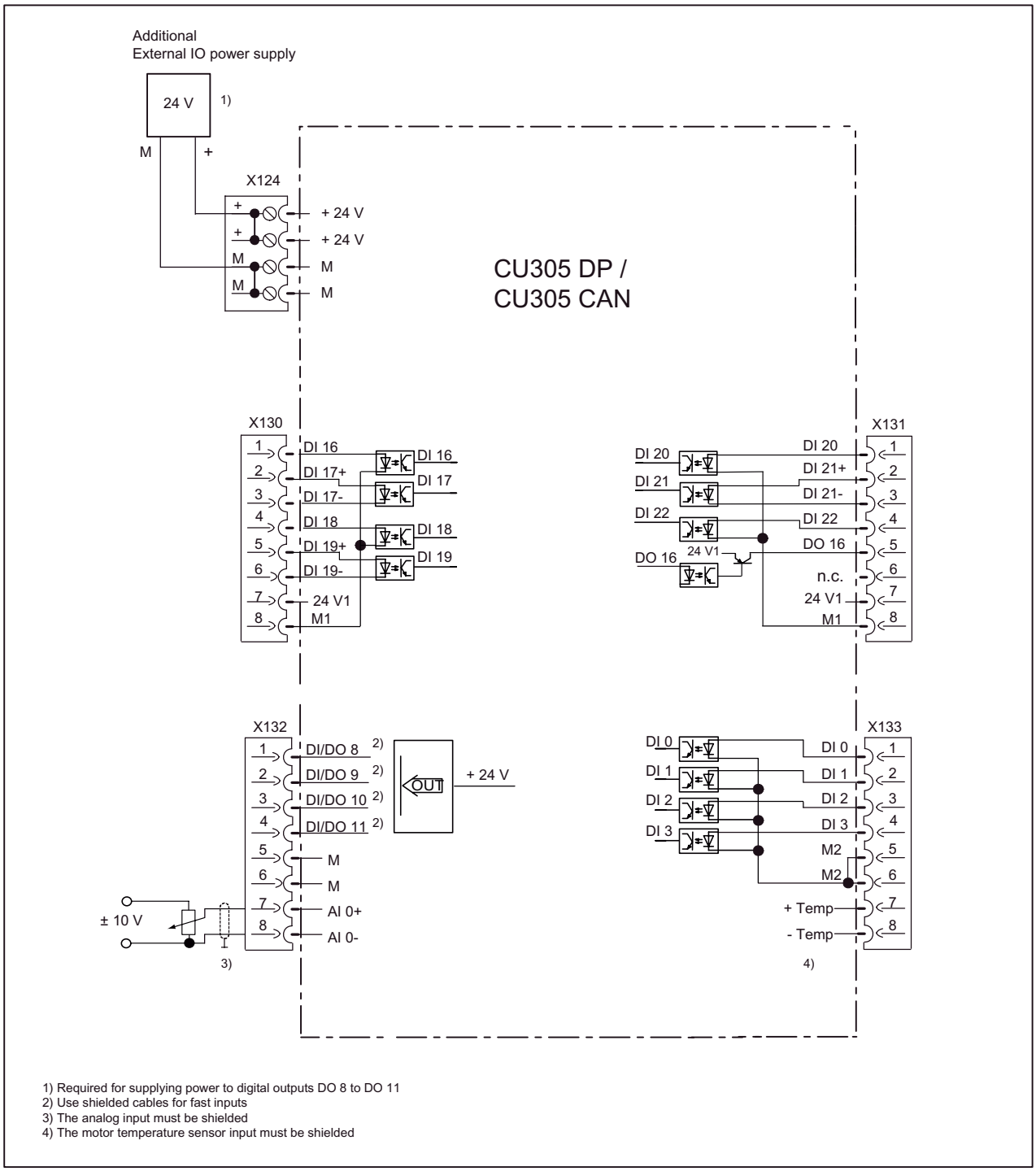


Figure 6-3 Internal connections of the CU305 without the safety function

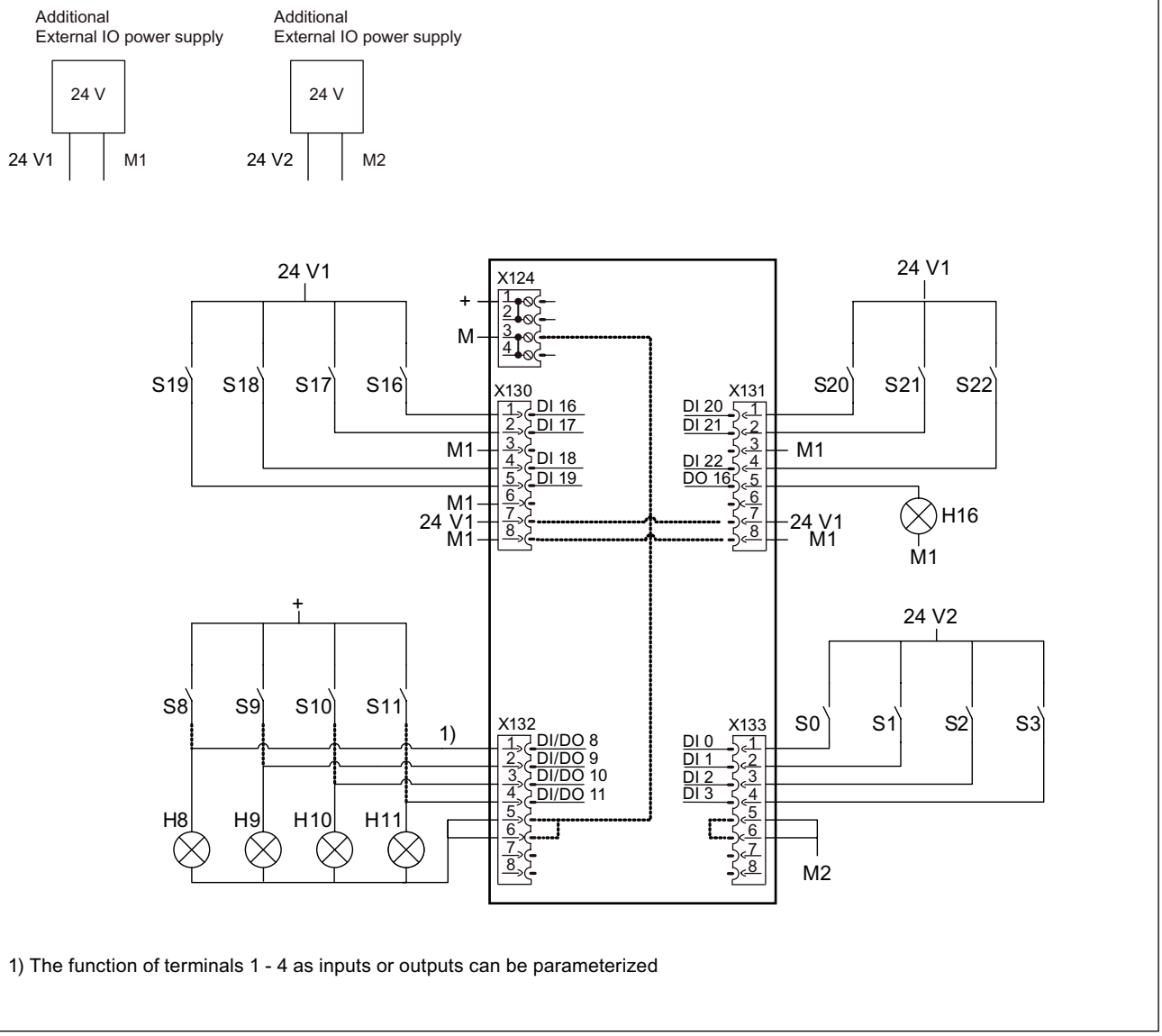


Figure 6-4 Example of circuits for the DI/DO without the safety function

Connection examples with the safety function

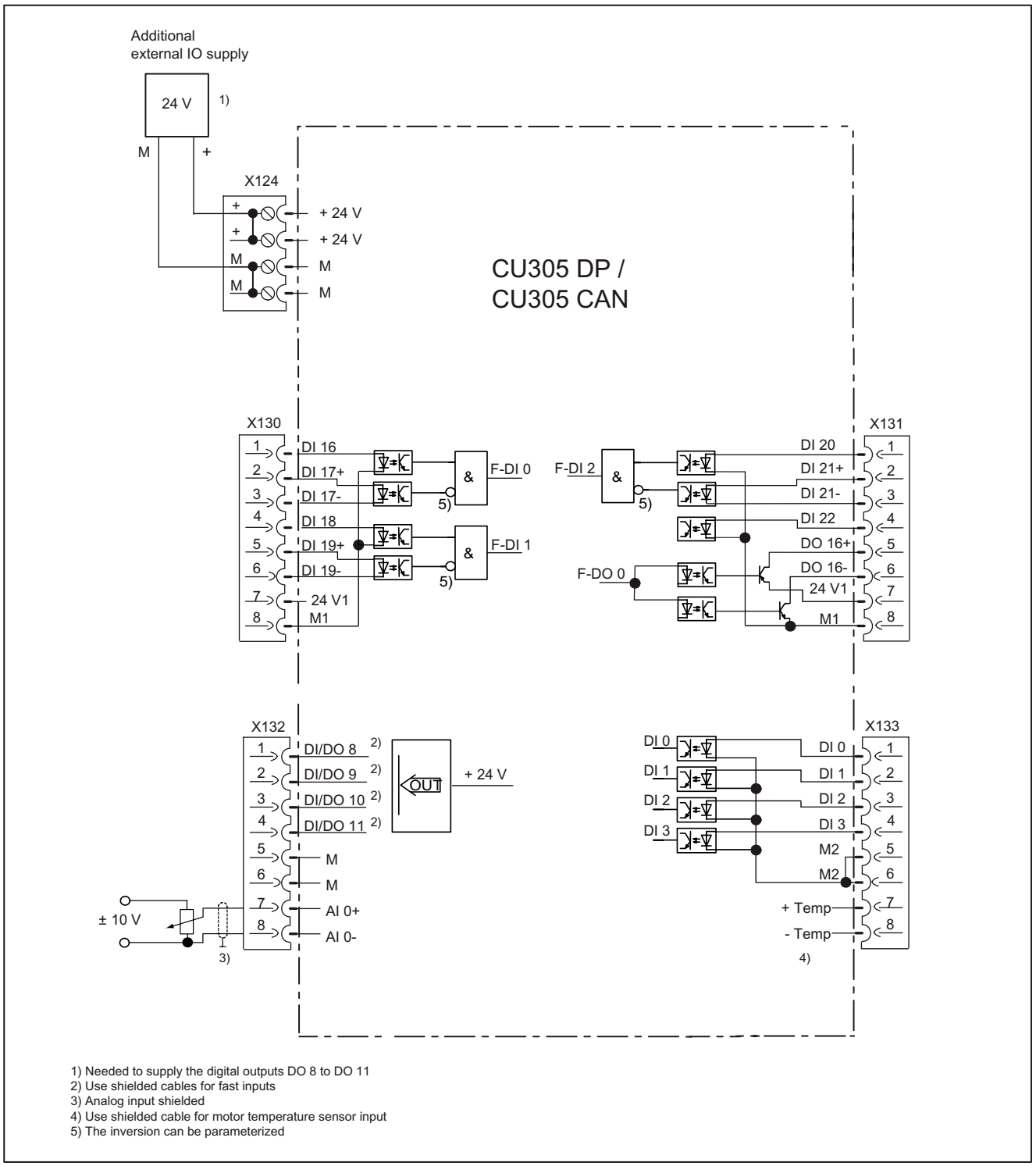
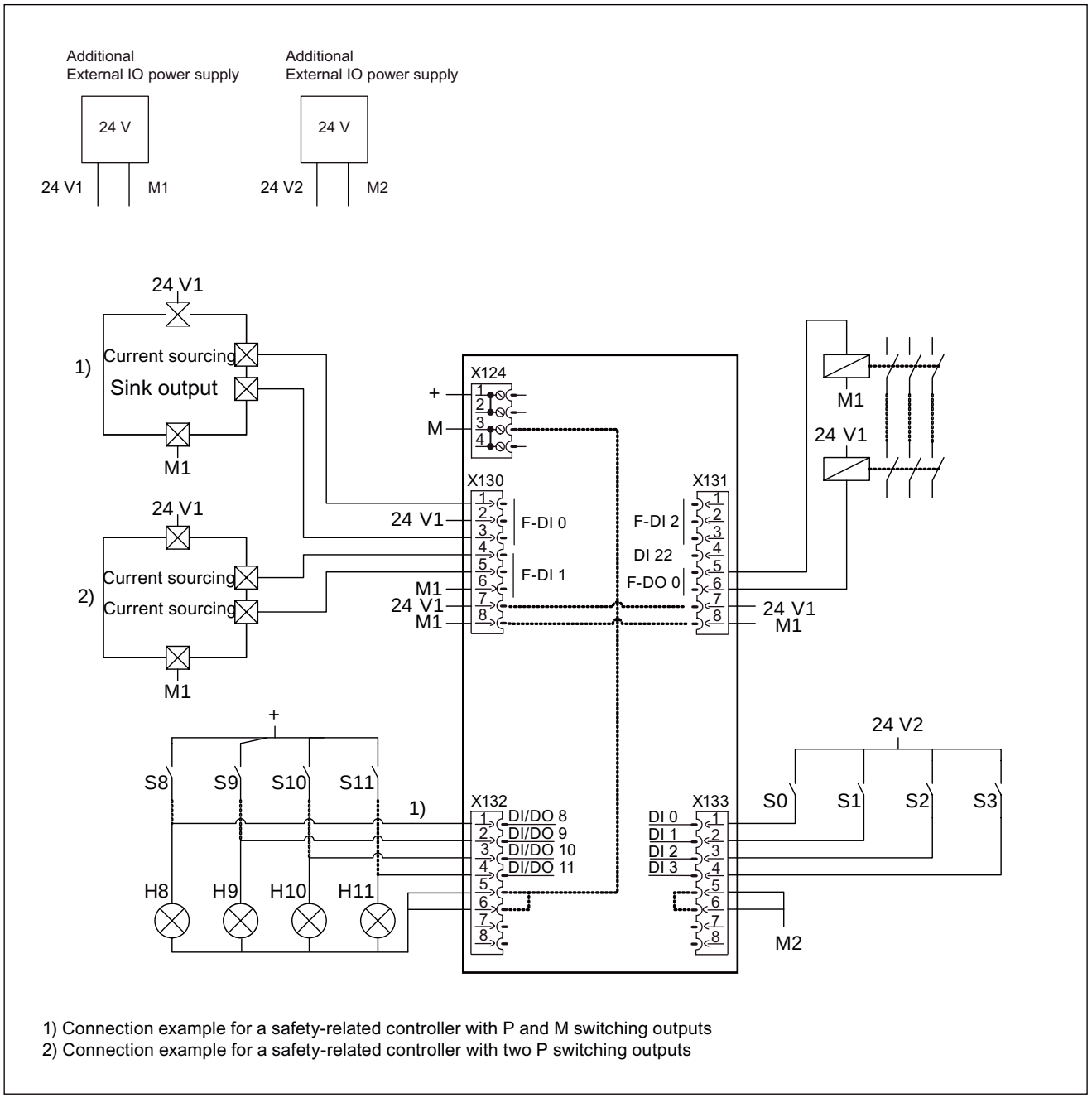


Figure 6-5 Internal connections of the CU305 with the safety function



1) Connection example for a safety-related controller with P and M switching outputs
2) Connection example for a safety-related controller with two P switching outputs

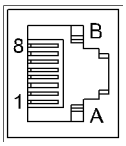
Figure 6-6 Example of circuits for the F-DI/F-DO with the safety function

For further information on connection methods, please refer to the following documents:
References: SINAMICS S110, Function Manual Drive Functions

6.3.4 CU305 DP and CU305 CAN, common interfaces

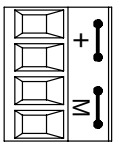
6.3.4.1 X100 DRIVE-CLiQ interface

Table 6- 2 DRIVE-CLiQ interface

	Pin	Signal name	Technical specifications
	1	TXP	Transmit data +
	2	TXN	Transmit data -
	3	RXP	Receive data +
	4	Reserved, do not use	
	5	Reserved, do not use	
	6	RXN	Receive data -
	7	Reserved, do not use	
	8	Reserved, do not use	
	A	+ (24 V)	Power supply
	B	GND (0 V)	Electronics ground
Blanking cover on DRIVE-CLiQ interface: Yamaichi company, Order No.: Y-ConAS-13 The maximum DRIVE-CLiQ cable length is 100 m.			

6.3.4.2 Electronics power supply X124

Table 6- 3 Terminal block X124

	Terminal	Function	Technical specifications
	+	Electronics power supply	Voltage: 24 V DC (20.4 V - 28.8 V) Current consumption: max. 0.8 A (incl. 0.35A for HTL encoders, without DRIVE-CLiQ and digital outputs) Max. current via jumper in connector: 20 A at 55 °C
	+	Electronics power supply	
	M	Electronic ground	
	M	Electronic ground	
Max. cross-section that can be connected: 2.5 mm^2 Screw terminal: see Appendix A			

Note

The two "+" or "M" terminals are jumpered in the connector. This ensures the supply voltage is looped through.

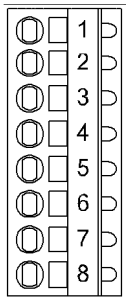
Note

An additional external electronics power supply via terminal X124 is required in two cases:

- If the digital outputs DO 8 to DO 11 are in use, the power supply needs to be connected to X124.
- The electronics power supply to the CU305 is supplied using the Power Module. If the CU305 needs to remain functional when the Power Module is switched off, the power supply needs to be connected to X124.

6.3.4.3 X130 failsafe digital inputs

Table 6- 4 Terminal block X130

	Terminal	Designation	Technical specifications
	1	DI 16	Input characteristics in accordance with IEC61131-2, Type 1 All digital inputs are electrically isolated. The reference potential is M1 Typical current consumption at 24 V DC: 6 mA Permissible level (incl. ripple) High level: 15 V to 30 V Low level: -3 V to 5 V
	2	DI 17+	
	3	DI 17-	
	4	DI 18	
	5	DI 19+	
	6	DI 19-	
	7	24 V1	Power supply for DO 16+, terminal X131/5
	8	M1	Reference potential for the failsafe digital inputs/outputs
F-DI 0 = terminals 16, 17+ and 17- F-DI 1 = terminals 18, 19+ and 19- Max. connectable cross-section: 1.5 mm^2 Type: Spring-loaded terminal 1 (see Appendix A)			

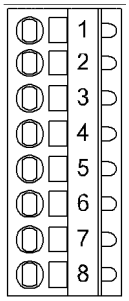
NOTICE
An open input is interpreted as "low".

Note

If M1 is connected to M (X124 or X132), the system is no longer electrically isolated.

6.3.4.4 X131 failsafe digital inputs/outputs

Table 6- 5 Terminal block X131

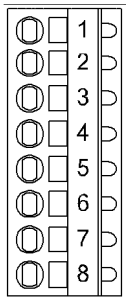
	Terminal	Designation	Technical specifications
	1	DI 20	Input characteristics in accordance with IEC61131-2, Type 1 All digital inputs are electrically isolated. The reference potential is M1 Typical current consumption at 24 V DC: 6 mA Permissible level (incl. ripple) High level: 15 V to 30 V Low level: -3 V to 5 V
	2	DI 21+	
	3	DI 21-	
	4	DI 22	
	5	DO 16+	Maximum load current 500 mA Short-circuit protection Load types: resistive, capacitive, inductive Demagnetization capacity 0.5 W The demagnetization capacity can be calculated using the following equation: $W = 0.5 \times L \times I^2 f$ W: Demagnetization capacity L: Inductance of converter load I: Load current f: Switching frequency Max. lamp wattage 2 W DO 16+: Current sourcing DO 16-: Sink output
	6	DO 16-	
	7	24 V1	Power supply for DO 16+
	8	M1	Reference potential for the failsafe digital inputs/outputs
F-DI 2 = terminals 20, 21+ and 21- F-DO 0 = terminals 16+ and 16- Max. connectable cross-section: 1.5 mm^2 Type: Spring-loaded terminal 1 (see Appendix A)			

Note

The failsafe digital output (DO 16+, DO 16-) switches off retentively in the event of a short-circuit.

6.3.4.5 X132 Digital inputs/outputs, analog input

Table 6- 6 Terminal block X132

	Terminal	Designation	Technical specifications
	1	DO 8 / DI 8	Digital inputs: Input characteristics in accordance with IEC61131-2, Type 1 All digital inputs are non-isolated. The reference potential is M Typical current consumption at 24 V DC: 7 mA Permissible level (incl. ripple) High level: 15 V to 30 V Low level: -3 V to 5 V Signal propagation times: L → H approx. 4 µs H → L: approx. 4 µs Digital outputs: Maximum load current 100 mA Short-circuit protected, automatic restart after short-circuit Load types: resistive, capacitive, inductive Demagnetization capacity 0.5 W The demagnetization capacity can be calculated using the following equation: $W = 0.5 \times L \times I^2 f$ W: Demagnetization capacity L: Inductance of converter load I: Load current f: Switching frequency Max. lamp wattage 2 W
	2	DO 9 / DI 9	
	3	DO 10 / DI 10	
	4	DO 11 / DI 11	
	5	M	Reference potential for the digital inputs/outputs and the analog input
	6	M	
	7	AI +	Differential input voltage: -10 to +10 V, maximum resolvable range: -11 to +11 V Common mode range: -15 V to +15 V Resolution 13 bits
	8	AI -	
Max. connectable cross-section: 1.5 mm^2 Type: Spring-loaded terminal 1 (see Appendix A)			

⚠ CAUTION

The common mode range may not be violated. This means that the analog differential voltage signals can have a maximum offset voltage of +/- 15 V with respect to the reference potential. If the range is violated, incorrect results may occur during analog/digital conversion.

NOTICE
An open input is interpreted as "low".

Note

The "fast inputs" DI 8 to DI 11 can be used in conjunction with a measuring system for position sensing.

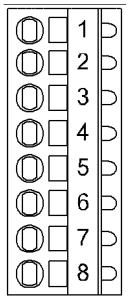
Note

A 24 V voltage supply must be connected to terminal X124 so that the digital outputs can be used.

If a the 24 V supply is briefly interrupted, then the digital outputs are de-activated during this time.

6.3.4.6 X133 digital inputs, motor temperature sensor input

Table 6- 7 Terminal block X133

	Terminal	Designation	Technical specifications
	1	DI 0	Input characteristics in accordance with IEC61131-2, Type 1 All digital inputs are electrically isolated. The reference potential is M2. Typical current consumption at 24 V DC: 6 mA Permissible level (including ripple factor) High level: 15 V to 30 V Low level: -3 V to 5 V
	2	DI 1	
	3	DI 2	
	4	DI 3	
	5	M2	Reference potential M2
	6	M2	
	7	+ Temp	Motor temperature measurement KTY84-1C130 (KTY+) Temperature sensor connection KTY84-1C130 / PTC
	8	M (- Temp)	Ground for KTY or PTC
Max. connectable cross-section: 1.5 mm^2 Type: Spring-loaded terminal 1 (see Appendix A)			

NOTICE
An open input is interpreted as "low".

NOTICE
The KTY temperature sensor must be connected with the correct polarity.

Note

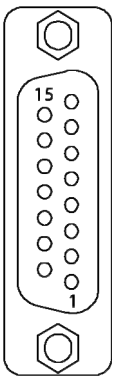
There are two ways of connecting the temperature sensor:

1. via X133, terminal 7 and 8
2. via X23, pin 1 and 8

However, only one temperature sensor may be connected as otherwise the parallel circuit will be recorded and incorrect temperature values will be generated.

6.3.4.7 X23 HTL/TTL/SSI encoder interface

Table 6- 8 Encoder connection X23

	Pin	Signal name	Technical specifications
	1	+ Temp	KTY or PTC input
	2	SSI_CLK	SSI clock, positive
	3	SSI_XCLK	SSI clock, negative
	4	P_Encoder 5 V / 24 V	Encoder power supply
	5	P_Encoder 5 V / 24 V	Encoder power supply
	6	P_Sense	Sense input encoder power supply
	7	M	Ground for encoder power supply
	8	M (- Temp)	Ground for KTY or PTC
	9	M_Sense	Ground sense input
	10	RP	R track positive
	11	RN	R track negative
	12	BN	B track negative
	13	BP	B track positive
	14	AN_SSI_XDAT	A track negative / SSI data negative
	15	AP_SSI_DAT	A track positive / SSI data positive
Type: 15-pin sub D connector			

NOTICE

The KTY temperature sensor must be connected with the correct polarity.

Note

There are two ways of connecting the temperature sensor:

1. via X133, terminal 7 and 8
2. via X23, pin 1 and 8

However, only one temperature sensor may be connected as otherwise the parallel circuit will be recorded and incorrect temperature values will be generated.

Table 6- 9 Specification, measuring systems that can be connected

Parameters	Designation	Threshold	Min.	Type	Max.	Unit
Permissible signal level in bipolar mode (parameter p0405.1=1); (TTL, SSI, HTL bipolar at X23)[1)2)]	U_{diff}		2,0		Vcc	V
Permissible signal frequency	f_S		-		500	kHz
Required edge clearance	t_{min}		100		-	ns
Permissible zero pulse (with $T_s = 1/f_s$)	Length		¼ · T_s		¾ · T_s	
	Center of the pulse position		50	135	220	Degrees
Operating point in unipolar mode (parameter p0405.0=0) and signals AN_SSI_XDAT, BN, RN at X23 connected to M_Encoder	$U_{(Switch)}$	High (p0405.4=1)	8,4	10,6	13,1	V
		Low (p0405.4=0)	3,5	4,8	6,3	V
Operating points in unipolar mode (parameter p0405.0=0) and signals AN_SSI_XDAT, BN, RN not connected to X23	$U_{(Switch)}$	High (p0405.4=1)	9	11,3	13,8	V
		Low (p0405.4=0)	5,9	7,9	10,2	V

1) Other signal levels according to the RS422 specification.

2) The absolute level of the individual signals varies between 0 V and V_{CC} of the measuring system.

Note

We recommend that bipolar encoders are used.

When using unipolar encoders the unused negative track signals can either be left unconnected or connected to ground. This results in two different operating points.

NOTICE

Prefabricated cable for 5 V - TTL encoder

If a 5 V - TTL encoder (6FX encoder) is used, the connecting cable 6FX8002-2CR00-.... has to be used.

Table 6- 10 Maximum encoder cable length

Encoder type	Maximum encoder cable length in m
TTL[1)]	100
HTL unipolar[2)]	100
HTL bipolar	300

1) 100 m with remote sense

2) Because the physical transmission media is more robust, the bipolar connection should always be used. The unipolar connection should only be used if the encoder type does not output push-pull signals.

Connection example 1: HTL encoder, bipolar, with reference signal

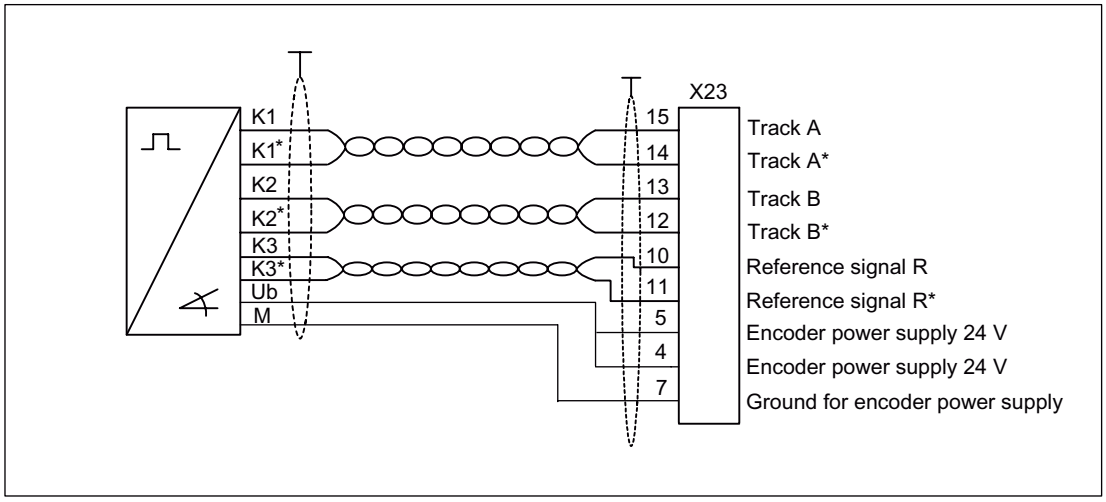


Figure 6-7 Connection example 1: HTL encoder, bipolar, with reference signal

Signal cables must be twisted in pairs in order to improve noise immunity against induced noise.

Connection example 2: HTL encoder, unipolar, with reference signal

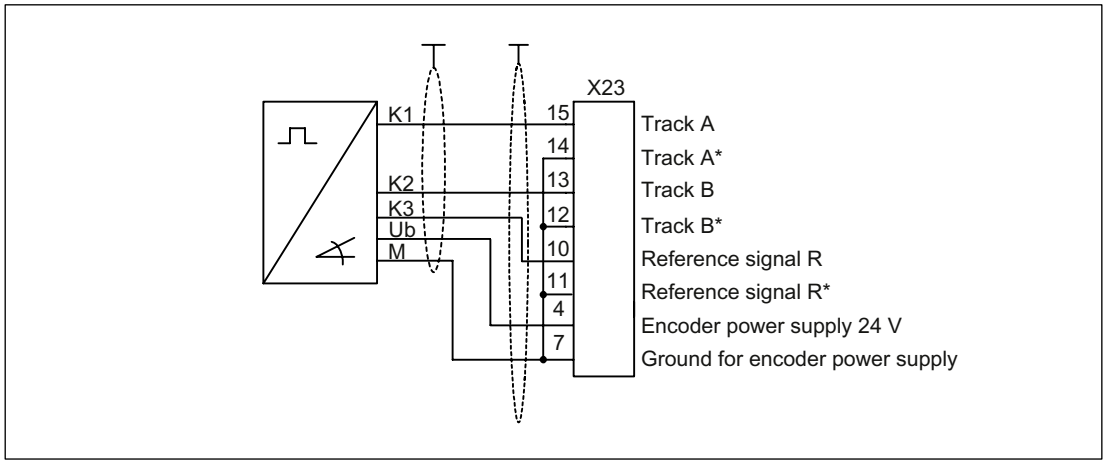
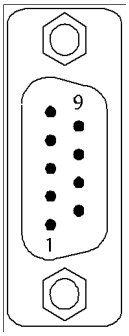


Figure 6-8 Connection example 2: HTL encoder, unipolar, with reference signal [1)]

[1)] Because the physical transmission media is more robust, the bipolar connection should always be used. The unipolar connection should only be used if the encoder type does not output push-pull signals.

6.3.4.8 X22 serial interface (RS232)

Table 6- 11 Serial interface (RS232)

	Pin	Designation	Technical data
	1	Reserved, do not use	
	2	RxD	Receive data
	3	TxD	Transmit data
	4	Reserved, do not use	
	5	Ground	Ground reference
	5	Reserved, do not use	
	6	Reserved, do not use	
	7	Reserved, do not use	
	8	Reserved, do not use	
	9	Reserved, do not use	
Type: 9-pin SUB D connector			

6.3.4.9 X520/521/522 measuring sockets

Table 6- 12 Measuring sockets X520, X521 and X522

Socket	Function	Technical specifications
T0	Measuring socket 0	Voltage: 0 V to 5 V Resolution: 8 bits Load current: max. 3 mA Continued-short-circuit-proof
T1	Measuring socket 1	
M	Ground for measuring sockets	
The measuring sockets are only suitable for bunch pin plugs with a diameter of 2 mm.		

Note

The test sockets are provided as a support to commissioning and diagnostics; they must not be connected for normal operation.

6.3.4.10 Memory card slot

The memory card is needed in the following cases:

1. Saving parameters
   Parameters are saved on the memory card and can simply be copied onto a new CU305 if it needs to be replaced.
2. Firmware update
   A firmware update is easy to carry out using a memory card.
3. License carrier
   The license is stored on the memory card.

The memory card is not required to use the CU305, it only needs to be inserted in the slot in the CU305 because the license is stored on it.

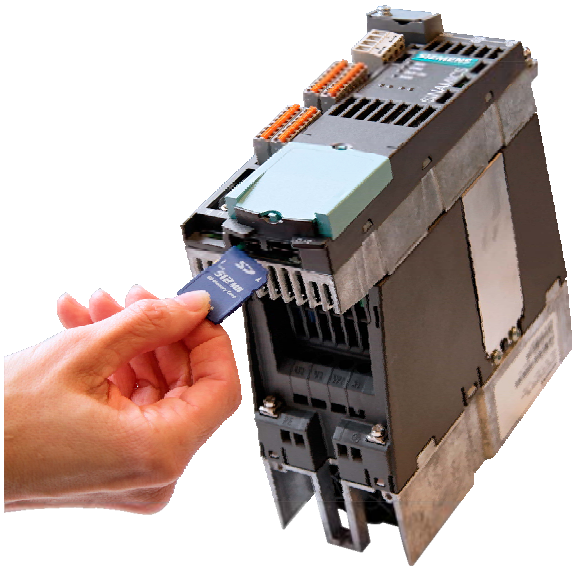


Figure 6-9 Memory card slot

CAUTION
The memory card may only be inserted as shown in the figure (arrow top right). The memory card should not be removed or inserted while data is being saved. When returning a defective Control Unit, remove the memory card and keep it for insertion in the replacement unit. This is important otherwise the data on the memory card (parameters, firmware, licenses, and so on) may be lost.

6.3.4.11 LEDs after the Control Unit CU305 has booted

Table 6- 13 Control Unit CU305 – description of the LEDs after booting

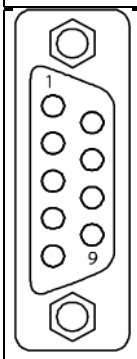
LED	Color	Status	Description, cause	Remedy
RDY (READY)	-	off	Electronics power supply is missing or outside permissible tolerance range.	-
	Green	Continuous	The component is ready and cyclic DRIVE-CLiQ communication takes place or the Control Unit waits for initial commissioning.	-
		Flashing 2 Hz	Writing to the memory card	-
	Red	Continuous	At least one fault is present in this component.	Remedy and acknowledge fault
		Flashing 2 Hz	Boot error	Replace Control Unit. Carry-out a POWER ON.
	Green/ Red	Flashing 0.5 Hz	Control Unit CU305 is ready for operation. However there are no software licenses.	Obtain licenses.
	Orange	Continuous	DRIVE-CLiQ communication is being established.	-
		Flashing 0.5 Hz	Updating the firmware of the DRIVE-CLiQ components.	-
		Flashing 2 Hz	Firmware update is complete for components. Wait for POWER ON for the components in question.	Turn POWER ON for the components in question
	Green/ orange or red/ orange	Flashing 1 Hz	Component detection via LED is activated (p0124[0]). **Note:** Both options depend on the LED status when component recognition is activated via p0124[0] = 1.	-
COM PROFIdrive cyclic operation/ CU305 DP	-	off	Cyclic communication has not (yet) taken place. **Note:** The PROFIdrive is ready to communicate when the Control Unit is ready to operate (see LED RDY).	-
	Green	Continuous	Cyclic communication is taking place.	-
		Flashing 0.5 Hz	Cyclic communication is not yet running fully. Possible reasons: • The controller is not transferring any setpoints. • During isochronous operation, no global control (GC) or a faulty global control (GC) is transferred by the Controller.	-
	Red	Continuous	Cyclic communication has been interrupted.	Remedy fault

LED	Color	Status	Description, cause	Remedy
	Orange	Flashing 2 Hz	Firmware CRC error.	Make sure that the memory card has been inserted properly. Replace the memory card. Replace Control Unit. Carry-out a POWER ON.
COM/ CU305 CAN	-	off	Cyclic communication has not (yet) taken place. **Note:** The CAN is ready to communicate when the Control Unit is ready to operate (see LED RDY).	-
	Green	Continuous	Cyclic communication is taking place.	-
		Flashing 0.5 Hz	Cyclic communication is not yet running fully. Possible reasons: • The controller is not transferring any setpoints. • During isochronous operation, no global control (GC) or a faulty global control (GC) is transferred by the Controller.	-
	Red	Continuous	Cyclic communication has been interrupted.	Remedy fault
	Orange	Flashing 2 Hz	Firmware CRC error.	Make sure that the memory card has been inserted properly. Replace the memory card. Replace Control Unit. Carry-out a POWER ON.
OUT>5 V	-	off	The voltage of the electronics power supply for the measuring system is 5 V.	-
	Orange	Continuous	The voltage of the electronics power supply for the measuring system is 24 V. **Important:** Make sure that the connected encoder can be operated with a 24 V power supply. If an encoder that is designed for a 5 V supply is operated with a 24 V supply, this can destroy the encoder electronics.	-
MOD	-	off	Reserved	-

6.3.5 Interface from CU305 DP

6.3.5.1 X126 PROFIBUS

Table 6- 14 PROFIBUS interface X126

	Terminal	Designation	Technical specifications
	1	Reserved, do not use	
	2	M	Ground to P24_SERV
	3	1RS_DP	RS-485 differential signal
	4	1RTS_DP	Request To Send
	5	1M	Ground to 1P5
	6	1P5	5 V power supply for bus terminal, external, short circuit-proof
	7	P24_SERV	24 V for teleservice, short circuit-proof, 150 mA max.
	8	1XRS_DP	RS-485 differential signal
	9	Reserved, do not use	

⚠ CAUTION

No CAN cables may be connected to the X126 interface. If CAN cables are connected, the CU305 DP and other CAN bus nodes could be seriously damaged.

6.3.5.2 PROFIBUS address switches

Table 6- 15 PROFIBUS address switches

Technical specifications	Switch	Significance
Significance: 2^0 2^1 2^2 2^3 2^4 2^5 2^6 1 2 4 8 16 32 64  ON / OFF S1 S2 S3 S4 S5 S6 S7 Example: 1 + 4 + 32 = 37 PROFIBUS address = 37	S1	$2^0 = 1$
	S2	$2^1 = 2$
	S3	$2^2 = 4$
	S4	$2^3 = 8$
	S5	$2^4 = 16$
	S6	$2^5 = 32$
	S7	$2^6 = 64$

Note

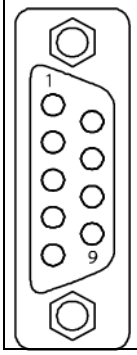
The factory setting for the DIP switch is 0 or 127. For the PROFIBUS, the bus address can be set with the parameter p0918 to values between 1 and 126. The address can also be set manually to values between 1 and 126 using the DIP switch. Then, using p0918, the address can only be read.

The address switch is behind the blanking plate. The blanking plate is part of the scope of supply.

6.3.6 Interface from CU305 CAN

6.3.6.1 X126 CAN interface

Table 6- 16 X126 CAN interface

	Terminal	Designation	Technical specifications
	1	Reserved, do not use	
	2	CAN_L	CAN signal
	3	CAN_GND	CAN ground
	4	Reserved, do not use	
	5	CAN_SHL	Optional shield
	6	CAN_GND	CAN ground
	7	CAN_H	CAN signal
	8	Reserved, do not use	
	9	Reserved, do not use	

⚠ CAUTION

If the CAN interface is connected to the PROFIBUS connector, then this can destroy the CAN interface.

6.3.6.2 S100 DIP switch

Table 6- 17 DIP switch

Switch	Function	Switch setting		Default
2	Bus terminating resistor 120 Ohm	Off	Inactive	Off
		On	Active	
1	Ungrounded, grounded operation	Off	Ground-free operation	Off
		On	Operation with ground	

6.4 Dimension drawing

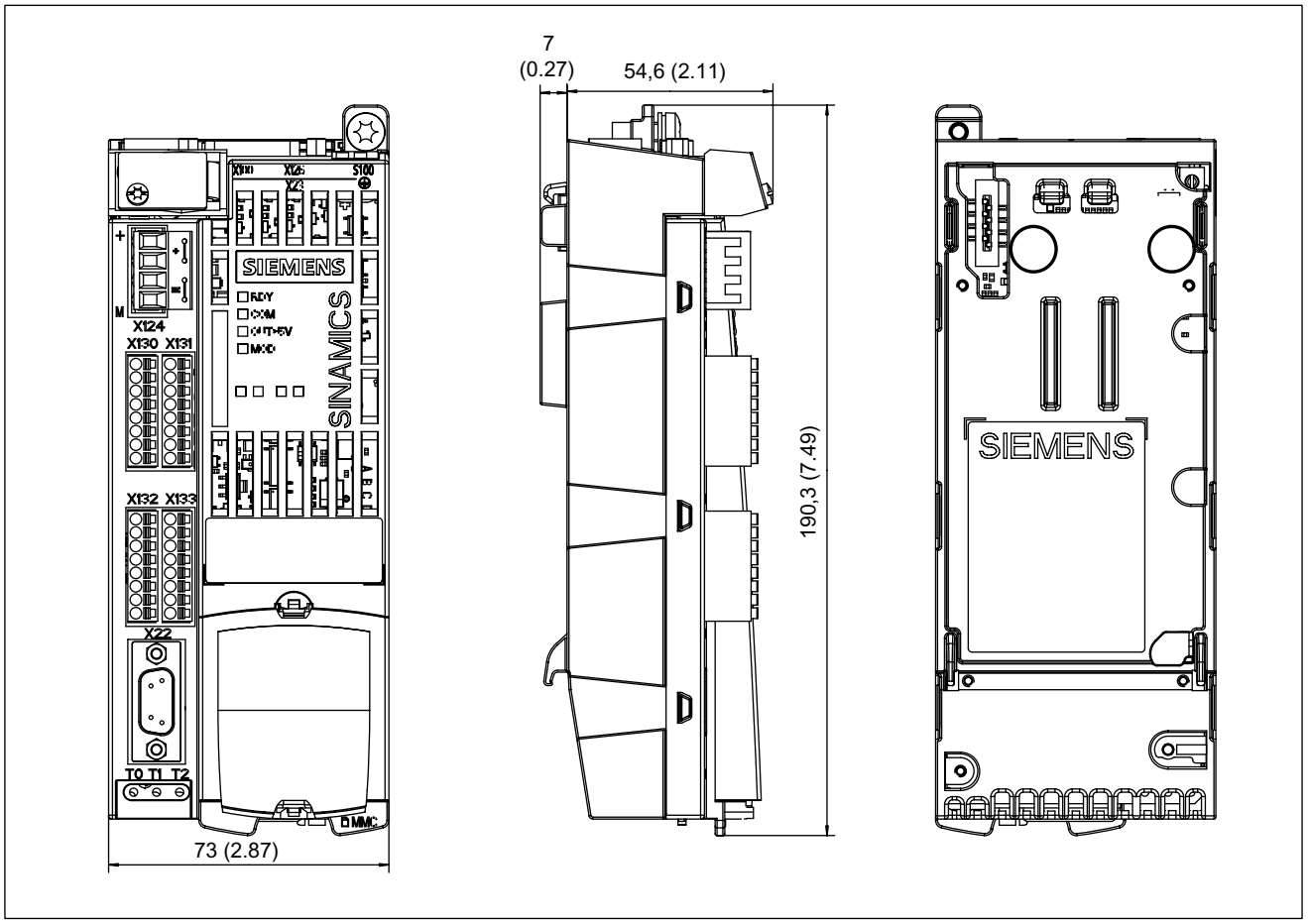
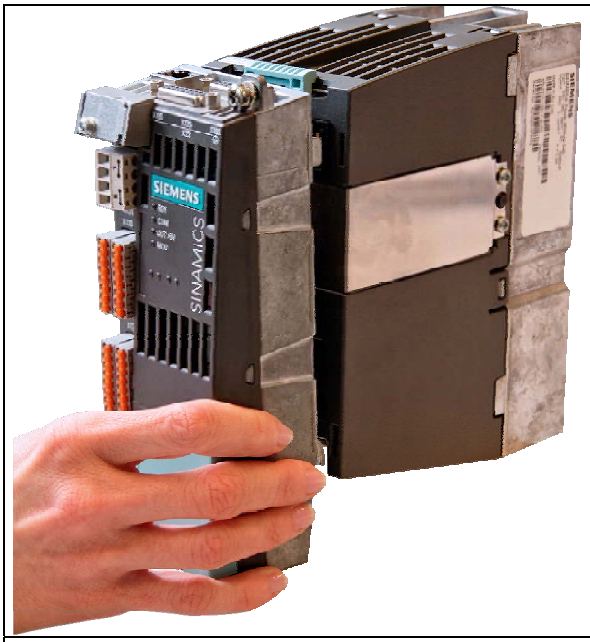
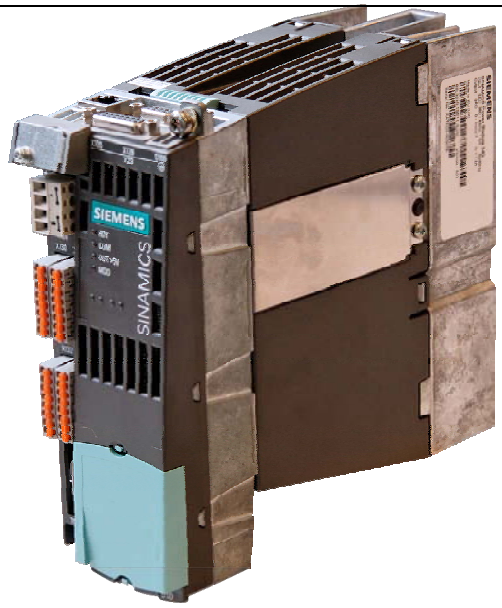


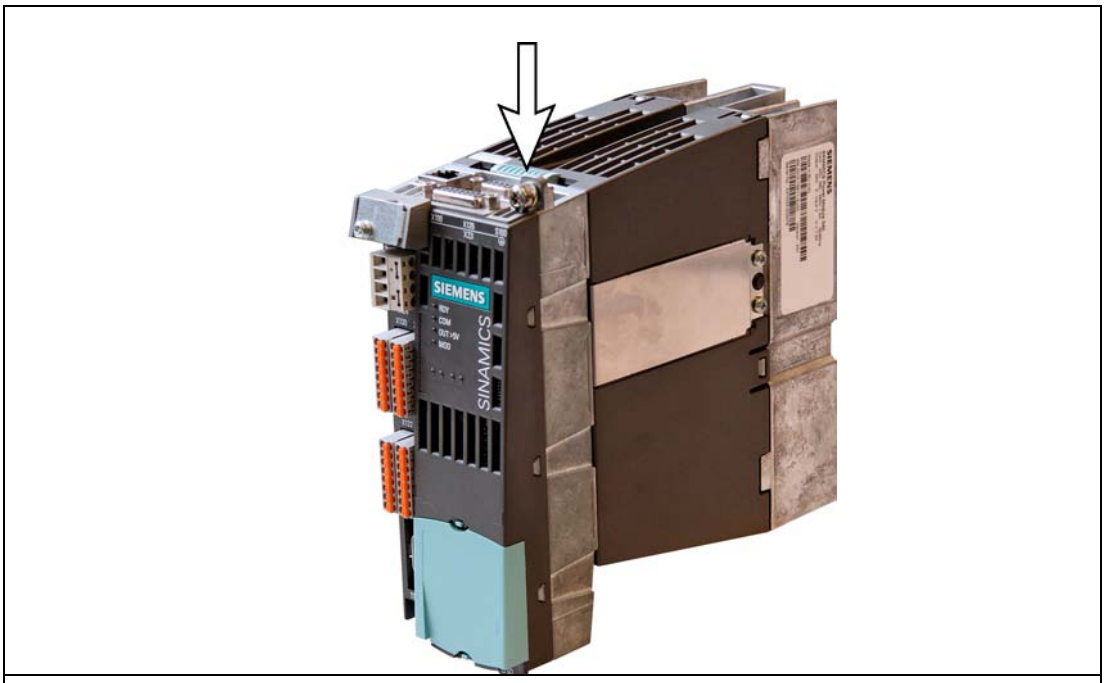
Figure 6-10 Dimension drawing: Control Unit CU305 DP and CU305 CAN

6.5 Mounting

	
Snap-mounting the CU305 onto the Power Module PM340 (frame size FSA)	Power Module PM340 (frame size FSA) with CU305

The procedure when mounting the Control Unit on the Power Module is independent of the frame size of the Power Modules.

Removing the Control Unit



Removing the CU305 from the Power Module PM340 (frame size FSA)

In order to remove the Control Unit from the Power Module, the blue release lever, as shown in the diagram, must be pressed downwards and the Control Unit swung out to the front.

6.6 Technical data

Table 6- 18 Technical data of the CU305 DP and CU305 CAN

	Unit	Value
Electronics power supply		
Voltage	V_{DC}	24 (20,4 – 28,8)
Current consumption (without DRIVE-CLiQ and digital outputs)	A_{DC}	0,8
Power loss	W	<20
Measuring system power supply		
Voltage	V_{DC}	TTL: 5 V (with or without Remote Sense) HTL: V_{DC} - 1 V
Current	A_{DC}	0.35
PE/ground connection	On housing with M4/3 Nm screw	
Response time	The response time of digital inputs/outputs depends on the evaluation (refer to the function diagram). **References:** /LH1/ SINAMICS S List Manual, Chapter "Function diagrams".	
Weight	kg	0,95

Supplementary system components and encoder system integration

7

7.1 Basic Operator Panel BOP20

7.1.1 Description

The Basic Operator Panel BOP20 contains six keys and a backlit display unit. The BOP20 can be plugged onto the SINAMICS Control Unit and operated. Operation is only possible from SINAMICS V2.4 onwards.

The following functions are possible with the BOP:

- Input of parameters and activation of functions
- Display of operating modes, parameters, alarms and faults

7.1.2 Interface description

Figure 7-1 Basic Operator Panel BOP20

Overview of displays and keys

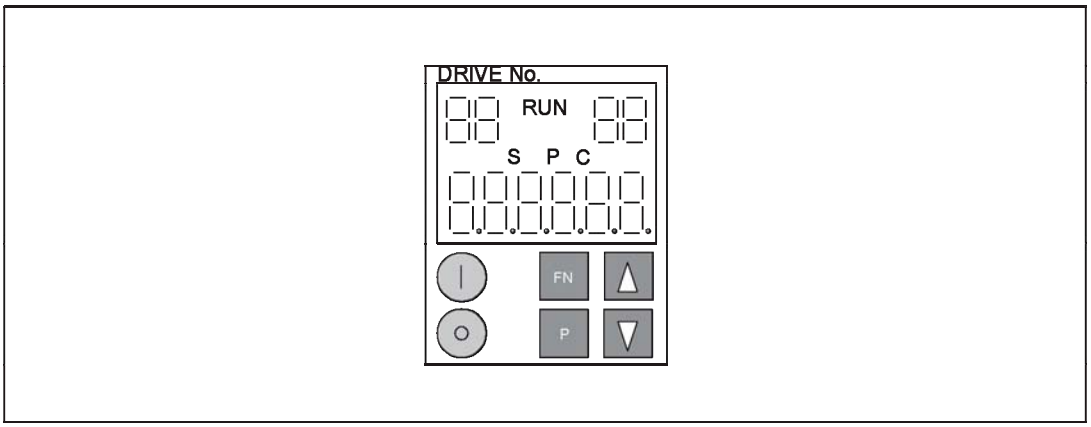


Figure 7-2 Overview of displays and keys

Table 7- 1 Displays

Display	Meaning
top left 2 positions	The active drive object of the BOP is displayed here. The displays and key operations always refer to this drive object.
RUN	Is lit (bright) if the displayed drive is in the RUN state (in operation).
top right 2 positions	The following is displayed in this field: • More than 6 digits: Characters that are present but cannot be seen (e.g. "r2" —> 2 characters to the right are invisible, "L1" —> 1 character to the left is invisible) • Faults: Selects/displays other drives with faults • Designation of BICO inputs (bi, ci) • Designation of BICO outputs (bo, co) Source object of a BICO interconnection to a drive object different than the active one.
S	Is (bright) if at least one parameter was changed and the value was not transferred into the non-volatile memory.
P	Is lit (bright) if, for a parameter, the value only becomes effective after pressing the P key.
C	Is light (bright) if at least one parameter was changed and the calculation for consistent data management has still not been initiated.
Below, 6 position	Displays, e.g. parameters, indices, faults and alarms.

BOP20 keyboard

Table 7- 2 Assignment of the BOP20 keyboard

Key	Name	Meaning
	ON	Powering-up the drives for which the command "ON/OFF1", "OFF2" or "OFF3" should come from the BOP.
	OFF	Powering-down the drives for which the commands "ON/OFF1", "OFF2" or "OFF3" should come from the BOP.
		Note: The effectiveness of these keys can be defined using the appropriate BICO parameterization (e.g. using these keys, it is possible to simultaneously control all of the axes that have been configured). The structure of the BOP control word corresponds to the structure of the PROFIBUS control word.
	Functions	The significance of these keys depends on the actual display. **Note:** The effectiveness of this key to acknowledge faults can be defined using the appropriate BiCo parameterization.
	Parameter	The significance of these keys depends on the actual display.
	Raise	The keys are dependent on the actual display and are used to raise or lower values.
	Lower	

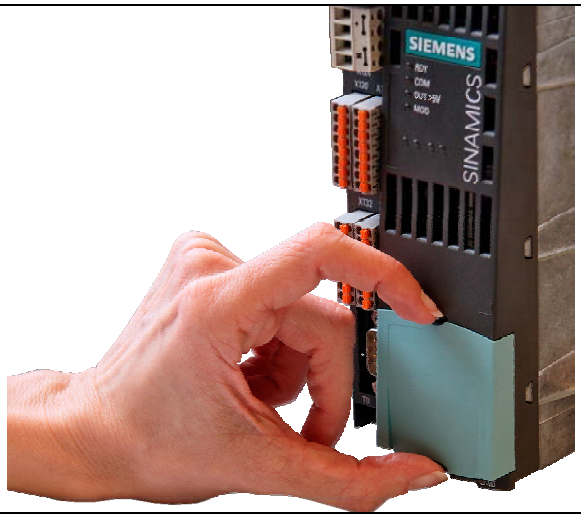
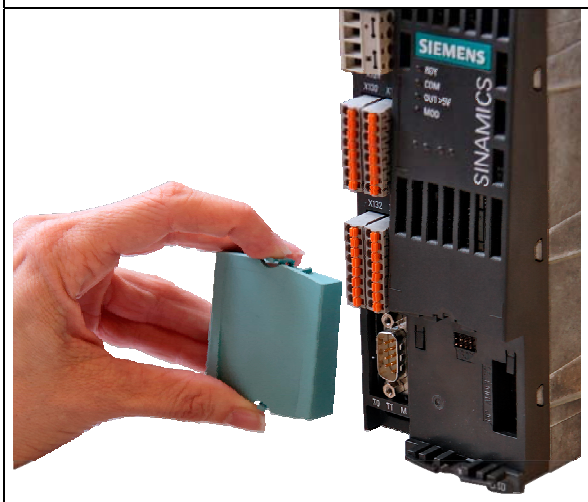
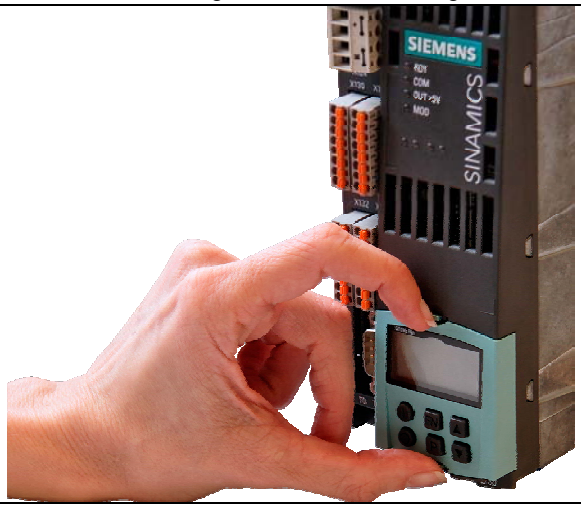
Displays and operating the BOP20

Information about the displays and using the BOP20 is provided in the following reference:

Reference: /IH1/ SINAMICS S120 Commissioning Manual

7.1.3 Installation

Table 7- 3 Mounting

	
1. BOP20 and Control Unit CU305	2. Press the latching cams of the cover together
	
3. Remove the cover	4. Locate the BOP20

7.2 Sensor Module Cabinet-Mounted SMC10

7.2.1 Description

The Sensor Module Cabinet-Mounted SMC10 evaluates encoder signals and transmits the speed, actual position value, rotor position and, if necessary, the motor temperature via DRIVE-CLiQ to the Control Unit.

The SMC10 is used to evaluate sensor signals from resolvers.

7.2.2 Safety Information

⚠ WARNING

The 50 mm clearances above and below the components must be observed.

NOTICE

Only one encoder system may be connected per Sensor Module.

Note

There must be no electrical connection between the encoder system housing and the encoder system electronics (this requirement is fulfilled for most encoder systems). If this is not carefully observed, under certain circumstances the system will not be able to reach the required noise immunity (there is then a danger of equalization currents flowing through the electronic ground).

⚠ CAUTION

Connecting cables to temperature sensors must always be installed with shielding. The cable shield must be connected to the chassis potential at both ends over a large surface area. Temperature sensor cables that are routed together with the motor cable must be twisted in pairs and shielded separately.

7.2.3 Interface description

7.2.3.1 Overview

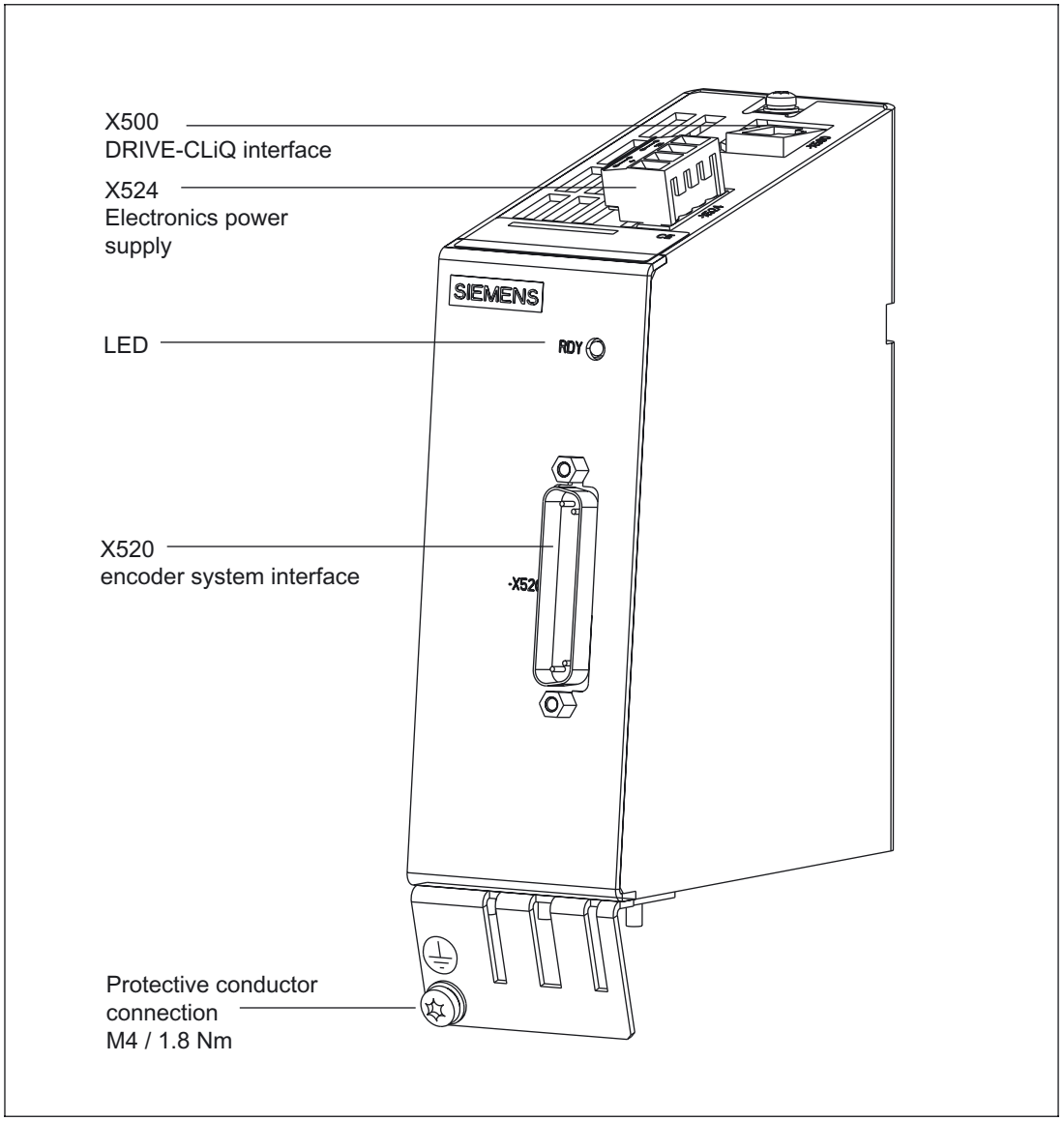
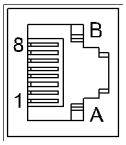


Figure 7-3 Interface description of the SMC10

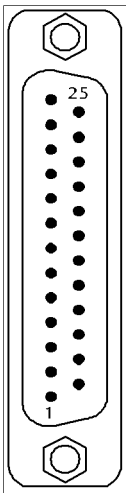
7.2.3.2 DRIVE-CLiQ interface X500

Table 7- 4 DRIVE-CLiQ interface X500

	Pin	Signal name	Technical specifications
	1	TXP	Transmit data +
	2	TXN	Transmit data -
	3	RXP	Receive data +
	4	Reserved, do not use	
	5	Reserved, do not use	
	6	RXN	Receive data -
	7	Reserved, do not use	
	8	Reserved, do not use	
	A	Reserved, do not use	
	B	GND (0 V)	Electronics ground

7.2.3.3 X520 encoder system interface

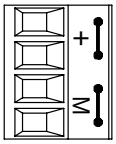
Table 7- 5 X520 encoder system interface

	Pin	Signal name	Technical specifications
	1	Reserved, do not use	
	2	Reserved, do not use	
	3	S2	Resolver signal A (sin+)
	4	S4	Inverse resolver signal A (sin-)
	5	Ground	Ground (for internal shield)
	6	S1	Resolver signal B (cos+)
	7	S3	Inverse resolver signal B (cos-)
	8	Ground	Ground (for internal shield)
	9	R1	Resolver excitation positive
	10	Reserved, do not use	
	11	R2	Resolver excitation negative
	12	Reserved, do not use	
	13	+ Temp	Motor temperature measurement KTY84-1C130 (KTY+) Temperature sensor KTY84-1C130 / PTC
	14	Reserved, do not use	
	15	Reserved, do not use	
	16	Reserved, do not use	
	17	Reserved, do not use	
	18	Reserved, do not use	
	19	Reserved, do not use	
	20	Reserved, do not use	
	21	Reserved, do not use	
	22	Reserved, do not use	

	Pin	Signal name	Technical specifications
	23	Reserved, do not use	
	24	Ground	Ground (for internal shield)
	25	- Temp	Motor temperature measurement KTY84-1C130 (KTY-) Temperature sensor KTY84-1C130 / PTC

7.2.3.4 Electronics power supply X524

Table 7- 6 Terminal block X524

	Terminal	Function	Technical specifications
	+	Electronics power supply	Voltage: 24 V (20.4 V – 28.8 V) Current consumption: max. 0,35 A Maximum current via jumper in connector: 20 A at 55°C
	+	Electronics power supply	
	M	Electronic ground	
	M	Electronic ground	
Max. connectable cross-section: 2.5 mm² Type: Screw terminal 2 (see Appendix)			

Note

The two “+” and “M” terminals are jumpered in the connector. This ensures the supply voltage is looped through.

7.2.3.5 Significance of LEDs on the Sensor Module Cabinet-Mounted SMC10

Table 7- 7 Sensor Module Cabinet-Mounted SMC10 – description of the LEDs

LED	Color	State	Description, cause	Remedy
RDY READY	-	Off	Electronics power supply is missing or outside permissible tolerance range.	–
	Green	Continuous light	The component is ready for operation and cyclic DRIVE-CLiQ communication is taking place.	–
	Orange	Continuous light	DRIVE-CLiQ communication is being established.	–
	Red	Continuous light	At least one fault is present in this component. **Note:** The LED is activated regardless of whether the corresponding messages have been reconfigured.	Remedy and acknowledge fault
	Green/red	Flashing, 0.5 Hz	Firmware is being downloaded.	–
		Flashing, 2 Hz	Firmware download is complete. Wait for POWER ON	Carry out a POWER ON
	Green/orange or Red/orange	Flashing	Component recognition via LED is activated (p0144). **Note:** Both options depend on the LED status when component recognition is activated via p0144 = 1.	–

Cause and rectification of faults

The following reference contains further information about the cause and rectification of faults:

References: /IH1/ SINAMICS S, Commissioning Manual

7.2.4 Dimension drawing

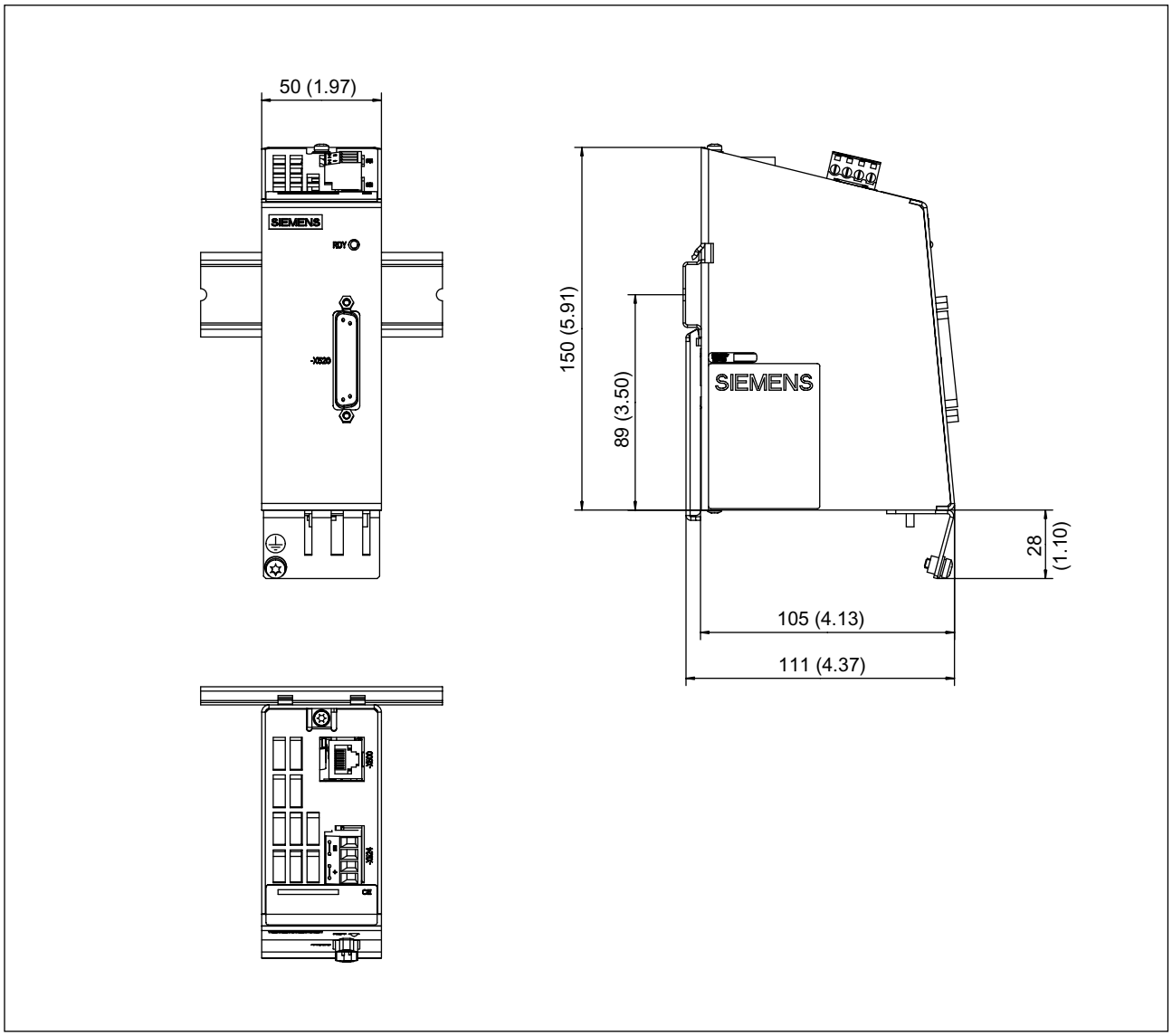


Figure 7-4 Dimension drawing of the SMC10

7.2.5 Installation

Installation

1. Place the component on the DIN rail.
2. Snap the component on to the DIN rail. Make sure that the mounting slides at the rear latch into place.
3. You can now move the component on the DIN rail to the left or to the right to its final position.

Removal

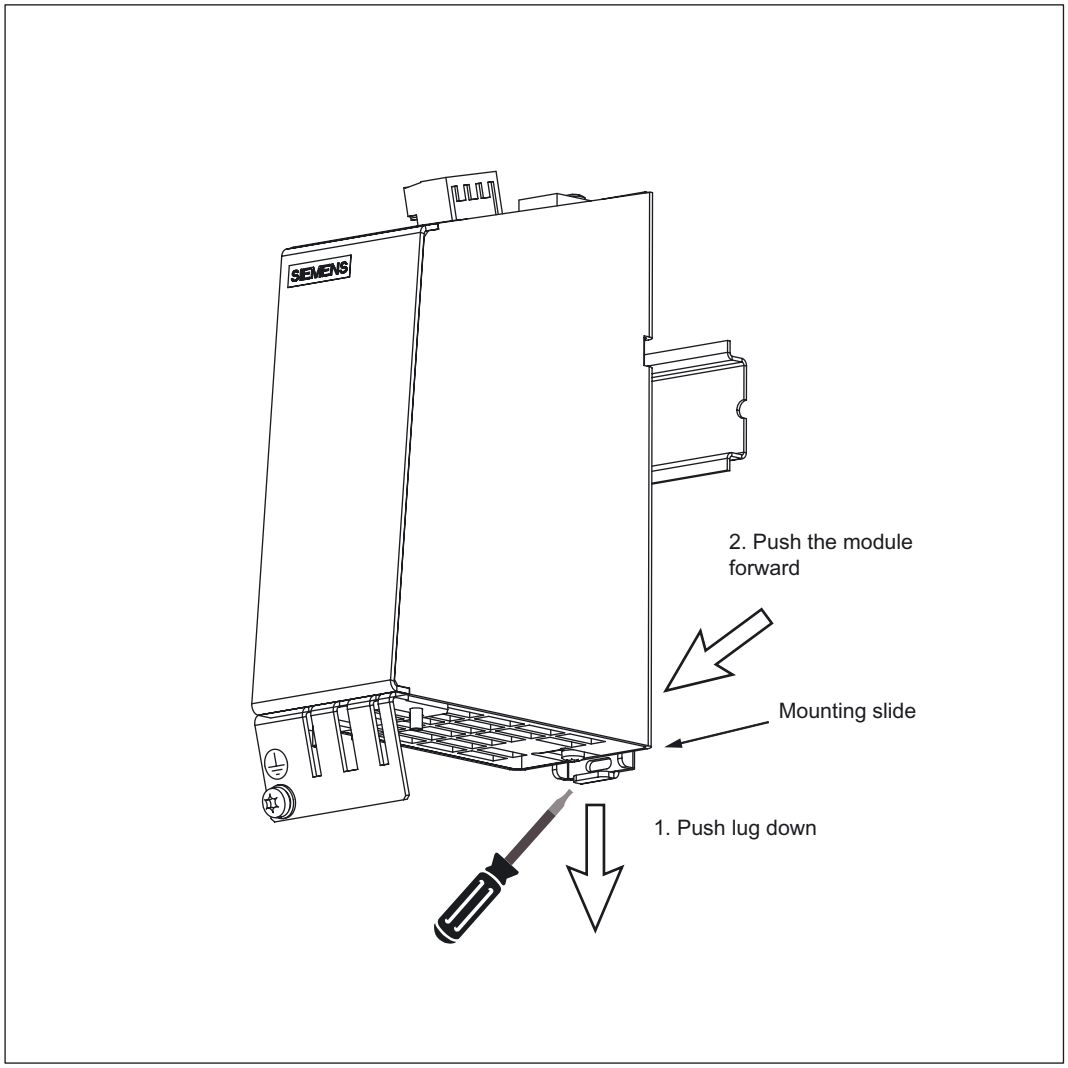


Figure 7-5 Releasing the component from a DIN rail

7.2.6 Technical data

Table 7- 8 Technical data

Sensor Module Cabinet-Mounted SMC10 6SL3055-0AA00-5AAx	**Designation**	**Unit**	**Value**
Electronics power supply Voltage Current (without encoder system) Current (with encoder system) Power loss	 V_{DC} A_{DC} A_{DC} W	 V A A W	 24 DC (20.4 – 28.8) ≤ 0.20 ≤ 0.35 ≤ 10
Specification Transmission ratio (ü) of the resolver Excitation voltage on the SMC10 when ü=0.5 Amplitude monitoring threshold (secondary tracks) of the SMC10	 ü = V_{rms} V_{rms}	 V V	 0,5 4,1 1
Excitation voltage (cannot be parameterized)	V_{rms}	V	4,1
Excitation frequency (synchronized to the current controller clock cycle)		kHz	5 to 10
PE/ground connection		On housing with M4 / 1.8 Nm screw	
Max. encoder cable length		m	130
Weight		kg	0,8
Degree of protection		IP20 or IPXXB	

Table 7- 9 Max. frequency that can be evaluated (speed)

Resolver		**Max. speed resolver / motor**		
Number of poles	**Number of pole pairs**	**8kHz/125 µsec**	**4kHz/250 µsec**	**2kHz/500 µsec**
2-pole	1	120,000 rpm	60,000 rpm	30,000 rpm
4-pole	2	60,000 rpm	30,000 rpm	15,000 rpm
6-pole	3	40,000 rpm	20,000 rpm	10,000 rpm
8-pole	4	30,000 rpm	15,000 rpm	7,500 rpm

The ratio between the ohmic resistance R and the inductance L (the primary winding of the resolver) determines whether the resolver can be evaluated with the SMC10. See the following diagram:

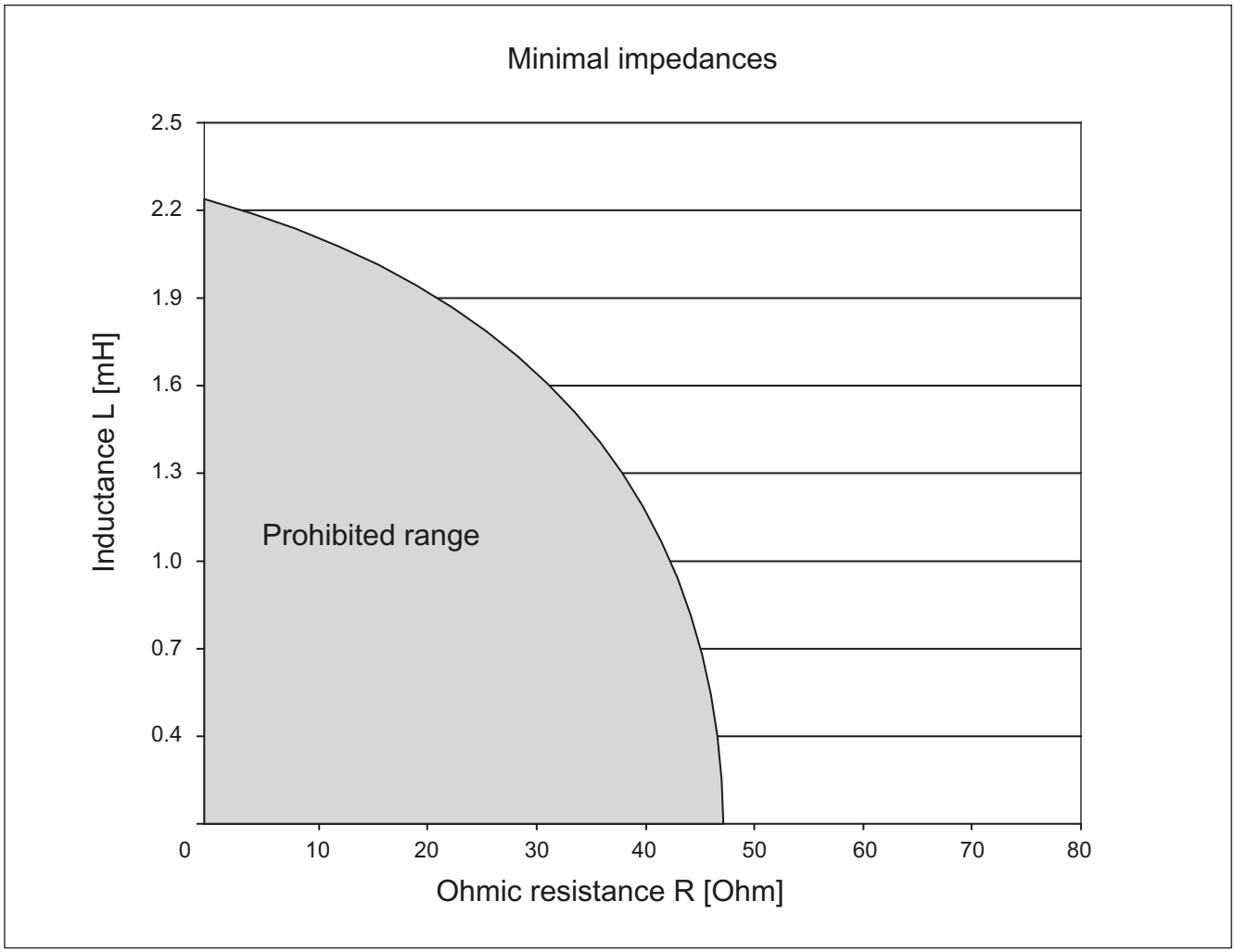


Figure 7-6 Connectable impedances with an excitation frequency f = 5000 Hz

7.3 Sensor Module Cabinet-Mounted SMC20

7.3.1 Description

The Sensor Module Cabinet-Mounted SMC20 evaluates encoder signals and transmits the speed, actual position value, rotor position and, if necessary, the motor temperature and reference point via DRIVE-CLiQ to the Control Unit.

The SMC20 is used to evaluate encoder signals from incremental encoders with SIN/COS (1 Vpp) or absolute encoders with EnDat 2.1 or SSI.

7.3.2 Safety information

⚠ WARNING

The 50 mm clearances above and below the components must be observed.

NOTICE

Only one encoder system may be connected per Sensor Module.

Note

There must be no electrical connection between the encoder system housing and the encoder system electronics (this requirement is fulfilled for most encoder systems). If this is not carefully observed, under certain circumstances the system will not be able to reach the required noise immunity (there is then a danger of equalization currents flowing through the electronic ground).

⚠ CAUTION

Connecting cables to temperature sensors must always be installed with shielding. The cable shield must be connected to the chassis potential at both ends over a large surface area. Temperature sensor cables that are routed together with the motor cable must be twisted in pairs and shielded separately.

7.3.3 Interface description

7.3.3.1 Overview

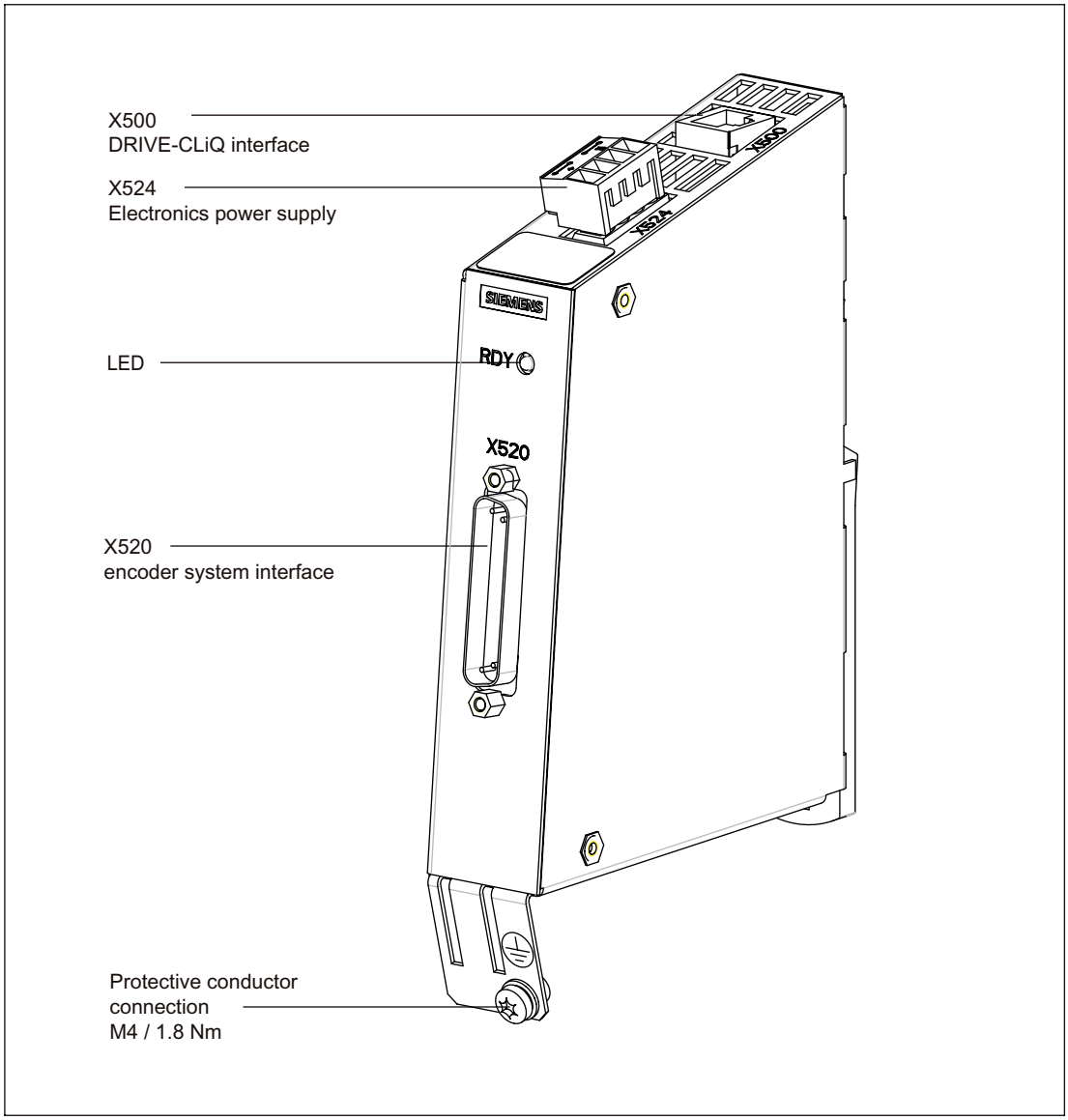


Figure 7-7 Interface description SMC20, 30 mm wide, order number: 6SL3055-0AA00-5BA2

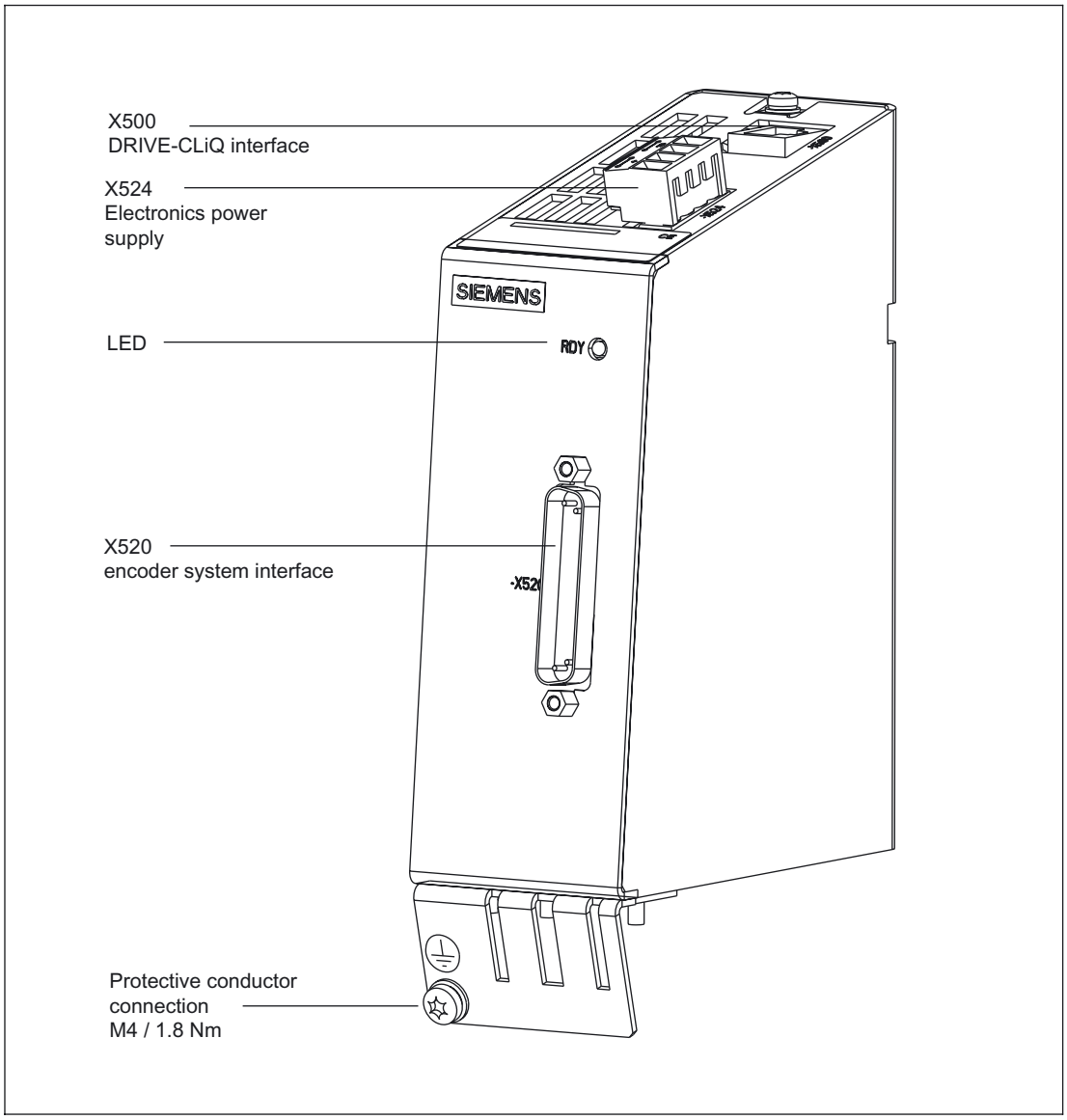
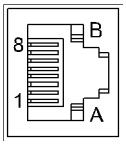


Figure 7-8 Interface description SMC20, 50 mm wide, order number: 6SL3055-0AA00-5BA1

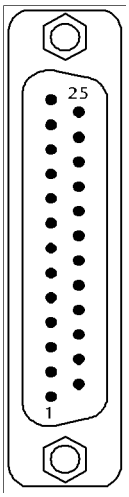
7.3.3.2 DRIVE-CLiQ interface X500

Table 7- 10 DRIVE-CLiQ interface X500

	Pin	Signal name	Technical specifications
	1	TXP	Transmit data +
	2	TXN	Transmit data -
	3	RXP	Receive data +
	4	Reserved, do not use	
	5	Reserved, do not use	
	6	RXN	Receive data -
	7	Reserved, do not use	
	8	Reserved, do not use	
	A	Reserved, do not use	
	B	GND (0 V)	Electronics ground

7.3.3.3 X520 sensor system

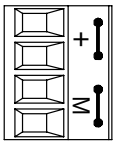
Table 7- 11 X520 encoder system interface

	Pin	Signal name	Technical specifications
	1	P encoder	Encoder power supply
	2	M encoder	Ground for encoder power supply
	3	A	Incremental signal A
	4	A*	Inverse incremental signal A
	5	Ground	Ground (for internal shield)
	6	B	Incremental signal B
	7	B*	Inverse incremental signal B
	8	Ground	Ground (for internal shield)
	9	Reserved, do not use	
	10	Clock	Clock, EnDat interface, SSI clock
	11	Reserved, do not use	
	12	Clock*	Inverted clock, EnDat interface, inverted SSI clock
	13	+ Temp	Motor temperature measurement KTY84-1C130 (KTY+) Temperature sensor KTY84-1C130 / PTC
	14	P sense	Sense input encoder power supply
	15	Data	Data, EnDat interface, SSI data
	16	M sense	Ground sense input encoder power supply
	17	R	Reference signal R
	18	R*	Inverse reference signal R
	19	C	Absolute track signal C
	20	C*	Inverted absolute track signal C

	Pin	Signal name	Technical specifications
	21	D	Absolute track signal D
	22	D*	Inverse absolute track signal D
	23	Data*	Inverse data, EnDat interface, Inverse SSI data
	24	Ground	Ground (for internal shield)
	25	- Temp	Motor temperature measurement KTY84-1C130 (KTY-) Temperature sensor KTY84-1C130 / PTC

7.3.3.4 Electronics power supply X524

Table 7- 12 Terminal block X524

	Terminal	Function	Technical specifications
	+	Electronics power supply	Voltage: 24 V (20.4 V – 28.8 V) Current consumption: max. 0,35 A Maximum current via jumper in connector: 20 A at 55°C
	+	Electronics power supply	
	M	Electronic ground	
	M	Electronic ground	
Max. connectable cross-section: 2.5 mm² Type: Screw terminal 2 (see Appendix A)			

Note

The two “+” and “M” terminals are jumpered in the connector. This ensures the supply voltage is looped through.

7.3.3.5 Significance of LEDs on the Sensor Module Cabinet-Mounted SMC20

Table 7- 13 Sensor Module Cabinet-Mounted SMC20 – description of the LEDs

LED	Color	State	Description, cause	Remedy
RDY READY	-	Off	Electronics power supply is missing or outside permissible tolerance range.	–
	Green	Continuous light	The component is ready for operation and cyclic DRIVE-CLiQ communication is taking place.	–
	Orange	Continuous light	DRIVE-CLiQ communication is being established.	–
	Red	Continuous light	At least one fault is present in this component. **Note:** The LED is activated regardless of whether the corresponding messages have been reconfigured.	Remedy and acknowledge fault
	Green/red	Flashing, 0.5 Hz	Firmware is being downloaded.	–
		Flashing, 2 Hz	Firmware download is complete. Wait for POWER ON	Carry out a POWER ON
	Green/orange or Red/orange	Flashing	Component recognition via LED is activated (p0144). **Note:** Both options depend on the LED status when component recognition is activated via p0144 = 1.	–

Cause and rectification of faults

The following reference contains further information about the cause and rectification of faults:

References: /IH1/ SINAMICS S, Commissioning Manual

7.3.4 Dimension drawing

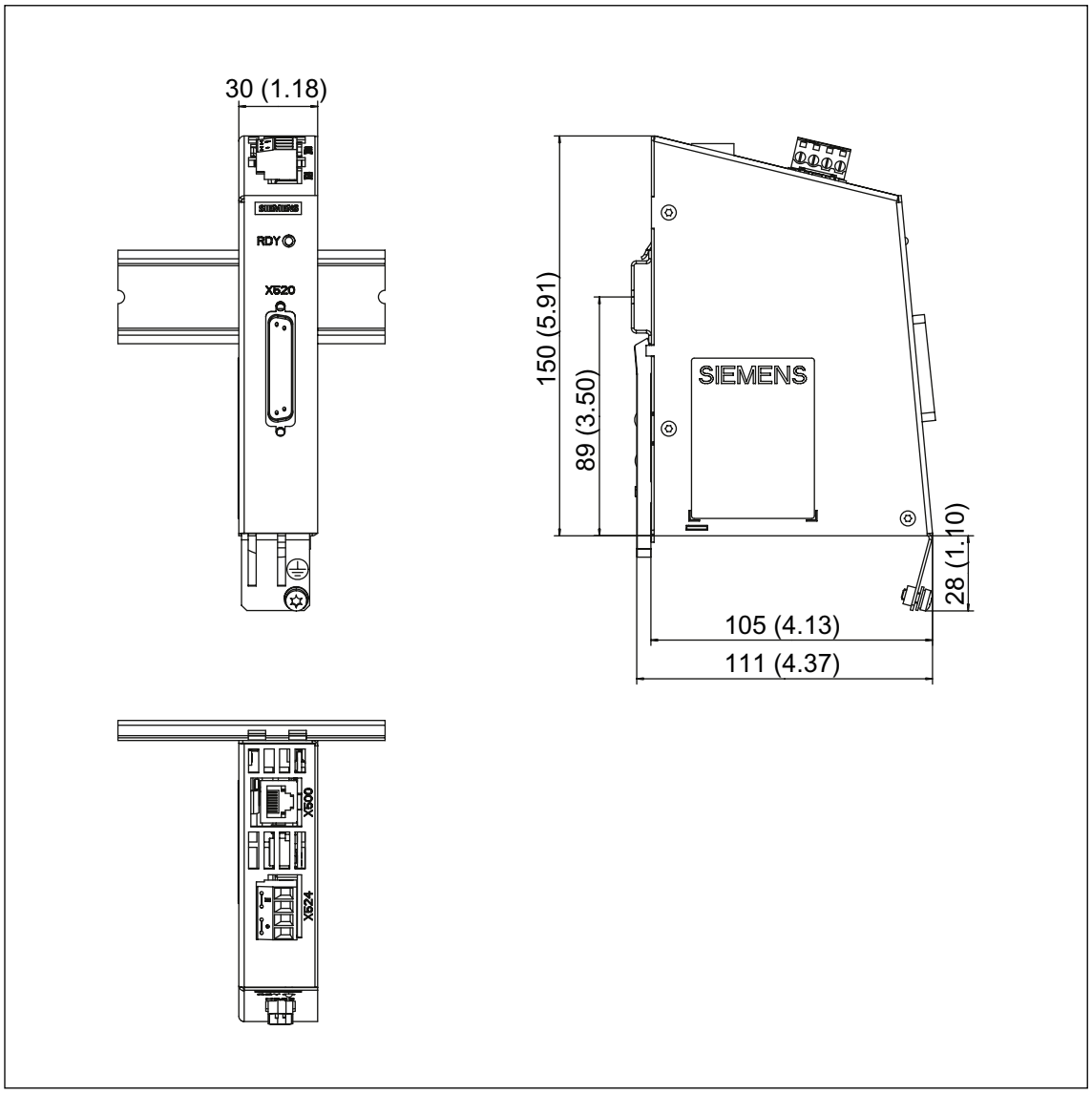


Figure 7-9 Interface description SMC20, 30 mm wide, order number: 6SL3055-0AA00-5BA2

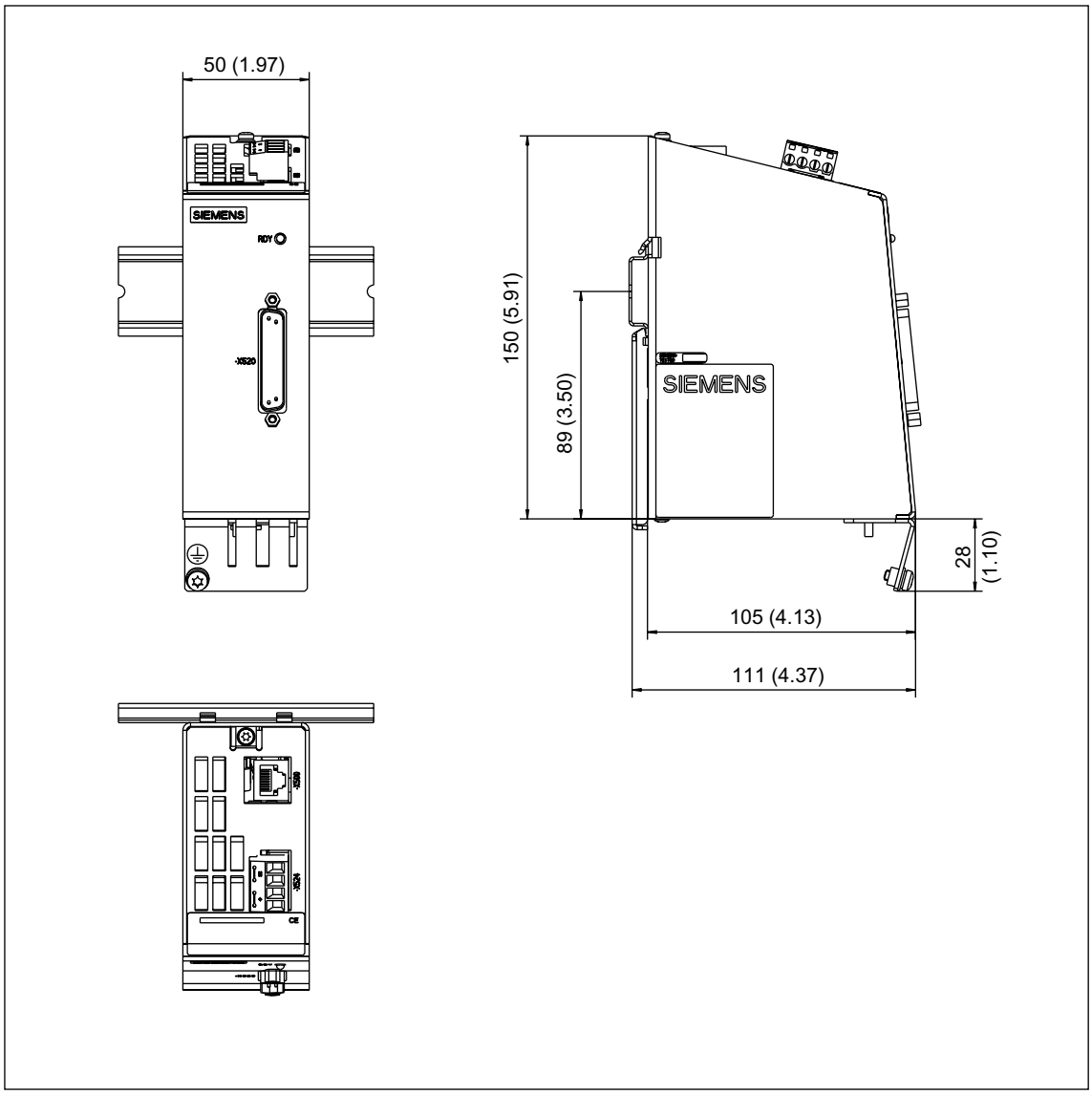


Figure 7-10 Interface description SMC20, 50 mm wide, order number: 6SL3055-0AA00-5BA1

7.3.5 Mounting

Mounting

1. Place the component on the DIN rail.
2. Snap the component on to the DIN rail. Make sure that the mounting slides at the rear latch into place.
3. You can now move the component on the DIN rail to the left or to the right to its final position.

Removal

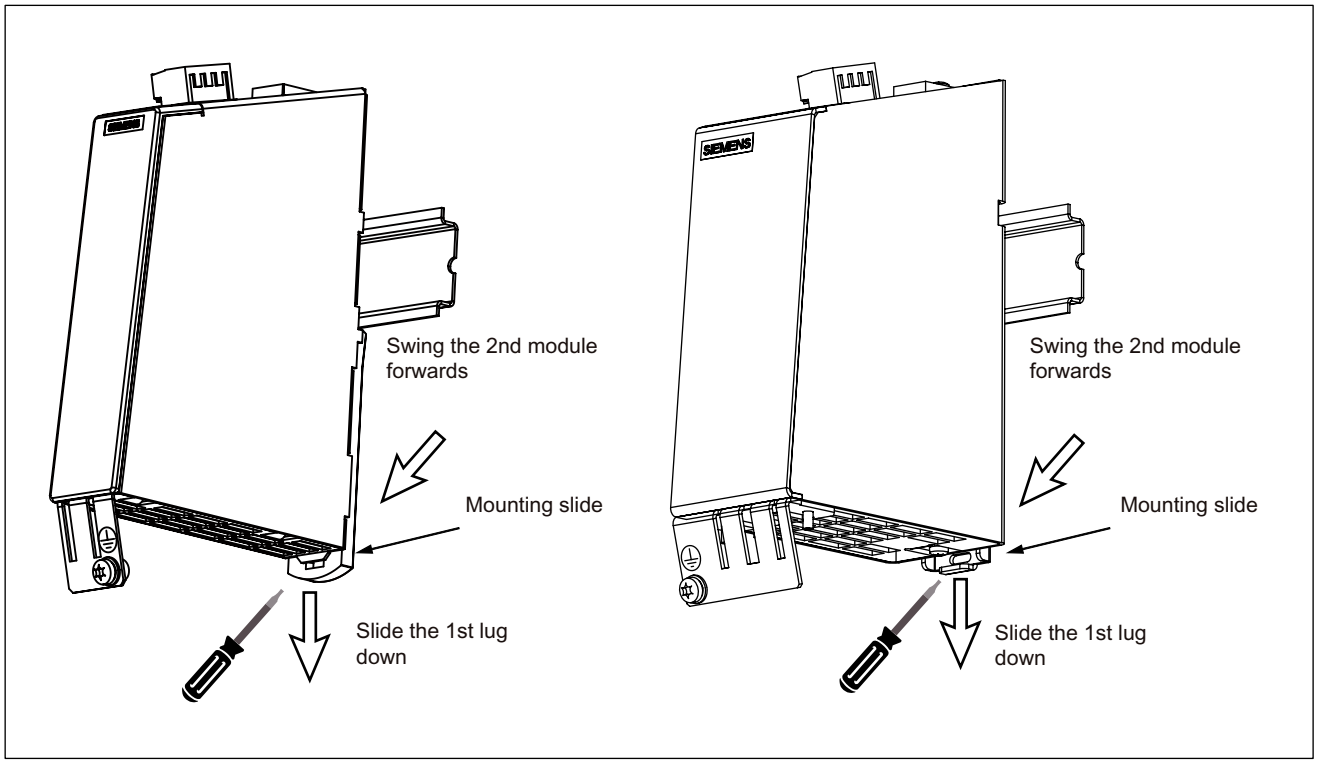


Figure 7-11 Disassembly of a DIN rail with a 30mm wide component (left) and with a 50mm wide component (right).

7.3.6 Technical Specifications

Table 7- 14 Technical data

Sensor Module Cabinet-Mounted SMC20 6SL3055-0AA00-5BAx	**Designation**	**Unit**	**Value**
Electronics power supply Voltage Current (without encoder system) Current (with encoder system) Power loss	 V_{DC} A_{DC} A_{DC} W	 V A A W	 24 DC (20.4 – 28.8) ≤ 0.20 ≤ 0.35 ≤ 10
Encoder system power supply Voltage Current	 $V_{encoder}$ $A_{encoder}$	 V A	 5 V DC (with Remote Sense) 1) 0.35
Encoder frequency that can be evaluated	$f_{encoder}$	kHz	≤ 500
SSI baud rate 2)		kHz	100
Max. encoder cable length		m	100
PE/ground connection		On housing with M4 / 1.8 Nm screw	
Weight		kg	0.45 (Order no.: 6SL3055-0AA00-5BA2) 0.8 (Order no.: 6SL3055-0AA00-5BA1)
Degree of protection		IP20 or IPXXB	

1) A controller compares the encoder system supply voltage - sensed via the remote sense cables - with the reference supply voltage of the encoder system, and adjusts the supply voltage for the encoder system at the output of the drive module until the required supply voltage is obtained directly at the encoder system (only for 5 V encoder system power supply). A controller compares the encoder system supply voltage - sensed via the remote sense cables - with the reference supply voltage of the encoder system, and adjusts the supply voltage for the encoder system at the output of the drive module until the required supply voltage is obtained directly at the encoder system (only for 5 V encoder system power supply).

2) only possible for SSI encoders with 5 V supply.

7.4 Sensor Module Cabinet-Mounted SMC30

7.4.1 Description

The Sensor Module Cabinet-Mounted SMC30 evaluates encoder signals and transmits the speed, actual position value and, if necessary, the motor temperature and reference point via DRIVE-CLiQ to the Control Unit.

The SMC30 is used to evaluate sensor signals from encoders with TTL, HTL or SSI[1)] interfaces.

A combination of TTL/HTL signal and SSI absolute signal is possible at terminals X521/X531, if both signals are derived from the same measured variable.

7.4.2 Safety information

⚠ WARNING

The 50 mm clearances above and below the components must be observed.

NOTICE

Only one encoder system may be connected per Sensor Module.

Note

There must be no electrical connection between the encoder system housing and the encoder system electronics (this requirement is fulfilled for most encoder systems). If this is not carefully observed, under certain circumstances the system will not be able to reach the required noise immunity (there is then a danger of equalization currents flowing through the electronic ground).

CAUTION

When the encoder system is connected via terminals, make sure that the cable shield is connected to the component.

⚠ CAUTION

Connecting cables to temperature sensors must always be installed with shielding. The cable shield must be connected to the chassis potential at both ends over a large surface area. Temperature sensor cables that are routed together with the motor cable must be twisted in pairs and shielded separately.

7.4.3 Interface description

7.4.3.1 Overview

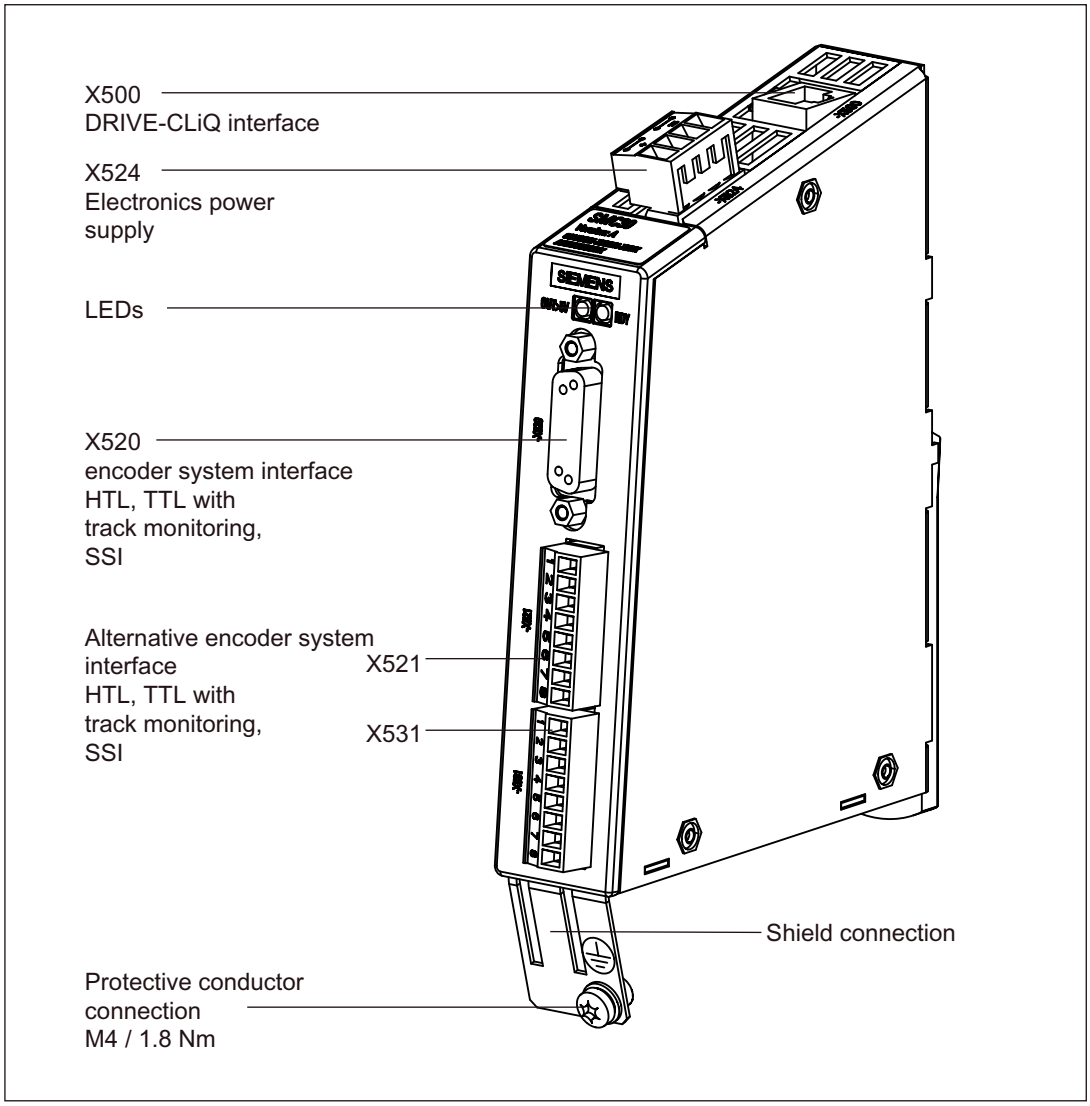


Figure 7-12 Interface description SMC30, 30 mm wide

The component is only available from order no. 6SL3055-0AA00-5CA2 and firmware 2.5 SP1 upwards.

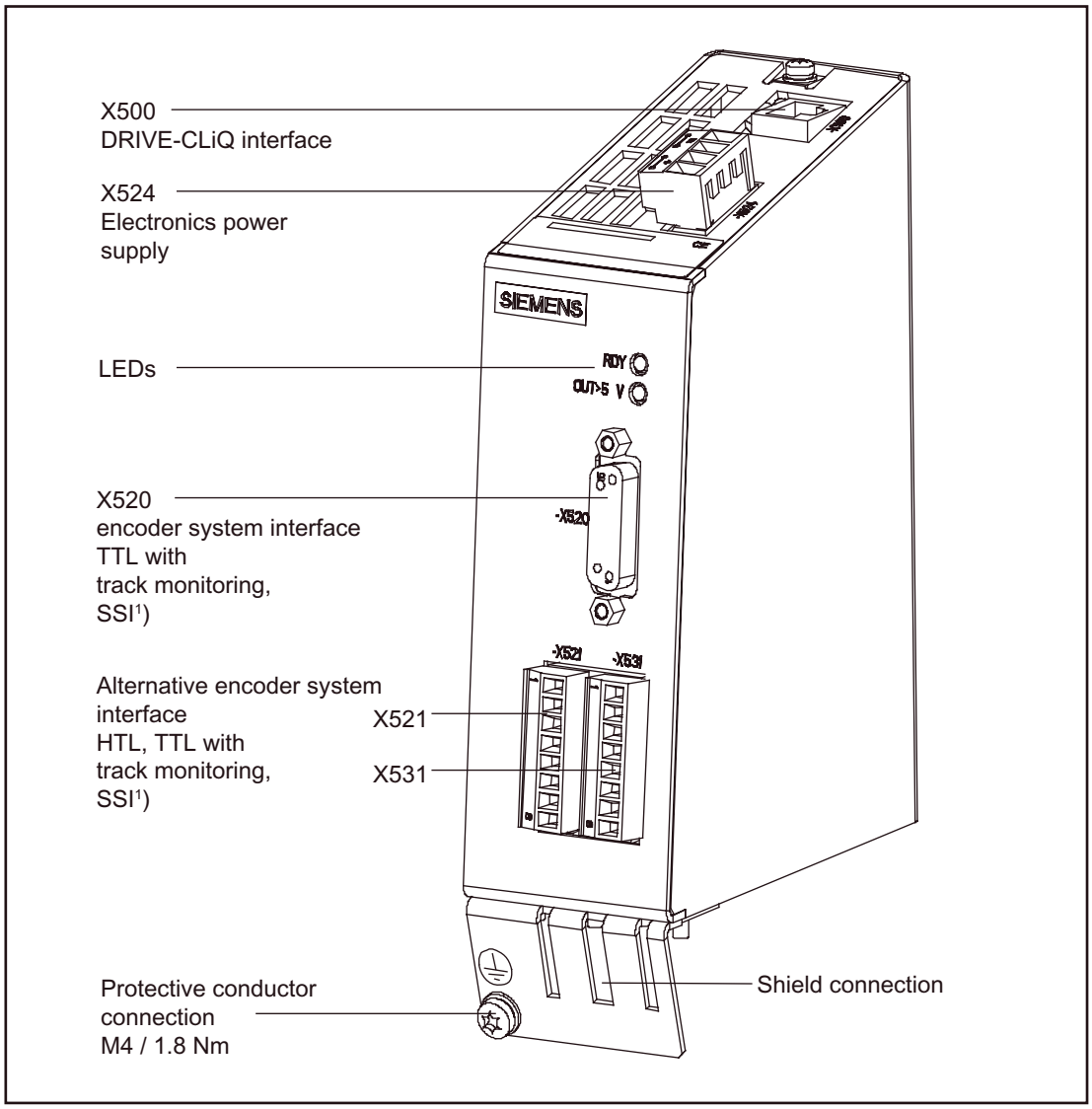


Figure 7-13 Interface description SMC30, 50 mm wide, order no. 6SL3055-0AA00-5CA0, 6SL3055-0AA00-5CA1

1) SSI only available from order no. 6SL3055-0AA00-5CA1 and firmware 2.4 upwards.

7.4.3.2 Connection examples

Connection example 1: HTL encoder, bipolar, with reference signal

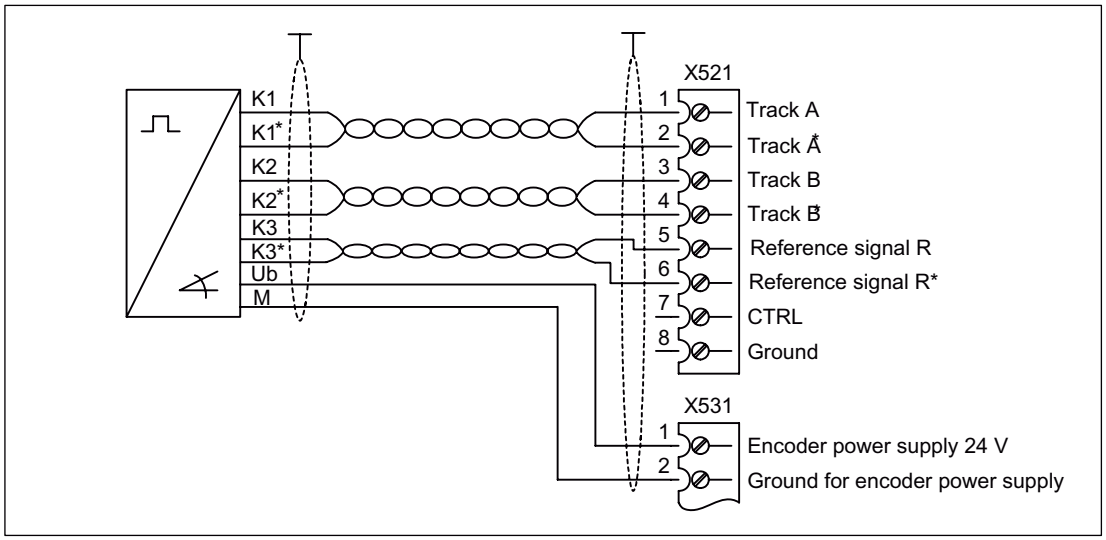


Figure 7-14 Connection example 1: HTL encoder, bipolar, with reference signal

Signal cables must be twisted in pairs in order to improve noise immunity against induced noise.

Connection example 2: HTL encoder, unipolar, with reference signal

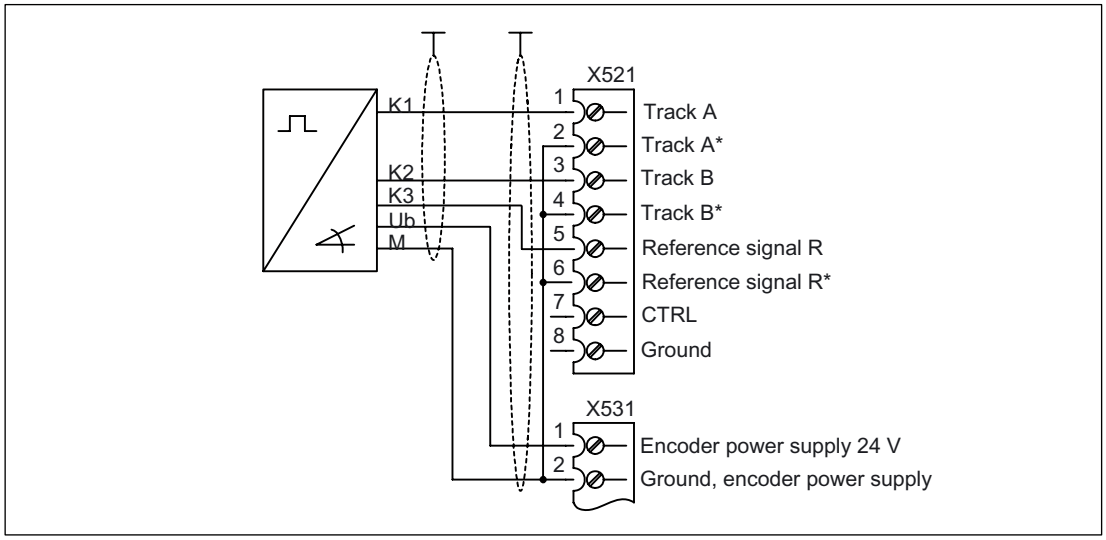


Figure 7-15 Connection example 2: HTL encoder, unipolar, with reference signal[1)]

[1)] Because the physical transmission media is more robust, the bipolar connection should always be used. The unipolar connection should only be used if the encoder type does not output push-pull signals.

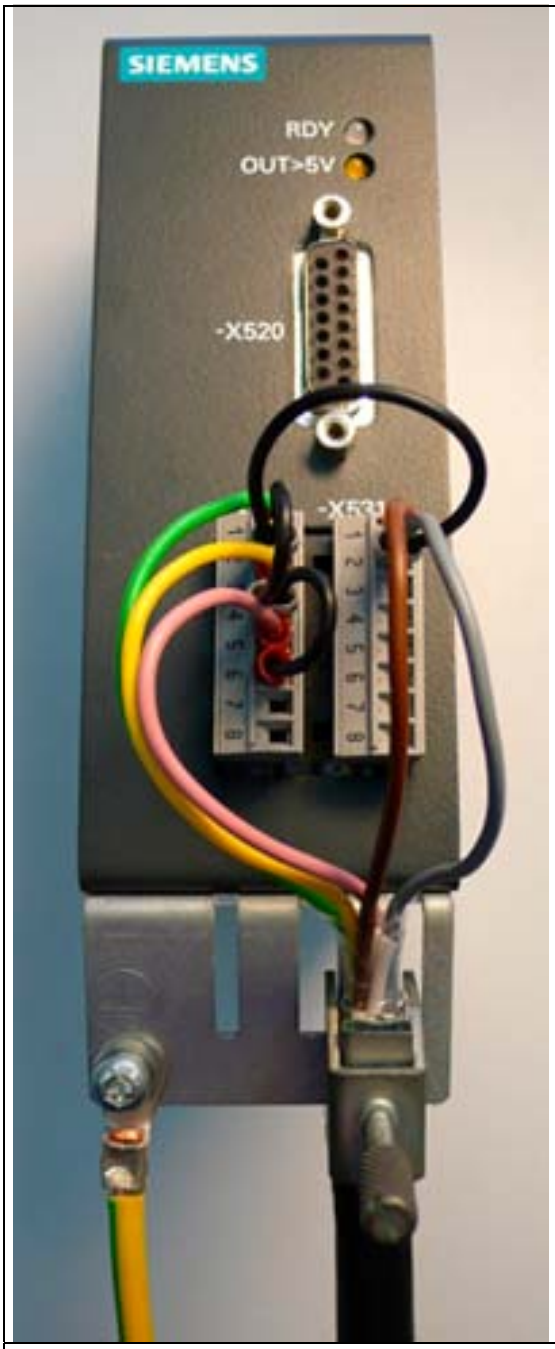
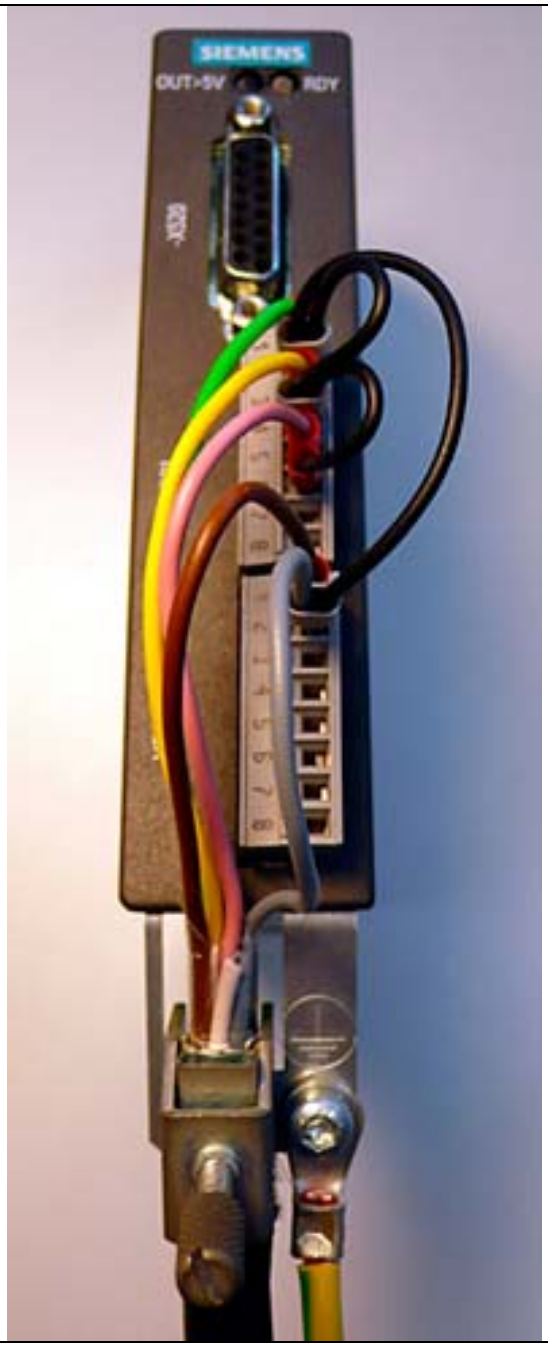
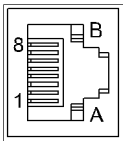
	

Photo of connection example 2: SMC30, 50 mm wide (Order No. 6SL3055-0AA00-5CA0, 6SL3055-0AA00-5CA1)	Photo of connection example 2: SMC30, 30 mm wide, from Order No. 6SL3055-0AA00-5CA2 and Firmware 2.5 SP1
Note: Diagram of the wire jumpers to connect unipolar HTL encoders with reference signal	

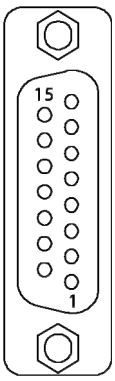
7.4.3.3 DRIVE-CLiQ interface X500

Table 7- 15 DRIVE-CLiQ interface X500

	Pin	Signal name	Technical specifications
	1	TXP	Transmit data +
	2	TXN	Transmit data -
	3	RXP	Receive data +
	4	Reserved, do not use	
	5	Reserved, do not use	
	6	RXN	Receive data -
	7	Reserved, do not use	
	8	Reserved, do not use	
	A	Reserved, do not use	
	B	GND (0 V)	Electronics ground

7.4.3.4 X520 encoder system interface

Table 7- 16 X520 encoder system interface

	Pin	Signal name	Technical specifications
	1	Reserved, do not use + Temp[2)]	Motor temperature measurement KTY84-1C130 (KTY+) Temperature sensor KTY84-1C130 / PTC
	2	Clock	SSI clock[1)]
	3	Clock*	Inverse SSI clock[1)]
	4	P encoder 5 V / 24 V	Encoder power supply
	5	P encoder 5 V / 24 V	
	6	P sense	Sense input encoder power supply
	7	M encoder (M)	Ground for encoder power supply
	8	Reserved, do not use - Temp[2)]	Motor temperature measurement KTY84-1C130 (KTY-) Temperature sensor KTY84-1C130 / PTC
	9	M sense	Ground sense input
	10	R	Reference signal R
	11	R*	Inverse reference signal R
	12	B*	Inverse incremental signal B
	13	B	Incremental signal B
	14	A* / data*	Inverse incremental signal A / inverse SSI data[1)]
	15	A / data	Incremental signal A / SSI data[1)]

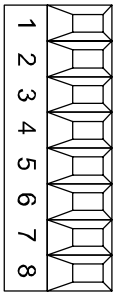
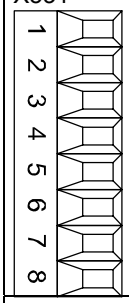
[1)] Only from Order No. 6SL3055-0AA00-5CA1 and Firmware 2.4

[2)] Only from Order No. 6SL3055-0AA00-5CA2 and Firmware 2.5 SP1

CAUTION
The sensor power supply can be parameterized to 5 V or 24 V. The sensor may be destroyed if you enter the wrong parameters.

7.4.3.5 X521 / X531 alternative encoder system interface

Table 7- 17 X521 / X531 alternative encoder system interface

	Pin	Designation	Technical specifications
X521 	1	A	Incremental signal A
	2	A*	Inverse incremental signal A
	3	B	Incremental signal B
	4	B*	Inverse incremental signal B
	5	R	Reference signal R
	6	R*	Inverse reference signal R
	7	CTRL	Control signal
	8	M	Ground
	1	P_Encoder 5 V / 24 V	Encoder power supply
	2	M_Encoder	Ground for encoder power supply
X531 	3	- Temp	Motor temperature measurement KTY84-1C130 (KTY-) Temperature sensor KTY84-1C130 / PTC
	4	+ Temp	Motor temperature measurement KTY84-1C130 (KTY+) Temperature sensor KTY84-1C130 / PTC
	5	Clock	SSI clock[2)]
	6	Clock*	Inverse SSI clock[2)]
	7	Data	SSI data[2)]
	8	Data*	Inverse SSI data[2)]
Max. connectable cross-section: 1.5 mm^2 When using unipolar HTL encoders, at the terminal block A*, B*, R* must be connected to (jumper) M_Encoder (X531)[1)].			

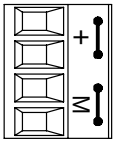
[1)] Because the physical transmission media is more robust, the bipolar connection should always be used. The unipolar connection should only be used if the encoder type does not output push-pull signals.

[2)] Only from Order No. 6SL3055-0AA00-5CA1 and Firmware 2.4

CAUTION
When the encoder system is connected via terminals, make sure that the cable shield is connected to the component. Refer to the Chapter "Electrical connection".

7.4.3.6 Electronics power supply X524

Table 7- 18 Terminal block X524

	Terminal	Function	Technical data
	+	Electronics power supply	Voltage: 24 V (20.4 V – 28.8 V) Current consumption: max. 0,55 A Max. current across jumper in connector: 20 A at 55°C
	+	Electronics power supply	
	M	Electronics ground	
	M	Electronics ground	
Max. connectable cross-section: 2.5 mm² Type: Screw terminal 2 (see Appendix A)			

Note

The two "+" and "M" terminals are jumpered in the connector. This ensures the supply voltage is looped through.

7.4.3.7 Significance of LEDs on the Sensor Module Cabinet 30 (SMC30)

Table 7- 19 Sensor Module Cabinet SMC30 – description of the LEDs

LED	Color	State	Description, cause	Remedy
RDY READY	-	Off	Electronics power supply is missing or outside permissible tolerance range.	–
	Green	Continuous light	The component is ready for operation and cyclic DRIVE-CLiQ communication is taking place.	–
	Orange	Continuous light	DRIVE-CLiQ communication is being established.	–
	Red	Continuous light	At least one fault is present in this component. **Note:** The LED is activated regardless of whether the corresponding messages have been reconfigured.	Remedy and acknowledge fault
	Green/red	Flashing, 0.5 Hz	Firmware is being downloaded.	–
	Green/red	Flashing, 2 Hz	Firmware download is complete. Wait for POWER ON.	Carry out a POWER ON
	Green/orange or Red/orange	Flashing	Component recognition via LED is activated (p0144). **Note:** Both options depend on the LED status when component recognition is activated via p0144 = 1.	–
OUT > 5 V	-	Off	Electronics power supply is missing or outside permissible tolerance range. Power supply ≤ 5 V.	–
	Orange	Continuous light	Electronics power supply for encoder system available. Power supply > 5 V. **Important:** Make sure that the connected encoder can be operated with a 24 V power supply. If an encoder that is designed for a 5 V supply is operated with a 24 V supply, this can destroy the encoder electronics.	–

7.4.4 Dimension drawing

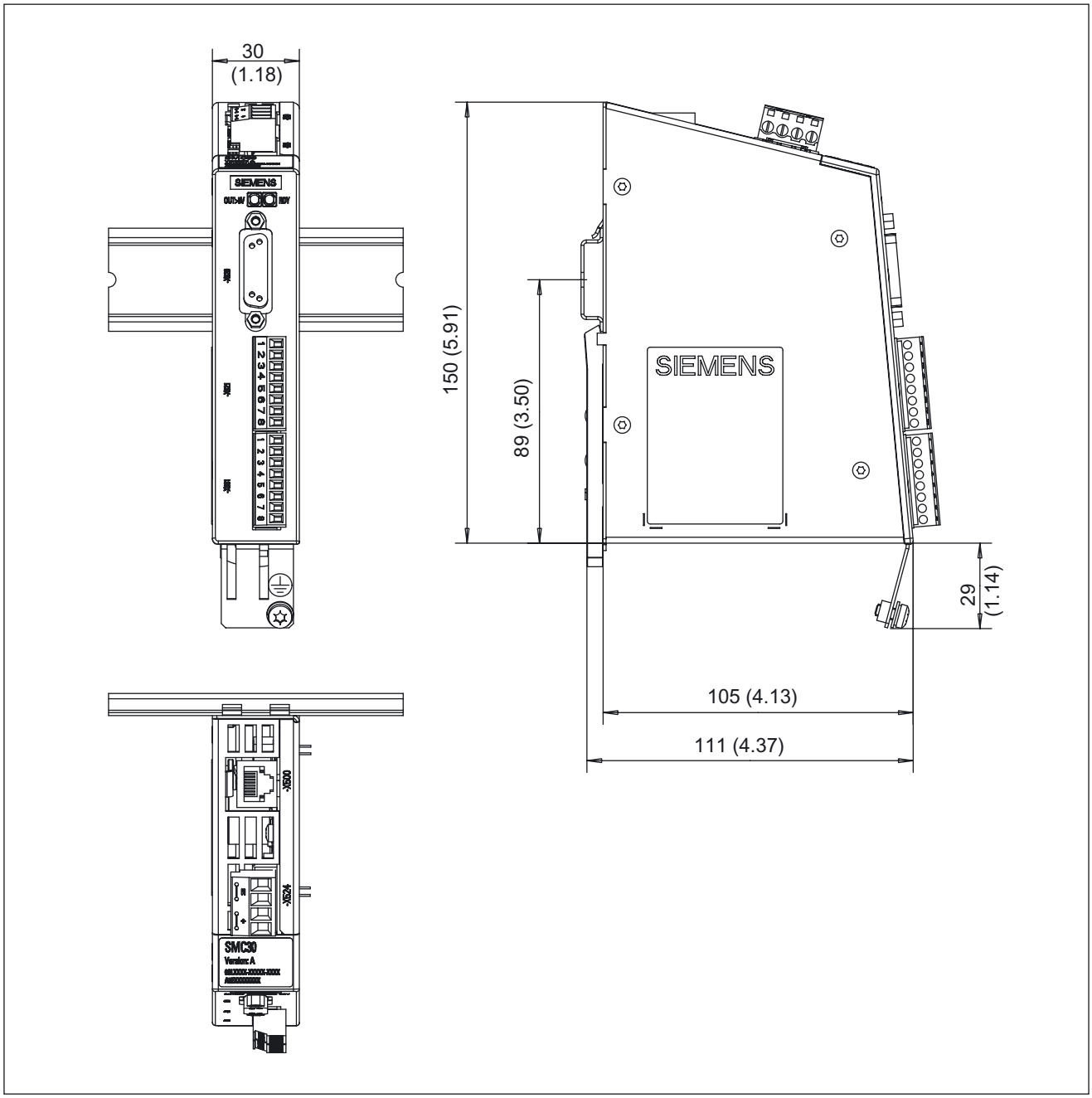


Figure 7-16 Dimension drawing SMC30: 30 mm wide

Only from Order No. 6SL3055-0AA00-5CA2 and firmware 2.5 SP1

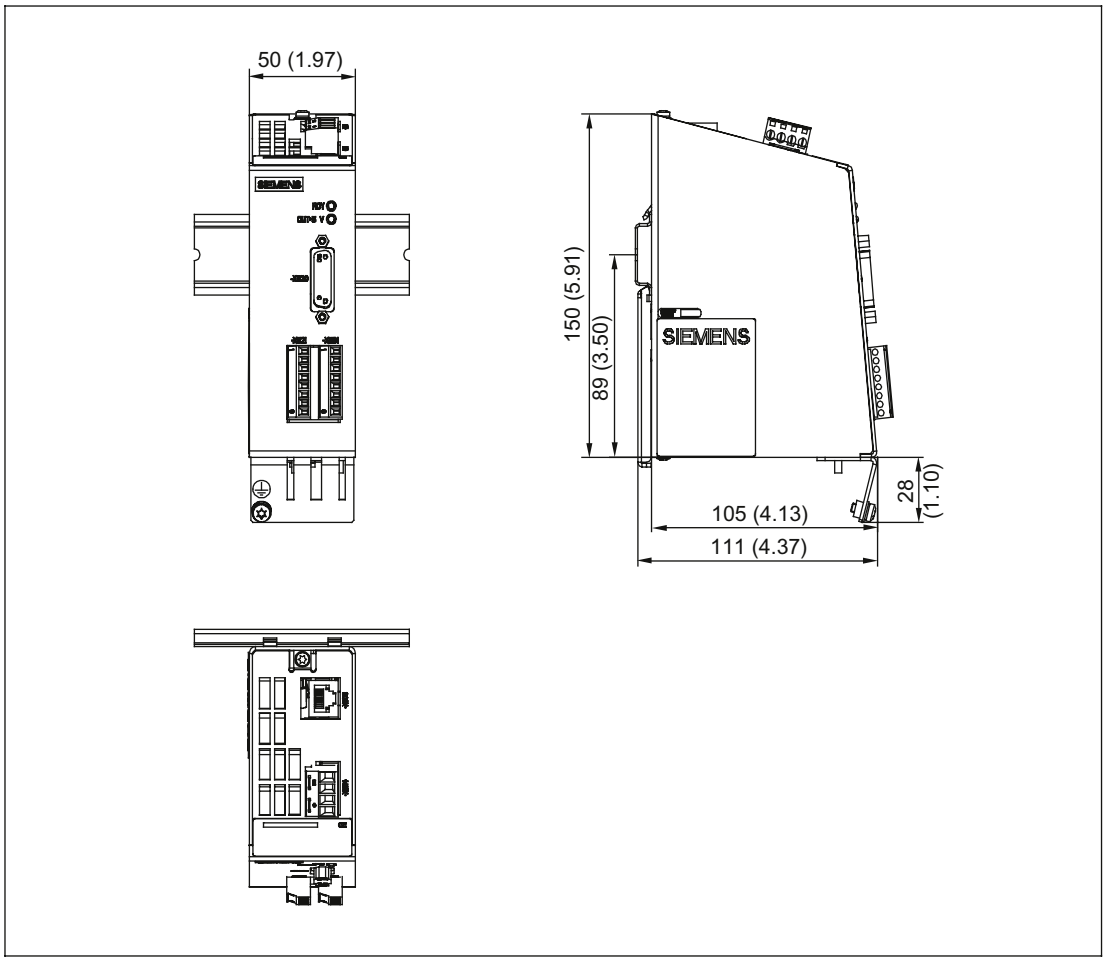


Figure 7-17 Dimension drawing SMC30: 50 mm wide

Order No.: 6SL3055-0AA00-5CA0, 6SL3055-0AA00-5CA1

7.4.5 Mounting

Mounting

1. Place the component on the DIN rail.
2. Snap the component on to the DIN rail. Make sure that the mounting slides at the rear latch into place.
3. You can now move the component on the DIN rail to the left or to the right to its final position.

Removal

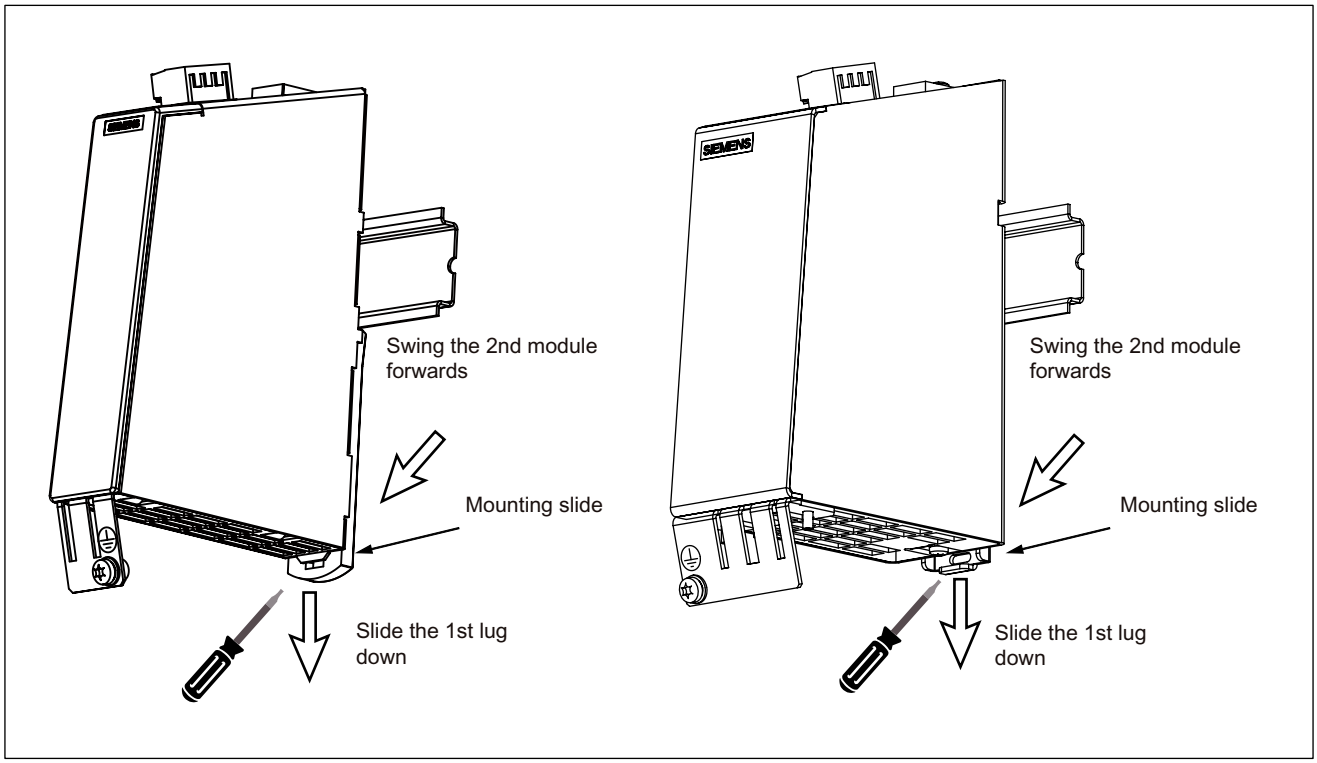


Figure 7-18 Disassembly of a DIN rail with a 30mm wide component (left) and with a 50mm wide component (right).

From Order No. 6SL3055-0AA00-5CA0, 6SL3055-0AA00-5CA1

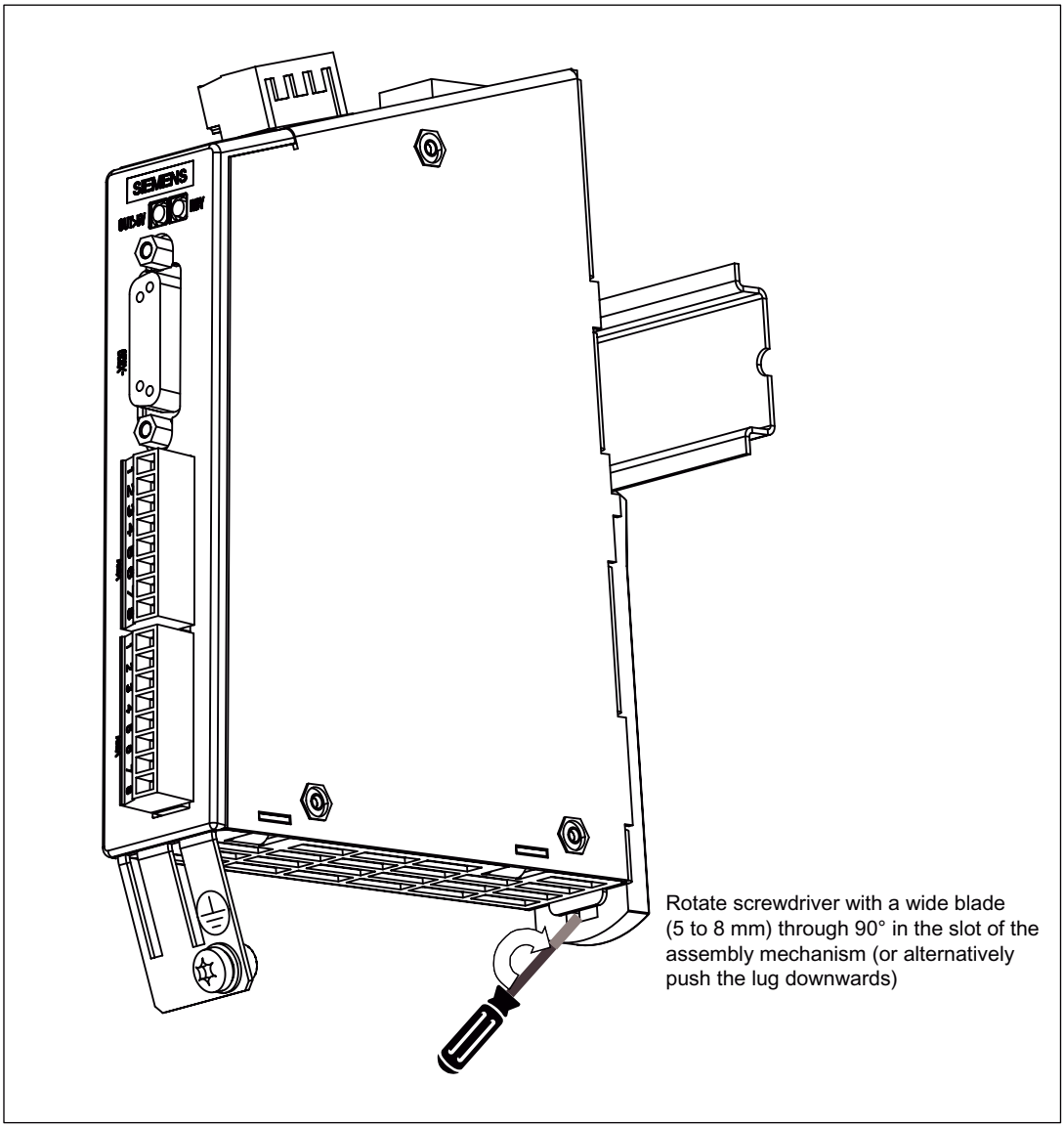


Figure 7-19 Removing: SMC30: 30 mm wide

Only from Order No. 6SL3055-0AA00-5CA2 and Firmware 2.5 SP1

7.4.6 Electrical Connection

Shield contacts are only required if the system is connected to X521/X531.

Terminal element from Weidmüller for the SMC30

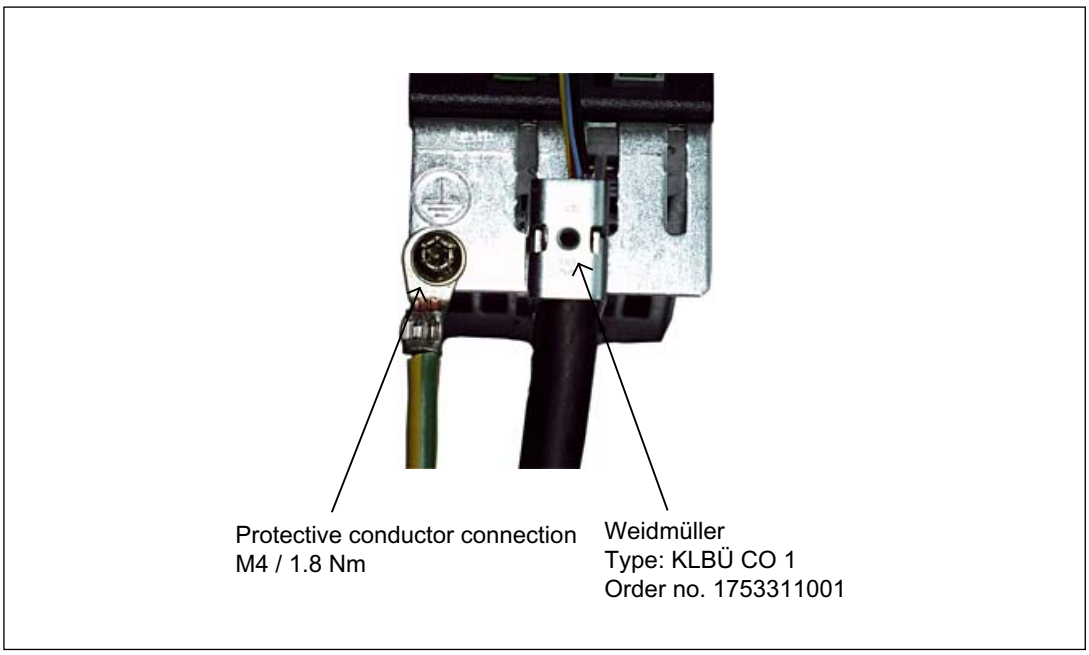


Figure 7-20 Shield contacts for the SMC30

Weidmüller: http://www.weidmueller.com

The bending radii of the cables must be taken into account (see MOTION-CONNECT description).

NOTICE
Only screws with a permissible screw-in depth of 4 - 6 mm may be used.

7.4.7 Technical Specifications

Table 7- 20 Technical data

Sensor Module Cabinet-Mounted SMC30 6SL3055-0AA00-5CAx	Designation	Unit	Value
Electronics power supply Voltage Current (without encoder system) Current (with encoder system) Power loss	 V_{DC} A_{DC} A_{DC} W	 V A A W	 24 DC (20.4 – 28.8) ≤ 0.20 ≤ 0.55 ≤ 10
Encoder system power supply Voltage Current	 $V_{encoder}$ $A_{encoder}$	 V A	 5 V DC (with or without Remote Sense) [1] or V_{DC} - 1 V 0.35
Encoder frequency that can be evaluated	$f_{encoder}$	kHz	≤ 300
SSI baud rate		kHz	100 - 250
PE/ground connection		On housing with M4 / 1.8 Nm screw	
Weight		kg	0,45 (Order No. 6SL3055-0AA00-5CA2) 0,8 (Order No. 6SL3055-0AA00-5CA0, 6SL3055-0AA00-5CA1)
Degree of protection		IP20 or IPXXB	

[1] A controller compares the encoder system supply voltage - sensed via the remote sense cables - with the reference supply voltage of the encoder system, and adjusts the supply voltage for the encoder system at the output of the drive module until the required supply voltage is obtained directly at the encoder system (only for 5 V encoder system power supply). Remote Sense only to X520.

Table 7- 21 Specification of encoder systems that can be connected

Parameter	Designation	Threshold	Min.	Max.	Unit
High signal level (TTL bipolar at X520 or X521/X531)[1]	U_{Hdiff}		2	5	V
Low signal level (TTL bipolar at X520 or X521/X531)[1]	U_{Ldiff}		-5	-2	V
Signal level high (HTL unipolar)	U_H[4]	High	17	V_{CC}	V
		Low	10	V_{CC}	V
Signal level low (HTL unipolar)	U_L[4]	High	0	7	V
		Low	0	2	V
High signal level (HTL bipolar)[2]	U_{Hdiff}		3	V_{CC}	V
Low signal level (HTL bipolar)[2]	U_{Ldiff}		$-V_{CC}$	-3	V
High signal level (SSI bipolar at X520 or X521/X531)[1][3]	U_{Hdiff}		2	5	V
Low signal level (SSI bipolar at X520 or X521/X531)[1][3]	U_{Ldiff}		-5	-2	V

Parameter	Designation	Threshold	Min.	Max.	Unit
Signal frequency	f_S		-	300	kHz
Edge clearance	t_{min}		100	-	ns
"Zero pulse inactive time" (before and after A=B=high)	t_{Lo}		500	$(t_{ALo-BHi} - t_{Hi})/2$ 5)	ns
"Zero pulse active time" (while A=B=high and beyond)6)	t_{Hi}		500	$t_{ALo-BHi} - 2*t_{Lo}$ 5)	ns

1) Other signal levels according to the RS422 standard.

2) The absolute level of the individual signals varies between 0 V and V_{CC} of the encoder system.

3) Only from Order No. 6SL3055-0AA00-5CA1 and Firmware 2.4.

4) Only from Order No. 6SL3055-0AA00-5CA2 and Firmware 2.5 SP1 this value can be configured using software. For older firmware releases and Order Nos. less than 6SL3055-0AA00-5CA2 then the "low" threshold applies.

5) $t_{ALo-BHi}$ is not a specified value, but is the time between the falling edge of track A and the next but one rising edge of track B.

6) Further information on setting the "Zero pulse active time" can be found in the following:

References: /FH1/ SINAMICS S120, Function Manual, tolerant encoder monitoring for SMC30

Table 7- 22 Encoders that can be connected

	X520 (D-Sub)	X521 (terminal)	X531 (terminal)	Track monitoring	Remote Sense4)
HTL bipolar 24 V	No / Yes5)	Yes		No / Yes5)	No
HTL unipolar 24 V3)	No / Yes5)	Yes (however, a bipolar connection is recommended)3)		No	No
TTL bipolar 24 V	Yes	Yes1)		Yes2)	No
TTL bipolar 5 V	Yes	Yes		Yes2)	To X520
SSI 24 V / 5 V1)	Yes	Yes		No	No
TTL unipolar	No				

1) As of order no. 6SL3055-0AA00-5CA1

2) For Order No. 6SL3055-0AA00-5CA0 only at X520

3) Because the physical transmission media is more robust, the bipolar connection should always be used. The unipolar connection should only be used if the encoder type does not output push-pull signals.

4) A controller compares the encoder system supply voltage - sensed via the remote sense cables - with the reference supply voltage of the encoder system, and adjusts the supply voltage for the encoder system at the output of the drive module until the required supply voltage is obtained directly at the encoder system (only for 5 V encoder system power supply).

5) As of Order No. 6SL3055-0AA00-5CA2

Table 7- 23 Maximum encoder cable length

Encoder type	Maximum encoder cable length in m
TTL[1)]	100
HTL unipolar[2)]	100
HTL bipolar	300
SSI[3)]	100

[1)] For TTL encoders at X520 → Remote Sense → 100 m

[2)] Because the physical transmission media is more robust, the bipolar connection should always be used. The unipolar connection should only be used if the encoder type does not output push-pull signals.

[3)] As of order no. 6SL3055-0AA00-5CA1

For sensors with 5 V supply at X521 / X531, the cable lengths (for 0.5 mm^2) cable cross-sections) depend on the sensor current:

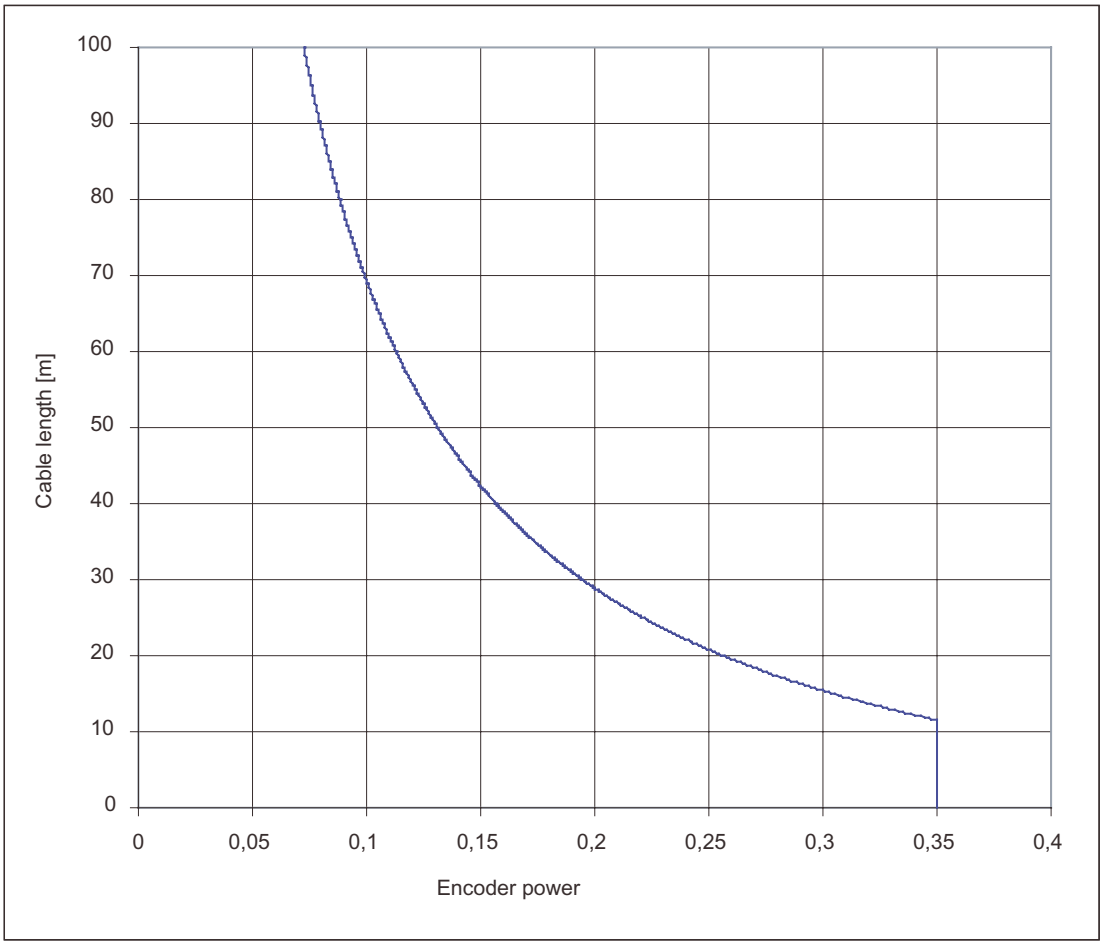


Figure 7-21 Max. cable length as a function of the encoder current drawn

For encoders without Remote Sense the permissible cable length is restricted to 100 m (reason: the voltage drop depends on the cable length and the encoder current).

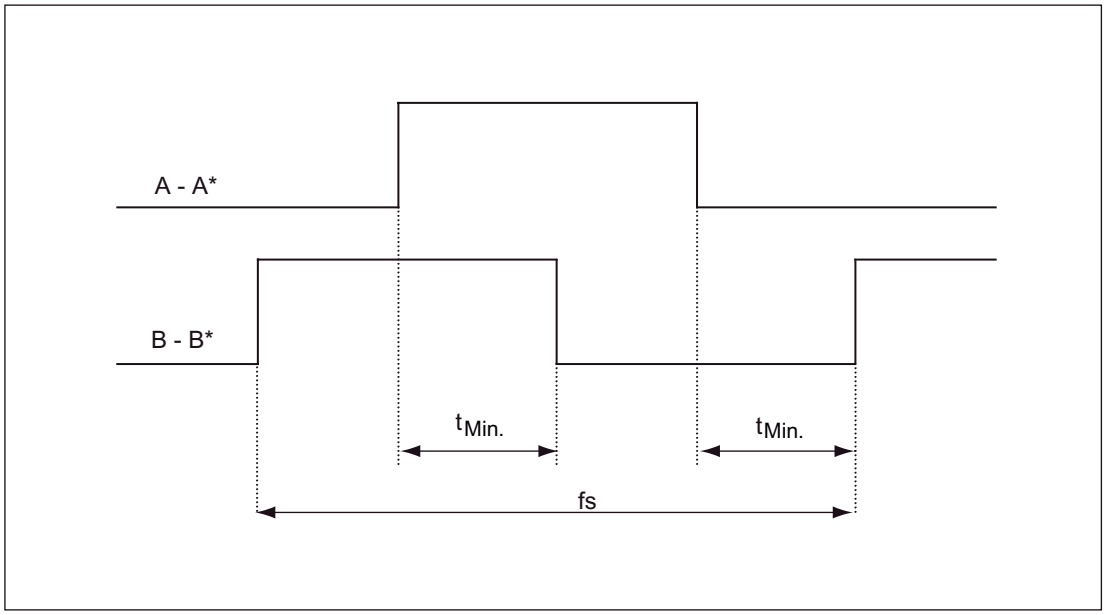


Figure 7-22 Signal characteristic of track A and track B between two edges: Time between two edges with pulse encoders

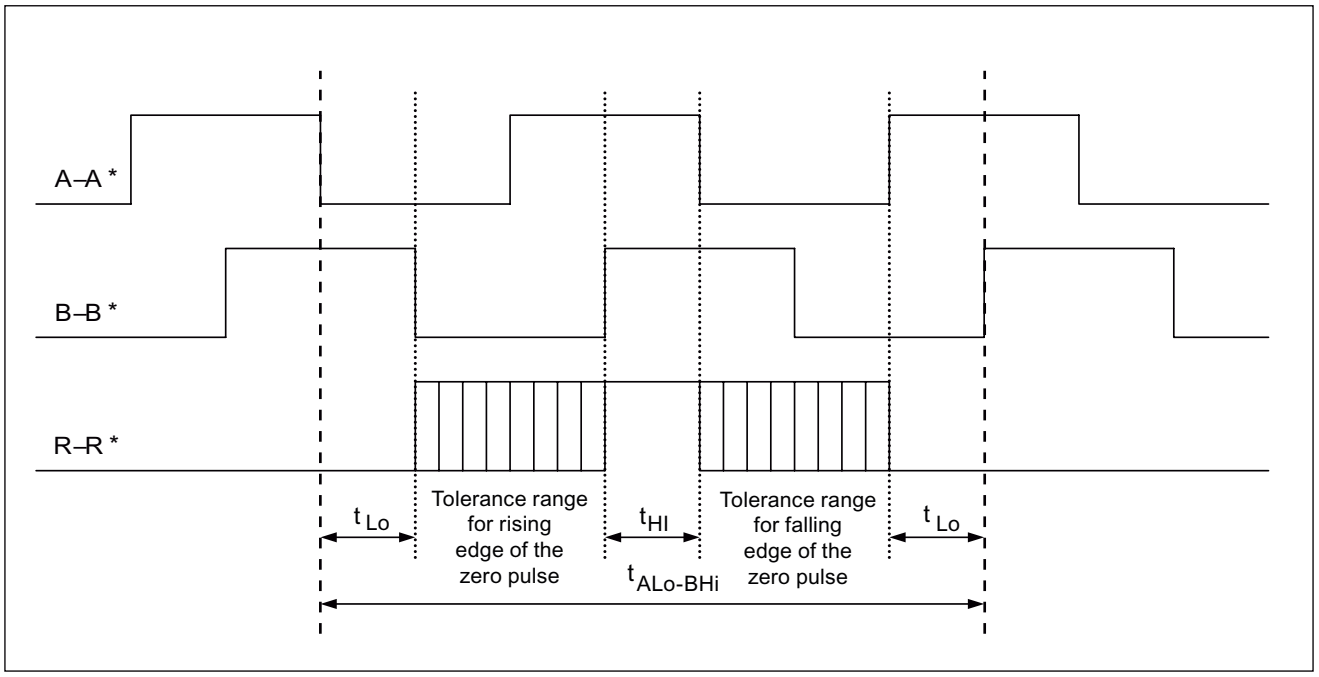


Figure 7-23 Position of the zero pulse to the track signals

8 Accessories

8.1 DRIVE-CLiQ cabinet gland

8.1.1 Description

The DRIVE-CLiQ cabinet gland is used to connect two DRIVE-CLiQ cables and can be installed in a cabinet panel.

At the interface outside the cabinet, a DRIVE-CLiQ connection is implemented with degree of protection IP67 acc. to EN 60529; however, on the other hand inside the cabinet, a connection with degree of protection IP20 or IPXXB acc. to EN 60529. The interface between the cabinet wall and DRIVE-CLiQ cabinet gland should have degree of protection IP54 acc. to EN 60529.

In addition to the data lines, the power supply contacts of DRIVE-CLiQ are also routed via the coupling.

8.1.2 Safety Information

Note

Only Siemens cables should be used for DRIVE-CLiQ connections.

8.1.3 Interface description

8.1.3.1 Overview

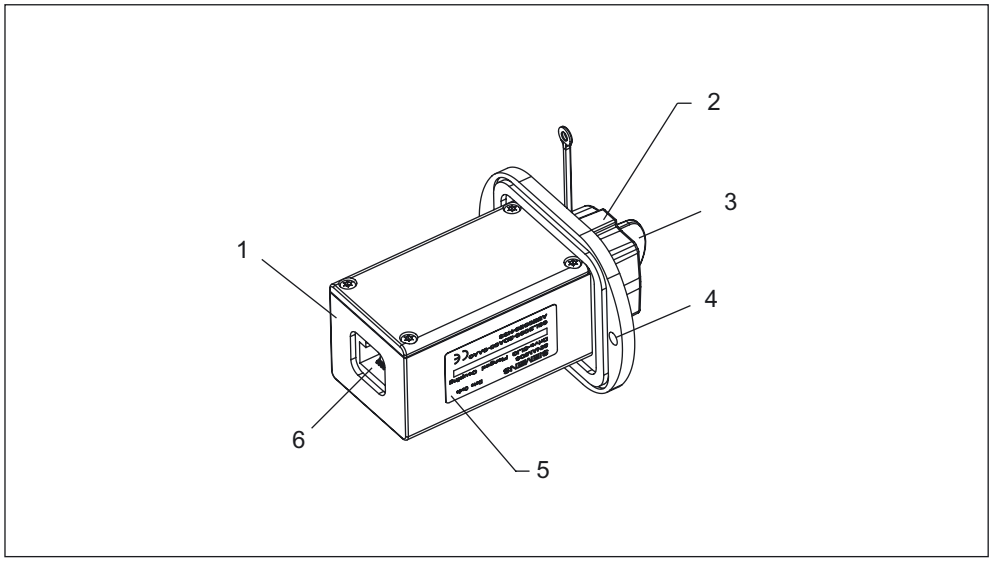


Figure 8-1 DRIVE-CLiQ cabinet gland

1	DRIVE-CLiQ cabinet gland
2	Covering cap, Yamaichi, order no.: Y-ConAS-24-S
3	IP67 acc. to EN 60529 interface
4	Mounting holes
5	Rating plate
6	IP20 or IPXXB acc. to EN 60529 interface

8.1.4 Dimension drawing

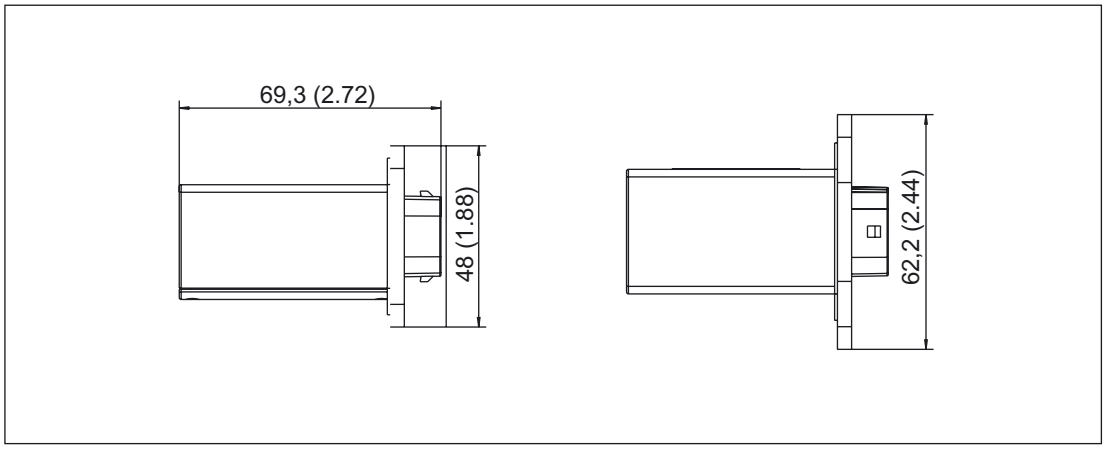


Figure 8-2 Dimensions of the DRIVE-CLiQ cabinet gland, all dimensions in mm and (inches)

Accessories	W [mm]	D [mm]	H [mm]
DRIVE-CLiQ cabinet gland (with seal)	69,3 (2.72)	62,2 (2.44)	48 (1.88)

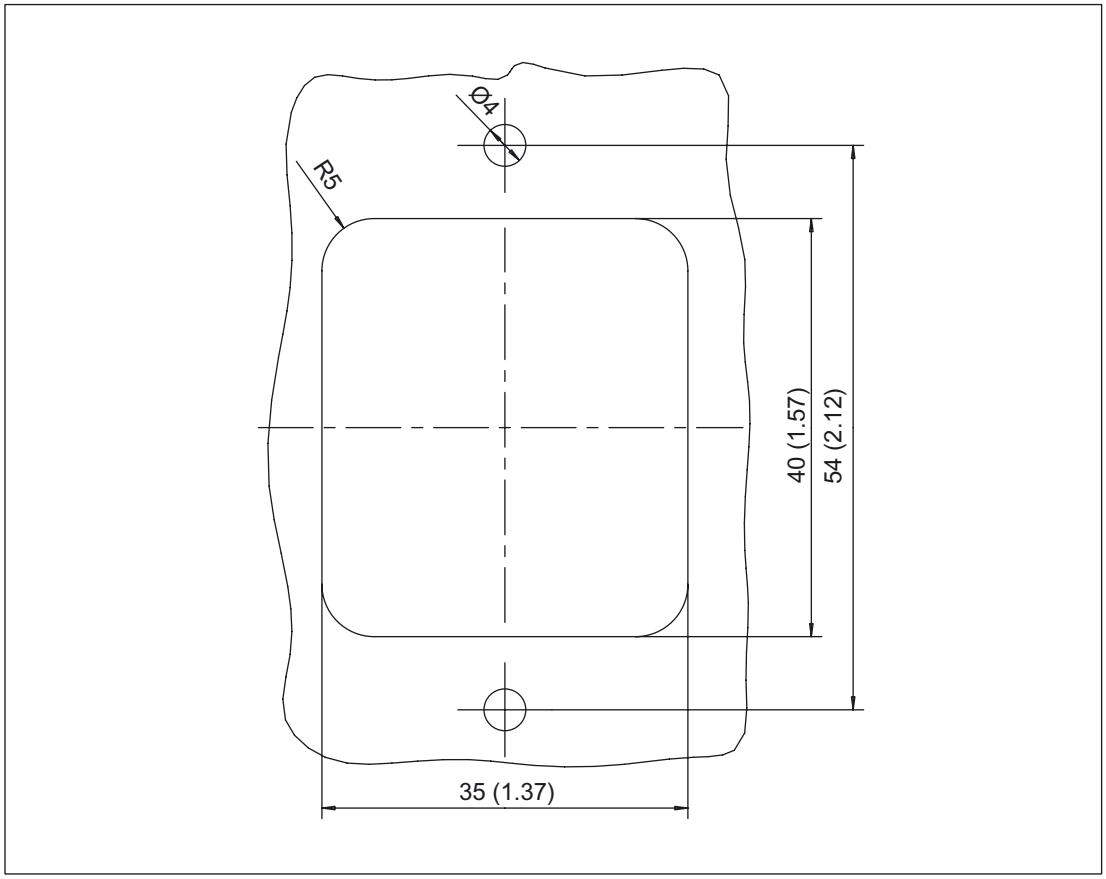


Figure 8-3 Cut-out for the cabinet

8.1.5 Mounting

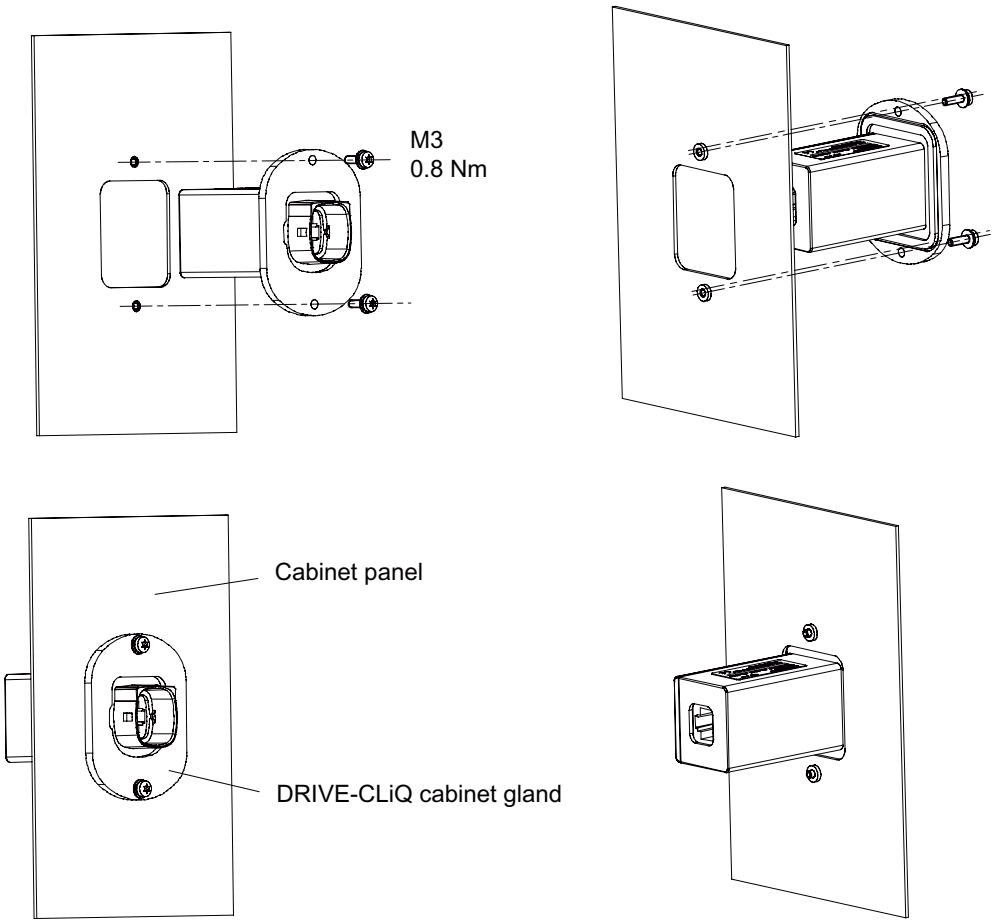


Figure 8-4 DRIVE-CLiQ cabinet gland

Installation

1. Make an opening in the cabinet panel according to the Chapter "Dimension drawing" for the DRIVE-CLiQ cabinet gland.
2. Insert the components from the outer side of the cabinet through the opening in the cabinet.
3. Secure the DRIVE-CLiQ cabinet gland to the outer cabinet panel using two M3 screws and two nuts. In order to ensure good electromagnetic compatibility, a good electrical connection must be established between the DRIVE-CLiQ cabinet gland and the cabinet panel.

8.1.6 Technical data

Table 8- 1 Technical data

DRIVE-CLiQ cabinet gland 6SL3066-2DA00-0AAx	Unit	
Weight	kg	0,135
Degree of protection	IP20 or IPXXB acc. to EN 60529 in the electrical cabinet IP54 to EN 60529 outside the electrical cabinet	

8.2 DRIVE-CLiQ coupling

8.2.1 Description

The DRIVE-CLiQ coupling is used to connect two DRIVE-CLiQ cables in accordance with degree of protection IP67 acc. to EN 60529.

In addition to the data lines, the power supply contacts of DRIVE-CLiQ are also routed via the coupling.

You can find information on the permissible cable length in the chapter "DRIVE-CLiQ cable".

8.2.2 Safety Information

Note

Only Siemens cables should be used for DRIVE-CLiQ connections.

8.2.3 Interface description

8.2.3.1 Overview

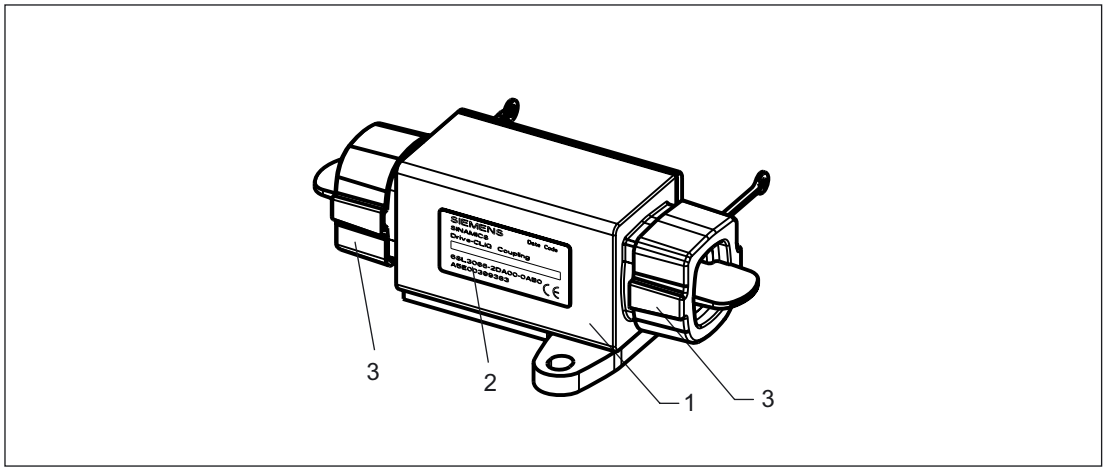


Figure 8-5 DRIVE-CLiQ coupling

1	DRIVE-CLiQ coupling
2	Rating plate
3	Covering caps, Yamaichi, Order No.: Y-ConAS-24-S

8.2.4 Dimension drawing

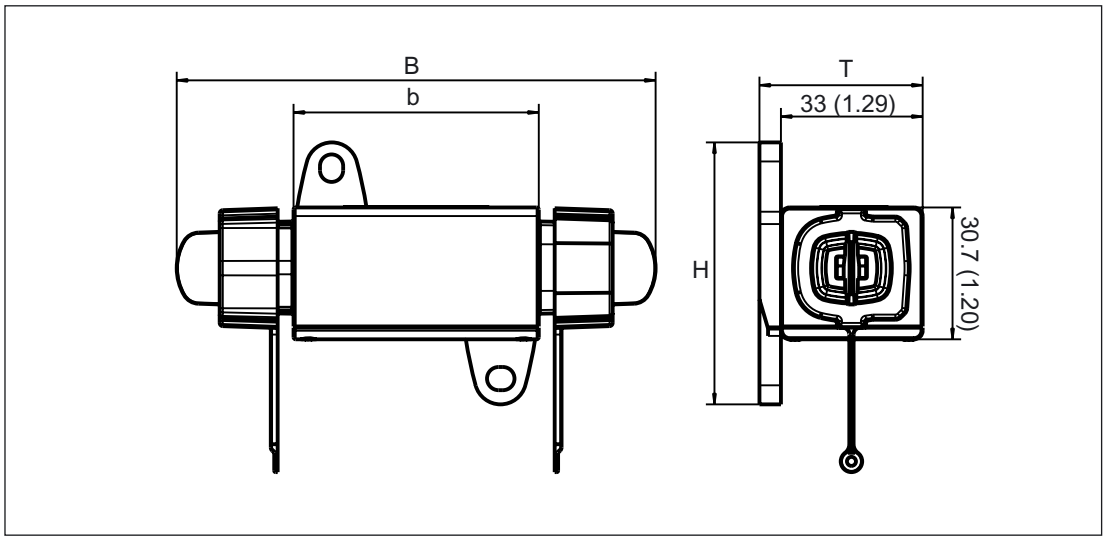


Figure 8-6 Dimension drawing, DRIVE-CLiQ coupling

Table 8- 2 Dimensions of the DRIVE-CLiQ coupling, all data in mm and (inches)

Accessories	W [mm]	b [mm]	H [mm]	D [mm]
DRIVE-CLiQ coupling	111,5 (4.38)	57,1 (2.24)	61 (2.40)	38 (1.49)

8.2.5 Installation

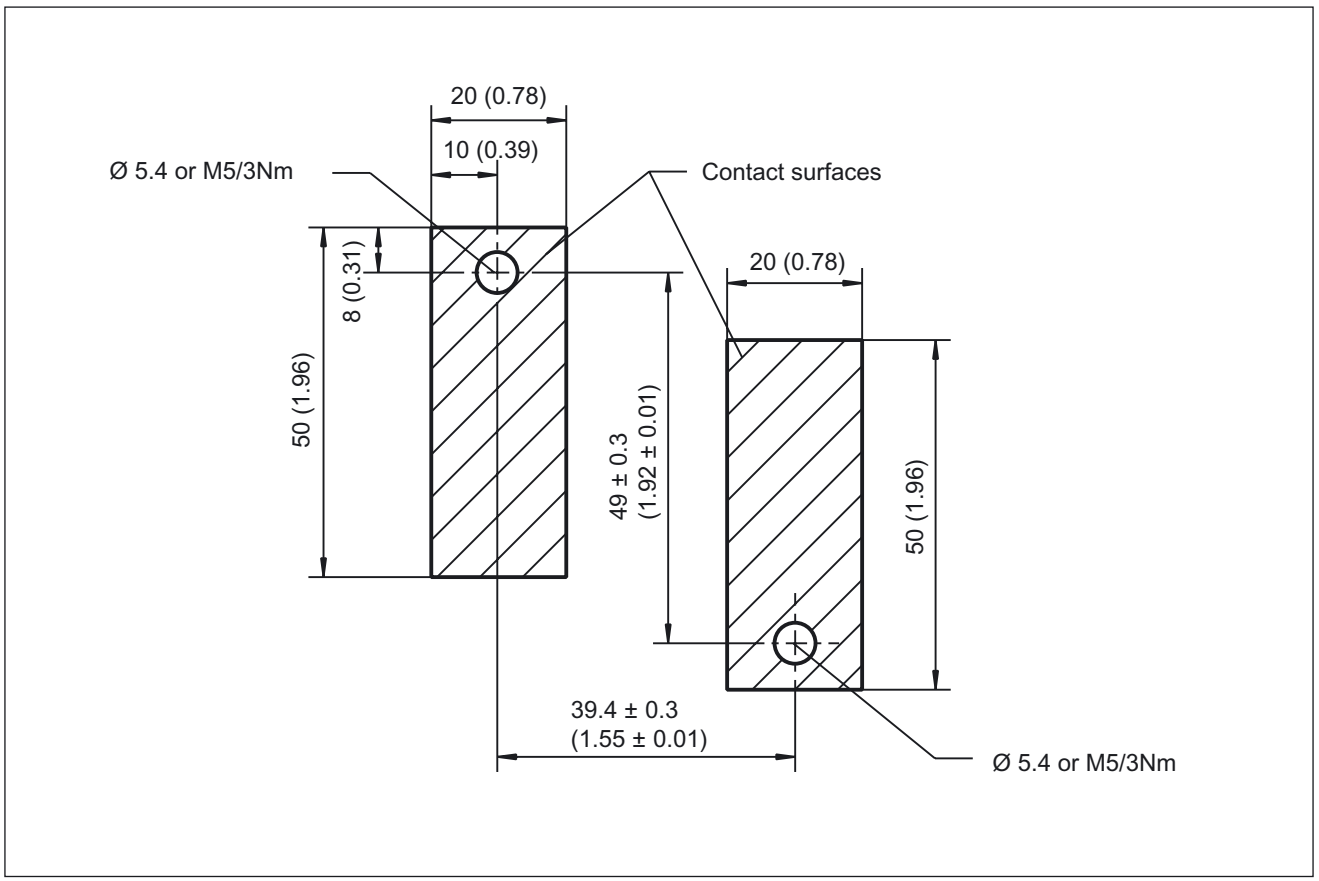


Figure 8-7 Hole drilling template for installation

1. Fit the DRIVE-CLiQ coupling to the mounting surface in accordance with the drilling template.
2. Remove the protective caps on the DRIVE-CLiQ coupling.
3. Insert the DRIVE-CLiQ connector at both ends of the DRIVE-CLiQ coupling.

8.2.6 Technical data

Table 8- 3 Technical data

DRIVE-CLiQ coupling 6FX2003-0DC1x	Unit	
Weight	kg	0,14
Degree of protection	IP67 acc. to EN 60529	

8.3 Screening Kit

8.3.1 Description

Shielding methods

A Screening Kit is available as option for all frame sizes to connect the shield. This Screening Kit is used to connect the shield of power cables. For frame sizes FSA to FSC, the Screening Kit is directly mounted on the electrical cabinet panel and for frame sizes FSD to FSF, it is screwed to the Power Module.

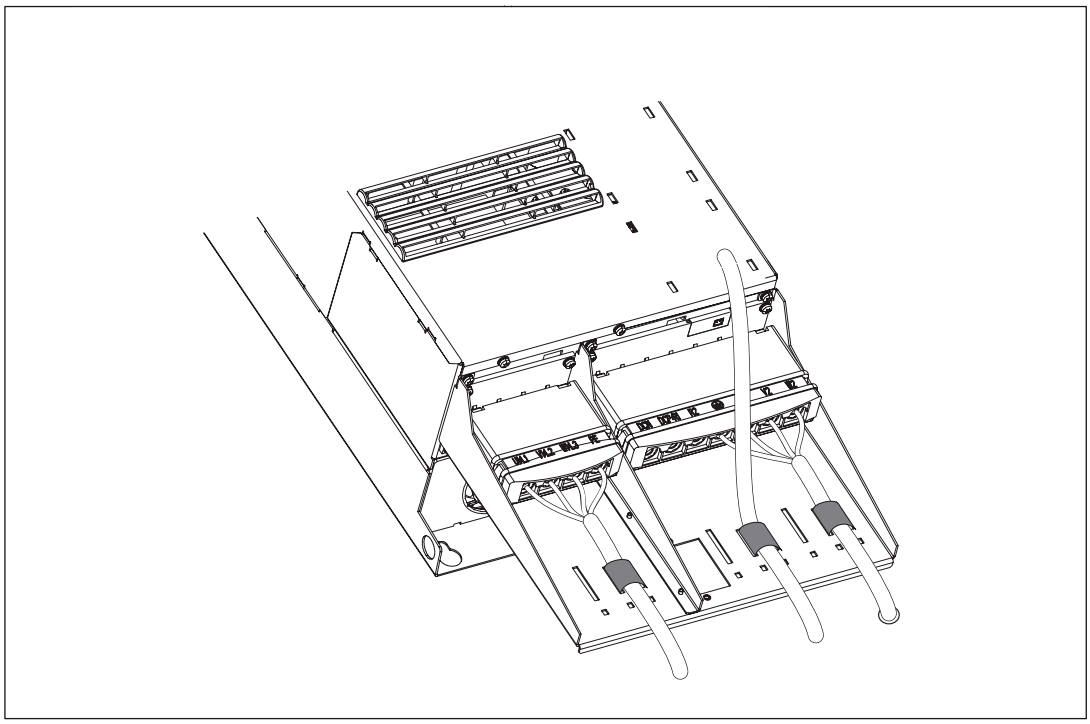


Figure 8-8 Power Module PM340 (frame sizes FSD and FSE) with Screening Kit

Table 8- 4 Overview, Screening Kit

Screening Kit 6SL3262-	1AA00-0BA0	1AB00-0DA0	1AC00-0DA0	1AD00-0DA0	1AD00-0DA0	1AF00-0DA0
for PM340 Frame size	FSA	FSB	FSC	FSD	FSE	FSF

8.3.2 Dimension drawings

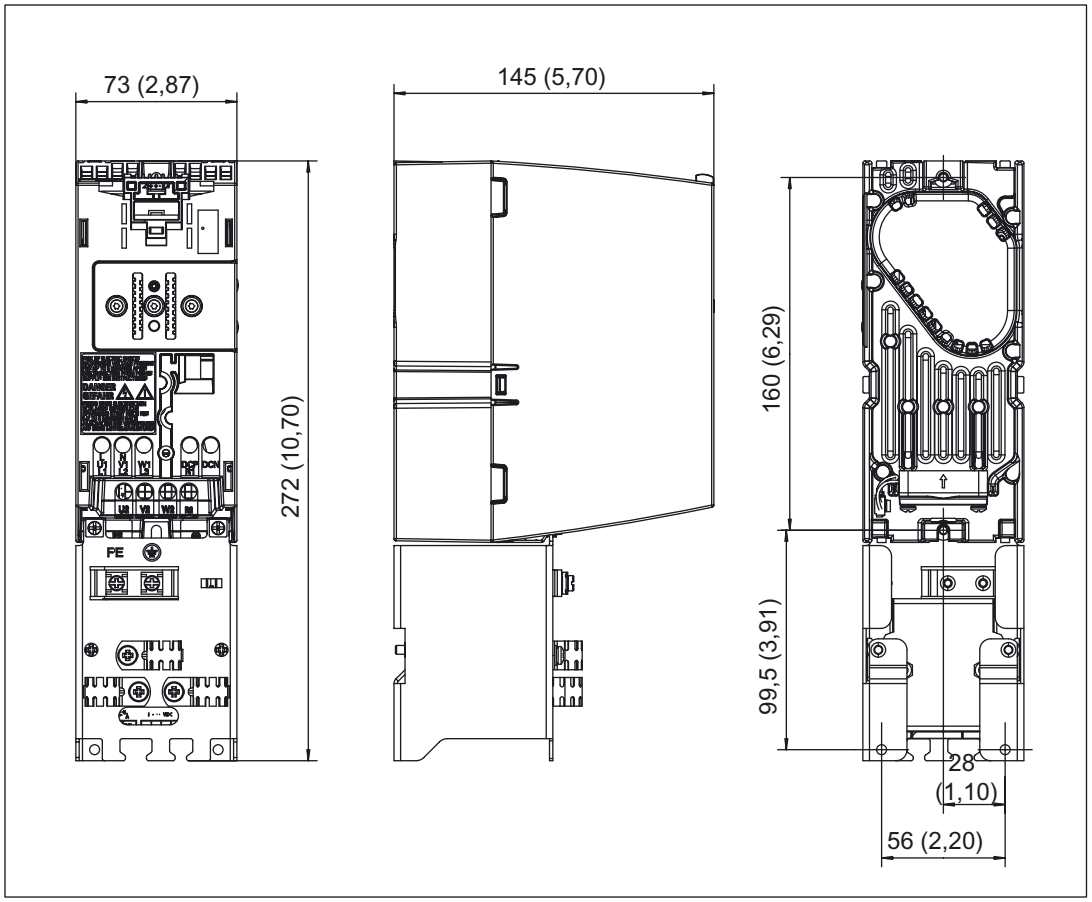


Figure 8-9 Dimension drawing: Power Module PM340 with Screening Kit and Brake Relay, frame size FSA

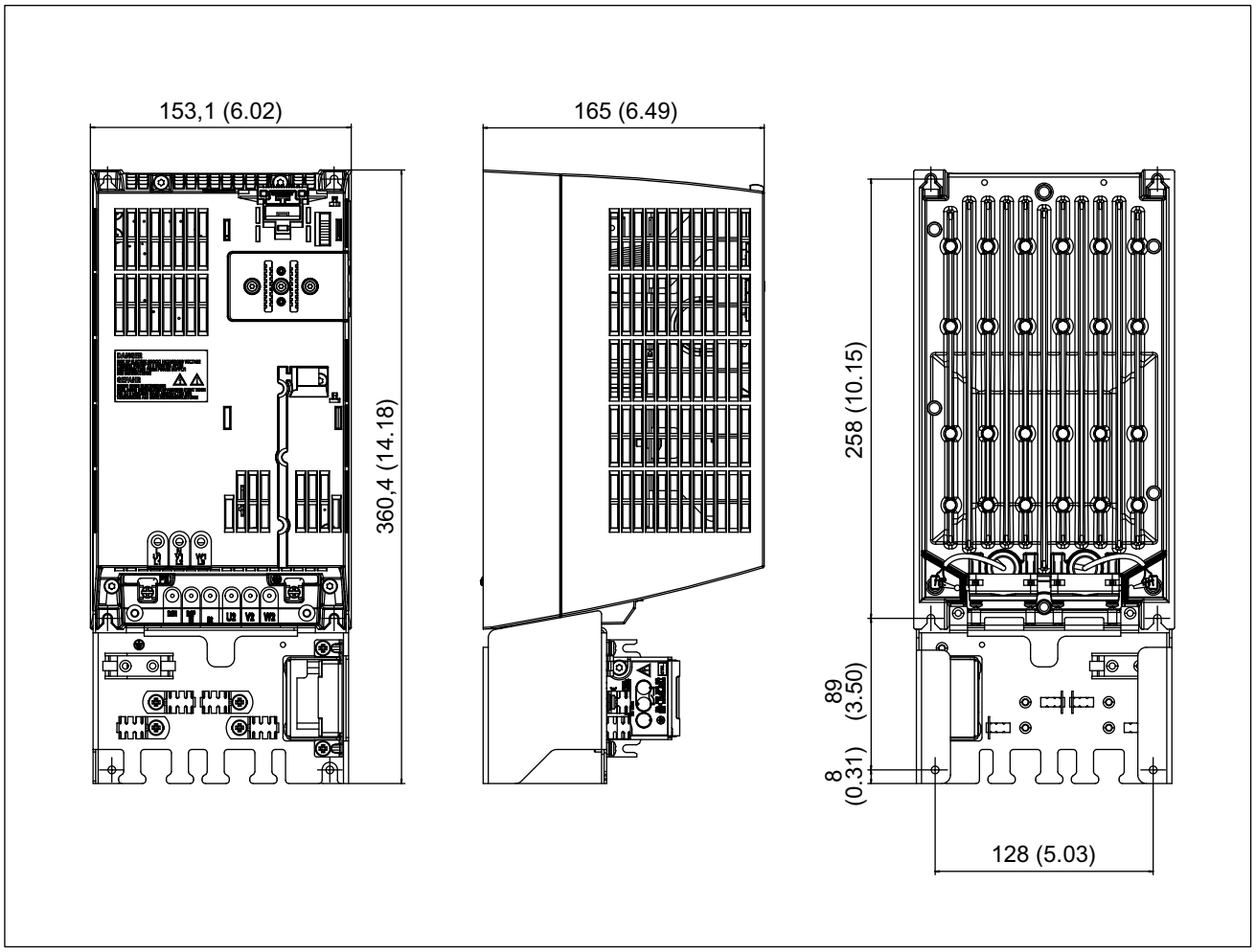


Figure 8-10 Dimension drawing: Power Module PM340 with Screening Kit and Brake Relay, frame size FSB

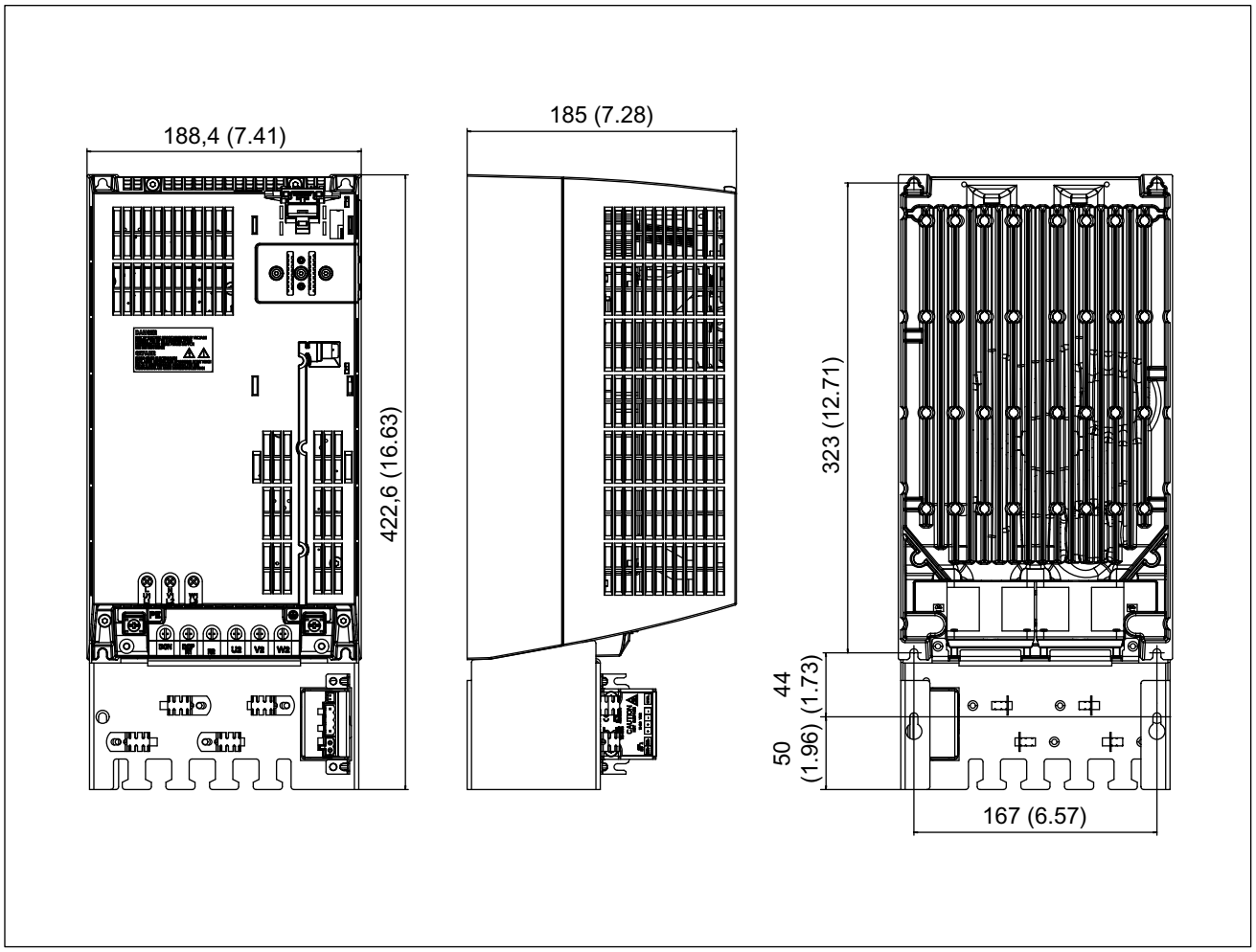


Figure 8-11 Dimension drawing: Power Module PM340 with Screening Kit and Brake Relay, frame size FSC

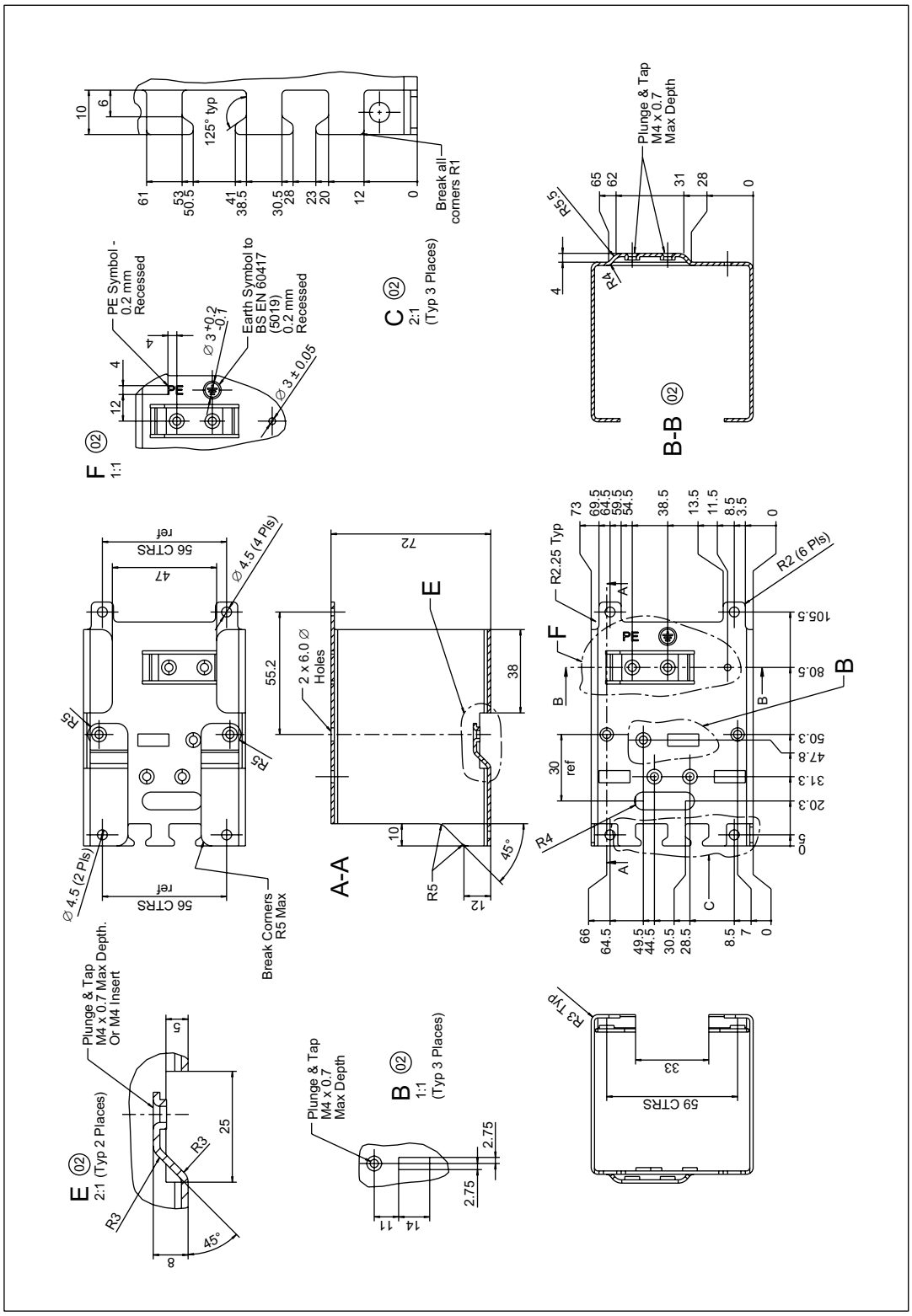


Figure 8-12 Dimension drawing: Screening Kit, frame size FSA

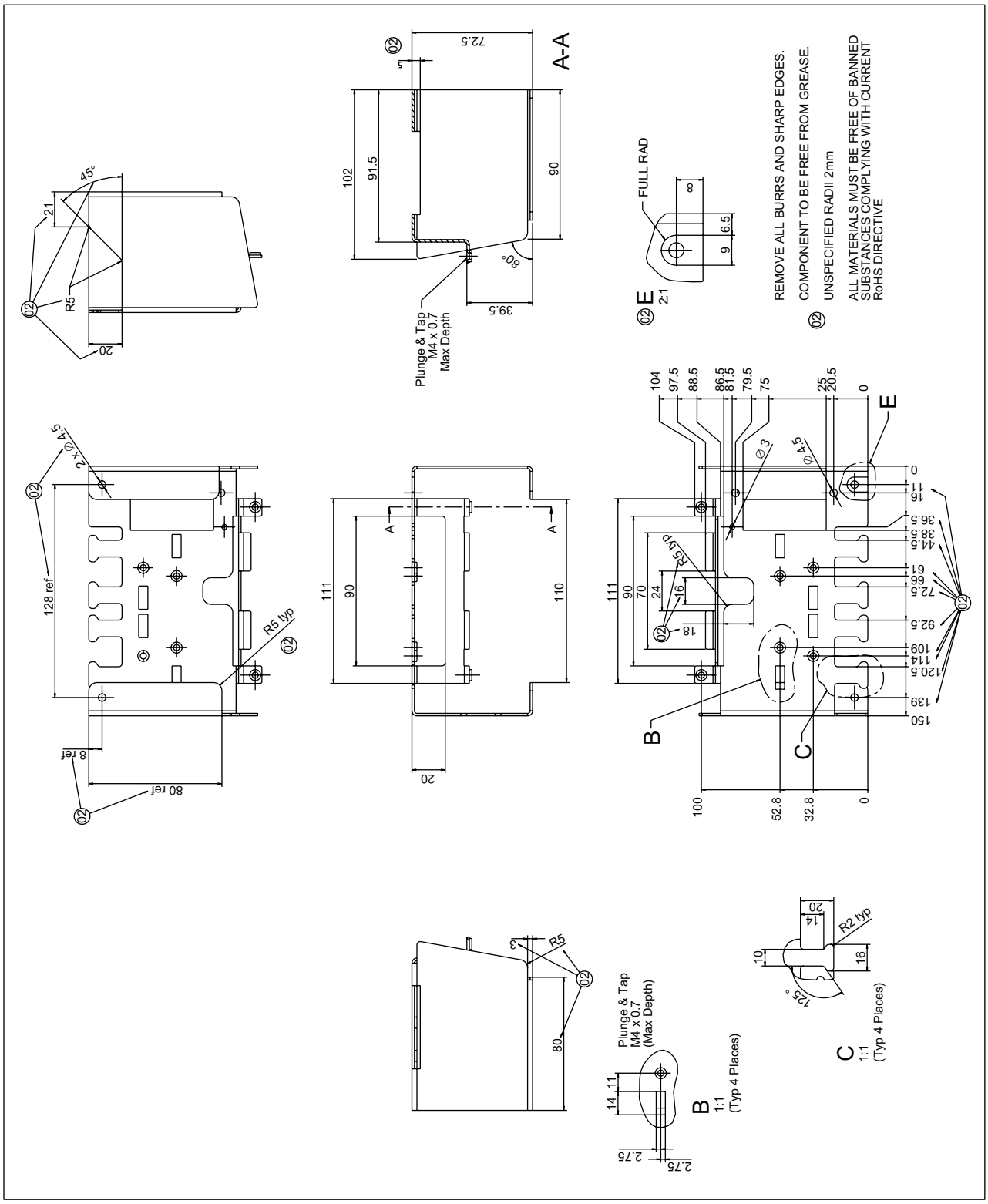


Figure 8-13 Dimension drawing: Screening Kit, frame size FSB

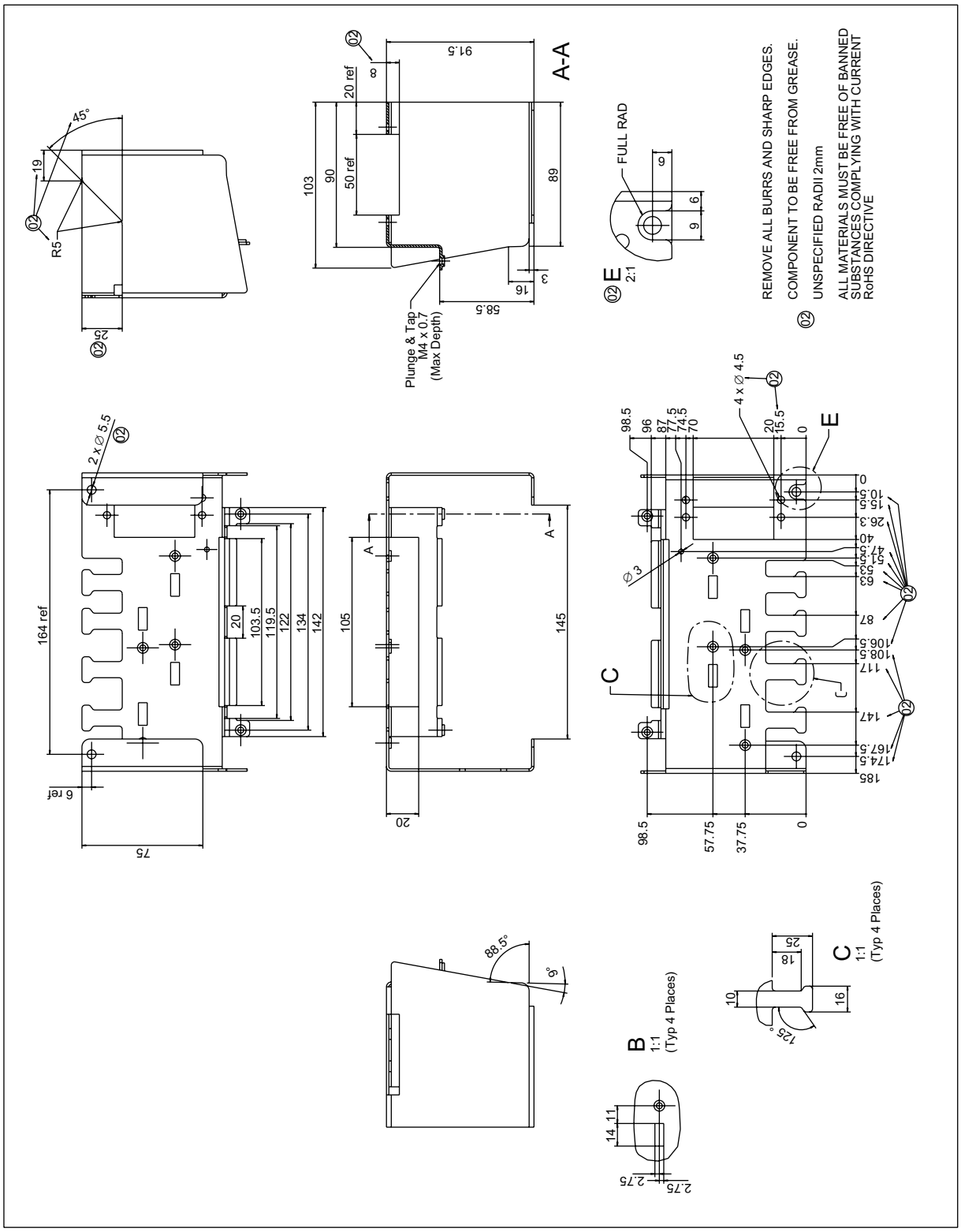


Figure 8-14 Dimension drawing: Screening Kit, frame size FSC

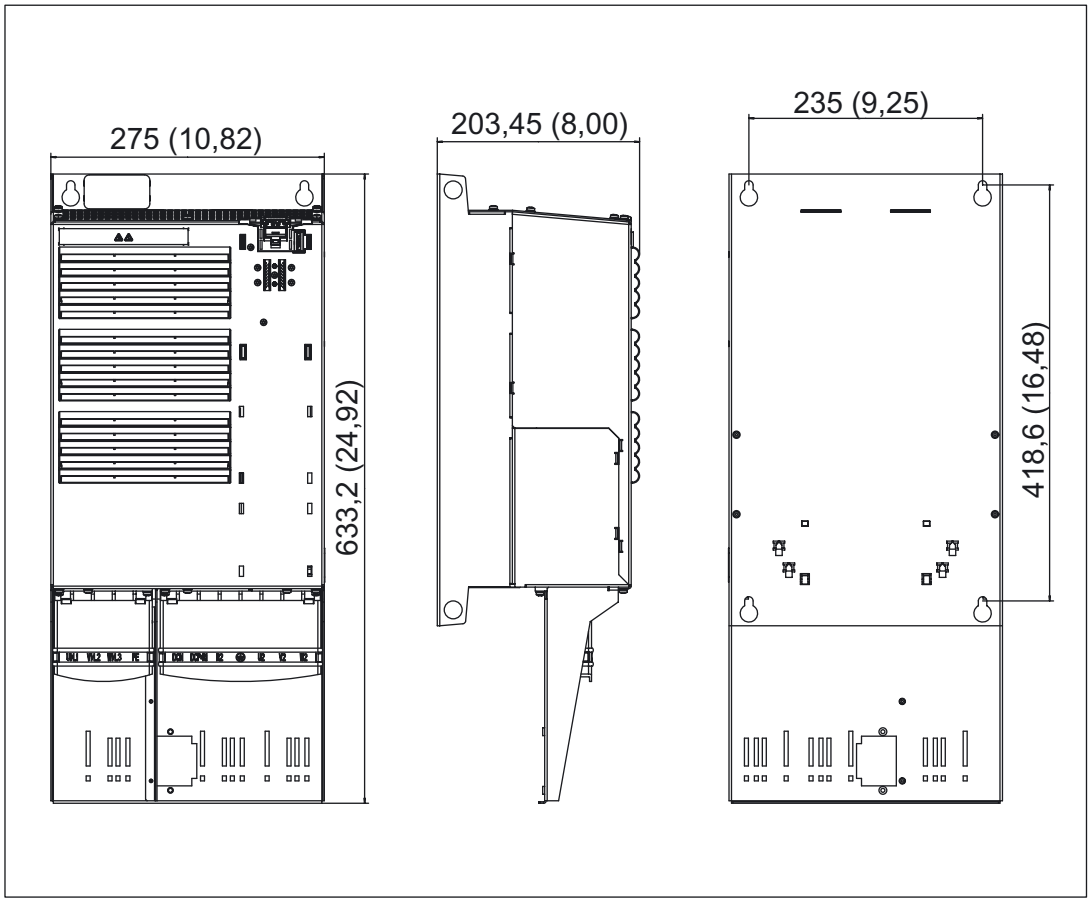


Figure 8-15 Dimension drawing: Power Module PM340 with Screening Kit, frame size FSD

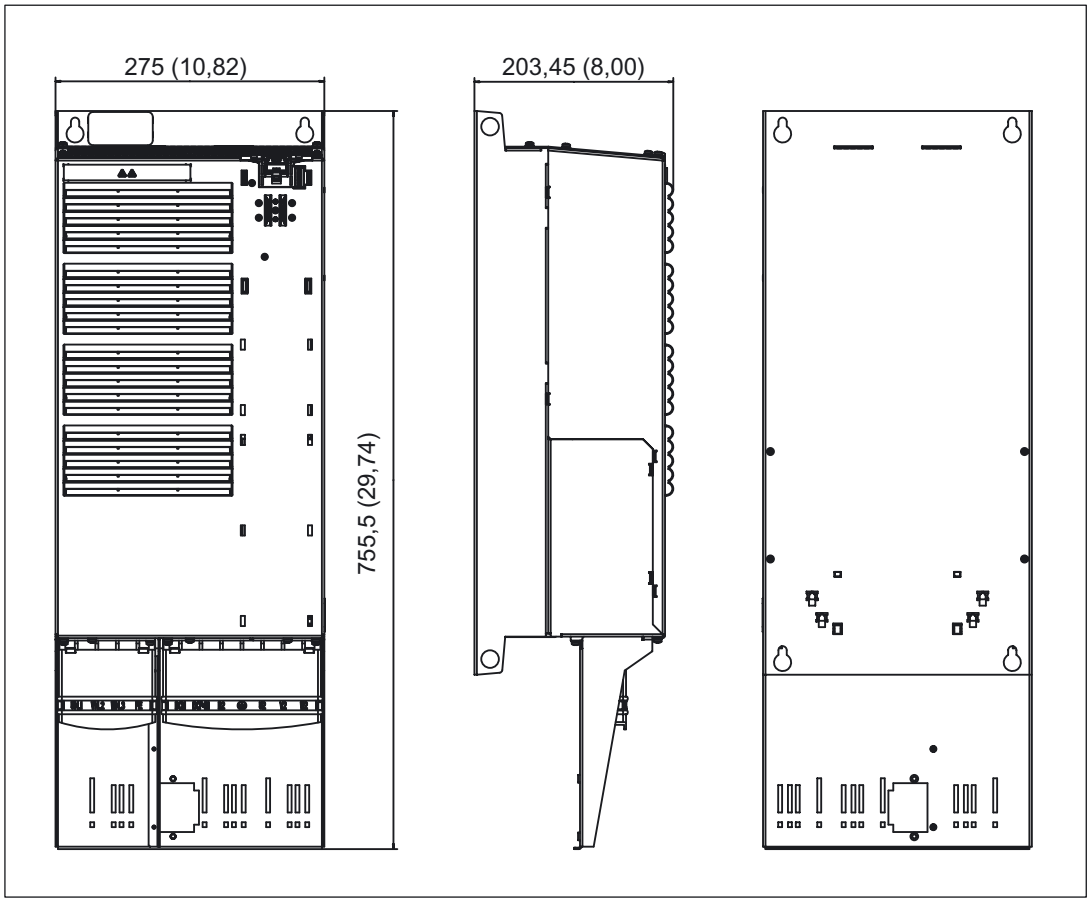


Figure 8-16 Dimension drawing: Power Module PM340 with Screening Kit, frame size FSE

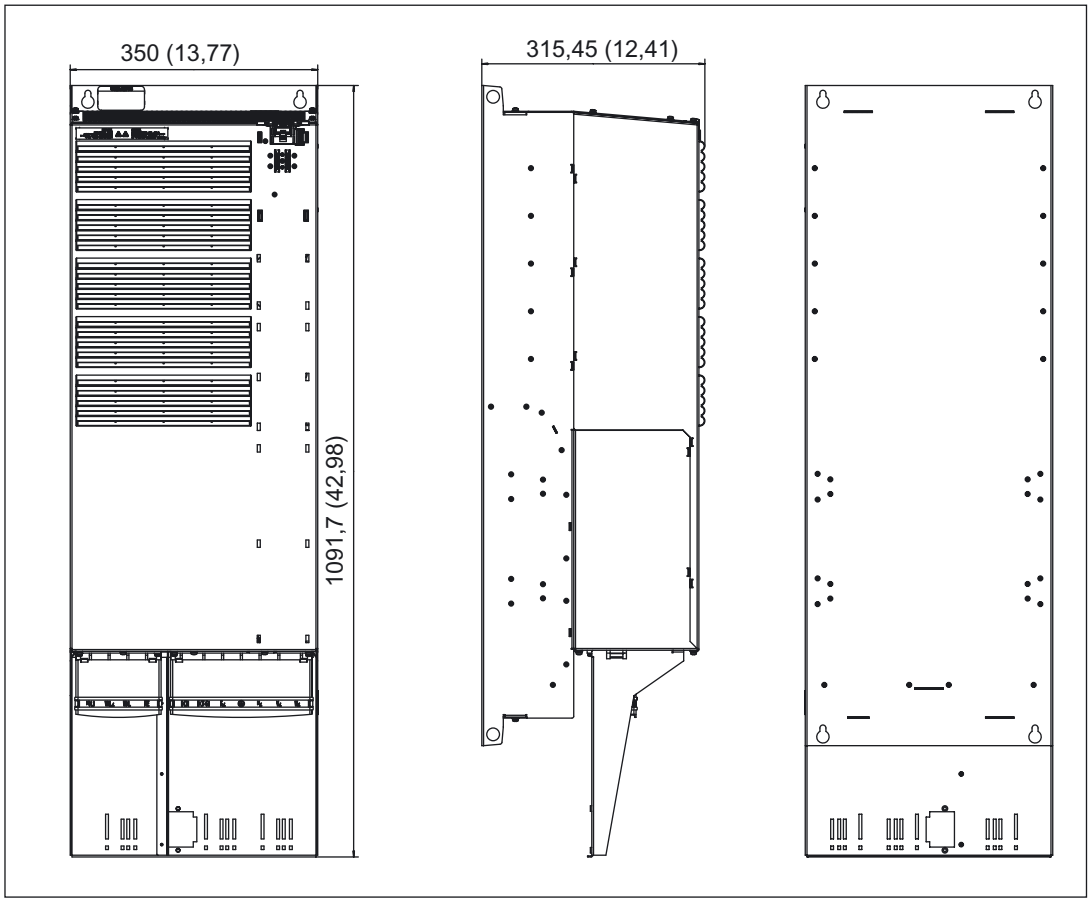


Figure 8-17 Dimension drawing: Power Module PM340 with Screening Kit, frame size FSF

8.3.3 Mounting

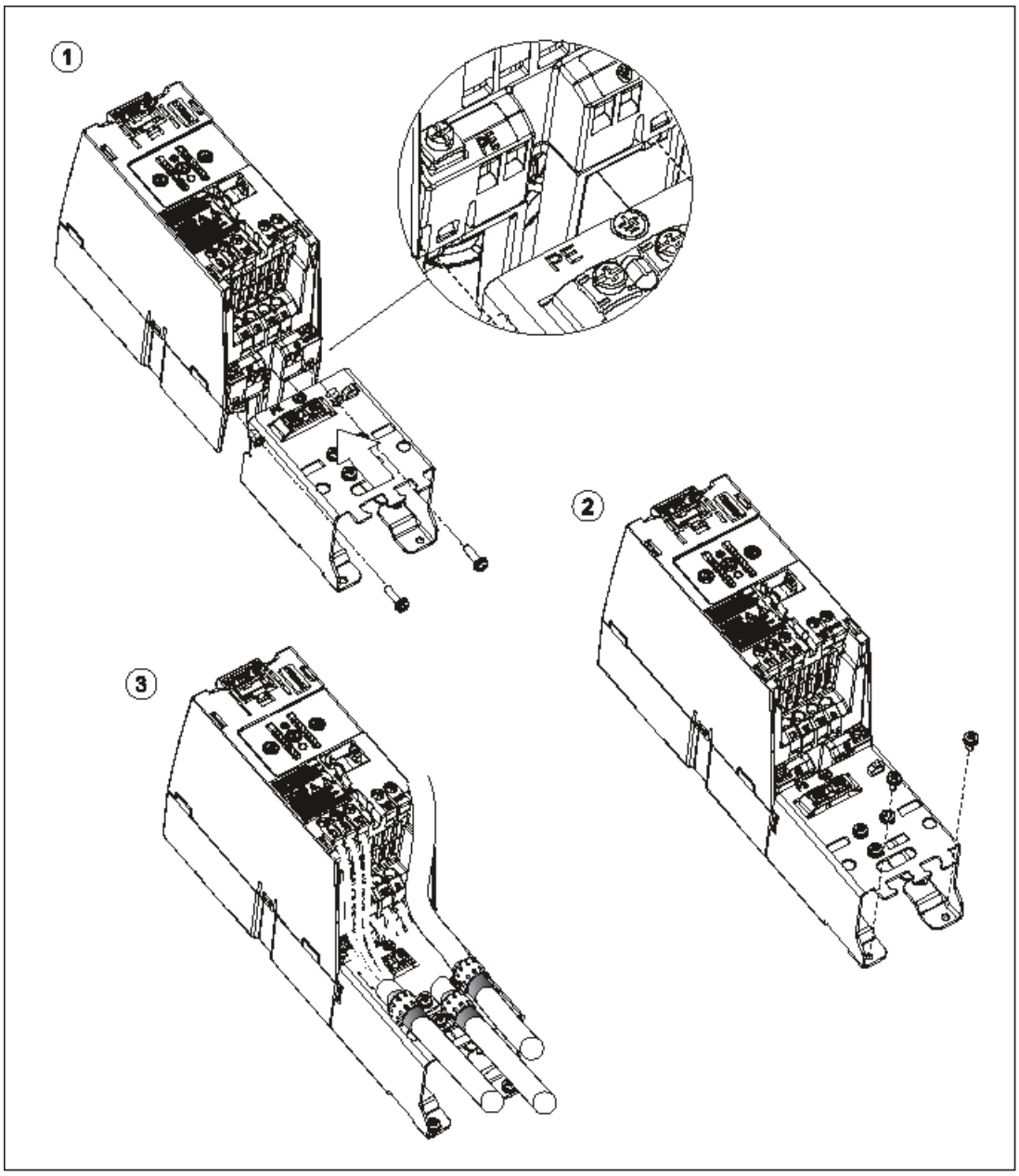


Figure 8-18 Mounting: Power Module PM340, frame size FSA, with Screening Kit

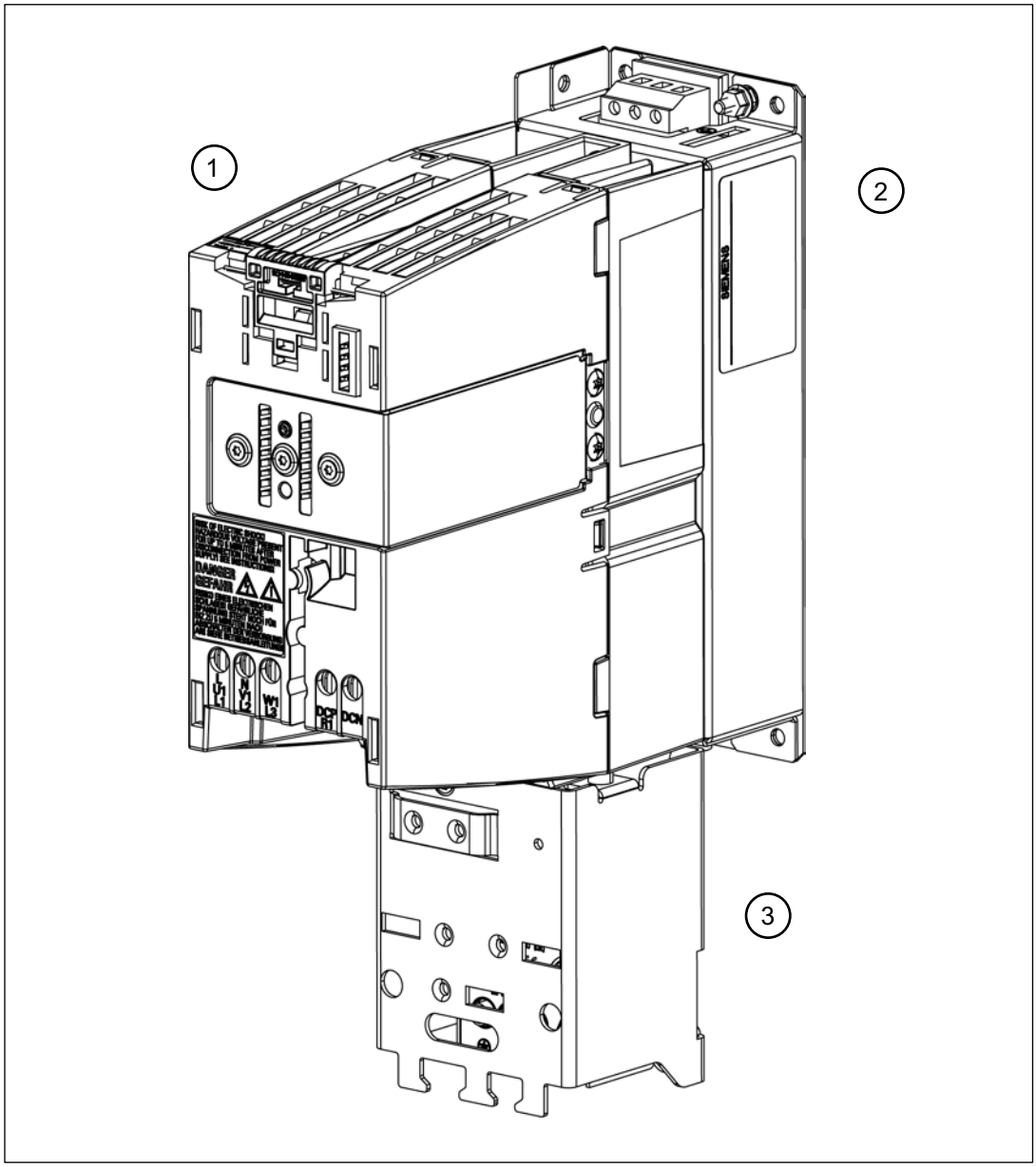


Figure 8-19 Power Module PM340, frame size FSA, with line filter and Screening Kit

1. Power Module PM340 frame size FSA
2. line filter
3. Screening Kit

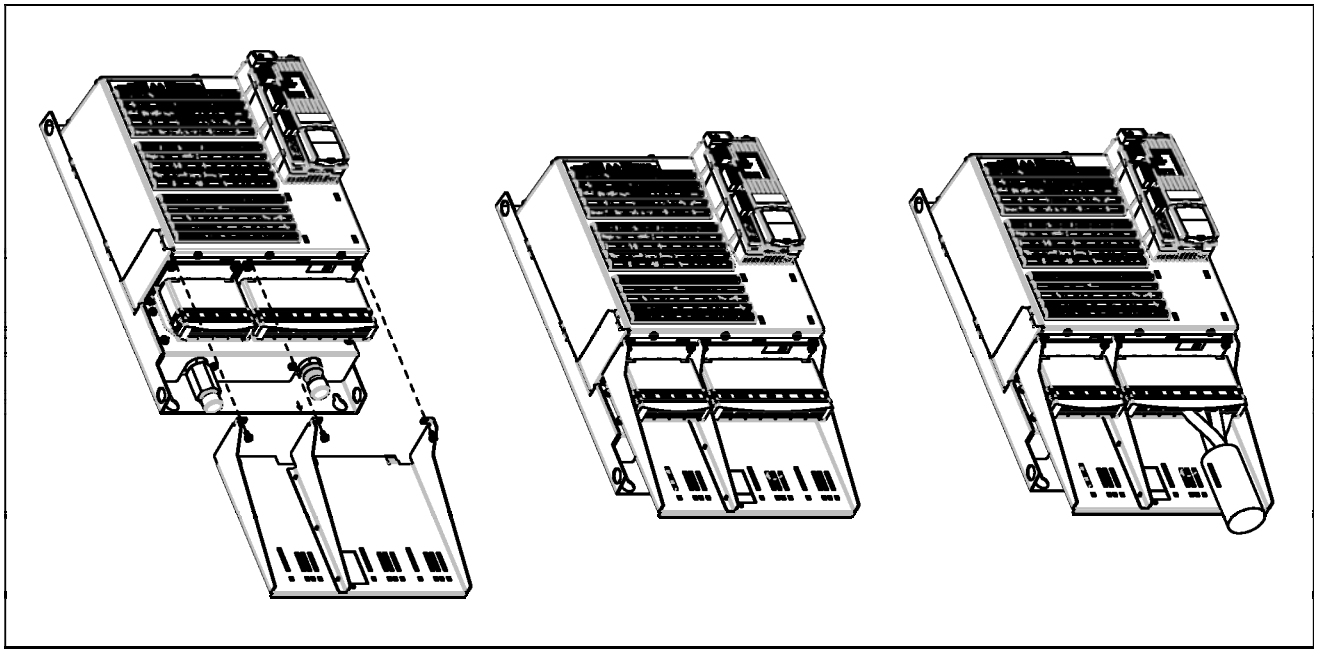


Figure 8-20 Mounting: Power Module PM340 liquid cooled, frame size FSD and Screening Kit

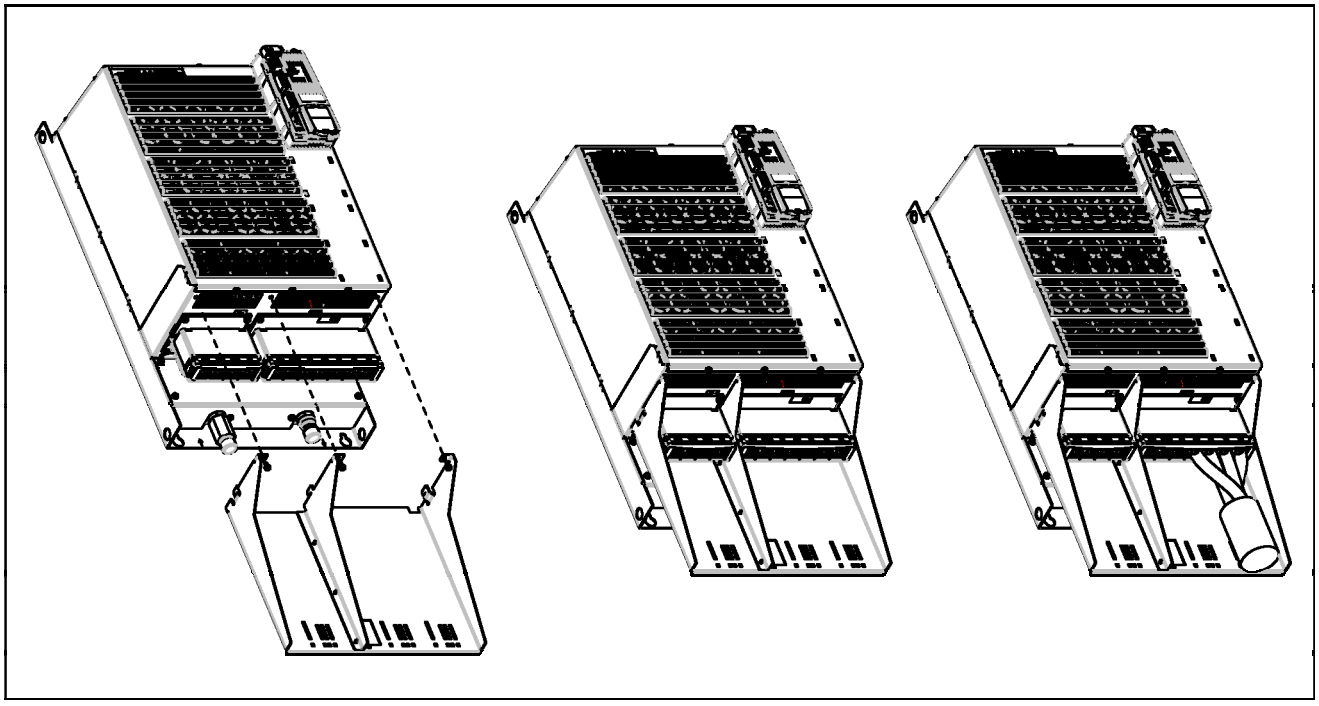


Figure 8-21 Mounting: Power Module PM340 liquid cooled, frame size FSF and Screening Kit

Cabinet design and EMC for components, Blocksize format

9

9.1 Information

9.1.1 General

The SINAMICS S components are designed in accordance with degree of protection IP20 or IPXXB acc. to EN 60529 and as open-type devices to UL 50. This ensures protection against electric shocks. To ensure protection against mechanical stress and climatic conditions too, the components should only be operated in housing/cabinets/rooms that fulfill at least degree of protection IP54 and, as enclosure types, are designed to UL 50.

Prefabricated MOTION-CONNECT cables are recommended.

The Safety Integrated safety function:

The components must be protected against conducted contamination (e.g. by installing them in a cabinet with degree of protection IP54).
Provided that conducted interference can be prevented at the installation site, the degree of protection for the cabinet can be decreased accordingly.

Low-voltage switchgear and controlgear assemblies

Part 1: Type-tested and partially type-tested low-voltage switchgear and controlgear assemblies

If the SINAMICS S drive line-up is used for the electrical equipment of machines, the applicable requirements of EN 60204-1 must also be adhered to.

Safety of machinery

Electrical equipment of machines

Part 1: General requirements

All information for device selection in this section applies to

- Operation in a TN system
- Operating voltage range 1-ph. 200 V AC to 3-ph. 440 V AC

⚠ DANGER
If the shielding procedures described and the specified cable lengths are not observed, the machine may not operate properly.

9.1.2 Safety information

Note

When installing the equipment in cabinets, the ventilation slots must be covered to prevent drill swarf, wire end ferrules, and the like from falling into the housing.

Safety regulations governing shock protection must be observed. See also EN 60204–1.

CAUTION

To ensure that the encoder system works properly, you are advised to use the original Siemens accessories from catalog PM 21.

Only motors with a safe electrically isolated holding brake may be connected. The brake conductors must also be safely electrically isolated.

If the motor power cable is connected to intermediate terminals, the power cables and brake cables must be routed apart (≥ 300 mm).

After an intermediate terminal (e.g. due to a terminal block), it is best to continue routing using the approved MOTION-CONNECT cable.

CAUTION

The conductor pair for the motor holding brake must be themselves shielded (braided shield). For MOTION-CONNECT cables, this is provided by the inner shield.

⚠ WARNING

Cable shields and unused conductors of power cables (e.g. brake conductors) must be connected to PE potential.

Non-observance can cause lethal shock voltages.

⚠ DANGER

To protect against electric shock the components should only be operated in closed electrical operating areas or in cabinets. Furthermore, an internal protective conductor connection of the components is absolutely essential.

The components generate high leakage currents in the protective conductor. In order to ensure protection against electric shocks if the external protective conductor is interrupted, one of the following measures must be implemented for the external connection:

- stationary connection and protective conductor connection by means of ≥ 10 mm^2 Cu or ≥ 16 mm^2 Al
- stationary connection and automatic shutdown of the power supply if the protective conductor is interrupted

9.2 Selection of Devices Required for Operating SINAMICS

9.2.1 General

The following components are required to connected to the line supply:

- Line disconnecting device
- Line fuse
- Line contactor (this is required for electrical isolation)
- Line filter (optional for Power Module PM340, frame size FSA)
- Line reactor (refer to Chapter Line supply connection)

To protect the units against line-side surge voltages, you are advised to install an overvoltage protection device directly at the infeed point (upstream of the main switch). To fulfill the requirements of CSA C22.2 no. 14-05, surge protection is essential. For examples of suitable voltage surge arresters, see www.raycap.com (for example)

9.2.2 Information about line disconnecting devices

The line disconnecting device for the electrical equipment may be used for correct isolation of the drive line-up from the power supply. This line disconnecting device must be designed for the electrical equipment of machines in accordance with the requirements of EN 60204-1, Section 5.3. The relevant technical specifications must be taken into consideration for the purpose of selecting the device. Other consumers of the electrical equipment must also be taken into consideration when the device is selected.

The accessories required for the line disconnecting device must be selected from the manufacturer catalogs. See also catalog PM 21.

9.2.3 Overcurrent protection using line fuses or circuit-breakers

The cables for the drive line-up power supply must be protected against overcurrents. NH, D, and DO-type fuses with a gL characteristic or suitable circuit-breakers can be used for this purpose.

Note

The devices can be connected to line supplies up to 480 V_{AC}, which can supply a maximum of 36 kA symmetrical ("uninfluenced current" acc. to EN 60269-1).

⚠ WARNING

During operation from networks with low short-circuit power (e.g. trial operation, operation with isolating transformer), the fuses must be designed in such a way that, if a fault occurs, the line fuses trip after 0.4 s with mobile equipment and after 5 s with stationary equipment to provide protection against electric shock after indirect contact and in the event of short-circuits.

For further information: See catalog PM 21.

9.2.4 Line filter

A separate line filter (see catalog) must be used for the SINAMICS S110 drive line-up.

NOTICE

An additional line filter must be used to suppress interference in other loads. To prevent mutual interference, this line filter must not be equipped with line-side capacitors with respect to ground. Filter series B84144A*R120 (EPCOS) is recommended.

In conjunction with line reactors and a systematic plant configuration, line filters limit the conducted interference emitted by the Power Modules to the limit values of category C2 to EN 61800-3. Line filters are only suitable for direct connection to TN systems.

Note

According to product standard IEC61800-3 RI suppression commensurate with the relevant operating conditions must be provided and is a legal requirement in the EU (EMC Directive). Line filters and line reactors are required for this purpose. The use of filters of other makes can lead to limit value violations, resonances, overvoltages and irreparable damage to motors or other equipment. The machine manufacturer must provide verification that the machinery to be operated with the drive products and the installed suppression elements, e.g. line filters, are CE/EMC-compliant before the machines are approved for delivery.

9.2.5 Line Contactors

Line contactors are required to provide electrical isolation between the drive line-up and the line supply.

When selecting a line contactor, the characteristic values in the technical data apply. The cable routing, the bundling factor and the factor for the ambient temperature according to EN 60204-1 must be taken into account when dimensioning the various cables.

Note

To limit the switching overvoltage, the contactor coil must be connected to an overvoltage limiter (e.g. flywheel diode or varistor).

⚠ CAUTION

Line contactors must not be switched under load.

When the digital output is used to control the line contactor, its making/breaking capacity must be taken into account.

9.3 24 V DC Supply Voltage

9.3.1 General

The 24 V DC voltage is required for the power supply of:

1. The load voltage of the Control Unit digital outputs.
   The Control Units are supplied with power via the PM-IF. 24 V must also be connected in the following cases:
   - Commissioning / diagnostics when the Power Module power supply is switched-out.
   - Using the digital outputs CU305
2. The electronics of the Sensor Module
3. The Safe Brake Relay (motor holding brake)

Other loads can be connected to these power supply units if they are separately protected from overcurrent.

Note

The user should provide the electronics power supply as described in Chapter "System data" in this documentation.

When connecting to a "DC power supply" in the sense of EN 60204-1:1997, Chapter 4.3.3, functional faults can occur due to the voltage interruptions that are permitted there.

NOTICE

If other consumers are connected to the power supply, connected inductance devices (contactors, relays) must be fitted with suitable overvoltage protection circuits.

NOTICE

A regulated DC power supply is required to operate motors with a built-in holding brake. The power is supplied via the 24 V connection (Safe Brake Relay). The voltage tolerances of the motor holding brakes and the voltage drops of the connection cables must be taken into account.

The DC power supply should be set to 26 V. This ensures that the power supply for the brake remains within the permissible range when the following conditions are fulfilled:

- Using Siemens three-phase motors
- Using Siemens MOTION-CONNECT power cables
- Motor cable lengths: max. 100 m

9.3.2 Selecting power supply units

You are advised to use the devices in the following table. These devices meet the applicable requirements of EN 60204-1.

Table 9- 1 Recommended SITOP Power

Rated output current [A]	Input voltage range [V]	Short-circuit current [A]	Order No.
5	2 AC 85-132/170 – 550	5,5	6EP1333-3BA00
10	2 AC 85-132/176 – 550	30 for 25 ms	6EP1334-3BA00
20	3-ph. 320 – 550 V AC	23	6EP1336-3BA00
40	3-ph. 320 – 550 V AC	46	6EP1337-3BA00

Table 9- 2 Recommendation for Control Supply Module

Rated output current [A]	Input voltage range [V]	Short-circuit current [A]	Order No.
20	3-ph. 380 V AC -10% (-15% < 1 min) to 3-ph. 480 V AC+10% DC 300 – 800	< 24	6SL3100-1DE22-0AA0

See catalog PM 21.

⚠ WARNING

When an external power supply is used, e.g. SITOP, the ground potential must be connected to the protective conductor system (DVC A).

9.3.3 24 V component current consumption

A separate 24 V power supply must be used for the SINAMICS S110 drive line-up.

The following table can be used to calculate the 24 V DC power supply. The values for typical current consumption are used as a basis for configuration.

Table 9- 3 Overview of 24 V DC current consumption

Component	Typical current consumption [A_{DC}]
CU305 DP for each digital output	0,8
CU305 CAN for each digital output	0,8
DRIVE-CLiQ (e.g. motors with DRIVE-CLiQ interface)	Typ. 0.25, max. 0.45
Brake (e.g. motor holding brake)	Typ. 0.4 to 1.1; max. 2
Sensor Module Cabinet	
SMC10	0,2
SMC20	0,2
SMC30	0,3
Sensor Module External	
SME20	0,11
SME25	0,11
SME120	0,16
SME125	0,16

9.3.4 Overcurrent Protection

Cables on both the primary and the secondary side of the power supply unit must be protected from overcurrent. Primary side protection must be implemented according to the manufacturer's instructions. Secondary side protection must be rated to deal with the actual conditions. In particular:

- Loading due to loads, possibly the simultaneity factor in response to machine operation
- Current carrying capacity of the conductors used and cables in normal and short-circuit conditions
- Ambient temperature
- Cable bundling (e.g. laying in a common duct)
- Cable laying method to EN 60204-1

EN 60204-1, Section 14, can be used to determine the overcurrent protection devices.

Circuit-breakers from the Siemens LV 1 and LV 1T catalogs are recommended as overcurrent protection devices on the primary side, and miniature circuit-breakers or SITOP select 6EP1961-2BA00 as overcurrent protection devices on the secondary side. The miniature circuit-breakers can also be selected from the Siemens LV 1 and LV 1T catalogs.

Miniature circuit-breakers are recommended as overcurrent protective device for cables and busbars. The ground potential M must be connected to the protective conductor system (DVC A).
When selecting the circuit-breaker, the following standards must be carefully observed:

EN 61800-5-1, EN 60204-1, IEC 60364-5-52, IEC 60287-1 to -3, EN 60228 and UL 508C.

In so doing, the following conditions for the conductors/cables must be carefully taken into consideration:

- Ambient temperature 55 °C
- Limiting conductor temperature ≥ 75 °C for operation with the rated load current
- Cable length max.:
  - 10 m for the supply supply cables
  - 30 m for signal lines

In addition, the conductors/cables should be routed so that

- Max. 1 conductor pair is bundled, and
- The 24 V conductors/cables must be routed separately from other cables and conductors that can conduct operating currents.

Table 9- 4 MCBs by conductor cross-section and temperature

Conductor cross-section	Max. value up to 40 °C	Max. value up to 55°C
1.5 mm^2	10 A	6 A
2.5 mm^2	16 A	10 A
4 mm^2	25 A	16 A
6 mm^2	32 A	20 A

The trip characteristic of the MCBs must be selected to match the loads to be protected and the max. current provided by the power supply unit in the event of a short-circuit.

9.4 Arrangement of components and equipment

9.4.1 General

The arrangement of the components and equipment takes account of

- Space requirements
- Cable routing
- Bending radiuses of the connection cables
  MOTION-CONNECT lines, see D21.1 catalog
- Heat dissipation
- EMC

Components are usually located centrally in a cabinet.

Always observe the mounting clearances necessary above and below the components.

9.4.2 Mounting

The components should be mounted on a conductive mounting surface to ensure low impedance between the component and the mounting surface. Mounting plates with a galvanized surface are suitable.

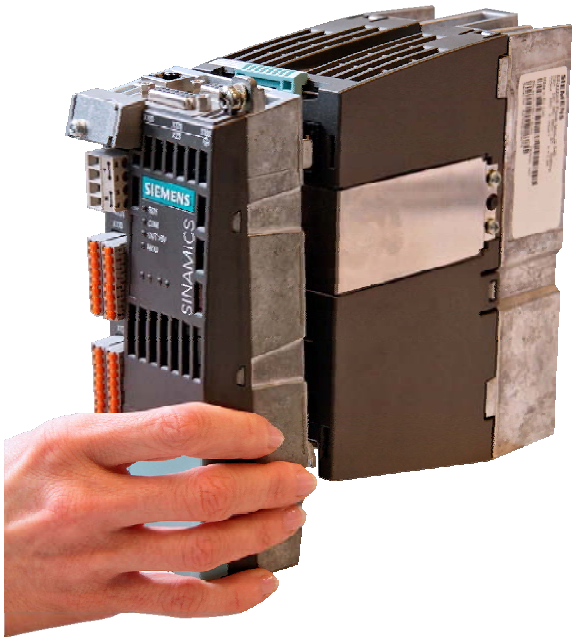


Figure 9-1 Mounting the CU305 onto the Power Module PM340 (frame size FSA)

Wiring rules for DRIVE-CLiQ

See References: /FH3/ SINAMICS S110, Function Manual Drive Functions

9.5 Information about Electromagnetic Compatibility (EMC) and Cable Routing

9.5.1 General

Requirements to implement EMC are listed in EN 61000-6-2, EN 61000-6-4, EN 61800-3, EN 60204-1 and in the EMC Design Directives - Order No. 6FC5297-0AD30-0*P2. German, *B: English). Conformance with the EMC Directive of the EC can be secured by following the measures described in the EMC Design Directives.
When mounting components in cabinets, in order to fulfill the EMC directive, the following conditions must be additionally observed:

- Connected to TN line supply systems with grounded neutral point
- SINAMICS line filter (optional for frame size FSA)
- Observance of information about cable shielding and equipotential bonding
- Only the recommended Siemens power and signal cables are used
- Only cables from Siemens may be used for DRIVE-CLiQ connections.

For MOTION-CONNECT cables see catalog D21.1

CAUTION
If couplings or cabinet glands are needed for the DRIVE-CLiQ connections, only the DRIVE-CLiQ coupling and DRIVE-CLiQ cabinet gland, described in the Chapter Accessories, may be used.

⚠ DANGER
If the shielding procedures described and the specified cable lengths are not observed, the machine may not operate properly.

9.5.2 Cable Shielding and Routing

In order to comply with the EMC requirements, certain cables must be routed apart from other cables and from certain components. To full EMC requirements, the following cables must be used with shields:

- Power supply cables from line filter via line reactor to Power Module
- All motor cables (if necessary, including cables for motor holding brake)
- Cables for "fast inputs" of the Control Unit
- Cables for analog direct voltage/current signals
- Signal cables for sensors
- Cables for temperature sensors

⚠DANGER

A suitable PE conductor must be connected to all devices in protection class I.

The PE conductor connection of the individual components must have at least 4 mm².

Alternative measures (e.g. routing behind mounting plates, suitable clearances) can also be used provided they have similar results. This excludes measures that relate to the design, installation, and routing of motor power cables and signal cables. If non-shielded cables are used between the line connection point and line filter, make sure that no interfering cables are routed in parallel.

The cable shields must be connected as close to the conductor terminal connections as possible to ensure a low-impedance connection with cabinet ground.

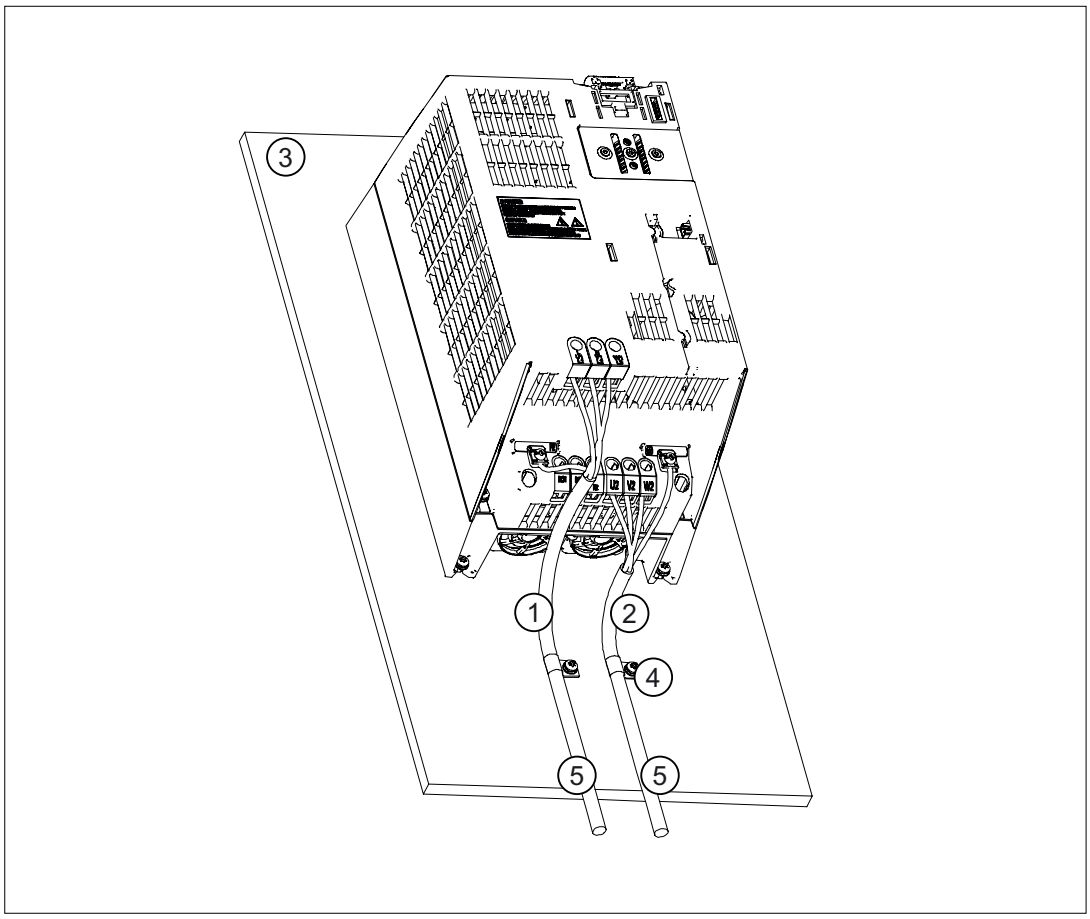


Figure 9-2 Shielding of a Power Module PM340

1. Line supply input
2. Motor cable
3. Rear metal panel
4. Use suitable clamps/clips to reliably connect the shield of the motor and field cable to the rear metal panel.
5. Shielded cable

Alternatively, the cable shields can be connected to them metal mounting plate using pipe clamps and serrated rails. The cable length between the shield contact point and the terminals for cable conductors must be kept as short as possible.

Shield connection plates with pre-prepared clip contacts are available for connecting the shields for power cables of Power Modules.

All cables inside the cabinet must be connected as closely as possible to parts connected with cabinet ground, such as a mounting plate or cabinet wall. Ducts made of sheet steel or routing cables between between steel sheets (e.g. between the mounting plate and back wall) should provide adequate shielding.

Avoid, where possible, routing non-shielded cables, connected to the drive line-up, in the immediate vicinity of noise sources, e.g. transformers. Signal cables (shielded and unshielded) connected to the drive line-up must be laid at a great distance from strong

external magnetic sources (e.g. transformers, line reactors). In both cases, a distance of ≥ 300 mm is usually sufficient.

Signal and DC power supply cables

Operating unshielded signal and direct current supply cables (e.g. 24 V infeed with external supply):

- DC power supply cables: Max. permissible length: 10 m
- Non-shielded signal cables: Max. permissible length: 30 m (without additional wiring)

For greater lengths, suitable wiring must be connected by the user to provide overvoltage protection. For example:

Table 9- 5 Recommendations for overvoltage protection

DC power supply	24 V signal cables
Weidmüller Type no.: PU DS 24V 16A	Weidmüller Type no.: MCZ OVP TAZ
Weidmüller GmbH & Co. KG An der Talle 89 33102 Paderborn Tel. 05252/960-0 Fax 05252/960-116 http://www.weidmueller.com	

CAUTION
The connected signal and power cables must not cover the ventilation slots.

CAUTION
Non-shielded signal cables must not be routed parallel to power cables.

9.5.3 Equipotential bonding

The SINAMICS S drive system is designed for use in cabinets with a PE conductor connection.

The machinery construction OEM must carefully ensure that all of the conditions regarding the assignment of the ground cable, ground connecting cables, protective conductor and potential bonding cable connections and terminals are clearly specified in his Technical User/Manufacturer Documentation, are clearly specified (this is especially important if there are several protective conductor/potential bonding conductor connections/terminals in the unit). It is especially important to note that the connections for potential bonding cables that exist in parallel to connections for protective connecting cables may not be used to loop-through the protective connecting cable.

If the drive line-up is arranged on a common unpainted metal-surfaced mounting plate, e.g. with a galvanized surface, no additional equipotential bonding is needed within the drive line-up as

- All parts of the switchgear assembly are connected to the protective conductor system.
- The mounting plate is connected with the external PE conductor by means of a finely-stranded copper conductor with a cross-section of 16 mm², including the outer conductor. From a cross-section of 25 mm² copper, the outer cross-section of the finely-stranded conductor is halved.

For other installation methods, equipotential bonding must be implemented using conductor cross-sections as stated in the second item in the list or at least equal to the conductance.

If components are mounted on DIN rails, the data listed in the second item applies for equipotential bonding. If only smaller connection cross-sections are permissible on components, the largest must be used (e.g. 6 mm² for TM31 and SMC). These requirements also apply to distributed components located outside the cabinet.

CAUTION
An equipotential bonding conductor with a cross-section of at least 25 mm² must be used between components in a system that are located a considerable distance from each other. If an equipotential bonding conductor is not used, leakage currents that could destroy the Control Unit or other PROFIBUS nodes can be conducted via the PROFIBUS cable.

9.6 Notes on electrical cabinet cooling

9.6.1 General

Electrical cabinets can be cooled, using among other things the following:

- filtered fans
- heat exchangers or
- cooling units.

The decision in favor of one of these methods will depend on the prevailing ambient conditions and the cooling power required.

The air routing within the electrical cabinet and the cooling clearances specified here must be observed. No other components or cables must be located in these areas.

CAUTION
If you do not observe the guidelines for installing SINAMICS equipment in the cabinet, this can reduce the service life of the equipment and result in premature component failure.

You must take into account the following specifications when mounting/installing SINAMICS components:

- Cooling clearance
- Cable routing
- Air guidance, air-conditioner

Table 9- 6 Cooling clearances around the components

Component	Clearance above and below in mm and (inches)	Lateral clearance in mm and (inches)
CU305 DP	50 (1.97)	0
CU305 CAN	50 (1.97)	0
SMCxx	50 (1.97)	0
line filter	100 (3.93)	
Line reactor	100 (3.93)	0
PM340 blocksize, frame size FSA	100 (3.93)	30 (1.18)
PM340 blocksize, frame size FSB	100 (3.93)	40 (1.57)
PM340 blocksize, frame size FSC	125 (4.92)	50 (1.97)
PM340 blocksize, frame sizes FSD and FSE	300 (11.81)	0
PM340 blocksize, frame size FSF	350 (13.77)	0

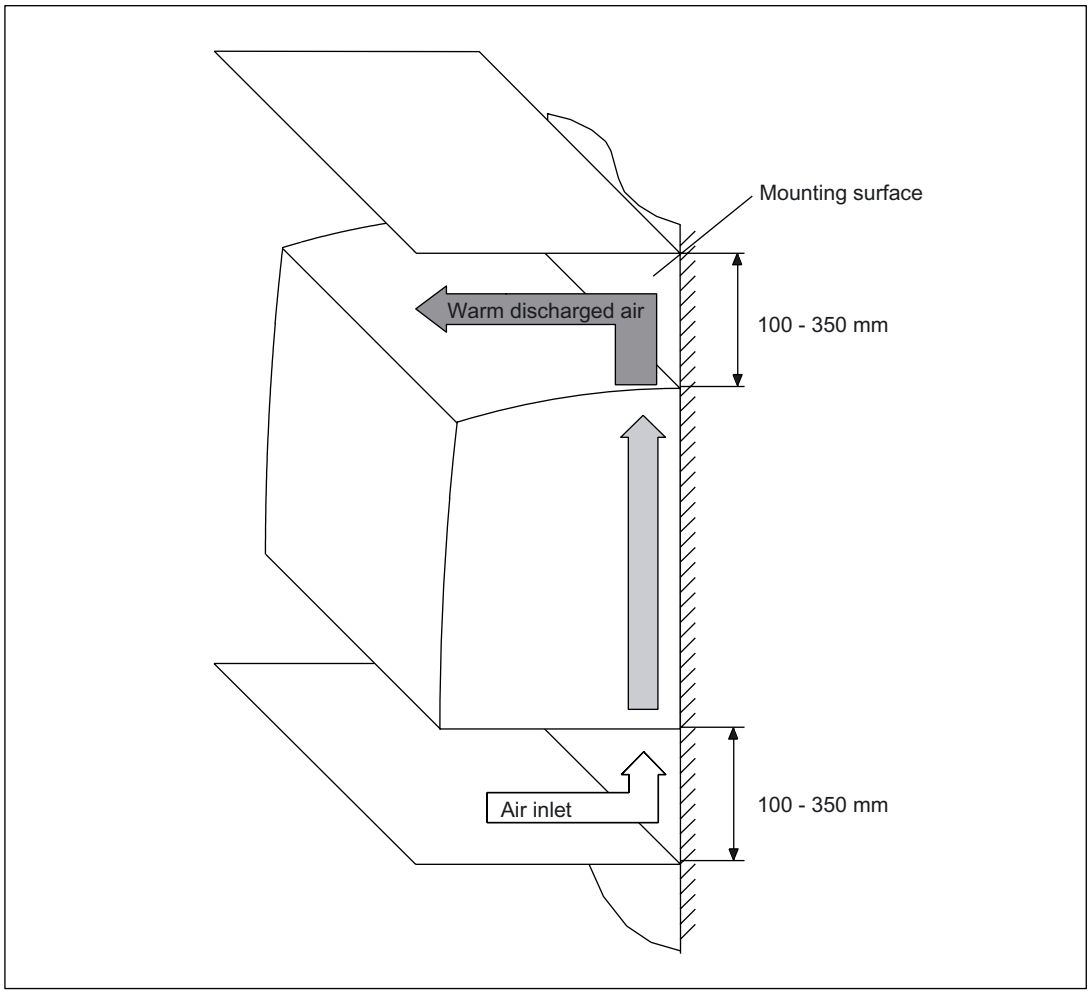


Figure 9-3 Cooling clearances

9.6.2 Ventilation

The SINAMICS equipment is ventilated separately by means of integrated fans and is in some cases cooled by means of natural convection.

The cooling air must flow through the components vertically from bottom (cooler region) to top (region heated by operation).

If filtered fans, heat exchangers, or air conditioners are used, you must ensure that the air is flowing in the right direction. You must also ensure that the warm air can escape at the top. The cooling clearance above and below must be observed.

Note

Cables must not be routed on the components; the ventilation meshes must not be covered.

Cold air must not be allowed to blow directly onto electronic equipment.

Note

The distance between the blow-out aperture of the air conditioner and the electronic equipment must be at least 200 mm.

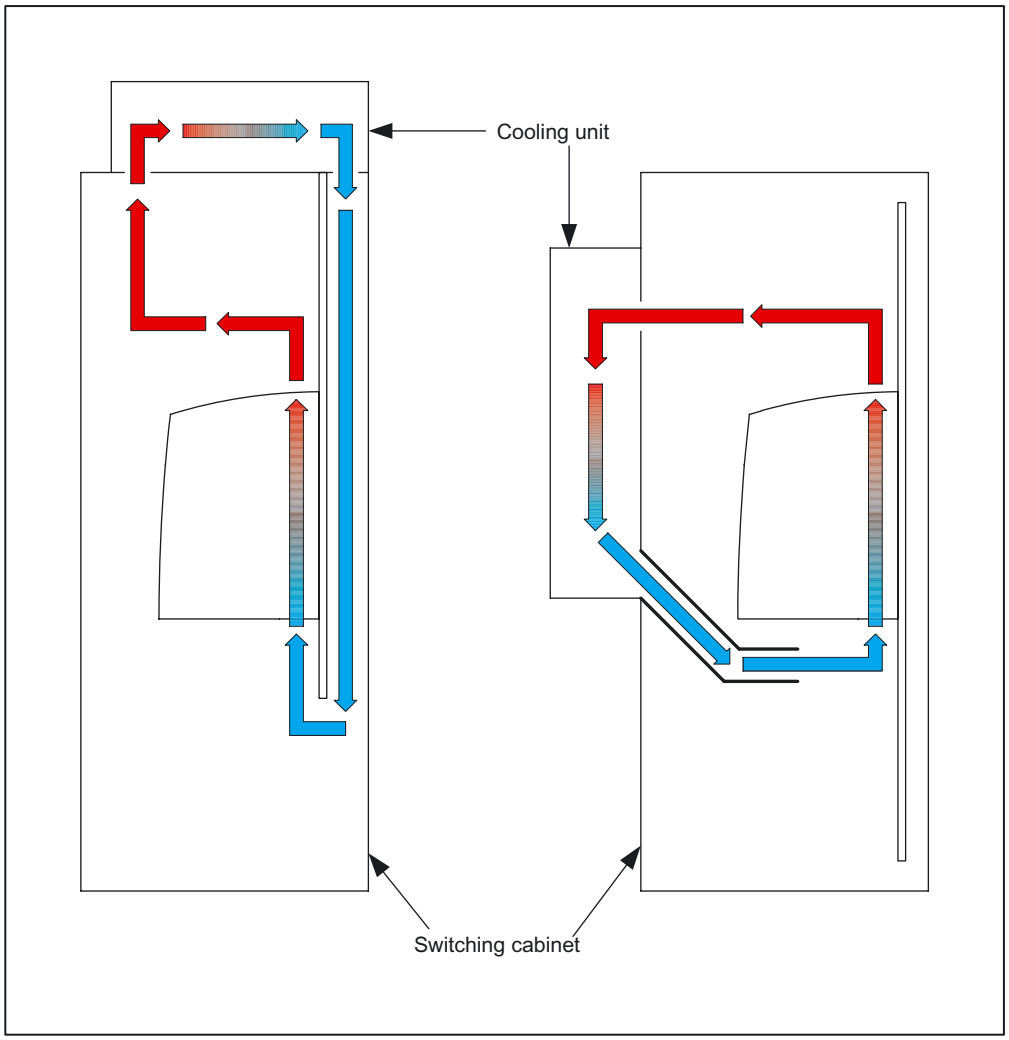


Figure 9-4 Examples of cabinet ventilation

CAUTION
The air guidance and arrangement of the cooling equipment must be chosen in such a way as to prevent condensation from forming. If necessary, cabinet enclosure heating may have to be installed.

If air conditioners are used, the relative air humidity of the expelled air increases as the air in the air conditioner cools and may exceed the dew point. If the relative humidity of the air entering the SINAMICS equipment is over 80% for an extended period of time, the insulation in the equipment may fail to function properly due to electrochemical reactions (refer to System Overview). Using air baffle plates, for example, you must ensure that the cold air expelled from the air conditioner mixes with warm air in the cabinet before it enters the equipment. This reduces the relative air humidity to uncritical values.

9.6.3 Power Loss of Components in Rated Operation

The following table shows the power loss for components. The characteristic values apply for the following conditions:

- Line supply voltage for Power Modules 1-ph. 200 V AC to 3-ph. 380 V to 480 V AC ±10 %.
- Pulse frequency of the Power Modules 4 kHz
- Rated pulse frequency of the Power Modules 8 kHz
- Operating components at their rated power

Table 9- 7 Overview of power losses

	Unit	Power loss
Control Units		
CU305 DP	W	< 20
CU305 CAN	W	< 20
Line reactors for Power Modules Blocksize	W	Refer to Line reactors, Chapter "Technical data".
Line filter for Power Modules Blocksize	W	Refer to Line filter, Chapter "Technical data".
PM340	W	Refer to Power Modules, Chapter "Technical data".
Sensor Modules		
SMC10	W	< 10
SMC20	W	< 10

Service and maintenance

10

10.1 Safety information

⚠ DANGER

Only Siemens customer service, repair centers that have been authorized by Siemens or authorized personnel may repair drive equipment. Al of the persons involved must have in-depth knowledge of all of the warnings and operating instructions as listed in this Manual.

All damaged parts or components must be replaced only using parts and components that are listed in the relevant spare parts list.

⚠ DANGER

Before starting any work, after the specified waiting time has elapsed, carefully measure the voltage! The voltage can be measured between the DC link terminals DCP and DCN and must be below 42.2 V DC.

⚠ DANGER

If the auxiliary 230 V AC supplies are present, then a hazardous voltage is present at the components even when the main switch is in the open state.

10.2 Service and maintenance for components, Blocksize format

10.2.1 Replacing hardware components

NOTICE
Hardware components may only be replaced when in the no-voltage state!

The following components can be replaced with replacement/exchange components with the same Order No.:

- Power Modules
- DRIVE-CLiQ components
- Control Units

10.2.2 Replacing the fan

PM340: For all frame sizes, the fans are accessible from the outside. For frame sizes FSA to FSC, a Phillips screwdriver is required when replacing fans.
The fan can be ordered as spare part.

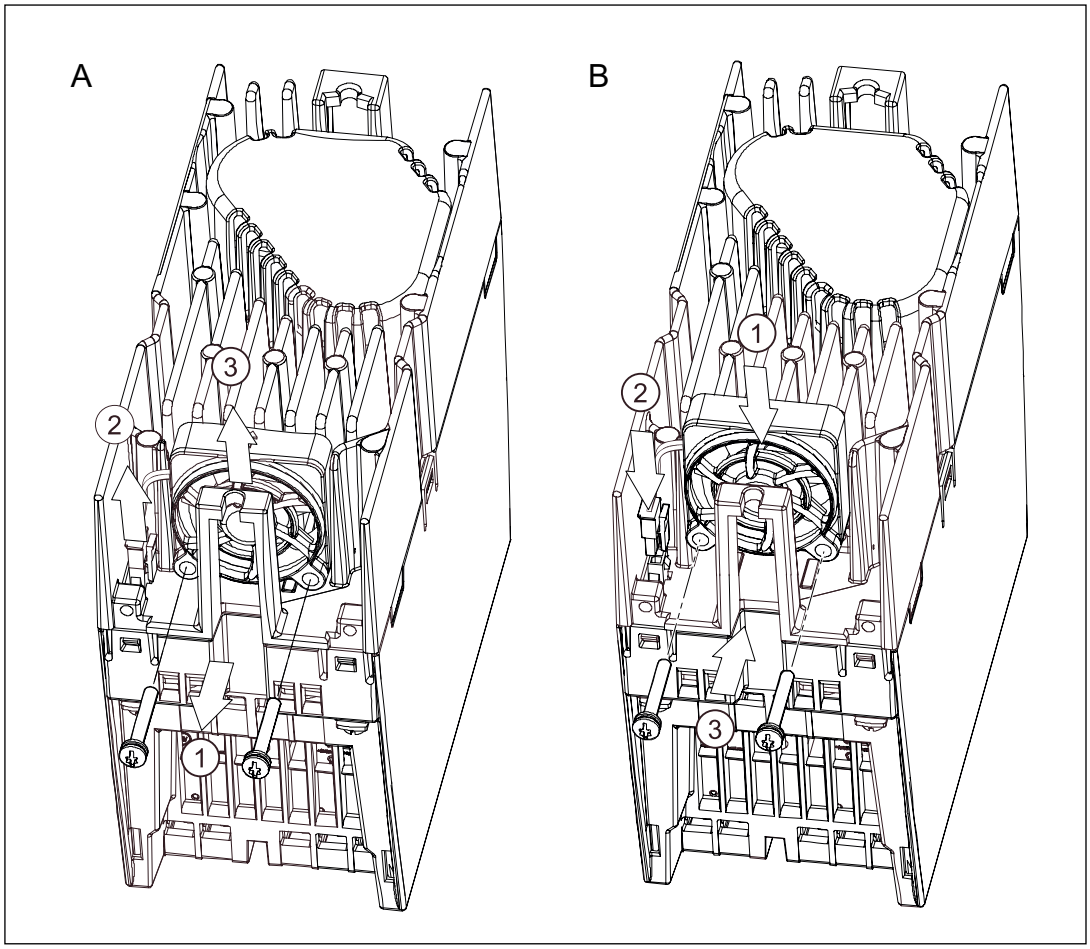


Figure 10-1 Replacing the fan for a Power Module PM340, frame size FSA

(tightening torque 0.4 Nm)

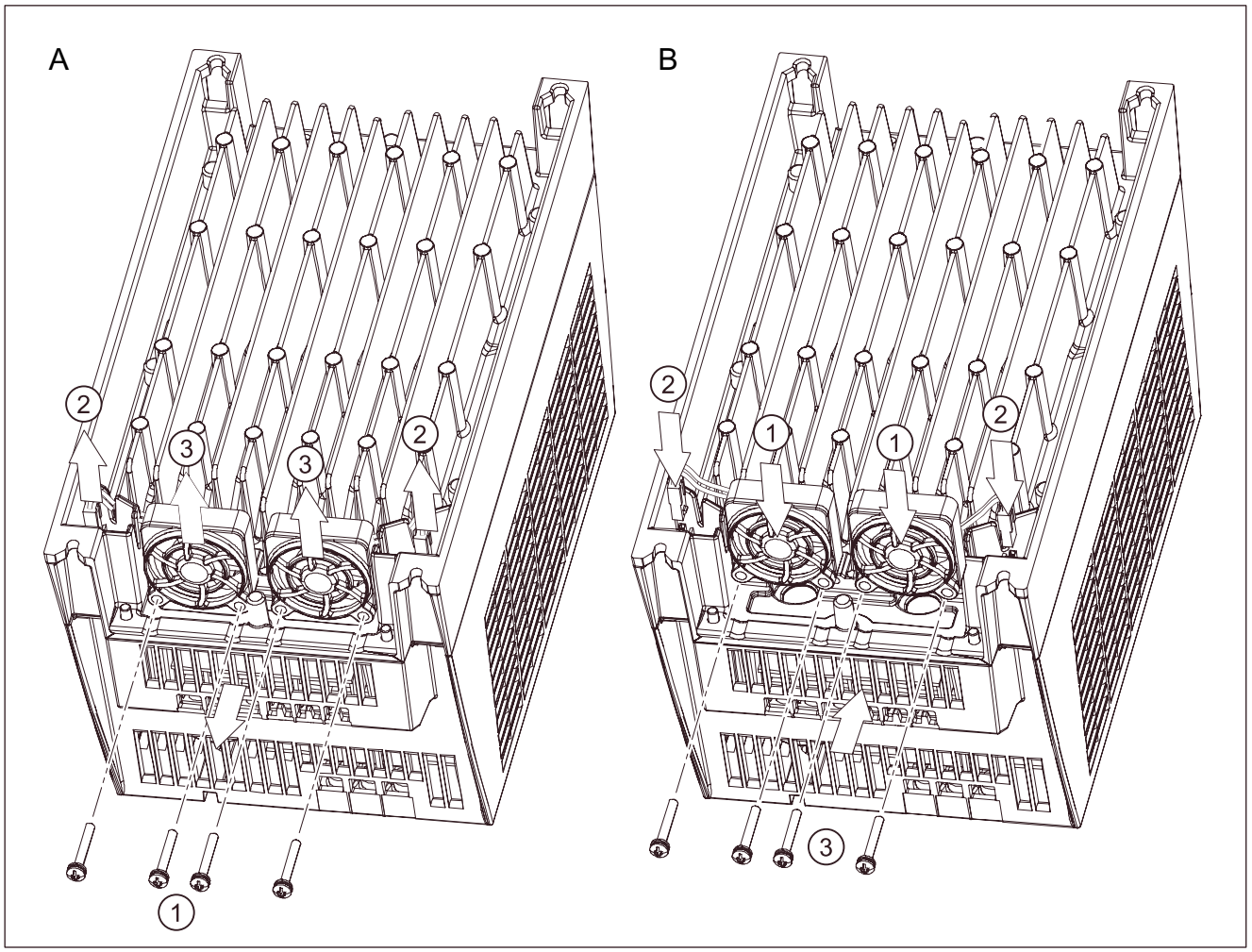


Figure 10-2 Replacing a fan for a Power Module PM340, frame sizes FSB and FSC

(tightening torque 0.4 Nm)

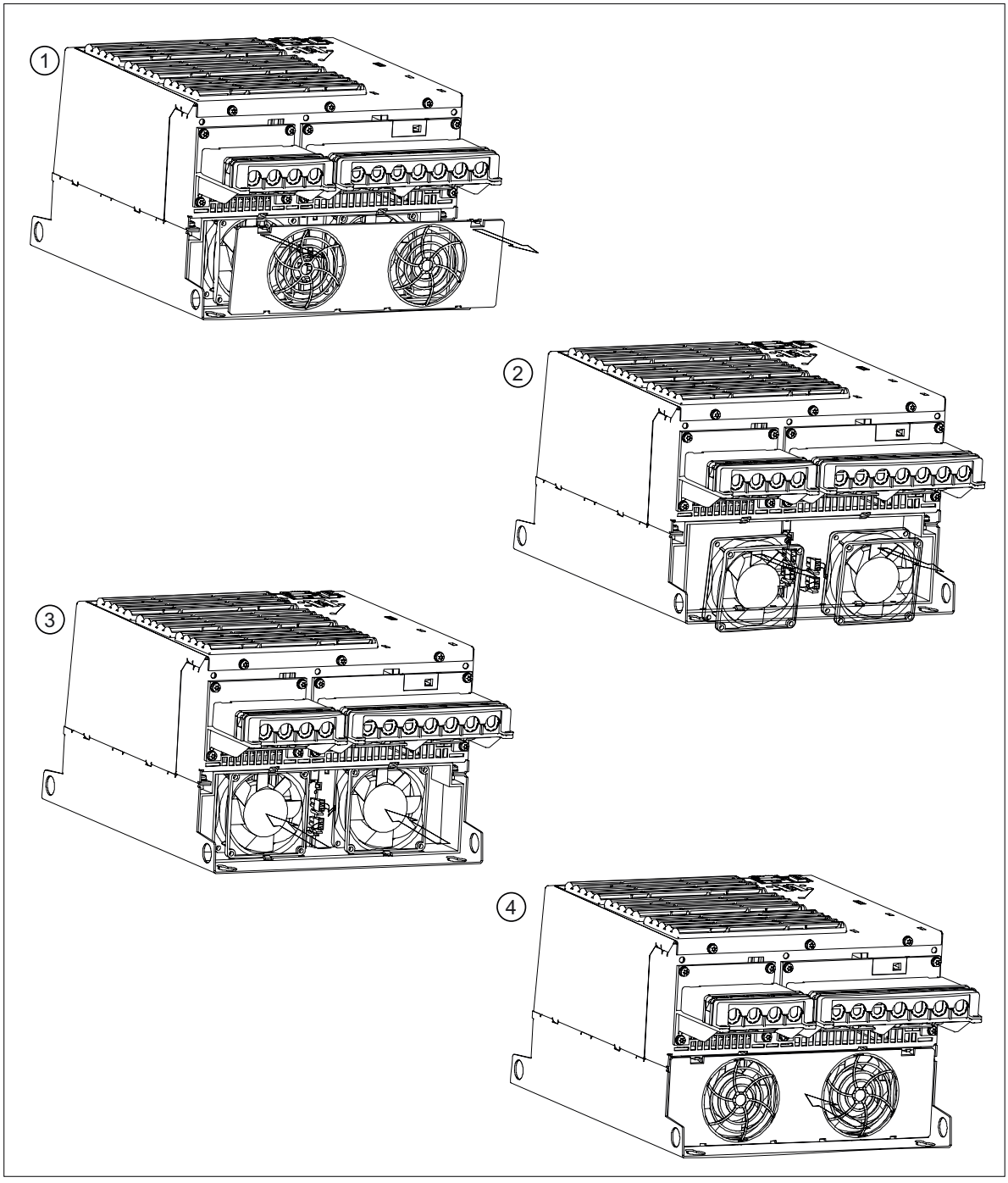


Figure 10-3 Replacing a fan for a Power Module PM340, frame sizes FSD and FSE

1. Removing the cover using a suitable tool.
2. Withdraw the two connectors shown and lift-out the fan.
3. Use the new fan and insert both connectors.
4. Close the protective cover.

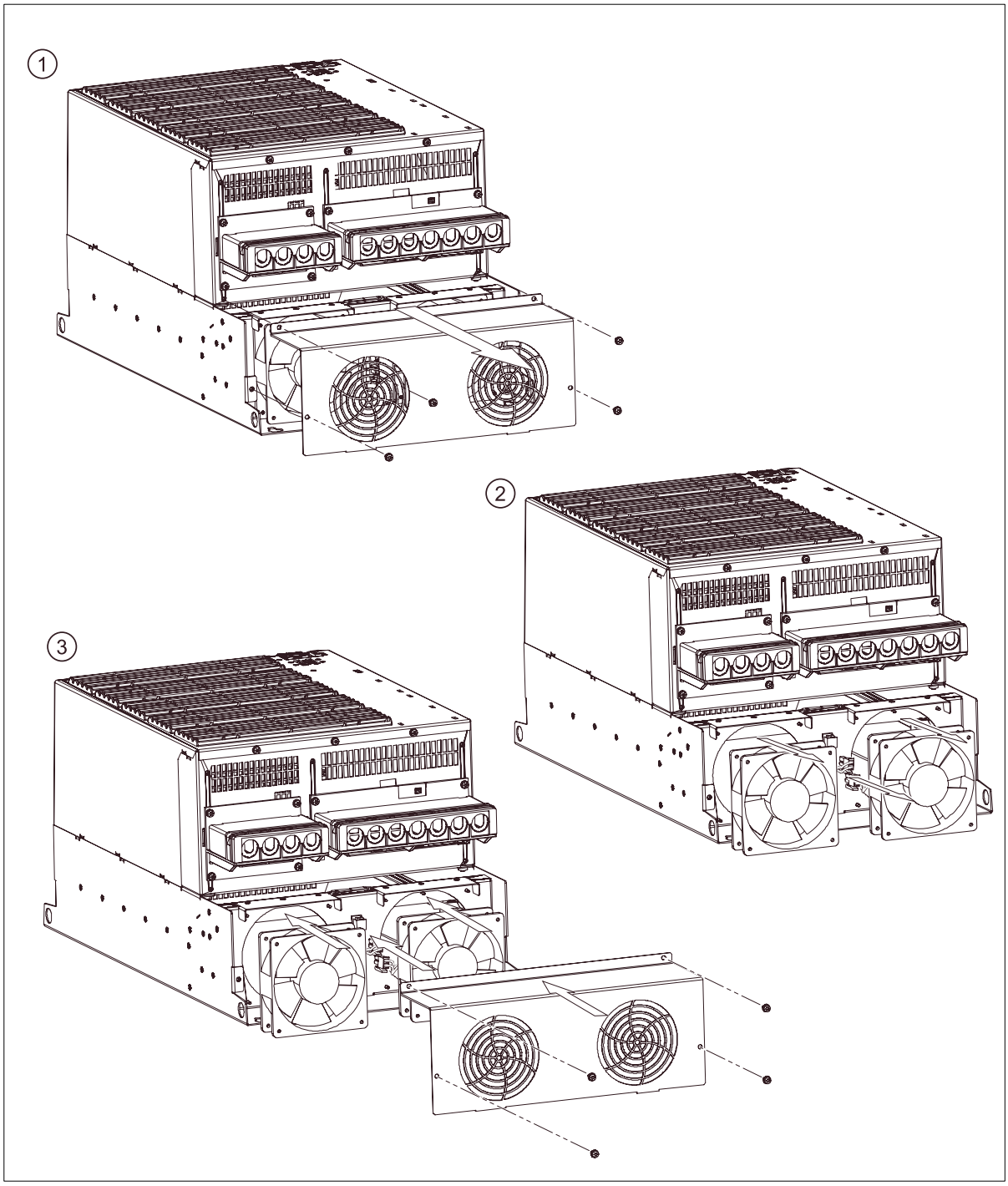


Figure 10-4 Replacing the fan for a Power Module PM340, frame size FSF

5. Release the screws and remove the cover.
6. Withdraw the two connectors shown and lift-out the fan.
7. Insert the new fan, locate both connectors, close the cover and tighten the screws (tightening torque, 3.0 Nm).

Appendix A

A

A.1 Spring-loaded terminals/screw terminal

Connectable conductor cross-sections of spring-loaded terminals

Table A- 1 Spring-loaded terminals

Spring-loaded terminal type			
1	Connectable conductor cross-sections	Flexible With wire end ferrule, without plastic sleeve With wire end ferrule, with plastic sleeve	0.14 mm^2 to 1.5 mm^2 0.25 mm^2 to 1.5 mm^2 0.25 mm^2 to 0.5 mm^2
	Insulation stripping length	7 mm	
	Tool	Screwdriver 0.4 x 2.0 mm	
2	Connectable conductor cross-sections	Flexible	0.08 mm^2 to 2.5 mm^2
	Insulation stripping length	8 to 9 mm	
	Tool	Screwdriver 0.4 x 2.0 mm	

Connectable conductor cross-sections of the screw terminal

Table A- 2 Screw terminal

Screw terminal		
Connectable conductor cross-sections	Rigid, flexible With wire end ferrule, without plastic sleeve With wire end ferrule, with plastic sleeve	0.08 mm^2 to 2.5 mm^2 0.5 mm^2 to 2.5 mm^2 0.5 mm^2 to 1.5 mm^2
Insulation stripping length	7 mm	
Tool	Screwdriver 0.6 x 3.5 mm	
Tightening torque	0.5 to 0.6 Nm	

Appendix B

B

B.1 List of abbreviations

Note:

The following list of abbreviations contains the abbreviations and their meanings used in the entire SINAMICS user documentation.

Abbreviation	Derivation of abbreviation	Meaning
A		
A...	Alarm	Alarm
AC	Alternating Current	Alternating current
ADC	Analog Digital Converter	Analog digital converter
AI	Analog Input	Analog input
AIM	Active Interface Module	Active Interface Module
ALM	Active Line Module	Active Line Module
AO	Analog Output	Analog output
AOP	Advanced Operator Panel	Advanced Operator Panel
APC	Advanced Positioning Control	Advanced positioning control
AR	Automatic Restart	Automatic restart
ASC	Armature Short-Circuit	Armature short-circuit
ASCII	American Standard Code for Information Interchange	American Standard Code for Information Interchange
ASM	Asynchronmotor	Induction motor
B		
BERO	-	Tradename for a type of contactless proximity switch
BI	Binector Input	Binector input
BIA	Berufsgenossenschaftliches Institut für Arbeitssicherheit	German Institute for Occupational Safety
BICO	Binector Connector Technology	Binector connector technology
BLM	Basic Line Module	Basic Line Module
BO	Binector Output	Binector output
BOP	Basic Operator Panel	Basic Operator Panel

Abbreviation	Derivation of abbreviation	Meaning
C		
C	Capacitance	Capacitance
C...	-	Safety message
CAN	Controller Area Network	Serial bus system
CBC	Communication Board CAN	CAN communication board
CD	Compact Disc	Compact Disc
CDS	Command Data Set	Command data set
CF Card	CompactFlash Card	CompactFlash card
CI	Connector Input	Connector input
CLC	Clearance Control	Clearance control
CNC	Computer Numerical Control	Computer numerical control
CO	Connector Output	Connector output
CO/BO	Connector Output/Binector Output	Connector output/Binector output
COB-ID	CAN Object-Identification	CAN object identification
COM	Common contact of a change-over relay	Common contact of a change-over relay
COMM	Commissioning	Commissioning
CP	Communications Processor	Communications processor
CPU	Central Processing Unit	Central processing unit
CRC	Cyclic Redundancy Check	Cyclic redundancy check
CSM	Control Supply Module	Control Supply Module
CU	Control Unit	Control Unit
D		
DAC	Digital Analog Converter	Digital Analog Converter
DC	Direct Current	Direct current
DCB	Drive Control Block	Drive Control Block
DCC	Drive Control Chart	Drive Control Chart
DCC	Data Cross-Check	Data cross-check
DCN	Direct Current Negative	Direct current negative
DCP	Direct Current Positive	Direct current positive
DDS	Drive Data Set	Drive data set
DI	Digital Input	Digital input
DI/DO	Digital Input/Digital Output	Bidirectional digital input/digital output
DMC	DRIVE-CLiQ Hub Module Cabinet	DRIVE-CLiQ Hub Module Cabinet
DME	DRIVE-CLiQ Hub Module External	DRIVE-CLiQ Hub Module External
DO	Digital Output	Digital output
DO	Drive Object	Drive object
DP	Distributed I/Os	Distributed I/Os
DPRAM	Dual-Port Random Access Memory	Dual-Port Random Access Memory

Abbreviation	Derivation of abbreviation	Meaning
DRAM	Dynamic Random Access Memory	Dynamic Random Access Memory
DRIVE-CLiQ	Drive Component Link with IQ	Drive Component Link with IQ
DSC	Dynamic Servo Control	Dynamic servo control
E		
EASC	External Armature Short-Circuit	External armature short-circuit
EDS	Encoder Data Set	Encoder data set
ELCB	Earth Leakage Circuit Breaker	Earth leakage circuit breaker
ELP	Earth Leakage Protection	Earth leakage protection
EMC	Electromagnetic Compatibility	Electromagnetic compatibility
EMF	Electromagnetic Force	Electromagnetic force
EN	Europäische Norm	European Standard
EnDat	Encoder-Data-Interface	Encoder interface
EP	Enable Pulses	Enable Pulses
EPOS	Einfachpositionierer	Basic positioner
ES	Engineering System	Engineering system
ESB	Ersatzschaltbild	Equivalent circuit diagram
ESD	Electrostatic Sensitive Devices	Electrostatic sensitive devices
ESR	Extended Stop and Retract	Extended stop and retract
F		
F...	Fault	Fault
FAQ	Frequently Asked Questions	Frequently asked questions
FBL	Free Blocks	Free function blocks
FCC	Function Control Chart	Function Control Chart
FCC	Flux Current Control	Flux current control
FD	Function Diagram	Function diagram
F-DI	Failsafe Digital Input	Failsafe digital input
F-DO	Failsafe Digital Output	Failsafe digital output
FEM	Fremderregter Synchronmotor	Separate-field synchronous motor
FEPROM	Flash-EPROM	Non-volatile write and read memory
FG	Function Generator	Function generator
FI	-	Fault current
FO	Fiber-Optic Cable	Fiber optic cable
FPGA	Field Programmable Gate Array	Field Programmable Gate Array
FW	Firmware	Firmware

Abbreviation	Derivation of abbreviation	Meaning
G		
GB	Gigabyte	Gigabyte
GC	Global Control	Global Control Telegram (Broadcast Telegram)
GND	Ground	Reference potential for all signal and operating voltages, usually defined with 0 V (also designated as M)
GSD	Gerätestammdatei	Device master file: describes the features of a PROFIBUS slave
GSV	Gate Supply Voltage	Gate supply voltage
GUID	Globally Unique Identifier	Globally unique identifier
H		
HF	High Frequency	High frequency
HFD	Hochfrequenzdrossel	High-frequency reactor
HMI	Human Machine Interface	Human Machine Interface
HTL	High-Threshold Logic	High-threshold logic
HW	Hardware	Hardware
I		
I/O	Input/Output	Input/Output
I2C	Inter Integrated Circuit	Internal serial data bus
IASC	Internal Armature Short-Circuit	Internal armature short-circuit
ID	Identifier	Identifier
IEC	International Electrotechnical Commission	International standard in electrical engineering
IF	Interface	Interface
IGBT	Insulated Gate Bipolar Transistor	Bipolar transistor with insulated control electrode
IGCT	Integrated Gate-Controlled Thyristor	Semiconductor circuit-breaker with integrated control electrode
IL	Impulslöschung	Pulse suppression
IP	Internet Protocol	Internet Protocol
IPO	Interpolator	Interpolator
IT	Isolé Terré	Insulated three-phase supply system
IVP	Internal Voltage Protection	Internal voltage protection
J		
JOG	Jogging	Jogging
K		
KIP	Kinetische Pufferung	Kinetic buffering

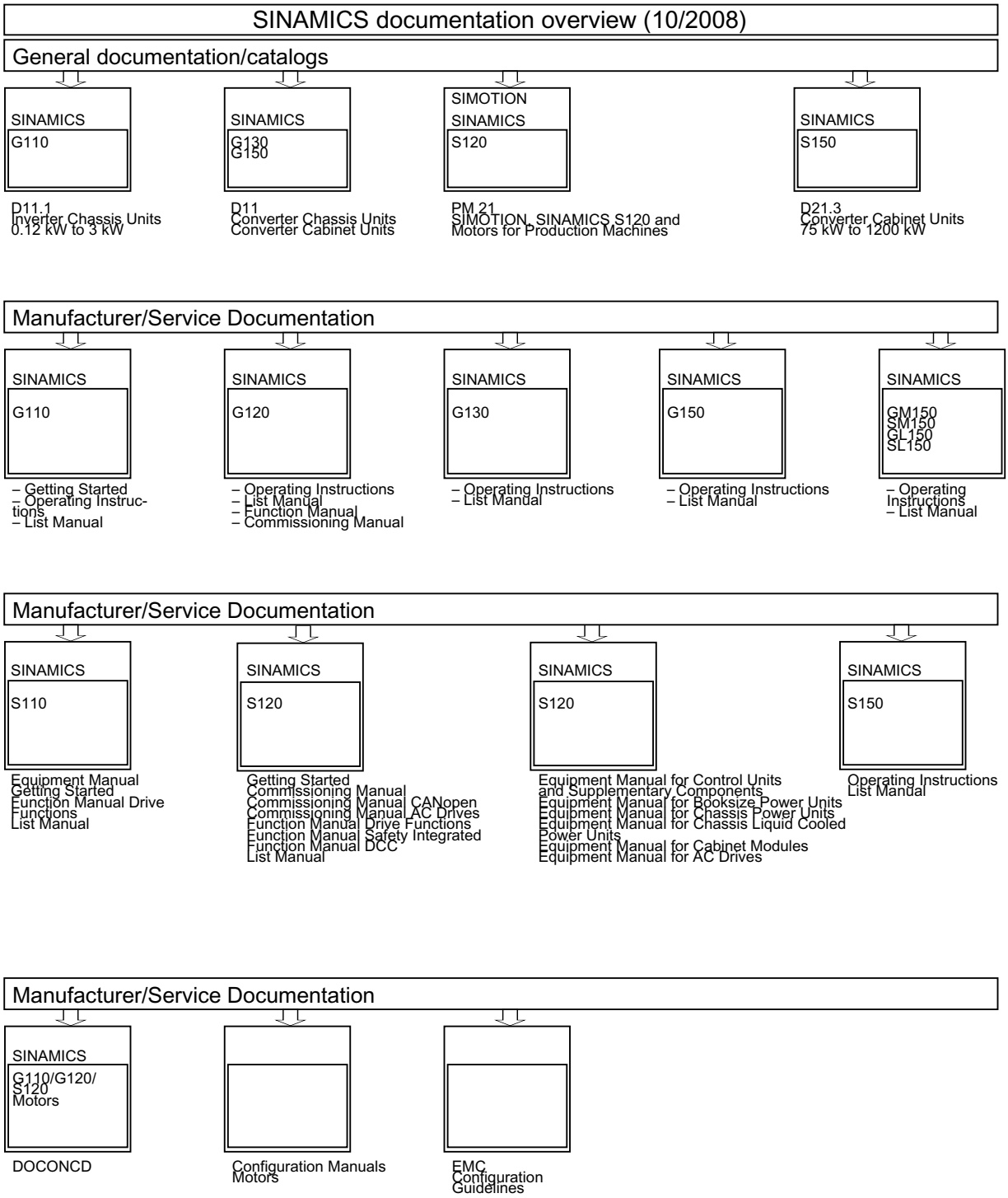
Abbreviation	Derivation of abbreviation	Meaning
Kp	-	Proportional gain
KTY	-	Special temperature sensor
L		
L	-	Formula symbol for inductance
LED	Light Emitting Diode	Light Emitting Diode
LIN	Linearmotor	Linear motor
LR	Lageregler	Position controller
LSB	Least Significant Bit	Least Significant Bit
LSC	Line-Side Converter	Line-Side Converter
LSS	Line Side Switch	Line Side Switch
LU	Length Unit	Length Unit
M		
M	-	Formula symbol for torque
M	Masse	Reference potential for all signal and operating voltages, usually defined with 0 V (also designated as GND)
MB	Megabyte	Megabyte
MCC	Motion Control Chart	Motion Control Chart
MDS	Motor Data Set	Motor data set
MLFB	Maschinenlesbare Fabrikatebezeichnung	Machine-readable product designation
MMC	Man-Machine Communication	Man-Machine Communication
MMC	Micro Memory Card	Micro Memory Card
MSB	Most Significant Bit	Most Significant Bit
MSC	Motor-Side Converter	Motor-Side Converter
MSCY_C1	Master Slave Cycle Class 1	Cyclic communication between master (class 1) and slave
MT	Messtaster	Probe
N		
N. C.	Not Connected	Not connected
N...	No Report	No report or internal message
NAMUR	Normenarbeitsgemeinschaft für Mess- und Regeltechnik in der chemischen Industrie	Standardization association for measurement and control in chemical indstries
NC	Normally Closed (contact)	Normally Closed (contact)
NC	Numerical Control	Numerical control
NEMA	National Electrical Manufacturers Association	Standards association in USA
NO	Normally Open (contact)	Normally Open (contact)
O		
OA	Open Architecture	Open Architecture

Abbreviation	Derivation of abbreviation	Meaning
OC	Operating Condition	Operating condition
OEM	Original Equipment Manufacturer	Original Equipment Manufacturer
OLP	Optical Link Plug	Optical link plug
OMI	Option Module Interface	Option Module Interface
P		
p...	-	Setting parameter
PB	PROFIBUS	PROFIBUS
PcCtrl	PC Control	Master control
PD	PROFIdrive	PROFIdrive
PDS	Power unit Data Set	Power unit data set
PE	Protective Earth	Protective Earth
PELV	Protective Extra Low Voltage	Protective Extra Low Voltage
PEM	Permanenterregter Synchronmotor	Permanent-field synchronous motor
PG	Programmiergerät	Programming device
PI	Proportional Integral	Proportional Integral
PID	Proportional Integral Differential	Proportional Integral Differential
PLC	Programmable Logic Controller	Programmable logic controller
PLL	Phase-Locked Loop	Phase-Locked Loop
PN	PROFINET	PROFINET
PNO	PROFIBUS Nutzerorganisation	PROFIBUS User Organization (PROFIBUS International)
PPI	Point to Point Interface	Point to point interface
PRBS	Pseudo Random Binary Signal	Pseudo Random Binary Signal
PROFIBUS	Process Field Bus	Serial data bus
PS	Power Supply	Power supply
PSA	Power Stack Adapter	Power stack adapter
PTC	Positive Temperature Coefficient	Positive Temperature Coefficient
PTP	Point-To-Point	Point-to-point
PWM	Pulse Width Modulation	Pulse width modulation
PZD	Prozessdaten	Process data
Q		
R		
r...	-	Display parameter (read only)
RAM	Random Access Memory	Read and write memory
RCCB	Residual Current Circuit Breaker	Residual current circuit breaker
RCD	Residual Current Device	Residual current device
RFG	Ramp-Function Generator	Ramp-function generator

Abbreviation	Derivation of abbreviation	Meaning
RJ45	Registered Jack 45	Describes an 8-pole connector system for data transfer with shielded or unshielded multicore copper cables
RKA	Rückkühlanlage	Cooling unit
RO	Read Only	Read only
RPDO	Receive Process Data Object	Receive Process Data Object
RS232	Recommended Standard 232	Interface standard for conducted serial data transfer between a transmitter and a receiver (also designated as EIA232)
RS485	Recommended Standard 485	Interface standard for a conducted differential, parallel and/or serial bus system (data transfer between several transmitters and receivers, also designated as EIA485)
RTC	Real Time Clock	Real time clock
S		
S1	-	Continuous duty
S3	-	Intermittent duty
SBC	Safe Brake Control	Safe brake control
SBH	Sicherer Betriebshalt	Safe Operating Stop
SBR	-	Safe Acceleration Monitor
SCA	Safe Cam	Safe cam
SD Card	SecureDigital Card	Secure Digital Card
SE	Sicherer Software-Endschalter	Safe software limit switch
SG	Sicher reduzierte Geschwindigkeit	Safely reduced speed
SGA	Sicherheitsgerichteter Ausgang	Safety-related output
SGE	Sicherheitsgerichteter Eingang	Safety-related input
SH	Sicherer Halt	Safe standstill
SP	Safety Integrated	Safety Integrated
SIL	Safety Integrity Level	Safety Integrity Level
SLM	Smart Line Module	Smart Line Module
SLP	Safely-Limited Position	Safely-Limited Position
SLS	Safely-Limited Speed	Safely Limited Speed
SLVC	Sensorless Vector Control	Sensorless Vector Control
SM	Sensor Module	Sensor Module
SMC	Sensor Module Cabinet	Sensor Module Cabinet
SME	Sensor Module External	Sensor Module External
SN	Sicherer Software-Nocken	Safe software cam
SOS	Safe Operating Stop	Safe operating stop
SP	Service Pack	Service pack
SPC	Setpoint Channel	Setpoint channel

Abbreviation	Derivation of abbreviation	Meaning
SPI	Serial Peripheral Interface	Serial I/O interface
SS1	Safe Stop 1	Safe Stop 1 (time-monitored, ramp-monitored)
SS2	Safe Stop 2	Safe Stop 2
SSI	Synchronous Serial Interface	Synchronous serial interface
SSM	Safe Speed Monitor	Safe feedback from speed monitor (n < nx)
SSR	Safe Stop Ramp	Safe brake ramp
STO	Safe Torque Off	Safely switched-off torque
STW	Steuerwort	Control word
SVA	Space-vector approximation	Space-vector approximation
T		
TB	Terminal Board	Terminal Board
TIA	Totally Integrated Automation	Totally Integrated Automation
TM	Terminal Module	Terminal Module
TN	Terre Neutre	Grounded three-phase supply system
Tn	-	Integral time
TPDO	Transmit Process Data Object	Transmit Process Data Object
TT	Terre Terre	Grounded three-phase supply system
TTL	Transistor-Transistor Logic	Transistor-Transistor-Logic
Tv	-	Derivative action time
U		
UL	Underwriters Laboratories Inc.	Underwriters Laboratories Inc.
UPS	Uninterruptible Power Supply	Uninterruptible power supply
V		
VC	Vector Control	Vector control
Vdc	-	DC link voltage
VdcN	-	Partial DC link voltage negative
VdcP	-	Partial DC link voltage positive
VDE	Verband Deutscher Elektrotechniker	Association of German Electrical Engineers
VDI	Verein Deutscher Ingenieure	Assocation of German Engineers
VPM	Voltage Protection Module	Voltage Protection Module
Vpp	Volt peak to peak	Volt peak to peak
VSM	Voltage Sensing Module	Voltage Sensing Module
W		
WZM	Werkzeugmaschine	Machine tool
X		
XML	Extensible Markup Language	Extensible Markup Language (standard language for Web publishing and document management)

Abbreviation	Derivation of abbreviation	Meaning
Y		
Z		
ZK	Zwischenkreis	DC link
ZM	Zero Mark	Zero mark
ZSW	Zustandswort	Status word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